February 13, 1996

Mr. Leon R. Eliason
Chief Nuclear Officer & President
Nuclear Business Unit
Public Service Electric and Gas Company
P. O. Box 236
Hancocks Bridge, New Jersey 08038

SUBJECT: CLOSURE OF ITEMS 2 AND 3 OF SALEM CONFIRMATORY ACTION LETTER 1-95-009

Dear Mr. Eliason:

This letter refers to items 2 and 3 of Confirmatory Action Letter (CAL) 1-95-009, dated June 9, 1995, in which you committed to perform a special review of the long-standing Salem issues and meet with NRC representatives to communicate and gain NRC agreement on the scope and comprehensiveness of your plan to support Salem restart. In your letter, dated November 24, 1995, you submitted to the NRC the results of your review of long-standing equipment reliability and operability issues, including corrective maintenance and operator work-arounds, and the effectiveness and quality of your past management oversight and review.

A meeting between the NRC and Public Service Electric and Gas (PSE&G) was held on December 11, 1995 in which you presented the results of your review and the corrective actions you plan to implement to ensure that Salem will be operated in a safe and reliable manner. The enclosures to this letter are a list of the principle attendees and a copy of the slides presented during that meeting. The NRC sought and acquired information from the states of New Jersey and Delaware relative to their concerns about the performance of the Salem units, as well as, concerns about your restart plan. Additionally, on December 18, 1995, the NRC conducted a meeting with interested members of the public to receive their comments and concerns. Collectively, these interactions provided the NRC valuable insight into your restart plan and the concerns of these external parties.

In two recent internal meetings on January 3 & 31, 1996, the NRC Salem Assessment Panel critically reviewed your restart plan to determine whether your recent activities satisfied items 2 and 3 of the Salem CAL (1-95-009). During our review, we considered: 1) the scope and depth of your overall restart plan; 2) assessment panel member reviews of your individual restart plans; 3) independent NRC inspections of your system readiness review process; 4) previous assessment panel deliberations and interactions with your staff, the state and the public; 5) the information you provided in the December 11 meeting; 6) improvements in recent safety review activities (Station Operations Review Committee and Corrective Action Review Board); and 7) the new management team you put in place with a demonstrated strong commitment to safety. Although we were generally satisfied that your plan satisfied CAL items 2 & 3, we noted that your plan did not specifically address recent weaknesses in Emergency Preparedness. We also noted that your performance

indicators are still under development, including those you will use to evaluate your overall readiness for plant restart after the completion of this extended outage. We were informed on January 4, 1996 by Clay Warren, General Manager- Salem Operations, that you intend to address these items and that you will be updating your overall plan from time to time. Based on the above, we have concluded that your overall restart plan, if implemented effectively, should adequately address the numerous Salem issues to support a safe plant restart. Thus, items 2 & 3 of the CAL have been satisfied.

We will continue to pursue the aforementioned items and other issues through our planned inspection activities. The assessment panel derived an initial list of items to be inspected from NRC Manual Chapter 0350. These items will be communicated to you in the near future.

At the conclusion of this extended outage, in accordance with the Confirmatory Action Letter, we will conduct a public meeting with you to discuss your operational readiness assessment for each unit. Additionally, we intend to conduct a Readiness Assessment Team Inspection (RATI), just prior to restart, to independently confirm that your actions have resulted in the necessary performance improvements to support safe plant restart. When you are satisfied in all respects that the facility is ready to restart, we request that you certify that in writing to the NRC Regional Administrator.

In summary, the NRC has found that commitments 2 and 3 of the subject CAL have been satisfied. In accordance with 10 CFR 2.790, a copy of this letter will be placed in the NRC Public Document Room. Closure of other CAL items will be addressed by separate correspondence.

Thank you for your cooperation.

ORIGINAL SIGNED BY:
Richard W. Cooper, II, Director
Division of Reactor Projects

Docket Nos. 50-272; 50-311

Enclosures:
1. Meeting Attendee List
2. Meeting Slides

cc w/encl:
L. Storz, Senior Vice President - Nuclear Operations
E. Simpson, Senior Vice President - Nuclear Engineering
E. Salowitz, Director - Nuclear Business Support
C. Schaefer, External Operations - Nuclear, Delmarva Power & Light Co.
C. Warren, General Manager - Salem Operations
M. Reddemann, General Manager - Hope Creek Operations
J. Benjamin, Director - Quality Assurance & Nuclear Safety Review
D. Powell, Manager, Licensing and Regulation
R. Kankus, Joint Owner Affairs
A. Tapert, Program Administrator
R. Fryling, Jr., Esquire
M. Wetterhahn, Esquire
P. MacFarland Goelz, Manager, Joint Generation
Atlantic Electric
Consumer Advocate, Office of Consumer Advocate
William Conklin, Public Safety Consultant, Lower Alloways Creek Township
Public Service Commission of Maryland
State of New Jersey
State of Delaware

Distribution w/encl:
Region I Docket Room (with concurrences)
Kay Gallagher, DRP
Nuclear Safety Information Center (NSIC)
D. Screnci, PAO
NRC Resident Inspector
PUBLIC

Distribution w/encl: (Via E-Mail)
L. Olshan, NRR
W. Dean, OEDO
J. Stolz, PDI-2, NRR
M. Callahan, OCA
Inspection Program Branch, NRR (IPAS)

DOCUMENT NAME: cal_item.2&3 (Salem)
To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	RI:DRP	E	NRR:PDI-2	N	RI:DRP		RI:RA	
NAME	SBarber		JStolz		RCooper		TMartin	
DATE	1/31/96		2/ /96		2/ /96		2/13/96	

OFFICIAL RECORD COPY

ENCLOSURE 1

NRC/PSE&G MEETING
DECEMBER 11, 1995 - 10:00 AM
LIST OF PRINCIPLE ATTENDEES

PSE&G SENIOR MANAGEMENT AND PRESENTERS

Jim Ferland	Chairman of the Board & CEO
Leon Eliason	President - Nuclear Business Unit & Chief Nuclear Officer
Louis Storz	Senior vice President - Nuclear Operations
Elbert Simpson	Senior Vice President - Nuclear Engineering
Clay Warren	General Manager - Salem Operations
Eric Salowitz	Director - Nuclear Support
Jeffrey Benjamin	Director - QA & Nuclear Safety Review
Jay Doering	NRB Member
Michael Rencheck	Technical Manager - Salem
Mark Reddemann	General Manager - Hope Creek Operations
Jerry McMahon	Director - Nuclear Training Center
Dave Garchow	Director - System Engineering
Chuck Johnson	Director - Nuclear HR & Administrative Services
Chris Bakken	Manager - Salem Operations
Jay Laughlin	Manager - Salem Maintenance
David Powell	Manager - Nuclear Licensing & Regulation

NRC

Tim Martin	Regional Administrator - Region I
William Dean	Regional Coordinator, OEDO, HQ
Eugene Kelly	Chief, Plant Systems Section, DRS, Region I (SAP Member)
John Stolz	Director, Projects Directorate I-2, NRR (HQ SAP Vice Chair)
Leonard Olshan	Licensing Project Manager, Salem, HQ (SAP Member)
Larry Nicholson	Chief, Projects Branch 3, DRP, Region I (SAP Chair)
Scott Barber	Project Engineer, Projects Branch 3, Region I (SAP Member)
Charles Marschall	Senior Resident Inspector, Salem, Region I (SAP Member)
Roy Zimmerman	Associate Director for Projects, HQ
Victor McCree	Regional Operations Staff Chief, OEDO, NRR
Richard Cooper	Director, Division of Reactor Projects, Region I
James Wiggins	Director, Division of Reactor Safety, Region I
Joseph Schoppy	Resident Inspector, Salem, Region I
Todd Fish	Resident Inspector, Salem, Region I

ENCLOSURE 2

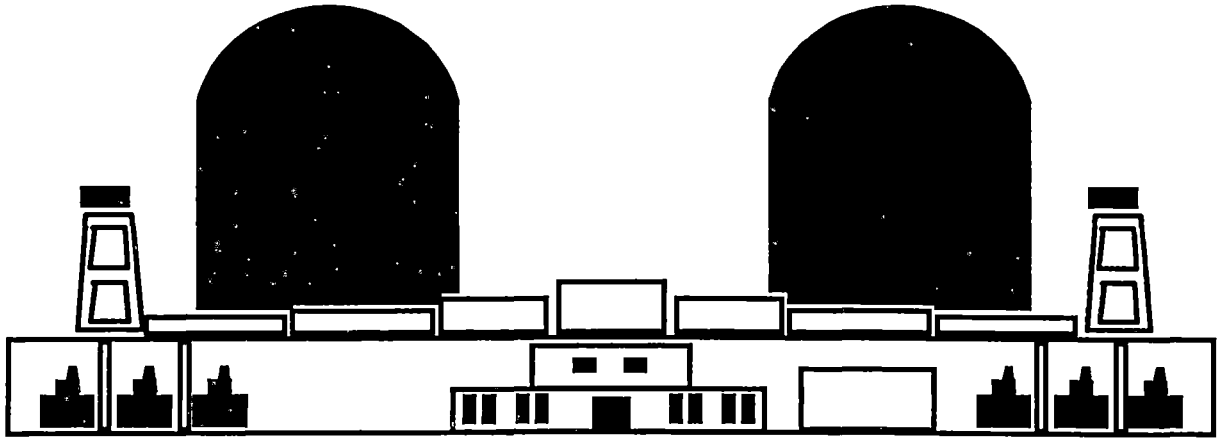
PSE&G

Public Service Electric and Gas Company

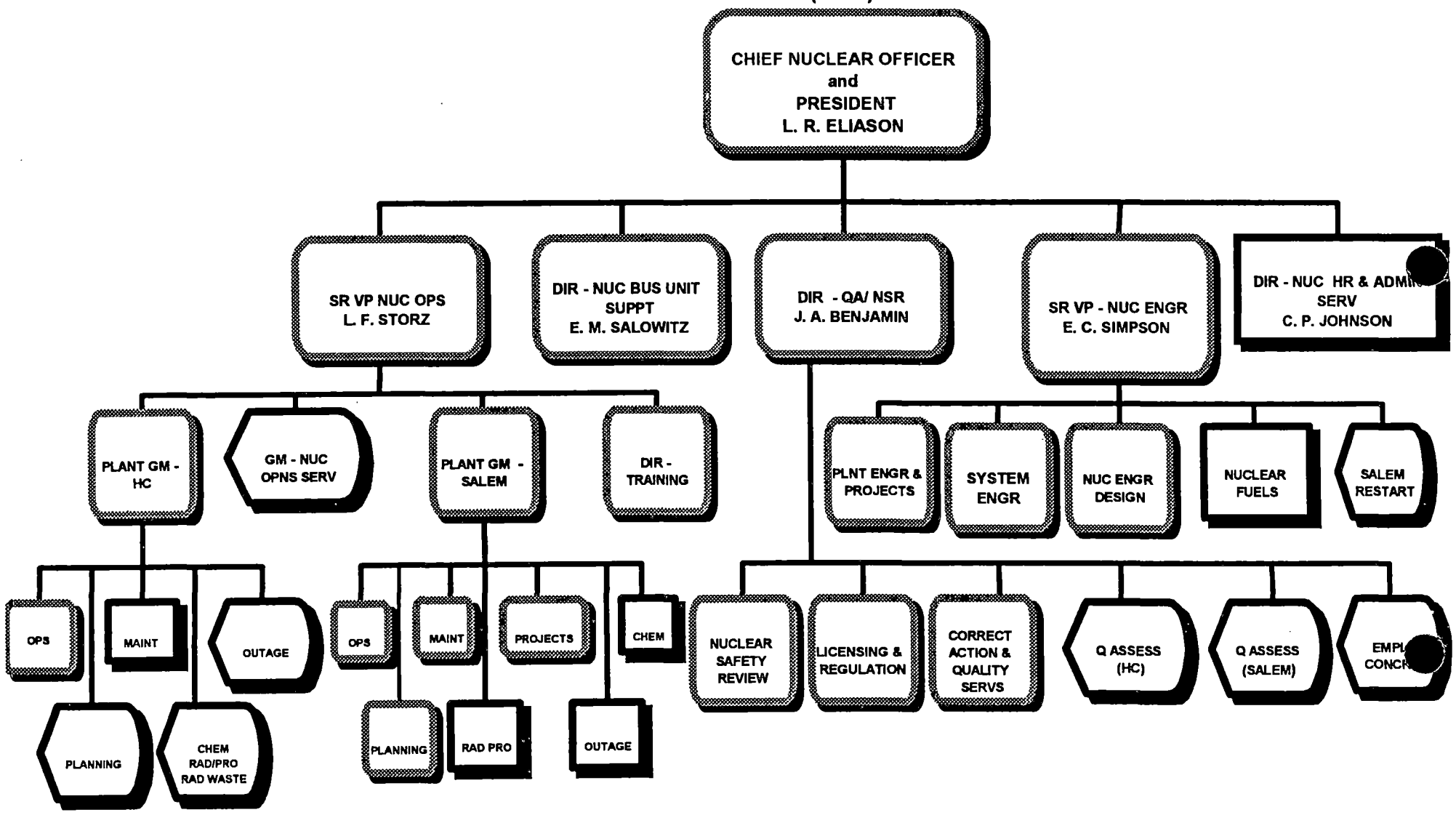
NUCLEAR BUSINESS UNIT
SALEM RESTART MEETING

December 11, 1995

SALEM
GENERATING STATION



NUCLEAR BUSINESS UNIT (NBU)



Denotes new employee - external hires

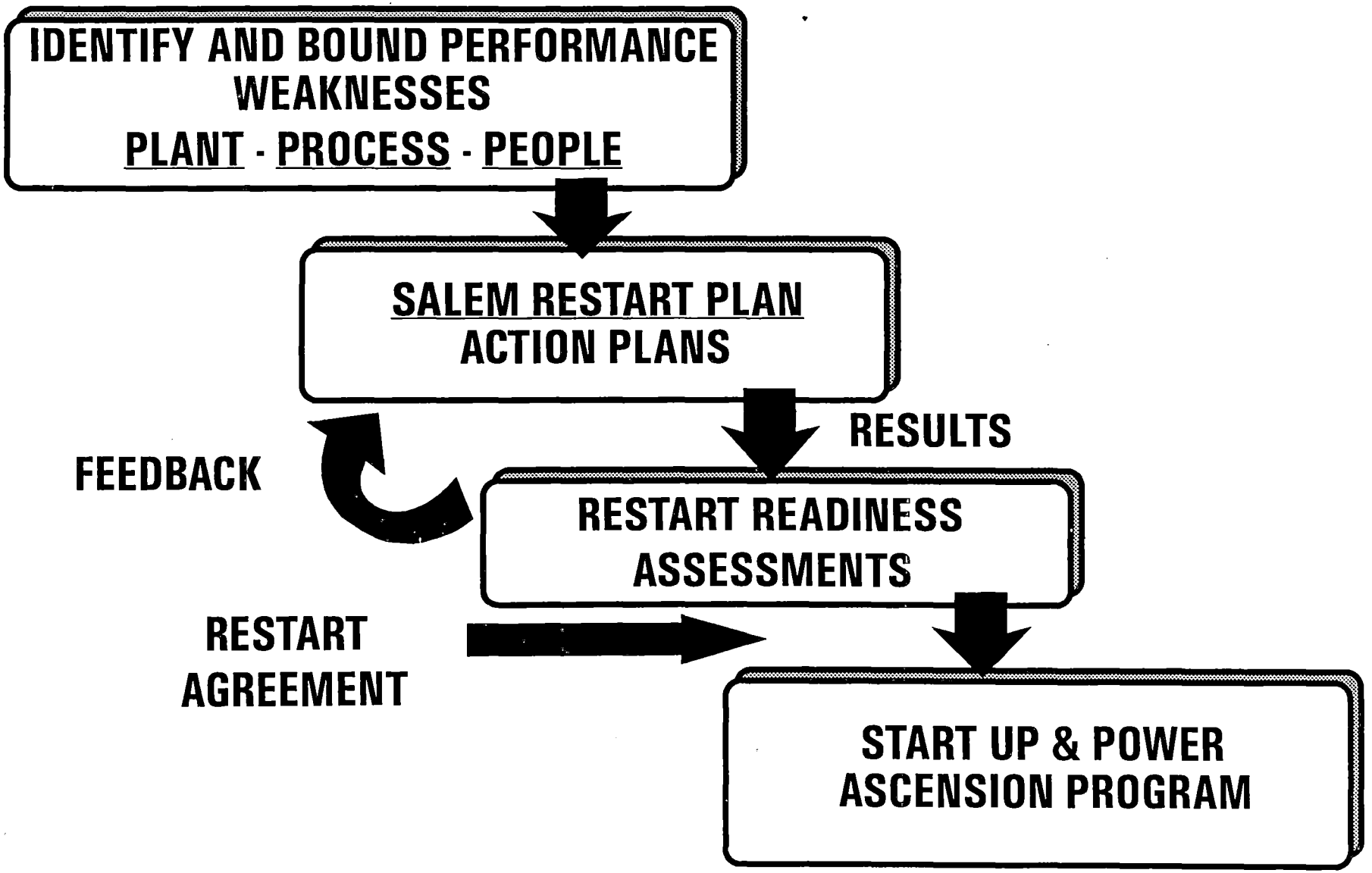
Denotes new responsibilities - internal hires

Denotes no change

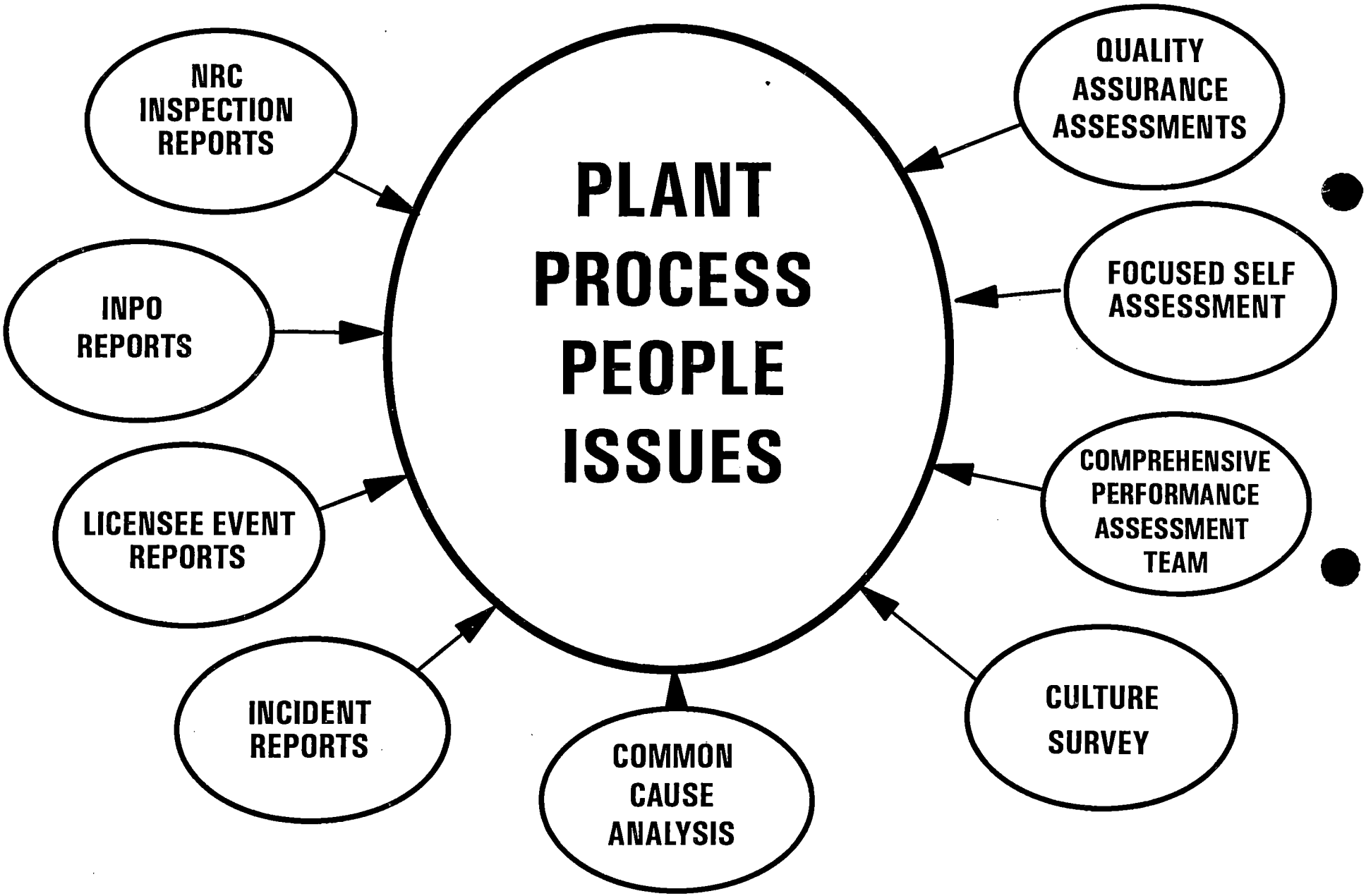
SALEM RESTART PLAN

• PROCESS OVERVIEW	CLAY WARREN
• CULTURAL CHANGES - HUMAN PERFORMANCE, SELF-ASSESSMENT & CORRECTIVE ACTION	CLAY WARREN
• OPERATIONS	CHRIS BAKKEN
• SYSTEM & EQUIPMENT RELIABILITY	MIKE RENCHECK
• MAINTENANCE / WORK CONTROL	JAY LAUGHLIN
• ENGINEERING	DAVE GARCHOW
• TRAINING	JERRY McMAHON
• READINESS FOR RESTART	CLAY WARREN
• KEYS FOR SUCCESS	LOU STORZ

Salem Restart Plan
PROCESS OVERVIEW



Salem Restart Plan
DEVELOPMENT OF COMMON CAUSE



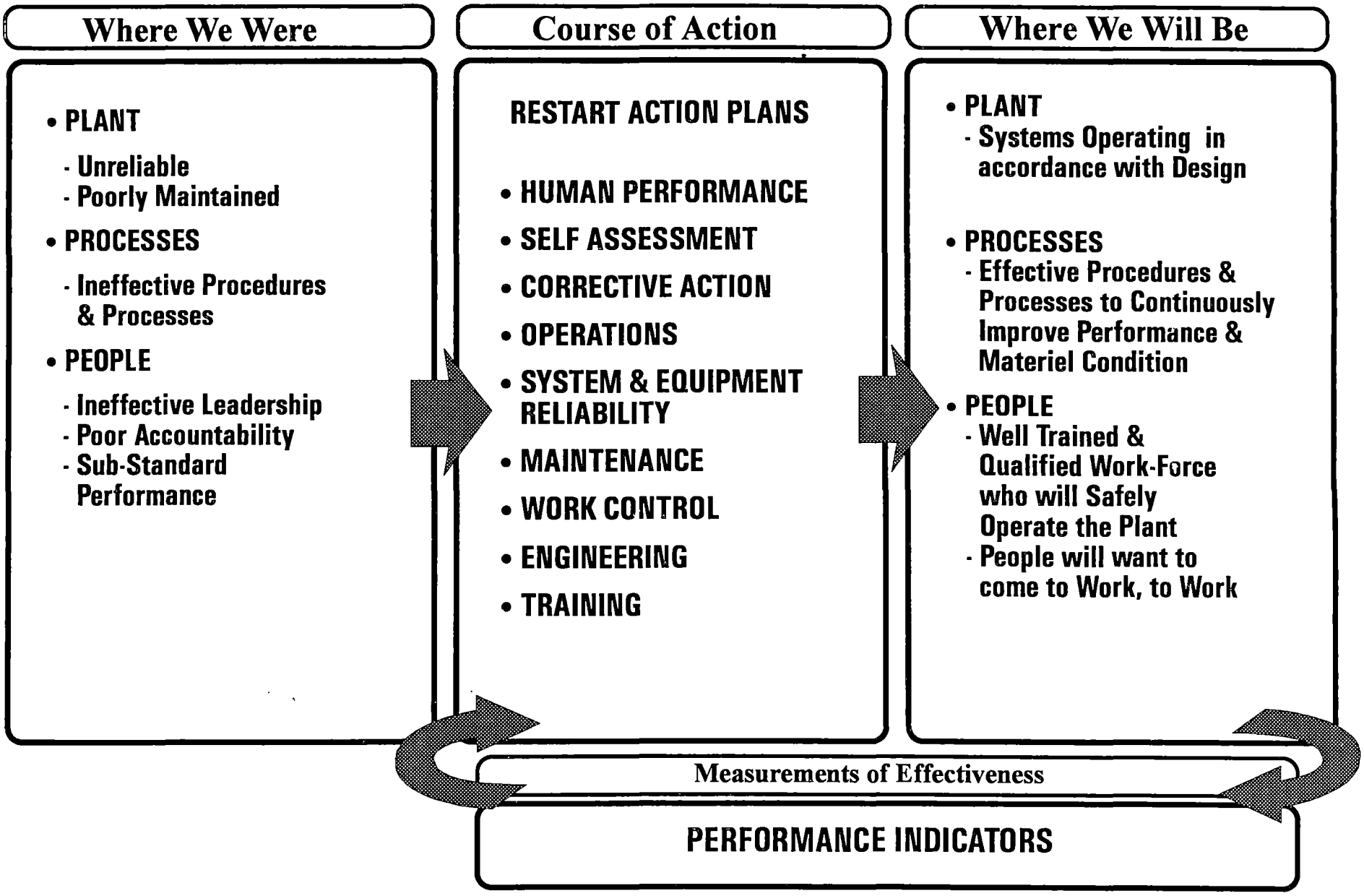
Salem Restart Plan

COMMON CAUSAL FACTOR AREAS

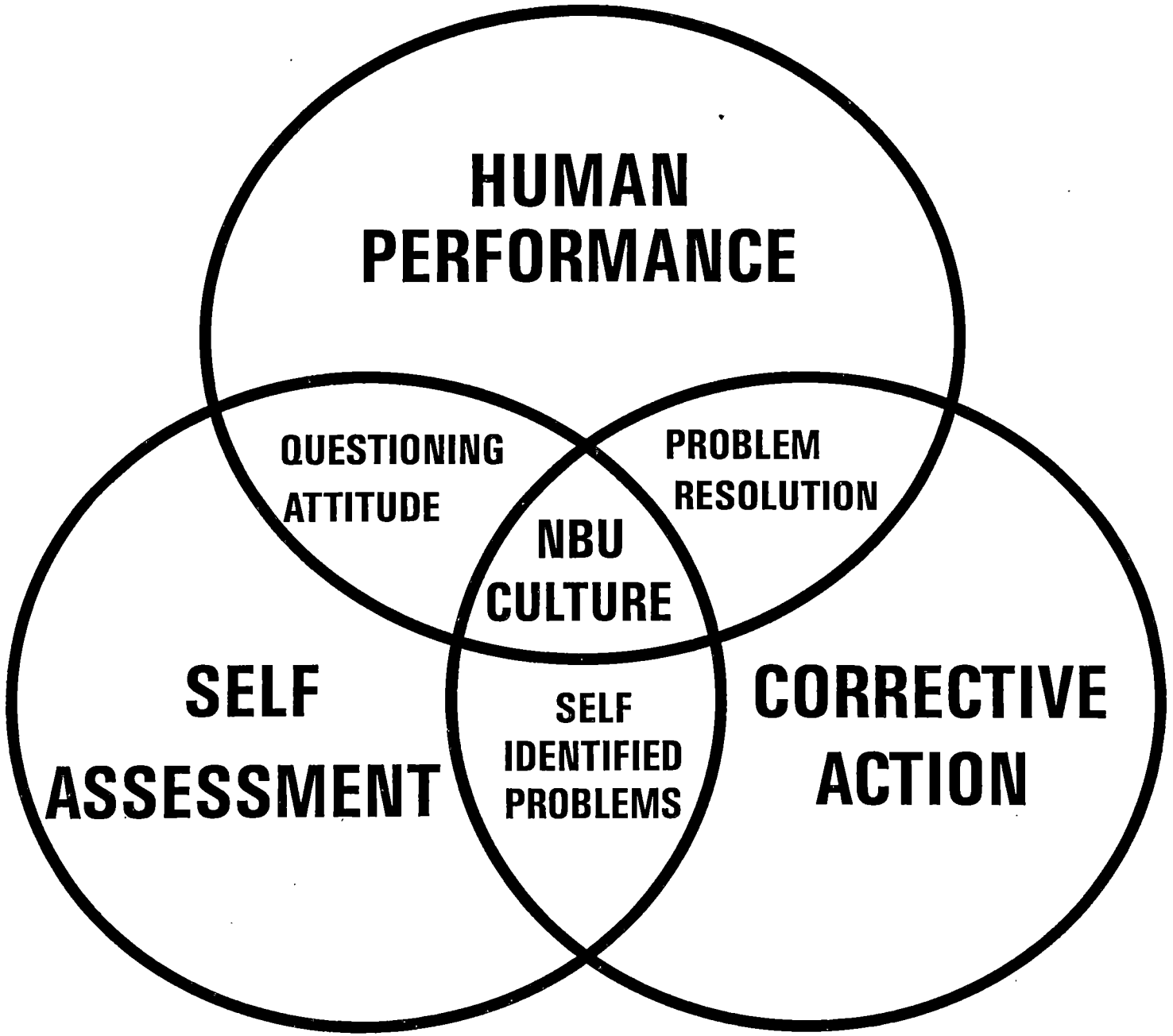
- Operations Focus of Organization
- Equipment Performance Standards
- Work Control Process
- Conservative Decision Making and Safety Perspective
- Root Cause Analysis and Corrective Action Effectiveness
- Self Assessment Process
- Roles, Responsibilities and Accountability
- Work Standards
- Monitoring and Enforcement of Performance Expectations
- Communications and Coordination (Vertical and Horizontal)
- Training and Qualifications
- Staffing and Work Loads

Salem Restart Plan

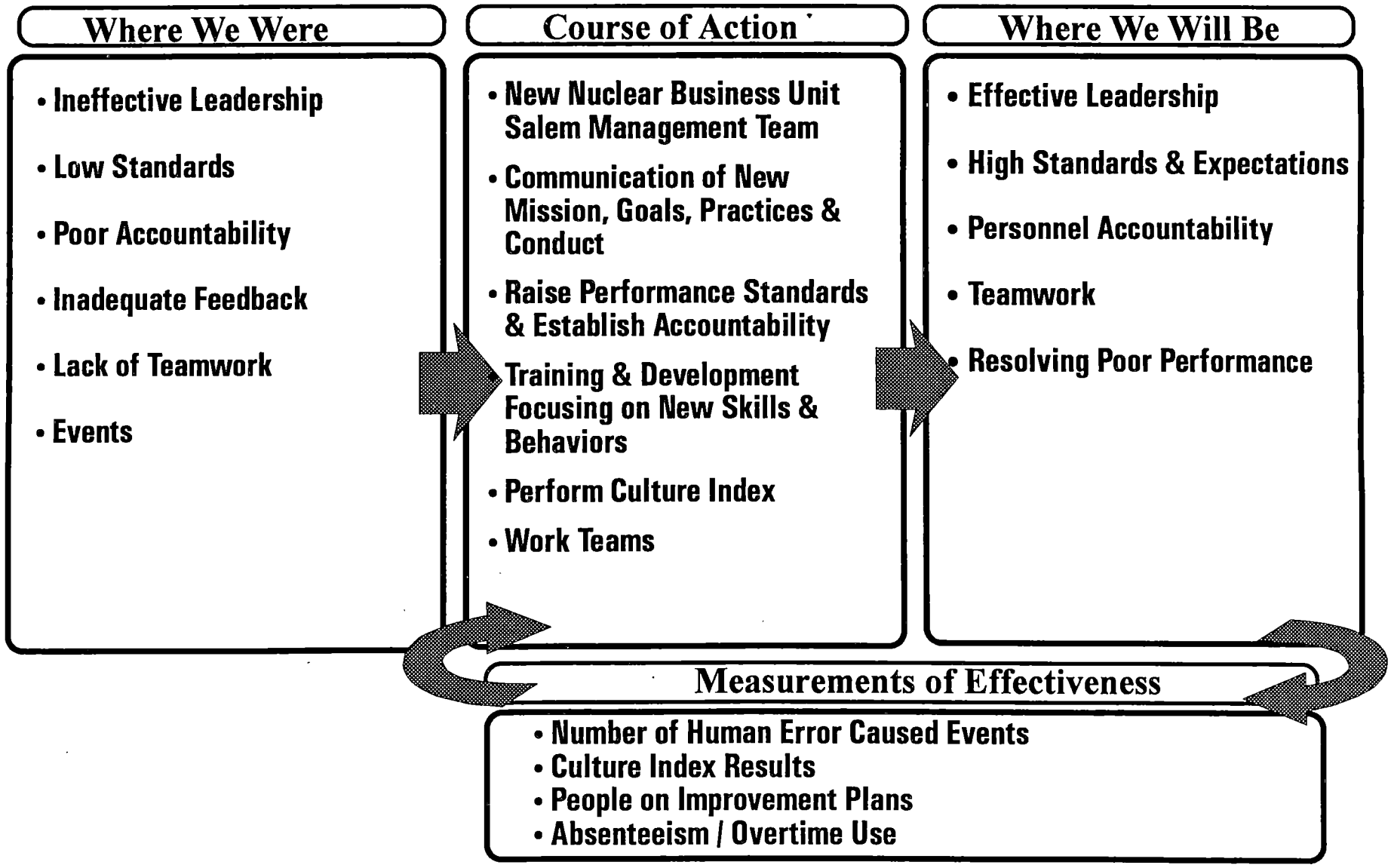
Overview of Implementation Process



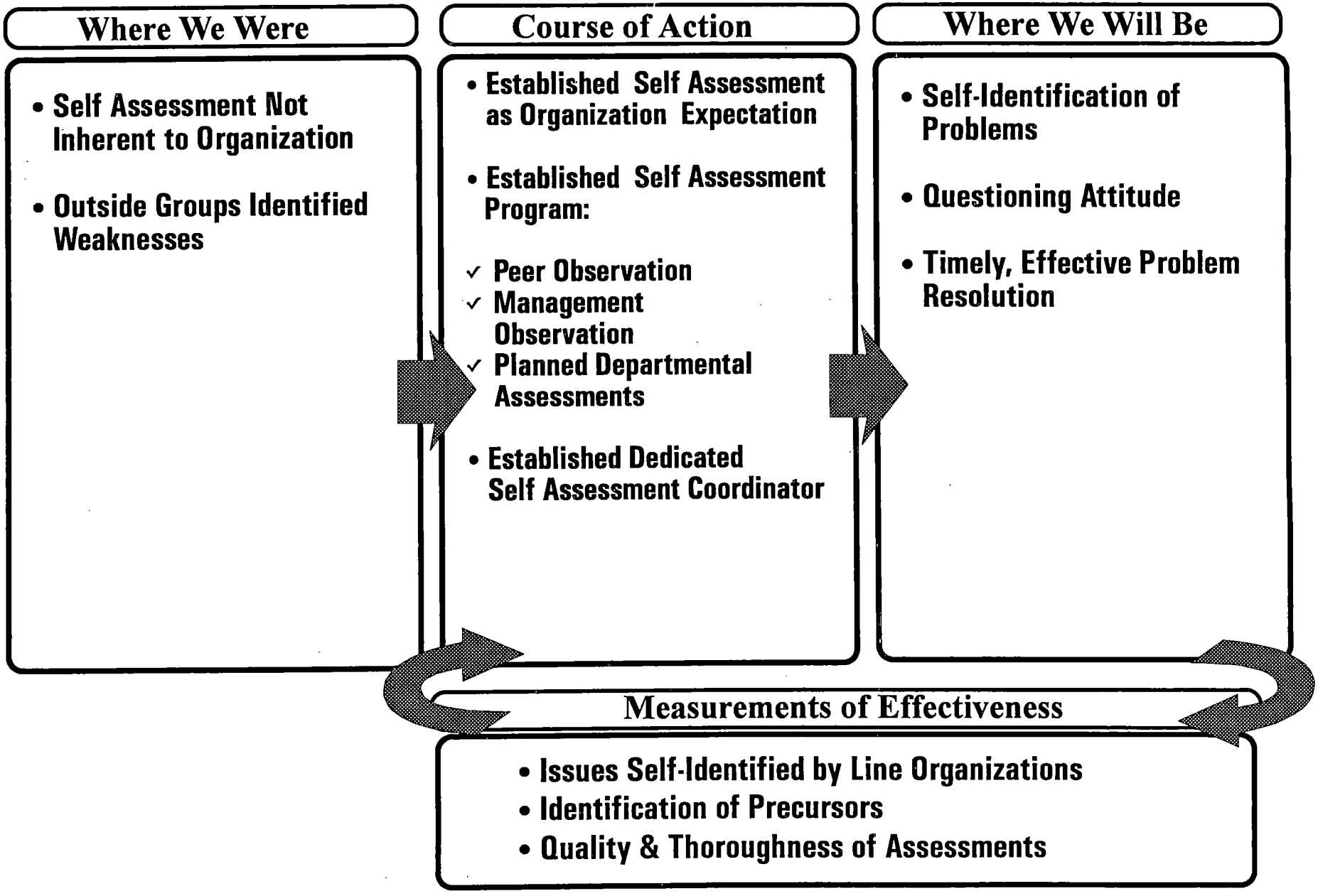
CULTURAL CHANGES - YOU ARE THE DIFFERENCE



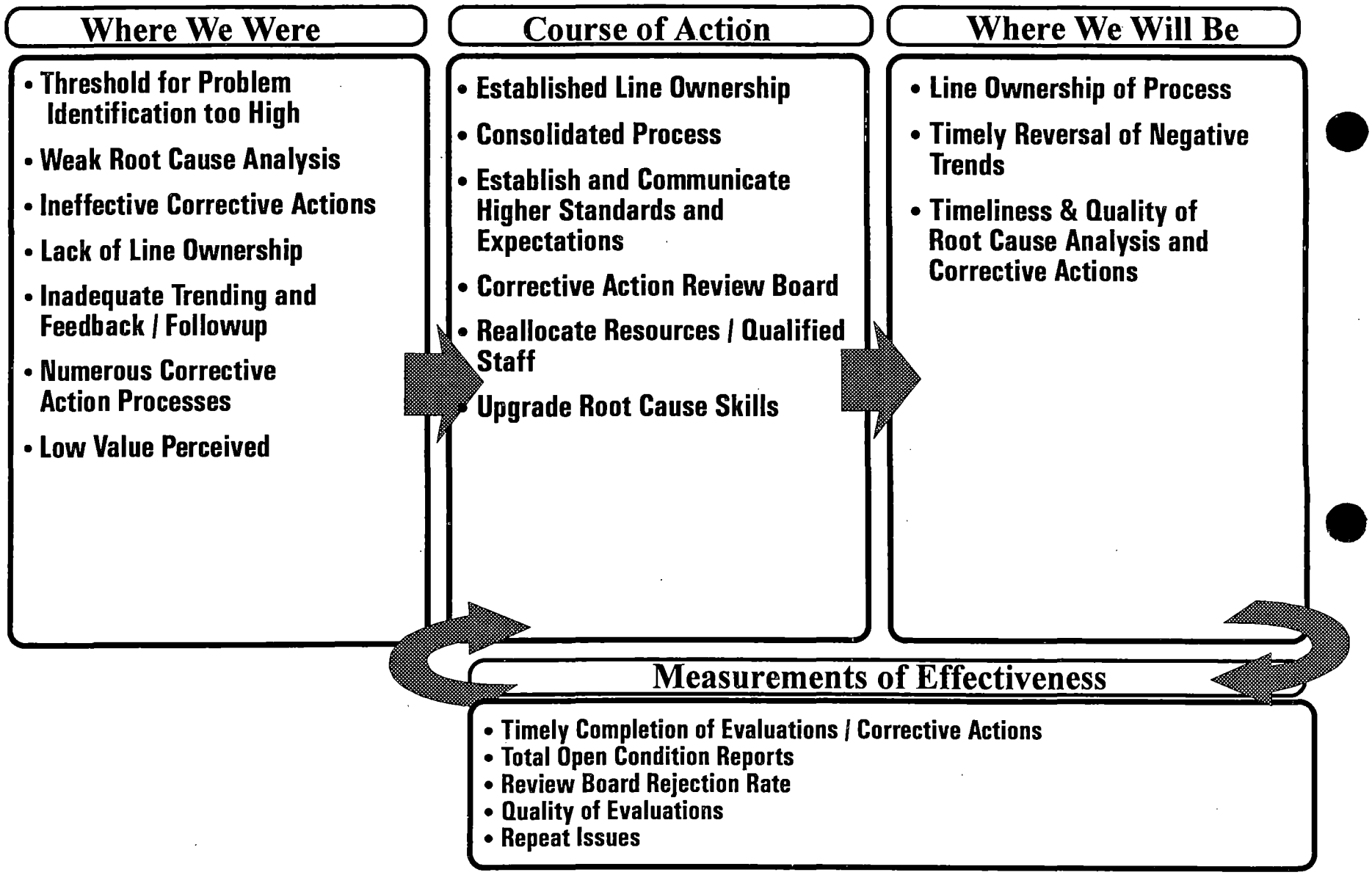
Salem Restart Plan
Human Performance



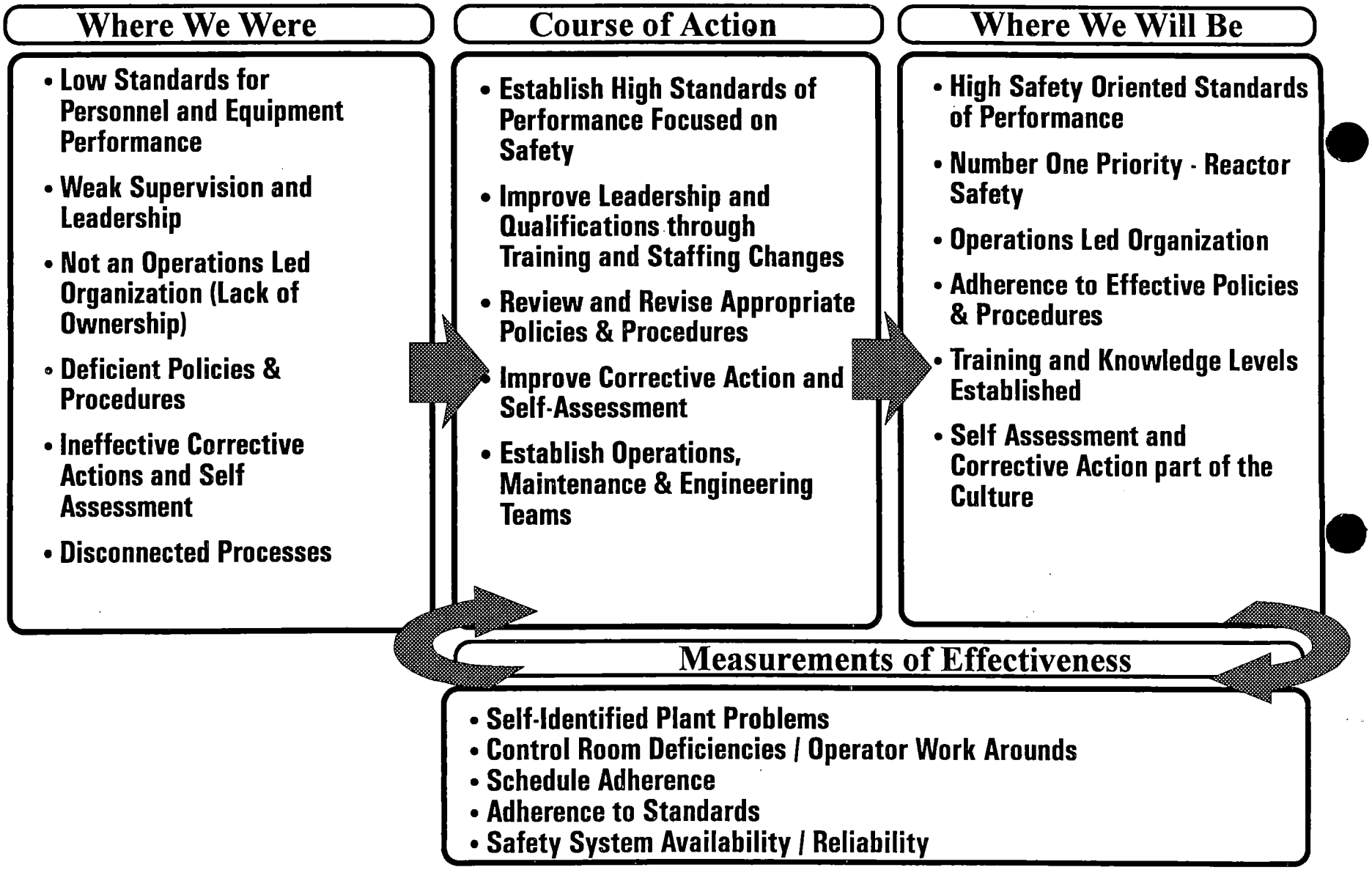
Salem Restart Plan
Self Assessment



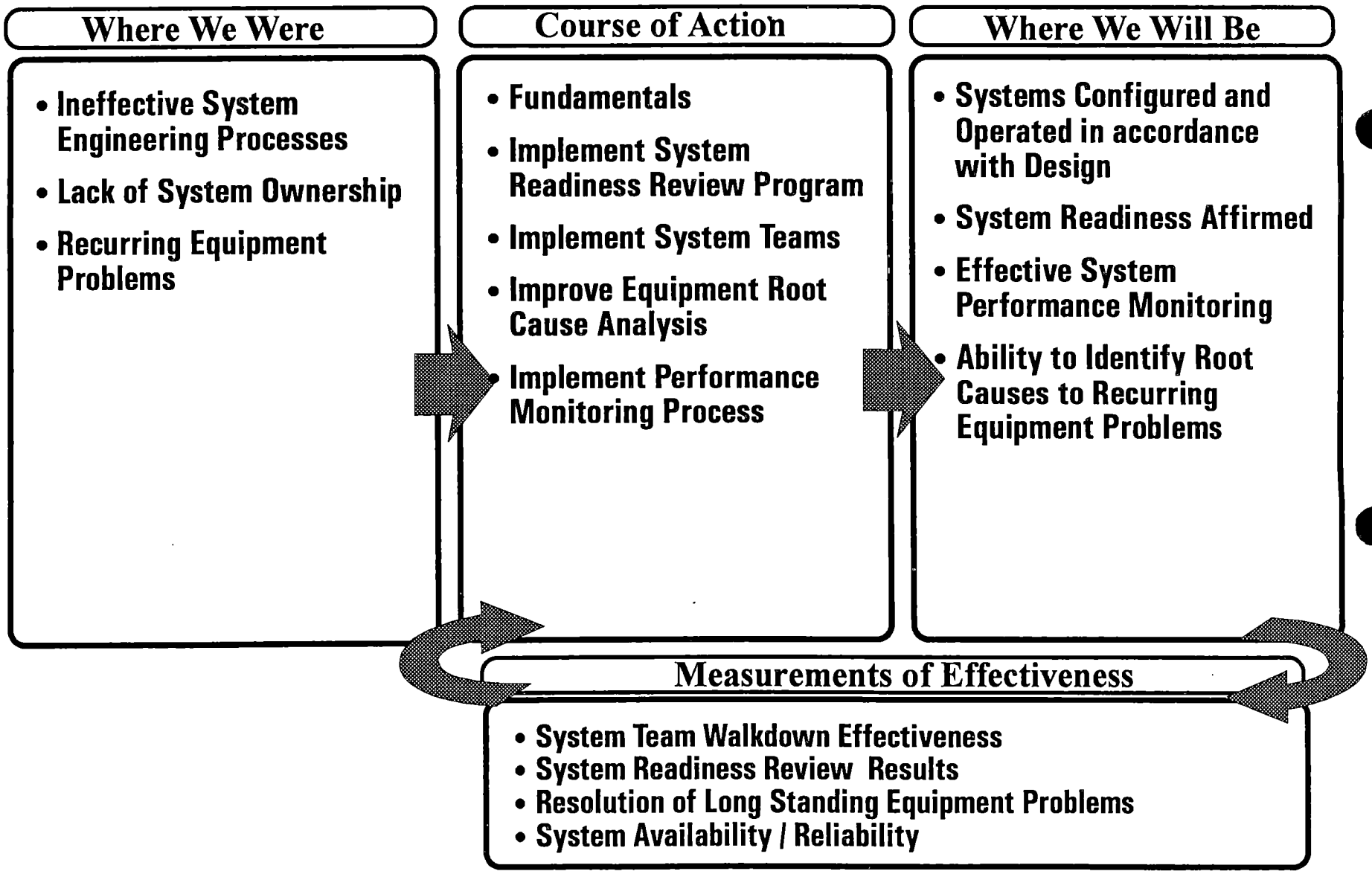
Salem Restart Plan
Corrective Action



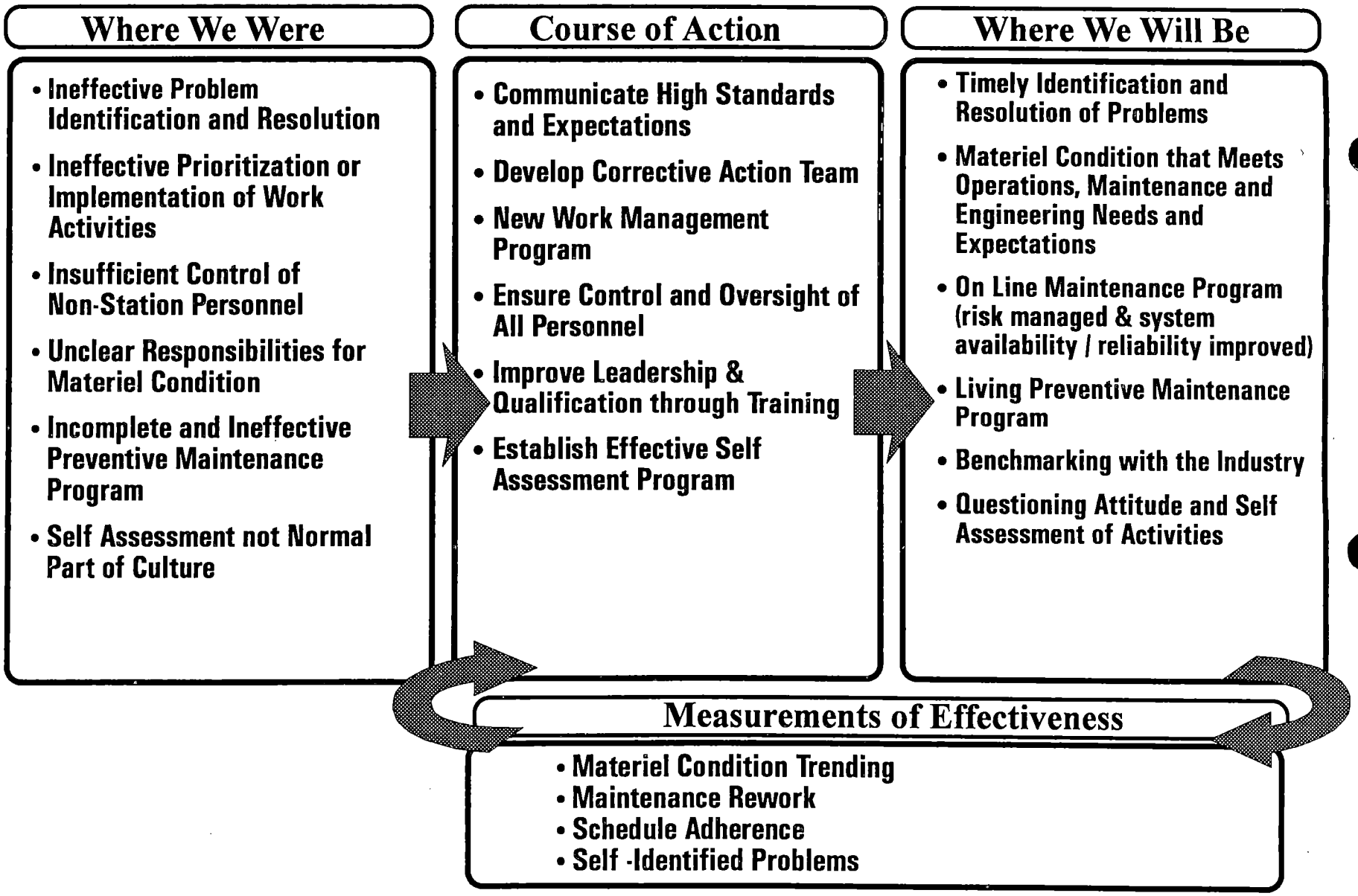
Salem Restart Plan
Operations



Salem Restart Plan
System & Equipment Reliability



Salem Restart Plan
Maintenance / Work Control



Salem Restart Plan
Engineering

Where We Were

- Expectations, Roles & Responsibilities Not Clearly Defined
- Issues Not Proactively Identified, Prioritized & Resolved
- Programs / Procedures Weaknesses
- Issues Backlogged
- Inadequate Safety Culture & Continuous Improvement
- Mixed Engineering Quality
- Weak Self Assessments & Training

Course of Action

- Communicate Expectations, Roles & Responsibilities
- Implement System Readiness & Configuration Reviews
- Prioritize Design Changes & Improve Quality
- Implement Improved Programs / Procedures
- Characterize & Reduce Backlog
- Strengthen Self Assessment Process
- Measure / Enhance Staff Technical Abilities

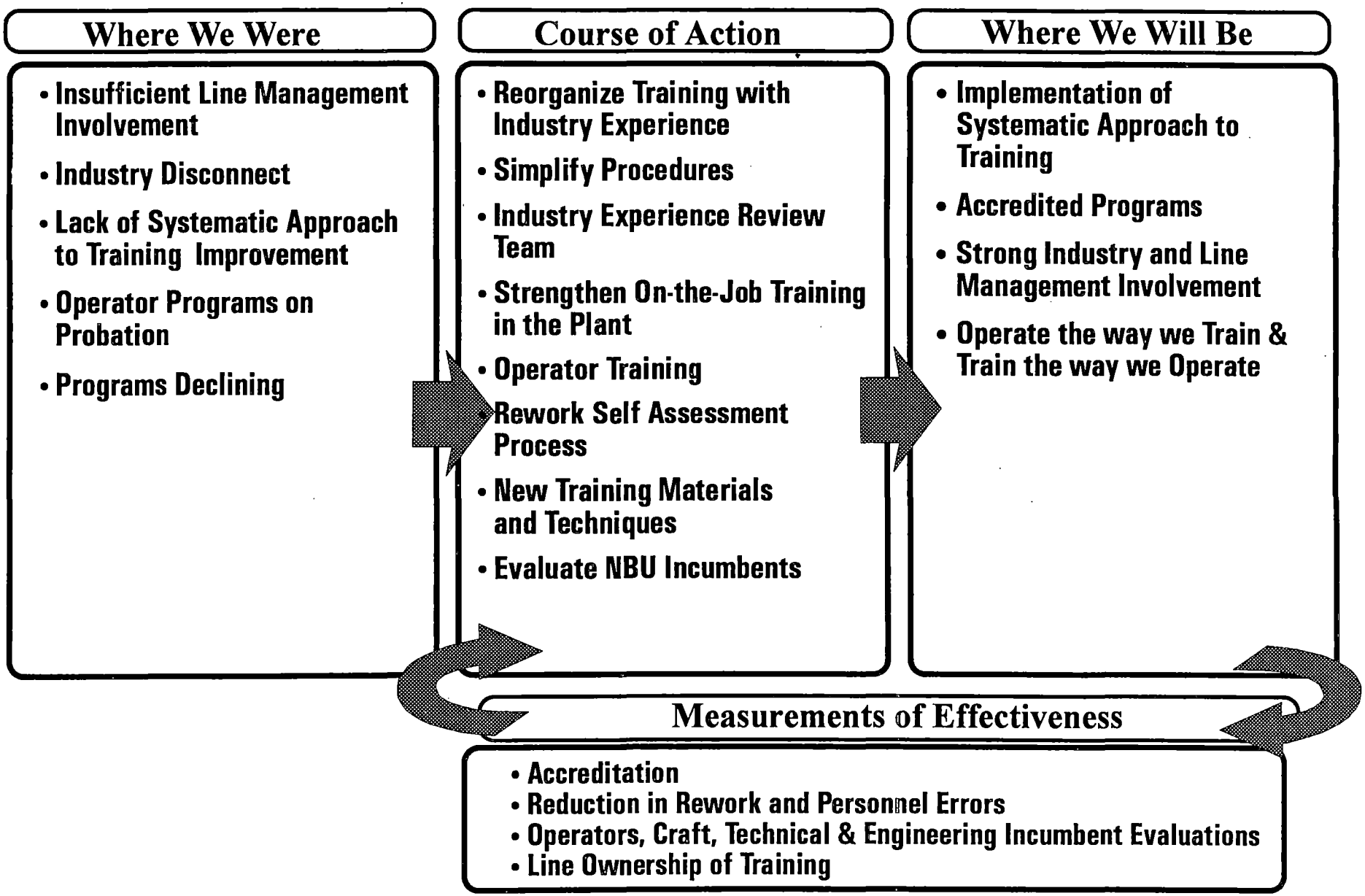
Where We Will Be

- Roles & Responsibilities Understood by Staff
- Systems Operated as Designed
- Design Changes Support Operations
- Engineering Processes Contribute to System Availability / Reliability
- Backlogs Effectively Managed
- Strong Safety & Continuous Improvement Culture
- High Quality Engineering Deliverables
- Effective Self Assessments
- Intrusive Engineering

Measurements of Effectiveness

- Backlog of Engineering Work Items
- Self Assessments & Benchmarking of Programs / Repeat Findings
- Availability / Reliability of Risk Significant Systems

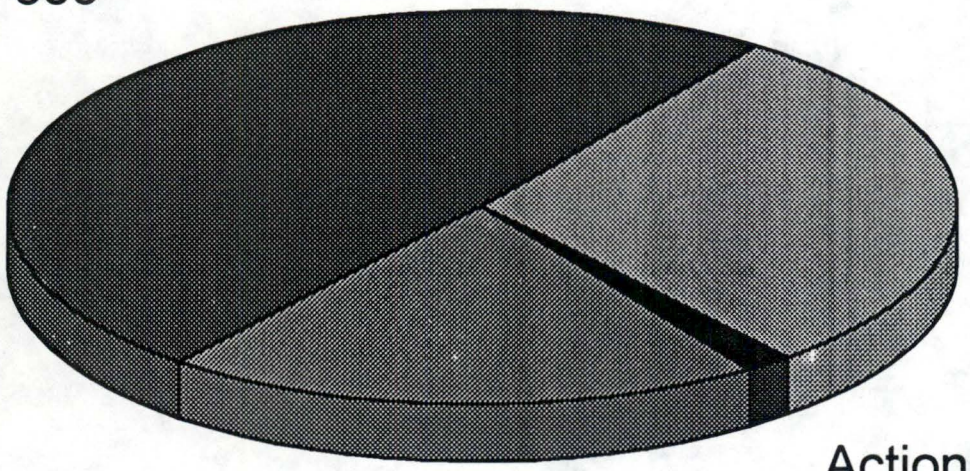
Salem Restart Plan
Training



Readiness For Restart
PROGRESS TO DATE
Nine Salem Restart Action Plans

Total Action Items
742

Actions Performed
363



Actions in Progress
216

Actions Scheduled
151

Actions Late	12
Work Control Process	1
System Engineering	1
Training	1
Operations	1
Maintenance	7
Engineering	1

Readiness For Restart

FOCUS ON RESULTS

- RESTART READINESS REVIEW
  - ROUTINE SELF-ASSESSMENTS
  - SYSTEM READINESS ASSESSSMENTS
  - DEPARTMENT READINESS ASSESSMENTS
  - OPERATIONAL READINESS ASSESSMENT
  - INTEGRATED READINESS ASSESSMENT
  - MANAGEMENT REVIEW COMMITTEE ASSESSMENT
  - QUALITY ASSURANCE RESTART VERIFICATION

Readiness For Restart

EXAMPLES OF RESTART CRITERIA

- MATERIEL CONDITION, RELIABILITY & SYSTEM READINESS
- OPERATIONS LED ORGANIZATION
- TIMELY AND EFFECTIVE CORRECTIVE ACTION PROCESS
- SYSTEM TEAM OWNERSHIP
- STAFFING AND QUALIFICATIONS
- DECREASING NUMBER OF PERSONNEL ERRORS
- OPERATOR WORK AROUNDS (NONE SIGNIFICANT)
- DECREASING REPEAT EVENTS AND MAINTENANCE REWORK
- INCREASING PROPORTION OF SELF-IDENTIFIED ISSUES

Keys for Success

EFFECTIVE LEADERSHIP

PRODUCTIVE TEAMWORK

CORRECTIVE ACTION

EFFECTIVE TRAINING

=

ACCOUNTABILITY FOR RESULTS

You Are The Difference

Salem Restart Meeting
December 11, 1995

CLOSING REMARKS

Public Service
Electric and Gas
Company

E. C. Simpson

Senior Vice President - Nuclear Engineering

Public Service Electric and Gas Company P.O. Box 236, Hancocks Bridge, NJ 08038 609-339-1700

FEB 13 1996

LR-N96035

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

**RESPONSE TO NRC GENERIC LETTER 95-07 -
PRESSURE LOCKING AND THERMAL BINDING OF SAFETY-RELATED
POWER-OPERATED GATE VALVES
SALEM GENERATING STATION UNIT NOS. 1 & 2
FACILITY OPERATING LICENSE NOS. DPR-70 & DPR-75
DOCKET NOS. 50-272 & 50-311**

The Nuclear Regulatory Commission issued Generic Letter (GL) 95-07, Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves, on August 17, 1995. In response to GL 95-07, Public Service Electric and Gas Company (PSE&G) has completed the Requested Actions for Salem Generating Station Units 1 & 2 in accordance with the 180 day schedule contained in the generic letter to ensure that safety-related power-operated gate valves susceptible to pressure locking or thermal binding will be capable of performing their intended safety functions under all modes of plant operation.

The Enclosure provides a summary description and results of the susceptibility evaluations. Attachment 1 contains the screening criteria used in determining which power operated safety related gate valves are or are not susceptible to pressure locking or thermal binding. Attachment 2 contains the listing of those valves that were determined to be susceptible to pressure locking and/or thermal binding, and a summary of the disposition of each of the valves based on the screening criteria contained in Attachment 1. Corrective actions completed or planned along with the schedule for completion are discussed in the Enclosure for those valves listed in Attachment 2 that remained susceptible to pressure locking or thermal binding.

A056
1/1

Should you have any questions on this submittal, please contact us.

Sincerely,

E. C. Simpson

Enclosure w/ Attachments (2)
Affidavit

C Mr. T. T. Martin, Administrator - Region 1
U. S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Mr. L. N. Olshan, Licensing Project Manager - Salem
U. S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Mail Stop 14E21
Rockville, MD 20852

Mr. C. S. Marschall (X24)
USNRC Senior Resident Inspector

Mr. Kent Tosch, Manager, IV
Bureau of Nuclear Engineering
33 Arctic Parkway
CN 415
Trenton, NJ 08625

REF: LR-N96035

STATE OF NEW JERSEY)
) SS.
COUNTY OF SALEM)

E. C. Simpson, being duly sworn according to law deposes and says:

I am Senior Vice President - Nuclear Engineering of Public Service Electric and Gas Company, and as such, I find the matters set forth in the above referenced letter, concerning Salem Generating Station Unit Nos. 1 and 2, are true to the best of my knowledge, information and belief.

E. C. Simpson

Subscribed and Sworn to before me
this 13 day of February 1996

Ann L Shump
Notary Public of New Jersey

My Commission expires on

ANN L SHUMP
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires Oct. 13, 1997

LR-N96035

ENCLOSURE

SUMMARY DESCRIPTION

**RESPONSE TO NRC GENERIC LETTER 95-07,
PRESSURE LOCKING AND THERMAL BINDING OF
SAFETY RELATED POWER OPERATED GATE VALVES
SALEM GENERATING STATION UNITS 1 & 2
DOCKET NOS. 50-272 & 50-311**

This report provides information to satisfy the 180 day reporting requirements of Generic Letter 95-07 (Ref. 1). The scope of the review for Salem Generating Station Units 1 and 2 includes all power operated gate valves (air, hydraulic and motor operated) for their susceptibility to pressure locking or thermal binding (PL/TB) as follows:

- Within the requested 90 days of the issuance of the generic letter, perform a screening evaluation of all safety related power operated gate valves to identify valves potentially susceptible to pressure locking or thermal binding. Provide a basis for operability for those valves identified as susceptible as required or take appropriate actions in accordance with Technical Specifications.

- Within the requested 180 days of the issuance of the generic letter, evaluate operational configurations of those valves identified as susceptible and perform further analyses as appropriate. Take needed corrective actions (or justify longer schedules) to ensure valves are capable of performing their intended safety function.

The Salem response is based on a review process following the screening criteria contained in Attachment 1 to identify those safety related power operated gate valves that may be susceptible to pressure locking or thermal binding. This resulted in a list of valves that may be susceptible to pressure locking or thermal binding. A total of 60 valves were identified as potentially susceptible. No hydraulically or air operated valves were determined to have a safety related open function. The identified valves were further screened for susceptibility using the criteria in Attachment 1 based upon the design and operating conditions to which the valve may be exposed, including process and ambient conditions. Valve surveillance requirements were also considered. Attachment 2 contains the results of this screening which concluded that 14 valves are susceptible to pressure locking and 8 valves are susceptible to thermal binding. Evaluation of power operated gate valves that could be

ENCLOSURE

SUMMARY DESCRIPTION

susceptible to pressure locking had previously been completed for Salem Units 1 and 2 during the plant design and construction phase. This evaluation resulted in design modifications to 24 valves that included 1) drilling a hole in one of the disk faces to vent the bonnet to the adjacent piping and 2) installation of a bypass line to vent the bonnet to the adjacent piping or another pressure sink as identified in Attachment 2.

Additional evaluations were performed including detailed operability analyses, as required, of the valves listed in Attachment 2. Operability for the valves listed below (identified with an *) could not be demonstrated using conservative design basis analysis methods. These deficiencies were reported to the NRC under 10CFR50.73(a)(2)(ii)(LER 272/96-002).

Valves Analyzed for Operability

11 & 12 CS2 21 & 22 CS2	Containment Spray Header Isolation Valves*
1 & 2 PR6 1 & 2 PR7	PORV Block Valves*
1 & 2 SJ1 1 & 2 SJ2	RWST Supply Isolation to Charging/Safety Injection*
2SJ12 2SJ13	BIT Outlet Isolation
11 & 12 SJ113 21 & 22 SJ113	RHR Discharge to SI Pump Suction Valves (SI Pump Cross-over Valves)*
11 & 12CC16 21 & 22CC16	RHR Heat Exchanger Component Cooling System Outlet Isolation

On the basis of these reviews, appropriate procedure changes and modifications have been initiated for completion prior to restart of Salem Units 1 and 2 from the current outage. The SJ1, SJ2, 2SJ12, 2SJ13 and SJ113 valves will be modified to preclude pressure locking by providing an appropriate bonnet cavity pressure relief path. Pressure locking of the CS2 valves will be addressed by a surveillance test procedure change to cycle the valves after the system has been depressurized. For thermal binding concerns, the PR6 and PR7 valves will be modified to

ENCLOSURE

SUMMARY DESCRIPTION

provide primary control of the motor operator based on disc position instead of torque control, and a maximum thrust limit will be identified as a test procedure control to assure a positive margin of capability. The thermal binding concern for the CC16 valves does not require a change to the method of motor control. Similar to the PR6 & PR7 valves, a maximum thrust will be identified.

References:

1. NRC Generic Letter 95-07, dated August 17, 1995

2. PSE&G initial response to Generic Letter 95-07, LR-N95164, dated October 16, 1995

3. MPR Associates, Inc. Report No. MPR-1693, Evaluation of Salem Valves for Pressure Locking and Thermal Binding, Rev. 0 dated November 1995, and Rev. 1 dated January 1996

4. Design Change Packages 1EC-3540 & 2EC-3467

ATTACHMENT 1

SUSCEPTIBILITY SCREENING METHODOLOGY

INITIAL SCREENING BASED ON VALVE TYPE/FUNCTION

An initial screen was performed for both pressure locking and thermal binding based on the valve type and function. All safety related air-, hydraulic- and motor-operated valves were identified. The bill of materials (BOM) for each valve was reviewed to determine the valve type (e.g., gate, globe, butterfly, etc.). All non-gate valves were eliminated, resulting in a list of all safety-related, power-operated gate valves. The design basis requirements of each valve were then reviewed to determine if the valve has a safety function to open. Valves which are not required to open are not susceptible to PL/TB and were eliminated from further evaluation.

SCREENING BASED ON VALVE MODIFICATIONS

Some valves at Salem have been modified to address potential pressure locking concerns. Modifications include 1) drilling a hole in one of the disk faces to vent the bonnet to the adjacent piping and 2) installation of a bypass line to vent the bonnet to the adjacent piping or another pressure sink. These modifications prevent pressure locking of a valve since the bonnet is vented. The maintenance history in MMIS was used to identify valves which have been modified; these valves are not susceptible to pressure locking.

Valve modifications were not used as thermal binding screening criteria.

SCREENING BASED ON DISK TYPE

Solid wedge gate valves are less susceptible to pressure locking than flexible wedge or double disk gate valves because the solid disk design does not allow bonnet pressure to apply a direct load on each disk half in the pipe-axis direction. Solid wedge gate valves are typically being removed from consideration in pressure locking evaluations. Further, pressure locking experience documented in NUREG-1275, Vol. 9 indicates that instances of problems have occurred strictly with double disk and flexible wedge gate valves, and not with solid wedge gate valves.

One solid wedge gate valve application was identified to have a scenario where the bonnet pressure may exceed that in the adjacent piping. This application is the component cooling water outlet isolation valves from the RHR heat exchangers (Valves 11CC16, 12CC16, 21CC16 and 22CC16). Analyses confirmed that

bonnet pressure does not result in a required thrust which exceeds actuator capacity for these solid wedge gate valves. This conclusion is consistent with the approach used for solid wedge gate valves at other plants, and is consistent with experience which indicates that pressure locking problems do not occur with solid wedge gate valves. Accordingly, these solid wedge gate valves at Salem were determined to be acceptable as is, and the remaining efforts were focused on the other gate valve types (flexible wedge, double disk).

Copes-Vulcan parallel disk gate valves are not susceptible to thermal binding since these valves do not "wedge" at closure. These valves have a spring between the parallel disk halves which maintains contact between the disks and seats. Differential thermal expansion between internal components will be accommodated by compression or relaxation of the spring. Anchor/Darling double disk gate valves are <u>not</u> susceptible to thermal binding as documented in NUREG-1275, Vol. 9. The valve assembly drawings and References 3 and 4 were reviewed to determine the disk type for each valve.

SCREENING BASED ON GENERAL CONDITIONS

For each valve that was not screened out based on type/function, modifications or disk type, the general conditions under which the valve operates were reviewed to determine if it is susceptible to PL/TB. This screening is described below.

<u>Pressure Locking</u>

Pressure locking occurs when the fluid in the valve bonnet is at a higher pressure than the adjacent piping at the time of valve opening. The following two scenarios for elevated bonnet pressure were considered.

"Bonnet Heatup" -- entrapment of incompressible fluid in the bonnet during valve closure, followed by bonnet heat-up prior to valve opening. The bonnet heatup scenarios considered were:

- heatup due to an increase in the temperature of the environment during an accident. (Normal ambient temperature variation is not considered because it occurs over a long time period and pressure changes tend to be alleviated through extremely small amounts of leakage. Experience indicates that normal

temperature variations are not a source of pressure locking events),

- heatup due to an increase in the temperature of the process fluid on either side of the valve.

"Pressure-Trapping" -- pressurization of the valve bonnet during normal system operation or system surveillance test conditions, followed by de-pressurization of the adjacent piping prior to valve opening. The following scenarios were considered:

- back-leakage past check valves, and

- system operating pressures (including surveillance test conditions) which are higher than the system pressure when the valve is required to open.

The normal and accident temperature envelopes from environmental design criteria for various plant locations were used to identify potential heatup of the environment. The applicable P&IDS, isometric drawings and Configuration Baseline Documents (CBD) were reviewed to determine process fluid temperatures and nearby heat sources. The CBDs were also used to determine the conditions when the valve is required to open to perform its design basis function and the conditions under which the valve is closed. Valves for which there were no plausible bonnet heatup or pressure-trapping scenarios are <u>not</u> susceptible to pressure locking.

The following assumptions were made in performing this screening evaluation.

1. For valves in water systems, the bonnet is completely filled with water upon valve closure.

2. There is no leakage from the bonnet either through the packing or through the bonnet-to-body seal.

3. The disk-to-seat seal allows leakage from the adjacent piping to the bonnet but not from the bonnet to the adjacent piping.

4. Check valves allow sufficient leakage such that the pressures are the same on both side of the check valve.

ATTACHMENT 1

SUSCEPTIBILITY SCREENING METHODOLOGY

Thermal Binding

Thermal binding occurs due to temperature changes of valve internal components. The following scenarios for thermal binding were considered.

The process fluid temperature is greater than the ambient temperature when the valve is closed, which can result in heat up and expansion of the stem after insertion (closure).

The valve temperature increases or decreases between the time the valve is closed and then opened under design basis conditions, which can result in:

- Differential expansion of the disk and body, and
- Differential expansion of the body and stem

The environment and process fluid temperatures during valve closure and subsequent opening under design basis conditions were determined as described above for pressure locking. Valves for which there were no plausible scenarios, as described above, were not susceptible to thermal binding.

SCREENING BASED ON SPECIFIC CONDITIONS

No pressure locking screening criteria based on specific conditions were used.

Thermal binding analysis criteria address uniform temperature conditions, i.e., they do not cover transient or steady-state temperature gradients in the valve body or disk. Based on the discussion of thermal binding events in NUREG-1275, Vol. 9, thermal binding tends to occur after temperature changes over long time periods, where the valve would be in thermal equilibrium.

The thermal binding analysis methods developed are intended to be conservative. For example, bounding values of valve stiffness were used based on data obtained in the EPRI MOV program. To ensure that the methods are bounding, they are validated against data. Specifically, six strokes (on five gate valves) were identified in the EPRI MOV Program data, where the valve temperature decreased significantly between closure and opening.

The screening criteria were based on the following inputs:

ATTACHMENT 1

SUSCEPTIBILITY SCREENING METHODOLOGY

- Valve body material,
- Valve disk material,
- Valve seat ring material,
- Valve stem material,

Process fluid temperature, ambient temperature, and valve steady state temperature when the valve is closed, and valve steady state temperature when the valve is opened under design basis conditions.

ATTACHMENT 2

RESULTS FROM SCREENING OF POTENTIALLY SUSCEPTIBLE SALEM VALVES

Valve ID(s)	Description	Pressure Locking[1]		Thermal Binding[1]	
		Susceptible?	Basis For No	Susceptible?	Basis For No
11CC16, 12CC16, 21CC16, 22CC16	RHR heat exchanger component cooling system outlet isolation valves	---	These solid wedge valves have a scenario with elevated bonnet pressure, but analyses indicate positive margin for operation under this condition	Yes	
11CS2, 12CS2, 21CS2, 22CS2	Containment spray header isolation valves	Yes		No	General Conditions screen (no heatup/cooldown)
1CS14, 2CS14	Spray additive tank isolation valves	No	General Conditions screen (no heatup/pressure-trapping)	No	General Conditions screen (no heatup/cooldown)
1CS16, 2CS16, 1CS17, 2CS17	Spray additive tank isolation valves	No	General Conditions screen (no heatup/pressure-trapping)	No	General Conditions screen (no heatup/cooldown)
11CS36, 12CS36	RHR to containment spray system isolation valves	No	Modifications screen (bypass line installed)	No	Disk Type screen (double disk)
21CS36, 22CS36	RHR to containment spray system isolation valves	No	Modifications screen (bypass line installed)	No	Specific Conditions screen $\Delta T = 0$
1PR6, 2PR6, 1PR7, 2PR7	PORV block valves	No	General Conditions screen (no heatup/pressure-trapping)	Yes	
1RH1, 1RH2, 2RH1, 2RH2	RCS hot leg suction isolation valves	No	Modifications screen (bypass line installed)	No	Disk Type screen (parallel disk)
11RH19, 12RH19	RHR heat exchanger discharge cross-connect	No	Modifications screen (bypass line installed)	No	Disk Type screen (double disk)
1SJ1, 1SJ2, 2SJ1, 2SJ2	RWST supply valves to the charging/safety injection pumps	Yes		No	General Conditions screen (no heatup/cooldown)
1SJ12, 1SJ13	Boron injection tank outlet isolation valves	No	Modifications screen (hole drilled in disk)	No	Disk Type screen (double disk)
2SJ12, 2SJ13	Boron injection tank outlet isolation valves	Yes		No	General Conditions screen (no heatup/cooldown)
11SJ40, 12SJ40, 21SJ40, 22SJ40	SI pump discharge valves to RCS hot legs	No	Modifications screen (hole drilled in disk)	No	Disk Type screen (double disk)
11SJ44, 12SJ44, 21SJ44, 22SJ44	Containment sump supply valves	No	Modifications screen (bypass line installed)	No	Disk Type screen (double disk)

ATTACHMENT 2

RESULTS FROM SCREENING OF POTENTIALLY SUSCEPTIBLE SALEM VALVES

Valve ID(s)	Description	Pressure Locking[1]		Thermal Binding [1]	
		Susceptible?	Basis For No	Susceptible?	Basis For No
11SJ45, 12SJ45	RHR heat exchanger supply valves to the SI and charging pump suction	No	Modifications screen (bypass line installed)	No	Disk Type screen (double disk)
21SJ45	RHR heat exchanger supply valves to the SI and charging pump suction	No	Modifications screen (bypass line installed)	No	General Conditions screen (no heatup/cooldown)
22SJ45	RHR heat exchanger supply valves to the SI and charging pump suction	No	Modifications screen (bypass line installed)	No	Specific Conditions screen $\Delta T=0$
11SJ54, 12SJ54, 13SJ54, 14SJ54, 21SJ54, 22SJ54, 23SJ54, 24SJ54	Accumulator isolation valves to the RCS cold leg	No	General Conditions screen (no heatup/pressure-trapping)	No	General Conditions screen (no heatup/cooldown)
11SJ113, 12SJ113, 21SJ113, 22SJ113	RHR discharge to SI pump suction to charging/safety injection pump suction valves (SI pump cross-over valves)	Yes		No	Specific Conditions screen $\Delta T=0$

Note 1: For valves identified as Susceptible, See enclosed Summary Description