

January 23, 1998

FOR: The Commissioners
FROM: L. Joseph Callan /s/ Executive Director for Operations
SUBJECT: QUARTERLY STATUS REPORT ON THE PROBABILISTIC RISK ASSESSMENT IMPLEMENTATION PLAN

PURPOSE:

To report the status of the Probabilistic Risk Assessment (PRA) Implementation Plan for the period of October 1 to December 31, 1997, and to respond to a Staff Requirements Memorandum dated May 28, 1997, which relates to staff plans for using Individual Plant Examination (IPE) results to assess regulatory effectiveness.

SUMMARY:

This paper describes accomplishments and changes to the staff's PRA Implementation Plan for the period of October 1, 1997 to December 31, 1997. The principal accomplishments include preparation of the final versions of Regulatory Guide (RG) 1.174 (formerly draft guide DG-1061) and Standard Review Plan (SRP) Chapter 19, which provide general guidance on the use of PRA in risk informed decisions for changes in a reactor current licensing basis, completion of the South Texas graded quality assurance pilot program, publication (for public comment) of the draft RG and SRP on risk-informed inservice inspection, and the development of the staff's plan to use IPE results to assess regulatory effectiveness in resolving major safety issues. The principal change is the delay of the application-specific regulatory guides and Standard Review Plan sections from December 1997 to March 1998, to permit the incorporation of the policy decisions associated with the finalization of RG 1.174.

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BACKGROUND:

In a memorandum dated January 3, 1996, from the Executive Director for Operations to Chairman Jackson, the staff committed to submitting quarterly reports on the status of its development of risk-informed standards and guidance. Previous quarterly reports were provided to the Commission on March 26, June 20, and October 11, 1996, and on January 13, April 3, July 22, and October 14, 1997. This quarterly report covers the period from October 1, 1997 to December 31, 1997.

DISCUSSION:

The significant accomplishments and changes to the PRA Implementation Plan in the past quarter are summarized below.⁽¹⁾ More detailed information is provided in Attachment 1.

Significant achievements during the past quarter include:

Section 1: Reactor Regulation (NRR)

1.1 Develop Standard Review Plans for Risk-Informed Regulation

NRR and RES staff met with ACRS and CRGR to discuss the final versions of the general guidance on use of PRA in risk-informed decision making in changes to the plant-specific current licensing basis; Standard Review Plan Chapter 19 (NRR lead) and Regulatory Guide 1.174 (RES lead). A Commission paper providing the final versions of these documents will be provided to the Commission in the near future.

Draft Standard Review Plan 3.9.8 (NRR lead) and Regulatory Guide DG-1063 (RES lead) on risk-informed inservice inspection of piping were published for public comment and the subjects of a public workshop on November 20 and 21, 1997. The workshop was well attended by industry representatives who offered a number of constructive comments, some criticisms, and some suggestions for changing the guidance. Overall, the comments indicated strong support for pursuing risk-informed inservice inspection (RI-ISI) but in a manner which would necessitate some modifications to the draft guidance.

1.2 Pilot Applications for Risk-Informed Regulatory Initiatives

The staff evaluation of the South Texas Project risk-informed graded quality assurance (QA) implementation plan was transmitted to the Commission via SECY-97-229 on October 6, 1997.

By SRM dated October 30, 1997, the staff was informed that the Commission had no objection to the issuance of the South Texas graded QA safety evaluation report. By letter dated November 6, 1997, the licensee was informed that the staff had approved the graded QA change and was provided with the associated staff safety evaluation.

The staff has received risk-informed inservice inspection pilot submittals from Surry 1, ANO-2, and Vermont Yankee which are currently being reviewed

for completeness. The staff will develop a review schedule if the submittals are determined to be complete and in conformance with the DG-1061 and DG-1063 submittal guidance. The staff is also developing schedules and priorities for the review of other RI-ISI pilot submittals as well as submittals expected subsequent to the pilot RI-ISI program approvals.

1.3 Inspections

The staff completed nine additional maintenance rule baseline inspections during this quarter, which included inspection of licensee methods for using PRA in maintenance programs and inspection of safety assessments performed by licensees when removing equipment from service for maintenance in accordance with Paragraph (a)(3) of the Maintenance Rule. As of December 31, 1997, the staff has completed a total of 45 inspections.

Section 2: Reactor Safety Research (RES)

2.1 Develop Regulatory Guides

As discussed above, NRR and RES staff met with ACRS and CRGR to discuss the final versions of Standard Review Plan Chapter 19 (NRR lead) and Regulatory Guide 1.174 (RES lead). A Commission paper on policy issues was forwarded to the Commission as SECY-97-287, dated December 12, 1997. A Commission paper providing the final versions of these documents will be provided in the near future.

2.4 Methods Development and Demonstration

A demonstration at the Seabrook nuclear power plant of the human reliability analysis method ATHEANA (A Technique for Human Event Analysis) has been completed. A medium break LOCA scenario, including inappropriate termination of makeup (an error of commission), was selected for analysis and simulator exercise. The ATHEANA demonstration helped plant personnel identify safety-related weaknesses in plant barriers and design. Specifically, the exercise identified weaknesses in the use of well-planned and tested emergency procedures as well as identifying improvements needed in the draft ATHEANA documentation.

2.5 IPE and IPEEE Reviews

The final version of NUREG-1560, "IPE Program: Perspectives on Reactor Safety and Plant Performance," has been submitted for publication. This report was initially issued in late 1996 for public comment. Based on the comments received, the report was revised, with an additional appendix written discussing the comments received and staff responses.

The first IPEEE staff evaluation report, for the Diablo Canyon Power Plant, was completed and issued to the licensee on December 4, 1997. In addition, requests for additional information on fifteen IPEEE submittals were prepared to send to licensees.

An interim report has been developed that provides preliminary IPEEE perspectives and summarizes the information presented in the first 24 IPEEE submittals reviewed by the staff. This interim report will be sent to the Commission in the near future. (A summary of the significant preliminary perspectives from the first 24 IPEEE reviews was provided to the Commission in Attachment 7 to SECY-97-234.)

Section 3: Analysis and Evaluation of Operating Experience and Training (AEOD)

3.1 Risk-Based Trends and Patterns Analysis

Letters are in the concurrence process to distribute the common cause failure (CCF) database and associated technical report to all U.S. nuclear utilities for their use. The database contains CCF events from 1980 through 1995.

3.2 Accident Sequence Precursor (ASP) Program

All 1996 precursor analyses have been finalized, with the 1996 ASP report now in publication. Three preliminary analyses of 1997 events are being reviewed. The annual Commission paper describing the ASP program in more detail was sent to the Commission on December 23, 1997 (SECY-97-296).

3.6 Staff Training

Development activities for the PRA Technology and Regulatory Perspectives (P-111) course were completed during this quarter. The first course presentation will be January 26 - February 6, 1998. The staff has established a goal of having one Resident Inspector at each site complete the course by the end of 1998.

Significant changes made to the Implementation Plan during the last quarter include:

Section 1: Reactor Regulation (NRR)

1.1 Develop Standard Review Plans for Risk-Informed Regulation

As discussed above, the general regulatory guide and Standard Review Plan for use of PRA in

plant-specific current licensing basis changes will be transmitted to the Commission in the near future. To permit efficient incorporation of the resolution of policy issues contained in these documents into the application-specific SRP sections on inservice testing and technical specifications, completion of these SRP sections has been delayed until March 31, 1998, a change from their previous completion date of December 31, 1997.

1.2 Pilot Applications for Risk-Informed Regulatory Initiatives

The staff is currently developing a draft safety evaluation report (SER) for the Comanche Peak risk-informed inservice testing program (RI-IST) program. The licensee (TU Electric) is currently developing a program that is sufficiently detailed and consistent with DG-1062. TU Electric has indicated that it intends to complete a draft revision to their program description by the end of January 1998. Assuming that the program is finalized by mid-February, the staff anticipates having a completed Comanche Peak RI-IST SER to the Commission in March 1998, rather than December 31, 1997.

The completion date for the graded quality assurance (GQA) pilot interactions has been revised from March 1998 to July 1998 to reflect the anticipated issuance date of the final GQA inspection guidance.

The staff received a supplemental amendment request from the San Onofre Nuclear Generating Station (SONGS) in early January 1998 to put the configuration risk management program description into the SONGS technical specifications. SONGS has recently become the lead plant for this Combustion Engineering Owner's Group (CEOG) activity, when the original lead plant decided not to pursue risk-informed TS changes at this time. With receipt of the SONGS supplemental request, the staff anticipates completing the SONGS review as the lead pilot plant and issuing the license amendment by March 31, 1998. This is a change from the previous date of December 31, 1997.

1.3 Inspections

The NRR Inspection Program Branch (PIPB) proposals for revising core inspection procedures have been transmitted to the appropriate NRR technical branches having responsibility for specific core inspection procedures. Due to the large number of branches involved, completing all individual branch concurrences is anticipated to take an additional two months. The revised completion date for this task is February 1998, a change from the previous date of October 1997.

1.6 Evaluate Use of PRA In Resolution of Generic Issues

As part of the IPE follow-up program, the staff is in the process of identifying generic issues to be audited. These issues are those which have been explicitly identified and addressed by the licensee as part of the IPE process.

A report that identifies the above generic issues and staff views on the adequacy of the proposed resolution is in preparation. The report will provide the basis for the selection of generic safety issues to be audited. The staff has moved the completion date for this milestone to March 1998, in order to utilize the report in the audit process.

In addition to the above issues, RCP seal LOCA had been identified as a dominant contributor to core damage in many PWR IPEs. The staff has a separate ongoing activity in RES to address this issue under Generic Issue 23, and will utilize IPE insights in the proposed resolution.

1.7 Regulatory Effectiveness Evaluation

In a Staff Requirements Memorandum dated May 28, 1997 (Attachment 2), the Commission requested that the staff provide the scope and schedule of activities related to using IPE results to assess regulatory effectiveness in resolving major safety issues. With respect to scope, the staff identified three major safety issues for assessment. The selection had been based on both the potential risk significance of the issue, and the fact that probabilistic techniques were used extensively in the resolution process. These issues include:

1. Resolution of USI A-44 Station Blackout at Nuclear Power Plants
2. Resolution of USI A-45 Decay Heat Removal Reliability
3. Resolution of USI A-09 Anticipated Transient Without Scram

To evaluate the three major issues, the staff will utilize both representative plants, and information contained in NUREG-1560, to audit and draw conclusions regarding regulatory effectiveness. Information generated under Task 1.6, as described above, and Task 1.10, as described below, will also be integrated into the assessment process. These tasks may expand the staff's consideration of other safety issues and effectiveness of the regulatory process. The staff will inform the Commission of any additional safety issues that come under consideration. The staff plans to complete Task 1.7 by the end of December 1998, and will recommend at that time any additional staff action.

1.8 Advanced Reactor Reviews

Due to personnel being assigned to higher priority activities, such as risk-informed pilot initiatives and IPE followup activities, the staff is reassessing their position regarding the development of an SRP, especially since there are no new advanced design certification submittals anticipated. We will provide the results of this reassessment in a future update of the PRA Implementation Plan.

1.10 Evaluation of IPE Insights

The staff has developed an IPE followup plan (Attachment 3) which describes those actions to be taken to ensure that plant improvements warranted by the IPE results are, in fact, made. This plan consists of a number of items and its implementation involves NRR, RES, and the Regions, as described in the plan.

Section 2: Reactor Safety Research (RES)

2.1 Develop Regulatory Guides

As discussed above, the general regulatory guide and Standard Review Plan for use of PRA in risk informed decision making for plant-specific current licensing basis changes will be transmitted to the Commission in the near future. To permit efficient incorporation of the resolution of policy issues contained in these documents into the application-specific regulatory guides on inservice testing, graded quality assurance, and technical specifications, completion of these guides has been delayed until March 31, 1998, a change from their previous completion date of December 31, 1997.

2.5 IPE and IPEEE Reviews

The staff has reviewed all the 76 IPE submittals and issued staff evaluation reports (SERs) on their findings to each licensee. In three of the SERs, it is indicated to the licensees that the staff was not able to conclude that the licensee met the intent of Generic Letter 88-20 for their plant(s). These three IPEs include Crystal River 3, Susquehanna 1&2, and Browns Ferry 3. The licensee for Crystal River 3 has indicated their intention to submit an updated analysis (February 1998) addressing the staff's concerns. It is anticipated that the review of this new IPE submittal will be concluded in June 1998. Discussions are still ongoing with licensees regarding Susquehanna 1&2 and Browns Ferry 3.

Section 3: Analysis and Evaluation of Operating Experience and Training (AEOD)

3.6 Staff Training

Eight PRA for Regulatory Applications courses are now planned for FY 1998 and FY 1999 to meet the needs of the technical staff. Funding for these courses was obtained by reducing the number of SRA series from two to one per year. Modifications to the PRA Basics for Regulatory Applications, PRA for Technical Managers, and PRA Technology and Regulatory Perspectives courses have been made to include the final draft R.G. 1.174 and SRP, Chapter 19. Seven PRA for Technical Managers courses are planned for FY 1998, which will allow two-thirds of agency technical managers to attend.

Procurement actions for acquisition of risk monitor software are in process. The EPRI Risk and Reliability (R&R) Workstation is the current industry standard for risk monitors. Current plans are to integrate the R&R workstation into the reactor technology and PRA technology curricula to improve student understanding of configuration management, the importance of plant operations to the risk profile of the plants, and use of the tool to provide insights regarding the use of risk informed applications by the industry. The workstation will also be used to demonstrate the capabilities and limits of this and similar tools as they are being used by the industry.

Section 4: Nuclear Materials and Low Level Waste Safety and Safeguards Regulation (NMSS)

4.4 Risk Assessment of Material Uses

The target schedule for the work to develop and demonstrate a risk assessment for industrial gauges containing cesium-137 and cobalt-60 using PRA (and other related techniques) has been extended from July 1998 to September 1998. The extension is due to difficulties in obtaining data from non-licensees related to actual and potential doses to the public resulting from gauges which enter the scrap metal cycle.

The target schedule for the work to develop and demonstrate risk assessment methods for application to medical and industrial licensee activities has been determined to be September 1998 based on scheduling of a planned Commission paper on the topic.

4.5 Framework for Use of PRA in Regulating Nuclear Materials

The target schedule for providing a plan for developing a framework has been extended from October 1997 to January 1998 to permit interoffice coordination.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objections to its issuance.

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Executive Director for Operations

Attachments: As stated

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PRA IMPLEMENTATION PLAN TASK TABLE (December 1997)

1.0 REACTOR REGULATION

Regulatory Activity	Objectives	Methods	Target Schedule	Lead Office(s)	Status (this quarter)
1.1 DEVELOP STANDARD REVIEW PLANS FOR RISK-INFORMED REGULATION	Standard review plans for NRC staff to use in risk-informed regulatory decision-making.	* Evaluate available industry guidance.		NRR /RES	
		* Develop a broad scope standard review plan (SRP) chapters and a series of application specific standard review plan chapters that correspond to industry initiatives.			
		* These SRPs will be consistent with the Regulatory Guides developed for the industry.			
		* Draft SRPs transmitted to Commission to issue for public comment			
		General IST ISI TS	4/97C ⁽²⁾ 4/97C 8/97C 4/97C		In final review Changed (Note 1) Changed (Note 1)
		* Final SRP transmitted to Commission for approval			
		General IST ISI TS	1/98 3/98 4/98 3/98		
1.2 PILOT APPLICATIONS FOR RISK-INFORMED REGULATORY INITIATIVES	* Evaluate the PRA methodology and develop staff positions on emerging, risk-informed initiatives, including those associated with:	* Interface with industry groups.		NRR/RES	
	1. Motor operated valves.	* Evaluation of appropriate documentation (e.g., 10 CFR, SRP, Reg Guides, inspection procedures, and industry codes) to identify elements critical to achieving the intent of existing requirements.	1. 2/96C		
	2. IST requirements. 2a. Comanche Peak 2b. Palo Verde	* Evaluation of industry proposals.	2a. 3/98 2b. TBD		Changed (Note 2)
	3. ISI requirements.	* Evaluation of industry pilot program implementation.	3. TBD		
	4. Graded quality assurance.	* As appropriate, complete pilot reviews and issue staff findings on regulatory requests.	4. 7/98		Changed (Note 3)
	5. Maintenance Rule.		5. 9/95C		
	6. Technical specifications. 6a. Commission Approval 6b. Pilot Amendments Issued		6a. 5/97C 6b. 3/98		Changed (Note 4)

	7. Other applications to be identified later (applications related to diesel generator start times and hydrogen control are expected)				
1.3 INSPECTIONS	* Provide guidance on the use of plant-specific and generic information from IPEs and other plant-specific PRAs.	* Develop IC 9900 technical guidance on the use of PRAs in the power reactor inspection program.	6/97C	NRR	
		* Revise IC 2515 Appendix C on the use of PRAs in the power reactor inspection program.	7/97 C		
		* Propose guidance options for inspection procedures related to 50.59 evaluations and regular maintenance observations.	10/97		Completed
		* Review core inspection procedures and propose PRA guidance where needed.	10/97		Completed
		* Complete revision to proposed core inspection procedures	2/98		Changed (Note 5)
		* Issue draft Graded QA Inspection Procedure	4/98		Changed (Note 6)
		* Issue final Graded QA Inspection Procedure	7/98		Changed (Note 6)
	* Provide PRA training for inspectors.	* Identify inspector functions which should utilize PRA methods, as input to AEOD/TTD for their development and refinement of PRA training for inspectors.	7/96C	NRR	
	* Provide PRA training for Senior Reactor Analysts (SRA)	* Develop consolidated and comprehensive 2-3 week PRA for regulatory applications training course.	10/97	NRR/ AEOD	Completed
		* Conduct training for Maintenance Rule baseline inspections	8/96C	NRR	
		* Conduct training courses according to SRA training programs	Ongoing	AEOD	
		* Rotational assignments for SRAs to gain working experience	Ongoing	NRR/RES	
	* Continue to provide expertise in risk assessment to support regional inspection activities and to communicate inspection program guidance and examples of its implementation.	* Monitor the use of risk in inspection reports.	Ongoing	NRR	
		* Develop new methodologies and communicate appropriate uses of risk insights to regional offices.			
		* Update inspection procedures as needed.			
		* Assist regional offices as needed.			
		* Conduct Maintenance Rule baseline inspections	7/98		
1.4 OPERATOR LICENSING	Monitor insights from HRAs and PRAs (including IPEs and IPEEEs) and	* Revise the Knowledge and Abilities (K/A) Catalogs (NUREGs 1122 and 1123) to	8/95C	NRR	

	operating experience to identify possible enhancements for inclusion in planned revisions to guidance for operator licensing activities (initial and requalification)	incorporate operating experience and risk insights.			
		* Revise the Examiner Standards (NUREG-1021), as needed to reflect PRA insights.	3/97C		
1.5 EVENT ASSESSMENT	* Continue to conduct quantitative event assessments of reactor events while at-power and during low power and shutdown conditions.	* Continue to evaluate 50.72 events using ASP models.	Ongoing	NRR	
	* Assess the desirability and feasibility of conducting quantitative risk assessments on non-power reactor events.	* Define the current use of risk analysis methods and insights in current event assessments.	TBD	NRR	
		* Assess the feasibility of developing appropriate risk assessment models.			
		* Develop recommendations on the feasibility and desirability of conducting quantitative risk assessments.			
1.6 EVALUATE USE OF PRA IN RESOLUTION OF GENERIC ISSUES	* Audit the adequacy of licensee analyses in IPEs and IPEEEs to identify plant-specific applicability of generic issues closed out based on IPE and IPEEE programs.	* Identify generic safety issues to be audited.	3/98	NRR/RES	Changed (Note 7)
		* Select plants to be audited for each issue.	3/98		Changed (Note 7)
		* Describe and discuss licensees' analyses supporting issue resolution.	TBD		
		* Evaluate results to determine regulatory response; i.e., no action, additional audits, or regulatory action.	TBD		
1.7 REGULATORY EFFECTIVENESS EVALUATION	* Assess the effectiveness of major safety issue resolution efforts for reducing risk to public health and safety. Note: Work in this activity will be integrated with broader agency efforts in response to DSI 23.	* Develop process/guidance for assessing regulatory effectiveness.	ongoing	NRR/RES	
		* Apply method to assess reduction in risk.	ongoing		
		* Evaluate resulting effectiveness of station blackout and ATWS rules and Unresolved Safety Issue A-45.	12/98		Changed (Note 8)
		* Propose modifications to resolution approaches, as needed (SBO rule implementation and RCP seal issue).	TBD		Changed (Note 8)
		* Identify other issues for assessment if appropriate.	ongoing		Changed (Note 8)

1.8 ADVANCED REACTOR REVIEWS	* Continue staff reviews of PRAs for design certification applications.	* Continue to apply current staff review process.	Ongoing	NRR	
	* Develop SRP to support review of PRAs for design certification reviews of evolutionary reactors (ABWR and System 80+).	* Develop draft SRP to tech staff for review and concurrence.	TBD	NRR	Changed (Note 9)
		* Finalize SRP.	TBD		
	* Develop independent technical analyses and criteria for evaluating industry initiatives and petitions regarding simplification of Emergency Preparedness (EP) regulations.	* Reevaluate risk-based aspects of the technical bases for EP (NUREG-0396) using insights from NUREG-1150, the new source term information from NUREG-1465, and available plant design and PRA information for the passive and evolutionary reactor designs.	12/96C	NRR/ RES	
1.9 ACCIDENT MANAGEMENT	* Develop generic and plant specific risk insights to support staff audits of utility accident management (A/M) programs at selected plants.	* Develop plant-specific A/M insights/information for selected plants to serve as a basis for assessing completeness of utility A/M program elements (e.g., severe accident training)	TBD	NRR/RES	
1.10 EVALUATING IPE INSIGHTS TO DETERMINE NECESSARY FOLLOW-UP ACTIVITIES	* Use insights from the staff review of IPEs to identify potential safety, policy, and technical issues, to determine an appropriate course of action to resolve these potential issues, and to identify possible safety enhancements. * Determine appropriate approach for tracking the regulatory uses of IPE/IPEEE results.	* Review the report "IPE Program: Perspectives on Reactor Safety and Plant Performance" and identify the initial list of required staff and industry actions (if any), including insights on A/M.	9/97C	NRR/RES	
		* Review IPE results and interact with licensees.	6/99	NRR/RES	
		* Complete backfit analysis and actions.	12/99	NRR	Changed (see Attachment 3)
		* Followup on accident management programs and licensee-stated actions.	9/98	NRR/ regions	Changed (see Attachment 3)
		* If appropriate, develop approach for linking IPE/IPEEE data bases.	12/98	NRR/RES	Changed (see Attachment 3)

2.0 REACTOR SAFETY RESEARCH

Regulatory Activity	Objectives	Methods	Target Schedule	Lead Office(s)	Status (this quarter)
2.1 DEVELOP	Regulatory Guides for industry to use	* Draft PRA Regulatory Guides transmitted		RES/NRR	

REGULATORY GUIDES	in risk-informed regulation.	to Commission for approval to Issue for public comment.			
		General IST ISI GQA TS	C C C C C		
		* Final PRA Regulatory Guides transmitted to Commission for approval: .			
		General IST ISI GQA TS	1/98 3/98 4/98 3/98 3/98		In final review Changed (Note 1) Changed (Note 1) Changed (Note 1)
2.2 TECHNICAL SUPPORT	* Provide technical support to agency users of risk assessment in the form of support for risk-based regulation activities, technical reviews, issue risk assessments, statistical analyses, and develop guidance for agency uses of risk assessment.	* Continue to provide ad hoc technical support to agency PRA users.	Continuing	RES	
		* Expand the database of PRA models available for staff use, expand the scope of available models to include external event and low power and shutdown accidents, and refine the tools needed to use these models, and continue maintenance and user support for SAPHIRE and MACCS computer codes.	Continuing		
		* Support agency efforts in reactor safety improvements in former Soviet Union countries.	Continuing		
2.3 SUPPORT FOR NRR STANDARD REACTOR PRA REVIEWS	* Modify 10 CFR 52 and develop guidance on the use of updated PRAs beyond design certification (as described in SECY 93-087).	* Develop draft guidance and rule.	5/98	RES	
		* Solicit public comment.	11/98		
		* Finalize staff guidance and rule.	12/99		
2.4 METHODS DEVELOPMENT AND DEMONSTRATION	* Develop, demonstrate, maintain, and ensure the quality of methods for performing, reviewing, and using PRAs and related techniques for existing reactor designs.	* Develop and demonstrate methods for including aging effects in PRAs.	9/98	RES	
		* Develop and demonstrate methods for including human errors of commission in PRAs.	9/98		

		* Develop and demonstrate methods to incorporate organizational performance into PRAs.	TBD		
		* Develop and demonstrate methods for fire risk analysis.	9/98		
		* Develop and demonstrate methods for assessing reliability/risk of digital systems	6/99		
2.5 IPE AND IPEEE REVIEWS	* To evaluate IPE/IEEE submittals to obtain reasonable assurance that the licensee has adequately analyzed the plant design and operations to discover vulnerabilities; and to document the significant safety insights resulting from IPE/IPEEEs.	* Complete reviews of IPE submittals.	TBD	RES	Changed (Note 10)
		* Complete reviews of IPEEE submittals.	6/99		
		* Continue regional IPE presentations.	C		
		* Issue IPE insights report for public comment.	10/96C		
		* Final IPE insights report	9/97		Completed
		* Issue preliminary IPEEE insights report	1/98		In final review
		* Initiate review of eight additional IPEEE submittals.	6/98		New milestone
		* Complete contractor evaluations on twelve IPEEE submittals.	6/98		New milestone
		* Issue draft IPEEE insights report for comment	6/99		New milestone
		* Issue final IPEEE insights report	12/99		
2.6 GENERIC ISSUES PROGRAM	* To conduct generic safety issue management activities, including prioritization, resolution, and documentation, for issues relating to currently operating reactors, for advanced reactors as appropriate, and for development or revision of associated regulatory and standards instruments.	* Continue to prioritize and resolve generic issues.	Continuing	RES	
2.7 NEI INITIATIVE TO CONDUCT "WHOLE PLANT" RISK STUDY	* Review NEI initiative to conduct three pilot "whole plant" risk-informed studies of requirements vs. risk and cost	* Agree on ground rules for study.	3/98	RES/NRR	
		* Complete study.	TBD		
2.8 PRA STANDARDS DEVELOPMENT	* work with industry to develop national consensus standard for PRA scope and quality	* Initiate activity.	9/97C	RES	
		* Finalize standard.	TBD		

2.9 LOW POWER AND SHUTDOWN BENCHMARK RISK STUDY	*Collect studies of LP&S risk as a benchmark for assessing the need for further staff activities	* Collect and review existing LP&S risk information (domestic and foreign).	9/98	RES	
		*Initiate additional work.	10/98		
2.10 SAFETY GOAL REVISION	*Assess need to revise Commission's Safety Goal to make core damage frequency a fundamental goal and make other changes.	*Initiate discussion with ACRS	2/98	RES	
		*Recommendation to Commission	3/98		

3.0 ANALYSIS AND EVALUATION OF OPERATING EXPERIENCE, AND TRAINING

Regulatory Activity	Objectives	Methods	Target Schedule	Lead Office	Status (this quarter)
3.1 RISK-BASED TRENDS AND PATTERNS ANALYSIS	* Use reactor operating experience data to assess the trends and patterns in equipment, systems, initiating events, human performance, and important accident sequence.	* Trend performance of risk-important components.	12/98	AEOD	
		* Trend performance of risk-important systems.	12/98		
		* Trend frequency of risk-important initiating events.	3/98		
		* Trend human performance for reliability characteristics.	TBD		
	* Evaluate the effectiveness of licensee actions taken to resolve risk significant safety issues.	* Trend reactor operating experience associated with specific safety issues and assess risk implications as a measure of safety performance.	As Needed	AEOD	
	* Develop trending methods and special databases for use in AEOD trending activities and for PRA applications in other NRC offices.	* Develop standard trending and statistical analysis procedures for identified areas for reliability and statistical applications.	C	AEOD	
		* Develop special software and databases (e.g. common cause failure)for use in trending analyses and PRA studies.	CCF-C Periodic updates		
3.2 ACCIDENT SEQUENCE PRECURSOR (ASP) PROGRAM	* Identify and rank risk significance of operational events.	* Screen and analyze LERs, AITs, IITs, and events identified from other sources to obtain ASP events.	Ongoing	AEOD	
		* Perform independent review of each ASP analyses. Licensees and NRC staff peer review of each analysis.	Annual report, Ongoing	AEOD	
		* Complete quality assurance of Rev. 2 simplified plant specific models.	3/97C	RES	
		* Complete feasibility study for low power and shutdown models.	11/96C	RES	
		* Complete initial containment	C	RES	

		performance and consequence models.			
		* Complete development of the Level 2/3 models	7/99	RES	
		* Complete the Rev. 3 simplified plant-specific models.	11/01	RES	
		* Complete external event models for fire and earthquake	TBD	RES	
		* Complete low power/shutdown models	TBD	RES	
	* Provide supplemental information on plant specific performance.	* Share ASP analyses and insights with other NRC offices and Regions.	Annual rpt	AEOD	
3.3 INDUSTRY RISK TRENDS	* Provide a measure of industry risk that is as complete as possible to determine whether risk is increasing, decreasing, or remaining constant over time.	* Develop program plan which integrates NRR, RES, and AEOD activities which use design and operating experience to assess the implied level of risk and how it is changing.	C	AEOD	
		* Update plan for risk-based analysis of reactor operating experience			Changed (Note 11)
		* Implement program plan elements which will include plant-specific models and insights from IPEs, component and system reliability data, and other risk-important design and operational data in an integrated frame work to periodically evaluate industry trends.	6/99		
3.4 RISK-BASED PERFORMANCE INDICATORS	* Establish a comprehensive set of performance indicators and supplementary performance measures which are more closely related to risk and provide both early indication and confirmation of plant performance problems.	* Identify new or improved risk-based PIs which use component and system reliability models & human and organizational performance evaluation methods.	C	AEOD	
		* Develop and test candidate PIs/performance measures.	9/00		
		* Implement risk-based PIs with Commission approval.	1/01		
3.5 COMPILE OPERATING EXPERIENCE DATA	* Compile operating experience information in database systems suitable for quantitative reliability and risk analysis applications. Information should be scrutable to the source at the event level to the extent practical and be sufficient for estimating reliability and availability parameters for NRC applications.	* Manage and maintain SCSS and the PI data base, provide oversight and access to NPRDS/EPHX, obtain INPO's SSPI, compile IPE failure data, collect plant-specific reliability and availability data.	Ongoing	AEOD	
		* Develop, manage, and maintain agency databases for reliability/availability data (equipment performance, initiating events, CCF, ASP, and human performance data).	Ongoing		
		* Determine need to revise LER rule to eliminate unnecessary and less safety-significant reporting.	6/98		
		* Determine need to revise reporting rules and to better capture ASP, CCF, and human performance events.	6/98		

		* Publish revised LER rule.	10/99		
3.6 STAFF TRAINING	* Present PRA curriculum as presently scheduled for FY 1998	* Continue current contracts to present courses as scheduled.	Ongoing	AEOD	
		* Maintain current reactor technology courses that include PRA insights and applications.	Ongoing		
		* Improve courses via feedback.	Ongoing		
		* Review current PRA course material to ensure consistency with Appendix C.	Complete		
	* Develop and present Appendix C training courses.	* Prepare course material based on Appendix C.	C	RES/AEOD	
		* Present courses on Appendix C.	C		
	* Determine staff requirements for training, including analysis of knowledge and skills, needed by the NRC staff.	* Review JTAs performed to date.	C	AEOD	
		* Perform representative JTAs for staff positions (JTA Pilot Program).	C		
		* Evaluate staff training requirements as identified in the PRA Implementation Plan and the Technical Training Needs Survey (Phase 2) and incorporate them into the training requirements analysis.	C		
		* Analyze the results of the JTA Pilot Program and determine requirements for additional JTAs.	C		
		* Complete JTAs for other staff positions as needed.	C		
		* Solicit a review of the proposed training requirements.	C		
		* Finalize the requirements.	C		
	* Revise current PRA curriculum and develop new training program to fulfill identified staff needs.	* Prepare new courses to meet identified needs.	Ongoing	AEOD	
		* Revise current PRA courses to meet identified needs.	Ongoing		
		* Revise current and New PRA course to include Reg Guide and SRP information	9/97C		
		* Revise current reactor technology courses as necessary to include additional PRA insights and applications.	Ongoing		
	* Present revised PRA training curriculum.	* Establish contracts for presentation of new PRA curriculum.	Ongoing	AEOD	
		* Present revised reactor technology courses.	Ongoing		
		* Improve courses based on feedback.	Ongoing		

4.0 NUCLEAR MATERIALS AND LOW-LEVEL WASTE SAFETY AND SAFEGUARDS REGULATION

Regulatory Activity	Objectives	Methods	Target Schedule	Lead Office(s)	Status (this quarter)
4.1 VALIDATE RISK ANALYSIS METHODOLOGY DEVELOPED TO ASSESS MOST LIKELY FAILURE MODES AND HUMAN PERFORMANCE IN THE USE OF INDUSTRIAL AND MEDICAL RADIATION DEVICES.	* Validate risk analysis methodology developed to assess the relative profile of most likely contributors to misadministration for the gamma stereotactic device (gamma knife).	* Hold a workshop consisting of experts in PRA and HRA to examine existing work and to provide recommendations for further methodological development.	8/94 C	NMSS	
		* Examine the use of Monte Carlo simulation and its application to relative risk profiling.	9/95 C		
		* Examine the use of expert judgement in developing error rates and consequence measures.	9/95 C		
	* Continue the development of the relative risk methodology, with the addition of event tree modeling of the brachytherapy remote after loader.	* Develop functionally based generic event trees.	TBD	RES/ NMSS	
	* Extend the application of the methodology and its further development into additional devices, including teletherapy and the pulsed high dose rate after loader.	*Develop generic risk approaches.	TBD	RES/ NMSS	
4.2 CONTINUE USE OF RISK ASSESSMENT OF ALLOWABLE RADIATION RELEASES AND DOSES ASSOCIATED WITH LOW-LEVEL RADIOACTIVE WASTE AND RESIDUAL ACTIVITY.	* Develop decision criteria to support regulatory decision making that incorporates both deterministic and risk-based engineering judgement.	* Conduct enhanced participatory rulemaking to establish radiological criteria for decommissioning nuclear sites; technical support for rulemaking including comprehensive risk based assessment of residual contamination.	8/94 PR C Final Rule Published 7/97 C	RES/NMSS	
		*Develop guidance for implementing the radiological criteria for license termination..	2/98		
		* Work with DOE and EPA to the extent practicable to develop common approaches, assumptions, and models for evaluating risks and alternative remediation methodologies (risk harmonization).	Ongoing		
4.3 DEVELOP GUIDANCE FOR THE REVIEW OF RISK ASSOCIATED WITH WASTE REPOSITORIES.	* Develop a Branch Technical Position on conducting a Performance Assessment of a LLW disposal facility.	* Solicit public comments	5/97 C.	NMSS/RES	
		* Publish final Branch Technical Position	TBD, Dependent on Resources		

4.4 RISK ASSESSMENT OF MATERIAL USES.	* Develop and demonstrate a risk assessment for industrial gauges containing cesium-137 and cobalt-60 using PRA and other related techniques.	* Develop and demonstrate methods for determining the risk associated with industrial gauges containing cesium-137 and cobalt-60.	9/98		Changed (Note 12)
	* The assessment should allow for modification based on changes in regulatory requirements.	* Final report as NUREG	12/98		Changed (Note 12)
	* Use empirical data as much as practicable. * Develop and demonstrate risk assessment methods for application to medical and industrial licensee activities.	* Working Group with contractor assistance to identify and document a technical basis for a risk-informed approach to the regulation of nuclear byproduct material, and to develop plans for a graded approach to nuclear byproduct material regulation based on risk information.	9/98		Changed (Note 13)
4.5 FRAMEWORK FOR USE OF PRA IN REGULATING NUCLEAR MATERIALS	* develop a framework for applying PRA to nuclear material uses, similar to the one developed for reactor regulation (SECY-95-280), where appropriate.	* Provide plan for developing framework	1/98	NMSS	Changed (Note 14)
		* Complete framework	TBD		

5.0 HIGH-LEVEL NUCLEAR WASTE REGULATION

Regulatory Activity	Objectives	Methods	Target Schedule	Lead Office(s)	Status (this quarter)
5.1 REGULATION OF HIGH-LEVEL WASTE	* Develop guidance for the NRC and CNWRA staffs in the use of PA to evaluate the safety of HLW programs.	* Assist the staff in pre-licensing activities and in license application reviews.	Ongoing	NMSS	
		* Develop a technical assessment capability in total-system and subsystem PA for use in licensing and pre-licensing reviews.			
		* Combine specialized technical disciplines (earth sciences and engineering) with those of system modelers to improve methodology.			
	* Identify significant events, processes, and parameters affecting total system performance.	* Perform sensitivity studies of key technical issues using iterative performance assessment (IPA).	Ongoing	NMSS	
	* Use PA and PSA methods, results and insights to evaluate proposed changes to regulations governing the potential repository at Yucca Mountain.	* Assist the staff to maintain and to refine the regulatory structure in HLW disposal regulations that pertain to PA.	Ongoing	NMSS	
		* Apply IPA analyses to advise EPA in its development of a Yucca Mountain regulation			
		* Apply IPA analyses to develop a site-specific regulation for a Yucca Mountain site			

	* Continue PA activities during interactions with DOE during the pre-licensing phase of repository development, site characterization, and repository design.	* Provide guidance to the DOE on site characterization requirements, ongoing design work, and licensing issues important to the DOE's development of a complete and high-quality license application.	Ongoing	NMSS	
		* Compare results of NRC's iterative performance assessment to DOE's VA to identify major differences/issues.			
5.2 APPLY PRA TO SPENT FUEL STORAGE FACILITIES	* Demonstrate methods for PRA of spent fuel storage facilities.	* Prepare user needs letter to RES.	4/97C	RES/NMSS	
		* Conduct PRA of dry cask storage.	9/99		
5.3 CONTINUE USE OF RISK ASSESSMENT IN SUPPORT OF RADIOACTIVE MATERIAL TRANSPORTATION	* Use PRA methods, results, and insights to evaluate regulations governing the transportation of radioactive material.	* Update the database on transportation of radioactive materials for future applications.	End of FY 99	NMSS	
		* Revalidate the results of NUREG-0170 for spent fuel shipment risk estimates.	6/99		

Notes

1. The general regulatory guide and Standard Review Plan for use of PRA in plant-specific current licensing basis changes will be transmitted to the Commission in the near future. To permit efficient incorporation of the resolution of policy issues contained in these documents into the application-specific regulatory guides and SRP sections, completion of these guides and sections has been delayed until March 31, 1998, a change from their previous completion date of December 31, 1997.
2. The staff's RI-IST team is currently working on a draft SE for the Comanche Peak RI-IST program. The staff and TU Electric have been actively interacting through meetings and discussions as the licensee develops a RI-IST program description that is sufficiently detailed and consistent with the draft RI-IST guidance provided in DG-1062. TU Electric has indicated that it would be able to complete a draft revision to their RI-IST Program Description by the end of January 1998. The staff will continue to develop a draft SE based on the licensee's responses to the staff's RAIs and discussions with the licensee. Assuming TU Electric finalizes its RI-IST Program Description by mid February 1998, the staff anticipates having a completed SE to the Commission on the proposed RI-IST program for Comanche Peak in March 1998.
3. The completion date for the Graded Quality Assurance pilot application has been revised to July 1998 to reflect the anticipated issuance date of the final GQA inspection guidance.
4. With respect to the risk-informed TS pilot program, the staff received a supplemental amendment request from SONGS in early January 1998 to put the configuration risk management program (CRMP) description into the SONGS TS. The staff will review the CRMP and, if acceptable, issue the risk-informed TS amendments for SONGS. Once similar supplemental amendment requests are received from the remaining pilot licensees, the staff will issue those pilot plant amendments. Based on information from the CEOG, the staff expects to receive the majority of the supplemental pilot amendment requests in the first quarter of 1998. With receipt of the SONGS supplemental request, the staff anticipates completing the SONGS review as the lead pilot plant and issue the amendment by March 31, 1998. This is a change from the previous date of December 31, 1997, for issuance of the lead pilot plant amendment, because of the decision by the original lead plant not to pursue risk-informed TS changes at this time.
5. The NRR Inspection Program Branch proposals for revising core inspection procedures have been transmitted to the appropriate NRR technical branches having responsibility for specific core inspection procedures. Due to the large number of branches involved, completing all individual branch concurrences is anticipated to take an additional two months. The revised completion date for this task is February 1998.
6. A decision has been reached to generate the risk-informed regulatory documents in a sequential manner, with the application specific guidance following the general regulatory guide and standard review plan. Under this schedule, the regulatory guide for graded QA will be finalized by the end of March 1998. Since the graded QA inspection procedure will be dependent upon the technical content of the companion regulatory guide, the draft graded QA Inspection Procedure will be prepared by April 1998 and finalized in July 1998 after having received appropriate NRC reviews.
7. As part of the IPE follow-up program, the staff is in the process of identifying generic issues to be audited. These issues will be those which have been explicitly identified and addressed by the licensee as part of the IPE process. A report that identifies the above generic issues and staff views on the adequacy of the proposed resolution is under preparation. The report will provide the basis for the selection of generic safety issues to be audited and selected plants. The staff has moved the completion date for this milestone to March 1998, in order to utilize the report in the audit process.

In addition to the above issues, RCP seal LOCA had been identified as a dominant contributor to core damage frequency in many PWR IPEs. The staff has a separate ongoing activity in RES to address this issue under Generic Safety Issue 23, and will utilize IPE insights in the proposed resolution.

8. In an SRM (9700207) dated May 28, 1997, the Commission requested that the staff provide the scope and schedule of activities related to using IPE results to assess regulatory effectiveness in resolving major safety issues. With respect to scope, the staff identified three major safety issues for assessment. The selection had been based on both the potential risk significance of the issue, and the fact that probabilistic techniques were used extensively in the resolution process. These issues include:

1. Resolution of USI A-44 Station Blackout at Nuclear Power Plants
2. Resolution of USI A-45 Decay Heat Removal Reliability
3. Resolution of USI A-09 Anticipated Transient Without Scram

To evaluate the three major issues, the staff will utilize both representative plants, and information contained in NUREG-1560, to audit and draw conclusions regarding regulatory effectiveness. Information generated under Task 1.6 and Task 1.10 will also be integrated into the assessment process. In particular, the RCP seal LOCA and station blackout issues are closely related; the station blackout analysis in this activity will incorporate the results of the RES seal LOCA analysis discussed in Note 7.

These tasks may expand the staff's consideration of other safety issues and effectiveness of the regulatory process. The staff will inform the Commission of any additional safety issues that come under consideration. The staff plans to complete its analysis of the three issues by the end of December 1998, and will recommend at that time any additional staff action.

9. Due to personnel being assigned to higher priority activities, such as risk-informed pilot initiatives and IPE followup activities, the staff is reassessing their position regarding the development of an SRP, especially since there are no new advanced design certification submittals anticipated.
10. The staff has reviewed all the 76 IPE submittals and issued staff evaluation reports (SERs) on their findings to each licensee. In three of the SERs, it is indicated to the licensees that the staff was not able to conclude that the licensee met the intent of Generic Letter 88-20 for their plant(s). These three IPEs include Crystal River 3, Susquehanna 1&2, and Browns Ferry 3. The licensee for Crystal River 3 has indicated their intention to submit an updated analysis (February 1998) addressing the staff's concerns. It is anticipated that the review of this new IPE submittal will be concluded in June 1998. Discussions are still ongoing with licensees regarding Susquehanna 1&2 and Browns Ferry 3.
11. The program plan in this activity has been subsumed into other planning documents which are periodically updated; thus the task to provide updates has been dropped here.
12. The target schedule for the work to develop and demonstrate a risk assessment for industrial gauges containing cesium-137 and cobalt-60 using PRA (and other related techniques) has been extended from July 1998 to September 1998. The extension is due to difficulties in obtaining data from non-licensees related to actual and potential doses to the public resulting from gauges which enter the scrap metal cycle.
13. The target schedule for the work to develop and demonstrate risk assessment methods for application to medical and industrial licensee activities has been determined to be September 1998 based on scheduling of a planned Commission paper on the topic.
14. The target schedule for providing a plan for developing a framework has been extended from October 1997 to January 1998 to permit interoffice coordination.

ATTACHMENT 2

IN RESPONSE, PLEASE
REFER TO: M970507

May 28, 1997

MEMORANDUM L. Joseph Callan
TO: Executive Director for Operations
FROM: John C. Hoyle, Secretary /s/
SUBJECT: STAFF REQUIREMENTS - BRIEFING ON IPE INSIGHT REPORT, 2:00 P.M., WEDNESDAY, MAY 7, 1997, COMMISSIONERS' CONFERENCE ROOM, ONE WHITE FLINT NORTH, ROCKVILLE, MARYLAND (OPEN TO PUBLIC ATTENDANCE)

The Commission was briefed by the NRC staff on the Individual Plant Examination (IPE) insight report. The Commission asked the staff to expedite activities in the following areas: (1) using IPE results to prioritize inspection activities; (2) improving regional capabilities for the use of PRA and risk insights; and (3) providing related inspector training.

(EDO)

(SECY Suspense: TBD)

The Commission asked the staff to provide the scope and schedule of activities related to using IPE results to assess regulatory effectiveness in resolving major safety issues. The Commission specifically requested that the staff provide an estimate of the average cost to respond to the Station Blackout rule per person-rem averted in achieving an average reduction in core damage frequency of 2E-5/Ry. These activities should be coordinated with the regulatory effectiveness organization.

(EDO)

(SECY Suspense: 6/27/97)

After the IPE database has been placed on the Internet, the staff should consider allowing licensees to update their IPEs voluntarily to reflect changes in plant configuration.

cc: Chairman Jackson
Commissioner Rogers
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan
OGC
CFO
CIO
OCA
OIG
Office Directors, Regions, ACRS, ACNW, ASLBP (via E-Mail)
PDR - Advance
DCS - P1-17

ATTACHMENT 3

IPE Followup Program

The IPE program was initiated to have licensees evaluate their plants for vulnerabilities to severe accidents and to take actions to correct these vulnerabilities, where appropriate. In this process it was recognized that licensees would gain an appreciation of their plant's overall susceptibility to severe accidents which would help in developing accident management strategies and programs. In this regard the IPE program was principally for the benefit of licensees. Now, however, as a result of completion of the IPE reviews (except for the three plants where completion is still under discussion) and insights report (NUREG-1560), the staff is now in a position to utilize these results to follow up and see if:

- any additional plant specific improvements are warranted,
- licensees have followed through on the actions they indicated they were taking as a result of their IPE, and
- any additional generic regulatory activities should be undertaken.

To accomplish this the staff has developed an IPE followup program which will involve the efforts of RES, NRR and the Regions. The followup program will consist of the following activities:

- 1) reviewing the IPE results for risk significant items that may warrant further attention. Examples of the screening criteria for selection of plants and items for additional followup are as follows:
 - any contributor with a CDF⁽³⁾ $>10^{-5}/RY$ or
 - any contributor with a LERF⁽⁴⁾ $>10^{-6}/RY$
- 2) reviewing the IPE results for similar plants and whether or not actions taken by some plants are applicable to other plants of similar design,
- 3) reviewing licensee responses to specific containment performance improvement items identified in the IPE generic letter supplements to see if additional actions are warranted,
- 4) reviewing the basis for very low risk contributors that appear to be out of line with other plants (i.e., was the analysis overly optimistic and should further action be taken?),
- 5) assessing licensee stated actions (e.g., safety enhancements) resulting from their IPE to see if, in fact, they have been completed,
- 6) assessing licensee accident management programs to see if, in fact, they reflect the results, assumptions and actions from the IPE. This action will be carried out through the staff assessment of the licensee's Severe Accident Management Guidelines (SAMG).
- 7) assessing the results for their implications for the resolution of generic safety issues or other major safety issues.

These activities are in addition to actions already underway to incorporate the IPE insights into the NRC inspection program.

Implementation of this program will consist of RES providing to NRR information related to activities 1 through 4 above with NRR then discussing with licensees the appropriateness of additional actions. This will provide licensees an opportunity to provide updated information related to these activities and ultimately for NRR to take regulatory action, if such action is warranted and can be justified by the backfit rule. Activities 5 and 6 will be performed by NRR, with Regional followup as necessary. Activity 7 is addressed by items 1.6 and 1.7 of the PRA Implementation Plan.

High priority issues identified in the screening process will be pursued as they are identified. Dates for accomplishing these activities relative to IPE followup are:

- RES supply information to NRR on items 1-4 12/98
- NRR interact with licensees on appropriateness of additional actions for items 1-4 6/99
- Backfit analysis and actions complete 12/99

- Item 5, identify items for Regional followup 9/98
- Item 6, identification of IPE insights for Severe Accident Management Guidelines 9/98

The specific IPEEE followup schedule will be developed following the completion of the IPEEE reviews.

¹ The staff has modified the format of the PRA Implementation Plan to reduce redundancy and improve readability. This revised format consists of the body of the Commission paper, which now provides a summary of accomplishments and changes to the plan for the past quarter, and the Plan's table (Attachment 1), modified to explicitly show where milestones have been added, completed, or changed. Such changes are discussed and additional information provided in endnotes to the table.

² C = Task previously completed

³ Core Damage Frequency

⁴ Large Early Release Frequency