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August 29, 1980

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Zion Station Units 1 and 2
Implementation of Six Month
Confirmatory Order Items
NRC Docket Nos. 50-295 and 50-304

Reference (a): February 29, 1980 letter from H. R. Denton to D. L. Peoples

Dear Mr. Denton:

Reference (a) contained a Confirmatory Order dated February 29, 1980 for Zion Station Units 1 and 2. That Order required Commonwealth Edison Company to perform certain actions within six (6) months of the date of the Order. Attachment A to this letter provides Commonwealth Edison's response to those items.

Please address any questions that you have concerning this matter to this office.

One (1) signed original and thirty-nine (39) copies of this letter and seven (7) copies of the attachments are provided for your use.

Very truly yours,

William F. Naughton

William F. Naughton
Nuclear Licensing Administrator
Pressurized Water Reactors

WFN:rap

Attachments

5848A

8009030439

NRC Docket Nos. 50-295
50-304

ATTACHMENT A

Commonwealth Edison Company's response to the NRC Staff's six (6) month items of Section F of Appendix A in Reference (a) follow.

F.1 Conduct a review of past Licensee Event Reports (LERs) at Zion Units 1 and 2. These LERs shall be reviewed to identify design inadequacies (common mode failures, systems interactions, etc.), procedural and training inadequacies, and man-machine/human factor inadequacies. Recommendations shall be submitted for correction of the base cause of the subject LERs. Immediate corrections of deficiencies will be made when possible, with the required notifications to be made to the NRC.

Commonwealth Edison Company has conducted a review of past Licensee Event Reports (LERs) at Zion Station in accordance with the above item. A report of the results of this review including the criteria and methodology employed is included in Appendix A to this letter. As this report indicates, portions of the study are continuing.

F.2 Meet meteorological acceptance criteria for emergency preparedness contained in Annex 2 to this Appendix, pending necessary equipment deliveries and installation (including computer hardware and software modifications). During the interim period while modifications are being completed, real time forecasting will be available and provided by a consultant.

Commonwealth Edison Company's response to this item is contained in Appendix B to this letter which contains Revision 2 of a report entitled the "Commonwealth Edison Company Offsite Dose Calculation System." This report describes a computer-based method for estimating the environmental impact of unplanned airborne releases of radioactivity from nuclear stations.

The Offsite Dose Calculation System (ODCS) is designed to meet the meteorological criteria of NUREG-0654, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," and the requirements of Item F.2 of the February 29, 1980 Confirmatory Order for Zion Station. As indicated in Appendix B, a real-time forecast will be provided during the period while modifications are being completed.

F.3 Conduct a study to determine and document the method by which its plants comply with current safety rules and regulations, in particular those contained in 10 CFR Parts 20 and 50.

Commonwealth Edison Company has conducted a study to determine the method by which the Zion plants comply with 10 CFR Parts 20 and 50. The results of this study are contained in Appendix C to this letter which contains a document entitled "10 CFR Parts 20 and 50, Compliance Study for Zion Units 1 and 2". This report does not include the post Three Mile Island plant modifications which are currently in progress.

F.4 Evaluate the reliability and failure modes of selected systems/components as follows:

a. Failure Mode Effects Analysis: Examine the failure modes (random failures and consequences of outages in support systems) of the active components on the reactor coolant pressure boundary. Assess the acceptability of these failure modes.

b. Implement Failure Mode Effects Analysis for minor departures from operating, maintenance and emergency procedues.

c. Explore ways to improve the reliability of those components with a particularly high failure rate as delineated in NUREG/CR-1205.

Commonwealth Edison Company has performed the recommended evaluations. The reuslts of these evaluations follow.

a. Commonwealth Edison has performed a failure mode and effects analysis of all active components on or within the reactor coolant boundary. The review included: reactor coolant pumps; relief and safety valves; pressurizer spray valves and auxiliary spray pumps; control rod drive mechanisms and housings; drain valves; and check and air operated valves interfacing with other systems. All these identified failure modes have been considered in earlier plant reviews. In particular, Chapter 14 of the Zion FSAR addresses the following items:

Control Rod Withdrawals;

Control rod Mechanism Housing Ruptures;

Reactor Coolant Pump Trips and Seizures;

Startup of an Inactive Reactor Coolant Pump; and

Primary System Pipe Ruptures that Bound Ruptures in Active Components on the Reactor Coolant System Boundary.

The Zion FSAR analyses bound the worst effects of single failures on the reactor coolant system boundary and have satisfactorily demonstrated acceptable system performance following such failures. The details of the review are shown in Table F.4-1.

In addition, a long term risk analysis is being performed by Pickard, Lowe and Garrick, Inc. (PL&G) to provide a detailed assessment of the dominant contributors to risk from the Zion Units. Failures on the reactor coolant pressure boundary are considered in that work along with equipment and human failures in other areas of the plant. Commonwealth Edison believes that a plant risk assessment is the proper vehicle for assessing the affects on risk of specific plant failures.

The PL&G study will apply the basic techniques of WASH-1400 to determine the public risk due to operation of the Zion units. The analysis will be site specific: the hardware systems in place at each unit are being analyzed using fault tree techniques; modeling of human interaction is based on the existing plant procedures; local terrain, meteorology, and demography are being used in the consequence assessement. Actual operating and maintenance histories from the units will be used to update generic industry data to obtain plant specific data. Causes of equipment faiure are being examined in detail and the final analysis will include the effects of random failures, human interactions, tests, maintenance, environmental factors, and various combinations thereof. Results of the study will include identification of dominant contributors to risk - systems, components, causes, etc. Although this PL&G study is scheduled for completion later this year, the NRC Staff is currently performing a detailed review of the study as it progresses.

b. The analysis for the reactor coolant system in Table F.4-1 included effects from maintenance and procedures. Detailed review of the effects of these procedures on power plant risk for other sytems is included in the PL&G risk analysis. Minor departures from operating and maintenance procedures can lead only to abnormal conditions that can be corrected before components or systems are lost. The more severe problems manifest themselves in the plant specific failure rate and initiating event frequency data developed for the plant risk study. Detailed review of that data, especially where it differs substantially from generic data, should provide clues to help identify problems that have developed due to departures from procedures and, more importantly, indicate ways in which procedures can be modified to help avoid problems.

Departures from emergency procedures have potentially more serious effects since the plant is in a degraded condition when these procedures are in use. However, most of the critical actions described in the emergency procedures occur automatically and are backed up by the operator (human interaction). Before minor departures from emergency procedures could have great significance, some failures in the automatic equipment must have already occurred. Errors such as securing an automatic function (ECCS for example) when still required must be considered major departures from emergency procedures and are handled explicitly in the forthcoming PL&G risk assessment. Once again, review of plant data (specifically Licensee Event Reports (LERs) and reactor trip records) can provide valuable information.

Currently, emergency procedures are receiving considerable detailed attention. The Zion technical staff has recently revised key emergency procedures to take advantage of the lessons learned at TMI. Furthermore, Commonwealth Edison is reviewing the procedural recommendations of the Westinghouse Owners Group. The Westinghouse Owners Group recommends restructuring the emergency procedures in a way that significantly enhances the likelihood of successful diagnosis and recovery.

c. The Commonwealth Edison process for reviewing component failures includes the LER review process. These review processes identify failure modes and implement corrective action to prevent recurrence. One component which is identified in NUREG/CR-1205 is the turbine-driven auxiliary feedwater pump. Modifications have been made on these pumps to improve reliability. The risk study evaluation by PL&G when completed will identify not only those components with high failure rates, but more importantly those components important to overall plant safety.

The response to this item is most properly addressed in the context of the complete plant risk assessment study. "Particularly high failure rate" of a component has no real meaning except in the context of system performance. When used in combination with other equipment, a component with a seemingly low reliability, may provide an essential and acceptably reliable system function. Moreover, redundancy and repairability can compensate for high failure rate leading to a high reliability group of low realibility components. A major result of the PL&G risk study will be a ranking of components with respect to each ones' contribution to overall risk.

F.5. Attain full compliance with NRC letters concerning AFWS reliability improvements.

To date, Commonwealth Edison has received one letter from the NRC Staff concerning AFWS requirements, specifically the September 18, 1979 letter from D. G. Eisenhut to Cordell Reed entitled "NRC Requirements For Auxiliary Feedwater Systems At Zion Station Units 1 and 2." In response to that letter Commonwealth Edison has submitted the following letters which either meet or provide schedules for meeting the NRC requirements on AFWS:

1. October 18, 1979 letter from D. L. Peoples to D. G. Eisenhut;

2. November 14, 1979 letter from D. L. Peoples to D. G. Eisenhut;

3. December 18, 1979 letter from D. L. Peoples to D. G. Eisenhut;

4. December 31, 1979 letter from D. L. Peoples to D. G. Eisenhut (Proposed License Amendment Change);

5. March 12, 1980 letter from W. F. Naughton to D. G. Eisenhut;

6. March 18, 1980 letter from W. F. Naughton to D. G. Eisenhut (Response to Generic Request);

7. March 18, 1980 letter from W. F. Naughton to D. G. Eisenhut; and

8. May 1, 1980 letter from D. L. Peoples to H. R. Denton.

Based on a review of these letters and commitments contained therein, Commonwealth Edison concludes that full compliance has been achieved for the Zion units with regard to commitments made to NRC Staff for improving AFWS reliability. Submittal of the AFW pump endurance test results will complete Commonwealth Edison's commitments to the NRC Staff regarding AFWS at Zion Station. This report is currently in draft form and will be transmitted to the NRC Staff in the near future.

Table F.4-1

ZION 1 AND 2 RC PRESSURE BOUNDARY FAILURE MODE AND EFFECTS ANALYSIS

Component	Failure Mode	Cause	Significance
1. Reactor Coolant Pumps (4)			
a.	Seize	Bearing failure (motor or pump). Loss of component cooling water and seal water (2 minutes). Loss of component cooling water (30 minutes).	Rapid loss of flow in one loop causing sudden loss of heat removal. Included as an initiating event in the global risk study but not of major significance with respect to risk.
b.	Broken shaft	Faulty repair, poor design, improper materials.	Same as 1a.
c.	Trip	Motor protective circuits, loss of offsite power.	Less severe than seizure.
d.	Seal leakage	#1 Seal failure - 400 gpm #2 Seal failure (to RCDT) - 400 gpm #1 Seal leak off valve fails closed, leak off through #2 Seal. #3 Seal is a gas trap only.	LOCA. Can be severe enough to require ECCS actuation. Included in the global risk study as a LOCA initating event.
e.	Overheating	Loss of component cooling water (30 minutes).	Bearings overheat, bearing damage and possible seizure. Pump trip.
f.	Loss of electric power	Breakers trip, etc.	Trip affected pumps.

Table F.4-1 (continued)

ZION 1 AND 2 RC PRESSURE BOUNDARY FAILURE MODE AND EFFECTS ANALYSIS (continued)

Component	Failure Mode	Cause	Significance
2. Power Operated Relief Valves (2)			
a.	Fail to open on demand	Signal failure (air or control circuit).	Pressurization of reactor coolant system continues. Backup relief provided by second PORV (possible) and three ASME code safety valves.
b.	Fail to open on demand	Mechanical failure - binding.	Same as 2a.
c.	Spurious operation	Inadvertent signal (testing).	Small LOCA, can occur as a result of a short in the control system. Can be isolated by motor-operated valve.
d.	Fails to reclose	Signal does not clear.	Small LOCA, but very unlikely failure cause. Isolable by motor-operated valve.
e.	Fails to reclose	Mechanical binding.	Most likely failure mode. Isolable by motor-operated valve.
f.	Fails to reduce system pressure	Operator/procedures. PORV block valves closed.	Both PORVs blocked--only the ASME code safety valves remain to protect against overpressure.

Table F.4-1 (Continued)

ZION 1 AND 2 RC PRESSURE BOUNDARY FAILURE MODE AND EFFECTS ANALYSIS (continued)

Component	Failure Mode	Cause	Significance
3. ASME Code Safety Valves (3)			
a.	Fails to open on demand	Maladjustment.	Valve opens at a slightly higher pressure. Very little plant significance.
b.	Fails to open on demand	Mechanical failure.	If all ASME code safety valves fail to open, a LOCA will certainly occur at some weak point in the system. Because of the safety valve design, it is extremely unlikely that all three will fail to lift before some other component in the reactor coolant system breaks.
c.	Fails to reseat at set pressure	Maladjustment.	Reactor coolant system pressure will blow out to below the design value. ECCS may actuate. Minor and self-correcting LOCA sequence.
d.	Fails to reseat at set pressure.	Mechanical failure.	LOCA.

Table F.4-1 (Continued)

ZION 1 AND 2 RC PRESSURE BOUNDARY FAILURE MODE AND EFFECTS ANALYSIS (continued)

Component	Failure Mode	Cause	Significance
4. Pressurizer Spray Valves (2)			
a.	Fails to open	Circuit failure.	Minor, backed up by auxiliary spray from charging system and PORVs and ASME code safety valves.
b.	Fails to open	Mechanical failure.	Minor. Same as 4a.
c.	Opens inadvertently	Control circuit failure.	Can lead to a low pressure reactor trip and a safety injection signal. Can be deenergized to stop transients.
d.	Fails to close	Control circuit failure.	Same as 4c.
e.	Fails to close	Mechanical failure.	Will lead to a low pressure reactor trip and a safety injection signal. Compensated for by pressurizer heaters.
5. Pressurizer Auxiliary Spray Valve			
a.	Fails to open	Circuit failure.	Backed up by PORVs and ASME code safety valves.

Table F.4-1 (Continued)

ZION 1 AND 2 RC PRESSURE BOUNDARY FAILURE MODE AND EFFECTS ANALYSIS (continued)

Component	Failure Mode	Cause	Significance
b.	Fails to open	Mechanical failure.	Same as 5a.
c.	Opens inadvertently	Control circuit failure.	Same as 4c.
d.	Fails to close	Control circuit failure.	Same as 4c.
e.	Fails to close	Mechanical failure.	Same as 4e.
6. Loop Drain Valves (3 drains per loop--1 manual valve per drain)			
a.	Fails open	Mechanical failure.	LOCA (RCDT). Very unlikely failure cause. (Manual valves).
7. Reactor Vessel Vent			
a.	Fails open	Mechanical failure.	LOCA (RCDT). Very unlikely failure cause, 4-series parallel valve arrangement (1/2" line).

Table F.4-1 (Continued)

ZION 1 AND 2 RC PRESSURE BOUNDARY FAILURE MODE AND EFFECTS ANALYSIS (continued)

Component	Failure Mode	Cause	Significance
8. Letdown and Excess Letdown Isolation Valves			
a.	Fails open	Control circuit failure.	Minor. Backed up by FC air-operated valve and manual valves. Flow restricted by orifice.
b.	Fails open	Mechanical failure.	Same as 8a.
9. Boron Injection Check Valves (Cold Leg)			
a.	Leak by	Mechanical failure.	All check valves are backed up by a normally open motor-operated valve (1/2" line) and a common check valve for all four lines.

Table F.4-1 (Continued)

ZION 1 AND 2 RC PRESSURE BOUNDARY FAILURE MODE AND EFFECTS ANALYSIS (continued)

Component	Failure Mode	Cause	Significance
10. Safety Injection System Check Valves (4) (Cold Leg)			
a.	Leak by	Mechanical failure.	Check valves are backed up by other check valves. Regular testing between the check valves to insure no leak by has been established (8" line). (Safety Injection pumps and RHR pumps.)
11. Safety Injection System Check Valves (2) (Hot Leg)			
a.	Leak by	Mechanical failure.	Check valves are backed up by other check valves and normally closed motor-operated valves.
12. Charging System Supply Check Valves (2)			
a.	Leak by	Mechanical failure.	Check valves are backed up by other check valves.

Table F.4-1 (Continued)

ZION 1 AND 2 RC PRESSURE BOUNDARY FAILURE MODE AND EFFECTS ANALYSIS (continued)

Component	Failure Mode	Cause	Significance
13. RHR Suction MOV			
a.	Fails open	Mechanical failure/operator error.	Interlocked with RCS pressure. Backed up by another normally closed MOV (14").
14. CRDM Penetrations			
a.	Leak/rupture	Mechanical failure.	LOCA.
15. Loop Drains (CVCS)			
a.	Fails open	Mechanical failure.	LOCA (RCDT). Normally open manual valve normally closed solenoid valve (2" lines) - 1 per loop. Normally closed manual valve 1 per loop (2" line). All loop drains to CVCS backed up by manually-operated normally closed valves in loop drain header.

Table F.4-1 (Continued)

ZION 1 AND 2 RC PRESSURE BOUNDARY FAILURE MODE AND EFFECTS ANALYSIS (continued)

Component	Failure Mode	Cause	Significance
16. RHR Hot Leg Discharge Check Valves (Normal) (2)			
a.	Fail open	Mechanical failure.	Backed up by second check valve (each line) and two series MOVs, one normally open (inside containment), one normally closed (outside containment). Minor impact.
17. Loop Isolation Valves (8)			
a.	Fails closed	Circuit failure.	Loss of flow in associated loop, possible reactor trip.
b.	Fails closed	Mechanical failure.	Same as 17a.
c.	Rupture/leak	Mechanical failure.	LOCA.
18. Loop Bypass Valves (4)			
a.	Leak/rupture	Mechanical failure.	LOCA (8" line).

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50-304

APPENDIX A

LICENSEE EVENT REPORT (LER) REVIEW

FOR

ZION UNITS 1 AND 2

1.0 INTRODUCTION AND SUMMARY

Licensee Event Reports (LERs) are submitted in accordance with the reporting requirements set forth in the Zion Station Technical Specifications. In most cases, the events reported have little, if any, impact on plant safety. However, the LER reporting requirement does provide an operational feedback mechanism by which design inadequacies, procedural and training inadequacies, and man-machine/human factor inadequacies can be identified and corrected to improve both plant reliability and overall safety.

In accordance with Item F.1 of Appendix A of the February 29, 1980 Zion Confirmatory Order, a review of past LERs for Zion Station was conducted by Commonwealth Edison. This review was conducted in three phases:

A. Phase 1 consisted of developing a criteria and methodology for scanning past LERs to identify those warranting further attention;

B. Phase 2 consisted of the scan per Phase 1 criteria to identify those LERs warranting further attention and also consisted of a second review to categorize the identified LERs into groups convenient for engineering evaluation; and

C. Phase 3 consisted of an evaluation to determine if the original corrective action was sufficient or additional action or study is warranted.

In summary, during Phase 1 a criteria was developed to scan past LERs for those events which demonstrated or suggested the existence of potential common mode failures; procedural, training, man-machine/human factor inadequacies; or system interactions. If any of these criteria were satisfied, then further attention was warranted.

Phase 2 utilized this criteria to scan approximately 543 past LER reports. In addition, repetitive occurrences of the same event or related events were identified. Of the 543 reports scanned, 159 were deemed to warrant further attention. Since the appropriateness of the original corrective action was not considered during this scan, many of the 159 selected LERs will probably require no additional study or corrective action.

For convenience of engineering evaluation, the 159 LERs were reviewed again and categorized into 40 separate groups, each containing related LERs. Usually the LERs in a group suggest a common problem or common equipment classification. This categorization was done so that specialized personnel could review specific groups. During this categorization, no deficiencies requiring immediate action were identified.

This is not surprising since the Commonwealth Edison system for reviewing LERs is quite extensive, as will be described later in this report.

Phase 3 is currently underway. The 40 groups have been identified and an initial evaluation of each group is being made. The final evaluation will be done by personnel with expertise in each of the groups. The results of these evaluations will be submitted for Commonwealth Edison On-Site and Off-Site approval.

In addition to the review contained herein, Commonwealth Edison also submitted to the NRC Staff on June 16, 1978 a report entitled "Commonwealth Edison Co. Zion Station Systems Interaction Study." This study which also involved an LER review was performed in response to an ACRS concern regarding possible systems interaction.

2.0 COMMONWEALTH EDISON SYSTEM FOR LER REVIEW

Commonwealth Edison Company extensively reviews all LERs for appropriate corrective action. The detailed review is conducted primarily by a Station Technical Staff Engineer. This review which contains a written description of the required corrective action is submitted for approval by the Station On Site Review Committee. This group consists of experienced supervisors covering operational, maintenance and engineering areas. Many of these supervisors have senior reactor operator licenses. Once approved by On Site Review, the report is submitted for review offsite. The primary purpose for the offsite review is to determine if the corrective action is appropriate or sufficient. In many cases, the Off Site Review Function will reject the proposed corrective action, requiring additional review or actions by the station. Typical additional requirements have involved equipment modifications, additional training, or revisions to operating or maintenance procedures, etc. This review process not only applies to LERs but also to all plant deviations whether or not they are reportable events.

Over the years, Commonwealth Edisn has found that this review process has been quite successful in reducing both the frequency and severity of unusual occurrences at all its nuclear stations.

In addition to this review process, Commonwealth Edison's Offsite Review Group also generates an annual internal report which summarizes LER experience at all of its nuclear stations. Each LER in this report is characterized by proximate cause, basic cause, system, equipment, status of reactor at time of incident, and effect on plant. Tabulations of the number of LERs in these classifications are provided to various departments to highlight those areas deserving more attention from operators, designers, etc.

Finally, in January 1978, Commonwealth Edison initiated a PRO (Professionalism) Program at all of its generating stations. The goal of this program is to create in personnel an awareness of the need to perform their work in a professional manner. This program provides for a formal investigation of all personnel errors with incentives for postive (good) performance including recognition and rewards and with sanctions for poor performance. The Corporate PRO Committee meets monthly, reviews incidents to detect trends and decides upon corrective action.

3.0 Goals of LER Re-Review

Commonwealth Edison considers its current LER review program more than adequate to satisfy the NRC requirements of the Zion Confirmatory Order. However, in response to the Order Commonwealth Edison inaugurated an independent review of past LERs for Zion Station. This study was formulated to reexamine the past LERs while incorporating the following improvements over the original reviews:

A. Removal of time constraint. The original reviews and analyses did not have the benefit of the experience gained in the time since the event occurred. Events which seemed isolated at the time, may have recurred later. Although the current review process is adequate to detect explicit recurrence through scans of previous LERs (by equipment name, type of event, etc), this review will improve the identification of repetitive events by removing the constraint of time.

B. Benefit of experience. The original reviews and analyses did not have the benefit of subsequent experience accrued since the event occurred. In addition, over the years since the initial operation of the Zion units, different individuals have performed past LER reviews. In this review, a single highly experienced person with a senior reactor operator license reviewed and categorized the LERs.

C. Scope of Review. The original LER reviews did not explicitly emphasize the concepts of common mode failure, systems interaction or human factors engineering. This review utilized a checklist to track those LER events which could be classified in one or more of these categories and, therefore, warranting additional consideration.

4.0 PHASE 1: CRITERIA/METHODOLOGY FOR REVIEW

Phase 1 consisted of selecting the criteria/methodology for performing the review. In accordance with the Order, the past LERs at Zion Station were reviewed against the following general criteria to determine if additional considerations were necessary:

a) Common mode failures;

b) Procedural, training, man-machine/human factors inadequacies;

c) System Interactions; and

d) Repetitive failures.

With the exception of repetitive failures, each of the other general criteria were broken down into specific checklists that included both definitions and checkpoints for testing the potential applicability of a given LER. The definition of repetitive failure is self evident. Exhibits 1, 2, and 3 contain the checklists for the general criteria listed in a), b) and c) above. Note that the definitions and checkpoints adopted were purposefully broad so as not to eliminate from consideration some possibly important LERs.

The individual checklists were then combined into a master checklist for use in the Phase 2 scan.

5.0 PHASE 2: LER SCAN AND CATEGORIZATION

Phase 2 consisted of scanning the 543 LERs for the years 1975 (when LER system was established) through 1979 against the criteria of Phase 1 to determine which past LERs require reexamination. In executing this scan, the original corrective action was not considered or utilized as a basis for elimination an LER for further consideration. Of the 543 LERs scanned, 159 fell into one or more of the definitions and checkpoints of Exhibits 1, 2, and 3, thus requiring additional consideration. Table 1 illustrates a breakdown of the selected LERs as reviewed against the Phase 1 criteria. As can be seen from this table, some LERs fell into or met more than one criteria.

The 159 LERs were then examined again and categorized into 40 separate groups to faciliate an engineering evalulation of related LERs in each group. Table 2 lists each LER group by number and includes a characterization of the type of concern (common mode failure, systems interaction, etc.) as well as the number of LERs related to that group.

6.0 PHASE 3: EVALUATION OF SELECTED LERs

Phase 3 of the study consists of an evaluation to determine if the original corrective action for LERs in a given group was sufficient or whether additional action or study is warranted. This phase is currently underway. Initial evaluations of each of the 40 groups are being made to provide guidance for the final evaluation.

These initial evaluations contain the Group title, LER numbers, a brief discussion of the related LERs, and a suggested action plan. Exhibits 4 and 5 contain examples of this initial evaulation for LER Group 2, Solenoid Valve Failure, and LER Group 3, Radiation Monitor Valving Errors.

These initial evaluations are being assigned to personnel with expertise in the subject groups for a final detailed evaluation and recommended disposition. These recommendations will be submitted for Commonwealth Edison On Site and Off Site approval before final disposition.

7.0 Conclusions

Commonwealth Edison conducted a review of past LERs at Zion Station in accordance with the Zion Confirmatory Order of February 29, 1980. The past 543 LERs were initially scanned against a criteria based on the concerns delineated in the Order item. Of the 543, 159 met the review criteria and thus, require additional consideration.

The 159 LERs were then reexamined and categorized into 40 groups for convenience in performing engineering evaluations. Each group was initially evaluated to determine if the past corrective actions were sufficient, and to recommend or suggest additional action.

During these reviews and categorizations, no additional design, procedural and training, or man-machine/human factor inadequacies which could lead to significant degradation of unit operating reliability or safety systems capabilities were identified. However, as the detailed evaluation of each group of LERs continues, any deficiencies requiring immediate corrective action will be made when possible, with the required notifications to be made to the NRC.

Exhibit 1

Potential Common Mode Failure Checklist

1.1 Definition: A common mode failure is when two or more items of equipment are rendered inoperable by the same cause. A common mode failure is far more significant when equipment items serve a redundant function.

1.2 Was this event a common mode failure?

1.3 Did this event illustrate a potential for common mode failure?

1.4 Did the failure result from an external influence which could have affected other equipment? For example, weather, power failure, earthquake, fire, etc. (Human error is specifically excluded.)

1.5 If this failure was caused by human error, procedural or training inadequacy, or man-machine/human factor inadequacy, could the same error, repeated, result in a common mode failure? For example, if an instrument failed to trip due to an error in the calibration procedure, a potential for the failure of identical redundant transmitters is possible.

1.6 If this failure was caused by a systems interaction, was a potential for common mode failure present? For example, an instrument failure due to high temperatures resulting from a HVAC failure is a sytems interaction and could result in a common mode failure.

Exhibit 2

Potential Procedural, Training, Man-Machine/Human Factor Inadequacies Checklist

2.1 Definition: These categories of inadequacies are commonly present when human error occurs. A procedure does not necessarily have to be written.

2.2 Was the cause identified in the original review as an installation error, or violation of procedure, or a procedural deficiency?

2.3 In the opinion of the reviewer, would a procedure change, additional training, equipment labeling, equipment layout or other personnel related changes have prevented the failure?

2.4 If the answer to 2.2 or 2.3 is positive, review this LER foc common mode failure potential.

Exhibit 3

Potential System Interaction Checklist

3.1 Definition: System interaction is a phenomenon whereby equipment is rendered inoperable or severly affected by an unanticipated interaction with other equipment. Excluded from this definition are obvious interactions for which design provisions exist. For example, a diesel generator fire resulting from a DC power failure is a systems interaction. Diesel generator failure to start due to a DC power failure is not a systems interaction.

3.2 Can this LER be characterized as a systems interaction?

3.3 If the answer to 3.2 is positive, reexamine this LER for common mode failure potential.

Exhibit 4

LER Group No. 2: Solenoid Valve Failures

I. Subject LERs (YEAR - UNIT# - LER# - DVR#)

75-1-3-35	75-2-11-63	76-1-61-192
75-1-4-36	75-2-28-162	77-1-4-6
75-1-5-37	76-1-44-164	77-1-29-65
75-1-32-237	76-1-45-165	77-1-42-107
75-1-10-62	76-1-46-166	77-1-43-108
77-1-103-199	78-1-17-21	78-1-124-230
77-1-104-200	78-1-32-58	78-2-39-73
77-2-30-76	78-1-59-117	78-2-45-90
77-2-36-89	78-1-86-160	78-2-51-105
77-2-39-94	78-1-94-170	79-1-11-22
79-1-20-32		
79-1-63-113		

II. Discussion

32 LERs resulted from failure of ASCO brand solenoid valves. These valves are used primarily to control air operated valves and dampers. The failure cause in each case was a foreign material (believed to be oil) baking into the gap between the plunger and the plunger sleeve.

These LERs were selected because the failure rate is sufficiently high that a possibility exists of one or more of these valves failing when required.

Various cures for this problem have been attempted: An additional non-lubricated air compressor was installed to reduce the oil in the Instrument Air System. Heavier duty solenoid valves were installed in some locations. Valve internals have been replaced.

It is believed that the corrective actions have been succesful because of the reduced number of failures in 1979. The few failures remaining seem to be the result of the residual oil remaining in the instrument air piping.

III. Suggested Action

Prepare a report which evaluates the status of the problem and recommends further corrective action if necessary.

It is suggested that the report include:

1. A table which identifies each safety related solenoid in the plant, the valve model, the date of each failure, and the date and description of each corrective action, i.e. cleaning, replacement, model change.

2. A plot of failure per calender quarter versus date.

3. If the failures are more frequent for certain valves, list those valves and attempt to find a common reason which makes them more susceptible to failure.

4. Survey other plants for

   1) Brand and model of solenoid used;

   2) Whether lubricated or non-lubricated air compressors are used; and

   3) Failure experience.

Exhibit 5

LER Group No. 3: Radiation Monitor Valving Errors

I. Subject LERs (YEAR - UNIT# - LER# - DVR#):

75-1-8-61
77-1-53-109
78-1-100-190
78-1-129-220

II. Discussion

These LERs describe 4 occassions where radiation monitors were improperly isolated. A possible contributing cause to these failures is that the valve numbers are not identified on the Piping and Instrument Drawings. Thus the equipment operator must determine the appropriate valves to operate by examining the piping in the field. The LERs do not discuss why the low flow alarm did not alert the operators that a low flow condition existed.

These LERs were selected because they suggest a potential man-machine/human factor problem.

III. Suggested Action:

Recommended Corrective Action. Evaluate the priority given for repairing malfunctioning low flow alarms. Evaluate the need to place valve numbers in the P & ID's.

Table 1

Number of LERs per Phase 1 Criteria Selected for Additional Review

Criteria	Number of LERs
Common Mode Failrues	42
Systems Interactions	9
Procedural, Training, Man-Machine/ Human Factor Inadequacies	72
Repetitive Failures	59
Total	182

Table 2
LER Groups

Group #	DESCRIPTION	# of LERs
1	Water Hammer Damage (System Interaction)	2
2	ASCO Solenoid Valve Failure (Common Mode Failure Repetitive)	34
3	Rad Monitor Valving Errors (Man-Machine/Human Factors)	4
4	RCS Pressure Control (Training, Man-Machine/Human Factors)	2
5	Operator Error Due to Written Procedure Error (Procedural)	5
6	H.U.T. Presssure Control (Systems Interaction)	1
7	Mechanical and Electrical Maintenance Personnel Errors Due to Written Procedure Errors (Procedural)	1
8	Effects of Low Voltage on Plant Equipment (Systems Interaction)	1
9	Miscellaneous Operator Errors (Procedural Training Man-Machine/Human Factors)	14
10	Containment Radiation Monitors (Repetitive Failures)	18
11	Boric Acid Tank Boron Concentration Low (Repetitive Failures)	2
12	Miscellaneous Containment Isolation Valve Failures (Common Mode Failure, Repetitive Failures)	5
13	Missed Surveillance Tests (Repetitive, Procedural)	10
14	Containment Spray Valve Failures (Repetitive, Common Mode Failure)	3
15	Pressurizer Level Instrument Calibrations (Common Mode Failure, Repetitive Failures)	2
16	Failure to take Samples for Radioactive Materials Monitoring (Repetitive, Procedural)	8
17	Instrument Loop Switch Left in Wrong Position Following Calibration (Repetitive, Common Mode Failure, Procedural, Training)	2

Group #	DESCRIPTION	# of LERs
18	Failure of all DELTA-T Overpressure and Over-Temperature Circuits Due to Single Error (Common Mode Failure, Procedural)	1
19	Cold Weather Protection of Safety Related Equipment (Common Mode Failure)	2
20	Air Craft Fire Detection Circuit Design Error (Common Mode Failure)	1
21	Overexposure of Personnel (Procedural)	1
22	Reactor Coolant System Dilution (Systems Interaction, Repetitive Failures)	2
23	Accumulator Level Transmitters (Repetitive Failures)	1
24	Auxiliary Contacts (Common Mode Failure, Repetitive Failures)	5
25	Reactor Coolant System Flow Transmitters (Repetitive Failures)	3
26	Valve 8106 Failures (Repetitive Failures)	1
27	Leakage of Radioactive Material Through Electrical Circuits (Systems Interaction)	1
28	Miscellaneous Instrument Failures (Repetitive, Common Mode Failure)	6
29	Hagen Summator Design Modification (Common Mode Failure, Training)	2
30	Errors During Release of Lake Discharge Tank (Training, Procedural)	1
31	Snubber Problems (Common Mode Failure)	4
32	Administrative Control of Instruments During Calibration (Repetitive Failures)	3
33	Pressurizer Level Loss Due to Testing (Procedural, Training, Common Mode Failure)	1
34	Miscellaneous Instrument Mechanic Errors (Procedural, Training)	1
35	Control Board Labling and Arrangement (Man-Machine/Human Factors)	2

Group #	DESCRIPTION	# of LERs
36	Effects of Rapid Lake Water Change (Systems Interaction)	1
37	Operator Dependence on Computer (Man-Machine/ Human Factors, Training)	1
38	Miscellaneous Radiation Protection Personnel Errors (Training, Procedural)	2
39	Miscellaneous Mechanical and Electrical Maintenance Errors (Procedural, Training)	1
40	Improper Diagnosis and Repair of Instruments (Procedural, Training)	2