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October 13, 1992

Generic Letter 88-20
Supplement No. 4

U S Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Docket Nos. 50-282 Licenses No. DPR-42
50-306 DPR-60

Response to Schedular Concerns associated with
Generic Letter 88-20, Supplement No. 4
Individual Plant Examination of External Events

In a letter dated July 29, 1992, you informed us that our schedule for the submittal of our response to Generic Letter 88-20, Supplement No. 4 was unacceptable. We have discussed this schedule with the NRC Staff on several occasions, including a meeting with the NRC Staff on September 29,1992. At this meeting, we were unable to agree on an acceptable submittal date. This letter documents our response to your request for our schedule to be changed

Please contact us if there is a problem with this schedule for the Individual Plant Examination of External Events for Prairie Island.

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c: Regional Administrator Region III, NRC
Monticello Senior Resident Inspector, NRC
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Attachment

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Attachment 1

We have reviewed the IPEEE schedule and have not been able to modify the schedule to conform with the requested June 1995 date proposed in your July 29, 1992 letter. The reasons for this are discussed below.

The NSP PRA philosophy is to develop living PRAs which will assist the corporation in making sound decisions on plant modifications, meet the requirements of the NRC and develop in-house personnel with the knowledge to use the PRAs. We plan to maintain living PRAs for both the NSP nuclear plants. In the process of doing this we will understand the important factors affecting risk, allowing us to reduce risk as much as possible.

We have 7 full time employees dedicated full time to PRA work. Two of these positions exist at Monticello, three in our general office and two at the Prairie Island site. This is a significant commitment in a atmosphere of financial restrain with every additional staff person being reviewed very carefully. In addition, substantial financial resources are required for consultant work.

The Monticello PRA has been submitted and the Prairie Island PRA will be submitted in March of 1994. We have found the PRA tool to be very useful. The PRA staff has many requests to evaluate different modification configurations as well as evaluate outage scenarios. We believe our PRA personnel are performing a significant safety function in evaluating modification and scheduling.

The specific objectives of the NSP IPEEE program are as follows:

Develop appreciation of severe accident behavior.
Understand most likely accident sequences.
Gain a quantitative and qualitative understanding of risk.
Reduce risk where appropriate.
Maximize use of NSP staff.
Insure the IPEEE reflects the current plant.
Support licensing and plant modification process.
Coordinate with SQUG.

To meet these objectives NSP plans to perform a seismic PRA, fire PRA, and screening for the other external events. The overall schedule including both the IPE and IPEEE for both Monticello and Prairie Island is shown on the attached figure. The completion of the IPE has the highest priority followed by the IPEEE with supporting work for the plant having lower priority.

We have reviewed the schedule for the Prairie Island IPEEE very carefully and will be able to revise the scheduled due date from March 1, 1997 to December 15, 1996. We realize this far from the June 1995 date requested. The fact that the Prairie Island PRA is not scheduled to be completed until March of 1994 makes the June 1995 unattainable using NSP personnel. Attachment 2 contains a more detailed schedule for the Prairie Island IPEEE. The details of the schedule may be revised when the project is started. The reasons as to why the scheduled date is beyond the requested date of June 1995 are as follows:

1. In the description of the examination process for the IPEEE, the NRC strongly requests each licensee to use its staff to the maximum extent practical in conducting the IPEEE. NSP has scheduled internal resources in a way to ensure maximum technology transfer to NSP personnel which also reduces the consulting costs, thereby meeting the IPE goal of using the utility engineers to the maximum extent possible.

   The Prairie Island IPE is scheduled for completion by March 1, 1994. Completion of the IPEEE by June of 1995 is not possible without having

.most all the work done by consultants at a very large cost to NSP which would not meet the intent of the IPEEE process to have utilities involved in the analysis.

The IPE and IPEEE have been scheduled in this mann because NSP has two sites with one site having two units. This requir significant additional resources to complete the IPE and IPEEE than that required for a single site or a single unit. To manage the additional burden, the work is first being completed at Monticello followed by Prairie Island. Resources are being shared between the sites to assure consistency and to avoid duplication. This will more effectively use the personnel and reduce cost, but does somewhat extend the schedule.

2. The NRC has stated that the IPEEE must reflect the current plant design. With changes and modifications being performed routinely to the plant, the PRA must be updated to ensure the IPEEE reflects the current plant design. Included in the schedule is updating the PRA before the quantification of the IPEEE. This is needed because the IPE and IPEEE process naturally spans several years. The update will include a review of initiating events, modifications to the plant, changes to procedures, changes in maintenance and other inputs to the PRA to determine if there is a significant change that could effect the conclusions of the IPEEE results. Only those significant changes will be updated.

3. In Generic Letter 88-20, the NRC suggests the benefits of a PRA include supporting licensing and the plant modification process. Modifications and other changes to Prairie Island are being reviewed using the PRA methods. This includes a review of the new diesel generators being installed in the fall of 1992. The review of plant changes is an ongoing effort using the same personnel that are developing the IPE and IPEEE.

   In addition, work has been done reviewing the outages at Prairie Island using the PRA models. This is a qualitative look at the Prairie Island outages to confirm the outage plan is reasonable. The same personnel who perform the IPE and IPEEE work on this review.

In the September 29, 1992 meeting between NSP and NRC Staff personnel, several ideas for schedular improvement were discussed. We have evaluated each:

1) Do not update the IPEEE to current plant conditions.

   To ensure the IPEEE conclusions are correct the PRA must be updated to include significant changes which may effect the results of the analysis. To minimize the effort only significant changes that may effect the conclusions of the IPEEE will be included in the update. It is anticipated that there will be changes that will require a requantification of the PRA because of the length of time since the PRA was last quantified.

2) Combine the walkdowns with USI A-46 program work.

   This is already included in the schedule. The IPEEE will be coordinated with the USI A-46 work.

3) Schedule the consultant work earlier.

   The only two tasks done by the consultants which can be completed earlier are the response and fragility analyses. Those two tasks are not critical path and to schedule them earlier would not improve the schedule.

4) Have more work done by consultants.

To have the consultants perform more of the effort would put a large budgetary burden on NSP and would result in not being able to meet the intent of the severe accident issues of having the utilities performing the work. It is very important to have the utility staff understand the insights and methods used.

5) Remove "slop" time from the schedule.

The "slop" in the schedule was removed by moving the date from March 1, 1997 to December 15, 1996. To move the schedule more would increase the probability of a request for extension during the project.

We believe the schedule for performing the Monticello and Prairie Island IPE and IPEEE is appropriate to meet the intent of the Generic Letter. By applying internal resources for both conducting and using the PRAs, NSP is being fully consistent with the intent of the safety issues including the IPEEE.

NSP IPE and IPEEE Schedule

Task	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Mnt IPEM	12/87	3 4	12/88								
Mnt IPE		9/88	4 4	4 4	4 4	3/92 4					
Mnt IPEEE						4/92 2 2	2 2	3 3	3/95 3		
PI IPEM		10/88	1 2	2 2	5/91 2						
PI IPE				8/90 1	1 3	3 5	5 5	3/94 3			
PI IPEEE							1/94	1 4	4 4	4 4	3/97 4
Shutdown Review						3	3				
Update PRA									4		

Value under each project is the number of people working on the project.

Attachment 2

Prairie Island IPEEE Schedule

The main objective is to perform an IPEEE for Prairie Island. This includes documentation consistent with the current NRC guidelines for submittal. In addition to addressing the Severe Accident Policy requirements, the models will be developed and documented in a manner that will support future use and application to regulatory, safety, and operating issues.

Another objective is that of technology transfer. The project will be conducted primarily by NSP staff under the guidance of consultants who are experienced in PRA and external events technology. The goal of this objective is to train the NSP staff to conduct similar studies with little or no consultant guidance and thereby provide NSP with the capability to update and utilize their analysis for related internal decisions with minimum outside assistance. The only exception is the fragility analyses, because of the detailed expertise required and there is not a need to reproduce the analyses in the future.

The schedule is made up of five major parts: 1) Project Management, 2) Seismic, 3) Fire, 4) Other, 5) Documentation, and 6) Update PRA. The attached figure provides the schedule for the completion of the Prairie Island IPEEE work.

1.0 Project Management
This task depicts the functions associated with effective project management. The key tasks include: Develop a detailed project plan that defines the objectives, scope, schedule, and cost for the tasks required. Ensure the objectives of the project are being met as work progresses. Provide the day-to-day direction of the technical work on the project and ensure that the tasks are completed in a timely manner. Provide the day-to-day management of the resources allocated to accomplish the project. Ensure that the containment analysis and the accident sequence analyses are fully integrated and consistent. Ensure that the work being done by the analysis team is reviewed at appropriate intervals in order to monitor the quality of the work being performed.

2.0 Seismic
Seismic is the largest part of the IPEEE and will be coordinated with the SQUG A-46 work. The scope of work will include a seismic PRA analysis which has three major parts to it: 1) Plant Information, 2) Quantification, and 3) Documentation.

2.1 Plant Information
The purpose of this task is to gather and compile the information necessary to perform the seismic evaluation. Completion of this task is comprised of four subtasks:

2.1.1 Component Information
This task includes gathering structural information, system information, and relevant analyses performed previously for seismic use to support the seismic IPEEE. Existing documentation on building construction, equipment support drawings and suspended system (piping, cable tray, conduit, and HVAC) configurations, and supports will be gathered together and reviewed. This will include types of materials, anchor types, foundations, supports, etc. which are available in construction and design basis documentation. In addition, relevant sections pertaining to seismic issues from the FSAR need to be collected. Analyses from the FSAR, Level 1 PRA work on

containment capability and flooding, Appendix R work on component locations and barriers, and A-46 tasks will b reviewed here as to component and structural response. Equipment seismic qualificati reports will be reviewed for components on the seismic PRA list.

2.1.2 Review Hazard Analyses
Seismic hazards performed by both the EPRI (EPRI NP-6395D) and LLNL (NUREG/CR-5250) will be reviewed to understand their basis and to determine how they are applicable to the Prairie Island site.

2.1.3 Walkdown
This task will involve planning the walkdown and documenting the findings for use in the IPEEE. Much of this work will be coordinated with the SQUG work.

The initial walkdown will be based upon recommendations and inputs from the EPRI seismic margins approach (EPRI NP-6041), the Generic Implementation Procedure (GIP) developed for A-46 by the Seismic Qualification Utility Group (SQUG) and EPRI, as well as the IPEEE Generic Letter.

The walkdowns will be performed to satisfy requirements of the IPEEE and the A-46 issues. A-46 issues and IPEEE seismic issues overlap in some areas, but are different in scope in other areas. A-46 is concerned only with one success path of equipment needed to bring the plant to safe shutdown, whereas the PRA approach for IPEEE is concerned with multiple success paths. A-46 and the GIP have more specific guidance on the walkdown, the GIP calls for the use of a wrench test for the bolt tightness check of expansion anchor bolts, whereas no specific testing is called for by the IPEEE. The GIP methods can be used for overlapping equipment to satisfy both the IPEEE and A-46 concerns, and sufficient information can be taken on the GIP forms to ensure fragilities can be generated for the PRA. The GIP must be used for equipment that is only within the scope of A-46, while the fragility methods defined in the IPEEE generic letter must be used for equipment only within the scope of the IPEEE.

Preparatory work for the walkdown includes: 1) Preparing the Team. The team should include plant operations personnel, systems engineers, PRA analysts, and seismic capability engineers. 2) Engineering work before the walkdown which includes: Familiarization with plant design features by reviewing P&IDs, FSAR, electrical one-line diagrams, operating procedures and recovery actions, arrangement drawings, and dependency matrices. Identifying important plant functions and systems which satisfy those design features. Identifying potential "success paths" of systems and actions which result in plant shutdown. And, identifying relays and contractors prone to chatter, this task is difficult and requires iterations between systems and seismic capability engineers. 3) Review the seismic capability which includes: Review seismic sections of FSAR, sample equipment qualification reports, selected equipment specifications, structural drawing, seismic analyses, available floor spectra, representative equipment seismic anchorage analyses and designs, seismic qualification review team forms if available, and review documentation available on qualification of relays and contractors against re chatter

Training will be required for the PRA group for either the SQUG or IPEEE effort. This will include industry training by SQUG and other training given by EQE or TENERA for the walkdown.

Confirmatory walkdowns will be conducted and documented as necessary following the preliminary assessment to verify the results of the sequence quantification and to support the recovery analysis.

2.1.4 System Analysis

Included in this task is the identification of components and equipment that may be needed in response to seismic events. IPEEE and A-46 issues will be addressed here.

Equipment required for safe shutdown must be identified. Much of the work done in the previous tasks will be used to develop lists of important equipment and structures. This task needs to be completed before the walkdown. Different lists are necessary for the IPEEE and the A-46 issues because of different requirements and scopes.

In performing the seismic evaluation for the IPEEE it is necessary to assess the impacts of the seismic event on not only active and passive components and systems, but upon the structures as well. Seismic system interactions should receive particular attention because of the potential for common cause failure mechanisms attributable to the seismic event. Active components are those which must change states in order to satisfy their associated safety function. Passive components need to continue to operate in the state that they are in. Structures of importance include masonry block walls, tanks, and other items whose integrity and position are vital to the continued operation of components and systems. Secondary interactions include failure or collapse of local equipment such as ceiling tiles, lighting fixtures, etc. onto systems being credited in the analysis. These interactions also include environmental concerns like temperature, pressure, and humidity. These will be identified through a combination of system familiarity, IPE results, and plant walkdown information.

The A-46 issue is concerned with the seismic qualification of equipment needed to bring the plant to safe shutdown. Seismically induced LOCAs and high energy line breaks need not be considered, and therefore piping and tubing require examination only if they have the potential to cause seismic interaction with other necessary equipment, above-ground tanks are an exception. Therefore, this list of equipment should be smaller than and a subset of the list developed for the IPEEE. Licensing concerns may dictate that an expanded A46 list be considered. Part of this task will include FSAR changes, broader A46 listed, replacement parts, etc.

Failure Modes and Effects Analyses (FMEAs) will be performed to both assess and screen the impact of failures associated with structural and equipment interactions. The FMEAs will be used to modify existing fault trees to reflect the impact of seismic events on plant systems.

The equipment will include that identified by the IPE as important to safety. Once again, passive and active equipment, structures, and secondary interactions will be considered. Other components such as relays, contractors and switches that are prone to chatter will be added to the list as well if judged or shown to be important. However, careful planning and use of generic insights are necessary at this stage to avoid large resource expenditures.

An assessment of relay chatter is required by the Generic Letter for the IPEEE and is also required for A-46. This task will be coordinated with the A-46 effort.

FMEA will be performed to both assess and screen the impact of failures associated with the incore instrumentation and seal table. This will address Generic Issue 131.

2.2 Seismic Quantification

This task deals with calculating the impact of seismic events upon the risk to the public in terms of core damage frequency and containment performance.

2.2.1 Response Analysis
This task will include the steps necessary to determine the response of the auxiliary/turbine building, reactor building, and containment to various magnitude seismic events. The building response is required for the fragility assessment and is a function of elevation, ground acceleration, and the ground acceleration spectral shape. Building response will require development of median centered response spectra to generate more accurate fragilities. The impact on plant operation will be assessed from the point of view of both potential for and consequences of liquefaction. NUREG-1150 and EPRI NP-6041 contain procedures for assessing soil liquefaction. The issue of incore instrumentation and seal table failure and the impact of various magnitude earthquakes.

2.2.2 Risk Models
The IPE models will be reviewed and modified to reflect the impacts of seismic events. The tasks completed for the IPE will essentially be repeated, with a specific focus on seismic events. Initiating events that could be caused by a seismic initiator such as LOOP, LOCA, fire, flood, etc. will be identified. Event trees will be reviewed and modification which includes new events in response to the impact of the seismic event. The seismic failure modes will be added to the appropriate fault trees to model potential failures of active and passive systems, components and structures, and secondary interactions. The fault tree cut sets will be formulated as Boolean algebra expressions, for systems, functions, and accident sequences as input into the sequence quantification. Identification of basic events in the Boolean expressions that represent similar components being subject to the same seismic motion and determining what should be coupled so as to not overlook common mode responses and failures to the seismic event.

2.2.3 Fragility Analysis
The fragility of structures relative to the earthquake level identified in earlier tasks, as impacted by the structural analyses, is determined by this task. Fragility curves and High Confidence of Low Probability of Failure (HCLPF) calculations will be performed.

The list of components for which these calculations are necessary will be limited if possible through the use of importance rankings and seismic capacities of the components. Those components identified as having inherent high seismic capacity and HCLPF will not require generation of fragility curves. Fragility curves for components relatively sensitive to seismic motion in the range of interest will be generated.

2.2.4 Sequence Quantification
This task is performed to calculate the impact of a seismic event upon the plant and its systems. The hazard curves will be convolved (combined) with the fragility information and the risk models to derive sequence frequencies. The Boolean expressions generated earlier for the accident sequences will be combined with the hazards and fragility analyses. HCLPF results for systems, sequences, and the plant will be generated.

Recovery actions will be considered at this time. The emphasis will be on actions taken from the control room and on accessibility for actions that must be taken outside of the control room. Time frames developed from the sequence analysis performed for the internal events evaluation will be used.

2.2.5 Containment performance
Similar to the "back-end" analysis performed for the IPE, an evaluation of containment performance is required for the IPEEE. Starting with the IPE results, the containment structures, penetrations, isolation paths, and supporting systems will be evaluated to determine the impact of the postulated seismic events upon the ability to contain radionuclides. Information gathered during the seismic walkdown will be of use here. The

emphasis will be placed on the following three systems/functions: (i) penetrations, (ii) isolation, and (iii) containment heat removal/pressure suppression. Early containment failures that might result in high consequence sequences or which may initiate accident sequences are also of concern.

Containment penetrations are generally seismically rugged. A rigorous fragility analysis is only needed at review levels greater than 0.3g. An evaluation of the back-up air system of the equipment hatch and personnel locks that employ inflatable seals will be performed for all review levels. The possibility of losing cooling to penetrations requiring cooling will be considered as well.

Valves in containment isolation systems are expected to be seismically rugged (NUREG/CR-4734). The walkdown should assure that they are similar to test data on valves having high capacities, and that there are no spatial interaction issues. Seismic failures of actuation and control systems are more likely to cause isolation system failures. The air system should be included if valves rely on a back-up air system.

Components of the containment heat removal/pressure suppression systems which are not included elsewhere and which are not known to have high capacities should be examined (e..g., a fan cooler unit supported on isolator shims). The walkdown will include these components and their anchorages. Support systems and other system interaction effects (e.g relay chatter) should be examined as applicable. The potential for gross structural failure will be considered.

2.2.6 Sensitivity Studies

The results with the LLNL hazard curves will be reviewed to determine if there are insights that were not established with the EPRI hazard curves.

Assumptions about the potential for the seismic event causing a fire and also affecting the ability to fight the fire by causing damage to plant systems at the same time will be assessed. This is one of the six Sandia fire issues required to be evaluated in the IPEEE.

Sensitivity studies will be performed to address uncertainties in elements such as hazard estimates, system responses, and structural capabilities. The potential uncertainties associated with recovery will be addressed here as well core damage results with and without operator action will be assessed in accordance with the generic letter. A sensitivity study will be performed to address the generic issue 131 on the seismic effect on the incore instrumentation and the seal table.

2.3 Documentation

This task's objective is to complete a set of documentation that will (i) satisfy the NRC's IPEEE, (ii) be useful to NSP for identifying and addressing seismic concerns, and (iii) be consistent with the IPE documentation and the "living PRA" concept.

A detailed technical and editorial review will be completed prior to completing the documentation. The review will be conducted by a team of experts. A separate review will be conducted by an in-house NSP review team. To facilitate the NSP review team's work, the NSP reviewers will receive training on the methods and results of the seismic evaluation.

3. FIRE

Fire is the second largest part of the IPEEE. The scope of work will include a fire PRA analysis which has three major parts to it: 1) Data, 2) Quantification, and 3) Documentation.

3.1 Data

The purpose of this task is to gather and compile the information necessary to perform the fire evaluation. This task includes gathering plant and system information including relevant analyses and procedures for use in supporting the fire IPEEE.

3.1.1 Plant Information
Existing documentation on plant layout such as room configuration, and fire barrier locations is required. Also necessary is information concerning the composition of the fire brigade, its training, and procedures relative to fire brigade actions. During this time, the analysis team will ensure that issues identified in NRC I&E notices concerning fire barrier qualification (see, the list of notices in Section 7 of the FIVE method) have been addressed. This will satisfy the Fire Barrier Qualification issue from the Sandia fire scoping study. The Seismic/Fire Interactions issue is addressed in the seismic evaluation.

Verification that there are remote control and monitoring circuits independent of the control room for alternate shutdown purposes will be done to address the Sandia issue on Control Systems Interactions. If a site does not have independent remote circuits, Appendix R must be reviewed to verify that the safe shutdown circuits have been located physically independent of, or can be isolated from, the control room for an exposure fire that causes a loss of control from the control room. Analyses from the FSAR, Level 1 PRA, and from the Appendix R analysis will be included as relevant to the plant's response to postulated fire events.

3.1.2 Identify Fire Areas
Before the detailed fire evaluation can begin, it is necessary to identify the areas within the plant where a fire might be an important concern. The likelihood of a fire starting in a particular area, the equipment located there, and other considerations must be factored into this task.

The likelihood of a fire initiating in a particular area is sensitive to the location within the area where the fire is postulated to begin. This is particularly true if fuel loading conditions, the potential for fire spread, and other factors are considered. Plant-specific information on fires and combustible loadings will be coupled with industry data. The plant fire walkdown information will also be incorporated as appropriate

From plant layout drawings and P&IDs, areas adjacent to the area in which a fire is postulated to occur will be identified. The area boundaries can be defined by existing FSAR and Appendix R work, using approved fire barriers as the dividing line between areas. Separation within and between areas will be considered, as well as potential pathways such as ventilation systems, penetrations, grates, etc.

Equipment located in an area will be used as a means of defining whether or not the area is an important fire area. The amount and type of equipment located in an area can be used as a screening mechanism to minimize the number of areas which must be investigated. An area might not contain any equipment important to safety, but it may be adjacent to and connected freely with an area that does contain important equipment. Therefore, areas such as those cannot be discounted automatically. The potential for cross-zone spreading of fires, and the possibility of transient fuels being located in an area, are important considerations.

Detection and suppression capabilities as a function of fire area will also be identified. P&IDs and other drawings and documentation such as Appendix R, should contain this information. The types of detectors and suppression systems in fire areas will be delineated.

Failure Modes and Effects Analyses (FMEAs) will be used to determine the impacts of postulated fire induced failures of equipment that might not be modeled in the fault trees. This information will be used to supplement the fault tree models.

3.1.3 Walkdown

This task will involve planning the walkdown and documenting the findings for use in the IPEEE. The walkdown will be conducted to support the evaluation and documentation requirements of the IPEEE generic letter. Preparatory work for the walkdown includes the familiarization with plant design features, P&IDs, FSAR especially fire-related sections, electrical one-line diagrams, operating procedures and recovery actions, arrangement drawings, dependency matrices, and Appendix R. Identifying important plant functions, systems which satisfy those functions, plant fire zones, potential propagation paths for fire, smoke, and water, and possible access paths for fire brigade when responding to fire alarms.

The walkdown has the following objectives: 1) Review previously developed plant system models for obvious fire impacts. 2) Select or verify potential success paths. 3) Verify assumptions on fire detection and suppression capabilities, or gather information to determine capabilities, in order to assist in the fire evaluation. 4) Verify or develop assumptions regarding cross-zone fire spread, fire brigade accessibility, transient and permanent fuel loadings, etc. 5) Identify failure modes of concern. 6) Ensure that cable routing used in the analysis represents as-built information, and verify the treatment of any existing dependence between remote shutdown and control room circuitry.

The walkdowns will be performed to satisfy requirements of the IPEEE issues. Confirmatory walkdowns may be necessary following the preliminary assessment to verify or modify the results of the sequence quantification and to support the recovery analysis.

3.1.4 COMBRN Code

The COMBRN code will be setup to evaluate the fire progression. The COMBRN code will have been check out during the Monticello effort.

3.2 Quantification

The initiating event frequencies for fires are combined with the probabilities associated with fire detection, fire growth, and fire suppression, as well as with random failure probabilities, to calculate the impact of fire upon the plant risk.

3.2.1 Initial Screening

A fire analysis could require a large effort. In order to minimize the resources devoted to the fire analysis, an initial screening effort is conducted. Only fires and fire areas that have a significant impact on plant risk are investigated in detail.

Initiating events will be related to the event trees. The fires that are postulated to occur in different areas could result in a variety of plant trips, ranging from manually initiated plant shutdowns or scrams to conditions such as loss of feedwater, turbine trip, loss of off-site power, or even a LOCA. An assessment will be made for each fire and area of concern as to what the bounding initiating event caused by a postulated fire would be. The equipment within a specified area that might be affected by a fire in that area is next related to the functions and systems contained within the IPE event trees. In this way the analyst begins to get an idea about the possible magnitude of impact the fire might have on the plant.

A quantitative screen will be performed by using the event tree and fault tree logic models and the quantification computer codes, and modifying the unavailabilities to reflect the postulated impact of the fire upon the equipment. By initially assuming that all equipment in a given area is disabled by the fire without crediting detection or suppression systems, and by quantitatively removing those equipment from the logic models by setting the failure probabilities to unity, the maximum impact of the fire can be quantified. Those areas which produce high core damage frequencies when a fire is postulated in this manner are retained for further refined investigation. The quantitative screen is first performed on each area individually, without considering the potential for fire spread. Areas which produce high CDFs in this quantification are maintained. They will also produce high CDFs if the fire spreads to adjacent areas. Areas with low CDFs will be investigated further to ensure that fire spread is not a factor.

Areas which have low CDFs from the first screen are now investigated further. If the fire has the possibility of spreading, then the adjacent areas are also considered to be involved in the fire, and the equipment in those areas is considered disabled. A new CDF is calculated. If it is low, then the area and its adjacent areas are dropped from further consideration. Otherwise, they are maintained.

This screening is done in two steps. It is first performed without considering the alternate shutdown panel. Low CDFs produced in this way indicate that the areas can be dropped. High CDFs continue to the next step. The probability of being able to use the alternate shutdown panel as a means of shutting down the plant is derived. This value is a combination of equipment failure probabilities and human error probabilities. Effects of the postulated fire must be considered. Once the unavailability is derived, it can be combined with the effects of the fire under consideration.

A qualitative screening approach will also be applied. This approach credits separation between equipment, including cable trays, and the layout of the area and its potential for preventing the fire from impacting all equipment. The high CDF fire areas maintained are reviewed qualitatively by fire experts to determine if any mitigating factors might exist which would lead the analyst to believe that the fire cannot impact sufficient equipment to cause a significant effect on plant risk. The results are documented thoroughly by the analyst, including assumptions and rationale, and the list of fire areas for further investigation is reduced more, if possible.

3.2 2 Fire Frequency
The initiating event frequency will be derived for those areas most important as determined by the initial screening. Combustible loadings in the areas under study will be determined or estimated. The amount of fixed combustibles should be available from plant documents such as the Appendix R report. Transient combustibles such as paint cans, wood, and trash are harder to pin down. Estimates must be made based on maintenance records, daily work traffic patterns through the areas, administrative controls, etc.

The fire frequency is derived as a function of the area, the combustible loadings, and the number and type of potential ignition sources. Plant-specific data on fires may exist for some areas, but dependence on generic information is usually necessary. The frequency can be derived from sources such as data in EPRI's FIVE method, FIVE, NRC Daily Plant Status Reports, and Shoreham and Seabrook PRA related studies. Where possible, a frequency should be estimated for both "large" and "small" fires within an area.

With the fire frequency assigned, the sequences will be re-quantified, still without any consideration of detection and suppression. If the combination of initiating event frequency and the conservative assumption that all equipment fails produces a low CDF, then this can be documented and the area can be dropped from further consideration.

3.2.3 Fire Damage
Now the factors of detection, propagation, and suppression must be applied

to the remaining fire areas and postulated fires. This task is to establish time windows for propagation and detection. The items that must be established for each area are: 1) Time from initiation of fire to spread of fire to important locations or equipment within the area. 2) Time from initiation of fire until detection by available automatic detection devices or by manual detection, by observing the fire or by observing effects of the fire upon equipment and instrumentation.

These time frames are important because they impact the probability of successfully suppressing the fire before sufficient damage to equipment to cause the onset of core damage occurs. The time available to suppress the fire is dependent on the initiating event and will be established as available from existing transient analyses performed for internal events. Methods of estimating these times include use of available computer codes to model the fire scenario, specifically, the COMPBRN code or the use of look-up tables included in the FIVE method. Bounding values can also be used, with sensitivities assessed by varying these times.

The fire modeling techniques incorporated into the FIVE method are derived from the same basic correlations used in the COMPBRN IIIE code. The look-up tables in the method should be compared to results from COMPBRN. If the results appear to be satisfactory, then the look-up tables be used by themselves. Otherwise, the use of COMPBRN may be required. This will satisfy the Sandia fire risk scoping issue Improved Analytical Codes.

Sensitivity analyses will be performed to test the impact of major assumptions upon the results. Possible candidates for these studies include: 1) Starting size and location of the fire. 2) Amount of transient combustibles in the fire. 3) Assumed personnel traffic patterns through or near the area. 4) Effect of area ventilation (e.g., vents open/vents closed). 5) Effects of multiple combustibles (i.e., original fire starts a different set of combustibles on fire).

3.2.4 Fire Suppression
Suppression of the fire via manual or automatic systems must be taken into account. The effectiveness of various systems (e.g., water vs. CO_2 vs. halon; hoses vs. sprinklers vs. deluge pipes vs. hand-held extinguishers, etc.) varies considerably and is a function of the type and size of the fire.

Fault trees for suppression systems, such as the fire water system will be developed and quantified using plant-specific data on fire equipment reliability where available, and on surveillance frequencies of the actual system configuration. Generic data may be necessary to supplement plant data.

If manual suppression is necessary, it is first necessary to determine if and when the fire is detected. For areas with automatic detection devices, such as smoke, flame, or heat detectors, the fire evaluation analyst needs to assign a reliability to the detection system. The effectiveness of the systems in detecting a fire influences the ability of the fire brigade to extinguish the fire. If plant-specific data is available for detector reliabilities, it should be used. Otherwise, reliance on generic data is expected.

With the reliabilities of detection and suppression systems derived, the effectiveness of those systems will now be calculated. Detection system effectiveness, a function of the type of detector and the type of fire, will probably require reliance on generic data. Some published PRAs have references which may be useful, as does the FIVE method.

Estimating automatic suppression system effectiveness is next on the list of tasks to accomplish. The size and type of the fire, and the type of suppression system responding to the fire, impact the effectiveness of the suppression efforts. The data in FIVE on fire suppression system unavailability refers to the probability of not extinguishing a fire upon demand. In other words, "availability" is defined as operation of the system and successful suppression of the fire given that the system operates. Halon and CO_2 systems are not included in the FIVE data, and will require estimation from other data sources.

If automatic suppression systems do not exist or do not work, the fire brigade must suppress the fire. The FIVE method contains a discussion on how to determine the effectiveness of the fire brigade. The relevant elapsed time is the time from fire initiation until the fire is controlled, as opposed to the time from detection. The impact of heat and smoke on manual fire fighting effectiveness, the fire fighter preparation time, and the time needed to locate the fire in a smoke filled area will also be considered. If these topics are addressed, this will satisfy the Sandia fire scoping issue on Manual Fire Fighting Effectiveness.

3.2.5 FMEA On Suppression System Operation
An FMEA will be used to supplement the existing fault tree models and results. This FMEA will focus on areas for which detailed models do not exist or may be difficult to complete. During this time the Sandia fire scoping issue on Total Environmental Equipment Survival should be addressed. This requires that an assessment of three topics be completed:

1. Potential for adverse effects on equipment caused by combustion products.

2. Spurious or inadvertent actuation of fire suppression equipment. This concern is being investigated in Generic Safety Issue 57. The fire evaluation will include an assessment of the susceptibility of safe shutdown equipment to damage from the suppressant being used. The plant walkdown will identify potential concerns regarding redundant trains of shutdown equipment being simultaneously damaged from inadvertent actuation of a suppression system.

3. Operator effectiveness in smoke-filled environments. Appendix R evaluations on the ability of the plant to implement fire procedures and use the alternate shutdown panel should be of use here.

3.2.6 Containment performance
The IPEEE Generic Letter does not really discuss containment performance in response to fire events. Past PRAs have indicated that the effects of fires upon containment have been small. However, if the fire evaluation determines that containment isolation or containment integrity may be impacted by the fire, a discussion of these events will be included. At a minimum, the fire evaluation will ensure that no sequences different from those of the internal events analysis are identified during the fire analysis.

3.3 Documentation
This task's objective is to complete a set of documentation that will satisfy the NRC's IPEEE and be useful for identifying and addressing fire concerns. It will also be consistent with the IPE documentation and the "living PRA" concept.

A detailed technical and editorial review will be completed prior to completion of the documentation. The review will be conducted by a team of experts. A separate review conducted by an in-house NSP review team. To facilitate the NSP review team' work, the NSP reviewers will receive training on the methods and results of the fire evaluation.

4. Other
This is the evaluation of other external events not part of the seismic or fire analysis. This includes external flooding, high winds, tornadoes, transportation

accidents and nearby facility accidents. This task will also ensure that no other plant unique external event hazard exists. This task in broken down into three parts; 1) Review Data and Licensing, 2) Screen Hazard, and 3) Documentation.

4.1 Review Data and Licensing
This task is the review of the currently available data and licensing requirements. Review all current hazard data available for the plant to determine to what extent the hazards have been documented. Review the current licensing bases for each external event. Review any significant changes in the operating license with respect to 1) military or industrial facilities within 5 miles, 2) on-site storage or other activities involving hazardous materials, 3) Transportation, or 4) developments that could affect the original design flooding conditions.

4.2 Screen Hazards
This is a screening of the hazards. Only those hazards which do not pass the previous screen are reviewed by the next screen.

Compare information obtained for conformance to the current criteria and perform a confirmatory walkdown on the plant. The walkdown would concentrate on outdoor facilities that could be affected by high winds, on-site storage of hazardous materials, and off-site developments. If the comparison indicates that the plant conforms to the current criteria and the walkdowns reveals no potential vulnerabilities not included in the original design basis analysis, it is judged that the contribution form that hazard to core damage frequency is less that 1E-6 per year and the IPEEE screening criterion is met. Otherwise, one or more of the following steps will be taken to further evaluate the situation.

If the original design basis does not meet the current requirements, then the original design bases will be reviewed to demonstrate that the frequency of the original design bases is sufficiently low. This is done by showing that the design bases is less then 1E-5 per year and that the conditional core damage frequency is less then 1E-1. If the original design bases with the conditional core damage frequency is not sufficiently low then additional analysis will be required. This analysis is intended to provide a conservative calculation showing that either the hazard would not result in core damage or the conditional core damage frequency is below the reporting criterion. The level of detail is that level required to prove the point. If the bounding analysis cannot be shown than additional analysis will be required.

A PRA consists of hazard frequency, plant systems, accident analysis and radioactive material release analysis. A core damage frequency less than 1E-6 per year would screen the event from further consideration. The level of detail is that level required to prove the core damage frequency is below 1E-6 or the determination of recommendations to reduce the frequency below 1E-6.

4.3 Documentation
This task's objective is to complete a set of documentation that will satisfy the NRC's IPEEE and be useful to NSP for identifying and addressing concerns. It should also be consistent with the IPE documentation and the "living PRA" concept.

A detailed technical and editorial review will be completed prior to completion of the documentation. The review will be conducted by a team of experts.

5.0 Documentation
This is all the final documentation and reviews. This task's objective is to put together all the documentation from the other main tasks into one consistent and complete a set of documentation that will satisfy the NRC's IPEEE and be useful for identifying and addressing concerns. It should also be consistent with the

IPE documentation and the "living PRA" concept. A detailed technical and editorial review will be completed prior to submitting the final IPEEE report. The review will be conducted by a team of experts.

The final IPEEE report for submittal to the NRC which incorporated the comments from the final review will be developed.

6.0 Update PRA
There will be several years since the PRA model was completed, and with changes and modifications being performed routinely, the PRA must be updated to ensure the IPEEE reflects the current plant design. Only significant changes which will effect the results of the IPEEE will be updated. The update includes reviewing the data, event trees, fault trees, quantification, and sensitivity studies to ensure that the IPEEE reflects the current plant design, and updating the data, models and documentation as needed. It is anticipated that a new quantification will be required to meet these objectives.

Prairie Island IPEEE Schedule

Task	1994 / 1995 / 1996
1. Project Management	1/1—12/15
2. Seismic	
2.1 Plant Information	
2.1.1 Component Information	1/1—6/2
2.1.2 Review Hazard Analyses	6/2—6/11
2.1.3 Walkdown	8/6—10/1 4/27—5/17 1/9—1/30
2.1.4 System Analysis	6/11—8/6 10/1—3/16
2.2 Quantification	
2.2.1 Response Analysis	3/16—8/11
2.2.2 Risk Models	8/11—1/6
2.2.3 Fragility Analysis	7/29—6/8
2.2.4 Sequence Quantification	1/30—4/17
2.2.5 Containment Performance	4/17—5/17
2.2.6 Sensitivity Studies	5/17—7/21
2.3. Documentation	4/17—8/30
3. Fire	
3.1 Data	
3.1.1 Plant Information	1/1—1/13
3.1.2 Identify Fire Areas	1/13—4/7
3.1.3 Walkdown	4/7—4/23
3.1.4 COMBRN Code	1/13—3/10
3.2 Quantification	
3.2.1 Initial Screening	4/23—6/21
3.2.2 Fire Frequency	6/21—7/28
3.2.3 Fire Damage	7/28—8/30
3.2.4 Fire Suppression	8/30—11/9
3.2.5 FMEA Suppression	11/9—11/19
3.2.6 Containment Performance	11/19—12/1
3.3 Documentation	12/1—2/2
4. Other	
4.1 Review Data and Licensing	1/1—1/27
4.2 Screen Hazards	1/27—2/24
4.3 Documentation	2/24—3/17
5 Documentation	7/21—12/15
6 Update PRA	2/2—9/7