

Note: This document was originally sent as an e-mail attachment to the GIP mailbox on February 14, 2008 by R. Sherry. It is the same file that he sent informally to J. Foster and J. Kauffman on August 7, 2007.

Form for NRC Staff to Propose a Generic Issue (GI)			
Name or Person Submitting Request Richard Sherry	E-Mail Address rrs1@nrc.gov	Position Title Sr. Reliability and Risk Analyst	Date of Request 07/30/07
Office/Division/Branch/Section RES/DRASP/OERA/PRB	Telephone 415-6778	Mail Stop T9F39	Supervisor Michael Check
<p>GENERAL INSTRUCTIONS FOR COMPLETING AND SUBMITTING THIS FORM: Please contact a Generic Issues Program (GIP) representative at GIP@NRC.gov for assistance in completing this form. When the form is complete, including supervisor acknowledgment, please submit completed form to GIP@NRC.gov.</p>			
<p>Identify Source(s) of Information for this Proposed GI (Self, NRC process, Independent Oversight Committee, Other) – Please Describe and Provide Contact Information for GIP Representatives to Obtain More Information, as Appropriate. Rick Sherry, SOARCA Project, EIS for License Renewal(Brunswick, Browns Ferry)</p>			
<p>INSTRUCTIONS FOR PROVIDING RESPONSES BELOW: Describe situation, condition, Issue, or concern by providing the following information to extent practical (i.e., use readily available information, these requests are not intended to cause an imposition). Describe basis for statements as available or indicate opinion or belief, as applicable. Contact a GIP representative at GIP@NRC.gov for assistance completing these responses.</p> <p>If you do not know how to respond to any question, then put "Don't know."</p>			
<p>What Occurs, Occurred, or What Could Occur (Performance Requirement, Standard, or Expectation Not Met, or Potentially Compromised)?</p> <p>Multi-unit station blackouts (SBO) and core damage accidents can potentially occur as a result of random or common cause failures of shared emergency AC power sources (e.g. emergency diesel generators) following a loss of offsite power (LOOP) or failures resulting from common cause accident initiators such as internal flooding or seismic events which can damage normal and emergency AC power sources in multiple units</p>			
<p>When It Occurs, Occurred, or Could Occur (Time and Circumstances)?</p> <p>See above</p>			
<p>Where It Occurs, Occurred, or Could Occur (Physical Location from General to Specific and in a Sequence of Process Steps or Activities)?</p> <p>Loss of offsite AC power to site (as a result of a seismic event or other external causes) followed by failures of emergency AC power to both units</p>			

<p>Frequency of Occurrence (Relevant Historical Rate, Best Estimate of Rate, and Conditions that Influence the Rate)?</p> <p>Internal Initiated Events</p> <p>For a number of plants with shared emergency AC power sources the LOOP/SBO initiated event are dominated by multi-unit core damage scenarios.</p> <p>Examples:</p> <p>LOOP initiated SBO core damage events at Peach Bottom will almost always involve both units (source Peach Bottom licensee PRA and discussions with plant PRA staff during SOARCA project meetings) – Frequency 5E-7/R Y</p> <p>LOOP initiated SBO core damage events at Brunswick will almost always involve both units. Dual-unit SBO accounts for 37 percent of the total CDF compared with only 2.3 percent from single-unit SBO (source Appendix G to NUREG-1437 for Brunswick Units 1 and 2 License Renewal Generic Environmental Impact Statement) – Frequency 1.5×10^{-5} per year</p> <p>It has also been noted that consideration of multi-unit operations in PRAs can result in an increase in the individual unit predicted CDF compared to results when only the target plant is considered in isolation. The observation was made in the Multiple Unit PSA for the Browns Ferry plants that the mean core damage frequency of Unit 2 is a factor of 4 greater with all three units operating compared to only Unit 2 operating (source Browns Ferry Multi-Unit Probabilistic Risk Assessment – TVA 1995, PLG-1045)</p> <p>External Initiated Events (Seismic, Internal Flooding)</p> <p>Surry Internal Flooding Scenario</p> <p>This scenario involves failure of a 96 in. diameter circulating water (CW) line upstream of the main turbine condenser which results in flooding of both units turbine buildings and overflow of water into the emergency switchgear rooms (ESGR) for both units resulting in loss of emergency AC and DC power leading to core damage in both units. – Frequency 3.3E-6/R Y (Source - Surry Plant PRA Analysis)</p> <p>Surry Seismic Events</p> <p>LOOP and SBO occurs due to an internal flooding, seismic or internal fire event.</p> <p>Frequency of 1E-05/yr to 2E-05/yr (Source - An Assessment of Dominant “External Event” Sequences for Surry NPP from a Risk Perspective, May, 2007, ADAMS ML071440386)</p> <p>Peach Bottom Seismic Events</p> <p>LOOP and SBO occurs due to a seismic or internal fire event. Frequency - 1E-06/yr to 5E-06/yr (Source - An Assessment of Dominant “External Event” Sequences for Peach Bottom NPP from a Risk Perspective, April, 2007, ADAMS ML071090224) - Note: As a result of the extensive sharing of emergency AC power sources discussed above, an SBO event at Peach Bottom has a very high probability of involving both units.</p>
<p>Significance of Occurrence (Reasons it is Important)?</p> <p>Multiple unit SBO challenges the ability of the plant operating staff to respond and may require resources (technical staff and equipment) that exceed what is currently available (e.g. diesel driven pumps, portable DC generators) based on the assumption that only a single unit experiences a SBO (other units have not lost Emergency AC power and can proceed to safe shutdown). Multi-unit SBOs that lead to core damage in two or more units will potentially increase the radionuclide releases and offsite consequences.</p>
<p>Ability to Anticipate and Prevent Occurrence (Leading Indicators or Signs)?</p> <p>Not Applicable/Don't know.</p> <p>Means to Detect or Discover Occurrence (Supporting Evidence)?</p> <p>Enhanced multi-unit PRAs that consider the interactions among units at a site and model shared systems and components. Enhanced external events PRAs which consider common cause failures of systems or components resulting from the initiating event (e.g., correlated failures of similar equipment in different units due to seismic events, flooding or fire events that lead to systems or component failures in multiple units).</p>
<p>Estimated Likelihood of Occurrence (Best Estimate of Chance Under Expected Conditions)?</p> <p>Existing information suggests that multi-unit core damage events will have a frequency of occurrence from all causes (internal and external initiating events) in excess of $1E^{-5}$ /R Y for many if not all current plants.</p>

Causes of Occurrence (Set of Necessary and Sufficient Actions and Conditions)?		
Shared systems among units (e.g., diesel generators, RHR Service Water and Emergency Equipment Cooling Water)		
Common cause initiators (seismic events, internal flooding events)		
Suggestions for Corrective Actions (Remedies to Prevent Adverse Consequences)?		
Development of Multi-Unit PRA models		
Development of EOP and SAMG guidance that recognizes potential for occurrence of multi-unit SBO and core damage sequences		
Recognition when planning and assessing severe accident mitigative measures and resources (equipment and staff) that dual unit scenarios may occur.		
Consideration of dual unit core damage scenarios in assessing accident consequences in cost-benefit studies for assessing severe accident mitigative measures.		
INSTRUCTIONS FOR PROVIDING RESPONSES BELOW: Describe why issue is suitable for assessment under the GIP (versus other NRC Programs or Processes) by providing the following information to extent practical (i.e., use readily available information, these requests are not intended to cause an imposition). Describe basis for statements as available or indicate opinion or belief, as applicable. If you do not know how to respond to any question, then put "Don't know." When one or more of the following responses are "No," the issue is generally not suitable for assessment under the GIP. In these instances, other NRC programs or processes might be better suited to assessing the issue. Contact a GIP representative at GIP@NRC.gov for assistance completing these responses.		
Issue impacts (or has potential to impact) public health and safety, common defense and security, or environment.		
Yes (please explain below)	No	Don't Know
Yes. As a result of plant improvements (e.g. risk informed operations, testing and maintenance) the frequencies of previously (frequency) dominant sequences has been reduced as well as the overall internal events CDF. This has resulted in current risk being dominated for many plants by external events initiated sequences and by internal sequences which have the potential for multi-unit involvement. NRC and licensee recognition of the possibility of multi-unit accidents would lead to regulatory guidance and licensee accident response plans (EOPS, SAMGs, etc.) that could reduce the risk (occurrence frequency and potential consequences) from multi-unit accidents.		
Issue indicates susceptibility of, or has applicability to, multiple licensees or entities regulated by NRC.		
Yes (please explain below)	No	Don't Know
Yes – multi-unit SBO and core damage scenarios have been identified for a number of plant sites. Sites with more extensive shared systems appear most susceptible to multi-unit SBO and core damage scenarios. However, all sites appear to have potential for multi-unit core damage scenarios resulting from common cause initiators, particularly seismic events.		
Issue indicates there are gaps, voids, conflicts, or excess in existing regulations or industry standards causing inadequate protection, opportunity to substantially improve safety, or undue regulatory burden.		
Yes (please explain below)	No	Don't Know
Yes. Little or no attention is given to multi-unit SBO and core damage events in current regulations. Regulatory guidance and industry standards (e.g. station blackout rule and guidance, ASME PRA standard)		
Issue resolution will likely result in new or revised regulation, policy, or guidance to prevent issue's occurrence (Note: dissenting views should be directed to other NRC programs – DPO, NCP, ROP Feedback, etc.).		
Yes (please explain below)	No	Don't Know
Yes. Issues resolution will likely involve revision to regulatory guidance and licensee accident response plans (EOPS, SAMGs, etc.) . In addition, industry standards such as the ASME PRA standard, ANS external event PRA standard and related regulatory guidance (e.g. R.G. 1.200) will likely be impacted by issue resolution,		
Issue will not require substantial new research to assess risk or safety significance or to gain sufficient understanding to support initial screening assessment (i.e., issue parameters are identified and sufficiently understood to support further assessment of the likelihood that the issue would cause or result in a severe accident).		

Yes (please explain below)	No	Don't Know
Yes. Current information is sufficient to assess significance of this issue.		
Issue is discrete with clear and specific technical scope (bounding physical conditions).		
Yes (please explain below)	No	Don't Know
Yes. The causes and susceptibility to multi-unit core damage accidents can be readily identified. The frequency of occurrence can be readily estimated. Regulatory and licensee actions that could reduce the risk from multi-unit accidents have been identified.		
Issue will likely result in actions by licensees or entities regulated by NRC to address issue.		
Yes (please explain below)	No	Don't Know
Yes. Resolution of this issue will likely result in modifications to EOPS/SAMGs, and development of multi-unit PRAs, for some or all licensees		
Supervisor's Acknowledgment Signature		Date
Supervisor's Comments or Recommendations		
Others Consulted or Contacted		
Provide Comments, Additional Information, Attachments, or References (as desired and appropriate to support comments above).		
The attached document provides additional details on multi-unit core damage accidents.		
Please submit completed form, with supervisor's acknowledgment, to GIP@NRC.gov .		