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ACRS Floating Nuclear Plant
Subcommittee Meeting Minutes
October 13, 1981
Washington, D.C.

Purpose: The purpose of the meeting was to review Supplement 4 to the FNP Manufacturing License (ML) SER, as well as review any remaining issues associated with ACRS review of this Project.

Attendees: Principal attendees are noted below:

ACRS

D. Moeller, Chairman
J. Ebersole, Member
J. Ray, Member
I. Catton, Consultant
Z. Zudans, Consultant
P. Boehnert, DFE

NRC

E. Adensam
M. Mallory
A. Marchese
C. Tinkler

Offshore Power Systems

B. Haga
D. Walker
R. Orr
J. Hammond
R. Kooney
J. Sutherland

A complete list of attendees is attached to the office copy of these minutes.

Meeting Highlights, Agreements, and Requests

1. Mr. B. Haga (OPS) summarized the status of the NRC ML review. OPS believes the review is now complete with issuance of Supplement 4 to the FNP ML SER.

The ASLB has set a prehearing conference date of November 2, 1981 to set the schedule to complete hearings. The hearing process is expected to be completed in November, provided ACRS review is completed this month. OPS noted that four separate ACRS reviews are required before an FNP can be licensed to operate: 2 for manufacture (ML and Amended ML (FDA)) and 2 for a sited plant (CP&OL).

2. NRC discussed the contents of SER Supplement 4 and the items to be addressed in the ACRS Letters on FNP dated June 1976 and April 1980. The June 1976 letter noted three items to be addressed. (NRC responses noted in parentheses): (1) ECCS performance analysis (Addressed in Supplement 4 - ECCS acceptable per 10 CFR 50.46); (2) liquid pathways (NRC has not yet determined an acceptable frequency of a molten core reaching the ocean - will keep ACRS informed of progress of this effort); (3) offsite accident probabilities (NRC position unchanged from that noted in Supplement 2 to FNP SER). The April 1980 core ladle letter also called out three items: (1) proper selection of ladle material vis-a-vis public risk (NRC Research has initiated a program at Sandia to help confirm ladle design); (2) Hydrogen release/containment pressure (addressed in Supplement 4); and (3) retention of high temperature materials consultant by NRC (NRC has selected Applied Science Associates - research progress reports will be sent to ACRS).

During the above discussion, a number of questions were posed by Subcommittee members. These questions were responded to during the scheduled presentations or directly as noted below.

3. Dr. D. Walker (OPS) discussed the containment vent design. OPS will install four 30" vents that exit near the top of the containment and vent at the bottom of the platform (~35 feet below the water). Dr. Catton suggested OPS investigate the "heat pipe" concept for lowering containment pressure. OPS agreed, noting they will be doing an NRC-required PRA study after ML issuance. In response to a question from Mr. Ebersole, OPS said the PRA study may also confirm the wisdom of a wet (water filled) ladle versus a dry ladle.

4. Dr. Walker discussed the concern raised in the June 1976 ACRS letter on offsite accident probabilities. OPS believes the question of the

sum of the total of individual accident probabilities being unacceptable (> 10^{-6}/reactor year) is a generic issue. Mr. Walker said OPS was required to assure that they meet a maximum probability from a given accident source type of 4×10^{-7}. This is based on the Staff's belief that no more than 4 events affecting the plant would co-exist at a single site (fire, toxic gas, explosive overpressure, etc.). OPS believes that a realistic analysis would show that the accident probability is much lower than cited in the SER.

5. Mr. R. Orr (OPS) discussed the upgrading of the containment strength. OPS has increased the design requirements to an internal pressure of 45 psig at Service Level C limits and an internal pressure of 25 psig at Service Level A limits. Mr. Orr said this increased the functional capability to 80 psig, based on realistic analyses. In response to questions from Dr. Zudans on containment buckling, Mr. Orr said OPS submitted a report to NRC on buckling potential. OPS will perform an independent dynamic buckling analysis prior to approval of the Final Design.

   The plant site design interface was discussed by Mr. Orr. The design interface has been revised in some areas to reflect new or updated requirements. The seismic design SSE envelopes an earthquake occurring at the site with a 0.3g horizontal acceleration.

6. Hydrogen control for FNP was reviewed by Mr. K. Perry (OPS). OPS uses an ice condenser containment and plans to install a distributed ignition system similar to Sequoyah and McGuire. OPS performed three analyses of the containment response to hydrogen combustion. The analyses were: (1) Sequoyah analyses with applicability to FNP (peak pressure ~15 psig); (2) H_2 release rate sensitivity analysis (peak pressure ~34 psig for 4.0 lb (m)/sec release rate); and, (3) a reduced containment spray and fan flow sensitivity analysis (peak pressure ~38 psig). In all cases peak pressure was below the 45 psig Service Level C limit.

   Mr. Ebersole raised the question of possible containment damage due to lower containment subcompartments being depressurized by containment

spray water condensing steam. OPS said this question would be explored during required post-ML studies of the hydrogen mitigation system to be ultimately installed in the plant. Dr. Catton suggested that NRC look at other codes being used in containment analyses (RALOC) as well as relevant work on-going at Battelle-Frankfurt to aid in verifying results of the code being used in OPS analyses (CLASIX).

7. OPS provided an update on the core ladle design work. The preliminary design has been reviewed by NRC/ACRS. Further design work is pending a plant customer. NRC noted that RES is sponsoring a program at Sandia to study candidate materials. Another concept is the use of a flooded thoria rubble bed. This is under consideration as a retrofit vis-a-vis the Z/IP study. Dr. Catton suggested that NRC and OPS consider the use of thorea for FNP. NRC said Sandia will evaluate thoria vis-a-vis the MgO_2 crucible as part of the above noted program.

8. The organization and management of OPS was reviewed by Messrs. Haga and Hammond. Mr. Haga described the overall organization. There are four main subelements: (1) Engineering (plant design), (2) Product Assurance (QA/QC), (3) Operations (construct plant), and (4) Others (Finance, Law, Marketing, etc.). All of these groups report directly to the President of OPS. Due to the lack of any plant orders, the present organization is structured somewhat differently than described above. A "Power Systems Technology" and a "Marine Design" division exist to generate cash flow by acting as consultants to the nuclear industry and others (Figures 1 and 2 contrast the two organizations noted above). Mr. Haga noted that OPS believes that its organization and standardized plant manufacturing concept eliminate most of the design and construction interfaces experienced by a typical utility (Figure 3).

Mr. Hammond described the operations organization and detailed the construction methodology for the plant manufacture. Plant manufacture is governed by a sequence of manufacturing assembly plans (MAPS). The MAPS are used to generate and develop progressively more complex and detailed plant design. The final MAP level (Level III) is used to generate manufacturing drawings (process sheets) for actual plant construction.

OPS described the modular scheme used to construct the hull portion of the plant. OPS believes that when in full stride a plant can be constructed in about 4 years. In response to a question from Mr. Ray, Mr. Orr said the plant is designed to travel in storms up to the size of a small hurricane.

9. The emergency response facilities were discussed by Mr. R. Kooney. The FNP will have a technical support center (TSC) and operational support center (OSC) both located below the control room (Figure 4). The TSC and OSC will have the same degree of shielding, environmental control, and security as the control room. In response to a question from Mr. Ray, OPS said the TSC has a separate ventilation system in case evacuation of the control room is necessary.

10. The details of the control room design were discussed by Dr. Walker. The control room design considerations, control board features, and human factors design aspects were detailed. OPS will be required to do a comprehensive human factors design review of the control room using a full-scale mockup. Dr. Moeller asked how the utility will interact in the control room design. Mr. Walker said the first customer will have a chance for such interaction but subsequent customers will not since this is a standarized plant design.

11. OPS reviewed the planned experience feedback systems designed to alert OPS to any potential problems based on plant operation experience. OPS will rely heavily on INPO's Significant Event Reports as well as NRC I&E bulletins, NSIC LERs, EPRI reports, W Owner's Group feedback as well as OPS in-house experience and FNP customer experience. These reports will be screened for distribution of significant items.

12. Plant shielding design was reviewed by Dr. Walker. OPS has adopted a criterion that doses outside shield walls in potentially occupied areas shall not exceed 3 Rem for an 8-hour exposure beginning 24 hours after an accident release. The RHR components have been shielded

such that one of the two trains can be drained for maintenance during an accident if necessary (Figure 4). RHR and containment spray system leakage is pumped back to the containment sump to limit exposure. The control room shielding calculations indicate a 2.5-3 Rem total dose based on use of TID sources. There are two separate ventilation intakes - the preferred intake is automatically selected via a wind direction controller with each intake alarmed for detection of airborne radionuclides.

13. The proposed FNP risk/reliability program (PRA study) was discussed. OPS will perform this study over a 2-year span beginning after issuance of the ML (Figure 5). The study will be similar to IREP and the work will be performed by OPS with outside assistance in specialized areas. OPS believes any potential design changes will be identified after the first year of the study. Mr. Ebersole suggested OPS evaluate the new W design that emphasizes decay heat removal. OPS said this will be investigated.

14. Mr. Ray asked a number of questions on the details of the plant electrical power system. FNP will have four safeguards compartments, each with an emergency diesel-generator and a train of emergency DC power. There would be two power cables per unit to transmit power to a shore station.

15. The Subcommittee recommended that this Project be brought to the full Committee for review. Dr. Moeller requested that NRC address some detailed questions on the SER Supplement at the full Committee. The Chairman also instructed OPS on the topics to be discussed at the full Committee.

The Meeting was adjourned at 4:30 p.m.

NOTE: Additional Meeting details can be obtained from a transcript of this meeting available in the NRC Public Document Room, 1717 H Street, N.W., Washington, D.C., or can be purchased from Alderson Reporting Company, Inc., 400 Virginia Avenue, S.W., Washington, D.C. 20024, (202) 554-2345.