APR1400 Probabilistic Risk Assessment (PRA), Severe Accident (SA), and Reliability Assurance Program (RAP) - Topics for Discussion (03/26/2015)									
The following questions are not requests for additional information (RAIs), but are for discussion only									
Item #	Category	Potential Issue	NRC Reviewer	Responsible KHNP Lead	Comment	KHNP		NRC	
						Action	Target Date	Action	Target Date
Sections 19.0 and 19.1 "PRA"									
Technical issue - Issue that may impact the technical contents of the submittal and staff's ability to reach a reasonable assurance finding.									
PRA-1	Technical issue	Section 19.1, "Probabilistic Risk Assessment," does not address asymmetric configuration and modeling. It is not clear whether the APR1400 PRA model is symmetric or not.	Hanh Phan		**RAI drafted**				
PRA-2	Technical issue	Section 19.1, "Probabilistic Risk Assessment," validation on the modeling of digital I&C including its adequacy, completeness, and common cause failures could not be found. The staff found no risk significance regarding digital I&C.	Courtney St. Peters		**RAI drafted**				
PRA-3	Technical issue	Section 19.1.5, "Safety Insights from the External Events," in accordance with SRP Chapter 19 guidance, the staff could not find any analyses for the applicable external hazards, especially since deterministic evaluations were addressed.	Hanh Phan		**RAI drafted**				
PRA-4	Technical issue	Section 19.1.6, "Safety Insights from the PRA for Other Modes of Operation," DCD Section 5.4.7 does not provide enough information for the staff to conclude that air entrainment during reduced inventory conditions has been adequately addressed deterministically, which impacts the estimated reduced inventory risk.	Marie Pohida		**RAI drafted**				
PRA-5	Technical issue	Section 19.1.6 , appears to have omitted initiating events (such as RCS overdraining-basic event %SO) from the risk achievement analyses.	Marie Pohida		**RAI drafted**				
PRA-6	Technical issue	Section 19.3.2.3, "Mid-Loop Operation," regarding station blackout mitigation strategies, gravity feed from the SITS is utilized to prevent core uncovery. Given a high elevation vent in the RCS, such as an open pressurizer manway, gravity feed may not be feasible due to surgeline flooding in the pressurizer. The staff could find no evaluations on the station blackout strategies given an open RCS with a high elevation vent.	Marie Pohida		**RAI drafted**				

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PRA-7	Technical issue	SRP Section 14.3 "Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)," indicates that "the important insights and assumptions from the PRA provided in FSAR Chapter 19 should be used to determine the appropriate top-level design features for inclusion in Tier 1. A discussion of how the important insights or assumptions from the PRA should be addressed in the selection of the Tier 1 material. The important integrated plant safety analyses from Tier 2 should be considered, such as analyses of internal events, fires, floods, severe accidents, and shutdown risk." Accordingly, it is unclear how the APR1400 PRA was used in determining the scope of ITAAC and which ITAAC that were derived from the important PRA insights and assumptions.	Hanh Phan		**RAI drafted**				
PRA-8	Technical issue	Page 19.1-260, "Key Assumptions," No. 5, "Room cooling is assumed not to be needed for the following rooms. The room heatup calculations to be supplied are expected to show that room cooling is not required. This assumption applies to each room when both the emergency HVAC and ECW are lost." The staff could not find the room heatup calculations for review. It is unclear why HVAC is not modeled as an IE.	Hanh Phan						
PRA-9	Technical issue	Page 19.1-110 states "This CCFP is the conditional probability of a large release (CPLR) for operations at power." The staff could not find the basis for assuming the conditional containment failure probability is equal to the conditional probability of a large release.	Jason Schaperow						

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PRA-10	Technical issue	An RCP seal leakage and failure model is needed to estimate severe accident progression and source term. The following statements related to the RCP seal leakage and failure model are made in Chapter 19: “RCP seal LOCA probability, given a total loss of seal cooling and the RCP trip, is assumed to be equal to 1x10-3 per pump.” “A detailed seal LOCA model will be developed when the RCP seal LOCA technical bases, including the seal LOCA probabilities, become available.” When will a detailed seal LOCA model become available? The staff could not find the seal leakage and failure model (including seal leak sizes and/or flow rates) assumed for the APR1400 PRA, including the basis for the model.	Jason Schaperow						
PRA-11	Technical issue	Section 19.1.4.1.1.1, it is not clear if there are any recovery actions considered during the IE analysis, as mentioned in ASME/ANS PRA Standard IE-C11.	Ayo Ayegbusi		**RAI drafted**				
PRA-12	Technical issue	Section 19.1.4.1.1.1, it is not clear if there is a ISLOCA analysis/calculation performed going by note 5 of Table 19.1-6, as mentioned in ASME/ANS PRA Standard IE-C14.	Ayo Ayegbusi		**RAI drafted (see RAI PRA-11)**				
PRA-13	Technical issue	To verify the accident sequence analysis in Section 19.1.4.1.1.3 meets the requirements of ASME/ANS PRA Standard SC-A5, it is not clear whether any sequences that exceeded the 24 hour mission time to achieve a stable condition and what assumptions were made for those sequences.	Ayo Ayegbusi		**RAI drafted (see RAI PRA-11)**				
PRA-14	Technical issue	In DCD Section 19.1.6.2.2.5, "Key Assumptions," the DCD states, “ B. Failure of hydrogen control from PARs and/or igniters is assumed to yield a conditional probability of containment rupture due to hydrogen detonation of 0.1, plus another conditional probability of containment rupture due to hydrogen burn of 0.1 or 0.01. These probabilities are believed to be conservative, but additional calculations are needed for confirmation.” The staff could not find the results of the calculations documenting the conditional containment failure probability due to hydrogen.	Marie Pohida / Jason Schaperow		**RAI drafted**				

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Verification / justification - Additional information may be necessary for the staff to evaluate conformance with the SRP or technical guidance and reach a reasonable assurance finding.									
PRA-15	Verification / justification	Section 19.1.2, “Quality of PRA,” additional justification of the “Gap Analysis” and the technical adequacy of internal fires PRA and PRA-based SMA are not found.	Hanh Phan		The gap analysis provided in Table 19.1-1 identifies several ASME/ANS supporting requirements that cannot be met. Clarification is needed to provide confidence in the results and risk insights.				
PRA-16	Verification / justification	Section 19.1.2, “Quality of PRA,” the applicant referenced the requirements in ASME/ANS 2009 PRA Standards for its “Gap Analysis,” however the previous PRA Standards nomenclature was used for supporting requirements when reporting the results in the DCD.	Hanh Phan						
PRA-17	Verification / justification	Section 19.1.4.2, “Level 2 Internal Events PRA for Operations at Power,” descriptions of the severe accident physical processes/phenomena and the success criteria used to delineate accident sequences are not clear.	Hanry Wagage						
PRA-18	Verification / justification	Section 19.1.6, appears to screen risk from a water solid condition given that the SCS relief valves are used for Low Temperature Overpressure Protection (LTOP). If these SCS relief valves are challenged but fail to reseat, there could be a low elevation RCS leak path as opposed to a high elevation leak path from the pressurizer. The staff could not find justification regarding the screening of shutdown events occurring in a water solid condition.	Marie Pohida		**RAI drafted**				

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PRA-19	Verification / justification	DCD Tier 1, Page 1.2-1 states: "The design target for CDF is 1E-5 events per reactor year, and the design target for LRF is 1E-6 events per reactor year. These targets include an assessment of internal and external events, excluding seismic events, sabotage, and other external events, and an assessment of shutdown events." However, in Chapter 19, the total CDF and LRF are estimated to be 7.7E-6/yr and 5.6E-7/yr, respectively, without seismic and other external events contributions and these design targets could be exceeded when including seismic risk and other external events risk.	Hanh Phan						
PRA-20	Verification / justification	Tier 1 Page 1.9-99, the term "Not applicable (COL)" is not defined.	Hanh Phan						
PRA-21	Verification / justification	Page 19.1-2 states that "If sufficient information is not available, then the information from the reference plants is used. The reference plants are Shin-Kori Units 3 and 4." Since Shin-Kori Units 3 and 4 are under construction, it is unclear what/how the information from these plants has been used.	Hanh Phan						
PRA-22	Verification / justification	DCD Chapter 1, Page 1.9-76, states that APR1400 conforms to SRP Section 19.1 "Determining the Technical Adequacy of Probabilistic Risk Assessment for Risk-Informed License Amendment Requests after Initial Fuel Load" however, SRP Section 19.1 is only applicable to the amendment requests after initial fuel load.	Hanh Phan						
PRA-23	Verification / justification	DCD Page 19.1-378 includes the basic event, "RC-POSRV V200/201/202/203." The staff is unsure whether this represents a CCF event for the POSRVs and if so, whether it was modeled in models other than the Level 1 internal model.	Tony Nakanishi						
PRA-24	Verification / justification	Figure 19.1-49 suggests that containment failure is avoided in 86.2% of severe accidents. What is causing containment failure to be avoided in these cases? What is preventing late overpressure failure of the containment in these cases?	Jason Schaperow						

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PRA-25	Verification / justification	One of the surrogate safety goals is that the large release frequency should be less than 1E-6/year. Should this number (1E-6) be compared with the PRA result of the total large release frequency for all initiators and operating modes? What is the resulting total large release frequency for all initiators for APR1400?	Jason Schaperow						
PRA-26	Verification / justification	Page 19.1-198 states "These probabilities [for failure of hydrogen control] are believed to be conservative, but additional calculations are needed to confirm." What is the basis for stating these probabilities are conservative? When will the additional calculations be completed?	Jason Schaperow						
PRA-27	Verification / justification	DCD Table 19.1-14 shows the basic event failure rate for I-ATWS-RPMCF as 2.98E-07 per day whereas NUREG/CR-6928 reports this failure rate as 2.98E-07 per hour. Does it affect the PRA?	Tony Nakanishi						
PRA-28	Verification / justification	Section 19.1.4.1.1.1, it is unclear how the initiating event frequencies are quantified and where it is documented.	Ayo Ayegbusi						
PRA-29	Verification / justification	Section 19.1.4.1.1.1, it is unclear whether any other references are used to calculate IE frequencies apart from NUREG/CR-6928.	Ayo Ayegbusi						
PRA-30	Verification / justification	Section 19.1.4.1.1.2, the staff could find no evaluation of plant response and how it was performed.	Ayo Ayegbusi						
PRA-31	Verification / justification	Section 19.1.4.1.1.2, in the RCS heat removal section, the word "may" is used for the feed and bleed operation. It is unclear whether which situations are considered and what they are.	Ayo Ayegbusi						
PRA-32	Verification / justification	Section 19.1.4.1.1.3, it is unclear what is meant by "based on the ASME standard."	Ayo Ayegbusi						
PRA-33	Verification / justification	Section 19.1.4.1.1.3, it is unclear which success criteria were performed using RELAP and which ones were not.	Ayo Ayegbusi						
PRA-34	Verification / justification	Section 19.1.4.1.1.3, it is unclear what is included in the emergency operating guidelines (EOGs) and where they are documented.	Ayo Ayegbusi						

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PRA-35	Verification / justification	Section 19.1.4.1.1.3, it is unclear what is meant by the representative results. Are the results provided not the results from the analysis performed?	Ayo Ayegbusi						
PRA-36	Verification / justification	Section 19.1.4.1.1.7, it is unclear how the dependencies between HFEs are assessed and how 'appropriate' is determined.	Ayo Ayegbusi						
PRA-37	Verification / justification	In Table 19.1-22, it is unclear why item rank #1 has a significantly higher RAW value than item rank #2.	Courtney St. Peters						
Completeness - Information that may need to be provided or docketed to support a reasonable assurance finding.									
PRA-38	Completeness	Section 19.1.1 "Uses and Applications of the PRA," the uses of PRA in the design process are not specifically described.	Hanh Phan						
PRA-39	Completeness	Section 19.1.3, "Special Design/Operational Features," the staff could find no tables or descriptions of the dependencies between front line systems and support systems interfacing and also the dependencies between support systems and support systems interfacing.	Courtney St. Peters						
PRA-40	Completeness	Section 19.1.4.1.1.1, "Initiating Events" and Section 19.1.4.1.1.3, "Success Criteria Analysis," the staff could not find the details of evaluations/analysis performed to support the information provided in the initiating events and success criteria sections.	Ayo Ayegbusi						
PRA-41	Completeness	Section 19.1.4.1.1.2, "Accident Sequence Analysis," the staff could find no discussions on event tree development and related assumptions.	Ayo Ayegbusi						
PRA-42	Completeness	Section 19.1.4.1.1.6, "Human Reliability Analysis," the staff could not find the human failure events and provide a defensible basis to support its probability estimate.	Courtney St. Peters						
PRA-43	Completeness	Section 19.1.4.1.2.5, "Key Assumptions," may not include all important assumptions in the PRA development and external hazards assessments.	Hanh Phan						

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PRA-44	Completeness	Sections 19.1.4, 19.1.5, and 19.1.6, "Safety Insights from Internal Events PRA, External Events PRA, and Low Power and Shutdown PRA," a comprehensive list of risk-insights derived by PRA and other quantitative assessments was not found.	Hanh Phan						
PRA-45	Completeness	Section 19.1.5.3, "Internal Flooding Risk Evaluation" and Section 19.1.6.4, "Internal Flooding PRA for Low Power and Shutdown Operations," the staff could not find a list of flooding sources that were evaluated along with a basis for each screened out flooding source, along with the equipment assumed to be affected in each flood area.	Tony Nakanishi						
PRA-46	Completeness	Section 19.1.6, appears to be missing event trees for all plant operational states other than plant operational state 5.	Marie Pohida		**RAI drafted**				
PRA-47	Completeness	Section 19.1.6, the staff acknowledges that the reactor cavity is filled to the level necessary for core alterations in POS 7 and POS 9. The staff also acknowledges the flow limitations in the letdown line. However, to screen POS 7 and POS 9 from the PRA, the staff could not find: (a) an evaluation documenting the time to core damage given an extended loss of the decay heat removal function and (b) an evaluation that considers all possible drain paths from the refueling cavity including: potential drain rates, the availability of instrumentation and alarms to detect and mitigate a potential drain path, the likelihood of the operator failing to terminate the leak path, and the availability of SSCs to restore RCS inventory.	Marie Pohida		**RAI drafted**				
PRA-48	Completeness	Section 19.1.6, the staff understands POS 12B was screened based on thermal-hydraulic analysis, assuming the time to core damage is greater than 24 hours after a loss of shutdown cooling. However, losses of inventory occurring in POS 12B may result in core damage occurring before 24 hours. The staff could not find the quantitatively assessment of POS 12B.	Marie Pohida		**RAI drafted**				

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PRA-49	Completeness	To evaluate the risk-insights provided in the DCD, it is unclear whether any single failure that would cause a loss of two trains/divisions was identified.	Hanh Phan						
PRA-50	Completeness	Section 19.1.2.4, "PRA Maintenance and Upgrade" states that "The APR1400 PRA model and supporting documentation are to be maintained so that they continue to reflect the as-designed characteristics of the plant. Consistent with the ASME/ANS PRA Standard, and NRC RG 1.200, a process is in place to perform the following as applicable to the certified design: a) Monitor PRA inputs and collect any new information relevant to the PRA; b) Maintain and upgrade the PRA to be consistent with the design; c) Consider cumulative impacts of pending changes when applying the PRA; d) Consider impacts of changes for previously implemented risk-informed decisions that used the PRA (e.g., RAP); e) Maintain configuration control of the computational methods used to support the PRA; and f) Document the PRA model and processes." The staff could find no details and timelines for these activities.	Hanh Phan		Item 8 in Interim Staff Guidance (ISG) DC/COL-ISG-3, "PRA Information to Support Design Certification [DC] and Combined License [COL] Applications," states that "PRA maintenance should commence at the time of application for both DC and COL applicants. This means that the PRA should be updated to reflect plant modifications if there are changes to the design." In addition, Title 10 of the *Code of Federal Regulations* (10 CFR), Section 52.47(a)(27), states that the design certification FSAR includes a "description of the design-specific [PRA] and its results." Therefore, the staff expects that the PRA be maintained during the application process such that it remains design-specific and that the FSAR at the time of certification describes this design-specific PRA. This process ensures that integrated effects of individual changes are reviewed by the staff and that the FSAR reflects both qualitative and quantitative (e.g., importance ranking) insights related to the design.				
PRA-51	Completeness	DCD Page 19.1-149 states, "Several cables have been identified as requiring fire protection features to prevent damage or spurious operation of related components." It is unclear which SSCs are affected by these cables and how the affected SSCs are modeled in the PRA. The staff found the same statement made on DCD Page 19.1-221 for LPSD fire analysis.	Tony Nakanishi		**RAI drafted**				

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PRA-52	Completeness	DCD Page 19.1-221 states, "No fires were identified that can fail both divisions of safety equipment without conditional failure of a fire barrier." This risk insight was identified for the LPSD fire analysis but not for at-power fire analysis.	Tony Nakanishi						
PRA-53	Completeness	It is unclear why some reactor trip sequences do not appear to include the consequential LOOP event. Also, it is unclear from the information in the DCD, how the consequential LOOP was modeled for LOCA and other events that may actuate the ESF.	Tony Nakanishi		**RAI drafted**				
PRA-54	Completeness	The staff could not find a summary of the uncertainty analysis results for the at-power fire analysis.	Tony Nakanishi		**RAI drafted**				
PRA-55	Completeness	It is unclear how the house load operation (HLO) described in DCD Page 19.1-20 is modeled or assumed in the PRA.	Tony Nakanishi						
PRA-56	Completeness	DCD Page 19.1-260 states, "The room heatup calculations to be supplied are expected to show that room cooling is not required." The staff could not find a summary of the results of these calculations.	Tony Nakanishi						
PRA-57	Completeness	DCD Page 19.1-46 states, "A thorough treatment of CCFs, intra-system dependencies, and selected intersystem dependencies is provided." The staff could not find a description of the intersystem dependencies modeled.	Tony Nakanishi						
PRA-58	Completeness	DCD Section 19.1.4.1.1.6 describes the HRA. It is unclear how the HFE patterns were determined for the subsequent dependency analysis.	Tony Nakanishi		**RAI drafted**				
PRA-59	Completeness	Page 19.1-224 states "LPSD flooding LRF is not quantified." It is unclear why LRF was not quantified for LPSD flooding.	Jason Schaperow						
PRA-60	Completeness	Section 19.1.4.1.1, under data analysis, it does not describe the data sources used for initiating events.	Ayo Ayegbusi						
PRA-61	Completeness	Section 19.1.4.1.1.1, it is unclear why initiating events in Table 19.1-5 lists only 4 initiating event types, when Table 19.1-6 identifies more than 4 initiating events.	Ayo Ayegbusi						

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PRA-62	Completeness	What qualitative evaluation is performed for each potential initiating events identified to assess applicability to APR1400 as stated in Section 19.1.4.1.1.1?	Ayo Ayegbusi						
PRA-63	Completeness	Section 19.1.4.1.1.1, what is meant by CCF potentials?	Ayo Ayegbusi						
PRA-64	Completeness	Section 19.1.4.1.1.1, what new initiators unique to APR1400 were identified?	Ayo Ayegbusi						
PRA-65	Completeness	Section 19.1.4.1.1.1, what special initiators were considered and/or modeled?	Ayo Ayegbusi						
PRA-66	Completeness	Section 19.1.4.1.1.1, how were potential initiating events screened from consideration if the frequency was low?	Ayo Ayegbusi						
PRA-67	Completeness	Section 19.1.4.1.1.1, what are the preliminary and final IE grouping definitions?	Ayo Ayegbusi						
PRA-68	Completeness	Section 19.1.4.1.1.1, what are the existing nuclear power plants referenced?	Ayo Ayegbusi						
PRA-69	Completeness	Section 19.1.4.1.1.2, how is "postulated disturbance" used in this section?	Ayo Ayegbusi						
PRA-70	Completeness	Section 19.1.4.1.1.2, multiple instances where the word potential is used to describe system response. Are the systems designed to respond or not?	Ayo Ayegbusi						
PRA-71	Completeness	Section 19.1.4.1.1.2, it is unclear how top events/gates were identified.	Ayo Ayegbusi						
PRA-72	Completeness	Section 19.1.4.1.1.2, it is unclear how the event sequence model structure is developed and where it is documented and how the results are used.	Ayo Ayegbusi						
PRA-73	Completeness	Section 19.1.4.1.1.2, it is unclear whether any unique trees were developed and how they would impact the results.	Ayo Ayegbusi						
PRA-74	Completeness	Section 19.1.4.1.1.2 does not list the referenced PWR PRA in the reference section. Thus, it is unclear which specific PRAs are being considered.	Ayo Ayegbusi						
PRA-75	Completeness	Section 19.1.4.1.1.2, it is unclear how the timing and progression of each accident sequence is determined and how it is used.	Ayo Ayegbusi						
PRA-76	Completeness	Section 19.1.4.1.1.2, it is unclear how the containment cooling function modelled in the event trees is used to prevent core damage.	Ayo Ayegbusi						

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PRA-77	Completeness	Section 19.1.4.1.1.2, it is unclear whether there are any cases where the top events are reordered to simplify the event tree.	Ayo Ayegbusi						
PRA-78	Completeness	Section 19.1.4.1.1.3, it is unclear whether there are any scenarios where containment failure is considered to cause core damage.	Ayo Ayegbusi						
PRA-79	Completeness	Section 19.1.4.1.1.3, it is unclear how the models incorporate existing PWR plant experience.	Ayo Ayegbusi						
PRA-80	Completeness	Section 19.1.4.1.1.3, describe the certain phenomenology that RELAP5 cannot model and how engineering judgment is applied to determine the appropriate code.	Ayo Ayegbusi						
PRA-81	Completeness	Section 19.1.4.1.1.3, it is unclear what margin was used to account for uncertainties in the models.	Ayo Ayegbusi						
PRA-82	Completeness	Section 19.1.4.1.1.3, it is unclear why the upstream and downstream of LSSB are not listed in the full power level 1 PRA initiating events list.	Ayo Ayegbusi						
PRA-83	Completeness	Section 19.1.4.1.1.3, it is not clear why LODC is not listed as LODCA and LODCB.	Ayo Ayegbusi						
PRA-84	Completeness	Section 19.1.4.1.1.3, it is not clear if TLODC was considered during the success criteria determination.	Ayo Ayegbusi						
PRA-85	Completeness	Section 19.1.4.1.1.3, it is not clear why RVR is not included in the list of initiating events.	Ayo Ayegbusi						
PRA-86	Completeness	The staff could find no CCFs of digital I&C in Table 19.1-23.	Courtney St. Peters						
PRA-87	Completeness	Section 19.1.4, the staff could find no mission times for any key design features.	Courtney St. Peters						
PRA-88	Completeness	The staff reviewed the applicant's definitions of Plant Operational States (POSs) defined in Table 19.1-81, LPSD Plant Operating States. The staff could not find detailed information regarding the POS definitions to review the LPSD PRA results, e.g., for each POS: (1) the anticipated decay heat level- how many hours post shutdown, (2) the size and locations of any RCS vents- other than the reactor vessel head, (3) the time to RCS boiling given a loss of the decay heat removal function, and (4) the time to core uncovery.	Marie Pohida		**RAI drafted**				

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						Action	Target Date	Action	Target Date
Consistency - Information within the submittal appears to be inconsistent and should be addressed.									
PRA-89	Consistency	DCD Chapter 1, Page 1.9-98, Item II.N states that "PRA covers seismic events, internal fire events, and internal flooding events as well as internal events. The COL applicant is to perform site-specific PRA evaluations to address any site-specific hazards." However, as discussed in DCD Chapter 19, APR1400 PRA does not include seismic events.	Hanh Phan						
PRA-90	Consistency	DCD Page 19.1-164 states, "This design confines flood water to one quadrant up to an elevation of 78 ft." However, Table 19.1-4 Item 50 states, "There are no doors or passageways connecting the divisions of safety-related equipment up to elevation 68 ft in the auxiliary building."	Tony Nakanishi						
PRA-91	Consistency	DCD Page 19.1-62 states, "the RCP seal LOCA probability, given a total loss of seal cooling and the RCP trip, is assumed to be equal to 1 × 10-3 per pump." It is unclear how this relates to the basic event, SEAL-AFSUC, which appears to have a assumed failure probability of 4E-3.	Tony Nakanishi						
PRA-92	Consistency	DCD Table 19.1-40 provides the results of the LRF sensitivity analyses where the "External Reactor Vessel Cooling is Credited" sensitivity case is the same as baseline. However, DCD Page 19.1-113 states, "External reactor vessel cooling is conservatively not credited in the baseline Level 2 analysis, but is evaluated in a sensitivity analysis."	Tony Nakanishi						
PRA-93	Consistency	DCD Table 19.1-137 which provides the LPSD LRF frequencies add up to about 6.6E-8, which is not consistent with the total LRF for LPSD of 1.2E-7.	Tony Nakanishi						
PRA-94	Consistency	DCD Table 19.1-148 which provides the LPSD fire LRF frequencies add up to about 1.17E-7, which is not consistent with the total LPSD fire LRF of 1.3E-7.	Tony Nakanishi						
PRA-95	Consistency	Section 19.1.4.1.1.1, it is not clear how the ISLOCA and RV Rupture IE's in Table 19.1-6 are calculated.	Ayo Ayegbusi						

APR1400 Probabilistic Risk Assessment (PRA), Severe Accident (SA), and Reliability Assurance Program (RAP) - Topics for Discussion (03/26/2015)									
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						Action	Target Date	Action	Target Date
PRA-96	Consistency	Section 19.1.4.1.1.7, it is not clear why this section states MAAP was used to evaluate the success criteria, when the success criteria section says MAAP and RELAP were used.	Ayo Ayegbusi						
Typo - Potential editorial error in the submittal that should be addressed.									
PRA-97	Typo	As discussed in DCD Chapter 19, the risk associated with seismic events was evaluated using a qualitative PRA-based SMA, rather than seismic PRA as stated on Page 1.9-98.	Hanh Phan						
PRA-98	Typo	DCD Chapter 9, Pages 9.5-144 and 9.5-148 state that "The PRA for external fire events is based on the methodology in NUREG/CR-6850, as described in Chapter 19 of DCD." However, Chapter 19 only addresses internal fires, not external fire events.	Hanh Phan						
PRA-99	Typo	DCD Page 19.1-198 states, "Failure of hydrogen control … is assumed to yield … another conditional probability of containment rupture due to hydrogen burn of 0.1 or 0.01." It is unclear whether this value is 0.1 or 0.01.	Tony Nakanishi						
PRA-100	Typo	DCD Page 19.1-693: The description and the corresponding basic event name do not match for the following: RCPVO-C-201 and RCPVO-A-200.	Tony Nakanishi						
PRA-101	Typo	DCD Page 19.1-716: The description and the corresponding basic event name do not match for the following: RCPVO-A-200.	Tony Nakanishi						
PRA-102	Typo	DCD Page 19.1-716: The description and the corresponding basic event name do not match for the following: CSMPM2A-PP01A.	Tony Nakanishi						
PRA-103	Typo	DCD Page 19.1-1157: The description and the corresponding basic event name do not match for the following: PSAVC-S-032.	Tony Nakanishi						
PRA-104	Typo	DCD Page 19.1-1164: The description and the corresponding basic event name do not match for the following: PSAVC-S-032.	Tony Nakanishi						
PRA-105	Typo	DCD Page 19.1-1167: The description and the corresponding basic event name do not match for the following: PSAVC-S-032.	Tony Nakanishi						
PRA-106	Typo	DCD Page 19.1-1169: FV should be RAW in the title for Table 19.1-142.	Tony Nakanishi						

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						Action	Target Date	Action	Target Date
PRA-107	Typo	DCD Page 19.1-1342: The description and the corresponding basic event name do not match for the following: PSAVC-S-032.	Tony Nakanishi						
PRA-108	Typo	DCD Page 19.1-1349: The description and the corresponding basic event name do not match for the following: PSAVC-S-032.	Tony Nakanishi						
PRA-109	Typo	DCD Page 19.1-1352: The description and the corresponding basic event name do not match for the following: PSAVC-S-032.	Tony Nakanishi						
PRA-110	Typo	One label on Figure 19.1-50 is SRF. The abbreviation SRF did not seem to be defined in Chapter 19.	Jason Schaperow						
PRA-111	Typo	Section 19.1.4.1.1.1, describes the potential initiating events. It is unclear why there would be "potential" initiating events.	Ayo Ayegbusi						
PRA-112	Typo	Section 19.1.4.1.1.1, error in Note 1 of Table 19.1-6, it used 'which a' instead of 'which are.'	Ayo Ayegbusi						
PRA-113	Typo	Section 19.1.4.1.1.6, “Human Reliability Analysis,” Page 19.1-54, Item b states "Human-induced initiating eventsand are not considered in detail." "Eventsand" should be "events."	Courtney St. Peters						
Section 19.2 "Severe Accident"									

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SA-1	Technical issue	Section 19.2.3.3.7, “Equipment Survivability,” the pressure and humidity for equipment survivability are not provided and there are cases where equipment required for severe accident mitigation is not shown to survive.	Jason Schaperow		SRP 19.0 states the following: The staff should review the applicant’s description and analysis of the design features to prevent and mitigate severe accidents, in accordance with the requirements in 10 CFR 52.47(23) or 10 CFR 52.79(a)(38), for a DC or a COL application, respectively. This review should specifically address the issues identified in SECY-90-016 and SECY-93-087, which the Commission approved in related SRMs dated June 26, 1990, and July 21, 1993, respectively, for prevention (e.g., anticipated transients without scram, midloop operation, station blackout, fire protection, and intersystem loss-of-coolant accident) and mitigation (e.g., hydrogen generation and control, core debris coolability, high-pressure core melt ejection, containment performance, dedicated containment vent penetration, equipment survivability).				
SA-2	Technical issue	10 CFR 52.47(a)(23) requires for light-water reactor designs to provide a description and analysis of design features for the prevention and mitigation of severe accidents, e.g., challenges to containment integrity caused by phenomena including hydrogen combustion. Section 19.2.3.3.2 Hydrogen Generation and Control of APR1400 DCD Rev. 0 describes hydrogen igniters but the sources of power to the igniters is not mentioned. The staff could not find the sources of power to the igniters in the DCD and the redundancy of power available to the igniters.	Hanry Wagage		**RAI drafted**				

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SA-3	Technical issue	10 CFR 52.47(a)(23) requires for light-water reactor designs to provide a description and analysis of design features for the prevention and mitigation of severe accidents, e.g., challenges to containment integrity caused by phenomena including high-pressure core melt ejection. Section 19.2.3.3.4.1.2 of APR1400 DCD Rev. 0 states that "the fraction of the dispersed corium that enters the upper containment via the RPV annulus is given by the ratio of the area of RPV annulus, 1.96 m2, to the total flow area, which is the sum of the area of PRV and the area of reactor cavity, 23.76 m2, or 0.082." No description or analysis is provided.	Hanry Wagage		This assumes the flow from the RPV divides into two, one entering the containment through the RPV annulus and the other through the reactor cavity. The fraction of the dispersed corium that enters the upper containment via the RPV annulus may increase due to factors such as (a) restrictions for the flow through the reactor cavity and (b) whether the flow path leads to a closed compartment. **RAI drafted**				
SA-4	Verification / justification	Section 19.2.6, "Consideration of Potential Design Improvements Under 10 CFR 50.34(f)" and technical reports, APR1400-E-P-NR-14006-P and APR1400-E-P-NR-14006-NP, "SAMDAs for the APR1400," the staff could find no justification to support the applicant's conclusion that risks from external hazards (i.e., tornadoes, high winds, external flooding, etc.) are negligible. Also, the staff could not find the cost estimates for design improvements that are needed for cases where the applicant determined that the benefit calculated from the improvement would be lower than the cost of the improvement.	Jason Schaperow						

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SA-5	Verification / justification	Section 19.2.2.5 of APR1400 DCD Rev. 0 states that "This SCS line design satisfies the ISLOCA acceptance criteria because all sections of the system and interfaces are designed to withstand full RCS operating pressure, or they have leak-test capabilities, valve position indications in the control room that function even when isolation valve operators are de-energized, and high-pressure alarms to warn operators when pressure is approaching the design pressure. Deletion of the interfaces from the SCS lines eliminates the potential for an ISLOCA without adversely affecting the performance or operations of the SCS." It is unclear why the first sentence implies the presence of interfaces between SCS and RCS while the second sentence states deletion of such interfaces.	Hanry Wagage						
SA-6	Completeness	Table 19.2.3-1 Hydrogen Control System Design Status of APR1400 DCD Rev. 0 identifies locations of only 2 of 8 igniters and 23 of 30 PARs. The staff could not identify locations of all the igniters and PARs on the table.	Hanry Wagage						
Section 17.4 "RAP"									
RAP-1	Technical issue	Section 17.4, Contrary to Table 1.9-2, DCD Section 17.4 does not follow the guidance in SRP 17.4, Rev. 1.	Ayo Ayegbusi		For example, it discusses essential elements of RAP instead of programmatic controls; processes for RAP in the operations phase; and development/integration of operational RAP (O-RAP), which is not included in the SRP guidance. RAI drafted				
RAP-2	Technical issue	Section 17.4, the DCD discussion does not meet the guidance in SRP 17.4.A.2.2, "Design Control," where the applicant should describe design change control processes relating to plant changes (not just the RAP list), quality controls of D-RAP inputs, controls of procedures and instructions and records.	Ayo Ayegbusi		**RAI drafted (see RAI RAP-1)**				

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						Action	Target Date	Action	Target Date
RAP-3	Technical issue	Section 17.4, the DCD does not discuss a rationale for excluding certain types of risk significant SSCs from the RAP such as pipes and ducts nor does the DCD address how other programs and requirements ensure these SSCs do not degrade as provided in SRP 17.4.A.3.	Ayo Ayegbusi		**RAI drafted (see RAI RAP-1)**				
RAP-4	Technical issue	Section 17.4, the RAP list does not identify the dominant failure modes of RAP SSCs as provided in SRP 17.4.A.6.	Ayo Ayegbusi		**RAI drafted (see RAI RAP-1)**				