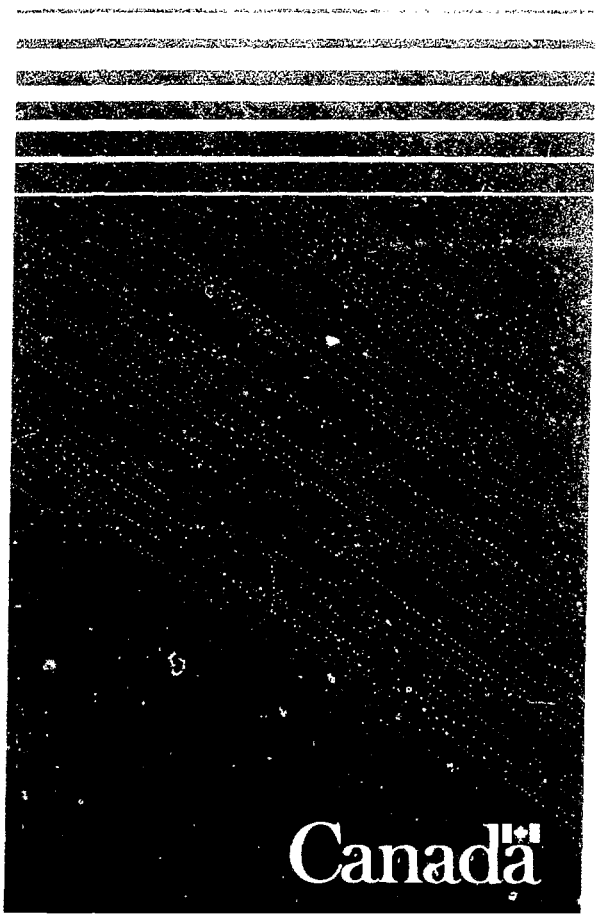
Report Rapport

Atomic Energy Control Board

Commission de contrôle de l'énergie atomique

AECB STAFF REVIEW OF
SAFE NUCLEAR OPERATIONS
FOR THE YEAR 1987



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AECB STAFF REVIEW OF BRUCE NGS'B' OPERATION FOR THE YEAR 1987

June 1988

Canada

Report

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1. INTRODUCTION

The operation of the Bruce "B" Nuclear Generating Station is monitored and licensing requirements are enforced by the AECB Bruce project staff, with appropriate support from other AECB personnel. The staff observes operation of the reactors, conducts audits, witnesses important activities, reviews station documentation and reports, and issues approvals where appropriate in accordance with licence conditions.

As required by a condition of its Operating Licence, Ontario Hydro, each year, submits Technical Reports which summarize various aspects of the operation of Bruce NGS"B" during the year. When these reports have been reviewed by AECB staff, a formal Annual Review Meeting is held with the station management to discuss safety-related aspects of the station operation, and to inform Ontario Hydro of AECB staff conclusions with respect to the performance of Ontario Hydro in operating the station during the year.

The purpose of this report is to summarize and record the conclusions of the AECB staff assessment of the operation of Bruce NGS"B" during 1987.

2. CONCLUSION

Bruce NGS"B" was operated safely by Ontario Hydro during 1987. Given the station and staff performance, there are no reasons to believe that the station will not be operated safely in 1988.

AECB staff does see a need for increased diligence by Ontario Hydro in completing preventative and required maintenance in a more timely manner.

Also, Ontario Hydro must take action to ensure that the requirement for minimum station staff complement is met on every shift.

3. REVIEW

3.1 Station Status

At the time of writing (April, 1988), Units 5 and 8 are operating normally. Unit 6 has a boiler tube leaking at a rate of about 2 kg/hr. Unit 7 is shutdown for an outage. Starting on May 19, all units will be shutdown to begin a containment structure test.

3.2 Licensee's Compliance with AECB Regulations and Licence Conditions

During 1987, Ontario Hydro did not fully comply with operating licence requirement A.A.3ii) which concerns the station staff complement. On twelve (12) occasions, the minimum required number of staff to make up sector survey crews was not met. Ontario Hydro has been advised by AECB staff that it is expected to comply with this licence requirement and has been asked to formalize the procedure by which the shift supervisors check station staff complement.

Also, AECB staff has growing doubts about Ontario Hydro's ability to comply with condition A.A.11 of the licence which states that the standard of maintenance must ensure that all equipment and systems are reliable and effective. Maintenance of Bruce NGS"B" is discussed in section 4.2.

3.3 Exposure to the Public and ARWs

There were no exposures during 1987 to either the public or to Atomic Radiation Workers which exceeded AECB regulations. There was one incident, described in the section on significant events - SER 87-08, which had the potential of causing an acute overexposure. In this incident, a radioactive particle (700 mR/hr Gamma, 6 R/hr Beta) had penetrated many protective barriers to reach the Zone 2 (Zone 2 is described as an area that has the potential to contain contamination) change room. It was found during cleaning.

3.4 Significant Licensing Activities

3.4.1 Fuelling Machine Flow Injection

This is a new feature on the fuelling machines which provides for a flow of D_2O from the fuelling machine into the channel during fuelling operations. It helps minimize fuelling machine contamination and was first installed on Unit 8. AECB staff supports Ontario Hydro's efforts in keeping the fuelling machines clean. However, a design or procedural change should be made so that reactor trips such as the one described in significant event report SER 87-46 (see section 3.6) are avoided. Ontario Hydro agrees and is taking measures to reduce the probability of recurrence of this type of event.

3.4.2 Unit 5 Uprating

During the outage in the fall of 1987, modifications were made to Unit 5 to allow the unit to operate at 940 MWe (from 890 MWe). In December, various tests were completed at the higher power level to demonstrate the unit capability. AECB staff reviewed the uprating plans and the test results and is satisfied that the unit can operate safely at these power levels. Ontario Hydro does, however, need to provide a means for following up on the recommendations made in the test report. AECB staff will also monitor Ontario Hydro's progress on these recommendations.

3.4.3 "J" Tube Covers

"J" tubes are the large pipes which join the vacuum building main chamber to containment. When the valves on the "J" tubes open, air is sucked from containment, through the "J" tubes, and into the vacuum building. A vacuum building douse test performed at Darlington, showed that the "J" tubes may become flooded during operation of the dousing system. This has raised some questions regarding the long-term capability of the se tubes for relieving or equilizing reactor vault pressure with the vacuum building. Ontario Hydro has installed covers over two of the "J" tubes and will cover the rest in 1992. These covers will prevent "J" tube flooding in the event of operation of the dousing system.

3.4.4 Load Maneuvering

As expected, the requirement to maneuver the station power output to match requirements and line capacity has continued. While most of the questions raised by AECB staff on this issue have been answered, some remain on trip coverage during the transient power levels. We expect these questions will be resolved soon with a new issue of the Bruce NGS"B" safety report. In the meantime, the Station Manager has provided formal assurance that adequate trip coverage exists.

3.4.5 Moderator Poison Concentration

Related to load maneuvering, it was found (see the review of 1987 significant events - SER 87-17) that operating continously at a lower power, having dropped from high power, requires a temporary increase in moderator poison concentration to counter a Pu-239 transient. The required poison concentration exceeded the existing limit. Analysis showed that the amount of excess reactivity in the core was still less than that assumed in the safety analysis due to the purity of the coolant D_2O. The poison limit has been revised to reflect this.

3.5 Licensee's Quarterly Reports

Quarterly technical reports for 1987 have been submitted by Ontario Hydro in a timely manner. These reports have been reviewed by AECB staff. Pertinent information has been drawn from the reports and summarized in a table of "Objective Measures" - see the attachment to Section 4. Major noteworthy points are:

1. There were no major unplanned outages.

2. There were no doses in excess of regulatory limits.

3. The airborne and waterborne radioactivity emissions met the Ontario Hydro operating target of 1% of the derived emission limits.

4. The actual past unavailability of special safety systems was well within the target of 1×10^{-3} years/year.

3.6 Significant Event Reports

The following paragraphs summarize AECB staff conclusions with regard to station and staff performance from review of the 1987 significant events.

There were a total of 63 recorded significant events in 1987. This is a drop from 1986 in which there were 78, which again was lower than in 1985 during which there were 93.

This positive trend may be the result of a falling off in the number of events related to station construction. It is certainly due, in part, to a change in Ontario Hydro's reporting requirements which obviate the need to report all of the more minor events. In this regard, it can be noted that while the total number of significant events has dropped, the number of events reportable to the AECB under the operating licence has not (13 in 1987 compared to 8 in 1986).

There are two other items related to past year's observations. The first concerns the number of events involving incorrect isolation. The noted high frequency of these continued into the first part of 1987 and then dropped to almost zero. We attribute this to positive steps taken by Ontario Hydro to improve verification of equipment isolation.

The second item concerns errors in applying guaranteed shutdown states. Again in 1987 there were errors of this type, some of which were found during an AECB audit of Unit 5 start-up from a warranty outage. Similar errors were being made at Bruce NGS"A" which prompted a letter from AECB staff asking Ontario Hydro to take actions to prevent recurrence of any errors in applying guaranteed shutdown states. Ontario Hydro has since put in place procedures which provide for increased verification of the guaranteed shutdown state.

Appendix B gives a selection of Significant Event Report summaries with AECB staff comments. The selection criteria for choosing these particular SERs were:

a) if the event was reportable under the operating licence
b) if it was part of a trend, or
c) if it was a single event which nevertheless showed a weakness.

Following is a discussion of what AECB staff regard as potential weaknesses revealed by an analysis of 1987 significant event reports.

SERs 87-15 and 87-33 are very similar. In each case a momentary power interruption resulted in a spurious initiation of emergency coolant injection. Ontario Hydro is working on a solution to this problem by investigating the possibilities of relays which will respond to shorter power interruptions.

SERs 87-21, 28, and 54 highlight a problem with using rupture disks in the moderator purification lines. In each of these events, one or more of these rupture disks burst resulting in a spill of D_2O. While the consequences of these spills are not large, it is the view of AECB staff that Ontario Hydro should produce a design solution to this problem. At present, Ontario Hydro rely on procedures to prevent recurrence.

SERs 87-38 and 87-53 both involve heat sinks being unavailable due to a very fundamental error or lack of understanding on the part of an operator. In the first case, the service water to the maintenance cooling heat exchanger was left valved out when bringing maintenance cooling into service. The other case caused a Level 1 impairment of the emergency core coolant system when the air supplies to all the boiler steam relief valves were isolated at the same time. These events were reviewed in detail with the operators involved.

SERs 87-42 and 87-59 are two serious events that both had poor maintenance as the root cause of the event. This will be discussed further under the section on station maintenance.

3.7 AECB Audits

Two audits of the Bruce NGS"B" Operations QA Program were carried out during 1987.

The first audit, carried out in March, examined the performance of maintenance activities and the completion of scheduled safety system tests by Production personnel. Although, in general, procedure compliance was found to be satisfactory, two procedure noncompliances were observed. These concerned the calibration of measuring and test equipment and the specification of material to be used in carrying out pressure boundary repairs. To obtain suitable remedial and corrective action, two AECB Quality Observation Action Notices were raised.

The second audit, carried out in two steps in October and November, examined activities associated with the prolonged shutdown and start-up of unit 5.

Although procedure compliance was found to be generally good, several important non-compliances were observed. These concerned the control of jumpers, the changing of guaranteed shutdown states without adequate approval, the control of operating memos, and the control of work plans. Ontario Hydro was directed to take action on these non-compliances.

3.8 Reliability of Special Safety Systems

As reported in the Quarterly Technical Reports, the special safety systems operated well within the unavailability target of 1×10^{-3} years/year.

3.9 Security

There were four significant events related to security. Each of these events involved temporary equipment failure. There were no breaches of security.

There was one security drill conducted in co-operation with the Ontario Provincial Police.

4. AECB STAFF COMMENTS ON STATION PERFORMANCE

4.1 Objective Measures

Attached as Appendix A is a list which can be used to objectively measure the performance of the station during 1987. It was compiled by AECB staff from Ontario Hydro reports and records.

It can be seen from this list that station performance has been generally good or satisfactory. Following is a discussion of the objective measures which indicate a need for action to be taken by Ontario Hydro.

The first item on the list is the total whole body dose of 141 person-rems. Although Ontario Hydro missed its target of 130 person-rems, 141 person-rems of dose for 1 year's operation is still low. The reason the target was missed is most probably due to the unexpectedly fast rise of radiation fields in the primary heat transport system. The reason for the rate of rise of the radiation field requires investigation and action, while the total whole body dose does not. Ontario Hydro has initated some investigations; for example, inspection of selected shield plugs. Further action has been planned.

The call-up completion rate of 50% is one symptom which indicates that plant maintenance may not be up to the standards the AECB staff expects at a nuclear generating station. Another symptom is the total number of outstanding jumpers. AECB staff is of the opinion that there are too many at present. Ontario Hydro should strive to reduce the number of jumpers in effect. Recently, we have seen some effort by Ontario Hydro in this direction. Further comments on maintenance are made in the next section.

There are also, in the opinion of AECB project staff, too many (386) operating memos in effect. This is an indication that operating manuals are not sufficiently current. Also, the station procedure of having no more than one operating memo per system category is not followed. There should be no operating memos in effect with expired review dates.

4.2 Maintenance of Bruce NGS"B"

This is the first review of Ontario Hydro's Bruce NGS"B" station and staff performance since all Bruce NGS"B" units have been declared "in-service". Thus, the timing is appropriate to discuss the standards of maintenance AECB staff expect to see at Bruce NGS"B" as a fully operating station. This is especially so since indications thus far suggest that the expected standards may not be met. Indications are that routine and preventative maintenance are not being given enough priority. While slippages of this sort (which in the past have been attributed to the attention required for commissioning) have not yet resulted in a significant reduction in station performance, AECB project staff is concerned that a degradation in performance may occur in the future unless Ontario Hydro increases its diligence in routine and preventative maintenance.

In support of the statements made above, elaboration must be made on some of the indications that have shown that Ontario Hydro has had difficulty in keeping pace with the required maintenance. Examples will be restricted to observations from the past year.

Unit 8 was declared in-service just over one year ago. It went critical some months before. At the time of writing, remnants of construction remain and painting is incomplete. The debris associated with construction constitutes a small hazard which Ontario Hydro was slower than necessary in removing from the final operating unit.

In the first month of 1987, AECB project staff was informed that design problems had been encountered with the emergency powerhouse venting system and that it would be temporarily out-of-service. Given that Ontario Hydro is aware (ref: J. Jennekens to R. Franklin, 86-01-29) of the Board's view on steam failures in the powerhouse, AECB project staff expected (and were verbally told) that action would be taken. The repairs to this system are only now being completed with final commissioning scheduled for the end of July.

In the previous section, it was stated that the number of jumpers in effect are an indicator of the level of station maintenance. Significant events SER-87-42 and 87-59 are examples of two serious events that had a root cause in inadequate maintenance. In both of these events, equipment was left too long in a jumpered state that required temporary procedures to overcome a system deficiency.

The completion rate of control and mechanical call-ups ran at approximately 30% in 1987 (as opposed to operator call-ups which ran at approximately 80% completion). It was similar in 1986. At the end of 1986, AECB project staff were told to expect an improvement in completion rate in 1987 because the call-up frequencies were being adjusted. The situation did not improve in 1987. AECB project staff has been told to expect an improvement in 1988 because management has set aside manpower for preventative maintenance call-ups. It is difficult to see how this can be achieved without a rise in outstanding deficiencies or extending outages.

AECB staff concern is that if routine and preventative maintenance is neglected, eventually most maintenance will be of the urgent type and this will be reflected in increased frequency of impairments and poorer station performance. The standard of maintenance should ensure a scheduled routine and preventative maintenance completion rate above 90% and at the same time keep outstanding deficiencies and jumpers at a reasonable number. Significant events such as 87-42 and 87-59 should be rare.

APPENDIX A

OBJECTIVE MEASURES OF STATION PERFORMANCE

		LAST YEAR'S VALUE	GOOD	ACCEPTABLE	NEEDS ACTION
1.	**Radiation Control**				
1.1	**Occupational Safety**				
1.1.1	Total Whole Body Dose 141 man-rem	73	☐	☒	☐
1.1.2	Total Extremity Dose 168 rem	90	☐	☒	☐
1.1.3	Total F/H Extremity Dose N/A rem	N/A	☐	☐	☐
1.1.4	Total Neutron Dose .239 rem	.94	☒	☐	☐
1.1.5	Number of Exposures > Regulatory Limits 0	0	☒	☐	☐
1.1.6	Number of Radiation related supervisor's investigations 26	8	☐	☒	☐
1.2	**Public Safety**				
1.2.1	**Releases from the Station**				
	a) **Airborne**				
	Tritium No of weeks >1% DEL 0	0		☒	☐
	Average % DEL for year .076%	.027		☒	☐
	Noble Gas No of weeks >1% DEL 0	0		☒	☐
	Average % DEL for year .031%	.029		☒	☐
	Iodine 131 No of weeks >1% DEL 0	0		☒	☐
	Average % DEL for year .0028%	.0019		☒	☐
	Particulates No of weeks >1% DEL 0	0		☒	☐
	Average % DEL for year .0031%	.0042		☒	☐

1.2.1 Continued	LAST YEAR'S VALUE	ACCEPTABLE	NEEDS ACTION
b) Waterborne			
Tritium No of months >1% DEL 0 Average % DEL for year .021 %	0 .024	X X	
Gross β No of months >1% DEL 0 Average % DEL for year .011 %	0 .0647	X X	
c) Total Heavy Water Loss 19 773 kg (if excessive, should be reflected in higher tritium releases)	14 907	X	
* 1.2.2 Environmental Measurements			
Average Boundary dose rate ____ μR/hr (Acceptable if within range of provincial reference sites value and not a significant increase from previous years)	4.4 μR/hr		
Average Boundary Tritium in Air ____%MPCa (> .1% MPCa would indicate a marked increase and would require investigation)	.049		
Average Tritium Concentration in Precipitation ____nCi/L (average of all measurement sites) (+)	30		
Average Gross β in Precipitation (+) ____mCi km^{-2} .$months^{-1}$	.53		
Average Tritium in Milk (+) ____pCi/L	712		

* Information for this section has not been received from Ontario Hydro yet.

1.2.2 Continued

	LAST YEAR'S VALUE	ACCEPTABLE	NEEDS ACTION
Average C14 in Milk (+)____pCi/L	6.8	☐	☐
Average I131 in Milk (+)____pCi/g	5.8	☐	☐
Average Tritium in drinking water (+) ____pCi/L	776	☐	☐
Average gross ß in drinking water (+) ____pCi/L	2	☐	☐
Local water and fish samples (++)		☐	☐

Specific items for comment:

_____

_____

_____

Terrestrial Samples (++)		☐	☐

Specific items for comment:

_____

_____

_____

Notes: (+) - marked increase from previous acceptable levels warrants investigation
(++) - review in detail and identify any specific problems

2. Plant Control

		LAST YEAR'S VALUE	GOOD	ACCEPTABLE	NEEDS ACTION
2.1	Number of Genuine Reactor Trips/Unit 1.25	1.33	[X]	[ ]	[ ]
2.2	Number of Serious Process Failures/Unit 0	0	[X]	[ ]	[ ]

2.3 Special Safety System Unavailability (10^{-3} Years/Year)

	This Year				Last Year (Combined)			
	U5	U6	U7	U8				
SDS1	0	0	0	0	.1	[X]	[ ]	[ ]
SDS2	0	0	0	0	0	[X]	[ ]	[ ]
Containment	.31	.31	.31	.31	.06	[ ]	[X]	[ ]
ECI	.39	.02	.02	.02	.18	[ ]	[X]	[ ]

2.4	Number of Reportable Incidents/Unit	3.25	2.67	[ ]	[X]	[ ]
2.5	Number of fires	10	6	[ ]	[X]	[ ]
2.6	Number of Significant Human errors reported	20	12	[ ]	[X]	[ ]
2.7	Plant Capacity Factor	84.81 %	87.9	[ ]	[X]	[ ]
2.8	% AECB compliance inspections "unsatisfactory"	0 %	N/A	[X]	[ ]	[ ]
2.9	Number of Safety Related/Support Systems not meeting availability target	1	1	[ ]	[X]	[ ]

			LAST YEAR'S VALUE	GOOD	ACCEPTABLE	NEEDS ACTION
3. Plant Maintenance						
3.1 Number of Unplanned Outages/Unit	1.75		3.33	☐	☒	☐
3.2 Number of Call-ups (Operational) Outstanding at end year	55%		50%	☐	☐	☒
3.3 Average of Monthly DRs Outstanding/Unit	1200		1200	☐	☒	☐
4. Plant Administration						
4.1 Documentation						
4.1.1 Total No. of Operating Memos force/unit on 31 December	386		82/unit	☐	☐	☒
4.1.2 Number of memos extant > 6 months	35/unit	(e.g., U5)	30	☐	☐	☒
4.1.3 No. of systems (USI) with >1 Op. Memo Extant	12/unit	(e.g., U5)	6	☐	☐	☒
4.1.4 No of Operating Memos behind schedule for review	6/unit		12	☐	☐	☒
4.1.5 Total Number of Jumpers	1169		N/A	☐	☐	☒
4.1.6 Number of Expired Jumper Review Dated	69		58	☐	☐	☒
4.2 Training						
4.2.1 % Scheduled drills completed	94%		65%	☒	☐	☐
4 2 % Candidates passing AECB exams	86%		78%	☐	☒	☐

		LAST YEAR'S VALUE	GOOD	ACCEPTABLE	NEEDS ACTION
4.3 Security					
4.3.1 Number of reportable security events	4	1	☐	☒	☐

4.4 Quality Assurance

Results of AECB Audits

1) Date March		☐	☒	☐
2) Date October/November		☐	☒	☐
3) Date		☐	☐	☐

APPENDIX B

REVIEW OF 1987 SIGNIFICANT EVENT REPORTS

SER Summary	AECB Project Staff Comments
SER 87-08 TITLE RADIOACTIVE PARTICLE FOUND IN ZONE 2 CHANGEROOM EVENT SUMMARY --- A MICROSCOPIC PARTICLE OF RADIOACTIVE MATERIAL WAS FOUND ON A S/M MOP FOLLOWING CLEANING OF THE 615' ELEVATION ZONE 2 MEN'S CHANGEROOM. LABORATORY ANALYSIS REVEALED THE PRESENCE OF MAINLY CO-60 WITH SOME CR-51. THE PARTICLE HAD A CONTACT GAMMA DOSE RATE OF 700 MREM/HR AND CONTACT BETA DOSE RATE OF 6 RAD/HR. IT IS BELIEVED THAT THIS PARTICLE ORIGINATED FROM THE LIQUID ZONE OR MODERATOR SYSTEM.	Reportable under operating licence. Possibility of excessive radiation exposure. Multiple breakdown of protective barriers for contamination to reach that point.
SER 87-12 TITLE UNAVAILABILITY OF INTERUNIT FDWTR TIE DUE TO JUMPER EVENT SUMMARY --- DISCOVERED PRESENCE OF EXISTING JUMPER WHICH PREVENTED THE OPERATION OF INTER-UNIT FEEDWATER [illegible] MOTORIZED VALVE 4323-MV321 ON ANY UNIT SHOULD A LOW BOILER LEVEL(-0.889 METERS) OCCUR IN ANY UNIT 8 BOILER. THE RELEVENT DIGITAL OUTPUTS HERE RESTORED BY PUSHING IN THE ASSOCIATED HIBA...	Breakdown of jumper removal/start-up procedures.
SER 87-15 TITLE CHANNEL 'K' EMERG. COOLANT INJECT.(ECI) INITIATION EVENT SUMMARY --- DURING AN EMERGENCY POWER SUPPLY TRANSFER TEST (SST 5.4) A MOMENTARY 48V/120V PWR INTERRUPTION OCCURRED ON CH'K' OF THE EMERG COOLANT INJECTI (ECI)SYS. THIS RESULTED IN THE INITIATION OF E ON CH'K'. THE RAPID DEPLETION OF FEEDWATER INV. [illegible]-ORY DUE TO BOILER STEAM RELIEF VALVE ACTUATION WAS TERMINATED BY TEMPORARILY BLOCKING CH'K' & RESEATING THE BSRV'S. THE ECI SYS. WAS THEN FULLY RESTORED AND REACTOR POWER INCREASED TO AVOID POISONING OUT.	Reportable under operating licence. This type of incident could result in a spurious injection of ECI with possible damage to HTS piping and components. Similar to SER 87-33. Root problem with time delay relay contacts needs to be addressed.

SER Summary	AECB Project Staff Comments
SER 87-17 TITLE VIOLATION OF OP&P - EXCESS REACTIVITY EVENT SUMMARY --- SECTION 30.1 OF OPERATING POLICIES AND PRINCIPLES WAS VIOLATED AS THE BORON CONCENTRATION IN UNIT 7 MODERATOR EXCEEDED THE STATED LIMIT. THE CAUSE OF THE EXCESS REACTIVITY WAS DETERMINED TO BE A PU-239 TRANSIENT CAUSED BY FABC LIMIT GENERATION MANEUVERING.	Reportable under operating licence. While this event has been resolved, there are still some outstanding questions with regards to generation maneuvering.
SER 87-21 TITLE D2O SPILL INTO CONFINEMENT EVENT SUMMARY --- APPROXIMATELY 500 KG OF D2O WAS SPILLED INTO THE WEST MODERATOR PUMP ROOM AND THE MODERATOR AUXILIARY ROOM WHEN TWO RUPTURE DISKS FAILED IN THE MODERATOR PURIFICATION CIRCUIT FLOODING THE MODERATOR COLLECTION TANK. D2O ESCAPED INTO THESE ROOMS BY BACKING UP THE ASSOCIATED PUMP SEAL LEAKAGE COLLECTION LINES. THE DISKS FAILED DUE TO A PRESSURE SPIKE CAUSED BY TWO MODERATOR PUMPS IN SERVICE.	Example of problems with moderator purification rupture disks and moderator pump start-up/change-over.
SER 87-22 TITLE DEAERATOR DAMAGE DURING LOAD REJECTION FROM 800MWE EVENT SUMMARY --- DURING A PLANNED LOAD REJECTION FROM 800 MW A TRANSIENT WAS INITIATED IN THE DEAERATOR WHICH APPEARED TO RESULT IN SEVERE BOILING /FLASHING IN THE VESSEL. SUBSEQUENT DAMAGE SURVEYS REVEALED THAT THE VESSEL HAD SHEARED ALL ITS HOLD DOWN BOLTS AND HAD DISLOCATED APPROXIMATELY 2-3 INCHES	Reportable under operating licence. Resulted in changes to DLC which have since been tested on unit 5 successfully.

SER Summary	AECB Project Staff Comments
SER 87-25 TITLE IMPAIRMENT OF SDS 2 PRESSURIZER LEVEL TRIP CH. J EVENT SUMMARY --- SDS 2 CH. J WAS FOUND TO BE IMPAIRED WHEN AN ATTEMPT TO PLACE CH. J IN THE SAFE STATE BY *FAILING PRESSURIZER VERY LOW LEVEL SAFE PROVED* TO BE INEFFECTIVE. THE CHANNEL WAS SUBSEQUENTLY FAILED SAFE, REPAIRED, TESTED AND RETURNED TO SERVICE.	Highlighted a failure which is not normally detected by an SST due to power level conditioning - only annunciation of very low level trip tested after channel has already been tripped by low level trip portion of SST.
SER 87-28 TITLE UNIT ALERT D2O SPILL DURING MOD. COLL. PUMPOUT EVENT SUMMARY --- A UNIT 6 ALERT WAS DECLARED DUE TO SPILL OF 10 KG OF MODERATOR HEAVY WATER AT THE MISCELLANEOUS D2O COLLECTION SYSTEM DRUMMING STATION. MODERATOR COLLECTION TANK REQUIRED PUMPOUT BECAUSE MODERATOR PURIFICATION RUPTURE DISK RD6 BURST DURING CHANGEOVER OF MAIN MODERATOR PUMPS.	Example of problems with moderator purification rupture disks and moderator pump start-up/change-over.
SER 87-29 TITLE HT PUMP 2 13.8KV/6.6KV TRANSFORMER FIRE EVENT SUMMARY --- FIRE OCCURRED ON 6.6KV CABLING AT B-3312-T2. H.T. PUMP 2 TRIPPED ON GROUND FAULT. A REACTOR STEPBACK OCCURRED. UNIT STABILIZED AT 50% R.P. FIRE CREW RESPONDED AND EXTINGUISHED FIRE. REACTOR POWER RAISED BACK UP TO 65%.	This SER uncovered a problem with low delta P trip caused by high frequency oscillations and a delay built into the power rundown discriminator scheme.

SER Summary	AECB Project Staff Comments
SER 87-33 TITLE ECI CHANNEL L SPURIOUS INITIATION EVENT SUMMARY --- WHILE PERFORMING SST 5.4 "120V AC/48V DC TRANSFER CONTACTOR TEST-UNIT" IN CONJUNCTION WITH CALL-UP 12-A158 TO BURNISH CONTACTS OF TRANSFER CONTACTOR, ECI WAS SPURIOUSLY INITIATED. AFTER AN INITIAL ASSESSMENT TO VERIFY SPURIOUS INITIATION, ECI WAS RESET, THE UNIT WAS RECOVERED IN POISON PREVENT MODE AND SUBSEQUENTLY RELOADED.	Reportable under operating licence. Like SER 87-15, another example of a spurious ECI initiation caused by a momentary interruption of 48 V DC power.
SER 87-38 TITLE UNAVAILABILITY OF MAINTENANCE COOLING EVENT SUMMARY --- WHEN MAINTENANCE COOLING WAS PUT IN SERVICE TO COOL UNIT 6 DOWN TO 70°C, THE HEAT EXCHANGER WAS FOUND VALVED OUT ON THE SERVICE WATER SIDE. THE SERVICE WATER WAS SUBSEQUENTLY VALVED IN AND COOLDOWN OF HEAT TRANSPORT CONTINUED NORMALLY. SHUTDOWN COOLING AND BOILERS WERE AVAILABLE AS BACK UP HEAT SINKS AT THE TIME.	Concern here about lack of understanding/questioning of operator who did not valve in service side water to heat exchanger.
SER 87-42 TITLE LEVEL I IMPAIRMENT OF NEGATIVE PRESSURE CONTAINMEN EVENT SUMMARY --- THE VACUUM BUILDING UPPER CHAMBER PRESSURE INCREASED TO 46KPA(A) RESULTING IN A LEVEL I IMPAIRMENT OF THE NEGATIVE PRESSURE CONTAINMENT SYSTEM. THIS WAS BROUGHT ABOUT THROUGH THE OPERATION OF A UPPER CHAMBER VACUUM PUMP WITH NO SEAL WATER FLOW TO IT, THUS ESTABLISHING AN AIR PATH FROM THE EMPTY AND VENTED SEAL WATER SUPPLY TANK TO THE UPPER CHAMBER.	Reportable under operating licence. A jumpered state (liquid drainer 7133-Y501 not working) was left unremoved with no proper control via supplementary operating documentation.

SER Summary	AECB Project Staff Comments
SER 87-43 TITLE RV17 LIFTED DURING COOLDOWN EVENT SUMMARY --- WHILE COOLING DOWN THE PRIMARY HEAT TRANSPORT SYSTEM USING SHUTDOWN COOLING, BLEED CONDENSER 3332-RV17 OPENED AND FAILED TO FULLY RESEAT.	These relief valves have a history of failing. AECB staff has an interest in Ontario Hydro's plans to replace them with more reliable valves.
SER 87-44 TITLE RELEASE OF TRITIUM TO LAKE WHILE LOWERING ECIS TK6 EVENT SUMMARY --- ECIS GRADE TANK TK6 LEVEL WAS LOWERED TO SPECIFIED LEVELS BY DRAINING SLOWLY TO AN INACTIVE DRAINAGE SUMP. SINCE THIS WATER HAS LOW LEVELS OF TRITIUM CONTAMINATION, 3 MPC(W) OF TRITIUM WAS RELEASED OVER A PERIOD OF 6 HOURS TO THE LAKE WITHOUT CONDENSER CIRCULATING WATER DILUTION.	Reportable under operating licence.
SER 87-46 TITLE SDS1 HIGH POWER TRIP WHILE FUEL SHUFFLING FINCH EVENT SUMMARY --- SDS1 EXPERIENCED A COMPLETED 3 CHANNEL TRIP DUE TO HIGH POWER DETECTION ON CHANNELS D&F IN ZONES 5,10 THE HIGH POWER WAS THE RESULT OF REMOVING THE CHANNEL CLOSURE PLUGS ON CHANNEL D11 WITH D2O FLOW INJECTION IN SERVICE BUT WITHOUT FIRST DISABLING THE CHANNEL POWER INPUT TO REACTOR REGULATING SYS (RRS). SUBSEQUENT RRS RESPONSE TO THE APPARENTLY REDUCED ZONE POWER OUTPUT WAS TO INCREASE THE ZONE POWER, WHICH IN TURN WAS FOLLOWED BY HIGH NEUTRON POWER TRIP.	Depending on an operator to manually disable the channel power input to RRS is unacceptable. Software and/or hardware changes should be made to eliminate this requirement.

SER Summary	AECB Project Staff Comments
SER 87-53 TITLE IMPAIRMENT OF ECI CRASH COOLDOWN EVENT SUMMARY --- DURING EXECUTION OF BOILER STEAM RELIEF VALVE HYDROSETTING WORK PLAN THE AIR SUPPLIES TO BOILER STEAM RELIEF VALVES 1 TO 16 WERE ISOLATED CAUSING A LEVEL 1 IMPAIRMENT OF ECI CRASH COOLDOWN CAPABILITY FOR APPROXIMATELY 3 HOURS. REACTOR IN ALTERNATE MODE AT 3.0% FP WITH HEAT TRANSPORT AT ZERO POWER HOT (256°C). HYDROSETTING OF BOILER STEAM RELIEF VALVES IN PROGRESS AS PER WORK PLAN WP 87-5072.	Reportable under operating licence. Very fundamental error for a first Operator to make.
SER 87-54 TITLE STATION ALERT DUE TO SPILL OF MODERATOR HEAVYWATER EVENT SUMMARY --- A SPILL OF APPROX. 500KG OF MODERATOR HEAVY WATER WITH A TRITIUM CONCENTRATION OF 13 CURIES/KG OCCURED ON 663' EL. DUE TO A BROKEN SIGHT GLASS ON THE MODERATOR COVER GAS COMPRESSORS SEAL WATER SUPPLY PART OF THE HEAVY WATER SPILLED RAN THROUGH AN ADJACENT PIPING ACCESS AND ACCUMULATED ON 639' EL. A UNIT ALERT WAS INITIALLY DECLARED AT 06:55 HOURS, THIS WAS CHANGED TO A STATION ALERT AT 07:33 HOURS WHEN A TRITIUM SAMPLE COLLECTED AT THE UNIT 5/6 BOUNDARY WAS ANALYZED AT 35 MPC(A).	Reportable under operating licence. As in SERs 87-21 and 87-28, rupture disk(s) burst on the purification lines in this event as well.
SER 87-57 TITLE EMERG. COOLANT INJECTION SUPPLY LEVEL 1 IMPAIRMENT EVENT SUMMARY --- A LEVEL 1 IMPAIRMENT OF THE EMERGENCY COOLANT INJECTION SUPPLY(ECIS) SYSTEM OCCURRED THREE TIMES DURING ROUTINE TESTING OF THE ACCUMULATOR WATER TANK LEVEL SWITCHES. THE TOTAL DURATION IN THE LEVEL 1 IMPAIRED STATE WAS 11 MINUTES 38 SECONDS. UNIT 5-8 OPERATING NORMALLY WITH ECI SYSTEM POISED UNIT 0 ECIS SYSTEM POISED.	Reportable under operating licence. Questionable whether continued testing should have been done when a Level 1 impairment had already occurred on the previous test.

SER Summary	AECB Project Staff Comments
SER 87-59 TITLE IRRAD. FUEL BROKEN & OVERHEATED IN I/F MECH. EVENT SUMMARY --- DURING DISCHARGE OF IRRADIATED FUEL (I/F) TO THE SOUTHWEST I/F MECHANISM, TWO MANUAL OPERATIONS WERE MISSED. AS A RESULT TWO BUNDLES HAD PENCILS BROKEN OFF, TWO PENCILS WERE BROKEN AND TWO BUNDLES WERE LEFT OUT OF WATER FOR A SIGNIFICANT TIME. NO RELEASE OF ACTIVITY TO THE STATION OR EVIRONMENT OCCURRED. THE MANUAL ACTIONS WERE NECESSITATED BY FAILURE OF I/F MECHANISM COMPONENTS.	Reportable under operating licence. Example of an incident caused by leaving equipment in a state of disrepair.
SER 87-61 TITLE BREACH OF CONTAINMENT LEVEL II IMPAIREMENT EVENT SUMMARY --- AN UNANNUNCIATED BREACH OF CONTAINMENT OCCURRED WHEN A TRANSFER CHAMBER EQUALIZATION VALVE INTERLOCK WAS ACCIDENTLY BYPASSED AND THE TRANSFER CHAMBER WAS EQUALIZED TO THE SERVICE-SIDE WHILE A CONTAINMENT SIDE DOOR WAS OPEN. THE PROBLEM WAS IMMEDIATELY RECOGNIZED AND CORRECTED BY THE PERSONNEL INVOLVED.	Reportable under operating license. The amount of time the interlock system could be breached to cause this type of impairment was very short.