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PRC HECG-SECT.06.4 (BASIS) 000	2	A	1	H	177908

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HOPE CREEK GENERATING STATION  
EVENT CLASSIFICATION GUIDE TECHNICAL BASIS  
October 8, 2003

CHANGE PAGES FOR  
REVISION #21

The Table of Contents forms a general guide to the current revision of each section and attachment of the Hope Creek ECG Technical Basis. The changes that are made in this TOC Revision #21 are shown below.

1. Check that your revision packet is complete.
2. Add the revised documents.
3. Remove and recycle the outdated material listed below.

ADD			REMOVE		
<u>Pages</u>	<u>Description</u>	<u>Rev.</u>	<u>Pages</u>	<u>Description</u>	<u>Rev.</u>
ALL	TOC	21	All	TOC	20
All	Section 6.4	02	All	Section 6.4	01

**HOPE CREEK ECG TECHNICAL BASIS  
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**REVISION SUMMARY**

Biennial Review Performed: Yes  No

Updated EAL Basis for 6.4.2.a and 6.4.2.b/c to correct reference to non-existent EALs.



**6.0 Radiological Releases/Occurrences****6.4 Irradiated Fuel Event****UNUSUAL EVENT - 6.4.1.a****IC    Unplanned Increase in Plant Radiation****EAL**

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**Uncontrolled water level drop in the Reactor Cavity as indicated by  
EITHER one of the following:**

- Visual Observation
- Reactor Water Level Shutdown Range Indicator 1BBLI-R605

**OPERATIONAL CONDITION - 5****BASIS**

An **Uncontrolled** lowering of Reactor Cavity Level during Refueling (Operational Condition 5) represents a condition which can result in rising radiation levels, due to the loss of radiation shielding, if the Reactor Cavity level drop can not be terminated. This event has a long lead time relative to potential for radiological release outside the site boundary, thus the impact to public health and safety is very low. **Uncontrolled** means that the level drop can not be terminated.

Determination of an **uncontrolled** level drop is made through either Visual Observation or indication in the Main Control Room. Visual Observation is the preferred method, whenever possible, however it is **NOT** intended that an individual must be dispatched for classification purposes, if the existing radiation level rise trend prevents personnel from accessing the Refuel Floor, or if cameras are available to remotely verify the condition. In the event visual observation is not available by any means, then Main Control Room indication should be used.

**Barrier Analysis**

N/A

EAL - 6.4.1.a  
Rev. 02

## ESCALATION CRITERIA

Emergency Classification will escalate to an Alert as a result of uncovering of a fuel assembly and/or indication of high radiation levels on the refueling floor.

## DISCUSSION

During Refueling operations, the RPV is flooded and RPV level indication is monitored on the shutdown instrument range. Limitations on evolutions on with a potential for draining the RPV are imposed when refueling is in progress. Lowering of RPV level may result in the loss of Shutdown Cooling if RPV level continues to lower unchecked. This may result in the loss of decay heat removal from the fuel contained in the RPV.

Technical Specifications requires at least 22 feet 2 inches of water be maintained over the top of the reactor pressure vessel flange while in Operating Condition 5 and either fuel assemblies are being handled or the fuel assemblies seated within the reactor vessel are irradiated. The Technical Specification minimum water level in the Reactor Vessel under these conditions is based on the minimum water level required to remove 99% of the assumed 10% iodine gap activity that would be released from the rupture of an irradiated fuel assembly.

## DEVIATION

- 1) NUMARC states that this EAL will be applicable in all modes of operation. In other than Operational Condition 5, the RPV head will be fully tensioned, and lowering of vessel level would be classified by EALs in Section 3.0, Fission Product Barriers, or Section 8.1, Loss of Heat Removal Capability.
- 2) NUMARC IC AU2 includes unexpected increases in Airborne concentration in addition to plant radiation. The corresponding Hope Creek IC does not address Airborne concentration, since an increase in Airborne concentration is not addressed in the example EALs or the basis for the Unusual Event or Alert. Apparently, the Airborne concentration example EAL was deleted by NUMARC, but the corresponding IC was overlooked.

## REFERENCES

NUMARC NESP-007, AU2.1  
HC.OP-AB.ZZ.0142 (Q), Loss of Shutdown Cooling  
HC.OP-AB.ZZ-0144 (Q), Loss of Fuel Pool Inventory/Cooling  
HC.OP-AB.ZZ-0101 (Q), Irradiated Fuel Damage  
HC.OP-AB.ZZ-126 (Q), Abnormal Release of Gaseous Radioactivity  
HCGS Technical Specifications Section 3/4 9.8

## 6.0 Radiological Releases/Occurrences

### 6.4 Irradiated Fuel Event

#### UNUSUAL EVENT - 6.4.1.b

IC Unplanned Increase in Plant Radiation

EAL

**Uncontrolled water level drop in the Spent Fuel Pool as indicated by  
Valid Fuel Pool Low Level Alarm Condition**

AND

Visual Observation

**OPERATIONAL CONDITION - All**

**BASIS**

An **Uncontrolled** drop in Spent Fuel Pool Level represents a condition which can result in rising radiation levels, due to the loss of radiation shielding, if the Spent Fuel Pool level drop can not be terminated. This event has a long lead time relative to potential for radiological release outside the site boundary, thus the impact to public health and safety is very low. **Uncontrolled** means that the level drop can not be terminated.

Determination of an **uncontrolled** level drop is made through receipt of the Spent Fuel Pool Low Level Alarm in the Main Control Room and Visual Observation.

**Barrier Analysis**

N/A

**ESCALATION CRITERIA**

Emergency Classification will escalate to an Alert as a result of uncovering of irradiated fuel as indicated by high radiation levels on the refueling.

EAL - 6.4.1.b  
Rev. 02

## DISCUSSION

Normal Spent Fuel Pool level is at 40' of water in the pool. This level provides approximately 25' of water above the top of fuel stored in pool, and 9' of water above fuel in transit. The low level alarm is set at 39' 9". This is above, but approaching the Technical Specification minimum required water level of 23 feet over the top of irradiated fuel assemblies seated in the spent fuel pool storage racks. The Technical Specification minimum water level in the Spent Fuel Pool is based on the minimum inventory and level required to remove 99% of the assumed 10% iodine gap activity that would be released from the rupture of an irradiated fuel assembly.

To prevent accidental draining of the Spent Fuel Pool, no piping connections are made to the fuel pool below the normal water level. The spent fuel pool cooling water return lines are provided with vacuum breakers to prevent water from being siphoned out of the fuel pool should a break occur in one of these lines. The skimmer surge tanks receive the overflow from the spent fuel pool and serve as the suction source to the fuel pool cooling pumps. Lowering of level in the skimmer surge tank will result in isolation of the pool filter demineralizers. This will result in the loss of the fuel pool cooling pumps. Subsequent heating of the water in the spent fuel pool may occur depending on the heat load present.

## DEVIATION

NUMARC IC AU2 includes unexpected increases in Airborne concentration in addition to plant radiation. The corresponding Hope Creek IC does not address Airborne concentration, since an increase in Airborne concentration is not addressed in the example EALs or the basis for the Unusual Event or Alert. Apparently, the Airborne concentration example EAL was deleted by NUMARC, but the corresponding IC was overlooked.

## REFERENCES

NUMARC NESP-007, AU2.2  
HC.OP-AR.ZZ-0014(Q), Annunciator Response Procedures, Window D3-A5 (D3834)  
HC.OP-AB.ZZ-0144 (Q), Loss of Fuel Pool Inventory/Cooling  
HC.OP-AB.ZZ-0101 (Q), Irradiated Fuel Damage  
HC.OP-AB.ZZ-126 (Q), Abnormal Release of Gaseous Radioactivity  
HCGS Technical Specifications Section 3/4 9.9  
HCGS UFSAR, Section 9.2.2.2

## 6.0 Radiological Releases/Occurrences

### 6.4 Irradiated Fuel Event

ALERT - 6.4.2.a

IC Major Damage to Irradiated Fuel

EAL

**Major Damage to Irradiated Fuel has occurred**

**AND**

**Valid High Alarm received from ANY one of the following RMS channels:**

- Refuel Floor Exhaust Channel A (9RX627)
- Refuel Floor Exhaust Channel B (9RX628)
- Refuel Floor Exhaust Channel C (9RX629)

**OPERATIONAL CONDITION - All**

**BASIS**

Damage to an irradiated fuel bundle that results in a High Refuel Floor Exhaust Radiation Monitor alarm warrants declaration of an Alert, due to the potential for an uncontrolled offsite release exceeding the Technical Specification limit. The intent of this EAL is to classify those events that result in the actual release of fission products from an irradiated Fuel Bundle, due to physical damage.

Events that result in rising radiation levels due to shine, as a result of lowered shielding, but do not involve a release of fission products, should not be classified under this EAL, but should be classified EAL 6.4.2.b when those conditions exist.

**Major Damage** is defined as physical damage to an Irradiated Fuel Bundle that results from either dropping or physical contact with other components in the Fuel Pool or Reactor Cavity, such that the magnitude of the damage specifically results in actuation of a Refuel Floor Exhaust High Radiation Alarm. **Valid** is defined as the High alarm occurring as a result of the damage to the irradiated fuel bundle which results in an actual release of fission products from the cladding.

EAL - 6.4.2.a  
Rev. 02

**Barrier Analysis**

N/A

**ESCALATION CRITERIA**

Emergency Classification will escalate to a Site Area Emergency when loss of control of radioactive materials causes significant offsite doses.

**DISCUSSION**

The Refuel Floor Exhaust Rad Monitors are Process Monitors and are designed to detect a release of Fission Products to the Reactor Building atmosphere. Hence, they are included as part of the EAL threshold, to confirm the magnitude of damage to an irradiated fuel bundle. These monitors can also react as Area Radiation Monitors, in the event of rising radiation levels due to lowered shielding, as would occur during a loss of Fuel Pool inventory event. It is important to distinguish between the cause for rising radiation levels when classifying an event under this EAL.

**DEVIATION**

None

**REFERENCES**

NUMARC NESP-007, AA2.1  
HC.OP-SO.SM-0001(Q), Isolation Systems Operation  
HC.OP-AB.ZZ-0116(Q), Containment Isolations and Recovery from an Isolation  
HC.RP-AR.SP-0001(Q), Radiation Monitoring System Alarm Response, Att. 54, 55, 56  
HCGS Technical Specifications, 3.3.2 Table 3.3.2-2  
HCGS-UFSAR, Section 11.5.2  
NUREG/CR-4982  
NRC Information Notice - 90-08

## 6.0 Radiological Releases/Occurrences

### 6.4 Irradiated Fuel Event

#### ALERT - 6.4.2.b/6.4.2.c

**IC** Events that have or may result in uncovering Irradiated Fuel outside the Reactor Vessel

#### EAL

EITHER one of the following:

- **Unplanned rise on ANY one of the following Area Rad Monitors or by general area rad survey indicates  $\geq 2000$  mRem/hr:**
  - Spent Fuel Storage Pool Area (9RX707)
  - New Fuel Criticality Storage Channel A (9RX612)
  - New Fuel Criticality Storage Channel B (9RX613)
  
- Visual observation of Irradiated Fuel uncovered

#### OPERATIONAL CONDITION - All

#### BASIS

An **Unplanned** Dose Rate of 2000 mRem/hr as indicated on any of the Refuel Floor Area Radiation Monitors (ARMs) warrants declaration of an Alert, as dose rates of this magnitude could be the result of a loss of shielding of irradiated Fuel Bundles or possible damage to an irradiated Fuel Bundle. Offsite doses during these accidents would be well below the EPA Protective Action Guidelines and the classification as an Alert is therefore appropriate.

The intent of these EALs is to classify those events that result in rising dose rates on the Refuel Floor. Specifically, those events that result in rising radiation levels due to shine, as a result of lowered shielding, but do not involve a release of fission products should be classified under this EAL. Those events that result in physical damage to an irradiated fuel assembly and are accompanied by rising radiation levels should not be classified under this EAL, but should be classified EAL 6.4.2.a, when those conditions exist.

**Unplanned** is defined as those events or conditions which are not associated with a planned evolution, such as lifting of the Reactor Vessel Internals, that results in radiation levels are rising

EAL - 6.4.2.b/6.4.2.c

Rev. 02

in an uncontrolled manner. The Dose Rate threshold of **2000 mRem/hr** was chosen based upon NC.NA-AP.ZZ-0024, Radiation Protection Program Administrative Dose Limits and Extension criteria which requires Senior Radiation Protection Supervisor approval prior to exceeding 2000 mRem/yr TEDE. This value is low enough to ensure classification of an Alert before personnel access is severely hampered and high enough to allow any rise in normal radiation level, by a factor of 1000, to be classified as an Unusual Event per EAL 6.3.1 Radiation levels could be indicated by either ARMs or radiological survey.

Uncovered irradiated fuel will result in Onsite dose rates rising significantly.

### **Barrier Analysis**

N/A

### **ESCALATION CRITERIA**

Emergency Classification will escalate to a Site Area Emergency when loss of control of radioactive materials causes significant offsite doses.

### **DISCUSSION**

The Refuel Floor ARMs are designed to detect rising radiation levels on the Refuel Floor. Hence, they are included as part of the EAL threshold, to determine the magnitude of a loss of shielding to irradiated Fuel Bundles.

Actual Damage to an irradiated fuel bundle will also cause a rise in these ARMs, however the Refuel Floor Exhaust Rad Monitors are specifically designed to detect the actual release of fission products to the atmosphere. It is important to distinguish between the possible causes for rising radiation levels when classifying an event under these EALs.

### **DEVIATION**

None

### **REFERENCES**

NUMARC NESP-007, AA2.3, AA2.4  
HCGS Technical Specifications, 3.3.7.1, Table 3.3.7.1-1  
HC.RP-AR.SP-0001(Q), Radiation Monitoring System Alarm Response, Att. 41, 42, 77  
NUREG-1229, Source Term Estimation During Incident Response to Severe Nuclear Power Plant Accidents  
EPA 400-R-92-001, Manual of Protective Action Guides and Protective Actions For Nuclear Incidents  
NRC Information Notice - 90-08