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

April 28, 1992

Docket No. 52-001 (formerly 50-605)

APPLICANT: GE Nuclear Energy (GE)

PROJECT: Advanced Boiling Water Reactor (ABWR)

SUBJECT: SUMMARY OF MEETING HELD ON MARCH 25 AND 26, 1992

A public meeting was held between the Nuclear Regulatory Commission (NRC) staff (staff) and GE representatives on March 25 and 26, 1992, in the GE office in San Jose, California, to discuss items related to the staff's review of the Standard Safety Analysis Report (SSAR) for the ABWR. The objective of the meeting was to discuss the status of a number of open issues, design interfaces and inspections, tests, analyses, and acceptance criteria (ITAAC). Enclosure 1 is list of the individuals who attended the meeting and Enclosure 2 is the agenda which was followed.

The following is a summary of the highlights of each of the discussion topics. The summary is not intended to provide the full scope and background of each issue, but instead is intended to provide a record of significant comments, commitments, and required actions for both the NRC and GE staff.

PROGRAMMATIC ITEMS

Progress in Closure of DSER Open Issues

Enclosure 3 was provided as a plot of the status of the progress in the closure of open items identified in the ABWR draft safety evaluation reports (DSERs). Discussion focused on the fact that the Office of Nuclear Reactor Regulation's (NRR) internal tracking system does not appear to show significant progress while GE believes that many, if not most issues, can be closed out based on the completion of GE actions and submittals made to date. The NRR projects staff indicated that based on frequent discussions with technical reviewers, a large number of items should be reflected as closed within the next month.

Status of GE Outstanding Submittals

Enclosure 4, which was provided to the staff by GE, indicated that GE had enhanced the scheduled submittal dates for PRA items from August to June to better support the staff's evaluation and FSER preparation. GE indicated that with the exception of ITAAC submittals in May, all subsequent submittals are considered to be confirmatory in nature. The staff also indicated that a cutoff date will be established, perhaps in April or May, beyond which any GE submittals would not be considered for inclusion in the FSER but would have

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to be reflected in the FSER supplement which is expected to be issued about 2 months after the final safety evaluation report (FSER).

Dr. Murley stated that it is important for GE to supply to the staff as much key information necessary to make its safety findings. He indicated that he needs to provide to the Commission a comprehensive description of the ABWR review process and the breadth and depth of design information upon which the staff's findings have been made. Therefore, timely and quality submittals will support the job of convincing the Advisory Committee on Reactor Safeguards (ACRS) and Commission that NRR's review process, criteria, and conclusions are technically sound and justifiable.

More specifically, it was indicated that the staff is committed to providing a SECY paper to the ACRS and Commission describing in detail the basis for and the application of design acceptance criteria (DAC) to the ABWR ITAAC. The paper will be issued no later than the first of May and will include two examples of approved DAC for the radiation shielding and piping areas (tentatively). GE's support to complete these packages by April 15 was requested and GE committed to do so. Since there appears to be some Commission anxiety over the certification of DAC, it is paramount that the two DACs be completed and of the best technical quality.

OPEN ISSUE DISCUSSIONS

Status of PRA Open Items

There was a meeting held between GE and the Division of NRR staff on March 24, 1992, to discuss DSER open items and a summary was provided to the attendees. It was indicated that approximately 36 out of the 50 open items had been resolved by agreements and GE commitments to provide additional information, clarify SSAR items, and perform additional analyses (see Enclosure 5). The remaining issues appear close to resolution and that by the end of June, all major PRA issues will be closed. The staff committed to maintaining frequent communication with GE to ensure that all remaining items are worked on as agreed. GE committed to providing to the staff a detailed list of action items, assignments, and due dates as agreed to in the previous meeting. The staff commented that GE should provide PRA insights to the human factors engineering staff to ensure that the control room DAC scheduled for completion by the end of May includes key aspects of the design. The staff indicated that additional questions may arise as the staff and GE address PRA design insights such as the use of PRA in the reliability assurance program, the shutdown risk evaluation, the design process, DAC/ITAAC development, and the identification of severe accident vulnerabilities.

Shutdown Risk

GE presented a discussion of the status of its efforts in resolving the staff's shutdown risk (SDR) concerns, a priority open item. It was indicated that the GE package on SDR risk will extract applicable insights and guidance from NUREG-1449 guidance and will be submitted as SSAR Appendix 19Q (see Enclosure 6). The most significant sections will deal with residual heat removal (RHR) reliability, flooding and fire protection, design features to

reduce SDR, risk impact of new features, and the review of significant shutdown events.

GE indicated that it was considering a RHR reliability goal of 10E (-4) (i.e., given an accident initiator, the unavailability upon demand of all mitigating systems contributing to success). GE indicated that the proposed goal was associated with its overall core damage frequency goal of 10E (-5) per year. The staff recommended that GE reconsider its 10E (-4) per year RHR reliability goal in light of the fact that containment is open during modes 4 and 5, and the Commission's large release goal is 10E (-6) per year. GE indicated that it would reconsider its RHR reliability goal and indicated that it intended to meet the goal by starting from a minimum set of systems and components, quantifying the DHR unavailability, and then adding more systems and components, as needed, to meet the goal. Insights from this analysis will be fed into the ITAAC process, as warranted. The staff stated that GE will need to address how important equipment needed for shutdown cooling will be factored into the reliability assurance program and the maintenance program required by the Maintenance Rule. The staff reiterated its concern about fires and floods and the physical separation of divisions during modes 3, 4, and 5.

The staff voiced a concern over the use of freeze plugs in any drain lines and that the ABWR design should negate any need for their use during hardware maintenance or replacement. GE indicated that it could not preclude freeze plug use through design but would govern their use through combined operating license (COL) administrative controls. GE committed to looking further at this issue and is considering measures such as designing the location of drain line valves above the top of active fuel to minimize the need for plug use.

Regarding GE's analysis, GE indicated that they would review the proposed technical specifications (TS) to determine if specified equipment availability meets their proposed RHR goal. GE indicated that its staff would look at other systems not included in the TS to determine the need for revising the TS or including guidelines for the COL applicant to include in its maintenance program and in outage planning. The staff noted that GE's success criterion in its analysis is "no core damage." This implies that steaming of secondary containment is an accepted consequence. The staff believes that this may not be the optimal success criterion and recommended that "not boiling" be considered as an alternative. GE indicated that it would consider this. Lastly, the staff commented on the mission time of 24 hours that it had some concerns and will provide further guidance in the near term.

Additional discussions will be required between the staff and GE prior to the submittal date in June.

Systems Interaction

The staff summarized its concern related to the fact that the lack of final design details on piping runs made it difficult to reach its safety conclusions on the physical effects of high energy line breaks including flooding.

What is needed is a justification that the effects of breaks would be confined to a given room or compartment, that impacted piping, conduits and cable trays would be adequately supported, and that adequate separation would be provided.

GE indicated that it relies on physical separation in its design to address the effects of fires, flooding, and pipe breaks. For fires, 3-hour fire barriers contain the effects to one division. While the ABWR design basis does not take credit for flood barriers between rooms of a division, the wall, floor, and door designs keep the water within the affected room or compartment. In addition, the outer corridor in the reactor building serves as a holding volume for fluid which escapes from the rooms or compartments. The effects of high energy pipe breaks are also confined to a room or compartment. For example, two of the high energy system lines outside containment are the reactor water cleanup system and the reactor core isolation cooling system. Potential breaks in these lines would be contained to the system (for the first system) and to Division A (for the second system).

GE staff presented a discussion of its separation philosophy and its analysis of high energy line breaks. Enclosure 7 provided by GE depicted the separation within portions of the reactor building, and Enclosure 8 reflected reactor building flooding control in the design.

The staff proposed the following:

1. GE should provide drawings showing the flood boundaries and descriptions of penetrations (curbs/sleeves) and watertight door designs.

2. A requirement to have penetrations located above maximum flood levels in any room should be included in ITAAC.

3. The hydrostatic head should be mentioned in the seismic Category 1 structures ITAAC.

4. The routing of equipment to address flooding should be included in ITAAC.

5. Where conduits of more that one division are included in the same room, leak detection should be specified in the design and included in the ITAAC and incorporated in the technical specifications, if appropriate.

6. The staff needs to determine if separation has been included in its sabotage evaluation (safeguards), and to provide feedback to GE.

7. GE in its SSAR will need to include in its discussion of USI A-17, a roadmap on how this issue is addressed in ITAAC.

8. The staff should review a sample of the GE subcompartment analysis and the hydrostatic load values should be evaluated.

9. GE should include in the ITAAC as built reconciliation to verify that pipe break mitigation features are constructed as designed.

10. GE should include electrical separation in its ITAAC or Tier I description. GE indicated that it would be included in the fire protection ITAAC.

Enclosure 9 was provided as a summary of the breakout session between the staff and GE representatives.

In-Service-Inspection (ISI)

GE indicated that the staff's guidance regarding what was required in the SSAR relative to the ASME Code version for the preservice inspection (PSI) and ISI had changed from that which was included in the DSER based on recent telephone conversations (see Enclosure 10). The staff provided the following guidance for closure of the issues for the FSER.

For design certification, GE is responsible for designing the reactor pressure vessel (RPV) for accessibility to perform preservice and inservice inspection. The design to perform preservice inspection on the RPV shall be based on the requirements of the ASME Boiler and Pressure Vessel Code, Section XI 1989 Edition and will be specified in the design certification rule. The RPV shell welds are designed for 100 percent accessibility for both preservice and inservice inspection. The RPV nozzle-to-shell welds will be 100 percent accessible for preservice inspection but might have limited areas that will not be accessible from the outer surface for inservice volumetric examination using current examination techniques. However, the inservice inspection program will be reviewed by the NRC staff based on the ASME Code edition in effect and inservice inspection techniques available at the time of the COL application.

For all ASME Code Class 1, 2, and 3 components, the development of the preservice and inservice inspection program is the responsibility of the COL applicant. In addition, the design responsibility to provide access to perform preservice and inservice inspections on ASME Code Class 1, 2, and 3 components (other that the RPV) belongs to the COL applicant. The COL applicant will also be responsible for specifying the Edition of the Section XI Code based on the procurement date of the component per 10 CFR 50.55a. These are considered to be COL applicant action items. The staff expects GE to revise the SSAR to reflect the above.

GE provided a discussion of the design of the feedwater nozzle for the ABWR and highlighted design features which are intended to address concerns over cracking and erosion.

Containment Response-ASME Level C Limits

The staff indicated that it was unclear whether GE had responded to the item included in SECY-90-016 that:

> The containment should maintain its role as a reliable leak tight barrier by ensuring that containment stresses do not exceed ASME service level C limits for a minimum period of 24 hours following the onset of core damage and that following this 24-hour period, the containment should continue to provide a barrier against the uncontrolled release of fission products.

GE responded by indicating that in its design, it had met the conditional containment failure probability of .1 and could also meet the service level C limits. The SECY had indicated that only one of the two requirements needed to be met. GE has completed its analysis relative to the "C" limits and provided a copy to the staff for evaluation (Enclosure 11). According to the analysis, GE claimed that the containment will not fail during the period of 24 hours following core damage and the service level C value is calculated to be about 80 psi. GE staff indicated that the drywell head design pressure had been elevated to 100 psi and the drywell head was considered to be the limiting device in pressure vulnerability. The staff recommended that GE consider other closure devices as potential failure points and that GE's final evaluation should be included in the severe accident evaluation in the SSAR. The staff committed to reviewing GE's analysis, evaluating the pressure-temperature profiles, and discussing this issue further in the near future.

SGTS Single Filter

GE indicated that it is changing the design to add a second filter train to the standby gas treatment system. This action will close out a DSER open item.

Source Term for ABWR and Credit for Pool Scrubbing

GE indicated that it has decided not to change the source term for the ABWR for technical and schedular reasons (see Enclosure 12). After discussions with the staff concerning credit for pool scrubbing, GE indicated that it would rely on a suppression pool scrubbing factor of two with the knowledge that it would limit the number of potential sites based on meteorological conditions. GE has not completed its evaluation of control room habitability based on this scrubbing factor and stated it has some concerns about the results.

The staff indicated that subject to the resolution of the technical basis for control room habitability, it considers that a credit of two for suppression pool scrubbing for the ABWR design is resolved.

Plant Shielding and Ventilation DACs

The staff stated that it has reviewed the latest version of the ABWR shielding and ventilation DAC and finds that it is very close to final form. GE indicated that the latest changes required are minor and will be completed promptly. The staff requested that GE prepare a radiation protection ITAAC which will include a Tier 1 text description taken from the SSAR with appropriate drawings incorporating the shielding and ventilation DAC. This package

needs to be in final and approved form by mid April and will be included in a SECY paper to be provided to the ACRS and Commission. GE agreed to provide the requested information.

Upper Drywell Shielding Design

The staff indicated that an open issue addressed in the DSER still requires GE action for resolution. The issue deals with a potential fuel bundle drop on the vessel flange creating a large exposure area for workers in the upper drywell area. GE stated that it has proposed adding additional shielding to the area in question to reduce the potential dose rates by a factor of 10, but needs to complete additional calculations for additional shielding sizes. It was also indicated that GE would need to coordinate the design change with the structural staff, and that the date for completion of the effort was yet to be determined.

Lower Drywell Access Concerns

The staff indicated that an open issue discussed in the DSER still requires GE action for resolution. This issue deals with the potential for exposure of operating personnel resulting from the movement of the TIP and drive cable. GE indicated that it is considering implementing in the design a set of warning and flashing lights in areas within exposure range of the cabling routes which would activate when power was applied to the TIP system. This would complement the requirement to have administrative controls to address TIP movement or lockup. GE did not indicate when its final position would be provided to the staff.

Referencing of Codes and Standards

GE presented a discussion concerning the lack of uniformity in the referencing of codes and standards in various portions of the SSAR and in the DSERs (Enclosure 13). The staff stated that one option would be to take all references to the editions of codes and standards be taken out of Tier 1 and include them in the SSAR as Tier 2 information with the exception of the PSI for reactor vessel and its nozzles only. This would provide sufficient flexibility for the COL applicant to chose the most current version of approved codes and standards as of the date of his application.

Results of February 27, 1992, Meeting on ITAAC and Interfaces

ITAAC

A summary of the results of the February 27, 1992, meeting on ITAAC and interfaces was presented (Enclosure 14). GE indicated that it will submit approximately 40 systems by March 31, 1992, and approximately 65 systems for review by May 31, 1992. All generic ITAAC will be included in the May submittal.

Out of the 139 systems in the SSAR, GE committed to providing Tier 1 Design Descriptions for 105. Of the remaining 34 systems, 17 will be covered in other system Design Descriptions, and GE stated that they did not plan to address 17 systems in Tier 1 (screened out based on the type of equipment

included in the systems and the fact that the systems were minor in nature with no safety significance). GE stated that they would attempt to accelerate the delivery of 10 system ITAAC which the staff had indicated would facilitate the ITAAC review process. Fuel and control rod systems would be reevaluated for what information was required in the SSAR, the Design Description, and the ITAAC based on further discussions between the staff and GE.

The staff presented a list of 9 "agreed to" and 6 potential generic ITAAC. It was agreed that in the area of piping DAC, piping layout concerns would be addressed as part of the piping systems interactions in the building systems ITAAC, high energy line breaks would be considered in the structural and building ITAAC (the SSAR Chapter 6 includes appropriate subcompartment pressurization analysis, and the ITAAC would include methods for as-built reconciliation), leak-before-break would be listed as an option for the COL applicant while GE will not be claiming credit for its application in the certified design, and as-built reconciliations per IE Bulletin 79-14 will be incorporated into the piping DAC. GE agreed to provide an additional generic ITAAC to address welding concerns and the staff indicated that it did not expect that additional generic ITAAC would be required for certification.

Other generic ITAAC discussion points on HVAC supports structural design, cable tray and conduit supports structural design, and seismic and non-seismic interaction were deferred for addressing as part of staff audits or reviewer-level discussions. Specifically, the staff committed to reviewing the SSAR to determine the adequacy of the analytical methods for HVAC ducting and supports and cable tray and support design.

The staff stated that it was examining the overlap of the Initial Test Program with ITAAC. The staff is currently reviewing the MC 2512 and 2513 inspection programs to identify the types of tests that are required prior to fuel load. This information will be compared to the tests included in the ABWR systems ITAAC to ensure that the proper tests are identified and to determine if adequate depth is provided in the test abstracts included in SSAR Chapter 14.2 (see Enclosure 14.1).

The staff will also be examining test abstracts and assessing the testing information included in ITAAC to determine if identified system characteristics will be testable and inspectable. It was noted that additional ITAAC information may be required as a result of the staff's evaluation.

The staff presented a list of analyses and issues that should be considered in the "roadmap" of where specific aspects of the design have been incorporated into ITAAC. A systems interaction analysis for piping was added to the list presented, and the PRA inputs and assumptions list would include (among other issues) shutdown risk, seismic analyses beyond design basis, and human reliability analysis inputs to the Human Factors DAC ITAAC.

GE agreed to provide the radiation protection and the piping DAC areas to the staff by April 15 for inclusion in a SECY paper and in presentations to the ACRS, as noted elsewhere in this summary.

Regarding DAC, the staff emphasized that it has informed the Commission that DAC would be applied to a limited number of review areas, namely radiation protection, control room design and I&C, and piping. Therefore, no other areas will be considered for DAC use in resolving safety concerns.

Review of Interfaces

Enclosure 15, provided to the attendees, summarized the results of the interface review effort conducted by both GE and NRR staff. It was agreed that the majority of items previously called interfaces are classified as COL action items. These are actions required as part of the COL application but do not meet the requirements of 10 CFR Part 52 interfaces. They will be presented in Chapter 1 of the SSAR as such and will also be reflected in the FSER. Most significantly, the total number of interfaces identified in the SSAR and DSERs (over 150) has been reduced to six. They are the ultimate heat sink, the offsite power system, the makeup water system (preparation), the portable and sanitary water system, portions of the service water system, and portions of the turbine service water system.

Items requiring further design description include the fuel, control rods, and the loose parts monitoring system. For the fuel and control rod design, the staff requested that GE provide a general description of the acceptance criteria and important characteristics for both in separate ITAAC (Tier 1) and to include a sample (reviewed and approved) fuel and control rod design in the SSAR. The COL applicant will be able to reference the SSAR designs or will have the option to provide alternate ones with sufficient justification for differences as a change to Tier 2 information.

Unresolved items included audits of design specifications and design reports, common industrial standards referenced in purchase specifications, licensing emergency support facility, in-plant radiation monitoring, containment structural details and other seismic Category I structures, plans for pre-service examination of reactor pressure vessel welds, and PRA for internal floods. Most of these items are being worked by the staff and GE. Their final disposition will need to be reflected in the SSAR and FSER.

The referenced enclosure included a list of proposed ITAAC (about 110) which GE committed to review in detail. Follow up discussions will be held within the next 2 weeks to discuss and resolve areas of disagreement in classification.

ITAAC Submittal Discussions

GE provided a discussion of the ITAAC submittal plans and provided Enclosure 16. The staff committed to providing comments back to GE within 2 weeks of receipt of the Phase 2 package. These comments will address the overall quality of the submittal as well as providing a resource estimate on the amount of staff review effort required to reach final agreement on the content of the ITAAC.

INTERFACES

Plans for Conceptual Designs

GE provided a discussion of the conceptual design for the ultimate heat sink included in the SSAR (see Enclosure 17). The staff committed to evaluating its adequacy relative to the requirements of 10 CFR Part 52 and providing feedback to GE. The approved heat sink conceptual design description will serve as the model for the remaining five interfaces. The staff will need to provide its formal evaluation in the FSER for each of the interfaces.

Verification of Reliability and Availability Targets Used in the ABWR PRA

The staff discussed the fact that GE has made assumptions about the reliability and availability of the ABWR interfaces and has used these as inputs to the PRA. GE needs to include in its system descriptions and conceptual design discussions a means to ensure that the assumptions or targets used in the PRA will be maintained through the design process by the COL applicant and throughout the life of the plant as appropriate. GE indicated that the requirement was understood and would be addressed.

HFE Issue Status

Chapter 18 Revision

The staff has received the latest Chapter 18 revision from GE and finds it to be satisfactory and responsive to the staff's DSER and previous discussions.

DAC

The staff has developed a model DAC for human factors engineering for the ABWR and was provided to GE (Enclosure 18). The staff indicated that the model will provide the basis for discussions on the scope, depth, and content of the final DAC to be provided by the end of May. The staff committed to having a detailed technical meeting on the content of GE's DAC prior to the submittal date.

Feedback on Control Room Inventory

The staff indicated that it has reviewed the control room inventory submittal provided by GE and has found it to be satisfactory.

I&C Diversity Study Results

Enclosure 19 was presented to the participants as examples of the results of the study which was prepared by LLNL staff to evaluate the effects of postulated common mode failures on the ABWR I&C design. The staff discussed the method that was used to prepare the evaluation and also discussed the features of the ABWR design which would reduce or eliminate potential common mode failure vulnerabilities. The staff discussed the conclusion that common mode failure due to a software error is a credible event which must have design features, such as diversity, to defend against.

The staff concluded that, for the two events and postulated common mode failures examined, that there is equipment and information available to mitigate the event given the postulated common mode failure. The staff expressed three primary concerns about the ABWR I&C design. In some cases, the information available to the operator is significantly reduced and it may be difficult for the operator to select the remaining valid information. The second concern is that GE has not demonstrated that there is sufficient time and information available to the operator for those events and failures which require manual action. The last concern is that all of the operator actions should be able to be taken in the main control room rather than at the remote shutdown station.

The staff and GE discussed the impact of these concerns on the ABWR design and some possible solutions. One option discussed would be to include in the control room a second remote shutdown panel with hardwired controls to provide an improved level of diversity. GE indicated this would require significant design changes and considerable effort, and indicated that it disagreed with the staff's conclusions on diversity and the need for the mentioned changes. The staff stated that this was a clear policy issue and was preparing a SECY paper to be provided to the Commission. The staff provided a draft copy of the issues to be included in the Commission paper (Enclosure 20) and requested that GE provide input to the staff to identify the implications of the required design changes as soon as possible. In addition, GE was requested to review the LLNL report for proprietary information and for inaccuracies.

I&C DAC/ITAAC Status

The staff discussed the limited progress that has been made on the completion of the I&C DAC. Enclosure 21 depicts the various areas where the DAC inputs are being developed for the I&C design. The instrument set point, EMI, SSLC, and non-safety systems needing ITAAC are yet to be completed. The staff voiced a concern that it may be difficult for GE to meet the May date for completion of these items and may leave some significant open items in the staff FSER.

Piping Stress Analysis Audit Preliminary Findings

An NRC staff audit of the ABWR piping design methods was being conducted during the same week of the management meeting. The purpose of the audit was to evaluate the design criteria, analysis methods, and sample piping calculations to establish whether adequate and sufficient information is available for the staff to reach a safety conclusion about the piping design.

The staff presented preliminary findings of the audit as of the fourth day of the effort. Concerning the stress analyses that were reviewed, it was indicated that GE had not included the overall ABWR design criteria in one document and this needs to be addressed. In addition, some of the specific criteria used in the problems were not consistent with current staff-approved criteria. The actual sample calculations which were reviewed appeared to be technically adequate, however, it was noted that the seismic input loadings to the piping appear to be overly conservative (excessively high). This could

result in the use of a large number of seismic restraints in the final design which could impair the flexibility and reliability of the piping.

The staff also reviewed the piping ITAAC/DAC being prepared by GE. The major concern is that additional information needs to be added to the DAC to broaden its scope and adequacy. Specifically, GE needs to add functional capability information, inelastic strain methods and limits, seismic deflection limits, and additional modelling techniques which might be used by the COL applicant to confirm the adequacy of future codes. GE indicated that most of the changes in the ITAAC could be made by the following week.

A discussion was held concerning the need for the staff to make copies of selected design record files and internal design procedures to bring back to Rockville for subsequent review. GE agreed to make available the majority of the information and would discuss further any exceptions with the staff during the audit.

Plant Systems Open Item Status

The staff met with GE in a separate meeting to discuss open items identified in DSER Chapters 3, 6, and 9. (This was not a specified item in the agenda). Discussion topics included equipment qualification, flood protection, the effects of high energy line breaks, subcompartment pressurization, the standby gas treatment system, spent fuel cooling, HVAC, service water, and makeup water. Progress was made towards closure of the open issues in these areas. A followup meeting is expected to be held in Rockville in early May.

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Enclosure 1

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Dennis Crutchfield	NRC/NRR
Thomas Murley	NRC/NRR
William Russell	NRC/NRR
Robert Pierson	NRC/NRR
Chet Poslusny	NRC/NRR
Gary Holahan	NRC/NRR
Frank Congel	NRC/NRR
Jim Richardson	NRC/NRR
David Terao	NRC/NRR
James Lyons	NRC/NRR
Gary Ehlert	GE
W. E. Maxwell	GE
A. E. Roger	GE

List of Attendees

March 26, 1992

NAME	AFFILLIATION
Ram Srinivasan	EPRI/S. Levy
Jack Fox	GE
Joe Quirk	GE
Pat Marriott	CE
Jack Duncan	GE
Adrian Heymer	NUMARC
Kashmiray Mali	DOE
Norman Fletcher	DOE
Calvin Tang	GE
John Chambers	GE
Carol E. Buchholz	GE
Tom Boyce	NRC/NRR
Rebecca L. Nease	NRC/NRR
Dennis Lawrence	LLNL
Robert Wyman	LLNL
George Thomas	NRC/NRR
Greg Suski	LLNL
James E. Lyons	NRC/NRR
David Terao	NRC/NRR
Scott Newberry	NRC/NRR
James Stewart	NRC/NRR
Goutam Bagchi	NRC/NRR
Glenn Kelly	NRC/NRR
Jack Roe	NRC/NRR
Gary Holahan	NRC/NRR
Chet Poslusny	NRC/NRR
Robert Pierson	NRC/NRR
William Russell	NRC/NRR
Thomas Murley	NRC/NRR
Dennis Crutchfield	NRC/NRR
Shou-nien Hou	NRC/NRR
Terence L. Chan	NRC/NRR
John McIntyre	NRC/NRR
W. P. Chen	ETEC
Joseph Braverman	BNL
E. D. Swain	Consultant/GE
John Knepp	GE
A. J. James	GE

Enclosure 2

AGENDA FOR MARCH ABWR OPEN ISSUES MEETING
GE Office San Jose, California
Building J Room 150

March 25

Morning Session Beginning 0800

PROGRAMMATIC ITEMS

Introduction (Staff and GE)

Progress in Closure of DSER Open Issues (Staff)

Status of GE Outstanding Submittals (GE)

OPEN ISSUE DISCUSSIONS

Status of PRA Open Items (GE, Staff)

Systems Interaction Concerns (GE, Staff)
- Piping Layout
- Cable Tray, Conduit Routing
- HVAC Design

Shutdown Risk Resolution Status (GE)

ISI Status (GE, Staff)

Containment Response-ASME Level C Limits
(Breakoff Session/Conference Call 10:00 am)

SGTS Single Filter (GE, Staff)

Working Lunch

Afternoon Session

Source Term for ABWR and Credit for Pool Scrubbing
(GE, Staff)

Plant Shielding and Ventilation DACs (GE, Staff)

Upper Drywell Shielding Design (Staff, GE)

Lower Drywell Access Concerns (Staff, GE)

Referencing of Codes and Standards (GE)

March 25 continued

Results of February 27 Meeting on ITAAC and Interfaces
- Agreement on Number of ITAAC (GE)
- Categorization of Interface Summary (Staff)
- New Open Issues (Staff,GE)

Interfaces (GE)
- Plans for Conceptual Designs
- Verification of Reliability and Availability Targets Used in the ABWR PRA

System ITAAC-Phase 2 Submittal Discussions -New ITAAC (GE, Staff)

March 26

Morning Session Beginning 0800

HFE Issue Status (Staff, GE)
- Chapter 18 Revision
- DAC
- Feedback on Control Room Inventory

I&C Diversity Study Results (Staff)

Working Lunch

Afternoon Session Ending 1500

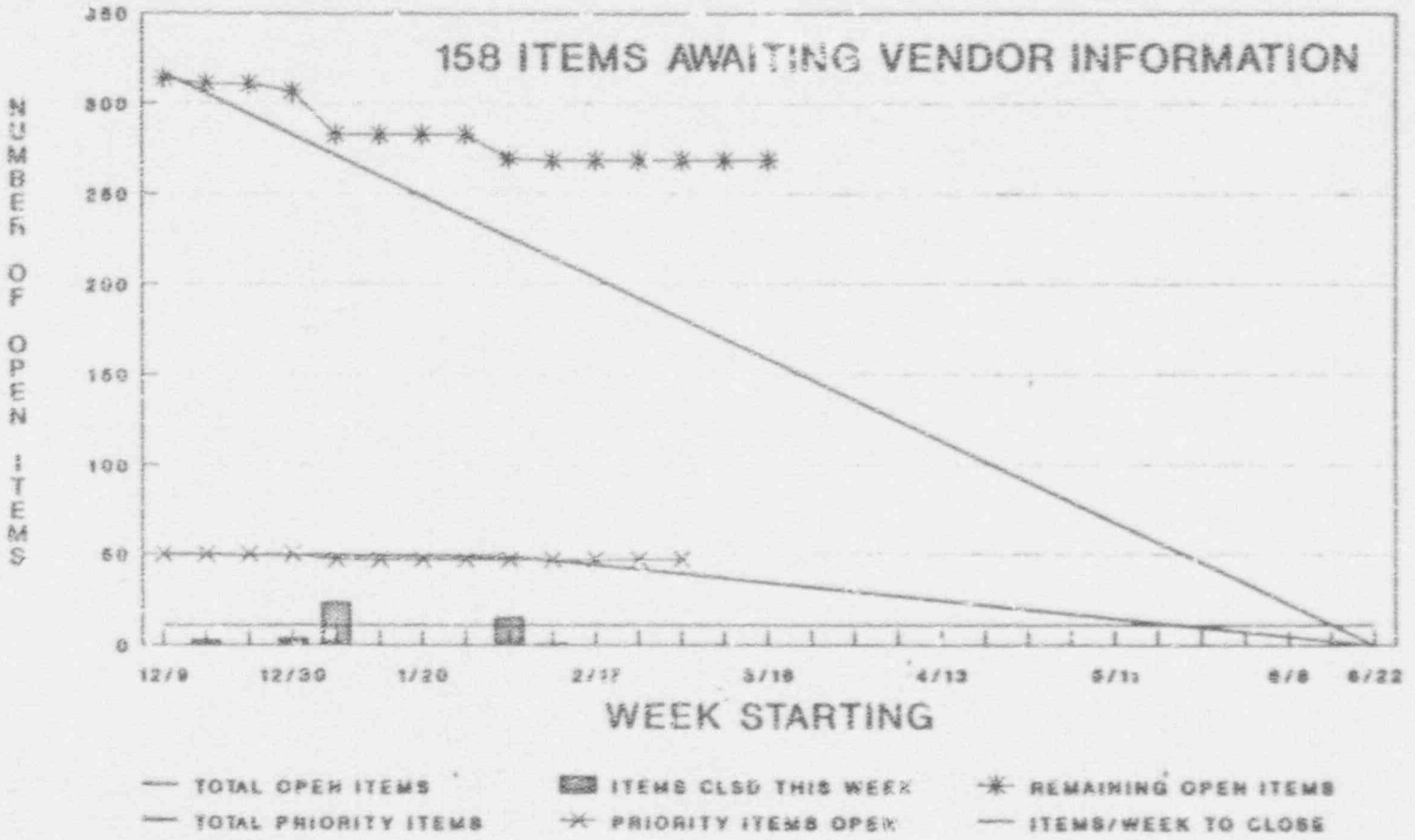
I&C DAC/ITAAC Status (GE, Staff)

Piping Stress Analysis Audit Preliminary Findings (Staff)

Concluding Remarks

ADT OPEN ITEM STATUS

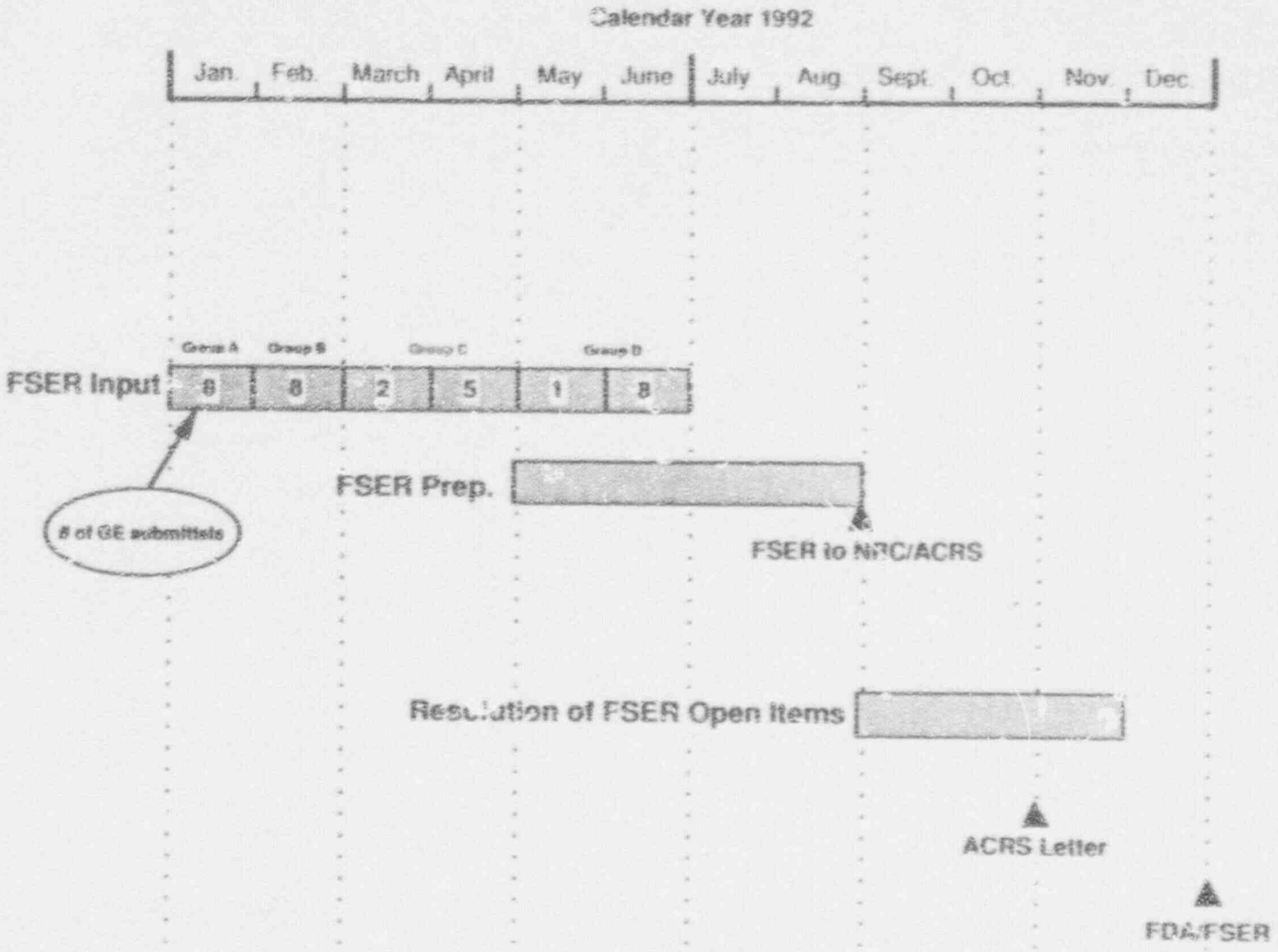
ABWR FSER (06/25/92)



DATA AS OF 03/18/92

Enclosure 3

ABWR FDA Schedule



Enclosure 4

JCB 3/23/92
Rev. 3

GE FSER Support

	Scheduled	Actual
Group A		
Inservice Inspection	06-Jan-92	06-Jan-92
ITAAC Phase 1 - Pilot Re-submittal	17-Jan-92	17-Jan-92
Main Steamline Seismic Classification	22-Jan-92	27-Jan-92
Chapter 15 LOCA Reanalysis	31-Jan-92	01-Feb-92
Leak Before Break	31-Jan-92	03-Feb-92
Piping and Instrumentation Diagram	31-Jan-92	03-Feb-92
Process Flow Diagram Update	31-Jan-92	03-Feb-92
Evaluation of Potential Modifications SAMDA	31-Jan-92	25-Feb-92
Group B		
Response to SECY-91-294 (Chapter 7)	04-Feb-92	03-Feb-92
Fixed Display Information	14-Feb-92	13-Feb-92
Control Room/I&C Design and Implementation Process	16-Feb-92	17-Feb-92
ABWR Design Differences	20-Feb-92	20-Feb-92
Radwaste Building Seismic Analysis	20-Feb-92	03-Mar-92
Response to SECY-91-320 (Chapter 18)	28-Feb-92	18-Feb-92
Level of Detail Piping System (FW)	28-Feb-92	24-Feb-92
Level of Detail Piping System (MSL)	28-Feb-92	12-Mar-92
Group C		
Response to SECY-91-353 (Ch1,2,3,5,6,8,9,10,12,13,14 & 15)	05-Mar-92	11-Mar-92
ITAAC - Phase 2	31-Mar-92	
Fire PRA Update	* 01-Apr-92	
Technical Specifications for ABWR Unique I&C Systems	** 10-Apr-92	
Uncertainty Analysis, Back End	*15-Apr-92	
Bypass Leakage	**15-Apr-92	
Intersystem LOCA	*** 30-Apr-92	
Group D		
ITAAC - Phase 3 (ITAAC Completed)	31-May-92	
Uncertainty Analysis, Front End	*30-Jun-92	
Shutdown Risk	*30-Jun-92	
PRA as a Design Tool	*30-Jun-92	
Human Factors Analysis	*30-Jun-92	
Response to SECY-91-309 (Chapter 19)	*30-Jun-92	
Flood PRA	*30-Jun-92	
Emergency Planning	*30-Jun-92	
Reassessment of Proprietary Information	***30-Jun-92	
Final SSAR	30-Nov-92	

* Scheduled dates established since GE/NRC January 28-29, 1992 meeting

** Re-scheduled

*** New Item

Rev. 2

3/23/92

PRA Requantification

- Current PRA reflects earlier design
- Staff corrections
- PRA verification

Current status

- Requantification in progress
- Agreed on all staff corrections (~15 open items resolved, eg:
  - Trip frequency: NRC Agreed with GE number of 1/year
  - IORV frequency: GE agreed to staff number of 0.1/year
  - ISLOCA resolved based on design change
- Agreed on interface /COL items (~4 open items resolved, eg:
  - Confirm estimated loss of AC power frequency, addressing site specific parameters

Clear path to resolution

Next actions

4/15	Level I summary results to NRC
6/30	SSAR draft to NRC

Enclosure 5

CEB-3/25/92-1

Human Reliability Analysis

Issue:

- Inadequate documentation of HRA data and references
- Uncertainty / sensitivity analysis
- Interface items

Current status / Action Path

- Agreement reached on level of HRA documentation to be provided
- GE is performing Level 1 uncertainty analysis supplemented by Level 1 sensitivity and importance analysis
- GE will identify and characterize key human errors as input to control room DAC/ITAAC and integration into "PRA Design Insights"

Next Action

- GE to submit above items as part of SSAR by June 30 (draft sooner if possible)

Seismic

Issue

- *Treatment of seismic analysis beyond design basis*

Current Status

- *GE understands no PRA required*
- *Requantification: several issues agreed to*
  - *Agreed to fuel assembly capacity*
  - *GE will reduce other capacities*

Clear Resolution Path

- *GE will recalculate HCLPFs, but*
- *Awaiting NRC clarification of submittal requirements*

Next Actions:

- *NRC to provide guidance on calculating HCLPFs*
- *NRC to provide clarification of requirements*

Internal Flooding

- General Issue
  - Evaluate internal floods to identify potential design vulnerabilities
- Current Status
  - GE outlined general approach and discussed early insights
  - GE identified some proposed design modifications
- Path to Resolution
  - General approach appears acceptable
- Next Actions
  - GE to continue flooding evaluation
  - GE/Staff to continue to discuss methodology and insights
  - GE to submit final analysis by June 30
    - Parts of analysis will be available sooner

Backend Issues

- Major issues are being addressed within uncertainty analysis and severe accident closure
- Current status
  - Screening analysis complete
  - Most of sensitivity studies complete
    - Bypass sensitivity studies done but decision as to continued study in uncertainty analysis not yet made
    - No other detailed uncertainty analyses identified
  - GE has responded to accident management issues, response found generally acceptable
- Next actions
  - Phone call Friday on severe accident closure document
  - GE to submit completed screening and sensitivity analysis within week
  - Detailed DCH analysis to be submitted by end of month
  - Considerations for rupture disk design to be submitted shortly

WORK STATUS

APPENDIX 19.Q: ABWR SHUTDOWN RISK EVALUATION

19.Q.1 Introduction *

19.Q.2 Evaluation Scope *

19.Q.3 Summary of Results *

19.Q.4 Decay Heat Removal **

19.Q.5 Inventory Control **

19.Q.6 Containment Integrity *

19.Q.7 Electrical Power **

19.Q.8 Reactivity Control **

19.Q.9 Instrumentation *

19.Q.10 Flooding and Fire Protection **

19.Q.11 Features to Reduce Shutdown Risk ****

19.Q.12 Decay Heat Removal Reliability ***

19.Q.13 Use of Freeze Seals **

19.Q.14 Risk Impact of New Features *

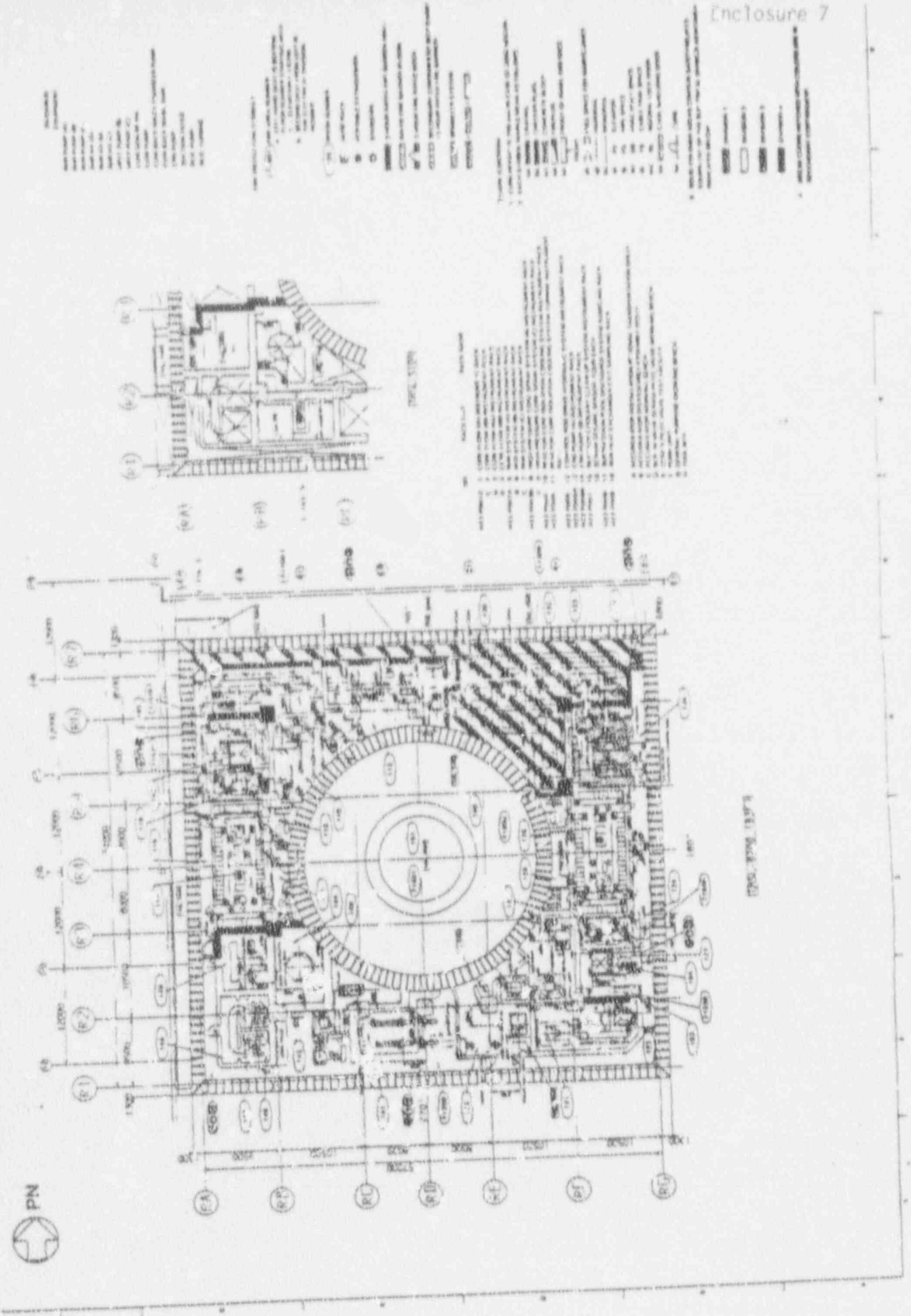
19.Q.15 Procedures *

19.D.16 Review of Significant Shutdown events ***

Attachment 19.Q.1 Decay Heat Removal Reliability Study

Attachment 19.Q.2 Review of Significant Shutdown Events

STATUS
* Work not started
** Work just started
*** Work in progress
**** Work nearly complete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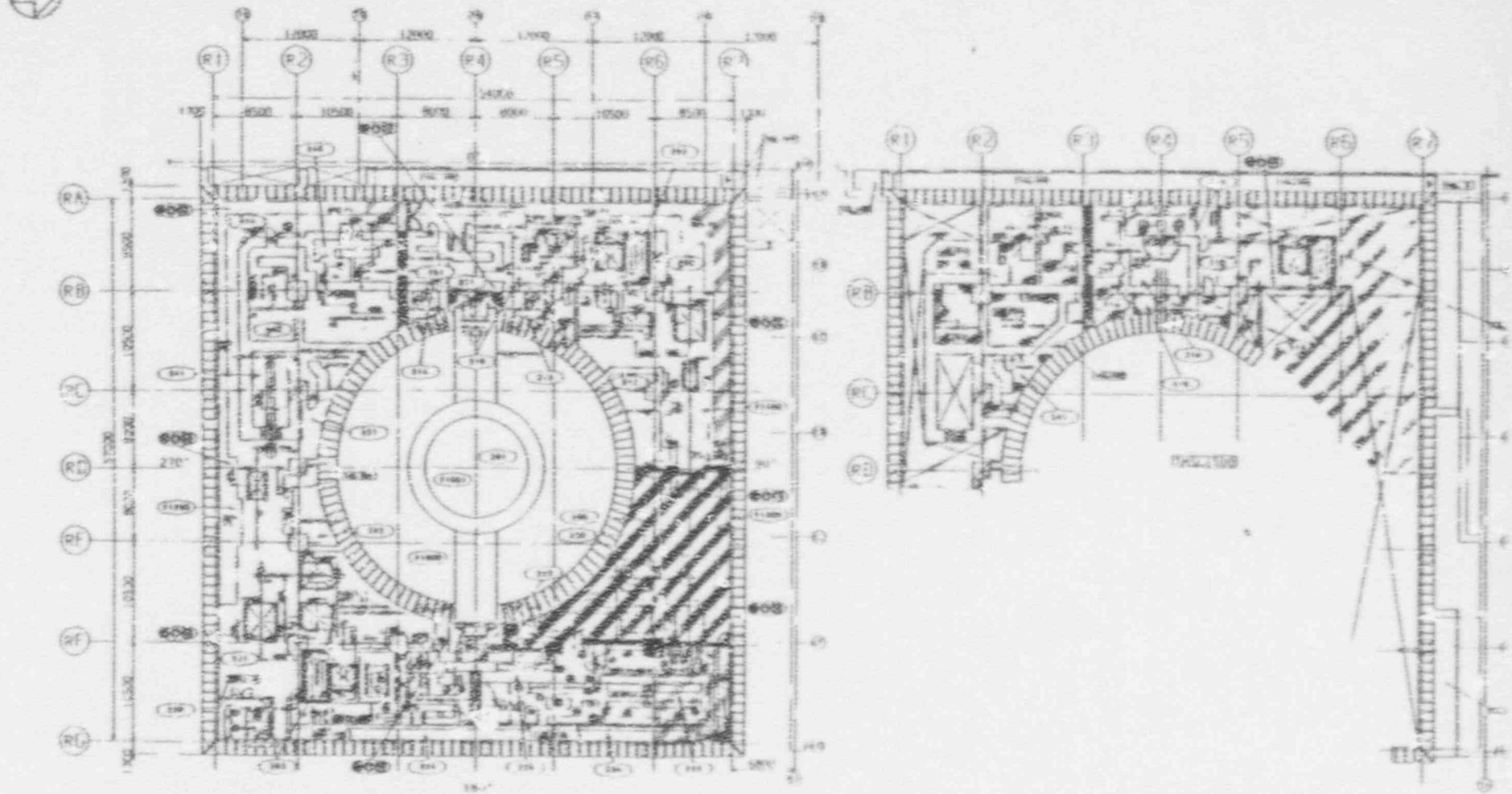
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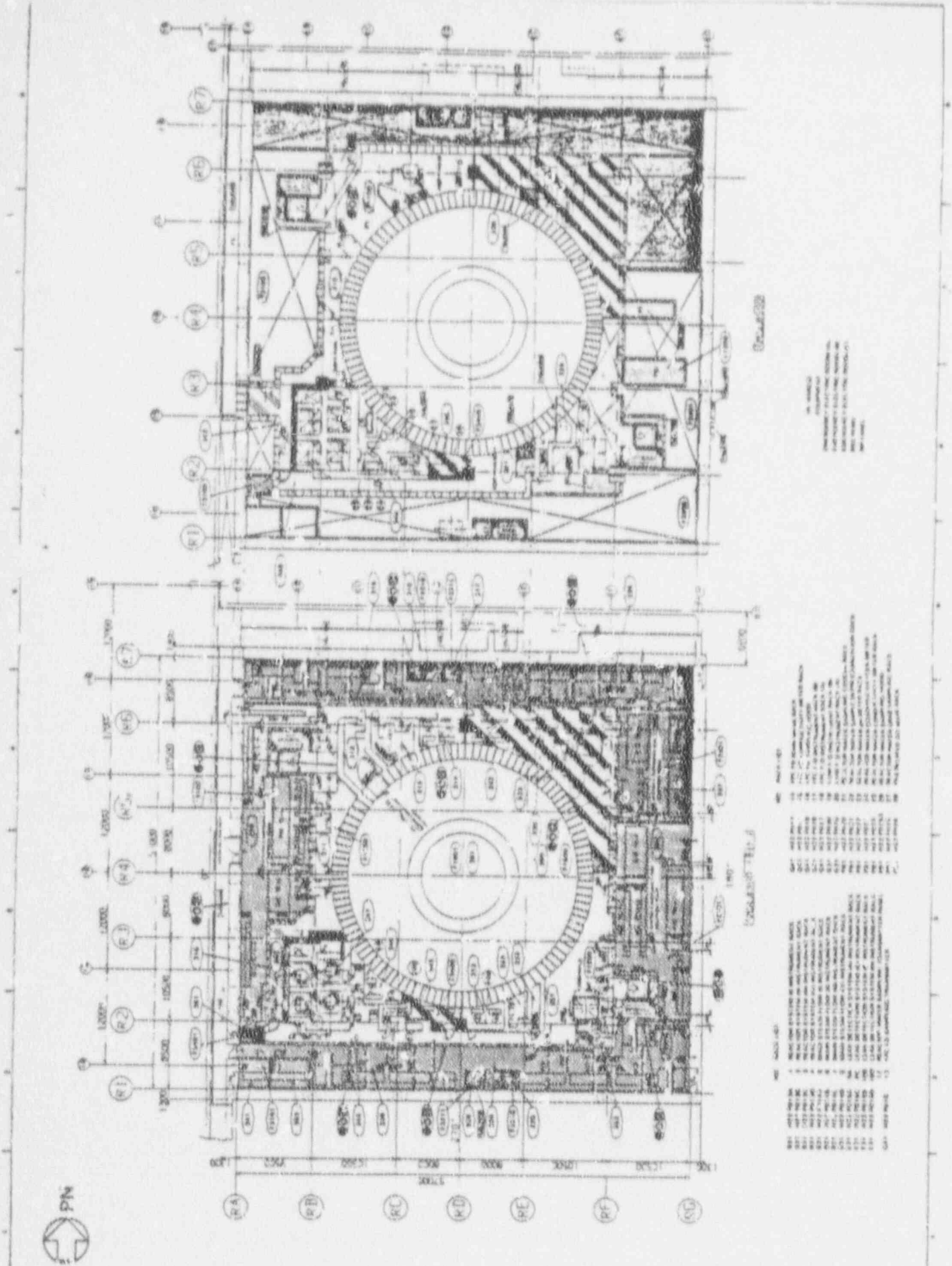

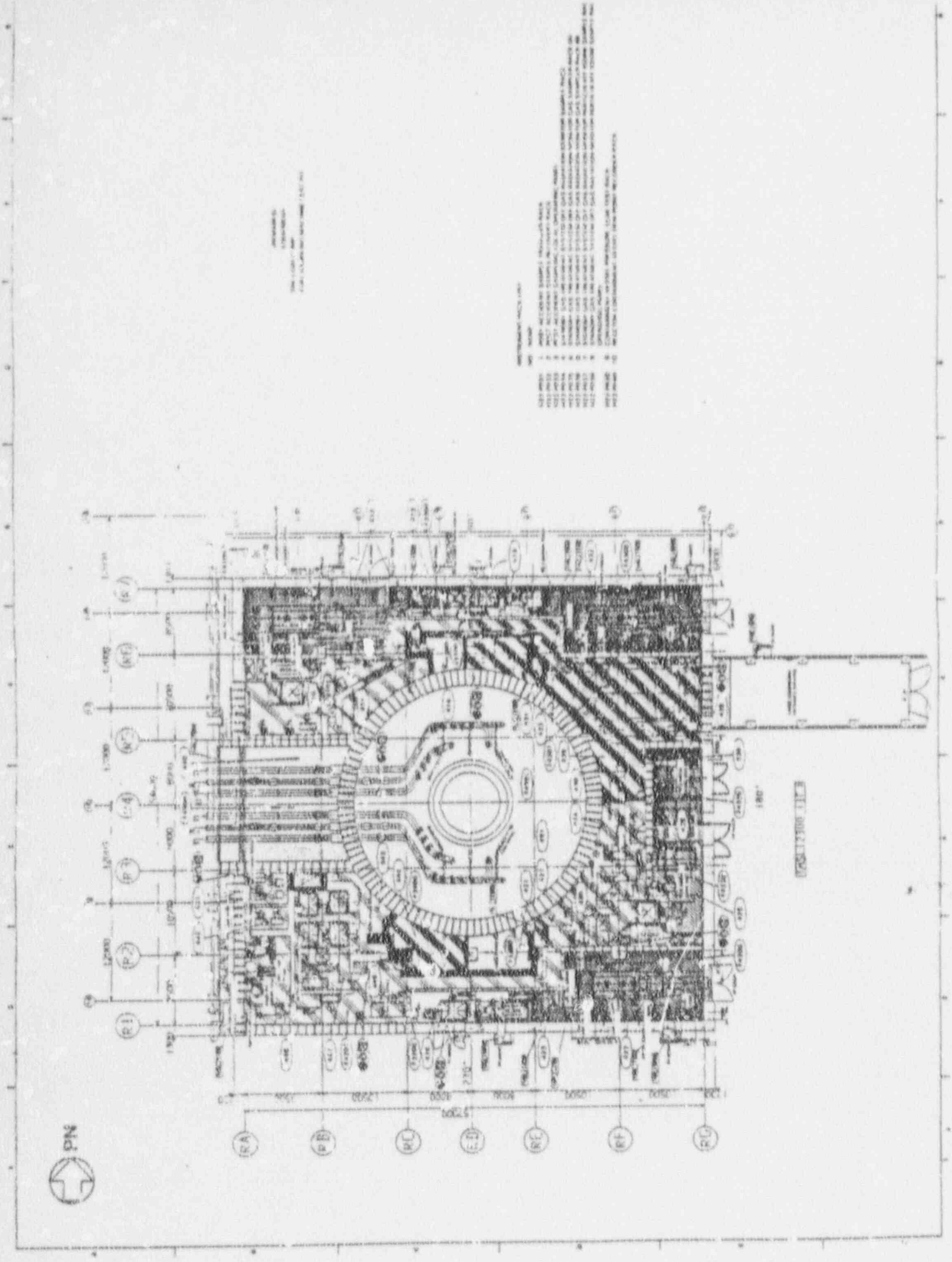

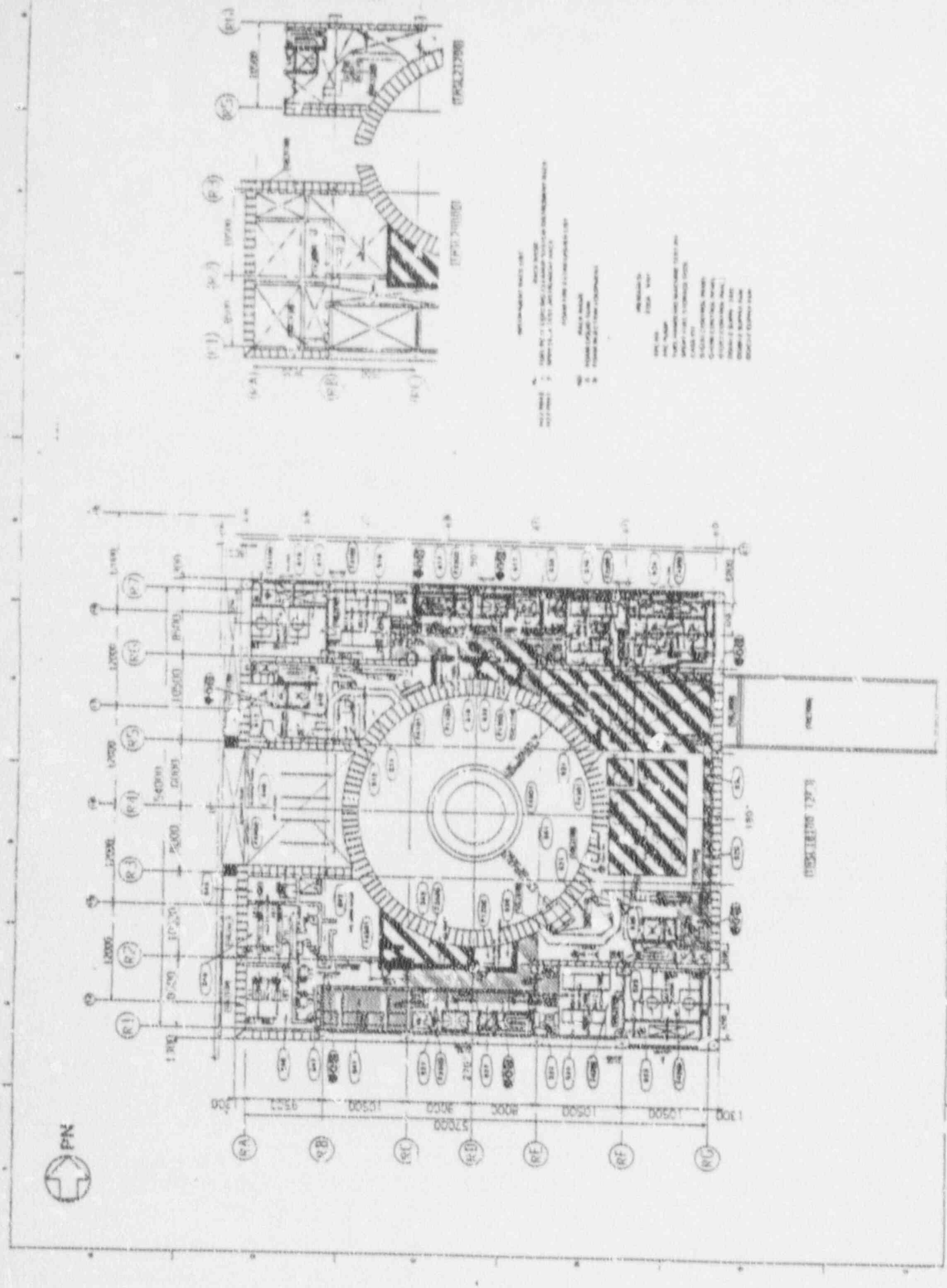

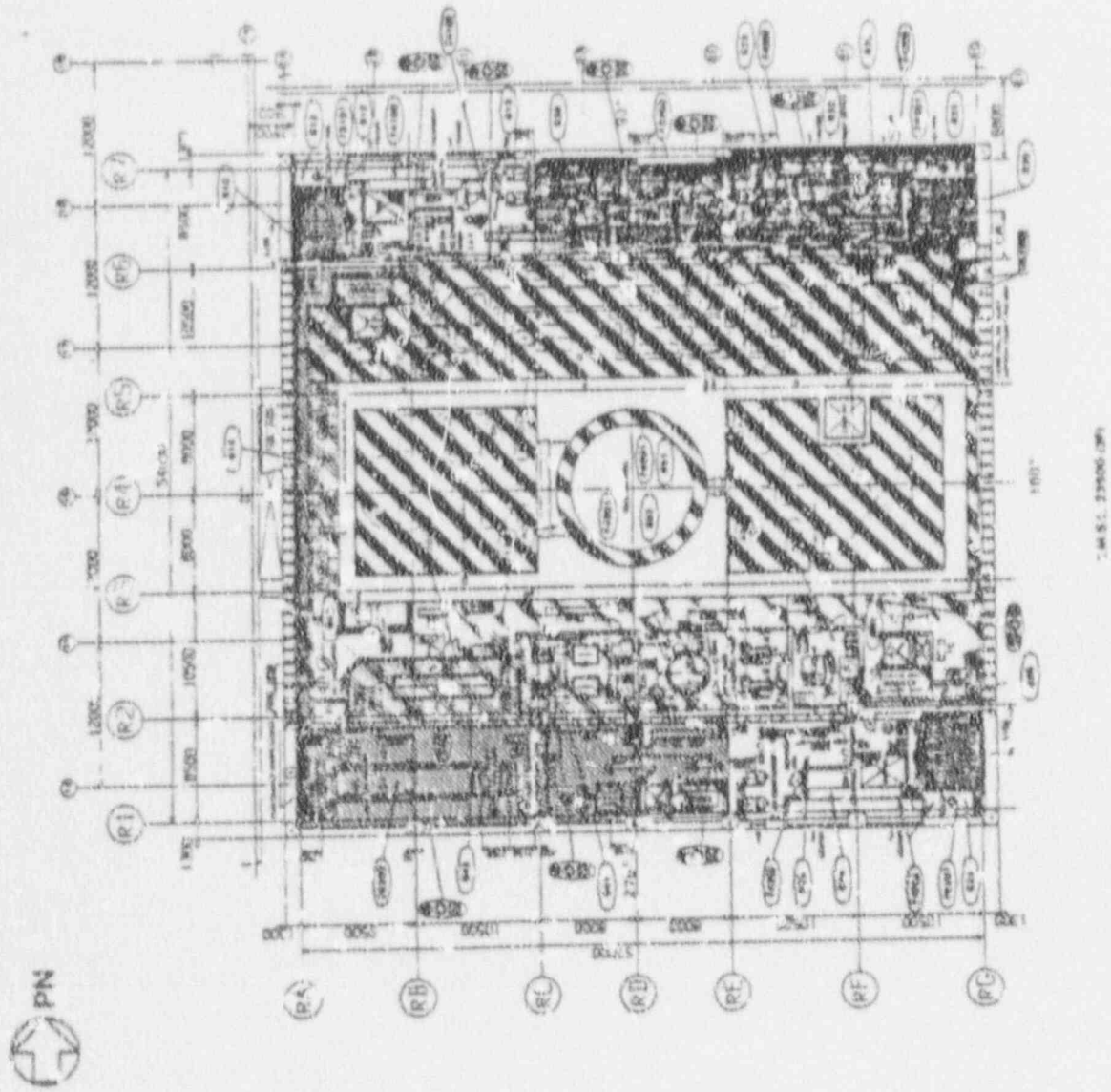

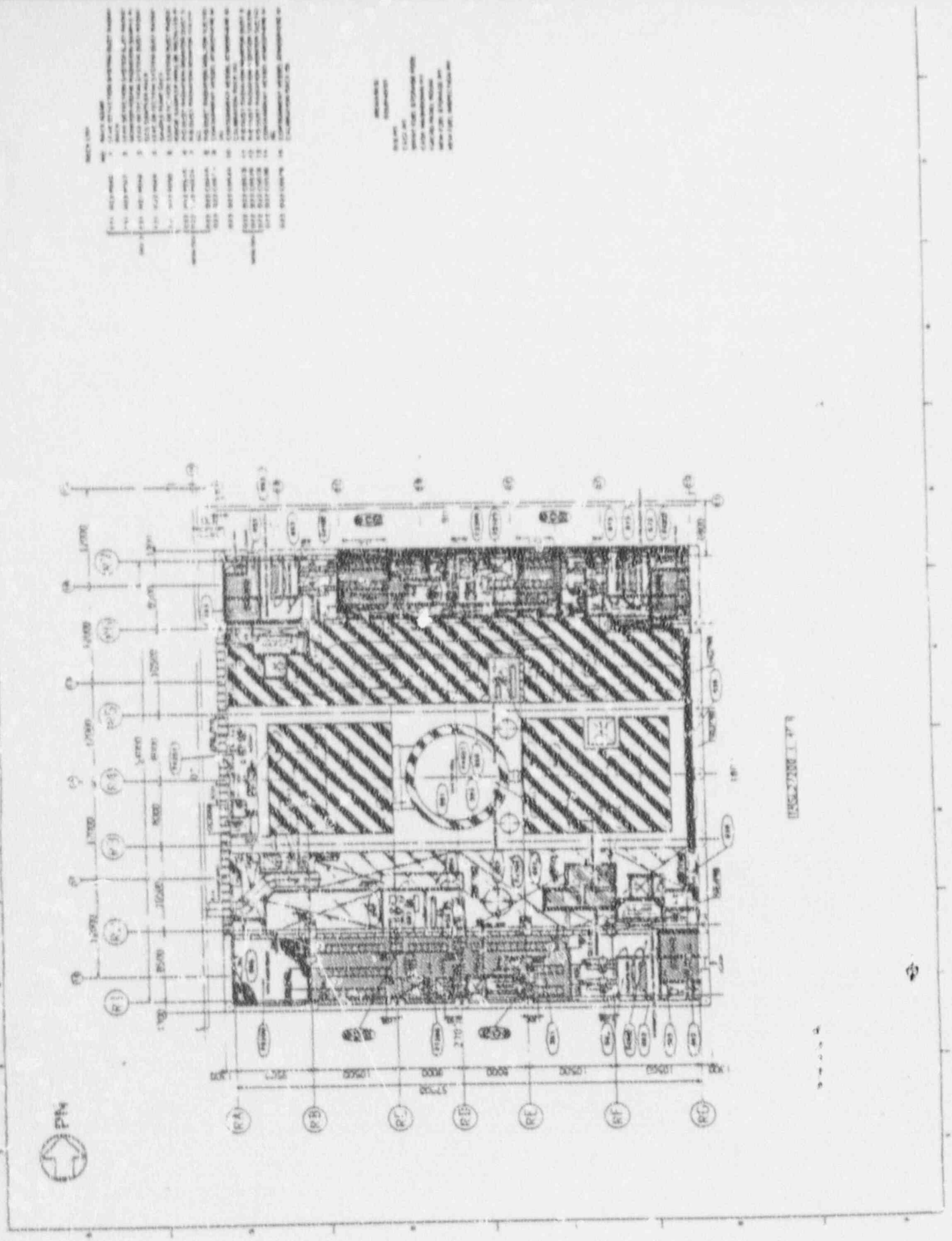

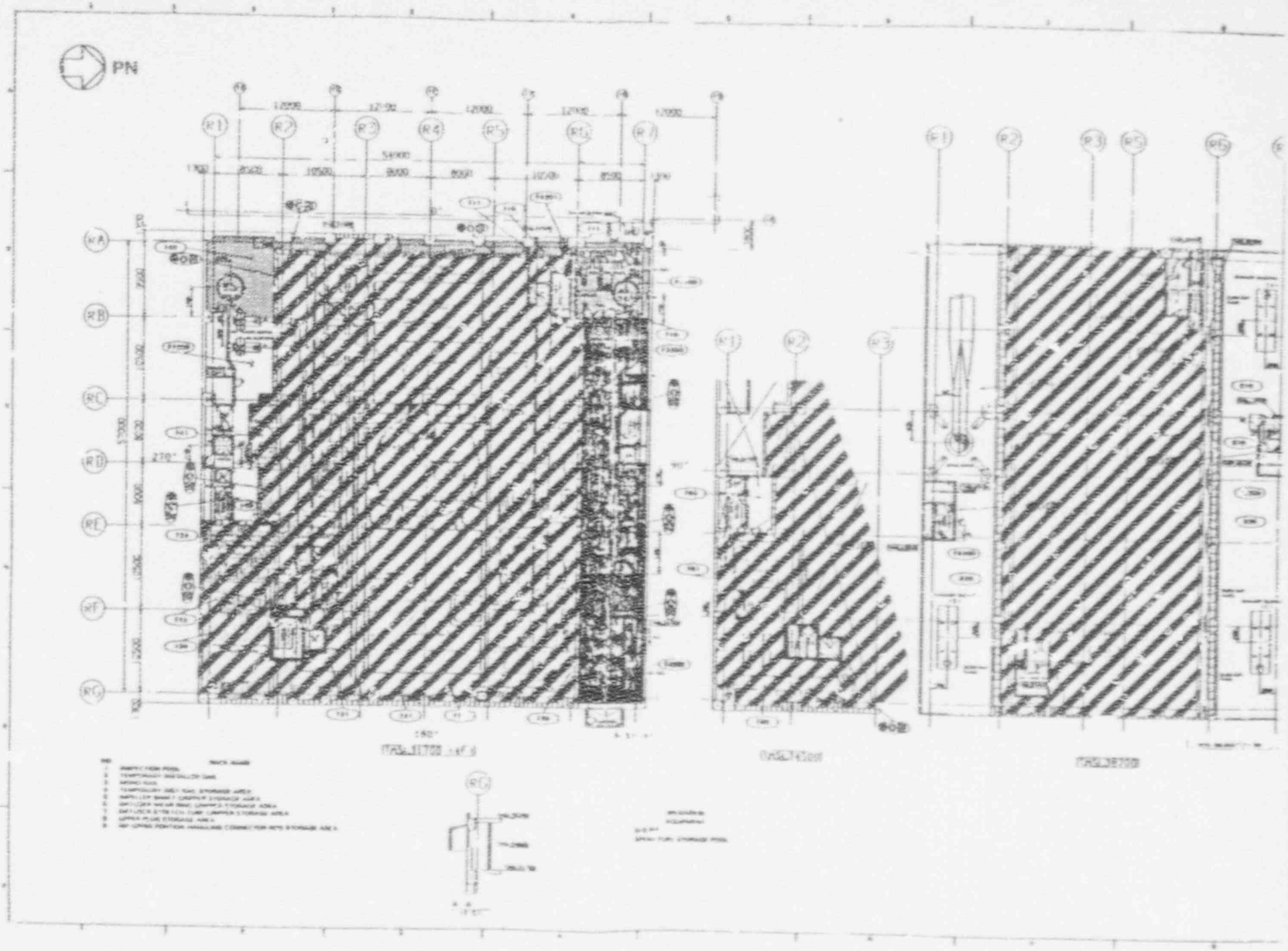
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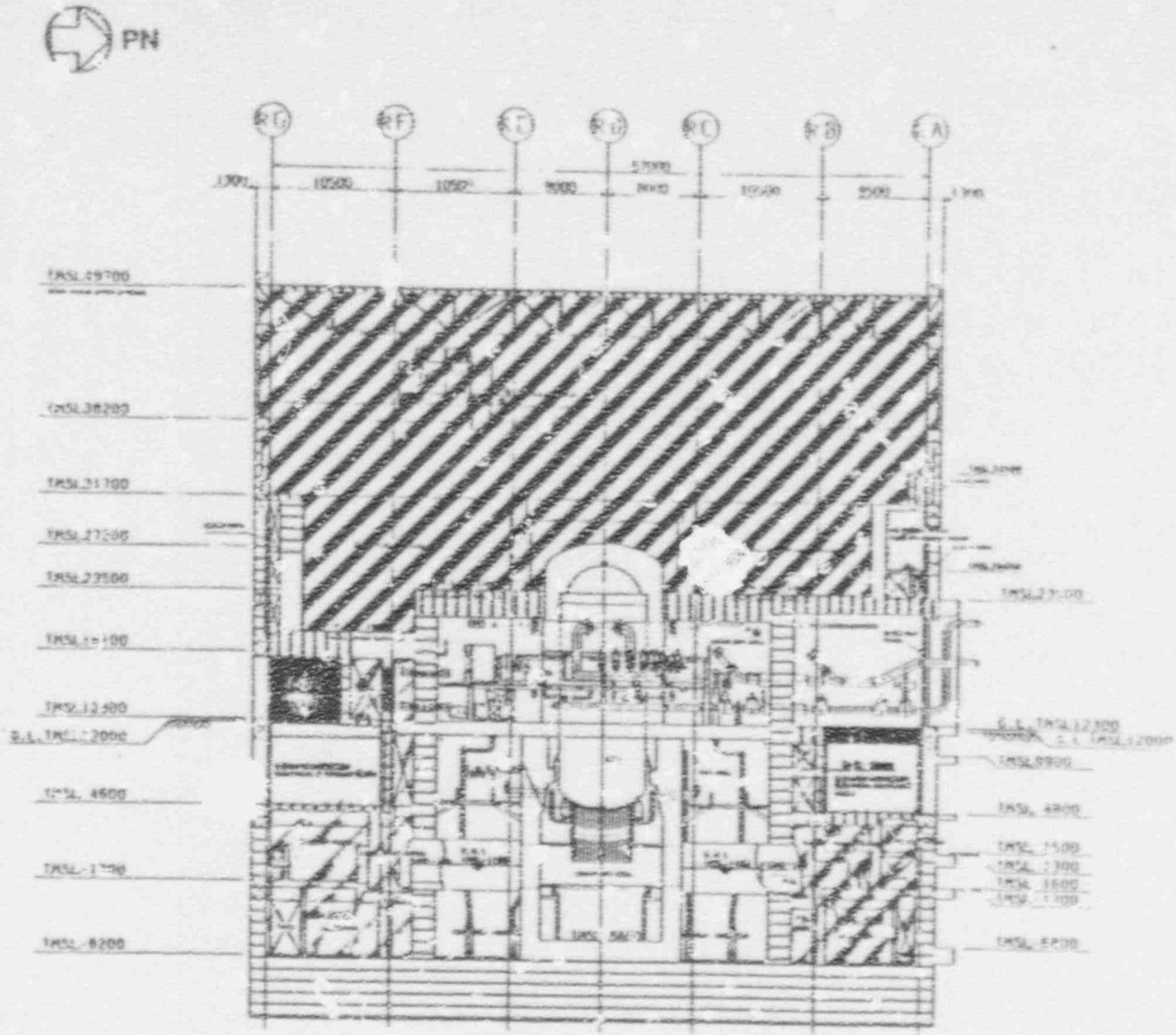
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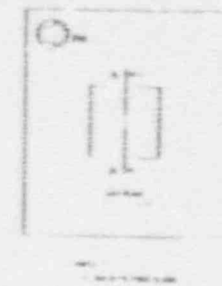
A-A SECTION



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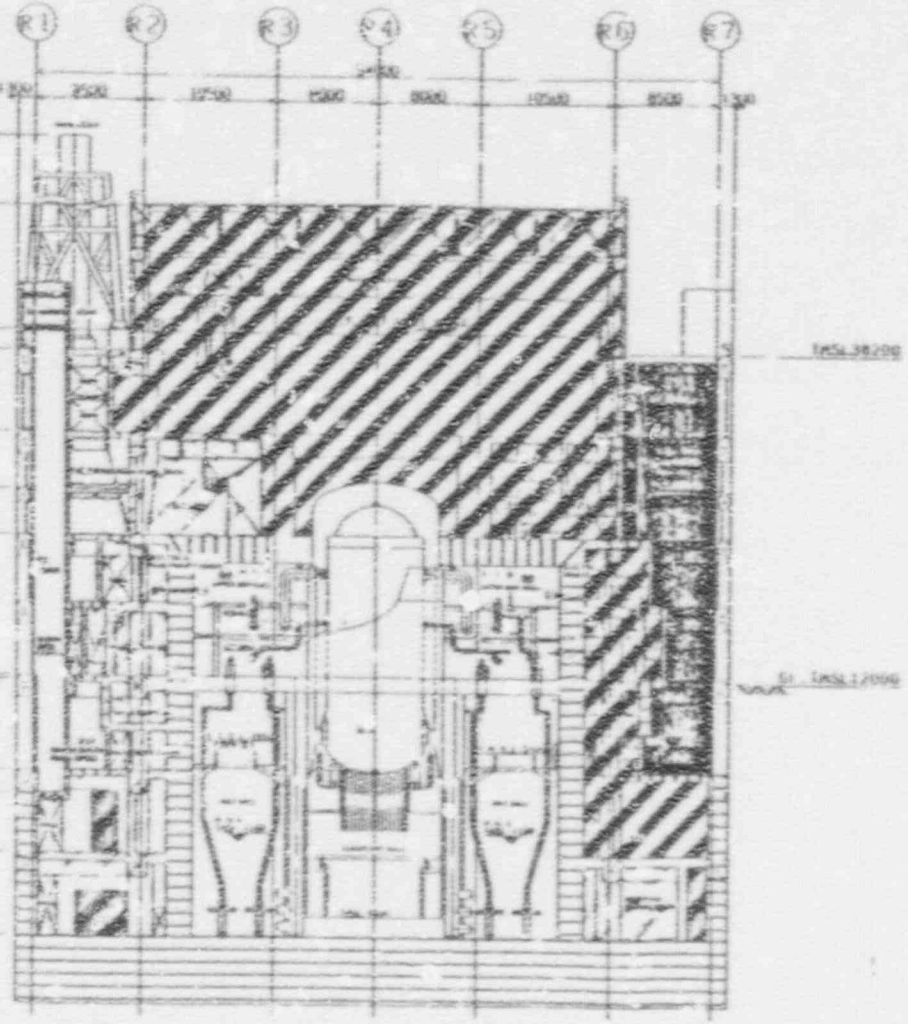
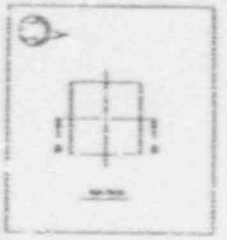




REACTOR BUILDING FLOODING

HIGH ENERGY SYSTEMS

PRESENTED BY
G.W. EHLERT

ON
OCTOBER 23, 1991

REACTOR BUILDING FLOODING

HIGH ENERGY SYSTEMS

- RCIC STEAM SUPPLY LINE
  - CONCRETE PIPE CHASE
  - RCIC EQUIPMENT ROOM AT -8200 TMSL
- CUW SUPPLY AND DISCHARGE LINES
  - CONCRETE PIPE CHASE
  - CUW REGENERATIVE HEAT EXCHANGER ROOM AT -1.7 TMSL AND CUW NONREGENERATIVE HEAT EXCHANGER ROOM AT -8.2 TMSL
- MAINSTEAM
  - MAINSTEAM TUNNEL
- FEEDWATER
  - MAINSTEAM TUNNEL

REACTOR BUILDING FLOODING

RCIC AND CUW LINE BREAKS

- RCIC SUPPLY LINE (150A)
- CUW SUPPLY AND DISCHARGE LINES (200A)
- BREAK CAN OCCUR IN CONCRETE PIPE CHASES OR EQUIPMENT ROOMS
- SUBCOMPARTMENT PRESSURIZATION ANALYSIS
  - 5 PSI DIFFERENTIAL PRESSURE IN PIPE CHASE AND EQUIPMENT ROOM OF BREAK
  - BLOWOUT PANEL INTO MAINSTEAM TUNNEL FOR PRESSURE RELIEF
  - LIMITED PRESSURIZATION OF SECONDARY CONTAINMENT
  - SAFETY-RELATED EQUIPMENT AND SECONDARY CONTAINMENT PENETRATIONS TO BE QUALIFIED FOR ENVIRONMENTAL EFFECTS OF PIPE RUPTURE

REACTOR BUILDING FLOODING

MAINSTEAM FEEDWATER LINE BREAKS

- SUBCOMPARTMENT PRESSURIZATION ANALYSIS
- MAINSTEAM LINE BREAK (700A)
  - 12 PSI DIFFERENTIAL PRESSURE
  - SHORT DURATION PULSE
- FEEDWATER LINE BREAK (550A)
  - 4 PSI DIFFERENTIAL PRESSURE
  - SHORT DURATION PULSE
- TUNNEL GREATER THAN 1.5M TO 2M THICK
  - FACTORED LOAD COMBINATION INCLUDES THE ABSOLUTE SUM OF SUBCOMPARTMENT PRESSURE, SSE AND OTHER NORMAL LOADS WITH APPROPIATE LOAD MULTIPLIERS.
  - CONDENSATION DRAIN INTO REACTOR BUILDING AND TURBINE BUILDING AREAS OF STEAM TUNNEL

SYSTEMS INTERACTION

FLOODING
PIPE BREAKS OUTSIDE CONTAINMENT
FIRES

DIVISIONAL SEPARATION PROVIDES PROTECTION

FLOODING

DESIGN BASIS DOES NOT TAKE CREDIT FOR FLOOD BARRIERS BETWEEN ROOMS. HOWEVER, WALLS WILL WITHSTAND HYDROSTATIC LOADS.

ROOMS EVALUATED FOR WORST CASE BREAK ASSUMING DETECTION AND ISOLATION.

CORRIDOR PROVIDES HOLDING VOLUME. WATERTIGHT DOORS PROTECT ECCS EQUIPMENT FROM WATER IN CORRIDOR.

GE WILL PROVIDE:

- DRAWINGS SHOWING FLOOD BOUNDARIES
- DESCRIPTION OF PENETRATIONS (CURBS/SLEEVES)
- DESCRIPTION OF WATER TIGHT DOOR DESIGN

PIPE BREAKS OUTSIDE CONTAINMENT

COMPARTMENT PRESSURIZATION EVALUATION IN CHAPTER 6
- ASSUMES DOUBLE ENDED BREAK
- PIPE DIAMETERS FROM P&IDs
- BREAK LOCATIONS FROM GENERAL LAYOUT OF SYSTEMS/COMPONENTS

JET IMPINGEMENT AND PIPE WHIP METHOD WILL BE REVIEWED BY THE NRC DURING THE PIPING AUDIT.

NRC WILL REVIEW INFORMATION TO BE PROVIDED BY GE BY THE END OF THIS MONTH.

EFFECTS OF FIRE

HVAC SYSTEM DESIGNED TO MAINTAIN FIRE AREA AT SLIGHTLY LOWER PRESSURE THAN SURROUNDING AREAS BY USE OF FIRE DAMPERS.

HVAC ITAAC SHOULD ADDRESS SMOKE REMOVAL MODE OF OPERATION.

FIRE PROTECTION FEATURES TO BE ADDRESSED IN BUILDING ITAAC.

GE WILL PROVIDE SYSTEMS INTERACTION ROAD MAP UNDER USI A-17 BY END OF APRIL.

Enclosure 10

ABWR/SSAR INSERVICE INSPECTION PROGRAM REVISIONS 2/25/92

RESPONSIVE CHANGES WERE MADE TO ADDRESS CONCERNS EXPRESSED THROUGH THE 12/10/91 MEETING.

ABWR/DSER CONTAINED MANY NEW ITEMS. SEVERAL OF THESE ITEMS REPRESENT A MAJOR CHANGE IN DIRECTION. IN CONFERENCE WITH MARTIN HUM AND OTHERS REGARDING THE DSER THE FOLLOWING CHANGES WERE RECOMMENDED TO RESOLVE DSER COMMENTS:

1. DELETE ALL RELIEF REQUESTS FOR ACCESS LIMITATIONS. ABWR/SSAR MUST COMMIT UNCONDITIONALLY TO DESIGN FOR ACCESS FOR EXAMINATION. NRC RECOMMENDS PURSUING ASME CODE CASES FOR NOZZLE LIMITATIONS.

2. DELETE REFERENCES TO SPECIFIC CODE EDITIONS. THIS IS AN INTERFACE ITEM FOR UTILITIES.

3. SSAR'S ISI PROGRAM PLAN SHOULD BE ONLY AN "EXAMPLE." THE NRC WILL NOT REVIEW THE SSAR ISI PLAN, WHICH IS BASED ON ASME 1989 EDITION. APPLICANTS MUST SUBMIT THEIR OWN PLAN IN ACCORDANCE WITH 10CFR50 SECTION 50.55a.

4. INCLUDE EROSION-CORROSION UNDER AUGMENTED EXAMINATIONS. EROSION-CORROSION MUST BE ADDRESSED IN ANTICIPATION OF FUTURE CODE ACTIONS AND IN RESPONSE TO BULLETIN 87-01.

STATUS OF SOURCE TERM AND ABWR SUPPRESSION POOL CREDIT

NEW SOURCE TERM WILL NOT BE UTILIZED

- DOES NOT SOLVE PROBLEM OF SUPPRESSION POOL SCRUBBING
- TOO MANY TECHNICAL ISSUES TO RESOLVE ON TREATMENT OF FISSION PRODUCTS IN CONTAINMENT AND REACTOR BUILDING.

CURRENT PLAN

- REVISE LOCA CALCULATION WITH OUT POOL SCRUBBING
- ADDRESS SITING ISSUE LATER ON A CASE BY CASE BASIS
- LOOKING AT TURNING SPRAYS ON SOMETIME AFTERWARDS FOR ENHANCED POOL CREDIT

ABWR SITING COMPARISON WITH SUPPRESSION POOL SCRUBBING, DF = 2

SITE	SITE BOUNDARY 2HR DOSE 300 LIMIT	LPZ 30DAY
ABWR 800M/3MI	24	30
EPRI 800M/2MI	110	485
1		59
2	11	36
3		47
4		26
5	197	476
6	8	23
7		124
8	21	13
9	32	122
10	21	38
11	47	104
12	94	209
13	105	23

PLANT SHIELDING
AND
VENTILATION DACs

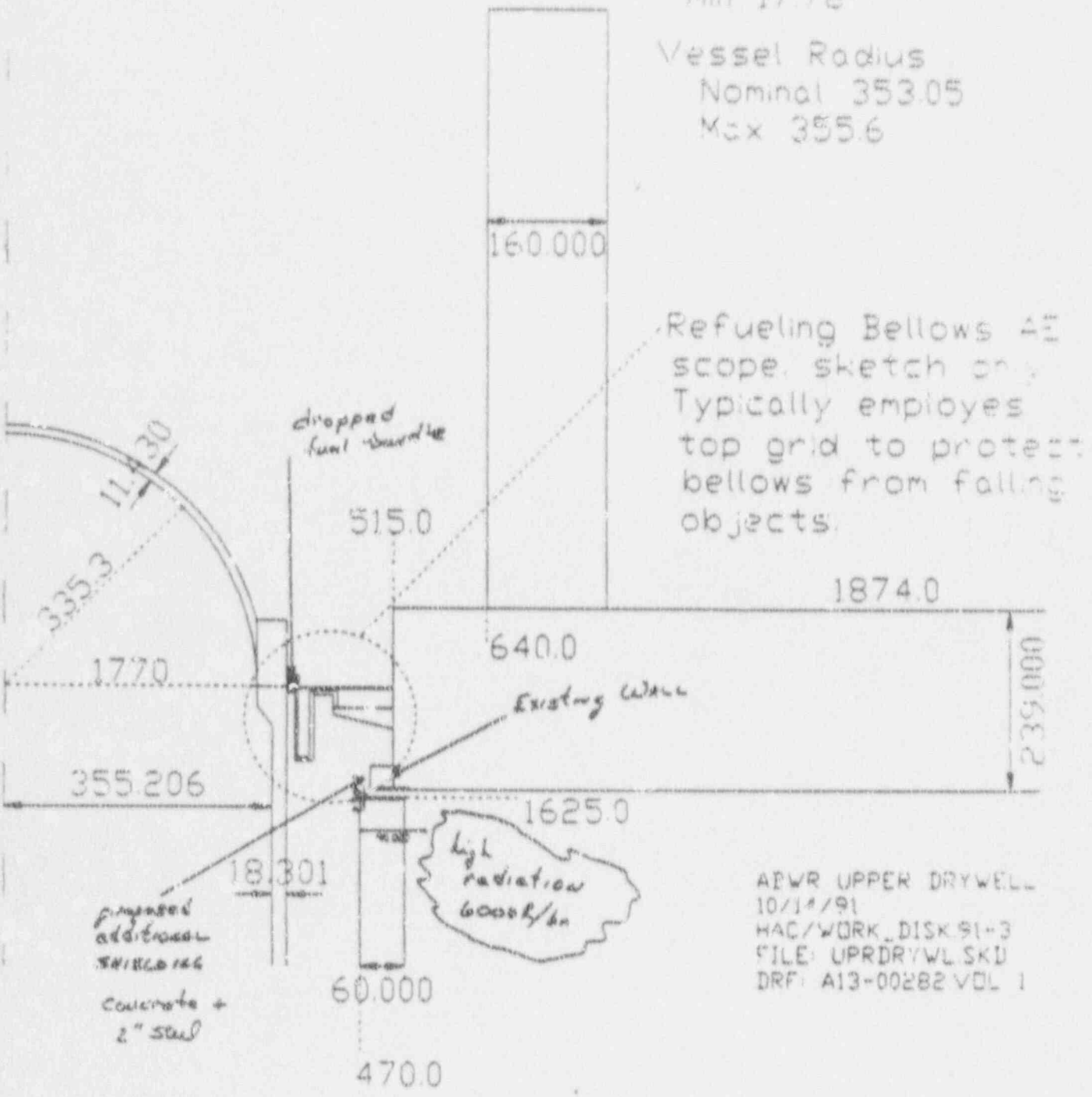
- GE AND NRC HAVE REVISED DACs
  - REMOVED REFERENCE TO SSAR
  - ADDED TOP LEVEL RADIATION ZONE DRAWINGS
  - REMOVED REFERENCES TO EXISTING CODES AND SPECIFIED DOSE LIMITS EXPLICITLY
- REMAINING
  - NRC REVIEW OF RADIATION ZONE DRAWINGS
  - UPPER LEVEL APPROVAL AT NRC AND GE

ABWR UPPER DRYWELL

All Dimensions are
Vessel Zero
Dimensions in centimeters

Vessel Head Thc-
Nominal 10.0
Max 11.5
Vessel Wall Thck
Min 17.78

Vessel Radius
Nominal 353.05
Max 355.6



ABWR UPPER DRYWELL
10/14/91
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