Westinghouse

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

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Your ref: Docket No. 52-006
Our ref: DCP_NRC_002937

June 30, 2010

Subject: AP1000 Response to Request for Additional Information (SRP6.2.2)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 6.2.2. These RAI responses are submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in the response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Responses are provided herein for:

RAI-SRP6.2.2-CIB1-31 R1
RAI-SRP6.2.2-SPCV-25 R2

Pursuant to 10 CFR 50.30(b), proprietary and non-proprietary versions of the response to the request for additional information on SRP Section 6.2.2 are submitted as Enclosures 3 and 4. Also enclosed is one copy of the Application for Withholding, AW-10-2880 (non-proprietary) with Proprietary Information Notice, and one copy of the associated Affidavit (non-proprietary).

This submittal contains proprietary information of Westinghouse Electric Company LLC. In conformance with the requirements of 10 CFR Section 2.390, as amended, of the Commission's regulations, we are enclosing with this submittal an Application for Withholding from Public Disclosure and an affidavit. The affidavit sets forth the basis on which the information identified as proprietary may be withheld from public disclosure by the Commission.

Correspondence with respect to the affidavit or Application for Withholding should reference AW-10-2880 and should be addressed to James A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P. 0. Box 355, Pittsburgh, Pennsylvania 15230-0355.

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Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

for/ John DeBlasio

Robert Sisk, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization

/Enclosures

1. AW-10-2880 "Application for Withholding Proprietary Information from Disclosure," dated June 30, 2010

2. AW-10-2880, Affidavit, Proprietary Information Notice, Copyright Notice dated June 30, 2010

3. Response to Request for Additional Information on SRP Section 6.2.2, RAI-SRP6.2.2-CIB1-31 R1 and RAI-SRP6.2.2-SPCV-25 R2 (Proprietary)

4. Response to Request for Additional Information on SRP Section 6.2.2, RAI-SRP6.2.2-CIB1-31 R1 and RAI-SRP6.2.2-SPCV-25 R2 NP (Non-Proprietary)

cc:	D. Jaffe	-	U.S. NRC	4E
	E. McKenna	-	U.S. NRC	4E
	P. Donnelly	-	U.S. NRC	4E
	T. Spink	-	TVA	4E
	P. Hastings	-	Duke Power	4E
	R. Kitchen	-	Progress Energy	4E
	A. Monroe	-	SCANA	4E
	P. Jacobs	-	Florida Power & Light	4E
	C. Pierce	-	Southern Company	4E
	E. Schmiech	-	Westinghouse	4E
	G. Zinke	-	NuStart/Entergy	4E
	R. Grumbir	-	NuStart	4E
	D. Lindgren	-	Westinghouse	4E
	D. Behnke	-	Westinghouse	4E

ENCLOSURE 1

AW-10-2880

APPLICATION FOR WITHHOLDING
PROPRIETARY INFORMATION FROM DISCLOSURE

Westinghouse

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Nuclear Services
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355
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U.S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
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Direct tel: 412-374-6206
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e-mail: sisk1rb@westinghouse.com

Your ref: Docket Number 52-006
Our ref: AW-10-2880

June 30, 2010

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: Submittal of Proprietary and Non-Proprietary Technical Document Information, Response to Request for Additional Information (RAI) on SRP Section 6.2.2

The Application for Withholding is submitted by Westinghouse Electric Company LLC (Westinghouse), pursuant to the provisions of Paragraph (b) (1) of Section 2.390 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

The proprietary material for which withholding is being requested is identified in the proprietary versions of the subject RAI responses In conformance with 10 CFR Section 2.390, Affidavit AW-10-2880 accompanies this Application for Withholding, setting forth the basis on which the identified proprietary information may be withheld from public disclosure.

Accordingly, it is respectively requested that the subject information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.390 of the Commission's regulations.

Correspondence with respect to this Application for Withholding or the accompanying affidavit should reference AW-10-2880 and should be addressed to James A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania, 15230-0355.

Very truly yours,

for/ John DeBlasio

Robert Sisk, Manager
Regulatory Affairs and Stratgey

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AW-10-2880
June 30, 2010

ENCLOSURE 2

Affidavit

AW-10-2880
June 30, 2010

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

Before me, the undersigned authority, personally appeared James W. Winters, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

James W. Winters, Manager
Passive Plant Technology

Sworn to and subscribed
before me this 30th day
of June 2010.

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Linda J. Bugle, Notary Public
City of Pittsburgh, Allegheny County
My Commission Expires June 18, 2013
Member, Pennsylvania Association of Notaries

Notary Public

(1) I am Manager, Passive Plant Technology, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse "Application for Withholding" accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in RAI-SRP6.2.2-CIB1-31 R1 and RAI-SRP6.2.2-SPCV-25 R2, in support of the AP1000 Design Certification Amendment Application, being transmitted by Westinghouse letter (DCP_NRC_002937) and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse for the AP1000 Design Certification Amendment application is expected to be applicable in all licensee submittals referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application in response to certain NRC requirements for justification of compliance of the safety system to regulations.

This information is part of that which will enable Westinghouse to:

(a) Manufacture and deliver products to utilities based on proprietary designs.

(b) Advance the AP1000 Design and reduce the licensing risk for the application of the AP1000 Design Certification

(c) Determine compliance with regulations and standards

(d) Establish design requirements and specifications for the system.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purposes of plant construction and operation.

(b) Westinghouse can sell support and defense of safety systems based on the technology in the reports.

(c) The information requested to be withheld reveals the distinguishing aspects of an approach and schedule which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar digital technology safety systems and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

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ENCLOSURE 4

Response to Request for Additional Information on SRP Section 6.2.2

RAI-SRP6.2.2-CIB1-31 R1 and RAI-SRP6.2.2-SPCV-25 R2

(Non-Proprietary)

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP6.2.2-CIB1-31
Revision: 1

Question:

In DCD section 15.6.5.4C.3, the effect of wall-to-wall flooding on containment flood level due to leakage between compartments is evaluated at a time of 14 days into the DEDVI line break accident. Inherent in this evaluation is the assumption that the backflow leak rates through the double in-series check valves in the drain lines and into the refueling cavity, PXS-A, PXS-B, and CVS compartments are limited to maximum values such that the compartment flooding occurs in no less than 14 days. A review of the inservice testing program (Table 3.9-16) for these valves (identified as valves SFS-PL-V071 and -V072 and WLS-PL-V071A, -V071B, -V071C, -V072A, -072B, and -V072C) indicates that their leak rates are not limited by periodic testing. In addition, there is a concern about the post accident leakage through the refueling cavity drain check valves (SFS-PL-V071 and -V072) after a period of forward flow with the assumed debris in the water. Provide the assumed maximum leak rates through the above eight check valves and the basis for ensuring that the assumed maximum leak rates will not be exceeded during the limiting accident.

Westinghouse Response:

In the wall-to-wall case evaluated in the DCD, the initial leak rate assumed was 24 gpm. This leakage represents the total leak flow from the initially flooded portion of the containment to the three volumes located below the flood level that did not initially flood. These volumes include the PXS A room, the CVS room and the refueling cavity (RC). Note that in this case, PXS B room initially floods because the LOCA is located in that room. The assumed leakage into the other three rooms includes all leak pathways, including the drain line check valves. In addition to the check valves the other source of significant leakage is through cracks in the walls; considering that steel module construction techniques used in the AP1000 leaks through the walls are expected to be insignificant. As a result, most of this leakage can be assigned to the drain line check valves such that the initial leak rate through each of the three drain lines could be as high as ~7 gpm per line. Leak rates through these check valves this high are considered very conservative as discussed in the following paragraphs.

The response to RAI SPCV-27, Rev 0, showed that the drain lines associated with the PXS rooms and the CVS room will not have debris transported into them during the accident and as a result their leak tightness would not be affected. These lines use 4 inch check valves that are designed to have a low leak rate, [ ][a,c] each of these check valves is tested in the factory prior to their installation in the plant to verify that their leak rate is less than or equal to this value. Although the leakage through these check valves may not be this low in the plant, they are expected to have leak rate much less than 7 gpm/line. Each line has two series valves which contribute to the low probability of significant leakage. These valves currently have inservice testing requirements that stroke each valve open and closed every refueling outage.

During this IST, the operation of the check valves is monitored using non-intrusive sensors that verify that the valves operate normally (the disc moves freely, opens and returns to the full closed position). Because of the large margin between the design leak rate and the allowable leak rate these check valves are not subjected to inservice leak rate testing.

Also as discussed in the response to RAI SPCV-27, Rev 0, the RC drain line will have some drain flow from IRWST over flow and as a result may transport some latent debris through the drain line and their check valves. As discussed in this response, the amount of latent debris in the RC and IRWST are expected to be low. In addition, it is very unlikely that MRI fines would be blown into the RC from the loop compartment or other break location. It is even more unlikely that sufficient amount of such debris would be blown into the RC and washed down into the drain sump such that they might be transported into the valve. Figure 1 shows the arrangement of the drain pit in the RC pit.

Finally, even if some MRI fines were transported into the drain lines the flow passage through the type of check valve used in this line (swing disc check valve) is not conducive for trapping debris and it is expected that MRI fines as well as latent debris would get carried through. Figure 2 shows a typical swing disc check valve. This line uses 6 inch check valves that are designed to have an low leak rate, [ ]^{a,c}; each of these check valves is tested in the factory prior to their installation in the plant to verify that their leak rate less than or equal to this value. Although the leakage through these check valves may not be this low in the plant, they will certainly be less than the [ ]^{a,c} gpm discussed below. This line has two series valves which contribute to the low probability of significant leakage. These valves currently have inservice testing requirements that stroke each valve open and closed every refueling outage. During this IST, the operation of the check valves is monitored using non-intrusive sensors that verify that the valves operate normally (the disc moves freely, opens and returns to the full closed position). Because of the large margin between the design leak rate and the allowable leak rate these check valves are not subjected to inservice leak rate testing.

Even though it is considered unlikely for latent debris to be trapped inside both drain check valves and to interfere with their operation, such a possibility has been evaluated. A sensitivity study was performed to assess the consequences of some latent debris being trapped around the disc / seat contact area when the valve closed and cause increased back leakage through these check valves. The concern is whether excess leakage might cause the containment water level to decrease more rapidly than has been previously considered which might challenge the ability of the PXS to provide sufficient recirculation flow to cool the core. This sensitivity study was performed using the following conservative assumptions:

1. Both of the limiting LTC cases (#3 and #10) were evaluated.
2. The back leakage through these two series check valves is conservatively assumed to start at the time when the LOCA occurs. The flow rate is assumed to start at time 0 and to increase to its maximum at the time PXS recirculation starts at 2.6 hours.

3. The containment conditions (pressure and water temperature) are assumed to stay constant. This is reasonable since the allowable time determined in these studies is not very long as shown below.
4. For each LTC case, the RCS pressure is assumed to remain constant following the time when the core cooling was analyzed. This assumption is conservative because over time decay heat will decrease and the recirculation flow will decrease (due to the drop in containment level) which will cause the RCS pressure to decrease. It is also reasonable since the allowable time determined in these studies is only slightly after the LTC analysis time as shown below.
5. The DP/flow relation through the core is assumed to vary with the flow raised to the [ ]^{a,c} power (refer to WCAP-17028-P, revision 5, section 5.2). This assumption is based on the AP1000 fuel assembly debris head loss testing. Using this exponent is conservative compared with using an exponent of 2, since it results in slightly greater decrease in recirculation flow.
6. Gross back leakage is not considered in the check valves in the drain lines of the PXS rooms and in the CVS room since there is no mechanism to transport debris into these check valves (refer to the response to RAI SPCV-27, Rev 0, for a detailed discussion).

For LTC case #3, the initial containment flood level assumed in the LTC analysis is 107.8 ft. The actual minimum calculated level is [ ]^{a,c}. If the RC flooded due to back leakage through the two series drain check valves, the containment level would drop about [ ]^{a,c}. The lower containment water level was estimated to reduce the PXS injection from 111 lbm/sec to [ ]^{a,c}. This reduced flow is able to match decay heat about [ ]^{a,c} hr after the LOCA occurred (instead of 2.6 hr). About [ ]^{a,c} gal of water must leak through the check valves to flood up the RC. If the initial back leakage is about [ ]^{a,c} gpm the containment water level would drop from its initial flood level of [ ]^{a,c} ft early in the event to a value greater than 107.8 ft at 2.6 hr and eventually reach the [ ]^{a,c} ft level (when the containment and the RC have reached the same level) in about [ ]^{a,c} hr after the LOCA. As a result, even with gross back leakage of [ ]^{a,c} gpm the containment water level assumed in LTC case #3 would be unchanged and the additional reduction in containment level that would occur after the LTC case #3 time would more than match decay heat.

For case #10, the initial containment flood level assumed in the LTC analysis is 108.6 ft. The actual minimum calculated level is about [

]^{a,c}. As a result of these two factors, the containment and the refueling cavity levels would equalize, the containment level will decrease only slightly below the level assumed in the LTC analysis (LTC case #10). As a result, LTC case #10 is less limiting than LTC case #3 would not be impacted by leakage through the RC drain check valves.

An additional sensitivity study was performed to estimate how far open the 6" drain check valve discs would have to be blocked open by debris in order to cause a back leak of [ ]^{a,c} gpm. The driving head was assumed to be based on an initial flood level of [ ]^{a,c} ft with the RC empty. These assumptions result in the largest DH and therefore the smallest valve opening. The opening was conservatively assumed to be completely free of debris in order to maximize the leak flow rate. This assumption is very conservative because if debris blocking the valve open it is likely to also block some of the check valve opening resulting in additional flow resistance. These assumptions result in both check valves needing to be [ ]^{a,c} open to have a back leak of [ ]^{a,c} gpm. Note that with this DH the force trying to close each of the two check valves is about [ ]^{a,c} pounds. As a result, it is not considered creditable that these two check valves would both have their discs blocked open enough by debris to challenge long term core cooling.

The conclusion reached from these studies is that a massive back leakage (more than [ ]^{a,c} gpm) through the two series check valves in the RC drain line would be required to challenge long-term core cooling and that such a leak rate is not creditable. As a result, the current DCD wall-to-wall flood case is conservative.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

Changes to APP-GW-GLR-079, Revision 7, (red-line strike-out) are provided at the end of this response. Note that these mark-ups have not changed from revision 0 of this RAI response.

a,c

a,c

Figure 1 – Refueling Cavity Drain Pit Arrangement (section and plan views)

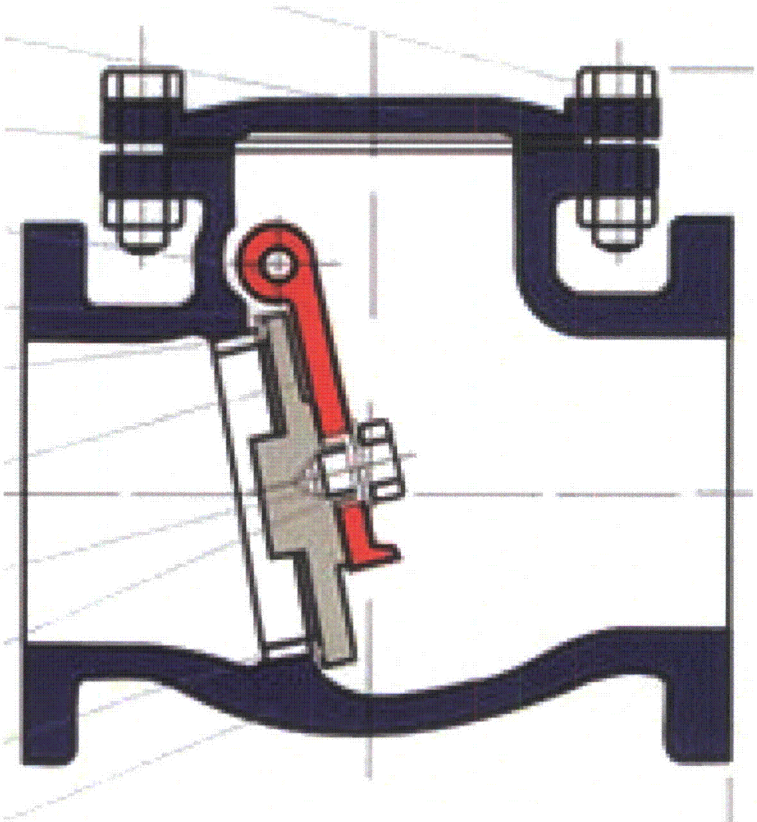


Figure 2 – Refueling Cavity Drain Line Check Valve, Swing Disc Type

Proposed changes to APP-GW-GLR-079, revision 7, section 5.2.4:

5.2.4 AP1000 Refueling Cavity Drain Lines

NEI 04-07 (References 18 and 19) provides the methodology guidance to perform a baseline sump performance evaluation. The types of insulation found in the AP1000 containment dictate the direction in which the evaluation is performed. The AP1000 is highly compartmentalized and insulated with MRI in the zone of influence (ZOI) and has two 6-inch drain connections (Figure 9.1-6 sheet 1, Reference 20) located in the refueling cavity. The drain line splits into two lines outside the cavity and separately penetrates the refueling cavity wall. Inside the refueling cavity, the lines end with a downward-facing 90° elbow which prevents debris that might enter the cavity from falling directly into the drain lines.

Section 3.4.3.2 of Reference 19 provides a discussion of the debris size distributions that have been used in various studies and specifies a two-size distribution for material inside the zone of influence (ZOI) of a postulated break for the baseline evaluation. [ ]^{a,c} Small fines are defined as any material that could transport through gratings, trash racks, and/or radiological protection fences by blowdown, containment sprays, or post-accident pool flows. Furthermore, small fines are assumed to be the basic constituent of the material for latent debris and coatings (in the form of individual fibers, particles, and pigments, respectively). Reference 18, Section 3.4.3.2, assumes the largest openings of the gratings, trash racks, or radiological protection fences to be less than a nominal 4 inches (less than 20 square inches total open area) and classifies the remaining material that cannot pass through gratings, trash racks, and radiological fences as large pieces. The MRI is sufficiently dense and the flow rates are also sufficiently small that the MRI debris is not transported to the AP1000 CR screens.

Reference 19, Sections 3.6.3.1, 3.6.3.2, and 3.6.3.3, which address the highly compartmentalized, mostly uncompartmentalized, and ice condenser containments, respectively, primarily contain compartmental specific debris transport assumptions. Table 3-4 of Reference 19 summarizes these assumptions for the small fines debris generated within the ZOI. The baseline guidance recommends that all debris generated outside the ZOI be treated as small fines debris that is subsequently transported to the sump screens (i.e., 100% transports to the sump pool and no transport into the inactive pools). The baseline guidance recommends the assumption that all of the large piece debris deposits onto the containment bottom floor, where it remains. The NEI 04-07 (Reference 18) guideline adopts the value of 75% for small fines and 5% for large pieces as the size distribution of any type of MRI inside a pipe break ZOI. For highly compartmentalized containments such as the AP1000, 25% of the MRI debris generated is large pieces and 75% of the MRI debris generated is in the form of small fines. 25% (~18% of the total MRI destroyed) of the small fines is assumed to be ejected to upper containment and 75% (~56% of the total MRI destroyed) of the small fines are deposited directly to the sump pool floor.

Since only a small percentage of MRI in the ZOI may be ejected to the upper compartment and even less into the refueling cavity, MRI debris is not expected to block the 6" refueling cavity drain lines or to be transported into the drain lines. In the unlikely event that some MRI debris is transported into the refueling cavity drain lines, the transported debris would not be flat sheets, but rather small pieces of deformed metal that would pass through the pipe and check valves. Thus, the coolant that is spilled into the refueling canal would drain into the lower compartment of the AP1000 reactor containment building. In addition, when the containment water level rose above the drain pipe elevation, the back pressure applied to the check valves would cause them to close.

Even though it is considered unlikely for latent debris to be trapped inside both of the series drain check valves and to interfere with their ability to close, such a possibility has been evaluated as a sensitivity study. This study determined that gross back leakage through both check valves of [ ]^{a,c} gpm could be tolerated and still provide adequate long-term core cooling. Both of the long-term cooling cases (#3 and #10 from Reference 17) were evaluated. Case #3 was determined to be limiting. In this case, the check valve leakage reduced the containment level from its minimum initial level of [ ]^{a,c} ft to a value greater than the level used in the #3 LTC analysis (107.8 ft) at the time case #3 was analyzed (2.6 hr). The containment level would eventually drop to [ ]^{a,c} ft (when the containment and the RC equilibrated at the same level) about [ ]^{a,c} hr after the LOCA. When the containment level drops to this lower level the containment recirculation rate is estimated to decrease by about [ ]^{a,c} %. With the long time required for the level to decrease (> [ ]^{a,c} hr) and the small decrease in flow, the recirculation flow rate is able to remove decay heat even with the large check valve leakage assumed.

Another part of the study estimated how far open the disc in these swing disc check valves would have to be blocked open in order to allow such a large leak. That opening was estimated to be ~ [ ]^{a,c} inch. In addition it was estimated that there would be a significant force (about [ ]^{a,c} lb) working to close the check valves.

The conclusion reached is that even with a gross back leakage of ~[ ]^{a,c} gpm through the two series refueling cavity drain check valves that LTC would still be provided. In addition, the possibility of such a leak occurring is not considered credible considering the likelihood of transporting debris into the check valves, having the debris be trapped in both valves, having both valves be blocked more to create a [ ]^{a,c} inch unimpeded flow opening that can withstand a large closing force.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP 6.2.2-SPCV-25
Revision: 2

Question:

ZOI Coatings Debris

a) The Revision 1 response to RAI-SRP 6.2.2-SPCV-25 described the evaluation of breaks at the terminal ends of the hot leg and cold leg lines. Per the SE on NEI 04-07, additional break locations can either be evaluated at 5 ft intervals or driven by the comparison of debris source term and transport potential. In the RAI response, the terminal end that produced the largest amount of coating debris was identified as the limiting break for that line and it was stated that additional break locations were not quantified because they were within the loop compartment and by inspection have similar characteristics, inventories and transport paths. The staff was unable to conclude from this statement, or from the supporting calc-notes, that the selected terminal end break location is limiting. Please provide justification as to why the amount of coatings on beams, pipes and surfaces in a ZOI centered at the cold leg/reactor coolant pump or hot leg/CL /steam generator bound all potential cold leg and hot leg breaks in the loop compartments.

b) While NEI 04-07 recommends that pipe breaks be postulated at locations that result in unique debris source terms, the amount of IOZ coatings debris identified for each of the break locations evaluated in APP-PXS-M3C-013 was zero. Because IOZ has different properties (thickness and density) than epoxy, discuss why it is not necessary to consider a break location that includes IOZ as a source term.

c) The DCD changes included in the Revision 1 response to RAI-SRP 6.2.2-SPCV-25 include a commitment to limit the amount of coatings debris fines that can be generated in the by a DECL or DEDVI LOCA jet to 70 pounds. Please describe how this commitment will be met.

d) In Section 5.2.2 of APP-PXS-M3C-013 R0, there is a statement that "only SGS piping will be effected and that DCP-1510 (Ref. 18) has changed the lines from carbon steel to stainless steel. Stainless steel will not be coated." The reference list does not provide a date for DCP-1510, which is also identified as APP-GW-GEE-1510. Please identify which lines were changed from carbon steel to stainless steel and when this change was made. Has this change been reviewed by the NRC? If not, discuss your plans to submit it for review, including related changes such as dissimilar metal welding.

Westinghouse Response: (This response replaces the responses provided in the Revision 0 and Revision 1 responses, except for the changes to the DCD and reports.)

a) AP1000 specific design and layout information has been used to determine the amounts of epoxy and inorganic zinc located within the CL ZOI.

The selection of break locations considered for this evaluation is consistent with the guidance in NEI 04-07 as well as the associated NRC SER. Note that this guidance was based on the need to evaluate plant designs that use different types of fibrous insulation such that consideration of break locations needs to be much more detailed than for the AP1000 which uses only metal reflective insulation within the ZOI. The only consideration for selecting the AP1000 break locations is to determine the maximum amount of coatings what could be damaged and create fine particle transportable debris. The AP1000 break locations do not generate any fiber and therefore do not need to look for different amounts and types of fiber.

Because of the unique characteristics of AP1000, CL LOCAs are limiting with respect to GSI-191 (as discussed in item b of RAI-SRP 6.2.2-SPCV-25, Rev 1). In order to support this conclusion the amount of coatings within the HL ZOI also needs to be identified. As a result, the maximum amount of coatings debris within the ZOI for both CL and HL LOCAs has been determined.

The first consideration in selecting the break locations was to determine which CL and HL pipes to quantify. The largest such lines are the main loop pipes which are 22 inches inside diameter (ID) for the CLs and are 31 inches ID for the HLs. The next smaller CL lines are the 8" DVI injection lines (6.8" ID); these lines will generate much less ZOI coatings because the ZOI sphere would be so much smaller (only 3% of the 22" ZOI sphere volume) and they are generally located in the same areas. The next smaller HL line is the 20" RNS pumps suction line (16.1" ID). This line will generate much less ZOI coatings because the ZOI sphere will be so much smaller (only 14% of the 31" ZOI sphere volume) and it is a short pipe stub that is connected directly to the HL so it is located in the same area as the HL.

The specific break locations quantified for the CLs and HLs were at the terminal ends. Figures 1, 2, and 3 show these break locations and the associated 4 D ZOIs that are used to quantify the amount of epoxy coatings.

For these two CL break locations in the AP1000, the limiting amount of CL ZOI coatings results from a break located at the CL connection to the reactor coolant pump. The coating surface areas within this CL break ZOI were calculated for the AP1000 to be [

]^{a,c} As a result, the licensing limit has been increased from 50 to 70 lb to provide a conservative basis for the AP1000. This increase is acceptable because all of the CL LOCA FA tests after #17 were conducted considering [

]^{a,c} In addition, as pointed out in item b) of RAI-SRP 6.2.2-SPCV-25, Rev 1, the AP1000 screen tests were performed with a large amount of extra particles.

For these two HL break locations, the limiting amount of ZOI coatings that could be generated in the AP1000 has been determined to be [ ]^{a,c} lb based on AP1000 specific design and layout information as discussed above for the CL breaks. A break located at the HL connection to the SG is limiting. The coating surface areas within a DEHL LOCA ZOI were calculated for the AP1000 to be about [

]^{a,c} As a result, the [ ]^{a,c} lb assumed in this evaluation is conservative for the AP1000. Considering that the amount of ZOI particle debris generated in a DECL LOCA is 70 lb, the DEHL LOCA would generate an additional [ ]^{a,c} lb. Therefore, for a HL LOCA the total amount of particles could increase from [ ]^{a,c} lb. Note there would be no additional fiber in this case.

The break locations that were quantified were selected because they are in different areas with potentially different coating inventories. The SER for NEI 04-07 states that it is acceptable to evaluate break locations every 5 ft along the lines. It also says that fewer break locations can be quantified (especially for large break locations) if the break locations are within the loop compartments and by inspection they have similar characteristics, similar debris inventories and transport paths.

The length of CL and HL lines within the loop compartment are greater than 5' so in order to provide additional evidence that the terminal end break locations are limiting, break locations every 5' have been evaluated, in accordance in the NRC guidance contained in the SE to NEI 04-07. Figure 4 shows the CL pipe break locations every 5' from the RCPs. Figure 8 shows the HL pipe break locations every 5' from the SGs.

From inspection of these break locations and the quantified terminal break location it is obvious that the CL breaks located at 15' and 20' are not limiting. The break at 15' is inside the bio-shield wall such are very little coatings would be located within the ZOI. The break location at 20' is near to the RV terminal end and since the RV terminal end break only had less than 30% of the coating surface area of the RCP terminal end it is concluded that it would also not be limiting. In a similar fashion, the HL break located at 15' is located near to the RV terminal end and since the RV terminal end break had less than 40% of the coating surface area of the SG terminal end it is concluded that it would also not be limiting. The CL breaks located at 5' and 10' and the HL breaks located at 5' and 10' are discussed below.

For the CL breaks located along the CL (at 5' and 10' from the RCP) a cube was also used to conservatively measure ZOI areas of plate, pipe and beams. Walls were calculated using a sphere ZOI to prevent excessive conservatism.

The CL breaks at 5' and 10' from the RCP are shown on figure 5; these figures show how the ZOI intersects with the loop compartment walls. Figure 6 shows how these ZOIs intersect with the platform located at the 104 ft 5.5 in. elevation. In figure 6 all break ZOIs are shown as a square because this was the shape used to quantify the length of the beams and platform surface areas. Note that the side of the square is conservatively set equal to the ZOI diameter. Figure 7 shows a section view that illustrates these ZOIs. An estimate was made of the changes that would occur in the coating surfaces within the ZOIs for these two break locations (5' and 10' from the RCPs). For example, the wall surface areas decrease by ~70 ft^2 at the 5' break and increase by ~40 ft^2 at the 10' break. The wall surface area decreases from the terminal end break to the 5' break because the terminal end break used a square ZOI, shown in Figure 1, which occupied more wall than did the sphere ZOI that was used at the 5' break, shown in figure 5. This was done to be conservative with the calculations. The 5' break ZOI will only come in contact with the side wall as did the break at the terminal end, but of a smaller area. The 10' break calculated by a sphere ZOI increases in wall area over the terminal end and 5' break because it will become in contact with both side wall and bio-shield wall between the loop compartment and RV. At both 5' and 10' breaks the amount of a platform plate increases by ~40 ft^2. Figure 6 shows exactly where the platform plate is positioned and shows when the break location is moved that more plate will be occupied. On the other hand, the amount of beam surface area [ ]^{a,c} for the 5' and 10' break locations. Also the amount of pipe surface area [ ]^{a,c} for the 5' and 10' breaks. The net effect of these changes is that the total area is estimated to [ ]^{a,c}.

For the HL breaks located along the HL (at 5' and 10' from the SG), a cube was also used to conservatively measure ZOI areas of plate, pipe and beams. Walls were calculated using a sphere ZOI to prevent excessive conservatism.

The HL breaks at 5' and 10' from the SG are shown on figure 9. In comparing these two breaks it can be seen from figure 12 that both of them are at a lower elevation than the SG terminal end such that the maintenance platform and structural beams located at elevation 116 ft 5 in. will no longer be within the ZOI. In addition, the break at 10' is closer to the RV bio-shield wall and therefore will have a larger wall surface area than the 5' break. As a result, only the 10' HL break location will be evaluated. This break location is shown on Figure 9 along with the SG terminal end location. In figure 10 and 11 the SG terminal end break ZOIs is shown as a square because this was the shape used to quantify the length of the beams and platform surface areas. Note that the side of the square is conservatively set equal to the ZOI diameter. Figure 11 shows these break locations at the 104 ft 5.5 in. platform elevation. Figure 10 shows these break locations at the 116 ft 5 in. platform elevation; note that at this elevation none of the platform is within the 10' break ZOI. For the 10' break location, the upper platform being outside the ZOI [ ] a,c. Since the 10' break location is closer to the RV bio-shield wall, the wall surface area [ ] a,c. There are no other significant changes, so there is a net [ ] a,c in area. As a result, the SG terminal end break location is [ ] a,c.

Note, in figures 3, 7, and 12 the grating is galvanized and plates are epoxy coated carbon steel.

b) Inorganic zinc is not different from epoxy coatings in that within a LOCA ZOI they both are assumed to result in fine particle debris that are transportable. The only difference is the mass of particles due to their different dry film thicknesses and densities. No inorganic zinc has been found in the HL 10 ID ZOI for the limiting SG terminal end break location; this ZOI covers almost all of the loop compartment such that other break locations within the loop compartment will not include any inorganic zinc coatings. The same is true for the limiting CL ZOI. The fact that no inorganic zinc was found in these ZOIs is not surprising since its use is very restricted in the AP1000. A limited amount of inorganic zinc was found in the RV terminal end break locations on the RV supports. This inorganic zinc had little impact on the amount of coating debris since the thinner coating thickness is mostly compensated for the higher density. As discussed in item a) the amounts of coatings in the RV ZOIs is considerably smaller than that in the limiting ZOIs at the RCP and SG terminal end breaks.

c) The CL LOCA ZOI coating debris limit will be verified by the same method that will be used to verify the amount of aluminum stated in the DCD in section 6.1.1.4. The approach is to perform a calculation note which will be maintained as part of the AP1000 design basis. The calculation note for the CL / DVI line ZOI coatings is APP-PXS-M3C-013.

d) DCP-1510 (APP-GW-GEE-1510) was approved by the Westinghouse Change Control Board (CCB) on April 23rd, 2010. The DCP changed all Steam Generator System (SGS) ASME Section III instrument piping to stainless steel. The DCD changes resulting from DCP-1510 will be submitted to the NRC staff and included in the amendment request for the certified design (DCD Revision 18). The change to stainless steel instrument piping was made due to corrosion concerns. The welding of dissimilar metals in the SG is not different from what is already standard practice in the pressurizer where SS instrument pipes are welded to a CS pressure vessel. The DCD markups associated with DCP-1510 (APP-GW-

GEE-1510) are provided as Figure 13. APP-GW-GEE-1510 will be submitted to the NRC via DCP_NRC_002932.

Figures attached:

1) CL Break Breaks Plan View, Terminal End Break ZOIs
2) HL Break Breaks Plan View, Terminal End Break ZOIs
3) CL and HL Breaks Section View, Terminal End Break ZOIs
4) CL Breaks Every 5' From RCPs Plan View
5) CL Breaks At RCP and 5' / 10' Plan View
6) CL Breaks At RCP and 5' / 10' Plan View (over 104' 5.5" elevation platform beams)
7) CL Breaks At RCP and 5' / 10' Section View
8) HL Breaks Every 5' From SGs Plan View
9) HL Breaks At SG and 5' / 10' Plan View
10) HL Breaks At SG and 5' / 10' Plan View (over 116' 5" elevation platform beams)
11) HL Breaks At SG and 5' / 10' Plan View (over 104' 5.5" elevation platform beams)
12) HL Breaks At SG and 5' / 10' Section View
13) DCD Changes From DCP-1510

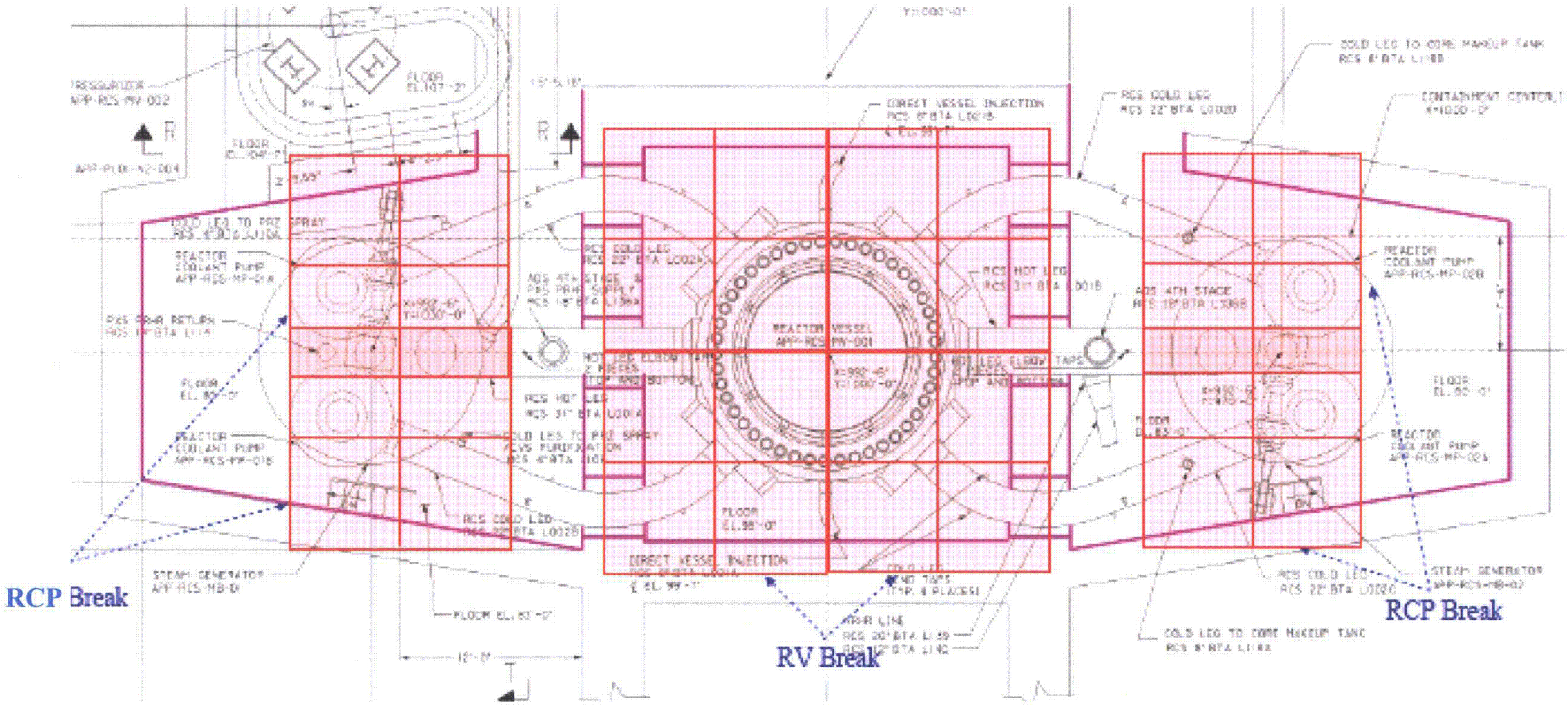


Figure 1 - CL Break Breaks Plan View, Terminal End Break ZOIs

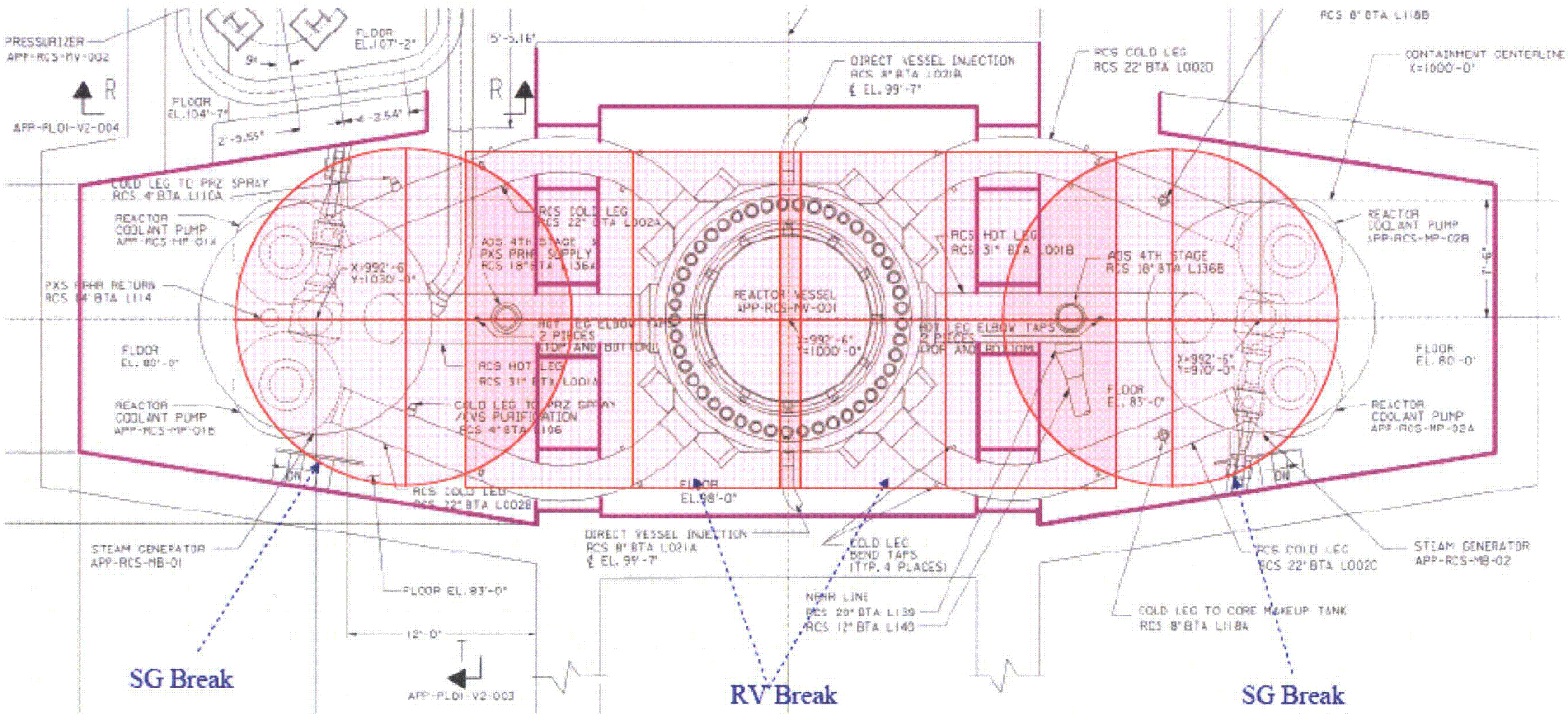


Figure 2 - HL Break Breaks Plan View, Terminal End Break ZOIs

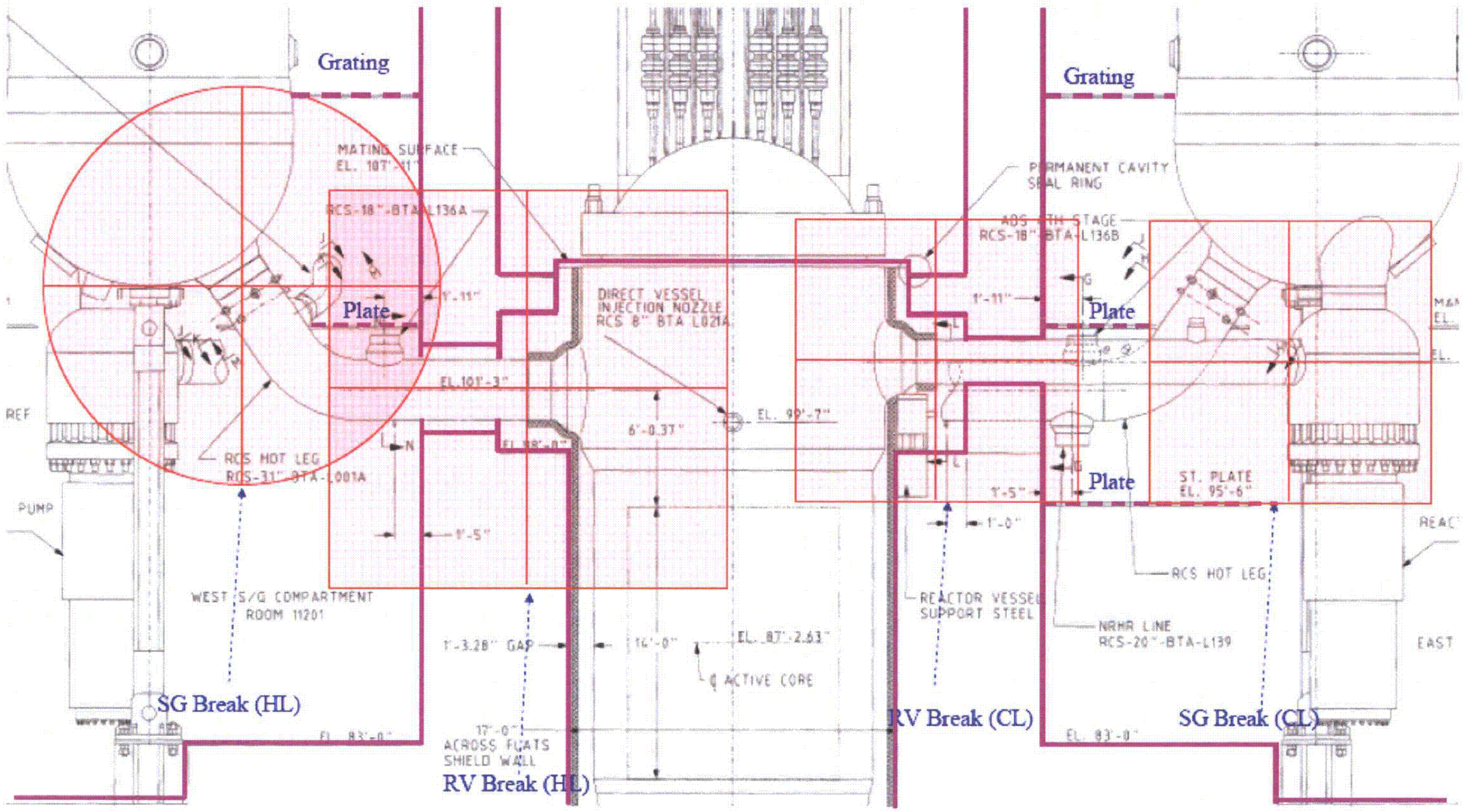


Figure 3 - CL and HL Breaks Section View, Terminal End Break ZOIs

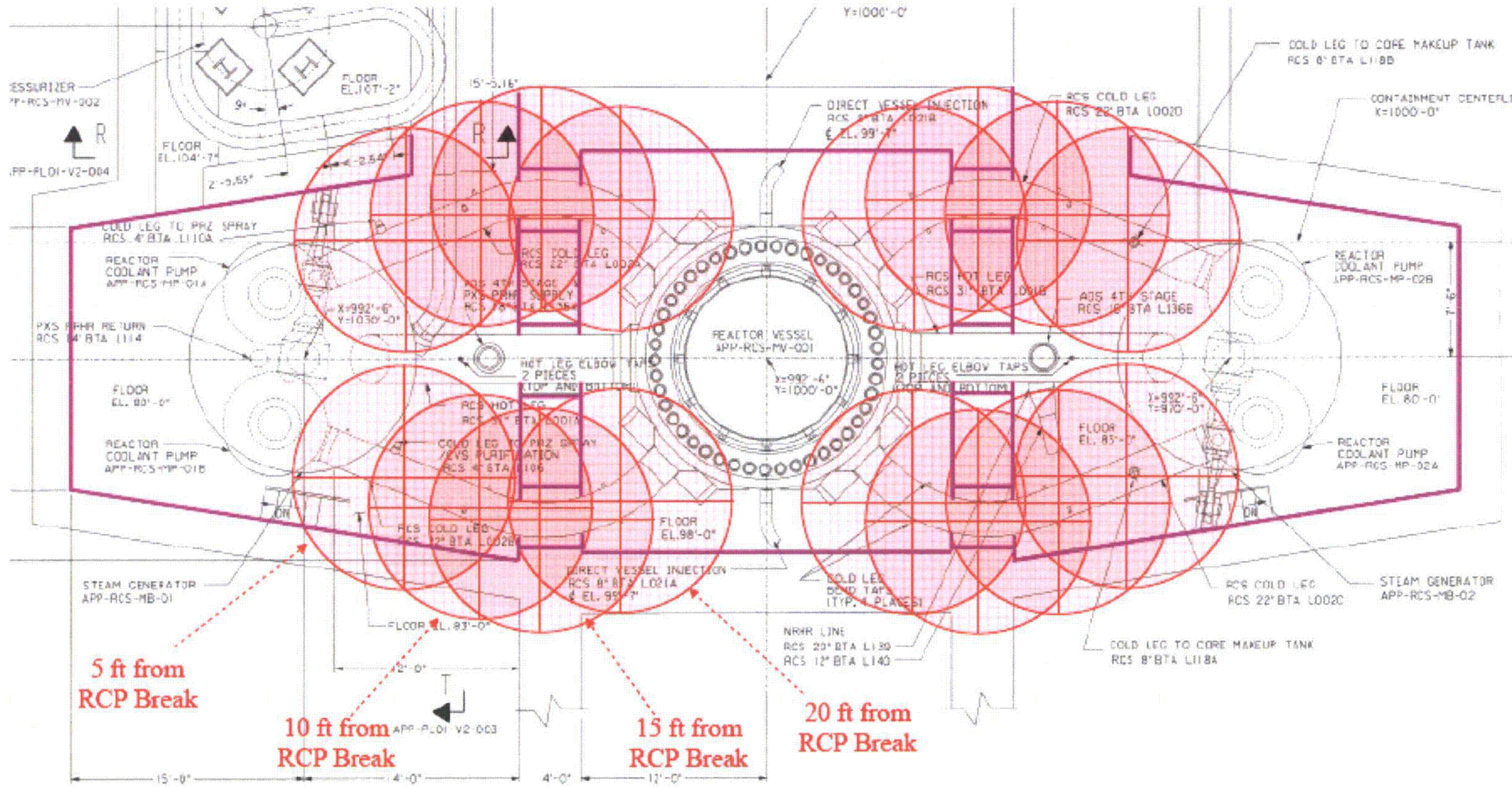


Figure 4 - CL Breaks Every 5' From RCPs Plan View

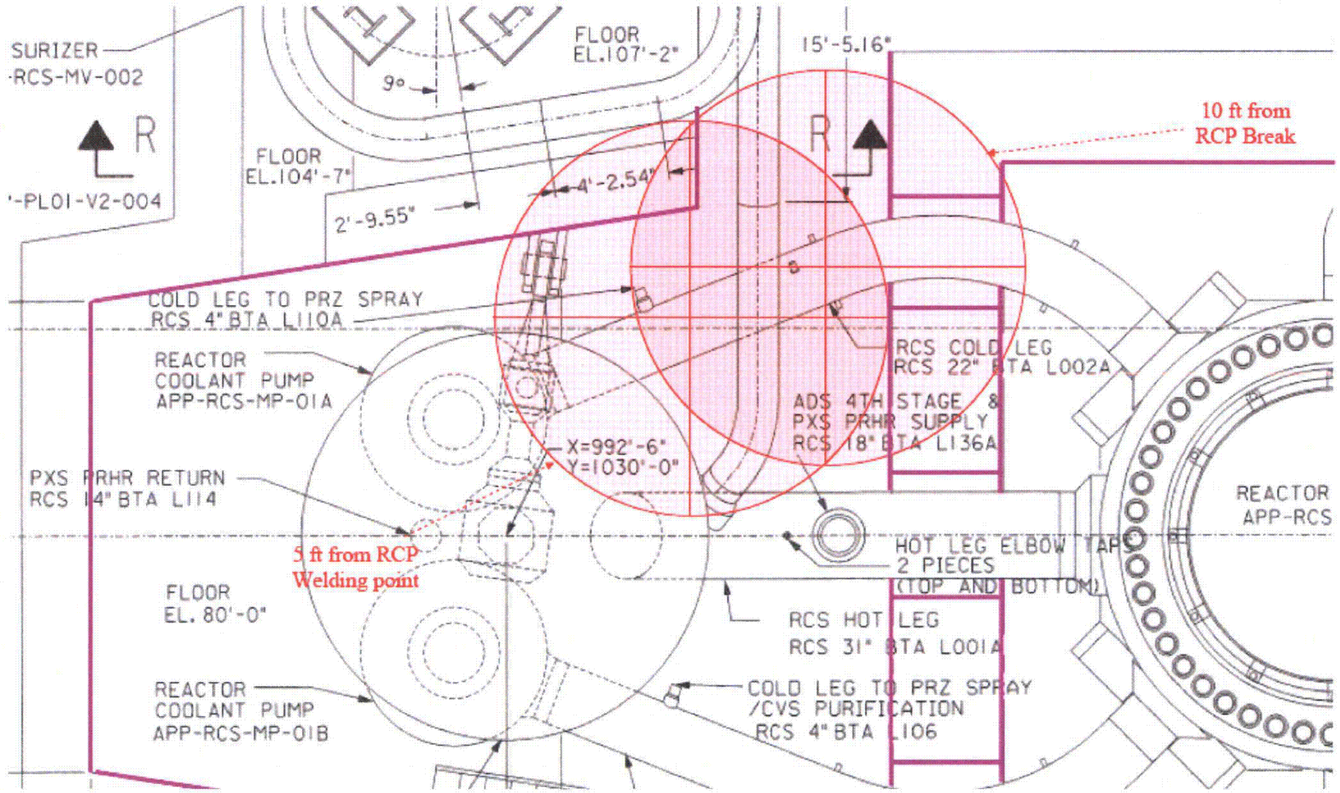


Figure 5 - CL Breaks At RCP and 5' / 10' Plan View

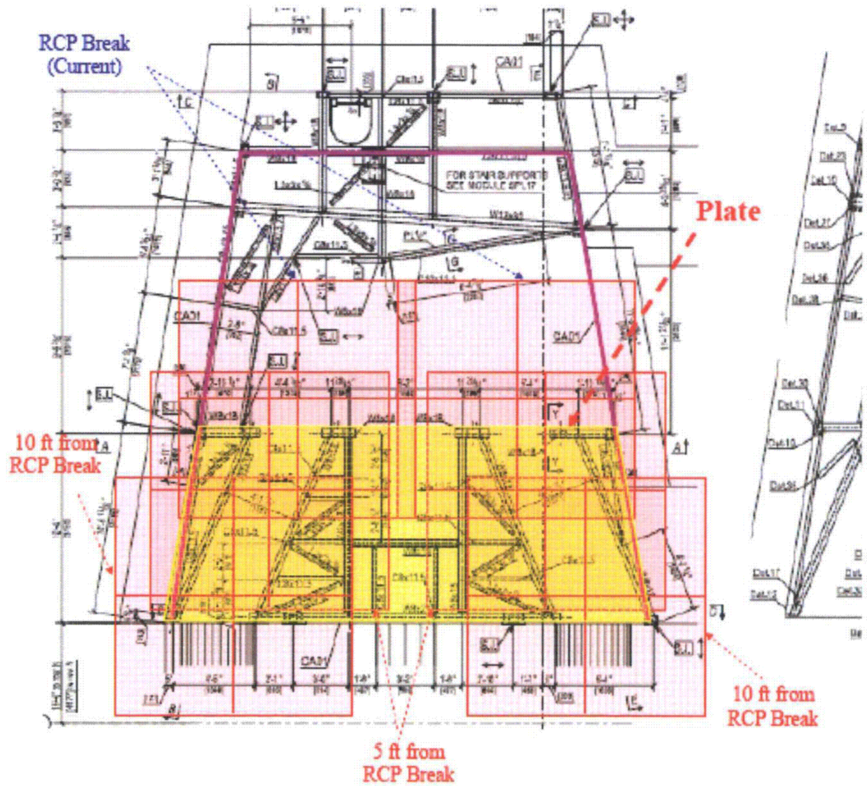


Figure 6 - CL Breaks At RCP and 5' / 10' Plan View (over 104' 5.5" elevation platform beams)

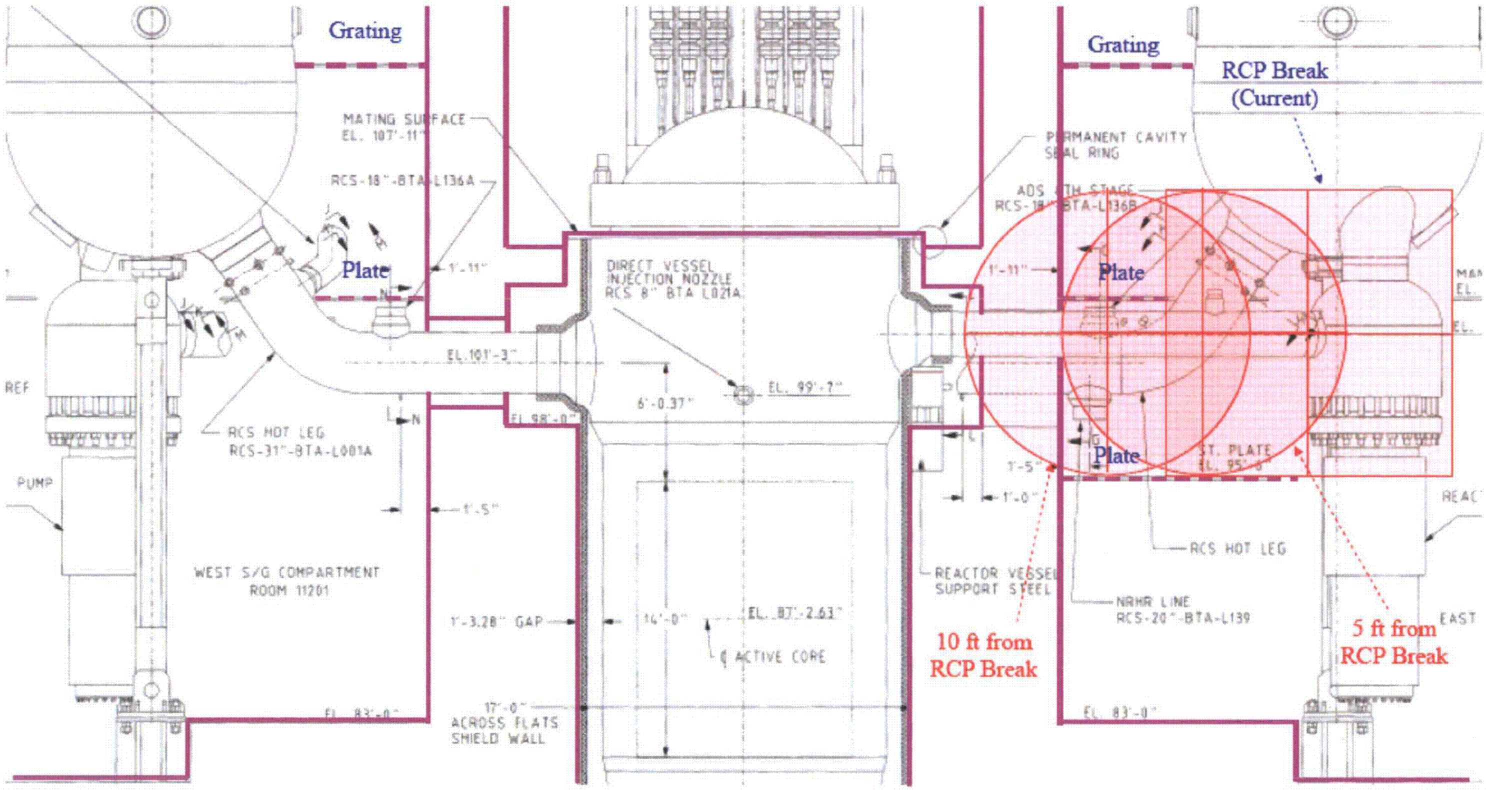


Figure 7 - CL Breaks At RCP and 5' / 10' Section View

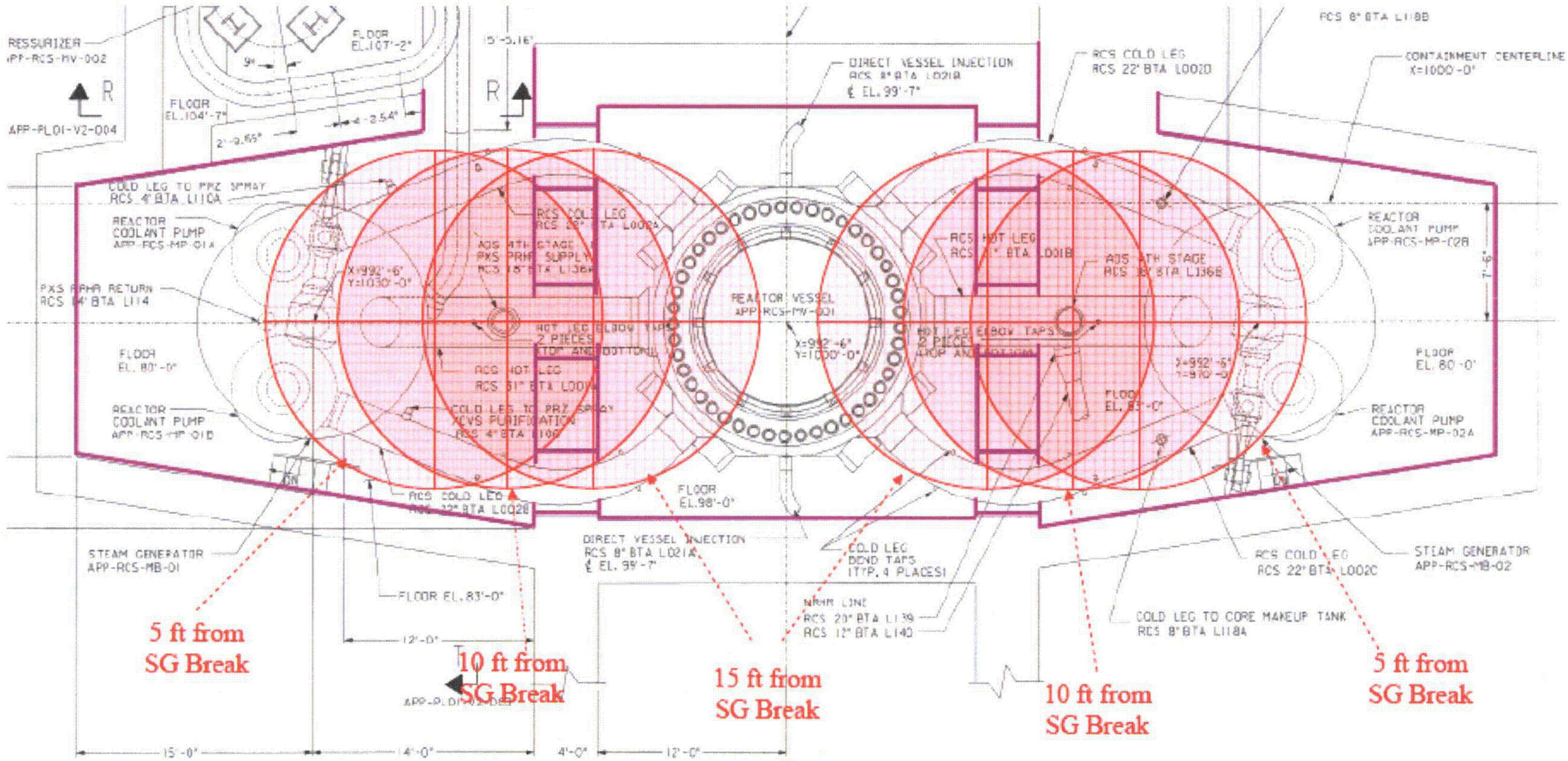


Figure 8 - HL Breaks Every 5' From SGs Plan View

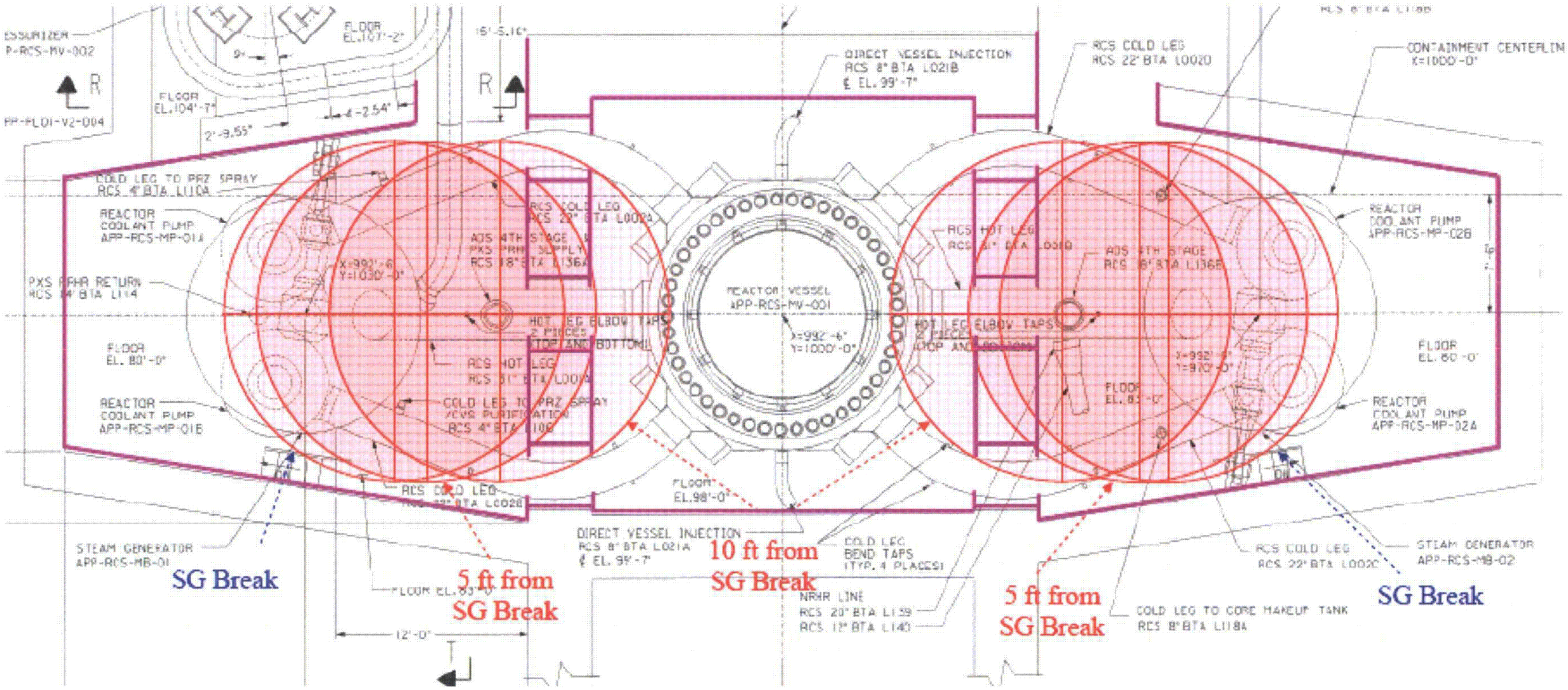


Figure 9 - HL Breaks At SG and 5' / 10' Plan View

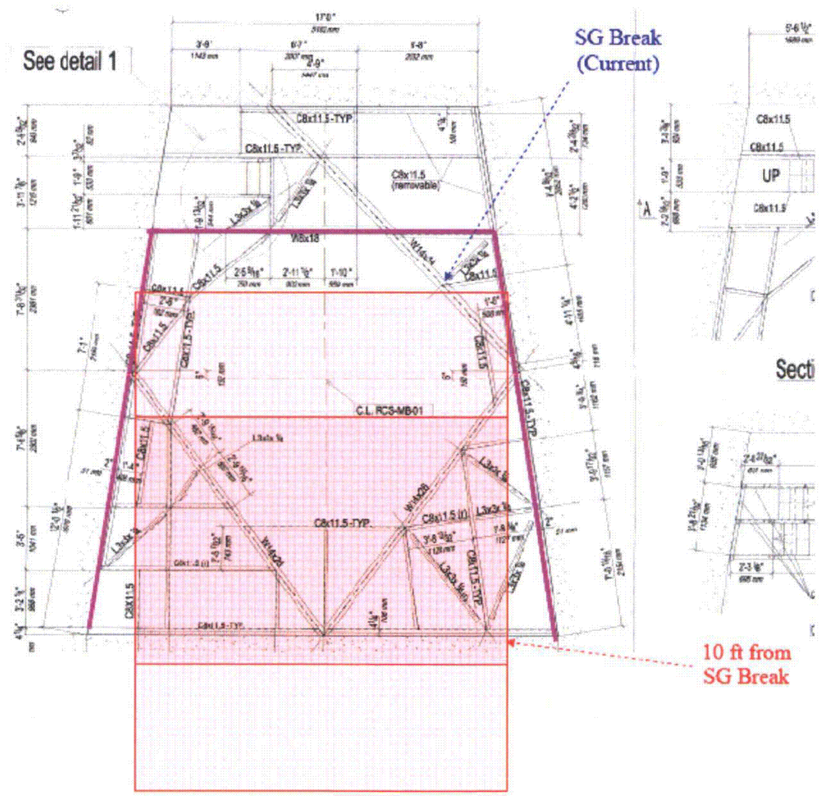


Figure 10 - HL Breaks At SG and 10' Plan View (over 116' 5"' elevation platform beams)

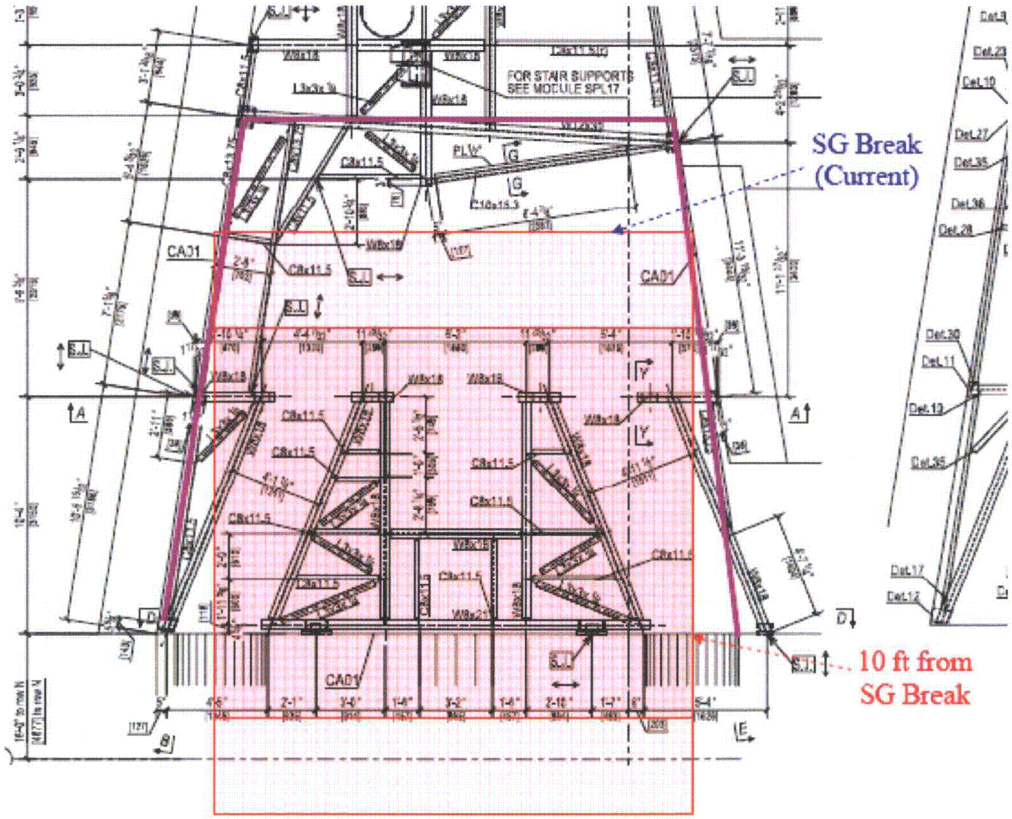


Figure 11 - HL Breaks At SG and 10' Plan View (over 104' 5.5" elevation platform beams)

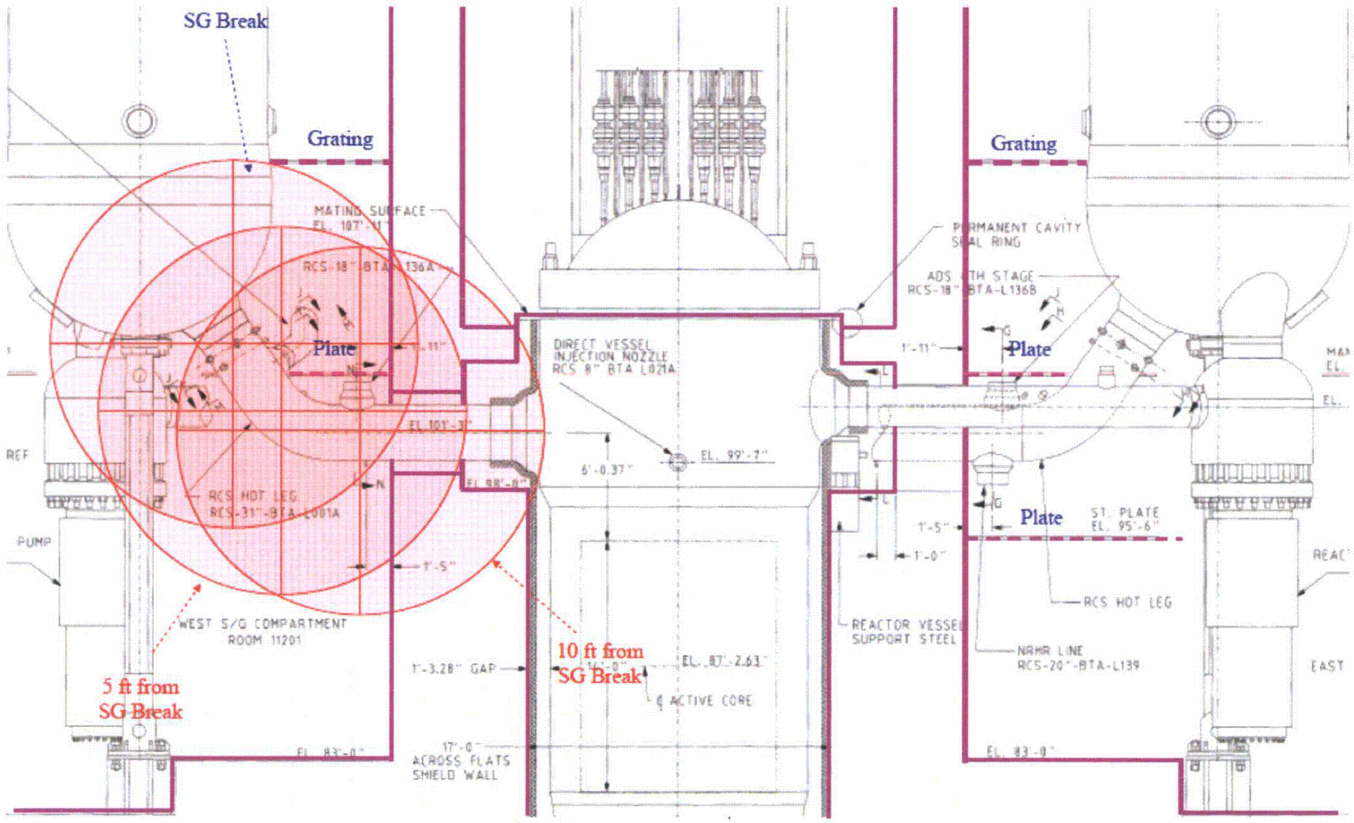


Figure 12 - HL Breaks At SG and 5' / 10' Section View

Figure 13: DCD Changes from DCP-1510

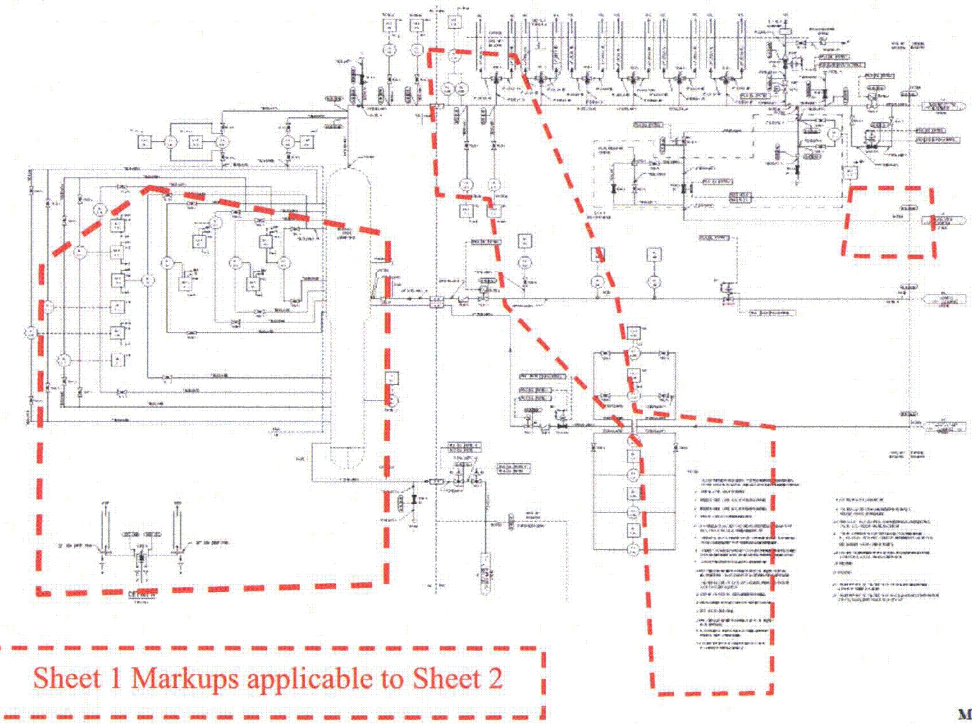
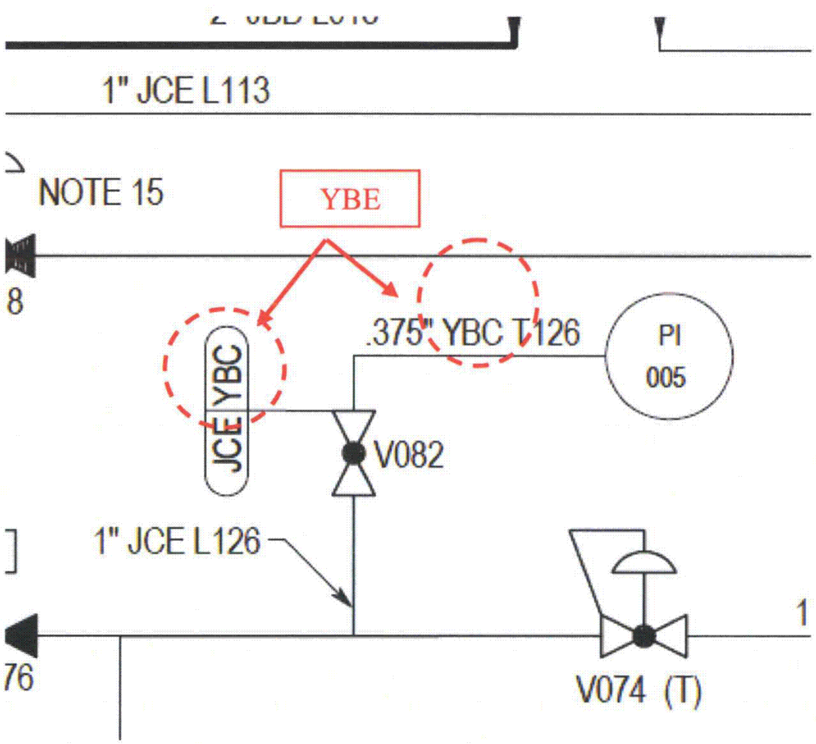
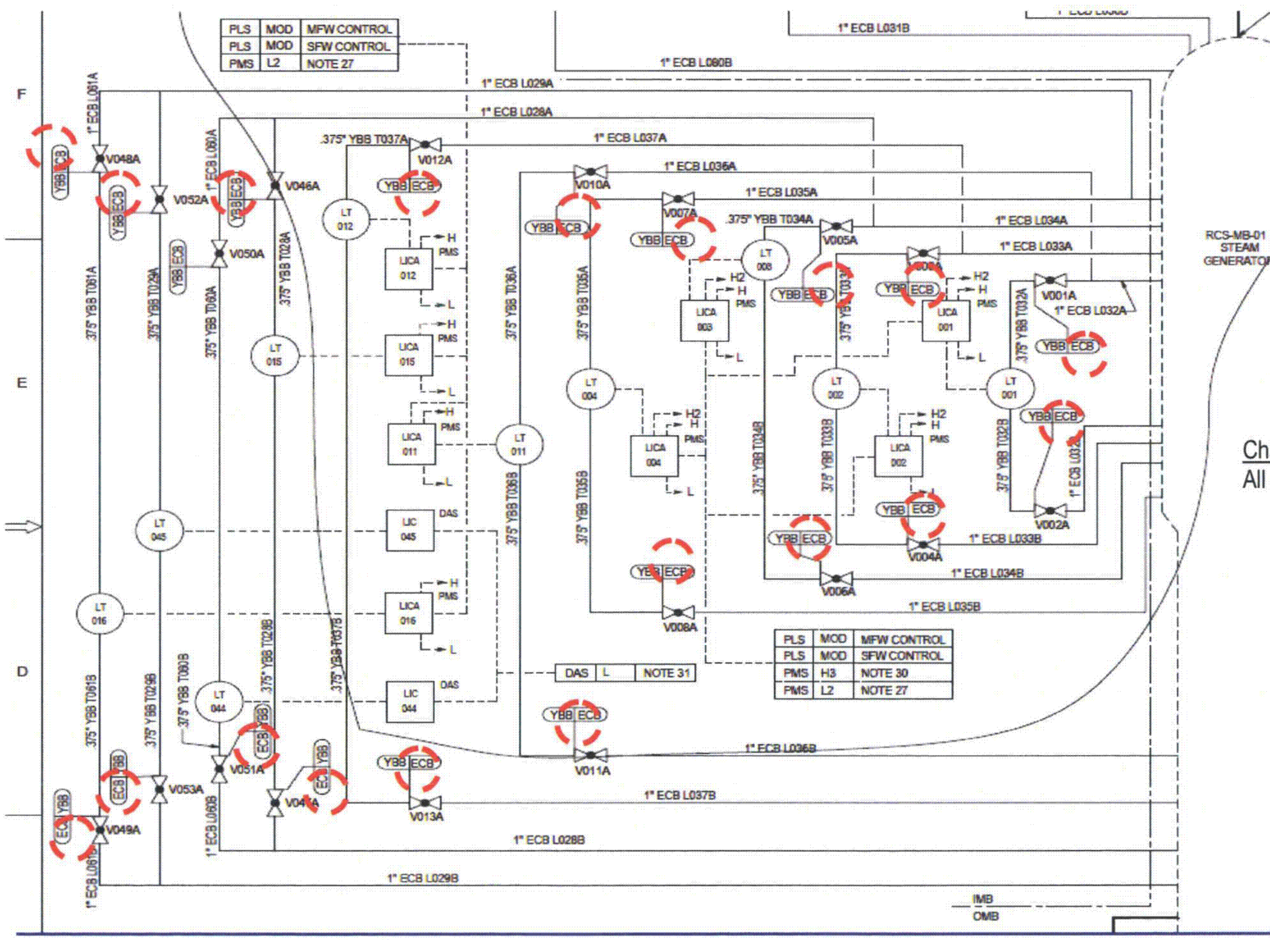


Figure 10.3.2-1 (Sheet 1 of 2)

Main Steam Piping and Instrumentation Diagram (Safety Related System) (REF) SGS 001


1" JCE L113
NOTE 15
YBE
8
JCE YBC
.375" YBC T126
PI
005
V082
1" JCE L126
1
76
V074 (T)



Change:
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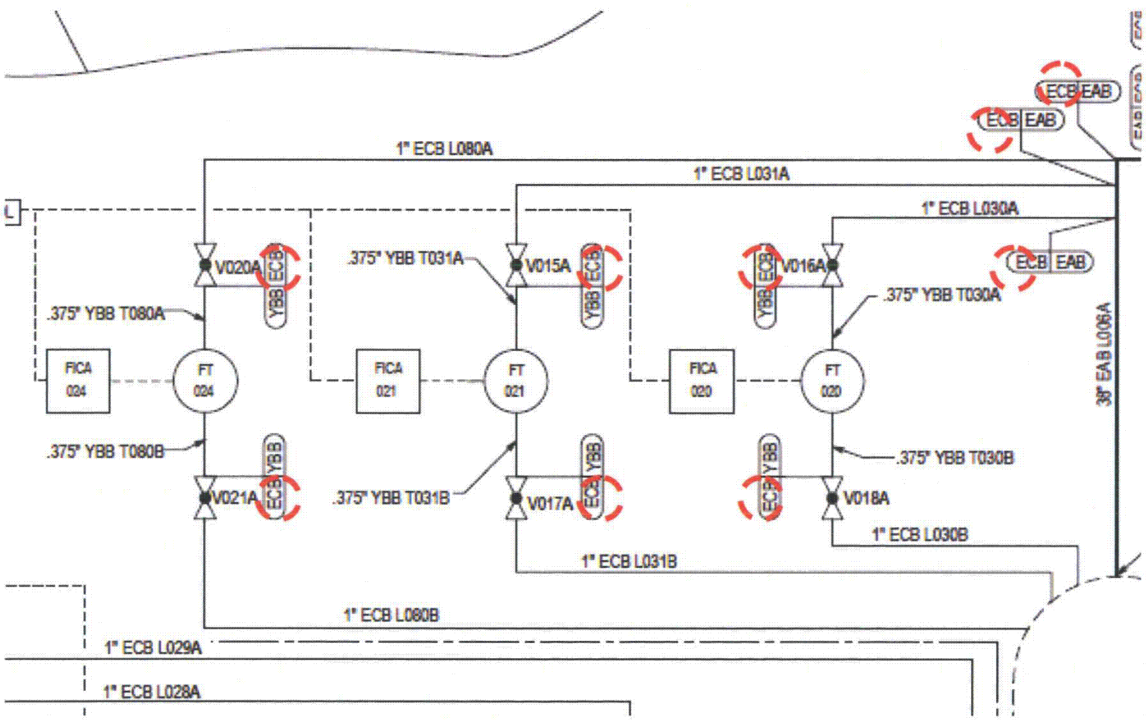

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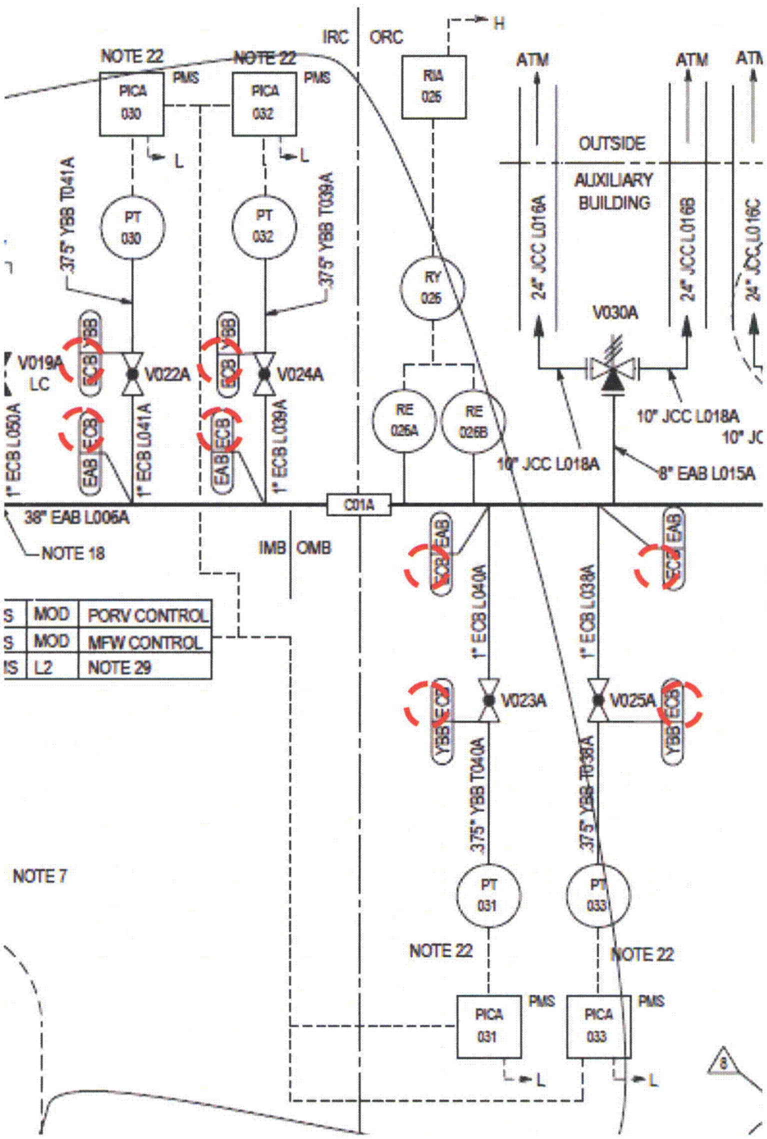

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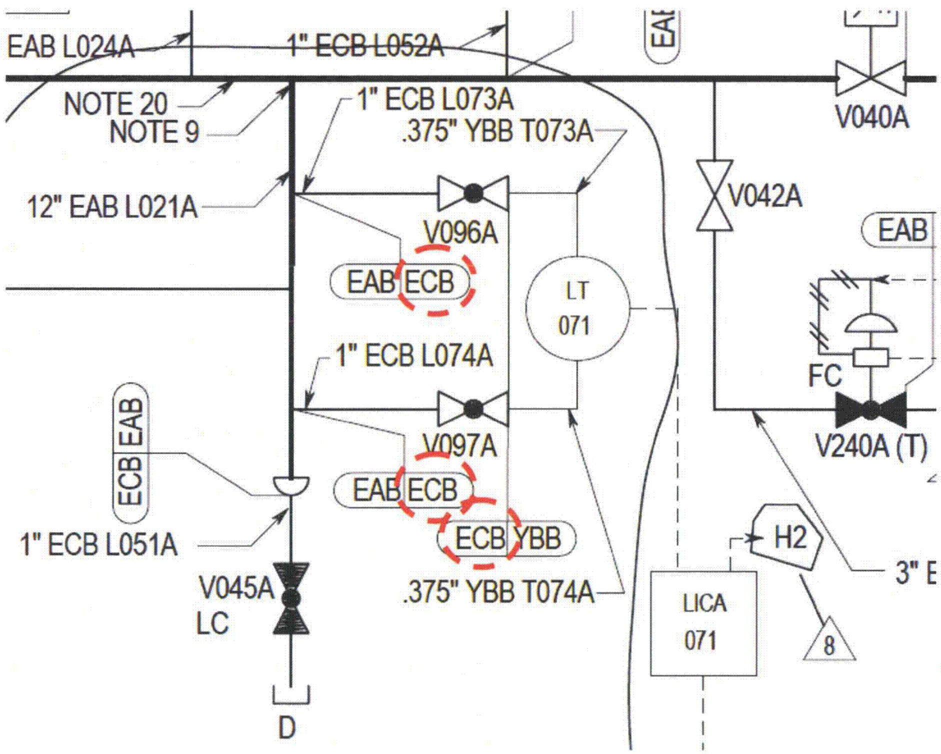

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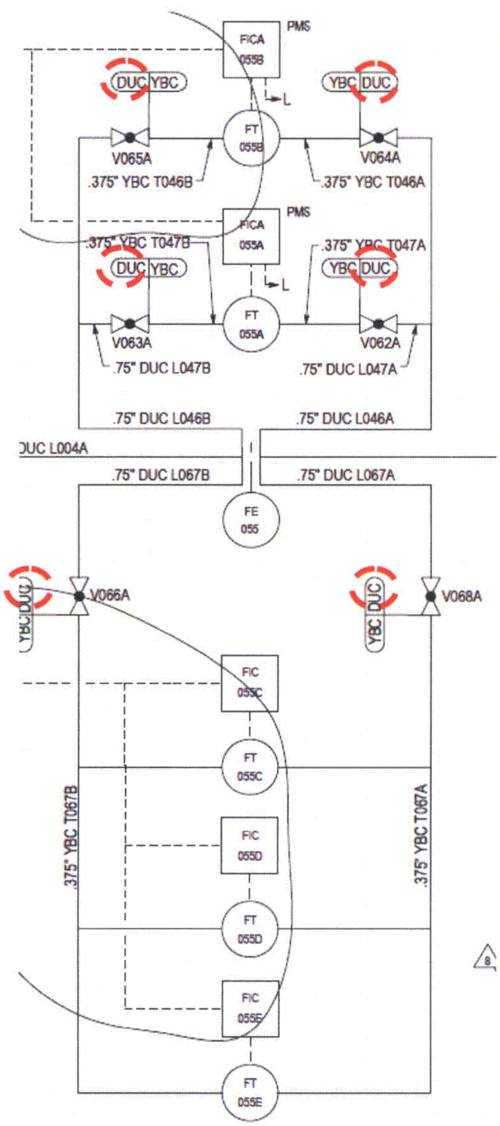

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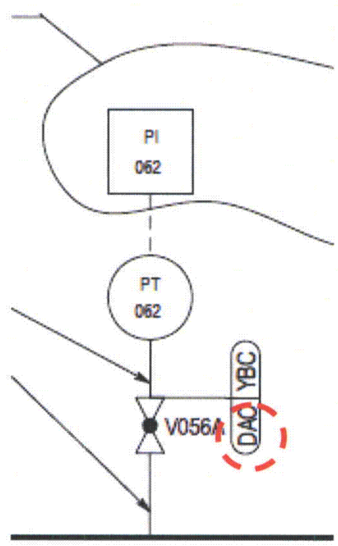

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

Design Control Document (DCD) Revision:
In-addition to those proposed in RAI-SRP 6.2.2-SPCV-25, Rev 1, see changes to Figure 10.3.2-1.

PRA Revision:
None

Technical Report (TR) Revision:
None in-addition to those proposed in RAI-SRP 6.2.2-SPCV-25, Rev 1.