10 CFR 50.71(e)

CP&L

Carolina Power & Light Company
Robinson Nuclear Plant
3581 West Entrance Road
Hartsville SC 29550

Serial: RNP-RA/00-0156
OCT 12 2000

United States Nuclear Regulatory Commission
Attn: Document Control Desk
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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23

ERRATA TO UPDATED FINAL SAFETY ANALYSIS REPORT REVISION 16

Ladies and Gentleman:

In accordance with the requirements of 10 CFR 50.71(e), Carolina Power & Light (CP&L) Company is submitting one original and ten copies of Revision 16 E1 to the Updated Final Safety Analysis Report (UFSAR) for the H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2. The Revision 16 E1 corrections are errata to the UFSAR Revision 16. These corrections have been appropriately incorporated into the UFSAR. Revision 16 was submitted by letter dated April 17, 2000.

If you have any questions please contact Mr. H. K. Chernoff or me.

Sincerely,

R. L. Warden
Manager, Regulatory Affairs

DJS/djs

Enclosure
c: USNRC Resident Inspector, HBRSEP
Mr. R. Subbaratnam, NRC, NRR (w/o enclosure)
Mr. L. A. Reyes, NRC, Region II

A053

HBR 2
Updated FSAR
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7.2.1-34	0
7.2.1-35	11
7.2.1-36	15
7.2.1-37	15E2
7.2.1-38	15
7.2.2-1	15
7.2.2-2	15
7.2.2-3	15
7.2.2-4	15
7.2.2-5	15
7.2.2-6	15
7.2.2-7	15

Regulatory Guide 1.88

REQUIREMENTS FOR COLLECTION, STORAGE, AND MAINTENANCE OF QUALITY ASSURANCE RECORDS FOR NUCLEAR POWER PLANTS

ANSI Standard N45.2.9-1979 "Requirements For Collection, Storage, And Maintenance of Quality Assurance Records For Nuclear Power Plants."

NRC Generic Letter 88-18, Plant Records, Storage on Optical Disk

As documented in CP&L Letter to the NRC dated March 23, 1993, the Robinson Plant is no longer committed to Regulatory Guide 1.88 "Collection, Storage, and Maintenance of Nuclear Power Plant Quality Assurance Records," August 1974.

The requirements for collection, storage, and maintenance of hardcopy and microfilmed copies of QA records at HBR Unit 2 will be in accordance with ANSI N45.2.9-1979 and UFSAR Section 17.3, subject to the following:

1. Section 1.5 titled Referenced Documents: - CP&L's commitment to other documents referenced in this standard shall be as stated in our commitment to that document.

2. Section 5.4 Item 2 "Records shall be firmly attached in binders or placed in folders or envelopes for storage in steel file cabinets or on shelving in containers." HBR complies with this requirement except for periods when records are in the receipt or microfilming process.

3. Section 5.6 states: "Records shall be stored in facilities constructed and maintained in a manner which minimizes the risk of damage or destruction from the following:

a. Natural disasters such as winds, floods, or fires.
b. Environmental conditions such as high and low temperatures and humidity.
c. Infestation of insects, mold, or rodents."

Records are stored in permanent and temporary facilities as follows:

1) One hour UL-rated fireproof file cabinets are utilized for temporary storage or records. These file cabinets are located at work locations throughout the plant and will contain the records until the records are transmitted to the appropriate Document Control Center. Records being processed in Document Control Centers will be stored in fireproof cabinets when they are not being processed and until they are sent to the vault.

2) Permanent storage of QA records will be in the plant vault constructed to meet the requirements of this ANSI standard, and via electronic means which also meet applicable provisions of this standard, in addition to those delineated below.

3) Selected records may be stored off-site by a QA Records Storage supplier provided that supplier meets the applicable sections of this ANSI standard.

4. Section 6.2 states: "Storage systems shall provide for retrieval of information in accordance with planned retrieval times based upon the record type."

Retrieval of records at the H.B. Robinson Plant is via a random access computer system using key words and document identification numbers. Or through a manual index for records completed prior to 1982. The manual system is keyed to Plant Systems.

5. Section 7.3.3 states: "Various regulatory agencies have requirements concerning records that are within the scope of this Standard. The most stringent requirements shall be used in determining the retention period."

H. B. Robinson will continue to adhere to the recommendations of Appendix A of ANSI N45.2.9-1974, or with the most stringent requirement with respect to records retention.

6. Records are stored on optical disk in accordance with the recommendations of Generic Letter 88-18, Plant Records Storage on Optical Disks. Records are also stored on other electronic media, i.e., magnetic tape, in accordance with the following requirements:

a. The electronic/optical technology does not allow deletion or modification of record date/files.

b. The data for each record is stored in the computer system and written to a backup media.

c. The legibility of the data for each record is verified to ensure that the data is legible in the computer system and on the backup media.

d. The computer system retains the working file for on-line retrieval. The second (backup) media is stored in a storage facility meeting the requirements of ANSI N45.2.9-1979 for single copy storage or in a separate location to comply with the requirements for dual record storage.

e. To ensure permanent retention of records, the records stored on electronic media are acceptably copied onto new electronic media before the manufacturer's certified useful life of the original electronic media is exceeded. This includes verification of the records so copied.

f. Periodic random inspections of data/files stored on electronic media are performed to verify that there has been no degradation of data/files quality.

g. If the electronic computer system in use is to be replaced by an incompatible new system, the records stored on the old system's media are acceptably converted into the new system before the old system is taken out of service. This includes verification of the records so copied.

4.4.2 Description

The following sections describe the thermal-hydraulic design of the reactor core. Chapter 5 of the Updated FSAR contains a description of the thermal-hydraulic design of the RCS.

4.4.2.1 Definition of Departure from Nucleate Boiling (DNB) Ratio

The ratio of the heat flux causing DNB at a particular core location to the existing heat flux at the same core location, is the DNB ratio. A DNB ratio equal to the safety limit corresponds to a 95 percent probability at a 95 percent confidence level that DNB does not occur. This value is chosen as the margin to DNB for all operating conditions.

DNB is not, however, an observable parameter during reactor operation. Therefore, the observable parameters, reactor power, reactor coolant temperature and reactor coolant pressure have been related to DNB through the DNB correlation. The HTP correlation for High Thermal Performance (HTP) fuel has a DNBR safety limit of 1.141 (Reference 4.4.2-3). Curves presented in the HBR 2 Technical Specifications represent the loci of points of reactor power, reactor coolant pressure and inlet temperature for which the DNB ratio is less than the safety limit. The area of safe operation is the lower inlet temperature and higher reactor coolant pressures limited by one specified curve of the reactor power parameter family of curves shown. The parameters used in the development of the curves are checked in the course of plant startup tests, and the curves are modified if necessary.

4.4.2.2 Hot Channel Factors

The enthalpy rise factors are thermal-hydraulic performance indicators. These factors indicate the effect on the enthalpy rise in the hot subchannel resulting from the geometry and components of the ANF fuel design. Each of the enthalpy rise factors was developed from the results of the thermal-hydraulic calculations. The ANF DNB methodology using the XCOBRA-IIIC computer code is described in Reference 4.4.2-1.

4.4.2.2.1 Engineering enthalpy rise factor

Because of tolerances in the manufacture of the fuel, in particular variations from the nominal design values of pellet density, pellet diameters, and enrichment over the active length, the local heat flux in the highest enthalpy rise subchannel could have been higher than nominal by three percent (engineering heat flux factor). The engineering enthalpy rise factor was evaluated by XCOBRA-IIIC computer runs with and without the three percent increase in local heat flux for the hottest fuel rod adjacent to the high enthalpy rise subchannel.

4.4.2.2.2 Inlet plenum maldistribution factor

The inlet plenum maldistribution is a reactor vessel characteristic that is specified in the HBR FSAR to be ± 5 percent. To assume a 5 percent increase in enthalpy rise in the hot subchannel would be overly conservative because of the effects of subchannel turbulent and cross flow mixing which tend to neutralize this inlet flow situation at the point of MDNBR. Because of the effects of turbulent and crossflow mixing, the enthalpy rise factor resulting from a ±5 percent inlet flow maldistribution is unaffected.

4.4.2.2.3 Flow mixing enthalpy rise factor

The enthalpy rise factor in the hot channel is adjusted for turbulent mixing in the XCOBRA III-C code. The turbulent mixing model is the ROWE-ANGLE model. See Reference 4.4.2-4.

4.4.2.2.4 Flow redistribution

The enthalpy in the hot subchannel is increased by flow diversion resulting from the higher frictional losses which result from subcooled nucleate boiling. The flow that is diverted from the hot subchannel due to the effect of subcooled voiding was found to cause a significant increase in the enthalpy rise.

where: $h_{stag} = 2 + 50x \quad 0 \le x \le 1.4$ (4)

h_{stag} = h for stagnant conditions (Btu/hr ft^2 °F)

X = steam to air weight ratio in containment

For concrete, the heat transfer coefficient is taken as 40 percent of the value calculated for steel.

Provision was made in the computer analysis for the effects of several engineered safeguards, including internal spray, fan coolers, and recirculation of sump water. The heat removal from containment steam-air phase by internal spray is determined by allowing the spray water temperature to rise to the steam-air temperature. The systems are described in detail in Section 6.2.2.

In the transients one spray pump and two fans starting at 60 sec were assumed. These acted to quickly reduce the pressure after the peak pressures were reached.

The containment pressure was calculated for a range of large area ruptures of the RCS. The rupture sizes considered were:

a) Double ended rupture

b) 6 ft^2 break

c) 3 ft^2 break, and

d) .5 ft^2 break.

The energy sources and mass release rates calculated for these LOCA events are discussed in Section 6.2.1.3.

In this calculation all energy generated by the core during blowdown is transferred to the coolant as it is generated. The sensible energy sources are transferred to the coolant as a function of time, and for longer blowdown times more sensible energy is absorbed. For the very large breaks very little energy is transferred to the steam generators (SG), because of the rapid uncovering of the tubes, while for smaller breaks the tubes do not uncover as rapidly, and significant heat transfer results.

A negligible amount of energy is transferred from the reactor vessel during the relatively fast blowdown.

Figure 6.2.1-1 presents the results of the transients. For all cases a pressure peak of less than 37.8 psig was calculated. Since the design pressure for the containment is 42 psig, a margin more than 11 percent above the conservative value of the blowdown peaks, is available.

Figure 6.2.1-2 presents the energy absorption capability within the 2.1×10^6 ft^3 free volume of the containment.

The integrated containment energy balance at the end of blowdown is given by:

$$U_f = U_i + \sum (mh)_{in} + \sum Q_{in} - \sum Q_{out} \quad (5)$$

where: U_f = Final internal energy in the containment

U_i = Initial external energy in the containment

$S\ (mh)_{in}$ = Enthalpy added by blowdown sources

SQ_{in} = Energy added directly to containment atmosphere by hydrogen-oxygen recombination

SQ_{out} = Heat removal by containment structures and cooling system

The internal energy is made up of three sources: air, steam, and sump water. Only the air-steam mixture with their respective partial pressures contribute to the containment total pressure. The internal energy for the initial assumed containment conditions, 120°F and 15 psia, is as follows:

Steam (m) (u) = (2110) (1077)	= 2.27×10^6 Btu
Air (m) (Cr) (T) = (1.51×10^5) (0.172) (120)	= 3.12×10^6 Btu
Sump (m) (u) = (1.23×10^4) (87.9)	= 1.06×10^6 Btu
	6.45×10^6 Btu

The internal energy balance at the end of the blowdown is given in Table 6.2.1-3. All entries are in millions of Btu.

The difference between the internal energies by the energy balance equation and by the COCO program represents an error of less than " 1 percent in the calculation.

Figure 6.2.1-3 shows the heat transfer coefficients calculated for the various break sizes.

Containment Margin Evaluation

Evaluation of the capability of the reactor containment and containment cooling systems to absorb energy additions without exceeding the containment design pressure requires consideration of two periods of time following a postulated large area rupture of the RCS.

The first period is the blowdown phase. Since blowdown occurs too rapidly for the containment cooling systems to be activated, there must be sufficient energy absorption capability in the free volume of the containment (with due credit for energy absorption in the containment structures) to limit the resulting pressure below design.

The second period is the post-blowdown period where the containment cooling systems must be able to absorb any postulated post-blowdown energy additions and continue to limit the containment pressure below design.

When the break is large, RCS depressurization occurs due to the large rate of mass and energy loss through the break to the containment. The system is arranged so that the RHR pumps take suction from the sump in the containment floor and deliver spilled reactor coolant and borated refueling water back to the core through the residual heat exchangers. The system is arranged to allow either of the RHR pumps to take over the recirculation function.

There are two sump return lines which lead from the containment to the RHR pumps. Each line is located inside of a larger diameter guard pipe. The lines are separated by approximately 18 ft. The lines are designed to allow for 2 in. differential movement between the containment and pump chamber and are designed as Seismic Class I equipment.

Staged debris removal of the water entering the RHR Pump suction piping during the recirculation mode is accomplished as follows: (Refer to Figure 6.3.2-3 and Containment Spray Flow Diagram)

1. Debris approximately 1" and above is stopped by the coarse screens located at the base of the shield wall inside the Reactor Coolant Pump Bays. These screens have openings approximately 1".

2. Submerged debris is stopped from entering the sump by the outer 9" baffle wall.

3. Floating debris is stopped from entering the sump screens by having the water level above the sump screens. The inner 4'6" baffle wall assures the water is above the screens before floating material is allowed to approach them.

4. Neutral and near neutral bouyant debris greater than 7/32" diameter are stopped by the sump screens. The screens consist of a prescreen with a 1/2" square mesh opening in series with a 7/32" square mesh opening screen. This prescreen reduces the debris loading on the final screen.

5. Debris smaller than 7/32" may pass through the screens and enter the pump suction without detrimental effect to the Containment Spray Nozzles.

6. A hood is located over the sump to deflect debris from falling directly into the area within the 4'6" baffle wall. (Fig. 6.3.2-3)

Recirculation may start with a water depth of 1.5 ft on the containment floor. This is equivalent to the amount of water in the primary systems plus 60 percent of the RWST contents, or approximately 215,000 gal of water at 263 F. The maximum inlet velocity between the upper baffle and the container floor, which is the smallest flow area in this design, is approximately 1 ft/sec.

6.3.2.2.3 Net Positive Suction Head (NPSH) Requirements

During the safety injection phase the worst case conditions for determining NPSH requirements occur with the single failure of a high head pump resulting in the following:

1. 1 high head pump at 661 gpm,
2. 2 low head pumps at 4572 gpm total, and
3. 2 containment spray pumps at 2467 gpm total.

A quantitative analysis of the available and required NPSH for the SI, RHR and containment spray pumps for both the safety injection phase (with suction from the RWST) and the recirculation phase (suction from the containment sump) shows:

1. During the safety injection phase with suction from the RWST, (at the RWST low level setpoint), operating as described above, the following applies:

Pump	NPSH, ft Required	Available
High head, 1 pump (most limiting)	32	35.8
Low head (RHR), 2 pumps	10	Approx 54
Containment spray, 2 pumps	20	Approx 35

From this it can be seen that the high head pump is the controlling component for NPSH. The safety injection phase will be terminated just before the RWST level decreases to the point at which the available NPSH is reduced to the required NPSH of 32 ft at the runout flow of 661 gpm. Transition to recirculation from the containment sump will commence at this point.

2. During the transition to the recirculation phase, conditions are such that one high head pump and one containment spray pump are operating. During this period the worst case NPSH conditions occur at the RWST low-low level setpoint as follows:

Pump	NPSH, ft Required	Available
1 high head pump at 662 gpm	32	35.7
1 containment spray pump at 1220 gpm	20	Approx 35

3. During the recirculation phase (from containment sump) the following applies:

a. High head SI pumps - During recirculation via the high head pump, this pump and the RHR pump would be aligned in series, with the RHR pump (which has a design discharge head of 240 ft) boosting the suction of the high head pump. Thus, no NPSH problems would be experienced.

b. Containment spray pump - Same as high head SI pump.

c. RHR (low head) pump - During recirculation from the containment sump at 3833 gpm, the available NPSH with 1.5 ft of water on the containment floor is 19.2 ft. The required NPSH at 3833 gpm is 15 ft.

The high head recirculation flow path via the high head SI pumps is only required for the range of small break sizes for which the RCS pressure remains in excess of the shut-off head of the RHR pumps at the end of the safety injection phase.

Those portions of the SIS located outside of the containment which are designed to circulate, under post-accident conditions, radioactively contaminated water collected in the containment, meet the following requirements:

1. Shielding to maintain radiation levels within the guidelines set forth in 10CFR100

2. Collection of discharges from pressure relieving devices into closed systems, and

3. Means to limit radioactivity leakage to the environs, within guidelines set forth in 10 CFR 100.

A program designed to reduce leakage from systems outside containment that would or could contain highly radioactive fluids during a serious transient or accident is implemented in accordance with Improved Technical Specifications (ITS) Section 5.5.2, "Primary Coolant Sources Outside Containment." The program applies to the Residual Heat Removal System and the Safety Injection System.

This program includes the following:

a. Preventative maintenance and periodic visual inspection requirements; and

b. Integrated leak test requirements for each system at refueling cycle intervals or less.

The program employs visual inspections of the mechanical joints and seals of the systems to detect leakage. The inspections are conducted with the system pressurized to normal system pressure using the system fluid as a test medium. The observed leakage is evaluated if the leakage is "as low as practical." Any leakage evaluated as not being "as low as practical" that cannot be corrected by the inspector will be identified on a work request.

The combined maximum allowable leakage from the Containment Spray System, the Residual Heat Removal System and the Safety Injection System is 2 gallons per hour.

Recirculation loop leakage is discussed in Section 6.3.2.5.5.

For the recirculation phase of the accident, the reactor coolant water which eventually is located on the containment floor is recirculated through the sump line from the containment to the suction of the RHR pump. Two independent and redundant recirculation lines are provided. Each line has two motor-operated valves. Both valves are located adjacent to the containment penetration in the RHR pit such that the line outside the containment can be isolated in the event of a passive failure. During recirculation, one recirculation train, which includes either of the two RHR pumps and either of the two residual heat exchangers, will be in service. The flow will go from the discharge of the RHR pump through the residual heat exchanger and then into the reactor via either the low head injection path or the high head injection path via the SI pumps. The high head injection path is provided in the event of a small break in which the pressure in the RCS is higher than the shut-off head of the RHR pumps.

In the event of a failure in the operating train during recirculation, the capability exists to switch to the other independent recirculation flow path; i.e., through the high head SI pumps to provide core cooling.

In the long term (post-accident) phase, injection through a separate header into the hot legs is possible by manual remote Control Room switch operation.

6.3.2.2.4 Cooling water

6.3.2.2.4.1 Component cooling system

During the recirculation mode, the Component Cooling System is used to cool the recirculation fluid as it passes through the residual heat exchanger. One of the three component cooling pumps and one of the two component cooling heat exchangers provide the cooling function during recirculation.

6.3.2.2.4.2 Service water system

The service water system is provided with redundant and independent loop headers and valves such that the two component cooling heat exchangers which are supplied with service water for cooling can have flow directed to them from the two independent headers. Two of the four service water pumps are required to operate during the recirculation phase.

6.3.2.2.5 Changeover from injection phase to recirculation phase

The sequence, from the time of the SI signal, for the changeover from the injection to the recirculation is as follows:

1. First, sufficient water is delivered into the containment during the injection phase to provide the required NPSH of the RHR pumps to allow the change to recirculation.

2. Second, the first low level alarm on the RWST sounds. At this point, the operator takes appropriate action to assure that sufficient NPSH exists for the operating pumps to run until the RWST is nearly empty. Between the first RWST low level alarm and the second low level alarm the operator performs the system alignment for recirculation. The change-over from injection to recirculation is effected by the operator

in the Control Room via a series of manual switching operations according to written procedures. Valves SI-856A and SI-856B are manually blocked closed at the valves. Valve SI-870A or SI-870B is manually closed if the motor operator is inoperable. At the first alarm the operator stops pumps to achieve the following configuration.

RHR pumps	-None running
SI pumps	-One running
Spray pumps	-One running (if required)
Charging pumps	-None running

The suction of the RHR pumps is aligned to the containment sump. If the RCS pressure is below the discharge pressure of the RHR pumps, a RHR pump is restarted when there is sufficient water level in containment. RHR will recirculate flow from the containment sump to the RCS.

3. Finally the second low level alarm on the RWST sounds. At this time, the operator will stop the remaining pumps taking a suction from the RWST.

   If RCS pressure is greater that the discharge pressure of the RHR pumps or if Containment Spray is required for pressure control, then the RHR system is aligned for the RHR pumps to recirculate flow from the containment sump to the SI pump suction header. ECCS flow to the RCS is interrupted for a period of time while this alignment is performed.

Remotely operated valves for the injection phase of the SIS (Figures 6.3.2-1 and 6.3.2-2) which are under manual control, (this is, valves which normally are in their ready position and do not receive a SI signal) have their positions indicated on a common portion of the control board. At any time during operation, when one of these valves is not in the ready position for injection, it is shown visually on the board. Table 6.3.2-1 is a listing of the instrumentation readouts on the control board which the operator can monitor during recirculation.

6.3.2.2.5.1 Location of the major components required for recirculation

The RHR pumps are located in the RHR pump room (Elevation 203 ft 0 in.) which is below the basement floor of the Auxiliary Building (Elevation 226 ft 0 in). The RHR pump room is located between the Containment Building and the Auxiliary Building. The residual heat exchangers are located on the first floor of the Auxiliary Building.

The high head SI pumps, component cooling pumps and component cooling heat exchangers are located in the Auxiliary Building (Elevation 226 ft 0 in).

The service water pumps are located in the intake structure, and the redundant piping to the component cooling heat exchangers is run underground.

6.3.2.2.6 Accumulators

The accumulators are pressure vessels filled with borated water and pressurized with nitrogen gas. During normal plant operation, each accumulator is isolated from the RCS by two check valves in series.

6.8.2 System Design

6.8.2.1 System Description

The IVSW system flow diagram is shown in Figure 6.8.2-1.

System operation is initiated either manually or by any automatic safety injection (SI) signal. When actuated, the IVSW System interposes water inside the penetrating line between two isolation points located outside the containment. The resulting water seal blocks leakage of the containment through valve seats and stem packing. The water is introduced at a pressure greater than the containment design basis accident pressure of 40 psig. The possibility of leakage from the containment or the RCS past the first isolation point is thus prevented by assuring that if leakage does exist, it will be from the seal water system into the containment. Service is discontinued after the manual reset buttons for PCV-1922 A and B are reset after a containment isolation Phase A reset.

The system includes one seal water tank capable of supplying the total requirements of the system. The tank is pressurized with a nitrogen blanket supplied from two independent sources. Primary supply is from the plant nitrogen supply header through a pressure regulating control valve. Automatic backup supply is provided from two high pressure nitrogen bottles through separate high and low pressure regulating valves. Design pressure of the tank and piping is 150 psig. The injection piping runs and the piping from the nitrogen supply bottles are fabricated using 3/8 in. OD stainless steel tubing, which is capable of 2500 psig service. Relief valves are provided to prevent over-pressurization of the system if a pressure control valve fails, or if a seal water injection line communicates with a high pressure line due to a check valve failure in the seal water line. The seal water tank requires no external power source to maintain the required driving pressure.

Local instrumentation is also provided, as shown in Figure 6.8.2-1. The primary source of N_2 from the plant N_2 supply header is backed up by two, independent, high pressure N_2 bottles. If there should be a break or failure of the N_2 header, the N_2 blanket pressure is maintained by the tanks and blowdown through the N_2 header is prevented by check valves.

The tank supplies pressurized water to four distribution headers. Header "A" is the manual header, meaning an isolation valve on this header must be pressurized by opening a manual valve supplying the individual isolation valve. Headers "B", "C", and "D" are automatic headers that are pressurized through one or both of two redundant, fail-open, air-operated valves in parallel. These valves open on receipt of an SI signal. A loss of power will cause the automatic valves to open, since automatic initiation is a de-energized signal to vent air from the valve operators. System operation is initiated by a Phase A containment isolation signal which accompanies any SI signal. System operation is discontinued after the manual reset buttons for valves PCV-1922 A and B are reset after the Phase A reset.

Liquid carrying piping two inches and larger with design pressure or temperature exceeding 200 psig or 200°F is typically isolated by one manual or remote-operated, double disc gate valve. A drawing of this valve is presented in Figure 6.8.2-2. Redundant isolation barriers are provided when the valve is closed. The upstream and downstream discs are forced against their respective seats by the closing action of the valve. Seal water is injected through the valve bonnet or body and pressurizes the space between the two valve discs.

The seal water pressure in excess of the potential accident pressure eliminates any outleakage past the first isolation point.

For smaller lines, isolation is typically provided by two globe valves in series with the seal water injected into the pipe between the valves. The valves are oriented such that the seal water wets the stem packing. When the valves are closed for containment isolation, the first isolation point is the valve plug in the valve closest to containment, and the water seal is applied between the valve plug and stem packing. In a number of the smaller lines, isolation is provided by two diaphragm (Saunders Patent) valves in series, with the seal water injected into the pipe between the valves.

The design of the IVSW System is based on the conservative assumption that all containment isolation valves serviced by the IVSW System are leaking at 50 cc/hr/inch of nominal pipe diameter.

Acceptable leakage criteria is based on a total allowable leakage value calculation for each of the four (4) IVSW System headers, using the IVSW System design leakage.

In addition, should one of the isolation valves fail to close, flow through the failed valve will be limited by a restricting orifice to a maximum leakage value of 63,200 cc/hr. A water seal at the failed valve is assured by proper slope of the protected line, or a loop seal, or by additional valves on the side of the isolation valves away from the containment.

The seal water tank is sized to provide at least a 24 hr supply of seal water under the following adverse circumstances: isolation valves leaking at the design rate of 50 cc/hr/in. plus the failure of the largest containment isolation valve to seat, resulting in leakage at the maximum rate of 1000 cc/hr/in. The seal water tank is sized to satisfy these conditions. Two separate, independent, seismically qualified sources of makeup water (primary water and service water) are provided to ensure that an adequate supply of seal water is available for long-term operation. Service water makeup is from two sources - the service water header, and from each of the service water booster pumps. This assures a redundant long-term supply of water from a source at greater than the 1.1 times the design basis accident pressure (approximately 46 psig). Based on maximum leakage and flows into the tank from makeup sources, use of the makeup source would be required for only minimal amounts of time each day at very low flows which will not affect other functions of the makeup system.

6.8.2.2 Isolation Valve Seal Water Actuation Criteria

Containment isolation and seal water injection are accomplished automatically for certain penetrating lines requiring early isolation, and manually for others, depending on the status of the system being isolated and the potential for leakage in each case.

The automatically operated containment isolation valves are actuated to the closed position by one of two separate containment isolation signals. The first of these signals is derived in conjunction with automatic SI actuation, and trips the majority of the remotely operated isolation valves. These valves are in the so-called "non-essential" process lines penetrating the containment. This is defined as the Containment Isolation Phase "A" Signal (T-Signal).