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UniStar
NUCLEAR ENERGY

10 CFR 50.4
10 CFR 52.79

October 20, 2011

UN#11-156

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3,
RAI 280, Internal Flooding

References:

1) Surinder Arora (NRC) to Robert Poche (UniStar Nuclear Energy), "FINAL RAI 280 SBPB 5276" email dated December 3, 2010

2) UniStar Nuclear Energy Letter UN#11-112, from Greg Gibson to Document Control Desk, U.S. NRC, Submittal of Response to RAI 280, Internal Flooding, dated March 25, 2011

3) UniStar Nuclear Energy Letter UN#11-257, from Greg Gibson to Document Control Desk, U.S. NRC, Submittal of Response to RAI 280, Internal Flooding, dated September 21, 2011

The purpose of this letter is to update the response to the request for additional information (RAI) identified in the NRC e-mail correspondence to UniStar Nuclear Energy, dated December 3, 2010 (Reference 1). This RAI addresses Internal Flooding, as discussed in Section 10.4.5 of the Final Safety Analysis Report (FSAR), as submitted in Part 2 of the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Combined License Application (COLA), Revision 7.

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NRO

Enclosure 1 provides our updated response to RAI 280, Question 10.04.05-5, and includes revised COLA content. A Licensing Basis Document Change Request has been initiated to incorporate these changes into a future revision of the COLA. This response replaces the response provided in Reference 2 in its entirety.

This letter provides the updated response to RAI 280 Question 10.04.05-5, in accordance with the schedule provided in Reference 3.

Our response does not include any new regulatory commitments. This letter does not contain any sensitive or proprietary information.

If there are any questions regarding this transmittal, please contact me at (410) 369-1905, or Mr. Wayne A. Massie at (410) 369-1910.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on October 20, 2011

Vincent Sorel
for Greg Gibson

Enclosures: 1) Updated Response to NRC Request for Additional Information, RAI 280, Question 10.04.05-5, Internal Flooding, Calvert Cliffs Nuclear Power Plant, Unit 3

2) Electronic Copy of FSAR Figure 2.5-173 (1 CD) , Calvert Cliffs Nuclear Power Plant, Unit 3

cc: Surinder Arora, NRC Project Manager, U.S. EPR Projects Branch
Laura Quinn, NRC Environmental Project Manager, U.S. EPR COL Application (w/o enclosure 2)
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application (w/o enclosures)
Charles Casto, Deputy Regional Administrator, NRC Region II (w/o enclosures)
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2 (w/o enclosure 2)
U.S. NRC Region I Office (w/o enclosure 2)

GTG/FRP/mdf

Enclosure 1

Updated Response to NRC Request for Additional Information
RAI 280, Question 10.04.05-5, Internal Flooding

Calvert Cliffs Nuclear Power Plant, Unit 3

RAI 280

Question 10.04.05-5

This is a follow-up to **RAI 246 Question 10.04.05-4**

In RAI 246 Question 10.04.05-4, the NRC staff requested additional details regarding a CWS flooding event and the locations of water exiting the turbine building. In the August 11, 2010 response to Question 10.04.05-4, it is stated:

> "To direct the flood flow away from the safety SSCs, and to avoid flood water from flowing toward the east where the reactor building is located, the finish grade between the north wall of the Turbine Building and the southwest corner of the Essential Service Water (ESW) cooling tower **is raised locally in the form of a berm**, in addition to other minor local grading in the yard area."

The response references Figure 2.5-173, but it appears that it should have been Figure 2.5-129. However, upon review of the site grading plan, the berm could not be located. Because the berm is being relied upon to direct the flood flow away from the safety SSCs, and to avoid flood water from flowing toward the east where the reactor building is located, additional information in the FSAR is needed. The FSAR should be updated to include the berm on the site grading plan. In addition, the applicant should provide a height and justification for the height of the berm to protect all safety SSCs from the CWS flooding event.

Response

A flood analysis was performed to assess the effect of a flood resulting from a postulated Circulating Water System (CWS) pipe failure inside the Turbine Building and exiting to the yard area. Details of the flood conditions can be found in the response to RAI 246, Question 10.04.05-4[1].

The FSAR Figure 2.5-129 referred to in Question 10.04.05-5 was renumbered as Figure 2.5-173 in the October 9, 2009, update to FSAR Sections 2.5.4 and 2.5.5[2], and is reflected as such in COLA Revision 7. As shown in the attached FSAR Figure 2.5-173 (updated for this response), the yard area on the north side of the Turbine Building is bounded by three roads, on the east, north, and west sides. The east road (boundary between flood areas and the safety-related SSCs) has the highest crown elevation and the north side road (drainage side) has the lowest crown elevation. The yard area north of the Turbine Building is graded toward the north road to prevent floods from overtopping the east road and adversely affecting safety-related SSCs. To reduce the flooding level from a postulated CWS pipe break, finish grade elevation on the north side of the Turbine Building is lowered by 2 feet to Elevation 83 ft NGVD29 and sloped toward the north road. Also, a berm, constructed of compacted structural fill protected with concrete lining on all sides, with a top of the berm at Elevation 85.5 ft NGVD29, is added between the north wall of the Turbine Building and the Essential Service Water (ESW) cooling tower and between the two ESW cooling towers.

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1 G. Gibson (UniStar Nuclear Energy) to Document Control Desk (NRC), "Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI 246, Circulating Water System," letter UN#10-228 dated August 11, 2010.

2 G. Gibson (UniStar Nuclear Energy) to Document Control Desk (NRC), "Update to Calvert Cliffs Nuclear Power Plant, Unit 3, FSAR Sections 2.5.4 and 2.5.5," letter UN#09-427 dated October 9, 2009.

The purpose of the berm is to prevent the flood flow from reaching the catch basins that are located between the Turbine Building and the ESW cooling tower. These catch basins are connected to the catch basins located near the Emergency Power Generating Building.

The flood flow resulting from the postulated break is conveyed by these features in a northward direction and toward the northern drainage ditch (north ditch). The transformers area, located on the west side of the Turbine Building, is enclosed by walls to divert the flood flow exiting the Turbine Building from the west side.

To control the flood path, relief siding will be installed on the north and west sides of the Turbine Building. These relief sidings will open under the hydrostatic pressure created by the CWS break flood waters in the Turbine Building. The relief siding will extend from the northwest stair tower toward the east along the north Turbine Building wall (approximately 110 ft). The same relief siding is installed for the north wall on the west side of the stair tower (approximately 50 ft) and for the entire wall on the west side of the building (approximately 180 ft). For the flooding analysis an opening of 160 ft on the north side of the Turbine Building is used.

The flood flow exiting the west side of the Turbine Building will be naturally diverted into two directions, to the north and south. However, to maximize the flood flow elevation outside of the Turbine Building, it is conservatively assumed that all the flood water exiting the Turbine Building occurs along the north side. Outside the Turbine Building, this flood water enters a relief flow path with an approximate flow width of 190 ft. At the north road (downstream end of the flood area), the width of the flow path continues to be approximately 190 ft, based on the finish grade elevations.

As the flood water flows northward away from the Turbine Building, it will be confined on the east by the two ESW buildings and the berm along the east side. On the west side, the flow will follow the topography between the west road and the transformers area.

Assuming a steady-state maximum flow out of the Turbine Building and over the north road and yard area, the conservatively calculated maximum flood water level at the north side of the Turbine Building is Elevation 85.0 ft NGVD29. The respective flood level continues over the north road, and the direction of the flood flow is toward the north ditch and away from the power block area. The safety-related SSCs in the Nuclear Island are protected by the new berm (which has a top Elevation of 85.5 ft NGVD29) between the Turbine Building and the ESW cooling tower and the two ESW cooling towers. Therefore, the flood water from a postulated break of the CWS pipe in the Turbine Building, conservatively evaluated as exiting towards the yard area on the north side of the building, will not introduce a flood hazard to the safety-related SSCs.

For added conservatism, the flood analysis assumes that the maximum flood flow occurs along the flood path instantly. In reality, the cooling tower basin is the flood water source having a finite volume, with circulating water pumps tripping upon the drop of water level at the pumps to a pre-set minimum control condition. The entire flood period is short, with peak flow lasting only for a small period of the flood duration, even with the inclusion of small cooling tower makeup flow rate. The analysis, however, conservatively assumed the flood peak occurs instantly and did not account for the filling volumes of the buildings and the yard area and the decrease in the flood peak for the short period of flood event.

There are no safety-related below grade penetrations located in the ESW Building walls that are exposed to the flood waters. In addition, the below grade penetrations (in the walls that are not exposed to flood waters) are sealed to prevent leakage of water into the buildings.

Also, FSAR Figure 10.4-1 (Circulating Water System P&ID – Circulating Water Pump Building) has been updated to reflect the design configuration consistent with RAI 246, Question 10.04.05-4[1] response.

COLA Impact

FSAR Section 10.4.5.3 is being updated as follows (only the impacted portions are shown):

10.4.5.3 Safety Evaluation

. . .

Flood waters, resulting from a CWS pipe failure inside the Turbine Building, would exit through relief sidings installed ~~in the building~~ on the north and west sides of the Turbine Building. The relief sidings open under the hydrostatic pressure created by the CWS pipe failure flood waters in the Turbine Building. Relief sidings are ~~is~~ installed on approximately 160 ft of the north wall (starting from the western corner and excluding the stair tower), and on the entire west wall of 180 feet to allow flood water to exit the Turbine Building in the event of a rupture in the CWS piping.

As shown in Figure 2.5-173, the yard area north of the Turbine Building is surrounded by three roads: on the west, north, and east sides. The eastern side road is the major flood drainage boundary between the turbine building and reactor building areas. The crest elevations of the eastern road are set above the maximum flood elevations of the turbine building area to provide a permanent flood protection barrier between the two areas. For this purpose, the crest of the eastern side road is set at Elevation 85.5 ft NGVD29, the yard elevation outside of the turbine building is set at Elevation 83.0 ft NGVD29, and the crest of the northern side road is set at Elevation 82.0 ft NGVD29.

The general yard grading near the Turbine Building is arranged in a way that flood water exiting the relief siding on the northern side of the building will flow primarily in a northerly direction. In addition to the flood barrier provided by the eastern boundary road, and to ~~To~~ direct the flood flow away from ~~the~~ safety-related SSCs~~,~~ and ~~to~~ avoid flood water from flowing toward the east through the storm drain (where the reactor building is located), the finish grade between the north wall of the Turbine Building and the southwest corner of the Essential Service Water (ESW) cooling tower, and between the two ESW cooling towers, is raised locally in the form of a berm. The berm will be constructed of compacted structural fill protected with concrete lining on all sides and with the top of the berm at Elevation 85.5 ft NGVD29; this will contain the maximum conservatively analyzed flood elevation of 85.0 ft NGVD29. These measures and other minor local grading in the yard area will convey the flood water in a northward direction and toward the northern drainage ditch (north ditch).~~, in addition to other minor local grading in the yard area.~~ The flood flow exiting the west side of the Turbine Building will be naturally diverted in two directions, to the north and the south by the enclosure walls of the transformers located west of the Turbine Building. These flow paths are farther away from the safety-related SSCs and have less flooding impact. For added conservatism, the flood analysis assumes that ~~all flood flow will exit through the north side of the Turbine Building~~the maximum flood flow occurs along the flood path instantly. In reality, the cooling tower basin is the flood water source having a finite volume, with circulating water pumps tripping upon the drop of water level at the pumps to a pre-set minimum control condition. The entire flood period is short, with peak flow lasting only for a small period of the flood duration, even with the inclusion of small cooling tower makeup flow rate. The analysis, however, conservatively assumed the flood peak occurs instantly and did not account for the filling volumes of the buildings and the yard area and the decrease in the flood peak in the short period of flood event.

As the flood water flows northward from the Turbine Building, it will be confined by the two ESW buildings, the east road and the berm along the east side. On the west side, the flow will follow the topography between the west road and the transformers area.

The flood analysis indicates that the postulated CWS piping rupture in the Turbine Building will not impact any safety-related SSCs. The safety-related SSCs in the Nuclear Island are protected by the berm that extends between the Turbine Building and the ESW cooling tower and between the two ESW cooling towers. The two safety-related ESW cooling towers on the north side of the Turbine Building are not affected by flood flow because their entrance opening is 14.0 ft above finish grade. Additionally, there are no safety-related below grade penetrations located in the ESW Building walls that are exposed to the flood waters, and below grade penetrations (in the walls that are not exposed to flood waters) are sealed to prevent leakage of water into the buildings. Therefore, the flood water from a postulated break of a CWS pipe in the Turbine Building, conservatively evaluated as exiting toward the yard area on the north side of the building, will not create a flood hazard to safety-related SSCs.

Considering the cooling tower yard topography and cooling tower basin elevation (see Figures 2.4-7 and 2.5-~~129~~173), a collapse in a cooling tower basin wall would result in flood water flowing toward the cooling tower area western boundary to design drainage ditches and away from the power block area; consequently, there is no impact to safety-related SSCs in the power block area due to a postulated collapse of a cooling tower basin wall.

Flooding resulting from a postulated CWS pipe failure in the yard area adjacent to the Switchgear Building will not result in a flood hazard to safety-related SSCs. The finish grade topography along the CWS pipe route is designed such that surface runoff is directed to the south away from the power block and toward drainage ditches (Figures 2.4-9 and 2.5-~~129~~173). To assess the effect of a flood resulting from a postulated CWS pipe failure in the yard area next to the non-safety related Switchgear Building (the closest CW pipe point to the power block area), a flood analysis was performed to determine the flood level. From the results of this analysis, the calculated maximum localized flood level at the non-safety related Switchgear Building (flood origination location) is Elevation ~~84.1~~84.2 feet NGVD29. The flood water both spreads and deceases in level as it flows downward and toward the southern drainage path. The respective flood level over the southern perimeter road is at Elevation ~~83.1~~83.2 ft NGVD29 and the direction of the flow is away from the power block area. Safety-related structures are located a few hundred feet away from this area and are protected by the high crown of the east side perimeter road and by having a design floor elevation of 84.6 feet NGVD29, which is above the maximum calculated flood elevation. Consequently, the flood water from a postulated break of a CWS pipe in the yard area will not reach the power block area and will not create a flood hazard to safety-related SSCs.}

FSAR Figure 10.4-1 is replaced with the following:

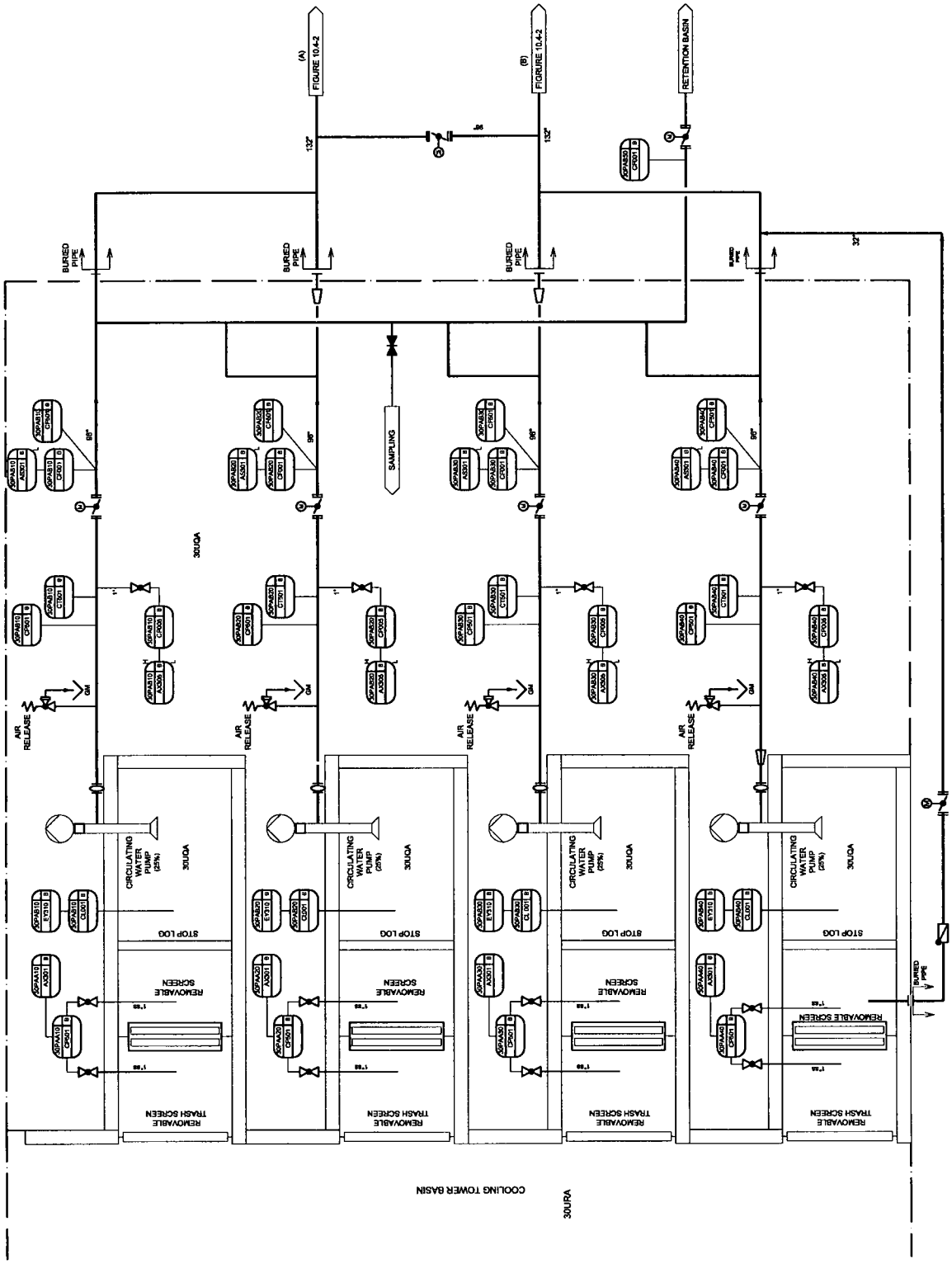
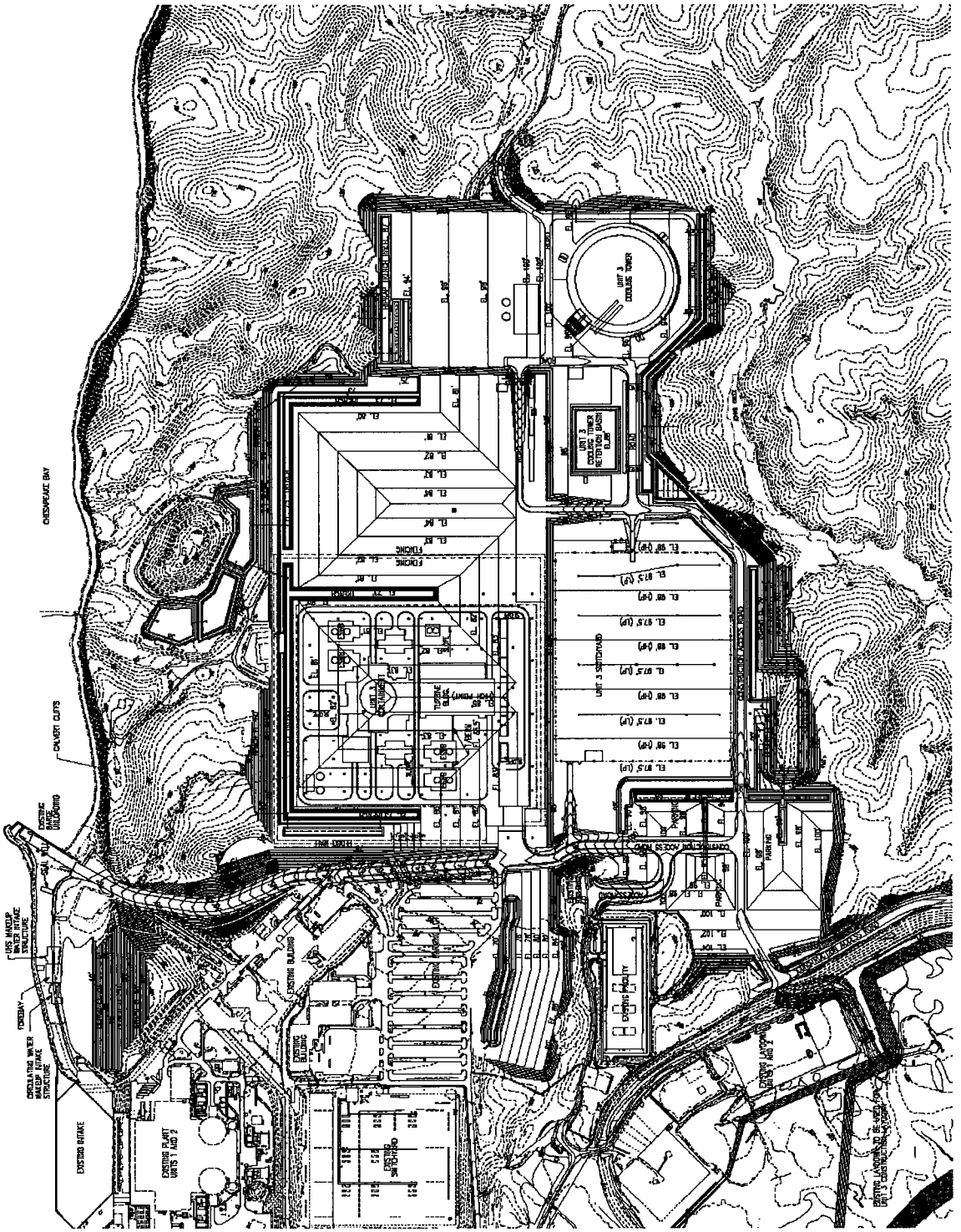


Figure 10.4-1 - { Circulating Water System P&ID (Circulating Water Pump Building)}

FSAR Figure 2.5-173 is replaced with the following (electronic copy provided in Enclosure 2):



Enclosure 2

Electronic Copy of FSAR Figure 2.5-173
(1 CD)

Calvert Cliffs Nuclear Power Plant, Unit 3