



Waterford Steam Electric Station, Unit 3 Condenser Wide Range Gas Monitor

Regulatory Conference

July 29, 2022



01

Introductions & Agenda

John Lewis - Regulatory Assurance Manager, Waterford 3

Agenda

Section	Presenter
Management Overview	John Ferrick
Issue Identification, Root Cause, Corrective Actions & Extent of Condition	Billy Steelman
Operator Actions	Stephen Smith
Emergency Planning	Dean Burnett
Enforcement Perspective	John Lewis
Closing Remarks	John Ferrick

02

Management Overview

John Ferrick - Site Vice President, Waterford 3

Management Overview

- Licensee Identified
- Prompt and timely corrective actions
- Not indicative of current performance

Failure to maintain the correct function of the Condenser Wide Range Gas Monitor (WRGM) is a performance deficiency

Failure to maintain correct calibration and engineering conversion factors did not adversely impact the ability to accurately and timely classify an emergency condition and did not adversely impact the capability to adequately estimate offsite releases

No Degraded Risk Significant Planning Standard Function

Nuclear Excellence Model



Committed to excellence

Our vision

We power life today and for future generations

Our mission

We exist to operate a world-class energy business that creates sustainable value for our stakeholders: customers, employees, communities and owners.

In support of the company's mission, we will safely and efficiently provide clean, reliable and sustainable nuclear energy.

Fleet focus areas



People:
Be professional



Plant:
Fix the plant



Process:
Operate as a fleet

OUR
VALUES

OUR
PRINCIPLES

OUR
TOOLS

SAFETY

Eliminate and mitigate risk

Prevention, detection, correction model

TEAMWORK

Engage people

Engagement model

**ALWAYS
LEARNING**

Maintain a learning environment

Culpability model

INTEGRITY

Develop strong ownership and accountability

Own it model

RESPECT

Strive for excellence

Continuous improvement culture model



03

Issue Identification, Root Cause, Corrective Actions & Extent of Condition

Billy Steelman – Strategic Engineering Manager, Waterford 3

Condition Description

Problem Statement: From January 2011 to February 2022, the Condenser WRGM mid and high-range detectors were out of calibration

- Licensee identified condition / Good questioning attitude
- Technical Conscience / Cross Functional Teamwork
- RD-72 detector is a Cadmium Telluride solid state detector used to detect mid and high range concentrations
- Immediate notification to shift manager and emergency planning
- Calibration requirements are not specifically called out in vendor documentation

Root Cause

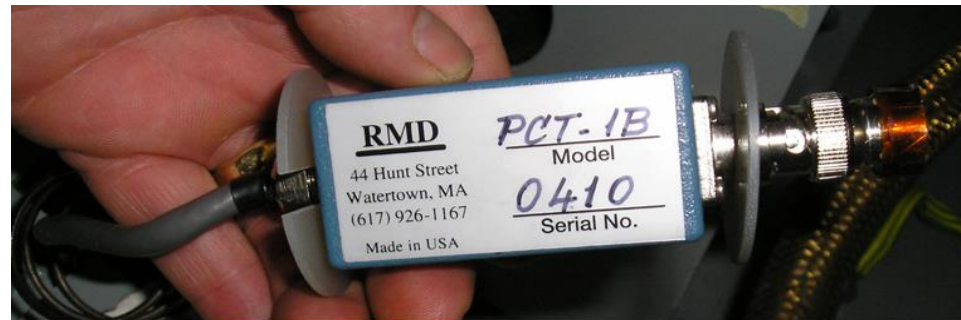
Root Cause:

Procedure revisions in 1985 removed critical steps and equipment requirements which supported replacement, calibration, and troubleshooting issues for specific detectors

Legacy Issue:

- Procedure allowed use of a scalar device instead of multi-channel analyzer
- Impact on future detector replacements was not recognized

RD-72 detector



Timeline

- 1985 – Procedural latent error introduced by deleting new detector calibration information
Allowed calibration issue to occur for future detector replacement
- 1986 – EPLAN procedure added the Condenser WRGM to Site Area Emergency (SAE) Classification
- 2011 – Condenser WRGM calibration error introduced
Detector replaced and not calibrated using a multi-channel analyzer
- 2021 – NEI 99-01, Rev. 6 implemented
This EPLAN version removed the Condenser WRGM for Emergency Action Levels (EALs)
- 2022 – Calibration issue identified (January)
Condenser WRGM calibrated, and condition corrected (February)

Corrective Actions

- Condenser WRGM calibrated correctly
- Vendor support obtained to validate issue and support resolution
- Condenser WRGM procedure updated to correct detector replacement calibration methodology
- Extent of Condition procedures for Plant Stack and Fuel Handling Building WRGMs were updated to correct detector replacement calibration methodology
- EPLAN-related detectors have either been calibrated or a compensatory measure has been established
- Organizational & Programmatic – latent procedure issue

Root Cause Safety Significance

Condenser WRGM Design Basis

Steam Generator Tube Rupture (SGTR) is limiting event for the Condenser WRGM

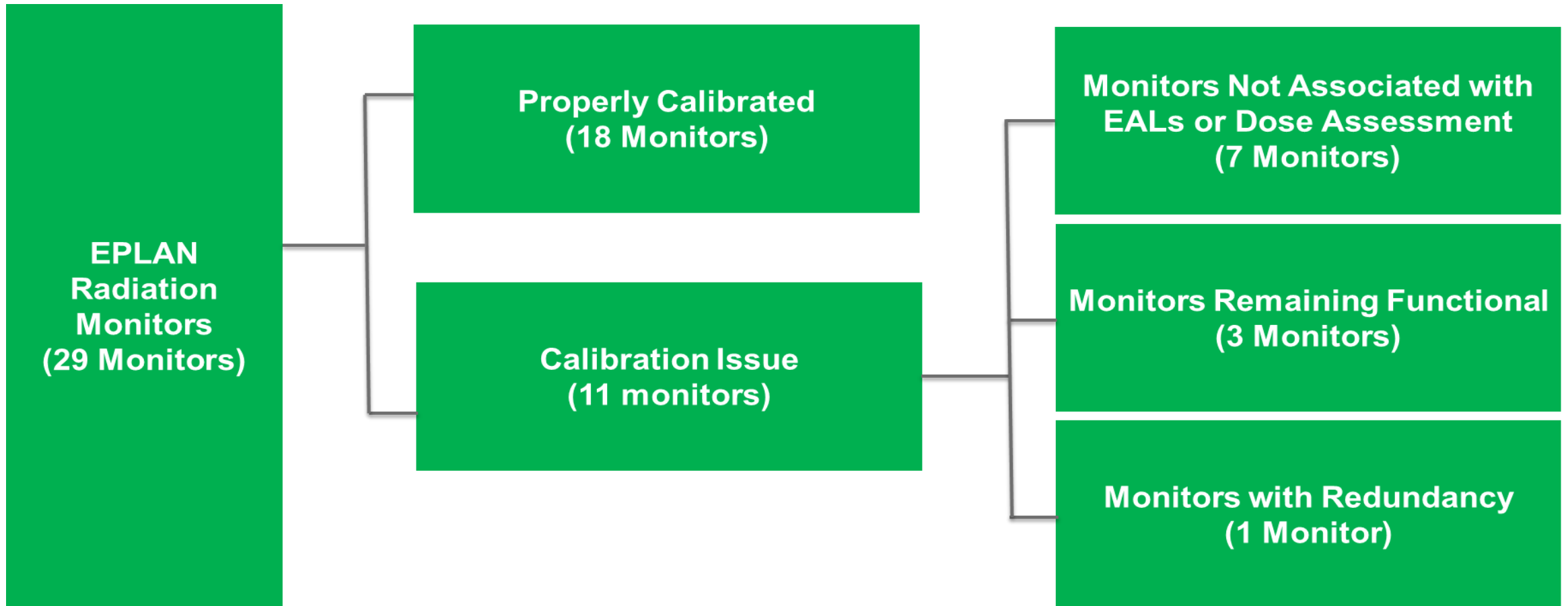
Design Basis SGTR does not credit the Condenser WRGM for accident mitigation

Emergency Operating Procedures drive to cool down the Reactor Coolant System to isolate the affected Steam Generator (SG) which limits the amount of radiological activity being released through the Condenser

EAL Classification and Dose Assessments would not result in an Over-Classification because the affected SG would be isolated from the Condenser

**Design Basis SGTR conditions would not adversely impact
EAL Classification or Dose Assessment**

Root Cause – Extent of Condition



Extent of Condition Findings: No adverse impact on offsite release estimates or ability to classify an emergency condition

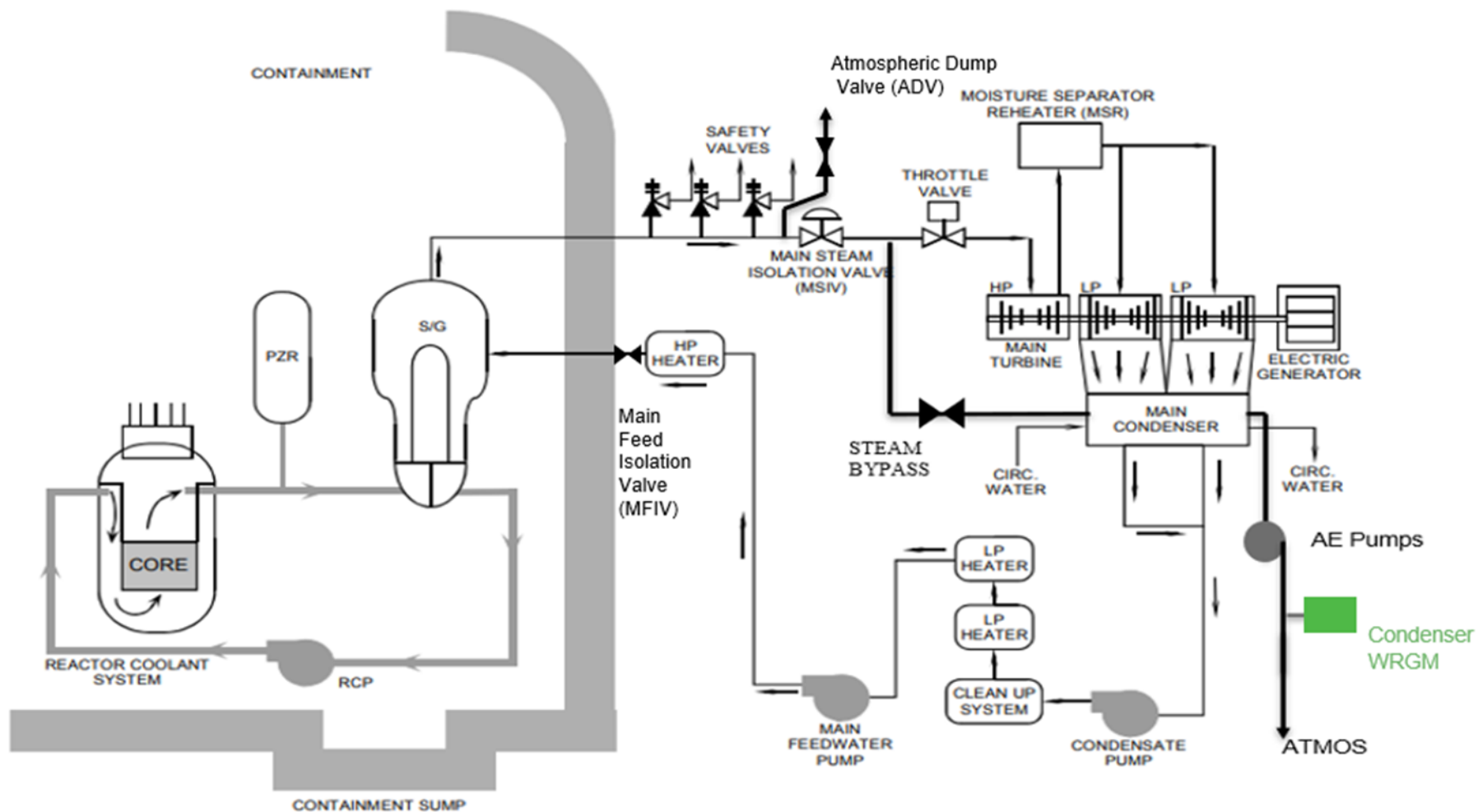
04

Operator Actions

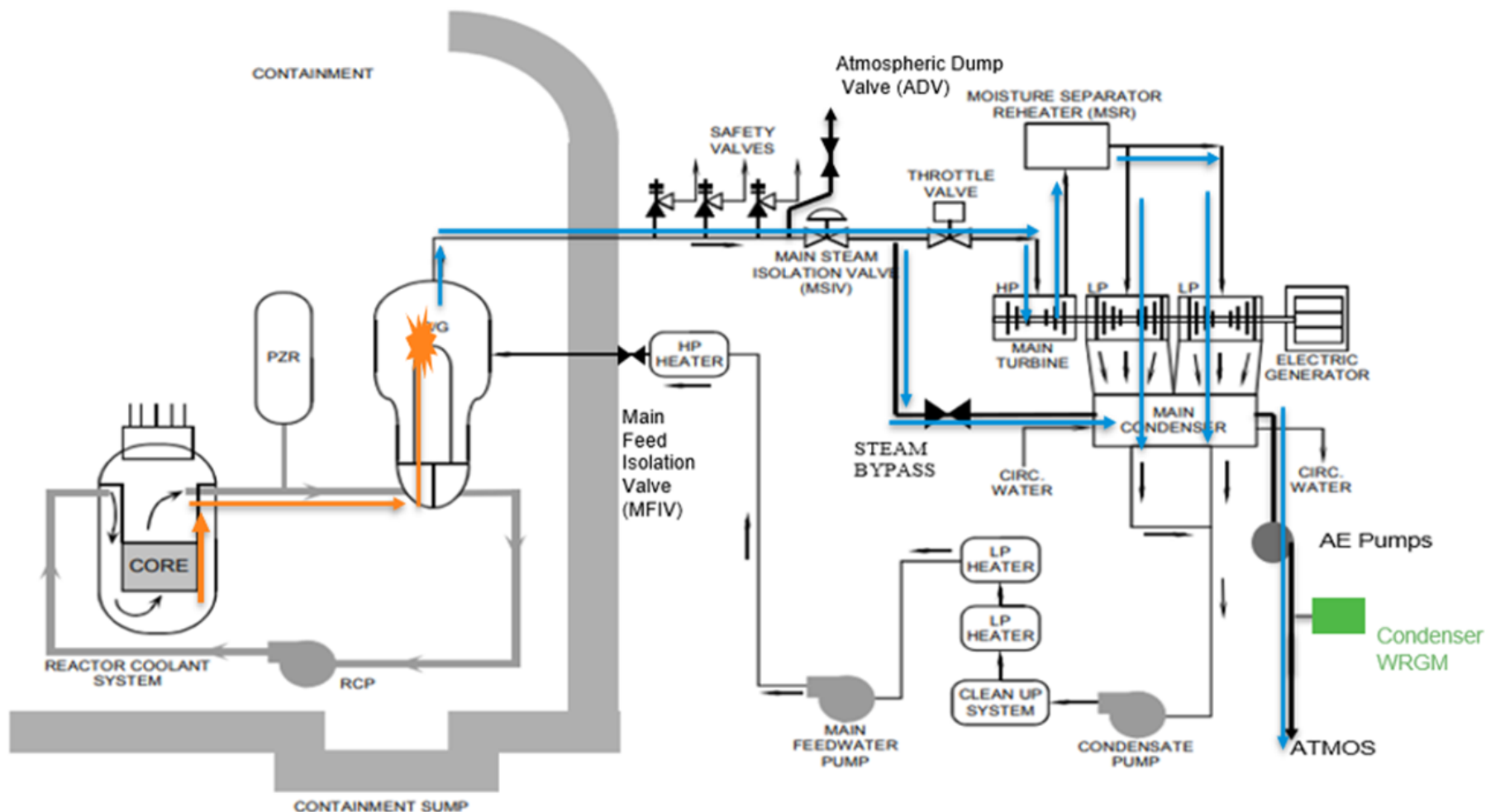
Stephen Smith – Assistant Operations Manager

Senior License Holder – Waterford 3

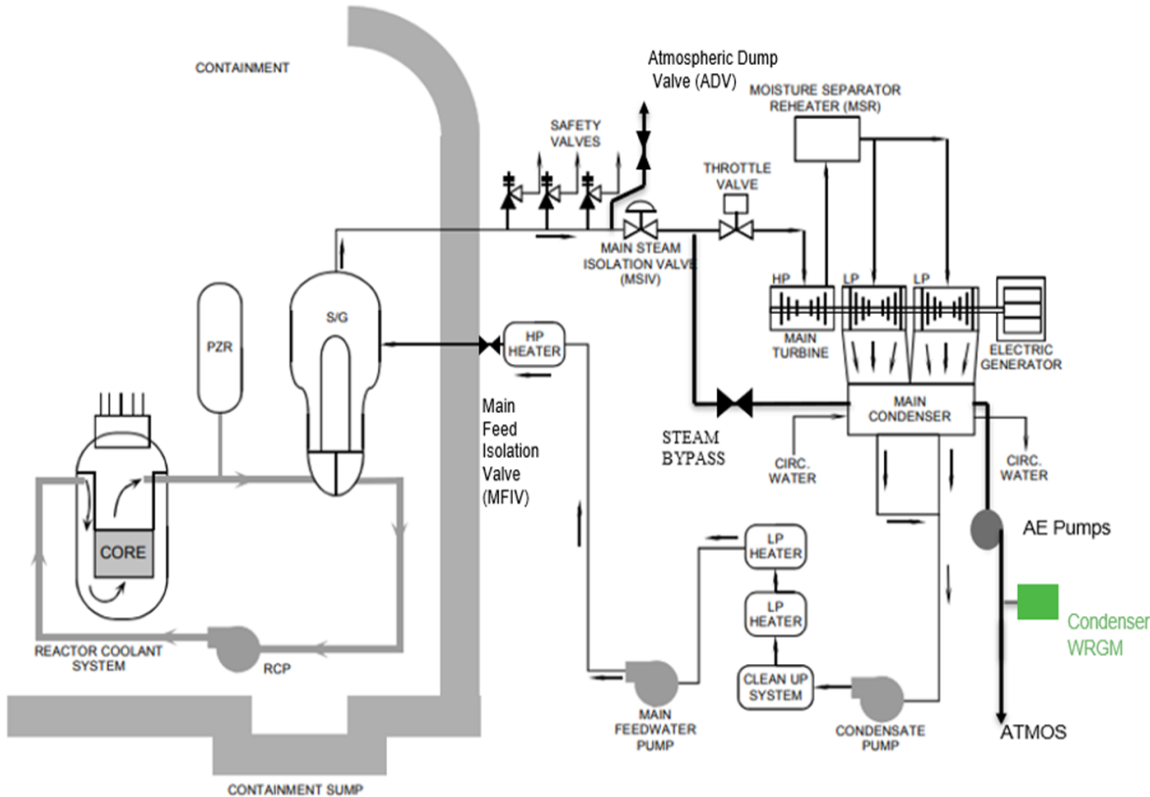
Plant Response to a Steam Generator Tube Rupture



Plant Response to a Steam Generator Tube Rupture



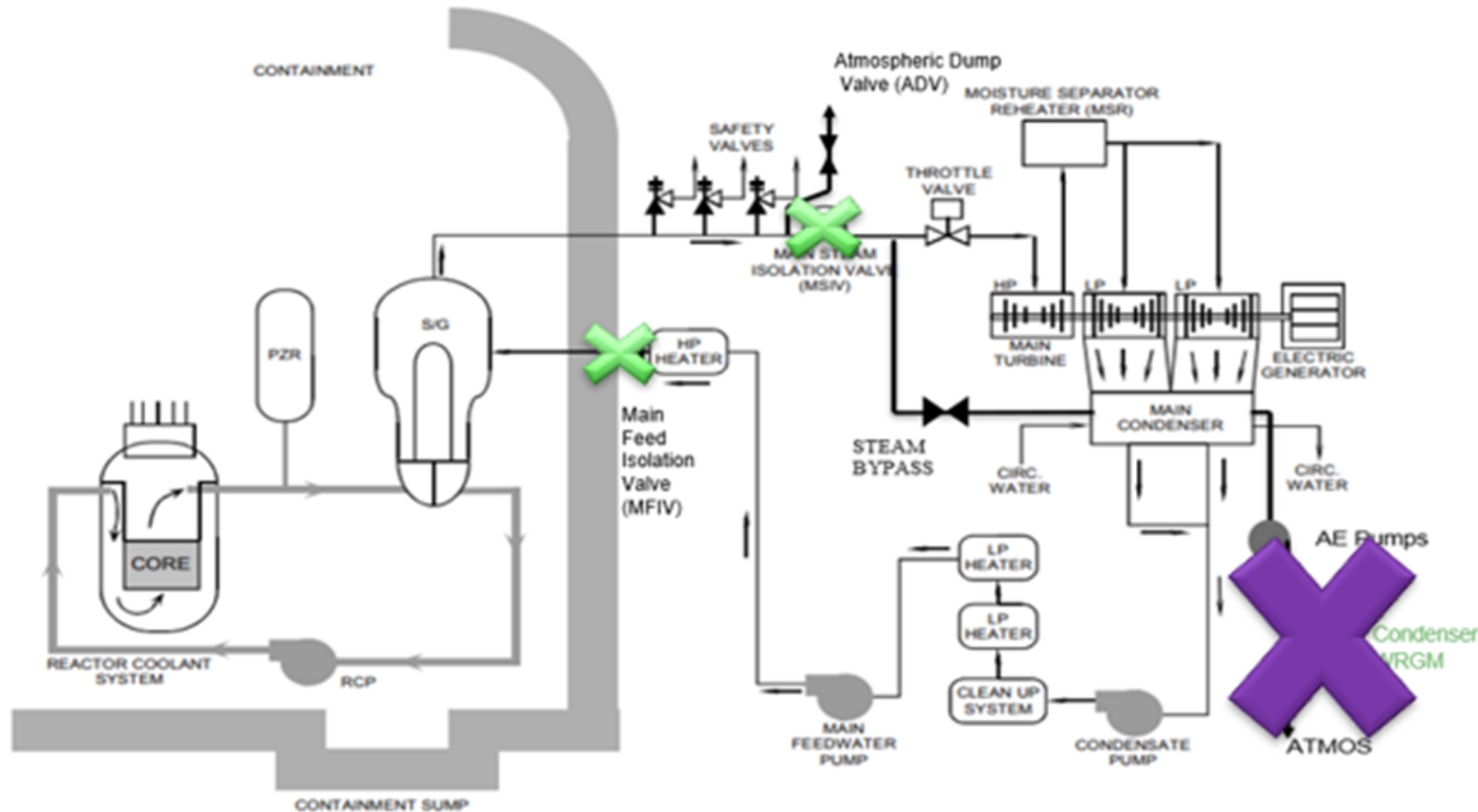
SGTR Mitigation Strategy



- Perform a Rapid Cooldown of the Reactor Coolant System to $< 520^{\circ}\text{F}$
- Determine and Isolate the affected Steam Generator
 - **Condenser WRGM isolated from affected SG** ←
- Reduce Reactor Coolant System Pressure
- Cooldown the Reactor Coolant System to Shutdown Cooling entry conditions

Condenser WRGM not relied on for SGTR mitigation strategy

Condenser WRGM isolation from SGTR



SGTR mitigating strategy results in isolation of the Condenser WRGM from affected Steam Generator

Monitors for Early Diagnosis of a SGTR

Radiation Monitors to diagnose primary to secondary leakage:

- The Air Evacuation PIG (Particulate, Iodine, Gas) Monitor detects small levels of primary to secondary leakage and monitors the condenser air evacuation system non-condensable gases directly from the discharge of the B & C Air Evacuation pumps
- Main Steam Line N16 (Nitrogen-16) Monitors are used to detect and display primary to secondary leakage specific to each Steam Generator

Air Evacuation PIG and N16 monitors are the first indications of low-level primary to secondary leakage due to range and sensitivity

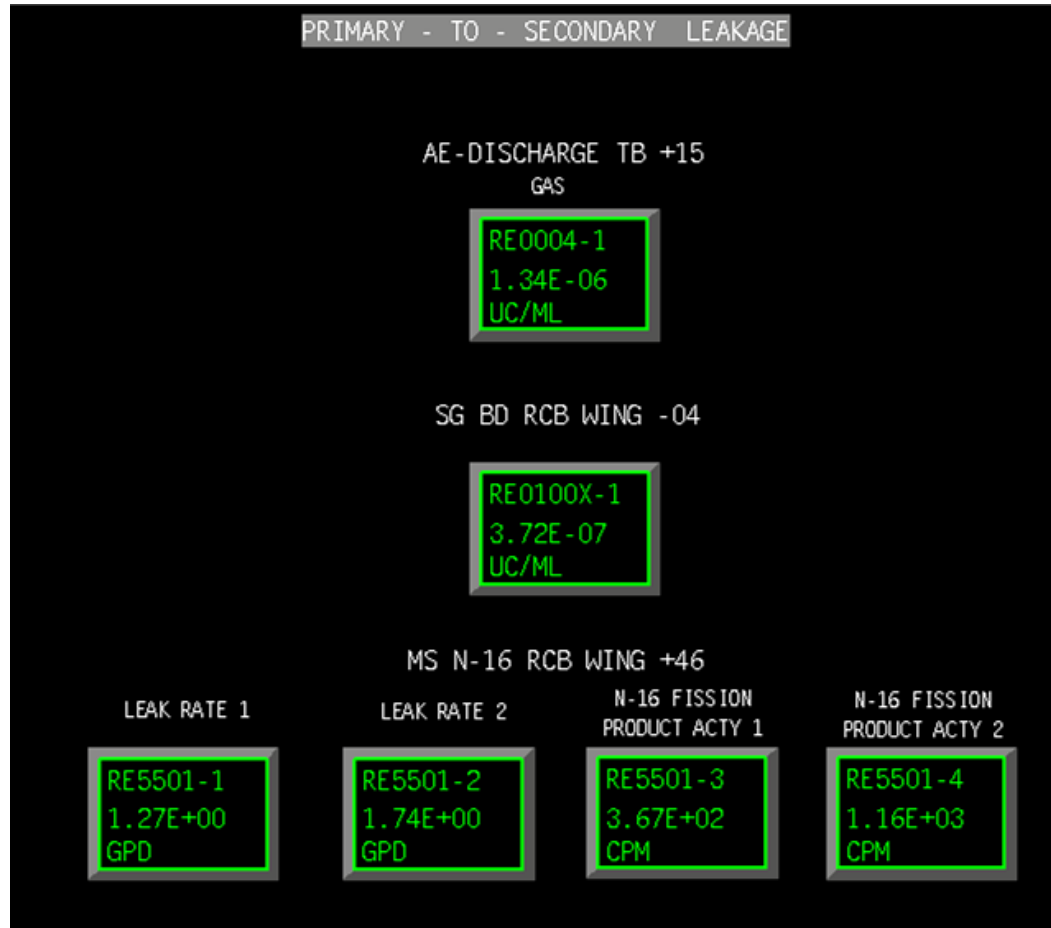
Redundant Monitors to Diagnose a SGTR

Additional radiation monitors to diagnose primary to secondary leakage:

- Blowdown Radiation Monitor – Samples the combined blowdown sample stream for activity
- Main Steam Radiation Monitors – These high-level radiation monitors are located adjacent to each main steam line as it exits Containment

**Due to the redundancy provided by these additional radiation monitors,
the ability to detect and mitigate SGTR
is not impacted by the Condenser WRGM calibration issue**

Control Room Indication of SGTR



SG Tube Leak Display

- Air Evacuation PIG
- SG Blowdown Monitor
- N-16 Monitors

Condenser WRGM is not one of the commonly used monitors for initial diagnosis of primary to secondary leakage

Failures necessary for WRGM to detect activity

Beyond Design Basis Simulator Initial Conditions:

- 1) All 4 Safety Injection Tanks isolated to prevent automatic or manual injection
- 2) Main Steam Isolation Valve fails to close
- 3) High Pressure Safety Injection Pumps A and B failed to start in automatic - Manual start not allowed
- 4) Low Pressure Safety Injection Pumps A and B failed to start in automatic - Manual start not allowed
- 5) Motor Driven Emergency Feedwater Pumps A and B failed to start in automatic - Manual start not allowed
- 6) Steam Driven Emergency Feedwater Pump failed to start in automatic - Manual start not allowed
- 7) Worse Case Tube Rupture is 285 gpm due to double ended sheer of one (1) tube - Approximately ten (10) tubes were failed to create a rupture leakage rate greater than 3000 gpm

Even with these failures, SAE or General Emergency (GE) conditions were met well in advance of readings directly from the Condenser WRGM

05

Emergency Planning

Dean Burnett - Director, Fleet Emergency Planning

Issues Significance: Risk Significant Planning Standards

Emergency Event Classification / Protective Action Recommendations

- Bounding event impacting Condenser WRGM is SGTR
- WRGM indications would not be reached with incorrect settings until more than six (6) hours after an event had been declared based on other instruments reaching their initiating condition thresholds
- Condenser WRGM no longer used for Emergency Plan Classification

Dose Assessment

- There is no credible accident scenario that would result in the Condenser WRGM seeing activity levels reaching the SAE or GE thresholds
- The Condenser WRGM would not have been used as an input into the Dose Assessment process
- Dose Assessments based on available effluent pathways would have provided technically adequate estimates of releases of radioactive material to the environment

Emergency Planning – EAL Classification

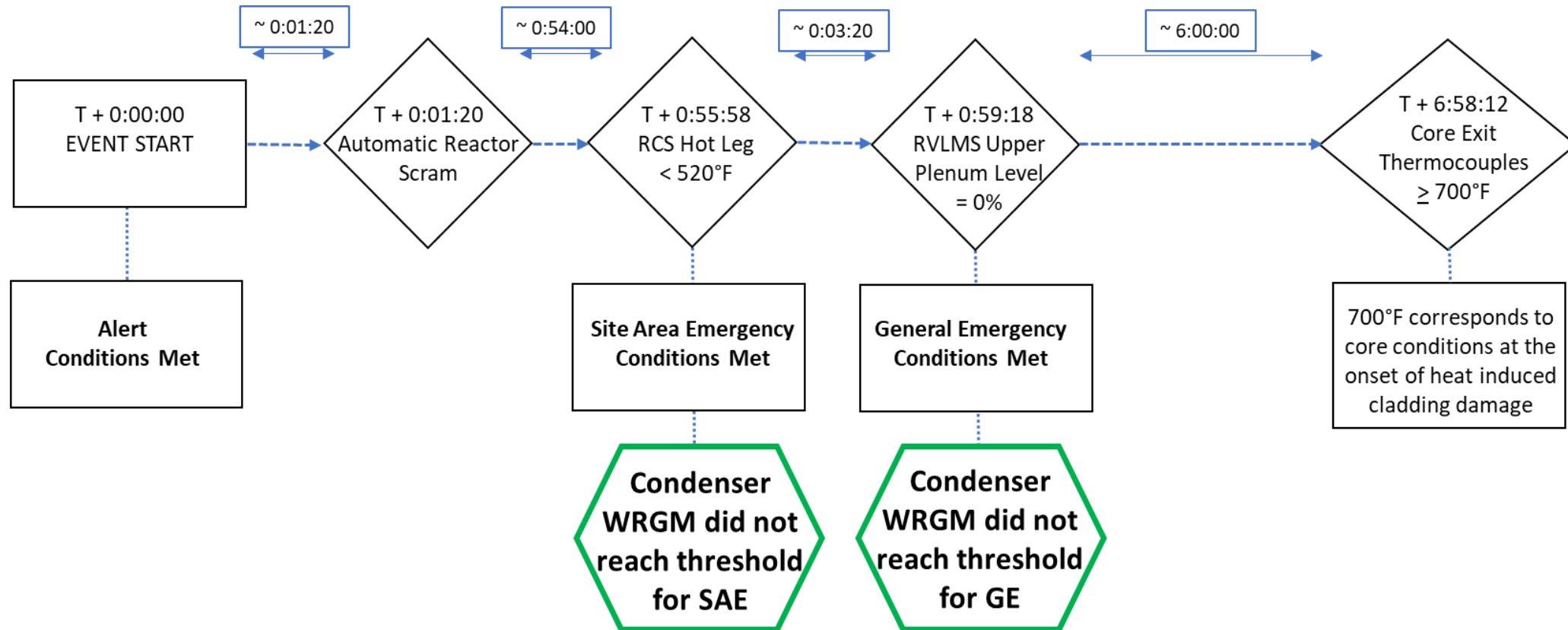
Beyond Design Basis Simulator Initial Conditions:

- 1) All 4 Safety Injection Tanks isolated to prevent automatic or manual injection
- 2) Main Steam Isolation Valve (MSIV) fails to close
- 3) High Pressure Safety Injection Pumps A and B failed to start in automatic - Manual start not allowed
- 4) Low Pressure Safety Injection Pumps A and B failed to start in automatic - Manual start not allowed
- 5) Motor Driven Emergency Feedwater Pumps A and B failed to start in automatic - Manual start not allowed
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- 7) Worse Case Tube Rupture is 285 gpm due to double ended sheer of one (1) tube - Approximately ten (10) tubes were failed to create a rupture leakage rate greater than 3000 gpm

**Even with these failures, SAE or GE conditions
were met well in advance of readings directly from the Condenser WRGM**

Emergency Planning – EAL Classification

Beyond Design Basis Simulator Run Timeline



SAE and GE declared based on Fission Product Barrier EALs long before plant conditions degrade to cause cladding damage

Emergency Planning – EAL Classification

Beyond Design Basis Simulator Run Timeline

T0 (Event Start) - Alert conditions met – Potential loss of RCS or Fuel Clad

T+ 0:55:58 - Site Area Emergency conditions met – Loss of RCS and Loss of Containment

T+ 0:59:18 - General Emergency conditions met – Loss of 2 barriers and potential loss of 3rd

T+ 6:58:12 - Core Exit Thermocouple (CET) reach 700° F
This is the core condition that are the onset of heat induced
fuel cladding damage*

* At this point both the SAE and GE Classifications are made well before conditions are present for the onset of fuel failure which is at +6:58:12 (almost 6 hours after the GE would have been initially declared based upon event Classification using the Fission Product Barrier EALs).

**The Condenser WRGM calibration issue WOULD NOT RESULT
in an Over-Classification of either a SAE or GE**

Emergency Planning – Dose Assessment

No impact to Dose Assessment

- Isolation of the affected SG ensures that adequate methods for assessing and monitoring actual or potential offsite consequences of a radiological emergency condition were available
- SGTR mitigating strategies include isolation of the Condenser WRGM from the affected SG resulting in the Condenser WRGM not being used for Dose Assessment
- The use of Dose Assessment using the output of the Condenser WRGM to determine emergency classifications or Protective Action Recommendations would not occur -- multiple system failures would have to occur for conditions to reach this level
- Dose Assessments based upon available effluent pathways would have provided technically adequate estimates of releases of radioactive material to the environment -- any Protective Action Recommendations resulting from Dose Assessments would have been accurate based on using the available effluent pathways

Dose Projection Process capable of providing technically adequate estimates of radioactive material releases or projected offsite doses

06

Enforcement Perspective

John Lewis - Regulatory Assurance Manager, Waterford 3

Enforcement Perspective

- No actual safety consequences
- No degraded Risk Significant Planning Standard function
- Condenser Wide Range Gas Monitor
 - Self Identified
 - Promptly corrected
 - Does not reflect current performance

No adverse impact on ability to classify an emergency condition
No adverse impact to offsite release estimates

Enforcement Perspective – Safety Significance

- Entergy's Dose Assessment Process remained capable of providing technically adequate estimates of offsite doses
- By procedure, the affected Steam Generator would be isolated from the Main Condenser removing the Condenser WRGM from the flow path
- No adverse impact of the ability to classify a potential emergency condition associated with effluent releases – made accurately and in a timely manner
- No adverse impact on the capability to adequately estimate offsite releases

No adverse impact on ability to classify an emergency condition
No adverse impact to offsite release estimates

Enforcement Perspective – EAL Classification

- Due to alternate mitigating factors, accurate and timely declaration would be made – the Classification function was neither lost nor degraded
- Diverse or redundant Program Elements would allow for the Risk Significant Planning Standard (RSPS) function to be accomplished
- In alignment with the industry, the Condenser WRGM is no longer in EAL Classification Scheme because the exhaust is not normally radioactive

**The Condenser WRGM calibration issue WOULD NOT RESULT
in an Over-Classification of either a SAE or GE**

Enforcement Perspective – Dose Assessment

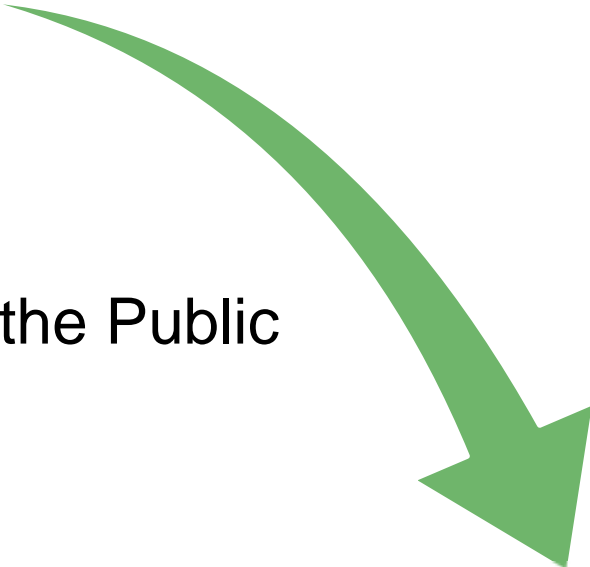
- Procedurally, the affected Steam Generator would be isolated from the Main Condenser, removing the Condenser WRGM from the flow path and not used for Dose Assessment
- Dose Assessments based on available effluent pathways would have provided technically adequate estimates of release of radioactive material to the environment, irrespective of the Condenser WRGM status
- Without the initiation of multiple additional failures beyond the Design Basis requirements, the Condenser WRGM would not see activity levels reaching the SAE or GE thresholds

Dose Projection Process capable of providing technically adequate estimates of radioactive material releases or projected offsite doses

Enforcement Perspective

No impact to EAL Classifications and
No impact to Dose Assessments

No Potential Consequences to the Public



**No loss or degradation of RSPS Function
Requirements of 10 CFR 50, Appendix E
and 10 CFR 50.47(b) were met
Very Low Safety Significance**

07

Closing Comments

John Ferrick - Site Vice President, Waterford 3



Questions?