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September 4, 1984

Mr. H. R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. NUCLEAR REGULATORY COMMISSION
Washington, D. C. 20555

Attention: Mr. J. R. Miller, Chief
Operating Reactors, Branch 3

Gentlemen:

DOCKET NOS. 50-266 AND 50-301
ADDITIONAL RESPONSE TO NUREG-0737
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

Our January 9 and February 23, 1981 letters provided our response to the requirements of Item III.D.3.4 of NUREG-0737 regarding control room habitability. As described in your letter of August 10, 1982, your staff concluded that Wisconsin Electric had adequately responded to Item III.D.3.4. The conclusion was based upon commitments by members of our staff to complete modifications and recommendations as identified in your Safety Evaluation Report (SER). The SER was enclosed with your August 10 letter.

As identified in the SER, our submitted control room habitability evaluation was accomplished using an overly conservative control room air in-leakage rate assumption. A parametric reanalysis of control room doses following a design basis accident was subsequently performed. As expected, the reanalysis confirmed that post-accident doses to control room personnel will be maintained less than the General Design Criterion 19 limits as identified in 10 CFR 50 Appendix A.

Unresolved control room design modifications identified in the SER included portable shielding and air supply line radioactive gas detection equipment. Portable radiation shield walls have been designed, procured, and are available to be located in the front of the control room window and doorways. The control room air supply system has been equipped with airborne radiation

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detection equipment capable of detecting and measuring noble gases and radioiodines. With the implementation of these modifications, we conclude the Point Beach control room design satisfies all criteria identified in Item III.D.3.4 and fulfills all unresolved commitments as identified in the SER.

Attached is a resubmittal of our control room habitability evaluation. The evaluation includes a confirmatory reanalysis of post-accident control room doses and addresses all items identified in the SER. The transmittal of this information completes our commitment to provide the results of the reanalysis to you; no due date had been specified for the provision of this information.

Please advise if you have any further questions regarding this submittal.

Very truly yours,

Vice President-Nuclear Power

C. W. Fay

Attachment

Copy to NRC Resident Inspector

ADDITIONAL RESPONSE TO NUREG-0737

POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-266 AND 50-301

III. D.3.4 CONTROL ROOM HABITABILITY

III.D.3.4 CONTROL ROOM HABITABILITY

In accordance with the requirements set forth in NUREG-0737, an evaluation of control room habitability has been performed for Point Beach Nuclear Plant (PBNP). The information required to perform the control room habitability evaluation and the results of the evaluation are summarized below.

I. CONTROL ROOM MODE OF OPERATION

The PBNP control room HVAC air supply system may be operated in one of four modes. The HVAC system for the control room at PBNP is shown in Figure 1.

(a) Mode I - Normal Operation

In the normal operation mode, either supply fan W13B1 or W13B2 operates to provide 19,800 cfm of air to the control room and computer room. About 25% of outside air is drawn in through damper CV-4849C.

(b) Mode II - 100% Recirculation Through HEPA Filters

In the event of a LOCA, increased pressure in the containment will automatically isolate the control room. Damper CV-4849A is closed so that the entire 19,800 cfm air supply is delivered to only the control room. For this mode, recirculation is only through a HEPA filter.

(c) Mode III - Recirculation Through Charcoal Filters

This mode is equivalent to Standard Review Plan 6.4, Type 2, i.e., zone isolation with filtered recirculated air. While W13B continues to run, about 25% (4,950 cfm) is diverted through the emergency charcoal filters by fan W14A or W14B. High airborne radioactivity as measured by the control room HVAC air supply radiation monitor will automatically actuate this mode of operation.

(d) Mode VI - Makeup Through Charcoal Filters

A manual signal from the control room opens the outside air damper (CV-4851A) and closes the filter air damper (CV-4851B). In this mode, 4,950 cfm of outside air is drawn through the charcoal filters by fan W14A or W14B and provides positive pressurization of the control room. This mode is equivalent to Standard Review Plan 6.4 Type 1, i.e., zone isolation with filtered incoming air and positive pressure.

Modes III and IV are appropriate modes of operation for accident conditions. Mode IV is the most appropriate mode of operation for severe radiological conditions.

II. CONTROL ROOM CHARACTERISTICS

(a) Control room air volume is 55,195 cubic feet.

(b) Control room emergency zone includes the control room, the snack bar, and the toilet. It does not include the computer room and the engineering offices which are located in the control building. The latter two facilities are isolated during emergency modes of operation.

(c) For Mode IV, an infiltration leakage rate of 10 cfm was used in the radiological evaluation. A value of 10 cfm is recommended by Section 6.4 of the Standard Review Plan; this is overly conservative to account for opening and closing of doors. For Mode III an infiltration rate of 55.2 cfm was assumed in accordance with the recommendation of Section 6.4 of the Standard Review Plan which specifies that 0.06 volume changes per hour may be assumed to occur in the absence of site specific testing.

(d) 100% HEPA filter efficiency is assumed for particulate, non-iodine radioisotopes. Charcoal absorber efficiencies of both 95% and 99% were examined in the evaluation for elemental and organic iodine.

(e) The closest distance between the control room air intake and the containment structure is 124 feet.

(f) The control room shielding consists of 18" of concrete except for the door structures located on the north and south walls at the eastern-most extent of these walls and a window located in the center of the east wall. Portable radiation shield walls are available to be moved in front of the doors and window following an accident. The portable shield walls are engineered to be quickly moved and located on the external side of the control room in front of the window and doors. The shield walls are of a lead equivalent thickness which will provide the appropriate attenuation of radiation emissions from the passing plume.

(g) Since dual intakes are not used at PBNP, damper closing times and leakages are not required for analysis.

(h) Chlorine or toxic gas detectors are not required at PBNP.

(i) Eight self-contained breathing apparatus (SCBA) are available for use in the control room. The eight units are either Biopak-60 or MSA Airpack devices or a combination of both units. The Biopak-60 units are self-contained positive pressure recirculating breathing devices with a rated protection factor of 5000. The MSA Airpack units are pressure demand devices with a protection factor of 10,000. There are a total of 24 Biopak-60 units and 8 MSA Airpacks on-site.

(j) There are no spare bottles of air in the control room. However, there are a minimum of 12 spare bottles for the MSA Airpacks and 12 spare bottles for the Biopak-60 units available on-site. The capability also exists to refill Biopak-60 bottles. The control room is also equipped with provisions for supplied air. There are three outlets on each side of the control room and six full-face masks available. Although the service air compressors are stripped on safety injection signal, they can be normally restored if loading permits.

(k) No food is kept in the control room. Approximately 30 to 60 T.V. dinners are maintained on hand in the cafeteria. The potable water available in the control room is supplied from the on-site well.

(l) Emergency equipment has been provided in the control room assuming a complement of six people, including one operations supervisor, one shift supervisor, two reactor operators, one relief man for normal operation, and a Duty Technical Advisor for emergency operation. It is assumed that, during an accident, other plant and NRC personnel admitted to the control room would bring their own equipment from elsewhere on-site.

(m) A minimum of 50 potassium iodide tablets are stored in the control room. Approval for the use of this compound by our employees has been obtained from the Company Medical Department.

(n) The control room HVAC air supply system has been equipped with airborne radiation detection equipment. The equipment is capable of detecting and measuring noble gases and radioiodines. High concentrations of noble gases, as detected by the air supply monitor, will automatically initiate isolation of the control room. Operation of the control room HVAC system in Mode III will recirculate control room air through both HEPA and charcoal filters.

III. OTHER PARAMETERS REQUIRED FOR CONTROL ROOM HABITABILITY EVALUATION

(a) The source term is based on operation at 1518.5 MW (t) for 500 days. Activity released to containment is assumed to be 100% core noble gases and 50% core halogens.

(b) The composition of halogens include; 91% elemental, 4% organic, and 5% particulate.

(c) Plate out of halogens occurs instantaneously. Dose calculations are made with halogen depletion factors of both 2 and 200.

(d) As per Standard Review Plan 6.5, the containment spray system is assumed to actuate immediately upon accident condition. The containment spray lambda (λ) = 3.4 hr^{-1}. Spray coverage of 100% is assumed. Containment spray is effective until 1% of the initial concentration of elemental halogens has been achieved.

(e) Containment leak rate is assumed to be 0.4% volume per day for the first 24 hours and 0.2% volume per day thereafter.

(f) Thyroid dose calculations assume a KI protection factor of 10.

(g) Breathing rate for control room personnel is 3.47×10^{-4} m^3/sec

(h) Control room meteorology and occupancy is assumed as follows:

Time	Wind Speed Factor	Direction Factor	Occupancy Factor	Effective X/Q (sec/m^3)
0-8 hr.	1	1	1	2.15×10^{-3}
8-24 hr.	0.8	0.85	1	1.46×10^{-3}
1-4 day	0.57	0.71	0.6	5.16×10^{-4}
4-30 day	0.36	0.41	0.4	1.29×10^{-4}

(i) Engineered Safety Feature (ESF) parameters used to evaluate control room doses are as follows:

1. 50% of core iodines are in containment sump.
2. Recirculation begins at 59 minutes post-accident.
3. Circulating water temperature is less than 212°F.
4. Volume of injection water is 317,000 gallons.
5. Auxiliary building charcoal absorber efficiencies are 95% for both elemental and methyl halogens.
6. Leakage rate from engineered safety features is 25,000 cc/hr.
7. 10% of iodines in the ESF leakage consist of volatile species.

IV. RADIOLOGICAL EVALUATION

A parametric evaluation of control room doses following a loss-ofcoolant accident was accomplished for control room ventilation operational modes III and IV. Operational modes III and IV are applicable for accident conditions. Thirty day integrated control room doses were calculated assuming a series of combinations of various control room ventilation operating parameters such as ventilation rate, recirculation rates, infiltration rates, and filter efficiencies. Containment leakage and engineered safety features leakage are contributors of airborne radioactivity available for intake into the control room. Direct radiation from containment and radiation emissions from the gas cloud surrounding the control room are additional contributors to whole body gamma doses. Results of the analysis are summarized in Table 1.

The radiological evaluation was accomplished using a number of conservative assumptions. The worse case doses resulting from control room in-leakage and/or recirculation are summarized in Case No. 7 of the attached Table 1. The worse case doses were calculated assuming an iodine plateout factor of 2 and an iodine filter efficiency of 95 percent.

Charcoal filter beds of 2" depth are provided for the control room at PBNP. Technical specifications provide for the periodic testing of the filters to assure a removal efficiency of 99% for elemental iodine and a removal efficiency of 90% for organic (methyl) iodine. Testing at PBNP for the last five years has consistently indicated removal efficiencies in excess of 95% for both elemental and methyl iodines. In fact, with few exceptions, efficiencies have been in excess of 99%. This analysis evaluated radiological habitability using a conservative filter efficiency of 95% for iodines.

Protection factors afforded by KI for 100 mg administration have been noted from 20 to 1,000, with lower protection factors if administered more than two or three hours after exposure. Since KI is available in the control room, administration of the KI can be expected in substantially less than two hours after commencement of exposure. For this evaluation, a KI protection factor of 10 has been conservatively assumed.

Recent studies of Los Alamos and Oak Ridge National Laboratories indicate that radioiodine releases in nuclear accidents are substantially less than previously assumed. The Nuclear Safety Oversight Committee in its December 21, 1980 letter to President Carter recommended that "the Nuclear Regulatory Commission and the U. S. Department of Energy should be responding more aggressively to this important development." In a recent paper published by the Electric Power Research Institute and entitled "Realistic Estimates of the Consequences of Nuclear Accidents", authors M. Levenson and F. Rahn have noted iodine partition factors ranging from 6 to 10^5. Levenson and Rahn pointed out that in the SL-1 and Windscale Accidents, the partition factors were approximately 10^3; for TMI-2, the partition factor was about 6×10^5. The analysis was accomplished using a platout factor of 2 and 200. Worse case doses are calculated assuming a conservative plateout factor of 2.

The worse case 30 day integrated thyroid dose is calculated as 23.7 Rem. This dose is below the GDC limit of 30 Rem.

The worse case beta skin dose is calculated as 57.1 Rem. Both eye protection and protective clothing is available in the control room for emergency personnel to meet the requirements of GDC 19. Credit is taken for the beta radiation shielding afforded by the protective clothing.

The whole body gamma dose consists of contributions from airborne radioactivity inside and outside the control room, as well as direct shine from containment. Control room whole body gamma doses attributable to the intake of radioactive air are highest when the control room ventilation system is in operational mode IV. The worse case gamma dose resulting from air in-leakage and/or recirculation is 2.51 Rem.

Radiation emitted directly from containment is an additional contributor to post-accident control room gamma doses. The calculated conservative thirty day integrated gamma dose to general areas of the control room attributable to direct containment radiation is 0.225 Rem. Calculated dose rates are very conservative because the attenuation of radiation by intervening equipment and components is not considered. Only the containment wall, control room wall, and other major intervening walls were considered as shielding.

Another addition to whole body gamma radiation dose is due to radiation emissions from the passing plume streaming through the control room doors and window. The term door refers to the 9 x 9 ft bullet-proof fire wall structures used for ingress and egress located at the northeast and southeast corners of the control room, and the term window refers to the 9 x 12 ft bullet-proof fire wall structure on the east wall of the control room. Assuming worse case conditions, the total whole body gamma doses attributable to air in-leakage and direct containment radiation is 2.74 Rem. Therefore, in order to comply with the GDC 19 whole body gamma dose limit of 5 Rem, portable shield walls are utilized to ensure that control room operator doses resulting from radiation emanating through the control room doors or window is limited to less than 2.26 Rem.

The post-accident dose rates resulting from radiation emissions from the passing plume decrease considerably with increasing distances inside the control room doors and window. Dose rates inside the control room window are greater than those inside the doors because of the larger size of the window. Doses inside the control room window are also more restrictive because radiation emanating through the window impinges on central areas of the control room where occupancy times are expected to be higher. Areas located immediately inside the control room doors are expected to be occupied for limited and infrequent periods. To facilitate the calculation of estimated integrated doses it is necessary to assume conservative occupancy factors. For purposes of this analysis, limiting dose rates are calculated assuming a control room operator is located 10 feet inside the control room window for 75% of the occupancy time and is stationed 5 feet inside of the window for the remaining 25% of the occupancy time. Assuming these occupancy factors, the unshielded thirty day integrated control room dose resulting from radiation emissions from the passing radioactive plume is 6.13 Rem. The utilization of 0.5 inches of lead equivalent thickness shielding for the window and 0.25 inches of lead equivalent thickness shielding for the doors will reduce the post-accident dose from the passing plume to 1.38 Rem. This shielding is stored on the turbine building operating floor and may be quickly moved in front of the control room doors and window to provide the required attenuation of radiation emissions from the passing plume.

The aggregate total whole body gamma resulting from all post-accident sources, i.e. airborne radioactivity inside and outside the control room and direct shine from containment, is conservatively calculated under worse case conditions to be 4.62 Rem.

V. ONSITE STORAGE OF CHLORINE OR OTHER HAZARDOUS CHEMICALS

A survey was conducted to identify any sources of hazardous chemicals or toxic gases on-site or within five miles. The survey was conducted in accordance with the criteria established by Regulatory Guides 1.70 and 1.78 and Standard Review Plan.

Several on-site sources of potentially hazardous chemicals or toxic gases have been identified. The hazardous chemical sources are the sulfuric acid storage tank, located in the vicinity of the water treatment plant (maximum of 5,700 gallons), and the sodium hydroxide spray additive tank located in the auxiliary building (maximum 5,100 gallons). Gaseous storage consists of nitrogen, carbon dioxide, and hydrogen. While these gases are not of themselves toxic, they represent potential asphyxiants or explosion hazard.

Because of their low volatility and distant location in the plant, the sulfuric acid and sodium hydroxide storage facilities are not of concern for control room habitability. The hydrogen and nitrogen tanks are located outside and east of the turbine building and similarly do not represent a potential concern for control room habitability. Carbon dioxide is used in the gas turbine building in the fire suppressor system and is also used to purge the main electric generators of hydrogen. The physical locations of these storage tanks and the quantity of gas in storage preclude any effect on the control room.

VI. OFFSITE MANUFACTURING, STORAGE, OR TRANSPORTATION FACILITIES OF HAZARDOUS CHEMICALS

There are no known manufacturing, storage, or transportation facilities for hazardous chemicals within a five-mile radius of PBNP. In fact, there are no significant industrial facilities of any type within this area, except for PBNP and the neighboring Kewaunee Nuclear Power Plant. The area is devoted primarily to agriculture. In addition to the survey for industrial facilities, the local gas company was contacted to confirm that there are no major gas distribution or transmission pipelines within a five mile radius of the plant.

There is one transportation corridor within five miles of the plant, namely State Highway 42. This traffic route is 1.5 miles from the site at its nearest point. Since there is no identified terminus for hazardous chemicals within a five mile radius, there is no basis for assuming frequent shipments along this route. Furthermore, Highway 42 is not a logical transportation route to any major industrial area such as Green Bay, Appleton, Sheboygan, or Milwaukee. No frequent shipments have been noted by employees who reside in the area.

The nearest rail line and the nearest Great Lakes shipping channel are both beyond the five mile radius of PBNP.

Consideration was given to the residential delivery of propane and the infrequent (once or twice a year) use of liquid ammonia for fertilization of farm fields. Analysis of a spill from a propane tank truck was presented in the PSAR Site Addendum for the Haven Nuclear Plant (application now withdrawn). This analysis is equally applicable for the PBNP site and demonstrated that no explosion hazard extends beyond 2,100 ft and that a flammable cloud could not reach 2,900 ft from the spill. The use of liquid ammonia in quantities expected for local use on farm fields (500 gallon tanks) does not exceed the values permitted in Table C-2 of Regulatory Guide 1.78. Again, the infrequent use of such materials in the vicinity of the site also precludes their consideration.

It is therefore concluded that toxic gas accident analysis for potential hazardous chemical releases on or within five miles of the plant site is not necessary for PBNP. Similarly, no modification of the control room habitability system or installation on local or remote toxic gas detectors is necessary.

VII. TECHNICAL SPECIFICATIONS

(a) Chlorine detection is not required at PBNP.

(b) Technical Specifications for the periodic testing of control room emergency filtration are attached.

FIGURE 1

CONTROL BUILDING VENTILATION

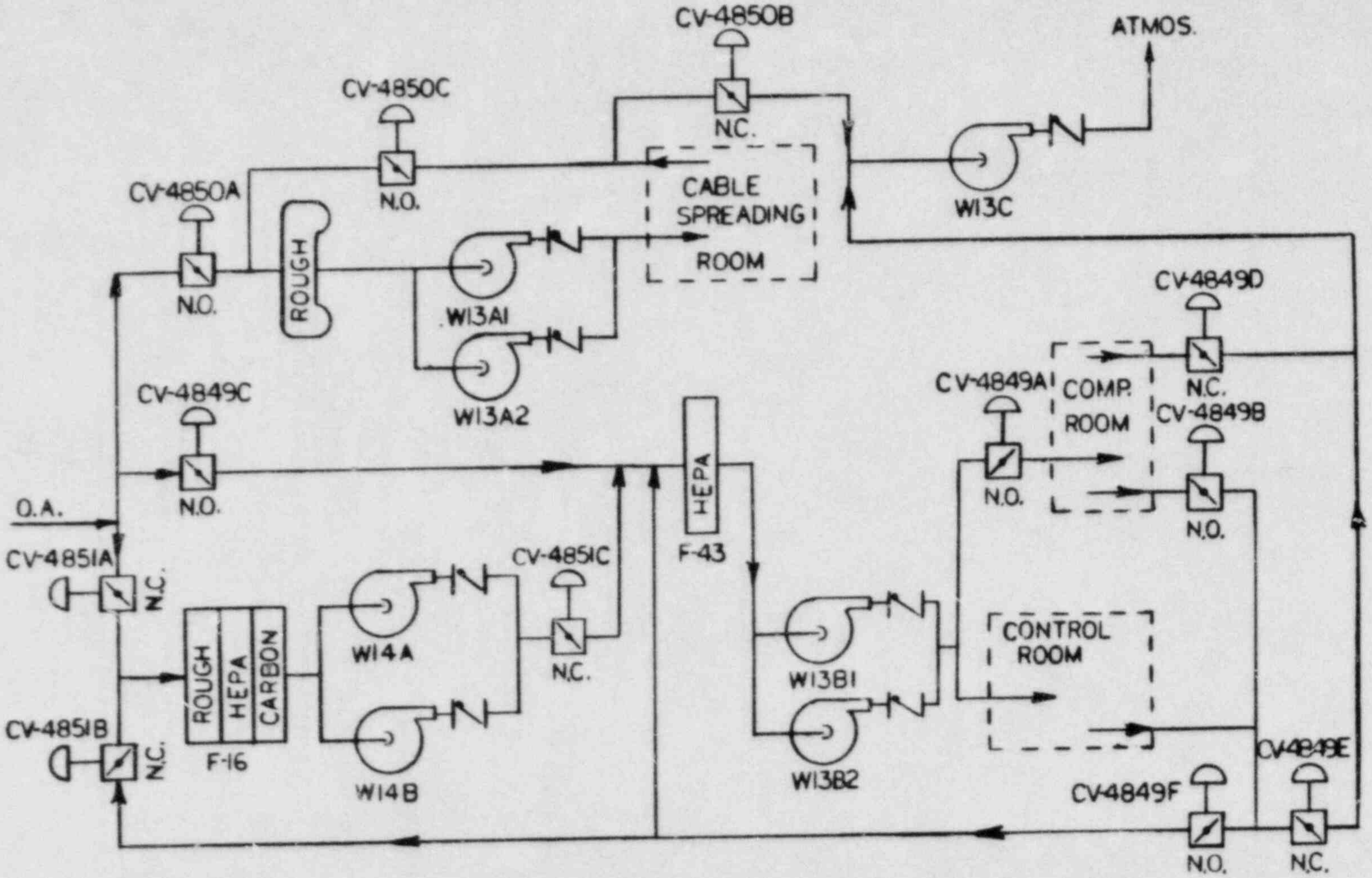

TABLE 1

SUMMARY OF PBNP POST-LOCA CONTROL ROOM DOSES

CASE NO.	OPERATION MODE	MAKE-UP CFM	RECIRC. CFM	INFILT. CFM	ELEM. IODINE FILTER EFF.	METHYL IODINE FILTER EFF.	IODINE PLATE-OUT FACTOR	CONTAINMENT LEAKAGE 30 DAY INTEGRATED POST-LOCA DOSE (REM) THYROID	CONTAINMENT LEAKAGE GAMMA	CONTAINMENT LEAKAGE BETA	ESF LEAKAGE 30 DAY INTEGRATED POST-LOCA DOSE (REM) THYROID	ESF LEAKAGE GAMMA	ESF LEAKAGE BETA	DIRECT * RADIATION FROM CONTAINMENT 30 DAY INTEGRATED DOSE (REM)	GAMMA DOSE ** FROM SEMI-INFINITE GAS CLOUD 30 DAY INTEGRATED (REM)	TOTAL 30 DAY INTEGRATED CONTROL ROOM DOSES (REM) THYROID	TOTAL GAMMA	TOTAL BETA
1	III	0	4950	55.2	99	99	2	8.72+00	6.85-01	3.32+01	1.27-01	2.63-02	8.18-01	2.25-01	1.88+00	8.85+00	2.82+00	3.40+01
2	III	0	4950	55.2	99	99	200	8.72-02	6.79-01	3.31+01	1.26-01	2.63-02	8.18-01	2.25-01	1.88+00	2.14-01	2.81+00	3.39+01
3	III	0	4950	55.2	95	95	2	8.91+00	6.85-01	3.32+01	1.32-01	2.63-02	8.18-01	2.25-01	1.88+00	9.04+00	2.82+00	3.40+01
4	III	0	4950	55.2	95	95	200	8.91-02	6.79-01	3.31+01	1.32-01	2.63-02	8.18-01	2.25-01	1.88+00	2.21-01	2.81+00	3.39+01
5	IV	4950	0	10	99	99	2	5.85+00	2.27+00	5.47+01	1.31-01	2.33-01	2.36+00	2.25-01	1.88+00	5.98+00	4.61+00	5.71+01
6	IV	4950	0	10	99	99	200	5.85-02	2.24+00	5.44+01	1.31-01	2.33-01	2.36+00	2.25-01	1.88+00	1.90-01	4.57+00	5.68+01
7	IV	4950	0	10	95	95	2	2.31+01	2.28+00	5.47+01	5.64-01	2.33-01	2.36+00	2.25-01	1.88+00	2.37+01	4.62+00	5.71+01
8	IV	4950	0	10	95	95	200	2.31-01	2.24+00	5.44+01	5.64-01	2.33-01	2.36+00	2.25-01	1.88+00	7.95-01	4.57+00	5.68+01

* Integrated values represent general area control room doses.

** Values represent doses from radiation emanating through the control room windows. The window is assumed shielded with 0.[illegible]0 inches of lead. Conservative occupancy factors assume the operators will be located at 10 feet inside the control room window for 75% of their occupancy time and at 5 feet inside the control room window for 25% of their occupancy time.

15.3.12 CONTROL ROOM EMERGENCY FILTRATION

Applicability

Applies to the operability of the control room emergency filtration.

Objective

To specify functional requirements of the control room emergency filtration during power operation and refueling operation.

Specification

1. Except as specified in 15.3.12.3 below, the control room emergency filtration system shall be operable at all times during power operation and refueling operation of either unit.

2. a. The results of in-place cold DOP and halogenated hydrocarbon tents, conducted in accordance with Specification 15.4.11, on HEPA filter and charcoal adsorber banks shall show a minimum of 99% DOP removal and 99% halogenated hydrocarbon removal.

   b. The results of laboratory charcoal adsorbent tests, conducted in accordance with Specification 15.4.11, shall show a minimum of 90% removal of methyl iodide. If laboratory analysis results for in-place charcoal indicate less than 90% methyl iodide removal, this specification may be met by replacement with charcoal adsorbent which has been verified to achieve 90% minimum removal and which has been stored in sealed containers, and retesting the charcoal adsorber bank for halogenated hydrocarbon removal.

   c. The results of fan testing, conducted in accordance with specification 15.4.11, shall show operation within ± 10% of design flow.

3. From the date that the control room emergency filtration is made or found to be inoperable, reactor operation or refueling operation of either unit may be continued only during the succeeding seven days, unless the system is sooner made operable.

4. If the conditions of 15.3.12.3 cannot be met, the operating reactor(s) shall be brought to cold shutdown conditions within 36 hours and refueling operations shall be terminated as soon as practicable.

Basis

The control room emergency filtration is designed to filter control room atmosphere and makeup air during control room isolation conditions. High efficiency particulate (HEPA) filters are installed before the charcoal adsorbers to prevent clogging and to remove essentially all particulate material. Charcoal adsorbers are installed to reduce the potential intake of radioactive iodine to the control room during accident conditions. If the system is found to be inoperable, there is no immediate threat to the control room and operation may continue for a limited period of time.