3/4.5.4 BORON INJECTION SYSTEM

BORON INJECTION TANK

LIMITING CONDITION FOR OPERATION

3.5.4.1 The boron injection tank shall be OPERABLE with:

a. A minimum contained volume of 900 gallons of borated water,

b. Between 20,100 and 21,800 ppm of boron, and

c. A minimum solution temperature of 145°F.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

With the boron injection tank inoperable, restore the tank to OPERABLE status within 1 hour or be in HOT STANDBY and borated to a SHUTDOWN MARGIN equivalent to 1% Δk/k at 200°F within the next 6 hours; restore the tank to OPERABLE status within the next 7 days or be in HOT SHUTDOWN within the next 12 hours.*

SURVEILLANCE REQUIREMENTS

4.5.4.1 The boron injection tank shall be demonstrated OPERABLE by:

a. Verifying the water level through a recirculation flow test at least once per 7 days,

b. Verifying the boron concentration of the water in the tank at least once per 7 days, and

c. Verifying the water temperature at least once per 24 hours.

*Effective 5:55 P.M. January 12, 1979 and expiring at 11:55 A.M., January 13, 1979 the following ACTION statement is applicable: With the boron injection tank inoperable, restore the tank to OPERABLE status within 1 hour or be in HOT STANDBY and borated to a SHUTDOWN MARGIN equivalent to 1% Δk/k at 200°F within the next 24 hours; restore the tank to OPERABLE status within the next 7 days or be in HOT SHUTDOWN within the next 12 hours.

HEAT TRACING

LIMITING CONDITION FOR OPERATION

3.5.4.2 At least two independent channels of heat tracing shall be OPERABLE for the boron injection tank and for the heat traced portions of the associated flow paths.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

With only one channel of heat tracing on either the boron injection tank or on the heat traced portion of an associated flow path OPERABLE, operation may continue for up to 30 days provided the tank and flow path temperatures are verified to be ≥ 145°F at least once per 8 hours; otherwise, be in HOT SHUTDOWN within 12 hours.

SURVEILLANCE REQUIREMENTS

4.5.4.2 Each heat tracing channel for the boron injection tank and associated flow path shall be demonstrated OPERABLE:

a. At least once per 31 days by energizing each heat tracing channel, and

b. At least once per 24 hours by verifying the tank and flow path temperatures to be ≥ 145°F. The tank temperature shall be determined by measurement. The flow path temperature shall be determined by either measurement or recirculation flow until establishment of equilibrium temperatures within the tank.

REFUELING WATER STORAGE TANK

LIMITING CONDITION FOR OPERATION

3.5.4 The refueling water storage tank (RWST) shall be OPERABLE with:

a. A contained volume of between 364,500 and 400,000 gallons of borated water,

b. A boron concentration of between 2000 and 2200 ppm, and

c. A minimum water temperature of 35°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With the refueling water storage tank inoperable, restore the tank to OPERABLE status within 1 hour or be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.5.4 The RWST shall be demonstrated OPERABLE:

a. At least once per 7 days by:

1. Verifying the water level in the tank, and

2. Verifying the boron concentration of the water.

b. At least once per 24 hours by verifying the RWST temperature when the outside air temperature is less than 35°F.

3/4.5.4 REFUELING WATER STORAGE TANK

The OPERABILITY of the RWST as part of the ECCS ensures that a sufficient supply of borated water is available for injection by the ECCS in the event of a LOCA. The limits on RWST minimum volume and boron concentration ensure that 1) sufficient water is available within containment to permit recirculation cooling flow to the core, and 2) the reactor will remain subcritical in the cold condition following mixing of the RWST and the RCS water volumes with all control rods inserted except for the most reactive control assembly. These assumptions are consistent with the LOCA analyses.

In addition, the OPERABILITY of the RWST as part of the ECCS ensures that sufficient negative reactivity is injected into the core to counteract any positive increase in reactivity caused by RCS cooldown. RCS cooldown can be caused by inadvertent depressurization, a loss-of-coolant accident or a steamline rupture.

The limits on contained water volume and boron concentration of the RWST also ensure a pH value of between 8.5 and 11.0 for the solution recirculated within containment after a LOCA. This pH band minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The contained water volume limit includes an allowance for water not usable because of tank discharge line location or other physical characteristics.

EMERGENCY CORE COOLING SYSTEMS

3/4.5.4 BORON INJECTION SYSTEM

BORON INJECTION TANK

LIMITING CONDITION FOR OPERATION

3.5.4.1 The boron injection tank shall be OPERABLE with:

a. A minimum contained volume of 900 gallons of borated water,

b. Between 20,000 and 22,500 ppm of boron, and

c. A minimum solution temperature of 145°F.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

With the boron injection tank inoperable, restore the tank to OPERABLE status within 1 hour or be in HOT STANDBY and borated to a SHUTDOWN MARGIN equivalent to 1% $\Delta k/k$ at 200°F within the next 6 hours; restore the tank to OPERABLE status within the next 7 days or be in HOT SHUTDOWN within the next 12 hours.

SURVEILLANCE REQUIREMENTS

4.5.4.1 The boron injection tank shall be demonstrated OPERABLE by:

a. Verifying the water level through a recirculation flow test at least once per 7 days,

b. Verifying the boron concentration of the water in the tank at least once per 7 days, and

c. Verifying the water temperature at least once per 24 hours.

HEAT TRACING

LIMITING CONDITION FOR OPERATION

3.5.4.2 At least two independent channels of heat tracing shall be OPERABLE for the boron injection tank and for the heat traced portions of the associated flow paths.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

With only one channel of heat tracing on either the boron injection tank or on the heat traced portion of an associated flow path OPERABLE, operation may continue for up to 30 days provided the tank and flow path temperatures are verified to be greater than or equal to 145°F at least once per 8 hours; otherwise, be in HOT SHUTDOWN within 12 hours.

SURVEILLANCE REQUIREMENTS

4.5.4.2 Each heat tracing channel for the boron injection tank and associated flow path shall be demonstrated OPERABLE:

a. At least once per 31 days by energizing each heat tracing channel, and

b. At least once per 24 hours by verifying the tank and flow path temperatures to be greater than or equal to 145°F. The tank temperature shall be determined by measurement. The flow path temperature shall be determined by either measurement or recirculation flow until establishment of equilibrium temperatures within the tank.

LIMITING CONDITION FOR OPERATION

3.5.4 The refueling water storage tank (RWST) shall be OPERABLE with:

a. A contained volume of between 364,500 and 400,000 gallons of borated water,

b. A boron concentration of between 2000 and 2200 ppm, and

c. A minimum water temperature of 35°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With the refueling water storage tank inoperable, restore the tank to OPERABLE status within 1 hour or be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.5.4 The RWST shall be demonstrated OPERABLE:

a. At least once per 7 days by:

1. Verifying the water level in the tank, and

2. Verifying the boron concentration of the water.

b. At least once per 24 hours by verifying the RWST temperature when the outside air temperature is less than 35°F.

ECCS SUBSYSTEMS (Continued)

With the RCS temperature below 350°F, one OPERABLE ECCS subsystem is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the limited core cooling requirements.

The limitation for a maximum of one safety injection pump to be OPERABLE and the Surveillance Requirement to verify all safety injection lumps except the allowed OPERABLE safety injection pump to be inoperable below 312°F provides assurance that a mass addition pressure transient can be relieved by the operation of a single POPS relief valve.

The Surveillance Requirements provided to ensure OPERABILITY of each component ensures that at a minimum, the assumptions used in the safety analyses are met and that subsystem OPERABILITY is maintained. Surveillance requirements for throttle valve position stops and flow balance testing provide assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: 1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration, 2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analyses, and 3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analyses.

3/4.5.4 REFUELING WATER STORAGE TANK

The OPERABILITY of the RWST as part of the ECCS ensures that a sufficient supply of borated water is available for injection by the ECCS in the event of a LOCA. The limits on RWST minimum volume and boron concentration ensure that 1) sufficient water is available within containment to permit recirculation cooling flow to the core, and 2) the reactor will remain subcritical in the cold condition following mixing of the RWST and the RCS water volumes with all control rods inserted except for the most reactive control assembly. These assumptions are consistent with the LOCA analyses.

In addition, the OPERABILITY of the RWST as part of the ECCS ensures that sufficient negative reactivity is injected into the core to counteract any positive increase in reactivity caused by RCS cooldown. RCS cooldown can be caused by inadvertent depressurization, a loss-of-coolant accident or a steam-line rupture.

The limits on contained water volume and boron concentration of the RWST also ensure a pH value of between 8.5 and 11.0 for the solution recirculated within containment after a LOCA. This pH band minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The contained water volume limit includes an allowance for water not usable because of tank discharge line location or other physical characteristics.

LCR# 85-07

ATTACHMENT A

MARKED-UP SALEM FSAR SECTION 15.4.8.2
STEAMLINE BREAKS

been shown on similar plants to less severe than the double ended hot leg break. Cold leg breaks, on the other hand are lower both in the blowdown peak and in the reflood pressure rise. Thus an analysis of smaller pump suction breaks is representative of the spectrum of break sizes.

For these analyses it was assumed that the single failure occurred on a diesel generator such that one spray pump and two fan coolers failed to operate.

Figures 15.4-86 and 15.4-87 give the containment pressure transients for several break sizes and locations for the design basis case. Additional margin cases assuming entrainment continues up to the 10 foot core level were analyzed with results presented in Figures 15.4-88 and 15.4-89. The peak pressures for these cases are summarized in Table 15.4-22.

Structural heat transfer coefficients as a function of time are indicated in Figure 15.4-90.

The DEPS results are shown in Figure 15.4-91. This transient results in the highest peak pressure of 45 psig.

15.4.8.2 Steamline Breaks

15.4.8.2.1 Analytical Methods

~~Various containment models have been utilized to analyze steam break in the Salem Plant.~~

steamline break analysis

The ~~majority of the Analyses~~ performed utilized the Westinghouse containment model developed for the IEEE-323-1971 Equipment Qualification program. These models and their justification (experimental and analytical) are detailed in References 56 through 60. Some major points of the model are as follows:

1. The saturation temperature corresponding to the partial pressure of the containment vapor is used in the calculation of condensing heat transfer to the passive heat sinks and the heat removal by containment fan coolers.

2. The Westinghouse containment model utilizes the analytical approaches described in References 6 and 60 to calculate the condensate removal from the condensate film. Justification of this model is provided in References 56, 59, 60, and 6. (For large breaks 100 percent revaporization of the condensate is used, and a calculated fractional revaporization due to convective heat flux is used for small breaks.)

3. The small steam line break containment analyses utilized the stagnant Tagami correlation, and the large steam line break analyses utilized the blowdown Tagami correlation with an exponential decay to the stagnant Tagami correlation. The details of these models are given in Reference 38. Justification of the use of heat transfer coefficients has been provided in References 58, 59, and 61.

A complete analysis of main steamline breaks inside containment has been performed using the ~~MARVEL~~ LOFTRAN code (WCAP-~~8843~~ 7907 ~~[62]~~ [27]) and the Westinghouse containment computer code, COCO, as described in WCAP-~~8936~~ 8326 ~~[60]~~ [6] and its references. All blowdown calculations with the ~~MARVEL~~ LOFTRAN code were done assuming the reactor coolant pumps were running, (i.e. offsite power available) because this increases the primary-to-secondary heat transfer and therefore maintains higher blowdown flow rates (Ref. Section 3.1.7 of WCAP-8822[63]). Although this is inconsistent with the delay times assumed in containment fan cooler and spray initiations, where loss of offsite power is assumed, the combined effect is extra conservatism in the calculated containment conditions.

15.4.8.2.2 Mass and Energy Releases

Several failures can be postulated which would impair the performance of various ~~steam~~ steamline break protection systems and therefore would change the net energy releases from a ruptured line. Three different single failures were analyzed for each break condition. These were: 1) failure of a main feed isolation valve; 2) failure of a main steam isolation valve; and 3) failure of auxiliary feedwater runout protection equipment.

Feedwater Flow

There are two valves in each main feedwater line which serve to isolate main feed flow following a steam line break. One is the main feed regulator valve which receives dual, separate train trip signals from the plant protection system on any safety injection signal and closes within five seconds of receipt of this signal. The second is the feed line isolation valve which also receives dual, separate train trip signals from the protection system following a safety injection signal. This valve closes within 30 seconds. Additionally, the main feed pumps receive dual, separate train trip signals from the protection system following a steam line break. Thus, the worst failure in this system is a failure of the main feed regulator valve to close. This results in an additional 25 seconds during which feedwater from the condensate feed system may be added to the steam generator. Also, since the feed isolation valve is upstream of the regulator valve, failure of the regulator results in additional feed line volume which is not isolated from the steam generator. Thus, water in this portion of the lines can flash and enter into the steam generator.

The only non-safety grade equipment in the main feed system which is relied upon to terminate the main feed flow to the steam generators are the main feedwater control valves. These valves are not seismic category I. However, each valve receives dual, independent, safety grade trip-closed signals from the protection system following a steam line break. Also, the valves are air-operated fail-closed design. Since the assumed break is inside containment in a seismic category I pipe, it is not assumed to be initiated by a seismic event. Therefore, to assume a coincident seismic event with the hypothetical pipe rupture is not required, and thus a seismic classification for the main feed regulation valve is not necessary to insure closure following a steam-line break inside containment.

Because of the conservative nature of the transient calculations used for the 1971 Equipment Qualification Program, the results of the Salem temperature transient calculation will fall under the peak transient calculated for the 1971 Equipment Qualification Program and presented in Reference 60 (approximately 385°F). The pressure transient will fall below the design limits for the Salem 2 containment.

Feedwater flow to the faulted steam generator from the main feed system is calculated using the hydraulic resistances of the system piping, head/flow curves for the main feed pumps, and the steam generator pressure decay as calculated by the ~~MARVEL~~ LOFTRAN code. In the calculations performed to match these systems variables, a variety of assumptions are made to maximize the calculated flows. These include:

1. No credit for extra pressure drop in the feed lines due to flashing of feedwater.

2. Feed regulator valve in the faulted loop is full open.

3. Feed regulator valves in the intact loop do not change position prior to a trip signal. ~~and close instantly upon receipt of a signal to close.~~

4. All feed pumps are running at maximum speed.

5. No credit is taken for flow reduction through the feed regulator or feed isolation valve until they are full closed.

6. Flow from the pumps decays linearly following pump trip.

Calculation of feedwater flashing is performed by the ~~MARVEL~~ LOFTRAN code as described in Section ~~2.2.3~~ 4.1.5 of WCAP-~~8843.~~ 7907. ~~[62]~~ [27] For the Salem units, the maximum volume of unisolated feed lines is 328.2 ft^3 without a feed regulator valve failure, and increases to 868.5 ft^3 with a feed regulator valve failure. ~~(See Table 4 of WCAP-8843).[62]~~

~~The feedwater flow as a function of time is presented in Figure 15.4-92.~~

Main Steam Isolation

Since all main steam isolation valves have closing times of no more than five seconds, failure of one of these valves affects only the volume of the main steam and turbine steam piping which cannot be isolated from the pipe rupture. ~~Table 4 of WCAP-8822[63] and~~ Table 15.4-23 shows the mass in the steam lines with and without an isolation valve failure at the four power levels considered in the analyses.

Steam contained in the unisolated portions of the steam lines and turbine plant were considered in the containment analyses in two ways. For the large double-ended ruptures, steam in the unisolated steam lines is released to the containment as part of the reverse flow. This is accomplished by having the reverse flow begin at the time of the break at the Moody critical flow rate for steam as established by the cross-sectional area of the steam line and the initial steam pressure. The flow is held constant at this rate for a time period sufficient to purge the entire unisolated portion of the steam lines. Enthalpy of the flow is also held constant at the initial steam enthalpy. Following the period of constant flow representing purging of the steam lines, flow from the intact steam generators, as calculated by ~~MARVEL~~ LOFTRAN, is added to the containment and continues until steam line isolation is complete.

When considering the split ruptures, steam in the steam lines is included in the analysis by adding the total mass in the lines to the initial mass of steam in the faulted steam generator. This is necessary because, unlike double-ended ruptures, the total break area for a split is unchanged by steam line isolation; only the source of the blowdown effluent is changed. Thus, steam flow from the piping in the intact loops is indistinguishable from steam leaving the faulted steam generator. However, by adding the piping mass to the faulted steam generator mass, and by having dry steam blowdowns, the steam line inventory is included in the total blowdown.

Auxiliary Feedwater Flow

The Auxiliary Feedwater System is actuated shortly after the occurrence of a steam line break. The mass addition to the faulted steam generator from the Auxiliary Feedwater System was conservatively determined by using the following assumptions.

1. The entire Auxiliary Feedwater System was assumed to be actuated at the time of the break and instantaneously pumping at its maximum capacity.

2. The affected steam generator was ~~assumd~~ assumed to be at atmospheric pressure.

3. The intact steam generators were assumed to be at the safety valve set pressure.

4. Flow to the affected steam generator was calcualted from the Auxiliary Feedwater System head curves, assumptions 2 and 3 above, and the system line resistances. The effects of flow limiting devices were considered.

5. The flow to the faulted steam generator from the Auxiliary Feedwater System was assumed to exist from the time of rupture until realignment of the system was completed.

6. The failure of auxiliary feedwater runout control was considered as one of three ~~separately as a~~ single failures. Failure of runout control was simulated by assuming a constant auxiliary feedwater flow of 2040 gpm to the faulted steam generator.

~~The analysis used the following auxiliary feedwater flow rates:~~

~~1. With runout protection operational, a constant auxiliary feed flow of 1840 gpm to the faulted steam generator.~~

~~2. Failure of runout control was simulated by assuming a constant auxiliary feedwater flow of 2040 gpm to the faulted steam generator.~~

~~The above flow rates were held constant from time of break until realignment, which was assumed at ten minutes.~~

In the analysis, the auxiliary feedwater flow to the faulted steam generator was assumed to exist from the time of the rupture until realignment of the system was completed. The Auxiliary Feedwater System is manually realigned by the operator after 10 minutes. Therefore, the analysis assumes maximum auxiliary feedwater flow to a depressurized steam generator for a full 10 minutes.

In the event a postulated main steam line break occurs, auxiliary feedwater to the affected steam generator must be terminated manually. Present design criteria allows ten minutes for the operator to recognize the postulated event and perform the necessary actions. However, the operator is expected to terminate auxiliary feedwater flow to the affected steam generator in much less time due to the amount of Class 1E indication provided to monitor plant conditions.

The information available to alert the operator of the need to isolate auxiliary feedwater to the affected steam generator is mounted on the control console in the control room. The pressure in each steam generator is monitored and ~~display~~ displayed by two independent channels of instrumentation. Also, a bank of pen recorders indicates steam and feedwater flows for each steam generator; this allows the control room operator to readily view and compare the steam flow of one steam generator to the others.

The suction and discharge pressures of each auxiliary feedwater pump are indicated on the control console. The auxiliary feedwater flow indications for each steam generator are mounted on the control counsole next to each other, allowing the operator to easily view and compare flows.

In addition to the above mentioned indications, high steam flow, low steam pressure, and steam-feed flow deviation conditions for each steam generator are alarmed on the main control console in the control room. Alarms for these conditions are also provided on the overhead annunciator.

Since a sufficient number of trains of instrumentation must be available for normal plant operation, steam generator instrumentation will be in operation at the time of the postulated event. Therefore, changes in steam generator pressure and steam flow will be detected as they occur. The only delay expected in transmitting the information to the control room is the time required for the instrumentation to react to the changing conditions. This delay is expected to be no more than a few seconds.

Failure of the auxiliary feedwater isolation valve to close has not been considered. The maximum auxiliary feedwater flow that can be delivered to a faulted steam generator has been assumed in the analysis for ten minutes with the single failure ~~two~~ case~~s~~ being considered: ~~1) runout protection operational; 2)~~ failure of runout protection. Only after ten minutes the operator takes action to isolate auxiliary feedwater isolation valves fails to close, the operator can trip the two auxiliary feedwater pumps feeding the broken steam generator until this valve or another in the line is manually closed.

The pump curves for the Auxiliary Feed pump are shown in Figure 15.4-93 (Steam Driven) and Figure 15.4-94 (Electrical Driven). A schematic of the Auxiliary Feed System is shown in Figure 10.4-17.

15.4.8.2.3 Heat Sinks

The worst effect of a containment safeguards failure is the loss of a spray pump which reduces containment spray flow by 50 percent. In all analyses, the times assumed for initiation of containment sprays and fan coolers are 59 and 35 seconds respectively following the appropriate initiating trip signal. These times are based on the assumption of a loss of offsite power and the delays are consistent with Technical Specification limits. The delay time for spray delivery includes the time required for the spray pumps to reach full speed and the time required to fill the spray headers and piping.

The saturation temperature corresponding to the partial pressure of the vapor in the containment is conservatively assumed for the temperature in the calculation of condensing heat transfer to the passive heat sinks. This temperature is also conservatively assummed for the calculation of heat removal by the containment fan coolers.

Parameters for the Sprays and Fan Coolers are presented in Table 15.4-24. The parameters for the Passive Heat Sinks are presented in Table 15.4-25.

The Fan Cooler heat removal rate as a function of containment temperature is presented in Figure 15.4-96.

15.4.8.2.4 Results

A total of ~~forty-eight (48)~~ twenty-nine (29) different blowdowns covering four power levels and ~~three~~ five different break sizes were evaluated. The ~~three~~ five break sizes considered at each power level (0, 30, 70 and 102 percent of nominal) ~~were a full double-ended rupture upstream of the steam line flow restrictor, a full double-ended rupture downstream of the steam line flow restrictor~~ [replace w/ Insert (A)] and the largest split rupture that will ~~not~~ neither result in generation of a steam line isolation signal from the primary plant

Insert (A)

were a 4.25 ft^2 full double-ended rupture with entrainment, a 1.4 ft^2 full double-ended rupture with entrainment, a small double-ended rupture having an area just larger than that at which entrainment occurs, a small double-ended rupture having an area just smaller than that at which entrainment occurs;

protection equipment.[1] nor result in entrainment. In the analysis of the ~~third~~ fifth (split) break, reactor trip, feed line isolation and steam line isolation are generated by high containment pressure signals. ~~Additionally, all blowdowns used in the analyses were assumed to consist of dry steam.~~

For each break condition, four different single failures were considered in the containment evaluation resulting in a limiting transient. ~~evaluated.~~ These were (1) failure of a containment safeguards train, (2) failure of a main feed ~~isolation~~ regulator valve, (3) failure of a main steam isolation valve, and (4) failure of the auxiliary feedwater runout protection equipment.

~~WCAP-8822 provides containment initial values (See Table 15.4-26), and containment temperatures and pressures resulting from all cases considered are presented in Table 15.4-27 along with pertinent trips, trip times, and single failures associated with each. Also shown in Table 15.4-27 are four additional entries. These show the results of analyses of the worst temperature and pressure transients as analyzed with the COCO code modified to conform to the NRC interim containment evaluation model and the results of the worst pressure transient initiated by a double ended rupture when analyzed assuming entrainment in the blowdown as specified in Section 3.2.2 for WCAP-8822.[63] These results have been provided for comparison of Westinghouse and NRC containment models and for quantification effects on peak pressure from entrained moisture which is expected to be present in large break blowdowns. As can be seen from the table, the peak pressure for any case using the Westinghouse model is 42.8 psig and the peak temperature for any case using the Westinghouse model is 333.5°F.~~ Mass and energy releases for the worst cases are provided in Table 15.4-28 thru 15.4-30. Graphical results ~~showing containment atmospheric temperature, containment pressure, and other pertinent variables~~ are provided in Figures 15.4-97 through 15.4-~~111~~ 102 illustrating the resultant containment pressure and temperature transients for the cases producing the limiting results in terms of the highest peak containment pressure and (insert B)

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[1]Reference Section 2.3 of WCAP-8822 for a complete discussion of this split break.

Insert (B)

temperature for both the large double-ended ruptures (DERs) and the small DERs and split breaks.

As illustrated in Figures 15.4-97 and 15.4-98, the 1.4 ft^2 DER at Hot Zero Power transient generated the pressure and temperature curves for this limiting large break case, producing a peak containment pressure of 45.5 psig and a peak containment temperature of 268.3 °F. The limiting small break case which produced the peak containment pressure of 46.4 psig was the split break at 30% power transient illustrated in Figures 15.4-99 and 15.4-100 for containment pressure and temperature. Figures 15.4-101 and 15.4-102 provide the containment pressure and temperature transients for the limiting temperature case for the small break cases. The 0.6 ft^2 DER without entrainment at Hot Full Power transient generated a peak containment temperature of 345.5°F.

In summary, the results provided in the steamline break analysis demonstrate sufficient margin available below the containment design pressure and equipment qualification temperature.

The large break case resulting in the calculated peak pressure has been identified as the 1.4 ft^2 break at 70 percent power. This case resulted in a peak pressure of 39.1 psig when dry steam blowdowns are used. When this same case was reanalyzed utilizing blowdowns which included the effect of liquid carryover from the secondary side, the resulting peak pressures were 37.7 and 37.2 using the Westinghouse and NRC containment models respectively. This indicates the overall conservatism of the Westinghouse containment model when used with dry steam, vs. using the expected mass and energy releases which include the effect of entrainment. Transients for the Westinghouse model with dry steam blowdowns are provided in Figures 15.4-97 through 15.4-99.

The case resulting in the calculated peak pressure for the small breaks has been identified as the 0.86 ft^2 break at 102 percent power. The resulting peak pressure for this case was 42.8 psig. When this case was reanalyzed utilizing the NRC containment model, and the same mass and energy release rates, the peak calculated pressure was found to be 43.0 psig. The transients for the Westinghouse model are provided in Figures 15.4-100 through 15.4-102. Similar transients for the case which used the NRC model are provided in Figures 15.4-103 through 15.4-105.

The case resulting in the calculated peak temperature has been identified as the 0.908 ft^2 break at 70 percent power. This case resulted in a peak temperature of 333.5°F. When this same case was analyzed with the NRC containment model a peak temperature of 347°F was calculated. These results verify that the Westinghouse and NRC models yield similar results. Transients for both of these cases have been provided in Figures 15.4-106 through 15.4-108.

An evaluation of the safety related instrumentation will be performed to show conformance with the requirements of IEEE-223-1971. This evaluation will be performed by comparing the containment equipment test conditions versus the calculated containment accident environments previously discussed. If a thermal analysis is necessary Westinghouse will

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use a thermal model similar to that presented in Reference 24. Any differences between the Westinghouse thermal analysis model and the proposed NRC interim model will be discussed and justified. Some major points of the model are the following:

1. The condensing heat transfer coefficient will be the same as used in the approved Westinghouse model for ECCS analysis. This model is documented in Appendix A of WCAP-8339[2] and is comparable to the model recommended in Branch Technical Position CBS 6-1.

2. A convective heat transfer coefficient comparable to that recommended by the NRC will be used. If necessary, sensitivity studies will be performed to justify any model differences.

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15.4.8.3 Subcompartment Pressure Analysis

Reference 64 presents the containment subcompartment pressure analysis using an 18 node containment model and the latest version of the TMD computer code.

15.4.8.4 Miscellaneous Analysis

15.4.8.4.1 Minor Reactor Coolant Leakage

The Hi Containment Pressure signal actuates engineered safety features. Since the set point for this signal is two psig, the maximum containment pressure caused by leakage is restricted to this value. The containment response to such leakage would be a gradual pressure and temperature rise which would reach a pressure peak of slightly less than two pounds gauge. At this point energy removal due to structural heat sinks and operating fan coolers would match the energy addition due to the leakage and other sources.

REFERENCES FOR SECTION 15.4

1. "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Cooled Nuclear Power Reactors," 10CFR50.46 and Appendix K of 10CFR50. Federal Register, Volume 39, Number 3, January 4, 1974.

2. Bordelon, F. M., Massie, H. W. and Zordan T. A., "Westinghouse ECCS Evaluation Model - Summary," WCAP-8339, July 1974.

3. Bordelon, F. M., et al., "SATAN-VI Program: Comprehensive Space-Time Dependent Analysis of Loss of Coolant," WCAP-8302, June, 1974 (Proprietary) and WCAP-8306, June 1974 (Non-Proprietary).

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TABLE 15.4-23 (Sheet 1 of 2)

EFFECTS OF SINGLE FAILURES ON CONTAINMENT ANALYSES

I. MAIN STEAM ISOLATION VALVES*

Break Area (ft^2)		Power Percent	Piping Blowdown (lb/sec)	Duration of Piping Blowdown (sec)		Steam Mass (lb)	
Forward	Reverse			No MSIV Failure	MSIV Failure	No MSIV Failure	MSIV Failure
1.4	4.25	102	7047	0.140 ~~0.136~~	2.587 ~~2.532~~	985 ~~959~~	18,323 ~~17,840~~
1.4	4.25	70	7595	0.136 ~~0.137~~	2.534 ~~2.541~~	1034 ~~1038~~	19,242 ~~19,302~~
1.4	4.25	30	8377	0.137 ~~0.137~~	2.550 ~~2.556~~	1148 ~~1151~~	21,358 ~~21,409~~
1.4	4.25	0	9002	0.137 ~~0.138~~	2.552 ~~2.568~~	1235 ~~1243~~	22,973 ~~23,115~~
~~4.25~~	~~1.4~~	~~102~~	~~2315~~	~~0.414~~	~~7.706~~	~~959~~	~~17,840~~
~~4.25~~	~~1.4~~	~~70~~	~~2495~~	~~0.416~~	~~7.736~~	~~1038~~	~~19,302~~
~~4.25~~	~~1.4~~	~~30~~	~~2752~~	~~0.418~~	~~7.780~~	~~1151~~	~~21,409~~
~~4.25~~	~~1.4~~	~~0~~	~~2957~~	~~0.420~~	~~7.817~~	~~1243~~	~~23,115~~

*Failure of main steam line isolation valve ~~increses~~ increases the unisolatable steam line volume from 542 ft^3 to 10,083 ft^3.

II MAIN FEED LINE ISOLATION VALVE

Maximum Unisolatable Feed Line Volume Without MFIV Failure = 328.2 ft^3

Maximum Unisolatable Feed Line Volume With MFIV Failure = 868.5 ft^3

Closing Time of Feed Regulation Valve = <5.0 sec.

Closing Time of Feed Isolation Valve = <30.0 sec.

III. AUXILIARY FEED SYSTEM RUNOUT PROTECTION FAILURE

~~Maximum Auxiliary Feed Flow Without Runout Protection Failure~~	~~= 1840 gpm~~
Maximum Auxiliary Feed Flow With Runout Protection Failure	= 2040 gpm

TABLE 15.4-24

SPRAY SYSTEM

Number of Spray Trains	2
Number of Spray Trains Operating in Minimum Safeguards Analysis	1
~~Number of Spray Trains Operating in Maximum Safeguards Analysis~~	~~2~~
Spray Flow Rate per Spray Train	2600 gpm

FAN COOLERS

Number of Fan Coolers	5
Number of Fan Coolers Operating in Minimum Safeguards Analysis	3
~~Number of Fan Coolers Operating in Maximum Safeguards Analysis~~	~~4~~

INITIATION TIMES/SETPOINTS

System	Containment Setpoint used	Delay After Setpoint (sec)
Spray	26.7 psig	59.
Fan Coolers	7.9 psig	35.

TABLE 15.4-25 (Sheet 1 of 2)

PASSIVE HEAT SINK

Wall No.	Area (ft2)	Layer	Composition	Thickness ft.	Thermal Cond. ~~BUT~~ BTU/HR-FT-°F	Volumetric Heat Capacity BTU/FT3-°F
1	45169	1	Paint	0.000625	0.083	39.6
		2	Steel	0.03125	27.0	58.8
		3	Concrete	0.5	0.92	22.6
		4	Concrete	4.0	0.92	22.6
2	14206	1	Insulation	0.2083	0.024	3.94
		2	Steel	0.03125	27.0	58.8
		3	Concrete	0.5	0.92	22.6
		4	Concrete	4.0	0.92	22.6
3	29249	1	Paint	0.000625	0.083	39.6
		2	Steel	0.04167	27.0	58.8
		3	Concrete	0.5	0.92	22.6
		4	Concrete	3.0	0.92	22.6
*4	11611	1	Paint	0.0015	0.083	39.6
		2	Concrete	0.5	0.92	22.6
		3	Concrete	3.0	0.92	22.6
5	6806	1	Paint	0.0015	0.083	39.6
		2	Concrete	0.5	0.92	22.6
		3	Concrete	0.5	0.92	22.6
		4	Concrete	0.5	0.92	22.6
6	9424	1	Paint	0.0015	0.083	39.6
		2	Concrete	0.5	0.92	22.6
		3	Concrete	1.21	0.92	22.6
7	31660	1	Paint	0.00117	0.083	39.6
		2	Concrete	0.5	0.92	22.6
		3	Concrete	1.0	0.92	22.6
8	13279	1	Stainless Steel	0.01773	8.0	53.6
		2	Concrete	0.5	0.92	22.6
		3	Concrete	1.4	0.92	22.6
9	47590	1	Paint	0.000625	0.083	39.6
		2	Steel	0.011	27.0	58.8

* in contact with sump

TABLE 15.4-25 (Sheet 2 of 2)

PASSIVE HEAT SINK

Wall No.	Area (ft^2)	Layer	Composition	Thickness ft.	Thermal Cond. ~~BUT~~ BTU/HR-FT-°F	Volumetric Heat Capacity BTU/FT^3-°F
10	76741	1	Paint	0.000625	0.083	39.6
		2	Steel	0.02102	27.0	58.8
11	19348	1	Paint	0.000625	0.083	39.6
		2	Steel	0.0437	27.0	58.8
12	9330	1	Paint	0.000625	0.083	39.6
		2	Steel	~~0.611~~ 0.0611	27.0	58.8
13	7452	1	Paint	0.000625	0.083	39.6
		2	Steel	0.086	27.0	58.8
14	3218	1	Paint	0.000625	0.083	39.6
		2	Steel	0.1112	27.0	58.8
15	1553	1	Paint	0.000625	0.083	39.6
		2	Steel	0.217	27.0	58.8
16	43740	1	Paint	0.000625	0.083	39.6
		2	Steel	0.0052	7.0	58.8
17	4272	1	Stainless Steel	0.0329	8.0	53.6
18	53745	1	Paint	0.000625	0.083	39.6
		2	Steel	0.0211	27.0	58.8
19	11244	1	Paint	0.000625	0.083	39.6
		2	Steel	0.0379	27.0	58.8
20	2989	1	Paint	0.000625	27.0	39.6
		2	Steel	0.15806	27.0	58.8

TABLE 15.4-26

CONTAINMENT INITIAL CONDITIONS
FOR MSLB

Containment Design Pressure	47 psig
Containment Volume	2,620,000 ft^3
Initial Containment Pressure	0.3 psig
Initial Air Partial Pressure	14.7 psia
Initial Steam Partial Pressure	0.3 psia
Initial Containment Temperature	120°F
Refueling Water Storage Tank Inventory	350,000 gal
Service Water Temperature	85°

~~TABLE 15.4-27~~

~~RESULTS FOR SPLIT RUPTURES~~

Break Area (ft²)	Power Level (%)	Single Failure	Reactor Trip Time (sec)	Time of Hi-1 Containment Pres. (sec)	Time of Hi-2 Containment Pres. (sec)	Time of Feedline Isolation (sec)	Time of Steam Line Isolation (sec)	Containment Model	Peak Pressure (psig)	Time of Peak Pressure (sec)	Peak Temp. (°F)
.860	102	1	HNF @ 14.7	23.0	95.0	33.0	101.0	W	42.0	809.6	330.9
.860		2	HNF @ 14.7	23.0	101.0	58.0	101.0	W	37.1	[illegible]	322.2
.860		3	HNF @ 14.65	23.0	97.5	33.0	101.5	W	36.5	701.0	323.6
.860		4	HNF @ 14.95	23.5	97.5	33.5	101.5	W	36.7	696.4	323.8
.908	70	1	CPI @ 21.0	21.0	89.5	31.0	95.5	W	42.1	870.4	333.5
.908		2	CPI @ 21.0	21.0	95.0	56.0	101.0	W	35.5	718.9	324.5
.908		3	CPI @ 21.0	21.0	91.5	31.0	97.5	W	[illegible]	674.7	326.4
.908		4	CPI @ 21.0	21.0	91.0	31.0	97.0	W	35.6	673.1	326.7
.942	30	1	CPI @ 19.0	19.0	89.0	29.0	95.0	W	37.0	870.5	332.3
.942		2	CPI @ 19.0	19.0	95.0	54.0	101.0	W	31.6	579.5	323.3
.942		3	CPI @ 19.0	19.0	91.5	29.0	97.5	W	31.9	592.3	325.2
.942		4	CPI @ 19.0	19.0	90.5	29.0	96.5	W	32.1	574.4	325.5
.960	0	1	N/A	17.0	90.0	27.0	96.0	W	32.7	791.5	329.0
.960		2	N/A	17.0	96.0	52.0	102.0	W	29.2	156.2	321.2
.960		3	N/A	17.5	93.0	27.5	99.0	W	29.3	152.4	322.7
.960		4	N/A	17.0	91.5	27.0	97.5	W	29.6	151.1	323.3
.908	70	1	CPI @ 21.5	21.5	93.0	31.5	[illegible]	W	42.4	895.1	347.0
.860	102	1	HNF @ 14.7	23.5	99.0	33.5	105.0	W	43.0	830.2	344.7
1.4	102	1	HFLP @ 0.5	3	141	10.0	0.0	W	38.7	632.0	260.0
1.4		2	HFLP @ 0.5	3	133	35.0	0.0	W	37.1	609.0	260.0
1.4		3	HFLP @ 0.5	3	142	10.0	0.0	W	35.2	615.3	260.0
1.4		4	HFLP @ 0.5	1	62	10.0	0.0	W	37.3	602.0	292.9
4.25		1	HFLP @ 1.0	4	112	10.0	0.5	W	35.3	630.3	249.4
4.25		2	HFLP @ 1.0	4	91	35.0	0.5	W	35.3	313.6	253.0
4.25		3	HFLP @ 1.0	4	111	10.0	0.5	W	32.3	606.5	246.6
4.25		4	HFLP @ 1.0	3	56	10.0	0.5	W	34.1	214.7	282.4
1.4	70	1	HFLP @ 0.5	3	133	10.0	0.0	W	39.1	657.0	262.1
1.4		2	HFLP @ 0.5	3	140	35.0	0.0	W	36.4	615.9	262.1
1.4		3	HFLP @ 0.5	3	140	10.0	0.0	W	35.0	617.1	262.1
1.4		4	HFLP @ 0.5	1	53	10.0	0.0	W	34.1	675.0	296.9
4.25		1	HFLP @ 1.0	4	110	10.0	0.5	W	36.2	626.0	251.2
4.25		2	HFLP @ 1.0	4	95	35.0	0.5	W	36.7	376.0	256.1
4.25		3	HFLP @ 1.0	4	111	10.0	0.5	W	33.15	620.4	248.5
4.25		4	HFLP @ 1.0	2	54	10.0	0.5	W	35.4	243.0	285.4
1.4	30	1	HFLP @ 0.5	3	141	10.0	0.0	W	38.0	707.1	265.6
1.4		2	HFLP @ 0.5	3	146	35.0	0.0	W	34.1	617.9	265.6
1.4		3	HFLP @ 0.5	3	143	10.0	0.0	W	33.0	618.5	265.6
1.4		4	HFLP @ 0.5	1	36	10.0	0.0	W	36.95	582.0	301.0
4.25		1	HFLP @ 1.0	4	116	10.0	0.5	W	37.4	614.2	254.2
4.25		2	HFLP @ 1.5	4	102	35.0	9.0	W	38.0	401.0	250.2
4.25		3	HFLP @ 1.[illegible]	4	113	10.0	9.0	W	[illegible]	609.0	251.2
4.25		4	HFLP @ 1.5	2	46	10.0	9.0	W	37.1	309.6	290.7
1.4	0	1	N/A	3	141	10.0	0.5	W	35.0	703.4	269.0
1.4		2	N/A	3	163	35.0	0.5	W	31.3	665.0	269.0
1.4		3	N/A	3	150	10.0	0.5	W	30.6	[illegible]	269.0
1.4		4	N/A	1	17	10.0	0.5	W	35.65	[illegible]	305.2
4.25		1	N/A	3	111	10.0	9.5	W	36.4	646.6	252.3
4.25		2	N/A	3	111	35.0	9.5	W	36.2	472.0	255.2
4.25		3	N/A	3	112	10.0	9.5	W	32.0	611.0	254.9
4.25		4	N/A	2	38	10.0	9.5	W	36.4	282.1	294.1
1.4	70	1	HFLP @ 0.5	3	136	10.0	0.0	WW	37.2	644.7	273.[illegible]
1.4		1	HFLP @ 0.5	3	127	10.0	0.0	WW	37.7	639.6	251.6

NOTES:

Single Failures
1 = Failure of a containment safeguards train
2 = Failure of a feedline isolation valve
3 = Failure of the auxiliary feedwater runout protection

Trip Symbols
HNF = High Nuclear Flux Trip
HFLP = High Steam Flow/Low Steamline Pressure Trip
CPI = High Containment Pressure Trip

Containment Models
W = Westinghouse COCO Model, Dry Steam Blowdowns
N = NRC Small Break Model, Dry Steam Blowdowns
WW = Westinghouse COCO Model, Wet Blowdowns

DELETE whole table

TABLE 15.4-28

MASS AND ENERGY RELEASES FROM A ~~0.86~~ 0.944 FT^2 SPLIT BREAK AT ~~102~~ 30 PERCENT POWER (Worst ~~Temperature~~ Pressure Case)

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)

~~a,e~~

~~PROPRIETARY~~

~~Refer to (50-311) "Application for Withholding"~~

~~R. L. Mittl to Olan D. Parr~~

~~November 20, 1978~~

~~and~~

~~NRC Approval letter,~~

~~Olan D. Parr to Wiesemann~~

~~January 22, 1979~~

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)	Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
0.0000	0.0000	0.0000	37.50	1420.	1.704
.5000	1741.	2.080	38.00	1416.	1.699
1.000	1741.	2.080	38.50	1411.	1.693
1.500	1728.	2.065	39.00	1406.	1.688
2.000	1718.	2.053	39.50	1401.	1.682
2.500	1708.	2.041	40.00	1396.	1.676
3.000	1698.	2.030	40.50	1392.	1.670
3.500	1688.	2.018	41.00	1387.	1.665
4.000	1678.	2.007	41.50	1382.	1.659
4.500	1669.	1.995	42.00	1377.	1.653
5.000	1659.	1.984	42.50	1372.	1.647
5.500	1650.	1.974	43.00	1367.	1.642
6.000	1641.	1.963	43.50	1362.	1.636
6.500	1633.	1.954	44.00	1357.	1.630
7.000	1625.	1.944	44.50	1352.	1.624
7.500	1617.	1.935	45.00	1348.	1.619
8.000	1608.	1.925	45.50	1343.	1.613
8.500	1602.	1.917	46.00	1338.	1.607
9.000	1594.	1.908	46.50	1333.	1.601
9.500	1587.	1.899	47.00	1328.	1.595
10.00	1579.	1.891	47.50	1323.	1.590
10.50	1572.	1.882	48.00	1319.	1.584
11.00	1565.	1.874	48.50	1314.	1.578
11.50	1558.	1.866	49.00	1309.	1.573
12.00	1552.	1.858	49.50	1304.	1.567
12.50	1545.	1.851	50.00	1299.	1.561
13.00	1539.	1.843	50.50	1295.	1.556
13.50	1533.	1.836	51.00	1290.	1.550
14.00	1526.	1.829	51.50	1287.	1.546
14.50	1520.	1.822	52.00	1287.	1.546
[illegible]5.00	1515.	1.815	52.50	1285.	1.544
[illegible]5.50	1509.	1.808	53.00	1283.	1.542
[illegible]6.00	1503.	1.801	53.50	1280.	1.539
16.50	1498.	1.795	54.00	1278.	1.536
17.00	1493.	1.790	54.50	1275.	1.533
17.50	1487.	1.782	55.00	1272.	1.529
18.00	1483.	1.777	55.50	1269.	1.526
18.50	1477.	1.770	56.00	1267.	1.522
19.00	1473.	1.766	56.50	1264.	1.519
19.50	1467.	1.759	57.00	1261.	1.516
20.00	1463.	1.754	57.50	1258.	1.512
20.50	1459.	1.749	58.00	1255.	1.509
21.00	1454.	1.744	58.50	1252.	1.505
21.50	1448.	1.736	59.00	1249.	1.502
22.00	1443.	1.731	59.50	1246.	1.498
22.50	1475.	1.768	60.00	1243.	1.494
23.00	1476.	1.769	60.50	1240.	1.491
23.50	1481.	1.776	61.00	1237.	1.487
24.00	1482.	1.777	61.50	1234.	1.483
24.50	1483.	1.778	62.00	1231.	1.480
25.00	1484.	1.779	62.50	1228.	1.476
25.50	1484.	1.780	63.00	1224.	1.472
26.00	1485.	1.781	63.50	1221.	1.469
26.50	1485.	1.781	64.00	1218.	1.465
27.00	1485.	1.781	64.50	1215.	1.461
27.50	1485.	1.781	65.00	1212.	1.457
28.00	1485.	1.781	65.50	1209.	1.454
28.50	1484.	1.780	66.00	1206.	1.450
29.00	1483.	1.779	66.50	1203.	1.446
29.50	1482.	1.777	67.00	1199.	1.443
30.00	1480.	1.774	67.50	1196.	1.439
30.50	1477.	1.771	68.00	1193.	1.435
31.00	1474.	1.768	68.50	1190.	1.431
[illegible]1.50	1471.	1.764	69.00	1187.	1.428
[illegible].00	1467.	1.760	69.50	1184.	1.424
[illegible].50	1463.	1.755	70.00	1181.	1.421
[illegible]3.00	1460.	1.751	70.50	1178.	1.417
33.50	1456.	1.746	71.00	1175.	1.413
34.00	1451.	1.741	71.50	1172.	1.410
34.50	1447.	1.736	72.00	1169.	1.406
35.00	1443.	1.731	72.50	1166.	1.403
35.50	1439.	1.726	73.00	1163.	1.399
36.00	1434.	1.721	73.50	1160.	1.396
36.50	1430.	1.715	74.00	1157.	1.392
37.00	1425.	1.710	74.50	1154.	1.389

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
75.00	1151.	1.385
75.50	1149.	1.382
76.00	1146.	1.378
76.50	1143.	1.375
77.00	1140.	1.372
77.50	1137.	1.368
78.00	1134.	1.365
78.50	1131.	1.361
79.00	1128.	1.358
79.50	1125.	1.354
80.00	1123.	1.351
80.50	1120.	1.348
81.00	1117.	1.344
81.50	1114.	1.341
82.00	1111.	1.337
82.50	1109.	1.334
83.00	1106.	1.331
83.50	1103.	1.327
84.00	1100.	1.324
84.50	1097.	1.321
85.00	1095.	1.318
85.50	1092.	1.314
86.00	1089.	1.311
86.50	1086.	1.308
87.00	1084.	1.305
87.50	1081.	1.301
88.00	1078.	1.298
88.50	1076.	1.295
89.00	1073.	1.292
[illegible]	1070.	1.289
[illegible]	1068.	1.285
[illegible]	1065.	1.282
91.00	1062.	1.279
91.50	1060.	1.276
92.00	1057.	1.273
92.50	1055.	1.270
93.00	1052.	1.267
93.50	1049.	1.263
94.00	1047.	1.260
94.50	1044.	1.257
95.00	1042.	1.254
95.50	1039.	1.251
96.00	1037.	1.248
96.50	1034.	1.245
97.00	1032.	1.242
97.50	1029.	1.239
98.00	1027.	1.236
98.50	1024.	1.233
99.00	1022.	1.230
99.50	1019.	1.227
100.0	1017.	1.224
100.5	1014.	1.221
101.0	1012.	1.218
101.5	1009.	1.215
102.0	1007.	1.212
102.5	1004.	1.209
103.0	1002.	1.206
103.5	999.4	1.203
104.0	996.7	1.200
104.5	994.5	1.198
105.0	991.9	1.194
105.5	989.7	1.192
106.0	987.1	1.189
106.5	985.0	1.186
[illegible]	982.4	1.183
[illegible]	988.6	1.191
[illegible]	969.7	1.168
108.5	956.5	1.152
109.0	943.8	1.137
109.5	931.6	1.122
110.0	919.6	1.108
110.5	908.3	1.094
111.0	897.6	1.081
111.5	886.8	1.068

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
112.0	876.6	1.056
112.5	866.8	1.044
113.0	857.2	1.033
113.5	848.0	1.021
114.0	839.1	1.011
114.5	830.5	1.000
115.0	822.1	.9902
115.5	814.0	.9805
116.0	806.2	.9710
116.5	798.6	.9618
117.0	791.2	.9529
117.5	784.0	.9442
118.0	776.9	.9357
118.5	770.1	.9275
119.0	763.5	.9194
119.5	757.0	.9116
120.0	750.7	.9040
120.5	744.5	.8966
121.0	738.5	.8893
121.5	732.6	.8822
122.0	726.9	.8753
122.5	721.3	.8685
123.0	715.9	.8620
123.5	710.5	.8555
124.0	705.3	.8492
124.5	700.3	.8431
125.0	695.3	.8371
125.5	690.5	.8313
126.0	685.8	.8256
126.5	681.1	.8200
127.0	676.6	.8146
127.5	672.2	.8093
128.0	668.0	.8041
128.5	663.8	.7990
129.0	659.7	.7941
129.5	655.7	.7893
130.0	651.8	.7846
130.5	648.0	.7800
131.0	644.3	.7755
131.5	640.7	.7711
132.0	637.2	.7669
132.5	633.8	.7627
133.0	630.5	.7587
133.5	627.2	.7548
134.0	624.1	.7510
134.5	621.0	.7472
135.0	618.0	.7436
135.5	615.1	.7401
136.0	612.2	.7367
136.5	609.5	.7333
137.0	606.8	.7301
137.5	604.2	.7269
138.0	601.6	.7238
138.5	599.1	.7208
139.0	596.7	.7179
139.5	594.4	.7151
140.0	592.1	.7123
140.5	589.9	.7096
141.0	587.7	.7070
141.5	585.6	.7045
142.0	583.6	.7020
142.5	581.6	.6996
143.0	579.7	.6973
143.5	577.9	.6950
144.0	576.0	.6928
144.5	574.3	.6907
145.0	572.6	.6886
145.5	570.9	.6866
146.0	569.3	.6847
146.5	567.7	.6827
147.0	566.2	.6809
147.5	564.7	.6791

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
148.0	563.2	.6773
148.5	561.8	.6756
149.0	560.4	.6740
149.5	559.1	.6723
150.0	557.8	.6708
150.5	556.5	.6692
151.0	555.3	.6678
151.5	554.1	.6663
152.0	553.0	.6649
152.5	551.8	.6635
153.0	550.7	.6622
153.5	549.6	.6609
154.0	548.6	.6596
154.5	547.6	.6584
155.0	546.6	.6572
155.5	545.6	.6560
156.0	544.7	.6549
156.5	543.8	.6538
157.0	542.9	.6527
157.5	542.0	.6517
158.0	541.2	.6506
158.5	540.3	.6496
159.0	539.5	.6487
159.5	538.8	.6477
160.0	538.0	.6468
160.5	537.2	.6459
161.0	536.5	.6450
161.5	535.8	.6441
[illegible]	535.1	.6433
[illegible]	534.4	.6425
[illegible]	533.8	.6417
163.5	533.1	.6409
164.0	532.5	.6401
164.5	531.9	.6394
165.0	531.3	.6386
165.5	530.7	.6379
166.0	530.1	.6372
166.5	529.6	.6366
167.0	529.0	.6359
167.5	528.5	.6352
168.0	527.9	.6346
168.5	527.4	.6340
169.0	526.9	.6334
169.5	526.4	.6328
170.0	526.0	.6322
170.5	525.5	.6316
171.0	525.0	.6311
171.5	524.6	.6305
172.0	524.1	.6300
172.5	523.7	.6295
173.0	523.3	.6290
173.5	522.9	.6285
174.0	522.5	.6280
174.5	522.1	.6275
175.0	521.7	.6270
175.5	521.3	.6265
176.0	520.9	.6261
176.5	520.5	.6257
177.0	520.2	.6252
177.5	519.8	.6248
178.0	519.5	.6244
178.5	519.1	.6240
[illegible]	518.8	.6235
[illegible]	518.5	.6231
180.0	518.2	.6228
180.5	517.8	.6224
181.0	517.5	.6220
181.5	517.2	.6216
182.0	516.9	.6213
182.5	516.6	.6209
183.0	516.3	.6205
183.5	516.0	.6202
184.0	515.8	.6199
184.5	515.5	.6196

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
185.0	515.2	.6192
185.5	514.9	.6189
186.0	514.7	.6185
186.5	514.4	.6182
187.0	514.2	.6179
187.5	513.9	.6176
188.0	513.7	.6173
188.5	513.4	.6170
189.0	513.2	.6167
189.5	512.9	.6164
190.0	512.7	.6161
190.5	512.5	.6158
191.0	512.2	.6156
191.5	512.0	.6153
192.0	511.8	.6150
192.5	511.5	.6148
193.0	511.3	.6145
193.5	511.1	.6142
194.0	510.9	.6140
194.5	510.7	.6137
195.0	510.5	.6135
195.5	510.3	.6132
196.0	510.1	.6130
196.5	509.9	.6127
197.0	509.7	.6125
197.5	509.5	.6122
198.0	509.3	.6120
198.5	509.1	.6117
199.0	508.9	.6115
199.5	508.7	.6113
200.0	508.5	.6111
200.5	508.3	.6108
201.0	508.1	.6106
201.5	507.9	.6104
202.0	507.8	.6102
202.5	507.6	.6099
203.0	507.4	.6097
203.5	507.2	.6095
204.0	507.0	.6093
204.5	506.9	.6091
205.0	506.7	.6089
205.5	506.5	.6086
206.0	506.3	.6084
206.5	506.2	.6082
207.0	506.0	.6080
207.5	505.8	.6078
208.0	505.6	.6076
208.5	505.5	.6074
209.0	505.3	.6072
209.5	505.1	.6070
210.0	505.0	.6068
210.5	504.8	.6066
211.0	504.7	.6064
211.5	504.5	.6062
212.0	504.3	.6060
212.5	504.2	.6058
213.0	504.0	.6056
213.5	503.8	.6054
214.0	503.7	.6052
214.5	503.5	.6050
215.0	503.4	.6048
215.5	503.2	.6046
216.0	503.1	.6045
216.5	502.9	.6043
217.0	502.7	.6041

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)	Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
217.5	502.6	.6039	255.0	491.4	.5903
218.0	502.4	.6037	255.5	491.2	.5901
218.5	502.3	.6035	256.0	491.1	.5899
219.0	502.1	.6033	256.5	490.9	.5898
219.5	502.0	.6031	257.0	490.8	.5896
220.0	501.8	.6029	257.5	490.6	.5894
220.5	501.7	.6028	258.0	490.5	.5892
221.0	501.5	.6026	258.5	490.3	.5890
221.5	501.3	.6024	259.0	490.2	.5889
222.0	501.2	.6022	259.5	490.0	.5887
222.5	501.0	.6020	260.0	489.9	.5885
223.0	500.9	.6018	260.5	489.7	.5883
223.5	500.7	.6017	261.0	489.6	.5881
224.0	500.6	.6015	261.5	489.4	.5880
224.5	500.4	.6013	262.0	489.3	.5878
225.0	500.3	.6011	262.5	489.1	.5876
225.5	500.1	.6009	263.0	489.0	.5874
226.0	500.0	.6007	263.5	488.8	.5872
226.5	499.8	.6006	264.0	488.7	.5871
227.0	499.7	.6004	264.5	488.5	.5869
227.5	499.5	.6002	265.0	488.4	.5867
228.0	499.4	.6000	265.5	488.2	.5865
228.5	499.2	.5998	266.0	488.1	.5863
229.0	499.1	.5996	266.5	488.0	.5862
229.5	498.9	.5995	267.0	487.8	.5860
230.0	498.8	.5993	267.5	487.7	.5858
230.5	498.6	.5991	268.0	487.5	.5856
231.0	498.5	.5989	268.5	487.4	.5854
231.5	498.3	.5987	269.0	487.2	.5853
232.0	498.2	.5986	269.5	487.1	.5851
232.5	498.0	.5984	270.0	486.9	.5849
233.0	497.9	.5982	270.5	486.8	.5847
233.5	497.7	.5980	271.0	486.6	.5845
234.0	497.6	.5978	271.5	486.5	.5843
234.5	497.4	.5977	272.0	486.3	.5842
235.0	497.3	.5975	272.5	486.2	.5840
235.5	497.2	.5973	273.0	486.0	.5838
236.0	497.0	.5971	273.5	485.9	.5836
236.5	496.9	.59[illegible]	274.0	485.7	.5834
237.0	496.7	.59[illegible]	274.5	485.6	.5833
237.5	496.6	.5966	275.0	485.4	.5831
238.0	496.4	.5964	275.5	485.3	.5829
238.5	496.3	.5962	276.0	485.1	.5827
239.0	496.1	.5960	276.5	485.0	.5825
239.5	496.0	.5959	277.0	484.8	.5824
240.0	495.8	.5957	277.5	484.7	.5822
240.5	495.7	.5955	278.0	484.5	.5820
241.0	495.5	.5953	278.5	484.4	.5818
241.5	495.4	.5952	279.0	484.2	.5816
242.0	495.2	.5950	279.5	484.1	.5815
242.5	495.1	.5948	280.0	483.9	.5813
243.0	494.9	.5946	280.5	483.8	.5811
243.5	494.8	.5944	281.0	483.6	.5809
244.0	494.6	.5943	281.5	483.5	.5807
244.5	494.5	.5941	282.0	483.3	.5806
245.0	494.3	.5939	282.5	483.2	.5804
245.5	494.2	.5937	283.0	483.0	.5802
246.0	494.0	.5935	283.5	482.9	.5800
246.5	493.9	.5934	284.0	482.7	.5798
247.0	493.7	.5932	284.5	482.6	.5796
247.5	493.6	.5930	285.0	482.4	.5795
248.0	493.4	.5928	285.5	482.3	.5793
248.5	493.3	.5926	286.0	482.1	.5791
249.0	493.2	.5925	286.5	482.0	.5789
249.5	493.0	.5923	287.0	481.8	.5787
250.0	492.9	.5921	287.5	481.7	.5786
250.5	492.7	.5919	288.0	481.5	.5784
251.0	492.6	.5917	288.5	481.4	.5782
251.5	492.4	.5916	289.0	481.2	.5780
252.0	492.3	.5914	289.5	481.1	.5778
252.5	492.1	.5912	290.0	480.9	.5777
253.0	492.0	.5910	290.5	480.8	.5775
253.5	491.8	.5908	291.0	480.7	.5773
254.0	491.7	.5907	291.5	480.5	.5771
254.5	491.5	.5905			

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)	Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
292.0	480.4	.5770	329.0	469.7	.5640
292.5	480.2	.5768	329.5	469.6	.5639
293.0	480.1	.5766	330.0	469.4	.5637
293.5	479.9	.5764	330.5	469.3	.5635
294.0	479.8	.5762	331.0	469.1	.5634
294.5	479.6	.5761	331.5	469.0	.5632
295.0	479.5	.5759	332.0	468.9	.5630
295.5	479.3	.5757	332.5	468.7	.5628
296.0	479.2	.5755	333.0	468.6	.5627
296.5	479.0	.5753	333.5	468.4	.5625
297.0	478.9	.5752	334.0	468.3	.5623
297.5	478.7	.5750	334.5	468.2	.5622
298.0	478.6	.5748	335.0	468.0	.5620
298.5	478.4	.5746	335.5	467.9	.5618
299.0	478.3	.5745	336.0	467.7	.5617
299.5	478.1	.5743	336.5	467.6	.5615
300.0	478.0	.5741	337.0	467.5	.5613
300.5	477.9	.5739	337.5	467.3	.5612
301.0	477.7	.5737	338.0	467.2	.5610
301.5	477.6	.5736	338.5	467.0	.5608
302.0	477.4	.5734	339.0	466.9	.5606
302.5	477.3	.5732	339.5	466.8	.5605
303.0	477.1	.5730	340.0	466.6	.5603
303.5	477.0	.5729	340.5	466.5	.5601
304.0	476.8	.5727	341.0	466.4	.5600
304.5	476.7	.5725	341.5	466.2	.5598
305.0	476.5	.5723	342.0	466.1	.5596
305.5	476.4	.5722	342.5	465.9	.5595
306.0	476.3	.5720	343.0	465.8	.5593
[illegible].5	476.1	.5718	343.5	465.7	.5591
[illegible].0	476.0	.5716	344.0	465.5	.5590
[illegible]7.5	475.8	.5715	344.5	465.4	.5588
308.0	475.7	.5713	345.0	465.2	.5586
308.5	475.5	.5711	345.5	465.1	.5585
309.0	475.4	.5709	346.0	465.0	.5583
309.5	475.2	.5708	346.5	464.8	.5581
310.0	475.1	.5706	347.0	464.7	.5580
310.5	475.0	.5704	347.5	464.6	.5578
311.0	474.8	.5702	348.0	464.4	.5576
311.5	474.7	.5701	348.5	464.3	.5575
312.0	474.5	.5699	349.0	464.1	.5573
312.5	474.4	.5697	349.5	464.0	.5571
313.0	474.2	.5695	350.0	463.9	.5570
313.5	474.1	.5694	350.5	463.7	.5568
314.0	474.0	.5692	351.0	463.6	.5566
314.5	473.8	.5690	351.5	463.5	.5565
315.0	473.7	.5688	352.0	463.3	.5563
315.5	473.5	.5687	352.5	463.2	.5561
316.0	473.4	.5685	353.0	463.0	.5560
316.5	473.2	.5683	353.5	462.9	.5558
317.0	473.1	.5682	354.0	462.8	.5556
317.5	473.0	.5680	354.5	462.6	.5555
318.0	472.8	.5678	355.0	462.5	.5553
318.5	472.7	.5676	355.5	462.4	.5551
319.0	472.5	.5675	356.0	462.2	.5550
319.5	472.4	.5673	356.5	462.1	.5548
320.0	472.2	.5671	357.0	462.0	.5547
320.5	472.1	.5670	357.5	461.8	.5545
321.0	472.0	.5668	358.0	461.7	.5543
321.5	471.8	.5666	358.5	461.6	.5542
322.0	471.7	.5664	359.0	461.4	.5540
322.5	471.5	.5663	359.5	461.3	.5538
323.0	471.4	.5661	360.0	461.1	.553[illegible]
[illegible].5	471.3	.5659	360.5	461.0	.5535
[illegible].0	471.1	.5658	361.0	460.9	.5533
[illegible].5	471.0	.5656	361.5	460.7	.5532
325.0	470.8	.5654	362.0	460.6	.5530
325.5	470.7	.5652	362.5	460.5	.5528
326.0	470.6	.5651	363.0	460.3	.55[illegible]
326.5	470.4	.5649	363.5	460.2	.5525
327.0	470.3	.5647	364.0	460.1	.5523
327.5	470.1	.5646	364.5	459.9	.5522
328.0	470.0	.5644	365.0	459.8	.5520
328.5	469.8	.5642			

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
[illegible]	459.7	.5519
[illegible]	459.5	.5517
366.5	459.4	.5515
367.0	459.3	.5514
367.5	459.1	.5512
368.0	459.0	.5510
368.5	458.8	.5509
369.0	458.7	.5507
369.5	458.6	.5506
370.0	458.4	.5504
370.5	458.3	.5502
371.0	458.2	.5501
371.5	458.0	.5499
372.0	457.9	.5497
372.5	457.8	.5496
373.0	457.6	.5494
373.5	457.5	.5493
374.0	457.4	.5491
374.5	457.2	.5489
375.0	457.1	.5488
375.5	457.0	.5486
376.0	456.8	.5484
376.5	456.7	.5483
377.0	456.6	.5481
377.5	456.4	.5480
378.0	456.3	.5478
378.5	456.2	.5476
379.0	456.0	.5475
379.5	455.9	.5473
380.0	455.8	.5471
380.5	455.6	.5470
[illegible]	455.5	.5468
[illegible]	455.4	.5467
[illegible]	455.2	.5465
382.5	455.1	.5463
383.0	455.0	.5462
383.5	454.8	.5460
384.0	454.7	.5459
384.5	454.6	.5457
385.0	454.4	.5455
385.5	454.3	.5454
386.0	454.2	.5452
386.5	454.0	.5451
387.0	453.9	.5449
387.5	453.8	.5447
388.0	453.6	.5446
388.5	453.5	.5444
389.0	453.4	.5443
389.5	453.3	.5441
390.0	453.1	.5439
390.5	453.0	.5438
391.0	452.9	.5436
391.5	452.7	.5435
392.0	452.6	.5433
392.5	452.5	.5431
393.0	452.3	.5430
393.5	452.2	.5428
394.0	452.1	.5427
394.5	451.9	.5425
395.0	451.8	.5423
395.5	451.7	.5422
396.0	451.5	.5420
396.5	451.4	.5419
397.0	451.3	.5417
397.5	451.1	.5415
[illegible]	451.0	.5414
[illegible]	450.9	.5412
[illegible]	450.8	.5411
399.5	450.6	.5409
400.0	450.5	.5408
400.5	450.4	.5406
401.0	450.2	.5404
401.5	450.1	.5403
402.0	450.0	.5401
402.5	449.8	.5400
403.0	449.7	.5398
403.5	449.6	.5396
404.0	449.4	.5395
404.5	449.3	.5393
405.0	449.2	.5392
405.5	449.1	.5390
406.0	448.9	.5389
406.5	448.8	.5387
407.0	448.7	.5385
407.5	448.5	.5384
408.0	448.4	.5382
408.5	448.3	.5381
409.0	448.1	.5379
409.5	448.0	.5378
410.0	447.9	.5376
410.5	447.8	.5374
411.0	447.6	.5373
411.5	447.5	.5371
412.0	447.4	.5370
412.5	447.2	.5368
413.0	447.1	.5367
413.5	447.0	.5365
414.0	446.9	.5363
414.5	446.7	.5362
415.0	446.6	.5360
415.5	446.5	.5359
416.0	446.3	.5357
416.5	446.2	.5356
417.0	446.1	.5354
417.5	445.9	.5352
418.0	445.8	.5351
418.5	445.7	.5349
419.0	445.6	.5348
419.5	445.4	.5346
420.0	445.3	.5345
420.5	445.2	.5343
421.0	445.0	.5341
421.5	444.9	.5340
422.0	444.8	.5338
422.5	444.7	.5337
423.0	444.5	.5335
423.5	444.4	.5334
424.0	444.3	.5332
424.5	444.1	.5331
425.0	444.0	.5329
425.5	443.9	.5327
426.0	443.8	.5326
426.5	443.6	.5324
427.0	443.5	.5323
427.5	443.4	.5321
428.0	443.2	.5320
428.5	443.1	.5318
429.0	443.0	.5317
429.5	442.9	.5315
430.0	442.7	.5313
430.5	442.6	.5312
431.0	442.5	.5310
431.5	442.4	.5309
432.0	442.2	.5307
432.5	442.1	.5306
433.0	442.0	.5304
433.5	441.8	.5303
[illegible]	441.8	.5302
[illegible]	441.7	.5300
[illegible]	441.5	.5299
435.5	441.4	.5297
436.0	441.3	.5296
436.5	441.1	.5294
437.0	441.0	.5293

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
[illegible]7.5	440.9	.5291
438.0	440.8	.5289
438.5	440.6	.5288
439.0	440.5	.5286
439.5	440.4	.5285
440.0	440.2	.5283
440.5	440.1	.5282
441.0	440.0	.5280
441.5	439.9	.5279
442.0	439.7	.5277
442.5	439.6	.5276
443.0	439.5	.5274
443.5	439.4	.5272
444.0	439.2	.5271
444.5	439.1	.5269
445.0	439.0	.5268
445.5	438.8	.5266
446.0	438.7	.5265
446.5	438.6	.5263
447.0	438.5	.5262
447.5	438.3	.5260
448.0	438.2	.5259
448.5	438.1	.5257
449.0	438.0	.5255
449.5	437.8	.5254
450.0	437.7	.5252
450.5	437.6	.5251
451.0	437.4	.5249
451.5	437.3	.5248
452.0	437.2	.5246
452.5	437.1	.5245
[illegible]3.0	436.9	.5243
[illegible].5	436.8	.5242
[illegible].0	436.7	.5240
454.5	436.6	.5239
455.0	436.4	.5237
455.5	436.3	.5236
456.0	436.2	.5234
456.5	436.1	.5233
457.0	435.9	.5231
457.5	435.8	.5229
458.0	435.7	.5228
458.5	435.6	.5226
459.0	435.4	.5225
459.5	435.3	.5223
460.0	435.2	.5222
460.5	435.1	.5220
461.0	434.9	.5219
461.5	434.8	.5217
462.0	434.7	.5216
462.5	434.5	.5214
463.0	434.4	.5213
463.5	434.3	.5211
464.0	434.2	.5210
464.5	434.0	.5208
465.0	433.9	.5207
465.5	433.8	.5205
466.0	433.7	.5204
466.5	433.5	.5202
467.0	433.4	.5201
467.5	433.3	.5199
468.0	433.2	.5197
468.5	433.0	.5196
469.0	432.9	.5194
469.5	432.8	.5193
[illegible]0.0	432.7	.5191
[illegible].5	432.5	.5190
[illegible].0	432.4	.5188
[illegible]1.5	432.3	.5187
472.0	432.2	.5185
472.5	432.0	.5184
473.0	431.9	.5182
473.5	431.8	.5181
474.0	431.7	.5179
474.5	431.5	.5178
475.0	431.4	.5176
475.5	431.3	.5175
476.0	431.2	.5173
476.5	431.0	.5172
477.0	430.9	.5170
477.5	430.8	.5169
478.0	430.7	.5167
478.5	430.5	.5166
479.0	430.4	.5164
479.5	430.3	.5163
480.0	430.2	.5161
480.5	430.1	.5160
481.0	429.9	.5158
481.5	429.8	.5157
482.0	429.7	.5155
482.5	429.6	.5154
483.0	429.4	.5152
483.5	429.3	.5151
484.0	429.2	.5149
484.5	429.1	.5148
485.0	428.9	.5146
485.5	428.8	.5145
486.0	428.7	.5143
486.5	428.6	.5142
487.0	428.4	.5140
487.5	428.3	.5139
488.0	428.2	.5137
488.5	428.1	.5136
489.0	427.9	.5134
489.5	427.8	.5133
490.0	427.7	.5131
490.5	427.6	.5130
491.0	427.4	.5128
491.5	427.3	.5127
492.0	427.2	.5125
492.5	427.1	.5124
493.0	427.0	.5122
493.5	426.8	.5121
494.0	426.7	.5119
494.5	426.6	.5118
495.0	426.5	.5116
495.5	426.3	.5115
496.0	426.2	.5113
496.5	426.1	.5112
497.0	426.0	.5110
497.5	425.8	.5109
498.0	425.7	.5107
498.5	425.6	.5106
499.0	425.5	.5104
499.5	425.4	.5103
500.0	425.2	.5101
500.5	425.1	.5100
501.0	425.0	.5098
501.5	424.9	.5097
502.0	424.7	.5095
502.5	424.6	.5094
503.0	424.5	.5092
503.5	424.4	.5091
504.0	424.2	.5089
504.5	424.1	.5088
505.0	424.0	.5086
505.5	423.9	.5085
506.0	423.8	.5083
506.5	423.6	.5082
507.0	423.5	.5080
507.5	423.4	.5079
508.0	423.3	.5077
508.5	423.1	.5076
509.0	423.0	.5074
509.5	422.9	.5073
510.0	422.8	.5071
510.5	422.6	.5070

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
[illegible]	312.4	.3753
[illegible]	312.3	.3752
534.0	312.2	.3751
534.5	312.2	.3750
535.0	312.1	.3749
535.5	312.0	.3748
536.0	311.9	.3747
536.5	311.8	.3746
537.0	311.7	.3745
537.5	311.6	.3744
538.0	311.5	.3742
538.5	311.4	.3741
539.0	311.3	.3740
539.5	311.3	.3739
540.0	311.2	.3738
540.5	311.1	.3737
541.0	311.0	.3736
541.5	310.9	.3735
542.0	310.8	.3734
542.5	310.7	.3733
543.0	310.6	.3731
543.5	310.5	.3730
544.0	310.4	.3729
544.5	310.3	.3728
545.0	310.3	.3727
545.5	310.2	.3726
546.0	310.1	.3725
546.5	310.0	.3724
547.0	309.9	.3723
547.5	309.8	.3721
[illegible]	309.7	.3720
[illegible]	309.6	.3719
[illegible]	309.5	.3718
[illegible]	309.4	.3717
550.0	309.3	.3716
550.5	309.2	.3715
551.0	309.2	.3714
551.5	309.1	.3713
552.0	309.0	.3711
552.5	308.9	.3710
553.0	308.8	.3709
553.5	308.7	.3708
554.0	308.6	.3707
554.5	308.5	.3706
555.0	308.4	.3705
555.5	308.3	.3704
556.0	308.2	.3702
556.5	308.1	.3701
557.0	308.0	.3700
557.5	308.0	.3699
558.0	307.9	.3698
558.5	307.8	.3697
559.0	307.7	.3696
559.5	307.6	.3695
560.0	307.5	.3693
560.5	307.4	.3692
561.0	307.3	.3691
561.5	307.2	.3690
562.0	307.1	.3689
562.5	307.0	.3688
563.0	306.9	.3687
563.5	306.8	.3686
564.0	306.7	.3684
564.5	306.7	.3683
[illegible]	306.6	.3682
[illegible]	306.5	.3681
[illegible]	306.4	.3680
[illegible]	306.3	.3679
567.0	306.2	.3678
567.5	306.1	.3677
568.0	306.0	.3675
568.5	305.9	.3674
569.0	305.8	.3673
569.5	305.7	.3672
570.0	305.6	.3671
570.5	305.5	.3670
571.0	305.4	.3669
571.5	305.3	.3667
572.0	305.3	.3666
572.5	305.2	.3665
573.0	305.1	.3664
573.5	305.0	.3663
574.0	304.9	.3662
574.5	304.8	.3661
575.0	304.7	.3660
575.5	304.6	.3658
576.0	304.5	.3657
576.5	304.4	.3656
577.0	304.3	.3655
577.5	304.2	.3654
578.0	304.1	.3653
578.5	304.0	.3652
579.0	303.9	.3650
579.5	303.8	.3649
580.0	303.7	.3648
580.5	303.7	.3647
581.0	303.6	.3646
581.5	303.5	.3645
582.0	303.4	.3644
582.5	303.3	.3642
583.0	303.2	.3641
583.5	303.1	.3640
584.0	303.0	.3639
584.5	302.9	.3638
585.0	302.8	.3637
585.5	302.7	.3636
586.0	302.6	.3634
586.5	302.5	.3633
587.0	302.4	.3632
587.5	302.3	.3631
588.0	302.2	.3630
588.5	302.1	.3629
589.0	302.1	.3628
589.5	302.0	.3626
590.0	301.9	.3625
590.5	301.8	.3624
591.0	301.7	.3623
591.5	301.6	.3622
592.0	301.5	.3621
592.5	301.4	.3620
593.0	301.3	.3618
593.5	301.2	.3617
594.0	301.1	.3616
594.5	301.0	.3615
595.0	300.9	.3614
595.5	300.8	.3613
596.0	300.7	.3612
596.5	300.6	.3610
597.0	300.5	.3609
597.5	300.4	.3608
598.0	300.4	.3607
598.5	300.3	.3606
599.0	300.2	.3605
599.5	300.1	.3604
600.0	300.0	.3602

TABLE 15.4-30

MASS AND ENERGY RELEASES FROM A 1.4 FT^2 ~~der AT 70 PERCENT~~ DER AT HOT ZERO POWER (Including Entrained Moisture Effects)

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)

~~a,c~~

~~PROPRIETARY~~

~~Refer to (50-311) "Application for Withholding"~~
~~R. L. Mittl to Olan D. Parr~~
~~November 20, 1978~~
~~and~~
~~NRC Approval letter,~~
~~Olan D. Parr to Wiesemann~~
~~January 22, 1979~~

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
0.000	11899.	14.179
2.552	14945.	14.849
3.052	14917.	14.530
3.552	14517.	13.977
4.052	14279.	13.607
4.552	13959.	13.224
5.552	13208.	12.469
6.552	12495.	11.753
7.552	11385.	11.104
8.552	11252.	10.527
9.552	10656.	9.986
11.052	9658.	9.197
11.552	9357.	8.958
11.602	4422.	3.028
12.00	4121.	2.760
12.50	3928.	2.667
13.00	3717.	2.569
13.50	3518.	2.476
14.00	3332.	2.387
14.50	3158.	2.302
15.00	2994.	2.221
[illegible]	2840.	2.143
[illegible]	2696.	2.070
[illegible]	2515.	1.985
[illegible].00	2311.	1.895
17.50	2131.	1.812
18.00	1971.	1.737
18.50	1829.	1.668
19.00	1701.	1.605
19.50	1587.	1.547
20.00	1483.	1.493
20.50	1389.	1.443
21.00	1304.	1.396
21.50	1226.	1.352
22.00	1154.	1.310
22.50	1089.	1.271
23.00	1028.	1.235
23.50	1005.	1.210
24.00	986.0	1.187
24.50	968.0	1.165
25.00	950.7	1.144
25.50	934.2	1.124
26.00	918.3	1.105
26.50	903.1	1.087
27.00	888.5	1.069
27.50	874.5	1.052
28.00	861.0	1.036
28.50	848.0	1.020
29.00	835.5	1.005
29.50	823.5	.9902
30.00	811.9	.9762
30.50	800.8	.9627
31.00	790.0	.9496
31.50	779.5	.9369
[illegible]	769.3	.9247
[illegible]	777.2	.9342
[illegible]	778.0	.9352
[illegible].50	778.5	.9358
34.00	778.8	.9361
34.50	778.8	.9361
35.00	778.6	.9358
35.50	778.2	.9353
36.00	777.6	.9346
36.50	776.8	.9337
37.00	775.9	.9326

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
37.50	774.8	.9313
38.00	773.6	.9298
38.50	772.3	.9282
39.00	770.8	.9264
39.50	769.2	.9245
40.00	767.5	.9225
40.50	765.8	.9203
41.00	764.0	.9181
41.50	762.1	.9158
42.00	760.1	.9135
42.50	758.2	.9111
43.00	756.2	.9087
43.50	754.2	.9063
44.00	752.1	.9038
44.50	750.1	.9014
45.00	748.1	.8989
45.50	746.0	.8964
46.00	744.0	.8940
46.50	742.0	.8915
47.00	740.0	.8891
47.50	737.9	.8866
48.00	736.0	.8842
48.50	734.0	.8818
49.00	732.0	.8794
49.50	730.0	.8770
50.00	728.0	.8746
50.50	726.0	.8722
51.00	724.1	.8698
51.50	722.1	.8676
52.00	720.1	.8650
52.50	718.2	.8627
53.00	716.3	.8604
53.50	714.4	.8581
54.00	712.5	.8558
54.50	710.6	.8535
55.00	708.8	.8512
55.50	706.9	.8490
56.00	705.1	.8468
56.50	703.3	.8446
57.00	701.5	.8424
57.50	699.7	.8403
58.00	697.9	.8381
58.50	696.2	.8360
59.00	694.5	.8339
59.50	692.7	.8318
60.00	691.0	.8298
60.50	689.4	.8277
61.00	687.7	.8257
61.50	686.1	.8237
62.00	684.4	.8217
62.50	682.8	.8198
63.00	681.2	.8179
63.50	679.7	.8160
64.00	678.1	.8141
64.50	676.6	.8122
65.00	675.1	.8104
65.50	673.6	.8086
66.00	672.1	.8068
66.50	670.6	.8050
67.00	669.2	.8033
67.50	667.7	.8015
68.00	666.3	.7998
68.50	664.9	.7981
69.00	663.5	.7964
69.50	662.1	.7947
70.00	660.8	.7931
70.50	659.4	.7914
71.00	658.1	.7898
71.50	656.8	.7882
72.00	655.5	.7866
72.50	654.3	.7852
73.00	653.0	.7836
73.50	651.7	.7821
74.00	650.5	.7806
74.50	649.2	.7791

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
75.00	648.0	.7776
75.50	646.8	.7761
76.00	645.6	.7747
76.50	644.4	.7733
77.00	643.3	.7718
77.50	642.1	.7704
78.00	641.0	.7690
78.50	639.8	.7677
79.00	638.7	.7663
79.50	637.6	.7650
80.00	636.5	.7637
80.50	635.5	.7624
81.00	634.4	.7611
81.50	633.3	.7598
82.00	632.3	.7586
82.50	631.3	.7573
83.00	630.3	.7561
83.50	629.3	.7549
84.00	628.3	.7537
84.50	627.4	.7526
85.00	626.4	.7514
85.50	625.5	.7503
86.00	624.6	.7492
86.50	623.7	.7481
87.00	622.8	.7470
87.50	621.9	.7460
88.00	621.1	.7450
88.50	620.3	.7440
89.00	619.4	.7430
89.50	618.6	.7420
90.00	617.9	.7410
90.50	617.1	.7401
91.00	616.3	.7392
91.50	615.6	.7383
92.00	614.9	.7374
92.50	614.2	.7366
93.00	613.5	.7357
93.50	612.8	.7349
94.00	612.1	.7341
94.50	611.5	.7333
95.00	610.8	.7325
95.50	610.2	.7317
96.00	609.6	.7310
96.50	609.0	.7302
97.00	608.4	.7295
97.50	607.8	.7288
98.00	607.2	.7281
98.50	606.6	.7274
99.00	606.1	.7267
99.50	605.5	.7261
100.0	605.0	.7254
100.5	604.4	.7248
101.0	603.9	.7241
101.5	603.4	.7235
102.0	602.9	.7229
102.5	602.4	.7223
103.0	601.9	.7217
103.5	601.4	.7211
104.0	601.0	.7206
104.5	600.5	.7200
105.0	600.1	.7195
105.5	599.6	.7190
106.0	599.2	.7184
106.5	598.8	.7179
107.0	598.4	.7174
107.5	598.0	.7169
108.0	597.6	.7164
108.5	597.2	.7159
109.0	596.8	.7155
109.5	596.4	.7150
110.0	596.0	.7145
110.5	595.6	.7141

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
111.0	595.2	.7136
111.5	594.8	.7131
112.0	594.5	.7127
112.5	594.1	.7123
113.0	593.7	.7118
113.5	593.4	.7114
114.0	593.0	.7109
114.5	592.7	.7105
115.0	592.3	.7101
115.5	592.0	.7097
116.0	591.6	.7092
116.5	591.3	.7088
117.0	590.9	.7084
117.5	590.6	.7080
118.0	590.3	.7076
118.5	589.9	.7072
119.0	589.6	.7068
119.5	589.3	.7064
120.0	588.9	.7060
120.5	588.6	.7056
121.0	588.3	.7052
121.5	588.0	.7048
122.0	587.7	.7044
122.5	587.3	.7041
123.0	587.0	.7037
123.5	586.7	.7033
124.0	586.4	.7029
124.5	586.1	.7026
125.0	585.8	.7022
125.5	585.5	.7018
126.0	585.2	.7015
126.5	584.9	.7011
127.0	584.6	.7007
127.5	584.3	.7004
128.0	584.0	.7000
128.5	583.7	.6997
129.0	583.4	.6993
129.5	583.1	.6990
130.0	582.9	.6986
130.5	582.6	.6983
131.0	582.3	.6979
131.5	582.0	.6976
132.0	581.7	.6972
132.5	581.4	.6969
133.0	581.2	.6966
133.5	580.9	.6962
134.0	580.6	.6959
134.5	580.3	.6955
135.0	580.1	.6952
135.5	579.8	.6949
136.0	579.5	.6946
136.5	579.2	.6942
137.0	579.0	.6939
137.5	578.7	.6936
138.0	578.4	.6933
138.5	578.2	.6929
139.0	577.9	.6926
139.5	577.6	.6923
140.0	577.4	.6920
140.5	577.1	.6916
141.0	576.9	.6913
141.5	576.6	.6910
142.0	576.3	.6907
142.5	576.1	.6904
143.0	575.8	.6901
143.5	575.6	.6898
144.0	575.3	.6895
144.5	575.0	.6891
145.0	574.8	.6888
145.5	574.5	.6885
146.0	574.3	.6882
146.5	574.0	.6879
147.0	573.8	.6876
147.5	573.5	.6873

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
[illegible]	573.3	.6870
[illegible]	573.0	.6867
149.0	572.8	.6864
149.5	572.5	.6861
150.0	572.3	.6858
150.5	572.1	.6855
151.0	571.8	.6852
151.5	571.6	.6849
152.0	571.3	.6846
152.5	571.1	.6843
153.0	570.8	.6841
153.5	570.6	.6838
154.0	570.4	.6835
154.5	570.1	.6832
155.0	569.9	.6829
155.5	569.7	.6826
156.0	569.4	.6823
156.5	569.2	.6820
157.0	568.9	.6817
157.5	568.7	.6815
158.0	568.5	.6812
158.5	568.2	.6809
159.0	568.0	.6806
159.5	567.8	.6803
160.0	567.5	.6800
160.5	567.3	.6798
161.0	567.1	.6795
161.5	566.9	.6792
162.0	566.6	.6789
162.5	566.4	.6787
[illegible]	566.2	.6784
[illegible]	565.9	.6781
[illegible]	565.7	.6778
164.5	565.5	.6775
165.0	565.3	.6773
165.5	565.0	.6770
166.0	564.8	.6767
166.5	564.6	.6765
167.0	564.4	.6762
167.5	564.1	.6759
168.0	563.9	.6756
168.5	563.7	.6754
169.0	563.5	.6751
169.5	563.2	.6748
170.0	563.0	.6746
170.5	562.8	.6743
171.0	562.6	.6740
171.5	562.3	.6737
172.0	562.1	.6735
172.5	561.9	.6732
173.0	561.7	.6729
173.5	561.5	.6727
174.0	561.2	.6724
174.5	561.0	.6721
175.0	560.8	.6719
175.5	560.6	.6716
176.0	560.4	.6713
176.5	560.2	.6711
177.0	559.9	.6708
177.5	559.7	.6706
178.0	559.5	.6703
178.5	559.3	.6700
179.0	559.1	.6698
179.5	558.8	.6695
[illegible]	558.6	.6692
[illegible]	558.4	.6690
[illegible]	558.2	.6687
[illegible]	558.0	.6685
[illegible]	557.8	.6682
182.5	557.6	.6679
183.0	557.3	.6677
183.5	557.1	.6674
184.0	556.9	.6672
184.5	556.7	.6669
185.0	556.5	.6666

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
185.5	556.3	.6664
186.0	556.1	.6661
186.5	555.8	.6659
187.0	555.6	.6656
187.5	555.4	.6654
188.0	555.2	.6651
188.5	555.0	.6648
189.0	554.8	.6646
189.5	554.6	.6643
190.0	554.4	.6641
190.5	554.2	.6638
191.0	553.9	.6636
191.5	553.7	.6633
192.0	553.5	.6631
192.5	553.3	.6628
193.0	553.1	.6625
193.5	552.9	.6623
194.0	552.7	.6620
194.5	552.5	.6618
195.0	552.3	.6615
195.5	552.1	.6613
196.0	551.9	.6610
196.5	551.6	.6608
197.0	551.4	.6605
197.5	551.2	.6603
198.0	551.0	.6600
198.5	550.8	.6598
199.0	550.6	.6595
199.5	550.4	.6593
200.0	550.2	.6590
200.5	550.0	.6588
201.0	549.8	.6585
201.5	549.6	.6583
202.0	549.4	.6580
202.5	549.2	.6578
203.0	549.0	.6575
203.5	548.7	.6573
204.0	548.5	.6570
204.5	548.3	.6568
205.0	548.1	.6565
205.5	547.9	.6563
206.0	547.7	.6560
206.5	547.5	.6558
207.0	547.3	.6555
207.5	547.1	.6553
208.0	546.9	.6550
208.5	546.7	.6548
209.0	546.5	.6545
209.5	546.3	.6543
210.0	546.1	.6540
210.5	545.9	.6538
211.0	545.7	.6536
211.5	545.5	.6533
212.0	545.3	.6531
212.5	545.1	.6528
213.0	544.9	.6526
213.5	544.7	.6523
214.0	544.5	.6521
214.5	544.3	.6518
215.0	544.1	.6516
215.5	543.9	.6514
216.0	543.7	.6511
216.5	543.5	.6509
217.0	543.3	.6506

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
217.5	543.1	.6504
218.0	542.9	.6501
218.5	542.7	.6499
219.0	542.5	.6496
219.5	542.3	.6494
220.0	542.1	.6492
220.5	541.9	.6489
221.0	541.7	.6487
221.5	541.5	.6484
222.0	541.3	.6482
222.5	541.1	.6480
223.0	540.9	.6477
223.5	540.7	.6475
224.0	540.5	.6472
224.5	540.3	.6470
225.0	540.1	.6467
225.5	539.9	.6465
226.0	539.7	.6463
226.5	539.5	.6460
227.0	539.3	.6458
227.5	539.1	.6455
228.0	538.9	.6453
228.5	538.7	.6451
229.0	538.5	.6448
229.5	538.3	.6446
230.0	538.1	.6444
230.5	537.9	.6441
231.0	537.7	.6439
231.5	537.5	.6436
232.0	537.3	.6434
[illegible]	537.1	.6432
[illegible]	536.9	.6429
[illegible]	536.7	.6427
234.0	536.5	.6425
234.5	536.3	.6422
235.0	536.1	.6420
235.5	535.9	.6417
236.0	535.7	.6415
236.5	535.6	.6413
237.0	535.4	.6410
237.5	535.2	.6408
238.0	535.0	.6406
238.5	534.8	.6403
239.0	534.6	.6401
239.5	534.4	.6399
240.0	534.2	.6396
240.5	534.0	.6394
241.0	533.8	.6392
241.5	533.6	.6389
242.0	533.4	.6387
242.5	533.2	.6385
243.0	533.0	.6382
243.5	532.9	.6380
244.0	532.7	.6378
244.5	532.5	.6375
245.0	532.3	.6373
245.5	532.1	.6371
246.0	531.9	.6368
246.5	531.7	.6366
247.0	531.5	.6364
247.5	531.3	.6361
248.0	531.1	.6359
248.5	530.9	.6357
249.0	530.7	.6354
[illegible]	530.5	.6352
[illegible]	530.4	.6350
250.5	530.2	.6347
251.0	530.0	.6345
251.5	529.8	.6343
252.0	529.6	.6340
252.5	529.4	.6338
253.0	529.2	.6336
253.5	529.0	.6334
254.0	528.8	.6331
254.5	528.6	.6329
255.0	528.4	.6327
255.5	528.3	.6324
256.0	528.1	.6322
256.5	527.9	.6320
257.0	527.7	.6317
257.5	527.5	.6315
258.0	527.3	.6313
258.5	527.1	.6311
259.0	526.9	.6308
259.5	526.7	.6306
260.0	526.6	.6304
260.5	526.4	.6301
261.0	526.2	.6299
261.5	526.0	.6297
262.0	525.8	.6295
262.5	525.6	.6292
263.0	525.4	.6290
263.5	525.2	.6288
264.0	525.1	.6286
264.5	524.9	.6283
265.0	524.7	.6281
265.5	524.5	.6279
266.0	524.3	.6277
266.5	524.1	.6274
267.0	523.9	.6272
267.5	523.8	.6270
268.0	523.6	.6268
268.5	523.4	.6265
269.0	523.2	.6263
269.5	523.0	.6261
270.0	522.8	.6259
270.5	522.6	.6256
271.0	522.5	.6254
271.5	522.3	.6252
272.0	522.1	.6250
272.5	521.9	.6247
273.0	521.7	.6245
273.5	521.5	.6243
274.0	521.3	.6241
274.5	521.2	.6238
275.0	521.0	.6236
275.5	520.8	.6234
276.0	520.6	.623[illegible]
276.5	520.4	.623[illegible]
277.0	520.2	.622[illegible]
277.5	520.1	.6225
278.0	519.9	.6223
278.5	519.7	.6221
279.0	519.5	.6218
279.5	519.3	.6216
280.0	519.2	.6214
280.5	519.0	.6212
281.0	518.8	.6210
281.5	518.6	.6208
282.0	518.5	.6206
282.5	518.3	.6204
283.0	518.1	.6202
283.5	517.9	.6199
284.0	517.8	.6197
284.5	517.6	.6195
285.0	517.4	.6193
285.5	517.2	.6191
286.0	517.1	.6189
286.5	516.9	.6186
287.0	516.7	.6184
287.5	516.5	.6182
288.0	516.3	.6180
288.5	516.2	.6178
289.0	516.0	.6176
289.5	515.8	[illegible]

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)	Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
290.0	515.6	.6171	326.0	503.0	.6018
290.5	515.4	.6169	326.5	502.8	.6016
291.0	515.3	.6167	327.0	502.6	.6014
291.5	515.1	.6165	327.5	502.4	.6012
292.0	514.9	.6163	328.0	502.3	.6010
292.5	514.7	.6160	328.5	502.1	.6007
293.0	514.5	.6158	329.0	501.9	.6005
293.5	514.4	.6156	329.5	501.8	.6003
294.0	514.2	.6154	330.0	501.6	.6001
294.5	514.0	.6152	330.5	501.4	.5999
295.0	513.8	.6149	331.0	501.3	.5997
295.5	513.6	.6147	331.5	501.1	.5995
296.0	513.4	.6145	332.0	500.9	.5993
296.5	513.3	.6143	332.5	500.7	.5991
297.0	513.1	.6140	333.0	500.6	.5989
297.5	512.9	.6138	333.5	500.4	.5987
298.0	512.7	.6136	334.0	500.2	.5985
298.5	512.5	.6134	334.5	500.1	.5983
299.0	512.3	.6132	335.0	499.9	.5981
299.5	512.2	.6129	335.5	499.7	.5979
300.0	512.0	.6127	336.0	499.6	.5977
300.5	511.8	.6125	336.5	499.4	.5975
301.0	511.6	.6123	337.0	499.2	.5973
301.5	511.4	.6121	337.5	499.1	.5971
302.0	511.3	.6118	338.0	498.9	.5969
302.5	511.1	.6116	338.5	498.7	.5967
303.0	510.9	.6114	339.0	498.6	.5965
[illegible]	510.7	.6112	339.5	498.4	.5963
[illegible]	510.6	.6110	340.0	498.2	.5960
[illegible]	510.4	.6108	340.5	498.1	.5958
305.0	510.2	.6106	341.0	497.9	.5956
305.5	510.0	.6103	341.5	497.7	.5954
306.0	509.9	.6101	342.0	497.5	.5952
306.5	509.7	.6099	342.5	497.4	.5950
307.0	509.5	.6097	343.0	497.2	.5948
307.5	509.3	.6095	343.5	497.0	.5946
308.0	509.2	.6093	344.0	496.9	.5944
308.5	509.0	.6091	344.5	496.7	.5942
309.0	508.8	.6089	345.0	496.5	.5940
309.5	508.6	.6087	345.5	496.4	.5938
310.0	508.5	.6085	346.0	496.2	.5936
310.5	508.3	.6082	346.5	496.0	.5934
311.0	508.1	.6080	347.0	495.9	.5932
311.5	507.9	.6078	347.5	495.7	.5930
312.0	507.8	.6076	348.0	495.5	.5928
312.5	507.6	.6074	348.5	495.4	.5926
313.0	507.4	.6072	349.0	495.2	.5924
313.5	507.3	.6070	349.5	495.0	.5922
314.0	507.1	.6068	350.0	494.9	.5920
314.5	506.9	.6066	350.5	494.7	.5918
315.0	506.7	.6064	351.0	494.5	.5916
315.5	506.6	.6062	351.5	494.4	.5914
316.0	506.4	.6060	352.0	494.2	.5912
316.5	506.2	.6058	352.5	494.0	.5910
317.0	506.1	.6056	353.0	493.9	.5908
317.5	505.9	.6053	353.5	493.7	.5906
318.0	505.7	.6051	354.0	493.6	.5904
318.5	505.6	.6049	354.5	493.4	.5902
319.0	505.4	.6047	355.0	493.2	.5900
319.5	505.2	.6045	355.5	493.1	.5898
320.0	505.0	.6043	356.0	492.9	.5896
[illegible]	504.9	.6041	356.5	492.7	.5894
[illegible]	504.7	.6039	357.0	492.6	.5892
321.5	504.5	.6037			
322.0	504.4	.6035			
322.5	504.2	.6033			
323.0	504.0	.6031			
323.5	503.8	.6028			
324.0	503.7	.6026			
324.5	503.5	.6024			
325.0	503.3	.6022			
325.5	503.1	.6020			

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
357.5	492.6	.5890
358.0	492.2	.5888
358.5	492.1	.5886
359.0	491.9	.5884
359.5	491.7	.5882
360.0	491.6	.5880
360.5	491.4	.5878
361.0	491.2	.5876
361.5	491.1	.5874
362.0	490.9	.5872
362.5	490.8	.5870
363.0	490.6	.5868
363.5	490.4	.5866
364.0	490.3	.5864
364.5	490.1	.5862
365.0	489.9	.5860
365.5	489.8	.5858
366.0	489.6	.5856
366.5	489.4	.5854
367.0	489.3	.5852
367.5	489.1	.5850
368.0	489.0	.5848
368.5	488.8	.5846
369.0	488.6	.5844
369.5	488.5	.5842
370.0	488.3	.5840
370.5	488.1	.5838
371.0	488.0	.5836
371.5	487.8	.5834
372.0	487.7	.5832
372.5	487.5	.5830
373.0	487.3	.5829
373.5	487.2	.5827
374.0	487.0	.5825
374.5	486.8	.5823
375.0	486.7	.5821
375.5	486.5	.5819
376.0	486.4	.5817
376.5	486.2	.5815
377.0	486.0	.5813
377.5	485.9	.5811
378.0	485.6	.5808
378.5	485.4	.5806
379.0	485.3	.5804
379.5	485.1	.5802
380.0	485.0	.5800
380.5	484.8	.5798
381.0	484.7	.5796
381.5	484.5	.5794
382.0	484.3	.5792
382.5	484.2	.5790
383.0	484.0	.5788
383.5	483.9	.5787
384.0	483.7	.5785
384.5	483.5	.5783
385.0	483.4	.5781
385.5	483.2	.5779
386.0	483.1	.5777
386.5	482.9	.5775
387.0	482.8	.5773
387.5	482.6	.5771
388.0	482.4	.5769
388.5	482.3	.5767
389.0	482.1	.5765
389.5	482.0	.5763
390.0	481.8	.5762
390.5	481.6	.5760
391.0	481.5	.5758
391.5	481.3	.5756
392.0	481.2	.5754
392.5	481.0	.5752
393.0	480.8	.5750
393.5	480.7	.5748
394.0	480.5	.5746
394.5	479.9	.5738

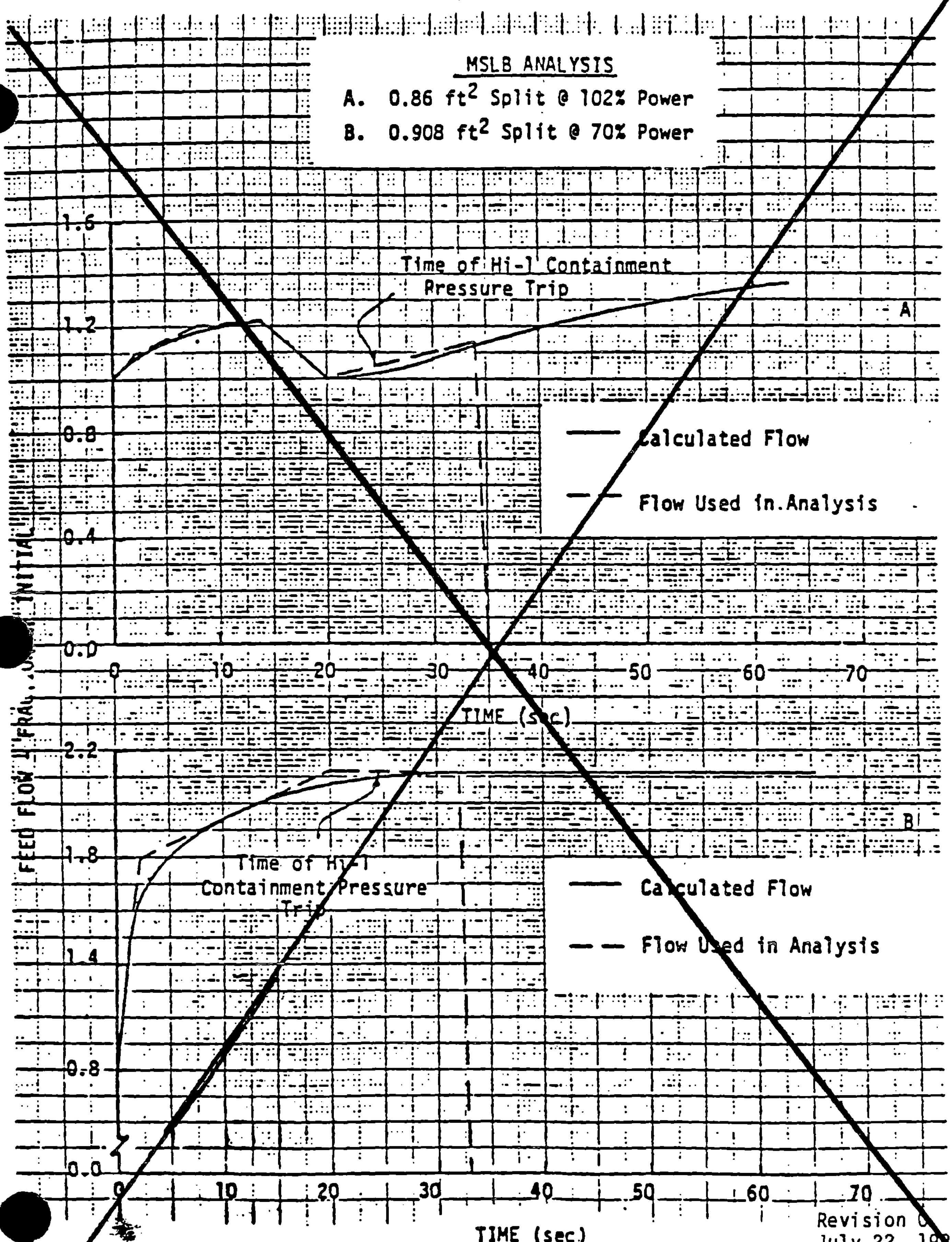
Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
395.0	478.5	.5722
395.5	476.8	.5700
396.0	474.8	.5677
396.5	472.7	.5651
397.0	470.5	.5625
397.5	468.2	.5597
398.0	465.8	.5568
398.5	463.3	.5537
399.0	460.7	.5505
399.5	458.0	.5473
400.0	455.1	.5438
400.5	452.2	.5403
401.0	449.2	.5367
401.5	446.2	.5330
402.0	443.0	.5292
402.5	439.8	.5252
403.0	436.5	.5213
403.5	433.2	.5172
404.0	429.7	.5131
404.5	426.3	.5088
405.0	422.7	.5046
405.5	419.1	.5002
406.0	415.5	.4958
406.5	411.8	.4913
407.0	408.1	.4868
407.5	404.3	.4822
408.0	400.4	.4776
408.5	396.5	.4728
409.0	392.6	.4681
409.5	388.6	.4633
410.0	384.6	.4584
410.5	380.6	.4535
411.0	376.5	.4486
411.5	372.4	.4436
412.0	368.3	.4386
412.5	364.1	.4336
413.0	359.9	.4286
413.5	355.8	.4235
414.0	351.6	.4185
414.5	347.4	.4134
415.0	343.2	.4084
415.5	339.1	.4033
416.0	334.9	.3983
416.5	330.8	.3933
417.0	326.6	.3884
417.5	322.6	.3835
418.0	318.5	.3786
418.5	314.6	.3738
419.0	310.6	.3690
419.5	306.7	.3644
420.0	302.9	.3598
420.5	299.2	.3552
421.0	295.5	.3508
421.5	291.8	.3463
422.0	288.2	.3421
422.5	284.8	.3379
423.0	281.4	.3338
423.5	278.2	.3299
424.0	275.0	.3261
424.5	271.9	.3224
425.0	268.9	.3188
425.5	266.0	.3153
426.0	263.3	.3120
426.5	260.6	.3088
427.0	258.0	.3057
427.5	255.6	.3027
428.0	253.2	.2999
428.5	250.9	.2971
429.0	248.8	.2945
429.5	246.7	.2921
430.0	244.7	.2897
430.5	242.9	.2874

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
431.0	241.1	.2853
431.5	239.4	.2833
432.0	237.8	.2813
432.5	236.3	.2795
433.0	234.8	.2778
433.5	233.5	.2761
434.0	232.2	.2746
434.5	231.0	.2731
435.0	229.8	.2718
435.5	228.7	.2705
436.0	227.7	.2692
436.5	226.8	.2681
437.0	225.9	.2670
437.5	225.0	.2660
438.0	224.2	.2650
438.5	223.5	.2641
439.0	222.8	.2633
439.5	222.1	.2625
440.0	221.5	.2617
440.5	220.9	.2610
441.0	220.4	.2604
441.5	219.8	.2598
442.0	219.4	.2592
442.5	218.9	.2587
443.0	218.5	.2582
443.5	218.1	.2577
444.0	217.8	.2572
444.5	217.4	.2568
[illegible]	217.1	.2565
[illegible]	216.8	.2561
[illegible]	216.5	.2558
446.5	216.2	.2554
447.0	216.0	.2551
447.5	215.8	.2549
448.0	215.5	.2546
448.5	215.3	.2544
449.0	215.2	.2541
449.5	215.0	.2539
450.0	214.8	.2537
450.5	214.7	.2535
451.0	214.5	.2534
451.5	214.4	.2532
452.0	214.2	.2530
452.5	214.1	.2529
453.0	214.0	.2527
453.5	213.9	.2526
454.0	213.8	.2525
454.5	213.7	.2524
455.0	213.6	.2523
455.5	213.5	.2522
456.0	213.4	.2521
456.5	213.4	.2520
457.0	213.3	.2519
457.5	213.2	.2518
458.0	213.2	.2517
458.5	213.1	.2517
459.0	213.0	.2516
459.5	213.0	.2515
460.0	212.9	.2515
460.5	212.9	.2514
461.0	212.8	.2513
461.5	212.8	.2513
[illegible]	212.7	.2512
[illegible]	212.7	.2512
[illegible]	212.7	.2511
463.5	212.6	.2511
464.0	212.6	.2511
464.5	212.6	.2510
465.0	212.5	.2510
465.5	212.5	.2509
466.0	212.5	.2509
466.5	212.4	.2509
467.0	212.4	.2508
467.5	212.4	.2508
468.0	212.4	.2508
468.5	212.3	.2508
469.0	212.3	.2507
469.5	212.3	.2507
470.0	212.3	.2507
470.5	212.3	.2506
471.0	212.2	.2506
471.5	212.2	.2506
472.0	212.2	.2506
472.5	212.2	.2506
473.0	212.2	.2505
473.5	212.1	.2505
474.0	212.1	.2505
474.5	212.1	.2505
475.0	212.1	.2505
475.5	212.1	.2504
476.0	212.1	.2504
476.5	212.0	.2504
477.0	212.0	.2504
477.5	212.0	.2504
478.0	212.0	.2504
478.5	212.0	.2503
479.0	212.0	.2503
479.5	212.0	.2503
480.0	212.0	.2503
480.5	212.0	.2503
481.0	211.9	.2503
481.5	211.9	.2503
482.0	211.9	.2502
482.5	211.9	.2502
483.0	211.9	.2502
483.5	211.9	.2502
484.0	211.9	.2502
484.5	211.9	.2502
485.0	211.9	.2502
485.5	211.9	.2502
486.0	211.8	.2502
486.5	211.8	.2502
487.0	211.8	.2501
487.5	211.8	.2501
488.0	211.8	.2501
488.5	211.8	.2501
489.0	211.8	.2501
489.5	211.8	.2501
490.0	211.8	.2501
490.5	211.8	.2501
491.0	211.8	.2501
491.5	211.8	.2501
492.0	211.8	.2501
492.5	211.8	.2501
493.0	211.8	.2501
493.5	211.7	.2500
494.0	211.7	.2500
494.5	211.7	.2500
495.0	211.7	.2500
495.5	211.7	.2500
496.0	211.7	.2500
496.5	211.7	.2500
497.0	211.7	.2500

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
[illegible]7.5	211.7	.2500
[illegible]98.0	211.7	.2500
498.5	211.7	.2500
499.0	211.7	.2500
499.5	211.7	.2500
500.0	211.7	.2500
500.5	211.7	.2500
501.0	211.7	.2500
501.5	211.7	.2500
502.0	211.7	.2500
502.5	211.7	.2499
503.0	211.7	.2499
503.5	211.7	.2499
504.0	211.7	.2499
504.5	211.7	.2499
505.0	211.7	.2499
505.5	211.6	.2499
506.0	211.6	.2499
506.5	211.6	.2499
507.0	211.6	.2499
507.5	211.6	.2499
508.0	211.6	.2499
508.5	211.6	.2499
509.0	211.6	.2499
509.5	211.6	.2499
510.0	211.6	.2499
510.5	211.6	.2499
511.0	211.6	.2499
511.5	211.6	.2499
512.0	211.6	.2499
512.5	211.6	.2499
[illegible]3.0	211.6	.2499
[illegible].5	211.6	.2499
[illegible].0	211.6	.2499
[illegible]4.5	211.6	.2499
[illegible]15.0	211.6	.2499
515.5	211.6	.2499
516.0	211.6	.2499
516.5	211.6	.2499
517.0	211.6	.2499
517.5	211.6	.2499
518.0	211.6	.2498
518.5	211.6	.2498
519.0	211.6	.2498
519.5	211.6	.2498
520.0	211.6	.2498
520.5	211.6	.2498
521.0	211.6	.2498
521.5	211.6	.2498
522.0	211.6	.2498
522.5	211.6	.2498
523.0	211.6	.2498
523.5	211.6	.2498
524.0	211.6	.2498
524.5	211.6	.2498
525.0	211.6	.2498
525.5	211.6	.2498
526.0	211.6	.2498
526.5	211.6	.2498
527.0	211.6	.2498
527.5	211.6	.2498
528.0	211.6	.2498
528.5	211.6	.2498
529.0	211.6	.2498
[illegible]9.5	211.6	.2498
[illegible]0	211.6	.2498
[illegible]5	211.6	.2498
[illegible].0	211.6	.2498
[illegible]31.5	211.6	.2498
532.0	211.6	.2498
532.5	211.5	.2498

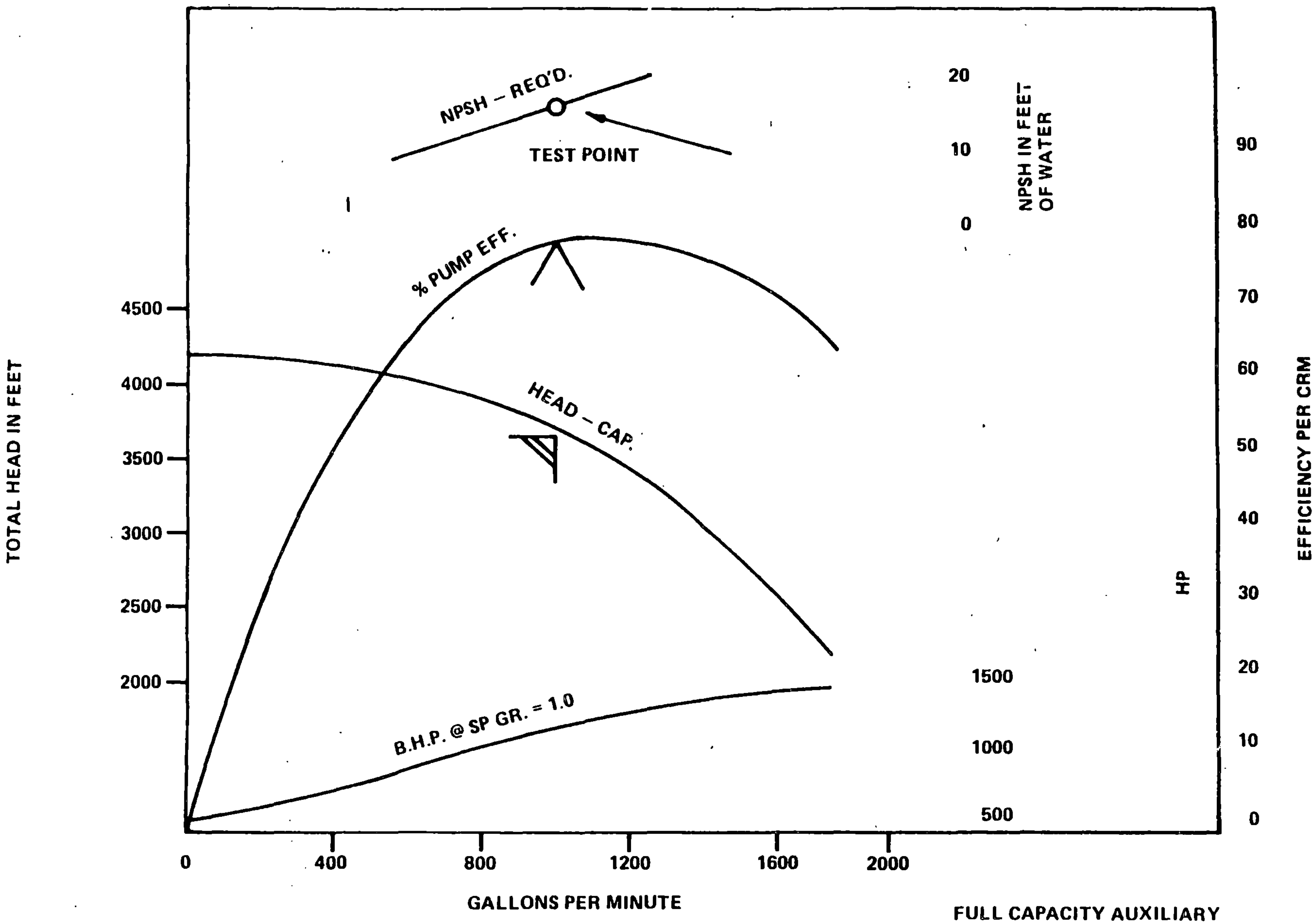
Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
533.0	211.5	.2498
533.5	211.5	.2498
534.0	211.5	.2498
534.5	211.5	.2498
535.0	211.5	.2498
535.5	211.5	.2498
536.0	211.5	.2498
536.5	211.5	.2498
537.0	211.5	.2498
537.5	211.5	.2498
538.0	211.5	.2498
538.5	211.5	.2498
539.0	211.5	.2498
539.5	211.5	.2498
540.0	211.5	.2498
540.5	211.5	.2498
541.0	211.5	.2498
541.5	211.5	.2498
542.0	211.5	.2498
542.5	211.5	.2498
543.0	211.5	.2498
543.5	211.5	.2498
544.0	211.5	.2498
544.5	211.5	.2498
545.0	211.5	.2498
545.5	211.5	.2498
546.0	211.5	.2498
546.5	211.5	.2498
547.0	211.5	.2498
547.5	211.5	.2498
548.0	211.5	.2498
548.5	211.5	.2498
549.0	211.5	.2498
549.5	211.5	.2498
550.0	211.5	.2498
550.5	211.5	.2498
551.0	211.5	.2498
551.5	211.5	.2498
552.0	211.5	.2498
552.5	211.5	.2498
553.0	211.5	.2498
553.5	211.5	.2498
554.0	211.5	.2498
554.5	211.5	.2498
555.0	211.5	.2498
555.5	211.5	.2498
556.0	211.5	.2498
556.5	211.5	.2498
557.0	211.5	.2498
557.5	211.5	.2498
558.0	211.5	.2498
558.5	211.5	.2498
559.0	211.5	.2498
559.5	211.5	.2498
560.0	211.5	.2498
560.5	211.5	.2498
561.0	211.5	.2498
561.5	211.5	.2498
562.0	211.5	.2498
562.5	211.5	.2498
563.0	211.5	.2498
563.5	211.5	.2498
564.0	211.5	.2498
564.5	211.5	.2498
565.0	211.5	.2498
565.5	211.5	.2498
566.0	211.5	.2498
566.5	211.5	.2498

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
[illegible].0	211.5	.2498
567.5	211.5	.2498
568.0	211.5	.2498
568.5	211.5	.2498
569.0	211.5	.2498
569.5	211.5	.2498
570.0	211.5	.2498
570.5	211.5	.2498
571.0	211.5	.2498
571.5	211.5	.2498
572.0	211.5	.2498
572.5	211.5	.2498
573.0	211.5	.2498
573.5	211.5	.2498
574.0	211.5	.2498
574.5	211.5	.2498
575.0	211.5	.2498
575.5	211.5	.2498
576.0	211.5	.2498
576.5	211.5	.2498
577.0	211.5	.2498
577.5	211.5	.2498
578.0	211.5	.2497
578.5	211.5	.2497
579.0	211.5	.2497
579.5	211.5	.2497
580.0	211.5	.2497
[illegible]0.5	211.5	.2497
[illegible].0	211.5	.2497
[illegible]1.5	211.5	.2497
582.0	211.5	.2497
582.5	211.5	.2497
583.0	211.5	.2497
583.5	211.5	.2497
584.0	211.5	.2497
584.5	211.5	.2497
585.0	211.5	.2497
585.5	211.5	.2497
586.0	211.5	.2497
586.5	211.5	.2497
587.0	211.5	.2497
587.5	211.5	.2497
588.0	211.5	.2497
588.5	211.5	.2497
589.0	211.5	.2497
589.5	211.5	.2497
590.0	211.5	.2497
590.5	211.5	.2497
591.0	211.5	.2497
591.5	211.5	.2497
592.0	211.5	.2497
592.5	211.5	.2497
593.0	211.5	.2497
593.5	211.5	.2497
594.0	211.5	.2497
594.5	211.5	.2497
595.0	211.5	.2497
595.5	211.5	.2497
596.0	211.5	.2497
596.5	211.5	.2497
597.0	211.5	.2497
597.5	211.5	.2497
598.0	211.5	.2497
598.5	211.5	.2497
599.0	211.5	.2497
599.5	211.5	.2497
600.0	211.5	.2497



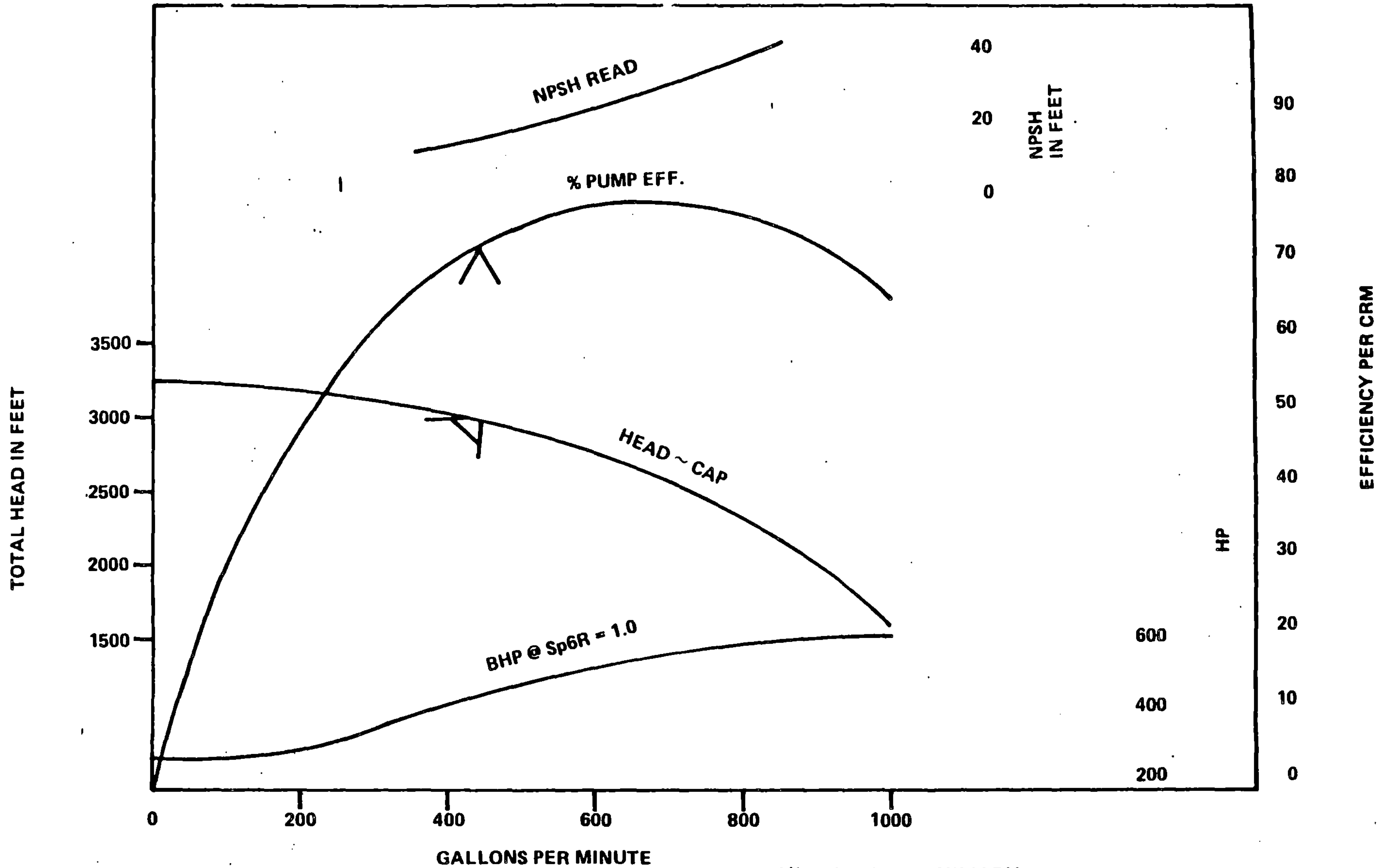
Revision 0
July 22, 1982

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Feedwater Flow to the Faulted Steam Generator
	Updated FSAR DELETE figure ~~Figure 15.4-92~~



Revision 0
July 22, 1982

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Pump Curves for Auxiliary Feed Pump/Steam Driven
	Updated FSAR — Figure 15.4-93



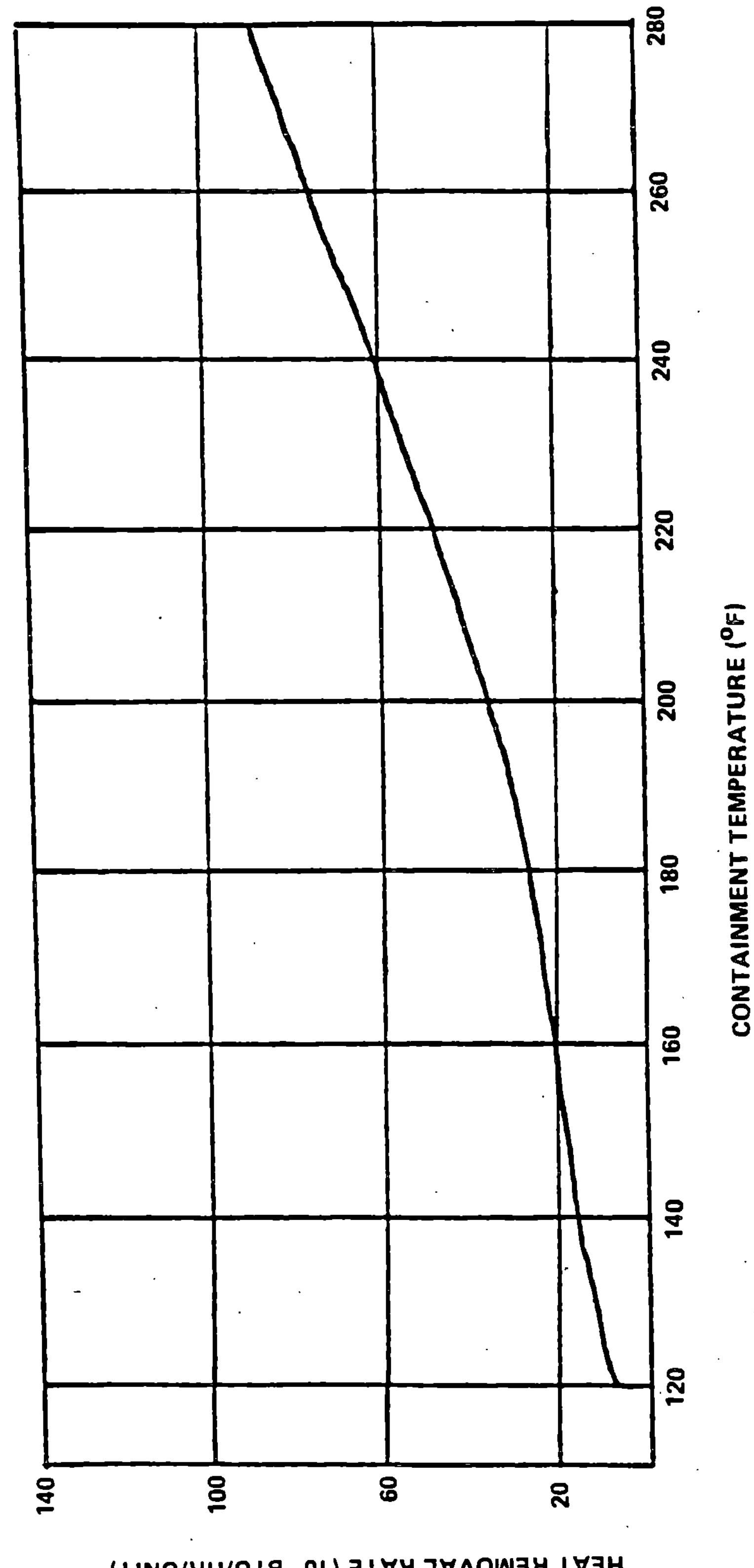
1/2 CAPACITY AUXILIARY BOILER FEED

Revision 0
July 22, 1982

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Pump Curves - Auxiliary Feed Pump/Electrical Driven Updated FSAR — Figure 15.4-94

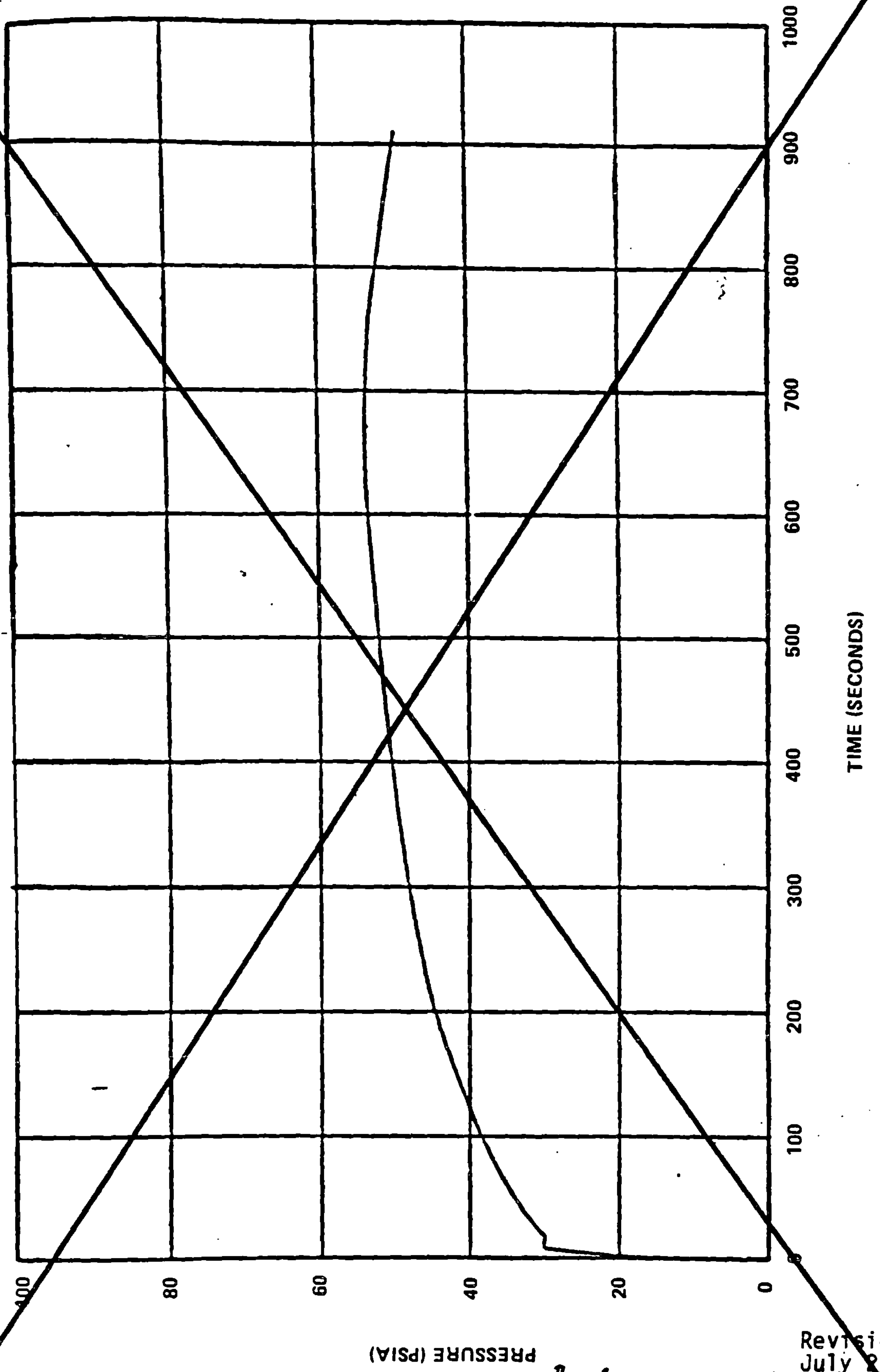
Figure 15.4-95

(Intentionally Deleted)



Revision 0
July 22, 1982

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Fan Cooler Heat Removal Rate	
	Updated FSAR	Figure 15.4-96



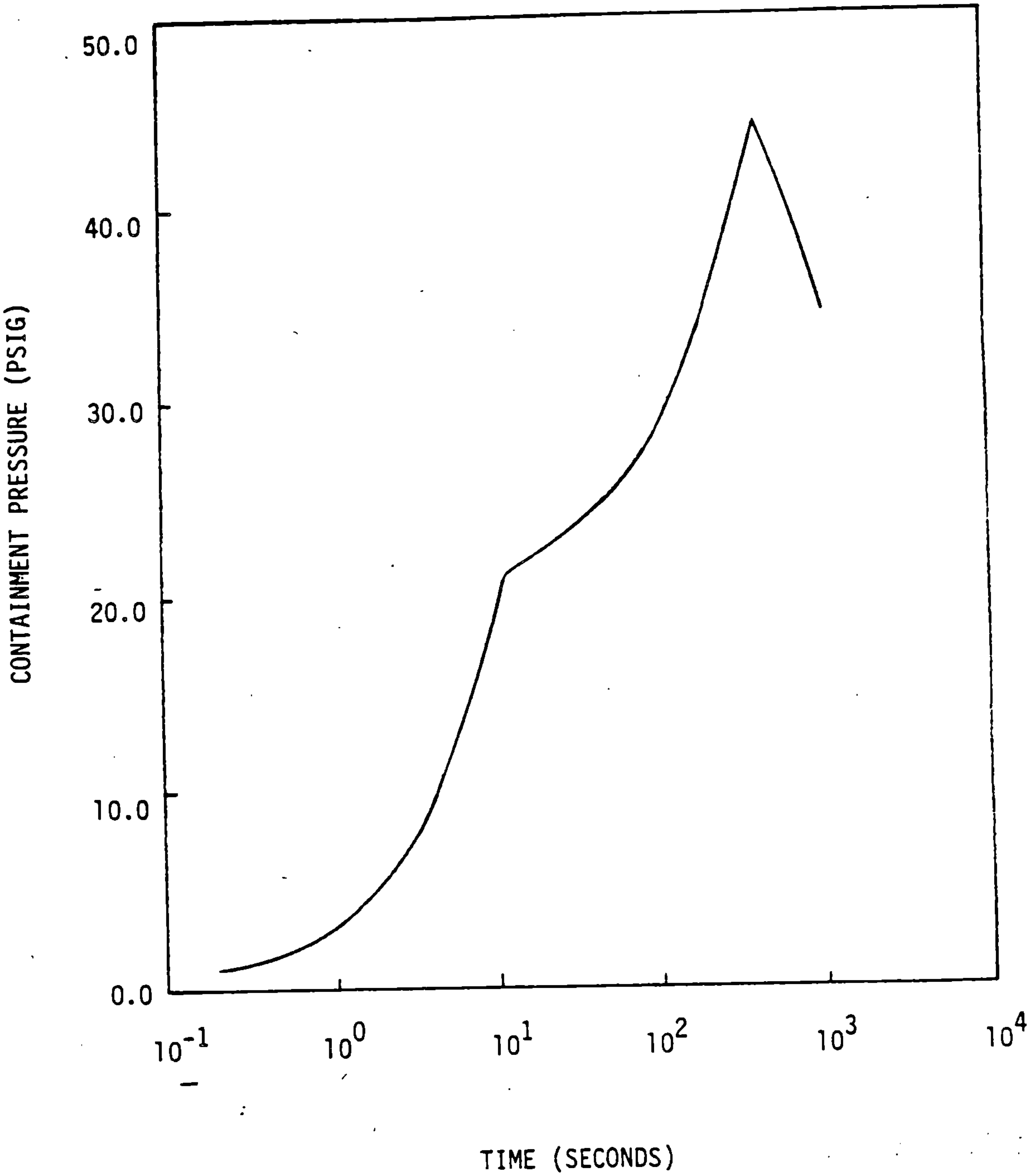
Revision 0
July 22, 1982

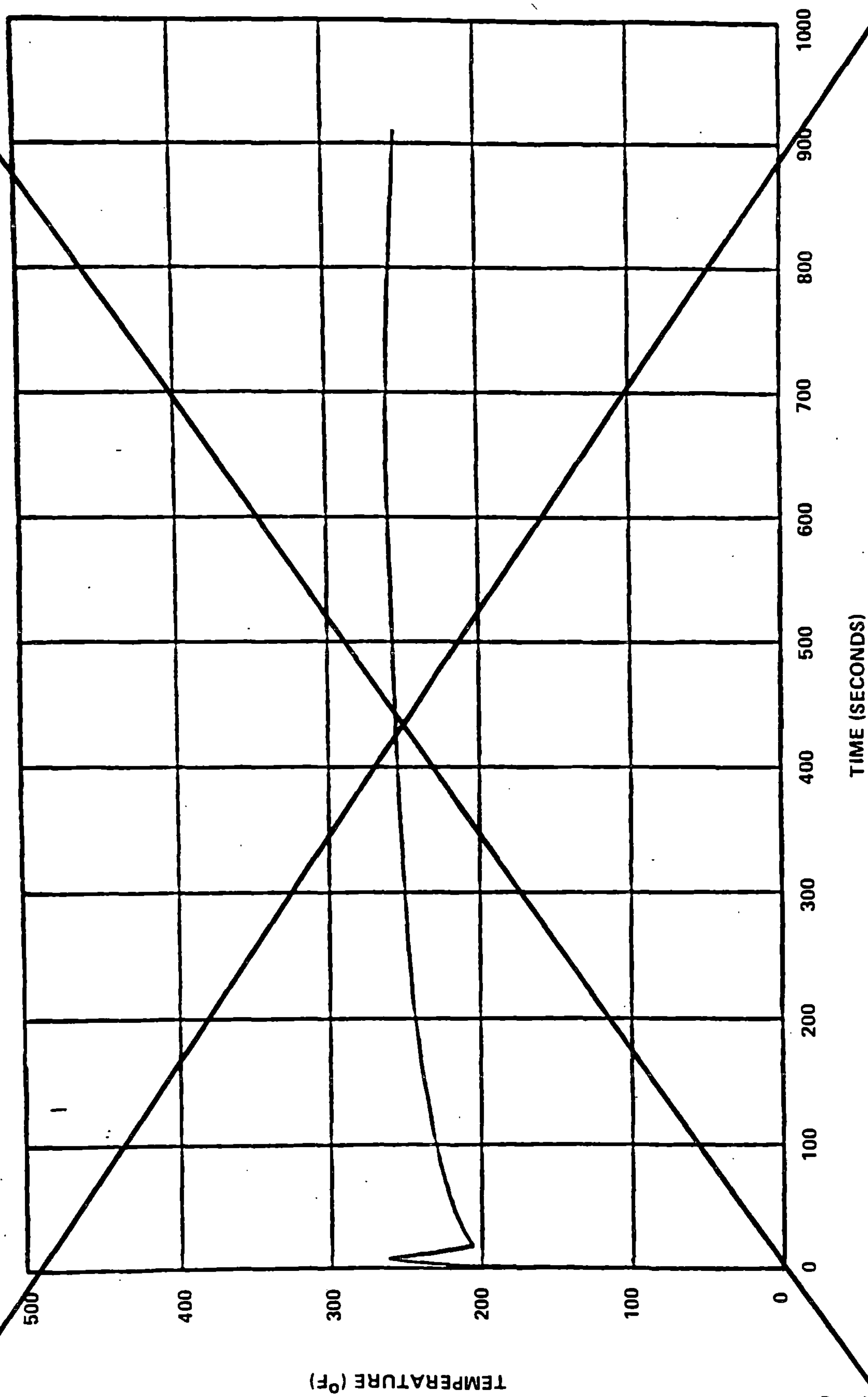
Replace w/ next sheet

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Pressure Transient 1.4 FT2 DE Break 70% Power Minimum Safeguards Westinghouse Mode 1
	Updated FSAR [redacted] ~~Figure 15.4-97~~

FIGURE 15.4-97

1.4ft^2 DER. HOT ZERO POWER





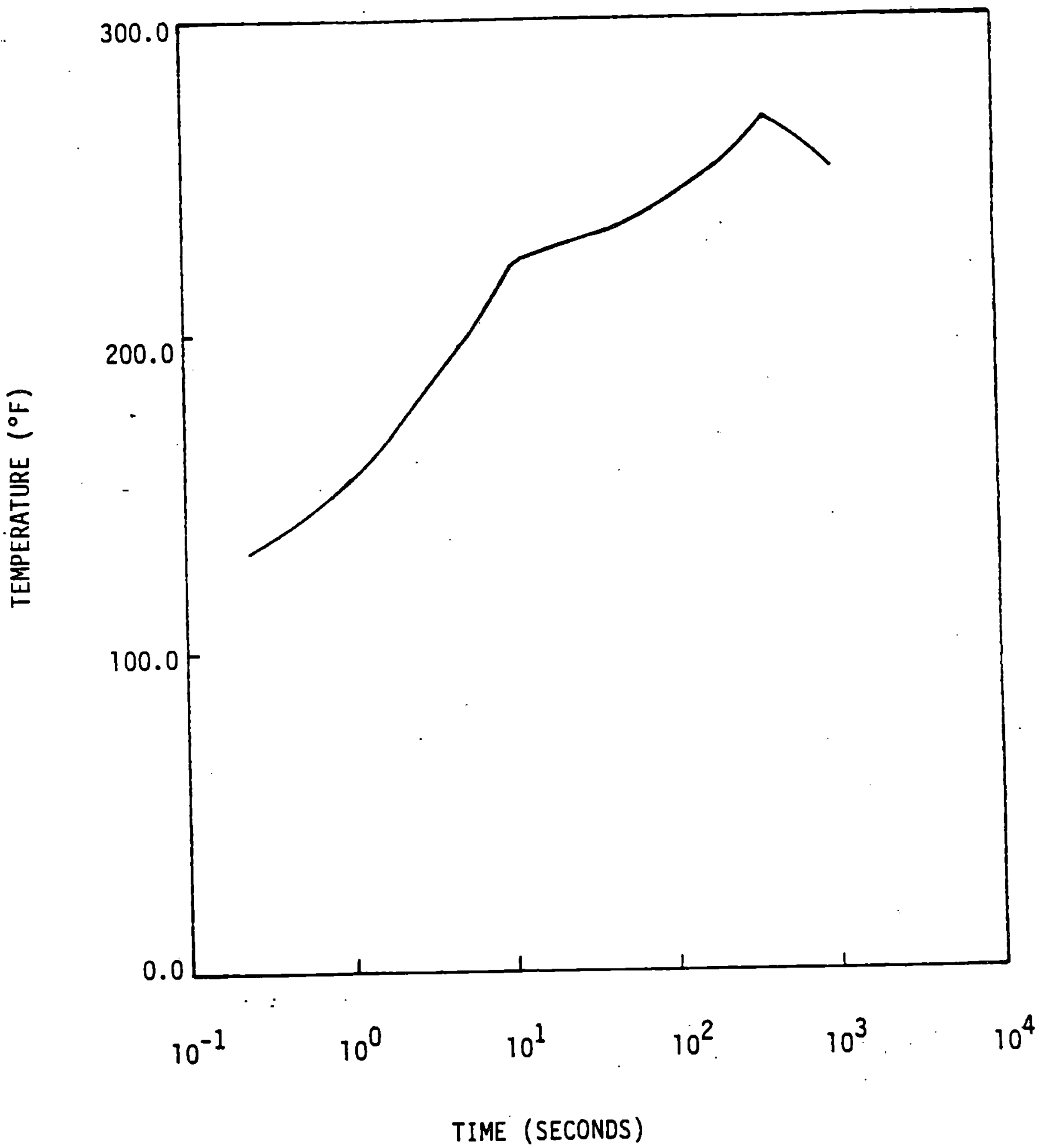
Revision 0
July 22, 1982

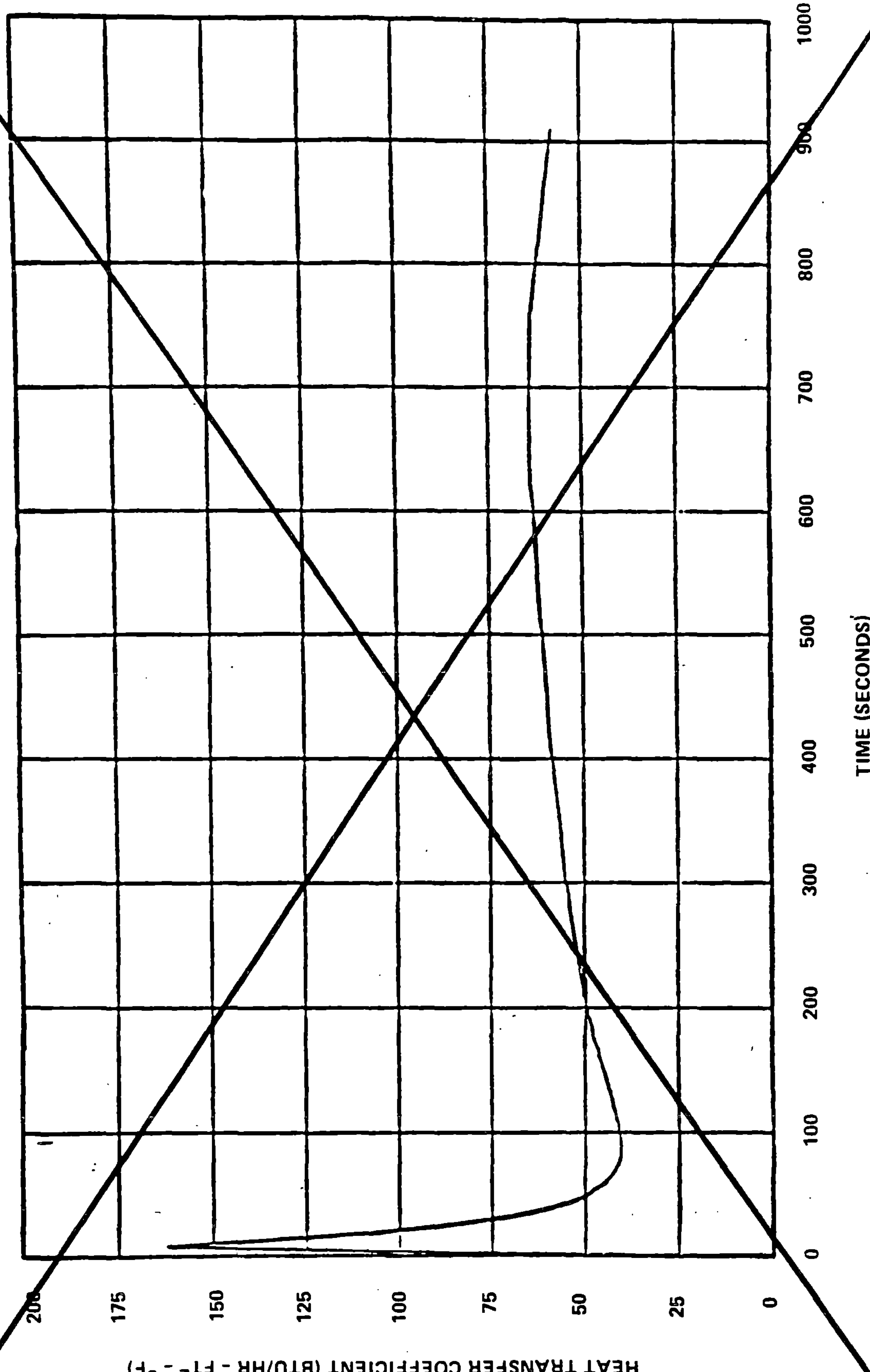
Replace w/ next sheet

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Temperature Transient 1.4 FT2 DE Break 70% Power Minimum Safeguards Westinghouse Mode 1
	Updated FSAR — Figure 15.4-98

FIGURE 15.4-98

1.4 ft^2 DER, HOT ZERO POWER





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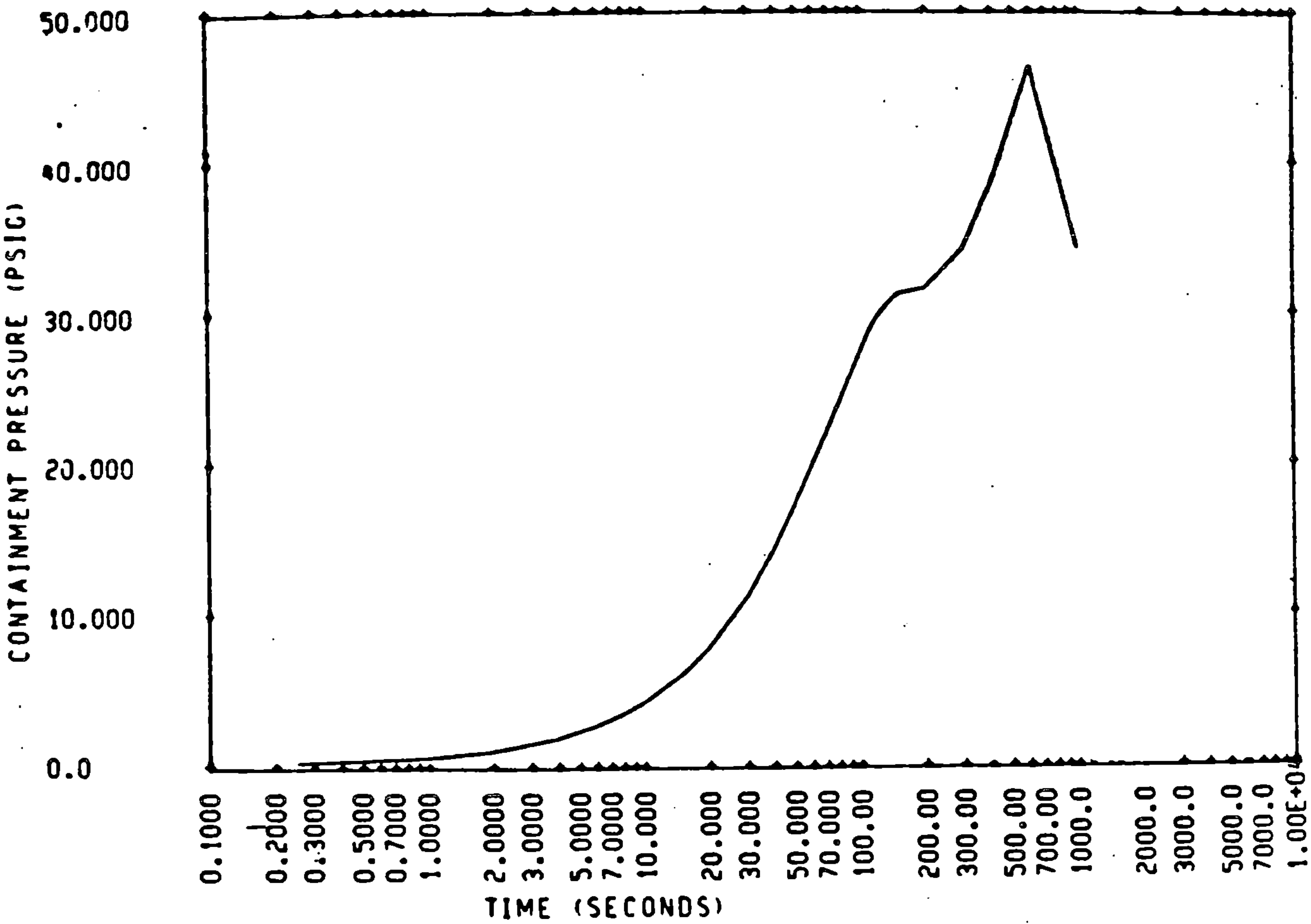
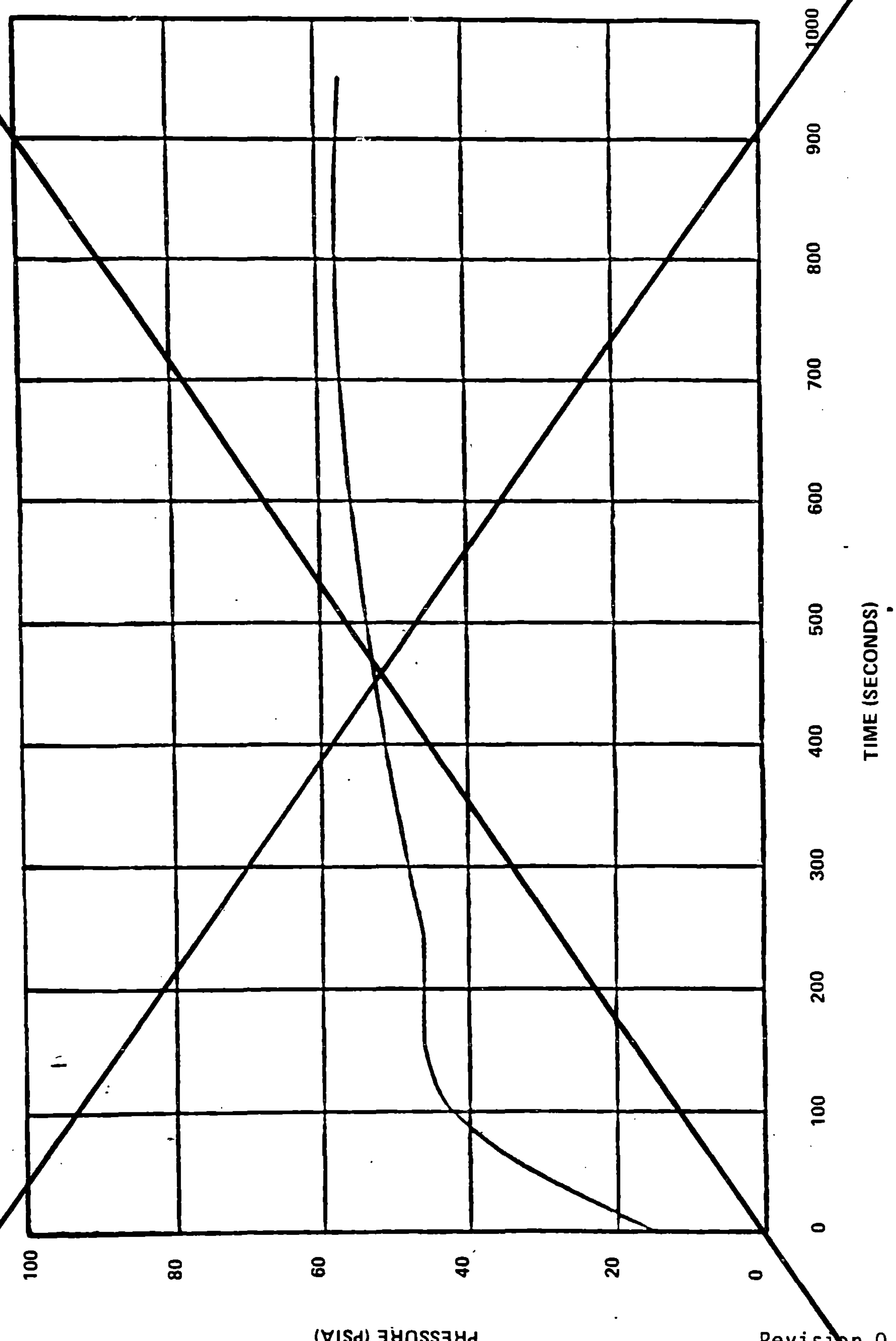
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Heat Transfer Coefficient 1.4 FT2 DE Break 70% Power Minimum Safeguards Westinghouse Mode 1
	Updated FSAR — Figure 15.4-99

FIGURE 15.4-99

SPLIT BREAK, 30 PERCENT POWER





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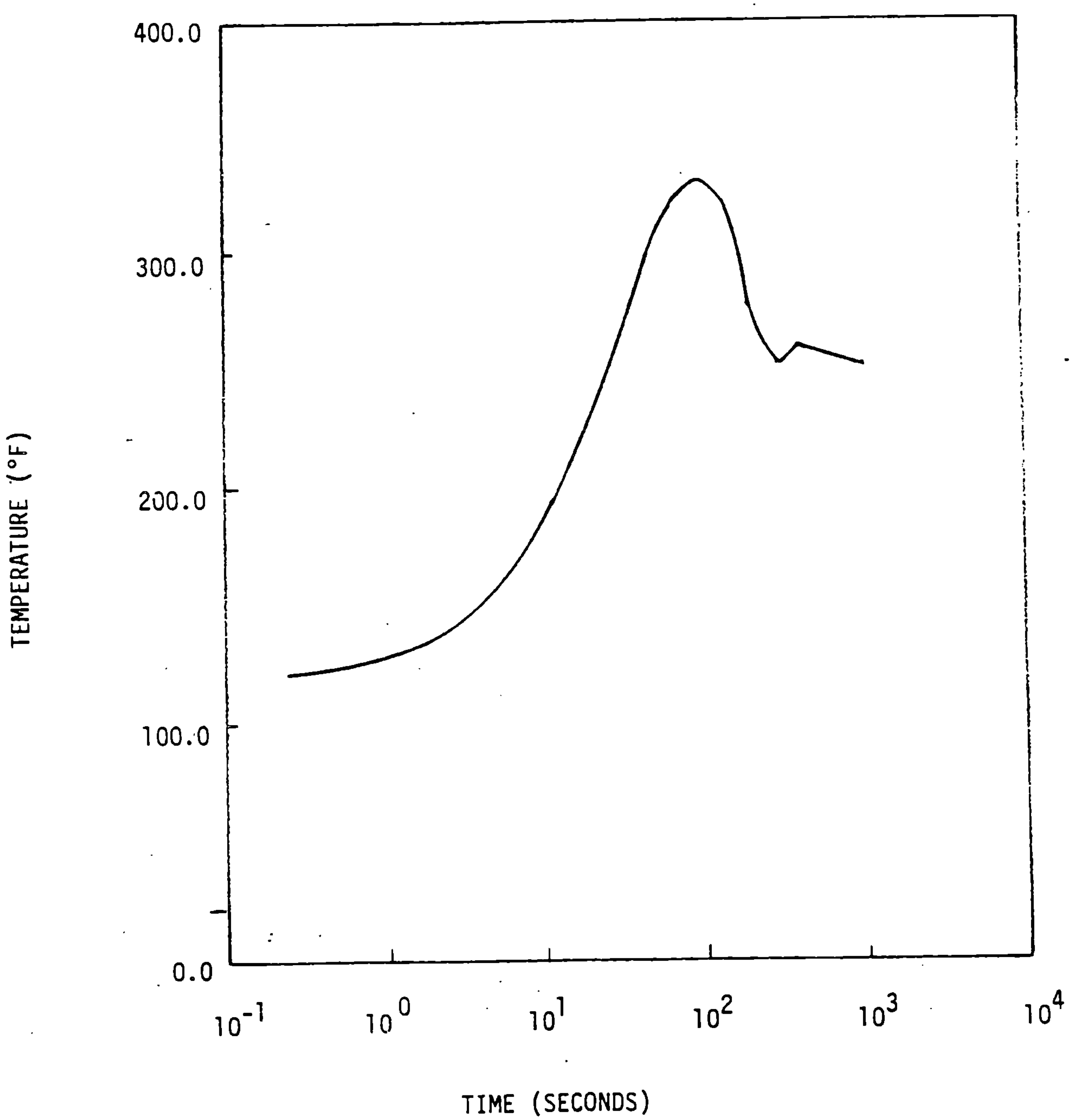
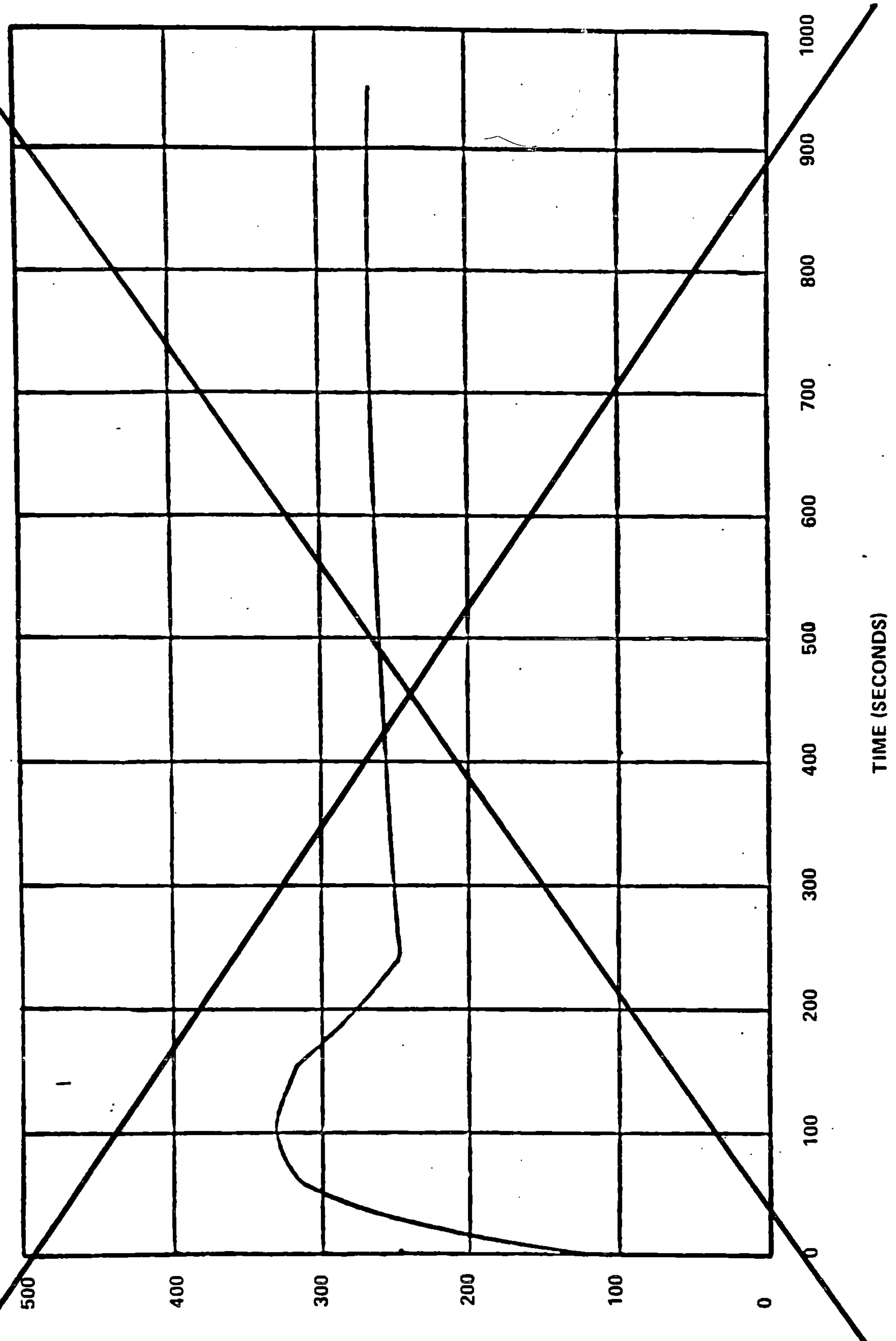
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Pressure Transient 0.860 FT2 Split Break 102% Power Minimum Safeguards Westinghouse Mode 1
	Updated FSAR — Figure 15.4-100

FIGURE 15.4-100

SPLIT BREAK, 30 PERCENT POWER





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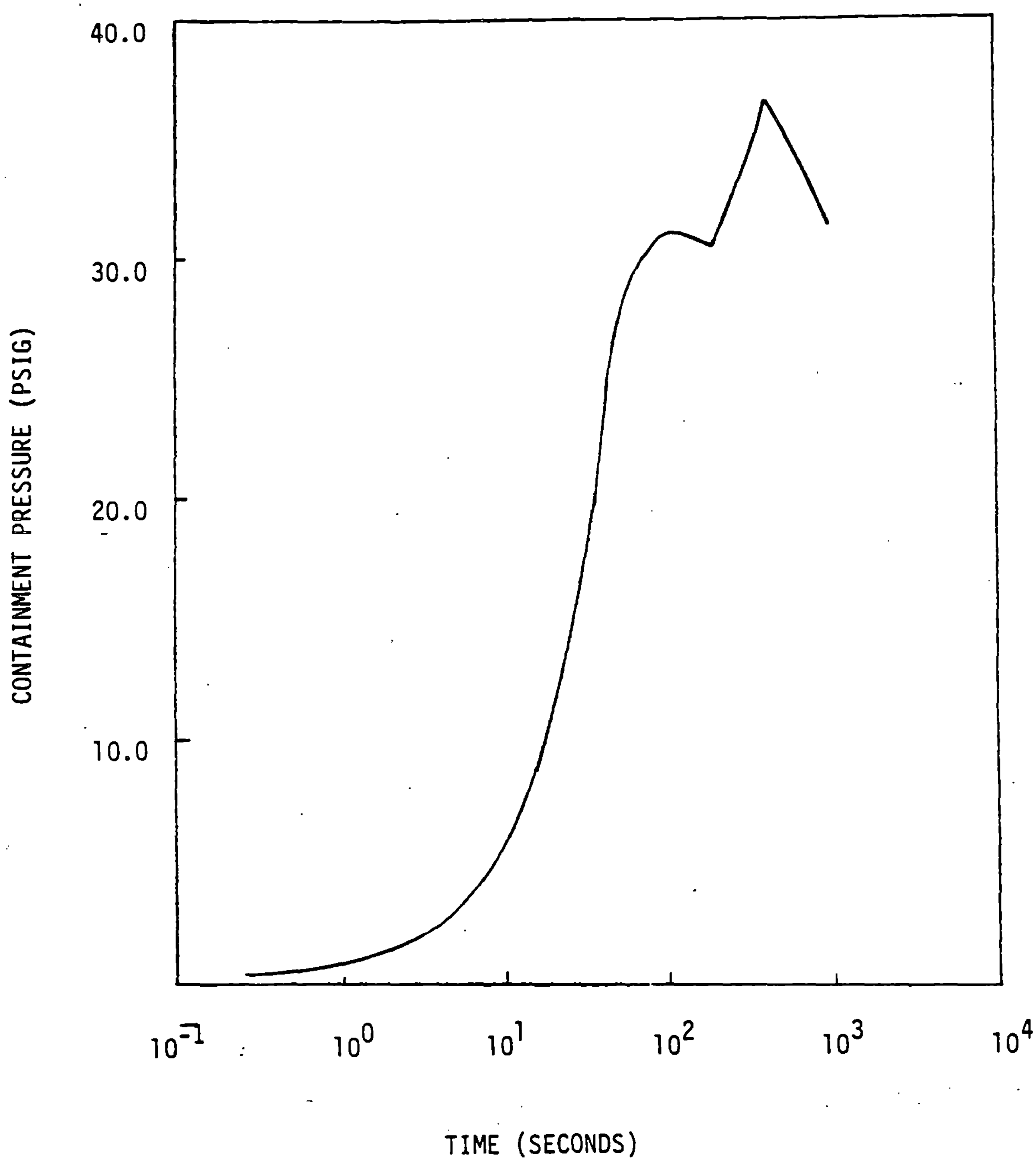
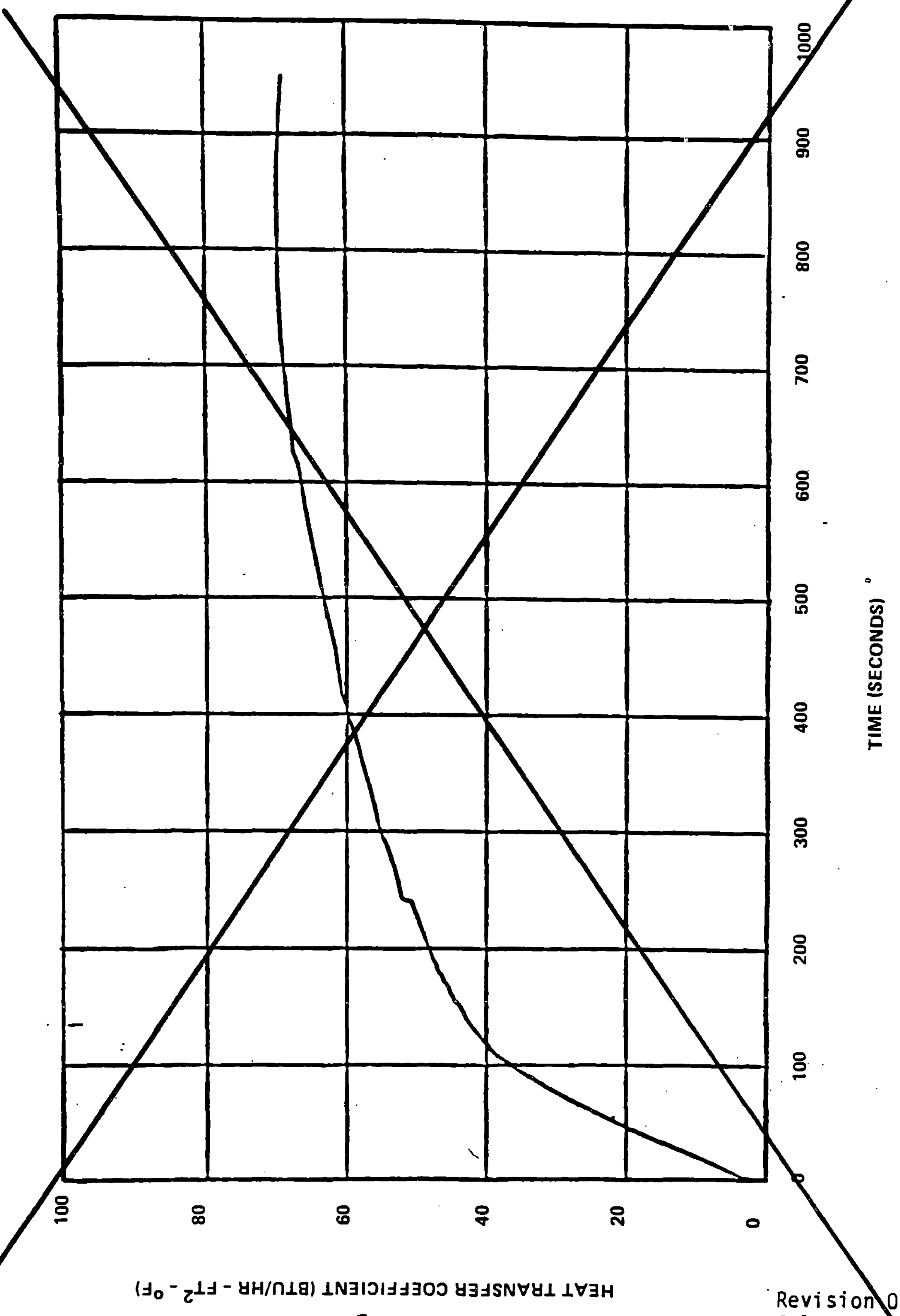
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Temperature Transient 0.860 FT2 Split Break 102% Power Minimum Safeguards Westinghouse Mode 1
	Updated FSAR — Figure 15.4-101

FIGURE 15.4-101

0.6 DER BREAK, HOT FULL POWER

W/O ENTRAINMENT





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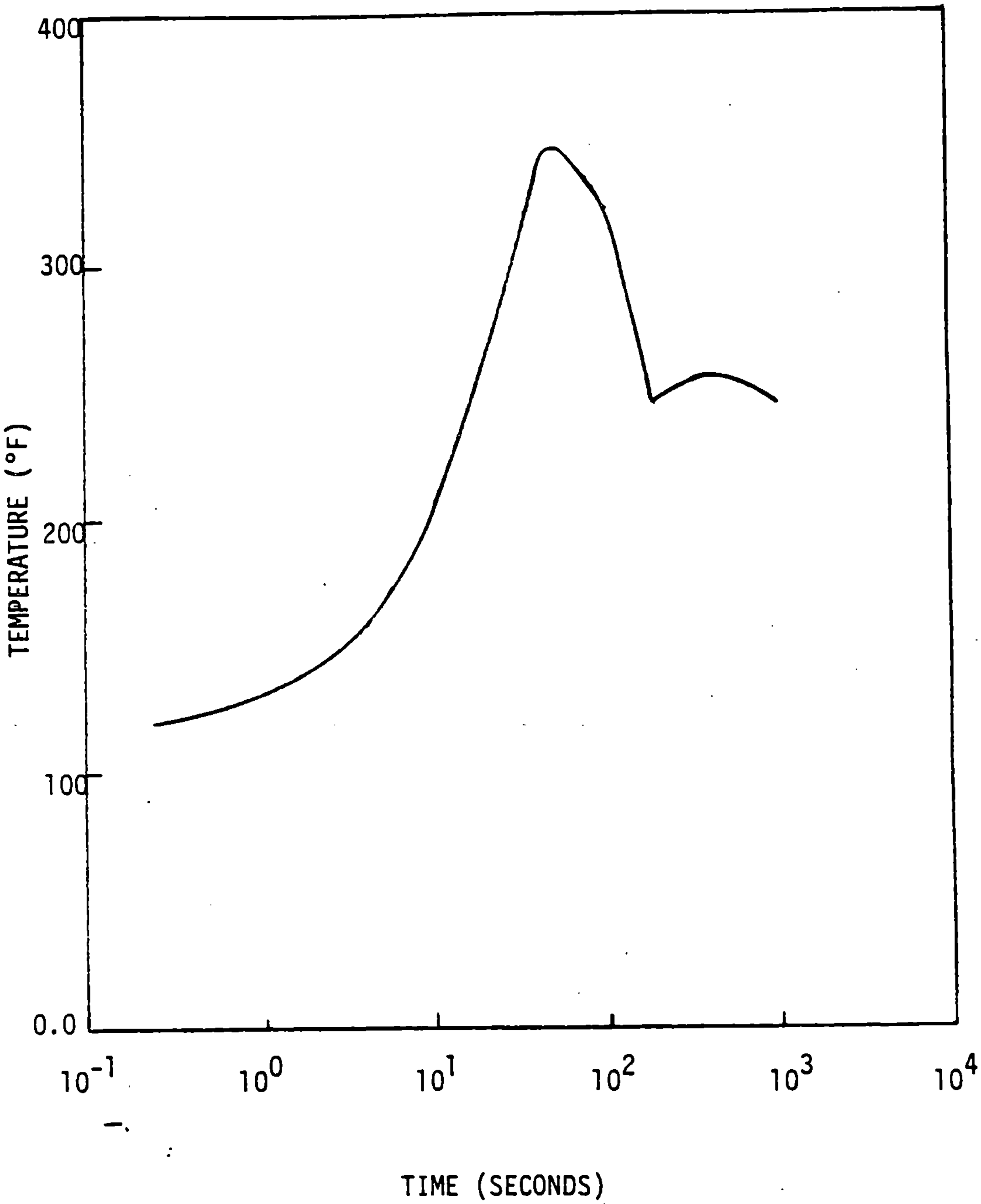
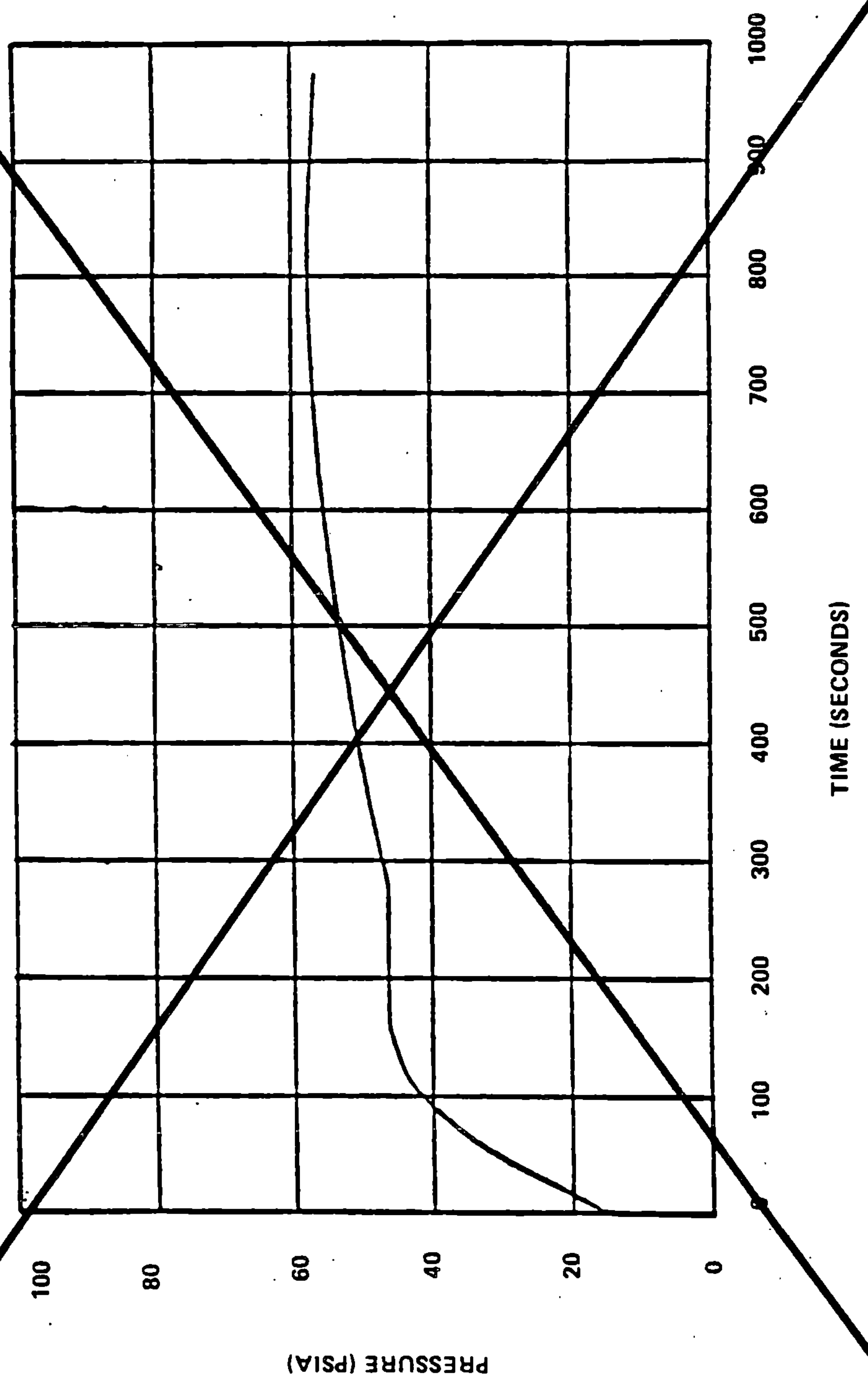
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Heat Transfer Coefficient 0.860 FT2 Split Break 102% Power Minimum Safeguards Westinghouse Mode 1
	Updated FSAR Figure 15.4-102

FIGURE 15.4-102

0.6 DER BREAK, HOT FULL POWER
W/O ENTRAINMENT





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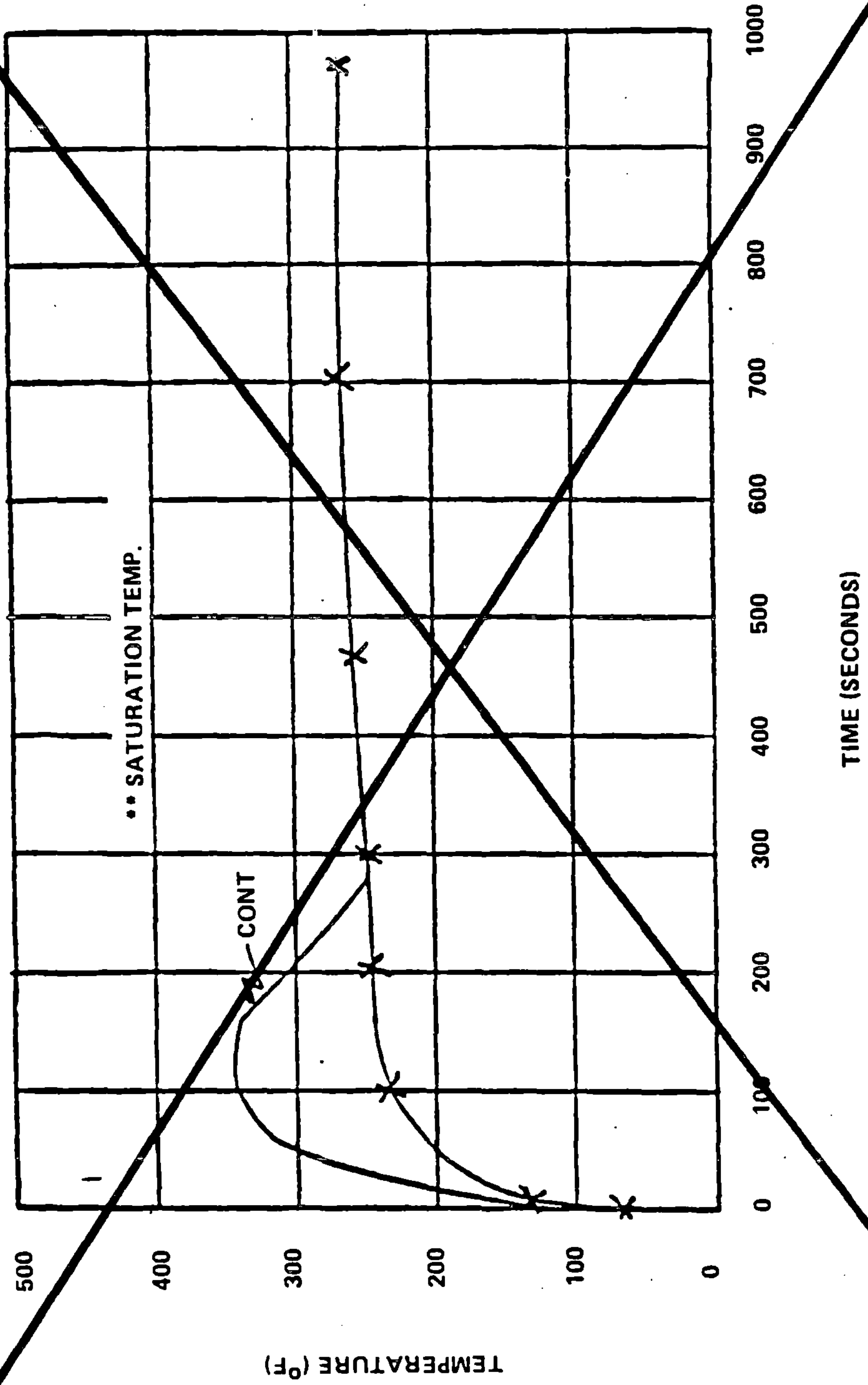
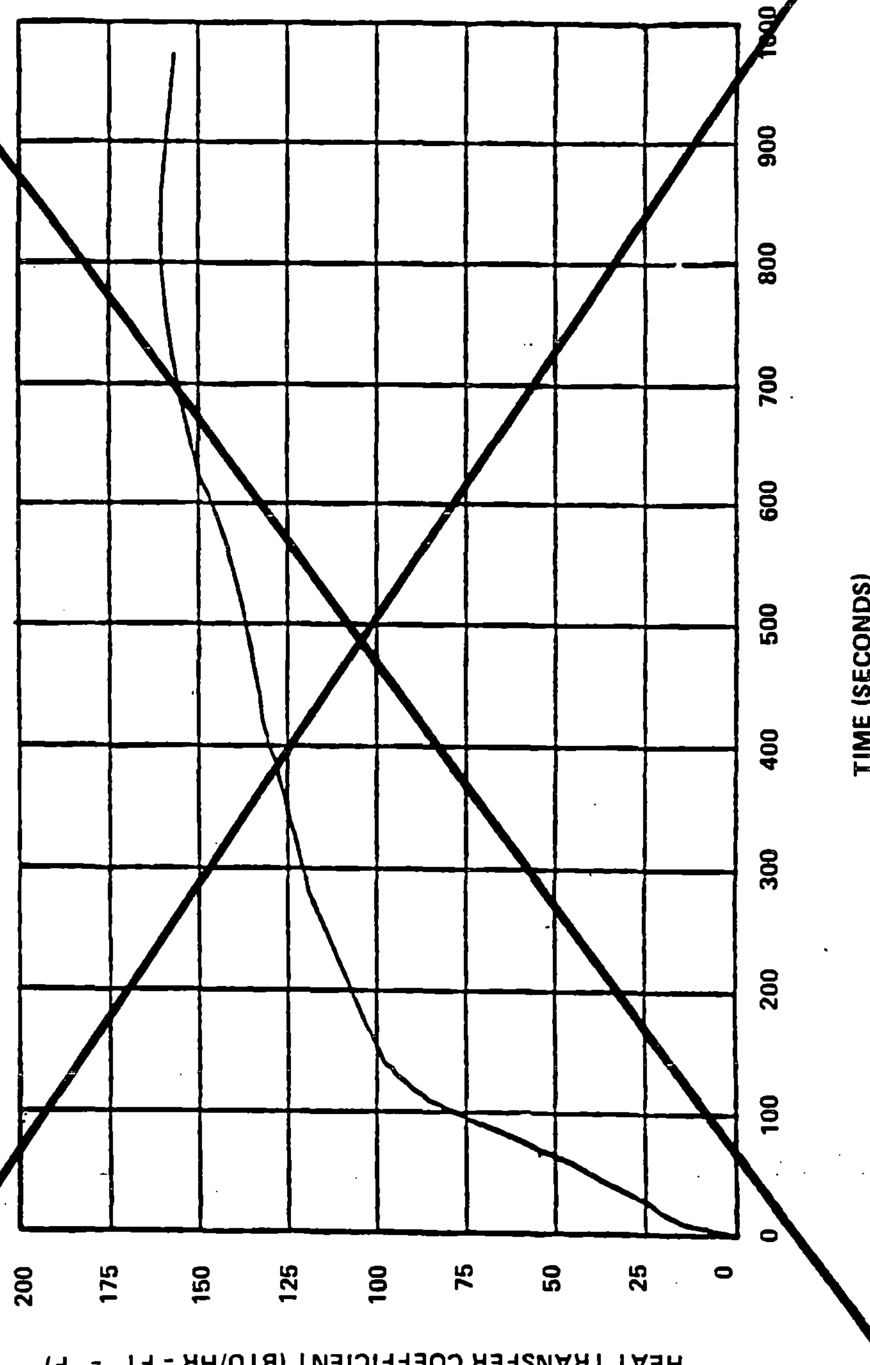
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Pressure Transient for 0.860 FT2 Split Break at 102% Power with Minimum Safeguards (NRC Model)



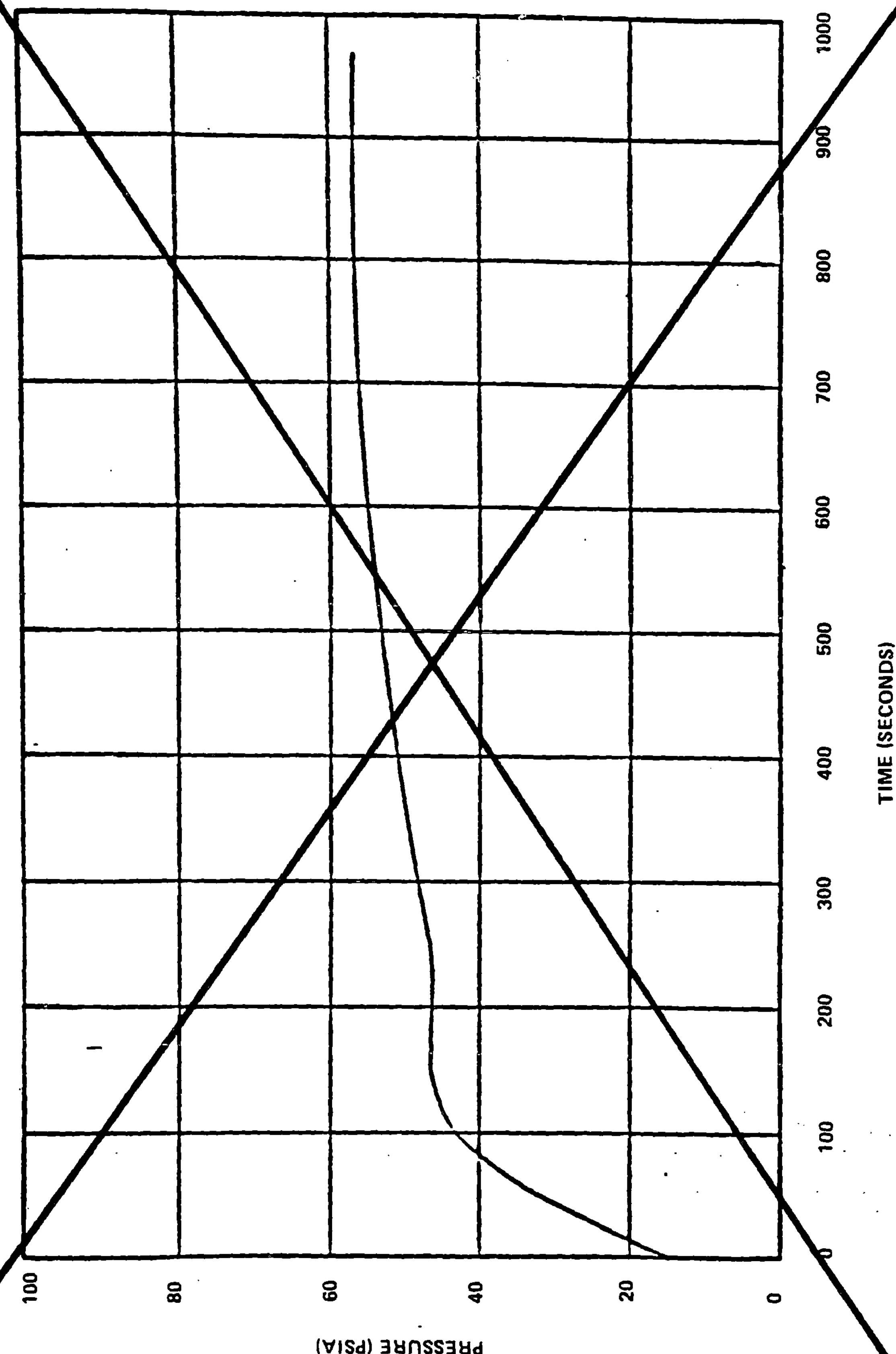
Revision 0
July 22, 1982

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Temperature for 0.860 FT2 Split Break at 102% Power with Minimum Safeguards (NRC Model)
	Updated FSAR DELETE ~~Figure 15.4-104~~



Revision 0
July 22, 1982

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Heat Coefficient for 0.860 FT2 Split Break at 102% Power with Minimum Safeguards (NRC Model)
	Updated FSAR DELETE Figure 15.4-105



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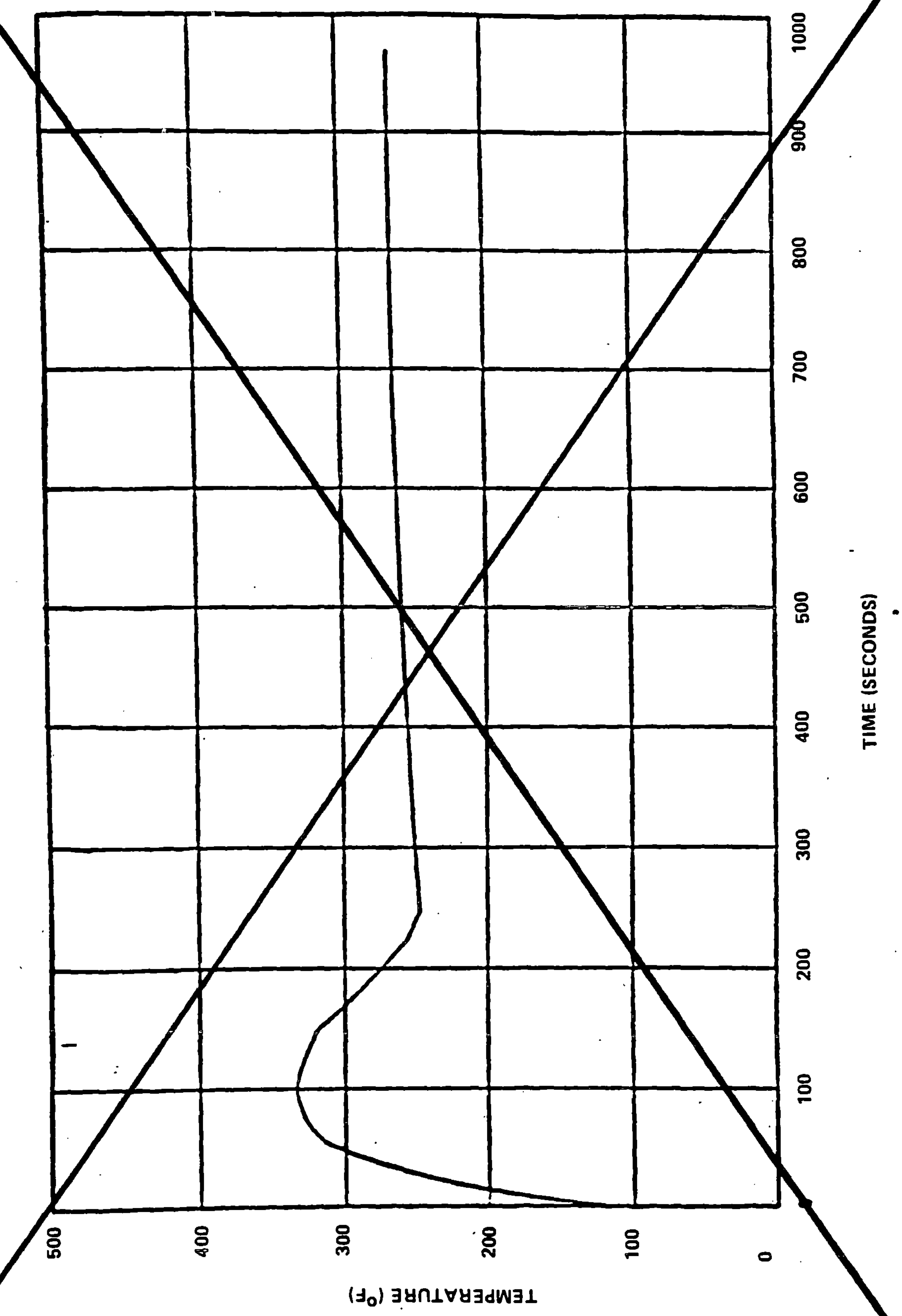
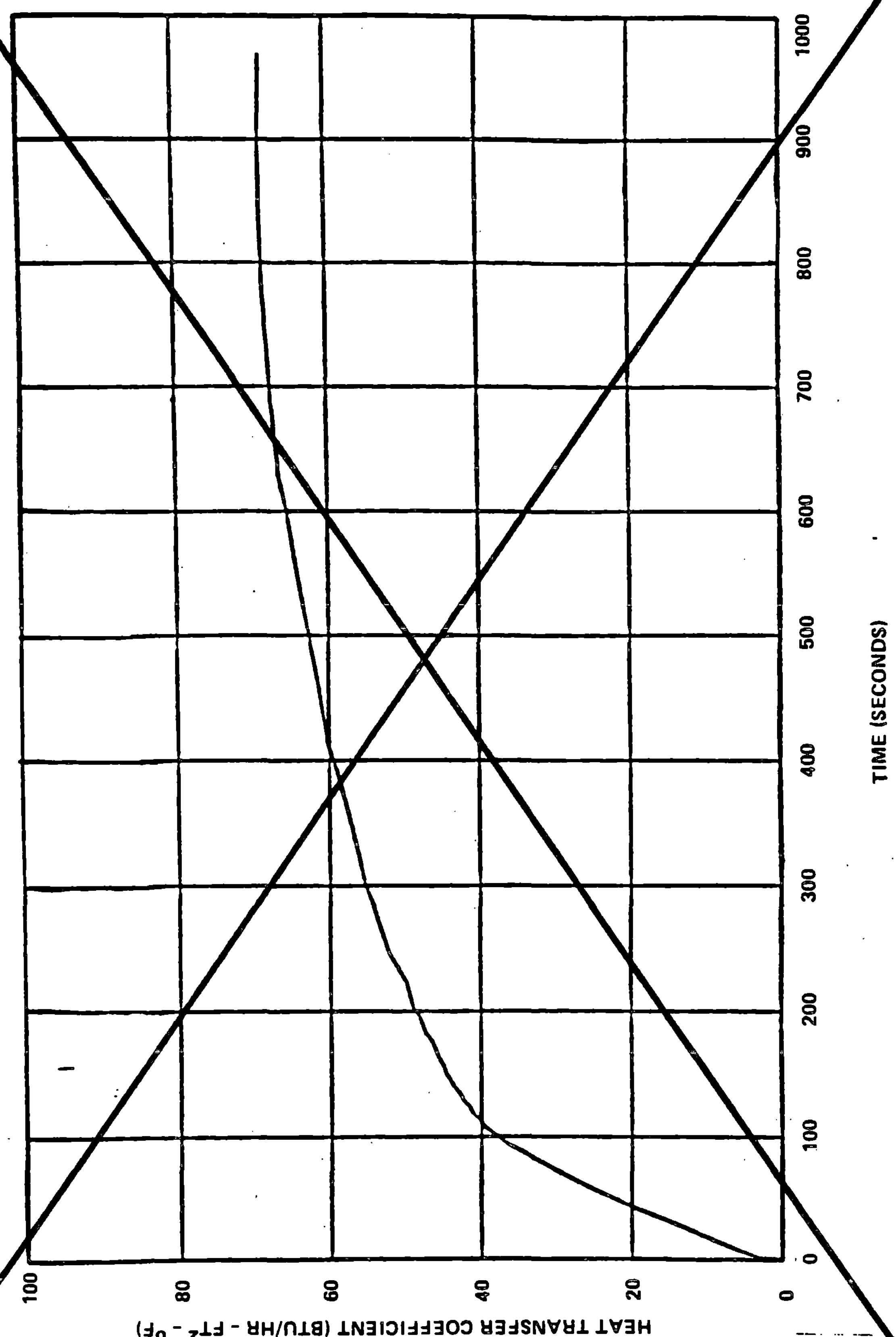
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Pressure Transient 0.908 FT2 Split Break 70% Power Minimum Safeguards Westinghouse Mode 1
	Updated FSAR DELETE ~~Figure 15.4-106~~



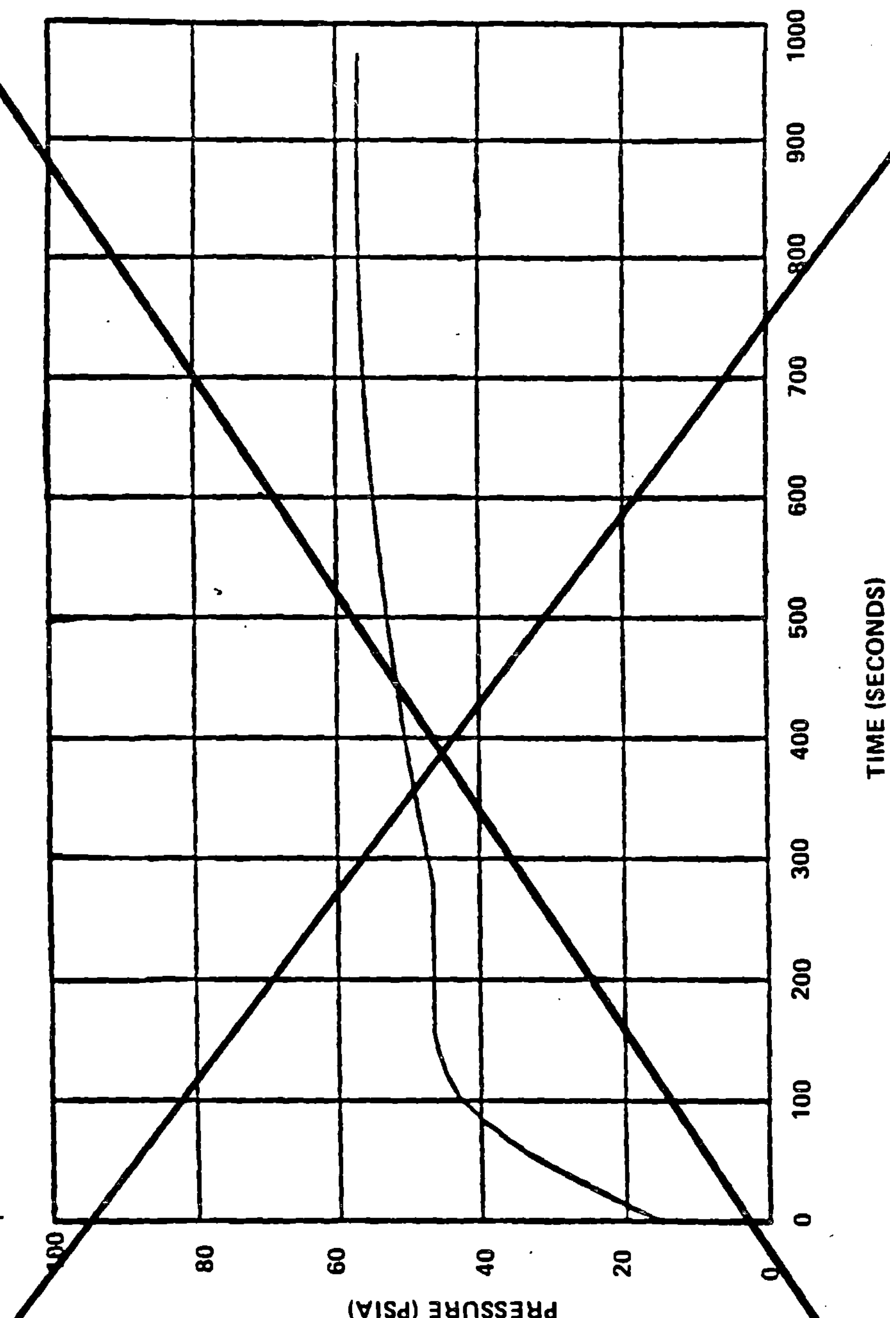
Revision 0
July 22, 1982

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Temperature Transient 0.908 FT2 Split Break 70% Power Minimum Safeguards Westinghouse Mode 1
	Updated FSAR DELETE ~~Figure 15.4-107~~



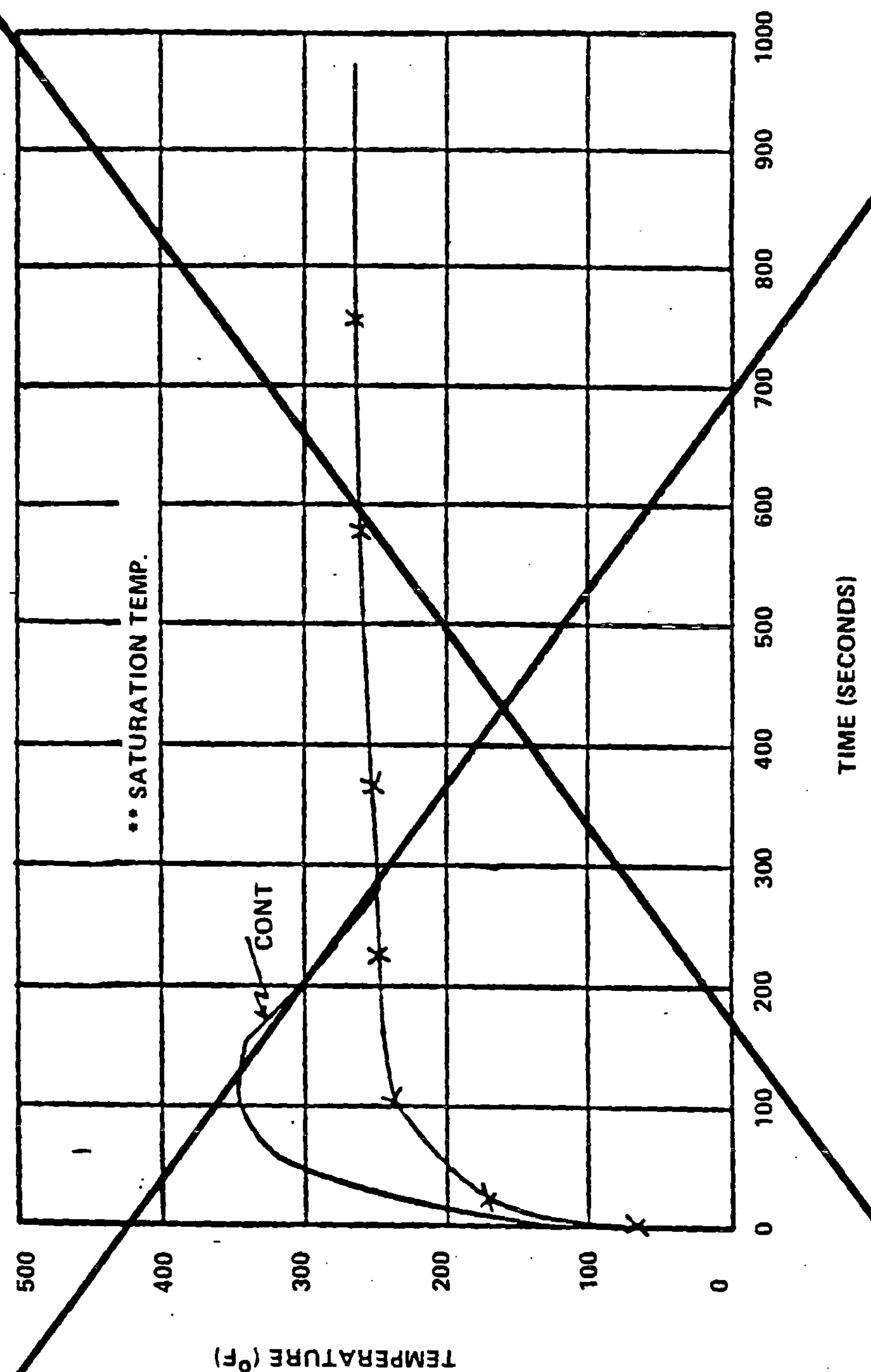
Revision 0
July 22, 1982

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Heat Transfer Coefficient 0.908 FT2 Split Break 70% Power Minimum Safeguards Westinghouse Mode 1
	Updated FSAR DELETE ~~Figure 15.4-108~~



Revision 0
July 22, 1982

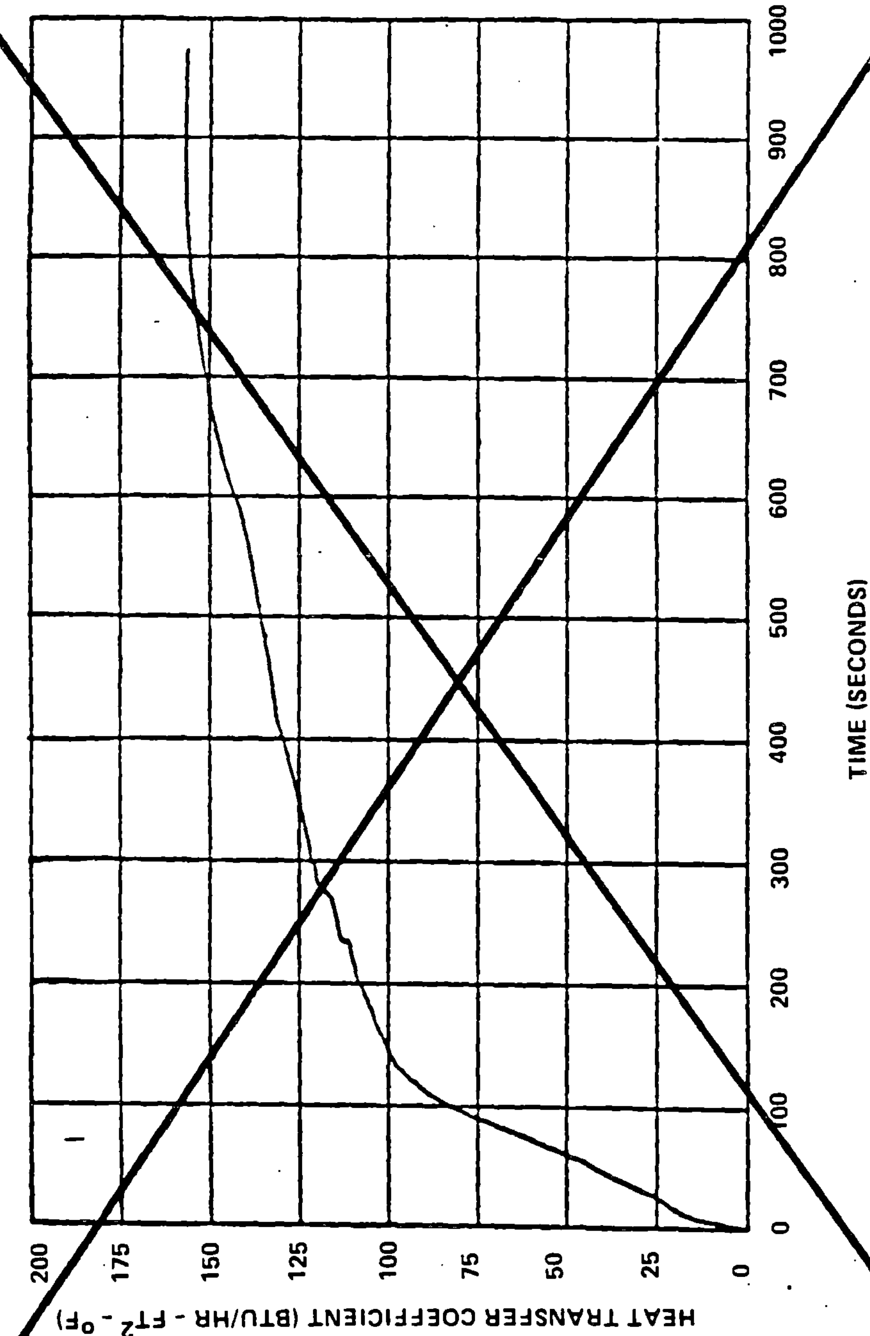
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Pressure Transient for 0.908 FT2 Split Break at 70% Power with Minimum Safeguards (NRC Model)
	Updated FSAR DELETE ~~Figure 15.4-100~~



Revision 0
July 22, 1982

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Temperature Transient for 0.908 FT2 Split Break at 70% Power with Minimum Safeguards (NRC Model)

Updated FSAR



Revision 0
July 22, 1982

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Heat Transfer Coefficient for 0.908 FT2 Split Break at 70% Power with Minimum Safeguards (NRC Model)

LCR # 85-07

ATTACHMENT B

REVISED SALEM FSAR SECTION 15.2.13
ACCIDENTAL DEPRESSURIZATION OF THE
MAIN STEAM SYSTEM

15.2.12.3 Results

Figure 15.2-38 illustrates the flux transient following the accident. Reactor trip on overtemperature ΔT occurs as shown in Figure 15.2-38. The pressure decay transient following the accident is given in Figure 15.2-39. The resulting DNBR never goes below 1.30 as shown in Figure 15.2-40.

15.2.12.4 Conclusions

The pressurizer low pressure and the overtemperature ΔT Reactor Protection System signals provide adequate protection against this accident, and the minimum DNBR remains in excess of 1.30.

15.2.13 ACCIDENTAL DEPRESSURIZATION OF THE MAIN STEAM SYSTEM

15.2.13.1 Identification of Causes and Accident Description

The most severe core conditions resulting from an accidental depressurization of the Main Steam System are associated with an inadvertent opening of a single steam dump, relief or safety valve. The analyses performed assuming a rupture of a main steam pipe are given in Section 15.4.3.

The steam release as a consequence of this accident results in an initial increase in steam flow which decreases during the accident as the steam pressure falls. The energy removal from the Reactor Coolant System causes a reduction of coolant temperature and pressure. In the presence of a negative moderator temperature coefficient, the cooldown results in a reduction of core shutdown margin.

The analysis is performed to demonstrate that the following criterion is satisfied: Assuming a stuck rod cluster control assembly and a single failure in the Engineered Safety Features there will be no return to

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The analysis is performed to demonstrate that the following criterion is satisfied: Assuming a stuck rod cluster control assembly, with or without offsite power, and assuming a single failure in the Engineered Safety Features there will be no consequential fuel damage after reactor trip for a steam release equivalent to the spurious opening, with failure to close, of the largest of any single steam dump, relief or safety valve. This criterion is satisfied by verifying the DNB design basis is met.

The following systems provide the necessary protection against an accidental depressurization of the Main Steam System:

1. Safety injection System actuation from any of the following:

    a. Two out of three channels of low pressurizer pressure,

    b. High differential pressure signals between steam lines.

2. The overpower reactor trips (neutron flux and ΔT) and the reactor trip occurring in conjunction with receipt of the safety injection signal.

3. Redundant isolation of the main feedwater lines: Sustained high feedwater flow would cause additional cooldown. Therefore, in addition to the normal control action which will close the main feedwater valves following reactor trip, a safety injection signal will rapidly close all feedwater control valves, trip the main feedwater pumps, and close the back up feedwater isolation valves.

15.2.13.2 METHOD OF ANALYSIS

The following analyses of a secondary system steam release are performed for this section.

1. A full plant digital computer simulation, LOFTRAN (Ref. 4), is used to determine Reactor Coolant System temperature and pressure during cooldown.

2. An analysis to determine that there is no consequential fuel damage.

The following conditions are assumed to exist at the time of a secondary system steam release:

1. End of life shutdown margin at no load, equilibrium xenon conditions, and with the most reactive assembly stuck in its fully withdrawn position. Operation of rod cluster control assembly banks during core burnup is restricted in such a way that addition of positive reactivity in a secondary system break accident will not lead to a more adverse condition than the case analyzed.

2. A negative moderator coefficient corresponding to the end of life rodded core with the most reactive rod cluster control assembly in the fully withdrawn position. The variation of the coefficient with temperature and pressure is included. The k_{eff} versus temperature at 1000 psi corresponding to the negative moderator temperature coefficient used plus the Doppler temperature effect is shown in Figure 15.2-41.

3. Minimum capability for injection of high concentration boric acid solution corresponding to the most restrictive single failure in the Safety Injection System. The injection curve used is shown in Figure 15.2-42. This corresponds to the flow delivered by one charging pump delivering its full contents to the cold leg header. No credit has been taken for the low concentration boric acid which must be swept from the safety injection lines downstream of the Refueling Water Storage Tank (RWST) prior to the delivery of boric acid (2,000 ppm) to the reactor coolant loops.

4. The case studied is an initial total steam flow of 228 lbs/second at 1015 psia from one steam generator with offsite power available. This is the maximum capacity of any single steam dump or safety valve. Initial hot shutdown conditions at time zero are assumed since this represents the most pessimistic initial condition.

   Should the reactor be just critical or operating at power at the time of a steam release, the reactor will be tripped by the normal overpower protection signals when power level reaches a trip point. Following a trip at power the Reactor Coolant System contains more stored energy than at no load, the average coolant temperature is higher than at no load and there is appreciable energy stored in the fuel.

   Thus, the additional stored energy is removed via the cooldown caused by the steam line break before the no load conditions of Reactor Coolant System temperature and shutdown margin assumed in the analyses are reached. After the additional stored energy has been removed, the cooldown and reactivity insertions proceed in the same manner as in the analysis which assumes no load condition at time zero. However, since the initial steam generator water inventory is greatest at no load, the magnitude and duration of the Reactor Coolant System cooldown are less for steam line breaks occurring at power.

5. In computing the steam flow the Moody Curve for fl/D = 0 is used.

6. Perfect moisture separation in the steam generator is assumed.

15.2.13.3 RESULTS

The results presented are a conservative indication of the events which would occur assuming a secondary system steam release since it is postulated that all of the conditions described above occur simultaneously.

Figure 15.2-43 shows the transient arising as the result of a steam release having an initial steam flow of 228 lbs/second at 1015 psia with steam release from one safety valve. The assumed steam release is typical of the capacity of any single steam dump or safety valve. In this case safety injection is initiated automatically by low pressurizer pressure. Operation of one centrifugal charging pump is considered. Boron solution at 2,000 ppm enters the Reactor Coolant System providing sufficient negative reactivity to assure no fuel damage. A DNB analysis was performed for this case and the minimum DNBR was above the limit value of 1.3. The reactivity transient for the case shown in Figure 15.2-43 is more severe than that of a failed steam generator safety or relief valve which is terminated by steam line differential pressure, or a failed condenser dump valve which is terminated by low pressurizer pressure. The transient is quite conservative with respect to cooldown, since no credit is taken for the energy stored in the system metal other than that of the fuel elements or the energy stored in the other steam generators. Since the transient occurs over a period of about ten minutes, the neglected stored energy is likely to have a significant effect in slowing the cooldown.

15.2.13.4 CONCLUSIONS

The analysis has shown that the criteria stated earlier in this section is satisfied since a DNBR less than 1.30 does not occur.

Coolant System providing sufficient negative reactivity to maintain the reactor well below criticality. The reactivity transient for the cases shown in Figures 15.2-43 and 15.2-44 is more severe than that of a failed steam generator safety or relief valve which is terminated by steam line differential pressure, or a failed condenser dump valve which is terminated by low pressurizer pressure and level. The transient is quite conservative with respect to cooldown, since no credit is taken for the energy stored in the system metal other than that of the fuel elements or the energy stored in the other steam generators. Since the transient occurs over a period of about five minutes, the neglected stored energy is likely to have a significant effect in slowing the cooldown.

15.2.13.4 Conclusions

The analysis has shown that the criteria stated earlier in this section is satisfied. Since the reactor does not return to critical the possibility of a DNBR less than 1.30 does not exist.

15.2.14 SPURIOUS OPERATION OF THE SAFETY INJECTION SYSTEM AT POWER

15.2.14.1 Identification of Causes

Spurious SIS operation at power could be caused by operator error or a false electrical actuating signal. A spurious signal in any of the following channels could cause this incident.

1. High containment pressure
2. High steam line differential pressure
3. High steam line flow and low average coolant temperature or low steam line pressure.

TABLE 15.2-1 (Sheet 1 of 10)

TIME SEQUENCE OF EVENTS FOR CONDITION II EVENTS

Accident	Event	Time (sec.)
Uncontrolled RCA Withdrawal from a Subcritical Condition	Initiation of uncontrolled rod withdrawal 7.5 x 10^{-4} ΔK/sec. reactivity insertion rate from 10^{-13} of nominal power	0.0
	Power range high neutron flux low setpoint reached	6.9
	Peak nuclear power occurs	7.0
	Rods begin to fall into core	7.5
	Peak heat flux occurs	7.8
	Peak average fuel temperature occurs	8.2
	Peak average clad temperature occurs	8.8
	Peak average coolant temperature occurs	9.2

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
511.0	422.5	.5068
511.5	422.4	.5067
512.0	422.3	.5065
512.5	422.2	.5064
513.0	422.0	.5063
513.5	421.9	.5061
514.0	421.8	.5060
514.5	421.7	.5058
515.0	421.5	.5057
515.5	421.4	.5055
516.0	421.3	.5054
516.5	421.2	.5052
517.0	421.1	.5051
517.5	420.9	.5049
518.0	420.8	.5048
518.5	420.7	.5046
519.0	420.6	.5045
519.5	420.4	.5043
520.0	420.3	.5042
520.5	420.2	.5040
521.0	420.1	.5039
521.5	420.0	.5037
522.0	419.8	.5036
522.5	419.7	.5034
523.0	419.6	.5033
523.5	419.5	.5031
524.0	419.4	.5030
524.5	419.2	.5028
525.0	419.1	.5027
525.5	419.0	.5026
526.0	418.9	.5024
526.5	418.7	.5023
527.0	418.6	.5021
527.5	418.5	.5020
528.0	418.4	.5018
528.5	418.3	.5017
529.0	418.1	.5015
529.5	418.0	.5014
530.0	417.9	.5012
530.5	417.8	.5011
531.0	417.7	.5009
531.5	417.5	.5008
532.0	417.4	.5006
532.5	417.3	.5005
533.0	417.2	.5003
533.5	417.0	.5002
534.0	416.9	.5001
534.5	416.8	.4999
535.0	416.7	.4998
535.5	416.6	.4996
536.0	416.4	.4995
536.5	416.3	.4993
537.0	416.2	.4992
537.5	416.1	.4990
538.0	416.0	.4989
538.5	415.8	.4987
539.0	415.7	.4986
539.5	415.6	.4984
540.0	415.5	.4983
540.5	415.3	.4981
541.0	415.2	.4980
541.5	415.1	.4979
542.0	415.0	.4977
542.5	414.9	.4976
543.0	414.7	.4974
543.5	414.6	.4973
544.0	414.5	.4971
544.5	414.4	.4970
545.0	414.3	.4968
545.5	414.1	.4967
546.0	414.0	.4965
546.5	413.9	.4964
547.0	413.8	.4962
547.5	413.7	.4961

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
548.0	413.5	.4959
548.5	413.4	.4958
549.0	413.3	.4957
549.5	413.2	.4955
550.0	413.1	.4954
550.5	412.9	.4952
551.0	412.8	.4951
551.5	412.7	.4949
552.0	412.6	.4948
552.5	412.5	.4946
553.0	412.3	.4945
553.5	412.2	.4943
554.0	412.1	.4942
554.5	412.0	.4941
555.0	411.9	.4939
555.5	411.7	.4938
556.0	411.6	.4936
556.5	411.5	.4935
557.0	411.4	.4933
557.5	411.3	.4932
558.0	411.1	.4930
558.5	411.0	.4929
559.0	410.9	.4927
559.5	410.8	.4926
560.0	410.7	.4925
560.5	410.5	.4923
561.0	410.4	.4922
561.5	410.3	.4920
562.0	410.2	.4919
562.5	410.1	.4917
563.0	409.9	.4916
563.5	409.8	.4914
564.0	409.7	.4913
564.5	409.6	.4911
565.0	409.5	.4910
565.5	409.3	.4909
566.0	409.2	.4907
566.5	409.1	.4906
567.0	409.0	.4904
567.5	408.9	.4903
568.0	408.7	.4901
568.5	408.6	.4900
569.0	408.5	.4898
569.5	408.4	.4897
570.0	408.3	.4895
570.5	408.1	.4894
571.0	408.0	.4893
571.5	407.9	.4891
572.0	407.8	.4890
572.5	407.7	.4888
573.0	407.5	.4887
573.5	407.4	.4885
574.0	407.3	.4884
574.5	407.2	.4882
575.0	407.1	.4881
575.5	406.9	.4880
576.0	406.8	.4878
576.5	406.7	.4877
577.0	406.6	.4875
577.5	406.5	.4874
578.0	406.4	.4872
578.5	406.2	.4871
579.0	406.1	.4869
579.5	406.0	.4868
580.0	405.9	.4867
580.5	405.8	.4865
581.0	405.6	.4864
581.5	405.5	.4862
582.0	405.4	.4861
582.5	405.3	.4859
583.0	405.2	.4858
583.5	405.0	.4856
584.0	404.9	.4855
584.5	404.8	.4854

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
[illegible]5.0	404.7	.4852
[illegible]5.5	404.6	.4851
586.0	404.4	.4849
586.5	404.3	.4848
587.0	404.2	.4846
587.5	404.1	.4845
588.0	404.0	.4843
588.5	403.9	.4842
589.0	403.7	.4841
589.5	403.6	.4839
590.0	403.5	.4838
590.5	403.4	.4836
591.0	403.3	.4835
591.5	403.1	.4833
592.0	403.0	.4832
592.5	402.9	.4831
593.0	402.8	.4829
593.5	402.7	.4828
594.0	402.5	.4826
594.5	402.4	.4825
595.0	402.3	.4823
595.5	402.2	.4822
596.0	402.1	.4820
596.5	402.0	.4819
597.0	401.8	.4818
597.5	401.7	.4816
598.0	401.6	.4815
598.5	401.5	.4813
599.0	401.4	.4812
599.5	401.2	.4810
[illegible]0.0	401.1	.4809

TABLE 15.4-29

MASS AND ENERGY RELEASES FROM A ~~0.908 FT^2 SPLIT BREAK~~ 0.6 FT^2 DER AT
~~AT 70~~ 102 PERCENT POWER (Worst Temperature Case)

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)

~~a,c~~

~~PROPRIETARY~~

~~Refer to (50-311) "Application for Withholding"~~
~~R. L. Mittl to Olan D. Parr~~
~~November 20, 1978~~
~~and~~
~~NRC Approval letter,~~
~~Olan D. Parr to Wiesemann~~
~~January 22, 1979~~

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
0.0000	0.0000	0.0000
.5000	2048.	2.452
1.000	2066.	2.474
1.500	2078.	2.488
2.000	2089.	2.501
2.500	2100.	2.514
3.000	2111.	2.527
3.500	2122.	2.539
4.000	2132.	2.551
4.500	2142.	2.563
5.000	2151.	2.574
5.500	2161.	2.585
6.000	2170.	2.596
6.500	2179.	2.606
7.000	2189.	2.617
7.500	2198.	2.628
8.000	2208.	2.640
8.500	2218.	2.651
9.000	2228.	2.663
9.500	2238.	2.674
10.00	2248.	2.686
10.50	2258.	2.697
11.00	2268.	2.709
11.50	2278.	2.721
12.00	2289.	2.733
12.50	2299.	2.745
13.00	2310.	2.757
13.50	2320.	2.769
14.00	2330.	2.780
14.50	2340.	2.792
15.00	2351.	2.804
15.50	2357.	2.811
16.00	2365.	2.820
16.50	2373.	2.829
17.00	2381.	2.838
17.50	2388.	2.847
18.00	2396.	2.856
18.50	2403.	2.864
19.00	2410.	2.872
19.50	2416.	2.879
20.00	2422.	2.886
20.50	2427.	2.891
21.00	2431.	2.896
21.50	2526.	3.009
22.00	2661.	3.168
22.50	2865.	3.411
23.00	2825.	3.363
23.50	2751.	3.276
24.00	2677.	3.188
24.50	2597.	3.093
25.00	2528.	3.011
25.50	2475.	2.949
26.00	2441.	2.908
26.50	2420.	2.883
27.00	2398.	2.857
27.50	2386.	2.843
28.00	2379.	2.835
28.50	2372.	2.827
29.00	2365.	2.818
29.50	2357.	2.809
30.00	2349.	2.800
30.50	2341.	2.791
31.00	2333.	2.781
31.50	2324.	2.771
32.00	2316.	2.761
32.50	2307.	2.751
33.00	2298.	2.740
33.50	2289.	2.730
34.00	2280.	2.719
34.50	2271.	2.709
35.00	2262.	2.698
35.50	2252.	2.687
36.00	2243.	2.676
36.50	2233.	2.665
37.00	2224.	2.654

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
37.50	2215.	2.643
38.00	2205.	2.632
38.50	2196.	2.621
39.00	2186.	2.610
39.50	2177.	2.599
40.00	2167.	2.588
40.50	2158.	2.577
41.00	2149.	2.566
41.50	2139.	2.555
42.00	2130.	2.544
42.500	3438.	4.100
43.000	2097.	2.505
45.000	1984.	2.371
47.500	1844.	2.204
50.000	1705.	2.039
52.500	1568.	1.876
55.000	1432.	1.714
57.500	1298.	1.554
60.000	1165.	1.395
62.500	1033.	1.238
65.000	902.1	1.083
67.500	772.4	0.928
70.000	643.7	0.775
70.50	626.6	.7546
71.00	624.7	.7523
71.50	622.7	.7500
72.00	620.8	.7477
72.50	619.0	.7454
73.00	617.1	.7432
73.50	615.3	.7411
74.00	613.6	.7389
74.50	611.8	.7368
75.00	610.1	.7348
75.50	608.4	.7327
76.00	606.7	.7307
76.50	605.1	.7287
77.00	603.5	.7268
77.50	601.9	.7249
78.00	600.3	.7230
78.50	598.7	.7211
79.00	597.2	.7193
79.50	595.7	.7175
80.00	594.2	.7157
80.50	592.8	.7139
81.00	591.3	.7122
81.50	589.9	.7105
82.00	588.5	.7088
82.50	586.9	.7069
83.00	585.6	.7053
83.50	584.2	.7037
84.00	582.9	.7021
84.50	581.6	.7005
85.00	580.3	.6989
85.50	579.0	.6974
86.00	577.8	.6959
86.50	576.5	.6944
87.00	575.3	.6929
87.50	574.1	.6915
88.00	572.9	.6900
88.50	571.7	.6886
89.00	570.5	.6872
89.50	569.4	.6858
90.00	568.2	.6844

Time ([illegible])	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)	Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
[illegible]	567.1	.6830	127.5	506.8	.6104
91.00	566.0	.6817	128.0	506.2	.6097
91.50	564.9	.6804	128.5	505.6	.6089
92.00	563.8	.6790	129.0	505.0	.6082
92.50	562.7	.6777	129.5	504.4	.6075
93.00	561.6	.6764	130.0	503.8	.6068
93.50	560.6	.6752	130.5	503.2	.6061
94.00	559.5	.6739	131.0	502.6	.6053
94.50	558.5	.6727	131.5	502.0	.6046
95.00	557.4	.6714	132.0	501.4	.6039
95.50	556.4	.6702	132.5	500.9	.6032
96.00	555.4	.6690	133.0	500.3	.6025
96.50	554.4	.6678	133.5	499.7	.6019
97.00	553.4	.6666	134.0	499.1	.6012
97.50	552.5	.6654	134.5	498.6	.6005
98.00	551.5	.6643	135.0	498.0	.5998
98.50	550.5	.6631	135.5	497.5	.5991
99.00	549.6	.6620	136.0	496.9	.5984
99.50	548.7	.6608	136.5	496.3	.5978
100.0	547.7	.6597	137.0	495.8	.5971
100.5	546.8	.6586	137.5	495.2	.5964
101.0	545.9	.6575	138.0	494.7	.5958
101.5	545.0	.6564	138.5	494.1	.5951
102.0	544.1	.6554	139.0	493.6	.5945
102.5	543.2	.6543	139.5	493.1	.5938
103.0	542.3	.6532	140.0	492.5	.5932
103.5	541.5	.6522	140.5	492.0	.5925
104.0	540.6	.6512	141.0	491.5	.5919
[illegible]	539.8	.6501	141.5	490.9	.5913
[illegible]	538.9	.6491	142.0	490.4	.5906
[illegible]	538.1	.6481	142.5	489.9	.5900
[illegible]	537.2	.6471	143.0	489.4	.5894
[illegible]	536.4	.6461	143.5	488.8	.5887
107.0	535.6	.6451	144.0	488.3	.5881
107.5	534.8	.6441	144.5	487.8	.5875
108.0	534.0	.6432	145.0	487.3	.5869
108.5	533.2	.6422	145.5	486.8	.5863
109.0	532.4	.6412	146.0	486.3	.5856
109.5	531.6	.6403	146.5	485.8	.5850
110.0	530.8	.6394	147.0	485.3	.5844
110.5	530.0	.6384	147.5	484.8	.5838
111.0	529.3	.6375	148.0	484.3	.5832
111.5	528.5	.6366	148.5	483.8	.5826
112.0	527.8	.6357	149.0	483.3	.5820
112.5	527.0	.6348	149.5	482.8	.5814
113.0	526.3	.6339	150.0	482.3	.5808
113.5	525.5	.6330	150.5	481.8	.5802
114.0	524.8	.6321	151.0	481.3	.5797
114.5	524.1	.6312	151.5	480.8	.5791
115.0	523.4	.6304	152.0	480.4	.5785
115.5	522.6	.6295	152.5	479.9	.5779
116.0	521.9	.6286	153.0	479.4	.5773
116.5	521.2	.6278	153.5	478.9	.5768
117.0	520.5	.6269	154.0	478.4	.5762
117.5	519.8	.6261	154.5	478.0	.5756
118.0	519.1	.6253	155.0	477.5	.5750
118.5	518.4	.6244	155.5	477.0	.5745
119.0	517.8	.6236	156.0	476.6	.5739
119.5	517.1	.6228	156.5	476.1	.5733
120.0	516.4	.6220	157.0	475.6	.5728
120.5	515.7	.6212	157.5	475.2	.5722
121.0	515.1	.6204	158.0	474.7	.5717
[illegible]	514.4	.6196	158.5	474.2	.5711
[illegible]	513.8	.6188	159.0	473.8	.5706
[illegible]	513.1	.6180	159.5	473.3	.5700
123.0	512.5	.6172	160.0	472.9	.5695
123.5	511.8	.6164	160.5	472.4	.5689
124.0	511.2	.6157	161.0	472.0	.5684
124.5	510.5	.6149	161.5	471.5	.5678
125.0	509.9	.6141	162.0	471.1	.5673
125.5	509.3	.6134	162.5	470.6	.5667
126.0	508.7	.6126	163.0	470.2	.5662
126.5	508.0	.6119	163.5	469.7	.5657
127.0	507.4	.6111	164.0	469.3	.5651
			164.5	468.8	.5646
			165.0	468.4	.5641

Time [illegible].)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
165.5	468.0	.5635
166.0	467.5	.5630
166.5	467.1	.5625
167.0	466.7	.5619
167.5	466.2	.5614
168.0	465.8	.5609
168.5	465.4	.5604
169.0	464.9	.5599
169.5	464.5	.5593
170.0	464.1	.5588
170.5	463.7	.5583
171.0	463.2	.5578
171.5	462.8	.5573
172.0	462.4	.5568
172.5	462.0	.5563
173.0	461.5	.5558
173.5	461.1	.5553
174.0	460.7	.5548
174.5	460.3	.5543
175.0	459.9	.5538
175.5	459.5	.5533
176.0	459.1	.5528
176.5	458.6	.5523
177.0	458.2	.5518
177.5	457.8	.5513
178.0	457.4	.5508
178.5	457.0	.5503
[illegible].0	456.6	.5498
[illegible]	456.2	.5493
[illegible]0	455.8	.5488
[illegible].5	455.4	.5483
[illegible]1.0	455.0	.5478
181.5	454.6	.5474
182.0	454.2	.5469
182.5	453.8	.5464
183.0	453.4	.5459
183.5	453.0	.5454
184.0	452.6	.5450
184.5	452.2	.5445
185.0	451.8	.5440
185.5	451.4	.5435
186.0	451.0	.5431
186.5	450.6	.5426
187.0	450.2	.5421
187.5	449.9	.5416
188.0	449.5	.5412
188.5	449.1	.5407
189.0	448.7	.5402
189.5	448.3	.5398
190.0	447.9	.5393
190.5	447.5	.5389
191.0	447.2	.5384
191.5	446.8	.5379
192.0	446.4	.5375
192.5	446.0	.5370
193.0	445.6	.5365
193.5	445.3	.5361
194.0	444.9	.5356
194.5	444.5	.5352
195.0	444.1	.5347
195.5	443.7	.5343
196.0	443.4	.5338
196.5	443.0	.5334
[illegible].0	442.6	.5329
[illegible].5	442.3	.5325
[illegible]8.0	441.9	.5320
198.5	441.5	.5316
199.0	441.1	.5311
199.5	440.8	.5307
200.0	440.4	.5302
200.5	440.0	.5298
201.0	439.7	.5293
201.5	439.3	.5289
202.0	438.9	.5285

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
202.5	438.6	.5280
203.0	438.2	.5276
203.5	437.8	.5271
204.0	437.5	.5267
204.5	437.1	.5263
205.0	436.8	.5258
205.5	436.4	.5254
206.0	436.0	.5250
206.5	435.7	.5245
207.0	435.3	.5241
207.5	435.0	.5237
208.0	434.6	.5232
208.5	434.3	.5228
209.0	433.9	.5224
209.5	433.5	.5219
210.0	433.2	.5215
210.5	432.8	.5211
211.0	432.5	.5207
211.5	432.1	.5202
212.0	431.8	.5198
212.5	431.4	.5194
213.0	431.1	.5190
213.5	430.7	.5185
214.0	430.4	.5181
214.5	430.0	.5177
215.0	429.7	.5173
215.5	429.4	.5169
216.0	429.1	.5165
216.5	428.8	.5162
217.0	428.5	.5158
217.5	428.1	.5154
218.0	427.8	.5150
218.5	427.5	.5146
219.0	427.2	.5143
219.5	426.9	.5139
220.0	426.6	.5135
220.5	426.3	.5132
221.0	426.0	.5128
221.5	425.7	.5124
222.0	425.4	.5120
222.5	425.0	.5117
223.0	424.7	.5113
223.5	424.4	.5109
224.0	424.1	.5105
224.5	423.8	.5102
225.0	423.5	.5098
225.5	423.2	.5094
226.0	422.9	.5091
226.5	422.6	.5087
227.0	422.3	.5083
227.5	422.0	.5079
228.0	421.7	.5076
228.5	421.4	.5072
229.0	421.0	.5068
229.5	420.7	.5065
230.0	420.4	.5061
230.5	420.1	.5057
231.0	419.8	.5053
231.5	419.5	.5050
232.0	419.2	.5046
232.5	418.9	.5042
233.0	418.6	.5039
233.5	418.3	.5035
234.0	418.0	.5031
234.5	417.7	.5028
235.0	417.4	.5024
235.5	417.1	.5020
236.0	416.8	.5016
236.5	416.5	.5013
237.0	416.2	.5009

T[illegible]	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
237.5	415.9	.5005
238.0	415.5	.5002
238.5	415.2	.4998
239.0	414.9	.4994
239.5	414.6	.4991
240.0	414.3	.4987
240.5	414.0	.4983
241.0	413.7	.4980
241.5	413.4	.4976
242.0	413.1	.4972
242.5	412.8	.4969
243.0	412.5	.4965
243.5	412.2	.4961
244.0	411.9	.4958
244.5	411.6	.4956
245.0	411.3	.4950
245.5	411.0	.4947
246.0	410.7	.4943
246.5	410.4	.4939
247.0	410.1	.4936
247.5	409.8	.4932
248.0	409.5	.4928
248.5	409.2	.4925
249.0	408.9	.4921
249.5	408.6	.4918
250.0	408.3	.4914
250.5	408.0	.4910
251.0	407.7	.4907
251.5	407.4	.4903
[illegible]	407.1	.4899
[illegible]	406.8	.4896
[illegible]	406.5	.4892
[illegible]3.5	406.2	.4889
[illegible]4.0	405.9	.4885
[illegible]54.5	405.6	.4881
255.0	405.3	.4878
255.5	405.0	.4874
256.0	404.7	.4870
256.5	404.4	.4867
257.0	404.1	.4863
257.5	403.8	.4860
258.0	403.5	.4856
258.5	403.2	.4853
259.0	402.9	.4849
259.5	402.6	.4845
260.0	402.3	.4842
260.5	402.0	.4838
261.0	401.7	.4835
261.5	401.4	.4831
262.0	401.1	.4827
262.5	400.8	.4824
263.0	400.6	.4820
263.5	400.3	.4817
264.0	400.0	.4813
264.5	399.7	.4810
265.0	399.4	.4806
265.5	399.1	.4802
266.0	398.8	.4799
266.5	398.4	.4795
267.0	398.1	.4791
267.5	397.8	.4788
[illegible]8.0	397.5	.4784
[illegible]	397.2	.4780
[illegible]	396.9	.4777
[illegible].5	396.6	.4773
[illegible]70.0	396.3	.4769
270.5	396.0	.4766
271.0	395.7	.4762
271.5	395.4	.4758
272.0	395.1	.4754
272.5	394.8	.4751
273.0	394.5	.4747
273.5	394.2	.4743
274.0	393.9	.4740

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
275.0	393.3	.4733
275.5	393.0	.4729
276.0	392.7	.4725
276.5	392.4	.4722
277.0	392.1	.4718
277.5	391.8	.4715
278.0	391.5	.4711
278.5	391.2	.4708
279.0	390.9	.4704
279.5	390.6	.4701
280.0	390.4	.4697
280.5	390.1	.4694
281.0	389.8	.4690
281.5	389.5	.4687
282.0	389.2	.4683
282.5	388.9	.4680
283.0	388.6	.4676
283.5	388.4	.4673
284.0	388.1	.4669
284.5	387.8	.4666
285.0	387.5	.4662
285.5	387.2	.4659
286.0	386.9	.4656
286.5	386.6	.4652
287.0	386.4	.4649
287.5	386.1	.4645
288.0	385.8	.4642
288.5	385.5	.4638
289.0	385.2	.4635
289.5	385.0	.4632
290.0	384.7	.4628
290.5	384.4	.4625
291.0	384.1	.4622
291.5	383.9	.4618
292.0	383.6	.4615
292.5	383.3	.4612
293.0	383.0	.4608
293.5	382.7	.4605
294.0	382.5	.4602
294.5	382.2	.4598
295.0	381.9	.4595
295.5	381.7	.4592
296.0	381.4	.4588
296.5	381.1	.4585
297.0	380.8	.4582
297.5	380.6	.4579
298.0	380.3	.4575
298.5	380.0	.4572
299.0	379.8	.4569
299.5	379.5	.4565
300.0	379.2	.4562
300.5	378.9	.4559
301.0	378.7	.4556
301.5	378.4	.4552
302.0	378.1	.4549
302.5	377.9	.4546
303.0	377.6	.4543
303.5	377.3	.4539
304.0	377.1	.4536
304.5	376.8	.4533
305.0	376.5	.4530
305.5	376.3	.4527
306.0	376.0	.4523
306.5	375.8	.4520
307.0	375.5	.4517
307.5	375.2	.4514
308.0	375.0	.4511
308.5	374.7	.4508
309.0	374.4	.4504
309.5	374.2	.4501
310.0	373.9	.4498
310.5	373.7	.4495

Time ([illegible])	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)	Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
[illegible]	373.4	.4492	349.0	354.8	.4267
311.5	373.1	.4489	349.5	354.6	.4264
312.0	372.9	.4485	350.0	354.4	.4261
312.5	372.6	.4482	350.5	354.1	.4258
313.0	372.4	.4479	351.0	353.9	.4256
313.5	372.1	.4476	351.5	353.7	.4253
314.0	371.8	.4473	352.0	353.4	.4250
314.5	371.6	.4470	352.5	353.2	.4247
315.0	371.3	.4467	353.0	353.0	.4245
315.5	371.1	.4464	353.5	352.8	.4242
316.0	370.8	.4461	354.0	352.5	.4239
316.5	370.6	.4458	354.5	352.3	.4237
317.0	370.3	.4454	355.0	352.1	.4234
317.5	370.1	.4451	355.5	351.9	.4231
318.0	369.8	.4448	356.0	351.6	.4228
318.5	369.5	.4445	356.5	351.4	.4226
319.0	369.3	.4442	357.0	351.2	.4223
319.5	369.0	.4439	357.5	351.0	.4220
320.0	368.8	.4436	358.0	350.8	.4218
320.5	368.5	.4433	358.5	350.5	.4215
321.0	368.3	.4430	359.0	350.3	.4212
321.5	368.0	.4427	359.5	350.1	.4210
322.0	367.8	.4424	360.0	349.9	.4207
322.5	367.5	.4421	360.5	349.7	.4204
323.0	367.3	.4418	361.0	349.4	.4202
323.5	367.0	.4415	361.5	349.2	.4199
324.0	366.8	.4412	362.0	349.0	.4196
324.5	366.5	.4409	362.5	348.8	.4194
325.0	366.3	.4406	363.0	348.6	.4191
[illegible]	366.0	.4403	363.5	348.4	.4189
[illegible]	365.8	.4400	364.0	348.1	.4186
[illegible]	365.6	.4397	364.5	347.9	.4183
[illegible]	365.3	.4394	365.0	347.7	.4181
[illegible]	365.1	.4391	365.5	347.5	.4178
328.0	364.8	.4388	366.0	347.3	.4176
328.5	364.6	.4385	366.5	347.1	.4173
329.0	364.3	.4382	367.0	346.9	.4170
329.5	364.1	.4379	367.5	346.6	.4168
330.0	363.8	.4376	368.0	346.4	.4165
330.5	363.6	.4373	368.5	346.2	.4163
331.0	363.3	.4370	369.0	346.0	.4160
331.5	363.1	.4367	369.5	345.8	.4158
332.0	362.8	.4364	370.0	345.6	.4156
332.5	362.6	.4361	370.5	345.4	.4153
333.0	362.4	.4358	371.0	345.2	.4151
333.5	362.1	.4355	371.5	345.0	.4149
334.0	361.9	.4352	372.0	344.9	.4146
334.5	361.6	.4349	372.5	344.7	.4144
335.0	361.4	.4347	373.0	344.5	.4141
335.5	361.2	.4344	373.5	344.3	.4139
336.0	360.9	.4341	374.0	344.1	.4137
336.5	360.7	.4338	374.5	343.9	.4134
337.0	360.4	.4335	375.0	343.7	.4132
337.5	360.2	.4332	375.5	343.5	.4130
338.0	360.0	.4329	376.0	343.3	.4127
338.5	359.7	.4326	376.5	343.1	.4125
339.0	359.5	.4323	377.0	342.9	.4123
339.5	359.2	.4320	377.5	342.7	.4120
340.0	359.0	.4318	378.0	342.5	.4118
340.5	358.8	.4315	378.5	342.3	.4116
341.0	358.5	.4312	379.0	342.2	.4113
341.5	358.3	.4309	379.5	342.0	.4111
342.0	358.1	.4306	380.0	341.8	.4109
[illegible]	357.8	.4303	380.5	341.6	.4107
[illegible]	357.6	.4300	381.0	341.4	.4104
[illegible]	357.4	.4298	381.5	341.2	.4102
[illegible]	357.1	.4295	382.0	341.0	.4100
[illegible]	356.9	.4292	382.5	340.8	.4097
345.0	356.7	.4289	383.0	340.6	.4095
345.5	356.4	.4286	383.5	340.4	.4093
346.0	356.2	.4284	384.0	340.3	.4090
346.5	356.0	.4281	384.5	340.1	.4088
347.0	355.7	.4278	385.0	339.9	.4086
347.5	355.5	.4275	385.5	339.7	.4084
348.0	355.3	.4272	386.0	339.5	.4082
348.5	355.0	.4270			

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
[illegible]	339.3	.4079
387.0	339.2	.4077
387.5	339.0	.4075
388.0	338.8	.4073
388.5	338.6	.4070
389.0	338.4	.4068
389.5	338.2	.4066
390.0	338.1	.4064
390.5	337.9	.4062
391.0	337.7	.4059
391.5	337.5	.4057
392.0	337.3	.4055
392.5	337.1	.4053
393.0	337.0	.4051
393.5	336.8	.4048
394.0	336.6	.4046
394.5	336.4	.4044
395.0	336.3	.4042
395.5	336.1	.4040
396.0	335.9	.4038
396.5	335.8	.4036
397.0	335.6	.4034
397.5	335.4	.4032
398.0	335.2	.4030
398.5	335.1	.4028
399.0	334.9	.4026
399.5	334.7	.4024
400.0	334.6	.4022
400.5	334.4	.4020
[illegible]	334.3	.4018
[illegible]	334.1	.4016
[illegible]	333.9	.4014
[illegible]	333.8	.4012
[illegible]	333.6	.4010
403.5	333.5	.4008
404.0	333.3	.4006
404.5	333.2	.4005
405.0	333.0	.4003
405.5	332.9	.4001
406.0	332.7	.3999
406.5	332.6	.3997
407.0	332.4	.3996
407.5	332.3	.3994
408.0	332.1	.3992
408.5	332.0	.3990
409.0	331.8	.3988
409.5	331.7	.3987
410.0	331.6	.3985
410.5	331.4	.3983
411.0	331.3	.3982
411.5	331.1	.3980
412.0	331.0	.3978
412.5	330.9	.3977
413.0	330.7	.3975
413.5	330.6	.3974
414.0	330.5	.3972
414.5	330.3	.3970
415.0	330.2	.3969
415.5	330.1	.3967
416.0	330.0	.3966
416.5	329.8	.3964
417.0	329.7	.3963
417.5	329.6	.3961
[illegible]	329.5	.3960
[illegible]	329.4	.3958
[illegible]	329.2	.3957
[illegible]	329.1	.3956
[illegible]	329.0	.3954
420.5	328.9	.3953
421.0	328.8	.3951
421.5	328.7	.3950
422.0	328.6	.3949
422.5	328.4	.3947
423.0	328.3	.3946
423.5	328.2	.3945

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
424.0	328.1	.3943
424.5	328.0	.3942
425.0	327.9	.3941
425.5	327.8	.3940
426.0	327.7	.3938
426.5	327.6	.3937
427.0	327.5	.3936
427.5	327.4	.3935
428.0	327.3	.3934
428.5	327.2	.3933
429.0	327.1	.3931
429.5	327.0	.3930
430.0	326.9	.3929
430.5	326.9	.3928
431.0	326.8	.3927
431.5	326.7	.3926
432.0	326.6	.3925
432.5	326.5	.3924
433.0	326.4	.3923
433.5	326.3	.3922
434.0	326.3	.3921
434.5	326.2	.3920
435.0	326.1	.3919
435.5	326.0	.3918
436.0	325.9	.3917
436.5	325.9	.3916
437.0	325.8	.3915
437.5	325.7	.3914
438.0	325.6	.3913
438.5	325.6	.3912
439.0	325.5	.3911
439.5	325.4	.3911
440.0	325.3	.3910
440.5	325.3	.3909
441.0	325.2	.3908
441.5	325.1	.3907
442.0	325.1	.3906
442.5	325.0	.3905
443.0	324.9	.3905
443.5	324.8	.3904
444.0	324.8	.3903
444.5	324.7	.3902
445.0	324.6	.3901
445.5	324.6	.3901
446.0	324.5	.3900
446.5	324.5	.3899
447.0	324.4	.3898
447.5	324.3	.3898
448.0	324.3	.3897
448.5	324.2	.3896
449.0	324.1	.3895
449.5	324.1	.3895
450.0	324.0	.3894
450.5	324.0	.3893
451.0	323.9	.3892
451.5	323.8	.3892
452.0	323.8	.3891
452.5	323.7	.3890
453.0	323.7	.3889
453.5	323.6	.3889
454.0	323.5	.3888
454.5	323.5	.3887
455.0	323.4	.3887
455.5	323.4	.3886
456.0	323.3	.3885
456.5	323.3	.3885
457.0	323.2	.3884

Time (sec.)	Break Flow (lb/sec.)	Energy Flow (million Btu/sec.)
[illegible]	323.1	.3883
[illegible]	323.1	.3882
458.5	323.0	.3882
459.0	323.0	.3881
459.5	322.9	.3880
460.0	322.9	.3880
460.5	322.8	.3879
461.0	322.7	.3878
461.5	322.7	.3878
462.0	322.6	.3877
462.5	322.6	.3876
463.0	322.5	.3876
463.5	322.5	.3875
464.0	322.4	.3874
464.5	322.4	.3874
465.0	322.3	.3873
465.5	322.2	.3872
466.0	322.2	.3872
466.5	322.1	.3871
467.0	322.1	.3870
467.5	322.0	.3870
468.0	322.0	.3869
468.5	321.9	.3868
469.0	321.8	.3867
469.5	321.8	.3867
470.0	321.7	.3866
470.5	321.7	.3865
471.0	321.6	.3865
471.5	321.6	.3864
472.0	321.5	.3863
472.5	321.4	.3863
473.0	321.4	.3862
[illegible]	321.3	.3861
[illegible]	321.3	.3860
[illegible]	321.2	.3860
[illegible]	321.1	.3859
475.5	321.1	.3858
476.0	321.0	.3858
476.5	321.0	.3857
477.0	320.9	.3856
477.5	320.9	.3855
478.0	320.8	.3855
478.5	320.7	.3854
479.0	320.7	.3853
479.5	320.6	.3852
480.0	320.5	.3852
480.5	320.5	.3851
481.0	320.4	.3850
481.5	320.4	.3849
482.0	320.3	.3849
482.5	320.2	.3848
483.0	320.2	.3847
483.5	320.1	.3846
484.0	320.0	.3846
484.5	320.0	.3845
485.0	319.9	.3844
485.5	319.8	.3843
486.0	319.8	.3842
486.5	319.7	.3842
487.0	319.7	.3841
487.5	319.6	.3840
488.0	319.5	.3839
488.5	319.5	.3838
489.0	319.4	.3838
489.5	319.3	.3837
490.0	319.3	.3836
490.5	319.2	.3835
[illegible]	319.1	.3834
[illegible]	319.0	.3834
[illegible]	319.0	.3833
492.5	318.9	.3832
493.0	318.8	.3831
493.5	318.8	.3830
494.0	318.7	.3829
494.5	318.6	.3828
495.0	318.6	.3828
495.5	318.5	.3827
496.0	318.4	.3826
496.5	318.3	.3825
497.0	318.3	.3824
497.5	318.2	.3823
498.0	318.1	.3822
498.5	318.1	.3822
499.0	318.0	.3821
499.5	317.9	.3820
500.0	317.8	.3819
500.5	317.8	.3818
501.0	317.7	.3817
501.5	317.6	.3816
502.0	317.5	.3815
502.5	317.5	.3814
503.0	317.4	.3813
503.5	317.3	.3813
504.0	317.2	.3812
504.5	317.2	.3811
505.0	317.1	.3810
505.5	317.0	.3809
506.0	316.9	.3808
506.5	316.9	.3807
507.0	316.8	.3806
507.5	316.7	.3805
508.0	316.6	.3804
508.5	316.5	.3803
509.0	316.5	.3802
509.5	316.4	.3801
510.0	316.3	.3800
510.5	316.2	.3799
511.0	316.1	.3798
511.5	316.1	.3797
512.0	316.0	.3796
512.5	315.9	.3795
513.0	315.8	.3794
513.5	315.7	.3793
514.0	315.7	.3793
514.5	315.6	.3792
515.0	315.5	.3791
515.5	315.4	.3790
516.0	315.3	.3789
516.5	315.3	.3788
517.0	315.2	.3787
517.5	315.1	.3786
518.0	315.0	.3785
518.5	314.9	.3784
519.0	314.8	.3783
519.5	314.8	.3781
520.0	314.7	.3780
520.5	314.6	.3779
521.0	314.5	.3778
521.5	314.4	.3777
522.0	314.3	.3776
522.5	314.2	.3775
523.0	314.2	.3774
523.5	314.1	.3773
524.0	314.0	.3772
524.5	313.9	.3771
525.0	313.8	.3770
525.5	313.7	.3769
526.0	313.6	.3768
526.5	313.6	.3767
527.0	313.5	.3766
527.5	313.4	.3765
528.0	313.3	.3764
528.5	313.2	.3763
529.0	313.1	.3762
529.5	313.0	.3761
530.0	313.0	.3760
530.5	312.9	.3759
531.0	312.8	.3758
531.5	312.7	.3756
532.0	312.6	.3755
532.5	312.5	.3754

TABLE 15.2-1 (Sheet 2 of 10)

TIME SEQUENCE OF EVENTS FOR CONDITION II EVENTS

Accident	Event	Time (sec.)
Uncontrolled RCCA Withdrawal at Power 1. Case A	Initiation of uncontrolled RCCA withdrawal at maximum reactivity insertion rate (7.5×10^{-4} ΔK/sec.)	0
	Power range high neutron flux high trip point reached	1.5
	Rods begin to fall into core	2.0
	Minimum DNBR occurs	2.7
2. Case B	Initiation of uncontrolled RCCA withdrawal at a small reactivity insertion rate (3.0×10^{-5} ΔK/sec. for 3 loop, 3.0×10^{-5} ΔK/sec. for 4 loop)	0
	Overtemperature ΔT reactor trip signal initiated	32.6
	Rods begin to fall into core	34.6
	Minimum DNBR occurs	34.7

TABLE 15.2-1 (Sheet 3 of 10)

TIME SEQUENCE OF EVENTS FOR CONDITION II EVENTS

Accident	Event	Time (sec.)
Uncontrolled Boron Dilution		
1. Dilution during refueling and startup.	Dilution begins	0
	Operator isolates source of dilution; minimum margin to criticality occurs	~2400 or more
2. Dilution During Full Power Operation		
a. Automatic Reactor Control	One percent shutdown margin lost	~1300
b. Manual Reactor Control	Dilution begins	0
	Reactor trip setpoint reached for overtemperature ΔT	52
	Rods begin to fall into core	54
	One percent shutdown is lost (if dilution continues) after trip)	~900

TABLE 15.2-1 (Sheet 4 of 10)

TIME SEQUENCE OF EVENTS FOR CONDITION II EVENTS

Accident	Event	Time (sec.)
Partial Loss of Forced Reactor Coolant Flow		
1. All loops operating, two pumps coasting down	Coastdown begins	0
	Low flow reactor trip	1.26
	Rods begin to drop	2.76
	Minimum DNBR occurs	3.7
2. All but one loop operating, two pumps coasting down.	Coastdown begins	0
	Low flow reactor trip	2.30
	Rods begin to drop	3.80
	Minimum DNBR occurs	4.70

TABLE 15.2-1 (Sheet 5 of 10)

TIME SEQUENCE OF EVENTS FOR CONDITION II EVENTS

Accident	Events	Time (sec.)
Loss of External Electrical Load 1. With pressurizer control (BOL)	Loss of electrical load	0
	Initiation of steam release from steam generator safety valves	9.0
	Overtemperature ΔT	9.1
	Rods begin to drop	11.1
	Minimum DNBR occurs	11.5
	Peak pressurizer pressure occurs	12.5
2. With pressurizer control (EOL)	Loss of electrical load	0
	Initiation of steam release from steam generator safety valves	9.0
	Overtemperature ΔT Reactor Trip Point Reached	9.5
	Rods begin to drop	11.5

TABLE 15.2-1 (Sheet 6 of 10)

TIME SEQUENCE OF EVENTS FOR CONDITION II EVENTS

Accident	Event	Time (sec.)
	Minimum DNBR occurs	(1)
	Peak pressurizer pressure occurs	10.5
3. Without pressurizer control (BOL)	Loss of electrical load	0
	Initiation of steam release from steam generator safety valves	9.0
	High pressurizer pressure reactor trip point reached	6.1
	Rods begin to drop	8.1
	Minimum DNBR occurs	(1)
	Peak pressurizer pressure occurs	9.5

(1) DNBR does not decrease below its initial value.

TABLE 15.2-1 (Sheet 7 of 10)

TIME SEQUENCE OF EVENTS FOR CONDITION II EVENTS

Accident	Event	Time (sec.)
4. Without pressurizer control (EOL)	Loss of electrical load	0
	Initiation of steam release from steam generator safety valves	9.0
	High pressurizer pressure reactor trip point reached	6.0
	Rods begin to drop	8.0
	Minimum DNBR occurs	(1)
	Peak pressurizer pressure occurs	9.0

(1) DNBR does not decrease below its initial value.

TIME SEQUENCE OF EVENTS FOR CONDITION II EVENTS

Accident	Event	Time (sec.)
Loss of Normal Feedwater and Loss of Off-site Power to the Station Auxiliaries (Station Blackout)	Low-low steam generator water level reactor trip; reactor coolant pumps begin to coast down	0
	Rods begin to drop	2
	Two steam generators begin to receive auxiliary feed from one motor-driven auxiliary feedwater pump	60
	Peak water level in pressurizer occurs	3250
Excessive feedwater at full load	One main feedwater control valve fails fully open	0
	Minimum DNBR occurs	15.2
	Feedwater flow isolated due to high-high steam generator level	14.0

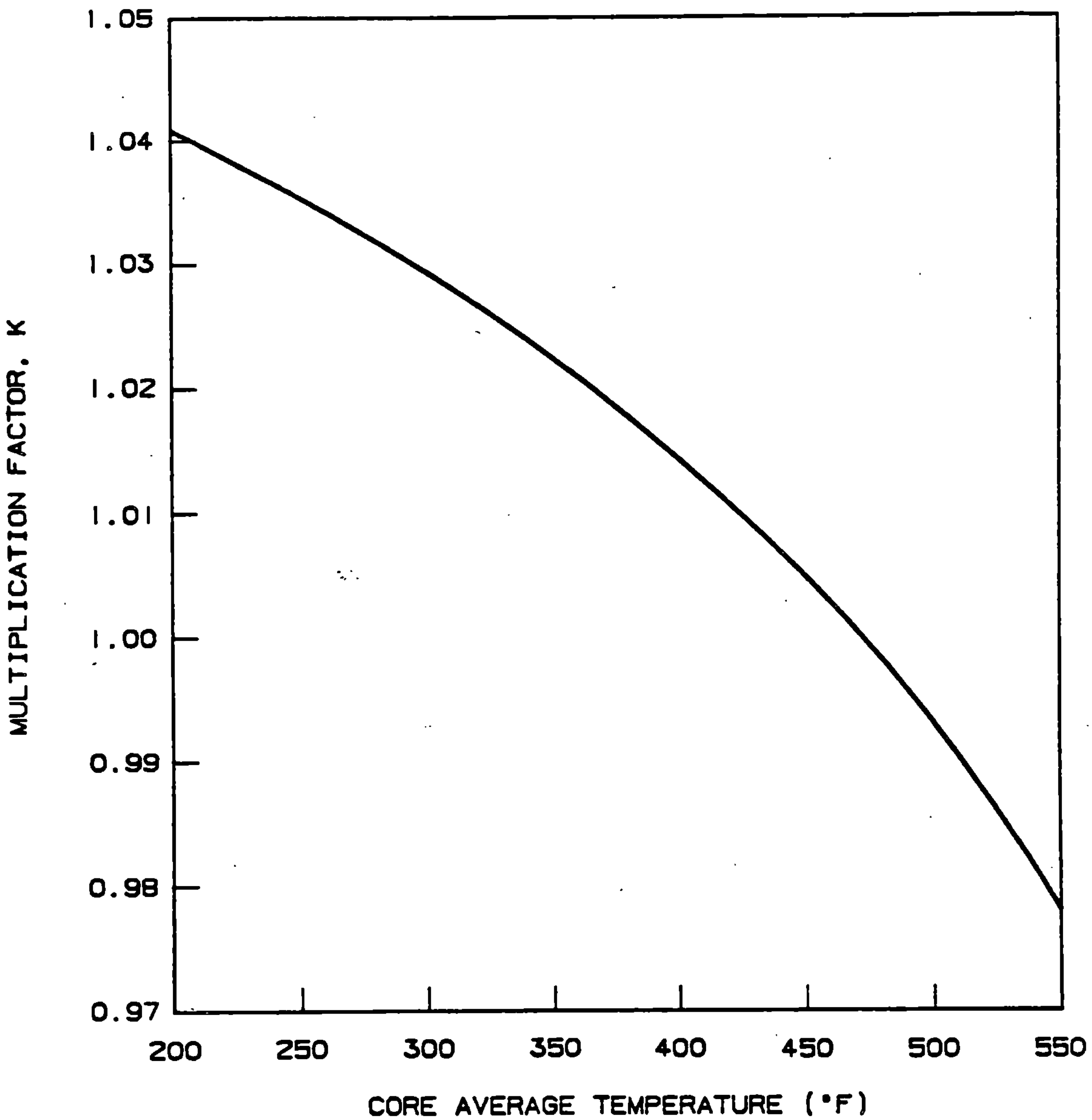
TABLE 15.2-1 (Sheet 9 of 10)

TIME SEQUENCE OF EVENTS FOR CONDITION II EVENTS

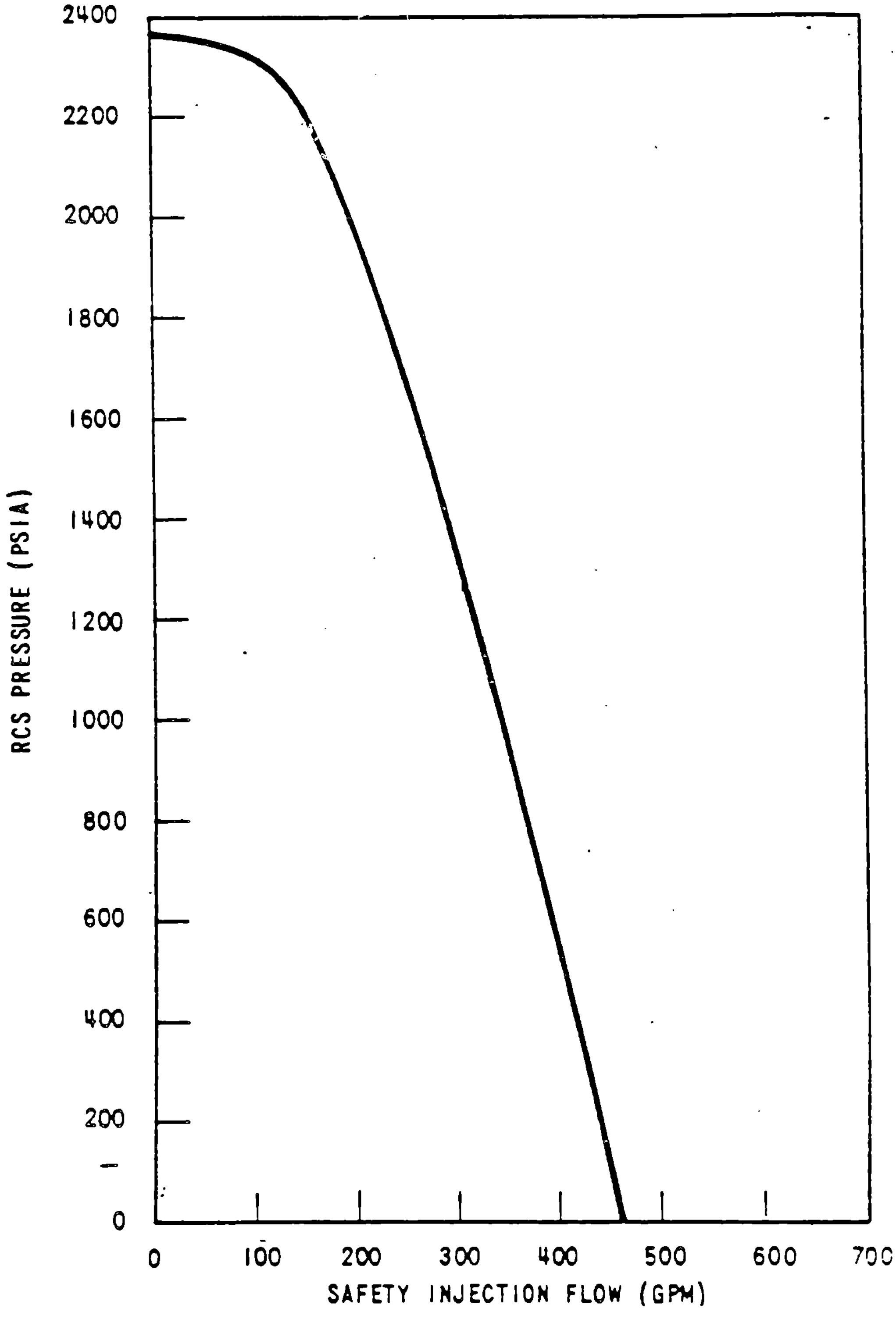
Accident	Event	Time (sec.)
Excessive Load Increase		
1. Manual Reactor Control (BOL)	10 percent step load increase	0
	Equilibrium conditions reached (approximate times only)	200
2. Manual Reactor Control (EOL)	10 percent step load increase	0
	Equilibrium conditions reached (approximate times only)	75
3. Automatic Reactor Control (BOL)	10 percent step load increase	0
	Equilibrium conditions reached	100
4. Automatic Reactor Control (EOL)	10 percent step load increase	0
	Equilibrium conditions reached (approximate time only)	50

TIME SEQUENCE OF EVENTS FOR CONDITION II EVENTS

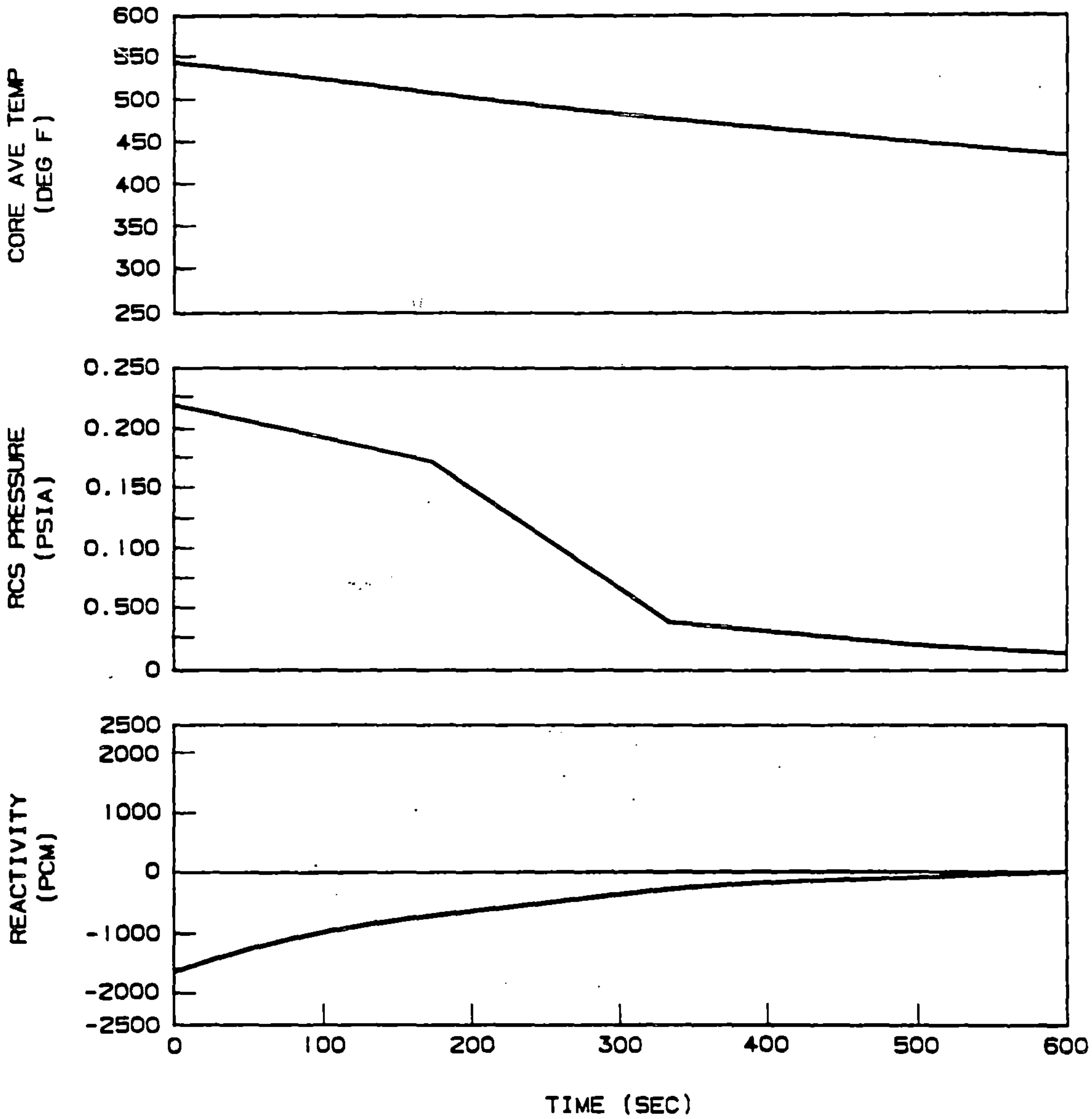
Accident	Events	Time (sec.)
Accidental depressurization of the Reactor Coolant system	Inadvertent Opening of one RCS Safety Valve	0
	Reactor Trip	22.1
	Minimum DNBR occurs	24.0
Accidental depressurization of the Main Steam System	Inadvertent Opening of one main steam safety or relief valve	0
	Pressurizer Empties	172
	2,000 ppm boron reaches RCS loops	214
Inadvertent Operation of SI during Power Operation	Charging pumps begin borated water	0
	Low pressure trip point reached	64
	Rods begin to drop	66



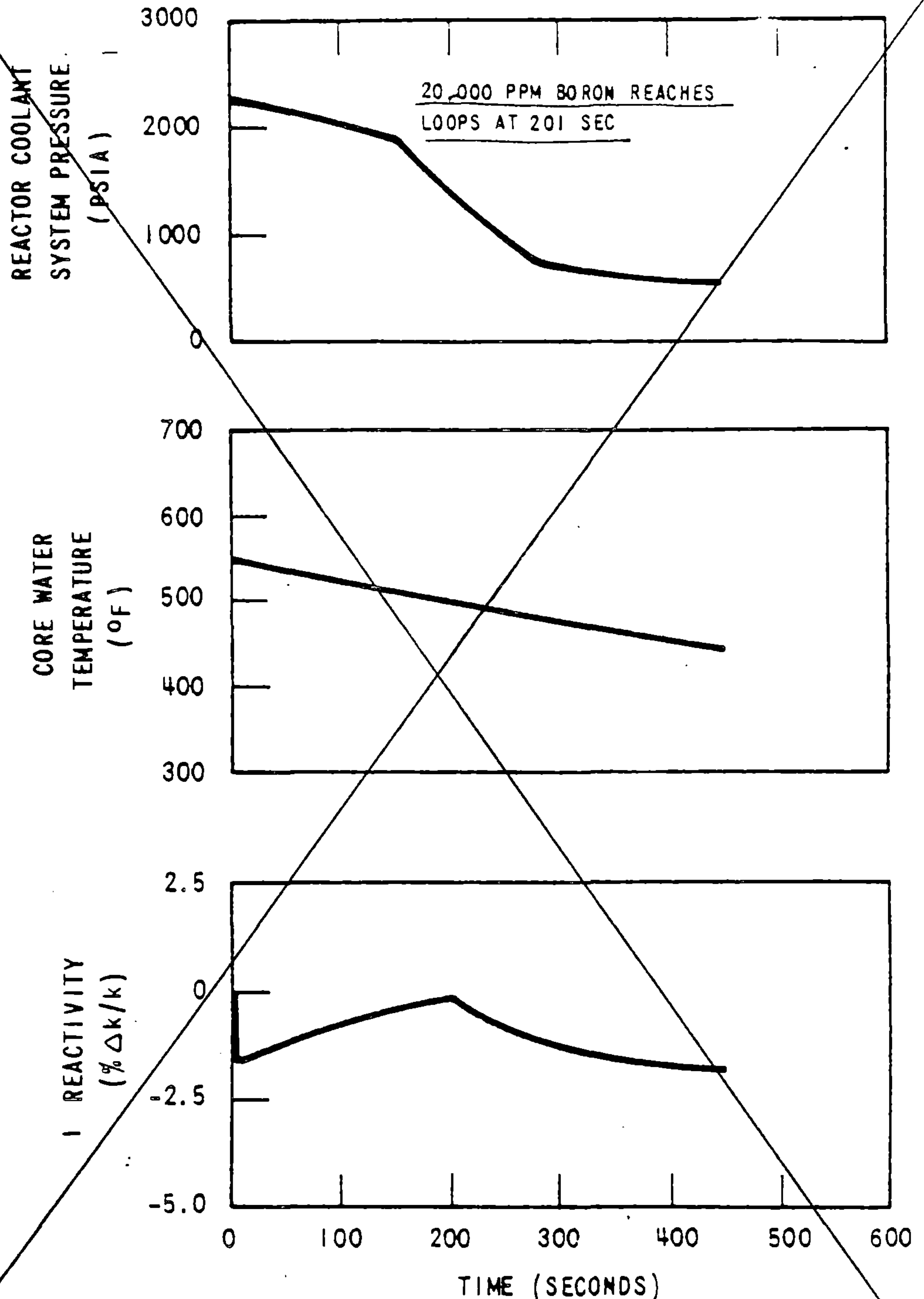
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Variation of K_{EFF} with Core Temperature
	Updated FSAR Figure 15.2-41



PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Safety Injection Curve	
	Updated FSAR	Figure 15.2-42



PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Transient Response for a Steam Line Break Equivalent to 228 Lb/Sec at 1015 PSIA with Outside Power Available
	Updated FSAR Figure 15.2-43



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Revision 0
July 22, 1982

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Transient Response for a Steam Line Break Equivalent to 228 Lb/Sec at 1015 PSIA with Outside Power Available (Unit 2)
	Updated FSAR ~~Figure 15.2-44~~

ATTACHMENT C

REVISED SALEM FSAR SECTION 15.4.2
MAJOR SECONDARY SYSTEM PIPE RUPTURE

15.4.2 MAJOR SECONDARY SYSTEM PIPE RUPTURE

15.4.2.1 IDENTIFICATION OF CAUSES AND ACCIDENT DESCRIPTION

The steam release arising from a rupture of a main steam pipe would result in an initial increase in steam flow which decreases during the accident as the steam pressure falls. The energy removal from the Reactor Coolant System causes a reduction of coolant temperature and pressure. In the presence of a negative moderator temperature coefficient, the cooldown results in a reduction of core shutdown margin. If the most reactive rod cluster control assembly is assumed stuck in its fully withdrawn position after reactor trip, there is an increased possibility that the core will become critical and return to power. A return to power following a steam pipe rupture is a potential problem mainly because of the high power peaking factors which exist assuming the most reactive rod cluster control assembly to be stuck in its fully withdrawn position. The core is ultimately shutdown by the boric acid injection delivered by the Safety Injection System.

The analysis of a main steam pipe rupture is performed to demonstrate that the following criteria are satisfied:

1. Assuming a stuck rod cluster control assembly, with or without offsite power, and assuming a single failure in the engineered safeguards there is no consequential damage to the primary system and the core remains in place and intact.

2. Energy release to containment from the worst steam pipe break does not cause failure of the containment structure.

Although DNB and possible clad perforation following a steam pipe rupture are not necessarily unacceptable, the following analysis, in fact, shows that no DNB occurs for any rupture assuming the most reactive assembly stuck in its fully withdrawn position.

The following functions provide the necessary protection against a steam pipe rupture:

1. Safety injection system actuation from any of the following:

   a. Two-out-of-three channels of low pressurizer pressure

   b. High differential pressure signals between steam lines

   c. High steam line flow in two main steam lines (one-out-of-two per line) in coincidence with either low-low Reactor Coolant System average temperature or low steam line pressure in any two lines.

   d. Two-out-of-three high containment pressure

2. The overpower reactor trips (neutron flux and ΔT) and the reactor trip occurring in conjunction with receipt of the safety injection signal.

3. Redundant isolation of the main feedwater lines: Sustained high feedwater flow would cause additional cooldown. Therefore, in addition to the normal control action which will close the main feedwater valves, a safety injection signal will rapidly close all feedwater control valves, trip the main feedwater pumps, and close the feedwater pump discharge valves.

4. Trip of the fast acting steam line stop valves (designed to close in less than 5 seconds) on:

   a. High steam flow in two main steam lines in coincidence with low-low Reactor Coolant System average temperature or low steam line pressure in any two lines.

   b. High-high containment pressure

Fast-acting isolation valves are provided in each steam line that will fully close within 7 seconds of a signal to close (including instrumentation delays). For breaks downstream of the isolation valves, closure of all valves would completely terminate the blowdown. For any break, in any location, no more than one steam generator would blowdown even if one of the isolation valves fails to close. A description of steam line isolation is included in Chapter 10.

Steam flow is measured by monitoring dynamic head in nozzles inside the steam pipes. The nozzles which are of considerably smaller diameter than the main steam pipe are located inside the containment near the steam generators and also serve to limit the maximum steam flow for any break further downstream.

15.4.2.2 METHOD OF ANALYSIS

The analysis of the steam pipe rupture has been performed to determine:

1. The core heat flux and Reactor Coolant System temperature and pressure resulting from the cooldown following the steam line break. The LOFTRAN[27] code has been used.

2. The thermal and hydraulic behavior of the core following a steam line break. A detailed thermal and hydraulic digital-computer code, THINC, has been used to determine if DNB occurs for the core conditions computed in (1) above.

The following conditions were assumed to exist at the time of a main steam line break accident.

1. End of life shutdown margin at no load, equilibrium xenon conditions, and the most reactive assembly stuck in its fully withdrawn position: Operation of the control rod banks during core burnup is restricted in such a way that addition of positive reactivity in a steam line break accident will not lead to a more adverse condition than the case analyzed.

2. The negative moderator coefficient corresponding to the end of life rodded core with the most reactive rod in the fully withdrawn position: The variation of the coefficient with temperature and pressure has been included. The k_{eff} versus temperature at 1000 psi corresponding to the negative moderator temperature coefficient used is shown in Figure 15.4-48. The effect of power generation in the core on over-all reactivity is shown in Figure 15.4-49.

   The core properties associated with the sector nearest the affected steam generator and those associated with the remaining sector were conservatively combined to obtain average core properties for reactivity feedback calculations. Further, it was conservatively assumed that the core power distribution was uniform. These two conditions cause underprediction of the reactivity feedback in the high power region near the stuck rod. To verify the conservatism of this method, the reactivity as well as the power distribution was checked. These core analyses considered the Doppler reactivity from the high fuel temperature near the stuck RCCA, moderator feedback from the high water enthalpy near the stuck RCCA, power redistribution and nonuniform core inlet temperature effects. For cases in which steam generation occurs in the high flux regions of the core, the effect of void formation was also included. It was determined that the reactivity employed in the kinetics analysis was always larger than the reactivity calculated for all cases. These results verified conservatism; i.e., underprediction of negative reactivity feedback from power generation.

3. Minimum capability for injection of boric acid (2,000 ppm) solution corresponding to the most restrictive single failure in the safety injection system. This corresponds to the flow delivered by one charging pump delivering its full flow to the cold leg header. Low concentration boric acid (<2,000 ppm) must be purged from the safety injection lines downstream of the Refueling Water Storage Tank prior to the delivery of boric acid to the reactor coolant loops. This effect has been allowed for in the analysis by assuming the lines to contain unborated water. The modeling of the Safety Injection System in LOFTRAN is described in Reference 27.

For the cases where offsite power is assumed, the sequence of events in the Safety Injection System is the following. After the generation of the safety injection signal (appropriate delays for instrumentation, logic and signal transport included), the appropriate valves begin to operate and the high head injection pump starts. In an additional 12 sec, the valves are assumed to be in their final position and the pump is assumed to be at full speed. The volume containing the unborated water is purged before the 2,000 ppm boron reaches the core. This delay, described above, is inherently included in the modeling.

In cases where offsite power is not available, a 12-sec delay is assumed to start the diesels and to load the necessary safety injection equipment onto them.

4. Four combinations of break sizes and initial plant conditions have been considered in determining the core power and Reactor Coolant System transients:

   a. Complete severance of a pipe outside the containment, downstream of the steam flow measuring nozzle, with the plant initially at no load conditions, full reactor coolant flow with offsite power available.

   b. Complete severance of a pipe inside the containment at the outlet of the steam generator with the plant initially at no load conditions with offsite power available.

   c. Case (a) above with loss of offsite power simultaneous with the initiation of the safety injection signal. Loss of offsite power results in coolant pump coastdown.

   d. Case (b) above with the loss of offsite power simultaneous with the initiation of the safety injection signal.

5. Power peaking factors corresponding to one stuck RCCA and non uniform core inlet coolant temperatures are determined at end of core life. The coldest core inlet temperatures are assumed to occur in the sector with the stuck rod. The power peaking factors account for the effect of the

local void in the region of the stuck control assembly during the return to power phase following the steam line break. This void in conjunction with the large negative moderator coefficient partially offsets the effect of the stuck assembly. The power peaking factors depend upon the core power, temperature, pressure, and flow, and thus, are different for each case studied.

All the cases above assume initial hot shutdown conditions at time zero since this represents the most pessimistic initial condition. Should the reactor be just critical or operating at power at the time of a steam line break, the reactor will be tripped by the normal overpower protection system when power level reaches a trip point. Following a trip at power the Reactor Coolant System contains more stored energy than at no load, the average coolant temperature is higher than at no load and there is appreciable energy stored in the fuel. Thus, the additional stored energy is removed via the cooldown caused by the steam line break before the no load conditions of Reactor Coolant System temperature and shutdown margin assumed in the analyses are reached. After the additional stored energy has been removed, the cooldown and reactivity insertions proceed in the same manner as in the analysis which assumes no load condition at time zero.

However, since the initial steam generator water inventory is greatest at no load, the magnitude and duration of the Reactor Coolant System cooldown are less for steam line breaks occurring at power.

6. In computing the steam flow during a steam line break, the Moody Curve[25] for fl/D = 0 is used.

7. Perfect moisture separation in the steam generator is assumed. The assumption leads to conservative results since, in fact, considerable water would be discharged. Water carryover would reduce the magnitude of the temperature decrease in the core and the pressure increase in the containment.

15.4.2.3 RESULTS

The results presented are a conservative indication of the events which would occur assuming a steam line rupture since it is postulated that all of the conditions described above occur simultaneously.

15.4.2.4 CORE POWER AND REACTOR COOLANT SYSTEM TRANSIENT

Figures15.4-50A and 15.4-50B show~~s~~ the Reactor Coolant System transient and core heat flux following a main steam pipe rupture (complete severance of a pipe) outside the containment, downstream of the flow measuring nozzle, at initial no load condition (case a). The break assumed is the largest break which can occur anywhere outside the containment either upstream or downstream of the isolation valves. Offsite power is assumed available such that full reactor coolant flow exists. The transient shown assumes an uncontrolled steam release from only one steam generator. Should the core be critical at near zero power when the rupture occurs the initiation of safety injection by high differential pressure between any steam line and the remaining steam lines, or by high steam flow signals in coincidence with either low-low Reactor coolant System temperature or low steam line pressure will trip the reactor. Steam release from more than one steam generator will be prevented by automatic trip of the fast action isolation valves in the steam lines by the high steam flow signals in coincidence with either low Reactor Coolant System temperature or low steam line pressure. The steam line isolation valves are designed to be fully closed in less than 5 seconds after receipt of closure signal with no flow through them. With the high flow existing during a steam line rupture the valves will close considerably faster.

The steam flow ~~on~~ Figure 15.4-~~50~~ 50B as well as Figures 15.4-~~51~~ 51B, 15.4-52B and ~~through~~ 15.4-53B represent steam flow from the faulted steam generator only. In addition, all steam generators were assumed to discharge through the break until steam line isolation has occurred.

As shown in Figures 15.4-52B and 15.4-53B, the core attains criticality with the rod cluster control assemblies inserted (with the design shutdown assuming one stuck assembly) before boron solution at 2,000 ppm enters the Reactor Coolant system from the Safety Injection System. The delay time consists of the time to receive and actuate the safety injection signal and the time to completely open valve trains in the safety injection lines. The safety injection pumps are then ready to deliver flow. At this stage a further delay time is incurred before 2,000 ppm boron solution can be injected to the Reactor Coolant System due to low concentration solution being purged from the safety injection lines. A peak core power well below the nominal full power value is attained.

The calculation assumes the boric acid is mixed with, and diluted by the water flowing in the Reactor Coolant System prior to entering the reactor core. The concentration after mixing depends upon the relative flow rates in the Reactor Coolant System and in the Safety Injection System. The variation of mass flow rate in the Reactor Coolant system due to water density changes is included in the calculation as in the variation of flow rate from the Safety Injection System and accumulator due to changes in the Reactor Coolant System pressure.

The Safety Injection System flow calculation includes the line losses in the system as well as the pump head curve. The accumulators provide the additional source of borated water if the RCS pressure decreases to below 580 psia. The integrated flow rate of borated water from both the accumulators and the Safety Injection System for each of the four cases analyzed are shown in Figure 15.4-54.

Figures 15.4-51A and 15.4-51B show case b, a steam line rupture at the exit of a steam generator at no load. The sequence of events is similar to that described above for the rupture outside the containment except that criticality is attained earlier due to more rapid cooldown and a higher peak core average power is attained.

52A,52B 53A,53B

Figures 15.4-52, and 15.4-53 show the responses of the salient parameters for cases c and d which correspond to the cases discussed above with additional loss of offsite power at the time the safety injection signal is generated. The Safety Injection System delay time includes 12 seconds to start the diesel (including instrumentation delay time) and 12 seconds to get the safety injection pump to full speed. In each case criticality is achieved later and the core power increase is slower than in the similar case with offsite power available. The ability of the emptying steam generator to extract heat from the Reactor Coolant System is reduced by the decreased flow in the Reactor Coolant System. For both these cases the peak core power remains well below the nominal full power value.

It should be noted that following a steam line break only one steam generator blows down completely. Thus, the remaining steam generators are still available for dissipation of decay heat after the initial transient is over. In the case of loss of offsite power this heat is removed to the atmosphere via the steam line safety valves which have been sized to cover this condition.

The sequence of events is shown on Table 15.4-1.

15.4.2.5 MARGIN TO CRITICAL HEAT FLUX

A DNB analysis was performed for the three cases most critical to DNB. It was found that all cases had a minimum DNBR greater than 1.30.

15.4.2.6 OFFSITE DOSES

The off-site doses resulting from the steam line break accident, assuming a primary to secondary steam generator tube leak in the intact steam generators, were calculated. The assumptions and parameters including the mass transferred through the steam generator tube leak used in the analysis are listed below:

1. Prior to the accident, activity of fission products in the primary system is as given in Table 15.4-8. The iodine concentration in the secondary side is 0.28 uCi/cc of equivalent I-131.

2. Off-site power is lost, main steam condensers are not available for steam dump.

3. Eight hours after the accident the Residual Heat Removal System starts operation to cool down the plant.

4. The primary to secondary leakage is evenly distributed in the three non-defective steam generators, no tube leakage in the defective steam generator.

5. Defective fuel is 1 percent.

6. After eight hours following the accident, no steam and activity are released to the environment.

7. No air ejector release and no steam generator blowdown during the accident.

8. No noble gas is dissolved in the steam generator water.

9. The iodine partition factor $\frac{\text{amount of iodine/unit mass steam}}{\text{amount of iodine/unit mass liquid}} = 0.1$ in steam generators

10. The atmosphere dispersion factors (x/Q) at site boundary and low population zone are as listed in Table 15.4-9. The breathing rate is 3.47×10^{-4} m^3/sec for 0-8 hours.

11. In the affected steam generator, all the water boils off and releases through the break immediately after the accident. One tenth of the iodines in the water is released to the environment.

12. The primary pressure remains constant at 2235 psig for 0-2 hour and decreases linearly to atmosphere from 2235 psig during the period 2-8 hour.

STEAM LINE BREAK

STEAM RELEASE

	0-2 Hours	2-8 Hours
Mass release from defective S.G. lbs	95,000	0
Steam release from non-defective S.G.'s lbs	424,000	1,188,000
Feedwater Flow to 3 non-defective S.G.'s lbs	433,000	1,300,000
Mass of reactor coolant transferred into 3 non-defective S.G.'s lbs for a primary to secondary leak rate of 1 gpm, lbm	719	2,510

Using the above assumptions, the thyroid inhalation exposure was calculated to be 2.1 rem at the minimum exclusion distance (1270 meters) and 0.37 rem at the 5 mile low population zone radius. Using the conservative calculational models presented in Safety Guide 4, the whole body doses were calculated to be 0.0067 rem at the minimum exclusion distance and 0.0014 rem at the low population zone radius.

TABLE 15.4-1 (Sheet 1 of 3)

TIME SEQUENCE OF EVENTS FOR CONDITION IV EVENTS

Accident	Event	Time(Seconds)
Major Reactor Coolant System Pipe Ruptures Double-Ended Cold Leg Guillotine		
1. (C_D = 1.0)	Start	0.0
	Reactor trip signal	1.65
	Safety injection signal	0.86
	Accumulator injection	14.1
	End of Blowdown	28.1
	Bottom of core recovery	40.34
	Accumulators empty	51.15
	Pump injection	25.86
	End of bypass	25.4
2. (C_D = 0.8)	Start	0.0
	Reactor trip signal	1.66
	Safety injection signal	0.92
	Accumulator injection	14.6
	End of Blowdown	28.8
	Bottom of core recovery	40.95
	Accumulators empty	51.6
	Pump injection	25.92
	End of bypass	26.0
3. (C_D = 0.6)	Start	0.0
	Reactor trip signal	1.66
	Safety injection signal	1.03
	Accumulator injection	16.8

TABLE 15.4-1 (Sheet 2 of 3)

TIME SEQUENCE OF EVENTS FOR CONDITION IV EVENTS

Accident	Event	Time(Seconds)
	End of Blowdown	30.46
	Bottom of core recovery	42.5
	Accumulators empty	53.64
	Pump injection	26.03
	End of bypass	27.51
Rupture of main feedwater pipe	Feedline rupture occurs	0.00
	High pressure reactor trip setpoint reached (This trip was not considered in the analysis).	11.0
	Affected steam generator liquid discharge; low level coincident with feed/steam flow mismatch in other steam generators; reactor trip setpoints reached.	18.5
	Reactor trip occurs	20.5
	Peak steam relief from pressurizer safety valves	22.5
	Pressurizer fills	527
	Bulk boiling begins in reactor coolant fluid	876

TABLE 15.4-1 (Sheet 3 of 3)

TIME SEQUENCE OF EVENTS FOR CONDITION IV EVENTS

Accident	Event	Time (Seconds)
	Core decay heat decreases to auxiliary feedwater heat removal capacity	2100
Major Secondary System Pipe Rupture		
1. Case a	Steam line ruptures	0
	Criticality attained	40
	Pressurizer empty	13
	2,000 ppm boron reaches loops	27
2. Case b	Steam line ruptures	0
	Criticality attained	24
	Pressurizer empty	13
	2,000 ppm boron reaches loops	27
3. Case C	Steam line ruptures	0
	Criticality attained	49
	Pressurizer empty	14
	2,000 ppm boron reaches loops	33
4. Case d	Steam line ruptures	0
	Criticality attained	28
	Pressurizer empty	15
	2,000 ppm boron reaches loops	34

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TABLE 15.4-7 (Sheet 1 of 3)

CORE PARAMETERS USED IN STEAM BREAK DNB ANALYSIS

Parameter	Case a, Time Point 1		2		3		4		5	
	Unit 1	Unit2	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2
Reactor Vessel inlet temperature to sector connected to affected steam generator °F	454.8	443.2	439.0	435.1	220.1	421.9	405.2	406.9	392.8	396.8
Reactor Vessel inlet temperature to remaining sector	497.4	494.8	495.3	494.3	492.6	493.0	483.2	485.5	468.0	473.8
RCS pressure, psia	907.3	869.5	868.6	849.1	796.7	799.2	693.1	702.4	578.0	597.4
RCS flow,	100	100	100	100	100	100	100	100	100	100
Heat flux,	6.18	6.76	6.63	8.28	6.99	8.14	6.83	7.39	6.43	6.32
Time (sec)	25	30	32.5	34.5	47.5	45.5	70	67.5	97.5	92.5

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TABLE 15.4-7 (Sheet 2 of 3)

CORE PARAMETERS USED IN STEAM BREAK DNB ANALYSIS

Parameter	Case b, Time Point 1		2		3		4		5	
	Unit 1	Unit2	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2
Reactor Vessel inlet temperature to sector connected to affected steam generator °F	391.4	386.7	377.8	375.9	348.7	372.5	340.1	367.7	328.6	358.4
Reactor Vessel inlet temperature to remaining sector °F	526.8	523.5	518.8	516.4	470.3	512.0	451.0	505.3	427.8	488.7
RCS pressure, psia	1303.9	1098.8	898.9	879.9	573.9	849.5	523.8	795.5	487.9	644.4
RCS flow,	100	100	100	100	100	100	100	100	100	100
Heat flux,	8.22	9.57	8.37	12.45	9.65	11.65	8.46	12.58	7.75	12.02
Time (sec)	25	27.5	35	37	80	41.5	100	49.5	122.5	70

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TABLE 15.4-7 (Sheet 3 of 3)

CORE PARAMETERS USED IN STEAM BREAK DNB ANALYSIS

Parameter	Case d, Time Point 1 Unit 1	1 Unit2	2 Unit 1	2 Unit 2	3 Unit 1	3 Unit 2	4 Unit 1	4 Unit 2	5 Unit 1	5 Unit 2
Reactor Vessel inlet temperature to sector connected to affected steam generator °F	390.5	375.5	356.6	350.9	345.5	322.1	312.1	303.2	281.5	284.3
Reactor Vessel inlet temperature to remaining sector °F	530.2	529.9	528.9	529.2	529.1	528.9	528.0	527.5	524.5	526.8
RCS pressure, psia	1712.5	1469.3	1359.1	1264.8	1270.4	1112.1	1004.9	998.3	877.5	891
RCS flow,	47	40.6	33.9	32.3	30.7	24.9	22.8	20.9	17.0	17.4
Heat flux,	5.27	5.8	6.10	6.74	6.2	7.87	4.52	5.10	3.59	3.58
Time (sec)	20	25	32.5	35	37.5	50.5	57.5	65	87.5	85

TABLE 15.4-8

REACTOR COOLANT EQUILIBRIUM FISSION AND CORROSION PRODUCT ACTIVITIES
(BASED ON PARAMETERS GIVEN IN TABLE 11.1-7)

Isotope	Activity μc/cc	Isotope	Activity μc/cc
Br-84	3.34×10^{-2}	CS-136	2.93×10^{-2}
Rb-88	2.66	Cs-137	.859
Rb-89	6.74×10^{-2}	Cs-138	.670
Sr-89	3.18×10^{-3}	Ba-140	3.24×10^{-3}
Sr-90	7.88×10^{-5}	La-140	1.27×10^{-3}
Sr-91	1.42×10^{-3}	Ce-144	3.88×10^{-4}
Sr-92	5.97×10^{-4}	Pr-144	3.88×10^{-4}
Y-90	1.05×10^{-4}	Kr-85	3.93
Y-91	5.83×10^{-3}	Kr-85m	1.70
Y-92	7.68×10^{-4}	Kr-87	.942
Zr-95	6.66×10^{-4}	Kr-88	2.66
Nb-95	6.57×10^{-4}	Xe-133	194.7
Mo-99	2.36	Xe-133m	2.09
I-131	1.87	Xe-135	5.45
I-132	.657	Xe-135m	.132
I-133	2.89	Xe-138	.468
I-134	.376	Mn-54	5.87×10^{-4}
I-135	1.46	Mn-56	2.20×10^{-2}
Te-132	.208	Co-58	1.89×10^{-2}
Te-134	2.04×10^{-2}	Co-60	5.67×10^{-4}
Cx-134	.142	Fe-59	7.87×10^{-4}

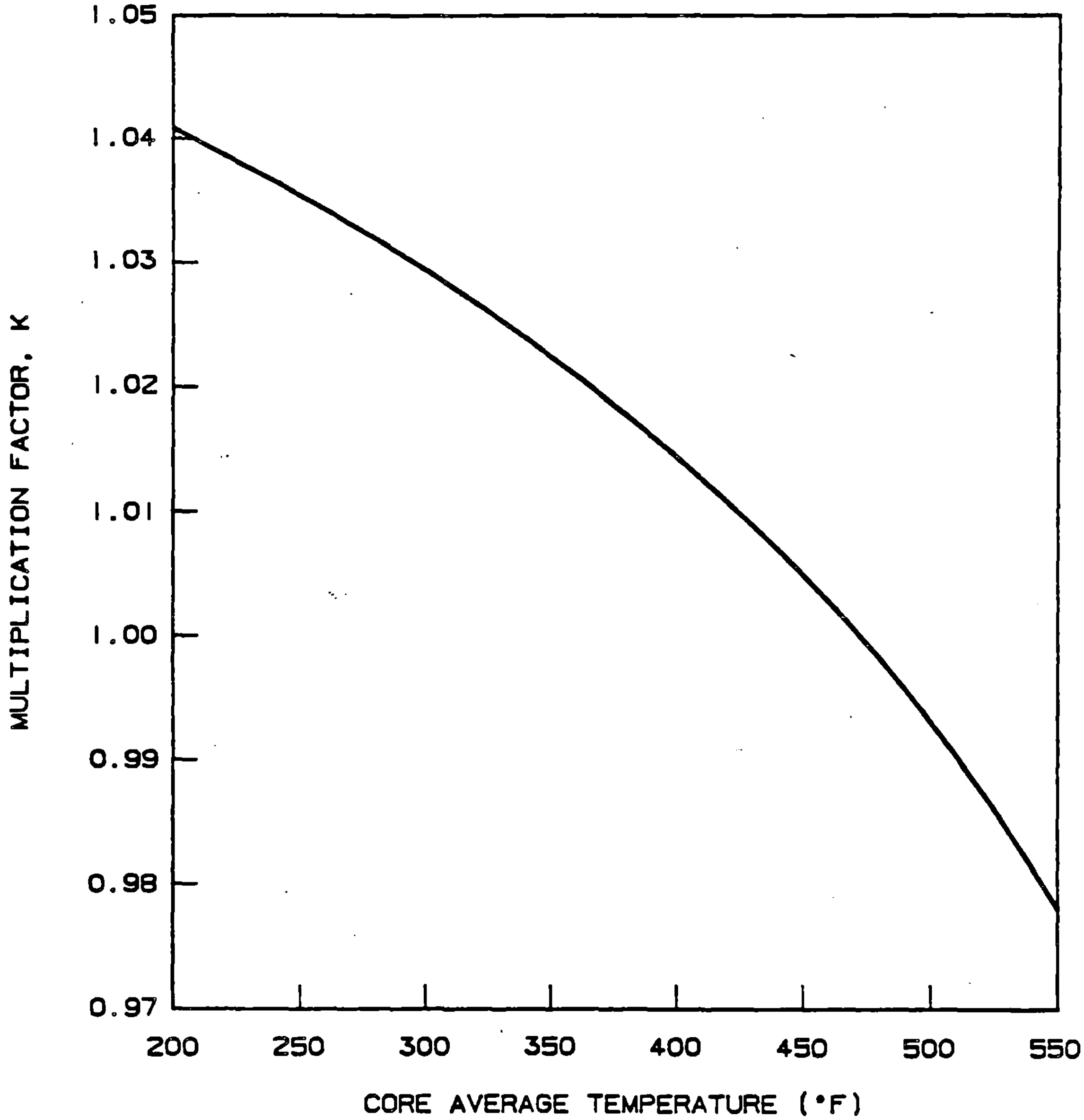
TABLE 15.4-9

ATMOSPHERIC DISPERSION FACTORS

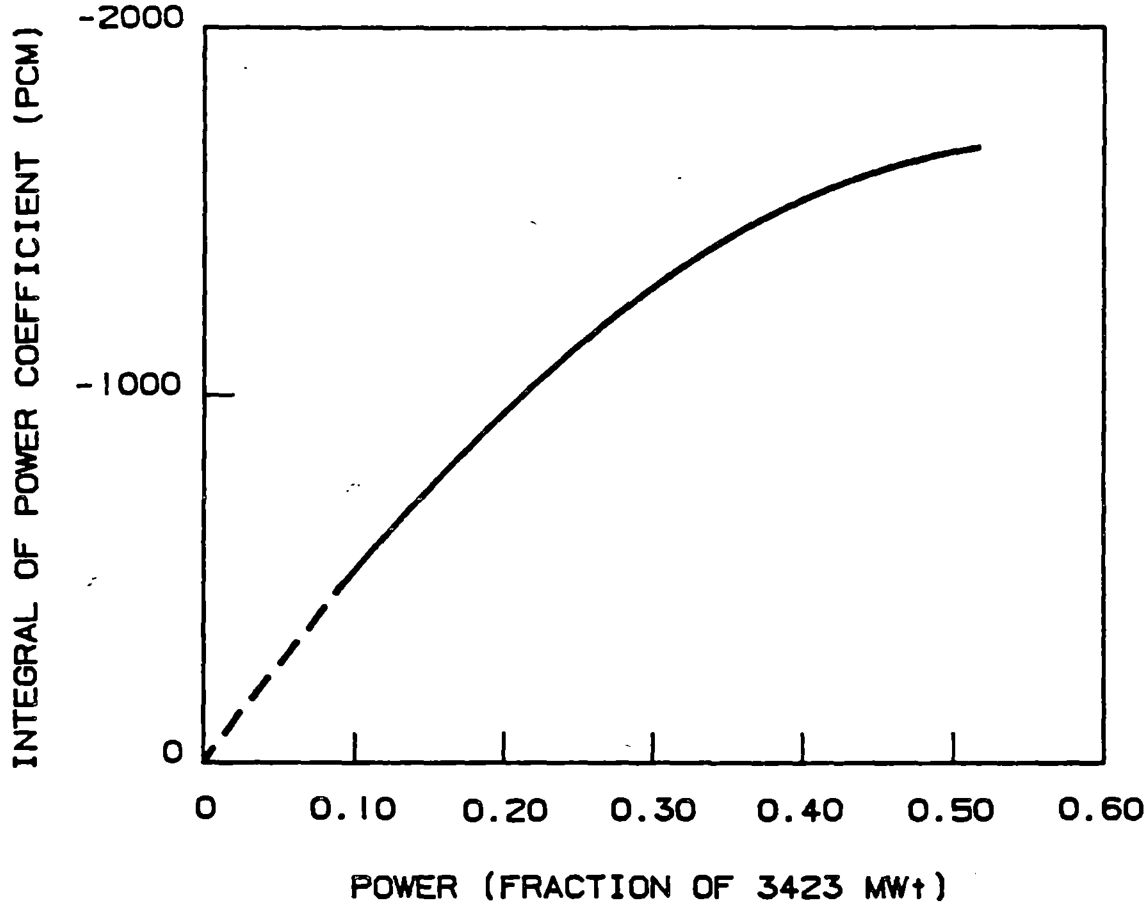
AND BREATHING RATES

Distance, m	Atmospheric Dispersion Factors, X/Q (sec/m^3)			
	0 - 2 hrs	2 - 24 hrs	1 - 5 days	5 - 30 days
1270	5.0×10^{-4}	2.5×10^{-4}	4.25×10^{-6}	2.53×10^{-6}
8052	4.0×10^{-5}	2.0×10^{-5}	1.8×10^{-7}	9.6×10^{-8}

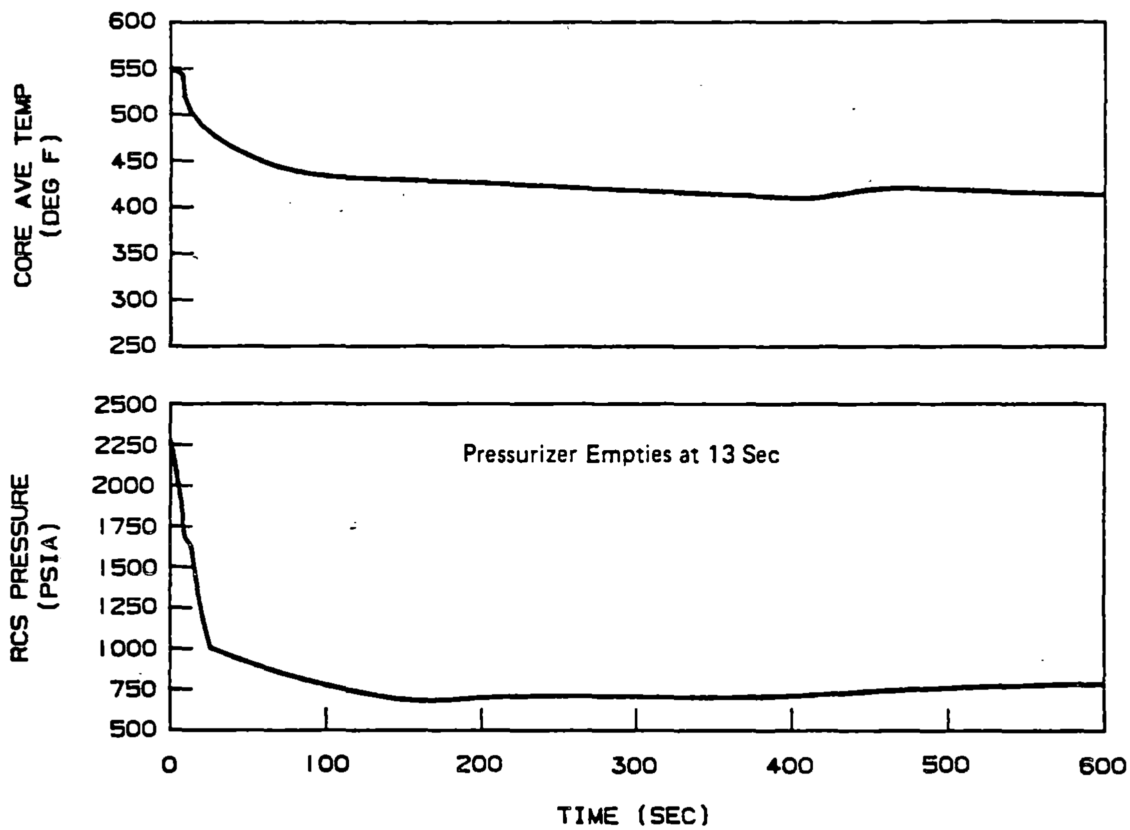
Time Period, hr	Breathing Rates, m /sec
0 - 8	3.47×10^{-4}
8 - 24	1.75×10^{-4}
24 - 720	2.32×10^{-4}



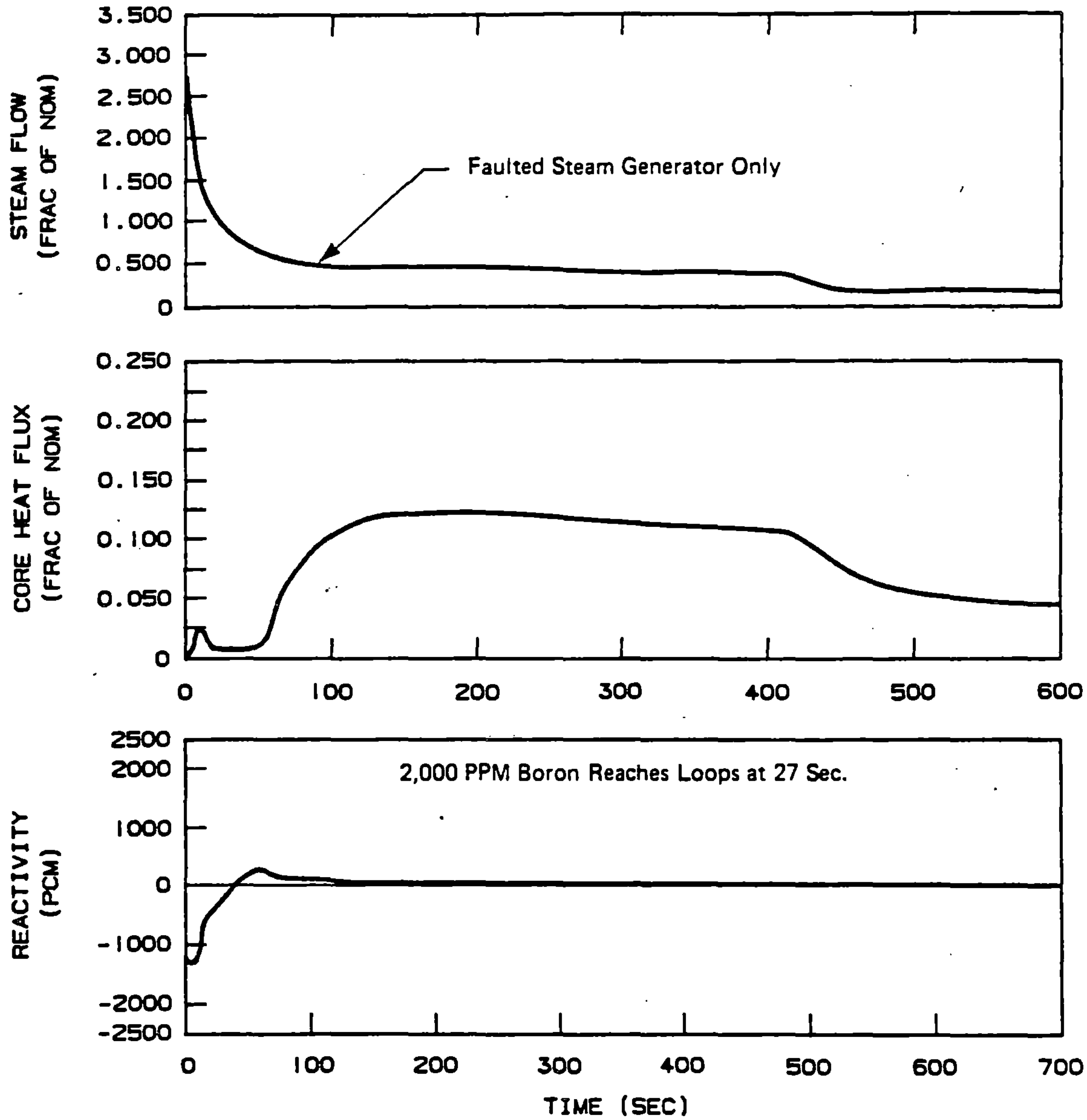
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Variation of K_{EFF} with Core Temperature	
	Updated FSAR	Figure 15.4-48



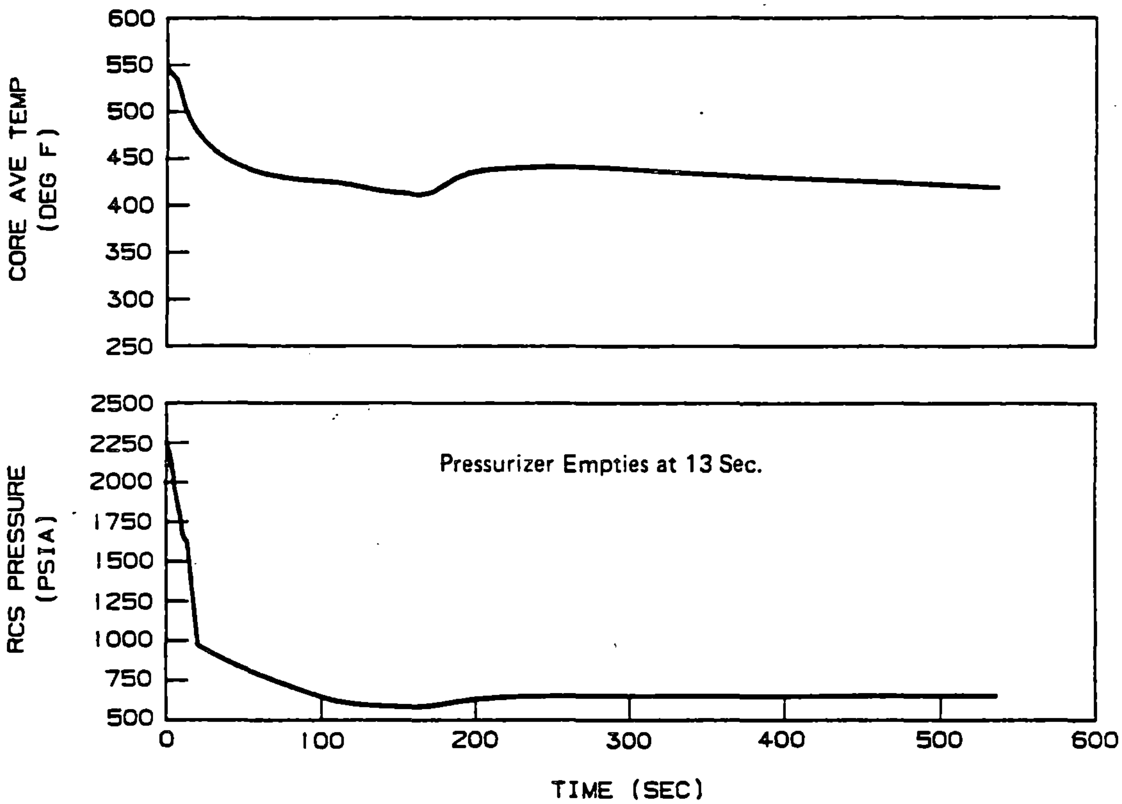
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Variation of Reactivity with Power at Constant Core Average Temperature	
	Updated FSAR	Figure 15.4-49



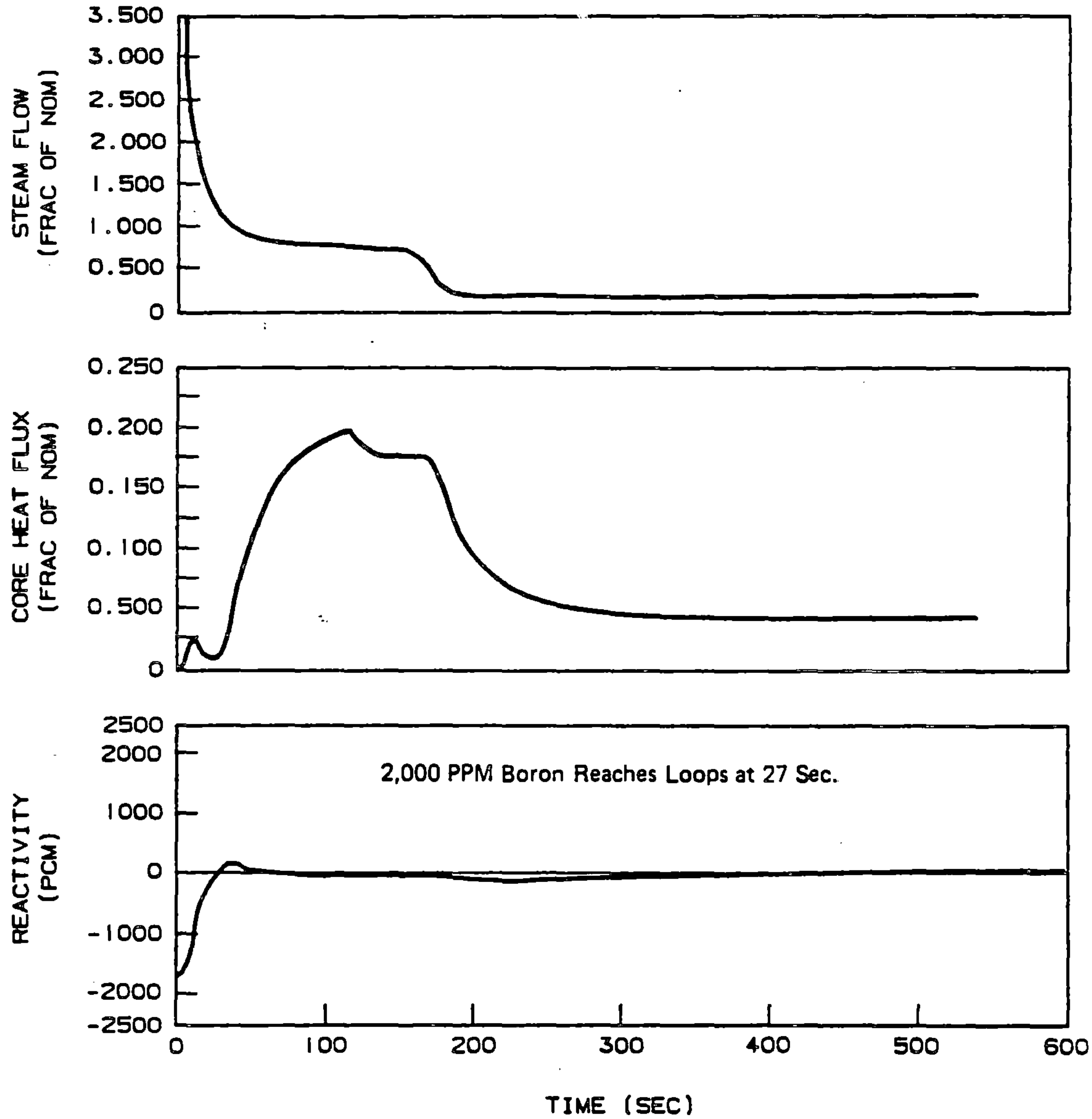
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Transient Response to Steam Line Break Downstream of Flow Measuring Nozzle with Safety Injection and Offsite Power (Case a)	
	Updated FSAR	Figure 15.4-50A



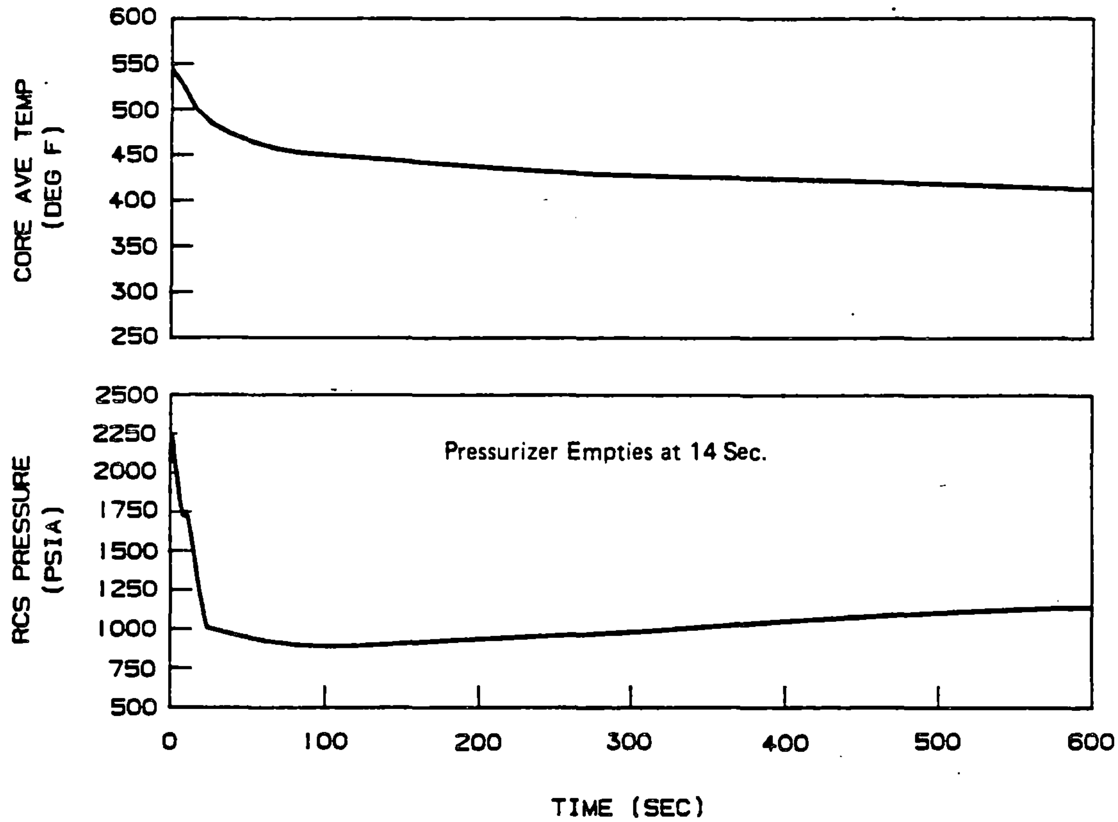
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Transient Response to Steam Line Break Downstream of Flow Measuring Nozzle with Safety Injection and Offsite Power (Case a)
	Updated FSAR — Figure 15.4-50B



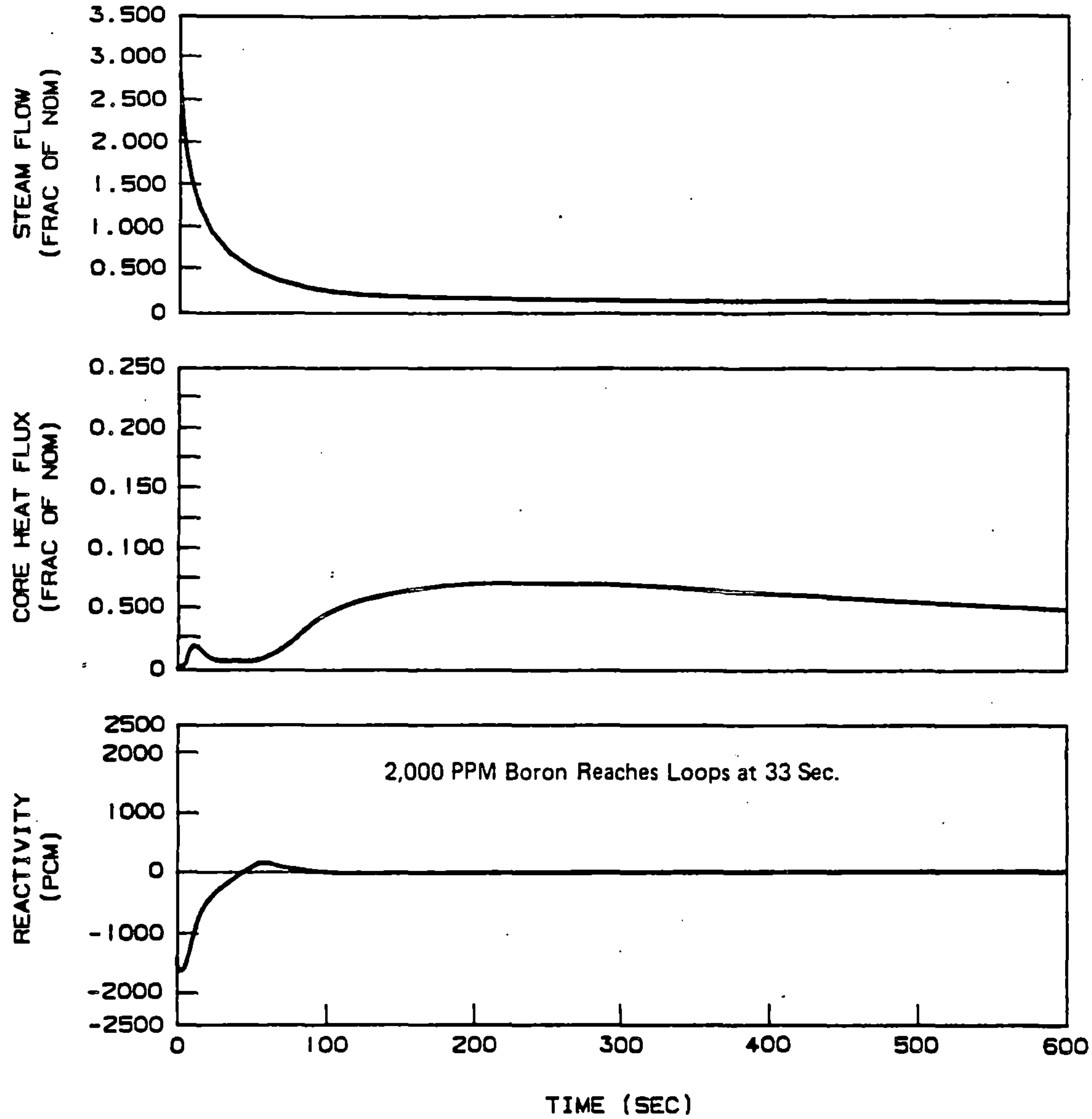
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Transient Response to Steam Line Break at Exit of Steam Generator with Safety Injection and Offsite Power (Case b)
	Updated FSAR Figure 15.4.51A



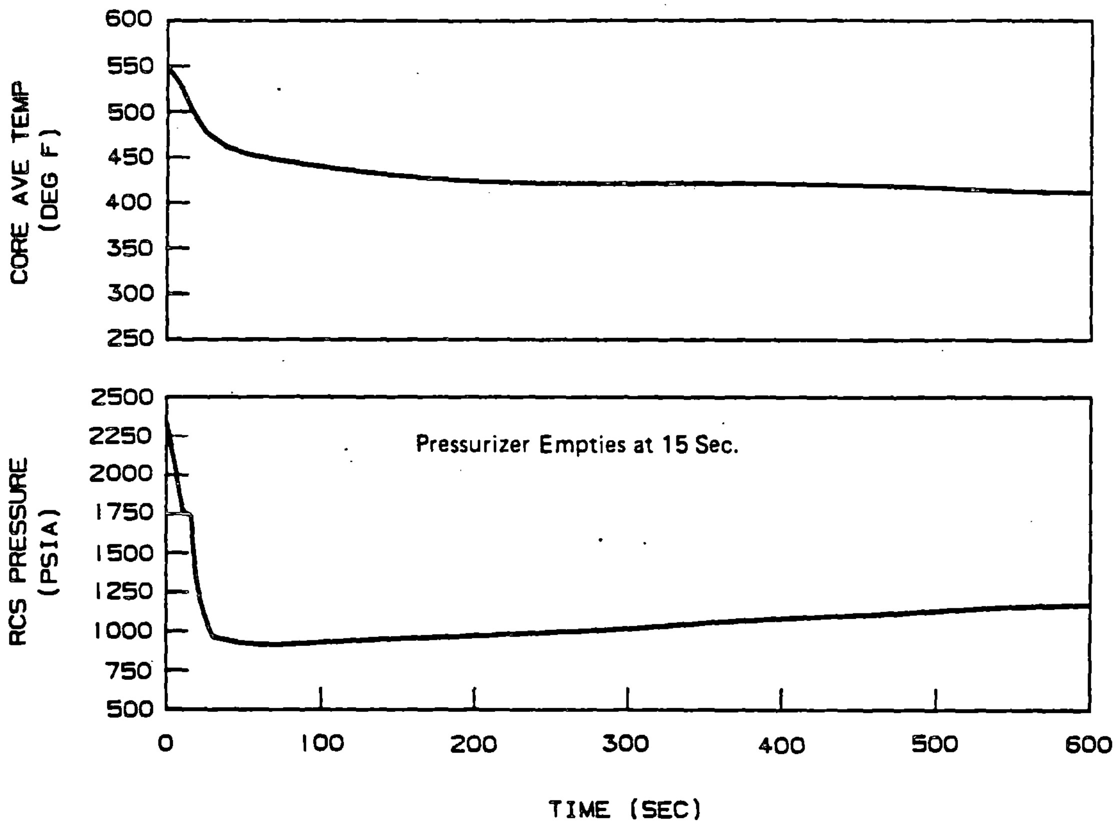
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Transient Response to Steam Line Break at Exit of Steam Generator with Safety Injection and Offsite Power (Case b)
	Updated FSAR — Figure 15.4.51B



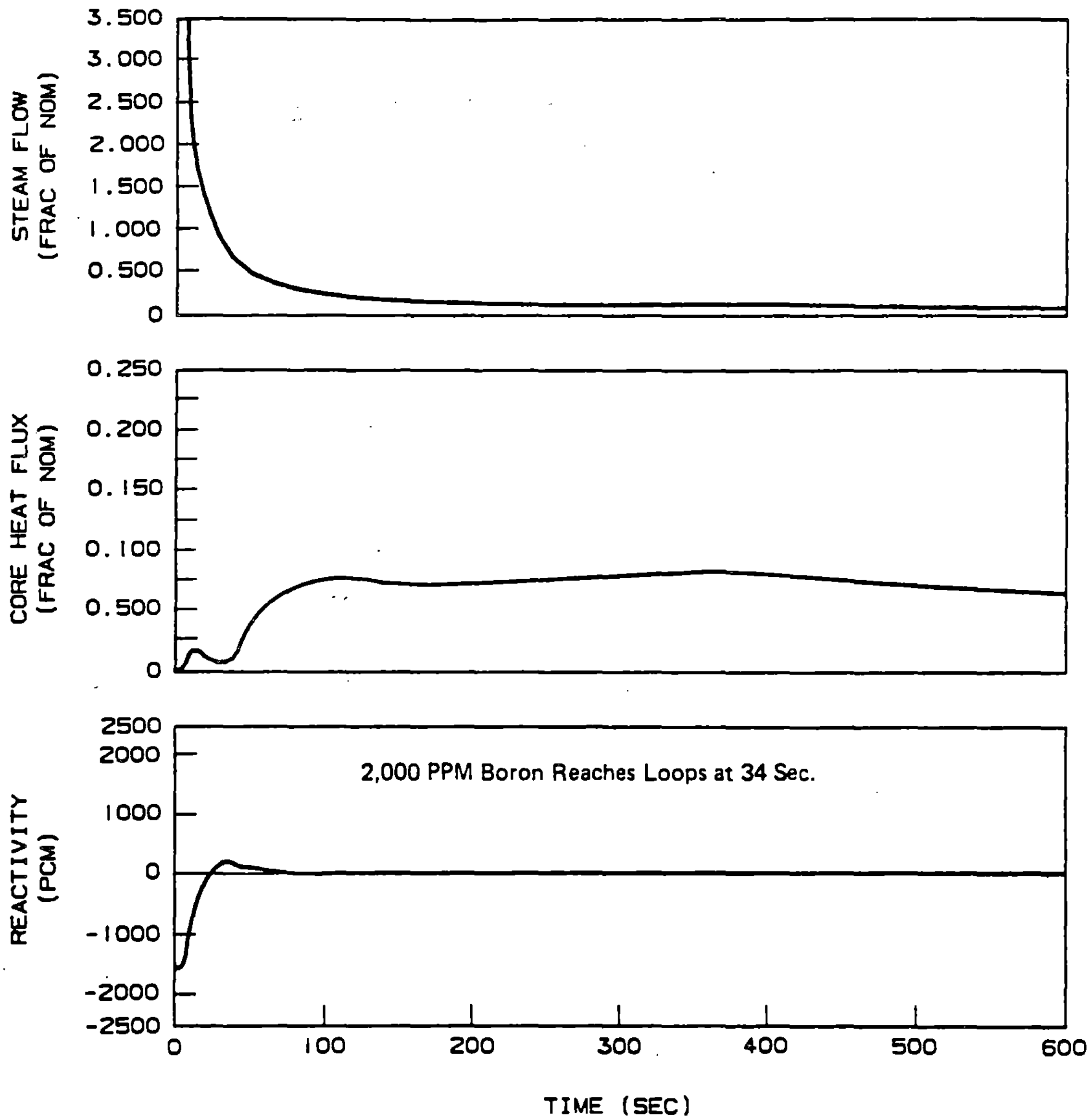
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Transient Response to Steam Line Break Downstream of Flow Measuring Nozzle with Safety Injection, Without Offsite Power (Case c)
	Updated FSAR Figure 15.4-52A



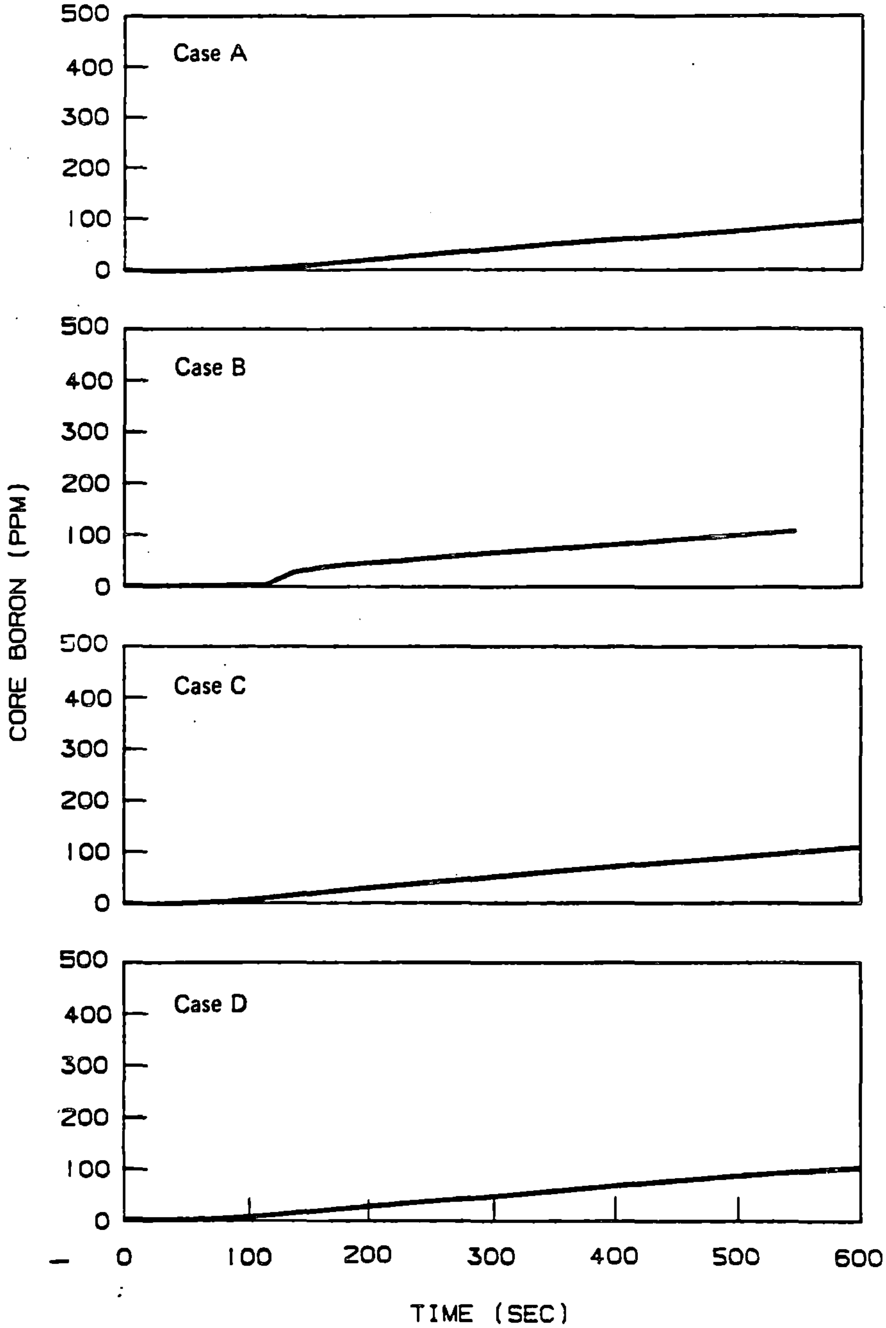
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Transient Response to Steam Line Break Downstream of Flow Measuring Nozzle with Safety Injection, Without Offsite Power (Case c)
	Updated FSAR — Figure 15.4-52B



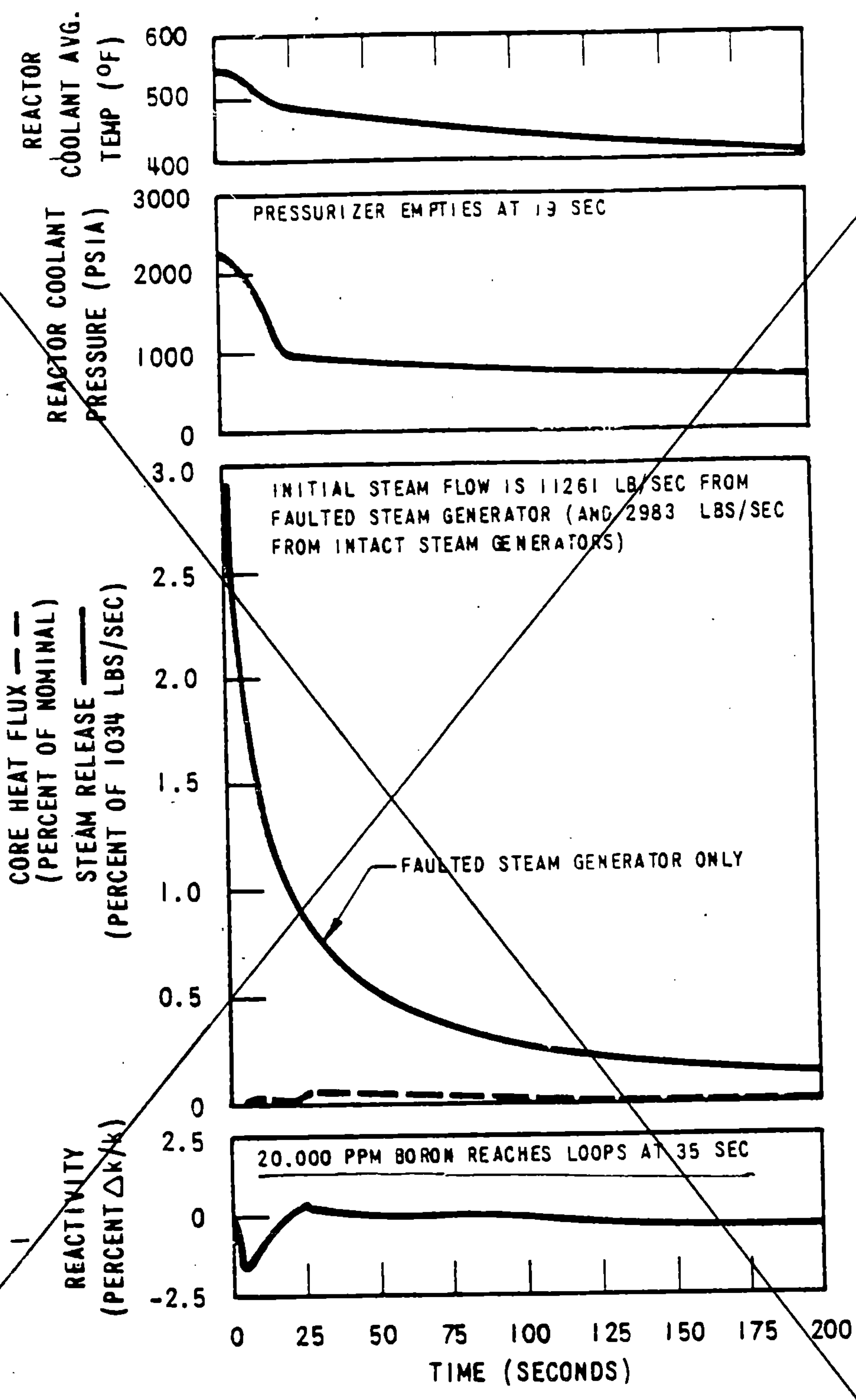
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Transient Response to Steam Line Break at Exit of Steam Generator With Safety Injection and Without Offsite Power (Case d)
	Updated FSAR — Figure 15.4-53A



PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Transient Response to Steam Line Break at Exit of Steam Generator With Safety Injection and Without Offsite Power (Case d)	
	Updated FSAR	Figure 15.4-53B



PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Integrated Flow Rate of Borated Water versus Time
	Updated FSAR Figure 15.4-54



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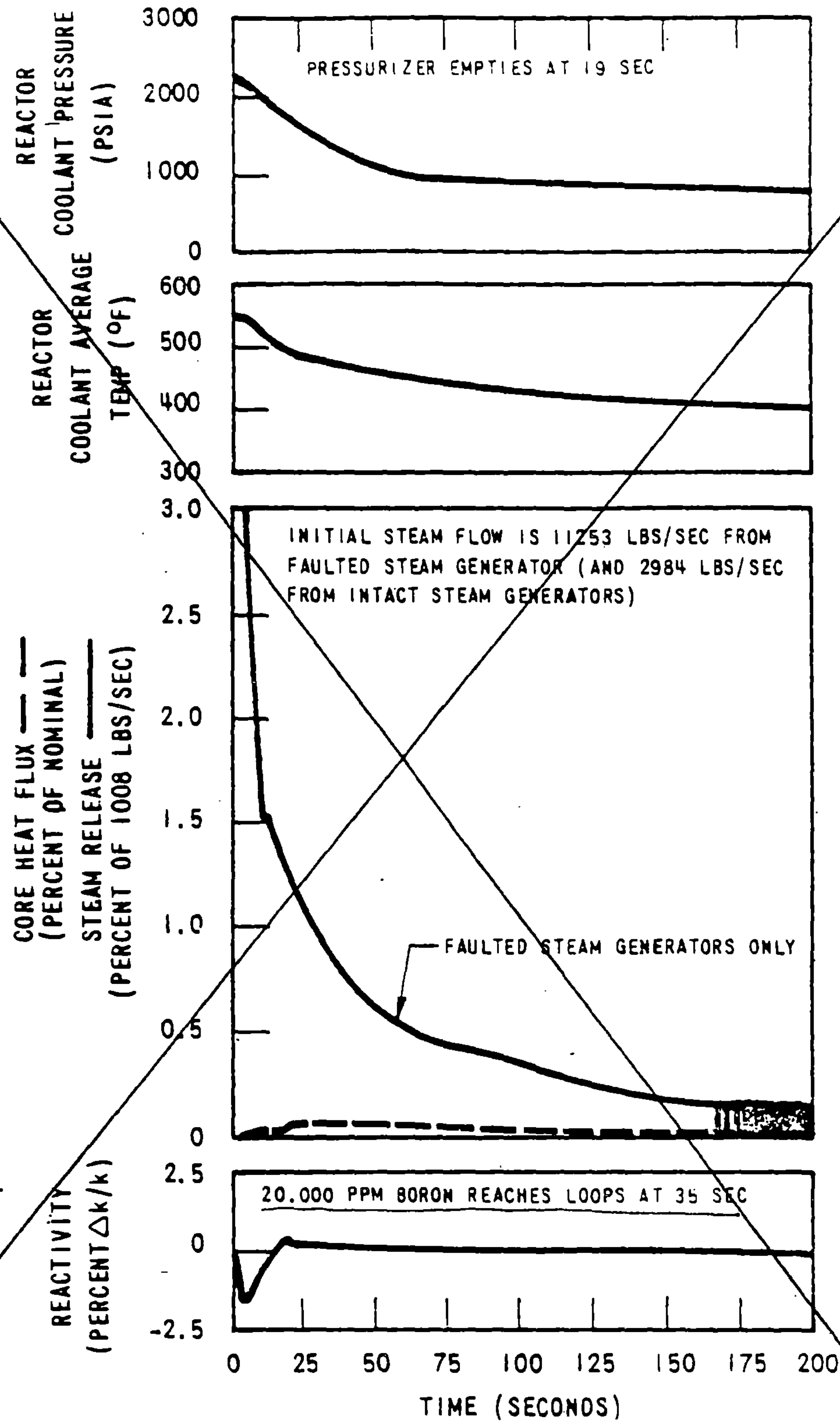
Revision 0
July 22, 1982

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Transient Response to Steam Line Break at Exit of Steam Generator with Safety Injection and Offsite Power (Case b) - Unit 2
	Updated FSAR ~~Figure 15.4-55~~



DELETE FIGURE

Revision 0
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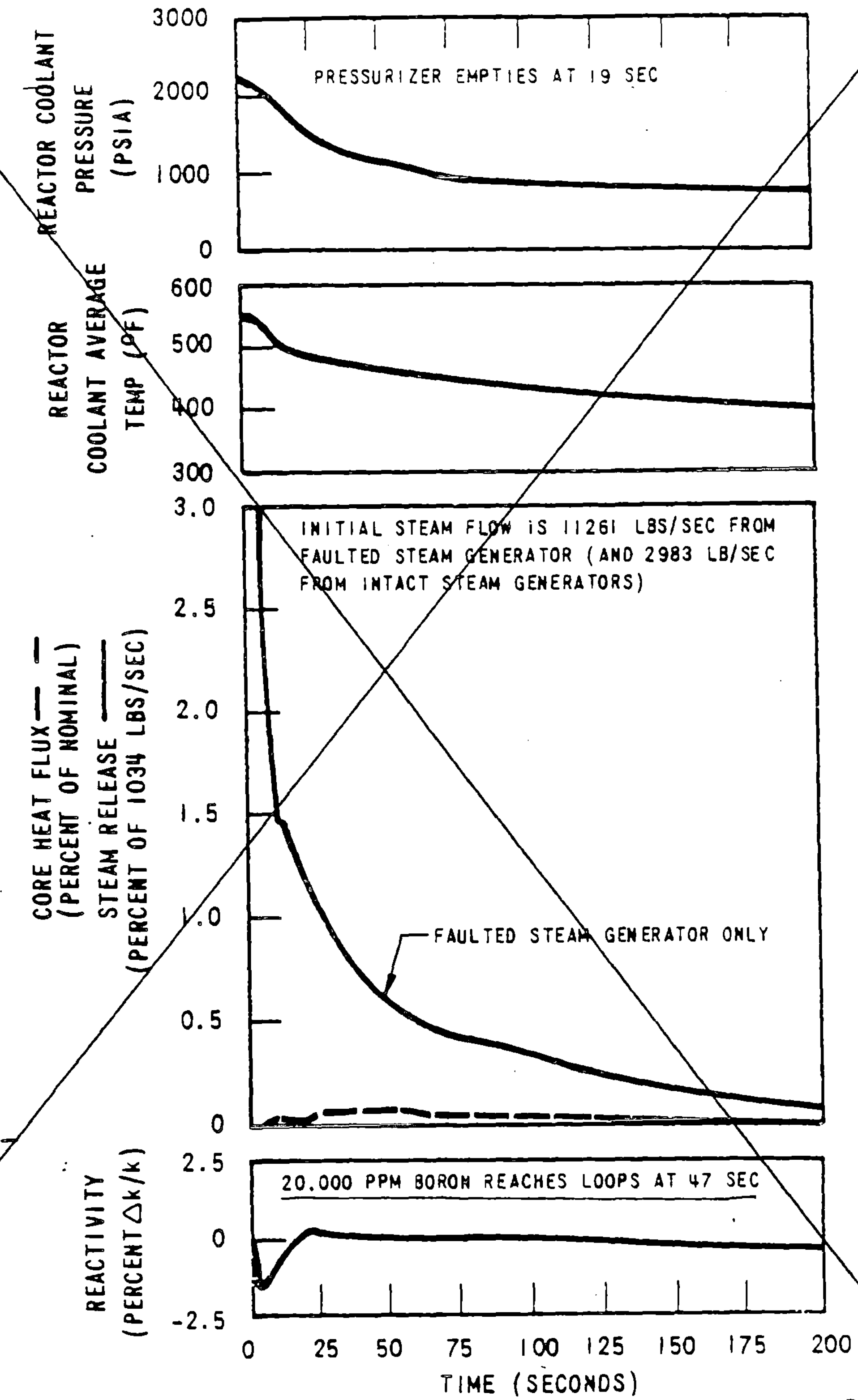
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Transient Response to Steam Line Break at Exit of Steam Generator With Safety Injection and Without Offsite Power (Case d) - Unit 1
	Updated FSAR ~~Figure 15.4-56~~



DELETE FIGURE

Revision 0
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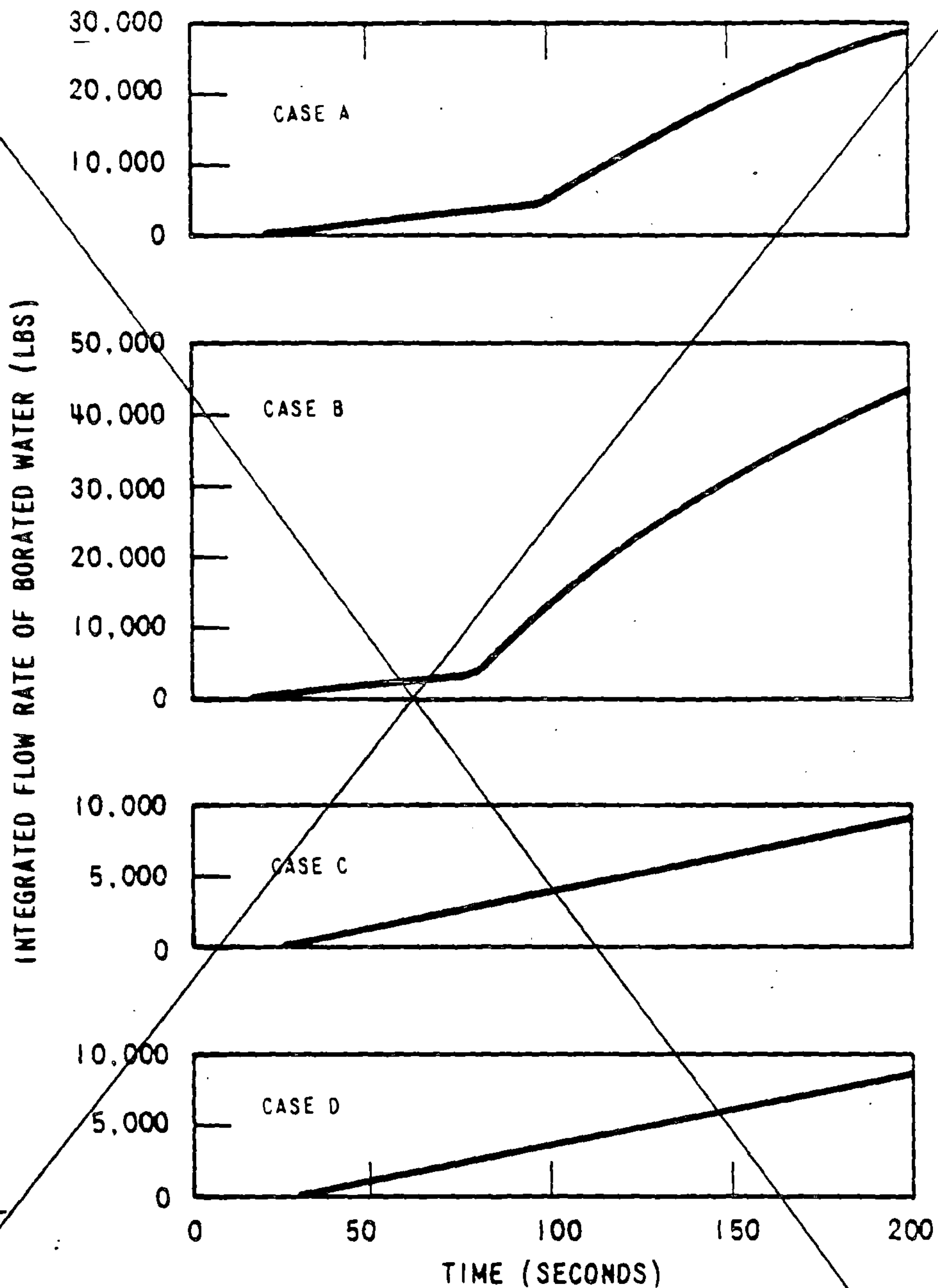
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Transient Response to Steam Line Break at Exit of Steam Generator With Safety Injection and Without Offsite Power (Case d) - Unit 2
	Updated FSAR ~~Figure 15.4-57~~



DELETE FIGURE

Revision 0
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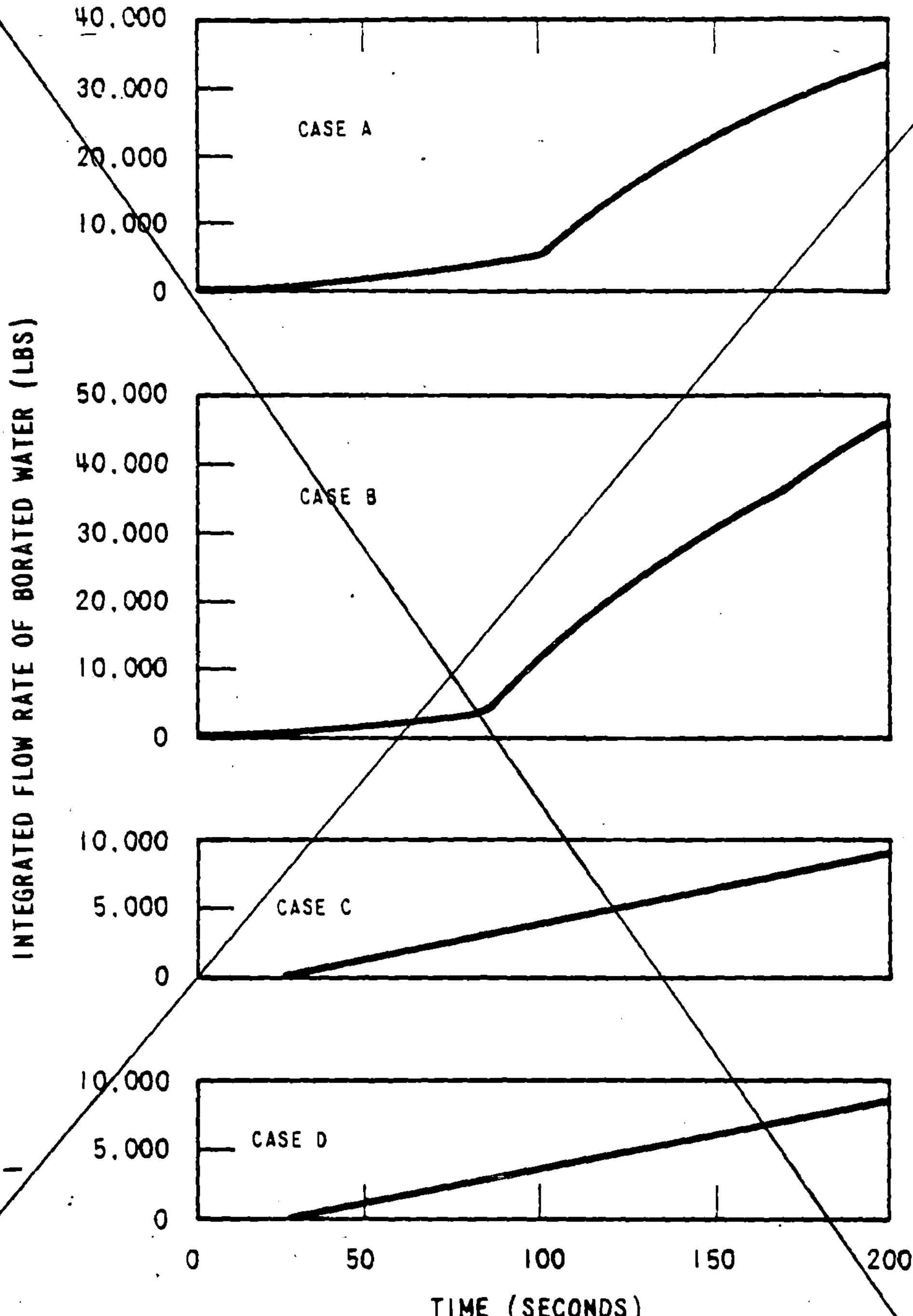
PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Integrated Flow Rate of Borated Water versus Time - Unit 1
	Updated FSAR ~~Figure 15.4-58~~



DELETE FIGURE

Revision 0
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PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Integrated Flow Rate of Borated Water versus Time - Unit 2
	Updated FSAR ~~Figure 15.4-59~~

LCR # 85-07

ATTACHMENT D

MARKED-UP SALEM FSAR TABLE 6.3-3
BORON INJECTION TANK DESIGN PARAMETERS

TABLE 6.3-3

BORON INJECTION TANK DESIGN PARAMETERS

Number	1
Total volume, gal (also useable volume)	900
~~Boron concentration~~	
~~Nominal, ppm~~	~~21,000~~
~~Maximum, ppm~~	~~22,500~~
~~Minimum, ppm~~	~~20,000~~
Design pressure, psig	2735
Design temperature, °F	150-180
Material	SS Clad Carbon Steel
Code	ASME III Class C

~~HEATERS~~

~~Number~~	~~2~~
~~Capacity, kw~~	~~6~~
~~Type~~	~~Strip~~

LCR # 85-07

ATTACHMENT E

REVISED SALEM FSAR TABLE 15.1-2

SUMMARY OF INITIAL CONDITIONS AND COMPUTER CODES USED

TABLE 15.1-2 (Sheet 1 of 4)

SUMMARY OF INITIAL CONDITIONS AND COMPUTER CODES USED

FAULTS	COMPUTER CODES UTILIZED	REACTIVITY COEFFICIENTS ASSUMED: MODERATOR[1] TEMPERATURE (Δk/°F)	REACTIVITY COEFFICIENTS ASSUMED: MODERATOR[1] DENSITY (ΔK/gm/cc)	DOPPLER[2]	INITIAL NSSS THERMAL POWER OUTPUT ASSUMED (MWT)
CONDITION II					
Uncontrolled RCC assembly Bank Withdrawal from a Subcritical Condition	WIT-6, FACTRAN	$+1 \times 10^{-5}$	---	Lower	0
Uncontrolled RCC Assembly Bank Withdrawal at Power	LOFTRAN	---	0 and 0.43	lower and upper	3423
RCC Assembly Misalignment	THINC, TURTLE, LOFTRAN	---	0	upper	3423
Uncontrolled Boron Dilution	NA	NA	NA	NA	0 and 3423
Partial Loss of Forced Reactor Coolant Flow	PHOENIX, LOFTRAN THINC, FACTRAN	---	0	upper	2396 and 3423
Start-up of an Inactive Reactor Coolant Loop	MARVEL, THINC	---	0.43	lower	2369
Loss of External Electrical Load and/or Turbine Trip	LOFTRAN	---	0 and 0.43	upper	3423
Loss of Normal Feedwater	BLKOUT	---	NA	NA	3577
Loss of Off-Site Power to the Plant Auxiliaries (Plant Blackout)	BLKOUT	---	NA	NA	3423

TABLE 15.1-2 (Sheet 2 of 4)

SUMMARY OF INITIAL CONDITIONS AND COMPUTER CODES USED

FAULTS	COMPUTER CODES UTILIZED	REACTIVITY COEFFICIENTS ASSUMED: MODERATOR[1] TEMPERATURE (ΔK/°F)	MODERATOR[1] DENSITY (ΔK/gm/cc)	DOPPLER[2]	INITIAL NSSS THERMAL POWER OUTPUT ASSUMED (Mwt)
CONDITION II (continued)					
Excessive Heat Removal Due to Feedwater System Malfunctions	MARVEL	---	0.43	lower	0 and 3423
Excessive Load Increase	LOFTRAN	---	0 and 0.43	lower	3423
Accident Depressurization of the Reactor Coolant System	LOFTRAN	---	0	upper	3423
Accident Depressurization of the Main Steam System	LOFTRAN	---	Function of Moderator Density See Sec. 15.2.13 (Fig. 15.2.41)	Fig. 15.4-49	0 (Subcritical)
Inadvertent Operation of ECCS During Power Operation	LOFTRAN	---	0	lower	3423
CONDITION III					
Loss of Reactor Coolant from Small Ruptured Pipes or from Cracks in Large Pipe which Actuate Emergency Core Cooling	WFLASH, LOCTA-R2				3577

TABLE 15.1-2 (Sheet 3 [illegible]

SUMMARY OF INITIAL CONDITIONS AND COMPUTER CODES USED

FAULTS	COMPUTER CODES UTILIZED	REACTIVITY COEFFICIENTS ASSUMED: MODERATOR[1] TEMPERATURE (ΔK/°F)	REACTIVITY COEFFICIENTS ASSUMED: MODERATOR[1] DENSITY (ΔK/gm/cc)	DOPPLER[2]	INITIAL NSSS THERMAL POWER OUTPUT ASSUMED (Mwt)
CONDITION III (continued)					
Inadvertent Loading of a Fuel Assembly into an Improper Position	LEOPARD, TURTLE	---	NA	NA	3423
Complete Loss of Forced Reactor Coolant Flow	PHOENIX, LOFTRAN THINC, FACTRAN	---	0	upper	2396 and 3423
Waste Gas Decay Tank Rupture	NA	---	NA	NA	3577
Single RCC Assembly Withdrawal at Full Power	TURTLE, THINC LEOPARD	---	NA	NA	3423
CONDITION IV					
Major rupture of pipes containing reactor coolant up to an including double-ended rupture of the largest pipe in the Reactor Coolant System (Loss of Coolant Accident)	SATAN LOCTA-R2	Function of Moderator density See Section 15.4.1		Function of Fuel Temp. See Section 15.4.1	3579
Major secondary system pipe rupture up to and including double ended rupture (Rupture of a Steam Pipe)	LOFTRAN, THINC	Function of Moderator Density See Section 15.2.13 (Fig. 15.2-41)		Fig. 15.4-49	0 (Subcritical)

TABLE 15.1-2 (Sheet 4 of 4)

SUMMARY OF INITIAL CONDITIONS AND COMPUTER CODES USED

FAULTS	COMPUTER CODES UTILIZED	REACTIVITY COEFFICIENTS ASSUMED: MODERATOR[1] TEMPERATURE (Δk/°F)	MODERATOR[1] DENSITY (ΔK/gm/cc)	DOPPLER[2]	INITIAL NSSS THERMAL POWER OUTPUT ASSUMED (MWT)
CONDITION IV (cont'd)					
Steam Generator Tube Rupture	NA	NA	NA	NA	3577
Single Reactor Coolant Pump Locked Rotor	PHOENIX, LOFTRAN THINC, FACTRAN	---	0	upper	2396 and 3423
Fuel Handling Accident	NA	NA	NA		3577
Rupture of a Control Rod Mechanism Housing (RCCA Ejection)	TWINKLE, FACTRAN LEOPARD	-1 pcm/°E BOL -26 pcm/°F EOL	---	Consistent with lower limit shown Fig. 15.1-5	0 and 3423

NOTES:

(1) Only one is used in an analysis i.e. either moderator temperature or moderator density coefficient

(2) Reference Figure 15.1-5