OCT 2 5 1967

Roger S. Boyd, Asst Dir, RP, DRL

THRU : Charles G. Long, Chief, RPB-3, DRL

Denwood F. Ross, RPB-3, DRL

SECOND TECHNICAL MEETING WITH METROPOLITAN-EDISON COMPANY, (DOCKET NO. 50-289)

A meeting was held on October 17-18, 1967 with the Metropolitan Edison Company, their suppliers, and their consultants to discuss Amendment 2 (Volume 4) relating to the Three Mile Island Station. A list of attendees is shown on Table I.

The meeting started with a discussion on hydrology, more particularly the projected water elevations for the design flood. Meyer of USGS and McLemore of GAI were the principals.

TABLE I
LIST OF ATTENDEES
MET-ED MEETING
October 17-18, 1967

B&W
J. M. Cutchin
F. R. Thomasson
W. B. Beisel
R. F. Ryan
R. M. Douglass
J. H. Kreps
D. M. Collings
D. E. Thoren
D. A. Nitti
M. F. Sankovich
R. E. Wascher
G. S. White
F. C. Heller

Gilbert Associates
R. H. McLemore
W. B. Shields
C. H. Bitting
D. A. Godfrey
D. K. Croneberger
J. E. Bohen
W. H. Traffas

Consultants
I. Cornet

USGS
Eric Meyer
E. H. Baltz

Met-Ed
G. F. Bierman
R. E. Neidig
G. Charnoff (Shaw-Pittman)
J. G. Miller
W. W. Lowe (Pickard-Lowe)
Keith Woodard (Pickard-Lowe)
D. W. Heward

DRL
R. L. Waterfield
D. F. Ross
B. Grimes
P. S. Check
S. Pawlicki
N. H. Davison
R. A. Birkel
C. G. Long
G. Burley
K. Kniel
M. Dunenfield
J. Murphy

POOR ORIGINAL

1446 321

OFFICE ▶						
SURNAME ▶					7910170676	
DATE ▶						

Form AEC-318 (Rev. 9-53) U.S. GOVERNMENT PRINTING OFFICE : 1966—O-214-629

POOR ORIGINAL

OCT 2 5 1967

Meyer's point was that a pool may back up, from the dam and up, during the design flood and cause higher water levels. Some doubt is in his mind about the possibility that the narrow section of river (by powerhouse) may act as a control and back water up.

A conclusion reached was: McLemore will furnish his computer program and input data (informally) so that Meyer can independently check.

We asked what the minimum flow rate was for intake supply. McLemore said 100-200 cfs (this assumes loss of York Haven Dam). We asked if there were any dams upstream for possible site inundation--and were assured there were none.

Containment

We brought up the question of long-term surveillance of grouted tendons. Inspection areas include loss of prestress and corrosion. Croneberger (GAI) discussed long-term surveillance. He thinks crack observation is good and displacement measurements are the best for detection of loss of prestress.

The facility operator must be able to measure 0.07-0.10 inch variation over an 80-foot dimension to detect one-third loss of prestress. Croneberger said a combination of tape and theodolites will be used to survey dimensional changes. Our concern is that some meaningful parameter must be postulated to serve as a limit on loss of prestress. We stated that greased tendons have been found acceptable before and that the surveillance features are quite attractive. Met-Ed requested time to confer with GAI prior to making any final decision.

Professor Cornet discussed his opinions on grouted vs greased tendons. He asserts that several ($\sim$ 3) inches of concrete around steel should serve as protective cover for steel. He used city of Los Angeles as reference data for both reinforced and prestressed piles. Some data that only 1-5/8-inch concrete was adequate over a 25-year life. He offered the (unsolicited) comment that dimensional measurements aren't very outstanding criteria for detection of loss of prestress.

We asked Professor Cornet what was the merit of grout inside the conduit, since the greater reliance was on external protection, and since some wires touch the conduit. We asked him about possible hydrogen embrittlement of tendons. He said no significant atomic hydrogen was formed, and hydrogen embrittlement does not occur if the environment is basic. He will send (informally) a reference. We asked if there was any related experience with similar structures and external cracks. The answer was "no."

We asked GAI where external cracking might occur under normal or emergency loads. Croneberger answered: Near the top of the wall--used criteria $6\sqrt{f'c}$ (or about 300 psi)--loads from thermal stress. There will be 100% visual inspection of the outer wall during the pressure test. In conclusion, we stated that the surveillance program as postulated by Met-Ed was not adequate for grouted tendons.

SURNAME ▶					
DATE ▶					

POOR ORIGINAL

OCT 2 5 1967

We had some questions about the seismic analysis--Met-Ed answer 3.2.2-b (page 3.2-1 of Volume 4). Dr. Newmark had questions about load combinations in the piping design: i.e., pressure loads, seismic, dead, temperature as related to yield strength. Also, we noted some deficiency in answer 3.2.5--what differential motion is forecast or allowable? Cronsberger asserted that the turbine foundation (or pedestal) is about 5 or 6 feet above rock, on very dense sand and gravel. This would give support to main steam line. However, feedwater train is on a different foundation. GAI says some feedwater components are Class I structures. We wanted more detail on exactly what systems and components are located on what foundation. Items include condensate storage tank, emergency feedwater pumps, interconnected piping. GAI stated that specific calculations on pipe vibration must await final design. We stated that different foundations give rise to different seismic responses. GAI said basically the auxiliary building and reactor building would be on rock--all others on soil.

We noted difficulty interpreting the answer to question 7.2. It appeared that the frequencies were added instead of the responses. Some rephrasing is indicated. We asked if the polar crane would be anchored when not in use. GAI said this was answered on page 3.2-2. We wanted to know if trolley and bridge were both locked when not in use. GAI said it was.

We asked if the prestess anchor was to be inspectable. GAI said that the anchor was to be grouted over. We said that inspection may be required.

We asked whether the turbine missile analysis considered the worst case. The Met-Ed answer was not particularly responsive. GAI will ask the turbine vendor (GE) for further information.

We expressed concern over turbine missile protection for feedwater train components, and stated our need for more information on shielding and distance factors. Apparently the two emergency feedwater pumps and the associated piping will be located 50 feet or better apart, so that missile effects are lessened.

A separate and concurrent meeting was held on the Met-Ed draft of answers to pressure-vessel thermal shock. Some of the results are:

1. We are basically satisfied with the analytical treatment but would like some more information on brittle failure--both the Pellini diagram method and for fracture mechanics.

2. Certain detailed requests were made: i.e., reports, curves. We stated we would like the information soon, in 2-3 weeks. It was unresolved whether B&W could formalize the submittal in time for the December ACRS meeting.

OFFICE ▶						
SURNAME ▶					1446 323	
DATE ▶						

We notified the applicant that there seems to be some general need for experimental information on thermal shock to thick slabs. Until these data are available the thermal shock problem cannot be considered fully analyzed. We stated that other reactor manufacturers are also being notified.

The response of the system to combined seismic--LOCA loadings was discussed. B&W stated that additional information would be available in January 1968. Final analysis would take 2 years--well after design and construction of the pressure vessel. We pointed out that three areas are:

1) loading combinations
2) stress limits and deformation limit for no loss of function
3) calculational method

We reminded the applicant that no formal requirement presently exists for compliance for combined loadings. We also reminded the applicant that usually seismic loadings are much smaller than blowdown forces.

We discussed answer 4.3--DNB correlations. Lack of a key reference was noted. DNBR's were lower using the new W-3 cold wall corrections. We asked for the significance of the change in the DNB correlation. B&W stated that their bundle data agree with the Westinghouse bundle data in the referenced report. The reason that the W-3 correlation gives low DNB ratios for the B&W design was stated to be the use of a low mixing factor in the "worst case" B&W calculations.

We asked for discussion on R&D items:

1. <u>Steam Generator Blowdown</u>

No specific results were presented. We need details before we can find that the R&D program has been successfully completed.

2. <u>Core Barrel Check Valve</u>

We stated our desire to know number and sizing information and redundancy criterion. B&W's present position is no redundancy in check valves. They are not in position to state how many valves, except that the number will be less than eight. Analysis is continuing, and results will not be available for several months. The sole basis for sizing is emergency core cooling. B&W stated that no dynamic vibration tests are envisioned on these valves. We questioned the advisability of this approach. We pointed out the general inability of existing analytical methods to predict dynamic response. B&W intends to do some

OFFICE ▶					1446 324	
SURNAME ▶						
DATE ▶						

research on check valves in their 1/6-scale model. We asked if flow reactions could hold the valve open under full flow conditions. There was no ready answer. We asked why the hinge pin could not be located on the inside of the core barrel. B&W's answer was that the hinge pin was a zero-stress item and captive design made the hinge uninspectable. Analysis of loss of one valve was questioned. We wanted to know why increased core coolant outlet temperature would not serve as an indicator. On another problem, we asked (and were assured in the negative) whether the valve lid could be swept against the bottom of the flow redistribution plate.

We asked the rationale behind in-core thermocouples. B&W stated that incorporation of such thermocouples was in error and was not a safety item as such. No fuel-clad thermocouples are envisioned.

We asked about the feasibility and desirability of electric-powered emergency feedwater pumps. The turbine-powered emergency pumps (two) pump from atmospheric up to 1000 psi. A small electric pump replenishes condensate from the river. Apparently each steam generator supplies one and only one emergency feedwater turbine; however the PSAR does not reflect this (in Chapter 10). This will be changed so that either steam generator can feed either turbine.

The next subject considered was efficacy of the sodium thiosulfate system. We asked if any R&D programs were being considered. We stated that insufficient evidence exists to form a precise conclusion. Areas of uncertainty include radiation instability, corrosion, condensate on drops, and effect on methyl iodide. Considerable discussion followed as to effectiveness of the system. Tests by B&W show that adding sodium hydroxide (up to pH of 9) helps iodine removal capacity. Radiation (10^8 rads) decreases pH, which is the motive for adding caustic. We asked about simultaneous irradiation and oxidation tests on sodium thiosulfate-boric acid tests. We stated the need for an R&D program by B&W. We also stated that proven efficiency is required to comply with the Part 100 limits, and that reliance on a government-sponsored program is inadequate. Industry programs should include:

1) mass transfer theory,
2) volume-to-spray density variations,
3) pressure, temperature, radiation effects,
4) condensation effect on drop,
5) stability of the mixture, and
6) alternate proposals.

1446 325

OFFICE ▶						
SURNAME ▶						
DATE ▶						

OCT 2 5 1967

We explained that the applicant must clearly identify the R&D program objectives and assume complete responsibility for supplying to DRL the results of the program. Completion of the program is not required for the construction permit but identification of the program is required in detail.

The next subject discussed was safe shutdown following loss of off-site power. B&W stated that the emergency feedwater pumps are started locally, and, for optimum results, should be started within 10 minutes. This answer may conflict with GDC No. 11. The scheme for depressurization used emergency feedwater down to 250° F, 135 or so psi and then DH pumps. We were later informed that the emergency pumps may also be started from the control room.

We noted that neither neutron detection nor concentration of boric acid in solution is provided in post-accident conditions. B&W stated that post-accident sampling poses great difficulties, mostly from radioactivity. Resistance to both neutron detection and chemistry sampling in the post-accident condition was offered. We reserved final comment.

An additional area discussed was safe shutdown from without the control room. Met-Ed firmly dissented, with the alternate being continued control room access. Difficulty in interpreting the word "access" is still being encountered; the applicant does not believe that GDC No. 11 requires consideration of evacuation.

One final item was heat transfer coefficients on the fan cooler for the RB cooling. We asked for something more detailed to review, preferably a preliminary design. The applicant prefers to leave this to the selected subcontractor and may specify that a proof test under simulated accident conditions be run. We also reserved final comment on this problem.

POOR ORIGINAL

1446 326

OFFICE ▶						
SURNAME ▶						
DATE ▶						

POOR ORIGINAL

OCT 2 5 1967

CONTROL AND INSTRUMENTATION MEETING
October 18, 1967
MET-ED

We asked which scheme was to be used to combat the undetected application of positive DC voltage to the magnet power supply bus. Further information is indicated, particularly if credit is taken for a rod drive-down in lieu of a scram.

Another question related to the adequacy of the flow monitor as a backup to the pump monitor. We asked about the adequacy, taking single failures into account.

We inquired into the failure nature of the in-core instrumentation alarm. A detailed question involved the possibility of exceeding DNB, as indicated by the in-core instrumentation, and not being aware of the occurrence. B&W noted that the out-of-core instruments are not adequate to detect xenon oscillations.

We asked if loss of one diesel decreased emergency core cooling below 100% of required--and were assured that 2/3 of diesel load provided 100% of requirements. There is no automatic cross-tie between emergency buses, only manual crossover and synchronization.

We inquired about cold weather, icing conditions, affecting external switchgear. Most ESF switchgear is inside buildings. Diesels are also kept warm; if heating system fails, the diesel starts and keeps itself warm.

Another question involved the likelihood and consequences of 3-phase reversal, involving possible reversal of control rod drives. Concern was expressed about the combination of phase-reversal and undetected application of power to the magnet bus, giving rise to a ganged rod withdrawal.

We thought more attention should have been given to phase reversal regarding power to ESF pumps, valve operators, etc. B&W thought proper maintenance would deny such an occurrence.

Some test program need for 3-phase reversal detection was indicated, both for maintenance and for periodic tests. A need to examine plant performance with one diesel supplying reversed-phase power was expressed by us. Discrepancy in the description of the battery charges was noted. Figure 8.1 of the original PSAR should be revised; the answer to question 9.10 is correct.

OFFICE ▶						7
SURNAME ▶					1446	321
DATE ▶						

OCT 2 5 1967

Final specifications on the diesel is lacking. We wanted to know the margin available in diesel load--that is, how much over 2000 kw could the diesel supply. B&W thinks 10% margin is nominally supplied. Also, B&W will specify 2000 kw as a continuous load rating. B&W might buy a diesel that is designed to deliver in the overload region, assuming that one of three does not start. We inquired about diesel self-protection features, such as overcurrent, etc.

We brought up the problem of fire in the control room, while facility is in full operation. What activities could still transpire? Applicant answer is that breathing apparatus would be used. Also, applicant states that external air inlet location would avoid ingestion of smoke. We asked if the facility can be shut down from alternate locations, granting that the reactor has been scrammed. The sequence of events was not readily available. However, it appeared that the plant possibly could take care of itself, staying at high pressure and extracting steam to drive the main feedwater pump turbines.

We inquired why the ranges of atmospheric radiation monitors could not be fixed at this time. B&W stated that they preferred to await further advances in state of the art.

Some documentation may be required in this line. Particular areas of concern include matching instruments to calculated dose levels.

We asked for a description of events following a radiation alarm in the vacuum pump exhaust. Such an alarm would be indicative of failed fuel and leaky steam generator tubes.

We asked about physical layout (physical separation) of scram relays and associated wiring. B&W noted that in actual construction physical separation is intended.

At the conclusion of the meeting we notified the applicant that we would send them a letter notifying our position on R&D programs, and other areas that came up during the meeting.

We asked them to consider the consequences of not isolating a broken LPI or HPI line--whether boiloff could enhance production of radiolytic gas. B&W stated that smaller HPI lines (and more of them) may be used. Of concern was: does the operator have to take corrective action?

We brought up the single operator action accident wherein the recirculation valve is opened prematurely and admits RB pressure to suction manifold. We requested B&W to look at the problem.

1446 328

OFFICE ▶						
SURNAME ▶						
DATE ▶						

OCT 2 5 1967

We also asked about minimum shutdown margin for the steam line break with leaky steam generator tubes. More information was promised by B&W.

We asked, about question 6.2, whether the CF tanks should have been included.

Another question was tornado design for auxiliary building. No immediate answer available.

We noted that some formal questions on control and instrumentation. They will be of general nature. Question areas will include adequacy of assurance that systems will operate as designed. Environmental testing is indicated for that portion of the system inside the RB. Also, for general instrument design criteria, we expressed a desire to know how the criteria would be met.

Another observation is that the revised PSAR does not clearly state that the emergency diesels are split with no automatic cross-ties.

cc:
P. A. Morris
S. Levine
D. F. Skovholt
D. Thompson
R. D. DeYoung
J. F. Newell
D. R. Muller
C. G. Long
G. Burley
N. H. Davison
S. S. Pawlicki
R. L. Waterfield
R. A. Birkel
K. Kniel
J. A. Murphy
M. Dunenfield
D. F. Ross
B. Grimes
P. S. Check
CO (2)

POOR ORIGINAL

Distribution
Suppl.
RPB-3 Reading

1446 329

OFFICE ▶	RPB-3/DRL	RPB-3/DRL				
SURNAME ▶	DRoss:pt DRC	CGLong CGL				
DATE ▶	10-25-67	10-25-67				

Form AEC-318 (Rev. 9-53)

U.S. GOVERNMENT PRINTING OFFICE : 19-- -O-21- 629