PSE&G NUCLEAR DEPARTMENT

NC.NA-AP.ZZ-0061(Q) REVISION 1

SIGNIFICANT EVENT RESPONSE TEAM MANAGEMENT

SPONSOR ORGANIZATION: Vice President - Nuclear Operations

REVISION SUMMARY

1. This minor revision adds the Manager - Nuclear Training Department to the list of people who are to receive SERT reports (Section 5.7.2.a.).

2. The procedure has been reformatted to comply with the Artificial Island Administrative Procedure Writer's Guide, NC.NA-WG.ZZ-0001(Z).

IMPLEMENTATION REQUIREMENTS

The station's SERT coordinators will ensure copies of all SERT reports issued prior to the implementation of this revision to the procedure are transmitted to the Manager - Nuclear Training Center.

This revision to the procedure is effective upon issuance.

CONCUR: _____ 1/23/91
General Manager - Quality Assurance/ Nuclear Safety Review — Date

APPROVED: _____ 2/7/91
Vice President - Nuclear Operations — Date

APPROVED: _____ 1/24/91
General Manager - Hope Creeek Operations — Date

APPROVED: _____ 1/23/91
General Manager - Salem Operations — Date

SIGNIFICANT EVENT RESPONSE TEAM MANAGEMENT

TABLE OF CONTENTS

Section	Title	Page
1.0	PURPOSE	2
2.0	SCOPE	2
3.0	RESPONSIBILITIES	3
4.0	PROCESS DESCRIPTION	7
5.0	PROCEDURE	8
	5.1 Convening the SERT - Immediate Response Events	8
	5.2 Convening the SERT - Events Not Requiring Immediate Response	13
	5.3 Analyzing the Event	15
	5.4 Identifying the Root Cause	17
	5.5 Determining Corrective Actions	18
	5.6 Preparing the SERT Report	19
	5.7 Issuing the SERT Report	20
	5.8 Records	21
6.0	DEFINITIONS	21
7.0	REFERENCES	22

ATTACHMENTS

Attachment 1 - Flowchart - Immediate Response Events
Attachment 2 - Flowchart - Events Not Requiring Immediate Response
Attachment 3 - Flowchart - Analysis & Report Preparation
Attachment 4 - Data/Information to be Considered
Attachment 5 - Corrective Action Guidelines
Attachment 6 - Sample SERT Report

SIGNIFICANT EVENT RESPONSE TEAM MANAGEMENT

1.0 **PURPOSE**

1.1 To proceduralize the Significant Event Response Team (SERT) process.

1.2 To provide a structured process for independent assessment of selected events, trends, or certain repetitive situations.

1.3 To fulfill the Nuclear Department commitment to perform an independent review of each reactor trip/safety injection.

1.4 To provide a timely, uniform, and comprehensive report for each reviewed event.

1.5 To ensure that all relevant aspects of an event or situation have been considered and appropriate corrective actions identified to prevent recurrence.

2.0 **SCOPE**

2.1 Applies to events determined to warrant a SERT by either a Station Manager or a Nuclear Department Vice President, including the following:

- o All reactor trips/scrams
- o All safety injections
- o Other concerns, problems, or events at the discretion of the above members of senior management.

> **NOTE**
>
> **Within this procedure the term Station Manager refers to the General Manager - Salem/Hope Creek Operations, his designated representative, or the Nuclear Department Vice President who commissioned the SERT**

2.2 Includes the following activities related to SERT duties:

- o Convening a SERT and responding in an appropriate time frame.
- o Investigating and analyzing the event.
- o Preparing the SERT report.
- o Issuing the SERT report.

3.0 RESPONSIBILITIES

3.1 The Station Manager is responsible for:

- o Determining the need for a SERT.
- o Designating a SERT Manager and arranging for a Technical Staff member.
- o Providing a base of operation for the SERT.
- o Defining the initial objectives of the SERT.
- o Making available to the SERT all data/information obtained relative to the event.
- o Making decisions regarding implementation of SERT recommendations.
- o Tracking implementation status of SERT recommendations utilizing the Action Tracking System IAW NC.NA-AP.ZZ-0057(Q).

3.2 The SERT Manager is responsible for:

- o Determining SERT membership needs.
- o Coordinating SERT activities.
- o Providing an independent assessment of the event, including root cause(s) and corrective action recommendations.
- o Ensuring prompt and complete data collection and interviews pertaining to personnel performance, beginning no later than 2 hours after the event, when possible.
- o Ensuring that relevant management issues are identified and addressed as part of the investigation.
- o Interfacing with station department managers.
- o Interfacing with the Station Manager concerning regulatory, external, and management issues, as required.
- o Obtaining initial SERT objectives from the Station Manager.
- o Issuing a complete and accurate SERT report.

- Issuing the report in a time frame consistent with the needs of the Station Manager.

> **NOTE**
>
> **As a goal, the report should be issued within 7 days of the event.**

3.3 SERT member responsibilities are both general and discipline specific.

> **NOTE**
>
> **Team membership for any particular investigation is at the discretion of the SERT Manager.**

3.3.1 All SERT members are responsible for:

- Coordinating fact finding interviews with department conducted interviews and higher priority plant activities.
- Providing a central point of contact for procedure review and investigation activities affecting their department.
- Participating in root cause analysis/determination.
- Participating in the development of corrective action recommendations.
- Performing any other duties or tasks assigned by the SERT Manager.

> **NOTE**
>
> **Ultimately, the duties or tasks of all team members are at the discretion of the SERT Manager.**

3.3.2 The Maintenance Department member is responsible for:

- Coordinating the investigation of event related site work activities, including the proper implementation of applicable work methods, safety rules, procedure compliance and procedure adequacy.
- Coordinating the scheduling of SERT related activities, including consideration of the impact of desired work on other plant activities.
- Reviewing preplanning of work activities which led to the event.

3.3.3 The System Engineer member is responsible for:

- o Coordinating deficiency resolution liaison activities.
- o Preparing special investigative and test rocedures.
- o Preparing industry experience reports (Nuclear Network).
- o Preparing 10CFR50.59 Safety Evaluations.
- o Preparing design change requests (minor or major).
- o Performing technical review of Change Packages (CPs) and procedures associated with the event.

3.3.4 The Technical Staff member is responsible for:

- o Providing administrative support to the SERT Manager, including calling out additional members as assigned.
- o Maintaining a log of SERT activities and time keeping.
- o Acting as the focal point for collecting material to be included in the SERT report.
- o Preparing the SERT report.
- o For events requiring immediate response, coordinating the investigation with plant activities.

3.3.5 The Operations Department member (currently or previously licensed or certified) is responsible for:

- o Providing the SERT with available requested information related to plant and personnel response.
- o Evaluating Operations Department procedures for adequacy and compliance.
- o Coordinating the investigation with plant operations activities.

3.3.6 The Radiation Protection/Chemistry Department member is responsible for:

- o Coordinating ALARA considerations, such as dose rate assessment and shielding requirements, with SERT investigation activities.
- o Obtaining and performing analysis of radiological and chemical/radiochemical trends and parameters prior to, during, and after the event.
- o Developing corrective action recommendations based upon analysis of radiological and chemistry data.

- o Determining cause(s) and failure mechanisms related to radiological and chemistry effects.
- o Coordinating job coverage in support of SERT investigations, including performing radiological surveys and air samples.
- o Coordinating RWP preparation and issue necessary to support SERT activities.

3.3.7 The Quality Assurance member is responsible for:

- o Identifying and reviewing administrative and engineering controls that might have failed during the event.
- o For events requiring immediate response, performing fact finding interviews in the Maintenance, Radiation Protection, and Chemistry disciplines.

3.3.8 The Nuclear Safety Review member is responsible for:

- o Reviewing plant data for correlation to the correctness of the plant response(s) to the event.
- o Acting as the focal point for constructing the event chronology.
- o Ensuring that the root cause analysis is thorough and comprehensive.
- o For events requiring immediate response, participating in fact finding interviews in the Operations and Technical disciplines.

3.3.9 The Nuclear Training Center (NTC) member is responsible for:

- o Reviewing the event for issues related to adequacy of training programs.
- o Developing corrective action recommendations related to personnel indoctrination and training.
- o Performing additional tasks as directed by the SERT Manager.
- o For events requiring immediate response, making necessary short term changes to NTC training programs.

3.3.10 Nuclear Engineering Department, Nuclear Services, and vendor personnel may be matrixed to the SERT, and are responsible for specific support or oversight functions as assigned by the SERT manager.

4.0 PROCESS DESCRIPTION

4.1 The major elements of the SERT process include:

- o The SERT itself.
- o Independence of the team from routine event investigation and reporting processes.
- o A focus on producing a comprehensive report.
- o A special variation of the process for situations, such as reactor trips and SIs, that require immediate response.
- o The SERT report as the major process output.

4.2 The SERT is a team of experienced personnel assembled to independently investigate events of concern. The following are characteristics of the SERT:

- o The SERT Manager and members are selected from lists of designated individuals to facilitate convening the SERT and to ensure an appropriate level of experience on the team.

> **NOTE**
>
> **Emergency Preparedness will maintain a list of designated to act as SERT Managers and members.**

- o The SERT Manager is a non-station manager to ensure independence of the SERT from routine station investigation and reporting activities.
- o A SERT team membership is identified to provide immediate response capability (see Section 5.1) for situations such as reactor trips or safety injections (SI)s, or for events where the need for a SERT is identified within 1 hour after event occurrence.
- o Full SERT membership is adjusted based on the nature of the event.

4.3 Although interfacing with the Station Manager, SERT operates independently from station management. The following features of the SERT - Station Manager relationship ensure SERT independence:

- o The Station Manager sets only the initial objectives of SERT activity.
- o The SERT Manager is free to pursue any aspects associated with the event, or any situations or concerns that evolve during the course of the investigation.

- The SERT is independent of station management in developing its conclusions and recommendations.

4.4 The SERT process is aimed at producing a timely, accurate and comprehensive report of the event. The following aspects of the process relate to this goal:

- A special variation of the process is established for immediate response to reactor trips/SIs or any other event where an immediate response is justified.
- The SERT report incorporates the findings of all investigative activities pertaining to the event.
- The independent SERT process is integrated with other routine processes as appropriate, including the Incident Report/Reportable Event Program and Quality/ Safety Concerns Reporting System (NC.NA-AP.ZZ-0006(Q)) and post trip review process (AD-16 at Salem, OP-AP.ZZ-101(Q) at Hope Creek).
- The process is flexible (for instance, relative to assigned duties and team membership) to facilitate adaptation to different situations.

4.5 The SERT report is the major deliverable from the process. Key features of the report include:

- A standard format and content.
- An independent point of view.
- A comprehensive scope.
- Identification of root causes and recommendations for short and long term corrective actions to prevent the event from recurring.

4.6 The report will be retained in a file by Nuclear Safety Review for use in assessing the effectiveness of corrective actions or for analyzing future events.

5.0 PROCEDURE

5.1 Convening the SERT - Immediate Response Events

The process described in Section 5.1 would normally apply to events where restart is a primary consideration or for events where the decision to formulate a SERT is made within 1 hour after event occurrence. For other situations go directly to Section 5.2.

When the Section 5.1 process is utilized, the primary objective of the immediate response team is to identify and pinpoint human performance aspects associated with the event (who was doing what, where, when and why).

5.1.1 Call Out - First Step

Upon deciding to convene a SERT for a reactor trip, SI, or other event requiring immediate response, the Station Manager shall assemble an initial response team as follows:

a. Designate a SERT Manager from the list of qualified individuals.

b. Call the designated SERT Manager and a Technical Staff member.

c. Brief them on the event and identify where the team will assemble.

> **NOTE**
>
> **The assigned Technical Staff member is normally an individual experienced in licensee event report preparation.**

5.1.2 Call Out - Second Step

Upon being called by the Station Manager, the Technical Staff member shall:

a. Notify the designated team member (or point of contact) from each of the following departments:

   1. Station Quality Assurance (SQA)

   2. Nuclear Safety Review (NSR)

   3. Nuclear Training Center (NTC)

b. Brief them on the event and identify where the team will assemble.

c. Travel to the site.

> **NOTE**
>
> **1. If a point of contact is reached, that person is responsible to notify an appropriate team member.**
>
> **2. Additional members of the initial response team may be called out at the discretion of the Station Manager or SERT Manager.**

5.1.3 Assembling the Initial Response Team

Following call out, the designated SERT Manager and initial response team members shall:

a. Travel to the site as soon as possible.

b. Gather at the identified location.

c. Participate in an initial briefing.

d. Perform an initial assessment of the event.

e. Begin investigating the event in accordance with the general tasks outlined in Sections 5.1.4 through 5.1.8.

NOTE

Due to the need for flexibility in investigating different types of events, the requirements in the following subsections are only guidelines and may be varied or performed in different sequence as the event dictates or at the discretion of the SERT Manager.

5.1.4 SERT Manager Tasks

During the initial investigation phase, the SERT Manager should perform the following duties or tasks:

a. Contact the Station Manager and other department managers as necessary to develop a strategy for investigating the event. Considerations include:

- o Defining the initial SERT objectives
- o Obtaining an up-to-date assessment of the event status
- o Arranging for the turnover of any data or information collected to date
- o Establishing specific SERT member responsibilities
- o Establishing meeting frequency
- o Establishing plans for relief (if needed)

o Identifying needed resources

NOTE

Participation on the SERT is assumed to be the "exclusive" duty of team members during the early stages of an investigation. SERT participation may become "non exclusive" as the investigation evolves.

b. Discuss the strategy for investigating the event with all team members.

c. Maintain an overview of the event to focus investigation activities.

d. Ensure that communication is maintained with the Station Manager, other managers and team members to ensure coordination of investigation activities.

e. Ensure the prompt collection of data pertaining to personnel performance.

NOTE

Experience shows that the quality of such data degrades rapidly with time. The target is to complete collection of personnel performance data within 2-3 hours following the event.

f. Discuss SERT preliminary findings and any restart recommendations with the Station Manager prior to restart.

g. At an appropriate point in the initial investigation, review the situation to determine the need for additional team members to complete the investigation in a timely fashion or to do an adequate assessment of root cause(s) and corrective actions. Go to Section 5.1.9.

5.1.5 Technical Staff Member Tasks

During the initial investigation phase, the Technical Staff member should perform the following duties or tasks:

a. Maintain an awareness of station activities related to the event and inform team members as needed. Station activities of interest include equipment trouble-shooting, incident investigation and reporting, and SORC meetings.

b. Maintain a log of team activities, findings, and time spent on the SERT.

c. Provide administrative support for the SERT Manager, as needed.

d. Start collecting material for the SERT report. Prepare draft report material as requested. See Section 5.6.

e. Provide data to other team members as appropriate.

f. Participate in team meeting(s) to identify root causes and corrective actions. Go to Section 5.1.9.

5.1.6 Nuclear Safety Review Member Tasks

During the initial investigation phase, the Nuclear Safety Review Department member should perform the following duties or tasks:

a. Contact appropriate Operations and Technical Department personnel, as required to ascertain the facts surrounding the event.

b. Interview pertinent personnel in these departments.

c. Start forming a sequence of events to be used in reconstructing the event during the event analysis phase. See Section 5.3.

d. Identify data needed for determining root causes or contributing factors of the event. See Section 5.4.

e. Provide data to other team members as appropriate.

f. Participate in team meetings to identify root causes and corrective actions. Go to Section 5.1.9.

5.1.7 Quality Assurance Member Tasks

During the initial investigation phase, the Quality Assurance Department member should perform the following duties or tasks:

a. Contact appropriate Maintenance, Radiation Protection, and Chemistry Department personnel as required to ascertain the facts surrounding the event.

b. Interview pertinent personnel in these departments.

c. Collect data related to the use of procedures, documents, or other administrative controls.

d. Provide data to other team members as appropriate.

e. Participate in team meetings to identify root causes and corrective actions. Go to Section 5.1.9.

5.1.8 Nuclear Training Center Member Tasks

During the initial investigation phase, the NTC Member should perform the following duties or tasks:

a. Assist in contacting and interviewing personnel involved in the event as directed.

b. Collect data related to the adequacy of training programs.

c. Provide data to other team members as appropriate.

d. Participate in team meetings to identify root causes and corrective actions. Go to Section 5.1.9.

5.1.9 Assembling the Full SERT

At an appropriate point after assembling the initial response team, the SERT Manager shall:

a. Assess the adequacy of the team in terms of continuing the investigation to completion.

b. If additional members are needed, have additional members identified and called out to the site to participate in the ongoing investigation.

c. If the present team is adequate, continue the investigation. To provide continuity, initial response team members should be maintained to the completion of SERT activity, if possible. If replaced they are expected to maintain contact with the team.

d. After increasing membership as appropriate, continue the investigation. Go to Section 5.3.

5.2 Convening the SERT - Events Not Requiring Immediate Response

5.2.1 If the event does not require immediate response, or the opportunity for immediate response is lost, the Station Manager shall:

a. Designate a SERT Manager from the list of qualified individuals.

b. Contact the assigned SERT Manager and meet with him/her to discuss the event.

5.2.2 Upon reviewing the event with the Station Manager, the assigned SERT Manager shall:

a. Set up a base of operations at a convenient location.

b. Assess needs for membership of the SERT.

c. Coordinate assignment of additional members. As a minimum, the SERT should consist of individuals from the following departments:

1. Station Technical

2. Station Quality Assurance

3. Nuclear Safety Review

4. Nuclear Training Center

d. It is anticipated that most events significant enough to warrant a SERT would also require membership from Operations, Maintenance, and System Engineering. Also, specialty services may be desirable. For instance, events with strong human performance implications would require HPES trained personnel.

e. Make plans for the initial SERT meeting. Have the Technical Staff member contact assigned members and inform them of the time and location of the meeting. Go to 5.2.4.

5.2.3 The Technical Staff member shall:

a. Call assigned members as instructed by the SERT Manager.

b. Start the event log and time-keeping.

c. Prepare materials for the initial meeting. Such materials may include at the direction of the SERT Manager:

- o Initial event description
- o Copies of data collected to date
- o An outline of plans for the investigation

5.2.4 The SERT Manager and assigned members shall assemble as the full SERT and commence investigation of the event. The following apply to SERT investigation activities:

a. The initial duties and tasks in investigating the event somewhat parallel those in Sections 5.1.4 through 5.1.8 above and should be performed by the SERT Manager and team members as applicable.

b. If a SERT member is assigned from a particular specialty, that member is responsible for the identification and adequate resolution of issues related to the specialty.

c. Personnel will be assigned to conduct interviews at the discretion of the SERT manager.

d. The investigation for an event not requiring immediate response may be conducted with less urgency than one for a reactor trip or SI (for example, round the clock coverage probably won't be required).

e. Depending on the nature of the event and other factors, such as the availability of resources, the investigation may vary considerably. Planning should include obtaining agreement of affected managers on resource allocations.

f. Upon completion of the initial investigation, SERT performs the event analysis as covered in the following section.

5.3 Analyzing the Event

NOTE

All team members participate in the following. The overall purpose is to reconstruct the event, identify human performance and equipment contributors to the event, and to identify root cause(s) and corrective actions to prevent recurrence.

5.3.1 Data/information collected by the team is used to reconstruct the event and assess equipment and human performance.

a. Data/information reviewed pertaining to the event would include:

- o Alarm activations.
- o Equipment response information.
- o Chart indications or printouts.
- o Written statements from personnel involved in the event.
- o Personnel actions obtained from interviews.

b. As the analysis progresses, the SERT should periodically review the emerging picture of the event to assess its completeness and identify any additional data/information needs.

5.3.2 The SERT should assess the need to obtain additional in house records that may be relevant to understanding the scenario, identifying the root cause(s) or corrective actions, or assessing the adequacy of past corrective actions. Such records may include:

a. Records of any similar events with which the event may be compared. Such events may be described in IRs, LERs, or other reports.

b. Any other records that may be of value in the analysis or reconstruction of the event. For instance, start-up test records may indicate that a certain item had failed in a similar manner during original installation.

5.3.3 The SERT should review additional information as needed to analyze or understand the event.

a. Such information may include:

- o Laboratory tests
- o Views or photographs of pertinent locations
- o Interviews of other individuals who have performed the same task
- o Communication with vendors
- o General references needed to provide theory or background information.

b. Additional information reviewed shall include relevant industry operating experience.

c. The SERT should specify any special tests or experiments needed to complete their understanding of the event. The following requirements apply:

1. Prepare a test procedure or test CP for performing the test IAW NC.NA-AP.AD-0032(Q), Preparation, Review, and Approval of Procedures, or NC.NA-AP.ZZ-0008(Q), Control of Design and Configuration Change, Tests and Experiments, respectively.

2. Closely coordinate test preparation with all SERT members and appropriate station management.

3. Use existing systems in support of these efforts. These systems include the planning function, design change process, and temporary modification control.

> **NOTE**
>
> **Attachment 4 lists the kinds of data/information that should be considered for retrieval.**

5.4 Identifying the Root Cause(s)

5.4.1 Upon assembling the various data and information into a chronology, the SERT should analyze the data and reconstruct the event (determine what, when, why, who).

a. Reconstructing the event is typically an iterative process involving:

1. Generating hypotheses as to possible relationships of different data.

2. Inferring possible facts from the observed data and possible relationships.

3. Deducing possible facts from the data, given theories or assumptions that may apply.

4. Testing the validity of the overall event description against known data.

b. The primary objective of the reconstruction process is to provide a model of the event that may be used in identifying the root cause(s) and contributing causes.

5.4.2 When the reconstruction is complete, the SERT shall analyze the event to identify the root cause(s) and any contributing causes. The following general considerations apply to root cause analysis:

- The purpose of root cause analysis is to provide the basis for corrective actions to prevent recurrence of similar events.
- Consider all possible causal factors. There are usually more than one.
- Consider all aspects of the event, including the technical, human, and environmental aspects.
- The general implications of a possible root cause should be kept in mind, as too narrow a view may result in overlooking the possibility of other events or consequences occurring.

5.4.3 The SERT should validate identified root cause(s) and contributing causes as follows:

a. Determine if the root cause is valid using the following criteria:

- o The problem would not have occurred if the cause had not been present.
- o The problem will not recur due to the same causal factors if the causes are corrected or eliminated.
- o Correction or elimination of the cause(s) will prevent occurrence of similar conditions.

b. Validate any major contributing causes using the same criteria as for root causes.

5.4.4 Any contributing factors may be validated by using tempered criteria. For instance, "the situation would have been less severe if ...." (the contributor had not been present)".

5.5 Determining Corrective Actions

5.5.1 Upon identifying the causes and contributing factors, the SERT shall develop recommendations for short and long term corrective actions as appropriate. The following guidelines apply to corrective actions in general:

a. The objective of a corrective action is to prevent recurrence of similar events.

b. At least one viable corrective action should be developed for each root cause or contributing cause.

c. A viable corrective action has the following characteristics:

- o It will prevent recurrence of the situation.
- o It is within our resources to implement.
- o It supports our primary objective of safe and reliable power production.

d. The SERT should consider the adequacy of a recommended corrective action. Attachment 5 contains guidance for making this determination.

e. Final decisions regarding the implementation of recommended corrective actions are the responsibility of the Station Manager.

5.5.2 The SERT should expedite completing short term corrective action recommendations in a time frame consistent with ongoing Station corrective action activities.

5.5.3 For events where restart is involved (e.g., reactor trips or SIs), SERT recommendations could influence the restart decision. The SERT Manager should communicate short term recommendations to the Station Manager in a timely manner so they can be considered in restart decision making.

5.6 Preparing the SERT Report

5.6.1 The SERT shall prepare a report documenting their investigation. The following guidelines apply in general:

a. A report shall be issued for each convened SERT.

b. The report issue date should be negotiated between the Station Manager and the SERT Manager. As a goal, the report should be issued within 7 days of the event.

c. The report should be a comprehensive source of information about the event incorporating the results of relevant analyses.

d. The SERT report should:

- Contain sufficient information to form the basis for any other required reports, such as the LER.
- Incorporate the results of other investigative activities related to the event, such as the post trip review or System Engineering assessments.
- Specifically address relevant management or programmatic issues.
- Be a "stand alone" document. If supporting information from other documents is used but not included in the SERT report, the documents should be referenced in the bibliography. The names of individuals interviewed should also be included in the bibliography.

5.6.2 The Technical Staff member is responsible for preparing the draft report. The overall responsibility for the content of the report lies with the SERT Manager.

5.6.3 As specific conclusions or parts of the report are developed, the cognizant SERT member should review them with affected manager(s), both inside and outside of the station. The early awareness of management may facilitate acceptance and implementation of recommended corrective actions.

5.6.4 An example of a final report is included as Attachment 6. The following guidelines apply to the final report content:

a. As a minimum, include the essential facts surrounding the event and SERT conclusions, including:

- o An event description
- o An assessment of equipment performance
- o The results of the root cause analysis
- o Short term corrective action recommendations
- o Long term corrective action recommendations
- o Man-hours spent investigating the event and preparing the report
- o Identification of SERT members

b. Identify any other observed issues not specifically addressed by SERT but needing corrective action.

5.6.5 The Technical Staff member should compile a bibliography of source documents and references including persons interviewed to be filed with the report for future use.

5.7 Issuing the SERT Report

5.7.1 The SERT report is issued under the signature of the SERT Manager.

a. The concurrence of all SERT members with the contents of the report is implied in the SERT Manager approval.

b. If there is disagreement between members as to particular conclusions or recommendations, the alternative views should be documented in the report.

5.7.2 The SERT Manager shall forward the SERT report to the Station Manager.

a. The SERT Manager shall distribute a copy of the SERT report to the Vice President - Nuclear Operations, General Manager - Quality Assurance/ Nuclear Safety Review, General Manager - External Affairs, Manager - Nuclear Training Department and other affected Department Managers.

b. SERT responsibilities generally end with issuance of the report. However, the SERT may be reconvened to discuss the SERT report findings or any related details.

5.7.3 Upon receipt of the SERT report, the Station Manager will review the report and make a decision as to the implementation of SERT recommendations.

5.8 Records

5.8.1 A copy of the completed report, the bibliography and other supporting documents or data shall be forwarded by the Technical Staff member to the applicable Safety Review Group for their use. Generally, the hard copy file will be maintained by the appropriate On-Site Safety Review Group for station events and the Off-Site Safety Review Group for other events.

5.8.2 The report is a QA Record and shall be forwarded by the Technical Staff for retention IAW NC.NA-AP.ZZ-0011(Q), Records Management Program.

6.0 DEFINITIONS (For Purpose of This Procedure)

6.1 Significant Event - Any event or condition determined by senior management to warrant investigation by a SERT. Includes all reactor trips and safety injections, as well as other concerns or problems that impact major systems important to safe operation of the plant. May also include conditions of concern such as adverse trends, performance problems, repetitive events, or unexpected conditions.

6.2 Significant Event Response Team (SERT) - A team of experienced personnel convened to independently investigate and report on events or situations of concern. The team is headed by a SERT Manager selected from a list of designated non-station managers. Team members are selected from a list of qualified individuals from the various technical disciplines.

6.3 Root Cause - The fundamental cause(s) that, if corrected, will prevent recurrence of an event or condition.

6.4 Contributing Causes - Causes that, if corrected, would not by themselves have prevented the event, but are important enough to be recognized as needing corrective action to improve the quality of the process or product.

6.5 Contributing Factor - A condition that may have affected the event.

6.6 Root Cause Analysis - Any method used to identify root cause(s) of problems or trends.

6.7 Corrective Action - Action taken to prevent recurrence of an identified adverse condition or trend. Includes Short and Long Term Corrective Action.

6.8 Short Corrective Term Action - Corrective action taken in the approximate time frame of the event to allow continued operation and development/implementation of effective long term corrective action.

6.9 Long Term Corrective Action - Corrective action taken in an extended period following the event to permanently prevent recurrence of the event.

7.0 **REFERENCES**

7.1 INPO Good Practice OE-907 (Preliminary May 1989), "Root Cause Analysis"

7.2 INPO Good Practice OP-211 (December 1988), "Post Trip Reviews"

7.3 US NRC Order Modifying License Nos. DPR-70 and DPR-73 (Salem Units 1 and 2). Enclosure to letter from D. G. Eisenhut to R. A. Uderitz,dated May 6, 1983

7.4 Cross - References

7.4.1 NC.NA-AP.ZZ-0006(Q), Incident Report/Reportable Event Program and Quality/Safety Concerns Reporting System

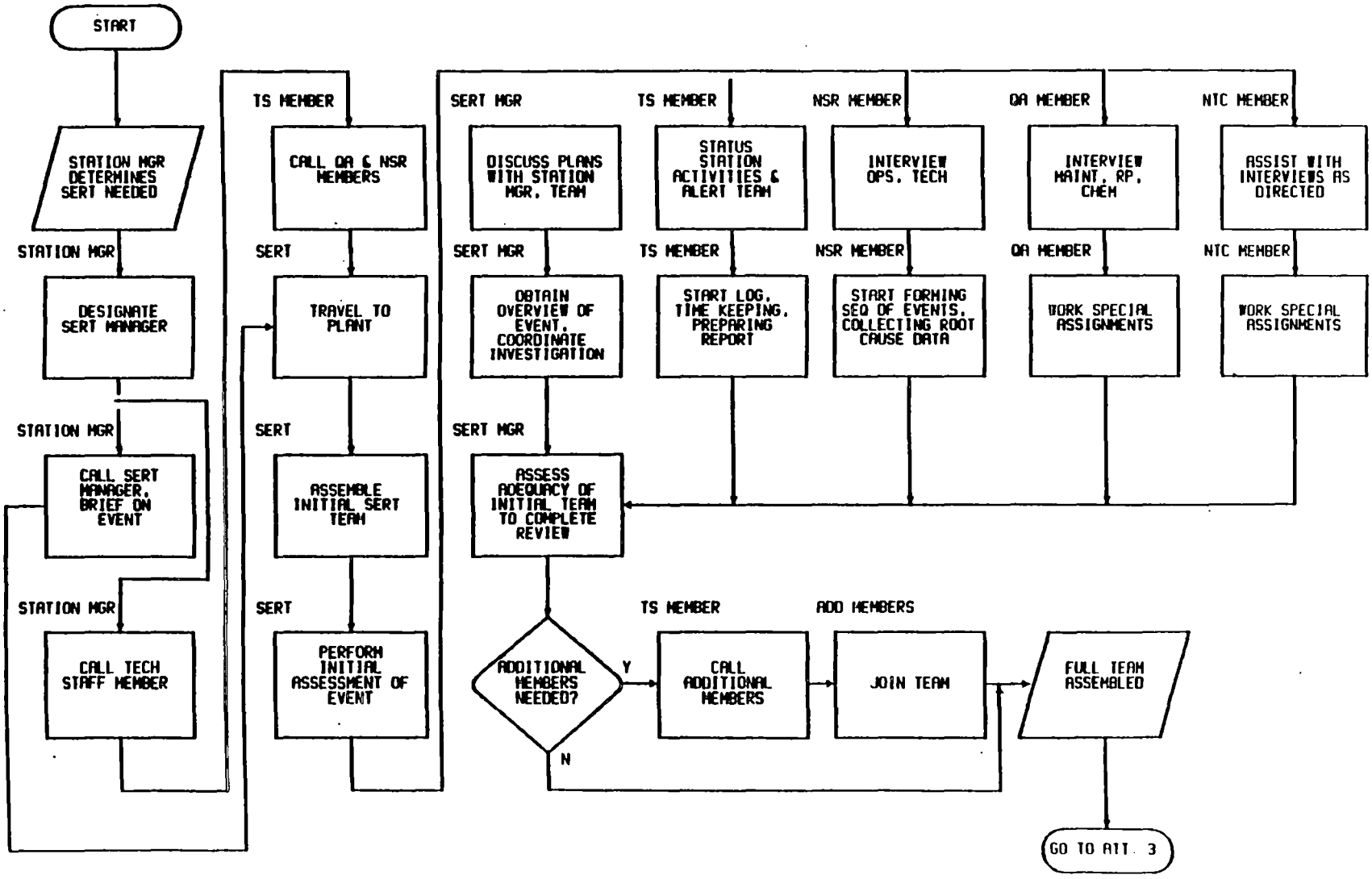
7.4.2 NC.NA-AP.ZZ-0008(Q), Control of Design and Configuration Change, Tests and Experiments.

7.4.3 NC.NA-AP.ZZ-0011(Q), Records Management Program

7.4.4 NC.NA-AP.ZZ-0057(Q), Action Tracking Program

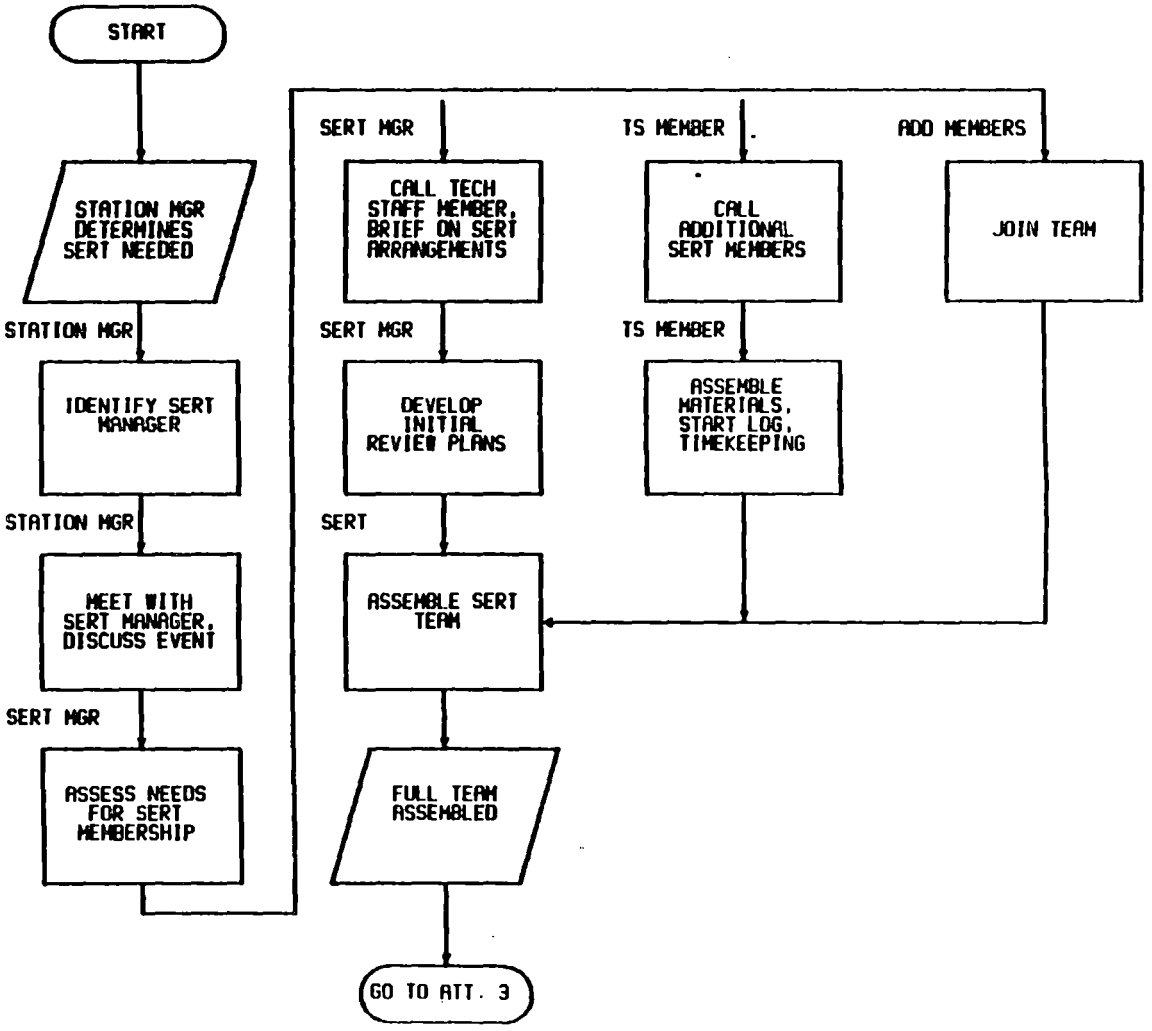
ATTACHMENT 1

FLOWCHART - IMMEDIATE RESPONSE EVENTS



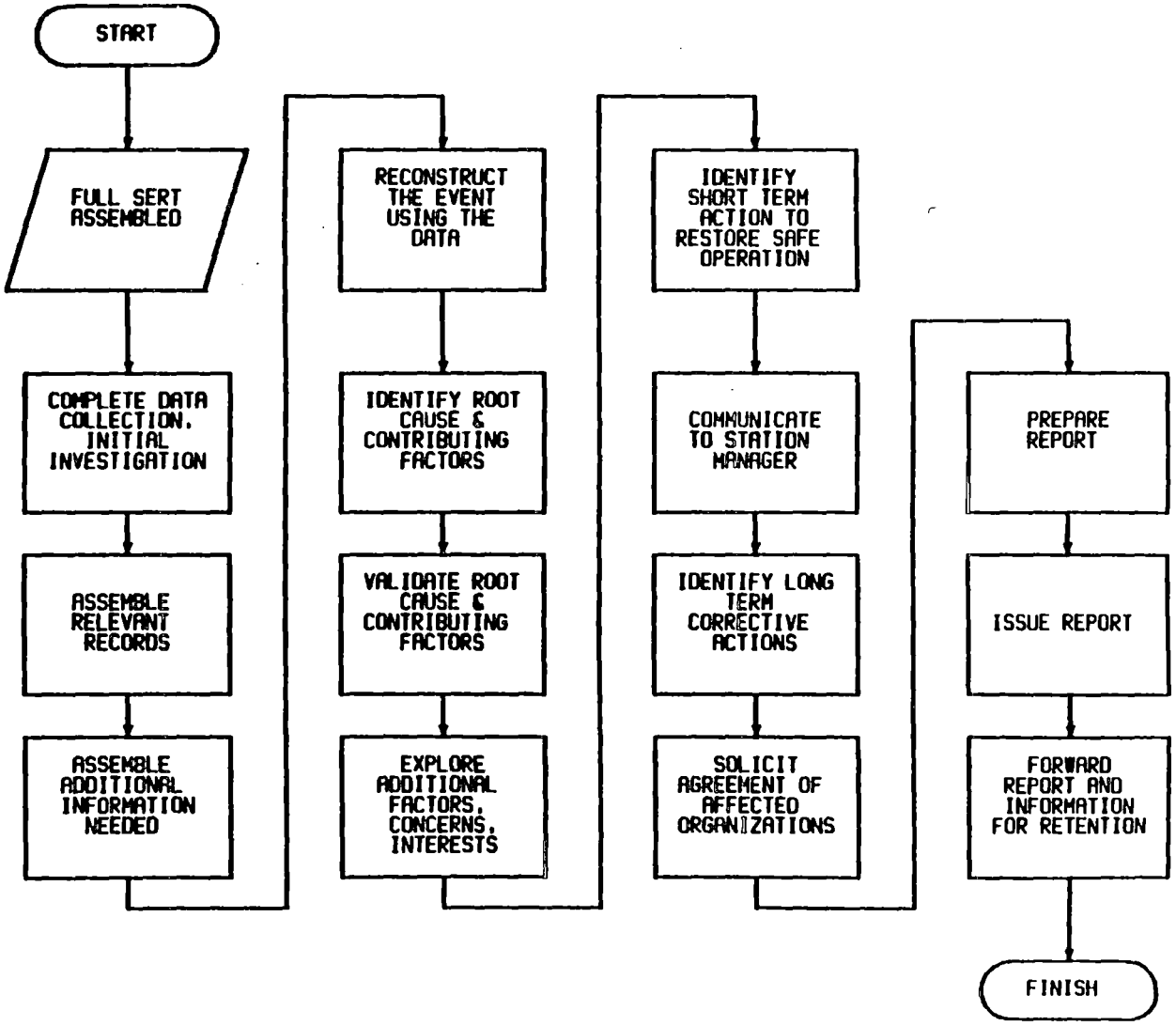
ATTACHMENT 2

FLOWCHART - EVENTS NOT REQUIRING IMMEDIATE RESPONSE



ATTACHMENT 3

FLOWCHART - ANALYSIS & REPORT PREPARATION



ATTACHMENT 4

DATA/INFORMATION TO BE CONSIDERED

- Control room charts and printouts
- Operating logs
- Related correspondence
- Inspection/surveillance records
- Maintenance records
- Meeting minutes
- Procedures and instructions
- Vendor manuals
- Drawings and specifications
- Equipment history records
- Design basis information
- FSAR/technical specifications
- Nuclear Plant Reliability Data System reports
- Trend charts and graphs
- Training lesson plans
- SRG reports
- LERs
- IRs

ATTACHMENT 5

CORRECTIVE ACTION GUIDELINES

In developing and implementing corrective actions, consideration of the following questions can help ensure adequacy:

- Do the corrective actions address all the root causes?
- Will the corrective actions cause detrimental effects?
- What are the consequences of implementing the corrective actions?
- What are the consequences of <u>not</u> implementing the corrective actions?
- What is the cost of implementing the corrective actions?
  - Capital costs?
  - O&M costs?
- Will training be required as part of the implementation?
- In what time frame can the corrective actions reasonably be implemented?
- What resources are required for successful development of the corrective actions?
- What resources are required for successful implementation and continued effectiveness of the corrective actions?
- What impact will the development and implementation of the corrective action have on other work groups?
  - Plant Engineering?
  - Quality Assurance?
  - Security?
  - Operations?
  - Drafting?
  - Materials Management?
  - Licensing?
  - Radwaste?
  - Work Control Center?
  - Safety Reviews?
  - Design Engineering?
  - Maintenance?
  - Health Physics?
  - Training?
  - Drawing Control?
  - Document Control?
  - Chemistry?
  - Computer Support?
  - Plant Modifications?
  - Configuration Management?
- Is the implementation of the corrective actions measurable?

  (For example, "Revise step 6.2 of the procedure to reflect the correct equipment location," is measurable; "Ensure the actions of procedure step 6.2 are performed correctly in the future," is not measurable.)

ATTACHMENT 6

SAMPLE SERT REPORT

August 31, 1989
HSR-89-079

To the General Manager- Hope Creek Operations

SCRAM ON LOW LEVEL OF AUGUST 30, 1989
SIGNIFICANT EVENT RESPONSE TEAM REPORT

At your request, a Significant Event Response Team was convened at 0600 on August 30, 1989 to investigate and report on the unplanned automatic scram which took place at Hope Creek earlier that day. The SERT team consisted of:

John P. Ronafalvy	E&PB	Manager
Dana E. Cooley	SRG	Member
Richard T. Griffith	QA	Member
Robert F. Briggs	QA	Member
James T. Ormond	Maintenance	Member
Gregory J. Ruane	E&PB	Member
Mitchell S. Dior	Technical	Member

We concluded our work at 1630 on August 31, 1989.

Our report is presented below:

EVENT CHRONOLOGY

The unit was operating steadily at approximately 81% power, limited by fuel content in a gradual coastdown to September 16, 1989, the start of a scheduled refueling outage. No control rod evolutions or surveillances were in progress. RCIC was out of service under an NRC-approved extended action statement, and Reactor Feed Pump "C" was cleared and tagged for maintenance. Service air compressor 10K107 was in service, with compressor 00K107 cleared and tagged for maintenance. A standby diesel compressor was available to augment service air.

Equipment operators were making normal rounds, including visits to the reactor building at 2040 and 2240 to add nitrogen to HCU accumulators (58-19 and 02-39). No unusual conditions were noted.

ATTACHMENT 6 (continued)

GM-Hope Creek Operations 2 8/31/89

0112 QEC

At ~~1110~~ the "Accumulator Trouble Alarm annunciated, followed by the rapid automatic insertion of control rods in the lower right hand quadrant of the full core display. As the insertion of control rods progressed to the left side of the display, the reactor then scrammed automatically on low level (-12.5 inches), with all rods inserted. The elapsed time was about 13 seconds. [CRIDS later showed that the interval between "CRD Accumulator Trouble" to CRD Pilot Air Header Pressure at 0 psig was about 23 seconds.]

As part of scram recovery, equipment operators were dispatched to the local feedwater level controllers in the turbine building. After the shift stabilized feedwater flow and reactor level, they attempted to reset the scram without success. Scram air header pressure was 20-30 psig, well below the operating pressure of 70 psig. The shift became concerned whether the MSIV's could remain open with the loss of header air pressure. Equipment operators were then sent to the reactor building to investigate the pressure loss. (time after event: 30 minutes).

They suspected failure of an authorized temporary repair to a 3" instrument air riser on Elevation 102.' Finding it intact, they proceeded to the HCU area. In the south bank the operators' attention was drawn by a hissing sound which led them to a failed 1/2" soldered connection above the scram valve pilot air valve on HCU 34-59.

They attempted to insert the tube back into its fitting, holding the joint in place with wire and tape. Later the shift electrician attempted a more permanent repair with solder, but was unsuccessful due to residual air line pressure. The SNSS halted further attempts at soldering. The tape and wire were replaced, and air header pressure increased sufficiently to allow scram reset.

Several significant designed plant features did not perform as intended:

- The startup level control valve (1-AE-HV1785) did not respond in automatic.
- Control rod 34-27 did not indicated fully inserted, although it was verified to be inserted.
- One channel of "Reactor Scram" (W, CRIDS point D2131) did not indicate on the printout, although it was verified to have occurred.

- Some or all of the main steam line seat drains did not open.
- Scram discharge volume outboard valves closed before inboard valves.

The Alarm Chronolog/Sequence of Events Record bears out this chronology. Within ten seconds after the scram the operators backed it up with a manual scram. Fifteen seconds after the scram the high SDV level scram logic actuated.

ROOT CAUSE AND ANALYSIS

The Significant Event Response Team concurs with the station's determination that the scram's initiating event was the near-instantaneous failure of a 1/2" soldered connection where the scram valve pilot air line from HCU 34-59 joined the 1-1/2" header interconnecting a bank of HCU's on the south side of Reactor Building Elevation 102.

The team concludes that the root cause of this failure was a combination of insufficient depth of insertion and undesirable joint alignment during original installation. There is evidence of excessive force having been used in the past on a nearby isolation valve with the potential to have transmitted weakend the already deficient joint. Activities of nearby painters cannot be directly linked to the break.

Our detailed analysis and ranking of root causes is as follows:

Insufficient Tubing insertion - Visual examination of the failed joint revealed that only about 1/4" out of a possible 1/2" insertion had been achieved during original construction. RANK: Highly probable as Root Cause and Potential Future Problem.

Poor Soldering Technique - Examination of the failed joint showed a uniformly wetted appearance, despite the limited engagement. RANK: Improbable.

Inadequate Bechtel Procedure- Procedure P107H-101-S1 dated December 28, 1973 and amended in April 1984 was reviewed and found to require correct solder and insertion for the given service. RANK: Eliminated.

ATTACHMENT 6 (continued)

GM - Hope Creek Operations | 4 | 8/31/89

Incorrect Solder Used - The AWS Soldering Manual, 2nd Ed., shows that metal-to-metal shear strengths for properly soldered joints should be about 5600 psi for 50% lead/50% tin soldered joints, as specified for this application. Use of a 90% lead/10% tin "household" solder, would yield about 2100 psi shear strength, adequate strength for the intended service. RANK: Eliminated.

Different Styles of Tee Fitting - It was determined that two styles of tee fitting had been used in the 185 soldered connections. Neither seemed to predominate, and both called for the same level of soldering skill. RANK: Eliminated

Shock and Vibration in Normal Service - A team member observed two half-scram demonstrations of HCU 34-59 and observed no movement of the subject tubing. In addition, inspection of the 1-1/2" line in the area of its supports for chafing and wear determined that vibration is not a concern. RANK: Eliminated.

Accidental Bumping by Nearby Work - Extensive painting has gone on in the immediate area for about a month. The entire HCU bank was enshrouded in scaffolding and plastic tarpaulins at the time of the event. Visual examination of the tubing revealed no marks other than a hand print on the 1-1/ 2" header. [Note: the 1/2" line is cantilevered from the tee fitting and unsupported in its 4-foot vertical drop to the HCU. It is behind two other steel hydraulic lines, relative to the nearest scaffolding, set in about 2 feet. Although it is difficult to get to, it is unsupported and susceptible to bumping.] RANK: Possible Contributing Cause and Potential Future Problem.

Isolation Valve Manipulation - Immediately upstream of each HCU's pilot air valve is a GE-supplied, plug type isolation valve. There is no installed handle, only a square stem. Many stems bore scars from prior manipulations and still had old strings and remnants from red tags. The team requested Operations to demonstrate the use of these valves. An EO, using a 1/2" box wrench was unable to turn two representative valves. The tubing was observed to deflect 1/4" inch at the elbow. Using more force would have caused undue deflection on the unsupported 4-ft riser, placing stress on the failed joint. RANK: Probable Contributing Cause and Potential Future Problem.

ATTACHMENT 6 (continued)

GM - Hope Creek Operations | 5 | 8/31/89

PSE&G Rework of Fitting - At SERT's request, Station Planning reviewed MMIS and its predecessor, FOCUS, and determined that PSE&G had never performed corrective maintenance on the subject HCU or any of its related fittings. RANK: Eliminated as Root Cause but Potential Future Problem.

Joint Cocked - This joint and several others appeared to have been made several degrees out of linear alignment. All such joints were included in the 20 selected for radiography. None were found to be internally misaligned. RANK: High Root Cause Probability, but low potential for future problems.

Operator Inattention/Error - Had the joint been leaking slightly before the failure, it would have been concealed among the racks of tubing above the HCU's. Any slight hissing would have been inaudible above the normal sound of the HCU's. The scram discharge air header pressure in the control room is tracked on a "quiescent" CRIDS screen and referred to regularly by the NCO's. The depressurization was too rapid to be corrected and the scram averted. RANK: Eliminated.

SAFETY SIGNIFICANCE

The instrument air system serves many plant systems which, although they fail safe upon loss of air, cumulatively affect nuclear safety. The principal incentive for assuring instrument air integrity and reliable supply is to avoid challenges to these fail-safe arrangements and to minimize unplanned shutdowns. Inability to "fail-safe" as a result of degraded air quality is the subject of Generic Letter 88-14, to which PSE&G responded earlier this year.

The irregular rod pattern which existed briefly during the early seconds of the event is being evaluated by Reactor Engineering and General Electric. It is possible that this pattern could have existed somewhat longer had low level not been reached and the reactor not scrammed until the SDV level rose.

TECHNICAL ASPECTS

Soldered joints exist in various other low pressure systems of the plant, and the potential for improperly made joints still exists there.

ATTACHMENT 6 (continued)

GM - Hope Creek Operations | 6 | 8/31/89

NEAR TERM RECOMMENDATIONS

These recommendations were developed by the team and include some activities which were intiated by the station:

Testing Prior to Restart -

a. Perform and interpret radiographic examinations on 20 selected 1/2" to 1-1/2" tee connections. Verify the above for complete insertion and proper utilization of installer's scribe marks.

b. If any deficiencies are found in the sampling, resolve them or radiographically examine all remaining tee fittings.

c. Leak check ("snoop") all 185 scram pilot air header risers at all four soldered connections (i.e. at the isolation valve, at the 90 degree elbow and at the tee).

d. "Pull" test all 185 tee joints to demonstrate the ability to withstand normal operating stresses.

LONG TERM RECOMMENDATIONS

Other Testing -

a. Continue the ongoing testing program for "large bore instrument air piping, which began prior to this event. Complete it prior to restart after the refueling outage.

b. Expand the above program to include smaller sizes of instrument air tubing (down to 1/2".). Complete this testing prior to restart after the refueling outage.

Procedure Changes -

a. Remove the word "recommended" from MD-SP.ZZ-001(Z), Step 5.2.3. Provide required minimum insertion depths.

b. Revise Step 5.2.5 to improve and standardize all future scribing of soldered joints.

ATTACHMENT 6 (continued)

GM - Hope Creek Operations | 7 | 8/31/89

Operational Changes-

a. Ensure, by administrative controls, that excessive force is never used to manipulate the scram valve pilot air header isolation valves on the HCU's.

b. Develop instructions for Operations and/or Maintenance on how to free and lubricate a stuck HCU scram valve pilot air header isolation valve.

c. Inform GE and the industry of our operating experience with these valves. Search for existing operating experience on these valves.

d. Develop a preventive maintenance program to ensure ease of operability of these valves OR consider replacing these valves with a design resistant to drying and airborne impurities, depending on cost-benefit.

f. Assure that Maintenance procedures address supporting the cantilevered 1/2" line in the event the HCU and/or its air valve require removal.

g. Publicize to plant personnel the need for care when working around soldered or brazed connections.

The members of the Significant Event Response Team appreciate the opportunity to assist Hope Creek by performing this root cause analysis. The team was in operation for two days as mentioned above and involved approximately 95 work hours.

We remain available to answer any questions you may have.

JPR/DEC

J. P. Ronafalvy
SERT Manager

DEC:srg

ATTACHMENT 2
SERT MEMBERSHIP

The SERT consisted of the following personnel:

SERT MANAGER

Craig Lambert	Manager - Nuclear Engineering and Project Services

SERT MEMBERS

Dan Eskesen	Salem - Operations
Lou Miceli	Salem - Technical
Ken Moore	Salem - Onsite Safety Review
Scott Ward	Salem - Station Quality Assurance
Mike Reese	Nuclear Training Center
Wayne Choromanski	Reliability and Assessment
Lyle Mayer	Nuclear Electrical Engineering
Dennis Connell	Salem - General Manager's Staff