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DUKE POWER

July 29, 1992

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

Subject: McGuire Nuclear Station, Units 1 and 2
Docket Nos. 50-369 and 50-370
Unqualified coatings inside Containment
Request for NRC approval

Dear Sir;

McGuire Nuclear Station has in place a program for the control of coatings inside containment. Recently, enhancements to this program have been identified. A fundamental criteria of the program enhancements involves limiting the amount of unqualified coatings inside containment to less than 20,000 square feet.

In support of the implementation of the program enhancements, Duke power requests NRC approval of the enclosed technical justification. The purpose of the justification is to show that a known quantity (20,000 square feet) of unqualified coatings inside containment will not degrade ECCS performance. The justification assumes that all unqualified coatings (20,000 square feet) inside containment fails and the impact of this failure on sump performance is assessed. Based on the results of this evaluation, the sump will not be clogged with the failed coatings and will still provide adequate NPSH requirements for all ECCS pumps during the entire event.

NRC approval of this evaluation prior to the start of McGuire unit 1 cycle 9 is requested. The current schedule for the start of cycle 9 is June 3, 1993.

If you have any questions regarding this issue, please contact Paul Guill of my staff at (704) 875-4002.

Very truly yours,

Ted C. McMeekin

xc: <u>with attachment</u>
S. D. Ebneter
Regional Administrator, Region II

P. K. Van Doorn
Senior Resident Inspector, McGuire

T. A. Reed, Project Manager
ONRR

Unqualified Coatings Inside Containment

Purpose

The purpose of this technical justification is to provide assurance that a known quantity of failed coatings inside the Containment will not degrade Emergency Core Cooling System performance.

Background

Coatings inside the McGuire Nuclear Station Containment were applied in accordance with the McGuire Painting and Coating Schedule (MC-1167.02) during original plant construction. The McGuire FSAR (Section 6.2.1.8) lists the coating systems, describes the DBA conditions the coatings will withstand, and describes where they were applied. The coating schedule has been superseded by the Nuclear aintenance Coating Schedule (MC-1167.00). McGuire Nuclear Station adopted Regulatory Guide 1.54 (Quality Assurance Requirements For Protective Coatings Applied To Water-Cooled Nuclear Power Plants) for all Civil components except for the provisions in ANSI N45.2-1971 (McGuire FSAR, Table 1-4). The original mechanical and electrical equipment does not comply with Regulatory Guide 1.54 since the equipment was procured prior to issuance of Regulatory Guide 1.54. To enhance our current coatings program, all coatings inside containment were inventoried and a maximum allowable quantity of failed coatings was conservatively determined to be 20,000 square feet. The 20,000 square feet of failed coatings is beyond the actual calculated value but will allow for any future coating deviations (Reference attachment 2 for a draft of proposed revisions to the McGuire FSAR).

Technical Justification

Less than 8% of all coatings inside Containment have unqualified coating systems. The McGuire recirculation intake sump has been designed to minimize the amount of debris which could reach the intake screens (Reference Attachment 1 for further description of sump features and draft of proposed revisions to the McGuire FSAR). The Containment sump structure, located in the pipe tunnel outside the polar crane wall, consists of an outer trash rack made of stainless steel grating to prevent large debris from entering the structure and a 1/4" fine mesh inner screen to prevent particles larger than .206" in diameter from passing through. Water collected in the lower Containment compartments reach the sump by flowing through a series of spare penetrations in the polar crane wall located near the Containment floor level. Lighter debris floating on the water surface is unable to reach the sump due to the water level being higher than the penetrations in the crane wall prior to ECCS operation. Heavier particles (specific gravity greater than 1) which settle to the Containment floor inside the crane wall also are unable to reach the sump screen due to the low approach velocity (.24 ft/sec), as determined by Alden Research Laboratory (ARL) from sump model testing. The optimum particle size most susceptible to being transported to the sump structure and causing screen blockage are particles with a diameter of .206". Larger particles will require higher water velocities to be transported to the sump. Water velocities in excess of 2 ft/sec are required to transport 1/8" coal particles (specific gravity=1.4) in either a suspended condition or as a sliding bed in large diameter horizontal pipes (NUREG-0797, Supplement 9, Comanche Peak Steam Electric Station). The failed coatings inside Containment have a specific gravity in the range of 1.1-1.5. In addition, the viscosity of water at 200°F is 1/3 that at 70°F. Therefore, the resistance to settlement is decreased and greater water velocities are required to transport these particles. Due to the low transport water velocity of .24 ft/sec inside Containment and particle settlement characteristics, particles larger than .206" in diameter will not be transported to the sump screens. After a LOCA, there would be an approximate minimum time of 20 minutes for particles to settle before any suction is taken from the sump. This 20 minute period allows the water level inside Containment to rise above the coverplate, thus preventing floating debris from entering the sump. Vortex formations or air entrainment will not occur at the sump as determined by ARL sump model tests. Floating debris will not be pulled into the sump. In addition, ARL sump model tests showed up to 50% screen blockage (67.5 square feet screen surface area) did not degrade ECCS performance. These sump design features are addressed in a letter from W.O. Parker to Mr. B.J. Youngblood, NRC, dated Sept. 24, 1980.

Due to the sump location and design features described above, the only particles which might be transported to the sump are particles which will pass through the screens (<.206" in diameter). The majority of failed coatings which might reach the sump screen and cause screen blockage are the failed coatings in the localized vicinity of the sump. Identified areas in the containment pipe chase with significant areas of unqualified coatings are at least 40′ from each side of the sump. Due to the low transport velocities and distance involved, these particles will not be transported to the sump screens. Since an insignificant amount of unqualified coatings exist in the localized area around the sump structure, there will be an insignificant amount of debris to block the screens.

Debris which might reach the sump screen must pass through a 1/4" fine mesh screen before entering the sump structure. To conservatively check the systems pulling water from the sump structure, all 20,000 square feet of failed coatings was assumed to be pulled into the sump structure. The Emergency Core Cooling and Containment Spray Systems can pull water from the sump structure following a LOCA. To check the systems for debris entrainment, a small break and large break LOCA were analyzed. For a small break LOCA, the High Head Safety Injection (HHSI, or NV) & Intermediate Head Safety Injection (IHSI, or NI) systems were analyzed. For a large break LOCA, the Residual Heat Removal (ND, or RHR), Containment Spray (NS, or spray), HHSI, and IHSI systems were analyzed. All system components (pumps, valves, pipes, heat exchangers, and spray nozzles) were analyzed for debris entrainment and clearances. The failure of 20,000 square feet of coatings was found not to degrade the systems performance based on a low debris/water ratio (194 ppm), input from equipment suppliers, and engineering judgement. The analysis conservatively assumed all 20,000 square feet of failed coatings entered the system, however, the sump design features described above will substantially reduce the amount of debris actually reaching the sump.

Accurate records of unqualified coatings inside Containment will continue to be maintained to insure the 20,000 square feet limit will not be exceeded. This programmatic approach improves the existing coating program and allows quantitative analysis to verify ECCS performance.

Conclusion

A programmatic and quantitative approach to controlling the inventory of unqualified coatings inside containment will further assure availability of the ECCS in an accident condition. This is done by limiting the amount of unqualified coatings being added inside the containment thereby further reducing the potential impact to the ECCS. Allowing a known and controlled quantity of unqualified coating materials inside containment does not reduce ECCS performance.

Piping

The Containment Spray System piping is austenitic stainless steel. This is required because the piping contains reactor coolant during recirculation operation.

Instrumentation and Control

All normally closed pump and refueling water storage tank isolation valves are provided with automatic remote operators which open upon receipt of the Containment high pressure signal. Position indication is provided in the Control Room for all remotely operated valves.

Material Compatibility

Parts of the system in contact with borated water are stainless steel or an equivalent corrosion resistant material. All exposed surfaces within the Containment have coatings which are not subject to breakdown under exposure to the Containment spray and which can withstand the steam pressure and temperature associated with the LOCA (without spalling or flaking). Insulation within the Containment does not contain materials which could potentially enter the pump and cause plugging of ECCS and Containment spray strainers and equipment. Electrical circuitry and equipment within the Containment which are required for accident and post-accident conditions are water tight or submersible and suitable for accident pressure and temperature conditions.

For the hypothetical double-ended rupture of a Reactor Coolant System pipe, the pH of the sump solution (and, consequently, the spray solution) is raised to at least 8.0 within one hour of the onset of the LOCA. It is possible to adjust the pH of the sump solution using the chemical mixing tank and the charging pumps, should it become necessary.

Containment Sump

The design of McGuire does not provide for a Containment sump as such. The lower compartment of the Containment collects sufficient volume of water following the injection phase of safety injection to allow the initiation of recirculation. Refer to Figure 1-10 on page 1-21 and Figure 1-16 on page 1-27 for plan and elevation drawings of the Containment sump. The design detail of the Containment sump is shown on Figure 6-196 on page 6-647.

The Containment sump structure consists of an outer trash rack made of stainless steel grating to prevent large debris from reaching the inner screen. A fine mesh inner screen is provided to prevent particles larger than .206" in diameter from passing through. All flow restrictors and Containment spray nozzle openings are larger than this value. A removable solid top deck is provided to facilitate inspection of the structure and pump suction intake.

See Next Page For Revision

After a LOCA, the potential debris that could be stripped off is not expected to adversely affect the operation of the emergency recirculation cooling system. Dense debris (specific gravity greater than 1) settles before reaching the Containment sump structure. This is accomplished by utilizing a 6" trash curb and maintaining a very low inlet velocity. Debris would generally be generated during the initial blowdown of the LOCA; thus, there would be an approximate minimum time of twenty minutes for particles to settle before any suction is taken from the sump. This twenty minutes also allows the water level to rise above the coverplate, thus preventing floating debris from blocking the screen.

Ice Condenser insulation and components are designed so as not to generate debris during a LOCA.

FSAR 6.5.2

Containment Sump

The design of McGuire does not provide for a Containment sump as such. The lower compartment of the Containment collects sufficient volume of water following the injection phase of safety injection to allow the initiation of recirculation. Water collected in the lower Containment compartments reaches the sump by flowing through a series of spare penetrations in the polar crane wall located near the Containment floor level. Refer to Figures 1-10 and 1-16 for plan and elevation drawings of the Containment sump. The design details of the Containment sump are shown on Figure 6-193.

The Containment sump structure, which is located in the pipe tunnel outside the polar crane wall, consists of an outer trash rack made of stainless steel grating to prevent large debris from reaching the inner screen. A fine mesh inner screen is provided to prevent particles larger than .206" in diameter from passing through. A removable solid top deck is provided to facilitate inspection of the structure and pump suction intake.

After a LOCA, the potential debris that could be stripped off will not adversely affect the operation of the emergency recirculation cooling system. Dense debris including failed coatings (specific gravity greater than 1) settles to the floor and cannot reach the Containment sump structure. This is accomplished by maintaining a very low inlet velocity of .24 fps, as determined by Alden Research Laboratory (ARL) from sump model testing. Debris including paint chips, insulation, etc. would be generated during the initial blowdown of the LOCA; thus, there would be an approximate minimum time of twenty minutes for particles to settle before any suction is taken from the sump. This twenty minutes also allows the water level to rise above the coverplate, thus preventing floating debris from blocking the screen. No vortex formations or air entrainment will occur at the sump as determined by ARL sump model test, therefore floating debris will not be pulled into the sump. However, if debris were able to reach the sump, the fine mesh screen (1/4" mesh size) is provided to prevent degradation of ECCS performance. The Containment spray nozzles, which have 3/8" spray orifices, are not subject to clogging by particles less than 1/4" in maximum dimension. All other valves, pumps, and heat exchangers have sufficient clearances to pass particles of less than 1/4". ARL sump model tests also showed that 50% screen blockage (67.5 square feet screen surface area) does not degrade ECCS performance.

Equipment insulation is designed so as not to become a source of sump blockage. The types of insulation used in the Containment are reflective or mass insulation as listed on Table 6-140 on page 6-644. Essentially all mass insulation is encapsulated.

The reflective insulation or mass (encapsulated/blanket) insulation, which is utilized on high energy piping, is expected to be stripped off during a postulated rupture in the vicinity of the rupture. All insulation in the vicinity of postulated pipe breaks is in the lower Containment area and would pose no problems in clogging drains. However, in the event that a break occurred, and reflective insulation, mass (encapsulated/blanket) insulation or parts thereof were thrown into the ice condenser via the lower inlet door, there is a possibility of clogging a bay drain. Under these circumstances, water would run over to the next bay after exceeding a level of 1 inch in the affected bay.

Non-safety related equipment in the Containment is also designed so as not to become a source of sump blockage.

The containment sump structure design is in conformance with Regulatory Guide 1.82 except that Section C is revised as follows:

C.1 A configuration utilizing the containment side structure and floor as the intake structure boundary is considered acceptable for those plants in which the post LOCA water level in the containment is sufficiently high, thus making additional sump depressions in the floor non-productive. Redundance is provided by two separate suction pipes protected by a trash rack, screen and guard pipes.

C.2 The containment recirculation intake structure and the suction piping should be protected from high energy piping systems to the extent practical to preclude damage by whipping pipes of high-velocity jets of water or steam.

C.4 A curb should be provided around the intake structure to prevent the accumulation of heavy debris against the outer screen.

C.7 A vertically mounted fine inner screen should be provided. The design coolant velocity at the inner screen should be approximately 45 cm/sec (1.5 ft/sec). The available surface area used in determining the design coolant velocity should be based on one-half of the free surface area of the fine inner screen to conservatively account for partial blockage. Only the vertical screens should be considered in determining available surface area.

Water is available, for recirculation, from the following sources:

1. Refueling water storage tank
2. Reactor Coolant System
3. Safety Injection System - accumulators
4. Ice Condenser - ice melt

At least 350,000 gallons of water are in the lower compartment of the Containment prior to the start of recirculation. After all the ice has melted there are available for recirculation 750,000 gallons or more. Water is collected in the refueling cavity during the initial transfer of water and during recirculation. Depletion of the recirculation supply is prevented by terminating the six refueling cavity drains in the lower compartment of the Containment.

Codes and Classifications

Safety class and code class for major components of the system are given in Table 3-4 on page 3-44.

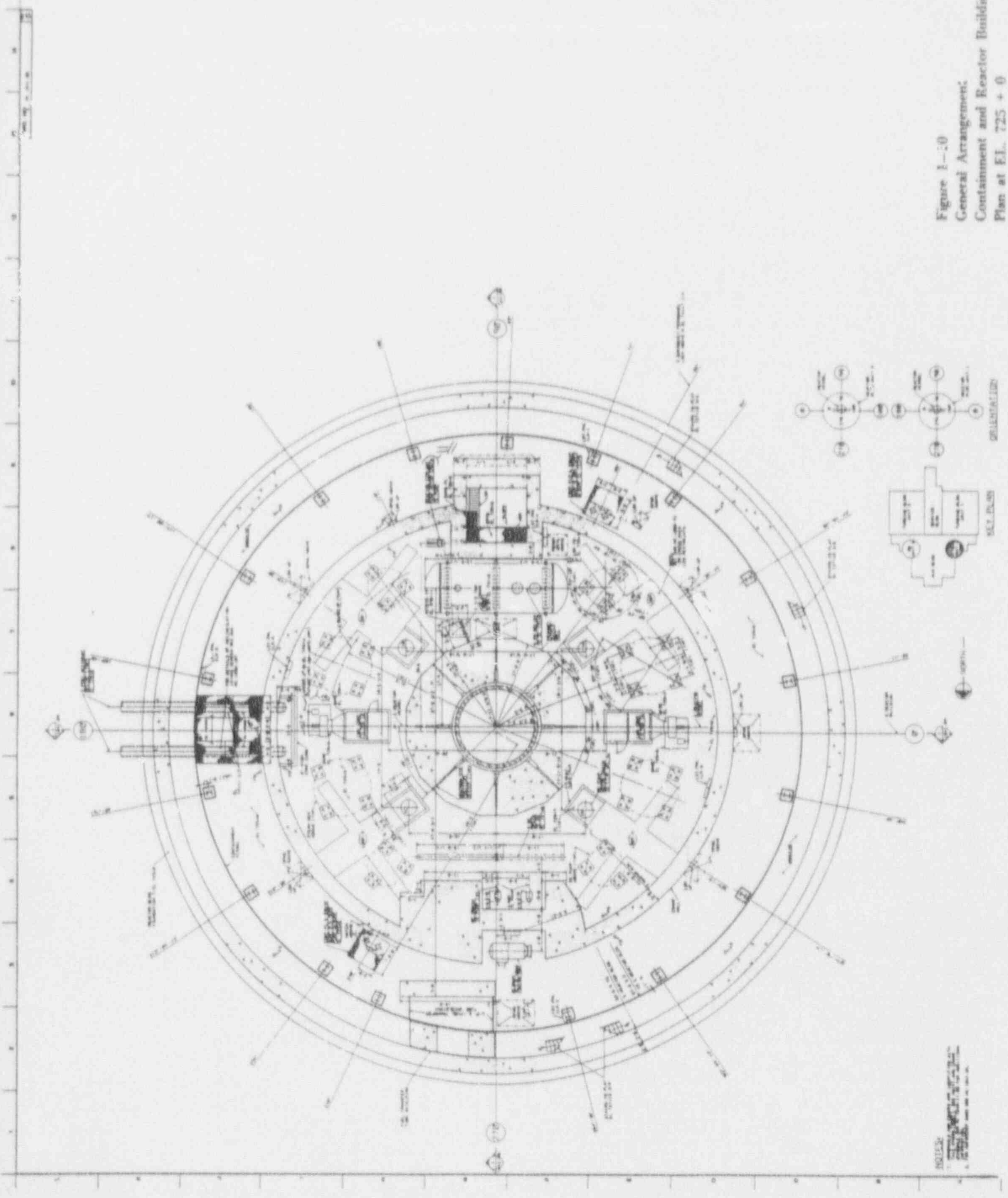


Figure 1-10
General Arrangement
Containment and Reactor Building Unit 1
Plan at El. 725 + 0

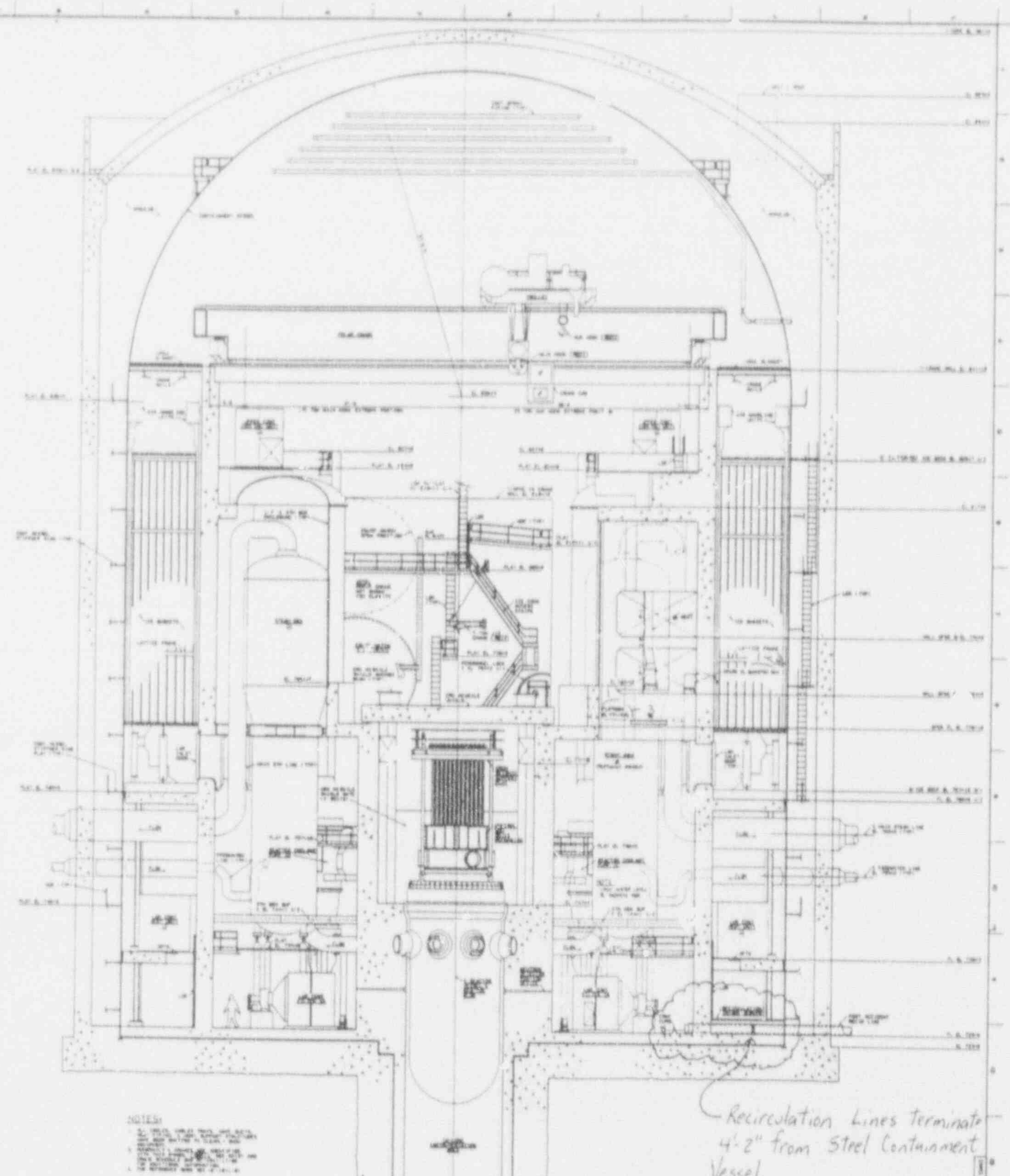


Figure 1-16
General Arrangement
Containment and Reactor Building
Sections

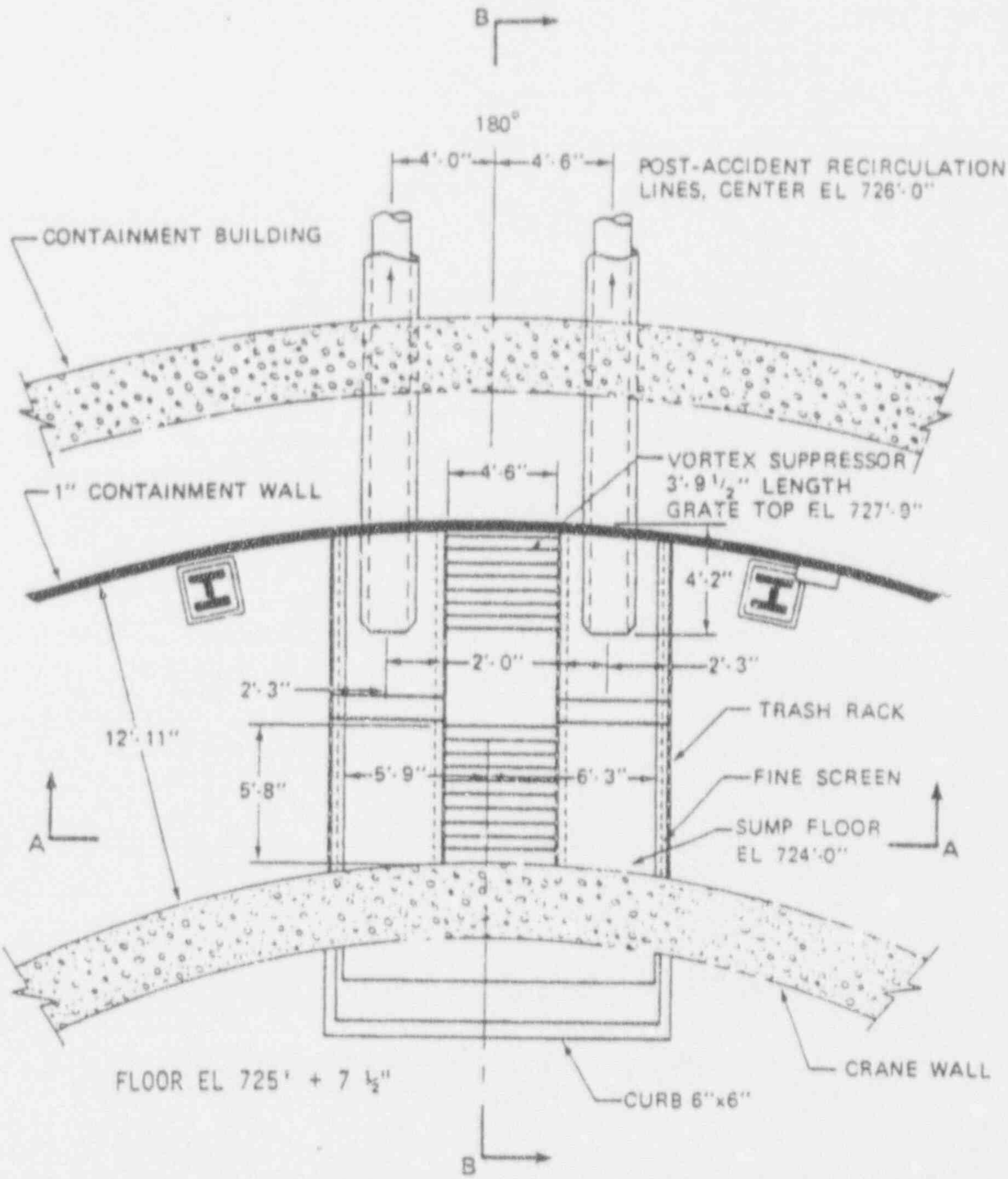
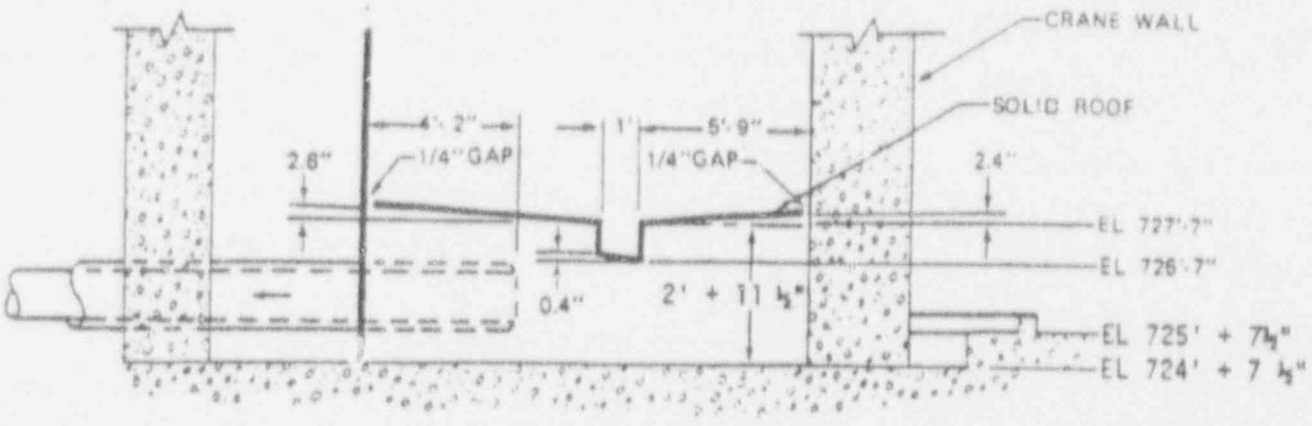
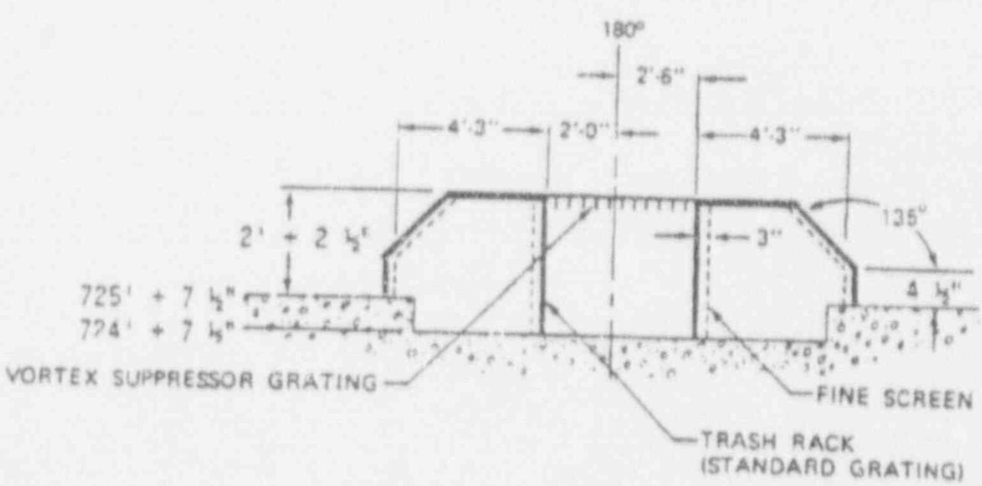


Figure 6-196 (Part 1 of 2).
Containment Sump



SECTION BB



SECTION A-A

Figure 6-196 (Part 2 of 2).
Containment Sump

6.2.1.8 Materials

The following coating materials and coating systems are those specified by Design Engineering and applied by the Duke Power Company Construction Department to all structures and equipment inside the Containment structure. These systems have been qualified for radiation exposure, pressure, temperature and water chemistry exposure during a DBA in the following manner. See Next Page For Revision

Radiation

1. ANSI N5.9-1967 Protective Coatings (Paints) for the Nuclear Industry Applica[illegible]es defined in Section 1.1.1, Table 1.1.1, a Summary Guide to Coating Performance Requirements and Table 1.1.2, Radiation Exposure Guide.

2. ANSI N101.2-1972 Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities.

   Applicable exposures defined in Subdivision 1.4.2.1, Normal Environmental Conditions for PSR's, Table 1 Typical Design Exposure Conditions of Coatings for Normal Operation of PWR's.

Temperature-Pressure

1. ANSI N101.2-1972 Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities.

   1 Subdivision 1.4.2.2, Design Basis Accident Environment Conditions for PWRs Table 3. Typical
   1 spray solution additives.

   Applicable exposures defined in Subdivision 1.4.2.2 Design Basis Accident Environmental Conditions for PWR's and Figure 1, Typical DBA Curve for PWR Containment facilities showing temperature and pressure versus time.

2. Pressure - Temperature Curve provided in Figure 6-69 on page 6-399 and Figure 6-70 on page 6-400 representing conditions for Westinghouse Ice Condenser Units.

Water Chemistry

1. ANSI N101.2-1972 Protective Coatings (Paints) For Light Water Nuclear Reactor Containment Facilities.

   Subdivision 1.4.2.2 Design Basis Accident Environment Conditions for PWR's Table 3. Typical Spray Solution Additives.

2. Chemical make up of spray solutions and water chemistry during the DBA cycle.

The Commercial names of Mobil Chemical Company coatings used in the Containment are listed below:

DP#12	13 F12 Mobil Zinc #7
DP#17	89-R-10 Val-chem High Build Epoxy Base
DP#34	89 Series Val-Chem H. Build Epoxy Enamel
DP#35	46-X-19 Epoxy Surfacer
DP#36	99-X-101 Water Base Epoxy Surfacer
DP#69	76 Series High Build High Solid Epoxy Enamel
DP#72	78 Series Tank Lining Epoxy

The Commercial names of Wisconsin Protective Coatings Corporation Coatings used in the Containment are listed below:

DP#71	7155 Series Plasite Lining

FSAR 6.2.1.8

Materials

The following coating materials and coating systems are those specified by Engineering and applied by the Duke Power Company Maintenance Department to all structures and equipment inside the Containment structure. These systems have been qualified for radiation exposure, pressure, temperature, and water chemistry exposure during a DBA in the following manner.

A maximum of 20,000 square feet of unqualified coatings inside Containment is considered to be a negligible fraction of the Containment interior surfaces. The effect of non-qualified coating failure on the Containment spray flowpath is presented in Section 6.5.