ENCLOSURE 1

SONGS 1 RCS Inventory Analysis for Station Blackout

Calculation # DC-3601

CALCULATION TITLE PAGE

Sheet 1

SONGS Unit 1 DCP/MMP No. & Rev. N/A Calc. No. DC-3601

Subject SONGS 1 RCS Inventory Analysis for Station Blackout

Engineering System Number N/A Primary Station System Designator RCS Q-Class SR

Tech Spec Effecting ☐ YES ☒ NO Section No. N/A Equipment Tag No. N/A

Computer Program	STANDARD COMPUTER PROGRAM	PROGRAM NO.(S)	VERSION/RELEASE NO.
	☒ YES ☐ NO	RETRAN-02	MOD 004

RECORD OF ISSUES

SCE DISC. or ESC	REV.	DESCRIPTION	TOTAL NO. of SHEETS	LAST SHEET NO.	ORIG.	IRE	GS	DM	DATE
NEDO	O-A	Issued for Comments	59	59	VFN	WHA			5/17/91
NFM	O	Original Issue	62	62	VFN	WHA		MRJ	6/21/91

Space for RPE Stamp, reference alternate calc., and notes as applicable.

This calc. was prepared for the identified DCP/MMP. DCP completion and turnover acceptance to be verified by receipt of a memorandum directing DCN Conversion. Upon receipt, this calc. represents the as-built condition. Memo date _____ by _____.

CALCULATION CROSS-INDEX

Subject Calculation No. DC-3601

Subject Calculation Revision No.	Superseded By Calc. No.	INPUTS These interfacing calculations and /or documents provide input to the subject calculation, and if revised may require revision of the subject calculation.		OUTPUTS Results and conclusions of the subject calculation are used in these interfacing calculations and/or documents.		Does the output interface calc/document require revision?	Identify output interface calc/document CCN or DCN TCN/Rev.	Group Supervisor or Station Technical Group Supervising Engineer Signature/Date
		Calc/ Document No.	Rev. No.	Calc/ Document No.	Rev. No.	YES / NO		
0	N/A	DC-3533	0	N/A		NO	N/A	
0	N/A	EOI-501-1.0-60	9	N/A		NO	N/A	
0	N/A	DC-2836	0	N/A		NO	N/A	
0	N/A	DC-3460	0	N/A		NO	N/A	

SCE 26-424 REV 5/90

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 3

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Subject **SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT** Sheet No. 4

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I. PURPOSE

10 CFR 50.63[1] requires that SCE demonstrate the ability of SONGS Unit 1 to cope with a Loss of all AC power (Station Blackout). Regulatory Guide 1.155 provides NRC guidance for addressing this situation[2]. This guide states that the NUMARC (NUclear Management And Resource Council) published guidelines[3] to demonstrate ability to cope with a station blackout (NUMARC 87-00) is compatible with the Reg. Guide. The basic NUMARC/REG. GUIDE criteria are as follows:

(i) procedures and equipment relied upon in station blackout should ensure that satisfactory performance of necessary decay heat removal systems is maintained for the required station blackout coping duration,

(ii) the core must be kept covered for the coping duration, and

(iii) appropriate containment integrity should be provided in a blackout to the extent that isolation valves perform their intended function without AC power.

The purpose of this calculation is to determine whether adequate RCS water inventory exists to perform the decay heat removal function and keep the core covered during a station blackout for the NUMARC defined coping duration.

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Subject **SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT** Sheet No. 5

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II. RESULTS/CONCLUSIONS AND RECOMMENDATIONS

A. RESULTS/CONCLUSIONS

The significant events occurring during a station blackout including operator actions are shown on Table II-1. A trend of some of the important parameters during the critical times of the coping duration are shown in Table II-2.

On initiation of the blackout, the Pressurizer begins to empty rapidly due to the RCS leakage (171 gpm (cold) for the first 2 minutes and 101 gpm (cold) thereafter) and coolant shrinkage. In 21 minutes the pressurizer has emptied. Thereafter, the Reactor vessel upper head begins to drain resulting in a steam bubble in the upper head of the vessel. In 45 minutes the vessel upper head is completely voided. The outlet plenum then begins to drain causing the steam bubble to expand into the outlet plenum. The mixture level in the outlet plenum drops to just above the top of the hot leg at the end of one hour. During this one hour period natural circulation removes the core decay heat and keeps the core covered.

At one hour after the initiation of the blackout the charging pumps when powered by the DSD will provide makeup flow to the RCS. Thereafter the RCS inventory will be maintained (or will increase) for the remaining three hours of the coping duration. Again the core decay heat continues to be removed and the core remains covered for this period.

B. RECOMMENDATIONS

1. The Technical Specification leakage allowance of 6 gpm (total identified & unidentified) remains valid for Station Blackout. No changes to the Technical Specifications are thus required.
2. The allowable letdown isolation valve leakage of 20 gpm remains acceptable.

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TABLE II-1
SEQUENCE OF MAJOR EVENTS FOR STATION BLACKOUT

TIME (MINUTES)	EVENT/ACTION
0	Loss of all on and offsite AC power accompanied by reactor and turbine trip
3	Operator takes manual control of ADV's
4.7	Auxiliary Feedwater Flow injected into the S.G.'s through turbine driven pump (G-10) to achieve and maintain S.G. level between 50% and 70% NR.
20.8	Pressurizer empty; Voiding begins in the upper Reactor head
45	Upper Reactor head completely voided; Voiding begins in the outlet plenum
60	Outlet plenum* approximately 40% voided; No voiding in the hot legs
60.1	RCS charging restored through powering north charging pump by the DSD diesel generator; RCS inventory reduction stops
240	End of coping duration

* Outlet plenum extends from the reactor head flange to the top of the core

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TABLE II-2
SIGNIFICANT PARAMETER TRENDS DURING A SBO+

TIME min	ACTIVITY/EVENT	RCS LEAKAGE lbm/sec	RCS CHARGING lbm/sec	RCS PRESSURE psia	RCS T_{cold} F	RCS T_{hot} F	RCS FLOW* % flow	RCS SUBCOOL -ING(F)
0	Steady State full power	0	0	2100	527.0	576.0	100	66.9
0.1	Reactor at 10% power	24.2	0	2062	526.5	572	68	68.2
2.1	letdown leakage reduced	14.6	0	1885	515.1	557.3	10	70.3
3.1	manual ADV control**	14.3	0	1838	515.8	539.7	7	84.3
4.7	AFW flow starts	14.2	0	1870	528.3	539.6	4.9	86.8
20.8	Pressurizer empty	14.0	0	1587	535.4	558.1	4.4	45.8
27	RCS at Saturation	13.9	0	1133	534.7	559.6	4.7	0
45	RV upper head voided	13.9	0	1073	535.3	553.1	4.4	0
55	Intermediate condition	13.9	0	1061	535.5	551.6	4.0	0
60	Outlet plenum 40% voided	13.9	0	1067	535.4	551.0	4.1	0
60.3	Charging starts	13.9	26.9***	1065	520.2	552.0	4.8	0

* 100% flow = 20,278 lbm/sec

** ADV in automatic mode prior to this time

*** Based on an estimated charging flow of 150 gpm

+ from Fiche ECFUELA J1262

TABLE II-2 (continued)
SIGNIFICANT PARAMETER TRENDS DURING A SBO*

TIME min	ACTIVITY/EVENT	S. G. SECONDARY PRESSURE psia	S. G. SECONDARY TEMP. F	PRESSUR -IZER LEVEL %	VESSEL MIXTURE HEIGHT** ft.	S.G. SECONDARY LEVEL++ % NR	AUXILIARY FEEDWATER FLOW++ gpm
0	Steady state full power	547	476.0	37.5	35.82	30	0
0.1	Reactor at 10% power	670	497.9	35	35.82	28.8	0
2.1	letdown leakage reduced	717	505.4	19.6	35.82	0	0
3.1	manual ADV control	856	525.6	15.9	35.82	0	0
4.7	AFW flow starts	895	530.8	17.0	35.82	0	370
20.8	Pressurizer empty	927	535.0	0	35.82	61	167.8
27	RCS at saturation	927	535.0	0	35.25	65	84.2
45	RV upper head voided	926	535.0	0	29.26	65	93.4
55	Intermediate condition	926	535.0	0	26.80	64	104.1
60	outlet plenum 40% voided	925	535.0	0	25.58	67	54.7
60.3	Charging starts	925	535.0	0	25.54	67	48.0

** Top of the core = 19.82 ft. Top of hot leg = 25.55 ft. Top of Lower head = 29.32 ft.
* from Fiche ECFUELA J1262
++ Actual AFW flow would be as little as 270 gpm at S.G. Pressure of 923 psia. The RETRAN analysis used 370 gpm during the period of S.G. recovery (15 min.) after which flow is manually throttled. Use of actual minimum flows have negligible impact on analysis results. AFW flows used are best estimate values and should not be considered design basis values.

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III. ASSUMPTIONS

A) NUMARC[2] BASED

1. The reactor is operating at 100% power for 100 days and at normal operating conditions at the time of the blackout.
2. All reactor support systems are within normal operating ranges.
3. The blackout does not occur during a design basis event.
4. Single failure criteria are not considered since SBO is not considered a design basis event.
5. The RCS pump seal leakage (cold) will not be greater than 25 gpm/pump.
6. **The coping duration is four (4) hours[6].**
7. The initiating event is a loss of offsite power.

B) OPERATIONS BASED

1. The Nominal pressurizer level at 100% power is 37.5%. This is the expected Pressurizer level at 551.5 F (i.e. based on the reduced Tavg program - see assumption B.2)[22] (confirmed by E-mail from Operations -- see Appendix B). NUMARC permits use of the nominal pressurizer level as the initial condition of the blackout (see assumption A.1 & A.2).
2. The plant is using a Reduced Tavg program (due to the steam generator tube corrosion and plugging)[20].
3. The total unidentified and identified leakage is less than 6 gpm (requirement from Section 3.1.4 of the tech. specs.[7]).

C) EOI[4,5] BASED

1. Steam generator level will be maintained between 50% and 70% NR during the blackout.

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2. Auxiliary feedwater flow will be provided to the steam generators to maintain the steam generator level between the above limits. Auxiliary feedwater flow is provided through the turbine driven pump (G-10). The operator can throttle flow to the steam generators to maintain the Steam generators within these limits[14].
3. **The DSD can be powered up to restore charging capacity within one hour after the initiation of the blackout[6].**
4. The number of steam generator tubes plugged will be less than 20%[20]. The safety analysis for Unit 1 cycle 11 assumes S.G. tube plugging of 20%. Therefore this assumption is used here.
5. The atmospheric dump valves are placed in manual mode to maintain plant subcooling conditions 3 minutes after initiation of the event. This is an expected operator action. However, this assumption will not compromise the conservatism of this calculation. If the manual operation of the ADV's were not credited, decay heat removal will still occur through automatic control of the ADV's and also through the Main Steam Safety Valves (MSSV).
6. The letdown leakage for the first two minutes after the blackout will be less than 90 gpm (i.e. 70 gpm greater than the leakage after blackout initiation). The 90 gpm value is the normal maximum letdown leakage (Section 9.3.4 of Reference 10). The letdown valve closure time is expected to be less than 30 seconds[8]. Therefore the assumption of a 90 gpm letdown leakage for 2 minutes since the initiation of the SBO is conservative.
7. The total letdown system leakage (cold) after the first two minutes is less than 20 gpm. This is the maximum expected leakage from the letdown orifice isolation valves after the letdown system is isolated[18].
8. Control rods are fully inserted within 3 seconds after initiation of the blackout[12].
9. No other leakage resulting in RCS water inventory drain exists.
10. The reactor trip is caused by the instantaneous loss of all AC. This produces the

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loss of the turbine bypass system which causes the initial opening of the ADV's. The ADV's are air operated and have Nitrogen backup. Therefore they will continue to be operable during a blackout.

11. Control room adequacy and battery are assured to function during the entire coping duration[19].

12. The minimum Auxiliary Feedwater flow delivered to all three steam generators at a secondary side pressure of approximately 923 psia, when driven by pump G-10 will be at least 270 gpm. The actual minimum deliverable flow is expected to be between 288 gpm and 300 gpm. Therefore, it is conservative to assume a minimum deliverable flow of 270 gpm.

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IV. DESIGN INPUT

Table IV-1 shows the design inputs used to determine the RCS inventory during the station blackout. The auxiliary feedwater flow that will be automatically delivered to each S.G. by means of the steam driven auxiliary feedwater pump (G10) is shown in Table IV-2. Some of the significant external inputs that require further explanation are described as follows:

(i) RCS Leakage -- NUMARC 87-00 suggests using the assumption of leakage rates of 25 gpm per pump seal (i.e. total seal leakage of 75 gpm). The Unit 1 technical specification 3.1.4 permits a maximum allowable unidentified and identified leakage of 6 gpm. The letdown leakage limit is assumed to be 90 gpm until the letdown isolation valves are closed (i.e. for the first 2 minutes of the blackout) and subsequently 20 gpm for the remaining duration of the transient. Therefore the total leakage assumed is 171 gpm for the first 2 minutes of the blackout and 101 gpm for the rest of the coping duration. On a loss of all ac power, the letdown system is automatically isolated. This occurs by closure of valves CV-202, CV-203 & CV-204 along with CV-525 and CV-526 (See note in letdown system drawing[21]). The closure time for the letdown isolation valves is less than 30 seconds[8]. For conservatism the closure time of 2 minutes is used in this calculation.

(ii) Auxiliary Feedwater -- After initiation of the blackout, main feedwater is not available as a decay heat removal system. Auxiliary feedwater however is available since it is driven by the steam driven auxiliary feedwater pump (G-10). AFW flow is automatically initiated when the SG level reaches a setpoint value of 5% NR (Table 5.5-3 of Reference 10). It is then assumed that the delay time for the pump to be available to deliver flow into the S.G.'s is 3 minutes (Section 6.5.2.2.3 of Reference 10). Thereafter once the S.G. level has reached between 50% and 70% NR, the operator manually throttles the AFW flow to maintain this level in the

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S.G.'s[4]. The philosophy employed here is to maintain temperature and Pressure control in the Secondary side and consequently in the primary side and thus continue to have this system available for decay heat removal.

(iii) Charging Flow -- After one hour the charging pump when powered by the DSD restores charging flow to the Reactor. From Table II-2, the RCS pressure at this time will be 1067 psia. The charging flow capable of being delivered at this pressure will be at least 198.5 gpm[9]. However for this calculation a conservative value of 150 gpm charging flow is used*. This minimum charging flow will be maintained from 1 hour to the end of the coping duration (i.e. 4 hours).

* Note that in this analysis it is only important that the charging flow delivered be greater than 101 gpm so that the RCS water that is lost due to the leakage can be made up.

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TABLE IV-1
DESIGN INPUT FOR STATION BLACKOUT

A. INITIAL CONDITIONS

#	PARAMETER	VALUE	REFERENCE	COMMENTS
1.	Core Power	1347 MW	10	100% Rated Power
2.	Core Average Temp.	551.5 F	11	At 100% power
3.	RCS Pressure	2100 psia	10	
4.	Pressurizer level	37.5%	--	Nominal level
5.	S.G. Pressure	547 psia	11	at 100% power
6.	S.G. Mass	43,000 lbm	17	per S.G.
7.	S.G. Tubes plugged	20%	11,20	
8.	S.G. Level	30% NR	--	Nominal
9.	Vessel Flow Rate	195,000 gpm	10,20	
10.	Vessel mass flow	$73*10^6$ lb/h	10	
11.	Core mass flow	$69.7*10^6$ lb/h	10	
12.	Core bypass flow	4.5%	10	
13.	Heat generated in Fuel	97.4%	10	
14.	No load Ref. Temp.	535 F	11	

B. AFTER BLACKOUT INITIATION

#	PARAMETER	VALUE	REFERENCE	COMMENTS
1.	RCS leakage for initial 2 min.	171 gpm	--	see Section IV discussion
2.	RCS Leakage after initial 2 min.	101 gpm	--	see Section IV discussion
3.	S.G. NR Level	50%-70%	4	Manually maintained
4.	Auxiliary Feedwater Auto. initiation	5% NR	10	see Section IV discussion
5.	Aux. Feedwater Auto initiation delay	3 min.	10	see Section IV discussion
6.	ADV manual initiation time delay	3 min.	4,5	Assumption
7.	ADV relief Capacity	$1.468x10^6$ lbm/hr	12	
8.	RCP flywheel inertia	45,000 lbm/ft^2	12	
9.	Charging Initiation	1 hour	--	See Section IV discussion
10.	Charging flow	150 gpm	--	See Section IV discussion

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TABLE IV-2
AUXILIARY FEEDWATER FLOW FOR STATION BLACKOUT[16]

PUMP DISCHARGE PRESSURE (Psia)	AFW FLOW* (Gpm)
0.0	123.3
995.0	123.3
1030.0	115.0
1055.0	108.3
1125.0	88.3
1155.0	64.3
1185.0	50.0
1240.0	33.3

* The AFW flow shown in this table was derived from Figure 2-1 of Reference 16 and used in the RETRAN case. However, the actual flow expected to be delivered to each S.G. through the steam driven AFW pump G-10 will be at least 90 gpm. This will not significantly affect the results of this calculation since reduced AFW flow has a negligible effect on RCS water inventory change and the reduced flow remains sufficient to meet decay heat removal requirements. The lower initial AFW flow will slightly delay the recovery of S.G. secondary side level relative to the RETRAN results. However, once the S.G. level has reached 50% NR, the operator will throttle the AFW flow to maintain S.G. level. The secondary side results will then be consistent with the RETRAN values. For these reasons the lower AFW flow will not impact the RCS water inventory level nor will it significantly impact the ability of the system to remove core decay heat. AFW flows used are best estimate values and should not be considered design basis values.

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V. METHODOLOGY

A. GENERAL

The RCS Inventory Analysis is performed based on the expected operator actions during a blackout as enumerated in EOI S01-1.0-60 and the expected Plant responses described in the Background Document for this EOI[5]. The simulation of the blackout and consequent plant actions and response is modeled using the RETRAN computer code. The results of the computer code will then be verified by a simplified hand calculation.

B. RETRAN CODE MODEL

The basic RETRAN model for Station Blackout was developed for the analysis performed to demonstrate the adequacy of the leakage technical specification (T.S. 3.1.4) and in response to LER 90-004[18]. A complete description of the input model used for this LER analysis is documented in Reference 12. The RETRAN nodal diagram describing the control volumes and junctions used in this analysis is shown in figure V-1. The code control systems for auxiliary feedwater flow and steam bypass are described in Figures V-2 and V-3.

The modifications made to the basic model[12] for this analysis are shown on Table V-1. The primary modifications along with the reasons for the changes are described as follows:

1. RCS Leakage -- The base model had the total RCS leakage only from one loop (i.e. volume 18). This approach is acceptable until such a time as the Pressurizer is drained. Thereafter the imbalance in the leakage appears to affect the convergence of the code. Therefore, a new junction (junction 51) was added for leakage from the other loops (i.e. volume 36). The amount of leakage through junction 50 will thus be reduced to one third of the total leakage and through junction 51 will be two thirds of the total leakage (since loops A & C are modeled

together as one loop). The HOT leakage is determined as follows:

$L_{hot} = L_{cold} * (d_{cold}/d_{hot})$

where,

L_{hot} = Hot leakage (gpm)

L_{cold} = Cold leakage (gpm)

d_{hot} = density of water at 535 F

= 47.7 lbm/ft^3

d_{cold} = density of water at 80 F

= 62.6 lbm/ft^3

The HOT leakage per RCS loop thus becomes 74.67 gpm (171*1.31/3) for the first 2 minutes of the SBO and 44.1 gpm (101*1.31/3) thereafter for the coping duration of 4 hours.

2. Charging -- The base model does not account for charging flow into the RCS system one hour after the SBO initiation. Therefore two extra junctions were added to provide this function (junctions 48 and 49). The amount of charging through these junctions will be one third through junction 48 and two thirds through junction 49. The hot charging flow per RCS loop will thus be 65.5 gpm (150*1.31/3) to be initiated one hour after the initiation of the SBO for the remaining 3 hours of the coping duration. In addition a charging initialization card was included to permit the initiation of charging flow.

3. RCS Flow Rates & Temperatures -- The base model flow rates were recalculated here based on the values from Table 4.4-1 of the FSAR[10]. Table V-2 shows the vessel flow rate, core flow rate and the calculation of the vessel inlet and outlet temperatures with the caveat that the Tavg will be maintained at 551.5 F (i.e. the Reduced Tavg program).

4. Bubble Rise Models -- The base model was developed for a RCS leakage of only 27 gpm. The criteria used was Pressurizer drain. Since the criteria here is core

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uncovery and the outlet plenum and upper head drain, a bubble rise model is included for the outlet plenum volume 6 (a bubble model in the upper head was in the original model). The model parameters are the same as for the upper head (i.e. Volume 7).

5. Volume overlaps -- Due to the occurrence of bubbles in Volumes 6 & 7, RETRAN was not converging at the time that volume 7 was drained. Therefore, the volume height of volume 6 was adjusted to 9.6 inches to produce an overlap of 0.1 inches (old value was 9.5 inches). For the same reason the volume height of volumes 11, 16, 29 & 34 were also adjusted to 8.605 inches to produce an overlap of 0.1 inches (old value was 8.505 inches).

6. Steam Generator Adjustments -- The mass of water in the secondary side of each S.G. is 43,000 lbm. However, the code model is set up to accept only volumes. Therefore, the volume of the S.G.'s are adjusted to result in this S.G. water mass (i.e. Volume 50 = 1395, Volume 60 = 2906). In addition the initial S.G. liquid level and gain are adjusted to 22.2938 and 0.1044 to obtain an initial S.G. liquid level of 30% NR.

7. AFW control block -- The automatic AFW flow injection is modeled to inject water into the S.G.'s when the S.G. low level reaches 5% NR with a time delay of 3 minutes to account for valve stroking, transit time and time for the pump to get to full speed. The base model erroneously set the trip function for AFW initiation on a parameter for ADV control. This error was conservative in Reference 12 since the AFW would be actuated later than if it was correct. However, for this analysis this error is corrected (Card # 040030).

8. Time step -- In order to reduce the unnecessary time steps and consequently the code execution time, the time steps after the first hour of the transient are changed from 0.05 sec to 0.10 sec.. This will not compromise any of the results or conclusions of the code.

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9. Problem Run Time -- The NUMARC guideline coping duration is 4 hours. However, the charging flow powered by the DSD diesel is restored after one hour. Therefore, the simulation need be performed only for one hour. This simulation is performed for 30 minutes more (i.e. 90 minutes) to simulate some of the recovery process once the charging is restored.

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1	V. F. Nazareth VFN	6/21/91	W. Alhassani WA	6/21/91	1					
2					2					

TABLE V-1
LIST OF MODIFICATIONS TO BASIC SBO MODEL

No.	Card #	Parameter	Modified value	Base Value	Purpose
1.	010001	No. of minor edits printed	-54	-40	More detail output
2.	010001	No. of trip functions	20	19	Additional trip for charging actuation
3.	010001	Number of bubble Sets	10	9	Addition of set for outlet plenum vol 6
4.	010001	Number of junctions	51	48	Addition of junctions for second leakage path and charging(2)
5.	010002	Number of fill tables	14	13	Addition of fill table for charging
6.	02000x	Minor Edits	--	--	Printing more output variables
7.	0300x0	Edit frequency	--	--	Changes in output edit print frequency
8.	030060	Time steps	.10	.05	less frequent time steps after 1 hr.
9.	040010	Problem run time	4800	7200	Running problem for 1.5 hrs.
10.	040030	Control block	-20	-13	Correction of AFW error
11.	040200	Charging trip	--	--	New charging initialization card
12.	050011	Vessel inlet temp.	527	528	corrected value
13.	050061	Bubble set	10	--	Assigning new bubble model set for vol 6

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 21

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
0	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

No.	Card #	Parameter	Modified value	Base Value	Purpose
14.	050061	Volume 6 height	9.6	9.5	Changed to get .1" vol 6/7 overlap
15.	050071	Vessel outlet temp.	576	575	corrected value
16.	050111	Volume 11 height	8.605	8.505	Increased to get 0.1 in. vol 11/12 overlap
17.	050161	Volume 16 height	8.605	8.505	Increased to get 0.1 in. vol 15/16 overlap
18.	050291	Volume 29 height	8.605	8.505	Increased to get 0.1 in. vol 29/30 overlap
19.	050341	Volume 34 height	8.605	8.505	Increased to get 0.1 in. vol 33/34 overlap
20.	050501	S.G. "B" Volume	1395	1310	water vol. adjusted to 43,000 lbm
21.	050601	S.G. "A+C" volume	2906	2620	Water vol. adjusted to 86,000 lbm
22.	060101	Bubble set	--	--	Bubble rise model for vol 6 same as vol 7
23.	080011	Junction 1 flow rate	19,361	20,583	Corrected core flow rate
24.	080081	Junction 8 flow rate	6,759	7,110	Corrected Loop "B" flow rate
25.	080091	Junction 9 flow rate	6,759	7,110	Corrected Loop "B" flow rate
26.	080211	Junction 21 flow rate	20,278	21,330	Corrected vessel flow rate
27.	080311	Junction 31 flow rate	13,519	14,220	Corrected Loop "A+C" flow rate
28.	080511	Junction 51	36	--	New RCS leakage path from volume 36

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 22

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
0	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91					

REV

No.	Card #	Parameter	Modified value	Base Value	Purpose
29.	080511	Junction 51	2.0	--	Area doubled to double leakage
30.	080512	Junction 51	--	--	continuation card for new junction 51
31.	131301	RCS leakage	-74.67	-35.4	total leakage per RCS loop for first 2 min
32.	131302	RCS leakage	-74.67	-35.4	total leakage per RCS loop for first 2 min
33.	131303	RCS leakage	-44.1	-35.4	total leakage per RCS loop after 2 min
34.	131304	RCS leakage	-44.1	-35.4	total leakage per RCS loop after 2 min
35.	131401	Charging flow	0.0	--	No charging flow at initiation of SBO
36.	131402	Charging flow	0.0	--	No charging flow for one hour of SBO
37.	131403	Charging flow	65.5	--	Charging flow after one hour
38.	131404	Charging flow	65.5	--	Charging flow after one hour
39.	702003	RCS Flow Rate	$4.93*10^{-5}$	$4.69*10^{-5}$	Adjust initial gain (1/vessel flow)
40.	702007	Vessel outlet temp.	576.0	575.01	Corrected value
41.	702008	Vessel inlet temperature	527.0	528.02	Corrected value
42.	702009	S.G. Liquid level	22.2938	22.3838	Adjusted to match steady state value
43.	703020	S.G. Level Gain	0.1044	0.1012	Adjusted to get initial 30% NR

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
0	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

TABLE V-2
CALCULATION OF RCS FLOWS AND TEMPERATURES

The basic equation to calculate heat transfer in the core is:

$$DH_c = Q / M_c \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 5.1}$$

where,

DH_c = Enthalpy Rise in the Core

Q = Heat generated in core
= $(4.596 * 10^9) * 0.974 = 4.477 * 10^9$ Btu/hr . (Reference 10*)

M_c = Core mass flow rate
= $69.7 * 10^6$ lbm/hr . . . . . (Reference 10*)

Therefore substituting in Equation 5.1,

DH_c = 64.2 Btu/lbm

The enthalpy changes in the core can be stated as:

$$h_{avg} = (h_{ov} + h_{in}) / 2.0 \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 5.2}$$

and

$$DH_c = h_{oc} - h_{in} \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 5.3}$$

where,

h_{avg} = average enthalpy in the core
= h(P=2100 psia, T_{avg}=551.5 F) (This is an approximation)
= 549.3 Btu/lbm (from steam tables)

h_{ov} = Vessel outlet enthalpy
h_{in} = Vessel inlet enthalpy
h_{oc} = Core outlet enthalpy

Therefore combining equations 5.2 and 5.3 and substituting for known quantities,

$$h_{ov} + h_{oc} = (2 * 549.3) + 64.2$$
$$= 1162.8 \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 5.4}$$

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

From Reference 10* the difference between the vessel temperature rise and the core temperature rise at full power is 2 F (i.e. 49.3 - 47.3)

Therefore, assuming that the core exit temperature and the vessel exit temperature are between 570 and 580 F and interpolating from the steam tables for a pressure of 2100 psia,

$$h_{ov} - h_{oc} = -2.6 \quad \text{. . . . . Equation 5.5}$$

Combining Equations 5.4 and 5.5 results in,

$$h_{ov} = 1160.2/2 = 580.1$$

Therefore,

T_{ov} = Vessel outlet Temperature
= T (P=2100 psia, h_{ov}=580.1 Btu/lbm)
= 575.4 F

Substituting in Equation 5.2,

h_{in} = (2 * 549.3) - 580.1
= 518.5

Therefore,

T_{in} = Vessel inlet temperature
= T(P=2100 psia, h_{in}=518.5 Btu/lbm)
= 526.4 F

Subsequently,

Calculated T_{avg} = (575.4 + 526.4) / 2.0
= 550.9 F

Since the actual T_{avg} = 551.5 F, the values of T_{in} and T_{ov} are adjusted by +0.6 F.

Therefore the values input into RETRAN are as follows:

T_{in} = 527 F

T_{ov} = 576 F

h_{in} = h(p=2100 psia, T=527 F)
= 519.3 Btu/lbm

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△	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91	△					↓
△					△					

h_{ov} = h(p=2100 psia, T=576 F)
= 580.8 Btu/lbm

M_c = Core mass flow rate
= (69.7 * 10^6 lbm/hr) / (3600 Sec/hr)
= 19,361 lbm/sec

M_v = Vessel mass flow rate
= (73 * 10^6 lbm/hr) / (3600 Sec/hr) . . . . . (Reference 10*)
= 20,278 lbm/sec
= 6,759 lbm/sec per RCS loop

* from Table 4.4-1

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 26

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

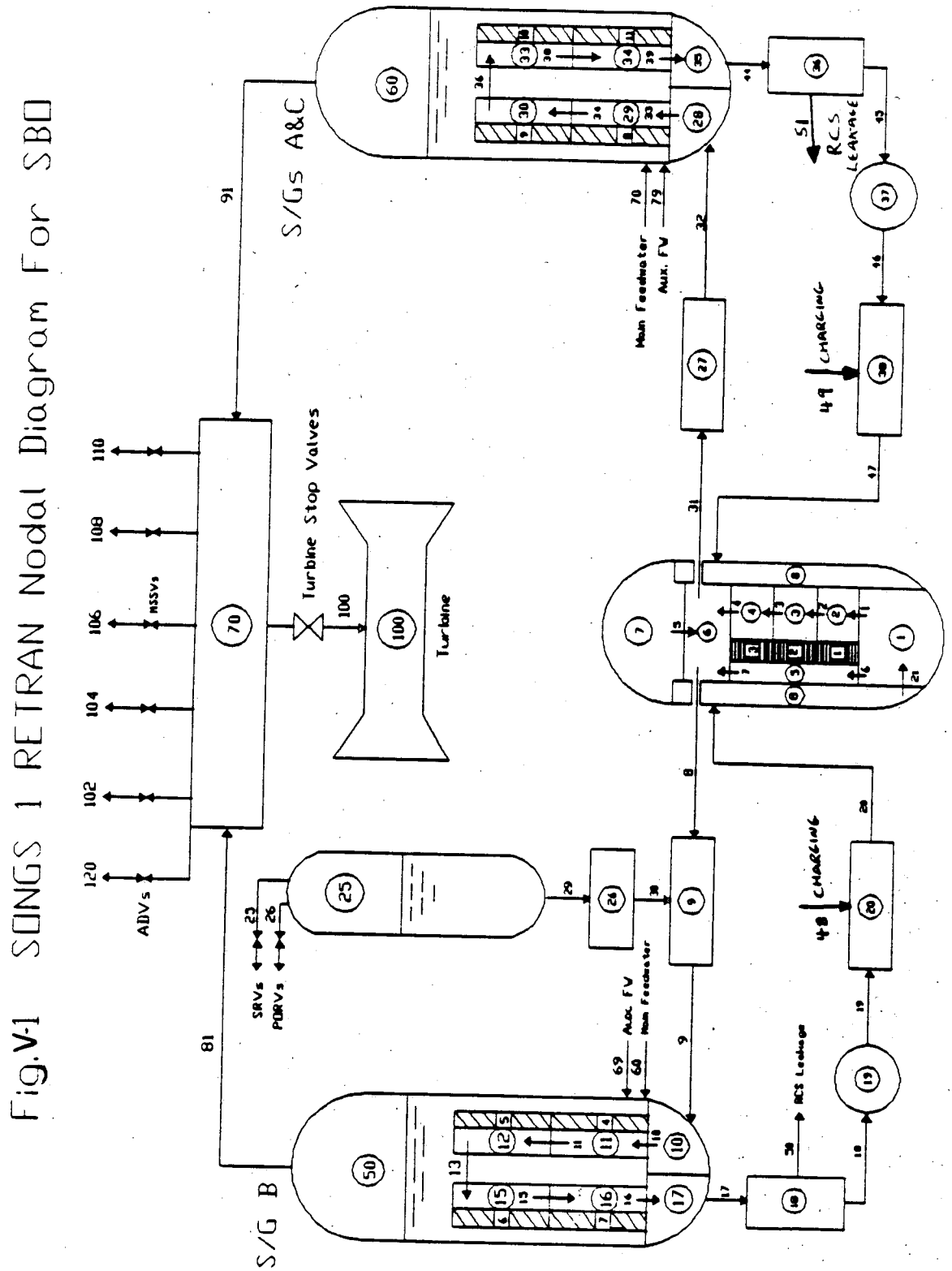

Fig. V-1 SONGS 1 RETRAN Nodal Diagram For SBO

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REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

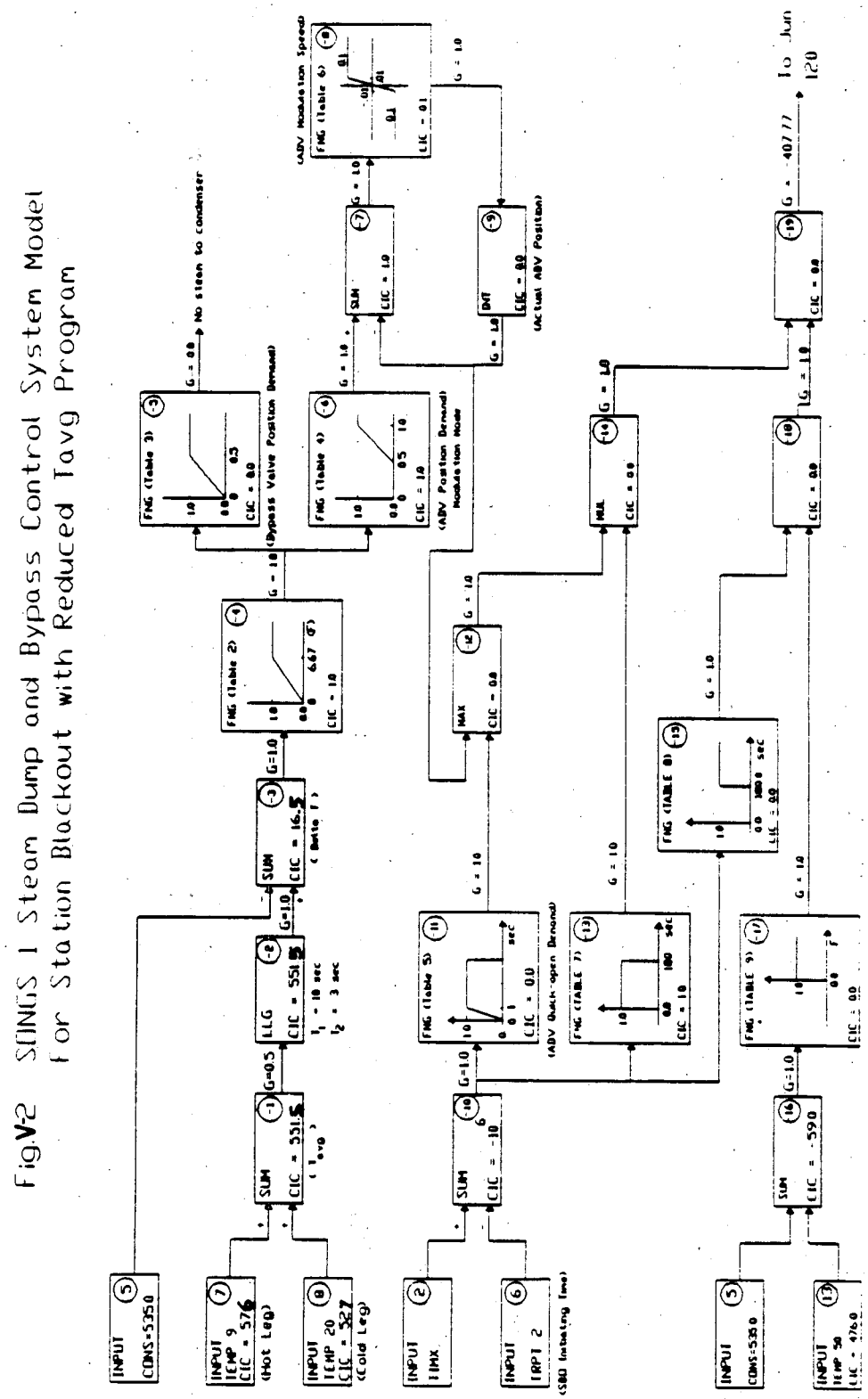

Fig.V-2 SONGS 1 Steam Dump and Bypass Control System Model for Station Blackout with Reduced Tavg Program

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 28

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

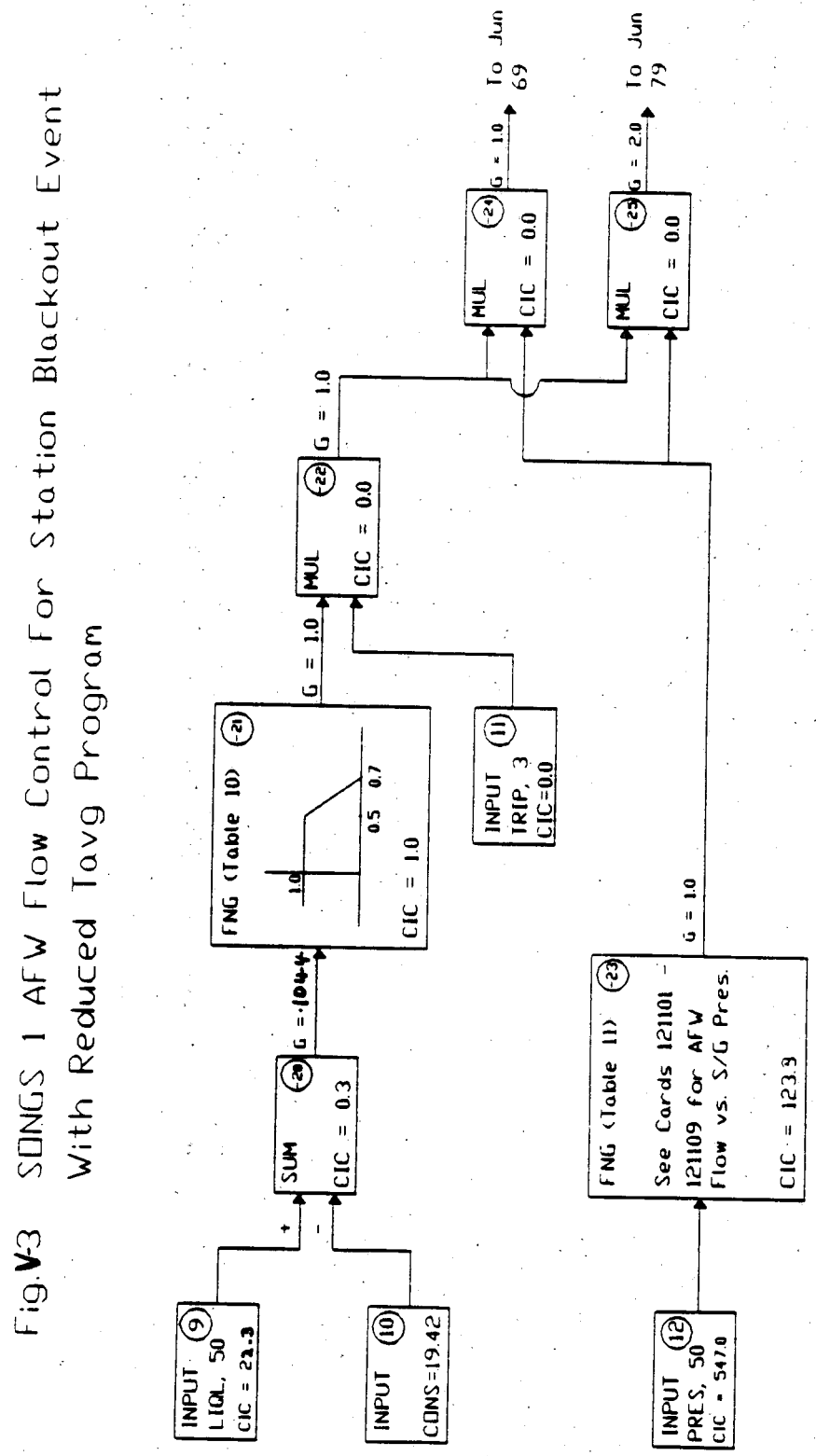

Fig. V-3 SONGS 1 AFW Flow Control For Station Blackout Event With Reduced Tavg Program

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
0	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

VI. REFERENCES

1. Code of Federal Regulations, 10CFR50.63.
2. NUREG 1.155, "Station Blackout", August 1988.
3. NUMARC 87-00, "Guidelines and Technical Bases for NUMARC initiatives addressing Station Blackout at Light Water Reactors", November 1987.
4. EOI S01-1.0-60, Rev. 9, "Loss of all AC power", February 13, 1991.
5. EOI S01-1.0-60.1, Rev. 2, "Background Document for Loss of all AC power", April 10, 1990.
6. Letter for M.O. Medford (SCE) to NRC "Docket Nos. 50-206, 50-361, 50-362; Response to 10 CFR 50.63, Loss of all alternating current power; San Onofre Nuclear Generating Station Units 1, 2 and 3", April 17, 1989.
7. SONGS Unit 1 Technical Specifications, Amendment 143.
8. MMP 1-3645.005N, Revision 0 (See sheet 437).
9. DC-3460, "CRS and Charging System Performance", P. Biba, January 9, 1991 (Attachment 46)
10. SONGS Unit 1 Updated Final Safety Analysis Report (UFSAR)
11. PFC # 1-89-003, "Unit 1 Cycle 10 Core Reload", January 23, 1989 (Attachment J).
12. DC-3533, "SONGS 1 RCS Leakage During Station Blackout", Y.P.Ting, March 8, 1991.
13. Intentionally Blank
14. Songs Unit 1 drawing 5178220-16.
15. Crane Reference Manual "Flow of Fluids through valves, fittings and pipe", 1981 (See chapter 1)
16. DC-2836, Supplement B, "AFW Flow Venturi Sizing", May 21, 1990.
17. Letter from H.C. Calton (Westinghouse) to L.K. Carlisle (SCE),"Southern California Edison Company, San Onofre Nuclear Generating Station Unit 1, Main Steamline

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
1	V. F. Nazareth VFN	6/21/91	W. Alhassani WAA	6/21/91	1					
2					2					↓

Break M & E Releases for SONGS-1", NS-OPS-OPL-I-90-613, October 26, 1990.

18. LER 90-004, "Potential for Reactor System Leakage greater than Technical Specification Basis, San Onofre Nuclear Generating Station, Unit 1", April 25, 1990.
19. Letter from F.R. Nandy (SCE) to NRC, "Supplemental Response to 10CFR 50.63, Loss of All Alternating Current Power, Station Blackout (TAC No. 68599/600), San Onofre Nuclear Generating Station Units 1,2 and 3", May 1, 1990.
20. Letter from M.F. Muenks (Westinghouse) to P.D. Myers(SCE), "Southern California Edison San Onofre Unit No. 1 Cycle 11 Reload Safety Evaluation Report", 90SC-G-0025, 9/26/90.
21. Songs Unit 1 drawing 5178130-13.
22. SONGS Unit 1 Systems Descriptions, SD-S01-280-3-3, Revision 2 (See Figure 3).

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REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
0	V. F. Nazareth VFN	6/21/91	W. Alhassani WHA	6/21/91						

V11. NOMENCLATURE

ADV	Atmospheric dump Valve
AFW	Auxiliary Feedwater Flow
AOV	Air Operated Valves
DSD	Dedicated Shutdown Diesel
EOI	Emergency Operating Instruction
LER	Licensing Event Report
MOV	Motor Operated Valves
NR	Narrow Range (SG level)
NRC	Nuclear Regulatory commission
NUMARC	Nuclear Management and Resource Council
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RV	Reactor Vessel
SBO	Station Blackout
SG	Steam Generator

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

VIII. CALCULATIONS

A. HAND VERIFICATION

In order to verify the accuracy of the RETRAN code results a simplified hand calculation will be performed. The purpose of this calculation is strictly to verify that the results are in the realm of reasonableness. The RCS inventory calculated during the station blackout is described in Table VIII-1. As shown on this Table the results of the hand verification calculation compare quite favorably with the results of RETRAN. Therefore it is concluded that the RETRAN results are acceptable.

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
1	V. F. Nazareth VFN	6/21/91	W. Alhassani WA	6/21/91	1					
0					0					

TABLE VIII-1
VERIFICATION OF RCS INVENTORY BY HAND ESTIMATE

NO.	CONTROL VOLUME NAME	RETRAN VOLUME NO.	LIQUID MASS[a] lbm	LEAKAGE[b]		DRAIN TIME (min.)[d]		RETRAN DRAIN TIME[e] min.
				INITIAL[c] lb/sec	REGULAR lb/sec	CONTROL VOLUME	CUMULATIVE SYSTEM	
1.	Pressur -izer	25	18,447	24.2	14.2	20.2	20.2	20.8
2.	Surge Line	26	927	0	14.0	1.1	21.3	22.0
3.	R.V. Upper head	7	17,261	0	13.9	20.7	42.0	45.0
4.	R.V. Outlet Plenum[f]	6	13,105	0	13.9	15.8	57.8	60.0

(a) from RETRAN model at steady state (i.e. at time = 0)
(b) from Table II-2
(c) for first 2 minutes of SBO only

(d) $t = \{[M - (L_i * c * k)] / (L_r * k)\} + c$

where,
- t = Drain time (minutes)
- M = Liquid mass
- L_i = Initial leakage Rate (i.e. for first 2 minutes of SBO)
- L_r = Regular leakage Rate (i.e. after first 2 minutes of SBO)
- k = conversion constant from seconds to minutes (i.e. 60.0)
- c = initial leakage time in minutes (i.e. 2.0 if initial leakage is greater than 0 or 0.0 otherwise)

(e) from Table II-1
(f) ONLY UNTIL TOP OF HOT LEG (i.e. 39.7% of outlet plenum)

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
0	V. F. Nazareth VFN	6/21/91	W. Alhassani WA	6/21/91						

APPENDIX A

LISTING OF RETRAN CODE MODEL

```
1    = RETRAN ANALYSIS OF SONGS 1 STATION BLACK OUT EVENT (PHASE 2)
2    *
3    *      CASE 2: CHARGING SYSTEM MAKEUP
4    *
5    *      ************************************************************
6    *      *                                                          *
7    *      *   1. 'REDUCED TAVG' PROGRAM WITH 20% TUBE PLUGGING       *
8    *      *   2. RCS LEAKAGE = 171.0 GPM (COLD) FOR 2 MINUTES        *
9    *      *                  = 101.0 GPM (COLD) THEREAFTER           *
10   *      *   3. ADV(S) ARE MANUALLY OPERATED AFTER 3 MINUTES         *
11   *      *      INTO THE SBO EVENT.                                 *
12   *      *   4. SG LEVEL(S) ARE MANUALLY MAINTAINED BETWEEN 50       *
13   *      *      AND 70% NR LEVEL.                                   *
14   *      *   5. PRESSURIZER INITIAL LEVEL = 37.5%                   *
15   *      *   6. STEAM GENERATOR INITIAL LEVEL = 30% NR              *
16   *      *   7. RCS CHARGING = 150.0 GPM (COLD) AFTER 1 HOUR        *
17   *      *                                                          *
18   *      ************************************************************
19   *
20   *      D1( AT  80F ) = 62.6 LBM/FT**3
21   *      D2( AT 535F ) = 47.7 LBM/FT**3
22   *
23   *      HOT LEAKAGE = ( D1 / D2 ) * COLD LEAKAGE
24   *                  = (62.6 / 47.7) * COLD LEAKAGE
25   *                  = 1.31 * COLD LEAKAGE
26   *
27   *      FOR A COLD LEAKAGE OF 101 GPM (171 GPM),
28   *      HOT LEAKAGE = 1.31 * 101 GPM (171 GPM)
29   *                  = 132.31 GPM (224.01 GPM)
30   *                  = 44.1 GPM (74.67 GPM) PER RCS LOOP
31   *
32   *     HOT CHARGING = ( D1 / D2 ) * COLD CHARGING
33   *                  = (62.6 / 47.7) * COLD CHARGING
34   *                  = 1.31 * COLD CHARGING
35   *
36   *      FOR A COLD CHARGING OF 150 GPM,
37   *     HOT CHARGING = 1.31 * 150 GPM
38   *                  = 196.5 GPM
39   *                  = 65.5 GPM PER RCS LOOP
40   *
41   * ASSUMPTIONS:
42   *
43   * (1) THE AUXILIARY FEEDWATER IS DELIVERED TO THE SG(S) BY THE STEAM-
44   *     DRIVEN PUMP (G-10) WITH 3 MINUTES DELAY AFTER SBO.
45   * (2) THE RCS LEAKAGE IS MEASURED AT COLD CONDITION (80 F).
46   * (3) FOLLOWING A SBO EVENT, OPERATORS WILL MAINTAIN THE S/G NR LEVEL
47   *     AT BETWEEN 50% AND 70% BY OPERATING THE AUXILIARY FEEDWATER
48   *     PUMP PER EOI SO1-1.0-60.
49   *
50   *
51   * PLANT INITIAL CONDITIONS:
52   *
53   * REF. : (1) RELOAD SAFETY EVALUATION, SAN ONOFRE NUCLEAR GENERATING
54   *            STATION, UNIT 1 CYCLE 10.
55   *        (2) ACCIDENT ANALYSIS BASIS DOCUMENTATION: MODULE 11, STEAMLINE
56   *            RUPTURE FOR SONGS1, WCAP12567, MAY, 1990
57   *        (3) SD-SO1-280, REVISION 2, FIG. 3.
58   *
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CCN CONVERSION: CCN NO. CCN --

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

```
59    * (1) THERMAL POWER  = 1347.0 MWT (100%)
60    * (2) TAVG           = 551.5 F
61    * (3) PZR PRESSURE   = 2100 PSIA
62    * (4) PZR LEVEL      = 37.5% (REF.3)
63    * (5) S/G PRESSURE   = 547.0 PSIA
64    * (6) S/G NR LEVEL   = 30%
65    * (7) S/G MASS       = 43,000 LBM (FROM FLB ANALYSIS BY W)
66    * (8) S/G TUBE PLUGGING LEVEL <= 20%
67    *
68    *          ****************************************
69    *          *                                      *
70    *          *     CODE VERSION: RETRAN02-MOD4      *
71    *          *                                      *
72    *          ****************************************
73    *
74    *
75    ************* PROBLEM CONTROL AND DESCRIPTION DATA - 01000Y *************
76    *
77    *
78    *----Y------1-----2-----3-----4-----5-----6-----7-----8-----9----10----
79    *
80    010001      0   -40     6    19    34     9     1    48     2     1
81    010001      0   -54     6    20    34    10     1    51     2     1
82    *
83    *
84    *----------11----12----13----14----15----16----17----18----19----20----
85    *
86    010002     11    13    11     2     4     3     0     0     2     0
87    010002     11    14    11     2     4     3     0     0     2     0
88    *
89    *
90    *----------21----22----23----24----25----26----27----28----29----30----
91    *
92    010003      0     0     0     0     0     1     0     0     1     1
93    *
94    *
95    *----------31----32----33----34----35----36----37----38----39----40----
96    *
97    *10004      0     0     1     4     0     0     0     1     0     0
98    010004      0     0     1     0     0     0     0     1     0     0
99    *
100   *
101   ************************* POWER (NUCLEAR ONLY) ****************************
102   *
103   *
104   010005     1347.00       * MEGWATTS (100% POWER)
105   *
106   *
107   ********************* MINOR EDIT VARIABLES - 02000Y ***********************
108   *
109   *    $$$$$ VFN MODIFIED $$$$$
110   *    THESE EDITS HAVE BEEN MODIFIED TO INCLUDE MORE OUTPUT EDITS
111   *    AND ALSO DELETE SOME IRRELEVANT EDITS
112   *    $$$$$ VFN MODIFIED $$$$$
113   *
114   020001 PNRM,   0  PRES,  25  MIXL,  25  MIXL,  26  MIXL,   7  TEMP,   9
115   020002 TEMP,  20  PRES,  60  SPED,   1  SPED,   2  AVEX,   6  AVEX,   7
116   020003 AVEX,  26  AVEX,  11  AVEX,  12  AVEX,  15  AVEX,  16  WP**,  50
117   020004 WP**,  60  WP**,  70  WP**,  79  WP**,  81  WP**,  91  WP**, 100
118   020004 WP**,  51  AVEX,   9  WP**,  79  WP**,  81  WP**,  91  WP**, 100
```

*** THIS CARD IS A REPLACEMENT CARD.

*** THIS CARD IS A REPLACEMENT CARD.

*** THIS CARD IS A REPLACEMENT CARD.

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 36

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CCN CONVERSION: CCN NO. CCN --

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

```
020005 WP**, 120  COUT,   1  COUT,   3  COUT,  -1  COUT,  -2  COUT, -19
020006 COUT, -20  COUT, -24  COUT, -25  PRES,  50  LIQL,  50  MIXL,  50
*20007 WP**,  69  WP**, 102  MIXL,  12  MIXL,  15  * $$ VFN REPLACED $$
020007 WP**,  69  WP**, 102  MIXL,  12  MIXL,  15  TEMP,  26  MIXL,  11
*
*  $$$ VFN NEW MINOR EDIT CARDS ADDED $$$
*
020008 TEMP,  12  TEMP,  50  MIXL,  10  MIXL,  17  PRES,   4  TEMP,   4
020009 MIXL,   4  AVEX,   4  TEMP,   6  MIXL,   6  PRES,   6  TEMP,  11
020009 MIXL,   4  AVEX,   4  TEMP,   6  MIXL,   6  WP**,  48  WP**,  49
*
*       COUT,   1 = NORMALIZED PZR LEVEL,
*       COUT,   3 = NORMALIZED RCS FLOW,
*       COUT,  -2 = TAVG,
*       COUT, -19 = ADV RELIEVING CAPACITY,
*       COUT, -20 = S/G NR LEVEL,
*       COUT, -24 = AUXFW FLOW TO S/G A,
*       COUT, -25 = AUXFW FLOW TO S/G B&C.
*
*
**************** TIME-STEP ALGORITHM CONSTANTS - 030001 ******************
*
*
*           FC3       FC4       FC5       FC6       FC7       FC8       FC9
*
*030001     0.0       0.0      10.0      10.0       0.0       0.0       0.0
*
*
*
************************ TIME STEPS DATA - 03XXX0 ************************
*
*    $$$  VFN CHANGES MADE  $$$
*    BETWEEN 1000 AND 3600 SECS
*        --  NO CHANGES TO EXECUTION TIME STEPS
*        --  MAJOR EDIT PRINTED EVERY 100 SECS (WAS 200 SECS)
*    BETWEEN 3600 SECS AND END OF EXECUTION
*        --  EXECUTION TIME STEPS EVERY 10 SECS (WAS 5 SECS)
*        --  MAJOR EDIT PRINTED EVERY 400 SECS (WAS 500 SECS)
*    $$$  VFN CHANGES MADE  $$$
*
*
*          NMIN      NMAJ      NDMP      NCHK      DELTM      DTMIN      TLAST
*
030010      100         5      9000         0       0.01        0.0       10.0
030020      100        25      9000         0       0.01        0.0      100.0
030030      100        50      9000         0       0.02        0.0      500.0
030040      250        20      9000         0       0.02        0.0     1000.0
030050      200        20      9000         0       0.05        0.0     3000.0
030060      400        25      9000         0       0.05        0.0     1.0E+6
030050      200        10      9000         0       0.05        0.0     3600.0
030060      200        20      9000         0       0.10        0.0     1.0E+6
*
*
************************ TRIP CONTROLS - 04XXX0 **************************
*
*
*       TRIP  SIG
*4XXX0   ID    ID    IX1  IX2   SETPT    DELAY
*
040010    1     1     0    0    7200.0     0.0  * PROBLEM RUNNING TIME
```

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT CCN CONVERSION: CCN NO. CCN -- Sheet No. 37

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

```
179    040010    1    1    0    0   4800.0     0.0  * PROBLEM RUNNING TIME
180    *
181    040020    2    1    0    0      0.01    0.0  * SBO OCCURS/RCPS TRIP
182    *
183    040030    3  -14  -13    0      0.05  180.0  * STEAM-DRIVEN AFW PUMP
184    040030    3  -14  -20    0      0.05  180.0  * STEAM-DRIVEN AFW PUMP
185    *                                              OPERATION
186    040040    4    1    0    0      0.0     0.0  * MFW OPERATION
187    *
188    *          ---------- PRIMARY PORVS AND SRVS -----------
189    *
190    040050    5    4   25    0   2215.0     0.0  * PORV SETPOINT (2 VALVES)
191    040060   -5   -4   25    0   2190.0     0.0  * RESET (ASSUMPTION)
192    *
193    *         PORV SETPOINTS = 2200/2215 PSIA (PAGE 17, SD-SO1-280)
194    *
195    040070    6    4   25    0   2525.0     0.0  * SRV SETPOINT (2 VALVES)
196    040080   -6   -4   25    0   2450.0     0.0  * RESET (ASSUMPTION)
197    *
198    *         PZR SRV SETPOINTS = 2500/2525 PSIA (PAGE 19, SD-SO1-280)
199    *
200    *
201    *          ---------- SECONDARY SAFETY VALVES ---------
202    *
203    040090    7    4   70    0   1000.0     0.0  * MSSV #1 SETPOINT
204    040100   -7   -4   70    0    950.0     0.0  * RESET (ASSUMPTION)
205    *
206    040110    8    4   70    0   1015.0     0.0  * MSSV #2 SETPOINT
207    040120   -8   -4   70    0    965.0     0.0  * RESET (ASSUMPTION)
208    *
209    040130    9    4   70    0   1035.0     0.0  * MSSV #3 SETPOINT
210    040140   -9   -4   70    0    985.0     0.0  * RESET (ASSUMPTION)
211    *
212    040150   10    4   70    0   1045.0     0.0  * MSSV #4 SETPOINT
213    040160  -10   -4   70    0    995.0     0.0  * RESET (ASSUMPTION)
214    *
215    040170   11    4   70    0   1050.0     0.0  * MSSV #5 SETPOINT
216    040180  -11   -4   70    0   1000.0     0.0  * RESET (ASSUMPTION)
217    *
218    040190   25    1    0    0      0.01    0.0  * LEAKAGE INITIALIZATION
219    *
220    *     $$$   VFN CHANGES   $$$
221    *      NEW TRIP SEQUENCE ADDED FOR CHARGING ACTUATION
222    *     $$$   VFN CHANGES   $$$
223    *
224    040200   26    1    0    0      0.01    0.0  * CHARGING INITIALIZATION
225    *
226    *
227    *
228    ********************* VOLUME DATA - 05XXXY (Y=1) ************************
229    *
230    *     $$$  VFN CHANGES MADE  $$$
231    *     IN VOLUME 6 (LOWER REACTOR VESSEL HEAD)
232    *        -- BUBBLE RISE MODEL INCLUDED (HAD NO B.R. MODEL)
233    *        -- INCLUDED OVERLAP OF 0.1 INCHES BETWEEN VOLUME 6 & 7
234    *             (HAD NO OVERLAP)
235    *     INLET AND OUTLET TEMPERATURES CORRECTED
236    *        -- VOLUME 1 TEMPERATURE 527 F (WAS 528 F)
237    *        -- VOLUME 9 TEMPERATURE 576 F (WAS 575 F)
238    *     IN VOLUMES 11, 16, 29, 34
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CALCULATION SHEET

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 38

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CCN CONVERSION: CCN NO. CCN -

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

```
*        -- INCLUDED OVERLAP OF 0.1 INCHES IN VERTICAL JUNCTIONS
*           BETWEEN THESE JUNCTIONS AND THOSE ABOVE THEM (I.E.
*           JUNCTIONS 12, 15, 30, 33)  (HAD NO OVERLAP)
*     $$$  VFN CHANGES MADE  $$$
*
*
*          1  2     3      4       5       6       7       8       9       10
*     Y   IB IR      P      H     X OR      VOL     ZVOL    ZM      FLOWL   FLOWA
*                                  XM
050011    0  0     0.0   520.1     0.0     758.7    9.82    9.82    9.82   1.0E+9
*                      (528.0 F)
050011    0  0     0.0   519.3     0.0     758.7    9.82    9.82    9.82   1.0E+9
*                      (527.0 F)
050021    0  0     0.0     0.0     0.0     117.0    3.33    3.33    3.33   46.60
050031    0  0     0.0     0.0     0.0     117.0    3.34    3.34    3.34   46.60
050041    0  0     0.0     0.0     0.0     117.0    3.33    3.33    3.33   46.60
050051    0  0     0.0     0.0     0.0     135.5    10.0    10.0    10.0    1.94
050061    0  0     0.0     0.0     0.0     734.0    9.5     9.5     9.5    1.0E+6
050061   10  0     0.0     0.0     0.0     734.0    9.6     9.6     9.6    1.0E+6
050071    4  0     0.0   579.9     0.0     383.1    6.5     6.5     6.5    1.0E+6
*                      (575.0 F)
050071    4  0     0.0   580.8     0.0     383.1    6.5     6.5     6.5    1.0E+6
*                      (576.0 F)
050081    0  0     0.0     0.0     0.0     393.0   23.25   23.25   18.33   16.9
050091    0  0     0.0     0.0     0.0      76.7    2.3     2.3     2.3    4.12
050101    0  0     0.0     0.0     0.0     103.7    7.5     7.5     7.5    1.0E+6
*
*50111    0  0     0.0     0.0     0.0     73.95   8.505   8.505   8.505   7.2
*50121    6  0     0.0     0.0     0.0     73.95   8.505   8.505   8.505   7.2
*50151    7  0     0.0     0.0     0.0     73.95   8.505   8.505   8.505   7.2
*50161    0  0     0.0     0.0     0.0     73.95   8.505   8.505   8.505   7.2
*
050111    0  0     0.0     0.0     0.0     59.25   8.505   8.505   8.505   5.8
050111    0  0     0.0     0.0     0.0     59.25   8.605   8.605   8.605   5.8
050121    0  0     0.0     0.0     0.0     59.25   8.505   8.505   8.505   5.8
050151    0  0     0.0     0.0     0.0     59.25   8.505   8.505   8.505   5.8
050161    0  0     0.0     0.0     0.0     59.25   8.505   8.505   8.505   5.8
050161    0  0     0.0     0.0     0.0     59.25   8.605   8.605   8.605   5.8
*                                       (20% TUBE PLUGGING)
*
050171    0  0     0.0     0.0     0.0     103.3    7.5     7.5     7.5    1.0E+6
050181    0  0     0.0     0.0     0.0     106.5    2.3     2.3     2.3     4.12
050191    0  0     0.0     0.0     0.0     133.0    5.0     5.0     5.0    1.0E+6
050201    0  0     0.0     0.0     0.0      53.5    2.3     2.3     2.3     4.12
050251    1  0  2100.0     0.0     0.0    1300.0   37.20   13.95   37.20   34.91
*
*        PZR NOMINAL WATER LEVEL  = 37.2 FT * 37.5% = 13.95
*
050261    5  0     0.0     0.0     0.0      24.5    5.13    5.13    5.13   0.55
050271    0  0  2105.53    0.0     0.0     153.4    2.30    2.30    2.30   8.24
050281    0  0     0.0     0.0     0.0     207.4    7.5     7.5     7.5    1.0E+6
*
*50291    0  0     0.0     0.0     0.0     147.9   8.505   8.505   8.505   14.4
*50301    8  0     0.0     0.0     0.0     147.9   8.505   8.505   8.505   14.4
*50331    9  0     0.0     0.0     0.0     147.9   8.505   8.505   8.505   14.4
*50341    0  0     0.0     0.0     0.0     147.9   8.505   8.505   8.505   14.4
*
050291    0  0     0.0     0.0     0.0     118.3   8.505   8.505   8.505   11.5
050291    0  0     0.0     0.0     0.0     118.3   8.605   8.605   8.605   11.5
050301    0  0     0.0     0.0     0.0     118.3   8.505   8.505   8.505   11.5
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CCN CONVERSION: CCN NO. CCN --

Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 39

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

```
299   050331   0  0    0.0     0.0     0.0    118.3     8.505   8.505   8.505   11.5
300   050341   0  0    0.0     0.0     0.0    118.3     8.505   8.505   8.505   11.5
301   050341   0  0    0.0     0.0     0.0    118.3     8.605   8.605   8.605   11.5
302   *                                       (20% TUBE PLUGGING)
303   *
304   050351   0  0    0.0     0.0     0.0    206.6     7.5     7.5     7.5     1.0E+6
305   050361   0  0    0.0     0.0     0.0    213.0     2.3     2.3     2.3       8.24
306   050371   0  0    0.0     0.0     0.0    266.0     5.0     5.0     5.0     1.0E+9
307   050381   0  0    0.0     0.0     0.0    107.0     2.3     2.3     2.3       8.24
308   *
309   *  S/G VOLUME FLOW AREA WAS DIVIDED BY AN ASSUMED RECIRCULATION RATIO
310   *  (5.0 AT 100% POWER) TO ACCOUNT FOR THE MASS FLUX IN THE S/G 2ND SIDE.
311   *
312   *  S/G VOLUME WAS ADJUSTED IN SUCH A WAY THAT THE RETRAN CALCULATED MASS
313   *  INVENTORY AT STEADY-STATE FULL POWER IS EQUAL TO 43,000 LBM.
314   *
315   *     $$$  VFN CHANGES MADE  $$$
316   *      S.G. VOLUME (VOL. 50) ADJUSTED TO PRODUCE MASS OF 43,000 LBM
317   *      S.G. VOLUME (VOL. 60) ADJUSTED TO PRODUCE MASS OF 86,000 LBM
318   *     $$$  VFN CHANGES MADE  $$$
319   *
320   050501   2  0  547.0    0.0    -1.0   1310.0    37.0    24.2    37.0     7.66
321   050601   3  0  547.0    0.0    -1.0   2620.0    37.0    24.2    37.0    15.32
322   050501   2  0  547.0    0.0    -1.0   1395.0    37.0    24.2    37.0     7.66
323   050601   3  0  547.0    0.0    -1.0   2906.0    37.0    24.2    37.0    15.32
324   *
325   *
326   050701   0  0  520.0    0.0     0.0   1960.0    20.0    20.0   200.0     4.76
327   *           (ASSUMPTION)
328   051001   0  1    0.0    0.0     0.0   1.0E+6    10.0    10.0   100.0   1.0E+6
329   *
330   *
331   *
332   * ----  VOLUME DATA - 05XXXY (Y=2)
333   *
334   *              11        12        13        14        15        16
335   *     Y      DIAMV     ELEV      INEQ     VRAIN     VLHTC     MESH
336   *
337   050012        0.0     -24.40       0       0.0       0.0       0
338   050022     0.0454     -14.58       0       0.0       0.0       0
339   050032     0.0454     -11.25       0       0.0       0.0       0
340   050042     0.0454      -7.91       0       0.0       0.0       0
341   050052        0.0     -14.58       0       0.0       0.0       0
342   050062        0.0      -4.58       0       0.0       0.0       0
343   050072        0.0       4.92       0       0.0       0.0       0
344   050082        0.0     -18.33       0       0.0       0.0       0
345   050092        2.3      -1.15       0       0.0       0.0       0
346   050102        0.0      -1.15       0       0.0       0.0       0
347   050112     0.0533       6.35       0       0.0       0.0       0
348   050122     0.0533     14.855       0       0.0       0.0       0
349   050152     0.0533     14.855       0       0.0       0.0       0
350   050162     0.0533       6.35       0       0.0       0.0       0
351   050172        0.0      -1.15       0       0.0       0.0       0
352   050182        2.3      -1.15       0       0.0       0.0       0
353   050192        0.0      -1.15       0       0.0       0.0       0
354   050202        2.3      -1.15       0       0.0       0.0       0
355   *
356   050252       6.67       6.18       1       4.0       0.0       0
357   *  252       6.67       6.18       0       0.0       0.0       0
358   *
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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 40

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REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazaretty	6/21/91	W. Alhassani	6/21/91						

```
050262        0.833         1.15        0        0.0       0.0         0
050272          0.0        -1.15        0        0.0       0.0         0
050282          0.0        -1.15        0        0.0       0.0         0
050292       0.0754         6.35        0        0.0       0.0         0
050302       0.0754       14.855        0        0.0       0.0         0
050332       0.0754       14.855        0        0.0       0.0         0
050342       0.0754         6.35        0        0.0       0.0         0
050352          0.0        -1.15        0        0.0       0.0         0
050362         3.25        -1.15        0        0.0       0.0         0
050372          0.0        -1.15        0        0.0       0.0         0
050382         3.25        -1.25        0        0.0       0.0         0
050502          0.0         6.35        0        0.0       0.0         0
050602          0.0         6.35        0        0.0       0.0         0
050702          0.0         40.0        0        0.0       0.0         0
051002          0.0         35.0        0        0.0       0.0         0
*
*
************************** BUBBLE DATA - 06XXX1 **************************
*
*    $$$  VFN CHANGES MADE  $$$
*     BUBBLE RISE MODEL INCLUDED FOR VOLUME 6 (HAD NO B.R. MODEL)
*    $$$  VFN CHANGES MADE  $$$
*
*
* XXX      ALPH      VBUB    IDALPH  IDVBUB
*
060011     1.00      3.00       0       0      * PZR (VOL 25) - ASSUMPTION
*
060021     1.00     58.50       0       0      * S/G (VOL 50)
060031     1.00     58.50       0       0      * S/G (VOL 60)
*
060041     1.00      3.00       0       0      * R.V. UPPER HEAD (VOL 7)
*
060051     1.00      3.00       0       0      * SURGE LINE (VOL 26)
*
060061     1.00      3.00       0       0      * UPPER TUBE (VOL 12)
060071     1.00      3.00       0       0      * UPPER TUBE (VOL 15)
060081     1.00      3.00       0       0      * UPPER TUBE (VOL 30)
060091     1.00      3.00       0       0      * UPPER TUBE (VOL 33)
060101     1.00      3.00       0       0      * R.V. LOWER HEAD (VOL 6)
*
*          CALCULATION OF VBUB FOR VOL 50 AND VOL 60:
*
*          STEAM FLOWRATE = VOL. FLOW AREA * VBUB * STEAM DENSITY
*
*
*                            528.3
*          VBUB = ------------------------ (SEE DATA CARD 050501)
*                 7.66 * 1.1793
*
*               = 58.5  FT/SEC
*
*
****************** TIME-DEPENDENT VOLUME DATA - 07XXYY ******************
*
*
*          -------------- TURBINE-GENERATOR -----------------
*
*
*                      TIME        PRES        TEMP        AVG.       MIXL
```

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 41

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CCN CONVERSION: CCN NO. CCN –

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazaretian	6/21/91	W. Alhassani	6/21/91						

```
*          N        (SEC)       (PSIA)       (F)        X        (FT)
*
070101     2          0.0         250.0        0.0        1.0      10.0
070102               1.0E+6        250.0        0.0        1.0      10.0
*
*
*          NOTE: THE TURBINE VOLUME IS TREATED AS A TDV IN ORDER TO
*                AVOID THE MASS FLOW IMBLANCE OCCURRING AT THE STEADY-
*                STATE.
*
*
********************** JUNCTION DATA - 08XXXY (Y=1) ********************
*
*     $$$  VFN CHANGES MADE  $$$
*      RCS FLOW RATES CORRECTED (NO ADJUSTMENTS MADE TO MATCH
*      VENDOR THOT DATA)
*        -- JUNCTION 1 WP 19,361 LBM/SEC (WAS 20583)
*        -- JUNCTION 8 WP 6,759 LBM/SEC (WAS 7,110)
*        -- JUNCTION 9 WP 6,759 LBM/SEC (WAS 7,110)
*        -- JUNCTION 21 WP 20,278 LBM/SEC (WAS 21,330)
*        -- JUNCTION 31 WP 13,519 LBM/SEC (WAS 14,220)
*      NEW LEAKAGE JUNCTION (JUNCTION 51) INCLUDED FOR VOLUME 36 IN
*      ORDER TO BETTER REPRESENT THE ACTUAL LEAKAGE IN THE PLANT
*      THEREFORE :
*        -- JUNCTION 50 : ONE THIRD OF TOTAL LEAKAGE
*        -- JUNCTION 51 : TWO THIRDS OF TOTAL LEAKAGE
*      NEW JUNCTIONS (JUNCTIONS 48 & 49) INCLUDED FOR
*      VOLUMES 20 AND 38 TO REPRESENT CHARGING MAKEUP
*      THEREFORE :
*        -- JUNCTION 48 : ONE THIRD OF TOTAL CHARGING
*        -- JUNCTION 49 : TWO THIRDS OF TOTAL CHARGING
*     $$$  VFN CHANGES MADE  $$$
*
*
*          1    2    3  4      5         6         7         8        9        10
* XXXY     VI   VO   IP IV     WP       AJUN      ZJUN      INERTA   FJUNF    FJUNR
*
080011     1    2    0  0  20583.0     46.60    -14.58     0.034    0.45     1.0
080011     1    2    0  0  19361.0     46.60    -14.58     0.034    0.45     1.0
*
*         ASSUMING CORE BYPASS FLOW = 4.5% OF TOTAL CORE FLOW.
*
080021     2    3    0  0      0.0     46.60    -11.25     0.068    0.0      0.0
080031     3    4    0  0      0.0     46.60     -7.91     0.068    0.0      0.0
080041     4    6    0  0      0.0     48.60     -4.58     0.034    1.0      0.45
080051     7    6    0  0      0.0     50.00      4.92     0.100    0.0      0.0
080061     1    5    0  0      0.0     13.55    -14.58     0.357    0.45     1.0
080071     5    6    0  0      0.0     13.55     -4.58     0.357   -1.0      0.45
080081     6    9    0  0   7110.0      4.15      0.0      2.241   -1.0      1.0
080091     9   10    0  0   7110.0      4.15      0.0      2.241    0.2      0.2
080081     6    9    0  0   6759.0      4.15      0.0      2.241   -1.0      1.0
080091     9   10    0  0   6759.0      4.15      0.0      2.241    0.2      0.2
*
*         THE CORE FLOWRATE HAS BEEN ADJUSTED TO MATCH THE THOT WITH
*         VENDOR'S RESULT.
*
080101    10   11    0  0      0.0      7.2       6.35     0.788    0.45     1.0
080111    11   12    0  0      0.0      7.2     14.855     1.182    0.0      0.0
080131    12   15    0  0      0.0      7.2      20.50     1.182    0.2      0.2
080151    15   16    0  0      0.0      7.2     14.855     1.182    0.0      0.0
```

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CALCULATION SHEET

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 42

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CCN CONVERSION: CCN NO. CCN -

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazaretty	6/21/91	W. Alhassani	6/21/91						

```
479    080161  16  17   0  0      0.0     7.2     6.35    0.788    1.0     0.45
480    080171  17  18   0  0      0.0    4.15      0.0    2.961    0.2      0.2
481    080181  18  19  -1  0      0.0    4.15      0.0    2.961    0.0      7.5
482    080191  19  20   1  0      0.0    4.15      0.0    1.578    0.0      7.5
483    080201  20   8   0  0      0.0    4.15      0.0    1.578    0.2     0.45
484    080211   8   1   0  0  21330.0    16.9   -18.33    1.376    0.0      0.0
485    080211   8   1   0  0  20278.0    16.9   -18.33    1.376    0.0      0.0
486    *
487    080251   0  25   5  0      0.0     1.0     43.3      0.0    0.0      0.0
       080261   0  25   6  0      0.0     1.0     43.3      0.0    0.0      0.0
489    *
490    080291  25  26   0  0      0.0    0.55     6.18   40.818    1.0      1.0
491    080301  26   9   0  0      0.0    0.55     1.15   40.818    1.0      1.0
492    080311   6  27   0  0  14220.0    8.30      0.0    1.129   -1.0      1.0
493    080311   6  27   0  0  13519.0    8.30      0.0    1.129   -1.0      1.0
494    080321  27  28   0  0      0.0    8.30      0.0    1.129    0.2      0.2
495    080331  28  29   0  0      0.0    14.4     6.35    0.394   0.45      1.0
496    080341  29  30   0  0      0.0    14.4   14.855    0.788    0.0      0.0
497    080361  30  33   0  0      0.0    14.4    20.50    0.788    0.2      0.2
498    080381  33  34   0  0      0.0    14.4   14.855    0.788    0.0      0.0
499    080391  34  35   0  0      0.0    14.4     6.35    0.394    0.2      0.2
500    080441  35  36   0  0      0.0     8.3      0.0    1.480    0.0      0.0
501    080451  36  37  -2  0      0.0     8.3      0.0    1.480    0.0      7.5
502    080461  37  38   2  0      0.0     8.3      0.0    0.789    0.2      7.5
503    080471  38   8   0  0      0.0     8.3      0.0    0.789   -1.0     0.45
504    *
505    080481   0  20  14  0      0.0     1.0      0.0      0.0    0.0      0.0
506    080491   0  38  14  0      0.0     2.0      0.0      0.0    0.0      0.0
507    *
508    080501   0  18  13  0      0.0     1.0      0.0      0.0    0.0      0.0
509    080511   0  36  13  0      0.0     2.0      0.0      0.0    0.0      0.0
510    *
511    080601   0  50   1  0      0.0     1.0      6.4      0.0    0.0      0.0
512    080691   0  50   3  0      0.0     1.0      6.4      0.0    0.0      0.0
513    *
514    080701   0  60   2  0      0.0     1.0      6.4      0.0    0.0      0.0
515    080791   0  60   4  0      0.0     1.0      6.4      0.0    0.0      0.0
516    *
517    080811  50  70   0  0    528.3     4.76    43.35    21.01   -1.0     -1.0
518    080911  60  70   0  0   1056.6     4.76    43.35    21.01   -1.0     -1.0
519    *
520    081001  70 100   0  1      0.0     9.52    43.35    21.01   -1.0     -1.0
521    *
522    081021   0  70   7  0      0.0     1.0     60.0      0.0    0.0      0.0
523    081041   0  70   8  0      0.0     1.0     60.0      0.0    0.0      0.0
524    081061   0  70   9  0      0.0     1.0     60.0      0.0    0.0      0.0
525    081081   0  70  10  0      0.0     1.0     60.0      0.0    0.0      0.0
526    081101   0  70  11  0      0.0     1.0     60.0      0.0    0.0      0.0
527    *
528    081201   0  70  12  0      0.0     1.0     60.0      0.0    0.0      0.0
529    *
530    *
531    ****** JUNCTION DATA - 08XXXY (Y=2)
532    *    $$$  VFN CHANGES MADE  $$$
533    *     NEW JUNCTION 51 CARD IN THIS SECTION-
534    *    $$$  VFN CHANGES MADE  $$$
535    *
536    *
537    *        11   12    13   14   15       16    17    18    19      20   21
538    *     Y JVERT CHOK   JCA  MIX  DIAMJ    CNTR  REGM  2PHS  ANGL  INDEX ISP
```

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 43

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

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CCN CONVERSION: CCN NO. CCN --

Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 44

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91					

*											
080012	0	-1	0	0	0.0445	1.0	0	0	0.0	2	0
080022	0	-1	0	0	0.0445	1.0	0	0	0.0	3	0
080032	0	-1	0	0	0.0445	1.0	0	0	0.0	3	0
080042	0	-1	0	0	0.0445	1.0	0	0	0.0	1	0
080052	0	-1	0	0	8.00	1.0	0	0	0.0	0	0
080062	0	-1	0	0	4.22	1.0	0	0	0.0	0	0
080072	0	-1	0	0	4.22	1.0	0	0	0.0	0	0
080082	1	-1	0	0	2.30	1.0	0	0	0.0	0	0
080092	1	-1	0	0	2.30	1.0	0	0	0.0	0	0
080102	0	-1	0	0	0.0533	1.0	0	0	0.0	2	0
080112	0	-1	0	0	0.0533	1.0	0	0	0.0	3	0
080132	1	-1	0	0	0.0533	1.0	0	0	0.0	3	0
080152	0	-1	0	0	0.0533	1.0	0	0	0.0	3	0
080162	0	-1	0	0	0.0533	1.0	0	0	0.0	1	0
080172	1	-1	0	0	2.30	1.0	0	0	0.0	0	0
080182	1	-1	0	0	2.30	1.0	0	0	0.0	0	0
080192	1	-1	0	0	2.30	1.0	0	0	0.0	0	0
080202	1	-1	0	0	2.30	1.0	0	0	0.0	0	0
080212	1	-1	0	0	4.64	1.0	0	0	0.0	0	0
*											
080252	0	-1	0	0	1.0	1.0	0	0	180.0	0	1
080262	0	-1	0	0	1.0	1.0	0	0	180.0	0	0
*											
080292	1	-1	0	0	0.84	1.0	0	0	0.0	0	0
080302	0	-1	0	3	0.84	1.0	0	0	0.0	0	0
080312	1	-1	0	0	3.25	1.0	0	0	0.0	0	0
080322	1	-1	0	0	3.25	1.0	0	0	0.0	0	0
080332	0	-1	0	0	0.0533	1.0	0	0	0.0	2	0
080342	0	-1	0	0	0.0533	1.0	0	0	0.0	3	0
080362	1	-1	0	0	0.0533	1.0	0	0	0.0	3	0
080382	0	-1	0	0	0.0533	1.0	0	0	0.0	3	0
080392	0	-1	0	0	0.0533	1.0	0	0	0.0	1	0
080442	1	-1	0	0	3.25	1.0	0	0	0.0	0	0
080452	1	-1	0	0	3.25	1.0	0	0	0.0	0	0
080462	1	-1	0	0	3.25	1.0	0	0	0.0	0	0
080472	1	-1	0	0	3.25	1.0	0	0	0.0	0	0
*											
080482	0	-1	0	0	1.0	1.0	0	0	0.0	0	0
080492	0	-1	0	0	1.0	1.0	0	0	0.0	0	0
*											
080502	0	-1	0	0	1.0	1.0	0	0	180.0	0	0
080512	0	-1	0	0	1.0	1.0	0	0	180.0	0	0
*											
080602	0	-1	0	0	1.0	1.0	0	0	0.0	0	0
080692	0	-1	0	0	1.0	1.0	0	0	0.0	0	0
*											
080702	0	-1	0	0	1.0	1.0	0	0	0.0	0	0
080792	0	-1	0	0	1.0	1.0	0	0	0.0	0	0
*											
080812	0	-1	0	0	2.46	1.0	0	0	0.0	0	0
080912	0	-1	0	0	2.46	1.0	0	0	0.0	0	0
*											
081002	0	-1	0	0	1.0	1.0	0	0	0.0	0	0
*											
081022	0	-1	0	0	1.0	1.0	0	0	180.0	0	0
081042	0	-1	0	0	1.0	1.0	0	0	180.0	0	0
081062	0	-1	0	0	1.0	1.0	0	0	180.0	0	0
081082	0	-1	0	0	1.0	1.0	0	0	180.0	0	0
081102	0	-1	0	0	1.0	1.0	0	0	180.0	0	0

```
*
081202    0   -1    0    0   1.0      1.0    0      0  180.0    0    0
*
*
****************** PUMP CURVE SET INPUT FLAGS - 100000 ******************
*
*
*       NOTE: UNIQUE PUMP CURVE SET IS USED, I.E. J = 1.
*
*           J        J
*       NPC(1)    NC(1)
*
100000     2          0
*
*
********************* PUMP DESCRIPTION DATA - 090XXY ********************
*
*       WHERE XX = IPUMP (SEE M3 ON CARDS 08XXXY),
*       AND   XX = 01 ( RCP  B ),
*                = 02 ( RCPS A & C).
*
*       REFERENCE: SONGS1 STATION MANUAL EQUIPMENT MANUAL DATA, VOL. 3.
*
*  XXY IPC ITPUMP IRP IPM IMT  POMGAR  PSRAT   PFLOWR   PHEADR  PTORKR
*                               (RPM)          (GPM)     (FT)  (LBF-FT)
*
090011  1     2    0   0   0   1180.0   1.0   69560.0   200.0  13887.0
*
090021  1     2    0   0   0   1180.0   1.0  139120.0   200.0  27773.0
*
*
*  XXY     PINRTA      VRHOI    TORKMR   TORKF1   TORKF2   TORKF3   TORKF4
*       (LBM-FT**2)            (LBF-FT)  (S**0)   (S**1)   (S**2)   (S**3)
*
090012    45000.0       0.0      0.0       0.0      0.0      0.0      0.0
*
090022    90000.0       0.0      0.0       0.0      0.0      0.0      0.0
*                                         (-------- ASSUMPTION --------)
*
* NOTE: THE RCP FLYWHEEL INERTIA IS 45,000 LBM/FT**2 (SEE SONGS1 SYSTEM
*       DESCRIPTION SD-SO1-300, P. 5)
*
*       PUMP MOTOR TORQUE = PUMP MOTOR POWER / PUMP SPEED
*                         = 2.2E+6 (LBF-FT/SEC)/123.57 (RAD/SEC)
*                         = 1.78E+4 LBF-FT
*       WHERE
*
*            PUMP MOTOR POWER  = 4000 HORSE POWER (P. 1-6, REF.)
*                              = 4000 (HP) * 2545 (BTU/HR)/(HP) * 778.2
*                                (LBF-FT)/(BTU) * 1 (HR)/3600(SEC)
*                              = 2.2E+6 LBF-FT/SEC
*
*            PUMP SPEED        = 1180 RPM (P. 1-5, REF.)
*                              = 1180 * (2 * 3.2416/60) RAD/SEC
*                              = 123.57 RAD/SEC
*
*       HYDRAULIC TORQUE  = OVERALL EFFICIENCY (P. 1-8, REF.)
*                           * PUMP MOTOR TORQUE
*                         = 0.78 * 1.78E+4
```

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 45

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

```
*                          = 13887. LBF-FT
*
*
******************** PUMP STOP DATA - 095XX1 ******************************
*
*
*           ELAPSED TIME        FORWARD         REVERSE
*95XX1          (SEC)          RPM (MAX)       RPM (MAX)
*
095011           0.0              0.0           -1.0E-6        * B
095021           0.0              0.0           -1.0E-6        * A & C
*
*
******************** PUMP MOTOR TORQUE DATA - 097XXY **********************
*
*
*             (MAY BE USED FOR THE CASE OF PUMP RESTART)
*
*
*                          TIME      SPEED
*  XXY       NTMO          SEC       RPM
*
*097011       -3            0.0       0.0
*097012                    10.0      1180.0
*097013                  1.0E+6      1180.0
*
*
************************** VALVE DATA - 11XXX0 ****************************
*
*
*            NOTE: XXX = IVALVE (N4 IN CARDS 08XXXY)
*
* XXX0   ITCV   IACV  IACV2   PCV  CV1  CV2  CV3
*      (TRIPID)
*
110010     2      1     0     0.0  0.0  0.0  0.0   * CLOSE TURBINE STOP
*                                                    VALVE - JUN 100
*
*
************************** GENERAL DATA - 12XXYY **************************
*
*
*                            VALVE                 * ------- TABLE 1 -------
* XXYY      N      TIME      POSITION               * CLOSING CURVE FOR JUN 100
*                                                   * ON LOSS OF CONDENSER
120101     -3       0.0         1.0                 * (ASSUMPTION)
120102              1.0         0.0
120103            1.0E+6        0.0
*
*
*                  DELTA      VALVE POSI.          * ------- TABLE 2 -------
* XXYY      N      TEMP.        DEMAND             * MASTER CONTROLLER
*
120201     -4     -1.0E+6         0.0
120202              0.0           0.0
120203              6.67          1.0
120204            1.0E+6          1.0
*
*
*              VALVE POSI. "BYPASS" VALVE  * ------- TABLE 3 --------
```

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 46

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CCN CONVERSION: CCN NO. CCN --

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

```
719     * XXYY        N      DEMAND      POSI. DEMAND
720     *
721     120301       -5     -1.0E+6       0.0
722     120302              0.0           0.0
723     120303              0.5           1.0
724     120304              1.0           1.0
725     120305              1.0E+6        1.0
726     *
727     *
728     *                  VALVE POSI.     "ADV"       * ------- TABLE 4 --------
        *            N       DEMAND     POSI. DEMAND
730     *
731     120401       -4     -1.0E+6       0.0
732     120402              0.5           0.0
733     120403              1.0           1.0
734     120404              1.0E+6        1.0
735     *
736     *
737     *                    TIME          VALVE       * ------- TABLE 5 -------
738     *            N       (SEC)       POSITION      * FOR QUICK-OPEN MODE
739     *                                              * ASSUMING FULL OPENED WITHIN
740     120501       -6     -1.0E+6       0.0           * 1.0 SECOND AND LASTS FOR 10
741     120502              0.0           0.0           * SECONDS.
742     120503              1.0           1.0
743     120504              10.0          1.0
744     120505              10.1          0.0
745     120506              1.0E+6        0.0
746     *
747     *
748     *                  VALVE POSI.     VALVE       * ------- TABLE 6 -------
749     *            N       ERROR         SPEED       * VALVE SPEED FOR MODULATION
750     *                                              * MODULATION SPEED = 10 SEC
751     120601       -5     -1.0E+6       -0.1
752     120602              -1.0E-6       -0.1
753     120603              0.0           0.0
754     120604              1.0E-6        0.1
755     120605              1.0E+6        0.1
756     *
757     *
758     *                    TIME          OUTPUT      * ------- TABLE 7 --------
759     *            N       (SEC)                     *
760     *                                              * ADVS ARE IN AUTOMATIC MODE.
761     120701       -4     -1.0E+6       1.0
762     120702              180.0         1.0
763     120703              180.1         0.0
764     120704              1.0E+6        0.0
765     *
766     *
767     *                    TIME          OUTPUT      * ------- TABLE 8 --------
768     *            N       (SEC)                     *
769     *                                              * ADVS ARE MANUALLY REGULATED.
770     120801       -4     -1.0E+6       0.0
771     120802              180.0         0.0
772     120803              180.1         1.0
773     120804              1.0E+6        1.0
774     *
775     *
776     *                    DELTA T       OUTPUT      * ------- TABLE 9 ----------
777     *            N       (F)
778     *
```

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 47

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CCN CONVERSION: CCN NO. CCN --

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

```
779    120901    -4    -1.0E+6          0.0
780    120902          0.0            0.0
781    120903          0.1            1.0
782    120904         1.0E+6          1.0
783    *
784    *
5      *                S/G
       *          N    NR LEVEL       OUTPUT     * ------- TABLE 10 ------
7      *
3      121001    -4    -1.0E+6          1.0      * OPERATOR ACTION ON S/G
9      121002          0.50             1.0      * LEVEL CONTROL
790    121003          0.70             0.0      * (ASSUMPTION)
791    121004         1.0E+6            0.0
792    *
793    *
794    *                S/G PRES.      AUXFW      * ------- TABLE 11 --------
795    *          N     (PSIA)      (GPM/SQ.FT)
796    *
797    121101    -9       0.0          123.3     * REFERENCE:
798    121102           995.0          123.3     * FIG. 21, DESIGN CALC. NO.
799    121103          1030.0          115.0     * DC-2836, SHEET R5-6A.
800    121104          1055.0          108.3
801    121105          1125.0           88.3
802    121106          1155.0           78.3
803    121107          1185.0           64.3
804    121108          1215.0           50.0
805    121109          1240.0           33.3
806    *
807    *
808    *
809    ************************** FILL TABLE - 13XXYY ************************
810    *
811    *
812    *          ---------- TABLE 1 (S/G B MFW - JUN 60) ----------
813    *
814    *
815    *              TRIP   JX        TIME       FLUX          H       PSIA
816    *  XXYY   N    ID  (TIME) JY    (S)  (LB/SEC-FT**2)
817    *
818    130101  -3     4     0     0   0.0        528.3        394.0    700.0
819    130102                         1.0          0.0        394.0    700.0
820    130103                       1.0E+6         0.0        394.0    700.0
821    *
822    *  NOTE: TOTAL MFW FLOWRATE AT FULL POWER IS 5.706E+6 LBM/HR (SEE P.20-1,
823    *        SONGS1 STATION MANUAL).
824    *
825    *
826    *          ----------- TABLE 2 (S/GS A&C MFW - JUN 70) ---------
827    *
828    *              TRIP   JX        TIME       FLUX          H       PSIA
829    *  XXYY   N    ID  (TIME) JY    (S)  (LB/SEC-FT**2)
830    *
831    130201  -3     4     0     0   0.0       1056.6        394.0    700.0
832    130202                         1.0          0.0        394.0    700.0
833    130203                       1.0E+6         0.0        394.0    700.0
834    *
835    *
836    *          ---------- TABLE 3 (S/G B AUXFW - JUN 69) ----------
837    *
838    *
```

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REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

```
839     *
840     * XXYY    N    TRIP ID   JX-CNTL BLK ID   JY   DUMMY VALUE   FLUX (GPM/FT**2)      H      PSIA
841     *
842     130301   1    1000        -24            1      0.0            0.0          40.8    1000.0
843     *                                                                          (70.0 F)
844     *
845     *          ------------ TABLE 4 (S/GS A&C AUXFW - JUN 79) ----------
846     *
847     130401   1    1000        -25            1      0.0            0.0          40.8    1000.0
848     *
849     *
850     *          ------------ TABLE 5 (PORVS - JUN 25) -------------
851     *
852     *
853     *                TRIP      JX      JY     PRES        FLUX
854     * XXYY    N      ID                      (PSIA)  (LBM/S-FT**2)      H      PSIA
855     *
856     130501   -4     5         1       0      0.0          0.0           1.0     1.0
857     130502                                  2215.0       0.0           1.0     1.0
858     130503                                  2281.5       -66.75        1.0     1.0
859     130504                                  1.0E+6       -66.75        1.0     1.0
860     *                                                    (2 PORVS)
861     *
862     *          A 3% OF ACCUMULATION RATIO IS ASSUMED.
863     *          REF: SEE P. 17 OF SD-SO1-280 FOR PORV SETPOINT AND CAPACITY.
864     *
865     *
866     *          ------------ TABLE 6 ( SRVS - JUN 26) ------------
867     *
868     *                TRIP      JX      JY                   FLUX
869     * XXYY    N      ID      (PSIA)          PRES    (LBM/S-FT**2)      H      PSIA
870     *
871     130601   -4     6         1       0      0.0          0.0           1.0     1.0
872     130602                                  2525.0       0.0           1.0     1.0
873     130603                                  2601.0       -133.33       1.0     1.0
874     130604                                  1.0E+6       -133.33       1.0     1.0
875     *                                                    (2 SRVS)
876     *
877     *          A 3% OF ACCUMULATION RATIO IS ASSUMED.
878     *          REF.: SEE P. 19 OF SD-SO1-280 FOR SRV SETPONT AND CAPACITY.
879     *
880     *
881     *          ------------ TABLES 7 - 11 (MSSV) --------------
882     *
883     *          REF.: SD-SO1-190
884     *
885     *             TRIP    JX                          FLUX        H     PSIA
886     * XXYY    N    ID    (PSIA)   JY    PRES    (LBM/FT**2-S)
887     *                                                                        * --JUN 102--
888     130701   -4    7       1      0      0.0          0.0           1.0     1.0  * VALVES WITH
889     130702                              1000.0       0.0           1.0     1.0  * SETPOINT =
890     130703                              1030.0       -332.6        1.0     1.0  * 1000.0 PSIA
891     130704                              1.0E+6       -332.6        1.0     1.0
892     *                                                (2 VALVES)
893     *                                                                        * --JUN 104--
894     130801   -4    8       1      0      0.0          0.0           1.0     1.0  * VALVES WITH
895     130802                              1015.0       0.0           1.0     1.0  * SETPOINT =
896     130803                              1045.5       -337.6        1.0     1.0  * 1015.0 PSIA
897     130804                              1.0E+6       -337.6        1.0     1.0
898     *
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REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazarethy	6/21/91	W. Alhassani	6/21/91						

```
899     *
900     130901  -4    9     1     0    0.0        0.0        1.0   1.0   * --JUN 106--
901     130902                     1035.0       0.0        1.0   1.0   * VALVES WITH
902     130903                     1066.0     -344.3       1.0   1.0   * SETPOINT =
903     130904                     1.0E+6     -344.3       1.0   1.0   * 1035.0 PSIA
904     *
905     *
906     131001  -4    10    1     0    0.0        0.0        1.0   1.0   * --JUN 108--
907     131002                     1045.0       0.0        1.0   1.0   * VALVES WITH
908     131003                     1076.0     -347.6       1.0   1.0   * SETPOINT =
909     131004                     1.0E+6     -347.6       1.0   1.0   * 1045.0 PSIA
910     *
911     *
912     131101  -4    11    1     0    0.0        0.0        1.0   1.0   * --JUN 110--
913     131102                     1050.0       0.0        1.0   1.0   * VALVES WITH
914     131103                     1082.0     -349.3       1.0   1.0   * SETPOINT =
915     131104                     1.0E+6     -349.3       1.0   1.0   * 1050.0 PSIA
916     *
917     *
918     *          ---------- TABLE 12 (ADV - JUN 120) ----------
 19     *
920     *
921     *                    TRIP    JX-CNTL          DUMMY    CNTL BLK OUTPUT
922     * XXYY    N           ID    BLK ID    JY      VALUE   (LBM/S-FT**2)      H      PSIA
923     *
924     131201  1     1000        -19       0       0.0          0.0          1.0    1.0
925     *
926     *
927     *          ------------ TABLE 13 (LEAKAGE - JUN 50) ------------
928     *
929     *     $$$  VFN CHANGES MADE  $$$
930     *      FOR FIRST 2 MINUTES OF SBO LEAKAGE IS 74.67 GPM/S.G.
931     *      FOR REMAINING TIME OF SBO LEAKAGE IS 44.1 GPM/S.G.
932     *     $$$  VFN CHANGES MADE  $$$
933     *
934     *
935     *                    TRIP                      TIME       FLUX
936     * XXYY    N           ID      JX      JY        (S)    (GPM/FT**2)      H      PSIA
937     *
938     131301  -2    25          0       1       0.0          -35.4        1.0    1.0
939     131302                                    1.0E+6       -35.4        1.0    1.0
940     131301  -4    25          0       1       0.0          -74.67       1.0    1.0
941     131302                                    120.0        -74.67       1.0    1.0
942     131303                                    120.1        -44.10       1.0    1.0
943     131304                                    1.0E+6       -44.10       1.0    1.0
944     *
945     *
946     *          ------ TABLE 14 (CHARGING - JUN 48 & 49) -------
947     *
948     *     $$$  VFN CHANGES MADE  $$$
949     *      FOR FIRST ONE HOUR OF SBO CHARGING IS 0.0 GPM/LOOP
950     *      FOR REMAINING TIME OF SBO CHARGING IS 65.5 GPM/LOOP
951     *     $$$  VFN CHANGES MADE  $$$
952     *
953     *
954     *                    TRIP                      TIME       FLUX
955     * XXYY    N           ID      JX      JY        (S)    (GPM/FT**2)      H      PSIA
956     *
        131401  -4    26          0       1       0.0          0.0          1.0    1.0
        131402                                    3600.0       0.0          1.0    1.0
```

*** THIS CARD IS A REPLACEMENT CARD.
*** THIS CARD IS A REPLACEMENT CARD.

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	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

```
131403                          3600.1      65.5      1.0       1.0
131404                          1.0E+6      65.5      1.0       1.0
*
*
*
************************** POINT KINETICS DATA **************************
*
*
*     REF.: ANALYSIS OF ATWS FOR SONGS1, NUS REPORT, OCTOBER 1974
*
*
*          KMUL      BOVL      RHOIN      UDUF      PROMPT      LAMBDA      TAU
*
140000      0.0      596.1      0.0        1.0        1.0         0.0        0.0
*
*          BOVL = EFFECTIVE BETA / NEUTRON LIFE TIME
*               = 0.00608 / 10.2E-6 (SEE P.4-4, ABOVE REFERENCE)
*               = 596.1
*
*
* ---------------------- DELAYED NEUTRON DATA -------------------------
*
*
*          DLAMDA1   DLAMDA2   DLAMDA3   DLAMDA4   DLAMDA5   DLAMDA6
*
140001      0.0126    0.0309    0.1173    0.3149    1.2639    3.3795
*
*
*          AJOVRJ1   AJVORJ2   AJVORJ3   AJVORJ4   AJVORJ5   AJVORJ6
*
140002      0.0300    0.2080    0.1892    0.3914    0.1360    0.0454
*
*
* ---------------------- REACTIVITY COEFFICIENT -------------------------
*
*
*                                          DOPPLER TEMP.      WATER TEMP
*               DENWT          FTWT          COEF ($/F)       COEF ($/F)
*
140010         0.333          0.333        -8.3333E-4            0.0
140020         0.334          0.334        -8.3333E-4            0.0
140030         0.333          0.333        -8.3333E-4            0.0
*                (ASSUMPTION)              (SEE CALC BELOW)
*
*                                                  (1)
*              AVG. FUEL TEMP                DOPPLER REAC.
*                   (F)                          ($)
*
*                 1200.0                        0.5
*                 1400.0                        0.0
*                                                        0.0 - 0.5
*              DOPPLER TEMPERATURE COEFFICIENT = ------------- / 3
*              (PER CORE CONDUCTOR)                      1400 - 1200
*
*                                                = -8.3333E-4 $/F
*
*        REF. (1): FIG. 4-30, A PARAMETRIC STUDY OF AN ATWS IN A W FOUR-
*                  LOOP PLANT, NSAC-91, NOVEMVER 1985.
*
```

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	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

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*       NOTE: VARIATION OF THE DOPPLER REACTIVITY RESULTS IN LITTLE
*             DIFFERENCE BETWEEN PRIMARY PRESSURE PEAKS AND TOTAL
*             REACTIVITY AS SHOWN IN FIGS. 4-28 AND 4-29, RESPECTIVELY,
*             IN THE REF. (1).
*
*
*       ----------------- SCRAM TABLE -----------------
*
*
*  XYY       N        TRIP        TIME          $
*                      ID        (SEC)
141001       -3        2           0.0          0.0
141002                             3.0        -10.0
141003                          1.0E+6        -10.0
*
*
*       ---------- DENSITY REACTIVITY TABLE ----------
*
*
*       REF.: A PARAMETRIC STUDY OF AN ATWS IN A W FOUR-LOOP PLANT,
*             NSAC-91, NOVEMBER 1985.
*
*
*       NOTE: SEE FIG. A-2 OF THE ABOVE REFERENCE FOR THE DENSITY
*             REACTIVITY CURVE.
*
*
*                          WATER DENSITY          $
*  XX        N             (LBM/FT**3)
*
*142000       -9              31.84           -4.37      * -4.0 PCM/F
*142001                       33.40           -3.26
*142002                       34.96           -2.36
*142003                       36.52           -1.63
*142004                       38.08           -1.11
*142005                       39.64           -0.69
*142006                       41.20           -0.34
*142007                       42.76           -0.17
*142008                       44.33            0.0
*
*
*142000       -9              31.84           -5.67      * -8.0 PCM/F
*142001                       33.40           -4.4
*142002                       34.96           -3.3
*142003                       36.52           -2.37
*142004                       38.08           -1.6
*142005                       39.64           -1.05
*142006                       41.20           -0.61
*142007                       42.76           -0.28
*142008                       44.33            0.0
*
*
*
142000       -9              31.84           -3.02      * 0.0 PCM/F
142001                       33.40           -2.15
142002                       34.96           -1.43
142003                       36.52           -0.91
142004                       38.08           -0.50
142005                       39.64           -0.28
142006                       41.20           -0.11
```

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REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

```
079   142007                        42.76            -0.05
080   142008                        44.33             0.0
081   *
082   *
083   *        ---------- DOPPLER REACTIVITY TABLE ----------
084   *
085   *
086   *   XX       N
087   *
088   143000       0
089   *
090   *
091   *        ---------- DIRECT MODERATOR HEATING ----------
092   *
093   *
094   *
095   *   XX          QP(I)          QD(I)
096   *
097   144000          0.025           0.0          * ASSUMPTION
098   144001          0.025           0.0          * ASSUMPTION
099   144002          0.025           0.0          * ASSUMPTION
100   *
101   *
102   *
103   ******************** HEAT CONDUCTOR DATA - 15XXXY ************************
104   *
105   *
106   *                    XXX = HEAT CONDUCTOR NUMBER
107   *
108   *
109   *       IVSL IVSR IGOM CELEV IMCL IMCR    ASUL       ASUR      VOLS
110   *        M1   M2   M3    M4   M5   M6      M7         M8        M9
111   * XXXY
112   150011   0    2    1   0.0    2    2       0.0     10407.3    91.5   * CORE
113   150021   0    3    1   0.0    2    2       0.0     10407.3    91.5
114   150031   0    4    1   0.0    2    2       0.0     10407.3    91.5
115   *
116   150041  11   50    2  4.2525  2    2    4727.5      5540.0    25.95  * S/G #B TUBES
117   150051  12   50    2 12.7575  2    2    4727.5      5540.0    25.95
118   150061  15   50    2 12.7575  2    2    4727.5      5540.0    25.95
119   150071  16   50    2  4.2525  2    2    4727.5      5540.0    25.95
120   *
121   150081  29   60    2  4.2525  2    2    9454.8     11080.0    51.75  * S/G A&C TUBES
122   150091  30   60    2 12.7575  2    2    9454.8     11080.0    51.75
123   150101  33   60    2 12.7575  2    2    9454.8     11080.0    51.75
124   150111  34   60    2  4.2525  2    2    9454.8     11080.0    51.75
125   *
126   *         HDML      HDMR      DHEL      DHER      CHNL    CHNR   IHXQF  NTUBES
127   *         M10       M11       M12       M13       M14     M15    M16     M17
128   * XXXY
129   150012   0.0       0.0454    0.0       0.0454    0.00    3.33     0
130   150022   0.0       0.0454    0.0       0.0454    0.00    3.34     0
131   150032   0.0       0.0454    0.0       0.0454    0.00    3.33     0
132   *
133   150042   0.0533    0.0918    0.0533    0.0980    8.505   8.505    1
134   150052   0.0533    0.0918    0.0533    0.0980    8.505   8.505    1
135   150062   0.0533    0.0918    0.0533    0.0980    8.505   8.505    1
136   150072   0.0533    0.0918    0.0533    0.0980    8.505   8.505    1
137   *
138   150082   0.0533    0.0918    0.0533    0.0980    8.505   8.505    2
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REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	5/21/91						

```
1139    150092   0.0533   0.0918   0.0533   0.0980   8.505   8.505   2
   0    150102   0.0533   0.0918   0.0533   0.0980   8.505   8.505   2
   1    150112   0.0533   0.0918   0.0533   0.0980   8.505   8.505   2
  42    *
1143    *        (1) FOR FUEL ROD:
1144    *
1145    *            REF.: CORE PHYSICS PARAMETERS AND PLANT OPERATIONS DATA
1146    *                  FOR SONGS1 CYCLE 9, FIG. 2-1.
1147    *
1148    *            NO. OF ASSEMBLY              = 157
   9    *            NO. OF FUEL ROD PER ASSEMBLY = 180
  50    *            FUEL ROD I.D.                = 0.422"
1151    *            PELLET I.D.                  = 0.3835"
1152    *            CLAD THICKNESS               = 0.0165"
1153    *
1154    *            ASUR = 180 * 157 * PI * 0.422" * 10.0' / 3
1155    *                 = 10407.3 FT**2
1156    *
1157    *            VOL  = (180 * 157 * PI * 0.422" ** 2 * 10.0' / 4) / 3
1158    *                 = 91.5 FT**3
1159    *
1160    *
1161    *        (2) FOR S/G:
1162    *
1163    *            REF.: VERTICAL S/G FOR SONGS1, TABLE 1-1, TECHNICAL MANUAL
1164    *                  1440-C77, DEC. 1965.
1165    *
1166    *            OUTER TUBE HEATING SURFACE = 27700 FT**2
1167    *
1168    *            TUBE O.D.                = 0.75"
1169    *            TUBE AVERAGE THICKNESS = 0.055"
1170    *            TUBE I.D.                = 0.75" - 0.055" * 2
1171    *                                     = 0.64"
1172    *
1173    *            INNER TUBE HEATING SURFACE = 27700 * 0.64 / 0.75
1174    *                                       = 23637 FT**2
1175    *
1176    *            ASUR = 27700 / 4 = 6925.0 FT**2 PER CONDUCTOR
1177    *            ASUL = 23637 / 4 = 5909.0 FT**2 PER CONDUCTOR
1178    *
1179    *            FOR 20% TUBE PLUGGING:
  80    *
1181    *            ASUR = 6925.0 * 0.8 = 5540.0 FT**2 / SG
1182    *            ASUL = 5909.0 * 0.8 = 4727.5 FT**2 / SG
1183    *
1184    *
1185    ********** CORE SECTION DATA - 16XXX0 **************************
1186    *
1187    *
1188    * XXX         ISLB          CLTI          QFRAC
1189    *
1190    160010          1           0.0           0.336
1191    160020          2           0.0           0.406
1192    160030          3           0.0           0.258
1193    *
1194    *       NOTE: NO STEAM-METAL REACTION FOR FUEL ROD CLAD OF STAINLESS
1195    *             STEEL.
1196    *
1197    *
1198    ********** CONDUCTOR GEOMETRY DATA - 17XXYY **********
```

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	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

```
99    *
00    *
01    *                TYPES OF HEAT CONDUCTOR:
02    *
03    *                XX =  1, CORE
04    *                   =  2, STEAM GENERATOR U-TUBES
05    *
06    *                HEAT CONDUCTOR MATERIAL IDENTIFICATION:
07    *
08    *                IM =  1, UO2
09    *                   =  2, GAP
10    *                   =  3, STAINLESS STEEL
11    *                   =  4, INCONEL
12    *
13    *
14    * XXYY   IG/IGP  NR   IM   NDX    XO        XR         PF
15    *
16    170101     2     3    1    4     0.0     0.015979     1.0   * FUEL PELLET
17    170102     1           2    1             0.000229     0.0   * GAP
18    170103     0           3    3             0.001375     0.0   * CLAD
19    *
20    170201     2     1     4    3   0.026667  0.004583     0.0   * S/G TUBES
21    *
22    *          S/G TUBE THICKNESS = 0.004583 FT
23    *                             = 0.055  INCH
24    *
25    *
26    ******************** THERMAL CONDUCTIVITY DATA - 18XXYY ******************
27    *
28    *                  UNIT: TEMPERATURE (F) VS. K (BTU/FT-HR-F)
29    *
30    *
31    *                  REF.: (1) NA-82-001
32    *                        (2) SEE TMI-2 ACCIDENT FOR CORE HEAT-UP
33    *                            ANALYSIS (SUPPLEMENT), FIG. 24, P.5-18,
34    *                            STAINLESS STEEL THERMAL PROPERTIES.
35    *
36    *                  ----- UO2 -----
37    180101     -21
38    *
39    *           F      K        F      K        F      K        F      K
40    *
41    180102      0.0  3.341    500.0  3.341    650.0  2.971    800.0  2.677
42    180103    950.0  2.439   1100.0  2.242   1250.0  2.078   1400.0  1.940
43    180104   1550.0  1.823   1700.0  1.724   1850.0  1.639   2000.0  1.568
44    180105   2150.0  1.507   2300.0  1.457   2450.0  1.415   2600.0  1.382
45    180106   3100.0  1.323   3600.0  1.333   4100.0  1.406   4600.0  1.538
46    180107   5100.0  1.730
47    *
48    *
49    *                  ----- GAP -----
50    180201      -6
51    *
52    *           F        K          F       K          F       K
53    *
54    180202     100.0   0.0937     1100.0   0.163     2100.0   0.212
55    180203    3100.0   0.253      4100.0   0.289     5100.0   0.322
56    *
57    *
58    *              ------- STAINLESS STEEL -------
```

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 55

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CCN CONVERSION: CCN NO. CCN --

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth VFN	6/21/91	W. Alhassani	6/21/91						

```
1259    180301        -6
1260    *
1261    *              F        K          F        K          F        K
1262    *
1263    180302       200.0     9.5       500.0    11.0      1000.0    13.1
1264    180303      1500.0    15.4      2000.0    17.6      2500.0    19.8
1265    *
1266    *
1267    *                    ----- INCONEL -----
1268    180401        -3
1269    *
1270    *              F        K          F        K          F        K
1271    *
1272    *180402       212.0    10.000     752.0    11.000    1832.0    18.000
1273    *
1274    180402       212.0     3.3139     752.0    3.4168    1832.0    3.8863
1275    *
1276    *     NOTE:  THE THERMAL CONDUCTIVITY TABLE HAS BEEN MODEIFIED TO INCLUDE
1277    *            THE EFFECT OF FOULING FACTOR ON THE OUTER TUBE SURFACE.
1278    *
1279    *
1280    ****************** VOLUME HEAT CAPACITY DATA - 19XXYY ********************
1281    *
1282    *                    UNIT: TEMPERATURE (F) VS. CP (BTU/FT**3-F)
1283    *
1284    *
1285    *                    REFERENCE: NA-82-001
1286    *
1287    *                    ----- UO2 -----
1288    190101        -16
1289    *
1290    *              F        CP         F        CP         F        CP
1291    *
1292    190102        32.0     34.45      122.0    38.35      212.0    40.95
1293    190103       392.0     43.55      752.0    46.80     2012.0    51.35
1294    190104      2732.0     52.65     3092.0    56.55     3452.0    63.05
1295    190105      3812.0     72.80     4352.0    89.70     4532.0    94.25
1296    190106      4712.0     98.15     4892.0   100.10     5144.0   101.40
1297    190107      8000.0    101.40
1298    *
1299    *
1300    *                    ----- GAP -----
1301    190201        -2
1302    *
1303    *              F        CP         F        CP
1304    *
1305    190202        32.0     0.0149    3400.0    0.0149
1306    *
1307    *                    ------- STAINLESS STEEL -------
1308    190301        -6
1309    *
1310    *              F        CP         F        CP         F        CP
1311    *
1312    190302       200.0     57.6       500.0    64.1      1000.0    67.7
1313    190303      1500.0     70.2      2000.0    76.2      2500.0    79.2
1314    *
1315    *                    ----- INCONEL -----
1316    190401        -8
1317    *
1318    *              F        CP         F        CP         F        CP
```

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 56

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CCN CONVERSION: CCN NO. CCN –

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

```
*
190402     200.0      57.2600      400.0      60.1409      450.0      60.6320
190403     500.0      61.1216      550.0      61.6216      600.0      62.0564
190404     800.0      64.1549     1000.0      67.2913
*
*
********** LINEAR THERMAL EXPANSION COEFFICIENT DATA - 20XXYY ***********
*
*          UNIT: TEMPERATURE (F) VS. COEF (1/F)
*
*
*                        REFERENCE: NA-82-001
*
*                        ----- UO2 -----
200101      -13
*
*            F          COEF          F          COEF          F          COEF
*
200102      440.6     3.40E-6       890.6     4.27E-6       1340.6     4.77E-6
200103     1790.6     5.19E-6      2240.6     5.71E-6       2960.6     6.02E-6
200104     3140.6     6.40E-6      3590.6     6.91E-6       4040.6     7.28E-6
200105     4490.6     7.68E-6      4940.6     8.10E-6       5390.6     1.48E-5
200106     5840.6     1.51E-5
*
*
*                        ----- GAP -----
*
200201      -2
*
*            F          COEF          F          COEF
*
200202      0.0         0.0        2000.0        0.0
*
*
*                  ------- STAINLESS STEEL -------
200301      -2
*
*            F          COEF          F          COEF
*
200302     500.0     11.25E-6      2500.0     11.25E-6
*
*          FROM REF. (2):
*
*          TEMPERATURE (F)        THERMAL EXPANSION (% DELTA L/L)
*              500.0                          2.75
*             2500.0                          0.5
*
*                                        2.75 - 0.5
*          THERMAL EXPANSION COEF. = ------------ %
*                                        2500 - 500
*
*                                   = 11.25E-6 / F
*
*                        ----- INCONEL -----
200401      -5
*
*            F          COEF          F          COEF          F          COEF
*
200402     200.0     7.10E-6       600.0     7.70E-6       1000.0     8.10E-6
200403    1400.0     8.70E-6      1600.0     9.00E-6
```

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 57

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CCN CONVERSION: CCN NO. CCN -	

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91					

```
*
*
********** NON-CONDUCTION HEAT EXCHANGER DATA CARDS - 21XXYY ***********
*
*
* XXYY   IHTX  IDTRP   JVOL  IHTYPE   W5(KW)  W6(SEC)
*
*210101         1000     99      7       0.0     0.0  * HEAT SINK LOSS
*
*
*
********** LOCAL CONDITION HEAT TRANSFER STACK CARDS - 2200YX **********
*
*
*   YX    ISHD    LENS     DZ      TQNCH     NCON1     NCON2
*
*220011    -1       2     0.0       0.0        4         5
*220021    -1       2     0.0       0.0        7         6
*220031    -1       2     0.0       0.0        8         9
*220041    -1       2     0.0       0.0       11        10
*
*
******* STEADY-STATE INITIALIZATION CONVERGENCE CRITERIA - 230000 ******
*
*
*          LCOUNT       ACEPSI          HEPSE          EPSIM        VSEPSI
*                       (PRES)       (ENTHALPY)       (MASS)     (SLIP VEL)
*
230000        25         1.0E-5          1.0E-5         1.0E-5        1.0E-5
*
*
*
************ STEADY-STATE POWER REMOVAL SYSTEM DATA - 230XXY ***********
*
*
*  XXY         ISGNUM        JBIAS         JBAL         POWF
*
230011             1            60           81        0.333
230021             2            70           91        0.667
*
*
******************** CONTROL SYSTEM MODELING - 70YXXX *******************
*
*
*            NO. OF CNTL        NO. OF CNTL       MAX. TIME
*           INPUT BLOCKS         BLOCKS            STEP
*
701000            13               25              0.01
*
*
*          --------- CONTROL INPUT BLOCKS ----------
*
*   $$$  VFN CHANGES  $$$
*   INLET AND OUTLET TEMPERATURES CORRECTED
*     -- INLET TEMP 527 F (WAS 528 F)
*     -- OUTLET TEMP 576 F (WAS 575 F)
*   SG LEVEL CHANGED TO GET INITIAL LEVEL AT 30% NR
*     -- LEVEL 22.2938 FT (WAS 22.3838)
*     -- GAIN (IN BLOCK -20) 0.1044 (WAS 0.1012)
*   RCS FLOW RATE GAIN ADJUSTED TO RESULT IN STEADY STATE
```

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 58

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91					

```
1439    *       NORMALIZED FLOW RATE OF 1.0
1440    *    $$$  VFN CHANGES  $$$
1441    *
1442    *  XXX   IDC  SYMBOL   IREG    CGAIN      CIC
1443    *
1444    702001    1    MIXL,     25 2.6882E-2     0.375 * PZR LEVEL (FRACTION)
1445    702002    2    TIMX,      0       1.0       0.0 * SYSTEM TIME
1446    702003    3    WP**,     21 4.6882E-5       1.0 * NORM. RCS FLOWRATE
1447    702003    3    WP**,     21 4.9315E-5       1.0 * NORM. RCS FLOWRATE
1448    702004    4    CONS,      0      -1.0      -1.0 *
1449    702005    5    CONS,      0     535.0     535.0 * NO LOAD T(REF)
1450    702006    6    TRPT,      2       1.0       0.0 * TRIP TIME FOR TRIP 2.
1451    702007    7    TEMP,      9       1.0    575.01 * HOT  LEG TEMP.
1452    702008    8    TEMP,     20       1.0    528.02 * COLD LEG TEMP.
1453    702009    9    LIQL,     50       1.0   22.3838 * S/G LIQUID LEVEL
1454    702007    7    TEMP,      9       1.0     576.0 * HOT  LEG TEMP.
1455    702008    8    TEMP,     20       1.0     527.0 * COLD LEG TEMP.
1456    702009    9    LIQL,     50       1.0   22.2938 * S/G LIQUID LEVEL
1457    702010   10    CONS,      0     19.42     19.42 * LOWER NR LEVEL TAP
1458    702011   11    TRIP,      3       1.0       0.0
1459    702012   12    PRES,     50       1.0     547.0
1460    702013   13    TEMP,     50       1.0   476.053
1461    *
1462    *
1463    *         ---------- CONTROL BLOCK DEFINITIONS ----------
1464    *
1465    *
1466    *          1     2      3     4      5      6      7      8      9     10
1467    *  XXX   IDC  ITYPE  INC1  INC2   GAIN    CP1    CP2    CIC    MIN   MAX
1468    *
1469    703001   -1   SUM,     7     8     0.5    1.0    1.0  551.5
1470    703002   -2   LLG,    -1     0     1.0   10.0    3.0  551.5
1471    703003   -3   SUM,     5    -2     1.0   -1.0    1.0   16.5  * DELTA T
1472    703004   -4   FNG,    -3     2     1.0    0.0    0.0    1.0
1473    703005   -5   FNG,    -4     3     0.0    0.0    0.0    0.0  * BYPASS
1474    703006   -6   FNG,    -4     4     1.0    0.0    0.0    1.0
1475    703007   -7   SUM,    -6    -9     1.0    1.0   -1.0    1.0
1476    703008   -8   FNG,    -7     6     1.0    0.0    0.0    0.1
1477    703009   -9   INT,    -8     0     1.0    0.0    0.0    0.0    0.0   1.0
1478    703010  -10   SUM,     2     6     1.0    1.0   -1.0 -1.0E+6
1479    703011  -11   FNG,   -10     5     1.0    0.0    0.0    0.0    0.0   1.0
1480    703012  -12   MAX,    -9   -11     1.0    0.0    0.0    0.0    0.0   1.0
1481    703013  -13   FNG,   -10     7     1.0    0.0    0.0    1.0    0.0   1.0
1482    703014  -14   MUL,   -12   -13     1.0    0.0    0.0    0.0    0.0   1.0
1483    703015  -15   MUL,   -10     8     1.0    0.0    0.0    0.0    0.0   1.0
1484    703016  -16   SUM,     5    13     1.0   -1.0    1.0 -58.947
1485    703017  -17   FNG,   -16     9     1.0    0.0    0.0    0.0    0.0   1.0
1486    703018  -18   MUL,   -15   -17     1.0    0.0    0.0    0.0    0.0   1.0
1487    703019  -19   SUM,   -14   -18  -407.77   1.0    1.0    0.0
1488    *
1489    *         SEE P.14 OF SD-SO1-190 FOR THE ADV RELIEVING CAPACITY.
1490    *
1491    *         ---------------------  AUXFN CNTL  -------------------------
1492    *
1493    703020  -20   SUM,     9    10  0.1012    1.0   -1.0     0.3    0.0   1.0
1494    703020  -20   SUM,     9    10  0.1044    1.0   -1.0     0.3    0.0   1.0
1495    703021  -21   FNG,   -20    10     1.0    0.0    0.0     1.0    0.0   1.0
1496    703022  -22   MUL,    11   -21     1.0    0.0    0.0     0.0    0.0   1.0
1497    703023  -23   FNG,    12    11     1.0    0.0    0.0   123.3
1498    703024  -24   MUL,   -22   -23     1.0    0.0    0.0     0.0  * TO J 69
```

*** THIS CARD IS A REPLACEMENT CARD.

*** THIS CARD IS A REPLACEMENT CARD.
*** THIS CARD IS A REPLACEMENT CARD.
*** THIS CARD IS A REPLACEMENT CARD.

*** THIS CARD IS A REPLACEMENT CARD.

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CALCULATION SHEET

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Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 59

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CCN CONVERSION: CCN NO. CCN -

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91						

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Subject **SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT** Sheet No. 60

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
1	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91	1					
2					2					

```
99
00
01
02
03
703025  -25  MUL,  -22   -23    2.0    0.0    0.0    0.0    * TO J 79
* *
* * ********** END OF DATA **********
```

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CCN CONVERSION: CCN NO. CCN --

Subject SONGS 1 RCS INVENTORY ANALYSIS FOR STATION BLACKOUT Sheet No. 61

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
0	V. F. Nazareth VFN	6/21/91	W. Alhassani WA	6/21/91						

APPENDIX B

PRESSURIZER PROGRAM LEVEL

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE	REV
1	V. F. Nazareth	6/21/91	W. Alhassani	6/21/91	1					
2					2					

[205] From: JOHN CUSTER at WEST3 6/20/91 1:41PM (859 bytes: 14 ln)
To: MIKE MCDEVITT at NESL3
Subject: Pressurizer Program level
---------- Message Contents ----------

Mike -

Although Pressurizer program level is not specifically addressed in Operations procedures, this information is common operator required knowledge. It is addressed in our training and system description and is set by I&C as required by engineering. Presently the program level for our lower Tave program (level is prgrammed to Tave) is 25% level from 0 to 15% power and ramps linearly from 25% to 37.5% level from 15% power to 100% power.

At our present normal full Rx power level of 92% PZR program level is approximately 36.5%.

John Custer 89271 6/20/91