FORM 1

ENGINEERING EVALUATION REPORT	EER No. 92-0352 Rev. No. 0 Page No. 1

1. Reference ACR, LER, WR/JO, etc. 1-92-018 File No. 8220
2. Brief description of item/activity CBEAF SINGLE FAILURE OPERABILITY ASSESSMENT

■ Class A (Q-List)
☐ Class B-3 (FP-Q)
☐ Other

3. Disposition
   - ☐ a. Use/acceptable as is
   - ☐ b. Permanent repair/rework
   - ■ c. Temporary change; Expiration date 4/1/93
     - ☐ Temporary repair
     - ☐ Temporary condition
     - ■ OA/STSI (☐ Preliminary)
   - ☐ d. Other

*Qualified Technical Reviewer if Quality Class A and box 4b checked

4. Final Resolution
   - ☐ a. Complies with system DBDs, FSAR, design, drawing, code, and quality requirements.
   - ■ b. Acceptable deviation from system DBD, FSAR, design, drawing, code, or quality requirements. Safety review (AI-109) required.

   Yes ☐ No ■ Changes to system DBD, FSAR, design, drawing, code, or quality requirements are required due to this EER. (Provide details on Attachment 3 within 10 working days from EER approval.)

5. Follow-up Requirements
   - ☐ a. Surveillance activities, responsible group(s)
   - ■ b. Action items, responsible group(s) NED, OM/M
   - ☐ c. None

FOR INFO ONLY
RECEIPT ACKNOWLEDGEMENT NOT REQUIRED

6. Review/Approval

			Print	Signature	Date
		Responsible Engineer *	N.D. SMITH	[signature]	10/5/92
		Group	NED/BESS/I&C		
■ Yes	☐ No	Technical Review *		Keith L. Allen	10/7/92
		Engineering Supervisor	R.N. ALLEN	R.N. Allen	10/7/92
☐ Yes	■ No	EQ Review			
☐ Yes	■ No	ANII Review			
■ Yes	☐ No	PNSC Review		R.E. Morgan	10-15-92
		Approved	R.N. ALLEN PER TELECOM WITH R.E. HELME	RMG	10-30-92

INDEPENDENT SAFETY REVIEWS (Reference 6.2.6)

REQ	NOT REQ	REVIEW	COMPLETED	DATE
■	NDS 10/5/92	CNSR (Prior to Approval)	REF: NSR-92-224	10/29/92
☐	■	CNSR (Review afer Aproval)		

7. Distribution:

BNP Records Management (EER File)
NED BESS Section Manager
Manager - Maintenance
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PROBLEM DESCRIPTION:

This EER is being written to provide an operability assessment under the guidance provided in ENP-12. The necessity for this EER stems from the fact that single failure modes to the Control Building Emergency Air Filtration System (CBEAF) have been identified. One of the two single failure modes can be eliminated in a relatively short time frame (≈ 2 months). The other requires extensive modification to the chlorine detection logic.

The proposed resolution to the above stated problem will be included in a two phase modification. Phase I would require modification to the start logic of both trains of EAF and the relocation of the Chlorine detection system logic power. This work would be required to be complete prior to start-up of either unit. Phase II would contain the permanent design required to eliminate the Chlorine detection system single failure input to the EAF. The work to install this design would take place during power operation.

This EER will demonstrate that although a single failure within the logic of the CBEAF (Chlorine Detection input) does not meet the design criteria for the CBHVAC as stated in the FSAR, the consequences of that single failure will not result in a situation in which the NRC Acceptance Limit for radiological consequences to Control Room personnel could be exceeded. The conclusion reached in this EER is that it is not acceptable to allow power operation of either unit until NRC acceptance of the plan outlined in this EER is obtained. Details of the single failure modes and how the problem was identified follow.

During investigation of an Operating Experience (OE) Report #5366 concerning "preferred/standby" logic for Standby Gas trains, it was noted that the Control Building HVAC Emergency Air Filtration (EAF) also utilized a "preferred/standby" logic configuration. As the Standby Gas Trains do not use the "preferred/standby" logic there was no problem with the existing design (Ref. DBD-10 for SBGT design details). The logic for the CBEAF was also reviewed and it was revealed that previously unidentified single failures could occur (Ref. ACR B92-642).

PROBLEM DESCRIPTION (Cont.):

Other than normal ventilation and heating/cooling of the Control Building, the CBHVAC system must provide habitability during three different design basis events. The first concerns a radiation event (Main Steam Line Break [MSLB] or Loss of Coolant Accident [LOCA]). The second event concerns the complete rupture of the 55 ton chlorine tank car located near the Service Water Building. The third is a smoke event.

In the radiation event the CBHVAC system is required to isolate and enter the recirculation mode on a Control Room Area or Control Room Intake High Radiation signal from the Area Radiation Monitoring System (ref.: CBHVAC System DBD-37, Section 1.3.1).

Upon receipt of a high radiation signal, the CBHVAC System is automatically realigned to the emergency mode of operation. The fresh air inlets close isolating the control room. At the same time, the emergency air filtration unit begins operation, recirculating control room air and providing filtered makeup air to minimize contaminated build-up and provide positive pressure in the occupied areas. The system responds to a smoke event in the same manner it does for radiation.

In the event of a Chlorine release the CBHVAC goes into full recirculation mode, with no outdoor air intake (except for the battery rooms). The emergency filtration trains do not start since they do not remove chlorine and may be damaged by it (ref.: CBHVAC System DBD-37, Section 1.3.2). The chlorine detection system is designed "fail-safe" such that any failure (i.e. loss of power, detector failure, etc.) will isolate the control room in the same manner as a true chlorine signal.

The CBEAF system is designed to meet the single failure criteria as described in IEEE 279-1971." (ref.: UFSAR Section 9.4.1.3.c, Safety Evaluation). In contradiction to the above requirement, the following describes how the single failure criteria is not met.

PROBLEM DESCRIPTION (Cont.):

Single Failure 1:

Loss of power to Train A Logic

Resultant:

The loss of power would de-energize Chlorine detectors 1X/2X-AT-2977 (LL-09046 Sh. P63A) which would in turn de-energize relays 3-63E and 3-63F. Contacts 1-2 of each relay would open and de-energize relays 3-63A and 3-63B. Contacts 5-6 and 7-8 of relay 3-63A would open thus preventing the ability to start either train of CBEAF.

Single Failure 2:

Loss of power to Train B Logic with Train B in preferred and Train A in Standby

Resultant:

The logic configuration is designed such that an automatic start signal (radiation or smoke) would energize relay 3-65E. This would start the fan inlet and outlet dampers opening which in turn would start the fan when the dampers reached full open. Concurrently, a 10 second time delay relay, 62-65 begins timing. If Fan B does not start within 10 seconds, changing the state of the 42X-1 contacts (LL-9252-30), relay 62-65 will close contacts 1-5 thus energizing relay 3-65A which in turn sends a start signal to Train A.

With a loss of power to Train B, the train will not start and the timing relay 62-65 does not energize to time out to send a start signal to train A. Train A could be started manually by placing the control switch to the "ON" position. In addition, if a smoke or radiation signal was present, Train A would start automatically by placing the control switch in the "preferred" position.

Note: The same problem exists with Train A in preferred, Train B in Standby, but both scenarios are overridden by the chlorine logic failure.

EVALUATION/DISPOSITION:

In order to resolve the problem identified, an understanding of the present system design requirements is essential.

The design basis for the Control Room HVAC System states "The Control Building HVAC System shall be designed to permit continuous occupancy of the control room emergency zone under normal operating conditions and under the postulated design basis accidents throughout the life of the plant." (DBD-37, Section 1.1.1.1.1)

As discussed in the "Problem Description" section of this EER the system must maintain habitability during three different events. Each of these will be discussed in detail.

Radiation Protection:

10CFR50 App. A, GDC-19 states "Adequate radiation protection shall be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body, or its equivalent to any part of the body, for the duration of the accident." NUREG-75/87 (Standard Review Plan) Section 6.4, p. 5, establishes the whole body equivalent as 30 rem to the thyroid and 30 rem to the skin. The CBEAF is designed, installed and maintained Q-List (Class A) as the system provides protection against radiation doses as a result of FSAR Chapter 15 radiation release events.

Operation of the Control Room Emergency Ventilation Subsystem is automatically initiated by abnormally high radiation levels detected by the Control Building Area Radiation Monitors. Should any of the monitors detect high radiation, the Control Room annunciator is actuated and the following control actions occur automatically:

- The normal intake damper for the control room is closed and the emergency makeup damper is opened.
- The Control Room Emergency Ventilation Subsystem is placed in service, with the emergency recirculation damper open.
- The Control Building exhaust fan is shut down and the exhaust damper closed.

EVALUATION/DISPOSITION (Cont.):

Radiation Protection (Cont.):

- The Cable Spreading Room and Mechanical Equipment Room ventilation fans are shut down.

Chlorine Protection:

One of the hazards which the CBHVAC system must cope with is toxic gas. NUS performed a study (NUS-3697 Rev. 2) to address Item III.D.3.4 "Control Room Habitability" of NUREG 0737 "Clarification of TMI Action Plan Requirements". The NRC recommended that the guidance of Regulatory Guides 1.78 and 1.95 be used in the analysis. Scoping calculations were performed for postulated spills of different toxic hazards per the guidance of Reg. Guide 1.78. The results of the NUS study determined that the only significant toxic chemical is the on-site 55 ton tank car of liquefied chlorine gas. A Chlorine Spill Analysis summary is contained in UC-07582, Study of Accidental Chlorine Release.

The allowable limits of chlorine gas as established in Reg. Guide 1.78 and the Standard Review Plan (NUREG-75/087) are as follows:

- Long term limit (1 hour or greater): the limit assigned for occupational exposure (40 hour week) - 1 ppm by volume

- Short-term limit (2 minutes to 1 hour): Limit that will assure that the operator will not suffer incapacitating effects after 1-hour exposure - 4 ppm

- Protective Action Limit (2 minutes or less): A limit that will assure that the operator will quickly recover after breathing apparatus is in place. In determining this limit, it should be assumed that the concentration increases linearly with time from zero to two minutes and that the limit is attained at two minutes - 15 ppm ($45 mg/m^3$).

EVALUATION/DISPOSITION (Cont.):

Chlorine Protection (Cont.):

The NRC has stated that "adequate protection from an on-site chlorine release will be achieved if provisions are included in the plant design to automatically isolate the Control Room to limit the potential build-up of chlorine within the control room and if equipment and procedures are provided to assure immediate use of breathing apparatus by the control room operators." (Ref. MISC-00678, Safety Evaluation Report of BSEP 1&2 - License Application with Appendices through 7/26/76 - Pages 7-10, 9-12 & 9-13, 1/01/73)

Reg. Guide 1.95 also states that "The Chlorine Detection Subsystem should automatically isolate the control room and provide an indication in the control room to alert the control room operators of a chlorine release.

The chlorine detection system is Non-Safety (downgraded from Class A in EER No. 85-0208) and designed seismically. No change to the current safety classification is anticipated as part of the modification (PM 92-108) to the detection logic. The FSAR Section M14.5 and UFSAR, Table 6.4.4-2 state that "No single failure in the Chlorine Detection System will prevent automatic isolation of the control room ventilation system in the event of an accident which causes the chlorine detectors to alarm" (ref.: CBHVAC System DBD-37, Section 3.1.6.3.).

Should any of the chlorine analyzers detect chlorine, the control room annunciator is actuated and the following control actions occur automatically:

- The normal intake damper for the control room is closed
- The Control Room Emergency Ventilation Subsystem (Emergency Air filtration fan) is isolated.
- The Control Building exhaust fan is shut down and the exhaust damper closed.
- The Cable Spreading Room and Mechanical Equipment Room ventilation fans are shut down.

EVALUATION/DISPOSITION (Cont.):

Chlorine Protection (Cont.):

In addition to the automatic actions described for a Chlorine release event the Brunswick Control Room maintains 12 self-contained breathing apparatus' for use by Control Room personnel during emergencies if desired.

Smoke Protection:

The FSAR Section 7.18-9 states "Sufficient controls shall be available to reduce the volume of normal make-up air/or to place the Control Room Emergency Ventilation Subsystem in service to remove smoke filled air from the control room."

A smoke and heat detection system is provided in the control room to alert the operator of an abnormal condition which could require control room isolation. Should smoke filled air be drawn into the control room, smoke detectors within the control room and mechanical equipment room alarm.

Controls are available to reduce the volume of normal make-up air, and/or to place the Emergency Air Filtration trains in service. Controls also permit complete or partial bypassing of the recirculation system and exhausting direct to atmosphere.

On detection of smoke and/or heat the following automatic actions occur:

- The normal intake damper for the control room is closed and the emergency makeup damper is opened.
- The Control Room Emergency Ventilation Subsystem is placed in service, with the emergency recirculation damper open.
- The Control Building exhaust fan is shut down and the exhaust damper closed.
- The Cable Spreading Room and Mechanical Equipment Room ventilation fans are shut down.
- Note: The actions stated above are the same as those that result from a High Radiation Isolation.

EVALUATION/DISPOSITION (Cont.):

As stated in the Problem Description section of this EER there are single failures in the CBEAF logic which would prevent the system from performing its safety function if they were to occur simultaneously with a design basis accident, or shortly thereafter.

In reviewing the CBEAF logic it can be shown that the single failures are introduced by logic design errors. The first is the original design of the start logic itself. The CBEAF trains were intended to be redundant to satisfy the single failure criteria of IEEE 279-1971. In order to meet this intent a mechanism had to be included in the start logic which would start the standby train should the preferred train fail to start as required.

The design provided a ten second timer which would start timing at the same time an initiation signal to the start logic was received. If the preferred train started normally the contacts upstream of the timer relay contacts would open thus preventing a start signal to the standby train. But, should the train in preferred fail to start the timer would time-out which in turn would energize a relay within the preferred trains logic sending a start signal to the stand-by train.

The problem arises when loss-of-power scenarios are introduced to the logic. Should power be lost to whichever train has been placed in the "preferred" position the fan is not able to start and the timer which is supposed to send the Fan "fail-to-start" signal to the standby train is never energized and therefore never sends the required signal.

To resolve this problem, a simple change to the start logic is required. The change involves reversing the timer logic so that the "preferred train fail-to-start" relays 3-62A, 3-65A are de-energized on a fail-to-start signal. This will automatically place the stand-by train in the "preferred" mode upon a loss of power to the preferred train or if the preferred train fails to start (the original design intent). In order to implement this change other minor circuit changes are required. The end result is that a loss of power or failure of the preferred train to start will automatically send an initiation signal to the stand-by train. This will fulfill the design intent of the CBEAF as stated in the FSAR.

EVALUATION/DISPOSITION (Cont.):

The second issue which must be addressed is the interface of the CBEAF with the chlorine detection logic. As stated in the chlorine protection discussion, the chlorine detection logic is "fail safe" to meet the requirements of the single failure criteria. As such the system does meet the original design intent. Any single component failure within the chlorine detection system logic will isolate the Control Building and prevent the EAF from starting or shutting it down if operating.

The issue of whether or not the CBEAF was operable regardless of the Chlorine detection system logic input to it has been addressed in the past. During work to replace the original Chlorine detectors, a technical specification interpretation was requested specifically asking if the failure of a chlorine detector would render the CBEAF inoperable. The response is included in TSI Serial No. 85-13. The response addressed the fact that if a chlorine detector failed the system would align into the full recirculation mode of operation (no make-up air). This in turn would reduce the positive pressure in the control room increasing the unfiltered inleakage from 275 scfm (CBEAF running) to approximately 1375 scfm (CBEAF isolated).

The TSI then references the LOCA dose values contained in NUS-3697 Rev. 2 for unfiltered inleakage. The study shows that airborne radioactivity in the control room will peak and level off at 2.8 rem thyroid and 0.004 rem whole body for in-leakage of 100,000 scfm or greater. When combined with other sources of radiation to the control room, the sum totals are 0.415 rem whole body and 2.8 rem thyroid. The TSI then reaches the conclusion that "neither a chlorine detector failure nor a CBEFS isolation from the chlorine detection system will create a problem with CBEFS operability per Design Criterion 19." This TSI has since been retracted.

EVALUATION/DISPOSITION (Cont.):

Since the time the TSI was issued (1985), several factors have changed the calculated doses expected in the control room as a result of Chapter 15 radiological events. Following TMI the adequacy of operator protection from radiation events came into question. As part of the TMI Action Plan, BNP was required to evaluate the existing habitability system against the Standard Review Plan (NUREG-75/087 Rev. 1). A report was submitted to the NRC in 1980 and a subsequent revision to the report was provided to the NRC in March of 1983. A safety evaluation was issued based on the 1983 revision to this document (NLU-83-673).

As part of the 1983 revision, BNP committed to maintaining the Control Room at 1/8 inch positive pressure during the radiation recirculation mode. After intensive effort directed at the ability to maintain 1/8 inch positive pressure, CP&L determined that this was not economically feasible. Instead, after negotiating with the commission, an analysis was performed in 1985 to determine the effect of increased unfiltered inleakage on the dose rates to the control room operators (NUS-4758).

In order to perform the analysis (NUS-4758) a new value for unfiltered inleakage was required. The Control Room was tested using the methodology outlined in the Standard Review Plan (NUREG-75/087 Rev. 1, Section 6.4) and Regulatory Guide 1.95, Revision 1, Regulatory Position 5. One of the items discussed in the Standard Review Plan is the method of determining the infiltration rate for isolated control rooms with neutral pressure. The document states "The leakage from the control room when pressurized to 1/8-inch water gauge is calculated on the basis of the gross leakage data. One-half of this value is used to represent the base infiltration rate."

The results of pressurization testing determined that the conservative exfiltration rate was 6000 scfm. One-half of that value (3000 scfm) was used as an input to the NUS-4758 analysis. Results of the reanalysis indicate that the dose rates at the increased unfiltered inleakage rate of 3000 cfm would not exceed General Design Criteria 19 limits. This analysis was performed for LOCA conditions. It was on this basis that the TSI (85-13) was determined.

EVALUATION/DISPOSITION (Cont.):

During the commission's review of this document (NUS-4758), questions arose on the doses during a Main Steam Line Break accident. A second SE on Control Room Habitability as related to radiation protection was issued in 1989 (NRC-89-103). This is the last SE received from the commission concerning control room habitability.

As part of the SE referenced above the commission performed an independent assessment of the control room radiological habitability for the steam line break. The commission states "The resulting doses in the control room, based upon the tabulated assumptions for the course of the steam line break accident, are 19 rem to the thyroid and less than 0.1 rem to the whole body and skin."

The commission confirmed CP&L's results in their independent analysis that the doses associated with a MSLB were significantly higher than those previously calculated. The main steam line break accident is now the more limiting accident for the control room radiological habitability assessment for the Brunswick 1 and 2 control room.

Though the SE determines that the MSLB is the limiting accident, it also determines that the control room meets the requirements of GDC 19 with respect to maintaining the control room in a safe and habitable condition under accident conditions. The conclusion reached by the commission was based on the fact that some positive pressure would be obtained by the operation of the EAF trains. The commission states "The licensee has demonstrated that with the pressurization test results obtained in the Brunswick 1 and 2, control room operators will be adequately protected."

As discussed previously the protection provided by the EAF can be defeated by the introduction of a single failure in the chlorine detection logic. Although the single failure in the chlorine detection logic would fail the EAF in the safe condition for a chlorine event, the control room is then vulnerable to a radiation event.

EVALUATION/DISPOSITION (Cont.):

In order to eliminate this problem and bring the EAF system into compliance with its design requirements, a modification is required. This modification will redesign the chlorine detection logic and its interface to the EAF such that it will not present a single failure input to the EAF.

The modification referenced above is extensive and will require several months of engineering before it will be released to BNP. This EER will demonstrate that although a single failure within the logic of the CBEAF does not meet the design criteria for the CBHVAC as stated in the FSAR, the consequences of that single failure will not result in a situation in which the NRC Acceptance Limit for radiological consequences to Control Room personnel could be exceeded.

Given that the failures identified can render the EAF inoperable during a radiation event, a study to determine whether or not the calculated dose received by the control room operator would exceed the limits of GDC 19 was requested from UE&C (Reference CP&L Calc. No. 0VA-0041).

The assumptions used in this study were that a MSLB had occurred. Concurrent with the MSLB a single failure prevents both trains of CBEAF from starting. The results show that the control room operator would receive approximately 96% of the allowed dose (30 rem thyroid) in six hours. The dose continues to increase up to 29.5 rem in approximately 24 hours. The dose then levels off at 29.5 rem for 30 days (duration of accident). The results of this analysis show that even without both trains of EAF the control room operator dose rates are within GDC 19 limits. Even though there is very little margin in the analysis the assumptions used are conservative.

Some of the conservatism included in the analysis is described here for understanding. It is assumed that for the design basis steam line break that a complete rupture of a main steam line takes place in the turbine building. 140,000 lbs of steam and water is released which in turn fails the turbine building enclosure.

EVALUATION/DISPOSITION (Cont.):

A puff release is assumed which then envelopes the Control Building. In order to determine the duration of Control Building exposure to the plume, a uniform spherical cloud which passes the Control Building at a conservative 1 meter per second wind velocity is assumed. To account for potential for non-spherical shapes and possible reduced wind velocity a conservative factor of 10 times the exposure duration is applied.

An indication of the conservativeness of the factor of 10 is that if the plume were assumed to be not spherical, but turbine building shaped, and to somehow approach the Control Building end-on; and if the inferred (UFSAR Section 2.3.6) plant design basis ground level release wind velocity of 0.54 meter/sec were used, the calculated increase in control room doses would be less than one-third the result obtained using the factor of 10.

Another factor which adds conservatism to this analysis is the fact that the design basis main steam line break as defined in the FSAR assumes a 10.5 second MSIV closure time after the break. In actuality the technical specification required closure time is ≥ 3 and ≤ 5 seconds (Technical Specification 3/4.4.7). The differences in the amount of steam and water released with a 3 to 5 second MSIV closure time have not been calculated but can be assumed to be significantly less than that released in 10.5 seconds. This would serve to reduce the size and activity of any release.

As in all habitability calculations for MSLB performed to date, no credit has been taken for atmospheric dilution. This is due to the fact that the turbine building puff release is in such close proximity to the control building intake plenum. All the above conservatism support the fact that doses received by the control room operations personnel would remain below GDC 19 limits. An independent review of the analytical methods and results obtained by UE&C has been performed by NUS (Reference CP&L Calc. No. 0VA-0042) which further confirms the validity of the study.

In addition to the dose calculation. a Probability Risk Assessment (PRA) was also performed to determine the probabilities of a main steam line break concurrent with a loss of EAF function due to a Chlorine Detection System failure. The results of that review show that the probability would be 1.1×10^{-7}.

EVALUATION/DISPOSITION (Cont.):

Based on the data presented in this EER, it can be demonstrated that although the EAF system does not meet the single failure criteria of IEEE 279-1971 fcr a radiation event, the probability of a MSLB concurrent with a failure which prevents the EAF from starting is extremely unlikely. In addition, should this scenario take place it can be shown by analysis that the GDC 19 dose limits for control room personnel will not be exceeded.

This EER will require review by the PNSC due to the reduced margin of safety as calculated in the UE&C dose calculation. The previous maximum calculated dose for any Design Basis Accident to the control room operator was 19 rem as stated in the final SE on control room habitability (NRC-89-103). This EER demonstrates that the maximum dose expecte in the control room would be 29.5 rem for a time period commencing with start-up of either unit and ending four months later. This time period is based on the assumptions used in the PRA.

The conclusion reached in this EER is that it is not acceptable to allow power operation of either(both) unit(s) until NRC acceptance of the plan outlined in this EER is obtained. Once NRC acceptance is obtained power operation would be allowed for a duration of four months (basis for PRA Analysis) with the knowledge that Plant Modification PM 92-108, Phase I will be installed and operable prior to start-up. The Phase I work will include the elimination of the single failure associated with the start logic of the EAF itself (timer logic problem) and will relocate the chlorine detector power to a UPS supply. By relocating the power for the chlorine detection logic to a UPS source a loss of Divisional power will not automatically isolate the CBEAF. This will serve to increase the reliability of the chlorine detection logic but will not eliminate the single failure input to EAF.

Phase II to the plant modification will be issued in a field revision and will include the permanent resolution of the Chlorine detection single failure input to EAF. Phase II can be implemented during unit(s) operation and will be declared operable prior to four months post start-up.

CORRECTIVE ACTIONS:

A benefit of installing the permanent chlorine detector system logic in the winter months is biological marine growth is at its lowest level. This will allow the temporary removal of the chlorine tank car from the owner protected area and allow work on the Chlorine Detection System without tech. spec. LCO's.

Design, and install Phase I of PM 92-108 which resolves the original loss-of-power single failure points within the start logic of the CBEAF. This will include the relocation of the power for Chlorine detection logic to another source. This work will take place prior to start-up of either unit.

Design and install Phase II of PM 92-108 which resolves the single failure input of the Chlorine detection logic. This will be accomplished by installing single failure proof/redundant Chlorine detection logic. This work may be completed during unit operation if required. This work must be operable no later than four months after start-up of either/both unit(s).

No other compensatory actions are required as a result of this EER.

ACCEPTANCE TESTING:

All necessary acceptance testing will be performed within the plant modification acceptance testing section. As this EER only provides the necessary operability assessment to allow power operation until a permanent chlorine detection system resolution can be implemented no other acceptance testing is necessary.

ACTION ITEMS:

Action Items will be issued as follows:

Action Item No. 1

NED - Prepare Plant Modification 92-108 (Phase I) to eliminate known single failures within the start logic of the CBEAF. Relocate the power to the Chlorine detection logic such that a loss of either Div. I or Div. II power will not prevent both trains of CBEAF from operating.

Action Item No. 2

NED - Prepare Field Revision (Phase II) to Plant Modification 92-108 to eliminate known single failure input of the Chlorine detection logic to the CBEAF.

Action Item No. 3

OM/M - Install PM 92-108 Phase I design and acceptance test according to instructions provided in the modification prior to start-up.

Action Item No. 4

OM/M - Install PM 92-108 Phase II design and acceptance test according to instructions provided in the modification no later than four months after start-up of either/both unit(s)

Action Item No. 5

Brunswick Licensing Unit - Obtain NRC approval of the plan outlined in this EER prior to startup or track completion of Phase II to ensure completior. prior to startup.

FORM 4
EER ACTION ITEM NOTIFICATION

EER No. 92-0352
Rev. No. 0
Page No. 20

TO:
- ☐ Manager - Operations Staff
- ☐ Manager - Maintenance
- ☐ Technical Support Manager - ________
- ■ MANAGER - NED/BESS/I&C

FROM: Manager - NED/BESS

SUBJECT: EER Action Item No. 1
Corporate Priority 2

Is this EER a temporary change? ■ Yes ☐ No
Expiration date 4/1/93
☐ Temporary repair ☐ Temporary condition ■ OA/STSI
Is this EER action item required for resolution of the temporary change? ■ Yes ☐ No

The following Action Item is assigned to you by the above Engineering Evaluation for completion no later than 10/30/92:

PREPARE PM 92-108 (PHASE I) TO ELIMINATE KNOWN SINGLE FAILURES WITHIN THE START LOGIC OF THE CBEAF.

This notification was reviewed with BEN WHITE (name) of the responsible organization, on 10/5/92 (date). Please sign below and return this notification upon the satisfactory completion of the specified action item.

[signature] / 10/5/92 — Responsible Engineer, Date
Ben R White / 10/5/92 — Responsible Manager, Date

To: Engineering Data Coordinator

The above action item requirement has been completed satisfactorily. The reference document (WR/JO number, procedure, or DSR reference) implementing this item is : PM 92-108 (PHASE I) 10-30-92

[signature] for B.R. WHITE / 12/1/92 — Responsible Manager, Date

Distribution: (by EDC)
BNP Records Management
Responsible Engineer
NED On-Site Design Control

FORM 4
EER ACTION ITEM NOTIFICATION

EER No. 92-0352
Rev. No. 0
Page No. 21

TO: ☐ Manager - Operations Staff
☐ Manager - Maintenance
☐ Technical Support Manager - ______________
■ MANAGER - NED/BESS/I&C

FROM: Manager - NED/BESS

SUBJECT: EER Action Item No. 2
Corporate Priority 2

Is this EER a temporary change? ■ Yes ☐ No
Expiration date 4/1/93
☐ Temporary repair ☐ Temporary condition ■ OA/STSI
Is this EER action item required for resolution of the temporary change? ■ Yes ☐ No

The following Action Item is assigned to you by the above Engineering Evaluation for completion no later than 1/6/93 :

PREPARE FIELD REVISION (PHASE II) TO PM 92-108 TO ELIMINATE KNOWN SINGLE FAILURE INPUT OF THE CHLORINE DETECTION LOGIC TO THE CBEAF

This notification was reviewed with BEN WHITE (name) of the responsible organization, on 10/5/92 (date). Please sign below and return this notification upon the satisfactory completion of the specified action item.

[signature] 10/5/92 [signature] 10/5/92
Responsible Engineer Date Responsible Manager Date

To: Engineering Data Coordinator

The above action item requirement has been completed satisfactorily. The reference document (WR/JO number, procedure, or DSR reference) implementing this item is : ______________

______________ / ______________
Responsible Manager Date

Distribution: BNP Records Management
(by EDC) Responsible Engineer
NED On-Site Design Control

FORM 4
EER ACTION ITEM NOTIFICATION

EER No. 92-0352
Rev. No. 0
Page No. 22

TO: ☐ Manager - Operations Staff
☐ Manager - Maintenance
☐ Technical Support Manager - ______________
■ MANAGER - OM/M

FROM: Manager - NED/BESS

SUBJECT: EER Action Item No. 3
Corporate Priority 2

Is this EER a temporary change? ■ Yes ☐ No
Expiration date 4/1/93
☐ Temporary repair ☐ Temporary condition ■ OA/STSI
Is this EER action item required for resolution of the temporary change? ■ Yes ☐ No

The following Action Item is assigned to you by the above Engineering Evaluation for completion no later than ~~TBD~~ * 1/30/93 NPS 12/1/92.

INSTALL P·92-108 PHASE I DESIGN AND ACCEPTANCE TEST ACCORDING TO INSTRUCTIONS PROVIDED IN THE MODIFICATION.

This notification was reviewed with CRAIG MARCH (name) of the responsible organization, on 10/5/92 (date). Please sign below and return this notification upon the satisfactory completion of the specified action item.

[signature] 10/5/92 [signature] 10/5/92
Responsible Engineer Date Responsible Manager Date

~~* PRIOR TO START-UP OF EITHER UNIT~~ NPS 12/1/92

To: Engineering Data Coordinator

The above action item requirement has been completed satisfactorily. The reference document (WR/JO number, procedure, or DSR reference) implementing this item is : ______________

______________ / ______________
Responsible Manager Date

Distribution: BNP Records Management
(by EDC) Responsible Engineer
NED On-Site Design Control

FORM 4
EER ACTION ITEM NOTIFICATION

EER No. 92-0352
Rev. No. 0
Page No. 23

TO: ☐ Manager - Operations Staff
☐ Manager - Maintenance
☐ Technical Support Manager - ______
■ MANAGER - OM/M

FROM: Manager - NED/BESS

SUBJECT: EER Action Item No. 4
Corporate Priority 2

Is this EER a temporary change? ■ Yes ☐ No
Expiration date 4/1/93
☐ Temporary repair ☐ Temporary condition ■ OA/STSI
Is this EER action item required for resolution of the temporary change? ■ Yes ☐ No

The following Action Item is assigned to you by the above Engineering Evaluation for completion no later than 4/1/93:

INSTALL PM 92-108 PHASE II DESIGN AND ACCEPTANCE TEST ACCORDING TO INSTRUCTIONS PROVIDED IN THE MODIFICATION PRIOR TO 4/1/93

This notification was reviewed with CRAIG MARCH (name) of the responsible organization, on 10/5/92 (date). Please sign below and return this notification upon the satisfactory completion of the specified action item.

[signature]	10/5/92	[signature] Ben R White	10/5/92
Responsible Engineer	Date	Responsible Manager	Date

To: Engineering Data Coordinator

The above action item requirement has been completed satisfactorily. The reference document (WR/JO number, procedure, or DSR reference) implementing this item is : ______

______ / ______
Responsible Manager Date

Distribution: BNP Records Management
(by EDC) Responsible Engineer
NED On-Site Design Control

FORM 4
EER ACTION ITEM NOTIFICATION

EER No. 92-0352
Rev. No. 0
Page No. 23A

TO: ☐ Manager - Operations Staff
☐ Manager - Maintenance
☐ Technical Support Manager - ________
■ MANAGER - BRUNSWICK LICENSING UNIT

FROM: Manager - NED/BESS

SUBJECT: EER Action Item No. 5
Corporate Priority 2

Is this EER a temporary change? ■ Yes ☐ No
Expiration date 4/1/93
☐ Temporary repair ☐ Temporary condition ■ OA/STSI
Is this EER action item required for resolution of the temporary change? ■ Yes ☐ No

The following Action Item is assigned to you by the above Engineering Evaluation for completion no later than DEC. 1, 1992 :

OBTAIN NRC APPROVAL OF THE PLAN OUTLINED IN EER 92-0352 PRIOR TO STARTUP OR TRACK COMPLETION OF PHASE II TO ENSURE COMPLETION PRIOR TO STARTUP

This notification was reviewed with BILL MURRAY/TONY HARRIS (name) of the responsible organization, on 10/30/92 (date). Please sign below and return this notification upon the satisfactory completion of the specified action item.

[signature], 10/30/92	[signature], 10/30/92
Responsible Engineer / Date	Responsible Manager / Date

FACTS: 92G0486

To: Engineering Data Coordinator

The above action item requirement has been completed satisfactorily. The reference document (WR/JO number, procedure, or DSR reference) implementing this item is : FACTS 92G0486

[signature] FOR B.R. WHITE, 12/1/92
Responsible Manager Date

Distribution: BNP Records Management
(by EDC) Responsible Engineer
NED On-Site Design Control

Attachment 1
Nuclear Project Prioritization Process
Scheduling Index Worksheet

1) Project I.D. ________ Priority # 2 Date 8-15-92

Title Single Failure of CBHVAC Emergency Filtration Trains

2) Scheduling Index Determination Initial X Revisit ___

IMPACT	SCALING FACTOR
High Positive Impact	1.0
Medium Positive Impact	0.5
Low Positive Impact	0.2
No Impact	0
Low Negative Impact	-0.2
Medium Negative Impact	-0.5
High Negative Impact	-1.0

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REV. No. 0
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Attribute	Scaling Factor		Weight			Basis for Scaling Factor*
Nuclear Safety	0	x	28	=	0	
Personnel/Public Safety	.5	x	27	=	~~14~~ 13.5 TFD 8-15-92	Enhances radiation protection for operators during accident.
Regulatory Posture	1	x	10	=	10	Brings system in line with commitments.
Unit Availability	0	x	10	=	0	
Unit Capacity	0	x	8	=	0	
ALARA	0.2	x	7	=	1.4	Reduces dose rates to operators during accident.
Cost Effectiveness	0	x	6	=	0	
Plant Enhancement	0	x	4	=	0	
			TOTAL		~~25.4~~ 24.9 TFD 8-15-92	

Scheduling Index ~~26~~ 25 TFD 8-15-92
(Round TOTAL to nearest whole number)

3) Reviews/Approvals

Initiator *Thomas F. Dwane* Date 8-15-92
Others** ________ Date ________

*Basis required for all nuclear safety scaling factors including zero with reference to 50.59 evaluation, PRA, FSAR reference, JCO, etc. For other attributes basis only required when scaling factor is other than zero.

**Department specific

SAFETY REVIEW COVER SHEET

DOCUMENT NO. EER 92-0352 REV. NO. 0

DESCRIPTION OR TITLE: CBEAF SINGLE FAILURES

1. Assigned Responsibilities:
   - Safety Analysis Preparer: N.D. SMITH
   - Lead 1st Safety Reviewer: N.D. SMITH
   - 2nd Safety Reviewer: K.L. ALLEN
2. Safety Analysis Preparer: Complete PART I, SAFETY ANALYSIS
   Safety Analysis Preparer [signature] / 9/29/92
   SIGNATURE DATE
3. Lead 1st Safety Reviewer: Complete Part II, Item Classification.
4. Lead 1st Safety Reviewer: Part III may be completed. If either question 1 or 2 is "yes," then Part IV is not required.
5. Lead 1st Safety Reviewer: Determine which DISCIPLINES are required for review of this item (including own) and mark the appropriate block(s) below.

DISCIPLINES Required:	(Print Name)	Signature/Date (Step 7)
[] Nuclear Plant Operations		
[] Nuclear Engineering		
[] Mechanical		
[] Electrical		
[✓] Instrumentation & Control	N.D. SMITH	[signature] 9/29/92 NDS 10/30/92
[] Structural		
[] Metallurgy		
[] Chemistry/Radiochemistry		
[] Health Physics		
[] Administrative Controls		

6. A QUALIFIED SAFETY REVIEWER will be assigned for each DISCIPLINE marked in step 5 and his/her name printed in the space provided. Each person listed shall perform a SAFETY REVIEW and provide input into the Safety Review Package.
7. The Lead 1st Safety Reviewer will assure that a Part III or Part IV is completed (see step 4 above) and a Part VI if required (see 9.d of Part II). Each person listed in step 5 shall sign and date next to his/her name in step 5, indicating completion of a SAFETY REVIEW.
8. 2nd Safety Reviewer: Perform a SAFETY REVIEW in accordance with Section 8.0.
   2nd Safety Reviewer [signature] KLA 10/30/92 Date 10/7/92
   DISCIPLINE: I&C / BESS
9. PNSC review required? If "yes," attach Part V and mark reason below: Yes [■] No []
   - [■] Potential UNREVIEWED SAFETY QUESTION
   - [] Question 9 of Part IV answered "Yes"
   - [] Other (specify):

PART I: SAFETY ANALYSIS
(See instructions in Section 8.4.1)
(Attach additional sheets as necessary.)

DOCUMENT NO. EER 92-0352 REV. NO. 0

DESCRIPTION OF CHANGE: SEE ATTACHED

ANALYSIS: SEE ATTACHED

REFERENCES:

SEE ATTACHED

PART II: ITEM CLASSIFICATION

DOCUMENT NO. EER 92-0352 REV. NO. 0

	Yes	No
1. Does this item represent:		
a. A change to the facility as described in the SAFETY ANALYSIS REPORT?	■	[]
b. A change to the procedures as described in the SAFETY ANALYSIS REPORT?	[]	■
c. A test or experiment not described in the SAFETY ANALYSIS REPORT?	[]	■
2. Does this item involve a change to the individual plant Operating License or to its Technical Specifications?	[]	■
3. Does this item require a revision to the FSAR?	[]	■
4. Does this item involve a change to the Off-Site Dose Calculation Manual?	[]	■
5. Does this item constitute a change to the Process Control Program?	[]	■
6. Does this item involve a major change to a Radwaste Treatment System?	[]	■
7. Does this item involve a change to the Technical Specification Equipment List (BSEP and SHNPP only)?	[]	■
8. Does this item impact the NPDES Permit (all 3 sites) or constitute an "unreviewed environmental question" (SHNPP Environmental Plan; Section 3.1) or a "significant environmental impact" (BSEP)?	[]	■
9. Does this item involve a change to a previously accepted:		
a. Quality Assurance Program	[]	■
b. Security Plan (including Training, Qualification, and Contingency Plans)?	[]	■
c. Emergency Plan?	[]	■
d. Independent Spent Fuel Storage Installation license? (If "yes," refer to Section 8.4.2, "Question 9," for special considerations. Complete Part VI in accordance with Section 8.4.6)	[]	■

SEE SECTION 8.4.2 FOR INSTRUCTIONS FOR EACH "YES" ANSWER.

REFERENCES. List FSAR and Technical Specification references used to answer questions 1-9 above. Identify specific reference sections used for any "Yes" answer.

SEE ATTACHED

PART III: UNREVIEWED SAFETY QUESTION DETERMINATION SCREEN

DOCUMENT NO. EER 92-0352 REV. NO. 0

	Yes	No
1. Is this change fully addressed by another completed UNREVIEWED SAFETY QUESTION determination? (See Sections 7.2.1, 7.2.2.5, and 7.9.1.1)	[]	[X]

REFERENCE DOCUMENT: N/A REV. NO. ____

	Yes	No
2. For procedures, is the change a non-intent change which only (check all that apply): (See Section 7.2.2.3)	[]	[]

[] Corrects typographical errors which do not alter the meaning or intent of the procedure; or,

[] Adds or revises steps for clarification (provided they are consistent with the original purpose or applicability of the procedure); or,

[] Changes the title of an organizational position; or,

[] Changes names, addresses, or telephone numbers of persons; or,

[] Changes the designation of an item of equipment where the equipment is the same as the original equipment or is an authorized replacement; or,

[] Changes a specified tool or instrument to an equivalent substitute; or,

[] Changes the format of a procedure without altering the meaning, intent, or content; or

[] Deletes a part or all of a procedure, the deleted portions of which are wholly covered by approved plant procedures?

If the answer to either Question 1 or Question 2 in PART III is "Yes," then PART IV need not be completed.

PART IV: UNREVIEWED SAFETY QUESTION DETERMINATION

DOCUMENT NO. EER 92-0352 REV. NO. 0

Using the SAFETY ANALYSIS developed for the change, test or experiment, as well as other required references (LICENSING BASIS DOCUMENTATION, Design Drawings, Design Basis Documents, codes, etc.), the preparer of the Unreviewed Safety Question Determination must directly answer each of the following seven questions and make a determination of whether an UNREVIEWED SAFETY QUESTION exists.

A WRITTEN BASIS IS REQUIRED FOR EACH ANSWER

	Yes	No
1. May the proposed activity increase the probability of occurrence of an accident evaluated previously in the SAFETY ANALYSIS REPORT?	[ ]	■
2. May the proposed activity increase the consequences of an accident evaluated previously in the SAFETY ANALYSIS REPORT?	[ ]	■
3. May the proposed activity increase the probability of occurrence of a malfunction of equipment important to safety evaluated previously in the SAFETY ANALYSIS REPORT?	[ ]	■
4. May the proposed activity increase the consequence of a malfunction of equipment important to safety evaluated previously in the SAFETY ANALYSIS REPORT?	[ ]	■
5. May the proposed activity create the possibility of an accident of a different type than any evaluated previously in the SAFETY ANALYSIS REPORT?	[ ]	■

1. SEE ATTACHED
2. SEE ATTACHED
3. SEE ATTACHED
4. SEE ATTACHED
5. SEE ATTACHED

PART IV: (Continued)

DOCUMENT NO. EER 92-0352 REV. NO. 0

		Yes	No
6.	May the proposed activity create the possibility of a malfunction of equipment important to safety of a different type than any evaluated previously in the SAFETY ANALYSIS REPORT?	■	[]
7.	Does the proposed activity reduce the margin of safety as defined in the basis of any Technical Specification?	[]	■
8.	Based on the answers to questions 1 - 7, does this item result in an UNREVIEWED SAFETY QUESTION? If the answer to any of the questions 1-7 is "Yes," then the item is considered to constitute an UNREVIEWED SAFETY QUESTION.	■	[]
9.	Is PNSC review required for any of the following reasons?	■	[]

If, in answering question 1 or 3 "No," it was determined that the probability increase was small relative to the uncertainties; or, in answering question 2 or 4 "No," it was determined that the doses increased, but the dose was still less than the NRC ACCEPTANCE LIMIT; or, in answering question 7 "No," a parameter would be closer to the NRC ACCEPTANCE LIMIT, but the end result was still within the NRC ACCEPTANCE LIMIT; then PNSC review is required.

REFERENCES: SEE ATTACHED

This Unreviewed Safety Question Determination is for the following DISCIPLINE(s): (Additional Part IV forms may be included as appropriate.)

- [] Nuclear Plant Operations
- [] Nuclear Engineering
- [] Mechanical
- [] Electrical
- ■ Instrumentation & Control
- [] Structural
- [] Metallurgy
- [] Chemistry/Radiochemistry
- [] Health Physics
- [] Administrative Controls

PART V: PNSC REVIEW

DOCUMENT NO. ______________________ REV. NO. __________

Determination/Evaluation: ______________________

Action Taken: ______________________

Basis: ______________________

PNSC Chairman: ______________________ Date: __________

PART VI: ISFSI CHANGES (10CFR72.48)

DOCUMENT NO. EER 92-0352 REV. NO. 0

		Yes	No
1.	Does this item represent:		
a.	A change to the Independent Spent Fuel Storage Installation (ISFSI) as described in the ISFSI Safety Analysis Report?	[]	■
b.	A change to the procedures as described in the ISFSI Safety Analysis Report?	[]	■
c.	A test or experiment not described in the ISFSI Safety Analysis Report?	[]	■
2.	Does this item involve a change to the license conditions incorporated in the ISFSI Operating License?	[]	■
3.	Does this item result in a significant increase in occupational exposure?	[]	■
4.	Does this item result in a significant unreviewed environmental impact?	[]	■

SEE SECTION 8.4.6 FOR INSTRUCTIONS FOR EACH "YES" ANSWER.

REFERENCES. List ISFSI SAR and Technical Specification references used to answer questions 1 and 2 above. Identify specific reference sections used for any "Yes" answer.

PART I: SAFETY ANALYSIS

DOCUMENT NO. EER NO. 92-0352 REV. NO. 0

DESCRIPTION OF CHANGE:

This safety analysis has been prepared to discuss the changes outlined in EER 92-0352.The EER is written to provide an operability assessment under the guidance provided in ENP-12. The necessity for the EER stems from the fact that single failure modes to the Control Building Emergency Air Filtration System have been identified. One of the two single failure modes can be eliminated in a relatively short time frame. The other requires extensive modification to the chlorine detection logic.

The EER demonstrates that although a single failure within the logic of the CBEAF does not meet the design criteria for the CBHVAC as stated in the FSAR, the consequences of that single failure will not result in a situation in which the NRC Acceptance Limit for radiological consequences to Control Room personnel could be exceeded. Although the EER demonstrates that the NRC acceptance limit will not be exceeded, power operation of either unit is not acceptable until NRC acceptance of the plan outlined in the EER is obtained.

The proposed resolution to the above stated problem will be included in a two phase modification. Phase I would require modification to the start logic of both trains of EAF and the relocation of the Chlorine detection system logic power. This work would be required to be complete prior to start-up of either unit.

Phase II would contain the permanent design required to eliminate the Chlorine detection system single failure input to the EAF. The work to install this design would take place during power operation. Details of the single failure modes and how the problem was identified follow.

PART I: SAFETY ANALYSIS

DOCUMENT NO. EER NO. 92-0352 REV. NO. 0

ANALYSIS (CONT.):

During investigation of an Operating Experience (OE) Report #5366 concerning "preferred/standby" logic for Standby Gas trains, it was noted that the Control Building HVAC Emergency Air Filtration (EAF) also utilized a "preferred/standby" logic configuration. As the Standby Gas Trains do not use the "preferred/standby" logic there was no problem with the existing design (Ref. DBD-10 for SBGT design details). The logic for the CBEAF was also reviewed and it was revealed that previously unidentified single failures could occur (Ref. ACR B92-642).

Other than normal ventilation and heating/cooling of the Control Building, the CBHVAC system must provide habitability during three different design basis events. The first concerns a radiation event (Main Steam Line Break [MSLB] or Loss of Coolant Accident [LOCA]). The second event concerns the complete rupture of the 55 ton chlorine tank car located near the Service Water Building. The third is a smoke event.

In the radiation event the CBHVAC system is required to isolate and enter the recirculation mode on a Control Room Area or Control Room Intake High Radiation signal from the Area Radiation Monitoring System (ref.: CBHVAC System DBD-37, Section 1.3.1).

Upon receipt of a high radiation signal, the CBHVAC System is automatically realigned to the emergency mode of operation. The normal fresh air inlets close isolating the control room. At the same time, the emergency air filtration unit begins operation, recirculating the control room air to minimize contaminated build-up in the occupied areas and providing filtered make-up air for pressurization. The system responds to a smoke event in the same manner it does for radiation.

In the event of a Chlorine release the CBHVAC goes into full recirculation mode, with no outdoor air intake (except for the battery rooms). The emergency filtration trains do not start since they do not remove chlorine and may be damaged by it (ref.: CBHVAC System DBD-37, Section 1.3.2).

PART I: SAFETY ANALYSIS

DOCUMENT NO. EER NO. 92-0352 REV. NO. 0

ANALYSIS (CONT.):

The chlorine detection system is designed "fail-safe" such that any failure (i.e. loss of power, detector failure, etc.) will isolate the control room in the same manner as a true chlorine signal. The CBEAF system is designed to meet the single failure criteria as described in IEEE 279-1971." (ref.: UFSAR Section 9.4.1.3.c, Safety Evaluation). In contradiction to the above requirement, the following describes how the single failure criteria is not met.

As discussed above ACR B92-642 identifies the fact that upon loss of power in the control logic of the preferred train, the standby train will not start automatically as intended. This is due to a lack of a start signal upon loss of power. By original design the system uses a 10 second timer which is used to initiate a start signal to the standby train should the preferred train fail to start. On a loss of power to the preferred train the 10 second timer is never energized and therefore an automatic start signal to the standby train is never sent. A plant test was initiated using an AI-117 to verify system operation and demonstrate that although the train would not automatically start, it could be manually started. The fuse providing control power to the A Train of EAF was pulled. The next step required the B Train to be started by placing the control switch to the "ON" position. It was discovered that when the control power fuse was pulled that the control room HVAC isolated. In addition the B Train of CBEAF was unable to be started manually.

It was determined that this was caused by the fact that the chlorine detection logic receives its power from the A Train CBEAF control logic. By pulling the fuse for the A Train the control power to the Chlorine Detection System was lost which in turn fails the logic in the "safe" position. The "safe" position for the Chlorine Detection System is to isolate control room HVAC and prevent or secure the operation of the CBEAF. This is done to prevent the intrusion of chlorine into the control room and CBEAF filter trains.

PART I: SAFETY ANALYSIS

DOCUMENT NO. EER NO. 92-0352 REV. NO. 0

ANALYSIS (CONT.):

The actions which occur in the CBEAF system as a result of a Chlorine Detection System failure or chlorine accident are appropriate and in compliance with the requirement of Reg. Guide 1.95 (Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release). The problem is that should a Main Steam Line Break in the turbine building occur, concurrent with a Chlorine Detection System single failure, the control room HVAC would isolate as required but the CBEAF would not start (isolated by the chlorine failure).

Given that the failures identified can render the CBEAF inoperable during a radiation event, a study to determine whether or not the calculated dose received by the control room operator would exceed the limits of GDC 19 was requested from UE&C (Reference CP&L Calc. No. 0VA-0041).

The assumptions used in this study were that a MSLB had occurred. Concurrent with the MSLB a single failure prevents both trains of CBEAF from starting. The results show that the control room operator would receive approximately 96% of the allowed dose (30 rem thyroid) in six hours. The dose continues to increase up to 29.5 rem in approximately 24 hours. The dose then levels off at 29.5 rem for 30 days (duration of accident). The results of this analysis show that even without both trains of EAF the control room operator dose rates are within GDC 19 limits. Even though there is very little margin in the analysis the assumptions used are conservative.

Some of the conservatism included in the analysis is described here for understanding. It is assumed that for the design basis steam line break that a complete rupture of a main steam line break takes place in the turbine building. 140,000 lbs of steam and water is released which in turn fails the turbine building enclosure.

PART I: SAFETY ANALYSIS

DOCUMENT NO. EER NO. 92-0352 REV. NO. 0

ANALYSIS (CONT.):

A puff release is assumed which then envelopes the Control Building. In order to determine the duration of Control Building exposure to the plume a uniform spherical cloud which passes the Control Building at a conservative 1 meter per second wind velocity is assumed. To account for potential for non-spherical shapes and possible reduced wind velocity a conservative factor of 10 times the exposure duration is applied.

An indication of the conservativeness of the factor of 10 is that if the plume were assumed to be not spherical, but turbine building shaped, and to somehow approach the Control Building end-on; and if the inferred (UFSAR Section 2.3.6) plant design basis ground level release wind velocity of 0.54 meter/sec were used, the calculated increase in control room doses would be less than one-third the result obtained using the factor of 10.

Another factor which adds conservatism to this analysis is the fact that the design basis main steam line break as defined in the FSAR assumes a 10.5 second MSIV closure time after the break. In actuality the technical specification required closure time is ≥3 to ≤5 seconds (Technical Specification 3/4.4.7). The differences in the amount of steam and water released with a 3 to 5 second MSIV closure time have not been calculated but can be assumed to be significantly less than that released in 10.5 seconds. This would serve to reduce the size and activity of any release.

As in all habitability calculations for MSLB performed to date no credit has been taken for atmospheric dilution. This is due to the fact that the turbine building puff release is in such close proximity to the control building intake plenum. All the above conservatism support the fact that doses received by the control room operations personnel would remain below GDC 19 limits. An independent review of the analytical methods and results obtained by UE&C has been performed by NUS (Reference CP&L Calc. No. 0VA-0042) which further confirms the validity of the study.

PART I: SAFETY ANALYSIS

DOCUMENT NO. EER NO. 92-0352 REV. NO. 0

ANALYSIS (CONT.):

In addition to the dose calculation, a Probability Risk Assessment (PRA) was also performed to determine the probabilities of a main steam line break concurrent with a loss of EAF function due to a Chlorine Detection System failure. The results of that review show that the probability would be 1.1×10^{-7}.

Based on the data presented in this analysis and the EER, it can be demonstrated that although the EAF system does not meet the single failure criteria of IEEE 279-1971 for a radiation event, the probability of a MSLB concurrent with a failure which prevents the EAF from starting is extremely unlikely. In addition, should this scenario take place it can be shown by analysis that the GDC 19 dose limits for control room personnel will not be exceeded.

The EER and this safety analysis will require review by the PNSC due to the reduced margin of safety as calculated in the UE&C dose calculation. The previous maximum calculated dose for any Design Basis Accident to the control room operator was 19 rem as stated in the final SE on control room habitability (NRC-89-103). This EER demonstrates that the maximum dose expected in the control room would be 29.5 rem for a time period commencing with start-up of either unit and ending four months later. This time period is based on the assumptions used in the PRA.

PART I: SAFETY ANALYSIS

DOCUMENT NO. EER NO. 92-0352 REV. NO. 0

ANALYSIS (CONT.):

The conclusion reached in this EER is that it is not acceptable to allow power operation of either(both) unit(s) until NRC acceptance of the plan outlined in the EER is obtained. Once NRC acceptance is obtained power operation would be allowed for a duration of four months (basis for PRA Analysis) with the knowledge that this modification, Phase I will be installed and operable prior to start-up and Phase II will be installed within four months after startup. The Phase I work will include the elimination of the single failure associated with the start logic of the EAF itself (timer logic problem) and will relocate the chlorine detector power to a UPS supply. By relocating the power for the chlorine detection logic to a UPS source a loss of Divisional power will not automatically isolate the CBEAF. This will serve to increase the reliability of the chlorine detection logic but will not eliminate the single failure input to EAF.

Phase II to the plant modification will be issued in a field revision and will include the permanent resolution of the Chlorine detection single failure input to EAF. Phase II can be implemented during unit(s) operation and will be declared operable prior to four months post start-up.

A benefit of installing the permanent chlorine detector system logic in the winter months is biological marine growth is at its lowest level. This will allow the temporary removal of the chlorine tank car from the owner protected area and allow work on the Chlorine Detection System without tech. spec. LCO's.

PART I: SAFETY ANALYSIS

DOCUMENT NO. EER NO. 92-0352 REV. NO. 0

REFERENCES:

EER No. 92-0352 - CBEAF Single Failures

DBD-37 - Control Building Heating, Ventilating, and Air Conditioning System

Reg. Guide 1.95 - Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release

NRC-89-103 - Safety Evaluation (SE) Regarding Control Room Radiological Habitability

LER 1-92-018 - Failure of the CBEAF System to Meet Single Failure Criteria for Radiation and Fire Events

NLS-85-311 - Control Room Habitability (NUS-4758 - Control Room Radiological Reanalysis attached)

CP&L Calc. No. 0VA-0041 - UE&C Analysis Control Room Doses Following a Main Steam Line Break

CP&L Calc. No. 0VA-0042 - NUS Design Verification of UE&C Calculation Set #9527-8-CB-01

10CFR50, App. A, General Design Criteria 19 - Radiation Protection for Control Room Operators

NUS-3697 Rev. 2 - Control Room Habitability Evaluation Brunswick Steam Electric Plant (NRC TMI Action Plan Item III.D.3.4)

NUREG-75/087 Rev. 1 - Standard Review Plan

PART IV: UNREVIEWED SAFETY QUESTION DETERMINATION

DOCUMENT NO. EER NO. 92-0352 REV. NO. 0

RESPONSES TO:

QUESTION 1: No. As discussed in the analysis the CBEAF System is provided to provide protection to the control room operators from a radiological event. Of the accidents discussed in Chapter 15 of the SAR the main steam line break is the most limiting. The acceptability of not meeting the single failure criteria of IEEE 279-1971 for the CBEAF system does not impact any system, structure or component associated with the initiation of a Main Steam Line Break (MSLB) accident and therefore the probability of occurrence of an accident analyzed in the FSAR is not changed.

QUESTION 2: No. The operability assessment provided in the EER demonstrates that the consequences associated with a main steam line break do not exceed the 10CFR50, App. A, GDC-19 limits. Although the GDC-19 limits are not exceeded the parameter (dose to control room operators) would be closer to the NRC acceptance limit thus requiring PNSC review of this EER and Unreviewed Safety Question Determination. The off-site consequences associated with the MSLB remain unchanged as this EER only addressees control room radiological consequences.

QUESTION 3: No. Although the CBEAF was designed to the single failure criteria of IEEE 279-1971 in order to insure that adequate protection would be provided to the control room operator, it can be shown that even with a single failure the system will perform its safety function and limit doses to the GDC-19 limits.

QUESTION 4: No. The consequences of malfunction of the CBEAF are specifically addressed in this EER. It has been demonstrated by analysis and verified that a failure of the CBEAF to initiate will not increase the consequences of an equipment failure above the limits set by GDC-19.

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QUESTION 5: No. This analysis and EER are written to address existing accident protection and do not affect the accident modes themselves. As the operability assessment only addresses the capability of the CBEAF to perform its safety function during a design basis event no new accident are created.

QUESTION 6: Yes. The previously accepted design basis for the CBEAF is that it meet the single failure criteria of IEEE 279-1971. It has been shown in this analysis and EER that the single failure criteria is not met due to the Chlorine Detection System input. This implies that up to this point the accident analysis contained in Chapter 15 of the FSAR assume proper operation of at least one train of CBEAF. This analysis and EER now present the possibility that one train of CBEAF will not be available for the duration of the accident. Although this is a malfunction which has not been evaluated in the FSAR this EER demonstrates that the doses received by the control room operator will not exceed GDC-19.

QUESTION 7: No. The bases given for the Control Room Emergency Filtration System (3/4.7.2) are that radiation exposures be limited to 5 rem or less, whole body or its equivalent. This is consistent with the guidance provided in 10CFR50, App. A, GDC-19. As discussed, the operability assessment demonstrates that exposures will meet the bases for this Technical Specification 3/4.7.2. The technical specification bases for Chlorine Detection Systems (3/4.3.5.5) states "Operability of the chlorine detection system ensures that an accidental chlorine release will be detected promptly and the necessary protective actions will be automatically initiated to provide protection for control room personnel." The chlorine detection system will remain in its present design configuration until permanent changes can be made in the logic. Until that time the chlorine detection will still provide it's fail safe input to the CBEAF which will meet the intent of this technical specification bases.

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REFERENCES:

FSAR Sections 5.4.4, 5.4.5, 6.4, 9.4.1, 15.6.3, and 15.6.4

Tech. Spec. Sections including bases 3/4 7.2, 3/4.4.7 and 3/4 3.5.5