



Prairie Island Nuclear Generating Plant

EAL Reference Manual

Notice to Users

This document has been prepared for the Prairie Island Nuclear Generating Plant (PINGP). Its purpose is to provide general information about Emergency Action Levels (EALs) to off-site authorities who are involved in planning for and responding to emergencies at the PINGP. This document is to be used for information only and is not to be used in place of existing procedures. While this manual provides descriptions of the various plant conditions which require emergency classification, the PINGP and the Nuclear Regulatory Commission (NRC) remain the sole source of accurate information regarding plant conditions during a real emergency.

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How to Use This EAL Reference Manual

Purpose of the EAL Reference Manual

This manual provides information that describes the various conditions that might require the Prairie Island Nuclear Generating Plant (PINGP) to declare an emergency at the site, what these conditions are, what they mean, and what impact each is likely to have on plant and public safety. With an understanding of what a particular condition or event means, emergency workers at the various off-site agencies should be able to relate their emergency plan response actions to the declared event. In addition, use of this manual will provide a picture of what is happening at the station during a drill or emergency event.

What is an Emergency Action Level (EAL)?

The specific events or symptoms that would signal to PINGP personnel that an emergency event is taking place are called Emergency Action Levels (EALs). In order to use an EAL, two conditions must be met; the EAL *Initiating Condition* must exist and the EAL *Threshold (Value)* must be reached. The applicable EAL is then used to classify an emergency event, initiate the Emergency Plan and related procedures which detail necessary response actions. The level of this response is based on how seriously the condition threatens plant and public safety, resulting in a graded response to the event by site personnel and off-site authorities.

How an Emergency is Classified

There are four classifications of emergencies, each having a matching level of response. The classifications are based on how seriously the event threatens the public or PINGP equipment. The emergency classifications, listed from the most serious to the least serious are as follows:

General Emergency (GE) –

Conditions have degraded to a point **threatening public safety** and requiring **some form of protective actions for the general public** and certain plant personnel.

Site Area Emergency (SAE) –

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** may be recommended.

Alert –

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

Notification of Unusual Event (NUE) –

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

Instructions for Using This Manual

Off-site agencies are notified at each of the four emergency levels, even though only the last one, General Emergency, actually poses a threat to public safety and warrants an action like evacuation to protect the public. Notifications are done so the agencies **can prepare** to respond appropriately.

If an emergency event is declared at PINGP, within 15 minutes the plant will send out an e-mail with the Emergency Notification Report Form and followup with a phone call to verify receipt. This notification process contains the information needed by off-site agencies to determine the appropriate response actions to take. This manual provides supplemental information to help interpret the plant conditions more easily. The notification will contain the appropriate emergency classification and other information regarding the event, including the EAL number.

HA6.1 is an example of an EAL number.

To determine more information about this or any EAL, follow these directions:

1. Find the EAL number provided with official notification that an emergency has been declared at PINGP (Block 5A on the Prairie Island Emergency Notification Report Form). EAL# - **HA6.1**
 - The first letter of the EAL number (**H**) is the Recognition Category and represents the type of problem and where it is discussed in this manual. There are six recognition categories for identified conditions:

R	=	Abnormal Radiation Levels / Radiological Effluent
C	=	Cold Shutdown / Refueling System Malfunction
E	=	Independent Spent Fuel Storage Installation
F	=	Fission Product Barrier Degradation
H	=	Hazards
S	=	System Malfunction

All “Hazards” items are discussed in the “H – Hazards” section of this manual. Sections of the manual are tabbed making them easy to locate.

- The second letter of the EAL number (**A**) represents the emergency classification. The four emergency classifications are designated as follows:

G = General Emergency
S = Site Area Emergency
A = Alert
U = Unusual Event

Each series of EALs are listed in order of most to least severe. For example HA1, (Alert EALs) would be listed before HU1, (Unusual Event EALs) in the Hazards recognition category.

- The first digit of the EAL number (**6**) represents the sequential listing of Initiating Conditions within each recognition category. **Do not** confuse this number with the severity of the event. The second digit (**1**) represents the EAL Threshold that was met for the identified Initiating Condition.
2. Let's put it all together using **HA6.1** as an example. Turn to the appropriate section of this manual and review the descriptions given for the event. In this case, **HA6**, Control Room evacuation:

H – Indicates that it is a **Hazard** Recognition Category

A – Indicates the event is classified as an **Alert**

6 – Indicates that the 6th Initiating Condition in the Hazard Recognition Category has been met

1 – Indicates that the 1st EAL Threshold of the Initiating Condition HA6 has been met. In this case, an event has resulted in plant control being transferred from the Control Room to an alternate location.

Note:

Some of the terms used in the detailed descriptions have special meaning. These terms have been identified by *italic typeface* and are defined within the glossary at the end of this manual. These terms are highlighted as they appear in the detailed description.

SECTION R

ABNORMAL RADIATION LEVELS/ RADIOLICAL EFFLUENT

Recognition Category 'R' Initiating Condition Matrix

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
RG1 Off-site Dose.	RS1 Off-site Dose.	RA1 Off-site Dose.	RU1 Off-site Dose.
RG2 Uncontrolled Loss of Storage Pool Water.	RS2 Uncontrolled Loss of Storage Pool Water.	RA2 Damage to Irradiated Fuel.	RU2 Unplanned Loss of Water above Irradiated Fuel.
		RA3 In-plant Radiation Levels.	

Abnormal Radiation Levels/Radiological Effluent**RG1****GENERAL EMERGENCY****RG1****Off-Site Dose****Brief Description:**

Radiation doses exceeding federal guidelines that specify protective measures be taken have been measured in or projected for areas beyond the immediate station area. Protective actions will be recommended for the public.

Detailed Description:

The thresholds specified in EALs RG1.1, RG1.2, and RG1.3 represent releases off-site that can reasonably be expected to exceed the Environmental Protection Agency's *Protective Action Guideline* values. In other words, they are the levels at which federal guidelines would recommend protective actions like sheltering, evacuation, and/or issuance of potassium iodide (KI).

RG1.1 requires a General Emergency to be declared if specific radiation monitors monitoring gaseous releases reach values equivalent to greater than 1000 mRem (1 Rem) *TEDE* (*total effective dose equivalent*) or 5000 mRem (5 Rem) thyroid *CDE* (*committed dose equivalent*).

RG1.2 requires a General Emergency to be declared if the projected dose from the release (for the duration of the event) at or beyond the immediate station area (*Site Boundary*) is determined to be greater than 1000 mRem (1 Rem) *TEDE* or 5000 mRem (5 Rem) thyroid *CDE*.

RG1.3 requires a General Emergency to be declared if field survey results at or beyond the immediate station area (*Site Boundary*) indicate dose rates greater than 1000 mRem/hr that are expected to continue for one hour or longer or analyses of field survey samples indicate thyroid *CDE* greater than 5000 mRem (5 Rem) for one hour of inhalation.

Since these conditions could pose a threat to the public, utility personnel will recommend that the state and local authorities consider appropriate protective actions.

Abnormal Radiation Levels/Radiological Effluent**RG2****GENERAL EMERGENCY****RG2****Uncontrolled Loss of Storage Pool Water****Brief Description:**

Plant operators are unable to maintain water level in the storage pool (Spent Fuel Pool) for used reactor fuel resulting in possible damage to the used reactor fuel. Protective actions will be recommended for the public.

Detailed Description:

Once the *fuel* in the *reactor* has been depleted, it is removed and stored in the *Spent Fuel Pool* where water is used to shield plant workers from radiation still being given off by the *fuel* as well as serve as a means of cooling the *fuel*.

In this case, a loss of the water from the *Spent Fuel Pool* has occurred and for the last 60 minutes or more plant operators have been unable to restore the water level high enough to adequately protect the used *reactor fuel assemblies*. Increases in radiation levels within plant buildings are occurring. The continued loss of water will result in additional damage to the used *reactor fuel assemblies* and a release of radioactive material to the environment.

Since these conditions could pose a threat to the public, utility personnel will recommend that the state and local authorities consider appropriate protective actions.

Abnormal Radiation Levels/Radiological Effluent**RS1****SITE AREA EMERGENCY****RS1****Off-Site Dose****Brief Description:**

Low level radiation doses have been measured at or projected for areas beyond the immediate station area.

Detailed Description:

The thresholds specified in EALs RS1.1, RS1.2, and RS1.3 represent releases off-site which are expected to exceed a fraction (10%) of the Environmental Protection Agency's *Protective Action Guideline* values. In other words, they are much lower than levels at which federal guidelines recommend protective actions like sheltering, evacuation, and/or issuance of potassium iodide (KI).

RS1.1 requires a Site Area Emergency to be declared if specific radiation monitors monitoring gaseous releases reach values equivalent to greater than 100 mRem (0.1 Rem) *TEDE* (*total effective dose equivalent*) or 500 mRem (0.5 Rem) thyroid *CDE* (*committed dose equivalent*).

RS1.2 requires a Site Area Emergency to be declared if the projected dose from the release (for the duration of the event) at or beyond the immediate station area (*Site Boundary*) is determined to be greater than 100 mRem (0.1 Rem) *TEDE* or 500 mRem (0.5 Rem) thyroid *CDE*.

RS1.3 requires a Site Area Emergency to be declared if field survey results at or beyond the immediate station area (*Site Boundary*) indicate dose rates greater than 100 mRem/hr that are expected to continue for one hour or longer or analyses of field survey samples indicate thyroid *CDE* greater than 500 mRem (0.5 Rem) for one hour of inhalation.

If levels continue to increase, a higher level of emergency might be declared.

Abnormal Radiation Levels/Radiological Effluent**RS2****SITE AREA EMERGENCY****RS2****Unplanned Loss of Storage Pool Water****Brief Description:**

The water level in the storage pool (Spent Fuel Pool) for used reactor fuel has reached a level requiring plant operator action to prevent further inventory loss and possible fuel damage.

Detailed Description:

Once the *fuel* in the *reactor* has been depleted, it is removed and stored in the *Spent Fuel Pool* where water is used to shield plant workers from radiation still being given off by the *fuel* as well as serve as a means of cooling the *fuel*.

In this case, a loss of the water from the *Spent Fuel Pool* has occurred and plant operators need to take action to restore the water level high enough to adequately protect the used *reactor fuel assemblies*. Increases in radiation levels within plant buildings are occurring. The continued loss of water without operator action may result in damage to the used *reactor fuel assemblies* and a possible release of radioactive material to the environment.

Since these conditions are recoverable, they don't pose an immediate threat to the public and protective actions are not required.

Abnormal Radiation Levels/Radiological Effluent**RA1****ALERT****RA1****Off-Site Dose****Brief Description:**

Low level radiation doses have been measured at or projected for areas beyond the immediate station area. Current plant conditions DO NOT threaten public safety.

Detailed Description:

The plant's vent system directs the gaseous output of various plant systems to the atmosphere. Gaseous and liquid releases from the plant are carefully monitored to alert operators to the presence of, and any increase in, radioactivity.

The system monitors are set to alarm at extremely low levels of radioactivity. In fact, the alarm points are set well below the radioactivity emission rates allowed (*Technical Specifications*) as calculated from the *Off-Site Dose Calculation Manual (ODCM)*. Should there be indication of a release, the plant operators act immediately to locate and isolate its source.

The thresholds specified in EALs RA1.1, RA1.2, RA1.3, and RA1.4 represent releases off-site which are expected to exceed a fraction (1%) of the Environmental Protection Agency's *Protective Action Guideline* values. In other words, they are much lower than levels at which federal guidelines recommend protective actions.

RA1.1 requires an Alert to be declared if specific radiation monitors monitoring gaseous releases reach values equivalent to greater than 10 mRem (0.01 Rem) *TEDE (total effective dose equivalent)* or 50 mRem (0.05 Rem) thyroid *CDE (committed dose equivalent)*.

RA1.2 requires an Alert to be declared if the projected dose from the release (for the duration of the event) at or beyond the immediate station area (*Site Boundary*) is determined to be greater than 10 mRem (0.01 Rem) *TEDE* or 50 mRem (0.05 Rem) thyroid *CDE*.

RA1.3 requires an Alert to be declared if analyzed sample results of releases at or beyond the immediate station area (*Site Boundary*) indicate dose rates greater than 10 mRem *TEDE* or 50 mRem (0.05 Rem) thyroid *CDE* for one hour of exposure.

RA1.4 requires an Alert to be declared if field survey results at or beyond the immediate station area (*Site Boundary*) indicate dose rates greater than 10 mRem/hr that are expected to continue for one hour or longer or analyses of field survey samples indicate thyroid *CDE* greater than 50 mRem (0.05 Rem) for one hour of inhalation.

If levels continue to increase, a higher level of emergency might be declared.

Abnormal Radiation Levels/Radiological Effluent**RA2****ALERT****RA2****Damage to Irradiated Fuel****Brief Description:**

Plant operators have indications of possible damage to or uncovering of reactor fuel outside the reactor pressure vessel. Current plant conditions DO NOT threaten public safety.

Detailed Description:

When new *fuel assemblies* are placed in the *reactor* and used to generate energy they become *irradiated*. Once all of the useful energy has been taken from the fuel it is called *spent fuel*. *Spent fuel* is removed from the *reactor pressure vessel* during plant *refueling* and stored in the *Spent Fuel Pool*. Even though the *spent fuel* does not provide enough energy to produce electricity it does generate heat for some time after being removed from the *reactor*.

The water in the *Spent Fuel Pool* serves two functions:

- 1) It shields station workers from radiation given off by the *fuel assemblies*.
- and**
- 2) It cools the *fuel assemblies* by removing the *decay heat* the *fission products* are still producing.

The *Spent Fuel Pool* is also used to store partially used *fuel assemblies* removed from the *reactor pressure vessel* during plant maintenance.

The thresholds specified in EALs RA2.1 and RA2.2 represent conditions indicating that some *irradiated fuel* outside the *reactor pressure vessel* has become damaged or may be uncovered.

The threshold specified in EAL RA2.3 represents a condition indicating a decreasing water level in the *Spent Fuel Pool*.

The conditions pose no threat to the safety of the general public.

Abnormal Radiation Levels/Radiological Effluent		
RA3	ALERT	RA3
In-plant Radiation Levels		

Brief Description:

Radiation levels in one or more area(s) of the plant are high, limiting operator's ability to safely operate plant equipment. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Control areas contain equipment necessary for the safe operation or safe *shutdown* of the plant. Plant personnel must have continuous access to these areas. Examples of control areas are:

- 1) Control Room (Main)
- 2) Central Alarm Station

Other areas of the plant which require infrequent access, such as *Auxiliary Building* areas, areas containing control cables/plant equipment/valves/pumps, etc., are also entered to allow for safe plant operations.

The thresholds specified in EALs RA3.1 and RA3.2 represent radiation exposure levels in one or more control areas are higher than normal or radiation levels in areas requiring infrequent access to maintain plant safety functions are much higher than normal. This could impede or prohibit access, without the use of extraordinary measures, to operating areas that are required for safe operation or *shutdown* of the plant.

High radiation levels inside the plant do not mean that any radioactivity has been released off-site.

The conditions pose no threat to the safety of the general public.

Abnormal Radiation Levels/Radiological Effluent**RU1****UNUSUAL EVENT****RU1****Off-Site Dose****Brief Description:**

Radioactive gases or liquids are being released at rates at least two times (2x) those allowed by the plant's operating license limits (Off-site Dose Calculation Manual) over a designated period of time. Current plant conditions DO NOT threaten public safety.

Detailed Description:

The plant's effluent release systems direct the gas or liquid released by various plant systems to the atmosphere or river. Plant radiation monitoring systems continuously measure the gases and liquids these systems are discharging. The plant's *radwaste* systems remove harmful levels of radiation from any gases or liquids being released. Gaseous and liquid releases from the plant are carefully monitored to alert operators to the presence of, and any increase in, radioactivity.

The system monitors are set to alarm at extremely low levels of radioactivity. Should there be indication of a release, the plant operators act immediately to locate and isolate its source.

The thresholds specified in EALs RU1.1, RU1.2, and RU1.3 represent levels of radioactivity being released at two times (2x) the rates allowed during normal plant operations (*Off-site Dose Calculation Manual*) for more than 60 minutes. Therefore, the EALs call for an Unusual Event to be declared. Although such release rates are above that allowed for normal operations, they are a small fraction of that which could cause measurable radiation beyond the immediate station area (*Site Boundary*).

The conditions pose no threat to the safety of the general public.

If radiation levels continue to rise, a higher level of emergency might be declared.

Abnormal Radiation Levels/Radiological Effluent**RU2****UNUSUAL EVENT****RU2****Unplanned Loss of Water above Irradiated Fuel****Brief Description:**

Plant Operators have observed an unexpected decrease in water level in components covering reactor fuel that has resulted in an increase in plant radiation monitors. Current plant conditions DO NOT threaten public safety.

Detailed Description:

When new *fuel assemblies* are placed in the *reactor* and used to generate energy they become *irradiated*. Once all of the useful energy has been taken from the fuel it is called *spent fuel*. *Spent fuel* is removed from the *reactor pressure vessel* during plant *refueling* and stored in the *Spent Fuel Pool*. The *Spent Fuel Pool* is also used to store partially used *fuel assemblies* removed from the *reactor pressure vessel* during plant maintenance. Even though the *spent fuel* does not provide enough energy to produce electricity it does generate heat for some time after being removed from the *reactor*. Once the *decay heat* of the *spent fuel* has cooled to a low level, the *spent fuel* is transferred to another on-site facility for interim storage.

The water in the *Spent Fuel Pool* and other components containing the *spent fuel* serves two functions:

- 1) It shields station workers from radiation given off by the *fuel assemblies*.
- and**
- 2) It cools the fuel assemblies by removing the *decay heat* the *fission products* are still producing.

A loss of water level covering *irradiated fuel assemblies* will result in an increase in plant radiation monitors. The indications specified in RU2.1 represent conditions that are used by plant operators to determine that an unexpected decrease in water level covering *irradiated fuel assemblies* has occurred.

This condition does not pose a threat to the safety of the general public.

If radiation levels continue to rise, a higher level of emergency might be declared.

SECTION C

COLD SHUTDOWN/REFUELING SYSTEM MALFUNCTION

Recognition Category ‘C’ Initiating Condition Matrix

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
CG1 Loss of Reactor Water Level.	CS1 Loss of Reactor Water Level.	CA1 Loss of Reactor Water inventory.	CU1 Reactor Water Level.
		CA2 Loss of all AC power.	CU2 Loss of AC power.
		CA3 Loss of Decay Heat Removal Capability.	CU3 Loss of Decay Heat Removal Capability.
			CU4 Loss of DC power.
			CU5 Loss of communications capabilities.
		CA6 Hazardous event affecting the site.	

CG1	Cold Shutdown/Refueling System Malfunction GENERAL EMERGENCY Loss of Reactor Water Level	CG1
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Brief Description:

While in the cold shutdown or refueling mode, plant operators have indications that a large amount of water has been lost from the reactor coolant system which may affect the ability to cool the reactor fuel. The ability of the plant's containment system to function properly is also challenged. Protective actions will be recommended for the public.

Detailed Description:

There are six defined plant operational conditions (modes) and *cold shutdown* is one of them. *Cold shutdown* refers to a plant condition where:

- 1) The *reactor* is *shutdown*; that is, the nuclear chain reaction has stopped.
and
- 2) The *Reactor Coolant Temperature* is at or below a temperature of 200 °F.
and
- 3) The *Reactor Coolant System* is closed (the same condition it would be in if the temperature was above 200 °F).

Refueling is a condition where, while in *cold shutdown*, the *Reactor Coolant System* is opened up to allow the movement of *fuel assemblies* in and out of the *reactor pressure vessel* or maintenance to system components.

When the operators prepare to remove the spent *fuel assemblies*, the top of the *reactor pressure vessel* (*reactor vessel head*) is removed and the *refueling cavity* is filled with water.

The water in the *refueling cavity* serves two functions:

- 1) It shields station workers from radiation given off by the *fuel assemblies*.
- and**
- 2) It cools the *fuel assemblies* by removing the *decay heat* the *fission products* are still producing.

Water level and radiation monitors provide indications to the operators if the water level in the *reactor pressure vessel* falls.

The threshold specified in EAL CG1.1 represents a condition during *cold shutdown* or *refueling* mode where the amount of water that has been lost from the *Reactor Coolant System* for 30 minutes or longer affects the ability to properly cool the reactor *fuel assemblies* and the *Containment*, which is the third *fission product barrier*, is challenged (either not intact or may fail). Therefore, this EAL requires that the plant declare a General Emergency.

The threshold specified in EAL CG1.2 represents a condition during *cold shutdown* or *refueling* mode where plant operators are unable to monitor the level in the *reactor pressure vessel* for 30 minutes or longer and an *unplanned* increase in radiation monitor readings or an *unplanned* level rise has been seen in plant components that indicate a *reactor pressure vessel* water level that is unable to properly cool the *reactor fuel assemblies* and the *Containment*, which is the third *fission product barrier*, is challenged (either not intact or may fail). Therefore, this EAL requires that the plant declare a General Emergency.

Since the conditions could pose a threat to the public, utility personnel will recommend that the state and local authorities consider appropriate protective actions.

CS1	Cold Shutdown/Refueling System Malfunction SITE AREA EMERGENCY Loss of Reactor Water Level	CS1
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Brief Description:

While in the cold shutdown or refueling mode, plant operators have indications that a large amount of water has been lost from the reactor coolant system which may affect the ability to cool the reactor fuel.

Detailed Description:

There are six defined plant operational conditions (modes) and *cold shutdown* is one of them. *Cold shutdown* refers to a plant condition where:

- 1) The *reactor* is *shutdown*; that is, the nuclear chain reaction has stopped.
and
- 2) The *Reactor Coolant Temperature* is at or below a temperature of 200 °F.
and
- 3) The *Reactor Coolant System* is closed (the same condition it would be in if the temperature was above 200 °F).

Refueling is a condition where, while in *cold shutdown*, the *Reactor Coolant System* is opened up to allow the movement of *fuel assemblies* in and out of the *reactor pressure vessel* or maintenance to system components. When the operators prepare to remove the spent *fuel assemblies*, the top of the *reactor pressure vessel* (*reactor vessel head*) is removed and the *refueling cavity* is filled with water.

The water in the *refueling cavity* serves two functions:

- 1) It shields station workers from radiation given off by the *fuel assemblies*.
and
- 2) It cools the *fuel assemblies* by removing the *decay heat* the *fission products* are still producing.

Water level and radiation monitors provide indications to the operators if the water level in the *reactor pressure vessel* falls.

The threshold specified in EAL CS1.1 represents a condition during *cold shutdown* or *refueling* mode where the amount of water in the *reactor pressure vessel* has reached a level that could affect the ability to properly cool the *reactor fuel assemblies* and the *Containment*, which is a part of the third *fission product barrier*, is not intact. Therefore, this EAL requires that the plant declare a Site Area Emergency.

The threshold specified in EAL CS1.2 represents a condition during *cold shutdown* or *refueling* mode where the amount of water in the *reactor pressure vessel* has reached a level that could affect the ability to properly cool the *reactor fuel assemblies* and the *Containment*, which is a part of the third *fission product barrier*, is intact. Therefore, this EAL requires that the plant declare a Site Area Emergency.

The threshold specified in EAL CS1.3 represents a condition during *cold shutdown* or *refueling* mode where plant operators are unable to monitor the level in the *reactor pressure vessel* for 30 minutes or longer and an *unplanned* increase in radiation monitor readings or an *unplanned* level rise has been seen in plant components that indicate a *reactor pressure vessel* water level that is unable to properly cool the *reactor fuel assemblies*. Therefore, this EAL requires that the plant declare a Site Area Emergency.

Further degradation of plant conditions may result in an escalation in the emergency level.

CA1	Cold Shutdown/Refueling System Malfunction ALERT Loss of Reactor Water Inventory	CA1
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Brief Description:

While in the cold shutdown or refueling mode, plant operators have indications that a large amount of water has leaked from the reactor coolant system or plant operators are unable to monitor the systems water level. Current plant conditions DO NOT threaten public safety.

Detailed Description:

There are six defined plant operational conditions (modes) and *cold shutdown* is one of them. *Cold shutdown* refers to a plant condition where:

- 1) The *reactor* is *shutdown*; that is, the nuclear chain reaction has stopped.
and
- 2) The *Reactor Coolant Temperature* is at or below a temperature of 200 °F.
and
- 3) The *Reactor Coolant System* is closed (the same condition it would be in if the temperature was above 200 °F).

Refueling is a condition where, while in *cold shutdown*, the *Reactor Coolant System* is opened up to allow the movement of *fuel assemblies* in and out of the *reactor pressure vessel* or maintenance to system components. When the operators prepare to remove the spent *fuel assemblies*, the top of the *reactor pressure vessel* (*reactor vessel head*) is removed and the *refueling cavity* is filled with water.

The water in the *refueling cavity* serves two functions:

- 1) It shields station workers from radiation given off by the *fuel assemblies*.
and
- 2) It cools the *fuel assemblies* by removing the *decay heat* the *fission products* are still producing.

Normally a small amount of monitored water (*reactor coolant*) is expected to leak from the components which make up the *reactor coolant system*. Plant operators continuously monitor the amount of this leakage in two ways, by measuring:

- 1) The rate at which water collection tanks (*Containment Sumps* or *Waste Holdup Tank*) that collect the leakage fill up.

and

- 2) The rate at which water must be added to the *reactor coolant system*.

The threshold specified in EAL CA1.1 represents a condition during *cold shutdown* or *refueling* mode where the amount of water in the *reactor pressure vessel* has reached a level that could affect the ability to properly cool the reactor *fuel assemblies*. Therefore, this EAL requires that the plant declare an Alert.

The threshold specified in EAL CA1.2 represents a condition during *cold shutdown* or *refueling* mode where plant operators are unable to monitor the level in the *reactor pressure vessel* for 15 minutes or longer and an *unplanned* level rise has been seen in plant components (*Containment Sumps* or *Waste Holdup Tank*) that indicate a loss of water from the *reactor pressure vessel* or *refueling cavity*. Therefore, this EAL requires that the plant declare an Alert.

These conditions pose no threat to the safety of the general public.

Further degradation of plant conditions may result in an escalation in the emergency level.

Cold Shutdown/Refueling System Malfunction**CA2****ALERT****CA2****Loss of AC Power****Brief Description:**

All alternating current (AC) electrical power from off-site and on-site sources has been lost for more than 15 minutes with the plant in cold shutdown mode, refueling mode, or defueled. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Much of the equipment in the plant, including important pumps and valves in safety systems, is powered by AC electrical power. There are a number of main and backup sources for this type of power, including:

- 1) Off-site AC power, which is supplied from outside the station through electric power transmission lines, passes through *transformers*, then is distributed on-site by networks called *buses*.
- 2) On-site AC power, which is produced by the plant or by *diesel-driven electric generators*. This power supply is totally independent of the off-site electric transmission lines.

The threshold specified in EAL CA2.1 represents a condition during *cold shutdown mode*, *refueling mode*, or *defueled* where all the off-site AC power and all the on-site AC power sources are unavailable to operate *vital equipment* for more than 15 minutes. Because the plant is in either *cold shutdown mode*, *refueling mode*, or *defueled* the operators have additional time available to restore power before any plant damage occurs.

This EAL threshold poses no threat to the safety of plant personnel or the general public.

Further degradation of plant conditions may result in an escalation in the emergency level.

Cold Shutdown/Refueling System Malfunction**CA3****ALERT****CA3****Loss of Decay Heat Removal Capability****Brief Description:**

Equipment needed to maintain the reactor water temperature below the boiling point has been lost for an extended period of time. Current plant conditions DO NOT threaten public safety.

Detailed Description:

There are six defined plant operational conditions (modes) and *cold shutdown* is one of them. *Cold shutdown* refers to a plant condition where:

- 1) The *reactor* is *shutdown*; that is, the nuclear chain reaction has stopped.
and
- 2) The *Reactor Coolant Temperature* is at or below a temperature of 200 °F.
and
- 3) The *Reactor Coolant System* is closed (the same condition it would be in if the temperature was above 200 °F).

During *cold shutdown* conditions, the reactor *core* is cooled by water in the *Reactor Coolant System*. This water is pumped through the piping and *reactor pressure vessel*. This water keeps the *core* completely covered and removes heat at all times.

Refueling is a condition where, while in *cold shutdown*, the *Reactor Coolant System* is opened up to allow the movement of *fuel assemblies* in and out of the *reactor pressure vessel* or maintenance to system components. When the operators prepare to remove the spent *fuel assemblies*, the top of the *reactor pressure vessel* (*reactor vessel head*) is removed and the *refueling cavity* is filled with water. Water in the *refueling cavity* is pumped through the piping and *reactor pressure vessel* which keeps the core completely covered while removing *decay heat* at all times.

The threshold specified in EAL CA3.1 represents conditions during *cold shutdown* and *refueling* where plant operators are unable to maintain the *reactor coolant temperature* below 200 °F due to an *unplanned* event. Unless the plant operators take further action, this condition could lead to overheating of the

reactor *fuel assemblies* and damage to the reactor *core*. These conditions indicate a loss of the ability to remove *decay heat* and keep the *core* covered with water. Therefore, this EAL threshold requires the plant to declare an Alert.

The threshold specified in EAL CA3.2 represents a condition during *cold shutdown* where plant operators are unable to maintain the *reactor coolant temperature* below 200 °F due to an *unplanned* event as indicated by an increase in *reactor coolant system pressure*. Unless the plant operators take further action, this condition could lead to overheating of the reactor *fuel assemblies* and damage to the reactor *core*. This condition indicates a loss of the ability to remove *decay heat* and keep the *core* covered with water. Therefore, this EAL threshold requires the plant to declare an Alert.

These EAL thresholds pose no threat to the safety of plant personnel or the general public.

Further degradation of plant conditions may result in an escalation in the emergency level.

Cold Shutdown/Refueling System Malfunction**CA6****ALERT****CA6****Hazardous Event Affecting the Site****Brief Description:**

A hazardous event, natural or destructive, has occurred that threatens vital equipment required for the safe operation of the plant during cold shutdown or refueling modes. Current plant conditions DO NOT threaten public safety.

Detailed Description:

There are six defined plant operational conditions (modes) and *cold shutdown* is one of them. *Cold shutdown* refers to a plant condition where:

- 1) The *reactor* is *shutdown*; that is, the nuclear chain reaction has stopped.
and
- 2) The *Reactor Coolant Temperature* is at or below a temperature of 200 °F.
and
- 3) The *Reactor Coolant System* is closed (the same condition it would be in if the temperature was above 200 °F).

Refueling is a condition where, while in *cold shutdown*, the *Reactor Coolant System* is opened up to allow the movement of *fuel assemblies* in and out of the *reactor pressure vessel* or maintenance to system components. When the operators prepare to remove the spent *fuel assemblies*, the top of the *reactor pressure vessel (reactor vessel head)* is removed and the *refueling cavity* is filled with water.

The plant and its equipment are designed to withstand most natural events (earthquakes, floods, high winds, tornados, etc.) or any damage that may occur from various other destructive events (fire, explosion, etc.).

The EAL threshold for CA6.1 addresses one of the following events that has occurred resulting in either degraded performance of a *safety system* OR visible damage to a *safety system*, component or structure needed during *cold shutdown* or *refueling*:

- An earthquake more intense than the plant was designed to withstand for continued plant operations (*Operational Basis Earthquake (OBE)*).
- Internal or external plant flooding which is affecting the operation or performance of *vital plant equipment*.
- High winds or a tornado strike, the result of which, is affecting the operation or performance of *vital plant equipment*.
- A fire or explosion which is affecting the operation or performance of *vital plant equipment*.
- Low river water level which affects the operation or performance of *vital plant equipment*.
- Other events with similar hazard characteristics as determined by the *Shift Manager*.

Due to the actual or potential substantial degradation of the level of safety of the plant resulting from any of these conditions, plant personnel will declare an Alert.

These conditions pose no threat to the safety of the general public.

Further degradation of plant conditions may result in an escalation in the emergency level.

Cold Shutdown/Refueling System Malfunction		
CU1	UNUSUAL EVENT	CU1
Reactor Water Level		

Brief Description:

While in the cold shutdown or refueling mode, the operators have observed an unplanned loss of water level in the reactor pressure vessel or refueling cavity. Current plant conditions DO NOT threaten public safety.

Detailed Description:

There are six defined plant operational conditions (modes) and *cold shutdown* is one of them. *Cold shutdown* refers to a plant condition where:

- 1) The *reactor* is *shutdown*; that is, the nuclear chain reaction has stopped.
and
- 2) The *Reactor Coolant Temperature* is at or below a temperature of 200 °F.
and
- 3) The *Reactor Coolant System* is closed (the same condition it would be in if the temperature was above 200 °F).

Refueling is a condition where, while in *cold shutdown*, the *Reactor Coolant System* is opened up to allow the movement of *fuel assemblies* in and out of the *reactor pressure vessel* or maintenance to system components. When the operators prepare to remove the spent *fuel assemblies*, the top of the *reactor pressure vessel* (*reactor vessel head*) is removed and the *refueling cavity* is filled with water.

The water in the *refueling cavity* serves two functions:

- 1) It shields station workers from radiation given off by the *fuel assemblies*.
and
- 2) It cools the *fuel assemblies* by removing the *decay heat* the *fission products* are still producing.

Normally a small amount of monitored water (*reactor coolant*) is expected to leak from the components

which make up the *Reactor Coolant System*. Plant operators continuously monitor the amount of this leakage in two ways, by measuring:

- 1) The rate at which water collection tanks (*Containment Sumps* or *Waste Holdup Tank*) that collect the leakage fill up.

and

- 2) The rate at which water must be added to the *reactor coolant system*.

The threshold specified in EAL CU1.1 represents a condition during *cold shutdown* or *refueling* mode where the amount of water in the *reactor pressure vessel* has reached a specific level for 15 minutes or longer due to an *unplanned* event. Therefore, this EAL requires that the plant declare an Unusual Event.

The threshold specified in EAL CU1.2 represents a condition during *cold shutdown* or *refueling* mode where plant operators are unable to monitor the level in the *reactor pressure vessel* and an *unplanned* level rise has been seen in plant components (*Containment Sumps* or *Waste Holdup Tank*) that indicate a lowering in *reactor pressure vessel* or *refueling cavity* water level. Therefore, this EAL requires that the plant declare an Unusual Event.

These conditions pose no threat to the safety of the general public.

Further degradation of plant conditions may result in an escalation in the emergency level.

Cold Shutdown/Refueling System Malfunction		
CU2	UNUSUAL EVENT	CU2
Loss of AC Power		

Brief Description:

All alternating current (AC) electrical power sources except for one, either on-site or off-site, have been lost for more than 15 minutes with the plant in cold shutdown mode, refueling mode, or defueled. Power is still available from a single source. Current plant conditions DO NOT threaten public safety.

Detailed Description:

The *reactor coolant temperature* is at or below a temperature of 200 °F.

Much of the equipment in the plant, including important pumps and valves in safety systems, is powered by AC electrical power. There are a number of main and backup sources for this type of power, including:

- 1) Off-site AC power, which is supplied from outside the station through electric power transmission lines, passes through *transformers*, then is distributed on-site by networks called *buses*.
- 2) On-site AC power, which is produced by the plant or by *diesel-driven electric generators*. This power supply is totally independent of the off-site electric transmission lines.

The threshold specified in EAL CU2.1 represents a condition during *cold shutdown mode, refueling mode, or defueled* where only one AC power source is available for more than 15 minutes. The plant is relying on this single AC power source to run *vital equipment* needed to cool the plant.

This EAL threshold poses no threat to the safety of plant personnel or the general public.

Further degradation of plant conditions may result in an escalation in the emergency level.

CU3	Cold Shutdown/Refueling System Malfunction UNUSUAL EVENT Loss of Decay Heat Removal Capability	CU3
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Brief Description:

Equipment needed to maintain the reactor water temperature below the boiling point has been lost with the plant in cold shutdown or refueling mode. Current plant conditions DO NOT threaten public safety.

Detailed Description:

There are six defined plant operational conditions (modes) and *cold shutdown* is one of them. *Cold shutdown* refers to a plant condition where:

- 1) The *reactor* is *shutdown*; that is, the nuclear chain reaction has stopped.
and
- 2) The *Reactor Coolant Temperature* is at or below a temperature of 200 °F.
and
- 3) The *Reactor Coolant System* is closed (the same condition it would be in if the temperature was above 200 °F).

During *cold shutdown* conditions, the reactor *core* is cooled by water in the *Reactor Coolant System*. This water is pumped through the piping and *reactor pressure vessel*. This water keeps the *core* completely covered and removes heat at all times.

Refueling is a condition where, while in *cold shutdown*, the *Reactor Coolant System* is opened up to allow the movement of *fuel assemblies* in and out of the *reactor pressure vessel* or maintenance to system components. When the operators prepare to remove the spent *fuel assemblies*, the top of the *reactor pressure vessel* (*reactor vessel head*) is removed and the *refueling cavity* is filled with water. Water in the *refueling cavity* is pumped through the piping and *reactor pressure vessel* which keeps the *core* completely covered while removing *decay heat* at all times.

The threshold specified in EAL CU3.1 represents conditions during *cold shutdown* and *refueling* where plant operators are unable to maintain the *reactor coolant temperature* below 200 °F due to an *unplanned* event. These conditions indicate a loss of the ability to remove *decay heat*. Therefore, this EAL

threshold requires the plant to declare an Unusual Event.

The threshold specified in EAL CU3.2 represents a condition during *cold shutdown* or *refueling* where plant operators are unable to monitor the *reactor coolant temperature* and *reactor pressure vessel level* for 15 minutes or more due to a loss of temperature and level indications. Therefore, this EAL threshold requires the plant to declare an Unusual Event.

These EAL thresholds pose no threat to the safety of plant personnel or the general public.

Escalation to a higher emergency level may be required if plant operators observe additional indications of significant water loss or temperature increases.

Cold Shutdown/Refueling System Malfunction		
CU4	UNUSUAL EVENT	CU4
Loss of DC Power		

Brief Description:

All sources of direct current (DC) electrical power are degraded while the plant is in cold shutdown or refueling mode. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Certain components and control devices – including many essential to monitoring or controlling the reactor *safety systems* – are powered by DC electrical power. This DC electrical power is usually obtained from redundant sets of reliable power supplies and batteries, then distributed to the components and controls through conductors (*buses*). If the voltage from all of these redundant supplies and batteries becomes low or is lost altogether, the safety systems would be less likely to perform as they should.

The threshold specified in EAL CU4.1 represents a condition during *cold shutdown* or *refueling* mode where all of the DC power supplies are degraded for 15 minutes or longer. Because the plant was in *cold shutdown* or *refueling* mode, plant operators have additional time to restore power before any serious plant damage would occur.

Although DC power is degraded, AC (alternating current) power is still available. Even though the degraded DC power system affects the ability to monitor or control many plant components, not all electrically operated equipment has been lost. Therefore, this EAL threshold requires the plant to declare an Unusual Event.

This EAL threshold poses no threat to the safety of plant personnel or the general public.

Further degradation of plant conditions may result in an escalation in the emergency level.

Cold Shutdown/Refueling System Malfunction		
CU5	UNUSUAL EVENT	CU5
Loss of Communications Capability		

Brief Description:

On-site or off-site communications equipment has been lost. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Plant personnel must be able to communicate throughout the station to safely operate the plant. Many communications systems are available on-site to perform required routine tasks (telephones, plant page system, or radios).

Plant personnel must also be able to communicate problems to off-site authorities and request assistance if needed. Many systems are also available to perform these communications as required (normal telephones, dedicated telephones/lines, and radios).

The threshold specified in EAL CU5.1 represents a condition during *cold shutdown* mode, *refueling* mode, or *defueled* where all on-site communications systems are unavailable. Since this condition may affect the ability of plant personnel to perform routine tasks, plant personnel will declare an Unusual Event.

The threshold specified in EAL CU5.2 represents a condition during *cold shutdown* mode, *refueling* mode, or *defueled* where all off-site communications systems used to notify local and state response organizations are unavailable. Since this condition may affect the ability of plant personnel to notify response organizations of an event or request support, plant personnel will declare an Unusual Event.

The threshold specified in EAL CU5.3 represents a condition during *cold shutdown* mode, *refueling* mode, or *defueled* where all off-site communications systems used to notify the Nuclear Regulatory Commission (NRC) are unavailable. Since this condition may affect the ability of plant personnel to notify the NRC of an event or request support, plant personnel will declare an Unusual Event.

These EAL thresholds pose no threat to the safety of plant personnel or the general public.

SECTION E

INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI)

Recognition Category ‘E’ Initiating Condition Matrix

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
			EU1 Damage To Loaded Cask Confinement Boundary.

Independent Spent Fuel Storage Installation		
EU1	UNUSUAL EVENT	EU1
Damage to Loaded Cask Confinement Boundary		

Brief Description:

Damage to a loaded spent fuel storage cask has occurred as indicated by increased radiation levels. Current plant conditions DO NOT threaten public safety.

Detailed Description:

After *reactor fuel assemblies* are no longer used for the fission process they are removed from the *reactor pressure vessel* and stored in the *Spent Fuel Pool*. The used reactor fuel assemblies (*spent fuel*) remain in the *Spent Fuel Pool* for a period of time that allows the by-products of the fission process (*fission products*) to decay, minimizing the heat produced by the *spent fuel assemblies* (at least five years).

Once the *spent fuel assemblies* have been sufficiently cooled, they are transferred to a storage cask that allows for long term dry storage outside of the *Spent Fuel Pool*. Prairie Island Nuclear Generating Plant (PINGP) is licensed to operate an *Independent Spent Fuel Storage Installation (ISFSI)* within the owner controlled area of the plant for temporary storage of the used reactor *fuel*. The used reactor *fuel* is loaded into a robust storage cask and transported to the *ISFSI* for long term temporary safe storage or until it can be transferred to a permanent storage facility.

The threshold specified in EAL EU1 represents a condition where an event has occurred that has damaged the *confinement boundary* of the storage cask as indicated by increased radiation levels. Therefore, this EAL threshold requires plant personnel to declare an Unusual Event.

This EAL threshold poses no threat to the safety of plant personnel or the general public.

SECTION F

FISSION PRODUCT BARRIER DEGRADATION

Recognition Category ‘F’ Initiating Condition Matrix

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
FG1 Loss of any two barriers and Loss or Potential Loss of the third barrier.	FS1 Loss or Potential Loss of two barriers.	FA1 Any Loss or any Potential Loss of either the Fuel Clad or RCS barrier.	

FG1	Fission Product Barrier Degradation GENERAL EMERGENCY Loss of Two Fission Product Barriers and Loss/Potential Loss of the Third	FG1
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Brief Description:

Loss of two of three fission product barriers with actual or potential loss of the third barrier. Protective actions will be recommended for the public.

Detailed Description:

Fission product barriers are plant structures specifically designed to hold in (contain) and prevent the spread of radioactive materials (*fission products*) created during the nuclear reaction. For the purpose of the PINGP Emergency Plan, there are three *fission product barriers*, one inside the other:

- 1) *Fuel Cladding*
- 2) *Reactor Coolant System*
- 3) *Containment*

As long as any one of these barriers stays intact, significant amounts of radioactive *fission products* **cannot** be released outside of the plant. However, if it is determined that two of the three barriers have failed and a third is potentially or actually failed, a General Emergency will be declared.

There are certain conditions under which each of these *fission product barriers* could fail:

Fuel Cladding: The *fuel cladding* forms the first *fission product barrier*. The sealed metal tubes surrounding the fuel pellets would fail to contain radioactive material (*fission products*) if the *core* is not cooled enough. This could happen if there is not enough water circulating around the metal tubes to cool them, or if a loose part hits and damages the *fuel cladding*.

Normally the reactor *core* is kept covered with water to remove the heat. Even when the reactor is *shutdown*, the nuclear *fuel* produces a significant amount of *decay heat* which must be removed. Without cooling water to remove this heat, the *fuel cladding* could overheat and crack.

In the worst case, a loss of cooling water (*loss of coolant accident*) could be combined with a failure of the back-up systems (*emergency core cooling systems*) that pump additional water to the *reactor pressure vessel* cooling the *reactor fuel assemblies*. This would lead to the *reactor fuel assemblies* becoming uncovered and inadequately cooled. Inadequate cooling would result in the *fuel cladding* becoming damaged.

Reactor Coolant System: The *reactor coolant system* could fail to hold in radioactive materials if radioactive water or steam leaks from it. The *reactor coolant system* forms the second *fission product barrier*. To function as an effective barrier against the release of radioactive materials it must remain intact, withstanding the pressure and temperature created by the water as it boils into steam. If the pressure within the *reactor pressure vessel* becomes too high, or if a mechanical failure occurs, the vessel or piping could fail, allowing steam and water to escape into the layer of protection which lies outside it (*containment*).

Containment: The third *fission product barrier*, *containment*, is specifically designed to hold in energy from the steam and prevent the release of radioactive materials if the first and second *fission product barriers* fail. Certain unlikely conditions might threaten the integrity of the *containment*. They are:

- 1) Too high a temperature in the containment
- 2) Too high a pressure in the containment
- 3) Combustible gas mixture in containment (hydrogen)
- 4) Mechanical failure of a containment isolation system

The threshold specified in EAL FG1 identifies conditions where the potential exists for a significant release of radioactive fission products outside of the plant. This condition warrants declaration of a General Emergency.

Since these conditions could pose a threat to the public, utility personnel will recommend that the state and local authorities consider appropriate protective actions.

FS1	Fission Product Barrier Degradation SITE AREA EMERGENCY	FS1
Loss or Potential Loss of any Two Fission Product Barriers		

Brief Description:

Loss or potential loss of two of three fission product barriers.

Detailed Description:

Fission product barriers are plant structures specifically designed to hold in (contain) and prevent the spread of radioactive materials (*fission products*) created during the nuclear reaction. For the purpose of the PINGP Emergency Plan, there are three *fission product barriers*, one inside the other:

- 1) *Fuel Cladding*
- 2) *Reactor Coolant System*
- 3) *Containment*

As long as any one of these barriers stays intact, significant amounts of radioactive *fission products* **cannot** be released outside of the plant. However, if it is determined that two of the three barriers have failed or potentially failed, a Site Area Emergency will be declared.

There are certain conditions under which each of these *fission product barriers* could fail:

Fuel Cladding: The *fuel cladding* forms the first *fission product barrier*. The sealed metal tubes surrounding the fuel pellets would fail to contain radioactive material (*fission products*) if the *core* is not cooled enough. This could happen if there is not enough water circulating around the metal tubes to cool them, or if a loose part hits and damages the *fuel cladding*.

Normally the reactor *core* is kept covered with water to remove the heat. Even when the reactor is *shutdown*, the nuclear fuel produces a significant amount of *decay heat* which must be removed. Without cooling water to remove this heat, the *fuel cladding* could overheat and crack.

In the worst case, a loss of cooling water (*loss of coolant accident*) could be combined with a failure of the back-up systems (*emergency core cooling systems*) that pump additional water to the *reactor pressure vessel* cooling the *reactor fuel assemblies*. This would lead to the *reactor fuel assemblies* becoming

uncovered and inadequately cooled. Inadequate cooling would result in the *fuel cladding* becoming damaged.

Reactor Coolant System: The *reactor coolant system* could fail to hold in radioactive materials if radioactive water or steam leaks from it. The *reactor coolant system* forms the second *fission product barrier*. To function as an effective barrier against the release of radioactive materials it must remain intact, withstanding the pressure and temperature created by the water as it boils into steam. If the pressure within the *reactor pressure vessel* becomes too high, or if a mechanical failure occurs, the vessel or piping could fail, allowing steam and water to escape into the layer of protection which lies outside it (*containment*).

Containment: The third *fission product barrier*, *containment*, is specifically designed to hold in energy from the steam and prevent the release of radioactive materials if the first and second *fission product barriers* fail. Certain unlikely conditions might threaten the integrity of the *containment*. They are:

- 1) Too high a temperature in the containment
- 2) Too high a pressure in the containment
- 3) Combustible gas mixture in containment (hydrogen)
- 4) Mechanical failure of a containment isolation system

The threshold specified in EAL FS1 identifies a condition where the plant operators have determined that two of the three fission product barriers have failed or potentially failed. This condition warrants declaration of a Site Area Emergency.

Fission Product Barrier Degradation**FA1****ALERT****FA1****Loss/Potential Loss of the Fuel Cladding or Reactor Coolant System****Brief Description:**

There are indications of a loss or potential loss of either the Fuel Cladding or Reactor Coolant System barrier. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Fission product barriers are plant structures specifically designed to hold in (contain) and prevent the spread of radioactive materials (*fission products*) created during the nuclear reaction. For the purpose of the PINGP Emergency Plan, there are three *fission product barriers*, one inside the other:

- 1) *Fuel Cladding*
- 2) *Reactor Coolant System*
- 3) *Containment*

As long as any one of these barriers stays intact, significant amounts of radioactive *fission products* **cannot** be released outside of the plant. However, if it is determined that any loss or any potential loss of either the Fuel Cladding or Reactor Coolant System *fission product barrier* has or will potentially occur, an Alert will be declared.

There are certain conditions under which either the Fuel Cladding or Reactor Coolant System *fission product barrier* could fail:

Fuel Cladding: The *fuel cladding* forms the first *fission product barrier*. The sealed metal tubes surrounding the fuel pellets would fail to contain radioactive material (*fission products*) if the *core* is not cooled enough. This could happen if there is not enough water circulating around the metal tubes to cool them, or if a loose part hits and damages the *fuel cladding*.

Normally the reactor *core* is kept covered with water to remove the heat. Even when the reactor is *shutdown*, the nuclear fuel produces a significant amount of *decay heat* which must be removed. Without cooling water to remove this heat, the *fuel cladding* could overheat and crack.

In the worst case, a loss of cooling water (*loss of coolant accident*) could be combined with a failure of the back-up systems (*emergency core cooling systems*) that pump additional water to the *reactor pressure vessel* cooling the *reactor fuel assemblies*. This would lead to the *reactor fuel assemblies* becoming uncovered and inadequately cooled. Inadequate cooling would result in the *fuel cladding* becoming damaged.

Reactor Coolant System: The *reactor coolant system* could fail to hold in radioactive materials if radioactive water or steam leaks from it. The *reactor coolant system* forms the second *fission product barrier*. To function as an effective barrier against the release of radioactive materials it must remain intact, withstanding the pressure and temperature created by the water as it boils into steam. If the pressure within the *reactor pressure vessel* becomes too high, or if a mechanical failure occurs, the vessel or piping could fail, allowing steam and water to escape into the layer of protection which lies outside it (*containment*).

The threshold specified in EAL FA1 identifies a condition where the plant operators have determined that there is a loss or potential loss of the Fuel Cladding or Reactor Coolant System *fission product barriers*. This condition warrants declaration of an Alert.

This EAL threshold poses no threat to the safety of the general public.

SECTION H

HAZARDS AND OTHER CONDITIONS

Recognition Category ‘H’ Initiating Condition Matrix

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
HG1 Security.	HS1 Security.	HA1 Security.	HU1 Security.
			HU2 Earthquake.
			HU3 Hazardous event affecting the site.
			HU4 Fire.
		HA5 Gaseous release.	
	HS6 Control Room Evacuation.	HA6 Control Room Evacuation.	
HG7 Miscellaneous Events.	HS7 Miscellaneous Events.	HA7 Miscellaneous Events.	HU7 Miscellaneous Events.

HG1	Hazards and Other Conditions GENERAL EMERGENCY Security	HG1
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Brief Description:

Station security has been compromised in a way that has caused a loss of physical control of the plant or caused the loss of the ability to maintain cooling of the fuel assemblies stored in the Spent Fuel Pool such that fuel damage is likely. Protective actions will be recommended for the public.

Detailed Description:

Property surrounding and controlled by plant personnel is contained within two distinct boundaries, the *Owner Controlled Area* and the *Protected Area*.

The *Owner Controlled Area (OCA)* boundary is the outermost zone and lies outside the *Protected Area (PA)* boundary. The OCA consists of the property surrounding the station. This area is bounded by the outermost fence and controlled for security purposes.

The *Protected Area (PA)* boundary is the innermost zone and includes plant *vital structures* and is surrounded by a security fence. Access to this area is restricted to authorized personnel and controlled by the station's Security Force. There are two separate protected areas within the Prairie Island Nuclear Generating Plant (PINGP) *Owner Controlled Area* - the *Independent Spent Fuel Storage Installation (ISFSI) PA* and the *Plant PA*. All PINGP *vital areas* are contained inside the *Plant PA*.

The threshold specified in EAL HG1.1 identifies one of two security conditions:

- 1) A security condition that exists due to a *hostile force* intrusion which has resulted in the loss of physical control of equipment required to maintain safety functions and control of that equipment **cannot** be transferred to and operated from another location. These safety functions are reactivity control (ability to *shutdown* the reactor and keep it *shutdown*), core cooling (ability to cool the *fuel assemblies* in the reactor *core*), and RCS heat removal (ability to maintain a *heat sink*).

- 2) A security condition that exists due to a *hostile force* intrusion which has resulted in the failure of the *spent fuel pool* or *spent fuel pool* cooling systems and damage to the *spent fuel assemblies* in the *spent fuel pool* is *imminent*.

If either of these security conditions exist, then station personnel would be required to declare a General Emergency. Station personnel would inform appropriate law enforcement agencies as well as those agencies normally notified during a General Emergency.

Since these conditions could pose a threat to the public, utility personnel will recommend that the state and local authorities consider appropriate protective actions.

HG7	Hazards and Other Conditions GENERAL EMERGENCY Micellaneous Events	HG7
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Brief Description:

A condition exists which indicates an actual or imminent release of radioactivity as large as that associated with a General Emergency. Protective actions will be recommended for the public.

Detailed Description:

The threshold specified in EAL HG7.1 provides the *Emergency Director* with the latitude to declare a General Emergency based on his or her own experience and judgment. It applies to any condition (not already described by another specific EAL threshold), including an actual loss of physical control of the plant due to *hostile action*, which involves the actual or potential release of radioactive material in amounts requiring protective actions for the public. Any releases of radioactive material can be reasonably expected to exceed *EPA Protective Action Guideline (PAG)* exposure levels off-site for more than the immediate site area.

This EAL threshold requires declaration of a General Emergency.

Since these conditions could pose a threat to the public, utility personnel will recommend that the state and local authorities consider appropriate protective actions.

HS1	Hazards and Other Conditions SITE AREA EMERGENCY Security	HS1
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Brief Description:

The site has come under a dedicated attack by a hostile force that has penetrated the plant Protected Area (PA). This condition, by itself, poses no immediate threat to public safety.

Detailed Description:

Property surrounding and controlled by plant personnel is contained within two distinct boundaries, the *Owner Controlled Area* and the *Protected Area*.

The *Owner Controlled Area (OCA)* boundary is the outermost zone and lies outside the *Protected Area (PA)* boundary. The OCA consists of the property surrounding the station. This area is bounded by the outermost fence and controlled for security purposes.

The *Protected Area (PA)* boundary is the innermost zone and includes plant *vital structures* and is surrounded by a security fence. Access to this area is restricted to authorized personnel and controlled by the station's Security Force. There are two separate protected areas within the Prairie Island Nuclear Generating Plant (PINGP) *Owner Controlled Area* - the *Independent Spent Fuel Storage Installation (ISFSI) PA* and the *Plant PA*. All PINGP *vital areas* are contained inside the *Plant PA*.

The threshold specified in EAL HS1.1 identifies a security condition in which a *hostile action* is occurring or has occurred within the PINGP Plant PA. A *hostile action* is an act directed toward PINGP or its personnel that includes the use of violent force to destroy equipment, take hostages, and/or intimidate utility personnel to achieve an end. This includes attack by air, land, or water using guns, explosives, projectiles, vehicles, or other devices to deliver destructive force. It does not include acts of civil disobedience or felonious acts that are not part of a concerted attack on PINGP which are addressed by other EAL thresholds. This EAL threshold is not based solely on the potential for a radiological release. Rather, the condition includes the need for off-site assistance due to the possibility for significant and indeterminate damage from additional *hostile action*. Therefore, this security condition warrants declaration of a Site Area Emergency.

HS6	Hazards and Other Conditions SITE AREA EMERGENCY Control Room Evacuation	HS6
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Brief Description:

The Control Room has been evacuated and plant operators have been unable to establish control of plant systems from remote locations within 15 minutes.

Detailed Description:

Normally the plant is operated, monitored, and controlled from the *Control Room*. If fire, smoke, radiological hazards, or other events were to force plant operators from the *Control Room*, they would still be able to take control of the plant from another location (*Hot Shutdown Panel*). From this panel plant operators can perform critical safety functions normally performed from the *Control Room*.

The thresholds specified in EAL HS6.1 represent conditions in which plant operators have evacuated the *Control Room* but have been unable to gain control of critical plant safety functions from the *Hot Shutdown Panel* within a reasonable amount of time (15 minutes). These safety functions are reactivity control (ability to *shutdown* the *reactor* and keep it *shutdown*), core cooling (ability to cool the *fuel assemblies* in the *reactor core*), and RCS heat removal (ability to maintain a *heat sink*). If control of these safety functions cannot be established in a reasonable amount of time, the ability to maintain the *reactor* in a safe and stable condition is degraded. Therefore, this conditions warrants declaration of a Site Area Emergency.

HS7	Hazards and Other Conditions SITE AREA EMERGENCY Miscellaneous Events	HS7
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Brief Description:

Conditions in the plant exist which call for the kind of response associated with a Site Area Emergency classification.

Detailed Description:

The threshold specified in EAL HS7.1 provides the *Emergency Director* with the latitude to declare a Site Area Emergency based on his or her own experience and judgment. It applies to any condition (not already described by another specific EAL threshold), including the results of a *hostile action*, which involves the actual or potential failures of plant *safety systems* needed to maintain the *reactor* in a safe condition and to protect the public. Therefore, this condition warrants a declaration of a Site Area Emergency.

Hazards and Other Conditions		
HA1	ALERT Security	HA1

Brief Description:

*The site has come under a dedicated attack by a hostile force within the Owner Controlled Area; **OR**, the site has been informed by the NRC of a credible threat of an aircraft attack within 30 minutes. Current plant conditions DO NOT threaten public safety.*

Detailed Description:

Property surrounding and controlled by plant personnel is contained within two distinct boundaries, the *Owner Controlled Area* and the *Protected Area*.

The *Owner Controlled Area (OCA)* boundary is the outermost zone and lies outside the *Protected Area (PA)* boundary. The OCA consists of the property surrounding the station. This area is bounded by the outermost fence and controlled for security purposes.

The *Protected Area (PA)* boundary is the innermost zone and includes plant *vital structures* and is surrounded by a security fence. Access to this area is restricted to authorized personnel and controlled by the station's Security Force. There are two separate protected areas within the Prairie Island Nuclear Generating Plant (PINGP) *Owner Controlled Area* - the *Independent Spent Fuel Storage Installation (ISFSI) PA* and the *Plant PA*. All PINGP *vital areas* are contained inside the *Plant PA*.

The threshold specified in EAL HA1.1 identifies a security condition in which a *hostile action* is occurring or has occurred within the PINGP *OCA*, which includes the *ISFSI PA*. A *hostile action* is an act directed toward PINGP or its personnel that includes the use of violent force to destroy equipment, take hostages, and/or intimidate utility personnel to achieve an end. This includes attack by air, land, or water using guns, explosives, projectiles, vehicles, or other devices to deliver destructive force. It does not include acts of civil disobedience or felonious acts that are not part of a concerted attack on PINGP which are addressed by other EAL thresholds.

The threshold specified in EAL HA1.2 identifies a security condition in which a very rapid progression of events due to an airborne terrorist attack, such as that experienced on September 11, 2001, is occurring. If

such an attack is directed against PINGP, plant personnel would be notified by the NRC or military personnel if the threat is estimated to be within 30 minutes of the site.

These EAL thresholds are not based solely on the potential for a radiological release. Rather the conditions include the need for off-site assistance due to the possibility for significant and indeterminate damage from a *hostile action*. Therefore, these security conditions warrant a declaration of an Alert.

These conditions pose no threat to the safety of the general public.

Hazards and Other Conditions		
HA5	ALERT	HA5
Gaseous Release		

Brief Description:

Access to rooms or plant areas containing plant equipment used for normal plant operations or normal shutdown and cooldown is prohibited or impeded due to the release of a toxic, corrosive, asphyxiant, or flammable gas. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Various rooms and areas contain plant equipment that is used during normal plant operations or whenever the plant is being *shutdown*. Access to these rooms/areas is required to operate equipment during these time frames. A release of potentially harmful quantities of hazardous gases into these rooms/areas that prohibits or impedes access for normal plant operations or *shutdown* could affect the safe operation of the plant.

The threshold for EAL HA5.1 identifies specific rooms/areas requiring access by plant operators. If access to these rooms/areas is prohibited or impeded due to a release of a hazardous gas, then plant personnel will declare an Alert.

This EAL threshold poses no threat to the safety of the general public.

Hazards and Other Conditions		
HA6	ALERT	HA6
Control Room Evacuation		

Brief Description:

The Control Room is being evacuated. Control of plant systems is being established from another location within the plant. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Normally the plant is operated, monitored, and controlled from the *Control Room*. If fire, smoke, radiological hazards, or other events were to force plant operators from the *Control Room*, they would still be able to take control of the plant from another location (*Hot Shutdown Panel*). From this panel plant operators can perform critical safety functions normally performed from the *Control Room*.

The threshold specified in EAL HS6.1 represents a condition in which plant operators have started an evacuation of the *Control Room* to gain control of critical plant safety functions from the *Hot Shutdown Panel*. These safety functions are reactivity control (ability to *shutdown* the *reactor* and keep it *shutdown*), core cooling (ability to cool the *fuel assemblies* in the reactor *core*), and RCS heat removal (ability to maintain a *heat sink*). This condition warrants declaration of an Alert. If control of the safety functions cannot be established in a reasonable amount of time after evacuating the *Control Room*, a higher level of emergency would likely be declared.

This EAL threshold poses no threat to the safety of the general public.

Hazards and Other Conditions		
HA7	ALERT	HA7
Miscellaneous Events		

Brief Description:

Conditions in the plant exist which call for the kind of response associated with an Alert classification. Current plant conditions DO NOT threaten public safety.

Detailed Description:

The threshold specified in EAL HA7.1 provides the *Emergency Director* with the latitude to declare an Alert based on his or her own experience and judgment. It applies to any condition (not already described by another specific EAL threshold), including the results of a *hostile action*, which involves the actual or potential substantial decrease in the level of safety of the plant. Therefore, this condition warrants a declaration of an Alert.

This condition poses no threat to the safety of the general public.

Hazards and Other Conditions		
HU1	UNUSUAL EVENT	HU1
Security		

Brief Description:

A credible threat to the physical security of the plant has been received. Current plant conditions DO NOT threaten public safety.

Detailed Description:

EAL threshold HU1.1 addresses security events that constitute a threat/compromise to site security, a threat/risk to site personnel, or a potential degradation to the level of safety of the plant. These events do not include *hostile actions*; that is, they do not include the use of violent force to destroy equipment, take hostages, and/or intimidate the plant staff to achieve an end. Therefore, this condition warrants an Unusual Event declaration.

EAL threshold HU1.2 addresses credible threat notifications received by Prairie Island Nuclear Generating Plant (PINGP) personnel. The intent of this threshold is to ensure that notifications of the security threat are made in a timely manner so that emergency response personnel are at a state of heightened awareness regarding the threat. Therefore, this condition warrants an Unusual Event declaration.

EAL threshold HU1.3 is met whenever PINGP personnel receive information regarding an aircraft threat from the NRC. The intent of this threshold is to ensure that notifications of the security threat are made in a timely manner so that emergency response personnel are at a state of heightened awareness regarding the threat. Therefore, this condition warrants an Unusual Event declaration.

These EAL thresholds pose no threat to the safety of the general public.

Hazards and Other Conditions		
HU2	UNUSUAL EVENT	HU2
Earthquake		

Brief Description:

An earthquake (seismic event), affecting the site, has occurred. Current plant conditions DO NOT threaten public safety.

Detailed Description:

EAL threshold HU2.1 addresses a seismic event (earthquake) that results in ground motion detected at the plant site that may affect the operation of the plant (*Operational Basis Earthquake - OBE*). An earthquake greater than an *OBE* should have no significant impact on plant systems, structures and components required to protect public health and safety; however, some time may be required for the plant staff to determine the actual post-event condition of the plant (e.g., perform plant walk-downs and post-event inspections). Given the time necessary to perform these walk-downs and inspections, and to fully understand any impact, this event represents a potential degradation to the level of safety of the plant. Therefore, plant personnel will declare an Unusual Event.

This condition poses no threat to the safety of the general public.

HU3	Hazards and Other Conditions UNUSUAL EVENT Hazardous Event Affecting the Site	HU3
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Brief Description:

A hazardous event, natural or destructive, has occurred within the plant protected area of the station. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Property surrounding and controlled by plant personnel is contained within two distinct boundaries, the *Owner Controlled Area* and the *Protected Area*.

The *Owner Controlled Area (OCA)* boundary is the outermost zone and lies outside the *Protected Area (PA)* boundary. The *OCA* consists of the property surrounding the station. This area is bounded by the outermost fence and controlled for security purposes.

The *Protected Area (PA)* boundary is the innermost zone and includes plant *vital structures* and is surrounded by a security fence. Access to this area is restricted to authorized personnel and controlled by the station's Security Force. There are two separate protected areas within the Prairie Island Nuclear Generating Plant (PINGP) *Owner Controlled Area* - the *Independent Spent Fuel Storage Installation (ISFSI) PA* and the *Plant PA*. All PINGP *vital areas* are contained inside the *Plant PA*.

The plant and its equipment are designed to withstand most natural events (floods, tornados, etc.) or any hazardous conditions which may occur from other destructive events (offsite chemical spills or toxic gas release, impeded plant access, etc.).

EAL thresholds HU3.1, HU3.2, HU3.3, HU3.4, and HU3.5 address one of the following events that has occurred:

- A tornado striking within the plant PA (HU3.1)
- Uncontrolled flooding in areas of the plant which may affect a *safety system* component (HU3.2)
- An offsite event involving hazardous materials impeding the movement of personnel within the *Plant PA* (HU3.3)
- Access to the site by plant personnel traveling in personal vehicles is prohibited due to hazardous event conditions on-site (HU3.4)
- High or Low river level which may affect the performance of plant systems (HU3.5)

These EAL thresholds require that an Unusual Event be declared.

These conditions pose no threat to the safety of the general public.

Hazards and Other Conditions		
HU4	UNUSUAL EVENT	HU4
Fire		

Brief Description:

A fire with the potential to degrade the safety of the plant has occurred. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Property surrounding and controlled by plant personnel is contained within two distinct boundaries, the *Owner Controlled Area* and the *Protected Area*.

The *Owner Controlled Area (OCA)* boundary is the outermost zone and lies outside the *Protected Area (PA)* boundary. The *OCA* consists of the property surrounding the station. This area is bounded by the outermost fence and controlled for security purposes.

The *Protected Area (PA)* boundary is the innermost zone and includes plant *vital structures* and is surrounded by a security fence. Access to this area is restricted to authorized personnel and controlled by the station's Security Force. There are two separate protected areas within the Prairie Island Nuclear Generating Plant (PINGP) *Owner Controlled Area* - the *Independent Spent Fuel Storage Installation (ISFSI) PA* and the *Plant PA*. All PINGP *vital areas* are contained inside the *Plant PA*.

A fire may be detected by visual observation (report from the field), multiple fire alarms or indications, or verification of a single fire alarm. Any significant fire that occurs within *Plant PA* or *ISFSI PA* potentially threatens plant safety. Those large enough to require *fire brigade* activation might both endanger personnel and cause significant property damage. In addition, the *Fire Brigade Leader* shall evaluate the need for off-site firefighting assistance and request these resources if needed.

EAL threshold HU4.1 applies to fires within a specific plant room or area containing *safety system* equipment that are not extinguished within 15 minutes of detection.

EAL threshold HU4.2 applies to receipt of a single fire alarm for a specific plant room or area containing *safety system* equipment that cannot be confirmed within 30 minutes of the alarm receipt.

EAL threshold HU4.3 applies to fires within the *Plant* or *ISFSI PA*, outside of specific plant rooms or areas containing *safety system* equipment, which are not extinguished within 60 minutes of the initial fire report, alarm, or indication.

EAL threshold HU4.4 applies to fires within the *Plant* or *ISFSI PA* that requires the firefighting support of off-site fire response agencies to extinguish.

These EAL thresholds require that an Unusual Event be declared.

These conditions pose no threat to the safety of the general public.

Depending on how severe the fire is and its impact on the plant, a higher level of emergency might be declared.

Hazards and Other Conditions		
HU7	UNUSUAL EVENT	HU7
Miscellaneous Events		

Brief Description:

Conditions in the plant exist which call for the heightened awareness and notifications associated with an Unusual Event Classification. Current plant conditions DO NOT threaten public safety.

Detailed Description:

The threshold specified in EAL HU7.1 provides the *Emergency Director* with the latitude to declare an Unusual Event based on his or her own experience and judgment. It applies to any condition (not already described by another specific EAL), including a security threat, which potentially threatens the safety of the plant. Therefore, this condition warrants an Unusual Event declaration.

This condition poses no threat to the safety of the general public.

SECTION S

SYSTEM MALFUNCTION

Recognition Category ‘S’ Initiating Condition Matrix

GENERAL EMERGENCY	SITE AREA EMERGENCY	ALERT	UNUSUAL EVENT
SG1 Loss of AC power.	SS1 Loss of AC power.	SA1 Loss of AC power.	SU1 Loss of AC power.
		SA2 Loss of Assessment Capability.	SU2 Loss of Assessment Capability.
			SU3 Reactor Coolant System Activity.
			SU4 Reactor Coolant System Leakage.
	SS5 Reactor Power.	SA5 Reactor Power.	SU5 Reactor Power.
			SU6 Loss of Communications Capabilities.
			SU7 Loss of Containment.
SG8 Loss of AC and DC power.	SS8 Loss of DC power.		
		SA9 Hazardous event affecting the site.	

SG1	System Malfunction GENERAL EMERGENCY Loss of AC Power	SG1
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Brief Description:

All alternating current (AC) electrical power from off-site and on-site electrical power sources has been lost and it is not expected to be restored for a prolonged period of time. Protective actions will be recommended for the public.

Detailed Description:

Much of the equipment in the plant, including important pumps and valves in *safety systems*, is powered by AC electrical power. There are a number of main sources and backup sources for this type of power, including:

- 1) Off-site AC power, which is supplied from outside the station through electric power transmission lines, passes through *transformers*, then is distributed on-site by networks called *buses*.
- 2) On-site AC power, which is produced by the plant or by *diesel-driven electric generators*. This power supply is totally independent of the off-site electric transmission lines.

The thresholds specified in EAL SG1.1 represents a condition where all the off-site AC power and all the on-site AC power sources are unavailable to operate *vital equipment*. If all AC power is lost for a prolonged period of time (longer than 4 hours), the ability to cool the *reactor fuel assemblies* could be lost.

Since these conditions could pose a threat to the public, utility personnel will recommend that the state and local authorities consider appropriate protective actions.

SG8	System Malfunction GENERAL EMERGENCY Loss of AC and DC Power	SG8
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Brief Description:

All alternating current (AC) electrical power from off-site and on-site electrical power sources has been lost concurrent with the loss of direct current (DC) electrical power for 15 minutes or longer. Protective actions will be recommended for the public.

Detailed Description:

Much of the equipment in the plant, including important pumps and valves in *safety systems*, is powered by AC electrical power. There are a number of main sources and backup sources for this type of power, including:

- 1) Off-site AC power, which is supplied from outside the station through electric power transmission lines, passes through *transformers*, then is distributed on-site by networks called *buses*.
- 2) On-site AC power, which is produced by the plant or by *diesel-driven electric generators*. This power supply is totally independent of the off-site electric transmission lines.

Certain components and control devices – including many essential to controlling and monitoring the reactor *safety systems* – are powered by DC electrical power. This DC electrical power is usually obtained from redundant sets of reliable power supplies and batteries, then distributed to the components and controls through conductors (*buses*). If the voltage from all of these redundant supplies and batteries becomes low or is lost altogether, the reactor *safety systems* would be unable to perform as they should.

The thresholds specified in EAL SG8.1 represents a condition where all the off-site AC power and all the on-site AC power sources are unavailable to operate *vital equipment* and all DC power is unavailable to control and monitor reactor *safety systems* for 15 minutes or longer. With a concurrent and sustained loss of all AC and DC power, multiple challenges to the *fission product barriers* exists.

Since these conditions could pose a threat to the public, utility personnel will recommend that the state and local authorities consider appropriate protective actions.

System Malfunction		
SS1	SITE AREA EMERGENCY	SS1
Loss of AC Power		

Brief Description:

All alternating current (AC) electrical power from off-site and on-site power sources has been lost for 15 minutes or longer.

Detailed Description:

Much of the equipment in the plant, including important pumps and valves in *safety systems*, is powered by AC electrical power. There are a number of main sources and backup sources for this type of power, including:

- 1) Off-site AC power, which is supplied from outside the station through electric power transmission lines, passes through *transformers*, then is distributed on-site by networks called *buses*.
- 2) On-site AC power, which is produced by the plant or by *diesel-driven electric generators*. This power supply is totally independent of the off-site electric transmission lines.

The threshold for EAL SS1.1 represents a condition where all off-site and on-site AC electrical power supplies to the reactor *safety systems* required to support cooling of the *reactor fuel assemblies* has been lost for 15 minutes or longer. Therefore, this condition warrants declaration of a Site Area Emergency.

System Malfunction		
SS5	SITE AREA EMERGENCY	SS5
Reactor Power		

Brief Description:

The reactor control rods have failed to shutdown the reactor resulting in a challenge to core cooling or heat removal capability.

Detailed Description:

A *reactor trip* is a way to rapidly *shutdown* the reactor (stop the *fission process* and bring the reactor *sub-critical*) by quickly inserting all *control rods* into the reactor *core*. *Reactor trips* can be initiated either automatically, by the *Reactor Protection System*, or manually, by the operators.

However, if a *reactor trip* is started and the *control rods* do not insert, the *reactor* may not *shutdown* fully. *Emergency Operating Procedures* provide direction to the operators on alternate ways to *shutdown* the *reactor*. If the *reactor* does not fully *shutdown* and alternate ways to shut it down fail, the *reactor* will continue to produce heat.

The threshold specified in EAL SS5.1 represents a condition where both automatic and manual signals to *shutdown* the reactor failed and the reactor is still generating power and heat. Unless plant operators take further action, this condition will threaten one or more of the *fission product barriers*. Therefore, this condition warrants declaration of a Site Area Emergency.

System Malfunction		
SS8	SITE AREA EMERGENCY	SS8
Loss of DC Power		

Brief Description:

DC (Direct Current) electrical power to vital equipment is degraded.

Detailed Description:

Certain components and control devices – including many essential to controlling and monitoring the reactor *safety systems* – are powered by DC electrical power. This DC electrical power is usually obtained from redundant sets of reliable power supplies and batteries, then distributed to the components and controls through conductors (*buses*). If the voltage from all of these redundant supplies and batteries becomes low or is lost altogether, the reactor *safety systems* would be unable to perform as they should.

The threshold specified in EAL SS8.1 represents a condition where all the DC power sources that supply equipment needed to safely *shutdown*, cooldown, and monitor reactor *safety systems* are degraded for 15 minutes or longer.

Although all vital DC power is degraded, AC (alternating current) power is still available. Therefore, while a degraded DC power system affects the ability to control and monitor many plant components, not all electrically operated equipment is lost. This condition warrants declaration of a Site Area Emergency.

SA1	System Malfunction ALERT Loss of AC Power	SA1
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Brief Description:

Many sources of AC (Alternating Current) electrical power have been lost. Only one source of AC power to safety systems has been available for 15 minutes or longer. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Much of the equipment in the plant, including important pumps and valves in *safety systems*, is powered by AC electrical power. There are a number of main sources and backup sources for this type of power, including:

- 1) Off-site AC power, which is supplied from outside the station through electric power transmission lines, passes through *transformers*, then is distributed on-site by networks called *buses*.
- 2) On-site AC power, which is produced by the plant or by *diesel-driven electric generators*. This power supply is totally independent of the off-site electric transmission lines.

The threshold for EAL SA1.1 represents a condition where only one source of AC power has been available to run the equipment needed to safely *shutdown* and cool the plant (*vital equipment*) for 15 minutes or longer. This condition warrants an Alert declaration. If the remaining source of power is lost, a higher level of emergency would be declared.

These conditions pose no threat to the safety of the general public.

SA2	System Malfunction ALERT Loss of Assessment Capability	SA2
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Brief Description:

The capability to monitor alarms or indicators in the control room has been lost for 15 minutes or longer in combination with another plant operating problem. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Plant operators continually monitor the status of the reactor and its associated safety and support systems. They rely on meters, gauges, *annunciators*, indicating lights, computer displays, and printouts to assess reactor and equipment performance. These components are also used to identify problems in a timely manner enabling timely response actions to be taken. In most cases, the operator has more than one instrument or alarm that would indicate problems in a specific area.

The *Control Room annunciators*, meters, and gauges are most crucial to the operator to help ensure that the reactor is operating safely. Key *safety system* parameters that are routinely monitored by plant operators are:

- *Reactor Power*
- *Pressurizer Level*
- *RCS Pressure*
- *Core Exit Temperature*
- *Level in at least one steam generator*
- *Auxiliary Feedwater Flow*

If an *unplanned* event occurs resulting in a significant loss of these indicators and a significant change in plant operating conditions occurs, the ability to adequately monitor and maintain the *reactor* in a safe condition is challenged.

The threshold for EAL SA2.1 represents this condition, which is indicative of degradation of the level of safety of the plant. Therefore, plant personnel will declare an Alert.

This EAL threshold poses no threat to the safety of the general public.

SA5	System Malfunction ALERT Reactor Power	SA5
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Brief Description:

Automatic or manual actions to insert the reactor control rods from the main control boards have been unsuccessful. Other actions taken by the plant operators have successfully inserted the reactor control rods and the reactor is shutdown. Current plant conditions DO NOT threaten public safety.

Detailed Description:

A reactor trip is a way to rapidly shutdown the reactor (stop the fission process and bring the reactor sub-critical) by quickly inserting all control rods into the reactor core. Reactor trips can be initiated either automatically, by the Reactor Protection System, or manually, by the operators.

However, if a reactor trip is started and the control rods do not insert, the reactor may not shutdown fully. Emergency Operating Procedures provide direction to the operators on alternate ways to shutdown the reactor, including actions away from the main control boards.

The threshold specified in EAL SA5.1 represents a condition where both automatic and manual signals to shutdown the reactor from the main control boards failed and the reactor was manually shutdown from another location. This condition requires plant personnel to declare an Alert.

This EAL threshold poses no threat to the safety of the general public.

SA9	System Malfunction ALERT Hazardous Event Affecting the Site	SA9
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Brief Description:

A hazardous event, natural or destructive, has occurred that threatens vital equipment required for the safe operation of the plant. Current plant conditions DO NOT threaten public safety.

Detailed Description:

The plant and its equipment are designed to withstand most natural events (earthquakes, floods, high winds, tornados, etc.) or any damage that may occur from various other destructive events (fire, explosion, etc.).

The EAL threshold for SA9.1 addresses one of the following events that has occurred resulting in either degraded performance of a *safety system* OR visible damage to a *safety system*, component or structure needed to support plant operation:

- An earthquake more intense than the plant was designed to withstand for continued plant operations (*Operational Basis Earthquake (OBE)*).
- Internal or external plant flooding which is affecting the operation or performance of *vital plant equipment*.
- High winds or a tornado strike, the result of which, is affecting the operation or performance of *vital plant equipment*.
- A fire or explosion which is affecting the operation or performance of *vital plant equipment*.
- Low river water level which affects the operation or performance of *vital plant equipment*.
- Other events with similar hazard characteristics as determined by the *Shift Manager*.

Due to the actual or potential substantial degradation of the level of safety of the plant resulting from any of these conditions, plant personnel will declare an Alert.

These conditions pose no threat to the safety of the general public.

System Malfunction		
SU1	UNUSUAL EVENT	SU1
Loss of AC Power		

Brief Description:

All off-site AC (alternating current) electrical power has been lost for 15 minutes or longer. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Much of the equipment in the plant, including important pumps and valves in safety systems, is powered by AC electrical power. There are a number of main sources and backup sources for this type of power, including:

- 1) Off-site AC power, which is supplied from outside the station through electric power transmission lines, passes through *transformers*, then is distributed on-site by networks called *buses*.
- 2) On-site AC power, which is produced by the plant or by *diesel-driven electric generators*. This power supply is totally independent of the off-site electric transmission lines.

The threshold for EAL SU1.1 represents a condition where all of the off-site AC power has been unavailable for 15 minutes or longer. The plant is relying totally on on-site AC power to run the equipment needed to operate the plant or safely *shutdown* and cool the plant (*vital equipment*). This condition warrants an Unusual Event declaration.

This condition poses no threat to the safety of the general public.

System Malfunction		
SU2	UNUSUAL EVENT	SU2
Loss of Assessment Capability		

Brief Description:

The capability to monitor alarms or indicators in the control room has been lost for 15 minutes or longer. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Plant operators continually monitor the status of the *reactor* and its associated safety and support systems. They rely on meters, gauges, *annunciators*, indicating lights, computer displays, and printouts to assess reactor and equipment performance. These components are also used to identify problems in a timely manner enabling timely response actions to be taken. In most cases, the operator has more than one instrument or alarm that would indicate problems in a specific area.

The *Control Room annunciators*, meters, and gauges are most crucial to the operator to help ensure that the reactor is operating safely. Key *safety system* parameters that are routinely monitored by plant operators are:

- *Reactor Power*
- *Pressurizer Level*
- *RCS Pressure*
- *Core Exit Temperature*
- *Level in at least one steam generator*
- *Auxiliary Feedwater Flow*

If an *unplanned* event occurs resulting in a significant loss of these indicators the ability to adequately monitor and maintain the *reactor* in a safe condition may be hampered.

The threshold for EAL SU2.1 represents this condition which is indicative of a potential degradation of the level of safety of the plant. Therefore, plant personnel will declare an Unusual Event.

This EAL threshold poses no threat to the safety of the general public.

SU3

System Malfunction
UNUSUAL EVENT
Reactor Coolant System Activity

SU3**Brief Description:**

Minor damage has occurred to the metal tubes that hold uranium fuel pellets (reactor fuel assemblies) resulting in an increase in reactor coolant system activity above allowable limits. Current plant conditions DO NOT threaten public safety.

Detailed Description:

The radioactive uranium pellets that are used for *fuel* are contained in sealed metal tubes, called *reactor fuel assemblies*. These *fuel assemblies* provide the first of the *fission product barriers*, the *fuel cladding*. These metal tubes contain the radioactive substances (*fission products*) produced when the uranium atoms split. If any of the metal tubes become damaged, some of these *fission products*, usually in the form of gases, would leak out into the *reactor coolant system*. As these radioactive gases leak from the *fuel cladding*, they mix with the surrounding water used to cool the *reactor fuel assemblies* (*reactor coolant*). *Reactor coolant activity* refers to the amount of radioactive material in this water. The *reactor coolant system (RCS)* water is monitored by installed radiation detectors. The *RCS letdown* radiation monitor continuously monitors the *reactor coolant system*, so that operators will know if and when radioactivity levels increase. Plant personnel also routinely sample the *reactor coolant system* and analyze the water for specific parameters, including radioactivity levels. An increase in radioactivity levels may also be identified through this analysis.

The thresholds specified in EALs SU3.1 and SU3.2 represent conditions where the *RCS letdown* radiation monitor has alarmed or a *reactor coolant activity* sample shows radioactivity above normal values. The *RCS letdown* radiation monitor detects radiation levels in the *reactor coolant system*. Although the *RCS letdown* radiation monitor reading or *reactor coolant activity* sample results do not indicate any threat to the public, they do indicate possible *fuel cladding* damage and a potential degradation in the level of safety of the plant. Therefore, these conditions require that an Unusual Event be declared.

It is important to note that the amount of *fuel cladding* damage indicated by these thresholds is very small. That is, the radioactive *fission products* being released from the *fuel cladding* to the water around it (*reactor coolant*) is being contained within plant cleanup systems. Therefore, this condition poses no threat to the safety of the general public.

SU4	System Malfunction UNUSUAL EVENT Reactor Coolant System Leakage	SU4
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Brief Description:

Water is leaking from the Reactor Coolant System in excess of identified limits. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Pipes and components used to carry water for cooling the *reactor fuel assemblies (core)* are called the *Reactor Coolant System*. They are connected to the *reactor pressure vessel* where the *fuel assemblies* are located and circulate water to cool the fuel or core. Normally a small amount of monitored water (*reactor coolant*) is expected to leak from the components which make up the *Reactor Coolant System*. Plant operators continuously monitor the amount of this leakage in two ways, by measuring:

- 1) The rate at which water collection tanks that collect the leakage fill up.
- and**
- 2) The rate at which water must be added to the *reactor coolant system*.

The thresholds specified in EAL SU4.1 and SU4.2 represent a condition where the amount of water leaking from the *reactor coolant system* is higher than the plant's *Technical Specifications* allow. These limits are very low and do not threaten the plant's ability to cool the *reactor fuel assemblies*. Therefore, these conditions require that the plant declare an Unusual Event.

The threshold specified in EAL SU4.3 represents a condition where water is leaking from the reactor coolant system outside of *containment* due to an *unisolable* leak. This leakage is very low and does not threaten the plant's ability to cool the *reactor fuel assemblies*. Therefore, this EAL requires that the plant declare an Unusual Event.

These conditions pose no threat to the safety of the general public.

SU5	System Malfunction UNUSUAL EVENT Reactor Power	SU5
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Brief Description:

The reactor control rods failed to automatically or manually shut down the reactor when initially required. Current plant conditions DO NOT threaten public safety.

Detailed Description:

A reactor trip is a way to rapidly shutdown the reactor (stop the fission process and bring the reactor sub-critical) by quickly inserting all control rods into the reactor core. Reactor trips can be initiated either automatically, by the Reactor Protection System, or manually, by the operators.

However, if a reactor trip is started and the control rods do not insert, the reactor may not shutdown fully. Emergency Operating Procedures provide direction to the operators to manually initiate a reactor trip.

The threshold specified in EAL SU5.1 represents a condition where the failure of the Reactor Protection System to automatically shutdown the reactor has occurred when required to do so. In this case, the reactor was manually shutdown by plant operators since the reactor did not shutdown after an automatic signal to do so was sent, **OR** the reactor was automatically shutdown by a subsequent/different reactor trip signal. This condition requires plant personnel to declare an Unusual Event.

This EAL threshold poses no threat to the safety of the general public.

SU6	System Malfunction UNUSUAL EVENT Loss of Communications Capabilities	SU6
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Brief Description:

On-site or off-site communications equipment has been lost. Current plant conditions DO NOT threaten public safety.

Detailed Description:

Plant personnel must be able to communicate throughout the station to safely operate the plant. Many communications systems are available on-site to perform required routine tasks (telephones, plant page system, or radios).

Plant personnel must also be able to communicate problems to off-site authorities and request assistance if needed. Many systems are also available to perform these communications as required (normal telephones, dedicated telephones/lines, and radios).

The threshold specified in EAL SU6.1 represents a condition where all on-site communications systems are unavailable. Since this condition may affect the ability of plant personnel to perform routine tasks, plant personnel will declare an Unusual Event.

The threshold specified in EAL SU6.2 represents a condition where all off-site communications systems used to notify local and state response organizations are unavailable. Since this condition may affect the ability of plant personnel to notify response organizations of an event or request support, plant personnel will declare an Unusual Event.

The threshold specified in EAL SU6.3 represents a condition where all off-site communications systems used to notify the Nuclear Regulatory Commission (NRC) are unavailable. Since this condition may affect the ability of plant personnel to notify the NRC of an event or request support, plant personnel will declare an Unusual Event.

These EAL thresholds pose no threat to the safety of plant personnel or the general public.

SU7	System Malfunction UNUSUAL EVENT Loss of Containment	SU7
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Brief Description:

The ability to maintain containment integrity has been lost or degraded. Current plant conditions DO NOT threaten public safety.

Detailed Description:

The *containment* building contains the *reactor vessel*, *reactor coolant pumps*, *pressurizer*, *steam generators*, and supporting equipment and components. It is the last of the *fission product barriers* designed to prevent the release of radioactive materials to the environment.

The *containment* building is designed to automatically isolate under specific conditions, containing any releases of radioactive materials within the structure. The environment within the building is also designed to be maintained at higher pressures while minimizing the release of radioactive material to the environment.

The threshold specified in EAL SU7.1 represents a condition where *containment* isolation has not automatically occurred as required by plant conditions and plant operators have not been successful in manually isolating *containment* within 15 minutes. This condition requires plant personnel to declare an Unusual Event.

The threshold specified in EAL SU7.2 represents a condition where *containment* pressure has reached a specified limit and plant equipment designed to maintain *containment* pressure below this limit is unavailable for 15 minutes or longer. This condition challenges the integrity of *containment* and requires plant personnel to declare an Unusual Event.

These EAL thresholds pose no threat to the safety of plant personnel or the general public.

GLOSSARY AND ACRONYMS

Glossary

The terms found in this glossary are defined in the context of their relationship to Emergency Action Levels.

Activity: With respect to radiation, the number of nuclear disintegrations occurring in a radioactive material per unit of time. Activity is directly related to the strength of a radiation source. The more nuclear disintegrations that occur, the more radiation that a radioactive substance emits.

Adequate Core Cooling: The removal of heat energy from the reactor *fuel* sufficient to prevent rupturing (breaking apart) the *fuel cladding*.

Annunciator: A device which provides plant operators with both a visible and audible alarm of a significant plant condition.

Auxiliary Building: The reinforced concrete structure which houses the *Control Room*, refueling and *spent fuel* storage facilities and reactor auxiliary equipment.

Auxiliary Feedwater: A standby supply of water provided from the *condenser* to the secondary side of the *steam generators*. This water is used to transfer heat from the *reactor coolant* to the secondary side of the *steam generators* during shutdown conditions.

Boron: A substance which is capable of efficiently absorbing neutrons and stopping the nuclear chain reaction. Used in the *control rods* and as an alternate method of shutting down the *reactor* by injecting high concentrations into the cooling water in the reactor *core*.

Bus: A rigid electrical conductor (normally a metal bar) used to connect multiple circuits. Provides a means of supplying electrical power to electric equipment.

Child Thyroid Exposure: A calculated radiation dose received by a child as a result of inhalation or ingestion of radioactive iodine. Radioactive iodine in the body collects and concentrates in the thyroid creating a concentrated source of radiation in that area. The thyroid exposure (dose) received is higher for children than that for adults due to the higher metabolism rate of children and the smaller size of the thyroid.

Circulating Water System: A cooling water system that removes excess heat from the *main condenser* by continuously supplying cooled water from the cooling tower or river to the main condenser and returning the heated water to the cooling tower or river.

Glossary (cont.)

Cold Shutdown: A plant condition in which the reactor is shut down (*sub-critical*) and the reactor coolant temperature is less than 200 degrees Fahrenheit.

Committed Dose Equivalent (CDE): Dose to a specific organ or tissue that will be received from an intake of radioactive material by an individual over a 50 year period following the intake of the radioactive material.

Condenser: A component which serves to condense steam back into water so that the water can be reused. The main condenser serves to condense the steam exhausted from the main turbine so that it can be pumped back to the *steam generators* for reheating and conversion back to steam.

Confinement Boundary: The barrier(s) between areas containing radioactive substances and the environment.

Containment: The structure which houses the *reactor pressure vessel*, *steam generators*, and piping of the *reactor coolant system*. The containment consists of the concrete shield building and steel containment vessel. The containment acts as the third *fission product barrier*.

Containment Integrity: A condition in which the *containment* structure is intact and all systems which operate to ensure its effectiveness as a *fission product barrier* are functional.

Containment Purge: A system used to assist in the reduction of either *containment* pressure or concentrations of undesirable gases inside the *containment*. The containment purge discharges into the *shield building vent* stack.

Containment Sumps: Tanks located beneath various plant equipment in containment that collect any leakage from the *reactor coolant system* and *reactor pressure vessel*.

Control Rod Assembly: A cluster of rods which can be withdrawn from or inserted into the reactor *core* to absorb neutrons and thus control reactor power. There are 29 control rod assemblies in each PINGP reactor.

Control Boards: Panels inside the *control room* that contain the equipment controls, switches, gauges, and instrumentation used by the plant operators to operate, monitor, and control the reactor and its support systems.

Control Room: The central location from which the plant is operated, monitored and controlled. The control room is equipped with the instrumentation and alarms necessary to continually assess the status of the reactor plant.

Glossary (cont.)

Core: The central portion of a nuclear reactor which is comprised of the *fuel assemblies* and the structural materials which together serve to promote the fission process

Core Damage: Damage to the components which comprise the reactor *core*. Core damage typically refers to the failure of *fuel cladding* and/or *fuel* melting as a result of overheating the fuel.

Credible Threat: A threat that is real and immediate as determined by federal, state, or local government agencies (e.g., NRC, FBI, DHS, State Police, etc.).

Critical: In reference to the *reactor*, a self-sustaining nuclear chain reaction that releases energy. During normal plant operations the reactor is 'critical'.

Decay Heat: The heat energy which results from the decay of radioactive *fission products*. Even after the reactor is *shut down* the reactor fuel will continue to produce significant amounts of decay heat. The longer the reactor has been shut down the less decay heat is produced.

Defense-In-Depth: The philosophy of plant design and operation which provides many lines of defense against accidents. Nuclear power plants incorporate this philosophy by having backup systems that are capable of working if the primary system or piece of equipment fails.

Defueled: A condition where all the reactor *fuel assemblies* have been removed from the *reactor pressure vessel* and are stored in the *Spent Fuel Pool* to allow for maintenance on plant systems and components.

Design Basis Earthquake: An earthquake of an intensity greater than the plant was designed to withstand and still be able to safely *shut down* the reactor.

Dose Projection: The calculation of individual radiation exposure at a given location at some time in the future. Dose projections are performed in response to an actual or anticipated release of radioactive material to the environment.

Emergency Action Level (EAL): Plant-specific indications, conditions or instrument readings which are used to classify an emergency as an Unusual Event, Alert, Site Area Emergency or General Emergency.

Emergency Core Cooling System (ECCS): Those systems which are designed to provide *adequate core cooling* under abnormal and accident conditions. The emergency core cooling systems consist of:

- *Safety Injection (SI) System*
- *Accumulators*
- *Residual Heat Removal System*

Glossary (cont.)

Emergency Diesel Generator: Diesel-driven electrical *generator* designed to provide the necessary electrical power to safely shut down the reactor during a total loss of off-site electrical power.

Emergency Director: The individual with overall command and control of the on-site PINGP Emergency Response Organization. The Emergency Director has the ultimate responsibility for emergency classification and providing protective action recommendations to off-site authorities.

Emergency Operating Procedure (EOP): Procedures utilized by the plant operators during emergencies which provide appropriate guidance to put the *reactor* in a safe and stable condition.

Emergency Plan Implementing Procedures (EPIPs): Procedures implemented by the plant's Emergency Response Organization members (during all classified emergencies) which provide appropriate guidance to assure the protection of the health and safety of plant personnel and the general public.

Engineered Safeguards System: A system which initiates automatic closure of appropriate pipelines to provide timely protection against the gross release of radioactive materials from the *containment*.

Engineered Safety System (ESF): Those systems and components which are specifically designed to ensure the reactor can be shut down, cooled down and placed in a safe and stable condition.

EPA Protective Action Guidelines: See *Protective Action Guidelines*.

Explosion: A rapid, violent and catastrophic failure of a piece of equipment due to combustion, chemical reaction or overpressurization. A release of steam (from high energy lines or components) or an electrical component failure (caused by short circuits, grounding, arcing, etc.) should not automatically be considered an explosion. Such events may require a post-event inspection to determine if the attributes of an explosion are present.

Feedwater System: A system of pipes, valves and pumps that serves to transfer water (feedwater) from the *condenser* to the secondary side of the *steam generators*. This feedwater is then reheated and converted into steam. The feedwater system is part of the secondary *reactor coolant system*.

Fire Brigade: An on-shift group of individuals, at least five, trained and qualified in firefighting techniques that responds to reports of fires and initiates actions to extinguish them and protect other plant components/equipment.

Glossary (cont.)

Fire Brigade Leader: The lead person on the fire brigade that acts as the on-scene incident commander providing direction to the fire brigade.

Fission Process: The splitting of an atom, which releases a considerable amount of energy (usually in the form of heat) that can be used to produce electricity. In addition to energy, this process usually releases gamma radiation and two or more neutrons.

Fission Product: Elements or compounds (radionuclides) which result from the *fission process* (splitting of uranium atoms). Most fission products are highly radioactive.

Fission Product Barrier: Those physical structures which are specifically designed to contain and preclude the release or spread of fission products. For the purpose of the PINGP Emergency Plan there are three fission product barriers: *fuel cladding*, *reactor pressure vessel* and *containment*.

Fuel: The uranium oxide pellets stacked inside the *fuel cladding* which make up a fuel rod.

Fuel Assembly: An array of 179 fuel rods (plus 16 guide thimbles and an instrument tube) held together by grid assemblies. There are 121 fuel assemblies in each reactor core at PINGP. Also referred to as a 'fuel bundle'.

Fuel Cladding: The long zirconium metal tubes in which the fuel pellets are stacked. The fuel cladding along with the fuel pellets are referred to as 'fuel rods'. The fuel cladding serves as the primary *fission product barrier*.

Fuel Handling Building: That part of the *auxiliary building* where reactor refueling operations are conducted. This involves periodic replacement and storage of *spent fuel*.

Generator: A device which converts mechanical energy into electrical energy (i.e. main turbine generator, emergency diesel generator).

Heat Sink: The medium which absorbs and dissipates waste heat energy. The circulating water, which passes through the main *condenser* and *cooling towers*, serves as the plant's primary heat sink.

Hostile Action: An act toward PINGP or its personnel that includes the use of violent force to destroy equipment, take hostages, and/or intimidate the site to achieve an end. This includes attack by air, land, or water using guns, explosives, projectiles, vehicles, or other devices used to deliver destructive force.

Hostile Force: One or more individuals who are engaged in a determined assault, overtly or by stealth and deception, equipped with suitable weapons capable of killing, maiming, or causing destruction.

Glossary (cont.)

Hot Shutdown Panel: Facility outside the control room that is designed to allow the plant to be *shut down* safely should the main control room become uninhabitable.

Imminent: The sequence of events or conditions is such that an *EAL* will be met within a relatively short period of time regardless of mitigation or corrective actions.

Independent Spent Fuel Storage Installation (ISFSI): A complex designed and constructed for the interim (temporary) storage of *spent fuel*. PINGP uses an ISFSI to store *spent fuel assemblies* on-site.

ISFSI Protected Area (PA): A security zone located within the *Owner Controlled Area (OCA)* that surrounds the *ISFSI*. Access to this area is restricted to authorized personnel and controlled by the station's security force.

Irradiated Fuel: A *fuel assembly* which has been involved in the fission process (any *fuel assembly* which has been in the *reactor pressure vessel* during plant operation). An irradiated *fuel assembly* has *fission products* inside the fuel rods and is highly radioactive.

Loss of Coolant Accident (LOCA): A rapid loss of the water used to cool the *core*, associated with a break in a *reactor coolant system* pipe or component.

Main Steam Isolation Valves (MSIVs): Valves located in the *main steam lines* designed to rapidly stop the flow of steam from the *steam generators*.

Main Steam Line: A pipe which transfers the steam generated in the *reactor pressure vessel* to the main turbine. There are four main steam lines connected to the reactor pressure vessel.

Main Steam System: A system of pipes and valves that serve to transfer steam from the secondary side of the *steam generators* to the main *turbine*. This steam is then condensed in the *condenser* and converted back into water. The main steam system is part of the secondary *reactor coolant system*.

Millirem: One one-thousandth of a rem. The rem is a unit of measure which defines the extent of biological injury that results from absorption of radiation by the body.

Glossary (cont.)

Mode: Used to define the condition of the plant. For the purposes of the EALs there are six (6) modes:

Mode 1 - Power Operations: The *reactor* is *critical* and generating power.

Mode 2 - Startup: The *reactor* and power is less than or equal to 5%.

Mode 3 – Hot Standby: The *reactor* is *shutdown* (sub-critical) and the *reactor coolant* temperature is 350 degrees Fahrenheit or greater.

Mode 4 - Hot Shutdown: The *reactor* is *shutdown* (sub-critical) and *reactor coolant system* temperature is greater than 200 but less than 350 degrees Fahrenheit.

Mode 5 - Cold Shutdown: The *reactor* is *shutdown* (sub-critical) and *reactor coolant system* temperature is less than or equal to 200 degrees Fahrenheit.

Mode 6 - Refueling: The *reactor* is *shutdown* (sub-critical), *reactor coolant system* temperature is less than or equal to 200 degrees Fahrenheit, and the *reactor pressure vessel* head is not bolted on to the reactor.

Defueled: All reactor *Fuel Assemblies* are removed from the *reactor pressure vessel*. This condition is not considered an operating mode.

Non-condensable Gas: Any gas which, under normal operating pressures, cannot be condensed (turned into a liquid). While gases such as steam are condensable, gases such as nitrogen, oxygen and hydrogen are not. Those *non-condensable gases* which accumulate in the *reactor coolant system* are removed and are called *waste-gas*.

Nuclear Disintegration: A spontaneous nuclear transformation which results in the emission of energy and/or mass from an atom's nucleus. The emitted energy and/or mass is referred to as radiation.

Off-site Dose Calculation Manual (ODCM): The document which specifies the methods for determining the impact of radiological releases and discharges from the station.

Off-site Electrical Power: That electrical power which is supplied to the PINGP site from off-site electric power transmission lines. This power is delivered to the on-site distribution networks (*buses*) via power supply *transformers*.

On-site Electrical Power: That electrical power which is produced by electric *generators* located physically on-site. These sources are totally independent of off-site electric transmission lines.

Operational Basis Earthquake (OBE): An earthquake of an intensity greater than the plant was designed to withstand for continued plant operation.

Owner-Controlled Area (OCA): That property around the plant bounded by the outer-most fence.

Glossary (cont.)

Plant Computer: A computer system which monitors thousands of plant process parameters and provides indications and alarms to the plant operator.

Plant Transient: A sequence of events which causes plant conditions to change rapidly. A *reactor trip* is considered a plant transient.

Pressurizer: A component of the primary *reactor coolant system* which maintains the reactor coolant system at a high pressure. The pressurizer helps ensure that water in the *reactor pressure vessel* does not boil.

Primary System: Any fluid system which connects directly to the *reactor pressure vessel* such that a reduction in reactor pressure will cause a decrease in the pressure in the fluid system.

Protected Area (PA): The area around and including the plant structures protected by a double chain link fence for either the plant or the *ISFSI* and to which access is controlled by the station's Security Force.

Protective Action Guidelines (PAGs): Radiation exposure guidelines established by the Environmental Protection Agency which are used to determine the appropriate protective actions to be taken on the part of emergency workers and the general public. These protective actions include sheltering and evacuation.

Radwaste: Radioactive waste materials. Radwaste may be in a solid, liquid or gaseous form. Radwaste generated at PINGP is treated and processed by the Radwaste System.

Reactivity: A term which describes the number of neutrons available to carry on the nuclear chain reaction. Withdrawing *control rods* adds positive reactivity because fewer neutrons are absorbed, so more are available to cause a fission.

Reactor: Those components which, together, support the controlled fission process and the generation of steam for the purpose of producing power. Components include the reactor *core*, *reactor pressure vessel*, *control rods* and *reactor coolant system*.

Reactor Coolant: The water which serves to remove the heat energy from the *core*. Typically, water is referred to as 'reactor coolant' only when it is located within a *reactor coolant system*.

Reactor Coolant Activity: With respect to radiation, the number of nuclear disintegrations occurring in the reactor coolant water per unit of time. The reactor coolant activity is directly related to the amount of radioactive material in the reactor coolant water.

Glossary (cont.)

Reactor Coolant Pressure: An operating parameter of the *reactor coolant system* measured by instrumentation and monitored by the plant operators in the *control room*.

Reactor Coolant System (RCS): Those pipes and components which act to transfer and process *reactor coolant*. Typically, the term 'reactor coolant system' refers to those systems which are closely related to the *reactor pressure vessel* (i.e. the 'Recirculation System' and the 'Reactor Water Cleanup System' are referred to as 'reactor coolant systems').

Reactor Coolant Temperature: An operating parameter of the *reactor coolant system* measured by instrumentation and monitored by the plant operators in the *control room*.

Reactor Power: The amount of energy (power) generated by the *fission process* inside the reactor *core*.

Reactor Pressure Vessel (RPV): The *RPV* is a large steel structure which is designed to provide a volume in which the reactor *core* can be submerged in *reactor coolant*. The *RPV* acts as part of the second *fission product barrier*.

Reactor Protection System (RPS): A system which initiates automatic *reactor trips* to provide timely protection against conditions which threaten *fission product barrier* integrity.

Reactor Trip: The rapid insertion of all *control rods* into the *core* for the purpose of making the reactor *sub-critical (shutdown)*. A reactor trip can be initiated automatically by the *reactor protection system* or manually by the plant operators.

Reactor Vessel Head: The top of the reactor pressure vessel that is removed during refueling to enable access to the fuel assemblies and other internal components.

Refueling: The process of removing used *fuel assemblies* and replacing them with new *fuel assemblies*.

Refueling Cavity: The refueling cavity is the area formed above the reactor vessel when the reactor vessel head is removed to allow movement and replacement of the spent fuel assemblies. This area is normally filled with water (*reactor coolant*) during refueling operations to provide radiation shielding and cooling.

Relief Valve/Safety Valve: A valve which serves to reduce pressure in a fluid system should pressure become excessively high. Both the *reactor coolant system* and *steam generators* have relief and safety valves to protect these systems from being damaged by excessive pressure.

Restricted Area Boundary: The outer boundary of the *owner controlled area* at which the public would be allowed unrestricted access.

Glossary (cont.)

Safety System: A plant system which performs a function critical to plant safety.

Safety System Equipment: Equipment (pumps, valves, breakers, etc.) required for safe operation of the plant, cooling down the plant, and/or placing it in a *cold shutdown* condition. This includes equipment related to the ECCS.

Security Condition: Any Security Event as listed in the approved security contingency plan that constitutes a threat/compromise to site security, threat/risk to site personnel, or a potential degradation to the level of safety of the plant. A *Security Condition* does not involve a *Hostile Action*.

Seismic Instrumentation: A device which detects and records ground acceleration (earthquakes) and provides an alarm to plant operators if ground acceleration exceeds preset values on-site.

Shield Building Vent: That part of the shield building ventilation system which directs the shield building and/or *containment* air to the outside atmosphere. Located on top of the *containment*, the discharge is continuously monitored for abnormal amounts of radiation and would be isolated if radiation levels approach federal limits.

Shift Manager(SM): The plant's senior U.S. Nuclear Regulatory Commission (NRC) licensed operations individual on-site. The SM holds a NRC Senior Reactor Operators license and has ultimate responsibility for the safe operation of the plant.

Shutdown (Shut Down): The condition (or actions taken to establish) of the plant when the *reactor* is *sub-critical*. When the reactor is 'shutdown' no significant heat is being generated from the *fission process* (although significant *decay heat* might still be generated). The *fission process* has been stopped effectively.

Site Boundary: The outer bounds of the Owner-Controlled property surrounding the PINGP.

Spent Fuel: Nuclear reactor fuel that has been used to the extent that it can no longer effectively sustain a chain reaction.

Spent Fuel Pool: A large, deep pool of purified water which is used to store the spent fuel and other radioactive components prior to their storage in the spent fuel storage facility. In addition to cooling, the water covering the spent fuel provides radiation shielding so that the *fuel handling building* is accessible. The spent fuel pool is located in the *fuel handling building*.

Glossary (cont.)

Steam Generator: A component which serves to transfer the heat energy from the primary *reactor coolant system* to the secondary reactor coolant (*feedwater*). The tubes within the steam generator ensures that reactor coolant does not mix with the water that is converted to steam. Each PINGP unit has two steam generators.

Sub-critical: In reference to the *reactor*, incapable of sustaining a chain reaction (fission). The reactor is *shutdown* when sub-critical.

Technical Specifications: A document which prescribes the conditions and limitations under which the plant must be operated. The Technical Specifications are a part of the plant's operating license.

Thyroid Committed Dose Equivalent: The dose allocated to the thyroid due to iodine releases.

Top of Fuel: The elevation within the *reactor core* below which enriched uranium *fuel* is used.

Total Effective Dose Equivalent: The sum of external exposure doses and internal doses.

Transformer: An electrical device which is used to either increase or decrease the voltage of electricity. PINGP has transformers which reduce off-site transmission line voltage from 345,000 to 13,800 and 4160 volts for use by plant equipment.

Turbine: A mechanical device which converts steam (heat) energy into mechanical (rotational) energy. The main turbine converts the energy of the steam from the *steam generators* to turn an electrical *generator* to make electricity.

Turbine Building: The plant structure which houses the main *turbine*, electrical *generator*, main *condenser*, and other support equipment.

Vital Area: An area within the plant process buildings which contains *vital equipment*.

Vital Equipment: That plant equipment which has been designated as being vital to the safe shutdown and cooling of the reactor. Particularly that equipment which is required under emergency conditions.

Vital Plant Structures: Those plant buildings and structures which house *vital areas*.

Waste-gas: *Non-condensable* gases removed from the reactor coolant system some of which are radioactive. Waste-gas is treated by the Waste-gas System.

Waste Holdup Tank: A collection tank for *reactor coolant* and other systems. The Waste Holdup Tank is a component of the liquid radwaste system.

Acronyms

This is a list of acronyms commonly used in emergency planning.

AC	Alternating Current
ANI.....	American Nuclear Insurers
ATWS.....	<i>Anticipated Transient Without Scram</i>
BEOF.....	Backup Emergency Operations Facility
BPO	Bulk Power Operations
DC	Direct Current
DOE.....	Department of Energy
DOT.....	Department of Transportation
EAL	Emergency Action Level
ECCS.....	<i>Emergency Core Cooling System</i>
ENS.....	Emergency Notification System (NRC)
EOC.....	Emergency Operations Center
EOF	Emergency Operations Facility
EOP	<i>Emergency Operating Procedure</i>
EPA.....	Environmental Protection Agency
EPIPs.....	<i>Emergency Plan Implementing Procedures</i>
EPZ.....	Emergency Planning Zone
ERF	Emergency Response Facility
ESF	<i>Engineered Safety Features</i>
FEMA.....	Federal Emergency Management Agency
FRMAC.....	Federal Radiological Monitoring Assessment Center
FRMAP	Federal Radiological Monitoring and Assessment Plan
GE	General Emergency
HPN	Health Physics Network (NRC)
INPO	Institute of Nuclear Power Operations
IRC	Incident Response Center (NRC)
ISFSI	<i>Independent Spent Fuel Storage Installation</i>

Acronyms (cont.)

JIC	.....	Joint Information Center
KI	.....	Potassium Iodide
LOCA	.....	<i>Loss of Coolant Accident</i>
MSIVs	.....	<i>Main Steam Isolation Valves</i>
NRC	.....	Nuclear Regulatory Commission
NUE	.....	Notification of Unusual Event
OBE	.....	<i>Operational Basis Earthquake</i>
ODCM	.....	Off-site Dose Calculation Manual
OSC	.....	Operational Support Center
PA	.....	Public Address
PAGs	.....	<i>Protective Action Guidelines</i>
PAR	.....	Protective Action Recommendation
PSIG	.....	Pounds per Square Inch Gauge
PWR	.....	Pressurized Water Reactor
RAC	.....	Regional Advisory Committee
RAFT	.....	Radiological Assessment Field Team
RCS	.....	Reactor Coolant System
REAC	.....	Radiological Emergency Assessment Center
RF	.....	Radio Frequency
RHR	.....	Residual Heat Removal
RO	.....	Reactor Operator
RPS	.....	<i>Reactor Protection System</i>
RPV	.....	<i>Reactor Pressure Vessel</i>
SAE	.....	Site Area Emergency
SFCP	.....	State Forward Command Post
SOP	.....	Standard Operating Procedures
SPDS	.....	Safety Parameter Display System
SRC	.....	State Radiological Coordinator
SRO	.....	Senior Reactor Operator
STA	.....	Shift Technical Advisor
TLD	.....	Thermoluminescent Dosimeter

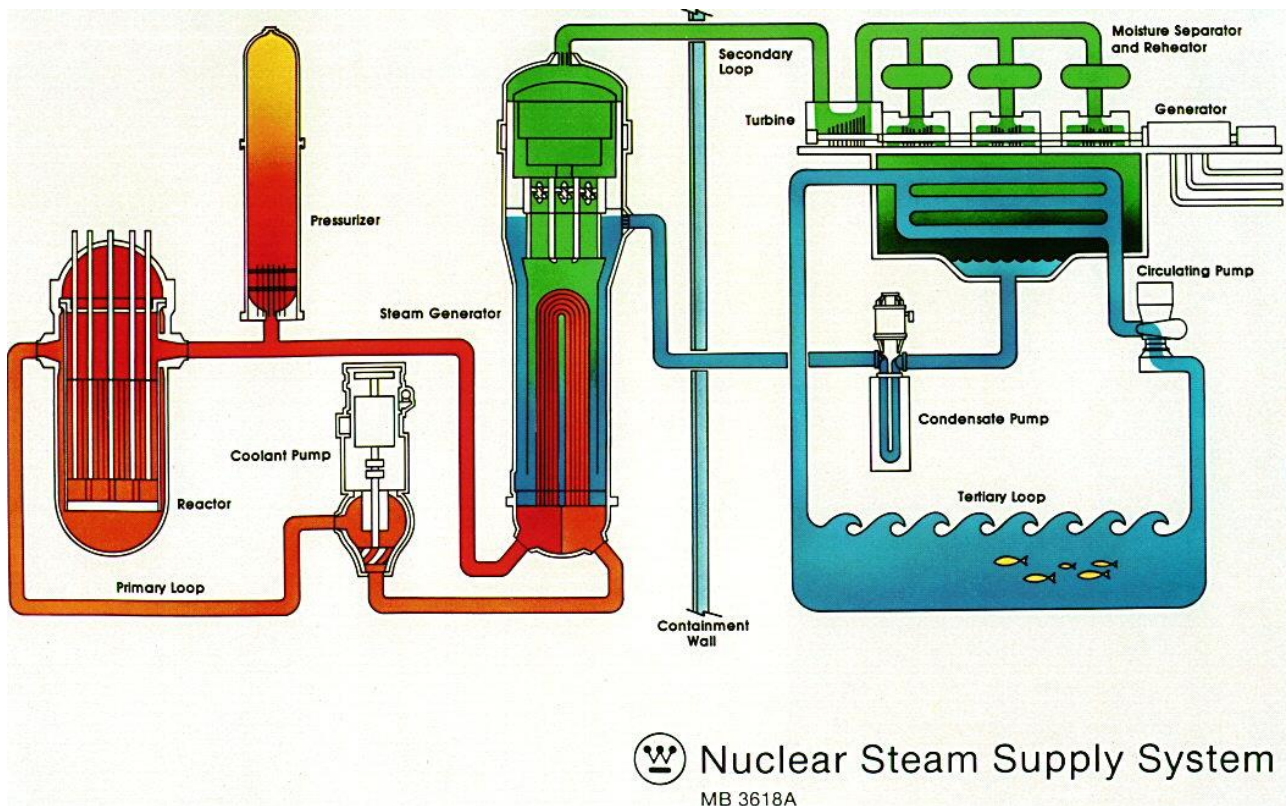
Acronyms (cont.)

TS.....*Technical Specifications*

TSCTechnical Support Center

PLANT INFORMATION

Plant Information



Plant Schematic Drawing

Plant Information

Location:

On a 578 acre site located approximately six miles northwest of Red Wing, Minnesota on the west bank of the Mississippi River.

Capacity:

1677 megawatt thermal/584 megawatt electric (each unit)

Generator:

Speed 1,800 revolutions per minute
Voltage 22,000 volts, 3-phase, AC
Cooling hydrogen gas

Turbine:

Type Westinghouse
Steam Temperature 511° Fahrenheit (266° Centigrade)
Steam Pressure 735/685 pounds per square inch
Steam Flow 7,300,000 pounds per hour

Substation Transformer Output:

Voltage Step-up 345,000 volts

Reactor:

Type Westinghouse 2 loop pressurized water
Coolant..... Water
Moderator..... Water
Core Coolant Flow Rate 178,000 gallons per minute
Coolant Pressure 2,235 pounds per square inch
Heat Output..... 572,000,000 BTU's per hour

Plant Information (cont.)

Steam Generators (2):

Steam Capacity	3,650,000 pounds per hour each
Feedwater Inlet Temperature	436° Fahrenheit (224° Centigrade)
Steam Outlet Temperature	511° Fahrenheit (266° Centigrade)
Steam Pressure	735 pounds per square inch
Reactor Coolant Inlet Temperature	592.6° Fahrenheit (311° Centigrade)
Height	67 feet
Number of U-tubes	4868
Number of Relief Valves	1 each
Number of Safety Valves	5 each

Fuel Core:

Pellets:

Material	Uranium dioxide (UO ₂)
Enrichment	4 to 4.2% U-235
Length	approximately 0.56 inches
Diameter	approximately 0.34 inches
Total Pellets in Core	approximately 5,200,000
Total Weight, Uranium	approximately 160,000 pounds (60 tons)

Rods/Fuel Assemblies:

Fuel Rod Cladding Material	Zircalloy
Fuel Active Length	12 feet (144 inches)
Rods per Assembly	179
Number of Assemblies	121

Control Rod Assemblies:

Control Rod Material	Stainless Steel
Neutron Absorber	Silver-Indium-Cadmium alloy
Assembly Length	12 feet
Rods per Assembly	16
Number	29

Plant Information (cont.)**Reactor Vessel:**

Material low alloy carbon steel
Height 39 feet
Inside Diameter 132 inches
Wall Thickness approximately 5 inches
Design Temperature..... 650° Fahrenheit
Design Pressure 2485 pounds per square inch

Pressurizer:

Operating Pressure 2235 pounds per square inch
Operating Temperature 653° Fahrenheit
Number of Heaters 78
Number of Relief Valves 2
Number of Safety Valves 2

Containment:

Material:

Shield Building Reinforced concrete
Containment Vessel Carbon steel

Height:

Shield Building 218 feet
Containment Vessel 207 feet

Diameter:

Shield Building 118 feet
Containment Vessel 105 feet

Wall Thickness:

Shield Building 2.5 feet
Containment Vessel 0.75 inches

Condenser (2 per unit):

Material Stainless steel tubing
Number of Tubes 42,168
Tubing Length..... 44 feet
Condensing Surface 425,000 square feet
Cooling Water Flow 300,000 gallons per minute
Heat transfer rate 3,873,616,764 BTUs per hour

Plant Information (cont.)**Cooling Towers (4 total for both units):**

Type Forced draft
Height 42 feet 6 inches
Length 432 feet
Water Flow 151,500 gallons per minute each