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September 9, 2002

U. S. Nuclear Regulatory Commission
Document Control Desk
Mail Station OP1-17
Washington, DC 20555

Subject: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Additional Information for 10CFR50 Appendix R
Exemption Request for Makeup Pump Rooms

Dear Sir or Madam:

By letter dated June 8, 2001 (1CAN060103), Entergy requested an exemption from the requirements of 10CFR50 Appendix R for the Arkansas Nuclear One, Unit 1 (ANO-1) makeup pump rooms. Subsequent conversations with the Staff have revealed the need for additional information. Additional information supporting the exemption request for the ANO-1 makeup pump rooms is attached. In addition, in the June 18, 2001, submittal Entergy stated that the ceiling height in the makeup pump rooms was 17 feet The ceiling height in this area is actually 16 feet 3 inches. This submittal contains no commitments. Should you have any further questions, please contact me.

Sincerely,

Sherrie R. Cotton

Sherrie R. Cotton
Director, Nuclear Safety Assurance

SRC/nbm
Attachment

A006

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Additional Information for ANO-1 Makeup Pump Rooms

Several conversations with the Staff were held to discuss additional details of the makeup pump room cubicles and assumptions used in a fire computer code model (CFAST). The following additional information and comments were provided to the Staff to support the CFAST model.

- A four inch diameter drain with multiple drain lines routed to the drain (i.e., drain is not plugged) is located in each cubicle.

- Each makeup pump motor contains a volume of 20 gallons of lubricating oil. The specific oil type utilized in the makeup pumps is Chevron Authentic Industrial ISO-46. Per the vendor, the specific heat is defined as 0.458 BTU/lb-°F and the heat of combustion is 18227 BTU/lb which equates to 8.72 MJ/kg.

- The makeup pumps (P36A, P36B, and P36C) have an oil retention dike. The motor/pump is located on a pedestal, approximately 2.5 feet above floor level. The equipment mounted on the pedestal accounts for approximately 50% of the surface area of the pedestal. A collection trough 1.625 inches wide and 1.75 inches deep rings the pedestal. During a major oil spill, the majority of the oil would flow into the collection trough with a small amount remaining on the pedestal.

- The open doorways into the corridor are approximately eight feet in width and are eight feet high. Additionally, there are no doors on the full height block walls located immediately north of the makeup pump pedestals. Open doorways extend to the ceiling height. The distance between the north/south block walls and the full height block walls (i.e., Wall A and Wall B on Figure 2a) immediately north of the makeup pump pedestals is three feet four inches. The makeup pump room cubicle ceiling height is 16 feet 3 inches. Since the block wall separating the 'A' makeup pump cubicle from the 'B' makeup pump cubicle is only eight feet high, the opening above the partial height wall between Wall A and Wall B is eight feet two inches in width and eight feet three inches high (i.e., reaches the ceiling). In addition to the hot gas layer being dissipated into the corridor (i.e., once it descends to the eight foot high open doorways), there is a three foot wide open doorway (height extends to the ceiling) that opens into the tank room immediately west of the 'A' makeup pump cubicle.

- Each of the makeup pump cubicles has a ventilation return duct rated at 700 cubic feet per minute (CFM) (i.e., 2100 CFM total). The return ducts join at a common header that is routed outside of the makeup pump cubicle space and through a fire damper on elevation 360'. Return ducts in the open areas adjacent to the makeup pump cubicles also connect to the common return header. The fusible link in the fire damper is rated at 165°F.

- The procedure utilized for restoring a makeup pump (fire scenario assumes P36B is running and suffers catastrophic failure; P36A or P36C need to be manually started from the control room) is OP-1203.006, "Loss of RCS Makeup." As part of the development of the probabilistic safety assessment model, the time required to perform certain human recovery actions was identified. The action to manually start a makeup pump was determined to require approximately seven minutes. The

auxiliary lube oil pump is required to run immediately prior to the start of a makeup pump. Once the makeup pump has begun operation, the auxiliary lube oil pump is no longer required to operate (i.e., lubrication is provided by shaft driven lube oil pump). Therefore, if fire damage does not occur to the auxiliary lube oil pump cables (which are located approximately two feet above floor level) within the first ten minutes of the fire, then there are no adverse consequences.

- The CFAST model is set up with four compartments. A five compartment configuration may be more appropriate. As modeled, the 'vent' to the fourth compartment (from compartments 1, 2, and 3) is specified as four feet wide with a soffit eight feet from ceiling. However, the 'doorway' into the tank room does not have a soffit (i.e., open to ceiling). The 'doorway' into the radwaste corridor does have a soffit, but each of the two openings is approximately eight feet wide.

- The architectural drawings that depict elevation 335' are A-107 sheet 1 and C-299 sheets 1, 6, 7, and 8. From these drawings, the tank room (suggested compartment #4) is located west of the makeup pump cubicles and is estimated from drawings to be 35 feet 10 inches x 24 feet 4 inches. The ceiling height is consistent with that of the makeup pump cubicles (i.e., 16 feet 3 inches). As noted on Figure 2b, the opening into the tank room is three feet wide and has no soffit (i.e., opening is flush with ceiling). The tank room ceiling is concrete except for the west end of the room, which is open to the elevation above. For conservatism and to simplify the model, the vent from the tank room to the elevation above should be neglected.

- Immediately north of the makeup pump cubicles is a small hallway. The volume of this hallway can be neglected, but will add to the conservatism of the model. The hallway connects the makeup pump cubicles to the tank room (via the above discussed opening) and to the larger corridor/open area (suggested compartment #5) that contains various radwaste equipment. The open area is large and can be conservatively estimated to be 95 feet x 95 feet. There are two openings into the open area (one north of P36A and the other north of P36B/P36C) These openings are approximately eight feet in width and have an eight foot soffit.

- The lower oxygen limit (i.e., third input for CHEMI) is set at 2%. Typically, this value is 10%.

- The radiative fraction of heat release (i.e., seventh input for CHEMI) is set to 0. It is unrealistic to assume that no energy is emitted via radiative effects. Typically, this value is set to 15%.

- The location of the fire (i.e., FPOS) is specified with negative values, which implies that the fire is not located within compartment #1.

- FHIGH (flame height) is listed as 0. Since the fire is postulated to occur on the makeup pump pedestal, the value should be (minimum) two feet (0.61 meters).

- The heat release rate (FQDOT) is specified as 5.2 MW. From the NRC's draft results, this value was apparently calculated by utilizing data provided in the SFPE handbook (Table 2-1.2) relative to transformer oil. However, the mass burning rate utilized in the equation was the rate associated with an unlimited size pool. Babrauskas specifies that for a defined diameter, the mass loss rate of a pool fire is:

  $$m'' = m''_{\infty}(1 - e^{-k\beta D})$$

  Utilizing this equation produces a mass burning rate of 0.0288 kg/m^2s, which results in a heat release rate of approximately 3.9 MW. It should be noted that the values specified in the FIVE methodology (i.e., 135 $BTU/s/ft^2$) equates to approximately 4.4 MW. In either case, the heat release rate value utilized in the model appears to be overly conservative.

- ANO Procedure 1203.009, "Fire Protection System Annunciator Corrective Action," contains instructions to start the standby makeup pump (including the auxiliary lube oil pump) if fire conditions are noted in the cubicle containing the operating makeup pump.

Figure 2a -- MU Pump Rooms

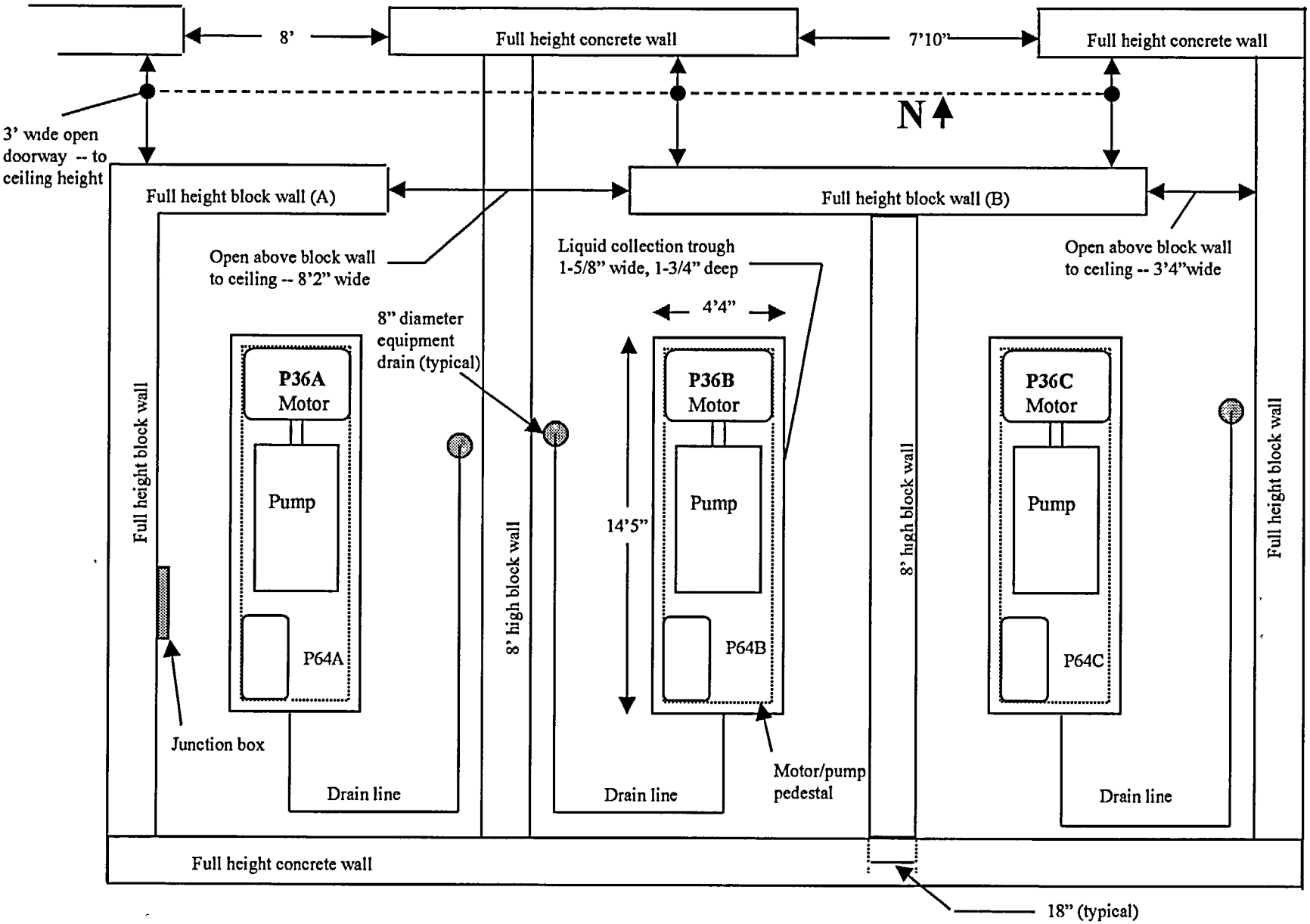
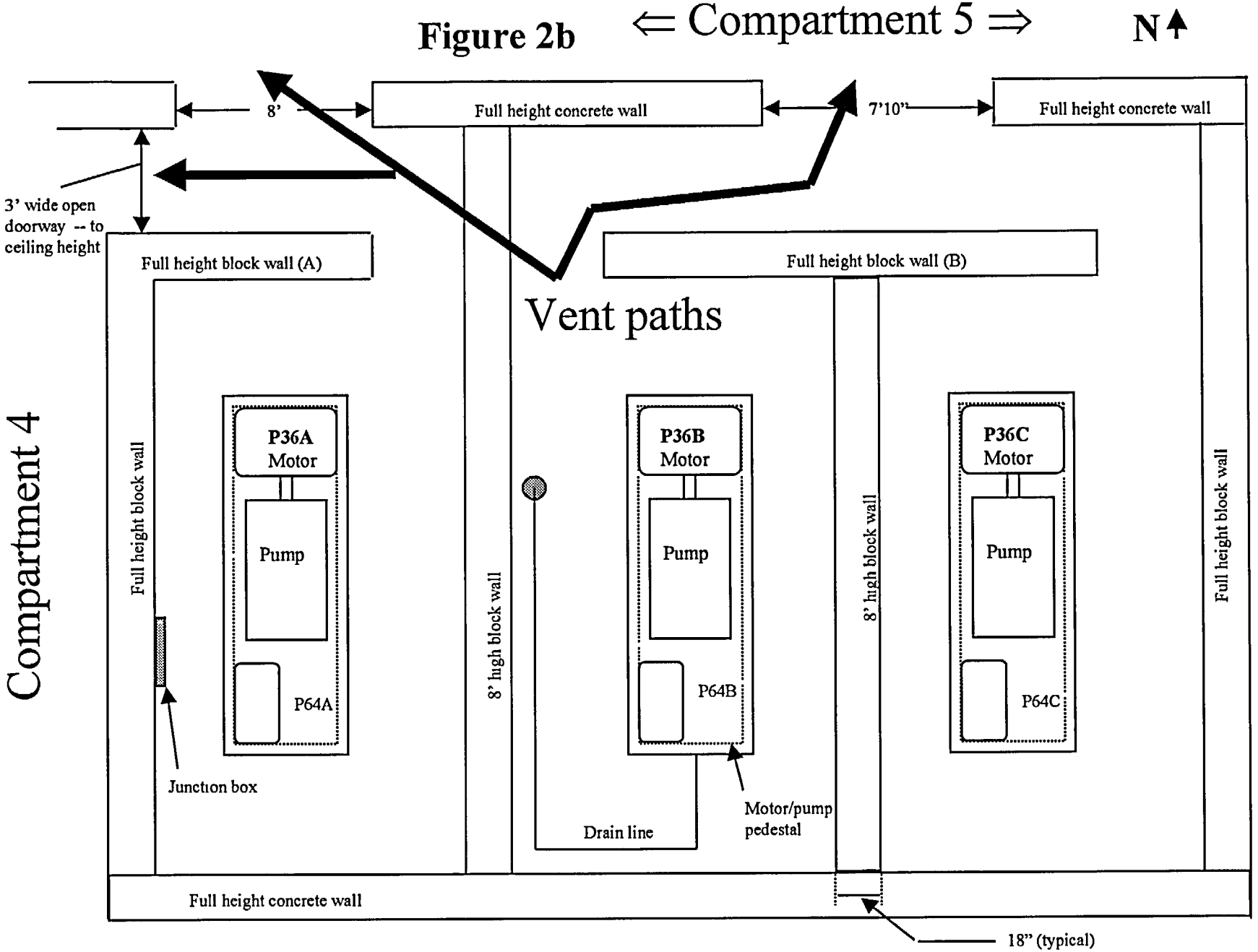


Figure 2b


⇐ Compartment 5 ⇒
N
8'
Full height concrete wall
7'10"
Full height concrete wall
3' wide open doorway -- to ceiling height
Full height block wall (A)
Full height block wall (B)
Vent paths
Compartment 4
Full height block wall
P36A Motor
Pump
P64A
8' high block wall
P36B Motor
Pump
P64B
8' high block wall
P36C Motor
Pump
P64C
Full height block wall
Junction box
Drain line
Motor/pump pedestal
Full height concrete wall
18" (typical)