J. E. Knighton

COMBUSTION ENGINEERING

February 6, 1987
LD-87-009

Docket No.: STN 50-470F

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

Subject: Auxiliary Pressurizer Spray System for CESSAR-F

Reference: NRC Letter, H. L. Thompson to A. E. Scherer, dated October 29, 1985

Dear Mr. Miraglia:

This letter responds to your request in the referenced letter for additional information in order to complete review of the CESSAR confirmatory issues on natural circulation cooldown and Steam Generator Tube Rupture (SGTR). Regrettably, it has taken some time to respond to your request, however, you should be aware that there have been a number of informal interactions between Combustion Engineering and previous NRC Project Managers leading up to this submittal.

We trust that you will find the material in the Enclosure to this letter responsive to your request. It is hoped that this letter will allow final closeout of the confirmatory actions on the two events in question. Pending a favorable response from you, we will follow up with the appropriate CESSAR amendment changes to formally incorporate the enclosed material into CESSAR-F.

If you have any questions on the Enclosure or would like to meet to discuss this submittal, please feel free to contact me or Mr. S. E. Ritterbusch of my staff at (203) 285-5206.

Very truly yours,

COMBUSTION ENGINEERING, INC.

A. E. Scherer
Director
Nuclear Licensing

AES:ss
Enclosure
cc: M. Lacitra (NRC) with Enclosure

Power Systems
Combustion Engineering, Inc.
1000 Prospect Hill Road
Post Office Box 500
Windsor, Connecticut 06095-0500
(203) 688-1911
Telex: 99297

E003
1/1

Responses to NRC
Letter of 10/29/85

The following information provides Combustion Engineering's (C-E's) response to NRC questions related to the Auxiliary Pressurizer Spray System (APSS). The NRC requested that C-E:

1) Address the need for a safety grade APSS and supporting systems, and

2) Propose any resulting changes in the CESSAR-F design and/or interface requirements

in view of experience at a System 80^{TM} plant.

In response to these specific concerns, the following is provided:

<u>Background</u>

The System 80 APSS was designed to be a reliable backup system to the main pressurizer spray system. It was qualified to meet ANSI N18.2 standards and, as such, was designed to ASME Section III requirements. Piping and valving were designed to meet Safety Class 1 and 2 specifications with some charging pump suction piping meeting Safety Class 3, all in accordance with ANSI N18.2. The APSS design function was to serve as a reliable backup to the main pressurizer spray system in the event of a loss or unavailability of forced circulation in the reactor coolant system. It was not designed to meet the single failure criterion.

Following the original system design effort, Branch Technical Position (BTP) RSB 5-1, "Design Requirements of the Residual Heat Removal System", was issued. This document provided certain recommended design guidelines on systems involved in the cooldown process, including the depressurization phase. NRC review of the System 80 design depressurization capability with the APSS was conducted in 1981 with the staff "...conclud(ing) that System 80 meets the requirements of Branch Technical Position 5-1 as appropriate for Class 2 plants with the exceptions noted." (Reference (A))

Those exceptions were closed out in the first supplement of the NRC's Safety Evaluation Report (SER) on CESSAR-F, after C-E agreed to certain system modifications. The SER supplement concluded that "The addition of a motor operator to valve 141...and the addition of emergency power to valves 536 and 501 will allow initiation of makeup and boration from the control room following a loss of offsite power...guidelines of BTP RSB 5-1 have, therefore, been satisfied..." (Reference (B)).

The only analyses in CESSAR-F which directly credit the APSS to mitigate an off-normal situation are the Natural Circulation Cooldown event (Reference (C)) and the Steam Generator Tube Rupture (SGTR) accident analyses.

Post Design System Reliability Improvements

As indicated earlier, the APSS was intended to provide a reliable backup to the main pressurizer spray system. Experience at a System 80 operating unit, however, led to a reexamination of whether the reliability goal had been achieved. As such, and after an extensive design reassessment, we are proposing modifications (Appendix (A)) to the CESSAR-F Chemical and Volume Control System design. (Figure 1 indicates the existing design while Figure 2 indicates the proposed design.) These design modifications to the APSS will ensure the desired highly reliable backup to the main pressurizer spray system.

Natural Circulation Cooldown Analysis

The Natural Circulation Cooldown analysis, which was submitted to the NRC in Reference (C), utilized the APSS in the latter stages of cooldown and depressurization. This analysis demonstrated acceptable results while utilizing the groundrules specified in Branch Technical Position (BTP) RSB 5-1 for a Class 2 plant. As indicated earlier, NRC's acceptance of CESSAR-F's compliance with BTP RSB 5-1 guidelines has been documented in References (A) and (B). Considering the proposed reliability improvements in the APSS, identified in Appendix (A), the staff's conclusions regarding compliance with BTP RSB 5-1 remain valid.

Steam Generator Tube Rupture Analysis

The SGTR analysis is contained in CESSAR-F, Appendix 15D. As stipulated, the analysis assumes a coincident loss of offsite power. Furthermore, although not specified in Standard Review Plan 15.6.3, the CESSAR-F analysis also considers the worst case single failure (stuck open atmospheric dump valve (ADV)). Addition of the single failure consideration was per agreement (Reference D) with the NRC, wherein the staff also specified that the Emergency Procedure Guidelines (CEN-152) should be assumed to direct the operator's actions. The SGTR analysis for CESSAR-F, therefore, assumes a loss of offsite power, stuck open ADV, and use of the APSS to allow the operator to meet the necessary guidelines for throttling HPSI flow. Given the reliability of the APSS with the modifications specified in Appendix (A), the system is expected to perform as designed. In the very unlikely situation where the APSS should be unavailable, however, a backup depressurization system (Reactor Coolant Gas Vent System) is specified in CESSAR-F interface requirements. This system has the necessary safety design, including tolerance to single failures.

As indicated in CESSAR-F Appendix 15D, Section 15.D.1, the consequences of a SGTR with loss of offsite power, the worst case single failure, and assuming reliance on the APSS are acceptable. In response to recent concerns about the reliability of the APSS, the proposed modifications to the system (Appendix (A)) significantly improve the system's availability to such a degree that it can be expected to fulfill it's function as assumed in the postulated SGTR, barring consideration of a single failure in the APSS coincident with the worst case single failure of the stuck open ADV. (Such an assumption is clearly beyond the plant's design basis.) Examination of the SGTR analysis in CESSAR-F indicates that either depressurization system could have been used without affecting the conclusions stated in paragraph 15.D.4. This is valid since no depressurization system is used in the analysis until well after the ADV has been isolated by shutting the ADV block valve. The depressurization system, therefore, has no significant impact on the offsite releases for the event, as long as the operator has some means available to eventually depressurize the system and terminate the event.

Summary

In addition to the main pressurizer spray system, the System 80 design includes a reliable, safety class Auxiliary Pressurizer Spray System (APSS) and an interface requirement for a safety class, single failure proof backup (Reactor Coolant Gas Vent System) to the APSS. C-E is, nevertheless, proposing a number of system modifications which, when implemented, will ensure that the APSS is more reliable than originally designed. Given these changes, the current CESSAR-F Natural Circulation Cooldown analysis (Reference (C)) and SGTR analysis (CESSAR-F Appendix D) remain valid. The related CESSAR-F confirmatory issues on these issues should, therefore, be closed by NRC.

References

(A) NUREG-0852, "Safety Evaluation Report related to the final design of the Standard Nuclear Steam Supply Reference System - CESSAR System 80", November 1981.

(B) NUREG-0852, Supplement 1, "Safety Evaluation Report related to the final design of the Standard Nuclear Steam Supply Reference System - CESSAR System 80", March 1983.

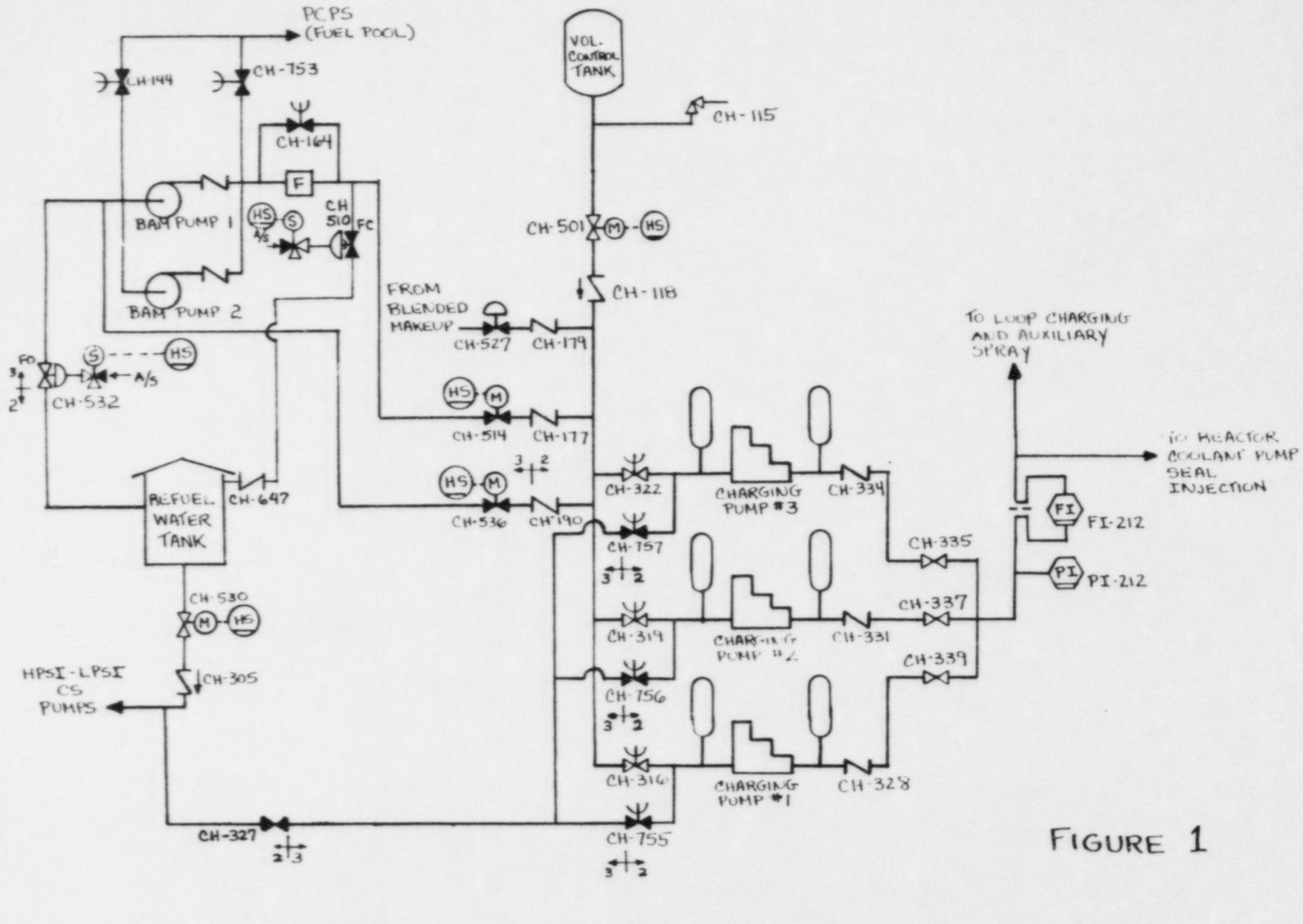
(C) C-E Letter, LD-83-074, "Natural Circulation Cooldown Re-Analysis for CESSAR-F", A.E. Scherer to D.G. Eisenhut, August 12, 1983.

(D) C-E Letter, LD-83-043, "Confirmatory Item 18, Steam Generator Tube Rupture Analysis", A.E. Scherer to D.G. Eisenhut, May 10, 1983.

Appendix (A) to
Enclosure to LD-87-009

Proposed Design Modifications to the APSS

1. Provide a separate reference leg for each of two VCT level transmitters. One reference leg shall be designed for dry calibration and one shall be designed for wet calibration.
2. Provide separate and redundant emergency power supplies for the VCT level transmitters (L-226 from Train B and L-227 from Train A). Power supply to these transmitters shall be non-interruptible, i.e., shall not be shed on SIAS, for example.
3. Add a second motor operated valve in series with the VCT outlet valve (This valve has been designated CH-501X in Figure 2).
4. Both CH-501 and CH-501X shall be capable of receiving power from an emergency 1-E supply (CH-501 from Train A and CH-501X from Train B). Power supplies to these valves shall be non-interruptible, i.e., shall not be shed on SIAS, for example. Handswitches shall be provided in the control room for remote operability of the valves.
5. CH-501X shall close on low-low level as indicated by L-226; CH-501 shall close on low-low level as indicated by L-227.
6. CH-536 shall be capable of receiving power from an emergency 1-E supply (Train A). Power supply to this valve shall be non-interruptible, i.e., power shall not be shed on SIAS, for example.
7. CH-536 shall open on low-low level on L-227.
8. Add a motor operated valve in parallel with CH-327 (Valve CH-327X in Figure 2). CH-327X shall be capable of receiving power from an emergency 1-E supply (Train B). Power supply shall be non-interruptible, i.e., shall not be shed on SIAS, for example. A handswitch shall be provided in the control room for remote operability of the valve.
9. CH-327X shall open on low-low level on L-226.
10. Add a check valve downstream of CH-327X and CH-327 (Valve CH-XXX on Figure 2). Piping downstream of CH-XXX shall conform to ASME Class 2, including CH-755, CH-756, and CH-757. Valves CH-755, CH-756, and CH-757 shall be normally open. (Current piping between CH-327 and CH-755, 756, 757 is ASME Safety Class 3)
11. CH-514 open, CH-510 close, and BAMP start on low-low level on L-227 shall remain unchanged.
12. High point vents on charging pump shall be directed to areas of the auxiliary building such that the likelihood of hydrogen explosion is minimized.
13. The switch over from the VCT to an alternate suction source on low-low level shall be interlocked to prevent the possibility of a charging pump taking a suction on an isolated or partially closed section of pipe. Closure of CH-501 and 501X would be delayed until either CH-536 (or 514) or CH-327X reached full open position. Automatic closure of CH-501 and 501X would not occur except on low-low VCT level.



PCPS
(FUEL POOL)
CH-144
CH-753
CH-164
F
BAM PUMP 1
BAM PUMP 2
HS
S
A/S
CH
510
FC
FO
CH-532
HS
S
A/S
VOL. CONTROL TANK
CH-115
CH-501
M
HS
CH-118
FROM
BLENDED
MAKEUP
CH-527
CH-179
HS
M
CH-514
CH-177
HS
M
CH-536
CH-190
REFUEL WATER TANK
CH-647
CH-530
M
HS
CH-305
HPSI-LPSI
CS
PUMPS
CH-322
CH-757
CH-319
CH-756
CH-316
CH-755
CH-327
CHARGING PUMP #3
CHARGING PUMP #2
CHARGING PUMP #1
CH-334
CH-331
CH-328
CH-335
CH-337
CH-339
TO LOOP CHARGING
AND AUXILIARY
SPRAY
TO REACTOR
COOLANT PUMP
SEAL
INJECTION
FI
FI-212
PI
PI-212

FIGURE 1

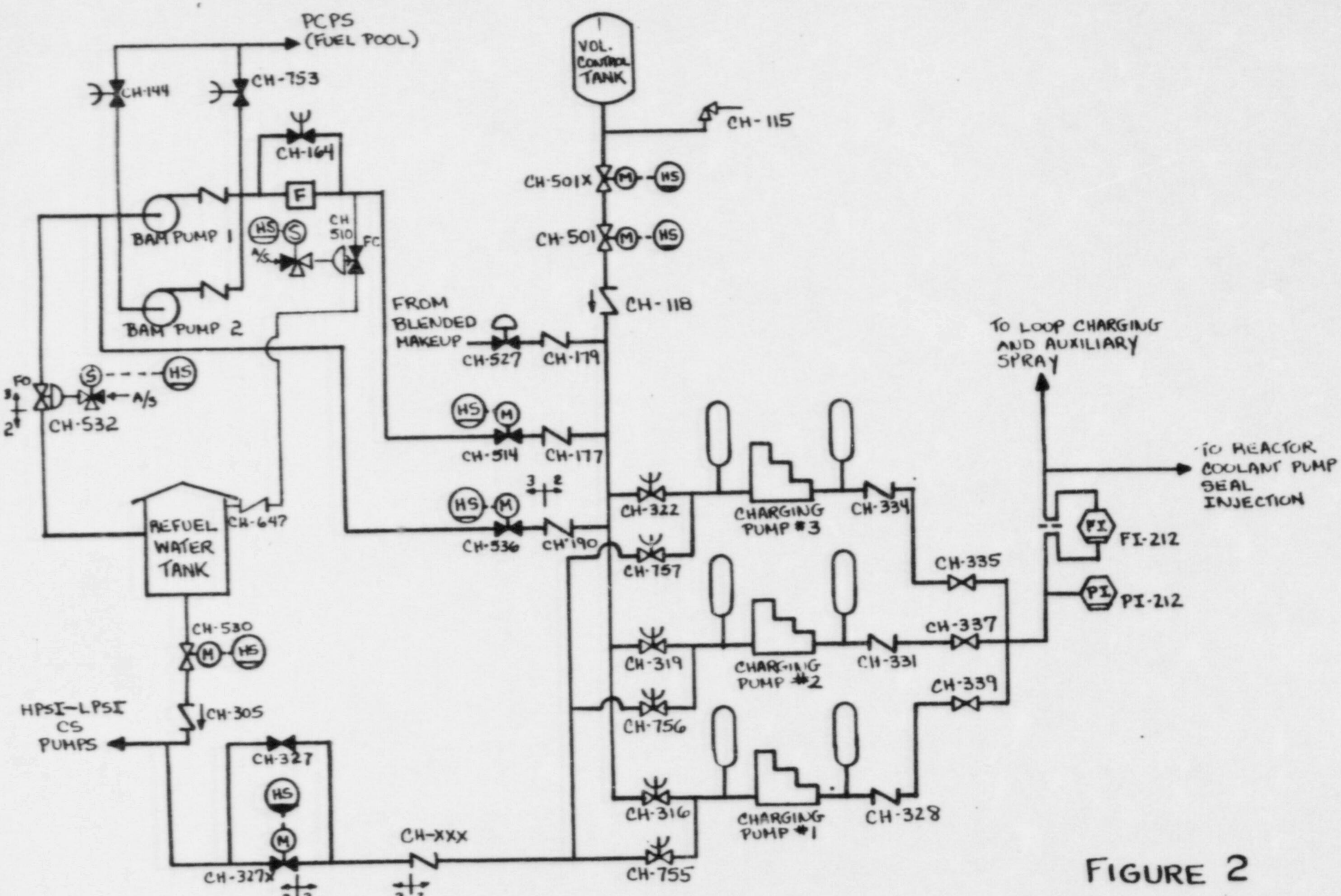

PCPS
(FUEL POOL)
CH-144
CH-753
CH-164
F
BAM PUMP 1
BAM PUMP 2
HS
S
A/S
CH 510
FC
FO
3
2
CH-532
VOL. CONTROL TANK
CH-115
CH-501X
CH-501
M
CH-118
FROM BLENDED MAKEUP
CH-527
CH-179
CH-514
CH-177
CH-536
CH-190
REFUEL WATER TANK
CH-647
CH-322
CH-757
CH-319
CH-756
CH-316
CH-755
CHARGING PUMP #3
CHARGING PUMP #2
CHARGING PUMP #1
CH-334
CH-331
CH-328
CH-335
CH-337
CH-339
TO LOOP CHARGING AND AUXILIARY SPRAY
TO REACTOR COOLANT PUMP SEAL INJECTION
FI
FI-212
PI
PI-212
CH-530
CH-305
HPSI-LPSI CS PUMPS
CH-327
CH-327X
CH-XXX

FIGURE 2