UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

October 1, 1996

MEMORANDUM TO: David B. Matthews, Chief
Generic Issues and Environmental Projects Branch
Division of Reactor Program Management, NRR

FROM: James H. Wilson, Senior Project Manager
Generic Issues and Environmental Projects Branch
Division of Reactor Program Management, NRR

SUBJECT: SUMMARY OF PUBLIC MEETING HELD ON SEPTEMBER 20, 1996, TO DISCUSS THE BOILING WATER REACTOR OWNERS' GROUP (BWROG) PSA CERTIFICATION PROCESS

On September 20, 1996, the staff attended a public meeting in the GE Nuclear Energy offices in Washington, DC to discuss the BWROG probabilistic safety assessment (PSA) certification process. A list of attendees and their affiliations is provided as Attachment 1. A copy of the handouts used by the BWROG in its presentation is provided as Attachment 2.

The BWROG has proposed a certification program to assist its members in achieving two objectives; to assure the quality of PSAs for applications, including those associated with risk-informed regulation, and to assure that each utility has a process in place for maintaining the level of quality. The process was described by Ed Burns of Erin Engineering, a contractor to the BWROG. Effectively, the certification process is a structured peer review performed by a team of PSA experts drawn from the utility PSA groups and contractors. The results of the certification process is a grading from 1 to 4 for each of the key elements of the PSA, and possibly for the PSA as a whole, though this is not yet decided upon. The higher the grade, the more use that can be made of the PSA in an application. For the highest grade, the PSA could be used as the principal argument in the application, whereas for the lower grades, it would either have to be supplemented by other analyses, or, for the lowest grade, play a subsidiary role. The review process is guided by use of checklists that identify the issues that should be addressed in each of the elements. The BWROG does not, however, intend to write definitive standards for PSA elements, nor, as was made clear during subsequent discussions, do they expect to see such standards in the forthcoming Reg Guides and SRPs.

The BWROG is scheduled to issue a report describing the process and its pilot application to three plants in mid-November. Mike Cheok, of the NRC staff, described the schedule for the development of the Reg Guides and SRPs, and it was agreed that the issuance of the BWROG report is timely in relation to that of the preparation of the public comment drafts of the Reg Guides and SRPs. The BWROG raised the possibility that they might request a slot on the agenda of the ACRS meeting in November. The checklists used to assess the quality of the PSAs are clearly of interest to the authors of the Reg Guides and SRPs. However, GE has a desire to make the certification process proprietary.

Subsequent to the meeting, Rick Hill (GE) stated that GE intends to submit this proprietary information to the staff for its information. The information will also be made available to interested members of the public who contact him at (408) 925-5388 and execute a non-disclosure agreement.

Project No. 691

Attachments: As stated

cc w/ attachments:
See next page

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See next page

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Docket File	PUBLIC	JHWilson	TMartin*	OGC*
PGEB r/f	BGrimes*	RZimmerman*	GHolahan *	ACRS*
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MRubin *				

Document Name: MEETSUM.920

OFC	PGEB	SC:PGEB	ADD:ADT	C:PGEB
NAME	JWilson:sw	RArchitzel	RJones	DMatthews
DATE	9/26/96	10/1/96	9/27/96	10/1/96

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Attachment 1

LIST OF ATTENDEES AT MEETING WITH BWROG HELD IN
WASHINGTON, DC ON SEPTEMBER 20, 1996

NAME	AFFILIATION
G. Parry	NRR/NRC
M. Cheok	NRR/NRC
R. Hill	GE
G. Krueger	PECO Energy
E. Burns	Erin Engineering
T. Brooks	INPO
C. Yeh	NYPA
A. Knoll	PG&E
R. Kirchner	Niagara Mohawk
G. Smith	Entergy
S. Meyer	Centerior Energy
R. Wachowiak	NPPD
C. Nierode	NSP
R. Labrecque	Northeast Utilities
K. Canavan	GPU Nuclear

PSA Peer Review Certification Process Feedback Form

ISSUE:
RECOMMENDED RESOLUTION:
PRIORITY:
PERSONS RECOMMENDING: PERSON ORGANIZATION

*PSA CERTIFICATION**

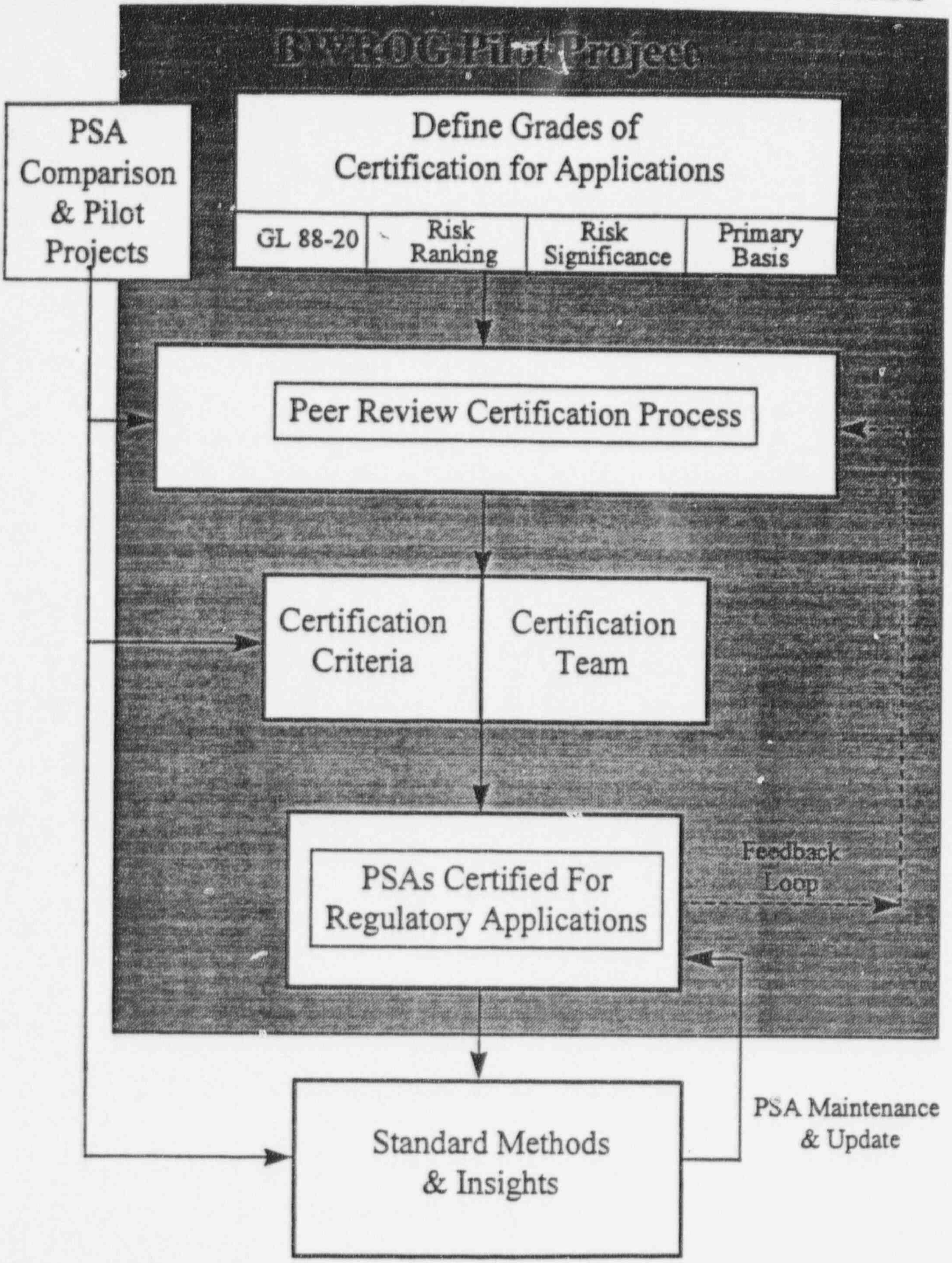
- Assure the Quality of PSAs for Applications

  and

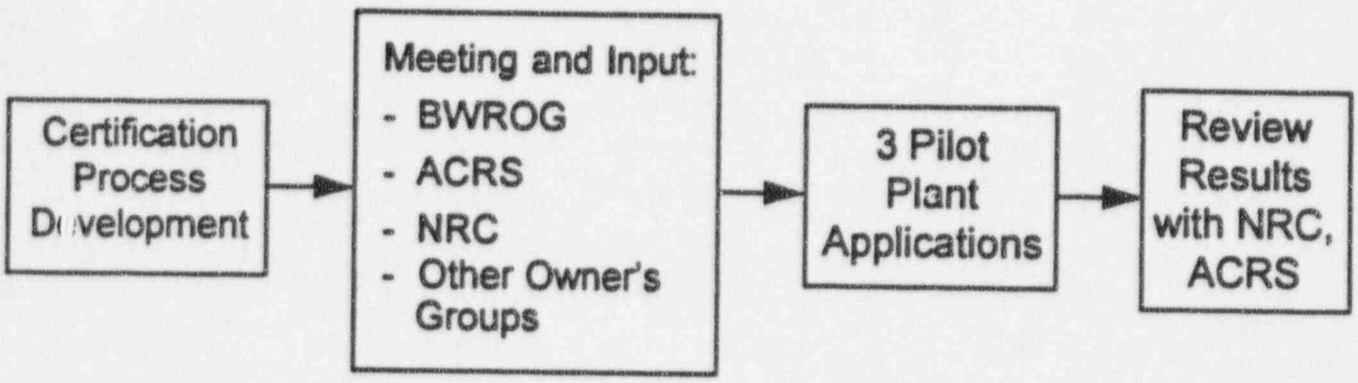
- Assure a process is available to maintain the Level of Quality

*Taken from Risk Based Application Task Force White Paper on Plant Specific PSA Certification.

INDUSTRY PSA CERTIFICATION PROCESS



CHRONOLOGY OF THE BWROG PILOT PSA CERTIFICATION PROCESS



OPTIONS

(Including Industry Approach)

VIABLE OPTIONS INCLUDE

- Qualifications Approach: An approach that focuses on the peer review process as a "short-cut" method of assuring overall quality at a given point in time.

- Consistency Check: Establish a method for checking that the methods, data, assumptions are consistent with other similar PSAs.

- Standards Approach: Establish a regulatory Guide or Standard.

- Certification Approach: Establish a process that allows a certification of the PSA and the PSA process.

- Pedigree Process: A rigorous and thorough approach that involves firmly establishing the Technical quality of the PSA model and documentation.

SCOPE OF THE PSA PEER CERTIFICATION

- Internal Events
- Internal Floods
- Level 2 (LERF)

PSA CERTIFICATION

- Objective: The PSA Peer Review Certification Process is Directed at Assuring the Plant Specific PSA and its update process are technically sufficient to support PSA Applications

- A goal is to make the process a positive experience for the host utility and for peer utility reviewers

- Peer Review Certification Process Includes:
  - Guidance Documents
  - Models, Data, Crucial Elements
  - Continuing PSA Program Elements (Living PSA)

- The PSA Peer Review Certification is the primary benefit

SUBSIDIARY OBJECTIVES

- Assure the quality and realistic nature of the PSA
- Assure the methods are at the state of the technology
- Assure use of appropriate data
- Acknowledge areas where applications may be hindered by modeling assumptions
- Identify areas where standard approaches which make technical sense could be developed.
  - Large LOCA initiating frequency
  - Scram Failure Probability
  - Use of SDC

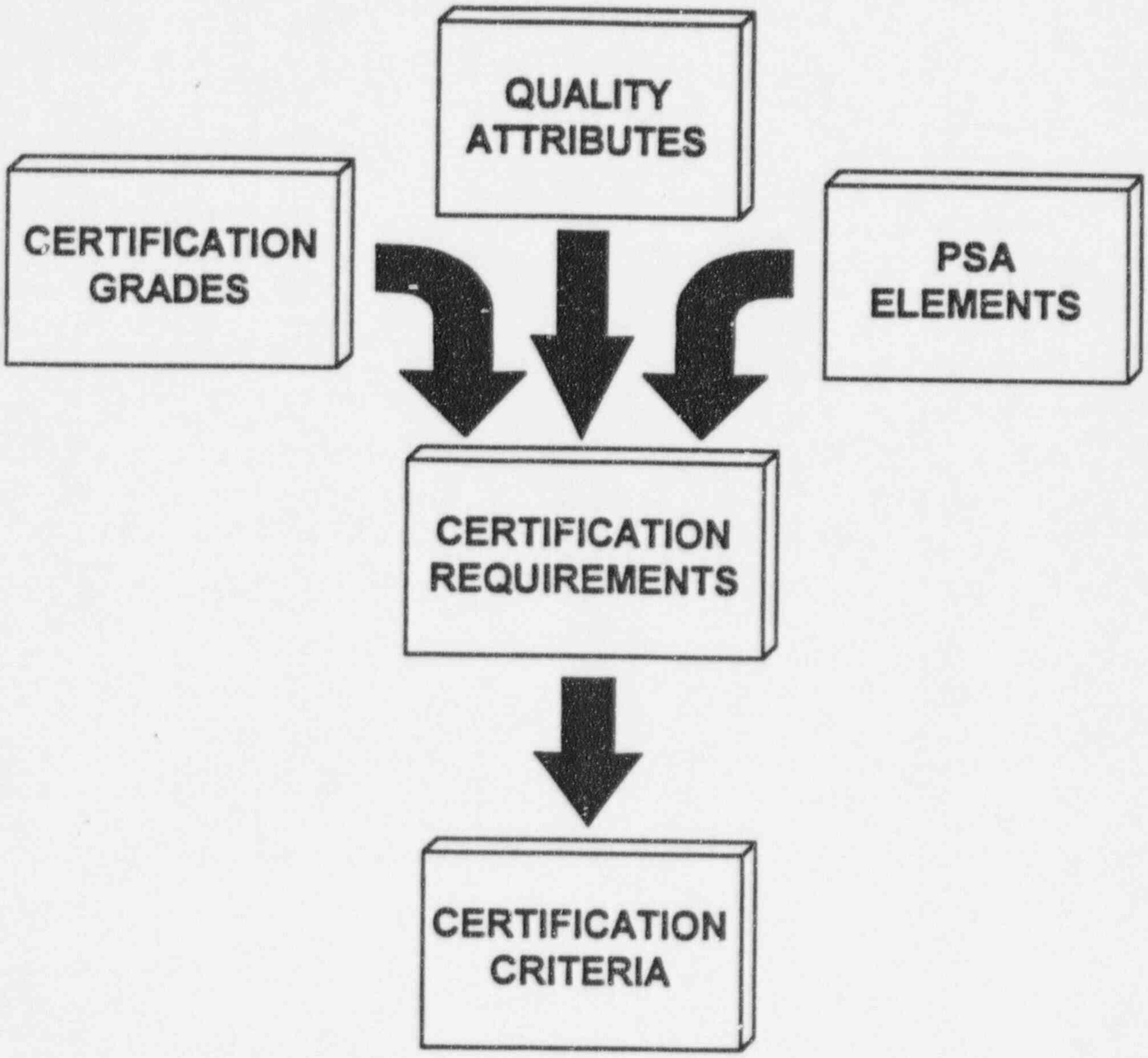
WHAT IS <u>NOT</u> THE PURPOSE OF PSA CERTIFICATION

- Extend the state-of the technology
- Develop new or standard techniques
- Replace in-house technical review

BASES FOR PROCESS DEVELOPMENT

- Logical: The process needs to be logical in its development.
- Derivative: The process needs to be directly derived from accepted principles related to PSA and good PSA practices.
- Discrimination: The process must be capable of discriminating between the grades of a PSA as appropriate to support different PSA applications.
- Reproducible: The process needs to be reproducible such that equivalent groups of independent experts applying the criteria will come to the same conclusion.
- Documented: The process needs to be documented in a form that makes implementation of changes to the PSA straightforward.

Development Process for Certification Criteria



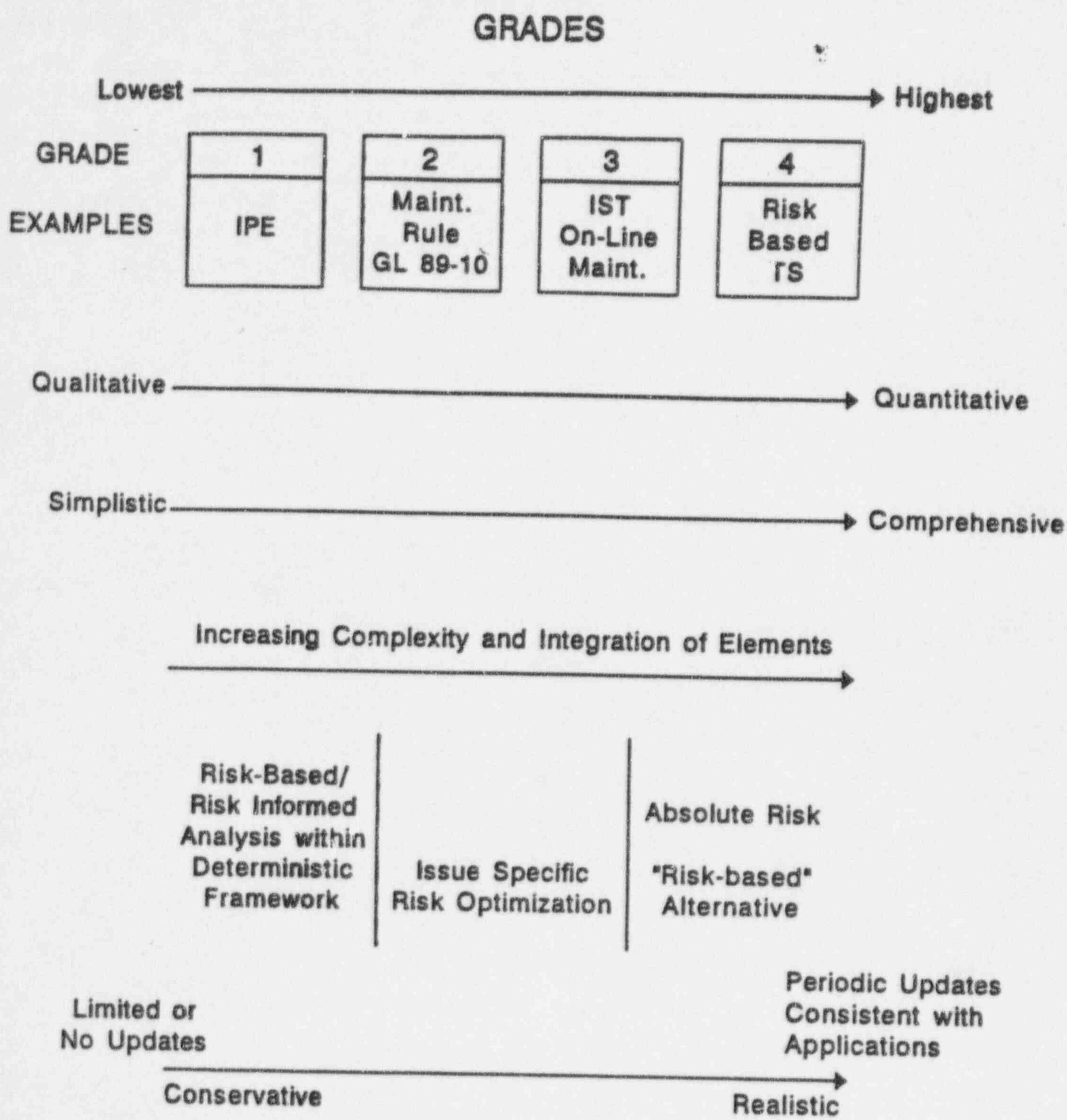


Figure 2-4
ATTRIBUTES OF THE PSA GRADES

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PROPOSED PSA GRADES

- Grade 1 - Useful for Identifying Severe Accident Vulnerabilities, Accident Management Insights, and General Prioritization of Issues

  This grade requires the minimum standard and has satisfied NRC expectations for responding to Generic Letter 88-20. Most PSAs are expected to be capable of meeting these requirements. This grade of certification would serve as an industry standard.

- Grade 2 - Useful for Risk Ranking with Deterministic Input

  This grade of certification requires a review of the PSA model, documentation and maintenance program. Certification at this grade would provide assurance that, on a relative basis, the PSA methods and models yield meaningful rankings for the assessment of systems, structures, and components, when combined with deterministic insights (i.e., a blended approach)

PROPOSED PSA GRADES
(cont'd)

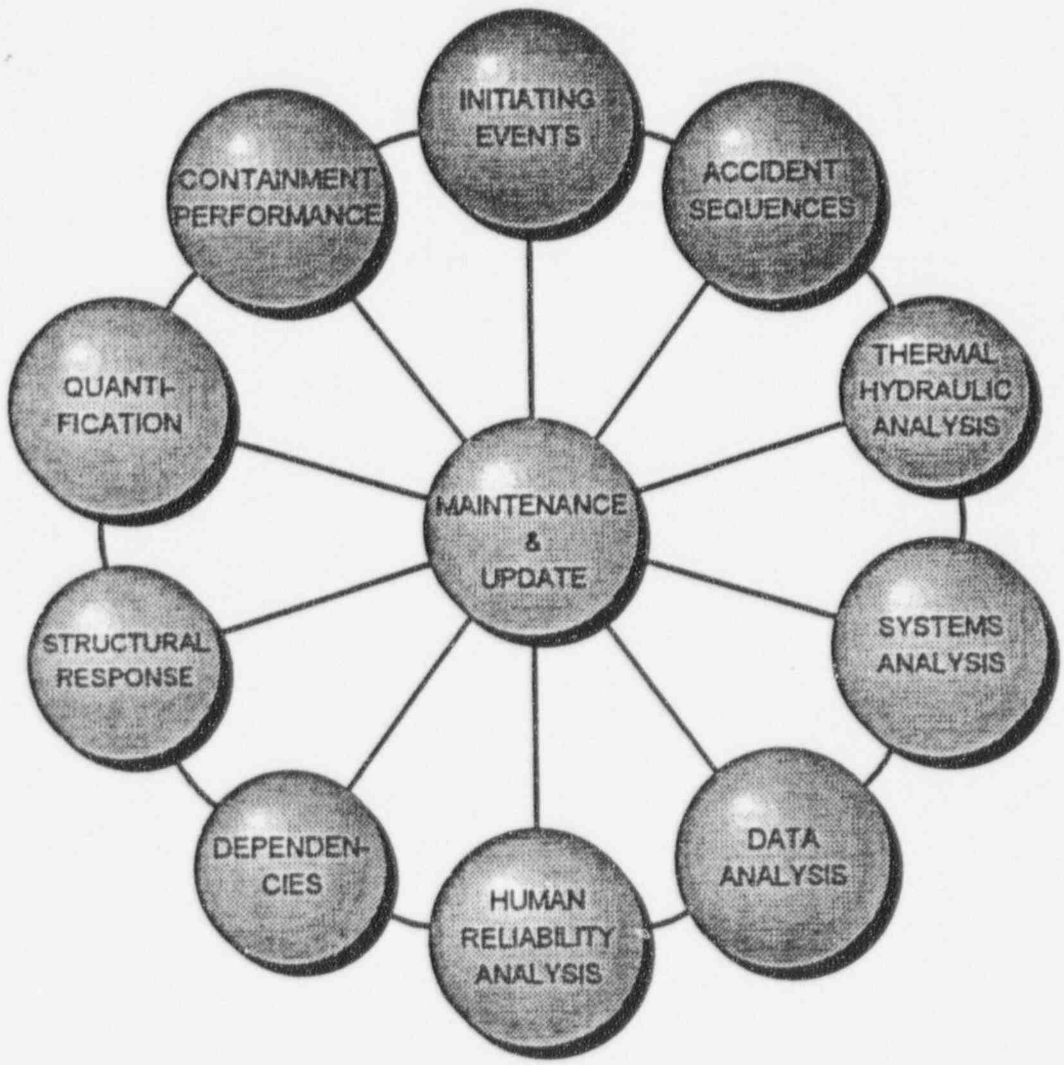
- <u>Grade 3 - Useful for Risk Significance with Deterministic Input</u>

  This grade of certification extends the requirements to assure that risk significance determinations made by the PSA are adequate to support regulatory applications, when combined with deterministic insights. This grade is expected to be the certification desired by most plants.

- <u>Grade 4 - Useful as Primary Basis for Decision-Making</u>

  This grade of certification requires a comprehensive, intensively reviewed study which has the scope, level of detail, and documentation to assure the highest quality of results. Routine reliance on the PSA as the basis for certain changes is expected as a result of this grade. It is expected that few plants would currently be eligible for this grade of certification.

PSA ELEMENTS FOR CERTIFICATION



QUALITY ATTRIBUTES

- Adequate Process
- Fidelity between model and plant (Accuracy)
- Appropriate Scope
- Completeness Consistent with Scope
- Appropriate methods, models, and software
- Adequacy of inputs
- Realistic assessment of risk measures
- Self consistency
- Independent review
- Ease and facility of updates
- Conclusions follow from the inputs, models, and results
- Reproducible
- Clear and scrutable documentation (Highlighting Assumptions)

CERTIFICATION TEAM

- Independence: Members of the team will not be members of the utility responsible for the PSA or contractors that are actively working for the utility.

- Expert in Phases of PSA: This is a difficult criteria to formalize because of the broad experience base that is required to effectively implement the certification process. Nevertheless, the following guidance provides:

  - Bachelors Degree in Engineering/Science/ Mathematics
    and
  - At least 10 years experience in the nuclear field
    and
  - Special focus experience of at least 5 years in one of the key areas of the process
    - PSA (Level 1 or Level 2)
      or
    - Organization/Management
      or
    - BWR Systems

CERTIFICATION TEAM (cont'd)

- Experience in Performance of PSAs: The members of the team will have participated in the performance or managed at least 1 PSA.

- Member of Utility: The Certification team must have adequate utility participation on the team. The team may be augmented by contractors to provide specific areas of expertise and to provide continuity from one review project to the next.

STEP-BY-STEP APPLICATION OF CERTIFICATION PROCESS AT PILOT PLANT

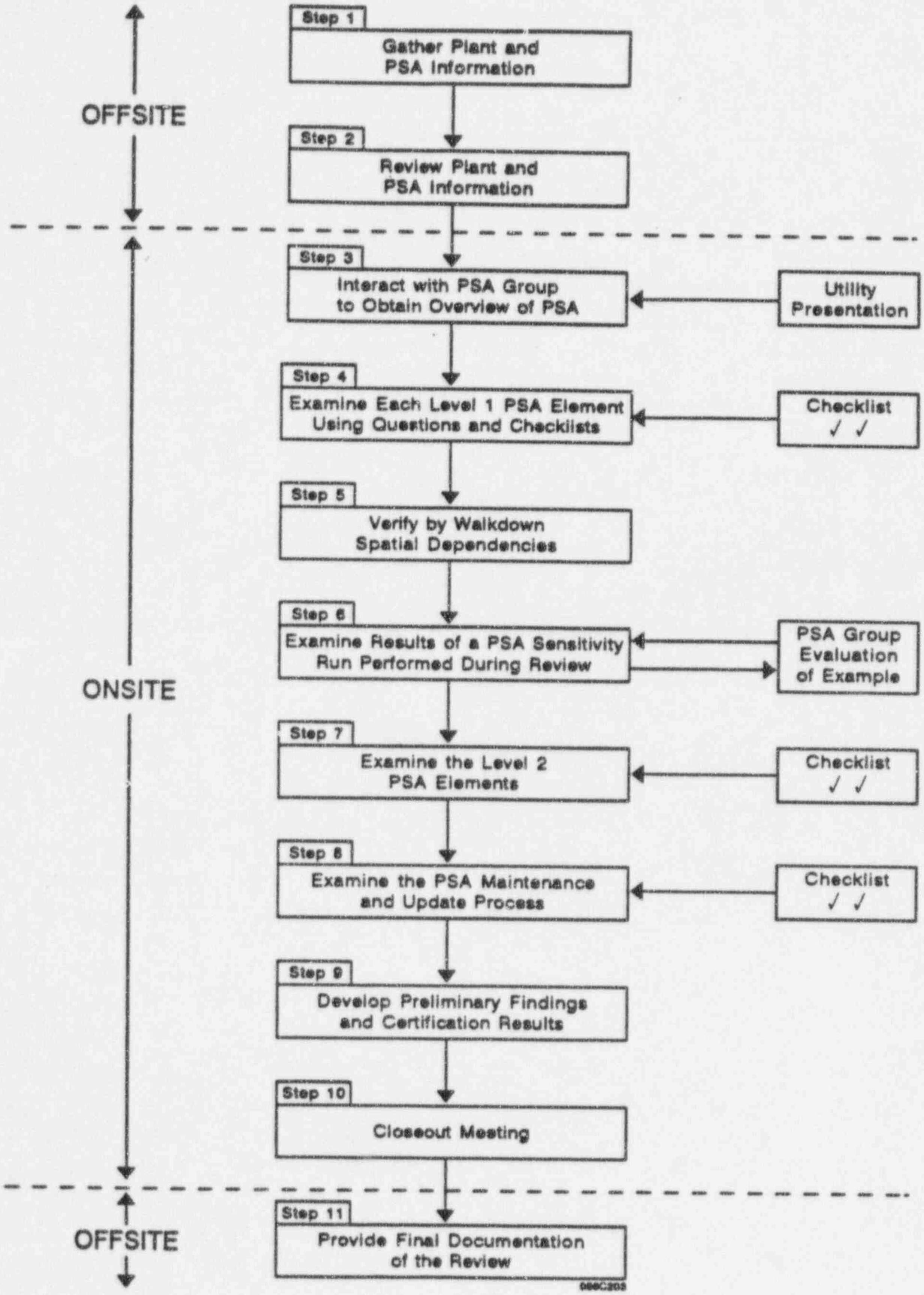


Table 2-3
REVIEW SCHEDULE AND AGENDA

MONDAY		Time
Overview Meeting of Team	(All)	8 - 9 a.m.
• Initial Observations and Changes in Focus		
Overview Presentation by Host Utility	(All)	9 a.m. - 12 noon
LUNCH		
Accident Sequence Models	(Reviewers 1 & 2)	1 - 5 p.m.
• Model Basis • Success Criteria • EOP Interface • Description • Dominant Sequences • Dominant Cutsets (if applicable) • Importance Rankings		
Initiating Events	(Reviewer 3)	1 - 3 p.m.
System Analysis	(Reviewers 4 & 5)	1 - 5 p.m.
• Documentation • Dependency Matrix • Success Criteria Bases		
Summary of Days Findings	(All)	6 - 9 p.m.
• Written Items - Strengths - Weaknesses • Open Questions		

Table 2-3 (cont'd)

REVIEW SCHEDULE AND AGENDA

TUESDAY		Time
Data Analysis • Components • Common Cause Failure Treatment	(Reviewer #3)	8 - 11 a.m.
Accident Response	(Reviewers 1 & 2)	8 - 11 a.m.
System Analysis • RPS • Reactivity Control • HPCI • RCIC • Feedwater • Depressurization • LPCI • CS • RHR • SDC	(Reviewers 4 & 5)	8 -11 a.m.
Summary of Mornings Findings • Written Items - Strengths - Weaknesses • Open Questions	(All)	11 a.m. - noon
LUNCH		
Host Utility Presentation on ATWS Accident Sequence	(All)	1 - 2 p.m.

Table 2-3 (cont'd)

REVIEW SCHEDULE AND AGENDA

TUESDAY (cont'd)		Time
System Analysis • AC Power • DC Power • Room Cooling • HVAC - Control Building • Service Water	(Reviewer 2 & 3)	2 - 5 p.m.
HRA	(Reviewer 1 & 5)	2 - 5 p.m.
Plant Specific Issues	(Reviewer 4)	2 -3 p.m.
• Spatial Dependencies • Internal Flood Evaluation	(Reviewer 4)	3 - 5 p.m.
Summary of Days Findings • Written Items - Strengths - Weaknesses • Open Questions	(All)	6 - 9 p.m.

Table 2-3 (cont'd)

REVIEW SCHEDULE AND AGENDA

WEDNESDAY		Time
Host Utility Presentation on SBO Accident Sequence	(All)	8 - 9 a.m.
Quantification Process	(Reviewers 1, 3, 5)	9 - 11 a.m.
Re-evaluation of Accident Sequence Models	(Reviewers 2 & 4)	9 - 11 a.m.
Summary of Mornings Findings	(All)	11 a.m. - noon
LUNCH		
Walkdown of Plant • Internal Flood Issues • Spatial Issues • Room Cooling	(Reviewer 2 & 4)	1 - 3 p.m.
Accident Sequence End States	(Reviewer 1 & 5)	1 - 3 p.m.
Data • Unique Unavailabilities	(Reviewer 3)	1 - 3 p.m.
Accident Sequence Overview and Quantification (Including HRA, Dependencies)	(All)	3 - 5 p.m.
Summary of Days Findings	(All)	6 - 9 p.m.

Table 2-3 (cont'd)

REVIEW SCHEDULE AND AGENDA

THURSDAY		Time
Level 2 (LERF)	(Reviewer 1,3, & 4)	8 - 11 a.m.
Maintenance and Update Process	(Reviewers 2 & 5)	8 - 11 a.m.
Summarize Morning Findings	(All)	11 a.m. - noon
LUNCH		
Review Host Utility Sensitivity Runs	(All)	1 - 2 p.m.
Write-up the Summary Sheets on PSA Elements/Sub-Elements	(All)	2 - 3 p.m.
Identify Findings	(All)	1 - 3 p.m.
Review Open Questions with PSA Group	(All)	3 - 5 p.m.
Finalize Findings	(All)	6 - 9 p.m.

Table 2-2

PILOT PLANT INVOLVEMENT AND RESOURCE REQUIREMENTS

- Supply Initial Information (1 Person Week)

  - IPE or PSA Document
  - Guidance Documents
  - Event Trees
  - Fault Trees
  - HRA and CCF Development
  - Event Tree Descriptions (If Available)

    - Include Sequence Description

  - LERF Basis (may be included in PSA Document)

    - CETs
    - Dominant Contributors
    - Treatment of Phenomena

  - Sensitivity Studies

- Host the certification team during the 1 week visit (Include Selected Plant Tours) (1 Person Week)

- Initial Presentation Information Desired (0.5 Person Week)

  - Initial Desired Grade of Certification Expected
  - Basis for the Expectation
  - Summary of Plant

    - Principal Design Features

  - Summary of the Maintenance and Update Process
  - Application Examples
  - PSA Group

    - Training

  - Management Role in Use of PSA

- Provide selected tours of the plant to augment the spatial assessments.

Table 2-2

PILOT PLANT INVOLVEMENT AND RESOURCE REQUIREMENTS (cont'd)

• Assemble all Supporting Documentation	(1 person week)
• Provide responses to questions as part of the Review Process	(1 Person Week)
• Provide presentations on selected topics	(2 Person Days)
• Provide a proof test run of the model	(.5 person Days)
• Provide access to the management chain to discuss the PSA process	
• Resolution of Comments/Findings	(1.5 Person Weeks)
• Closeout Meeting	(5 Person Days ~ 1 Person Week)
TOTAL PILOT PLANT Resource Requirement for Certification	7.5 Person Weeks[1]

[1] This estimate is associated with a PSA with good documentation and technical bases. With excellent documentation and Technical Bases, this estimate could be reduced to 5 person weeks. With reduced levels of documentation, the estimate could be as high as 10 person weeks.

EXAMPLE OF PROCESS

- PSA Element: Initiating Events Example
- Sub-elements for Initiating Events
- Criteria for Initiating Events
- Applicable Grades
- Peer Review Summary Form

Table 3-2

INITIATING EVENT RELATED GRADES

CRITERIA	PSA GRADES			
	1	2	3	4
GUIDANCE • Describes the process used		✓	✓	✓
• Consistent with industry practices		✓	✓	✓
• Sufficient detail provided for reproducing the evaluation		✓	✓	✓
GROUPING • Grouped initiators by plant response consistent with event tree structure and success criteria		✓	✓	✓
• For multi-unit sites with shared systems, the impact of initiators requiring simultaneous response (e.g. LOOP, loss of cooling source due to ice, loss of an AC or DC bus etc.) are included	✓	✓	✓	✓
• Initiators considered cover the spectrum of internal event challenges	(1)	✓	✓	✓
• All experience initiators are accounted for in the model	✓	✓	✓	✓
• Basis for exclusion of initiators is documented	✓	✓	✓	✓
• Perform an FMEA for plant support systems to determine if a special loss of support system initiator presents a unique challenge to the plant	✓	✓	✓	✓
• Subsumed initiating events are traceable and bounded	✓	✓	✓	✓
• Subsumed initiating events are acceptable, <u>or</u>	✓			
• Subsumed initiating events are acceptable in non-risk significant sequences or non-risk significant initiators, <u>or</u>		✓	✓	
• Complete list of initiating events within the state of the technology. Detailed plant specific development.				✓
DATA • Initiating event frequencies and recovery are consistent with industry experience or analysis	✓	✓	✓	✓
• Plant specific features are reflected in the initiating event frequency and recovery inputs where appropriate	✓	(2) ✓	(2) ✓	(2) ✓
• Plant specific experience reflected in the initiating event definitions and frequency plus recovery inputs where appropriate			✓	✓
• Plant specific models or FMEAs are used to quantify initiating event frequencies and recovery where appropriate				✓

Table 3-2

INITIATING EVENT RELATED GRADES

CRITERIA	PSA GRADES			
	1	2	3	4
<u>DOCUMENTATION</u>				
• Documentation provides the basis of the quantified values and is traceable	✓	✓	✓	✓
• Documentation reflects the process used	✓	✓	✓	✓
• Documentation provides the basis for the initiating event frequency groupings	✓	✓	✓	✓
• Independent review provided for the document results	✓	✓	✓	✓

(1) Conservatively treat the spectrum with at least bounding analysis.

(2) LOOP frequency based on NUREG-1032 or equivalent; ISLOCA frequency based on plant specific features and NSAC-154 or equivalent.

Table 2-4

DIFFERENTIATION AMONG PSA GRADE LEVELS

(Selected Issues)

PSA Element	Attributes	Grades			
		Grade 1	Grade 2	Grade 3	Grade 4
General	Level of documentation	NUREG-1335	Grade 1 Plus ranking and update process	Grade 2 Plus risk determination process description	Grade 3 Plus additional detail
	Latent conservatisms	Present in model	Limited to non-dominant contributors	Limited to non-dominant contributors minimized for saved results	Limited to contributors below truncation
	Balanced realism	Possible, but not required	Possible, but required for dominant contributors only	Yes, required	Yes
	Absolute risk measures characterization	May be conservative	May retain conservatism in non-risk significant portions	Realistic	Realistic

(1) When performing applications, those systems structures or components (SSCs) or operator actions that are to be ranked by RAW based on the model must be artificially drawn into the model so that they are represented and not truncated out.

(2) The screening truncation level is that associated with elimination of a consideration from the model. Model truncation is application specific and not a quality issue. The truncation used in a specific application must be left to the analyst to determine on an application specific basis.

Table 2-4

DIFFERENTIATION AMONG PSA GRADE LEVELS

(Selected Issues)

PSA Element	Attributes	Grades			
		Grade 1	Grade 2	Grade 3	Grade 4
Initiating Events	Completeness	Subsumed IEs Are acceptable	Non-risk significant subsumed IEs are acceptable	Non-risk significant subsumed IEs are acceptable	Complete list of IEs within state-of-technology (Detailed development)
	Frequencies	Generic or Conservative	Generic and Realistic in dominant contributors	Realistic and use of Plant Specific Data	Realistic and use of Plant Specific Data
Event Tree Evaluation	Dominant Sequences	X	X	X	X
	Dominant Contributors	X	X	X	X
Thermal Hydraulic Analysis	Success Criteria: Level of plant specificity	Conservative or Generic	Generic and Realistic	Plant Specific and Realistic	Plant Specific and Realistic
System Analysis	Systems with detailed models	Safety Systems	Safety Systems & Selected BOP	Key Systems	All Systems
Data	Data characterization	Generic or conservative	Generic and Realistic in dominant contributors	Realistic and use of Plant Specific Data	Realistic and use of Plant Specific Data
	Review of operating experience	No operating experience review	Dominant Contributors reviewed vs. operating experience	Operating Experience Review of LERs and system performance	Operating Experience Review of LERs and system performance

Table 2-4

DIFFERENTIATION AMONG PSA GRADE LEVELS

(Selected Issues)

PSA Element	Attributes	Grades			
		Grade 1	Grade 2	Grade 3	Grade 4
Dependencies	Common Cause Failure (CCF)	Generic CCF values	• Use NUREG/CR-4780 to develop CCF groups • Generic CCF values	• Use NUREG/CR- 4780 to develop CCF groups • Use of plant specific operating experience to confirm or modify CCF values and groups	Full NUREG/CR-4780 evaluation of CCF
Human Reliability Analysis	Level of detail	Screening or detailed	Detailed for dominant contributors	Detailed for dominant contributors	Detailed for dominant contributors
	Post-Initiator His reviewed by operating staff	Minimal required	Dominant contributors reviewed by operating staff	HRA reviewed by the operating staff and their input included in the process	HRA reviewed by the operating staff and their input included in the process
	Recovery	May or may not be included	Recovery may be included selectively	Systematic application of recovery actions	Systematic application of recovery actions
Model Quantification	Scope	Limited	Within the scope definition, a detailed treatment of the dominant contributors	Within the scope definition, a detailed treatment of identified issues	Includes full scope Level 1 and 2 with both internal and external initiators

Table 2-4

DIFFERENTIATION AMONG PSA GRADE LEVELS

(Selected Issues)

PSA Element	Attributes	Grades			
		Grade 1	Grade 2	Grade 3	Grade 4
Model Quantification (cont'd)	Screening Truncation (CDF)[2]	Screening (10^{-7}/yr)	10^{-8}/yr[1]	10^{-9}/yr	10^{-9}/yr
Containment Performance	Scope	Screening	Level 2: Dominant failure mode contributors (For LERF)	Level 2: Dominant and Less Significant Contributors (For LERF)	Level 2: All postulated failure modes encompassed (For LERF)
	Phenomena	Screening Approach	Screening Approach (For LERF)	Screening Approach (For LERF)	All postulated phenomena considered and modeled to recognize state of technology (For LERF)
Structural Response	Containment	Conservative	Generic and Realistic	Plant Specific and Realistic	Plant Specific and Realistic
Maintenance & Update	Process	Not Required	Required	Required	Required

PSA CERTIFICATION RESULTS: PROCESS ORIENTED

- Findings by PSA Element
- Summary Findings

Table 5.2-1

PSA CERTIFICATION REPORT
ELEMENT: INITIATING EVENTS
Guidance/Documentation:
Grouping:
Treatment of Support System/Special Initiators:
Treatment of Interfacing Systems LOCA & BOC:
Data:
Recommended Enhancements:
Overall Process Assessment:
Recommended Certification Grade: ☐ Grade 1 - Supports Assessment of Plant Vulnerabilities ☐ Grade 2 - Supports Risk Ranking Applications ☐ Grade 3 - Supports Risk Significance Evaluations w/Deterministic Input ☐ Grade 4 - Provides Primary Basis For Application

Table 5.3-1
SUMMARY REPORT

PSA CERTIFICATION REPORT

OVERALL ASSESSMENT

PSA ELEMENT	GRADE
Initiating Events	
Accident Sequence Evaluation	
Thermal Hydraulic Analysis	
System Analysis	
Data Analysis	
Human Reliability Analysis	
Dependencies	
Structural Response	
Quantification	
Containment Performance	
Maintenance & Update	

Overall Assessment:

Overall Certification Grade:

- ☐ Grade 1 - Supports Assessment of Plant Vulnerabilities
- ☐ Grade 2 - Supports Risk Ranking Applications
- ☐ Grade 3 - Supports Risk Significance Evaluations w/Deterministic Input
- ☐ Grade 4 - Provides Primary Basis For Application

Areas Requiring Enhancement:

Areas Recommended For Enhancement:

Fact/Observation Regarding PSA Technical Elements

OBSERVATION:
LEVEL OF SIGNIFICANCE:
POSSIBLE RESOLUTION:
PLANT RESPONSE OR RESOLUTION:

LEVEL OF IMPORTANCE

Importance Level	Definition
A.	Extremely important and necessary to address to assure the technical adequacy of the PSA or the quality of the PSA update process. (Contingent Item for Certification.)
B.	Important and necessary to address, but may be deferred until the next PSA update. (Contingent Item for Certification).
C.	Marginal importance, but considered desirable to maintain maximum flexibility in PSA Applications and consistency in the Industry.
D.	Editorial or Minor Technical Item, left to the discretion of the host utility

PROCESS IMPROVEMENTS

- Inputs from:
  - Certification Team
  - Host Utility
  - IRBR