Florida Power
CORPORATION

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Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72
Control Room Habitability
NUREG 0737, Item III.D.3.4
Request for Additional Information (TAC No. 64805)

Dear Sir:

This letter responds to your March 29, 1988 request for additional information regarding Crystal River Unit 3 (CR-3) control room habitability conformance to NUREG 0737, Item III.D.3.4. Due to the length of your inquiry statements they are not repeated in our response. In reviewing the responses provided herein please also refer to Florida Power Corporation (FPC) letters of December 18, 1986, May 7, 1987 and June 30, 1987.

In response to our telecon of April 19, 1988, FPC performs a quarterly calibration on the local SO_2 tank detectors.

1. Deleted by NRC

2. Single Failures
FPC utilized SRP 6.4 as a guideline and no commitment was made to adhere to Standard Review Plan (SRP) 6.4. Modifications have been made to the plant in response to NUREG 0737. Required adherence to SRP 6.4 is beyond our commitments made in response to NUREG 0737 and would be a backfit for CR-3.

3. Doors
In the event that control room habitability doors need to be left open, a watch will be posted to provide a means of closure if an event occurs which require the doors to be closed. The effect of door opening for personal ingress and egress during the event was considered in the analysis by including an additional 10 CFM unfiltered inleakage as specified by RG 1.78. This subject is discussed further in our June 30,1987 submittal.

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4. Penetration Seals

Regulatory Guides do not require FPC to test the control complex envelope for air tightness since the CR-3 control complex habitability analyses demonstrate conservative margin while utilizing required in-leakage values.

The following additional information is provided to support the use of "SILASTIC" 732 RTV Adhesive/Sealant to reduce air in-leakage to the CRE at penetration seals.

Silicone sealants are accepted by industry as being very stable with high recovery properties (Reference 1). These sealants are not affected by ozone, have excellent resistance to weathering, to moisture, and to ultra violet radiation. Because of these properties, silicone sealants are frequently selected for exterior applications (Reference 2). There are two major manufacturers of silicone sealants: General Electric Company and Dow Corning Corporation. Both furnish finished sealant products. Therefore, they have the capability for exercising in-plant quality control that assures the end product is quite uniform from batch to batch. In this case, the Dow Corning "SILASTIC" 732 RTV Adhesive/Sealant has been selected for a sealing application within a building interior where the environmental conditions are relatively controlled and benign compared to exterior applications. Due to the inherent stability of the silicone sealant and its interior environment applications, no deterioration of the sealant is anticipated over the life of the plant.

In this particular application, the sealant is used as an edge and surface caulking in non-working joints, i.e. no movement. The very minor pressure due to 1/8 inch water gauge pressure differential causes negligible stresses in the sealant used as a caulking at contact joints between materials forming the penetration seal. Where the sealant is used as caulking at ductwork penetrations, stresses in the sealant due to vibration are not anticipated for the following reasons: HVAC equipment to which the ducts attach are mounted on vibration isolation devices. Second, flexible joints are included in the ductwork in close proximity to the connected equipment further isolating any equipment vibration from the ductwork.

Manufacturer data sheets for "SILASTIC" 732 RTV Adhesive/Sealant were furnished previously as Attachment No. 3 to the Control Room Habitability Evaluation Report, June 30, 1987. The manufacturer's description of this material states that the material can be used in applications for extended periods in temperature environments up to 450^{O}F.

As substantiation, Attachment No. 3 presented test data in Graphs I and II for peel strength versus Heat Aging and Elongation vs. Heat Aging, respectively. The maximum service temperature that the sealant will be exposed to as part of the penetration seals for the CRE is the maximum building internal design temperature of 120^{O}F. The two graphs clearly indicate neither peel strength nor elongation sealant properties will be affected by use in a 120^{O}F environment.

The test results curve depicting design life versus service temperature at 50% elongation presented in the same Attachment No. 3 indicates a minimum design life of 40 years at a temperature of 202°F. For this application, the sealant will experience a maximum 120°F temperature and will not be elongated because it is used in non-working joints within the building. This testing demonstrates that the material retained its flexibility under more severe conditions than the sealant will be subjected to in this application, therefore, no other test results for the silicone sealant are considered necessary to substantiate use in this application.

The following discussion is provided regarding the characteristics of the interface between the sealant and the adjacent materials necessary to perform the passive sealing function in these nonworking joints.

"SILASTIC" 732 RTV Adhesive/Sealant has been formulated by Dow Corning to function as either an adhesive or as a sealant. Typical adhesive uses as described in the manufacturer's data sheet include bonding gaskets in heating and refrigeration units, adhering auto and appliance trim and other similar uses. When used as an adhesive, bond between the two joined materials must exhibit good strength characteristics. Surface preparation of the two joined materials is important, in those cases, to obtaining a strong bond. Similarly, for a sealant joint designed to accommodate expansion and contraction movements, i.e. a working joint such as in a building exterior joint, the strength of the sealant bond to the adjoining materials must be capable of transmitting the tension and compression in the sealant as the adjoined materials move. In this penetration sealing application, the sealant joints are passive, i.e. no movement, and are not required to transmit forces. Therefore, development of bond strength typical for adhesive applications or for sealants in expansion/contraction movement joints is not required for the details shown on attached Figure 4.1 to perform the air tight sealing function. The bondability characteristic of the "SILASTIC" 732 RTV Adhesive/Sealant which qualifies the material for use as an adhesive, assures the minimal bonding necessary for these applications.

As a conservative redundancy to the penetration air seals design, the sealant caulking is provided on each face of typical penetrations. Typical penetration sealing details where sealant was utilized are shown in attached Figure 4.1.

5. Technical Specifications

Toxic gas detection system technical specifications were originally submitted in response to Generic Letter 83-37 "NUREG-0737 Technical Specifications" on June 22, 1983. However, as a result of reanalysis of postulated accidental releases of toxic gas, the toxic gas detection system technical specifications have been revised. These revised technical specifications were submitted by FPC letter dated April 25, 1988.

With regard to periodic testing of the control room inleakage rate, the infiltration rate used in the dose calculations is 355 CFM (equal to 0.06 volume changes per hour) while the calculated inleakage per RG 1.78 is 236 CFM. Therefore, according to the Regulatory Guide this air exchange rate is typical of a control room with normal leakage construction features that do not require field verification. FPC does not believe that one-time or periodic tests are required due to the fact that the control room habitability analyses conservatively (50% margin) assumed the specified 0.06 air volume changes per hour.
This position is consistent with those stated in SRP Section 6.4, and RGs 1.78, 1.95 and other accepted references (e.g. Murphy and Campe). As a result, in-leakage determination technical specifications are considered to be inappropriate.

6. Emergency Filters

A. Design, Testing and Maintenance

The compliance of the design testing and maintenance of the emergency filters with RG 1.52 is described in FSAR Section 9.7.2.8 and Technical Specifications 3.7.7.1 and 4.7.7.1.

In accordance with current CR-3 Technical Specification (TS) 4.7.7.1, the emergency filters shall be tested and maintained as follows:

1. At least once per 31 days on a STAGGERED TEST BASIS by initiating, from the control room, flow through the HEPA filters and charcoal absorbers and verifying that the system operates for at least 15 minutes.

2. At least once per 18 months or (1) after any structural maintenance on the HEPA filter or charcoal absorber housings, or (2) following painting, fire or chemical release in any ventilation zone communicating with the system by:

   a. Verifying that with the system operating at a flow rate of 43,500 cfm $\pm$10% and exhausting through the HEPA filters and charcoal absorbers, the total bypass flow of the system to the facility vent, including leakage through the system diverting valves, is $\leq$ 1% when the system is tested by admitting cold DOP at the system intake.

   b. Verifying that the ventilation system satisfies the in-place testing acceptance criteria and uses the test procedures of Regulatory Positions C.5.a, C.5.c* and C.5.d* of Regulatory Guide 1.52, Revision 2, and the system flow rate is 43,500 $\pm$ 10%.

   c. Verifying within 31 days after removal that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2.

   d. Verifying a system flow rate of 43,500 CFM ± 10% during system operation when tested in accordance with ANSI N510-1975.

3. After every 720 hours of charcoal absorber operation by verifying within 31 days after removal that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2.

4. At least once per 18 months by:

   a. Verifying that the pressure drop across the combined HEPA filters and charcoal absorber banks is < 6 inches Water Gauge while operating the system at a flow rate of 43,500 CFM ±10%.

5. After each complete or partial replacement of a HEPA banks remove ≥ 99% of the DOP when they are tested in-place in accordance with ANSI N510-1975* while operating the system at a flow rate of 43,500 CFM ±10%.

6. After each complete or partial replacement of a charcoal absorber bank by verifying that the charcoal absorbers remove ≥ 99% of a halogenated hydrocarbon refrigerant test gas when they are tested in-place in accordance with ANSI N510-1975* while operating the system at a flow rate of 43,500 CFM ±10%.

*The air flow distribution test of Section 8 of ANSI N510-1975 may be performed downstream of the HEPA filters.

B. Emergency Filter Dose Calculation Assumptions/Sensitivity

The assumptions used in the dose calculations for the effectiveness of the emergency filter system consist of a) 95% efficiency for the removal of all iodine species, b) an unfiltered in-leakage of 285 CFM and c) immediate actuation of the emergency filter system flow upon receipt of reactor building high pressure or RM-A5 high radiation signals.

1. The 95% efficiency is considered conservative based upon the periodic testing efficiency acceptance criteria of 99% as noted above. In addition, this value is consistent with the suggested guidance provided in RG 1.52 for a charcoal filter with a 2 inch bed depth designed to operate outside the primary containment.

2. The assumption of an unfiltered in-leakage rate of 285 CFM and 70 CFM filtered in-leakage equals the total assumed in-leakage of 355 CFM used in the dose evaluation. In addition, it is more conservative than the calculated in-leakage rate of 236 CFM.

3. In the event of a ten (10) minute delay in the manual initiation of the emergency filter system the calculated control room doses are as follows:

	Delayed
Thyroid Inhalation Dose:	28.0 Rem
Whole Body Gamma Dose:	1.9 Rem
Beta Skin Dose:	17.7 Rem

	Immediate
Thyroid Inhalation Dose:	26.5 Rem
Whole Body Gamma Dose:	1.9 Rem
Beta Skin Dose:	17.7 Rem

7. Toxic Gas Protection

FPC's submittal to the NRC dated June 30, 1987 identified chlorine (Cl_2), sulfur dioxide (SO_2), and ammonia (NH_3) as potential toxic gas hazards that require consideration in evaluating the Crystal River Unit-3 (CR-3) Plant control room habitability. The allowable limits, as defined in SRP Section 6.4, used by FPC as a guideline in evaluating these potential toxic gas hazards, are summarized below. The bases for the selection of these limits are discussed below for each of the toxic gas hazards.

SRP 6.4 EXPOSURE CATEGORY	TOXICITY ALLOWABLE LIMITS Concentration ppm By Volume			EXPOSURE PERIOD
TOXIC CHEMICAL:	Cl_2	SO_2	NH_3	
Protective Action	15	36	100	2 min. or less
Short-Term:	4*	12*	60	2 min. to 1 hr.
Long-Term:	1*	5*	50	1 hr. or greater

* Not applicable to CR-3 because the operators don self-contained breathing apparatus within 2 minutes.

Chlorine

The protective action limit (2 minutes or less) utilized in evaluating the chlorine hazard to the control room operators is based upon the value of 15 ppm provided in Regulatory Guide 1.78. The short-term (2 minutes to 1 hour) and long term (1 hour or greater) limits of 4 ppm and 1 ppm respectively correspond to the example of appropriate limits provided in SRP 6.4, page 6.4-6.

Sulfur Dioxide

As noted in our previous submittals and discussions, the protective action limit of 5 ppm provided in RG 1.78 for SO_2 is not considered to be appropriate nor consistent with either the RG 1.78 toxicity limit definition, the SRP 6.4 allowable limit determination guidelines, or industrial experience.

Regulatory Guide 1.78 specifies that the limit to be used as an acceptance criteria is the maximum concentration that an average human can tolerate for two minutes without physical incapacitation. SRP 6.4 specifies that the protective action limit should assure that the operators will quickly recover after breathing apparatus is in place, therefore, it is also to be used to determine the acceptability of emergency zone protection provisions during the time personnel are in the process of fitting themselves with self-contained breathing apparatus.

An SO_2 concentration of 5 ppm is the OSHA limit assigned for occupational exposure (40 hour week), and corresponds to the SRP 6.4 guideline for establishing a long-term limit value (1 hour or greater). The use of this concentration as a protective action limit would preclude the need for or consideration of the availability of self-contained breathing apparatus to mitigate the toxic gas hazards associated with SO_2. Since self-contained breathing apparatus is provided and will be utilized by the control room operators, a protective action limit of 5 ppm is considered to be unnecessarily restrictive.

Our previous submittal of May 7, 1987 on "Control Room Habitability Sulfur Dioxide Supplemental Report" provided a discussion of a realistic short term toxicity limit and basis. The proposed limit of 125 ppm is consistent with current industry toxicity limits for short term exposures, especially when considering a linear increase from ambient and the only operator action required is placing his/her self-contained breathing apparatus into operation during this 2 min. period.

However, because of the sensitivity of the limit issue, additional data on SO_2 effects were consulted (Ref. 3 and 4). The Reference (3) Methodology results in a limit of 36 ppm to be used as the Emergency Exposure Limit (EEL) as defined by the Committee on Toxicology of the National Academy of Sciences: "The EEL for short-term exposure to an airborne contaminant is a concentration which when inhaled for a specified single, brief period rare in the lifetime of an individual is believed not to result in a period of disability or interference with the performance of his assigned task." This EEL value was determined based upon methods presented in reference (3) which proposes that the EEL be calculated by 0.3 of the RD_{50} value (where RD_{50} is the concentration of a sensory irritant at which a 50 percent decrease in respiratory rate occurs, i.e. 120 ppm for SO_2).

This concentration (120 ppm) is the value at which toxic effects could be incurred with extended exposure to SO_2 and is also considered to be immediately dangerous to life or health in the general literature. Based upon this data, the FPC acceptance limit has been changed to 36 ppm for SO_2.

Reference (3) proposes that the short-term exposure limit (STEL) be based upon a value equal to 0.2 of the RD_{50} (24 ppm). However, due to differences in the defined exposure period for occupational STEL (15 minutes exposures, 4 excursions per day) versus the SRP 6.4 accident STEL (2 minutes to 1 hour) as well as reported effects at this concentration, a short-term limit value equal to 0.1 RD_{50} (12 ppm) was selected.

References (3) and (4) provide summaries of experimental data on the effects of the inhalation of SO_2 on man. These data show that the FPC proposed protective action and short limits are acceptable. Furthermore, no chronic or acute effects have been reported nor expected at the proposed limits for the specified exposure periods.

Ammonia
The protective action limit utilized in evaluating the NH_3 hazard to the control room operators is based upon the value of 100 ppm provided in Regulatory Guide 1.78. The short term limit (60 ppm) is based upon a value equal to 0.2 RD_{50} where an ammonia RD_{50} value of 300 ppm is used. The long-term limit (50 ppm) corresponds to the OSHA-TWA limit for occupational exposure (40-hour week).

FPC letter dated March 17, 1988, advised you of the removal of the ammonia detectors.

Toxic gas detection system technical specifications were originally submitted in response to Generic Letter 83-37 "NUREG-0737 Technical Specifications" on June 23, 1983. However, as a result of reanalysis of postulated accidental releases of toxic gas, the toxic gas detection system technical specifications have been revised. These revised technical specifications were submitted by FPC letter dated April 25, 1988.

Self-Contained Breathing Apparatus
Commitments for self-contained breathing apparatus were previously made in our December 18, 1986 letter. The commitments were as follows:

> FPC will ensure there are five air packs in the control room for the necessary control room shift, as well as refill bottles. Ample additional equipment to support extended use is located at strategic locations throughout the plant.
>
> The air packs are included in the preventative maintenance program for air packs, and the control room shift will receive refresher instruction on donning and using the air packs annually.

8. SRP Methodology
CR-3 is not an SRP plant and therefore, does not comply with the SRP sections. Various SRP sections were used as guidelines only. Required adherence to the SRP's for CR-3 will be considered a backfit. Nevertheless, FPC has addressed your concerns in the following:

A. Damper Calculated Leakage During Emergency Operation, Return and Emergency Fans in Service:

The calculated damper leakage is shown in Figure 3.3-1 (attached) of the "Control Room Habitability Evaluation Report" furnished in the June 30, 1987 submittal. The leakage noted in the figure was based on the return and emergency fans in service stated in SRP 6.4. In part, SRP 6.4 states the leakage through the dampers must consider the additional leakage due to fan pressure in addition to the base 1/8 in. wg. differential pressure.

The following describes how the leakage through the various dampers was calculated. Conservative assumptions used will also be described.

1. Dampers AHD-1 & AHD-1D:

As shown in the attached figure, these dampers are arranged in series and located upstream (suction side) of the emergency fans. As such it is subjected to a fan negative pressure in addition to the required base 1/8 in. wg. differential pressure. The calculated negative pressure created by the fan is 0.11 in. wg. Thus, stated in SRP 6.4, leakage must be based on the total of 0.24 in. wg.

These dampers are replacement dampers installed in 1981. They were bought to meet the leakage requirement of ANSI-509-1980, Class II dampers (Class I being bubble tight damper). For Class II dampers, ANSI-509 requires leakage rate not to exceed 8 CFM per sq. ft. of damper area when subjected to a 1 in. wg. differential pressure.

Dampers AHD-1 and AHD-1D are 44"H x 78"W (23.8 ft^2) 44"H x 56"W (17.1 ft^2) in size, respectively. For conservatism, the calculated leakage through these series dampers assumed that the smaller damper failed to close and leakage through the bigger damper is 191 CFM (23.8 ft^2 x 8 CFM/ft^2) based on a 1" wg. differential pressure. Leakage through the damper at 0.24" wg. can be calculated as prescribed by ANSI-509 in the following relationship:

$$\left(\frac{DP_1}{DP_2}\right)^{1/2} = \frac{CFM_1}{CFM_2}$$

$$CFM_1 = 191 \left(\frac{0.24}{1.0}\right)^{1/2} = 191 \times 0.49 = 94 \text{ CFM}$$

Therefore, the in-leakage of 191 CFM noted in the previous submittal, is extremely conservative and takes credit for the series damper.

2. Dampers AHD-2 & AHD-99:

From the attached Figure 3.3-1, AHD-2 is located downstream of the return fans. As such the damper is subjected to a positive discharge fan pressure in addition to the base 1/8 in. wg differential pressure. The total combined pressure used to calculate damper out-leakage is equal to 0.7 in wg. Based on the manufacturer's published data, the out-leakage from this damper (60" W x 54" H) at 0.7 in. wg. pressure differential is equal to 68 CFM.

AHD-99 (36" W x 24" H) is not subjected to any fan pressure. SRP 6.4 suggests that leakage should be calculated based on the base 1/8 in. wg. differential pressure. For conservatism 1/4" wg. differential pressure was used. Based on the manufacturer's published data, the leakage is equal to 16 CFM. From the attached figure it can be seen that leakage from AHD-2 out the discharge duct would now be the source of in-leakage through AHD-99 and therefore, the net out-leakage would be 68 CFM 16 CFM=52 CFM. However, the larger out-leakage of 68 CFM was considered for the combination.

3. Damper AHD-12:

This damper is located in the supply duct downstream of the emergency fans and is subjected to a positive fan pressure in addition to the base 1/8 in. wg. differential pressure. The total combined pressure used to calculate damper out-leakage from this damper (15" H x 42" W) is equal to 0.60 in. wg. Based on the manufacturer's published data, the out-leakage is equal to 37 CFM.

4. Dampers AHD-24 and AHD-25 (both 22" diam):

These dampers are the isolation dampers for fan AHF-21A. The dampers open (close) when the fan is operating (not operating). In the emergency operation mode the fan is not operating (dampers close). For conservatism, it was assumed that one damper failed to close. Since the fan is not operating, in-leakage through the other closed damper is based on the SRP 6.4 base 1/8 in. wg. differential pressure. For conservatism, 1/4 in. wg. differential pressure was used. Per manufacturer's published data, the in-leakage is equal to 15 CFM.

5. Dampers AHD-26 and AHD-27:

Same as item 4 above, except that these dampers are the isolation for fan AHF-21B.

Leakage through this set of dampers is additive to the set of dampers in item 4 because the two sets are in parallel paths.

Leakages through the above dampers are summarized on Figure 3.3-1. The summary describes those dampers that leak out and leak in. Since these two types are non-additive the greater of the two in-leakage 221 CFM was used in the analyses.

B. Damper Calculated Leakage Following RM-A5 Actuation Without Fans in Service.

The previous June 30, 1987 submittal did not include damper leakage following an RM-A5 actuation without fans in service because this was not the worst case. Without the fans in service, SRP 6.4 suggests that leakage should be calculated by pressurizing the CRE to 1/8 in. wg. pressure. One-half of this value is used to represent the base infiltration rate.

The damper leakage summarized in the attached Figure 3.3-1 is based on pressures higher than 1/8 in. wg., therefore, will bound the case without fans in service. Nevertheless, this case is briefly addressed as follows:

Using the ANSI-509, (1980)

$$\left(\frac{DP_1}{DP_2}\right)^{1/2} = \frac{CFM_1}{CFM_2}$$

For Dampers AHD-1 & -1D:

$$\left(\frac{1/8}{1.0}\right)^{1/2} = \frac{CFM_1}{191}$$

$CFM_1 = 191\ (0.35) =$ 67.5 CFM

Similarly, for the other dampers:

$$\text{AHD-2} = 68\left(\frac{1/8}{0.7}\right)^{1/2} = 28.7 \text{ CFM}$$

$$\text{AHD-99} = 16\left(\frac{1/8}{1/4}\right)^{1/2} = 11.3 \text{ CFM}$$

$$\text{AHD-12} = 37\left(\frac{1/8}{0.6}\right)^{1/2} = 16.9 \text{ CFM}$$

$$\text{AHD-24 \& -25} = 15\left(\frac{1/8}{1/4}\right)^{1/2} = 10.6 \text{ CFM}$$

$$\text{AHD-26 \& 27} = 15\left(\frac{1/8}{1/4}\right)^{1/2} = \underline{10.6 \text{ CFM}}$$

TOTAL 145.6 CFM

1/2 x 145.6 = 72.8 CFM, < 221 CFM, Fans in service

C. Leakage Through Access Doors and Each Segment of the CRE:

1. Each access door:

Based upon the test results described in Item 3.1.1 for Doors, and in Attachment No. 2 to the "Control Room Habitability Evaluation Report" furnished in a previous submittal, the following are the calculated in-leakage rates for each sealed door:

Door No.	Calculated In-leakage, CFM
C-101	1.16
C-301	1.16
C-508	1.16
C-503	0.61
C-701	0.61
C-802	0.61
	Total = 5.31 ≅ 5.0

2. Each segment of the control room envelope boundary:

As stated in Item 2.2 Control Room Envelope Inspection of the "Control Room Habitability Evaluation Report", a field walkdown inspection was performed to visually examine each penetration through the CRE. All penetrations where the examination resulted in any question regarding airtight integrity under the required design basis 1/8 inch water gauge pressure differential were subsequently provided with airtight sealing. Sealing details consisted of silicone sealant caulking, grout, and blanking plates as described in Item 3.1.2 Penetrations of the "Control Room Habitability Evaluation Report". Sealing was installed on both faces of each penetration to provide further assurance of airtight integrity.

With all penetrations sealed, air in-leakage for 1/8 inch water gauge differential will be negligible. However, for purposes of postulated accident analyses, a conservative assumed value of 240 CFM is reflected in the analyses for penetration in-leakage.

Since penetrations into the CRE are sealed against air in-leakage, the percentage of assumed in-leakage through each of the segments of the CRE boundary, i.e. walls, floor, and roof, is reasonable based upon the relative number of penetrations through the particular segment. The breakdown of the 240 CFM assumed in-leakage is as follows:

Segment	Assumed In-leakage, CFM
Floor	26
Wall	208
Roof	6

D. Calculated Leakage vs. Analysis Leakage

The calculated CRE leakage rates versus the values used in the radiological and hazardous chemical analyses are shown below:

	Calculated Rate CFM	Analysis Rate CFM	Allowable Rate* CFM
Penetrations	Negligible	240	480
Doors	5	5	10
Opening/closing - doors	10	10	10
Dampers (filtered path)	191	70	70
Dampers (unfiltered path)	30	30	60
	236	355	630

* Calculated gross leakage due to 1/8 in. wg. can be reduced by 1/2 per SRP 6.4 Section 3.d.2.i.

The calculated rate of 236 CFM, if used in the analyses, would require periodic testing (to ensure that it is not being exceeded) since this represents a value less than 0.06 volume changes per hour. To avoid the need for testing, the analyses used 355 CFM (equal to 0.06 volume change per hour).

For conservatism in the radiological analysis, the 191 CFM filtered damper leakage was reduced to 70 CFM with the balance of this leakage assumed to come via the unfiltered penetration in leakage pathway.

9. Doses

Section 4.1.2 of our June 30, 1987 letter described the worst case condition for Building Spray operating modes which are consistant with the requirements of NUREG 0737, Item III.D.3.4. See Section 6.B.3 of this letter for doses.

10. X/Q

$$\frac{X}{Q} = \frac{1}{(\sigma_y\sigma_z + cA)\bar{\mu}}$$

where

X/Q = concentration (X) normalized to source strength (Q), seconds per cubic meter

$\sigma_y\sigma_z$ = horizontal and vertical dispersion parameters, meters

$\bar{\mu}$ = the mean wind speed, meters per second

c = the building shape factor (0.5), dimensionless

A = the minimum cross-sectional area of the containment structure, 1850 square meters

For the control room location at 10 to 40 meters downwind from the containment the dilution of radioactive release would be determined only by the wind speed and the turbulance within the building wake cavity.

Therefore, σ_y and σ_z are assumed to be negligible so that the equation becomes

$$\frac{X}{Q} = \frac{1}{cA \times \bar{\mu}}$$

Based on analysis of available (6/19/70 - 6/19/71) low level (35') wind data, X/Q values at the control room for the 0 - 2 hour time period were determined by ranking maximum X/Q values for one hour wind speed samples and establishing the 5th percentile conditions. This approach is similar to the procedure for determining the X/Q value at the exclusion distance for the 0 - 2 hour period of the DBA for the CR-3 FSAR. However, only winds flowing from the SSE - clockwise - NNW were considered for this analysis since the control room is located to the ENE of the containment. The 5th percentile X/Q value was determined to be 9.0×10^{-4} Sec/m^3 associated with a 1.2 m/sec wind speed. The X/Q value for the 2 - 24 hour period is also considered to be 9.0×10^{-4} sec/m^3 since the sector average conditions of the 2 - 24 hour of the DBA are not significant considerations for calculations within the building wake cavity.

11. Bounding Event

As stated in the June 30, 1987 submittal, the MHA is considered the bounding DBE for the control room radiological evaluation. The source terms for the design basis events considered in the FSAR are all well below those of the MHA.

The radiological source terms for DBE's in areas surrounding the CRE in conjunction with the rates of infiltration (see Response 8) would not result in Control Room Operator doses that are in excess of those presented for the MHA.

Sincerely,

R. C. Widell, Director
Nuclear Operations Site Support

TABLE 1

CR-3 PLANT TOXIC GAS HAZARDS

ALLOWABLE LIMITS

SRP 6.4 EXPOSURE CATEGORY	TOXICITY LIMIT Concentration ppm By Volume			EXPOSURE PERIOD
TOXIC CHEMICAL:	Cl_2	SO_2	NH_3	
Protective Action:	15	36	100	2 min. or less
Short-Term:	*	*	60	2 min. to 1 hour
Long-Term:	*	*	50	1 hour or greater

* Not applicable to CR-3 because the operators don self-contained breathing apparatus within 2 minutes.

References

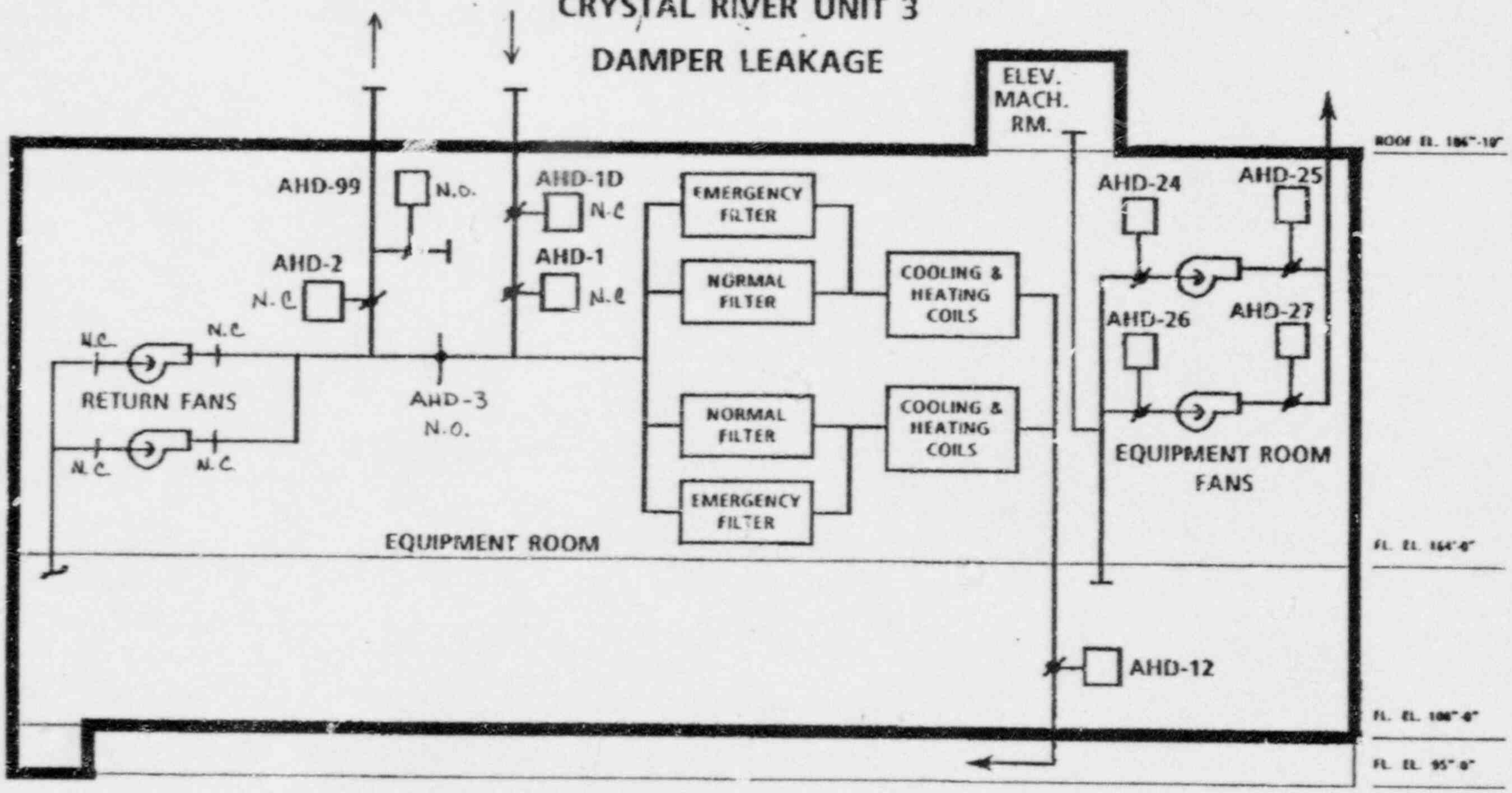
1. Construction Sealants and Adhesives, Cook, John Philip, Wiley Series of Practical Construction Guides, John Wiley and Sons, 1970.

2. ACI 504R-11, Guide to Joint Sealants for Concrete Structures.

3. Kane, L. E., Barrow, D. S. and Alarie, Y., "A Short-Term Test to Predict Acceptable Levels of Exposure to Airborne Sensory Irritants," American Industrial Hygiene Association Journal 40:207 (3/79).

4. Greenwald, I., "Effects of Inhalation of Low Concentrations of Sulfur Dioxide Upon Man and Other Mammals," Archives of Industrial Hygiene and Occupational Medicine, 10:455 (12/54).

FIGURE 3.3-1
CRYSTAL RIVER UNIT 3
DAMPER LEAKAGE



DAMPER NO.	IN-LEAKAGE CFM	OUT-LEAKAGE CFM	BASIS	COMMENTS
AHD-1, -1D	191 (FILTERED PATH)	-	-1.0" WG	> 1/8" WG ATM. PRESSURE
AHD-2, -99	-	68	+ 0.7" WG	RETURN FAN DISCHARGE PRESSURE
AHD-12	-	37	+ 0.6" WG	SUPPLY FAN DISCHARGE PRESSURE
AHD-24, -25	15	-	1/4" WG	> 1/8" WG ATM. PRESSURE
AHD-26, -27	15	-	1/4" WG	> 1/8" WG ATM. PRESSURE
TOTAL	221	105		

Since in-leakge and out-leakage are non-additive; use the greater of the two, 221 CFM

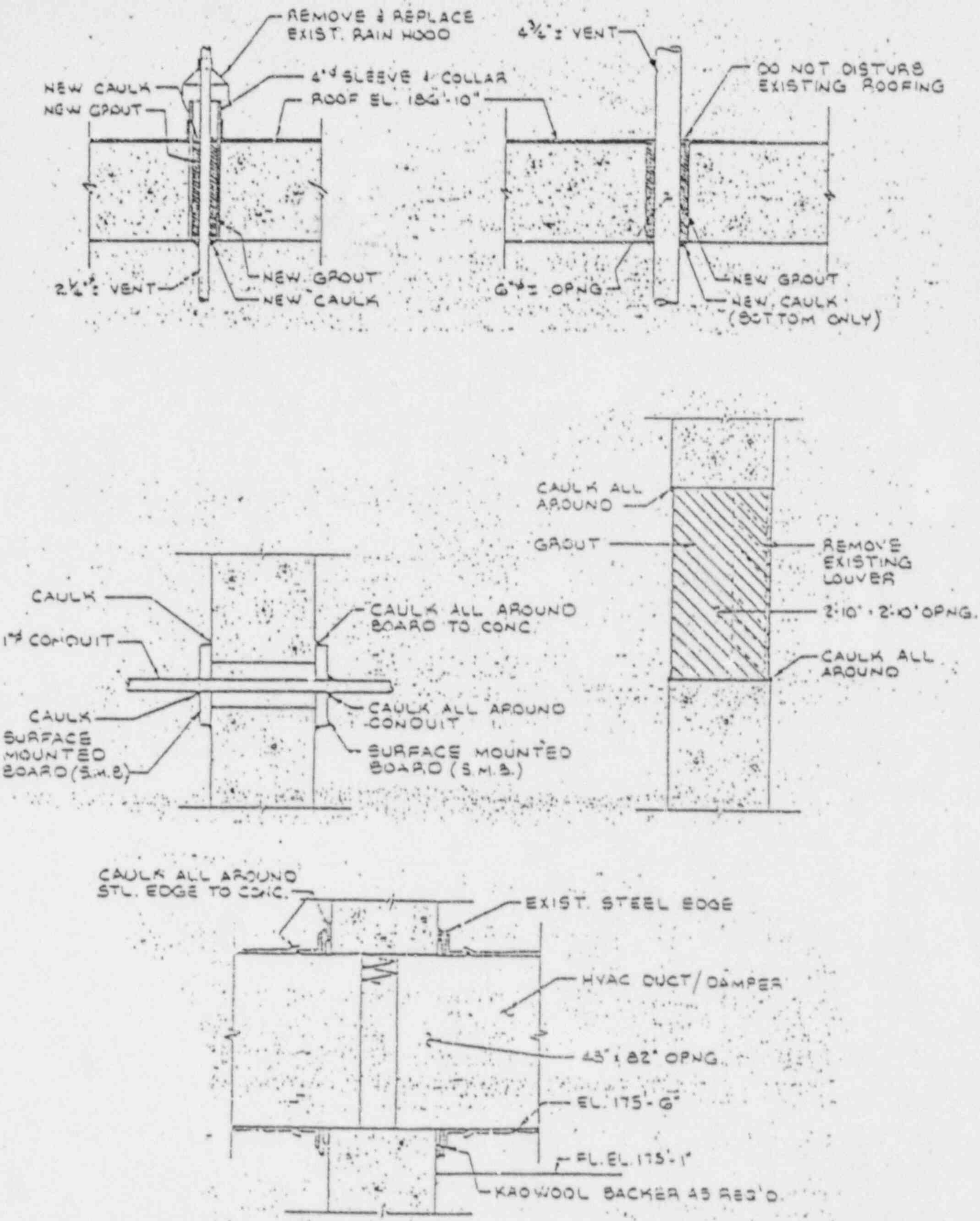


FIGURE 4.1

TYPICAL PENETRATION SEALS
WITH SEALANT CAULKING