

PRA, SEVERE ACCIDENT AND RAP

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

Content

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