

**Appendix D-1:  
Senior Reactor Analyst Training and  
Qualification Program**

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## **Introduction**

The Senior Reactor Analyst Training and Qualification Program is an advanced course of study leading to certification as a Senior Reactor Analyst. You must complete the formal training courses, the individual study activities, and on-the-job activities. After completing the program you will be required to appear before an SRA Qualification Board, which will verify your ability to apply what you have learned to various situations.

Your supervisor will assign a certified SRA to work with you on completing the tasks in this qualification journal.

The SRA Qualification Board will consist of at least three members, at least two of which will be certified Senior Reactor Analysts. The board chairman will be at least the division director level in the region and at the branch chief level in NRR, but cannot be the individual's immediate supervisor. Whenever practical, your immediate supervisor is expected to observe the board.

The board will review the significant work products you completed as part of the training and development activities. The purpose of this review is to inform the board on the extent and depth of the analytical work you have performed and to provide the board the opportunity to explore the benefits you have gained for those activities.

You will be expected to submit a package to the board documenting the work products you completed during your training and qualification program. You will receive specific direction from the board chairman on this matter when you are ready for your board appearance.

### **Requirements:**

You must qualify as or be qualified as an NRC Reactor Operations inspector. If you are not qualified as an inspector, you may work on your inspector qualification in parallel with your SRA qualification activities.

### **Prerequisites:**

You must complete either a PWR or a BWR technology full series prior to taking the SRA required training courses.

### **Required Senior Reactor Analyst Training Courses**

1. Probability and Statistics for PRA Course (P-102)
2. System Modeling Techniques Course for PRA (P-200)
3. Human Reliability Assessment Course (P-203)
4. Risk Assessment in Event Evaluation Course (P-302)
5. PRA Technology and Regulatory Perspective (P-111)
6. SAPHIRE Course (P-201)
7. Advanced SAPHIRE Course (P-202)
8. External Events (P-204)
9. Accident Progression Analysis (P-300) or Reactor Safety (R-800)
10. Must complete the full series for the alternate reactor technology

### **Required Senior Reactor Analyst Refresher Training**

SRA's are required to attend inspector refresher training for both PWR and BWR technology on the same periodicity as required for operations inspectors.

## **Senior Reactor Analyst Individual Study Activities**

# SRA Individual Study Activity

**TOPIC:** (ISA-SRA-1) Regulatory Guidance for SRAs

**PURPOSE:** An SRA is expected to have a general knowledge of the topics addressed in the references. For the documents identified as skim only, the SRA is required to have knowledge of the general content of these documents (i.e. for use as reference documents).

**COMPETENCY AREA:** REGULATORY FRAMEWORK  
TECHNICAL AREA EXPERTISE

**LEVEL OF EFFORT:** 80 hours in office; 16 hours at a site

**REFERENCES:** See list at the end of this activity.

**EVALUATION CRITERIA:** The application of the specific regulatory guidance references should be studied or reviewed to the extent required to satisfactorily address each of these evaluation criteria. You will demonstrate your understanding of the content of the reference documents by successfully addressing each of the evaluation criteria. Your discussion activities should be conducted by a current or former certified SRA.

1. Discuss the Quantitative Health Objectives (formerly known as probabilistic safety goals)
2. Discuss differences in deterministic and probabilistic approaches to regulation.
3. Discuss the Commission Policy statement regarding expanding the use of PRA in regulatory matters in support of defense in depth and traditional engineering, to reduce unnecessary conservatism, support additional regulatory requirements, assist in regulatory decision making, and consider uncertainties in regulatory decisions.
4. Discuss the scope of Level 1, 2, 3 PRAs. Explain the purposes of IPEs and IPEEEs.
5. Explain the criteria for identifying SSCs covered by the Maintenance Rule and the criteria for determining their risk significance.
6. Explain how a risk assessment of online maintenance may be performed. Discuss qualitative considerations for establishing

action thresholds to manage the risk. Discuss the ICDP and ILERP thresholds for plant specific configurations.

**TASKS:**

1. Review the references listed for this activity.
2. Review a selected licensee's IPE and IPEEE. Identify the dominant accident initiators and sequences.
3. Review two risk assessments performed by a licensee in accordance with 10CFR50.65 a(4) for conducting online maintenance.
4. Review Maintenance Rule scoping documentation for one licensee and identify how the licensee determined the risk significance of systems, structures and components.
5. Meet with the person designated to be your resource for this activity and discuss the items listed in the Evaluation Criteria section.

**DOCUMENTATION:**

SRA Proficiency Level Qualification Signature Card Item ISA-SRA-1

## REFERENCES FOR ISA-SRA-1

### **CATEGORY A: Documents for which detailed knowledge is required**

#### Regulatory Guides

RG-1.160, Monitoring the Effectiveness of Maintenance in Nuclear Power Plants

RG-1.182, Assessing and Managing Risk Before Maintenance Activities at Nuclear Power Plants

#### NUREGS

NUREG-1449, Shutdown and Low Power Operations at Commercial Power Plants

NUREG/CR-5750, "Rates of Initiating Events at U.S. Nuclear Power Plants: 1987-1995"

NUREG/CR-6544, A Methodology for Analyzing Precursors to Earthquake - Initiated and Fire-Initiated Accident Sequences

#### NRC Generic Letters

GL 88-20 & supplements Individual Plant Examination For Severe Accident Vulnerabilities

#### Federal Register Notices

Federal Register, 8/21/86, "Safety Goals for the Operations of Nuclear Power Plants: Policy Statement"

Federal Register, 8/8/85, "Policy Statement on Severe Reactor Accidents regarding Future Designs and Existing Plants"

Federal Register, 8/16/95 "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities: Final Policy Statement"

#### Other Documents

Idaho National Engineering and Environmental Laboratory (INEEL/EXT-99-00041, January 1999) "Revision of the 1994 ASP HRA Methodology (Draft)"



## REFERENCES FOR ISA-SRA-1 (CONTINUED)

### CATEGORY B: Documents for which a general knowledge is required.

#### Regulatory Guides

- RG-1.174, An Approach for using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Current Licensing Basis
- RG-1.175, An Approach for Plant-Specific, Risk-Informed Decision making: Inservice Testing
- RG-1.176, An Approach for Plant-Specific, Risk-Informed Decision making: Graded Quality Assurance
- RG-1.177, An Approach for Plant-Specific, Risk-Informed Decision making: Technical Specifications
- RG-1.178, An Approach for Plant-Specific, Risk-Informed Decision making: Inservice Inspection

#### NUREGS

- NUREG-1570, Risk Assessment of Severe Accident Induced Steam Generator Tube Rupture
- NUREG/CR6141, Handbook of Methods for Risk Based Analyses of Technical Specifications
- NUREG-6265, Multidisciplinary Framework for HRS with an Application of Errors of Commission and Dependencies
- NUREG-0492, Fault Tree Handbook
- NUREG-1032, Evaluation of Station Blackout Accidents at Nuclear Power Plants

#### NRC Information Notices

- IN 2000-13 "Review of Refueling Outage Risks"

#### Other Documents

EPRI TR-105396 "PSA Application Guide"

National Research Council "Understanding Risk-Informing Decisions in a Democratic Society"

# SRA Individual Study Activity

**TOPIC:** (ISA-SRA-2) NRC Inspection Manual for SRAs

**PURPOSE:** An SRA is expected to assist the inspection staff by providing risk insights during inspection planning. The SRA is also expected to guide inspectors as they assess the risk significance of their inspection findings. SRAs are expected to perform Phase 3 SDP evaluations when necessary. In addition, the SRA is expected to independently evaluate risk assessments performed by licensees.

**COMPETENCY AREA:** REGULATORY FRAMEWORK  
TECHNICAL AREA EXPERTISE

**LEVEL OF EFFORT:** 3 Months

- REFERENCES:**
1. IMC 2515 Part 9900 Technical Guidance on Operability, Degraded Conditions, Voluntary LCO Entry
  2. IMC 0609 "Significance Determination Process". Emphasis on App. A, F, G, H, and other risk-informed SDPs, as appropriate
  3. IMC 0608 "Performance Indicator Program"
  4. IMC 2901 "Team Inspections"
  5. IMC 0305 "Operator Reactor Assessment Program"
  6. IMC 2515 Part 9900, Technical Guidance on Notice of Enforcement Discretion
  7. RIS 2001-010, "Revision to Staff Guidance on Notices of Enforcement Discretion"

**EVALUATION CRITERIA:** Upon completion of the tasks, you should be able to:

1. Discuss NOED process. Discuss how the staff may evaluate the risk associated with the condition and input to the decision process.
2. Discuss why PRA may not be used in determining operability of an SSC.
3. Explain how a reactor safety phase 2 SDP is performed. Include in the discussion the basis for each step in the process and the basis for each of the table and usage rules.

4. Describe conceptually how the SDP result is considered a change in annualized CDF and why this risk metric was chosen.
5. Discuss the Phase 3 SDP process including the criteria for when to conduct a Phase 3 SDP analysis.
6. Discuss how increases in plant risk are used in determining Performance Indicator thresholds.
7. Discuss the SRA role in inspection planning.

**TASKS:**

1. Review the references listed for this activity.
2. Review the basis for an NOED that was granted to a licensee. Identify how the risk of the condition was assessed.
3. Perform four reactor safety Phase 2 SDP evaluations.
4. Perform two Phase 3 SDP evaluations.
5. Participate in the planning phase of two team inspections and two individual inspections.
6. Meet with the person designated to be your resource for this activity and discuss the items listed in the Evaluation Criteria section.

**DOCUMENTATION:**

SRA Proficiency Level Qualification Signature Card Item ISA-SRA-2

# SRA Individual Study Activity

- TOPIC:** (ISA-SRA-3) NRC Management Directives
- PURPOSE:** An SRA is expected to evaluate the increase risk associated with operating events and provide input to the agency response decision process.
- COMPETENCY AREA:** REGULATORY FRAMEWORK  
TECHNICAL AREA EXPERTISE
- LEVEL OF EFFORT:** 40 hours
- REFERENCES:**
1. NRC Management Directive 8.1 (Abnormal Occurrence Reporting)
  2. NRC Management Directive 8.2 (NRC Incident Response and related regional procedures and policies for risk informing decisions during incident response)
  3. NRC Management Directive 8.3 (Incident Investigation Program)
- EVALUATION CRITERIA:** Upon completion of the tasks, you should be able to:
1. Discuss the criteria for identifying a significant operational event which should be evaluated for risk.
  2. Discuss how risk is evaluated following a reactor event and how it is used to determine the need for a special inspection, an Augmented Inspection Team or Incident Investigation Team.
  3. Discuss the criteria for identifying Abnormal Occurrences.
- TASKS:**
1. Review the references listed for this activity.
  2. Identify two previous significant operational events and review the risk evaluations that were performed.
  3. Perform risk evaluations for two significant operational events.
  4. Meet with the person designated to be your resource for this activity and discuss the items listed in the Evaluation Criteria section.

**DOCUMENTATION:**

SRA Proficiency Level Qualification Signature Card Item ISA-SRA-3

## **Senior Reactor Analyst On-the-Job Activities**

# Senior Reactor Analyst On-the-Job Activity

- TOPIC:** (OJT-SRA-1) Rotational Assignment to SPSB/NRR
- PURPOSE:** The purpose of this assignment is to help the SRA to become thoroughly familiar with the operation and risk analysis tools and techniques used by the Probabilistic Safety Assessment Branch at NRC Headquarters.
- COMPETENCY AREA:** TECHNICAL AREA EXPERTISE
- LEVEL OF EFFORT:** Length of rotation is 2 months.
- REFERENCES:** None noted
- EVALUATION CRITERIA:** Upon completion of the tasks, you should be able to:
1. Demonstrate proficiency in using SAPHIRE/GEM to assess the risk of events and conditions.
  2. Be able to identify lead technical experts in NRR and Research, who can provide information on structure, system and component performance to be used in risk assessments.
  3. Demonstrate an understanding of risk application to licensee program change submittals and technical specification amendments.
- TASKS:**
1. Run ASP/SPAR model analyses using SAPHIRE/GEM and/or interpret existing PRA results for event/condition evaluation or for inspection planning/focus.
  2. Assist with resolution of Maintenance Rule PRA issues or discuss how risk insights are used in the maintenance rule with lead technical experts in SPSB/NRR.
  3. Discuss current risk issues with insights and applications with lead technical experts in SPSB/NRR in the following areas:
    - a. Containment Performance
    - b. Event Analysis and Response
    - c. SDP phase 2 worksheet development
    - d. External Event Analysis (includes fire risk and shutdown risk)

4. Discuss the use of risk insights for event/condition response using MD 8.3 with IRO, NRR event assessment, and SPSB personnel.
5. Understand computer-based simplified PRA (SPAR) models:
  - a. Perform sensitivity studies and generate and interpret various importance measures
  - b. Identify and understand modeling and data limitations
  - c. Perform analysis of at least 3 selected events from NUREG/CR-4674 (Precursors to Potential Severe Core Damage Accidents) using the appropriate model and compare your results with ASP results. Discuss any differences with an SRA or HQ risk analyst.
6. Discuss risk application with SRA or HQ risk analyst regarding:
  - a. Decision criteria for PRA use (e.g. risk-informed licensee amendments)
  - b. ISI/IST Graded QA
  - c. Technical Specifications
  - d. Use in SDP phase 1 and phase 2 Worksheets
  - e. Limitations of on-line risk monitoring software (e.g. re-qualification vs. re-solving)
7. Make an oral presentation to an audience, including risk analysts, on a risk subject of interest chosen by the SRA trainee or on an analysis/event assessment performed during the rotation.
8. Meet with the person designated to be your resource for this activity and discuss the items listed in the Evaluation Criteria section.

**DOCUMENTATION:** SRA Proficiency Level Qualification Signature Card Item OJT-SRA-1



# Senior Reactor Analyst On-the-Job Activity

**TOPIC:** (OJT-SRA-2) Rotational Assignment to Regional Office

**PURPOSE:** The purpose of this assignment is to help the SRA to become thoroughly familiar with the application of operation and risk analysis tools and techniques to emerging plant events and inspection findings.

**COMPETENCY AREA:** TECHNICAL AREA EXPERTISE

**LEVEL OF EFFORT:** Length of rotation is 2 months.

**Note:** Rotation may not be to your home region. For headquarters personnel, the selection of the region at which you will do your rotation must be agreed upon by

**REFERENCES:** None

**EVALUATION CRITERIA:** Upon completion of the tasks, you should be able to:

1. Discuss the SRA role in evaluating the risk associated with inspection findings.
2. Discuss the SRA role in evaluating the significance of operational events.
3. Discuss the SRA role in inspection planning.

**TASKS:**

1. Evaluate the potential risk significance of plant events and inspection findings using known risk insights, the SDP, and quantitative assessment techniques. Integrate these risk insights with other regulatory insights, and develop recommendations to NRC management for appropriate regulatory responses (including enforcement) based on these insights
2. Evaluate licensee PRA practices and specific analyses for adequacy (e.g. Maintenance Rule)
3. Discuss awareness of the risk assessment capabilities, limitations of licensee-generated risk insights, and NRC-

generated risk insights for those licensees specifically assigned. Integrate these risk insights with other regulatory insights (e.g. defense-in-depth, licensing basis, performance history). Based on the above, develop risk-informed insights for use in inspection planning.

4. Participate with other NRC offices (e.g. RES) performing PRA or SDP related functions.
5. Brief/advise regional management on significant PRA or SDP issues and changes.
6. Provide an oral presentation on important risk insights to inspectors and other staff. Provide specific SDP and other risk assessment assistance to inspectors.
7. Participate in the inspection planning phase by reviewing plant PRA information and providing risk insights to the inspectors.
8. Attend regulatory or enforcement panel briefing and participate in the evaluation of inspection findings.

**NOTE:** If the assignments can not be completed while on rotational assignment to headquarters or assigned regional office, they may be completed in the candidate's home office/region under the supervision of a qualified SRA. The qualified SRA is required to sign the qualification card for the completed assignments.

9. Meet with the person designated to be your resource for this activity and discuss the items listed in the Evaluation Criteria section.

**DOCUMENTATION:** SRA Proficiency Level Qualification Signature Card Item OJT-SRA-2.

## Senior Reactor Analyst Advanced Level Signature Card and Certification

<i>Inspector Name:</i> _____	<i>Employee Initials/ Date</i>	<i>Evaluator Signature/Date</i>
<i>A. Training Courses</i>		
BWR or PWR technology full series		
Probability and Statistics for PRA Course (P-102)		
System Modeling Techniques Course for PRA (P-200)		
Human Reliability Assessment Course (P-203)		
Risk Assessment in Event Evaluation Course (P-302)		
PRA Technology and Regulatory Perspective (P-111)		
SAPHIRE Course (P-201)		
Advanced SAPHIRE Course (P-202)		
External Events (P-204)		
Accident Progression Analysis (P-300) or Reactor Safety (R-800)		
Reactor Technology Full Series in alternate reactor type		
<i>B. Individual Study Activities</i>		
ISA-SRA-1 Regulatory Guidance for SRAs		
ISA-SRA-2 NRC Inspection Manual for SRAs		
ISA-SRA-3 NRC Management Directives		
<i>C. On-the-Job Training Activities</i>		
OJT-SRA-1 Rotational Assignment to SPSB/NRR		
OJT-SRA-2 Rotational Assignment to Regional Office		

Supervisor's signature indicates successful completion of all required courses and activities listed in this journal and readiness to appear before the Oral Qualification Board.

Supervisor's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**Form 1: Senior Reactor Analyst Advance Level  
Equivalency Justification**

Inspector Name: \_\_\_\_\_

*Identify equivalent training and experience for which the inspector is to be given credit.*

**A. Training Courses**

BWR or PWR technology full series	
Probability and Statistics for PRA Course (P-102)	
System Modeling Techniques Course for PRA (P-200)	
Human Reliability Assessment Course (P-203)	
Risk Assessment in Event Evaluation Course (P-302)	
PRA Technology and Regulatory Perspective (P-111)	
SAPHIRE Course (P-201)	
Advanced SAPHIRE Course (P-202)	
External Events (P-204)	
Accident Progression Analysis (P-300) or Reactor Safety (R-800)	
Full Reactor Series in alternate reactor type	

<i>B. Individual Study Activities</i>	
ISA-SRA-1 Regulatory Guidance for SRAs	
ISA-SRA-2 NRC Inspection Manual for SRAs	
ISA-SRA-3 NRC Management Directives	
<i>C. On-the-Job Training Activities</i>	
OJT-SRA-1 Rotational Assignment to SPSB/NRR	
OJT-SRA-2 Rotational Assignment to Regional Office	

Supervisor's Recommendation:      Signature / Date \_\_\_\_\_

Division Director's Approval:      Signature / Date: \_\_\_\_\_

Copies to: Inspector and official training file