

PRA, SEVERE ACCIDENT AND RAP

- Overview of PRA, SA and RAP documents
- 123 Comments
- Future Audits

Content

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- Documents/Information Necessary for the Audit

Overview of PRA, SA and RAP Documents

- **Documents for Probabilistic Risk Assessment (PRA)**
- **Documents for Severe Accident (SA)**
- **Documents for Reliability Assurance Program (RAP)**

Documents for PRA

- DCD 19.0 and 19.1
- PRA Summary Report (APR1400-E-P-NR-14001-P, Rev.0)
- PRA Notebooks
- Procedures

Documents for PRA

● Full Power Level 1 PRA

Document Number	Title
APR1400-K-P-NR-013101-P	Full Power Level 1 PRA - Initiating Event Analysis
APR1400-K-P-NR-013102-P	Full Power Level 1 PRA - Accident Sequence Analysis
APR1400-K-P-NR-013103-P	Full Power Level 1 PRA - Success Criteria Analysis
APR1400-K-P-NR-013104-P	Full Power Level 1 PRA - Data Analysis
APR1400-K-P-NR-013105-P	Full Power Level 1 PRA - Human Reliability Analysis
APR1400-K-P-NR-013106-P	Full Power Level 1 PRA - System Analysis Guideline
APR1400-K-P-NR-013107-P	Full Power Level 1 PRA - Quantification Notebook
APR1400-K-P-NR-013108-P	Full Power Level 1 PRA - Sensitivity and Uncertainty Analysis

Documents for PRA

● Full Power Level 1 PRA – System Notebooks

Document Number	Title
APR1400-K-P-NR-013201-P	Full Power Level 1 PRA - Safety Injection System Notebook
APR1400-K-P-NR-013202-P	Full Power Level 1 PRA - Shutdown Cooling System Notebook
APR1400-K-P-NR-013203-P	Full Power Level 1 PRA - Containment Spray System Notebook
APR1400-K-P-NR-013204-P	Full Power Level 1 PRA - Reactor Coolant System Notebook
APR1400-K-P-NR-013205-P	Full Power Level 1 PRA - Chemical Volume Control System Notebook
APR1400-K-P-NR-013206-P	Full Power Level 1 PRA - Reactor Coolant Gas Vent System Notebook
APR1400-K-P-NR-013207-P	Full Power Level 1 PRA - Auxiliary Feedwater System Notebook
APR1400-K-P-NR-013208-P	Full Power Level 1 PRA - Feedwater System Notebook
APR1400-K-P-NR-013209-P	Full Power Level 1 PRA - Main Steam System Notebook
APR1400-K-P-NR-013211-P	Full Power Level 1 PRA - Auxiliary Power System Notebook
APR1400-K-P-NR-013212-P	Full Power Level 1 PRA - Component Cooling Water System Notebook
APR1400-K-P-NR-013213-P	Full Power Level 1 PRA - Essential Service Water System Notebook
APR1400-K-P-NR-013214-P	Full Power Level 1 PRA - Essential Chilled Water System Notebook
APR1400-K-P-NR-013215-P	Full Power Level 1 PRA - HVAC System Notebook
APR1400-K-P-NR-013216-P	Full Power Level 1 PRA - Instrument Air System Notebook
APR1400-K-P-NR-013217-P	Full Power Level 1 PRA - ESFAS System Notebook
APR1400-K-P-NR-013218-P	Full Power Level 1 PRA - Reactor Protection System Notebook
APR1400-K-P-NR-013221-P	Full Power Level 1 PRA - Cavity Flooding System Notebook
APR1400-K-P-NR-013222-P	Full Power Level 1 PRA - Containment Isolation System Notebook
APR1400-K-P-NR-013223-P	Full Power Level 1 PRA - Hydrogen Control System Notebook

Documents for PRA

● Full Power Level 1 PRA

Document Number	Title
APR1400-K-P-NR-013301-P	Seismic Margin Analysis - Seismic Equipment List Development
APR1400-K-P-NR-013302-P	Seismic Margin Analysis - Seismic Accident Sequence and Model Development
APR1400-K-P-NR-013303-P	Seismic Margin Analysis - Quantification Notebook
APR1400-K-P-NR-013401-P	Internal Fire PRA - Volume I
APR1400-K-P-NR-013402-P	Internal Fire PRA - Volume II
APR1400-K-P-NR-013403-P	Internal Fire PRA - Volume III
APR1400-K-P-NR-013404-P	Internal Fire PRA - Volume IV
APR1400-K-P-NR-013501-P	Internal Flooding PRA - Flood Area Definition
APR1400-K-P-NR-013502-P	Internal Flooding PRA - Accident Sequence Analysis
APR1400-K-P-NR-013503-P	Internal Flooding PRA - Initiating Event Frequency Development
APR1400-K-P-NR-013504-P	Internal Flooding PRA - Human Reliability Analysis

Documents for PRA

- Full Power Level 2 PRA

Document Number	Title
APR1400-K-P-NR-013601-P	Full Power Level 2 PRA - PDS Analysis
APR1400-K-P-NR-013602-P	Full Power Level 2 PRA - CET/DET Analysis
APR1400-K-P-NR-013603-P	Full Power Level 2 PRA - Source Term Category Analysis
APR1400-K-P-NR-013604-P	Full Power Level 2 PRA - Quantification Notebook

Documents for PRA

● LPSD Level 1 PRA

APR1400-K-P-NR-013700-P	Low Power and Shutdown PRA - Plant Operating States Development
APR1400-K-P-NR-013701-P	Low Power and Shutdown PRA - Initiating Event Analysis
APR1400-K-P-NR-013702-P	Low Power and Shutdown PRA - Accident Sequences Analysis
APR1400-K-P-NR-013703-P	Low Power and Shutdown PRA - Success Criteria
APR1400-K-P-NR-013704-P	Low Power and Shutdown PRA - Data Analysis
APR1400-K-P-NR-013705-P	Low Power and Shutdown PRA - Human Reliability Analysis
APR1400-K-P-NR-013706-P	Low Power and Shutdown PRA - System Analysis
APR1400-K-P-NR-013707-P	Low Power and Shutdown PRA - Quantification Notebook

Documents for PRA

● LPSD Level 1 PRA – Internal Fire and Flooding

Document Number	Title
APR1400-K-P-NR-013741-P	LPSD Fire PRA Notebook, Task 1, Plant Boundary Definition and Partitioning
APR1400-K-P-NR-013742-P	LPSD Fire PRA Notebook, Task 2, Component Selection
APR1400-K-P-NR-013743-P	LPSD Fire PRA Notebook, Task 3 and 9, Cable Selection and Circuit Analysis
APR1400-K-P-NR-013744-P	LPSD Fire PRA Notebook, Task 4, Qualitative Screening
APR1400-K-P-NR-013745-P	LPSD Fire PRA Notebook, Task 5, Fire Induced Risk Model
APR1400-K-P-NR-013746-P	LPSD Fire PRA Notebook, Task 6, Fire Ignition Frequencies
APR1400-K-P-NR-013747-P	LPSD Fire PRA Notebook, Task 7, Quantitative Screening
APR1400-K-P-NR-013750-P	LPSD Fire PRA Notebook, Task 11, Detailed Fire Modeling for F000-TB
APR1400-K-P-NR-013751-P	LPSD Fire PRA Notebook, Task 11, Detailed Fire Modeling for F157-AMCR
APR1400-K-P-NR-013752-P	LPSD Fire PRA Notebook, Task 11, Fire Scenario Selection
APR1400-K-P-NR-013754-P	LPSD Fire PRA Notebook, Task 11, Multi-Compartment Analysis
APR1400-K-P-NR-013755-P	LPSD Fire PRA Notebook, Task 12, Post-Fire Human Reliability Analysis
APR1400-K-P-NR-013756-P	LPSD Fire PRA Notebook, Task 14, Fire Risk Quantification
APR1400-K-P-NR-013757-P	LPSD Fire PRA Notebook, Task 15, Uncertainty and Sensitivity Analyses
APR1400-K-P-NR-013758-P	LPSD Fire PRA Notebook, Task 16, Fire PRA Documentation
APR1400-K-P-NR-013759-P	Internal Flooding Analysis For Low Power and Shutdown

Documents for PRA

- **LPSD Level 2 PRA**

APR1400-K-P-NR-013761-P	LPSD Level 2 MAAP Analyses
APR1400-K-P-NR-013762-P	LPSD Level 2 Modeling Notebook
APR1400-K-P-NR-013763-P	LPSD Level 2 Internal Events Quantification
APR1400-K-P-NR-013764-P	Low Power and Shutdown Level 2 Fire Quantification

Documents for PRA

- Others

Document Number	Title
APR1400-K-P-NR-013801-P	Other External Events
APR1400-K-P-NR-013901-P	SAMDA Analysis
APR1400-K-P-NR-013902-P	Level 3 Notebook

- RAP Notebook: 1-037-N417-001

- Total 75 Notebooks

Procedures

- **RM Procedures**

- DC-DG-03-24, “Risk Management procedure”
- EP-6.41, “Risk Management Engineering Configuration Control”
- EP-6.42, “Risk Management Documentation”
- EP-6.45, “Risk Management Engineering Training and Certification”
- EP-6.47, “Risk Management Engineering Peer Review, Independent Review and Self Assessment”

- **RAP Procedure**

- DC-DG-03-09, “Implementation of the Reliability Assurance Program (RAP)”
- DC-DG-03-10, “Expert Panel Roles and Responsibilities”
- DC-DG-03-11, “Risk Significance Determination of RAP SSCs”
- EP-6.43, “Risk Management Input to RAP”

- **SAMDA Procedure**

- DC-DG-03-23, “Implementation of Severe Accident Mitigation Design Alternatives”

Future Audit Plan

- **Part 1: Initial interactions**
 - Orientation of the PRA documents
 - A demonstration of the software (SAREX and FTREX)
- **Part 2: Follow-up audits**
 - To be carried out at the NRC Headquarters, to continue examining PRA-, SA-, and RAP-related electronic documents via KHNP's electronic reading room, from April 30 through October 2015.
- **Part 3: Four-day onsite regulatory audit**
 - At KHNP/CRI facilities in Daejeon, Korea in June 2015 (two days)
 - Shin-Kori 3&4 plant walkdown (two-days)

Documents/Information Necessary for the Audit

No	Documents	Availability
1	PRA Summary Report, Rev.0	Already submitted
2	All PRA notebook and documents	4/30/2015
3	Success criteria calculation and MAAP and RELAP results supporting these success criteria calculations	4/30/2015
4	APR1400 emergency operating guidelines (EOGs)	Available
5	Peer Reviews, independent reviews, and self-assessments	Partial
6	PRA input to design programs and processes	TBD
7	PRA input to the reliability assurance program	4/30/2015
8	PRA input to the severe accident mitigation design alternatives	4/30/2015
9	Room cooling analysis performed to support PRA development	TBD
10	Detailed failure modes and effects analysis (FMEA) performed to identify initiating events and support the development of system fault tree	4/30/2015
11	Procedures used to assess all APR1400 design changes for PRA impact (including documentation that implements the procedure)	4/30/2015
12	List of source of uncertainty and key assumptions which drive the PRA models and results	4/30/2015
13	KHNP Quality Assurance Program Description (QAPD) for the APR1400 design certification, Rev. 4	Available

Documents/Information Necessary for the Audit

No	Documents	Availability
14	RAP implementation Procedure and /or Instruction	Available
15	RAP expert panel meeting minutes/summaries	Available
16	RAP corrective actions issued	TBD
17	Description of calculation of corium spreading on the containment floor and drawings showing spreading area	TBD
18	CORQUENCH results for MCC1 in the reactor cavity sump	4/30/2015
19	WinMACCS computer code output files for source term categories, STC-3 and STC-19	4/30/2015
20	Calculations of onsite doses for source term categories, STC-3 and STC-19	4/30/2015
21	Supporting seismic fragility calculations, and basis and justification for assumed HCLPF values (including screened out components)	TBD
22	Procedure to ensure HCLPF of 1.67 times the CSDRS for equipment on the SEL qualified by seismic qualification tests	TBD
23	Related to the containment performance goal, supporting deterministic finite element evaluation that meets the Factored Load Category requirements of ASME Code, Section III, Division	4/30/2015
24	Documentation of the MAAP model and MAAP calculations used to develop the source terms in DCD Table 19.1-029 on pages 19.1-391	4/30/2015
25	List of key sources of uncertainty and key assumptions which drive the MAAP calculations and MAAP results	4/30/2015

Overview of 123 Comments

- **Sections 19.0 and 19.1 "PRA" (113 items total)**
 - Technical issue: 14 items
 - Verification / justification: 23 items
 - Completeness: 51 items
 - Consistency: 8 items
 - Typo: 17 items
- **Section 19.2 "Severe Accident" (6 items total)**
 - Technical issue: 3 items
 - Verification / justification: 2 items
 - Completeness: 1 item
- **Section 17.4 "RAP" (4 items total)**
 - Technical issue: 4 items

123 Comments

- Information located in the PRA notebooks
- Overlapping items
- Long term items
- Process-related items