Official

JAN 31 1992

Docket Nos. 50-413, 50-414
License Nos. NPF-35, NPF-52

Duke Power Company
ATTN: Mr. M. S. Tuckman
Vice President
Catawba Site
P. O. B... 256
Clover ... 29710

Gen...:

SUBJECT: MEETING SUMMARY - CATAWBA DOCKET NOS. 50-413 AND 50-414

This letter refers to the Catawba self assessment meeting conducted at your request at the NRC Region II Office in Atlanta on January 28, 1992. The purpose of the meeting was to allow Duke Power Company to make a presentation on the results of the self-assessment conducted by your staff in the areas of operations, maintenance/surveillance, radiological protection, security, engineering/technical support, emergency preparedness and safety assessment/quality verification.

It is our opinion that this meeting was beneficial and provided a better understanding of the results of the self-assessment and the perceived strengths, improvements and weaknesses that were identified in the presentation.

Enclosed is a list of the meeting attendees and a copy of your presentation.

In accordance with 10 CFR 2.790 of the NRC's "Rule of Practice," a copy of this letter and its enclosures will be placed in the NRC Public Document Room.

Should you have any questions concerning this letter, please contact us.

Sincerely,

Original Signed by
Jon R. Johnson /for

Luis A. Reyes, Director
Division of Reactor Projects

Enclosures:
1. List of Attendees
2. Self-Assessment Meeting Summary
3. Self-Assessment Meeting

cc w/encls 1 & 2: (See page 2)

IE01 1/1

cc w/encls 1 & 2:
A. V. Carr, Esq.
Duke Power Company
422 South Church Street
Charlotte, NC 28242-0001

J. Michael McGarry, III, Esq.
Bishop, Cook, Purcell and Reynolds
1400 L Street, NW
Washington, D. C. 20005

North Carolina MPA-1
Suite 600
P. O. Box 29513
Raleigh, NC 27626-0513

Heyward G. Shealy, Chief
Bureau of Radiological Health
South Carolina Department of Health
and Environmental Control
2600 Bull Street
Columbia, SC 29201

Richard P. Wilson, Esq.
Assistant Attorney General
S. C. Attorney General's Office
P. O. Box 11549
Columbia, SC 29211

Michael Hirsch
Federal Emergency Management Agency
500 C Street, SW, Room 840
Washington, D. C. 20472

North Carolina Electric
Membership Corporation
P. O. Box 27306
Raleigh, NC 27611

Karen E. Long
Assistant Attorney General
N. C. Department of Justice
P. O. Box 629
Raleigh, NC 27602

Saluda River Electric
Cooperative, Inc.
P. O. Box 929
Laurens, SC 29360

cc w/encls 1 & 2: (See page 3)

cc w/encls 1 & 2: (Continued)
Frank Modrak, Project Manager
Mid-South Area ESSD Projects
Westinghouse Electric Corporation
MNC West Tower - Bay 241
P. O. Box 355
Pittsburgh, PA 15230

County Manager of York County
York County Courthouse
York, SC 29745

Piedmont Municipal Power Agency
121 Village Drive
Greer, SC 29651

R. L. Gill
Nuclear Production Department
Duke Power Company
P. O. Box 1007
Charlotte, NC 28201-1007

R. C. Futrell
Compliance
Duke Power Company
P. O. Box 256
Clover, SC 29710

bcc w/encl 1:
R E. Martin, NRR
J. Johnson, RII
W. Miller, RII
G. A. Belisle, RII
A. R. Herdt, RII

bcc w/encls 1, 2, & 3:
Document Control Desk

NRC Resident Inspector
U.S. Nuclear Regulatory Commission
Route 2, Box 179-N
York, SC 29745

RII:DRP	RII:DRP	RII:DRP	RII:DRP
SNinh	ABelisle	AHerdt	LReyes
1/30/92	1/30/92	1/31/92	1/31/92

ENCLOSURE 1

LIST OF ATTENDEES

U.S. Nuclear Regulatory Commission

L. A. Reyes, Director, Division of Reactor Projects (DRP), Region II (RII)
A. F. Gibson, Director, Division of Reactor Safety, RII
B. S. Mallett, Deputy Director, Division of Radiation Safety and Safeguards (DRSS), RII
A. R. Herdt, Chief, Reactor Projects Branch 3, DRP, RII
D. B. Matthews, Director, Project Director II-3, Nuclear Reactor Regulation (NRR)
G. A. Belisle, Chief, Reactor Projects, Section 3A, DRP, RII
W. T. Orders, Senior Resident Inspector, Catawba, DRP, RII
R. F. Martin, Senior Project Manager, Catawba, Project Directorate II-3, NRR
S. Q. Ninh, Project Engineer, DRP, RII
W. M. Sartor, Senior Radiation Specialist, Emergency Preparedness Section, DRSS

Duke Power Company

M. S. Tuckman, Site Vice President, Catawba Nuclear Station (CNS)
W. R. McCollum, Station Manager, CNS
J. S. Forbes, Engineering Manager, CNS
T. P. Harrall, Safety Assurance Manager, CNS

ENCLOSURE 2

CATAWBA NUCLEAR STATION

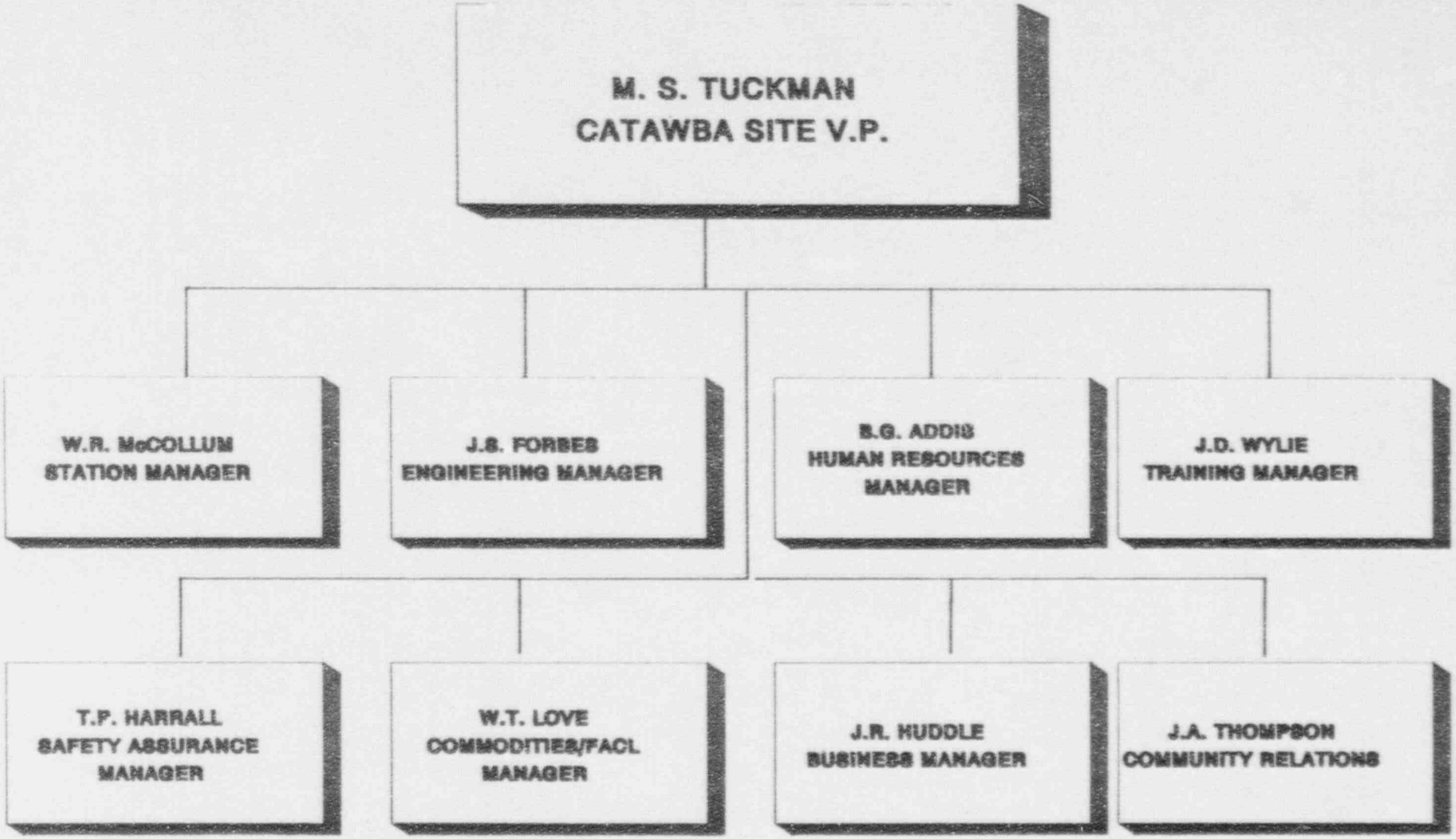
SELF-ASSESSMENT MEETING

JANUARY 28, 1992

CATAWBA NUCLEAR STATION

SELF-ASSESSMENT MEETING AGENDA

• INTRODUCTION	M.S. TUCKMAN
• OPERATIONS	W.R. McCOLLUM
• MAINTENANCE	W.R. McCOLLUM
• RADIATION PROTECTION	W.R. McCOLLUM
• SECURITY	W.R. McCOLLUM
• ENGINEERING/ TECHNICAL SUPPORT	J.S. FORBES
• EMERGENCY PREPAREDNESS	T.P. HARRALL
• SAFETY ASSURANCE/ QUALITY VERIFICATION	T.P. HARRALL
• CLOSING REMARKS	M.S. TUCKMAN


M. S. TUCKMAN
CATAWBA SITE V.P.
W.R. McCOLLUM
STATION MANAGER
J.S. FORBES
ENGINEERING MANAGER
B.G. ADDIS
HUMAN RESOURCES
MANAGER
J.D. WYLIE
TRAINING MANAGER
T.P. HARRALL
SAFETY ASSURANCE
MANAGER
W.T. LOVE
COMMODITIES/FACL
MANAGER
J.R. HUDDLE
BUSINESS MANAGER
J.A. THOMPSON
COMMUNITY RELATIONS

OPERATIONS

Focus for Improved Operation

I. Outages

II. Human Performance

III. Organization

OPERATIONS

Outage Management

- Plant Conditions and Mode Change Process
- Improved Control of Reactor Coolant Draining
- Strong Controls for Mid-loop Operation
- Independent Outage Review During June, 1991
- Modifications to Improve Plant Operation

OPERATIONS

Human Performance

- Human Factors Upgrade of EOPs and AOPs to Improve Usability

- Improvements in Operator Training

- Employee Involvement in Improvement 1991

OPERATIONS

Organization Changes

- Shift Managers Report to Operations

- Performance Technicians Report to Operations

- Significant Changes in Operations Management

OPERATIONS

Summary

- Improvements in Outage Operation
- Improvements in Operations Teamwork, Management Focus
- Organization Changes to Strength Leadership
- Continuing Challenge - Human Performance

MAINTENANCE/SURVEILLANCE

I. People

II. Programs

III. Plant

MAINTENANCE/SURVEILLANCE

People

- Specialized Crews/Training/Qualifications
- Low Turnover

MAINTENANCE/SURVEILLANCE

Programs

- Aggressive Preventative Maintenance Program Post-Maintenance Testing
- Work Control Center
- Computerized Work Management System

MAINTENANCE/SURVEILLANCE

Plant

- Major Control Upgrades
- Increasing Reliability of Major Equipment

RADIOLOGICAL PROTECTION

Dose Control

- Goal-Oriented Focus
- Aggressive ALARA Efforts
- Source Reduction
    - Crudburst
    - Shielding
    - High Radiation Area Controls
- Long-Term RP Outage Worker Contract
- Results
    - Dose at Industry Median Despite Ice Condenser Containment

RADIOLOGICAL PROTECTION

Contamination Control

- Control of Contaminated Square Footage
- Aggressive Follow-up on Contamination Events
- Improved Tool Monitors
- Results
    - Very Positive Trend of Contaminations

RADIOLOGICAL PROTECTION

Monitoring

- Upgraded Post-Accident Liquid and Gas Sampling Panels
- Digital Radiation Monitoring
- Improved Calibration Equipment
- Continued Improvements to Process Monitors

RADIOLOGICAL PROTECTION

Effluent Controls

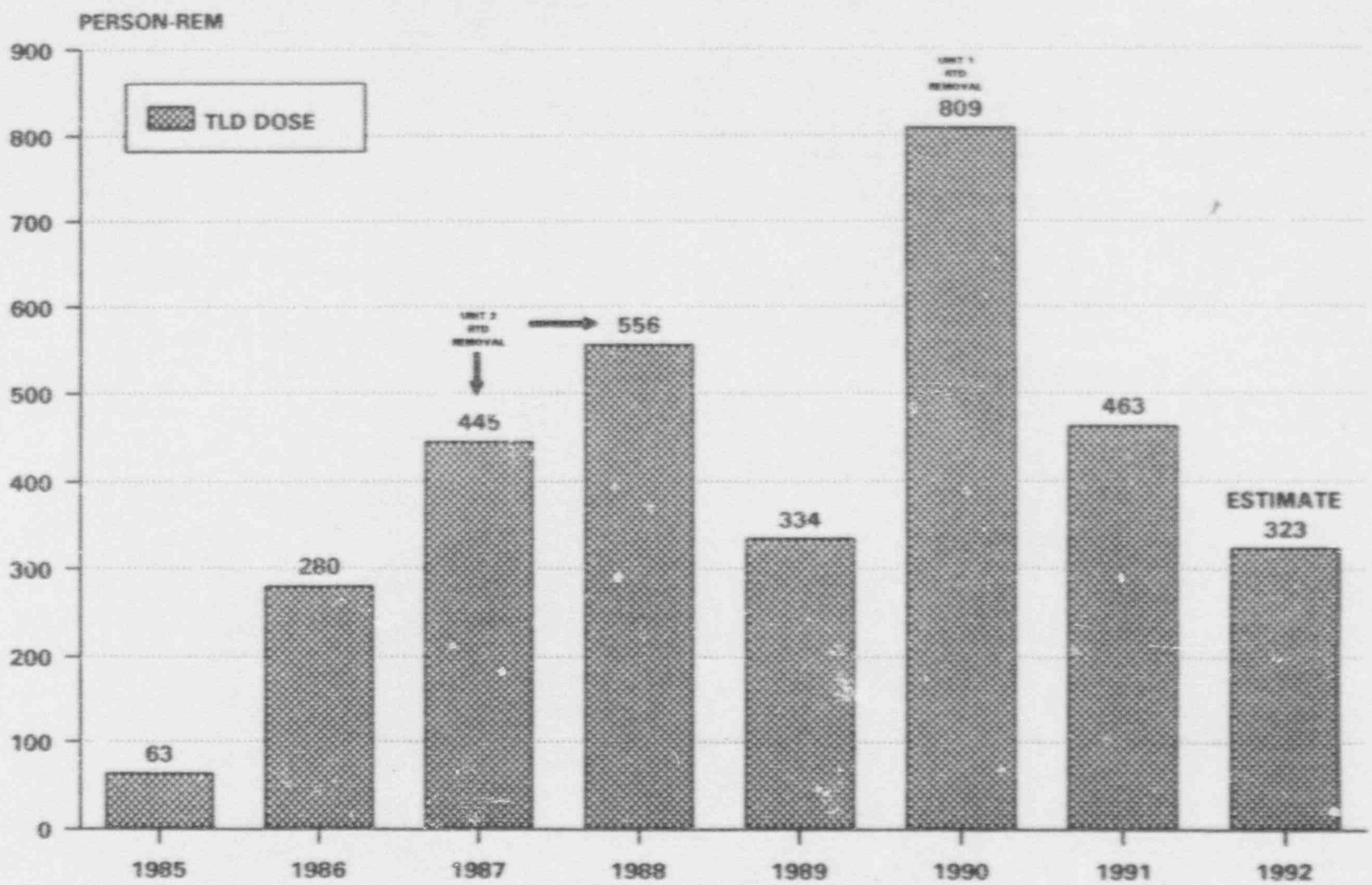
- Improved Monitoring and Control of Waste Gas Releases
- Aggressive Control of Solid Waste Volume
- Improved Monitoring and Control of Liquid Waste

RADIOLOGICAL PROTECTION

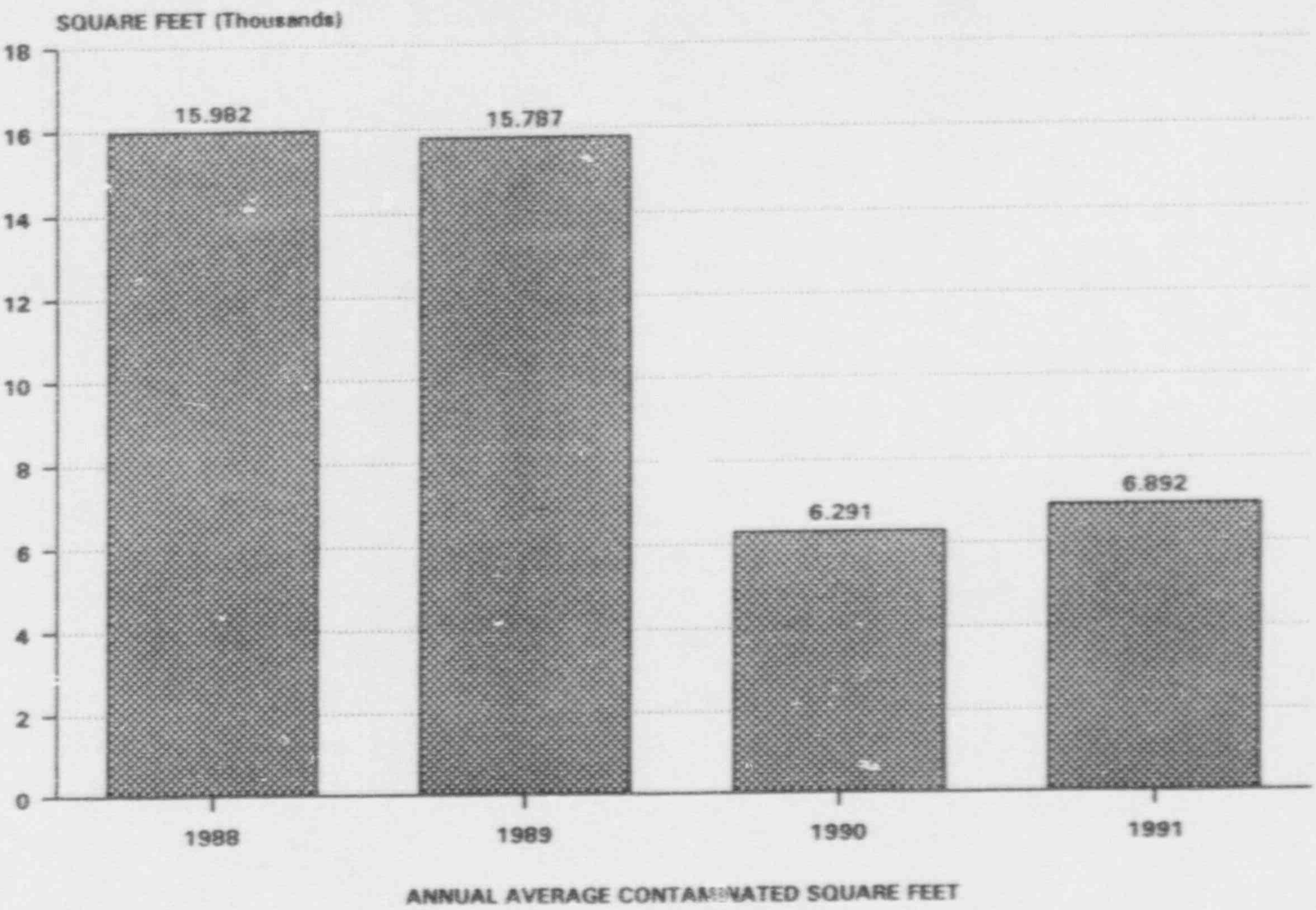
Summary

- Strong Dose Control Performance
- Aggressive Contamination Control
- Improved Monitoring
- Positive Effluent Control

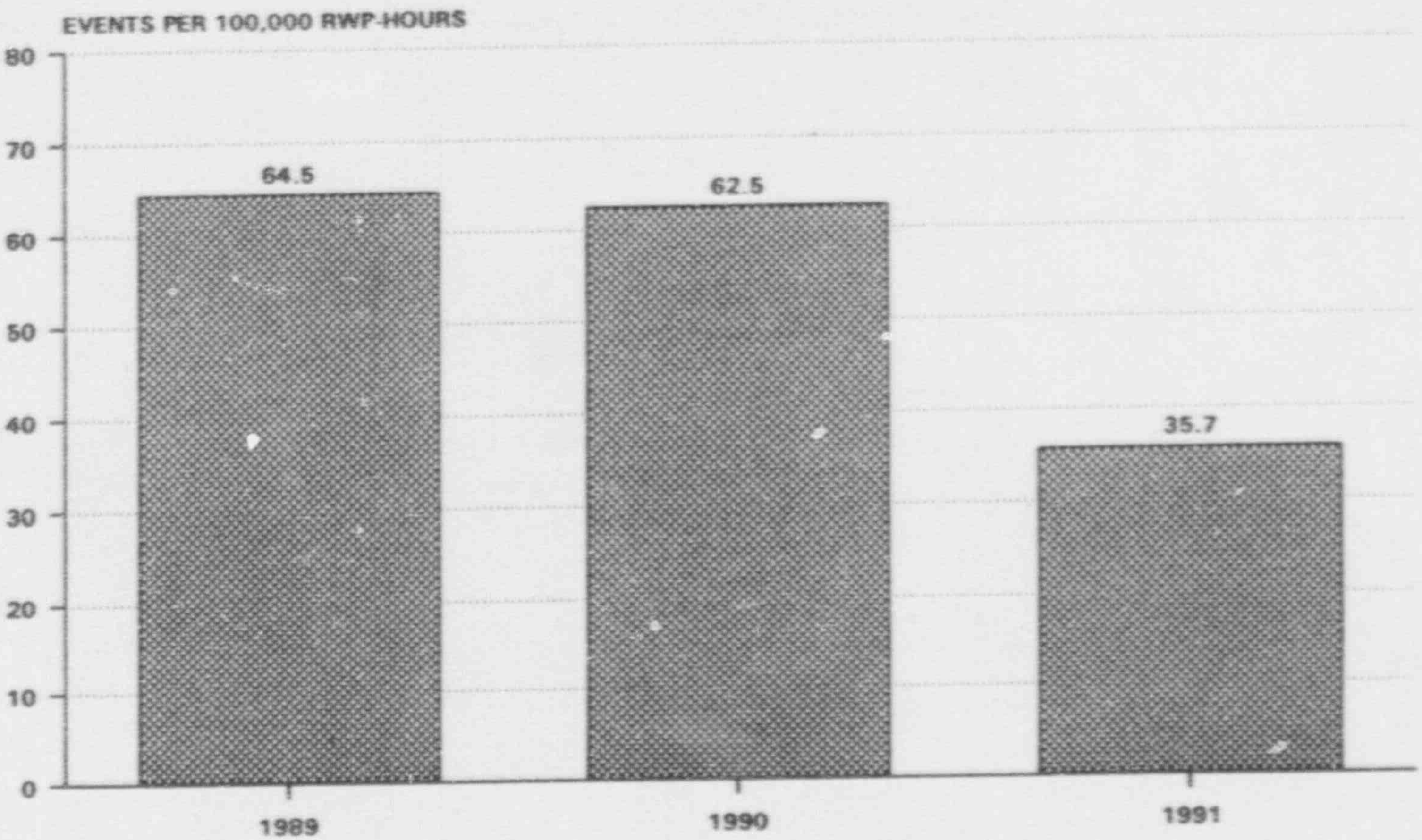
CATAWBA NUCLEAR STATION
EXPOSURE TREND



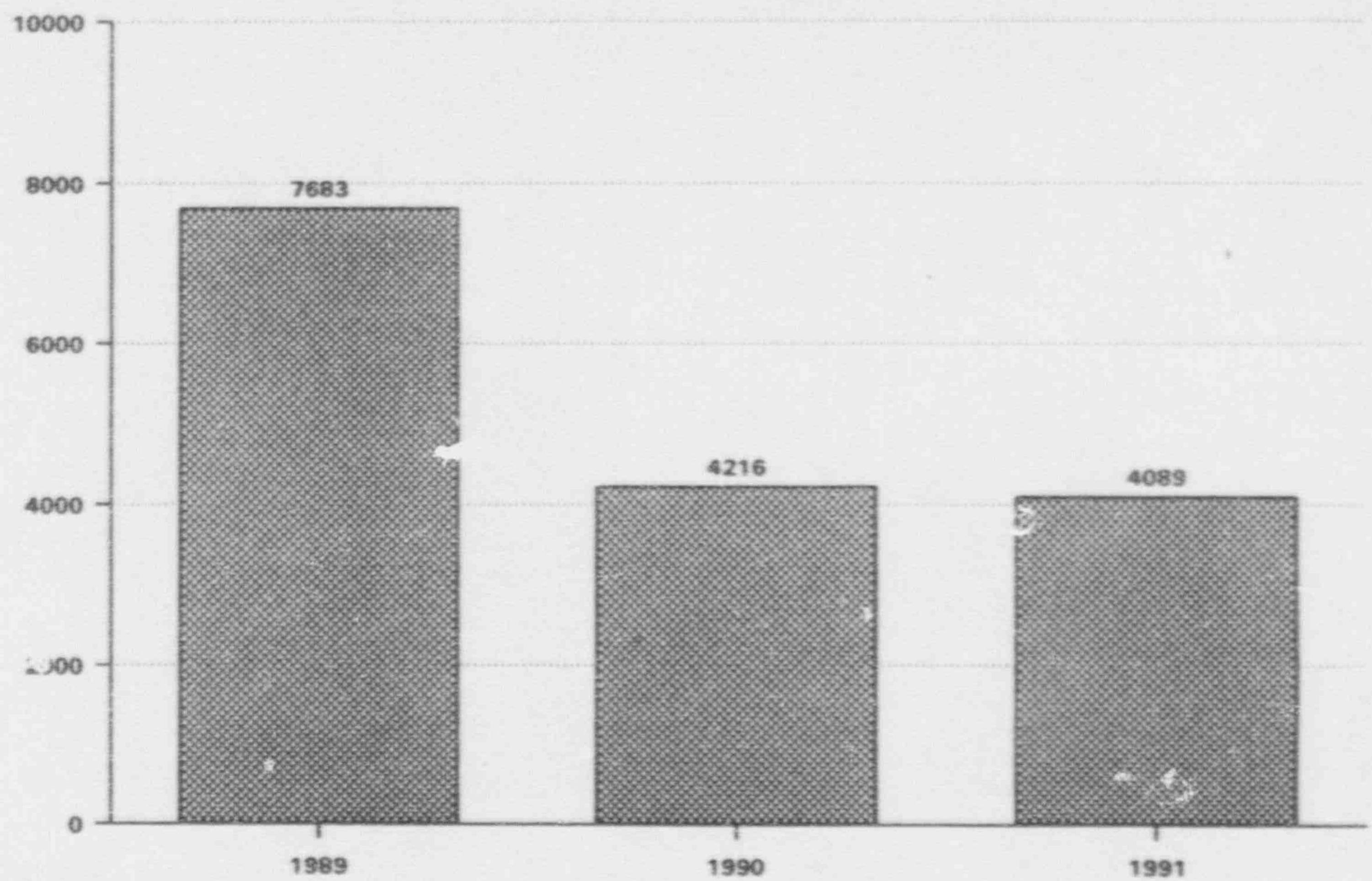
CATAWBA NUCLEAR STATION
CONTAMINATED SQUARE FOOTAGE



CATAWBA NUCLEAR STATION
CONTAMINATION EVENTS PER RWP-HOUR
THREE YEAR HISTORY



CATAWBA NUCLEAR STATION
SOLID RADWASTE SUMMARY



SECURITY

Strong Performance

- No LERs
- Loggable Events Reduced 41% (1990 to 1991)

Reasons

- Strong Technical Support
- Management Involvement
- Aggressive Trending and Problem Solving
- Proactive Focus

ENGINEERING

I. Organization

II. Modification Highlights

III. Engineering Programmatic Support

IV. Challenges for 1992

Organization

- System Engineering - 40% increase
- Turnover Reduced
- System Teams
  - 5 Original
  - 11 Current
  - Concept Extremely Successful
- 4 SROs in Engineering Supervisory Positions
- Organizational Changes-Improved Communication, Quality and Teamwork

Modification Highlights

- RN System Availability and Reliability Improvements
  - RN Pump modifications ($607,000)
  - Valve replacements ($564,000)
  - EMF process lines modified ($291,000)
  - RN/CA piping modified ($1,042,000)
  - ASP Cooling moved from RN to KC
  - VG aftercooler piping modified ($330,000)

- RCS Vacuum Refill Modification

    - 1st US Plant to successfully implement
    - Improves RCS Chemistry, Reactor Coolant Pump Operations and the Fill and Vent process

- Temporary Modifications

    - #'s reduced
    - Current - 22
    - 1 year ago ~100

- Security cameras reliability improved

    - Tube type changed to solid state

Engineering Programmatic Support

- Safety System Availability
  - System Engineering and System Teams
  - CA System - Previous Problems
    - Clam Flushes, RN to CA Suction Piping
    - Governor Valve Sticking (CAPT)
    - Pump Testing
    - PMs
    - RN Outages

- Safety System Availability (Cont'd)
  - Action Taken to Improve Availability
    - RN to CA piping modified: Clam Flushes
    - CAPT Governor Valve stem material modified
    - Pump tests revised
    - PM frequencies changed
    - Scheduling improvements
    - KC Cross Connect to Safety Related Motors
    - Unit 1: 51% Improvement
    - Unit 2: 26% Improvement

- **Design Basis Document Upgrade**

    - 19 DBDs Completed in 1991
    - Year 2 of program: 36 completed
    - Better decisions

- **Piping Erosion Program**

    - Aggressive inspection and analysis
    - EPRI Checkmate
    - CF/CA Piping
    - NRC Inspection

- EMF-34 (S/G Blowdown)

  - EMF-34 Functions: Detection and Isolation

    - Detection
      - Administrative change: 4 of 4
      - Steam Monitor reliability problems eliminated
      - Combination of Offgas and Steam Monitors provide excellent detection capability

    - Isolation

      - Modification scheduled for 1992 to move control functions to offgas monitor

  - EMF-34 to be placed on single generator to monitor trends in leak rate

- HVAC System Upgrades
  - VE System
  - DBD and Systematic Assessment Completed
  - Significant Improvements on VE
    - 1990 - 10 PIRs
    - 1991 - 1 PIR
- VC System
  - DBD Complete
  - FMEA Complete
  - 1 Violation resulted from FMEA
  - Additional Modification Planned
  - SITA Audit Planned

- Reactivity Management

  - Modification reviews
  - PIR reviews
  - Training
  - Reactor Engineer present on all startups
  - Procedure change reviews

- Compensatory Measures

  - Est'd standardized program for doors
  - Evaluates design basis for each applications
  - Specific instructions

Compensatory Action Guidelines
Plant Access Doors
Auxiliary Building 594

Door No.	Door Description	Location	FIRE	SECURITY	TORNADO MISSILE	TORNADO PRESSURE	VENTILATION	ENVIRONMENTAL QUALIFICATIONS	INSTRUCTIONS
AX300A	Unit 1 UHI	HH-JJ,42				Y	NA/OUT	M/O	8
AX301A	Unit 2 UHI	HH-JJ,72				Y	NA/OUT	M/O	8
AX302B	D/G 1A	EE,38-39		Y		Y	NA/OUT	M/O	8
AX304B	D/G 1B	AA,38-39		Y		Y	NA/OUT	M/O	8
AX306B	D/G 2A	EE,75-76		Y		Y	NA/OUT	M/O	8
AX308B	D/G 2B	AA,75-76		Y		Y	NA/OUT	M/O	8
AX600	UNIT 1 FUEL POOL	UU,47-48		Y		Y	VF/OUT	M/O	9
AX600B	UNIT 1 FUEL POOL	UU,47-48		Y		Y	VF/OUT	M/O	9
AX602	U1 FUEL BLDG TO AUX SERVICE BLDG	UU-VV,52	Y	Y		Y	VF/VA	M/M	1
AX627	UNIT 2 FUEL POOL	UU-VV,62	Y	Y		Y	VF/NA	M/M	1
AX629	UNIT 2 FUEL POOL	UU,66-67		Y		Y	VF/OUT	M/O	9
AX629B	UNIT 2 FUEL POOL	UU,66-67		Y		Y	VF/OUT	M/O	9
AX630	AUX SERVICE BLDG TO COUNTING ROOM	QQ,58-59	Y			Y	VA/VA	M/M	
AX632	AUX SERVICE BLDG TO RESPIRATOR ROOM	QQ,56-57	Y		Y	Y	VA/VA	M/M	
AX635	U2 AUX BLDG TO AUX SERV BLDG	QQ,60-61	Y		Y	Y	VA/VA	M/M	
AX635E	U1 AUX BLDG TO AUX SERV BLDG	QQ,54	Y		Y	Y	VA/VA	M/M	
AX635F	U1 AUX BLDG EQUIP DOOR TO AUX SERV BLDG	QQ,54	Y		Y	Y	VA/VA	M/M	

NOTE: This list does not contain all doors. If a door is NOT on this list it will require a review to be performed to determine potential Compensatory Action Requirements.

- EPRI Research
  - Civil Group leads study
  - Criteria development for piping and support design and operability
  - Findings presented to ASME
  - Section XI

Challenge for 1992

- To realize the full potential of the new engineering organization

EMERGENCY PREPAREDNESS

I. Drills/Exercises

II. Facilities and Equipment

III. Management Involvement

EMERGENCY PREPAREDNESS

Drills/Exercises

- Sixteen Drills and Exercises by End of SALP Period
- Drills are Simulator-Driven
- Special Drill (INPO Casualty Control Drill)

EMERGENCY PREPAREDNESS

Facilities and Equipment

- Dedicated TSC and OSC
- Siren System Upgrades
- Emergency Communications Improvements

EMERGENCY PREPAREDNESS

Management Involvement

- Resolution of FEMA Deficiency
- Increased EP Staffing

EMERGENCY PREPAREDNESS

Challenges

- Maintain High Level of Performance
- Integrate New Site Organization Into Emergency Plan

SAFETY ASSESSMENT/ QUALITY VERIFICATION

I. Self-Assessment Activities

II. Organizational Changes

III. Review and Resolution of Safety Issues

SAFETY ASSESSMENT/ QUALITY VERIFICATION

Self-Assessment Activities

- Quality Verification Audits
- Nuclear Safety Review Board Reviews
- Self-Initiated Technical Audits
- Safety Review Group Reviews
- Integrated Safety Assessment

Recent Additions

- Significant Event Investigation Team
- Problem Investigation Process/Lower Tier Program

SAFETY ASSESSMENT/ QUALITY VERIFICATION

Organizational Changes

- Quality Verification/Safety Review Group
- Regulatory Compliance

SAFETY ASSESSMENT/ QUALITY VERIFICATION

Review/Resolution of Safety Issues

- PZR Code Safety Valves
- Shutdown Risk Management
- Safety System Availability Improvement
- Erosion/Corrosion Monitoring
- Operability Evaluation/Compensatory Action Program

SAFETY ASSESSMENT/ QUALITY VERIFICATION

Challenges

- Effectively Analyze Trends Identified From Lower Tier Program
- Use Trends to Develop a Management Strategy for Continuous Improvement

ENCLOSURE 3

CATAWBA NUCLEAR STATION

SELF-ASSESSMENT MEETING

JANUARY 28, 1992

TABLE OF CONTENTS

DUKE POWER COMPANY

OPERATIONS SELF-ASSESSMENT REPORT

REVIEW PERIOD 02/91 - 05/92

TABLE OF CONTENTS

I. OUTAGES

During this review period, Catawba has dedicated a considerable amount of resources towards the goal of improving team efficiency and effectiveness during outages. This was done in response to past weaknesses that were identified in the outage area and in response to Catawba's strategic plan which identified needed improvements in this area. As a result, several programs were implemented and several processes were revised to achieve this goal.

A. Outage Management

Several changes and programs were implemented to strengthen the ability of Catawba personnel to manage outages in a more effective, error-free manner. These changes and programs are:

1) A program was introduced to apply special attention to plan, execute and evaluate complex or infrequently performed operations.

   a) An interim policy was implemented, November 22, 1991, during the Unit 2 outage which required management oversight for mid-loop operations, vacuum refill of the Reactor Coolant System, feedwater and turbine control modifications and low power physics testing, as examples.

   b) Each station group reviewed tests and procedures under their cognizance against established criteria and established controls which required management involvement prior to conducting the evolution meeting the criteria.

   c) Management involvement includes a pre-job briefing, establishing a high margin of safety and observation of the actual test.

   d) An interim policy was put into effect while permanent station procedures are being modified to include this management oversight as a normal part of performing critical evolutions. Tests or evolutions that fit the following definition were reviewed to determine the need for additional monitoring and oversight by station management:

      - Tests or evolutions not specifically covered under existing procedures that place the plant in an unusual configuration and which have the potential to significantly degrade the plant's level of nuclear safety.

      - Tests or evolutions that are not performed on any specific frequency but involve complicated coordination of sequencing or place the plant in an unusual configuration having the potential to significantly degrade the plant's level of nuclear safety.

- Activities involving major changes to plant components, operating practices, or test methods.

Tests or evolutions that meet this definition shall be supported with the following management controls:

- A Management Designee shall be appointed by the Superintendent of Operations to exercise continuous oversight over the test or evolution.

- A Pre-Activity Briefing shall be conducted either by the Management Designee or by others in the presence of the Management Designee. The details of the briefing may include, but are not limited to, communication of management expectations (i.e., caution and conservatism, high margin of safety, open communications, personnel responsibilities, etc.) and communication of technical details (i.e., procedure summary, differences between test/evolution and normal operating practices/procedures, lessons learned from pertinent operating experiences, Tech Spec limitations, overall effect on plant/systems, expected major alarms, procedure limits and precautions, test/evolution termination criteria, etc).

- The Pre-Activity Briefing described above shall be documented in the SRO Logbook or in the station procedure.

- The responsibilities listed in the formal Position Paper shall be followed.

2) Operations has formed the Outage Planning Group (OPG) to focus more operating experience on the outages at Catawba. This group consists of a Unit Operations Manager with an SRO license and 14 years experience at Catawba along with five experienced Operations engineers. Two of these engineers have SRO licenses and each have ten years of operating experience at Catawba.

The main function of this new group is expressed in their mission statement: "We will continually improve processes so that outage plans will result in (1) improved configuration control; (2) improved outage durations, and (3) more methodical and controlled outage execution." To accomplish this mission, each identified process will be reviewed, evaluated, and innovative proposals will be developed and presented to the station team for consideration. The

OPG will take a leadership role in developing these new and better ways of doing business.

Some of the processes that are being reviewed are as follows:

- Modification process,
- System removal and return to service process,
- IAE valve testing process including ΔP testing,
- Containment penetration work, containment closure and refueling integrity concerns,
- Work identification and work scheduling process,
- Outage scheduling codes for work control, and the
- Block tagout process.

In addition to the above items, the OPG will perform the routine Operations functions for outage preparation such as developing logic, making tagouts, and attending various outage meetings.

3) A great deal of time and energy has been focused on improving our refueling outage process. One aspect of this endeavor was the formation of the HERO TEAM FOR SYSTEM ALIGNMENTS.

This team's charge was to examine the process of Operations alignments and re-alignments during outages. In doing so, it was apparent there were areas involving the fill and vent of ECCS systems that could be improved. The team first discovered that there were some key components of this process that were not specifically visible in the outage schedule. These elements were better identified and logically tied to our outage schedule.

Another aspect under consideration was the process of clearing safety tag paperwork in conjunction with the fill and vent of the systems and the completion of the system valve checklist. To streamline this process, the decision was made to develop a specific written procedure for the fill and vent of ECCS systems during the outage. This new approach eliminates the need to research the sequence of this task each time it is required. It also streamlines the turnover from shift to shift and reduces the chance for error. Each shift appointed an "alignment coordinator" to spearhead the process and ensure a higher quality turnover from shift to shift occurred.

Finally, the team looked at the requirements associated with the performance of ECCS flow balance testing. In-depth research was conducted to identify the items that require performance of this test. By better defining these commitments, we can appropriately manage these activities to ensure that Catawba executes the appropriate ECCS flow balance.

The HERO Team for System Alignments will be an ongoing endeavor that will look at other areas for improvement in the future, such as the Block Tagout process and other system alignment concerns.

This team is closely aligned to our vision of the pursuit of excellence, both during outages and normal plant operation.

B. Shutdown Safety

Special attention has been given to assure outage operations address all concerns related to shutdown risk.

1) Draining of the S/G tubes has always presented a special set of problems in a U-tube S/G. Historically, the reactor coolant level was lowered and the tubes were "burped." This can present problems with reactor coolant level control and critical path time. A new solution was needed to increase the safety of the evolution and reduce the amount of critical path time required.

   Nitrogen injection into the S/Gs presents an option that replaces the water in the tubes with nitrogen. Basically, the reactor coolant level is at the vessel flange when the process is started. The control room operator establishes a drain down rate (normal charging is in service) so the reactor coolant level is maintained right at the flange level. Nitrogen is then injected into the reactor coolant pump flow transmitter taps. As water is displaced by the nitrogen, the drain rate must be adjusted to maintain the level at the vessel flange. Once two full bottles of nitrogen per S/G have been injected, the S/G tubes have been drained and the reactor coolant level then starts to decrease. This level decrease is a sign to the control room operator that the tubes have been drained. This evolution is only done one time for the initial reactor coolant draining.

   One of the major benefits of this draining method is an increase in safety. The S/G tubes are now drained at the level of the reactor vessel flange instead of at a slightly below normal mid-loop level. Under the old method, the level was dropped to mid-loop and held there until the tubes were "burped" of all their water. During the "burping" process, the control room operator had to keep on top of the reactor coolant level which rises with every "burp" and is then decreased manually to maintain the mid-loop level. Another safety benefit is the ability to maintain higher ND flows with less risk to the residual heat removal system. Since draining the S/G tubes is usually done at the beginning of a refueling cycle or during a forced outage, there is more decay heat in the core. Under the old method, the residual heat removal pump flow had to be reduced while the unit was in mid-loop operations. Now full flow capability can be maintained since the level is now maintained at the vessel flange. As a result, mid-loop operations now do not have to begin until the unit is ready to install the nozzle dams. Therefore, the amount of time at minimum reactor coolant inventory conditions is reduced.

Nitrogen injection of the S/Gs has been performed a number of times here at Catawba, and is now routine during outages. This method has been proven to be a great time saver as well as adding to the safety of the unit.

2) Catawba has recently employed a vacuum refill system to refill the Reactor Coolant System. This new system has several advantages over the old refill method.

Under the old refill method, the Reactor Coolant System is filled from the mid-loop level until the Pressurizer is full. The reactor coolant pumps are then "bumped" three to four times in a sequential order. Air and non-condensable gases are then vented from the Reactor Coolant System between "bumps." Hydrazine is then added to the system to reduce the oxygen levels. This method generally takes between twenty four and thirty six hours to complete.

Using the old method places undue stress on the reactor coolant pump motors and seals since it utilizes several pump starts. It also means that the system must be purged of all the air and non-condensable gases that naturally reside in the reactor coolant system.

Three major advantages can be obtained from using the vacuum refill system. First, a reduced number of reactor coolant pump starts and a corresponding reduction in the potential for reactor coolant pump seal problems is achieved. Second, a reduction in critical path time can also be obtained by removing the unwanted air and non-condensable gases prior to filling the system. Finally, better chemistry conditions can be obtained at the start of the system heat up.

Vacuum refill employs a vacuum pump to pull a vacuum on the reactor coolant system from the pressurizer relief line. The reactor coolant system is in mid-loop operations at the start of this process. After pulling a vacuum on the system, it is then filled until it overflows the top of the pressurizer. At this point, the system is ready for a reactor coolant pump to be placed in service.

Vacuum refill was recently employed on Unit 2 with excellent results. This was the first time that this method had ever been used here at Catawba. Although a reduction of critical path time was not achieved, the number of reactor coolant pump starts was reduced and better chemistry for heat up was achieved. The team involved with the new method believes that a substantial time savings can be achieved later on as more experience is gained using the new system.

Some information which was gained from this initial trial run of the vacuum refill system is:

- Design Engineering calculations and what actually happened were very close. The only calculation slightly off was the pressurization calculation which has been updated from actual data.

- Critical instruments were replaced with vacuum resistant instruments prior to pulling a vacuum . Current plans are to replace all remaining instruments which are unable to withstand a vacuum with vacuum resistant instruments. This will allow the control room operators complete use of their instruments (non-vacuum resistant instruments were isolated prior to pulling a vacuum) during the process.

- The vacuum pump designed and purchased for this purpose performed flawlessly. The Reactor Coolant System was brought under 25" hg of vacuum in ninety minutes. Some testing was performed at 24" hg to verify positive control over the vacuum in the Reactor Coolant System. Absolute control could be maintained. A remote gauge was placed in the control room so that the control room operators would have remote indication of the vacuum.

- Radiation Protection provided support in monitoring the discharge air and seal water samples. There was no activity in either sample. This indicated that we were not pulling any reactor coolant up from the PRT or carrying over coolant gases out of the Reactor Coolant System.

- The procedure used was carefully prepared prior to running the vacuum refill system. A post run critique was also held so that the procedure could be edited to help the operators during future use of the system.

- Ultrasonic level indication was installed prior to running this new system since it would be unaffected by vacuum. It performed very well as long as residual heat removal flows were not too high (above mid-loop normal flows). Plans are in the works to move the ultrasonic level detectors to the passive reactor coolant system legs. This will eliminate all the noise on the channel from the residual heat removal system. However, the normal reactor coolant level instruments all continued to operate and performed very well during the entire evolution.

- Dissolved oxygen in the system was at 1000 ppm and 3000 ppm in the pressurizer after vacuum refill. This is an improvement over normal refill values.

- Each reactor coolant pump was run for five minutes to verify that all air was removed from the system. No more air was seen after the five minute pump runs. Future plans include omitting the five minute pump runs and just placing a pump in service.

- A reduction in critical path time is expected as plant personnel become more familiar and experienced with the vacuum refill system. This first trial was necessarily slow as each step of the process was reviewed and analyzed prior to performing the step.

Catawba Nuclear Station is very excited about the bright future of the vacuum refill system. The first test of the system has shown that it meets expectations. The system greatly improves the reliability of the Reactor Coolant System components and can be operated safely and efficiently.

3) During this review period, significant improvements were realized in the management of outage activities. A program was developed and implemented to ensure all Work Orders potentially required for Tech Spec operability of systems during an outage are identified and tracked to completion prior to specific Plant Conditions or Mode Changes (PCMC). This includes tracking of functional and retest requirements prior to mode changes during plant heatup and pressurization. This program aids the operators in verifying that all required plant equipment is properly tested and returned to service to ensure proper plant configuration control.

   A Work Control Center was implemented to provide a centralized location for processing outage work orders. Operations provides an SRO to this organization to ensure that all testing and maintenance work is properly reviewed and controlled. Having an Operations supervisor within this group ensures that Operations is cognizant and in control of any work that could potentially affect plant operation. The implementation of this group has reduced the burden on the Unit Supervisors and allows them to devote more of their time on monitoring unit operations and plant evolutions.

4) The fuel handling evolutions during the last two refueling outages were completed with no problems. The primary reasons for this improvement are:

   - Catawba now has a small full-time crew to maintain the fuel handling equipment and perform other non-outage related fuel handling activities. This crew is made up of both mechanical and electrical maintenance technicians which are not only trained to operate the equipment, but to perform all preventative and corrective maintenance on the equipment. This ensures that the equipment is ready when the outage begins.

- Most members of the full outage fuel handling crew have been working together as a team for several years. They have become very familiar with the operation and maintenance of the equipment. If equipment problems do occur during fuel movement, the operators themselves are trained to troubleshoot and make the necessary repairs with little disruption of the schedule. This has also developed a high degree of teamwork between the members of the fuel handling crew. They have a great deal of pride in their abilities to perform their jobs safely and efficiently.

- The shift rotation for the crew has been improved so that each member of the crew gets rotated every three hours to prevent fatigue, which could cause lack of attention to detail, leading to errors.

5) Mid-Loop Operations - Catawba has implemented several changes to strengthen the ability of the operators to safely operate under mid-loop conditions.

- Detailed briefings which covered industry events were held with each operating shift in the presence of a senior management representative. These briefings were recognized by the NRC Resident Inspectors as a strength.

- Increased SRO staffing.

- Increased switchyard controls.

- Implemented procedural enhancements.

- Developed and implemented a Selected Licensee Commitment which formalized the requirements for entering mid-loop operations.

- An Ultrasonic Level Measurement System has been added to both units. This system enhances the operator's ability to monitor and control Reactor Coolant System level and core cooling flow since this system is not influenced by varying Reactor Coolant System pressure differentials.

C. **Plant Modifications**

Several major modifications were made during the last two outages which will enhance the ability of the operators to control the plant and deal with transient conditions.

1) A Digital Steam Generator Feedwater Control System has been installed on both units. This system will enhance the ability of the operators to control the feedwater system and S/G levels during configuration changes and transients. This will result in smoother plant operation and reduced transients due to equipment failures or personnel errors.

2) A Digital Turbine Control System has been installed on both units. This system provides improved control response, upgraded control and monitoring features and an enhanced troubleshooting system. The capacity to specifically determine system malfunctions will enhance the ability of plant personnel to apply corrective actions and reduce the number of transients initiated by faulty turbine control components.

II. HUMAN PERFORMANCE

Improving human performance is another area in which Catawba has devoted considerable time and effort. Catawba is dedicated to pursuing excellence in all efforts and feels strongly that improvement in the area of human performance is critical to achieving this goal. During this review period, several problem areas were identified and several new programs and processes were implemented to deal with these problems.

A. Employee Involvement

We feel that to achieve continuous improvement with wide spread ownership by employees, they must be involved in problem identification and regulation. Several new processes have been implemented.

1) It had been decided that Catawba would have a lower tier problem reporting process to track, trend and correct problems that did not meet criteria for problem investigation reports (PIRs). In the interim, the threshold for PIRs was lowered and station personnel were encouraged to submit more PIRs covering less significant events. Tracking these PIRs for the first quarter of 1991 showed an alarming trend of incidents attributed to the Operations Group. During the second quarter of 1991 a special team was formed to address this trend and take action to "reverse the trend" (RTT).

   The RTT Team utilizes employee input and involvement to identify generic/system/process type issues and propose changes. These changes are intended to create a work environment and process that will lead to a reduction in PIRs.

   Several areas of focus were identified by the RTT and proposed changes are in various stages of approval and implementation. These areas and implementation status are as follows:

   - Fire Panel

     A large percentage of the PIRs reviewed involved the fire panel. Most problem causes were attributed to poor communications. Employees identified the root cause as no ownership for the fire panel. The RTT recommended assigning an operator to the panel and this action has been taken. Along with this action, a thorough review and revision of all fire panel procedures was accomplished. Special training was given to quality fire panel operators to the revised procedures. The implementation of this item virtually eliminated problems previously experienced.

- Removal and Restoration (R&R) Tagout Procedures

  The RTT recommended changes to R&R forms and a thorough review and updating of pre-plan tagouts. To aid in configuration control, a process of tagging vents and drains was adopted. An improved block tagout process is being developed and piloted.

- Management

  In order to focus on continuous improvement and assure ownership and buy-in by all operations shift and staff groups, a Continuous Improvement Action (CIA) Team was formed. Selected improvement projects are aligned with the vision that "Catawba Operations will be a family of nuclear professionals who have achieved and continue to maintain the highest possible level of operational excellence." Much work remains to be done for this to become a shared vision.

  To promote teamwork and professionalism, the non-licensed operator assembly area was relocated in close proximity to supervisor offices, the control room and work control center. Improved facilities to include study cubicles were designed into the new facility.

- Training

  A number of training issues have been raised. Some immediate actions were taken such as providing reference lesson plans in the control room for operators going through task training and qualification. Guidelines were prepared and operations management briefings were given to each shift to emphasize ETQS expectations.

  The continuous improvement action team is utilized to prioritize training concerns and work on training enhancements.

- Staff Support For The Shifts

  It was felt that the two staff groups that support the shifts with work planning, procedures, etc. should conduct organizational performance improvement reviews. These groups have been reorganized, and other changes will be forth coming from these reviews to enhance the support provided to the shifts.

- Control Room

  Enhancements to access control, configuration and equipment condition are needed. The Reverse The Trend Team has asked the Continuous Improvement Action Team to handle this project since the CIA Team has representatives from each shift.

  The handling of these projects utilizing employee involvement has demonstrated the value that can be added to solving station problems through teamwork. A goal of continuous improvement will be pursued.

2) Employee surveys within Operations have indicated some dissatisfaction with management follow-up on employee suggestions/ideas and a tendency of management to make quick fixes rather than correct the root causes. The existence of five different shifts and three separate staff groups has made common agreement on problem solutions and priorities difficult. The formation of a Continuous Improvement Action (CIA) Team was recommended by a special team that was addressing an alarming trend of problems involving Operations. The CIA team has representatives (Senior Operator, Reactor Operator and Non-Licensed Operator) from each shift and each staff group. The Superintendent of Operations leads the team.

   The purpose of the CIA Team is to identify and prioritize problems/concerns and determine the right solutions. Total quality management techniques will be utilized as experience is gained. Several members have recently received problem solving training. Techniques learned during this training helped the team to select and prioritize initial projects.

   Important to long term improvement and success is a shared vision. You need agreement on where you are headed so that there will be alignment and movement toward common goals. Establishing a vision, gaining acceptance, identifying measures and moving forward with improvement projects has been an on going process early in the teams development.

   One project concerns an incident involving operator error that caused a partial safety electrical bus blackout. A special team investigated the incident and reported 15 conclusions. The CIA Team project involves implementing appropriate corrective actions based on these conclusions.

   Another significant problem concerns component mispositionings. The CIA Team reviewed a series of mispositioning incidents and proposed a plan of action. It was determined that a multi-disciplined team should concentrate on this problem. This effort has been initiated and a non-licensed operator has been assigned full-time to the project.

Additional projects have been identified and work will continue to achieve continuous improvement.

3) As mentioned above, a Component Mispositioning Team was formed. This team's mission is to help the station reduce or eliminate component mispositioning events. This team has five objectives: (1) make sure everyone is aware of the significance of mispositioned components, (2) develop an accurate measure and trend of these events, (3) analyzes past events to determine the root cause, (4) propose corrective actions to prevent future events and (5) investigate future events should they occur.

B. Procedures

Technical procedures and administrative policies have been upgraded to enhance the man/machine interface.

1) An improved operating procedure was written to direct the fill and vent of the Chemical Volume Control System. This procedure brings together many separate operations that formerly were addressed by independent instructions. Operator and staff member cooperation achieved this task to the benefit of all and resulted in a time savings and improved quality during 2EOC4. Based on the success of this effort similar procedures will be written for other systems as appropriate.

2) A review and rewrite of the Catawba Emergency (EP) and Abnormal Procedures (AP) was completed on May 31, 1991. This accomplishment culminated an 18 month effort to address NRC, INPO, Duke Design Engineering and operator concerns. The procedures were re-written for human factor concerns based on a procedure writer's guide edited and approved by the Communications Performance Group (human factor experts) of Columbia, Maryland. A subsequent NRC audit of the EP/AP's resulted in a reduction of noted deficiencies from 103 to 10 items. These 10 items will be addressed in individual procedures as they apply.

3) A new computer program was adopted for publishing procedures. This program (WordPerfect) allows for a greater variety of format techniques to include word processing in two column format, variable emphasis intensity, form generation capability, inclusion of procedure graphics and a much larger symbol selection. The transition from the current computer program to the new program will continue to completion of all Operation's procedures.

C. **Training**

We feel there is much to be gained by making improvements to our training program and much attention is being focused on this area.

1) Each Operations' shift participated in "team building" training which was conducted by Doug Herrington of Senn-Delaney Consultants. This training was targeted towards helping the shifts overcome barriers to good communication and team work. Practical exercises and candid feedback from co-workers were a part of this training. It included an initial multi-day session and a follow-up session for each shift. Members of operations management also participated in this training with each shift.

2) Operations management conducted extensive briefings with each operating shift to emphasize and clarify the expectations of each employee as related to the Employee Training and Qualification Standards (ETQS) during operator requalification training. This was performed to strengthen the overall program by explaining the fundamental concepts and proper implementation procedures to each individual in a classroom environment.

3) The Catawba Operator Requal training program was determined to be satisfactory by the NRC. The NRC administered requal exams were given to twenty four licensed operators. Twenty one of these passed all phases of the exam. In addition, a license preparation class for both ROs and SROs was completed during this review period. Thirteen of fourteen candidates passed the initial license exam.

D. **Process**

Two major changes were made to the processes that gather, report, trend and take action concerning station problems.

1) As mentioned earlier, a Lower Tier Problem Identification Process was implemented. This system was put in place to track, trend and correct problems that fall below the Problem Investigation Report (PIR) threshold. This system is used as a mechanism to measure results against expectations to help in identifying weaknesses.

2) System Availability Teams have been created to take the lead role in improving the availability and reliability of critical plant systems. These teams are tasked with monitoring system reliability, identifying existing or potential problems and utilizing their collective knowledge and experience to develop innovative solutions. The formation of these teams has led to improved

availability of critical plant systems and has heightened awareness of the importance of this issue.

CATAWBA NUCLEAR STATION

DUKE POWER COMPANY

RADIATION PROTECTION SELF-ASSESSMENT REPORT

REVIEW PERIOD 02/91 THROUGH 05/92

JANUARY 1992

TABLE OF CONTENTS

ATTACHMENTS (GRAPHS)

I. COLLECTIVE RADIATION EXPOSURE

Catawba achieved a significant reduction of collective radiation exposure in 1991 when compared with 1990. Catawba's 1991 station exposure of 463 person-rem (projected TLD) or 231.5 person-rem/unit is a marked improvement from the 1990 station exposure of 809 person-rem or 404.5 person-rem/unit. Attachment #1 shows how Catawba's actual exposure for 1991 compared with the station estimate (goal) of 740 person-rem. Catawba's 1991 exposure was also well below the Corporate Goal of 750 person-rem. The station performance placed the station's three year exposure average of 268 person-rem/unit below the INPO June 1991 median exposure of 277 person-rem/unit. This trend is expected to continue in 1992 as indicated by Catawba's estimated station exposure of 323 person-rem (Attachment #2). Catawba's entire annual exposure history (Attachment #3) displays positive changes in Catawba's radiation exposure trends. Refueling outages are Catawba's largest contributor for radiation exposure. Attachments #4 and #5 display outage exposure reduction in 1991 for Unit 1 and Unit 2, respectively. This effort, along with a 36 percent decrease in normal operational exposure from 66 person-rem in 1990 to 42 person-rem in 1991, produced Catawba's overall exposure reduction success for the year. This effort is supported by the decline of exposure per person-hour in 1991 (Attachment #6) which indicates that Catawba is improving radiological efficiency and effectiveness.

Catawba's 1991 exposure reduction success is credited to the following:

- Increased work efficiency (Work Control Center, tagouts, etc.), outage scheduling improvements, outage length (no extension to outage), and work scope control (no major work additions),
- Improved Crudbursts with extended clean up times,
- Increased employee participation in the ALARA program through worker education campaigns and application of the basic ALARA principles of time, distance, and shielding,
- Expanded use of shielding during outages, and
- Implemented World Class (90 percent of estimate) and Excellent Class (95 percent of estimate) goals for outage exposures.

Each work group at the station participates in the development of exposure estimates (goals) for the year. An estimate for normal operational exposure, refueling outage(s) exposure, and forced outage(s) exposure is determined for each work group through the use of historical exposure data and the best available initial job scope estimates. Each of these estimates is reviewed for alignment with corporate and industry standards, and adjusted, when necessary, to develop the total station estimate.

II. CONTROL OF RADIATION AREAS

A. Crudbursts

Catawba uses induced crudbursts at the beginning of refueling outages to reduce primary system radiation levels. In 1991, Catawba implemented a revised crudburst program that included relying on a pH release (via early boration / lithium removal) and an oxidation release (via hydrogen peroxide injection as soon as possible after the Pressurizer bubble collapse) with an extended purification time to achieve maximum benefit.

Other parameters of this program include:

- Placing demineralizers in service as early as possible with maximum purification flow,
- Starting both Residual Heat Removal trains initially (to permit exposure to activity release conditions) with at least one train swap (preferably two) after the oxidation release,
- Running Reactor Coolant pumps (with approximately equal run times) for a total 48 to 60 hours or until Cobalt 58 activity is less than or equal to 0.02 uCi/ml, and
- Switching to Residual Heat Removal (ND) purification when its clean up flow exceeds that of the Chemical and Volume Control system (as pressure decreases) and maintaining this clean up as long as ND is operating OR until Cobalt 58 activity is less than or equal to 0.01 uCi/ml (or pre-outage levels) OR until no significant dose rate reductions are being realized.

During the Unit 1 EOC 5 outage, the crudburst clean up removed 402.84 curies of Cobalt 58 and 17.71 curies of Cobalt 60 for a total of 420.55 curies removed. This clean up resulted in the elimination of approximately 50 person-rem (TLD) of exposure.

During the Unit 2 EOC 4 outage, the activity removed was 318.07 curies of Cobalt 58 and 10.11 curies of Cobalt 60 for a total of 328.18 curies.

Additional successes which in part can be attributed to the use of crudburst are:

- Fewer personnel contamination events,
- Less radioactivity in laundry water,
  (See section 4 Attachment 7)

- Fewer articles of protective clothing being discarded,
- Reduced primary system contamination levels when opening components, and
- Reduced need (or amount) of shielding

B. **Source Term Reduction**

Catawba uses several processes to reduce source term in the plant. Some of these are:

- The stellite control program, which minimizes the introduction of Cobalt 59 into the Reactor Coolant system and other primary systems,
- System and component flushes to remove hot spots and/or reduce ambient radiation fields, and
- When feasible, sources (filters, piping and/or valves) that create exposure problems are replaced.

The following are some examples of these actions during the last year.

- Flushed Unit 2 Floor and Equipment Sumps A and B. Reduced radiation levels on contact from 450 mrem/hr to 50 mrem/hr and general areas from 150 mrem/hr to 45 mrem/hr. (RP)
- Removed additional piping (elbow) when 1 NI 395 valve was removed and replaced. Reduced contact and general area exposure levels. (MES, RP)
- Decontaminated mirror insulation from 2 NV 946 using ultrasonic decon sink. Reduced contact radiation levels from 450 mrem/hr to 20 mrem/hr. (RP)
- Changed Spent Fuel Pool Cooling filter prior to work in filter pit. Reduced contact and general area radiation levels. (Planning, RP)
- Changed Reactor Coolant (letdown) filter prior to work in filter pit. Reduced contact and general area radiation levels. (I&E, Planning, RP)
- Flushed letdown line from Reactor Coolant loop through letdown heat exchanger for support of valve work during 1 EOC 5 outage. Significantly reduced contact and general area radiation levels in all affected areas and also benefitted other work in areas. (MES, OPS, RP)
- Removed hot particles from Refueling Canal during 2 EOC 4. Highest particle removed was 30 R/hr on contact. (RP)

- Decontaminated steam generator channel heads with 3000 psi washer for 1 EOC 5 and 2 EOC 4. Saved approximately 8 rems for Unit 1 and 5 rems for Unit 2. (MES, RP)

- Flushed the Pressurizer Relief Tank at start of 1 EOC 5 and 2 EOC 4 outages. Reduced general area radiation levels by 34 percent. (OPS, RP)

  NOTE: Acronyms in parentheses indicate groups responsible for these improvements.

  RP=Radiation Protection
  OPS=Operations
  MES=Maintenance
  I&E=Instrument and Electrical Maintenance

C. High Radiation Area Controls

The number of High Radiation Area (locked) doors that were improperly controlled was reduced from three in 1990 to two in 1991. This decrease is attributed to the following actions that have been implemented:

- Changed the High Radiation Area and Extra High Radiation Area Access procedures to require a preventive maintenance inspection of the door (closure mechanism and lock) when establishing a High Radiation Area or Extra High Radiation Area,

- Changed the "Duties of Radiation Protection Shift / Routines Personnel" procedure to require a weekly operability test of the door closure mechanism and lock when the daily High Radiation Area / Extra High Radiation Area door check is performed,

- Established a periodic maintenance program for High Radiation Area / Extra High Radiation Area door closure mechanisms and locks,

- Conducted a worker education campaign and revised the High Radiation Area key log certifications to emphasize the "pull check" requirement when exiting a locked High Radiation Area, and

- Installed audible (siren) alarms and/or voice message devices that activate when High Radiation Area doors are opened.

III. ALARA PROGRAM

A. Programs

Employee support of Catawba's ALARA program continues to grow as experience and education expands. Catawba's ALARA Station Directive outlines the station's program and the responsibilities of all employees and specific positions. Catawba holds each person ultimately responsible for ALARA - individual and collective exposures. Job sponsors and system engineers contribute to Catawba's ALARA program by identifying and implementing exposure reducing processes and methods. Job sponsors utilize pre and post job critique meetings to identify ALARA successes and concerns. The Radiation Protection (RP) ALARA Planning group also issues a Post Outage Report for each outage, detailing radiological related information collected through the outage and from worker feedback (critiques). Report topics include:

- Exposure summaries,
- Narratives on major tasks,
- ALARA successes and problems, and
- Reports on exposure extensions, shielding, contamination control / decon, crudburst, Radiation Protection staffing, system / component flushes, and personnel contamination events.

ALARA Planning at Catawba is a team effort. Maintenance Planning performs pre-job ALARA planning on tasks estimated to be less than one person-rem and Radiation Protection ALARA Planning performs pre-job planning for tasks greater than or equal to 1 person-rem or tasks requiring special attention. Regardless of which group does the preplanning, close communications are maintained between the groups to ensure adequate planning. Other groups (craft and engineering) are brought into the process when needed. Following task completion, feedback from execution and management personnel is solicited for incorporation into future work on the same or similar tasks.

Catawba has revised its shielding program to use specific, predefined (scheduled for each appropriate outage) and corrective (new shielding needs) work orders, so that each specific shielding job can be tracked and managed by Catawba's computerized Work Control Center. This change for improved scheduling of shielding and work activities and permitted greatly improved system operability controls.
Other positive changes to the ALARA program include:

- Increasing the RP ALARA staff from 4 to 5 members,

- Implementing a RP ALARA Planning procedure,

- Requiring Radiation Protection outage supervision to generate a post outage critique for their area,

- Having RP ALARA Planners work with Maintenance Planners to develop communications, promote team growth, increase the Maintenance Planners' ALARA planning skills, and

- Enhancing the understanding of each group's roles.

Management is involved in, and supports the ALARA program This is evident by their:

- Participation in the development of estimates,

- Monthly review of exposures received,

- Challenges to the teams to work towards ALARA goals, and

- Serving as members of the station ALARA committee.

Management also backs their employees' efforts to identify and implement ALARA initiatives as shown by allowing the extension of critical path time for a longer crudburst clean up and by providing for continued use of robotics for steam generator work.

The ALARA Planning group monitors radiation exposure for tasks and individuals daily and investigates any unusual exposures.

B. Support

Support of and involvement in ALARA at Catawba is best demonstrated by the actions of employees. Catawba recognizes that many ALARA initiatives are being applied that are not documented via ALARA Improvement Notices, ALARA Problem Reports, Post Job Critiques, and Post Job Meeting minutes. Efforts are underway to increase Catawba's ability to capture these successes to ensure continued utilization of them on future work. The following examples of exposure reduction actions illustrate significant ALARA involvement and support by all station employees.

- Used scaffolding rather than ropes and cables to shield the Pressurizer Relief Tank. Saved installation and removal exposure. (CMD)

- Utilized a robotic arm and remote readout radiation meter for steam generator bowl surveys for [illegible] EGC 4. Eliminated RP exposure for surveys (800 mrem). (RP, MES, Busitech)

- Opened the Catawba Interim Maintenance Training Facility which provides classrooms and hands-on training and allows for mock-up training on the same or similar equipment. Utilized for mock-up training by I&E during 2 EOC 4. (PSD, I&E, M/M, CMD)

- Utilized a robotic arm for steam generator nozzle dam installation for 2 EOC 4. Eliminated exposure for manual installation (4.54 rem). (RP, MES, Busitech)

- Partially filled the Pressurizer prior to performing in service inspection of welds on the Pressurizer and the Pressurizer surge line. Reduced contact radiation levels by 300 mrem/hr. (RP, MES, QA, OPS)

- Utilized longer cables for MOVATS / VOTES testing which allowed set-up of computer in a low dose rate area and permitted testing of more than one valve with only cable moving required. Significant exposure savings when compared to the computer being set-up in close proximity to the valve. (RP, I&E, MES)

- Removed obsolete Upper Head Injection pipe hangers to permit better access to Reactor Head ductwork on Unit 2. Saved 500 mrem due to time savings. (MES, CMD)

- Placed mobile shield racks in various rooms in the Auxiliary Building to use as shadow shielding and for low dose waiting areas. Reduced exposures for multiple jobs. (CMD, RP)

- Replaced valves in high exposure areas with new more reliable valves verses working in place. Primarily used for valves with history of redundant mechanical problems. Saved exposure in the recent Unit 1 and 2 outages as well as for future outages. (MES, M/M, CMD, RP)

- Filled the shell side of the letdown heat exchanger prior to work in the room for 1 EOC 5. Reduced contact and general area radiation levels by approximately 50 percent. (OPS, RP)

- Postponed work in the Unit 1 and 2 letdown heat exchanger rooms to later outages to allow for removal of heat exchanger and installation of additional shielding. Savings of 10 to 15 rem. (MES, RP)

- Coordinated work by plant area so that scaffolding, shielding, and tools (when worked simultaneously) could be used to support more than one task in the area. Example is 2 NI 93 and 94. (MES)

- Utilized extensive mock-up training for steam generator tasks and for CETNA work (on Reactor Head). (MES, CMD, QA, RP, B&W)

- Match marked the internals lifting rig when aligned with the storage stand, internals and vessel. (MES, CMD)

- Filled upender sump area with water for shielding to support work on lift rig (coating), blind flange, and proximity switch. (OPS, RP, MES)

- Modified Reactor Head mirror insulation removal process to allow for removal of all but one bolt without respirators. Reduced time required by approximately 8 hours. (MES, CMD, RP)

- Installed vertical missile shields to reduce exposure levels around vessel opening in the refueling canal. (MES, CMD, RP)

IV. PERSONNEL CONTAMINATION AND CONTROL OF CONTAMINATED AREAS

Catawba has significantly reduced the number of personnel contaminations and improved control of contaminated areas. To account for various work, different outage schedules, etc., a method accepted by the industry is comparing personnel contamination events per Radiation Work Permit hour. Attachment #7 demonstrates the downward trend in the rate of personnel contamination events over a three year period. From 1990 to 1991, there was a 56 percent reduction in the number of personnel contaminations. This is graphically represented on Attachment #8. Catawba's personnel contamination event goal for 1992 will reflect a further reduction with expectations of the downward trend continuing in the future.

Several measures have proven effective to achieve this reduction in personnel contamination events and simultaneously reflect an improvement in control of contaminated areas.

A. Decon and Control of Total Contaminated Area (square feet)

In 1988, the contaminated area at Catawba was 14,600 square feet and later reached 26,750 square feet. A decon team was formed with recovering contaminated area as their primary responsibility. Their initial goal was to reduce the total contaminated area to 8,000 square feet. This goal was achieved and a new minimal record was reached in October, 1991 of 4,866 square feet of contaminated area. The decon team has proven to be successful in minimizing contaminated areas, which allows entry into many areas without the use of protective clothing, resulting in savings and radwaste reduction. The decon team is also staffed for outages and was able to keep total contaminated area during 2EOC4 below 10,000 square feet. Other preventive measures are used such as requiring catch containments when venting, draining, or breaching a contaminated system. Attachment #9 shows the reduction average of total contaminated area over a four year period.

B. Use of Disposable Coveralls Worn Over Cotton Coveralls

During a typical refueling outage approximately seven to eight thousand personnel entries will be made into lower containment. For the last two refueling outages (2EOC4 and 1EOC5), disposable coveralls were required by the Radiation Work Permits for each entry into lower containment. The use of disposable coveralls has turned out to be beneficial in more than one area:

- The number of personnel contaminations in lower containment has been reduced (Attachment #10). Note the 1990 to 1991 reduction and the downward trend over 5 years.

- The cotton coveralls are "cleaner" (less contaminated) after being used.

- Disposable coveralls protect against hot particle contaminations. The number of hot particle contaminations has been reduced (Attachment 11). Note the 1990 to 1991 reduction and the downward trend over a three year period.

- Disposable coveralls reduce the number of hot particles introduced into cotton coveralls and therefore into the laundry process.

- Wearing disposable coveralls prevents hot particles from "jumping" off cotton coveralls into "clean" areas and contaminating other personnel.

- A reduction in the replacement rate of cotton coveralls which results in dollar savings to the company. A disposable coverall cost about $2.45 compared to a cotton coverall which costs in the range of $18.00 to $25.00, plus burial cost as radioactive waste if rejected.

- Additional savings is realized with the reduced number of personnel contaminations. It takes approximately three work-hours to process the documentation for one contamination event.

C. Automated Laundry Facility Setpoint Reduction

As of April 1991, the alarm setpoint on Catawba's Automated Laundry Facility (ALF) was 115 nCi. Over the period of a month (also during outage time), the alarm setpoint on the ALF was reduced to 75 nCi or about a 35 percent reduction. This essentially means that Catawba's protective clothing was 35 percent "cleaner" when it was placed back on the shelf for workers to wear. Rejection rates on the coveralls did not greatly increase. The cotton coveralls were "cleaner" because of the protection of the disposable coveralls. The ALF setpoint could be lowered and the cotton coveralls going back to the shelf were "cleaner". The alarm setpoint on the ALF is now as low as interference from several background contributors during outages will allow. (All alarm setpoint values are at a 95 percent confidence level.)

D. Maintaining Upper Containment as a Clean Area

As Catawba started up and the first refueling outages came along, management made the decision to keep Upper Containment clean. In the future this would require careful planning and communication between work groups to perform the tasks required for refueling outages and keep the operating deck clean. To complicate the process more, Radiation Control Zones must be constructed and removed for some of the work to proceed. To realize the tremendous benefit of this decision, entries into Upper Containment during the last two refueling outages can be examined (1EOC5 and 2EOC4). During 1EOC5, there were approximately 12,813 personnel entries into Upper Containment. Of these, 9,609 were able to enter for observation, work, surveys, etc. and did not have to wear protective clothing. During 2EOC4, out of 11,181 entries, 8,725 did not have to wear protective clothing. On the average, approximately 76 percent of the entries into Upper Containment during an outage do not require protective clothing. This results in savings in work-hours, radwaste, and protective clothing.

V. RADIOLOGICAL WORK PRACTICES

Catawba's Radiation Protection organization is proactively pursuing improvements in the radiological work practices of station workers. Included in this effort is a commitment to simplify RP requirements, educate workers regarding proper radiological practices, promote consistent RP practices/requirements within the RP section itself and develop an improved working relationship between the rest of the station and the RP section. The following examples illustrate these changes:

- In June of 1991, the Surveillance and Control (S&C) group was reorganized to provide two work groups providing RP job coverage to the station instead of four. During non outage periods, this eliminates worker confusion and improves RP consistency since all work performed in the Auxiliary building or the Reactor building is now under one supervisor's jurisdiction. Previously, the Reactor and Auxiliary building RP support was divided up by units between four RP Supervisors.

- During refueling outages, RP S&C Supervisors continue to be responsible for their non outage areas (i.e., Reactor or Auxiliary building). Again, this practice has proven beneficial in maintaining consistency of RP requirements for station workers and in improving RP services to the station.

- During refueling outages, the S&C (job coverage) group physically relocates to the Operations Support Center (OSC), an office area outside of the Radiation Control Area (RCA), to provide service to other station workers without first having to enter the RCA. The OSC is utilized for this and is conveniently located to maximize face to face communications between RP and the people they provide services to. Many unnecessary RCA entries are eliminated and improved productivity of the workforce has resulted from this. Non outage utilization of this work by RP is being evaluated at this time.

- During the two refueling outages in 1991, the RP section installed a FAX machine inside of lower containment. This equipment has eliminated the need to remove contaminated paperwork from the building, bagging and tagging it and then copying it for removal from the RCA. In addition to reducing waste, it is used to transmit RP survey date from technicians to Supervisors. Other work groups use it to transmit data/forms to and from Lower Containment.

- In October 1991, CNS RP implemented an enhancement to the Station's Radiation Work Permit (RWP) numbering system which will allow RWP numbers to remain the same from year to year for the same work on each unit. This change was coordinated with the other two Duke Nuclear Stations for standardization and will particularly benefit the transient work force.

- On January 1, 1992, CNS RP initiated utilization of a computer generated RWP form.

Again, this work was coordinated with the other Duke Nuclear Stations for consistency and is intended to standardize RP requirements for workers at all three sites.

- In January 1991, CNS radiation workers were introduced to additional radiological work practices training in the form of an ANNUAL CREW DEMONSTRATION. This training is conducted by the crew supervisor in a contaminated area mock-up with the assistance of RP personnel. This training is intended to provide practical refresher training to station workers with involvement by their supervision.

- In August/September 1991, the RP section developed and distributed three lesson plans devoted to improving radiological work practices at the station. Again, these lesson plans were distributed to station supervisors for presentation to their work crews. The topics included personnel contamination prevention, dose reduction methods and Radiation Control Zone (RCZ) boundary violations.

- In September 1991, the RP section developed/distributed materials designed to heighten worker awareness for the Station's Radiological Protection Program. The ALARA QUEST program consisted of an information handbook sent to each station radiation worker. The handbook also contained a test sheet to be completed and returned to RP. All participants returning a completed test were given a CNS ALARA Swiss Army knife. Five different tests were used. Personnel who scored 100% correct on the test were entered into a drawing for additional prizes. While difficult to quantify the effectiveness of the program, if employee participation can be used as a gauge, it was a tremendous success. The cost of the program ($20,000) was an indication to station personnel of the true management commitment to the ALARA program. This was the first such program conducted by CNS RP.

- The CNS RP section routinely publishes its own one or two page newsletter to station personnel. This paper (CNS RP "HOT TOPICS") is used as an additional mechanism to notify the station of important RP related matters. The HOT TOPICS can be quickly produced and distributed, making it a very effective method to disseminate radiological work related information.

- In December of 1991, the RP section distributed a series of seven posters to the various station work groups who perform work activities inside the RCA. These posters featured photographs of plant workers (staged) correctly or improperly conducting activities inside the RCA and brief messages to encourage compliance with approved radiological work practices. The posters are now located throughout the station in office/work areas as well as inside the RCA.

- In November of 1991, CNS discontinued the practice of allowing personnel to enter the RCA without dosimetry (even though federal regulations permit such entries). In the past, dosimetry was issued only to personnel expected to receive measurable exposure to radiation or radioactive materials. Catawba's current approach will allow us to fully quantify the radiological consequences of every entry into the RCA.

- Along with several other groups at Catawba RP management developed a program in which RP Supervision is required to perform routine observations of work activities in the plant. These observations are documented on 3 x 5 pocket cards with an emphasis upon obtaining increased supervisory field time. Supervisors can now easily document quality work or deficiencies they observe while in the plant. This user friendly program has proven significantly more effective than a previous program which required completion of a two page form for each observation.

- During 1991, Radwaste reduction training was provided to CNS exempt personnel. The three hour training concentrated on the financial impact to the station of maintaining Catawba's current rate of generation of radioactive wastes. Those attending were educated on the amount of solid waste generated at the station and the resulting costs. In addition, a look ahead at expected processing and burial cost increases was presented to further emphasize the need to keep Catawba's radwaste to an absolute minimum. This training will also be offered (in 1992) to all station personnel who work inside the RCA.

- Solid radioactive waste buried in 1991 amounted to 4089 cubic feet compared to 4216 and 7683 cubic feet in 1990 and 1989 respectively (Attachment 12). These improvements are a direct result of efforts such as the Auxiliary building decontamination program, heightened worker awareness and reduction in radioactive fluid system leakage due to improved plant maintenance.

- CNS RP personnel were very successful in reducing the usage of radiological respiratory protective equipment in 1991. The 3638 filter respirators issued in 1991 compares to 8119 in 1990 and 6180 in 1989 (Attachment 13). At the same time, the number of body burden analysis above INPO Level II remained at zero.

VI. RADIATION MONITORS (EMFs)

Catawba continues to make progress in the improvement of the process and area radiation monitors.

A. EMF 34

The design function of EMF 34, Steam Generator Blowdown Monitor, is the early detection and tracking of Steam Generator tube ruptures. Modifications were made in late 1990 and early 1991 to improve operability. Continued investigation of EMF 34 operability determined that EMF 33, Condenser Air Ejector Offgas Monitor would be better suited to detect a Steam Generator tube rupture.

Modifications to switch automatic functions (blowdown isolation and sample re-route) from EMF 34 to EMF 33 are scheduled for 4th Quarter, 1992. When modifications are completed, EMF 33 will be used to identify a Steam Generator tube rupture, sampling will identify the affected generator and EMF 34 will be used as a trending monitor.

Administrative controls are in place to ensure that the Catawba Main Steam Line Monitors are in compliance with Regulatory Guide 1.97 commitments.

B. EMF Working Group/System Expert Group

The EMF Working Group that has existed for the past three years has evolved into the EMF System Team. Team members include:

- EMF System Engineer
- Radiation Protection
- Maintenance Engineering
- Instrument and Electrical
- Operations
- Chemistry
- Design Engineering

All major inoperability concerns with this system have been addressed by this group and repair work and/or modifications are planned/underway. This commitment of resources indicates a recognition of the importance of the EMFs and a commitment to maximize EMF performance, availability and reliability.

C. Post Accident Containment Air Sampling System (PACs)

Catawba enhanced PAC's maintenance and testing in 1991. New detailed controlled manuals to support field work on the PAC's were researched and issued. Periodic Testing procedures were upgraded to ensure design basis operation was met and to include root cause evaluation of any failures.

The periodic test frequency has been increased to gain system reliability information. Each panel will be tested monthly (previously semi-annually) for 6 months. Upon successful completion of monthly testing, quarterly testing will be implemented for 1 year, after which, with demonstrated reliability, the testing frequency will be returned to semi-annual.

During initial testing of the Unit 2 panel a problem was identified which prevented the sample from reaching the panel. The problem was corrected and retesting of the panel is scheduled for mid-January, 1992 when containment gaseous activity is at a testable level.

In a proactive effort, Duke Power is studying the PACs panel efficiency for methyl iodide sampling. Although methyl iodide is a very small fraction of the iodine present in containment immediately following an accident, within a few days, it represents approximately 50% of the iodine present and it is important to ensure adequate collection.

D. Module Upgrades

Catawba is in the initial phase of a Radiation Monitoring System upgrade. Digital output modules, designed in-house, will replace the analog output modules currently installed. The digital modules are designed as a direct replacement for the analog modules and will work with the existing detectors and sample delivery systems. All EMF system procedures are being reviewed and improved in conjunction with the upgrade.

VII. EQUIPMENT UPGRADES

A. **EMF Modules** ($260,000)

Catawba is replacing the Radiation Monitoring System output modules with digital modules to provide easier and more accurate read-out, and decrease time and expense associated with repair of the older analog modules. Also, the digital modules allow connection of the monitors to a token-ring network to transfer data to a centralized computer system for status display, generation of reports and logging of historical data.

B. **Shepherd Irradiator** ($60,000)

The Shepherd instrument calibrator was upgraded to a newer model containing a larger Cesium-137 source. The upgrade allows RP to perform improved instrument calibrations at higher dose rates. In addition, the new model has a linear guide drive which provides greater accuracy, greater repeatability and smoother operation with less maintenance.

C. **Tool Monitors** ($105,000)

RP purchased and installed Small Article Monitors at the exit from the Radiation Control Area (RCA) and at the Radwaste Facility. The monitors automate frisking while providing a higher sensitivity by using plastic scintillation detectors and a more effective geometry than the conventional frisker.

D. **Chemplot** ($5,000)

Radiation Protection implemented revised Count Room Multi-Channel Analyzer (MCA) software and new Catawba VAX Computer System software that allow automated electronic transfer of Chemistry sample results. Sample results are sent from the MCA via the VAX where results are edited to the IBM Chemplot program used by Chemistry to trend radionuclides and their activities.

E. **Body Burden Analysis System** ($120,000)

Catawba purchased and installed a new Whole Body Counting System manufactured by Canberra Instruments. The System was purchased to replace a Canberra System purchased in 1985. The new System incorporates state-of the-art software and hardware. Some of the improved capabilities are:

- Capability to maintain personnel data and analyses results in a data base,
- Decrease in Body Burden Analysis processing time, and

- Greater sensitivity due to increased detector size.

F. **WAN/LAN - EDC Project** ($1-2 Million, includes 3 Stations & GO)

RP has installed a Local Area Network (LAN) to provide software tools needed for routine work, centralized location for document storage and a centralized system for backup and recovery of this information. The LAN gives RP better access, higher reliability of access and more efficient maintenance of the information.

The Station is in the process of installing a Wide Area Network (WAN). Installation should be completed in mid-1992 at which time the Station will have access to process data and corporate information systems currently being developed. Installation of the WAN in mid-1992 will also allow use of an Electronic Dose Capture System (EDC). EDC is currently in use at Oconee, it is being installed at McGuire and installation at Catawba will allow company-wide use of a standardized record keeping system in January, 1993.

VIII. GENERAL EMPLOYEE TRAINING (GET)

Improvements to the GET Program have continued during this review period. Program improvements reflect input from GET instructors, employee feedback, Radiation Protection Managers, trending and new and revised RP Programs at all three Duke Power Company Nuclear Stations. Program enhancements include:

- Use of "Do the Right Thing" video tape to emphasize good ALARA and contamination control practices,
- Addition of "Food for Thought" topic to emphasize prohibitions against eating, drinking and smoking requirements in the RCA,
- Precautions to take when encountering Boron contamination,
- Incorporation of Information Notice 90-47, "Radiation Exposures to Personnel Due to Improper Handling of Radioactive Sources", to inform workers of the dangers of handling highly radioactive sources,
- Use of ALARA booklets and rewards to re-educate workers on ALARA principles,
- Distribution of a crew meeting package to alert workers to the hazards associated with climbing on flex conduit in the doghouses, and
- Removal of Security requirements from the GET RP Study Guide for distribution as a separate GET Security Study Guide, to improve focus on core GET topics.

IX. CONTROL OF RADIATION PROTECTION CONTRACT WORKERS

Duke Power Company has contracted General Technical Services (GTS) to provide RP technicians for three years at all three Nuclear Stations. This has allowed Duke Power's stations to have consistent, knowledgeable personnel familiar with the site. A major success has been the "CORE" program. The "CORE" program is a group of 45 RP technicians with 15 technicians at each station. The 15 "CORE" technicians support all outages at that station. They are assigned to outages at other stations when the home station is not in an outage. The "CORE" receives training equal to that of the station technicians. This includes systems training, procedure updates, and operational experience. They also are offered incentives to increase their knowledge using both GTS and other outside sources. The average "CORE" person has 8.3 years of Radiation Protection experience. Their familiarity and station experience has been a valuable asset to Catawba. These technicians have also provided immediate support for unplanned outages without compromise of quality of personnel.

The program has also shown financial advantages. The cost of security, radiological records processing and other in-processing costs has been significantly reduced. Both 1992 outages were significantly under budget.

X. AUDITS

A. NRC Audits

(1) Inspection Report # 50-413, 414/91-02
Date: 2/15/91

Non-cited Violation 91-02-01, Failure to maintain a locked and posted High Radiation Area (HRA) in accordance with HP/0/B/1000/25.

Action Taken: Increased restrictions on Chemistry key and door control and checks of door locking mechanism following each closure of the HRA door.

(2) Inspection Report #50-413, 414/91-14
Date: 7/2/91

Non-cited Violation 91-14-01, Failure to maintain the Unit 1 PAGS system and to implement an adequate PAGS system testing procedure.

Action Taken: PAGS system's design drawings and manuals were revised for clarity. Procedures for testing the PAGS system were revised to:

- Include provisions for sampling and analysis of containment atmosphere.
- Specify acceptance criteria for comparison of analytical results between the PAGS system and the routine containment atmosphere sampling system.

(3) Inspection Report #50-413, 414/91-18
Dated: 11/12/91

(a) Violation 91-18-03, Failure to evaluate worker's exposure to the skin of the body properly, in that from January 1, 1991 through August 23, 1991 exposures to workers from concentrations of Xenon-133 gas were evaluated through a tissue equivalent absorber thickness of approximately 15 mg/cm^2 rather than the required 7 mg/cm^2.

Actions Taken:

(1) Changed procedure HP/0/B/1000/24 to have beta dose assignments calculated from a beta dose rate obtained from gamma analysis of a gas sample rather than beta dose rates from beta survey instruments.

(2) Changed instrument procedures to include multiple beta correction factors and ensured that appropriate poly bags were issued with the instruments.

(3) Appropriate training given to Radiation Protection technicians and vendor technicians.

(b) Violation 91-18-01, Failure to follow/have adequate respiratory protection procedures to provide guidance for use of respiratory protective equipment by RP personnel conducting pre-job surveys of contaminated systems, equipment or areas.

Actions Taken:

(1) A training package describing this incident and the planned procedure changes was sent to S&C RP personnel.

(2) Procedure HP/0/B/1000/04 was revised to:

- Include the use of respiratory protective equipment for all light work in areas where the contamination levels generally exceed 100,000 dpm/100cm^2

- Require respiratory protection/engineering controls for RP personnel performing surveys when contamination levels are known (or are anticipated) to exceed 100,000 dpm/100cm^2.

- Require respiratory protection/engineering controls if the survey itself is likely to create airborne radioactivity in the breathing zone.

(c) Non-cited Violation 91-18-02, Failure to conduct adequate survey of external dose rates associated with reactor coolant piping during valve repair resulting in two administrative over-exposures.

Action Taken: The corrective actions included:

- Disciplinary action for the contract RP technician providing job coverage.

- Revisions of the Containment Entry/Authorization Form to include instructions for evaluating non-uniform radiation fields, whole body dosimetry location and providing a summary of the event to all RP personnel.

(d) Non-cited Violation 91-18-04, Failure to follow RP procedures for labeling containers of contaminated .naterials maintained in a RCZ.

Actions Taken: The Licensee took appropriate actions to label each drum properly with a yellow radioactive material tag.

(e) Non-cited Violation #50-413, 414/91-18-05, Failure to meet 10CFR20.203 requirements for area posting. 10CFR Part 20, Appendix C Limits

Actions Taken: The Licensee properly labeled seven resin liners and initiated a change to RP procedure HP/0/B/1000/30 to include requirements for labeling any containers of licensed material with contents exceeding 10CFR20, Appendix C or Appendix B, Table 1, Column 2 limits.

B. QA 1991 INSPECTION, NP-91-09 (CN)

Dated: May 16, 1991

Finding: No Radiation Protection findings were noted.

C. ANI LIABILITY INSPECTION

Dated: May 31, 1991

Recommendation: 91-1, A surveillance program should be instituted for checking to ensure outdoor radioactive material containers are stored such as to prevent container degradation.

Action Taken: Revised RP procedure HP/0/B/1000/37 and HP/0/B/1000/38 to include a program to inspect and correct degradation of outdoor containers.

Note: The main purpose of this audit was to demonstrate ANI availability and retrievability of records. These records included:

- Radiological surveys,
- Instrumentation calibration records,
- Instrument daily source check records,
- Documentation of job and ALARA pre-briefs,
- Identification of the person supplying RP coverage,
- Documentation of significant or unusual radiological events the individual was involved in,

- Personal exposure history records,
- Bioassay results,
- Radiation Protection related training records (proof of attendance, test grades, course syllabi, student signatures),
- Employment records (where required: resume, employment application, medical results, signatures), and
- Documentation of respirator qualifications (medical, training and fitting).

ANI acknowledged that the audit was successful and completed in a prompt time frame.

XI. ORGANIZATION AND OPERATIONAL EXPERIENCE

Duke Power Company's reorganization has positively enhanced Radiation Protection's effectiveness and communication. The RP Manager now reports directly to the Station Manager. This will allow direct input to the Station Manager concerning radiation protection. The station Radiation Protection organizations are also in alignment. This will improve communication and interaction between stations.

Even though Catawba is the newest DPC station it's RP worker experience is equal to or greater than McGuire and Oconee. Low turnover rates have strengthened the experienced work force by adding stability. In the past year Catawba has released four people and gained two. All of these were personnel movements within the company strengthening Catawba's corporate support to all stations. Attachment 14 shows time with the company and years of related work experience.

Catawba continues to upgrade the knowledge level of personnel through training. Two staff members have attended special training for preparation for the Health Physics Certification Test. Both people passed one part of the test. Two more staff members will attend the spring session. A majority of the RP technicians have completed two weeks of Systems training. The remaining ones are scheduled for Spring '92 classes. RP technicians and supervisors annually attend Continuing Training which highlights systems, Operating Experience and refreshes current skills. All personnel will be able to increase their knowledge of radiation protection through a new computer based training program.

XII. ANALYSIS EQUIPMENT QA/CONFIRMATORY MEASUREMENTS

A. Intrastation/Interstation Cross Check Program

During the review period, the Radiation Protection Counting Room (radiation analysis) processed more than 423 quality assurance samples in Catawba's cross check programs. With two exceptions, all samples fell within NRC acceptance criteria. The exceptions were found to be problems with the samples and not the analysis equipment.

B. NRC Confirmatory Measurements Program

The NRC Mobile Analysis Van was on site June 3 - 7, 1991 to review the quality of Catawba's Counting Room analysis. As noted in NRC Inspection Report #50-413/91-14, there was excellent agreement between Catawba's and the NRC's analytical results. There was a disagreement with a Fe-55 spiked sample sent by the NRC to Catawba and analyzed by an outside laboratory. This one issue has not been resolved.

XIII. EFFLUENTS CONTROL/UNPLANNED RELEASES

A. Environmental Monitoring

1033 environmental samples were collected in 1991 as required by CNS Technical Specifications. An additional 85 environmental samples were collected inside the plant protected area to provide a more complete picture of station impact. In 1992, 62 samples have been collected per the required Technical Specifications.

Activity levels in the environment continue to remain low. Review of 1991 environmental sampling results indicated that all positive indications of radioactivity were well below reporting levels specified by Technical Specifications. A comparison of dose calculations from environmental measurements and doses from effluent data demonstrated that levels of radioactivity were not higher than expected. The highest percent of Technical Specification reporting levels were observed in fish samples (Cs-137, 14%) and surface water (H-3, 25.3%). These levels were recorded in the area adjacent to the Catawba effluent discharge. All other samples and locations were reported as being less than 10% of Technical Specification reporting limits. Catawba's contribution to environmental radioactivity is small and continues to have no significant radiological impact upon the health and safety of the general public.

B. Gaseous and Liquid Effluents

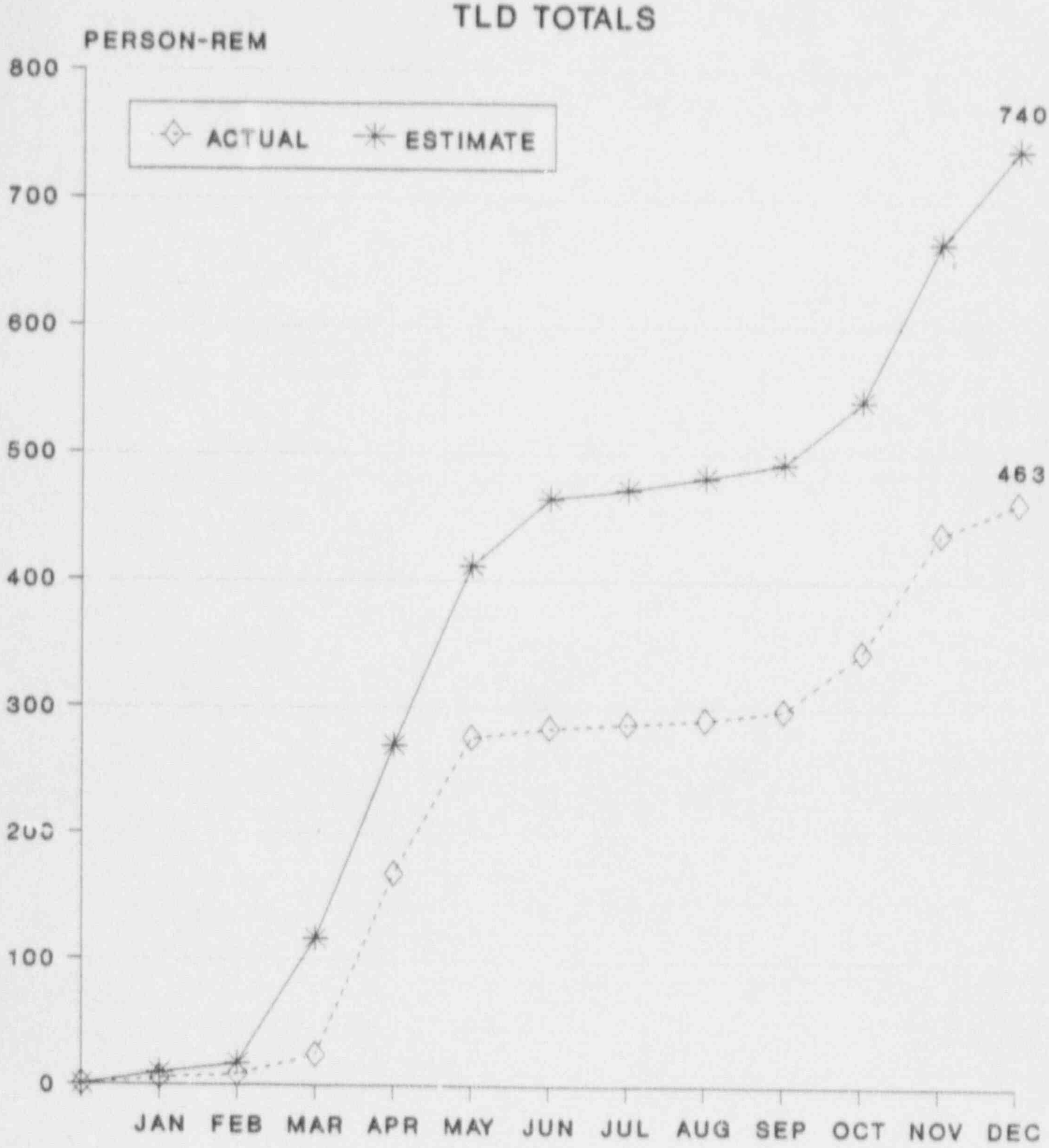
During the review period, 325 liquid releases and 129 gaseous releases were made from the station. The total body dose to the public (through November 1991) as a result of liquid releases is approximately 10% of the dose limit specified in the Technical Specifications. For gaseous releases, the highest percent of the dose limit is approximately 2% of the Technical Specification limit.

C. Unplanned/Abnormal Releases

One abnormal radioactive liquid release to the environment occurred since the beginning of the review period. A technician's error released liquid effluent at greater than Technical Specification limits of one MPC, but this was less than the reportable 10CFR20.405 limit of two MPCs when averaged over two hours.

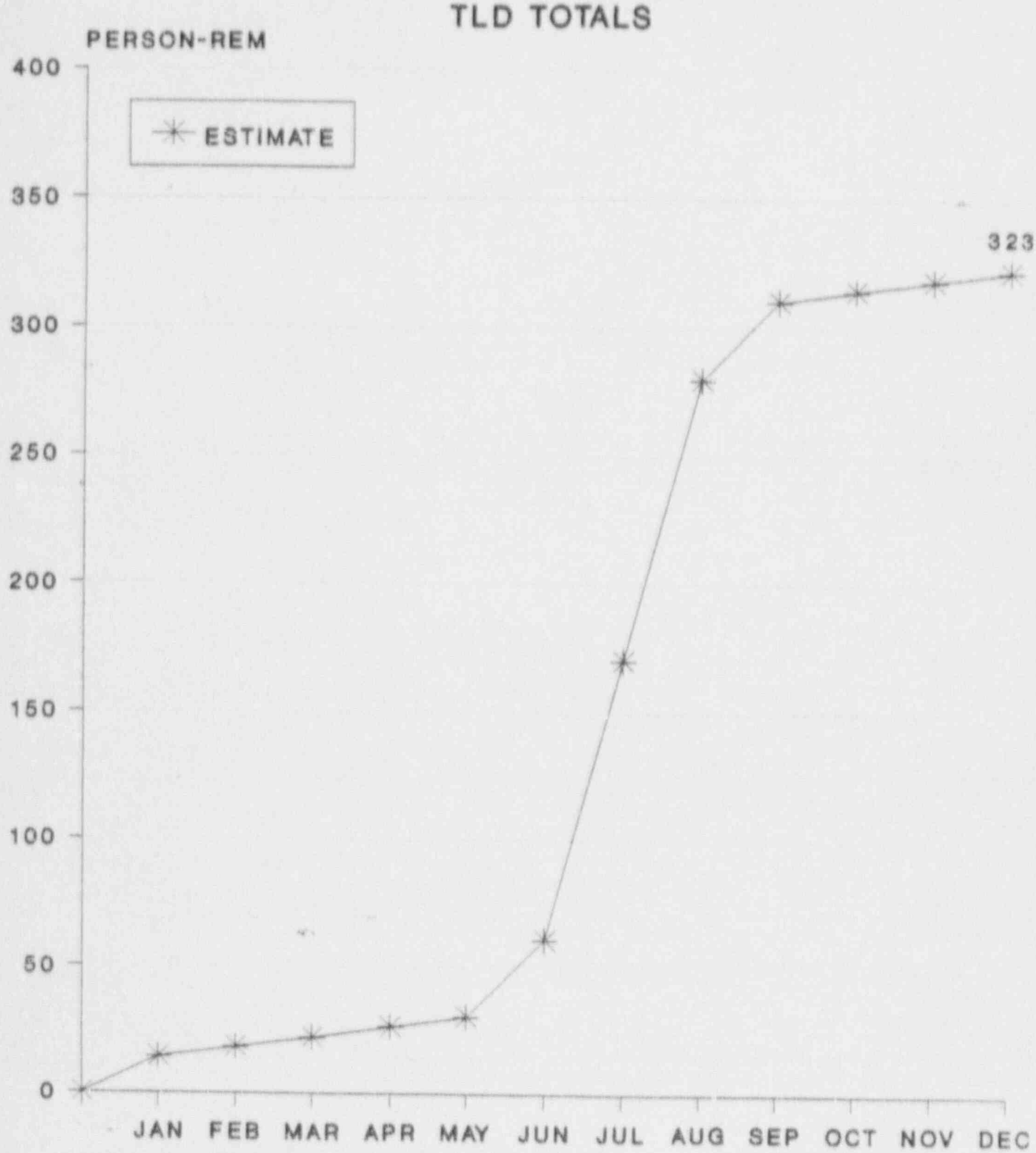
One unplanned gaseous release occurred during the review period. During the Unit 1 outage, 0.193 curies of radioactive gases escaped through open penetrations during a pressure test on the Containment building. No regulatory limits were exceeded during this release.

CATAWBA NUCLEAR STATION
1991 EXPOSURE

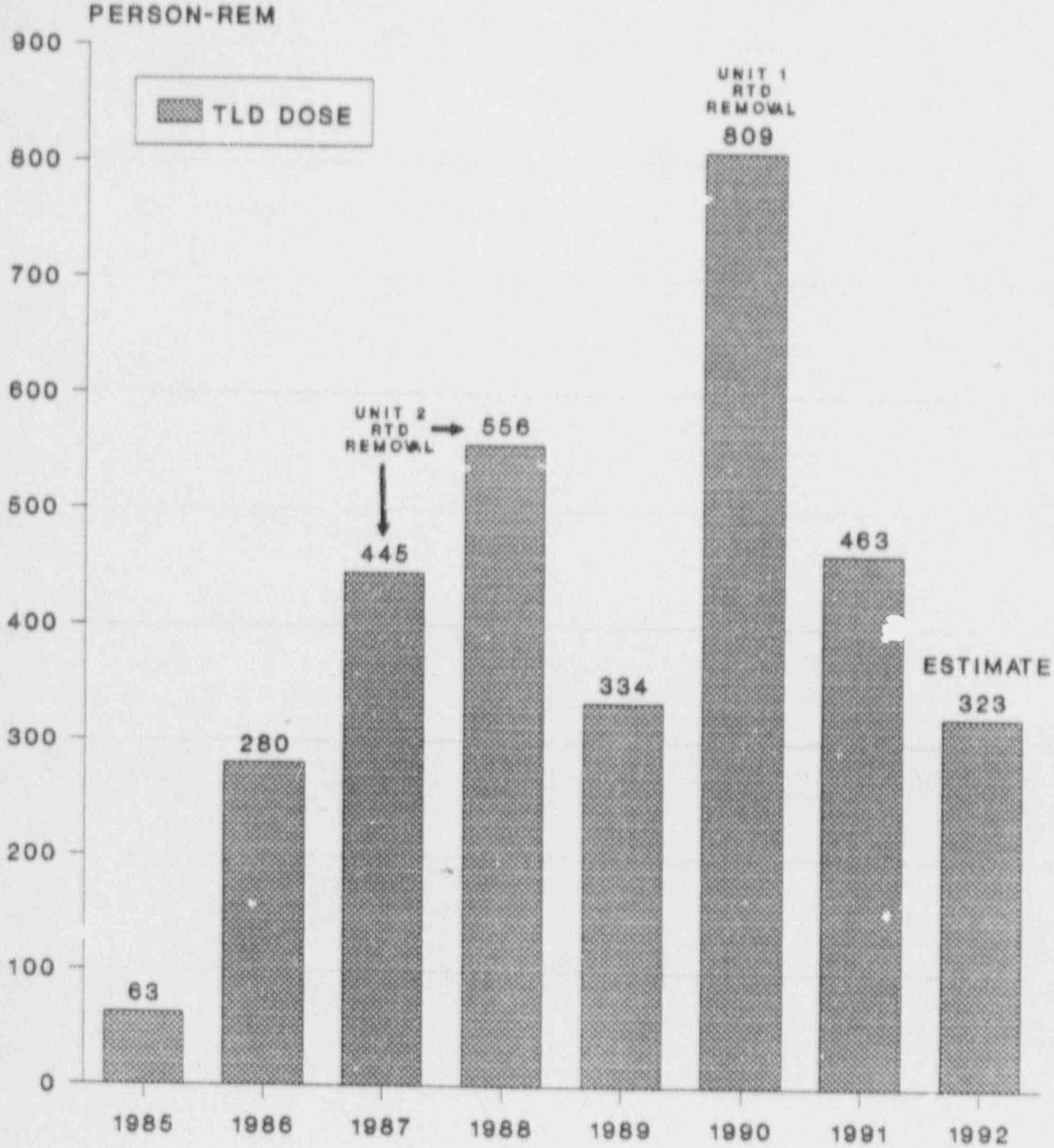


NOTE: DECEMBER EXPOSURE IS CORRELATED POCKET DOSIMETER EXPOSURE.

CATAWBA NUCLEAR STATION
1992 EXPOSURE

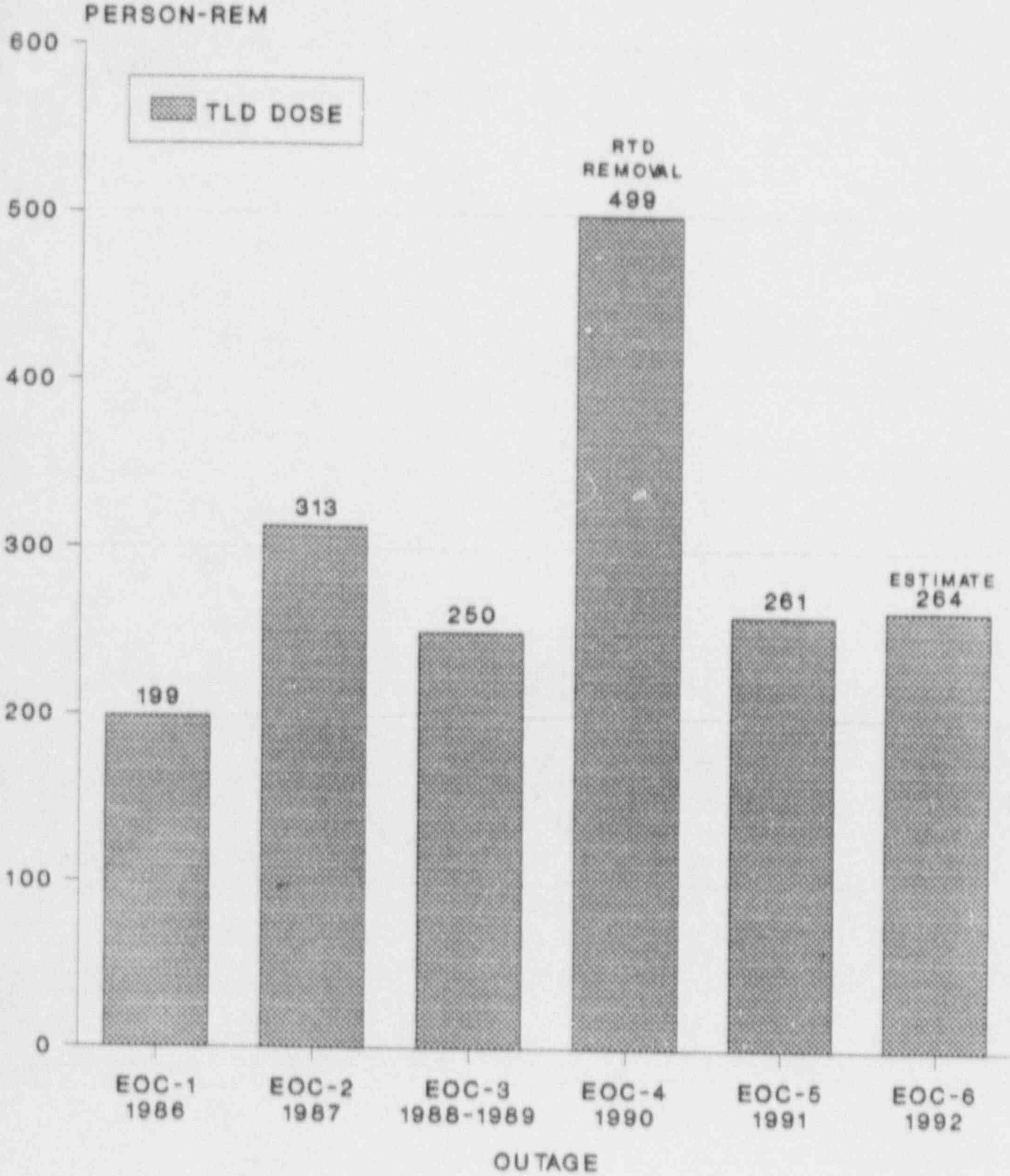


CATAWBA NUCLEAR STATION EXPOSURE TREND

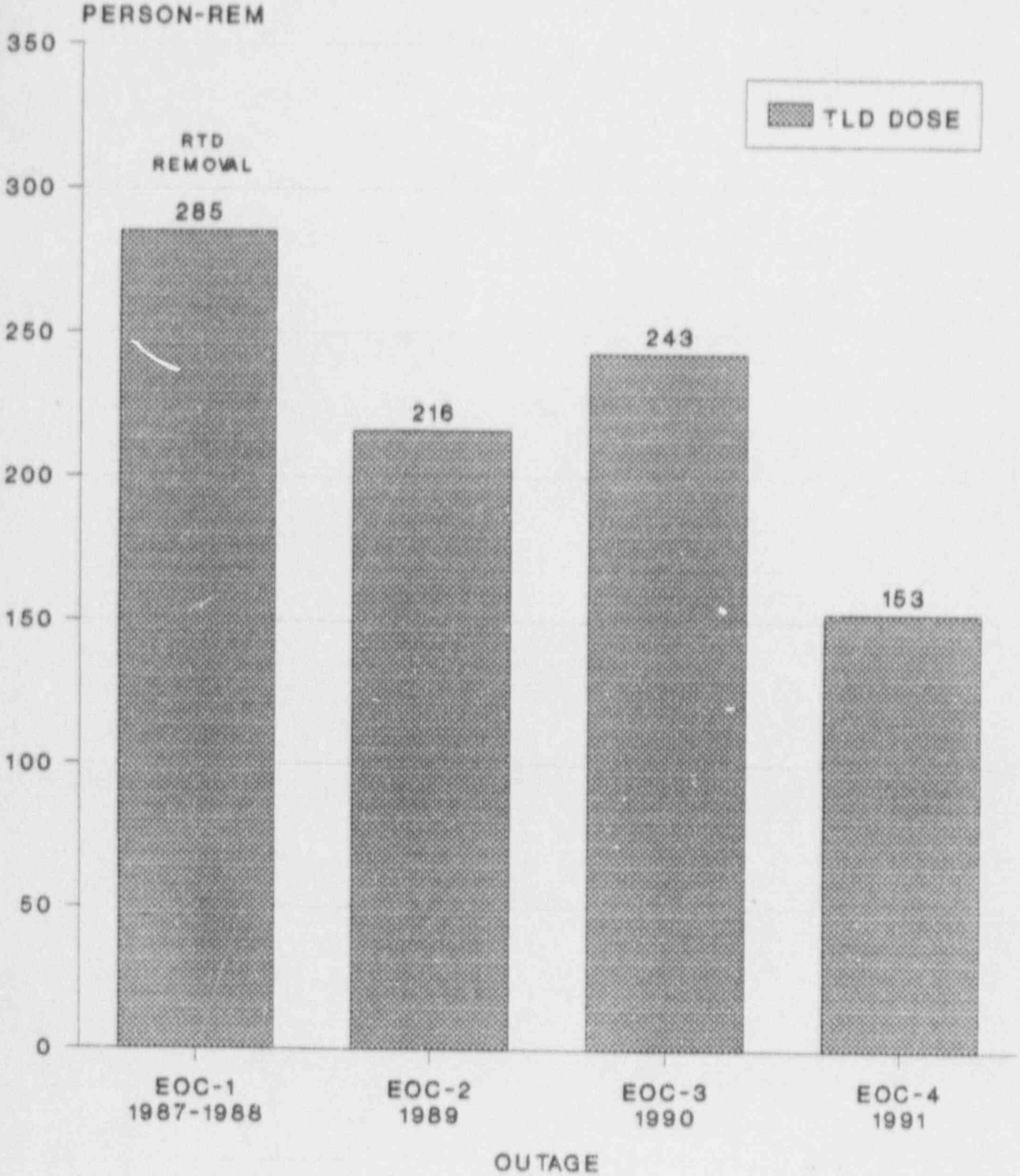


NOTE: DECEMBER 1991 EXPSOURE IS CORRELATED POCKET DOSIMETER EXPOSURE.

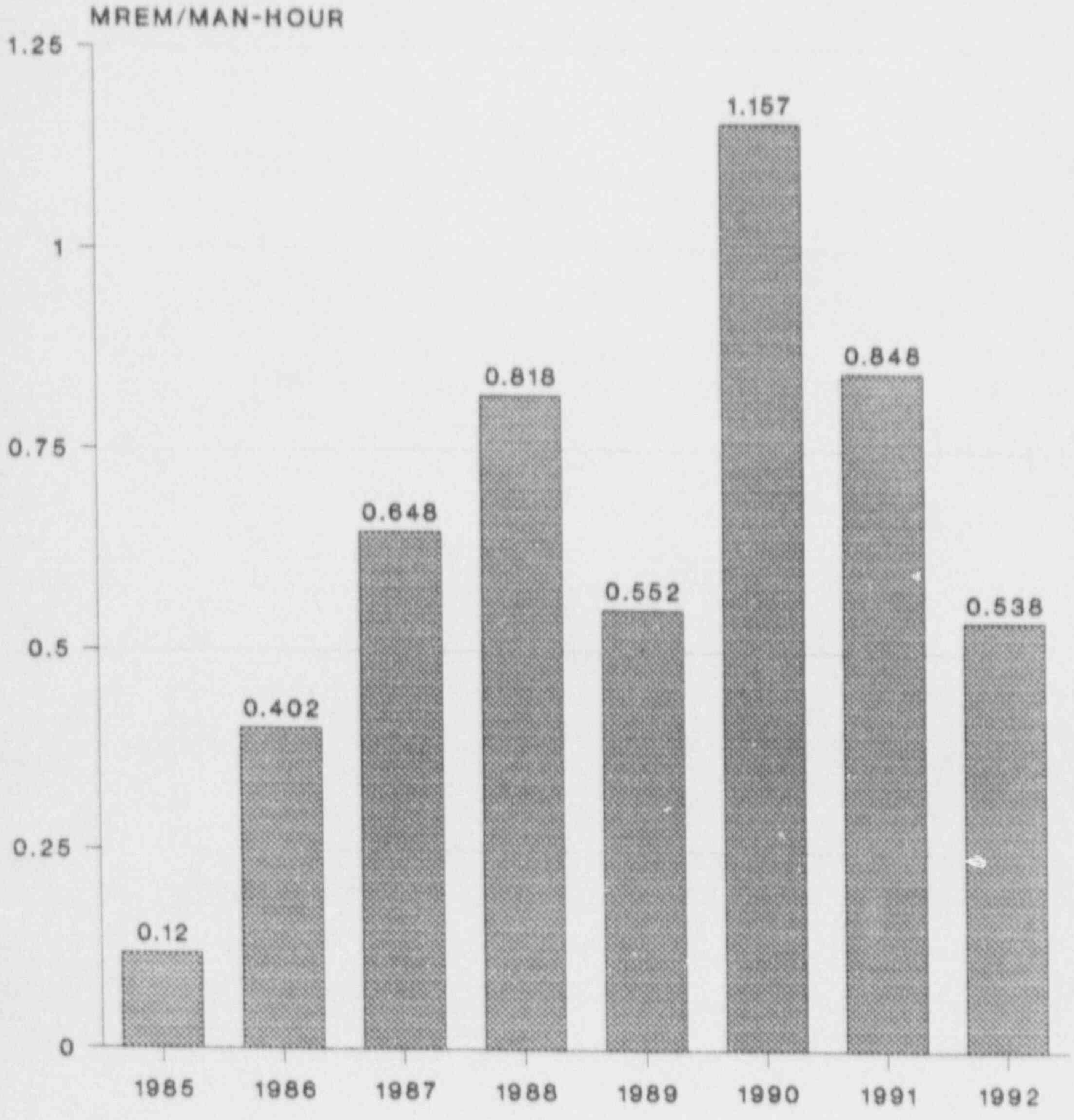
CATAWBA NUCLEAR STATION
UNIT 1 REFUELING OUTAGE EXPOSURE



CATAWBA NUCLEAR STATION
UNIT 2 REFUELING OUTAGE EXPOSURE

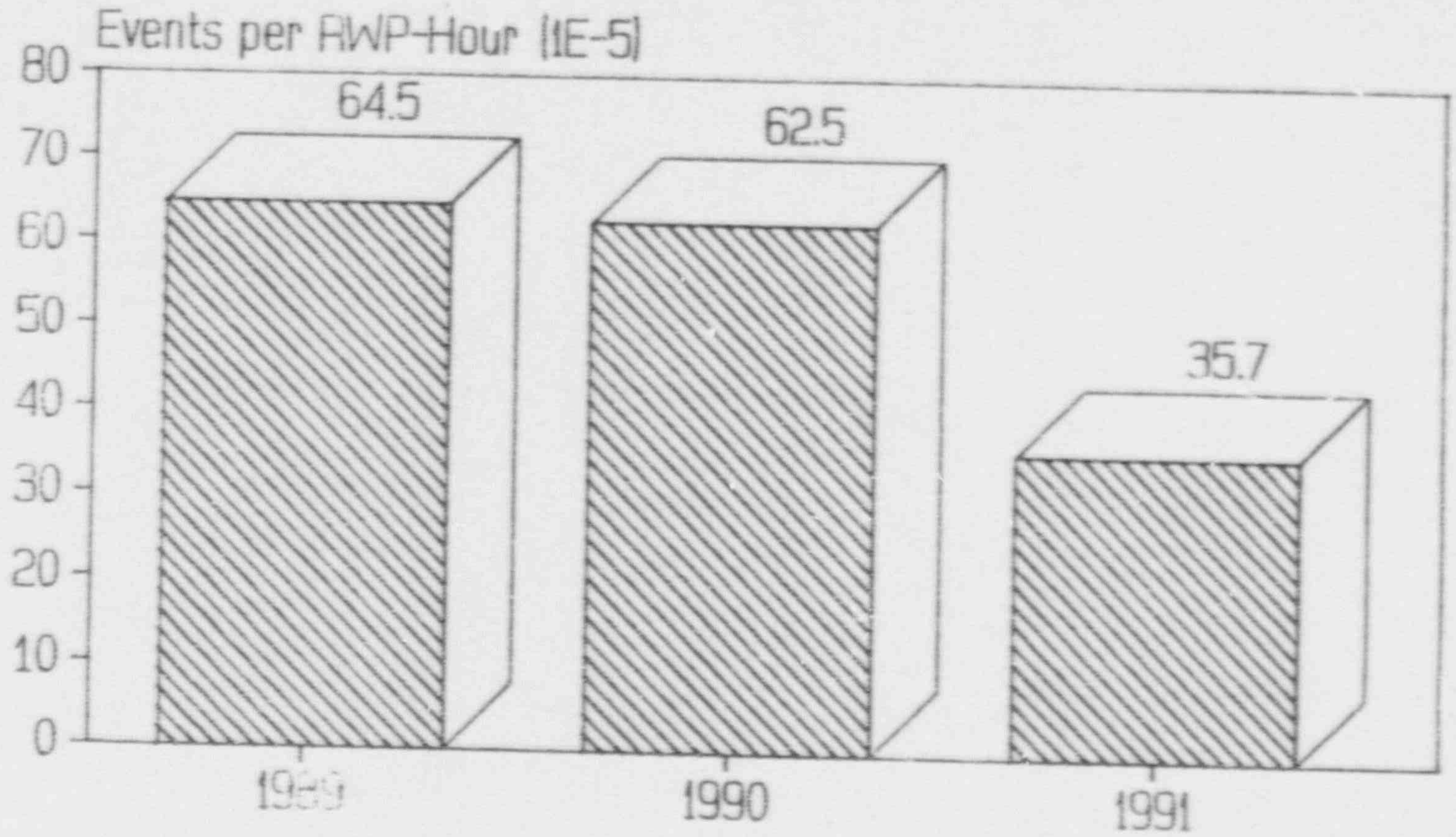


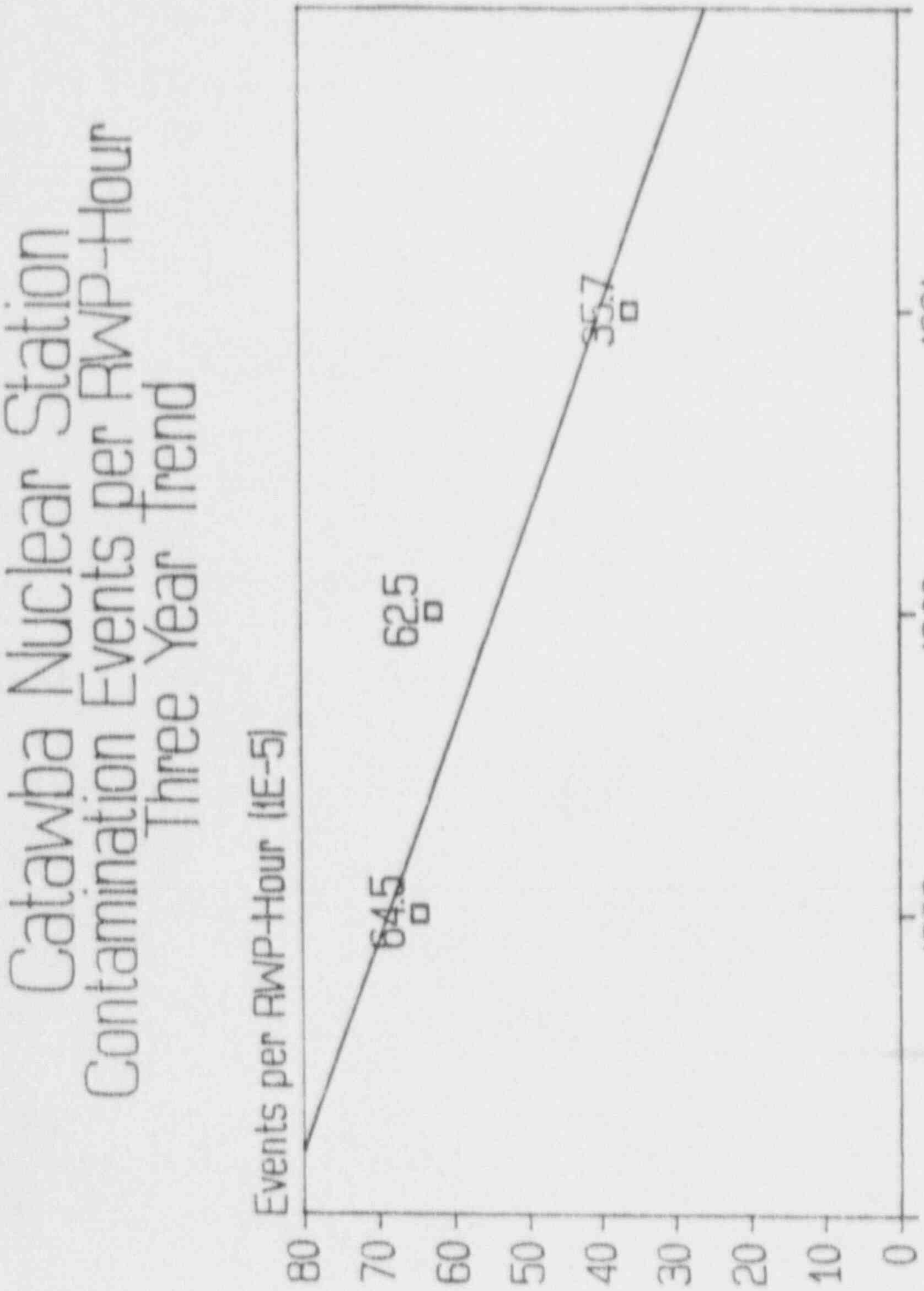
CATAWBA NUCLEAR STATION
EXPOSURE PER MAN-HOUR
(UNITS IN MREM)



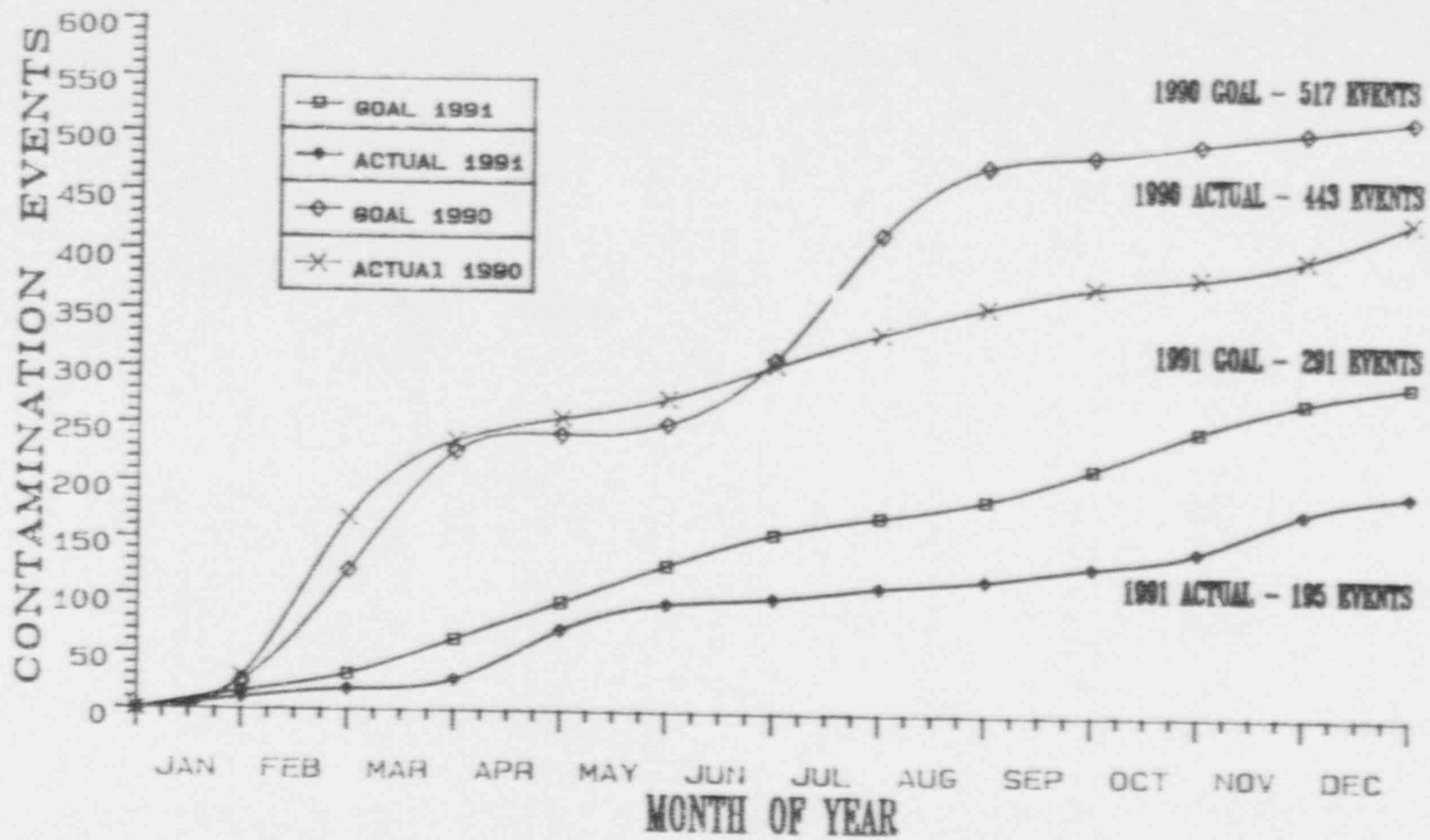
NOTE: 1992 DATA BASED ON ESTIMATED EXPOSURE AND HISTORICAL MAN-HOURS.

Catawba Nuclear Station
Contamination Events per RWP-Hour
Three Year History

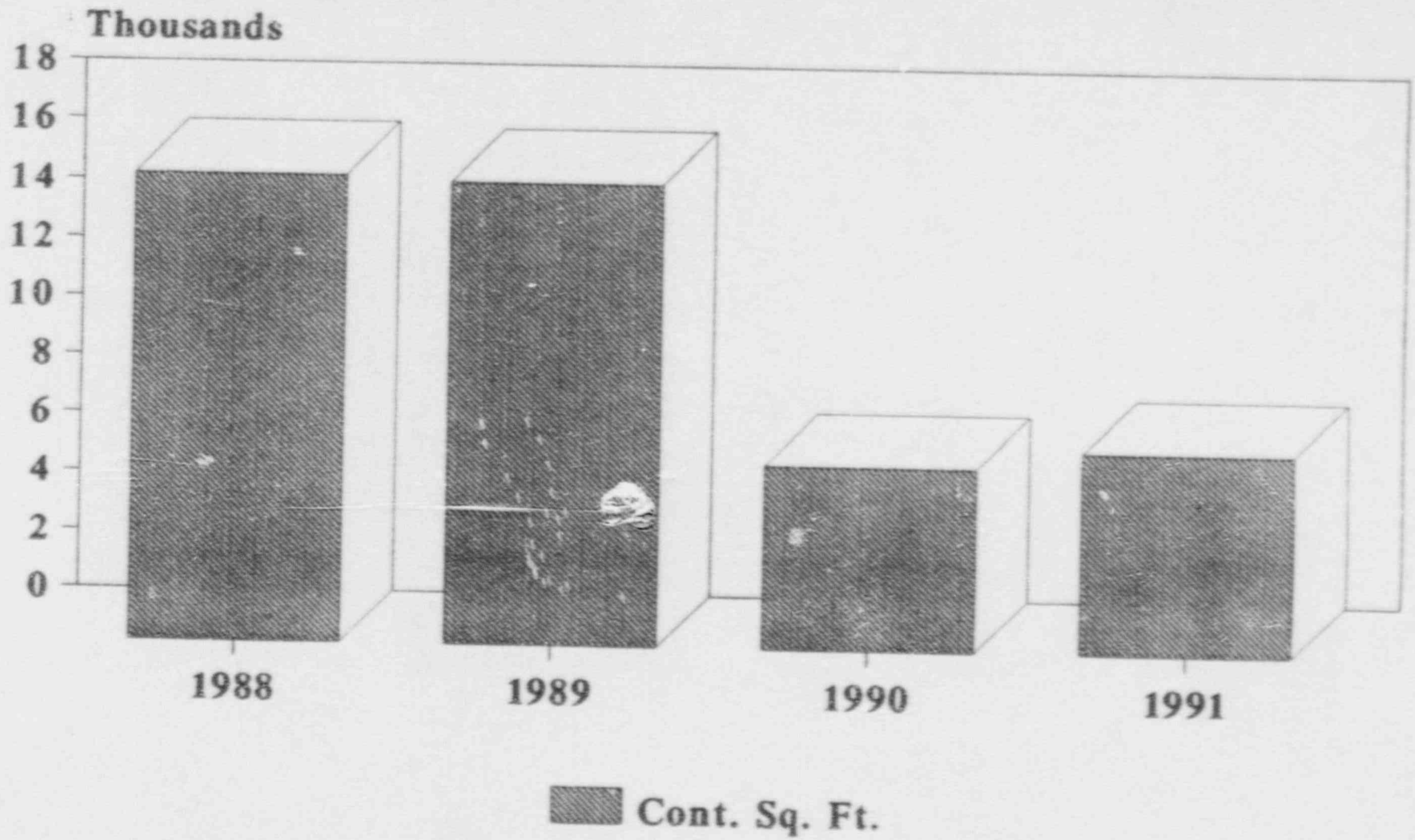



Catawba Nuclear Station
Contamination Events per RWP-Hour
Three Year Trend
Events per RWP-Hour (1E-5)
80
70
60
50
40
30
20
10
0
64.5
62.5
35.7
1989
1990
1991

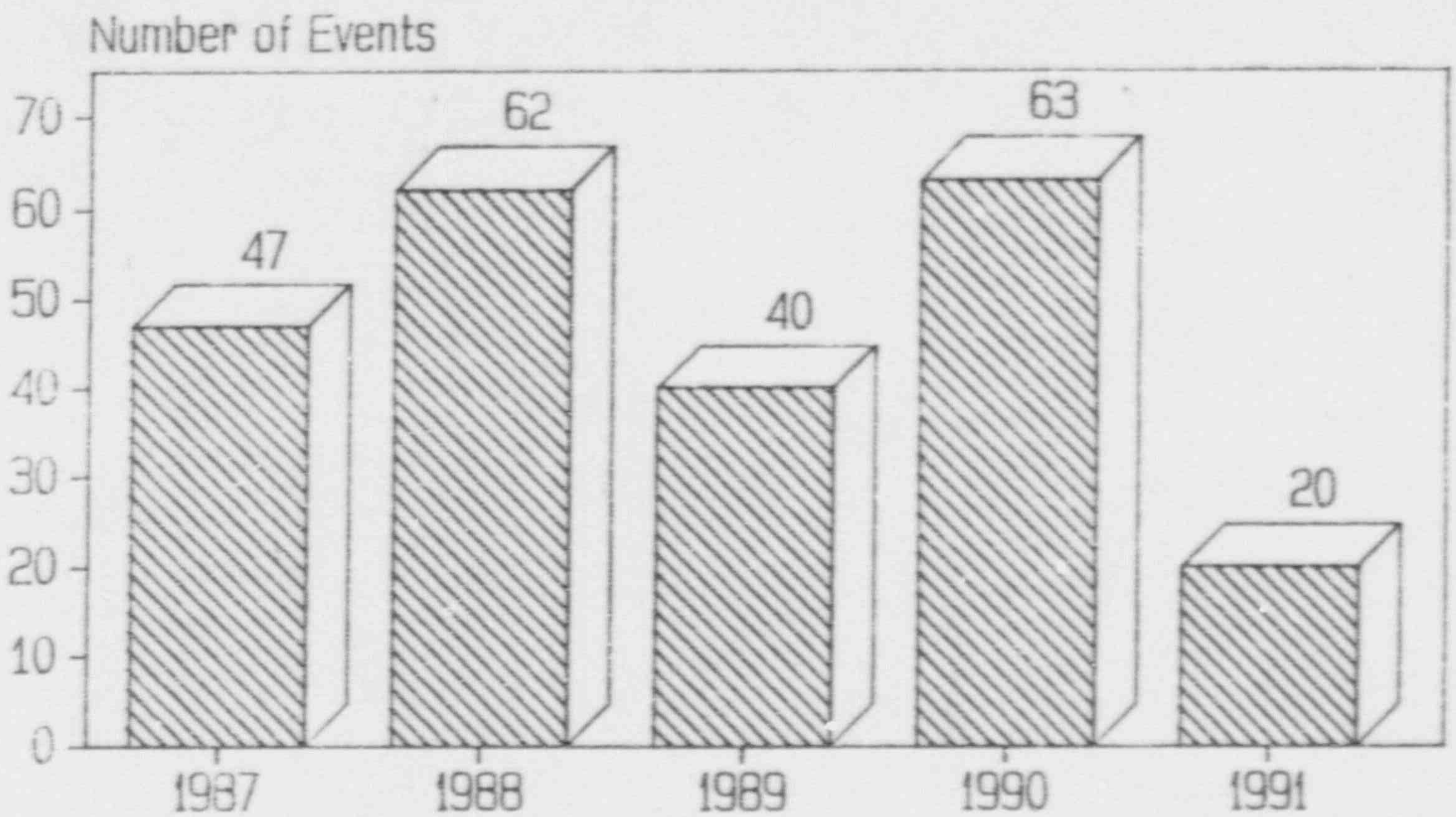
CATAWBA NUCLEAR STATION
PERSONNEL CONTAMINATION EVENTS
1990 and 1991 Comparison



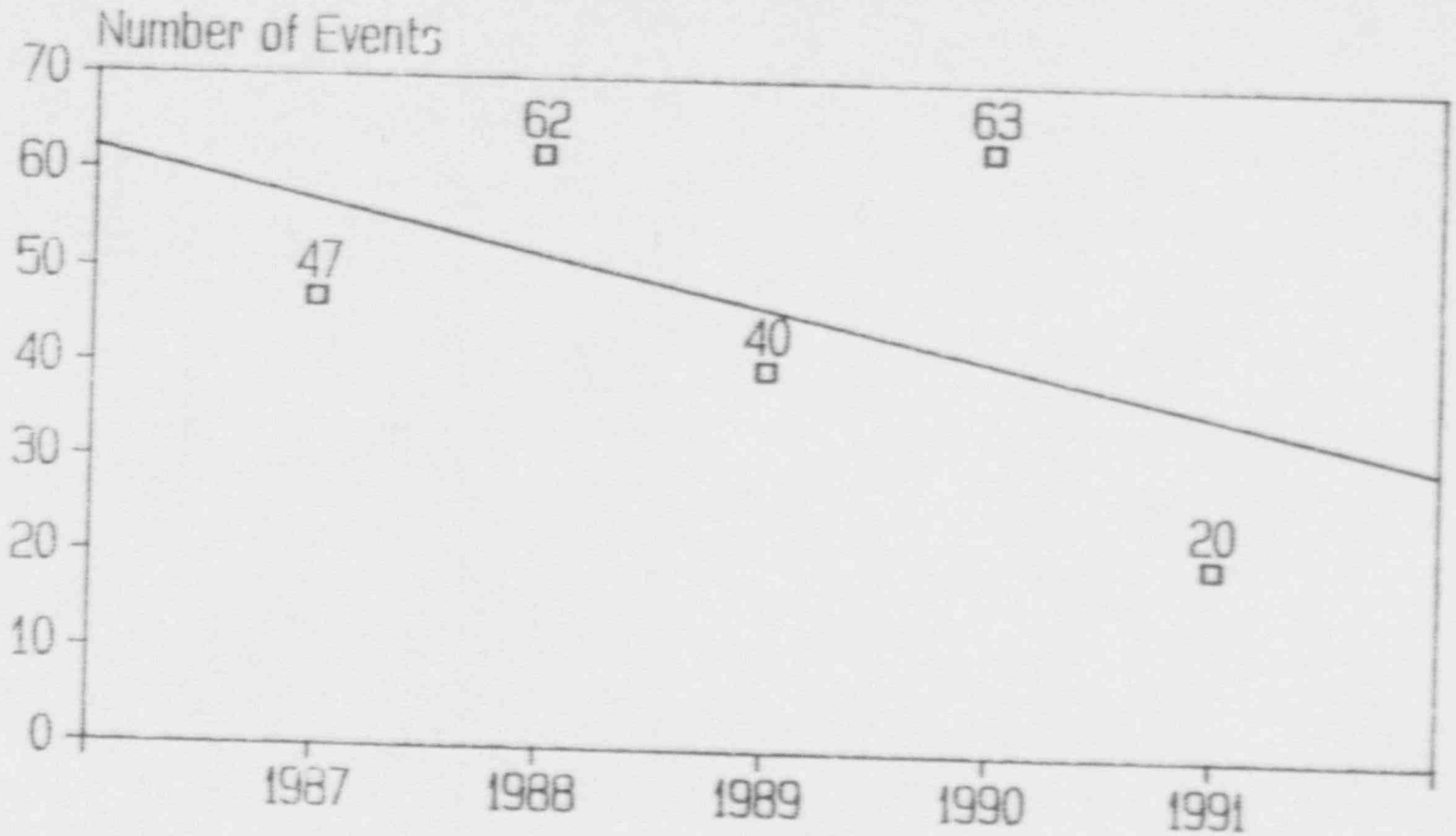
Catawba Nuclear Station
Contaminated Square Footage



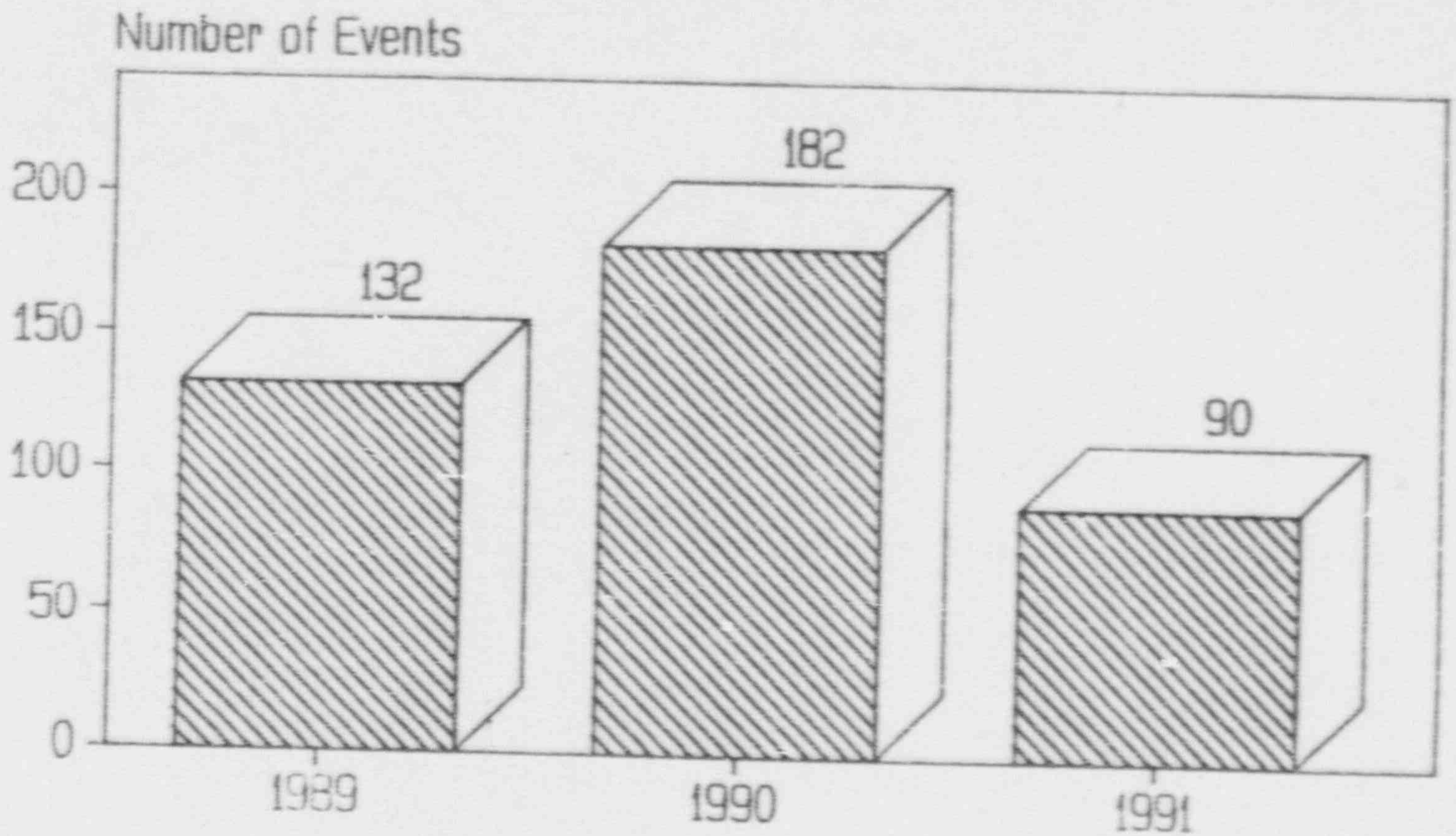
Catawba Nuclear Station
Contamination Events - Lower Containment
Five Year History



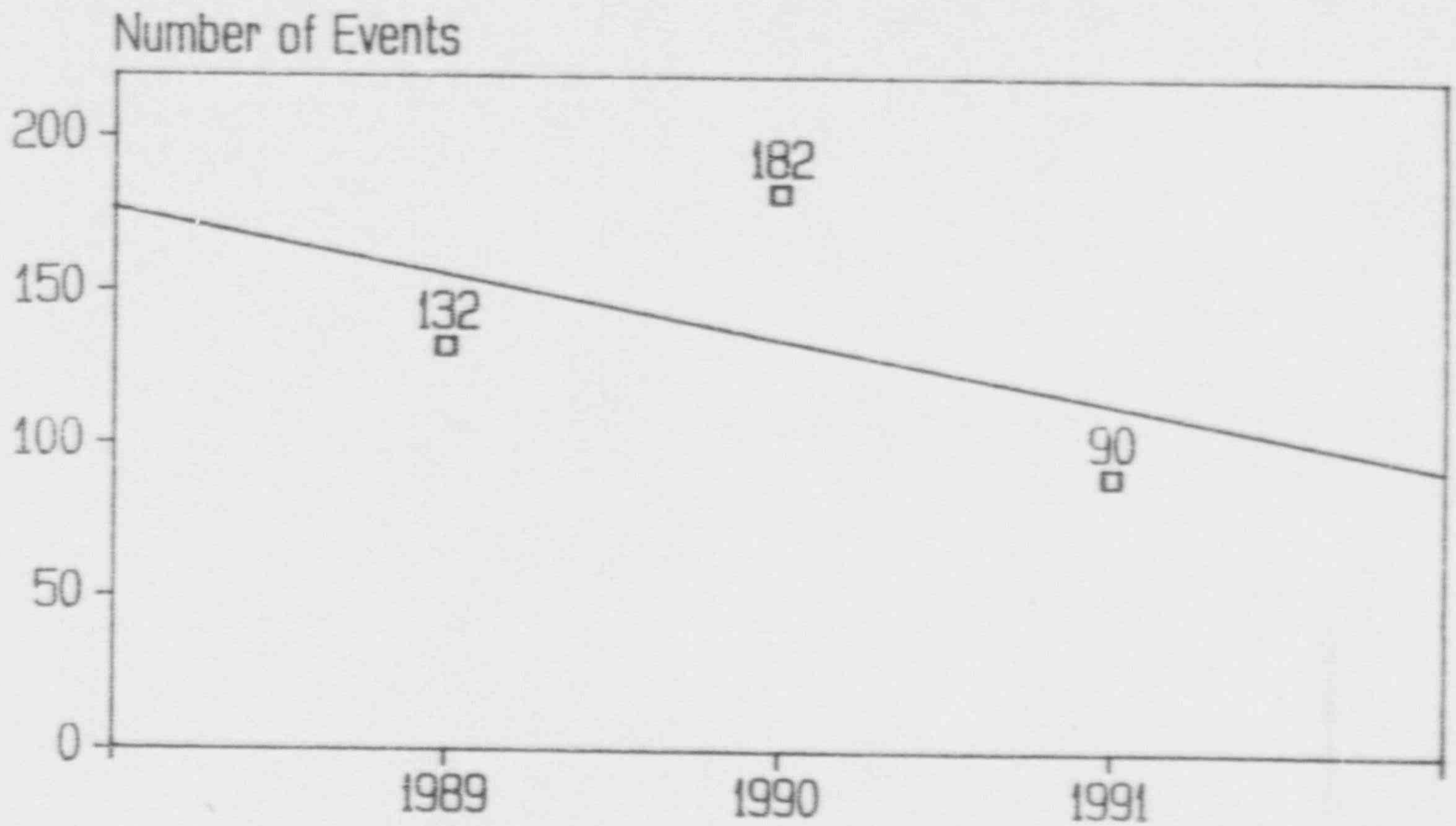
Catawba Nuclear Station
Contamination Events - Lower Containment
Five Year Trend



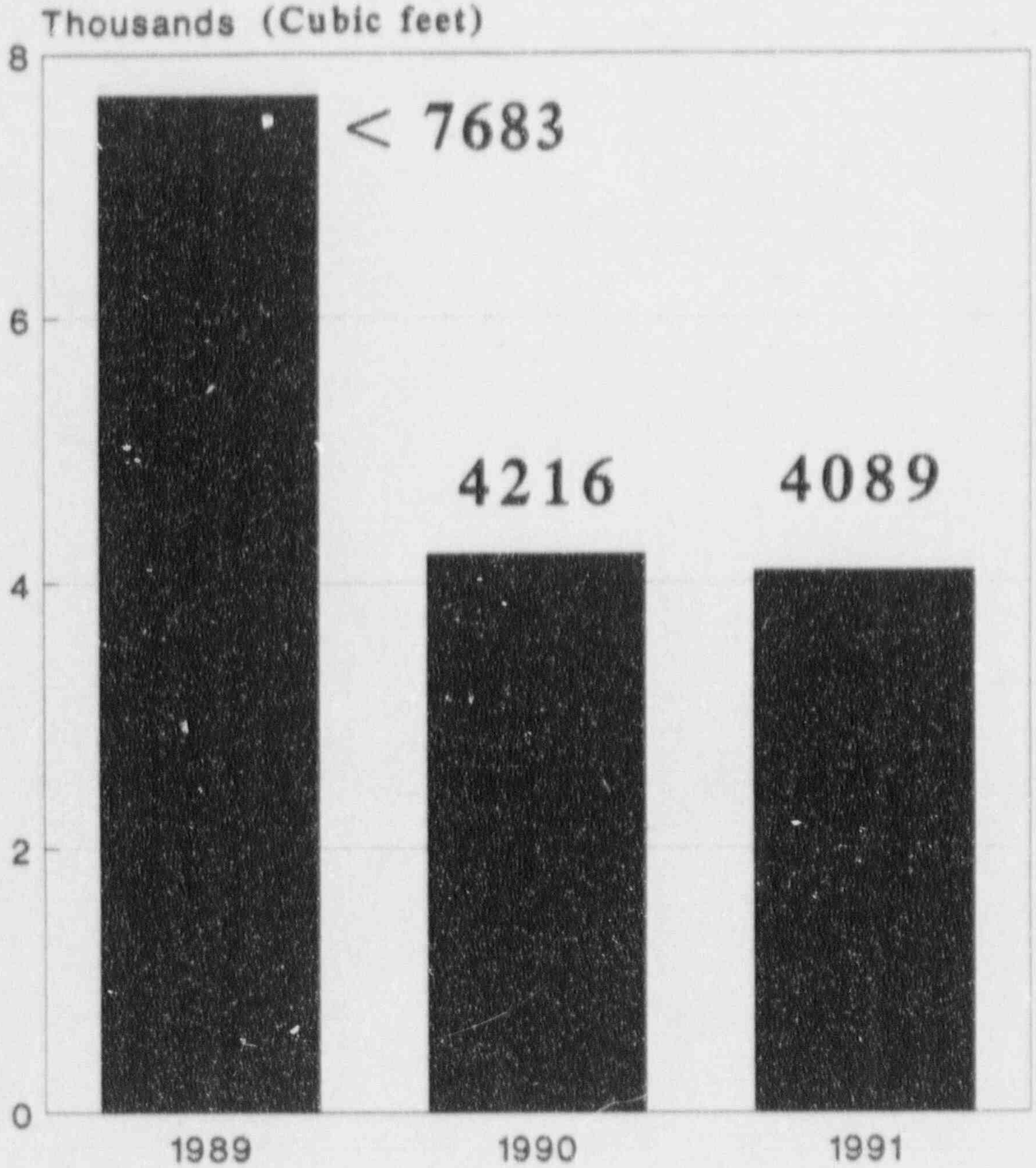
Catawba Nuclear Station
Hot Particle Contaminations
Three Year History



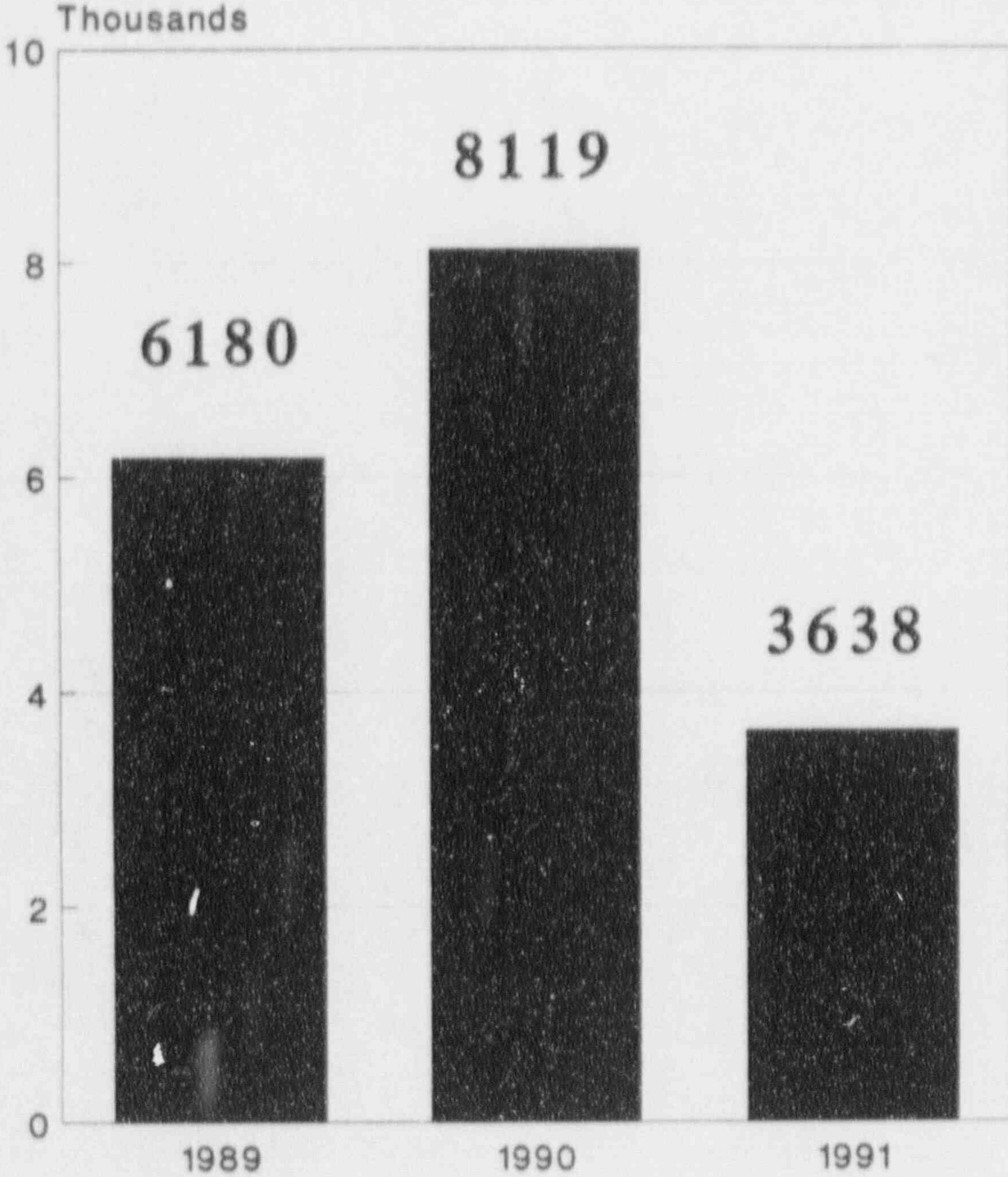
Catawba Nuclear Station
Hot Particle Contaminations
Three Year Trend



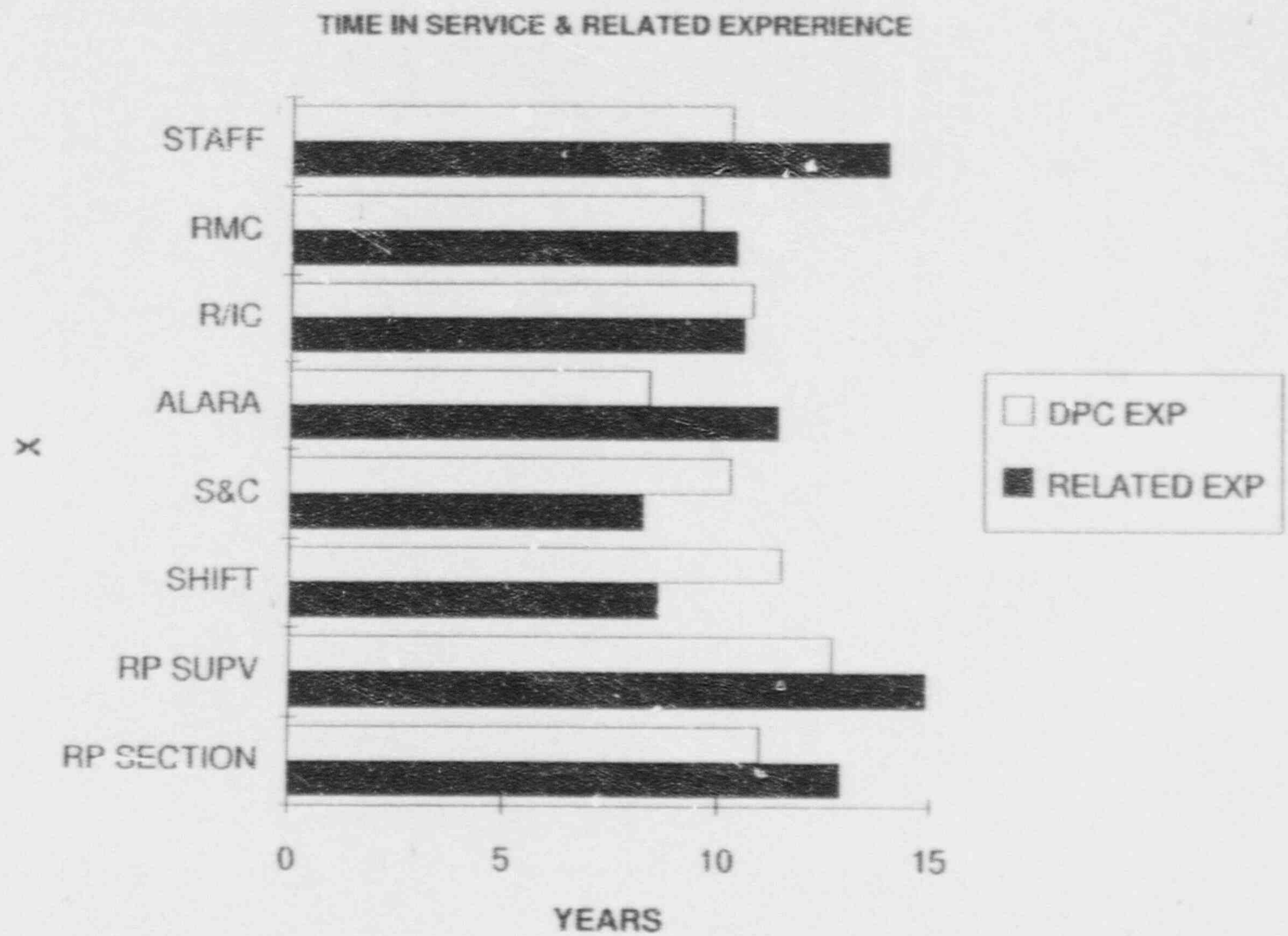
CATAWBA NUCLEAR STATION
SOLID RADWASTE SUMMARY



CATAWBA NUCLEAR STATION
PARTICULATE RESPIRATOR USEAGE



SHEET1.XLS Chart 1



ATTACHMENT 14

DUKE POWER COMPANY

MAINTENANCE SELF-ASSESSMENT REPORT

REVIEW PERIOD 02/91 - 05/92

TABLE OF CONTENTS

MAINTENANCE

I. PERSONNEL

A. Training and Qualification

1. Mechanical Maintenance

In 1989 the training and qualification (T&Q) system was upgraded to emphasize specialty groups among the Mechanical Maintenance Department. By redefining the ETQS Program, Catawba emphasized the systematic approach to training and qualification by utilizing the group concept. Instead of having a task for each Maintenance Procedure, Catawba set qualification parameters and grouped similar procedures, which require the same knowledge and skills, under on particular task. Catawba has approximately 180 station specific tasks and 65 directed tasks. When new procedures are written or existing procedures are revised, the Employee Training and Qualification Coordinator and Training Personnel review the procedure. This review determines whether the procedure is added to an existing task or if a New Training and Qualification Guide is developed. Supervisors are notified of procedure changes and of tasks that are applicable to their specific area.

Catawba continues to revise and upgrade task guides as changes occur.

2. Maintenance IAE

The IAE Training and Qualification upgrade program consists of a through review of existing job analysis information to determine if existing tasks are still valid. Once the validity is established, the identification of which tasks require analysis, qualification and/or training is conducted by rating a task according to difficulty, frequency performed and importance. When a task is identified as requiring qualification, a thorough task analysis is performed. The task analysis consists of the systematic breakdown of the task into its instructional elements:

- the steps required to perform the task,
- the knowledge and skills needed to perform these steps,
- the desired standards and conditions under which the task is performed, and
- the tools and equipment needed.

From the Task Analysis, a training and qualification guide is developed stating the elements required for training and qualification. After development, the T&Q Guide is reviewed by subject matter experts for technical accuracy. The guides are then approved and placed in service. Five IAE Technicians are assigned full time to this effort.

B. **Training**

1. A interim Maintenance Training Facility was established at Catawba. It has allowed hands-on Maintenance Training and task qualifications to be conducted without effecting plant operation. The facility consists of a ten thousand square foot building (2 classrooms/labs, and an open shop space for hands on applications). More than 2500 manhours of training has been conducted from June through December 1991 which included OJT, task qualifications, formal classroom/lab presentations, and pre-job practice. All Maintenance groups have utilized the facility.

2. Supervisors and Planners are being rotated between IAE, Mechanical Maintenance and Planning to broaden their experience.

3. IAE, Planning and Mechanical Maintenance personnel have attended Team Building Training sessions.

C. **Turnover Rate**

Turnover rate has remained low in the Maintenance Department during the period. Catawba has had a total turnover of 3% in 1991, which includes some internal transfers.

D. **Power Group Reorganization**

The reorganization announce in November 1991 and put in place in January 1992 at CNS is expected to improve quality, efficiency, and productivity. This reorganization moved Maintenance personnel from the site Construction Maintenance Department who were working full time in the nuclear station on maintenance and modifications into the station Maintenance organization. Also, the Mechanical QA/QC group was made a part of the Station Mechanical Maintenance group. This reorganization will greatly improve work interaction and support among Maintenance groups who were working together but located and reporting to three different departments within Duke Power Company. There were other reorganizations involving Engineering, Materials, Human Resources, and Work Control which will also contribute to improved work execution by improving effectiveness of support efforts .

II. PROGRAMS

A. Procedure Upgrades

IAE has continued to emphasize a procedure upgrade program. Currently there are 1469 approved IAE procedures. Of these 830 have been fully upgraded or developed to conform to the current Nuclear Production Department Procedure Development Guide standards. Procedures are prioritized based on a set criteria related to the impact the procedure has on safety and reliability of both plant and personnel. The status of the effort is as follows:

Priority 1: 215 complete (100%) Completed 1-14-92

Priority 2: 494 complete (77%) Target Completion 8-1-92

In completing the lower priority procedures, Catawba has changed some fundamental ways of doing business in order to encourage more ownership of the procedures by the technician teams that use them. Catawba will complete this effort with increased ownership by the technicians and improved procedures in the field. In reality this upgrading effort will never be "complete" because even as we rewrite procedures each year, Catawba is constantly upgrading standards to incorporate the best lessons learned from industry.

Mechanical Maintenance has also continued emphasis on procedure upgrades. As of January 16, 1992, Catawba has 58 procedures remaining of a total of 516 Mechanical Maintenance procedures. Thirty seven of these are high and medium priority procedures which are scheduled to complete by April 1, 1992. Twenty one are low and low-low priority procedures which will be completed by September 1, 1992.

Catawba is currently on schedule to meet the commitment deadlines for the high and medium priority procedures and will better the September 1, 1992 date for the total Mechanical Maintenance Procedure Upgrade Process commitment. Catawba has improved the upgrade process by stressing the necessity to produce a quality product. Strong support has been gained from Component Engineering, Quality Assurance and the Mechanical Maintenance Section for the requirements and goals of the Procedure Upgrade process. The upgrade process has improved the quality of mechanical work execution due to the procedures being more user friendly by incorporating human factors considerations and better quality drawings and attachments in the procedures.

B. Work Control Center (WCC)

The Work Control Center was formed in March 1991 and has been utilized successfully during the Unit 1 Fifth Refueling Outage and the Unit 2 Fourth Refueling Outage. The Work Control Center was formed by bringing together representatives from Operations, Mechanical Maintenance, IAE and Generation Services to become a team to accomplish the following objectives:

- Remove the some of the burden for work initiation and completion from OPS Shift Personnel to allow them to concentrate on operating the plant.
- Have crews begin work more effectively at the beginning of their shifts.
- Improve the status and tracking of work packages
- Improve the communication so that staff and execution group personnel clearly understand the status and priority of scheduled work activities.
- Provide a point of contact for coordination of problem resolution associated with work activities.

During the first refueling outage of 1991, Catawba identified another use of the Work Control Center personnel that would benefit Catawba's interfaces and control of maintenance activities. Catawba established a Red Tag Control Group in the Work Control Center with the mission of centralizing this information and making it more readily available to the station on a 24 hr/day basis.

Catawba reviewed the operation and intended function of the Work Control Center following the initial implementation. Catawba's review indicated the concept was good, and that the Work control Center provided a benefit for the station.

During the second outage of 1991, Catawba enhanced the work request tracking function by providing knowledgeable maintenance personnel to assign the correct tracking codes into Catawba's on-line work management system, giving us real-time status and location information. Catawba also included a job review by the Operations SRO following the maintenance activity to identify the affected Technical Specifications after review of the actual maintenance work performed. Catawba strengthened the Post-maintenance Testing Program similarly, by including both SRO and maintenance review of actual work performed and required conditions for testing following the completion of the maintenance work. These reviews were being performed previously, but by performing this function in the WCC, the results of this review were then captured in the work management system by the Work Control Center personnel.

Other efforts to streamline the station processes in the Work Control Center were:

- control of the station key locker,

- containment access log,
- Compensatory Actions for Tornado Doors,
- after-hours access to document control, and
- central location of work schedules and work packages for all maintenance supervisors.

The concept of having a single place to go to begin problem resolution, receive guidance on how to proceed, and enhancing the communication of information between shift schedules was a significant factor in Catawba's improved outage performance.

Following the 1991 outages, Catawba is reviewing the function of the Work Control Center again to see what additional gains can be made through further utilization of this resource. Catawba has also made the decision to implement this concept during non-outage as well. Management has continued to review the performance of the WCC in meeting the objectives listed above and feels that the program has been successful. These initial objectives have been accomplished and further improvements are being made.

C. Post Maintenance Testing Program

A program has been developed which utilizes a list which gives detailed testing requirements for plant items such as valves. This reduces the possibility of failure to give an item a proper test before returning it to service after maintenance. This program pools together in a single document, which is easily accessible, all post maintenance testing requirements.

D. Work Management System (WMS) Implementation

In March of 1991, Catawba implemented a new computerized work management system for the station. This system replaced the Nuclear Maintenance Database to provide us more data storage capability. The system was designed to provide more functions and to allow us to implement a more controlled and easily accessible equipment history in the future. This system will allow us to replace systems that are currently dependent on hard copy for the exchange of information and to streamline many of Catawba's work control processes as a result.

The specific programs improved by this new system are:

- Equipment/Component Data,
- Work Request Origination, Maintenance History,

- Employee Data,
- and Work Request/Order Tracking.

There have also been improvements in the areas of work scheduling, generation of crew schedules and time reporting information, and the ability to provide reports to the technical decision makers.

Catawba is currently working on implementation of the Failure and Trending portion of this system, to centralize the information that is currently captured in PC-based programs by individual engineers. This effort will be aligned with the reporting of Nuclear Plant Reliability Data Systems information to the Institute of Nuclear Power Operations. Simultaneously, Catawba will be developing component Failure Reports for NPRDS from this system.

During 1992, Catawba will be implementing the paperless work request origination feature this system offers us and this will allow us to improve Catawba's productivity because hard copy will not have to change hands, it will also provide improved control of identified deficiencies.

Finally, Catawba is developing stronger ties between scheduling information and coordination activities contained in the work management system and the critical path schedulers Catawba utilizes for outage, operating, and modification work activities.

E. Maintenance Management/Supervisory Observation Program

Last year Maintenance started a program of more formalized work observation. Pocket cards (blue cards) were developed which can be carried and used to document findings. The card has a checklist to help us remember important points and a grading system to indicate our ranking of the area. The card also has fields for designating who performed the observation and what work was observed. Management has established goals for numbers of observations to be conducted by Managers and General Supervisors. Although Managers and General Supervisors are the persons who normally use the cards, they are available for anyone to use. As an example, a Supervisor or Manager may fill out a card and also ask one of the workers to step back and fill out one independently. They then compare their findings and discuss differences. Data from the observations are entered in a data base. This information can then be trended and reviewed to identify further opportunities for improvement. If a blue card observation identifies a certain level of deficiency, Catawba requires that a lower tier problem report be written, thereby tying Catawba's blue card system into the station lower tier program.

III. EQUIPMENT ISSUES

During 1991, a number of changes were implemented to improve operator information, reduce demands on operators and enhance reliability. Examples of some of these improvements include replacement of Control Room chart recorders with more reliable digital modes and upgrading cooling tower fan controls for reliable operation and remote monitoring. Some of Catawba's other accomplishments were:

A. Digital Feedwater Control, Digital Turbine Control
B. Reactor Vessel Level Instrumentation
C. Ultrasonic Reactor Coolant Level Monitor
D. Replacement of D/G Emergency Trip System
E. Rebuilding of Nuclear Service Water Pumps
F. Auxiliary Feedwater Pumps

A. Digital Feedwater Control Modification, Digital Turbine Control Modification

The decision was made to replace the turbine control systems supplied initially with the Catawba turbine generators. Both the Unit 1 and 2 analog electrohydraulic control systems were replaced during the scheduled 1991 unit outages with state-of-the-art digital electrohydraulic control systems using Bailey Network 90 System hardware.

The pre-existing control systems were not well suited for other than a steady-state set of operating conditions. The new turbine control system provides for greater future unit reliability, flexibility, ease of operation, ease of maintenance, ease of valve calibration and allows for system expansion. Also, with implementation of the digital turbine control modification, this will allow the plant to better withstand plant transient conditions which will result in less challenges to plant safety systems.

The man/machine interface offered by the new turbine control systems are greatly enhanced through the use of a dedicated control board mounted 19" color CRT and keyboard panel through which all operating and operator initiated testing functions are entered. The enhanced systems diagnostics capability offered by the new control systems also allows the maintenance personnel to view all current on-line parameters and retrieve past data through the trending capability.

The Unit 1 and Unit 2 feedwater control systems were replaced with new Digital Feedwater Control Systems during the 1991 refueling outages. These are Westinghouse WDPF systems. The old systems had been the cause of reactor trips due to card failures, field device failures, and poor automatic steam generator level control at low power. The new systems, through the added sophistication of digital techniques, allow for single input transmitter failures and internal card failures without any affect upon the output signals. Also, a more sophisticated control strategy provides better control at low power and better response to plant transients. This will result in fewer reactor trips and fewer challenges to safety systems.

Although not safety systems, these systems were subjected to extensive Post-Modification Testing, including the plant transients of a Trip of a Main Feedwater Pump from 100% Power and a Generator Load Rejection from 65% Power.

B. Reactor Vessel Level Instrumentation System/Inadequate Core Cooling Monitor Software Upgrade

System software deficiencies in the original design were identified by Engineering. Software upgrades were obtained from the manufacturer (Westinghouse). These enhancements were implemented during the refueling outages this past year. Although these improvements were mostly cosmetic in nature, human factors were improved in the areas of ease of operation and understanding. Some changes were provided to improve equipment reliability. A few examples are:

- Normal delta pressure (Δp) values were defined generically based on how many reactor coolant pumps were running. In reality, the normal Δp value is different for a pump running in a particular loop (e.g. the Δp generated with a pump running on a loop with a Reactor Vessel Level Instrumentation System (RVLIS) process tap is much greater than the Δp in a non-RVLIS loop). This was corrected in the software upgrade.

- Subcooling alarms are now based on the highest of the hot leg temperatures or the incore thermocouples. The original software generated the alarms based exclusively on the incore thermocouples.

- When reactor coolant pumps are running, the lower range transmitters are driven off-scale due to the large Δp generated by the flow. The original software generated an alarm due to an off-scale sensor, when in reality, this was an expected occurrence. This is no longer the case with the upgraded software.

- If one of the three thermocouple reference junction RTDs failed, the original software would not compensate the indicated incore temperature for the temperature of the reference junction. The upgraded software disregards a failed RTD and uses the remaining good RTDs to compensate for the reference junction.

C. Ultrasonic Level Measurement System (ULMS)

The Merlin Gerin ULMS was installed during the last outages for Unit 1 and 2. It accurately measures the level in the Reactor Coolant System (NC) Hot Legs between 0 and 7.25% with the use of Ultrasonic signals. This is a critical measurement during mid-loop operations because it helps in avoiding a loss of suction to the Residual Heat Removal (ND) pumps. Since the sensors are mounted external to the NC piping, dynamic changes to the NC system, such as those occurring during vacuum backfill, do not affect them like other pressure measuring level devices.

D. Diesel Generator (D/G) Control System Replacements

Because of numerous problems with the pneumatic control system for the D/Gs, the safety related trip functions were replaced with electronic devices during U1EOC4 and U2EOC3. There have been no valid failures caused by a safety related trip function since this change. Also, during U1EOC6 and U2EOC5 outages, the pneumatic non-emergency trip functions will be replaced with electronic devices. This should eliminate the numerous problems seen with the pneumatic components.

E. Refurbishment of all Nuclear Service Water (RN) Pumps and the Shaft Tube Modifications

There has been a joint effort underway with Maintenance personnel and Design Engineering personnel to improve RN pump operation and availability. One of the main improvements for the spare RN pumps was the deletion of the external bearing lube injection line requirements. This enhancement allows the pumps to provide their own bearing lube injection without external lube lines. Loss of lube injection flow to the original pumps resulted in RN pump inoperability, thus reducing pump availability.

Prior to the modification mentioned above, RN pump maintenance required that both pumps on a particular train be tagged inoperable since the pumps share a common lube injection strainer. Isolation valves installed as part of this modification will enable the unaffected pump to remain operable while the other RN pump is out of service. This will increase the RN system availability by allowing continued operation of the particular train to support station cooling water requirements.

Also, due to the length of service for the Nuclear Service Water Pumps, all the pumps have been completely rebuilt. During the rebuilds, the pump columns showed signs of pitting and corrosion. Details were worked out with Engineering to coat the inside of the pumps.

F. Auxiliary Feedwater Turbine

Due to the potential for the vendor supplied stem to corrode, we insisted that the vendor provide chrome plated stems for use in the governor valves. The stems have been provided and have been installed in the governor valves on both units. Drain valves that were installed for class breaks could clog up and stop leakoff from the turbine valves. They have now been deleted from the system to provide unobstructed flow paths for the leak-off lines. This will reduce overspeed trips due to better operation of the valve.

IV. PREVENTATIVE MAINTENANCE

Preventative Maintenance Programs have enhanced Equipment Reliability

- Feedwater Regulator Valves: only one transient associated with these items.
- Thermography: this technology has been used to detect equipment problems.
- Protective Relaying: Preventative Maintenance program was begun on protective relaying SCRs
- Preventative Maintenance Trending: Problems with Reactor Trip Breaker Degradation and Feedwater and Auxiliary Feedwater Piping Erosion were detected and resolved through trending.

These improvements have had a positive impact on operations and reliability.

The Predictive Maintenance Program at Catawba currently consists of:

- vibration data collection on approximately 300 components,
- lube oil sampling and analysis on approximately 100 components, and
- motor current data collection on 30 motors.

Vibration data is collected on a periodic basis which varies depending on the operating schedule of the component. Lube oil is sampled when the oil is changed and sent to an offsite laboratory for analysis. A vendor is brought onsite to perform the analysis of Reactor Coolant pump motor lube oil because of the radiological concerns. During the past year Duke Power has participated in a research project with EPRI and Computational Systems Inc., involving motor current analysis. Catawba chose the 30 motors to include this effort.

Two recent successes of Catawba's predictive maintenance are:

- Recently, a nuclear service water motor was determined to have a worn lower motor bearing through oil and vibration analysis. The motor was replaced prior to pump damager or severe motor damage.
- Thrust bearing degradation was identified through oil analysis on one of the auxiliary feed water pumps. Bearing replacement was scheduled for an outage and the bearing was replaced.

Predictive maintenance has also been used for verifying maintenance effectiveness. In one case, post maintenance vibration data indicated a problem with a new bearing installed on a control room air handling unit.

During the past six months Catawba has begun a program to test run all new safety-related motors received on site to determine acceptability. One defective motor was discovered and returned to the manufacturer. This program reduces component down time during maintenance, as the motor and sheeve or coupling hub can be trimmed prior to installation.

As a result of aggressive preventative maintenance efforts, a number of improvements to equipment reliability were made during 1991. Some examples include:

A. Nuclear Instrumentation Setpoint Trending

Setpoint trending databases established by the Engineering group have identified erratic responses from various components associated with the setpoint circuitry due to normal aging. An example of this is the level trip bistable and the remote equipment isolation amplifier adjustment potentiometer. For a given parameter, the potentiometer wiper is continually positioned in a certain area on the windings. This eventually causes a 'dead spot' for the adjustment, thereby creating an erratic output and/or setpoint voltage. We replaced these components prior to failure and thus precluded reduced plant margin of safety due to safety system unavailability.

B. Reactor Trip Breaker Response Time Trending

Analysis of the response time trending data base, following Unit 1 EOC5, revealed a step increase of approximately 41 msec (i.e. increase from 83 to 124 msec) for reactor trip breaker B. Although the time was below the Technical Specification limit of 150 msec, Engineering initiated a work request to investigate and repair the step increase prior to the unit returning to power operations. Subsequent investigation discovered a degraded undervoltage trip coil mechanism. After replacement, the measured response time decreased to approximately 68 msec. This action vastly increased equipment reliability and plant safety margin. A similar occurrence was recently identified following the required surveillance on the unit 1 reactor trip breaker A.

Although the response time had remained within allowable limits, Duke contracted Westinghouse to perform an investigation to determine the root cause of the degradation. The results of the tests and inspections determined the most probable cause of the slow response time was a slightly bent latch arm on the UVTA reset bracket. The problem is not considered generic since the response time remained within allowable limits, the degradation was detected through routine standard testing and the cause of the slower response time is not attributed to wear or breaker cycles.

C. Nuclear Instrumentation Cable Quality Degradation

While performing the preventative maintenance (PM) activity for trending the Nuclear Instrumentation cable quality for degradation during the Unit 1 EOC5, a change in the Time Domain Reflectometer signal trace was discovered. Extensive followup activities revealed an intermittent open in a detector connector for a power range channel. The detector was immediately replaced. This expedient action most likely prevented a possible plant transient.

D. Watts Type B-20 Filter Regulators

Watts type B-20 Filter Regulators started to exhibit a high failure rate. The failure was attributed to mechanical failure of the plastic spring cage assembly on the top of the regulators. A task group was initiated to identify and replace all plastic spring cages on Watts type B-20 regulators with a Metal spring cage assembly. The majority of the Unit 2 critical to operation valve regulators have been reworked either prior to or during the last outage. Unit 1 critical to operation valves are on the trip list to be done if the unit trips or when the unit comes down for refueling in June of 1992.

V. OUTAGE

Catawba is committed to improving the safety, quality , and efficiency of outages. Several administrative enhancements have been made which enhance outage performance, some of these are:

- Operations' Engineers, Power Delivery, and Scheduling have worked together to develop a schedule for electrical work that groups "train" related activities and requires only one essential power train to be removed from service each outage. Team work has improved the complicated scheduling and tagouts of electrical equipment and made essential power supplies more available during shutdown conditions.

- The WCC has served to greatly reduce distractions in the control room and provided a more orderly and efficient use of resources in work clearance and hanging and clearing tagouts. Communications and work coordination have benefitted greatly from the WCC.

- Ownership of work is a concept that has shown marked improvement during the last two outages. IAE has provided an outage coordinator who brings an understanding of IAE's capabilities and limitations in performing the tremendous amount of work required during the outage. This ownership has been evident in the higher interest in the identification, planning, scheduling, and coordination of valve work, IAE work, testing, and other areas. This has resulted in a more detailed and accurate schedule.

The following are steps that have been incorporated into outage planning, scheduling, and execution as enhancements to Catawba's risk management during shutdown conditions:

- A high visibility is maintained for the availability of equipment that is necessary for reactor safety during current plant conditions or system alignments. This is achieved by the display of visual aids in the outage meeting room. One shows equipment currently not available and the reactor coolant level. Another shows the logical relationship of the significant blocks of work as scheduled in the outage. Also each morning the daily status sheet used in the outage meeting contains a listing of required equipment for the current unit conditions.

- A generic schedule is maintained and used as the bases for each specific outage schedule. Standard work windows are used to add work to this generic schedule for each specific outage. As Catawba has learned, changes have been made to this schedule to enhance the safety of the plant. Examples of these changes are:

  - Restraining the first "mid-loop" period until 7 days after unit shutdown to increase safety by limiting decay heat load.

  - Maintaining one diesel generator and two offsite power sources or two diesel generators and one offsite power source to be operable during mid-loop operation.

- Minimizing equipment hatch openings during mid-loop operation.

- Extended critical path time in the generic schedule for crud release and cleanup. Catawba has also added increased shielding activities in the generic schedule.

- Added standard flushing activities to the generic schedule.

- Specifically "flagging" activities that affect containment closure or integrity.

- Added Operations' activities for system alignments, filling, venting, and review to allow them more time following maintenance to enhance configuration control.

• The standard work windows are periods of work or train designated work activities that have been developed to help assure the proper configuration of equipment as Catawba changes unit conditions during the outage, such as from "Reactor Coolant System Filled" to "Not Filled" or the "Reactor Head Off" to "Low Temperature Over Pressure Protection Needed". The Operations' outage group is currently revising these windows to better define the required conditions for primary systems work.

• Licensed operators review all work request scheduled in the outage. They are also involved daily in the clearance for work and coordination of these work request.

• In the interest of safety, an independent review of the outage schedule is performed by the Catawba Safety Review Group. Reduced inventory periods are of major interest during this review.

VI. AREAS FOR IMPROVEMENT

Maintenance has established a working group composed of representatives from Maintenance Planning and Scheduling, Work Control Technical Support, and Integrated Planning and Control towards the goal of reducing the number of missed surveillances.

The objectives of the working group are to:

1. Research, define, and categorize recent problems.

2. Propose a new way of doing business that will:

    a. Prevent all unanalyzed missed surveillances
    b. Eliminate inconsistencies in the method of handling predefined workorders by IAE and Mechanical Maintenance where appropriate.
    c. eliminate the duplication of efforts where appropriate while still providing a way of double checking important surveillances.
    d. Define roles and responsibilities in appropriate documents.

3. Implement new systems/procedures and verify the outcome matches the intended results.

    The working group is to be established and objectives presented by January 6, 1992. Meetings will be held on a weekly basis or more frequently if required. The working group will present proposals to the Work Control Section Managers during the week of February 3, 1992 with a goal of implementation by the week of March 2, 1992.

DUKE POWER COMPANY

EMERGENCY PLANNING SELF-ASSESSMENT REPORT

REVIEW PERIOD 02/91 - 05/92

TABLE OF CONTENTS

I. MANAGEMENT INVOLVEMENT

Many positive challenges were presented to the Emergency Planning Section at Catawba during this review period providing us with opportunities to improve our EP Program.

A. The reporting level of the Station Emergency Planner was raised and two staff positions were added to the Emergency Planning Section as a result of our recent reorganization.

B. Catawba aggressively participated in the resolution of FEMA identified deficiencies associated with an EPZ county.

C. Greater training/qualification requirements for all Emergency Response Organization members were implemented including respiratory and GET Level II training. Severe Accident Management training was provided to most management level members of the SC, OSC, and Crisis Management Organization (EOF).

D. EPZ Evacuation Time Estimates were completely revised as a result of population growth based on 1990 census.

E. Budget provisions were made to support the use of mock-ups for OSC Repair Teams in Casualty Control type quarterly drills on a continuing basis.

F. Negotiating a new Agreement Letter with the Regional Trauma Center (backup hospital) to provide helicopter transport of contaminated severe injuries.

II. FACILITIES

A. Siren Feedback System software and hardware additions were made improving both Silent Testing and maintenance capabilities. Installed a passive Siren System Controller in the TSC for siren system operability monitoring and feedback.

B. Decontamination facility improvements were made at one of our Offsite Plant Evacuation Points (Newport Transmission Facility) by adding two decontamination showers and a female restroom.

C. The OSC was redesigned and reorganized to parallel the TSC management organization resulting in improved OSC Repair Team direction and control, efficiency, and communications.

D. Revised TSC organization by deleting nonessential administrative-type personnel from the Emergency Organization.

III. DRILLS AND EXERCISES

A. Regional Inspectors observing our successful March, 1991 annual exercise noted a controlled document problem in the OSC. Immediate corrective actions were taken to resolve the noncited violation before the Inspectors exited. A weakness noted in the contaminated injury portion of the exercise was quickly corrected by two remedial exercise demonstrations to the Site Resident Inspectors. We committed to two remedial exercises (under differing radiological and scenario conditions) instead of one to ensure all weakness concerns in this important area were resolved.

B. Sixteen drills and exercises will have been conducted prior to the end of this review period. Twelve drills/exercises were conducted in 1991 consisting of five simulator-driven station drills, one simulator-driven annual exercise, one contaminated injury drill, one contaminated injury exercise, two remedial contaminated injury exercises, one fire drill, and one off-hours unannounced staff augmentation drill. Eight drills and exercises are scheduled for 1992 with four to be completed by May, 1992 including an annual graded exercise. All drills and exercises except fire and contaminated injury will be simulator-driven.

C. Catawba voluntarily conducted an INPO Casualty Control Drill in October, 1991. The CCD was based on industry experience paralleling the Vogtle SD LOP event; employed the use of several mock-ups and required resources equivalent in magnitude to an annual NRC graded exercise. Areas noted in the conduct of the drill where program improvements are possible were discussed with the Senior Resident Inspector immediately following the drill.

IV. AUDITS AND INSPECTIONS

No findings, weaknesses, nor violations were noted in any of the NRC unannounced inspections or internal QA audits during this review period. The overall conclusion of the August 5-9, 1991 unannounced NRC inspection as stated in the report "was that the emergency preparedness program was being maintained in a fully adequate state of operational readiness."

V. STAFF AUGMENTATION

Improvements have been made in the area of staff augmentation by adding a 50 telephone line computer-driven automatic dialing capability for the recall of emergency response staff in the event of a plant emergency. In addition, pagers utilizing a group-call feature have been issued to most of the emergency response organization members to doubly ensure their prompt notification and recall to the plant in the event they cannot be reached by phone.

CATAWBA NUCLEAR STATION

DUKE POWER COMPANY

SECURITY/SAFEGUARDS

SELF-ASSESSMENT REPORT

REVIEW PERIOD 2/91 THROUGH 5/92

JANUARY 28, 1992

TABLE OF CONTENTS

SECURITY / SAFEGUARDS

Management Initiatives

- Management continues to be interested and involved with Security issues. Station and Security management continue to work together to ensure that Security issues are addressed. Security management continues to seek ways to involve security personnel in varying areas of security operations.

Station Management Involvement

- Security has continued to receive management's interest and support during development of the budget.

- Station management received training from Security in hostage negotiation.

- An engineer has been assigned to work with Security in reevaluating the Armed Response Program's ability to protect vital areas.

- As a result of a corporate reorganization, an engineer has been assigned to each station to work with Security on security related modifications. Also a Security Specialist has been reassigned to each station's Compliance Staff.

Security Management / Officer Interface

- A uniform committee made up of team personnel, has selected a new uniform for security. Transition to the new uniform has begun.

- A study of the shift rotation schedule that was recommended by the officers has been completed. The new shift rotation has been adopted and will be implemented by January 6, 1992.

- The Security Management meets regularly with each team to inform them of ongoing security activities and to discuss officer's concerns and suggestions.

- Team personnel are utilized to review proposed procedure revisions for applicability and to provide suggestions for improvement.

IAE Support

- Three IAE technicians have been assigned to security to work on equipment. The technicians report to the Security Support Supervisor and are directed by security to work assignments.

- Security has been allowed to develop a Work Request System independent of the normal station Work Request System.

The assignment of the technicians and the development of an independent Work Request System allows malfunctioning security equipment to be prioritized by security personnel and repaired quickly.

Security System Improvements

- Replaced the printer in the Badging Office with video monitors which allow officers to view badge transactions without leaving the issue window and allows for more efficient badge issuance.

- Placed a terminal in the Badging Office which allows officers in Badging to input transactions. This reduces demands on the CAS/SAS operators, increases operator efficiency and expedites badge transactions.

- Purchased an additional x-ray machine to be used as a back up.

- Improved CCTV cameras by replacing the tube cameras with solid state cameras. This replacement improves picture quality and reduces maintenance.

- Upgraded protected and vital area barriers including barriers in yard drains and HVAC. Work on vital area barriers is still in progress.

- Purchased equipment to test badge detectors used in conjunction with the Badge Exit Alarm System. During this SALP period two badges were inadvertently taken outside the protected area. An investigation revealed that both badges had broken detectors which prevented the badge exit alarm from activating. The equipment will allow officers to easily test the detector in each badge to identify broken detectors.

- A Security Maintenance working group has been developed that includes representatives from the corporate office and three sites from multiple disciplines. The group is evaluating security systems reliability, maintenance history, obsolescence and spare parts availability, and system upgrade options. This review includes replacement priorities, determining funding requirements through capital budgeting processes and sharing knowledge and system operational experience between the Duke sites. This effort is a part of of a larger effort in DPC to identify equipment obsolescence and establish 5, 10, and 15 year business plans. This group is helping to resolve current problems and laying the ground work for major modifications in the future.

Security Self Assessment

- Catawba has enhanced its Station Trending Program by including more details that can be used to review and evaluate data.

- A Management Summary of the assessed data is provided to station management on a regular basis.

- Regular meetings are held involving the security staff and team members to discuss the data gathered as a result of the trending program and find solutions to problems.

- In addition to annual audits conducted by Q.A., the station Q.A. Surveillance Group performs periodic surveillances on security activities. In addition Security has requested that the surveillance group conduct special surveillances of security compensatory posts and p.a. lighting.

- Security developed guidelines for their own audit program. The guideline ensures that audits are conducted consistently and are therefore more useful in evaluating performance.

Personnel Training

- Security implemented an improved combat stress course for officers.

- Selected personnel on each team received training as hostage negotiators.

- Two security training instructors received NRA rifle training.

- Selected personnel on each team received training with rifles.

- IAE technicians assigned to security, received training as security watchman to enable them to stand compensatory posts while working on equipment.

- Security Officer IIIs were given specialized assignments as CAS/SAS operators or Access Control Officers to develop specific areas of expertise.

- Officer qualification to post is now being conducted by the Security Shift Supervisors.

Security Awareness Program

- Station management has incorporated security events among outage goals that are established prior to each outage. The goals are then made known to station employees.

- As a result of local and regional events Security has implemented two changes to enhance employee safety and protect security equipment.

  1. In order for employees to exit the PAP Area quickly during an emergency and still prevent an employee from walking out with a badge the PAP access doors was unlocked but equipped with an alarm that will alert security if it is opened.

  2. The range house, used to store ammunition at the pistol range, has been equipped with an alarm system to alert security of unauthorized entry.

Fitness For Duty

- Duke Power continues to use a lower cut off level for marijuana than the NRC requires. Testing at this lower level (50ng) identified three positive drug screens for marijuana during the SALP period that would have been declared negative at the higher cut off of 100ng.

- The following measures have been taken during this period to improve effectiveness of the recall directive as it relates to Fitness For Duty (FFD):

  1. A letter was sent to all groups on site during the month of June, 1991 re-emphasizing the importance of the call-out questions.

  2. The Shift Manager's Group took the lead in helping with this effort by reminding supervision of the need to ask the FFD questions when they are calling someone in. Many times they are aware that groups are going to call someone in before it happens. This simple reminder to the individual making the actual call provides another means of keeping the call-out questions a #1 priority in addition to the purpose of the call-out.

  3. The call-out questions were included in Station Directive 3.1.3., "Recall of Station Personnel", Revision 3, dated March 15, 1991.

  4. The Station FFD Program Administrator has been added to the distribution for the daily Shift Manager's Logbook that is sent out via PROFS. This log provides useful information concerning plant activities and helps to identify call-outs made by the Shift Manager and other groups

on site. The FFD Program Administrator is making periodic phone calls to individuals identified as being called out to ensure the call-out questions were asked.

5. The QA Department conducted their annual audit of our FFD Program in March, 1991. During the course of the audit, questionnaires were mailed to 55 randomly selected individuals representing the various aspects of the FFD program. As a result of the evaluations of completed questionnaires, it was evident that employees had a good understanding and acceptance of the program. At the conclusion of the site audit, the Team Leader noted that the fact the audit had gone well was indicative of a concerned and professional Medical and Human Resources staff.

- The FFD Program Administrator has been working with the Emergency Planning Section at Catawba throughout this SALP period exploring new possibilities in the area of TSC/OSC activation and the relationship with FFD requirements. Activation by way of beeper and an automated telephone dialing system are being researched and will continue to be reviewed during the upcoming SALP Period in an attempt to increase efficiency with activation while maintaining compliance with 10CFR26.

Achievements

- No Licensee Event Report (LERS) have occurred during this SALP period.
- Reduced Safeguard Event Log entries by 165 entries or 41% from 1990 to 1991.
- Significant reduction in human error events by 35 entries or 48% from 1990 to 1991.

Opportunities For 1992

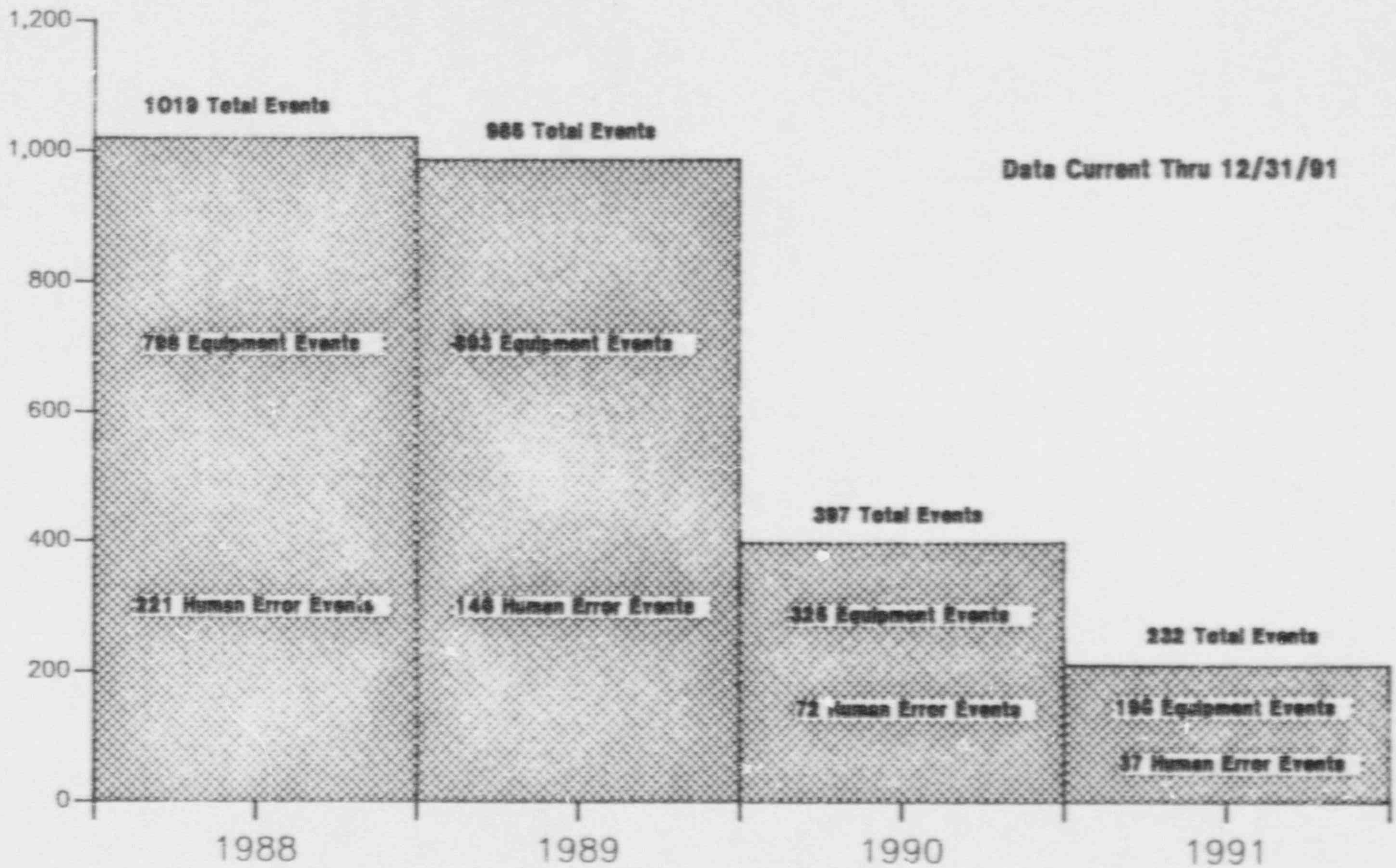
- As a member of Southeastern Nuclear Security Association (SENSA) Catawba and other utilities meet semi-annually to share information which can be used to evaluate their program.
- Catawba is a member of Catawba Regional Criminal Intelligence Council and the State Criminal Intelligence Council. This organization includes local, state and federal law enforcement agencies. This organization provides Catawba with an opportunity to share information and build a rapport with the other member organizations.
- Implement the Physical Performance Test Battery for security officers, developed for Duke Power by Human Performance System Inc. (HPSI). Implementation is schedule for April 1, 1992.

- A computerized badging system is being developed and networked that will tie in the badging computers of all three stations. This will allow the stations to transfer badging information electronically.

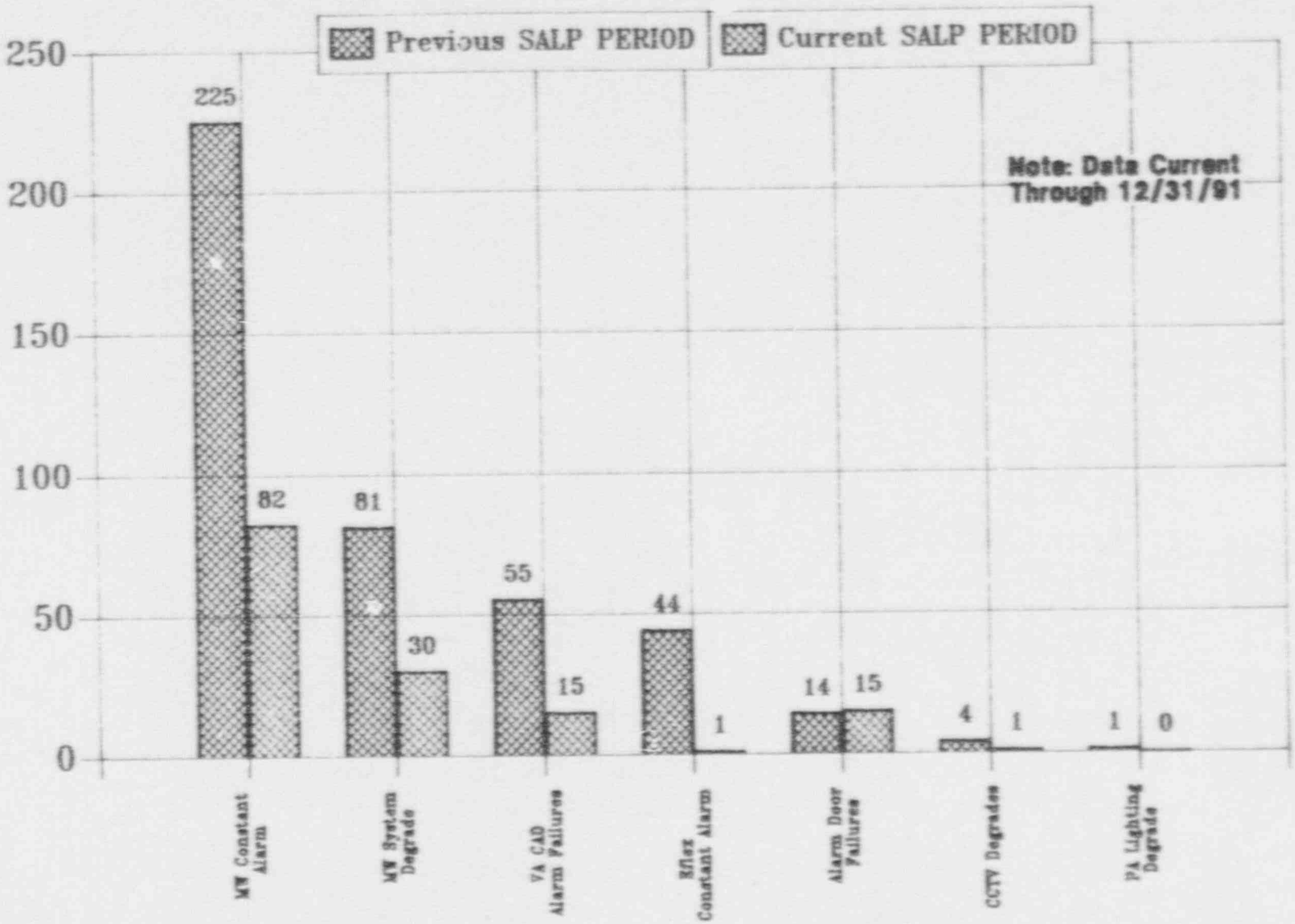
- Catawba will proceed with plans to replace the CCTV Switcher with a more efficient type.

- Catawba plans to evaluate and phase into operation semi-automatic hand guns.

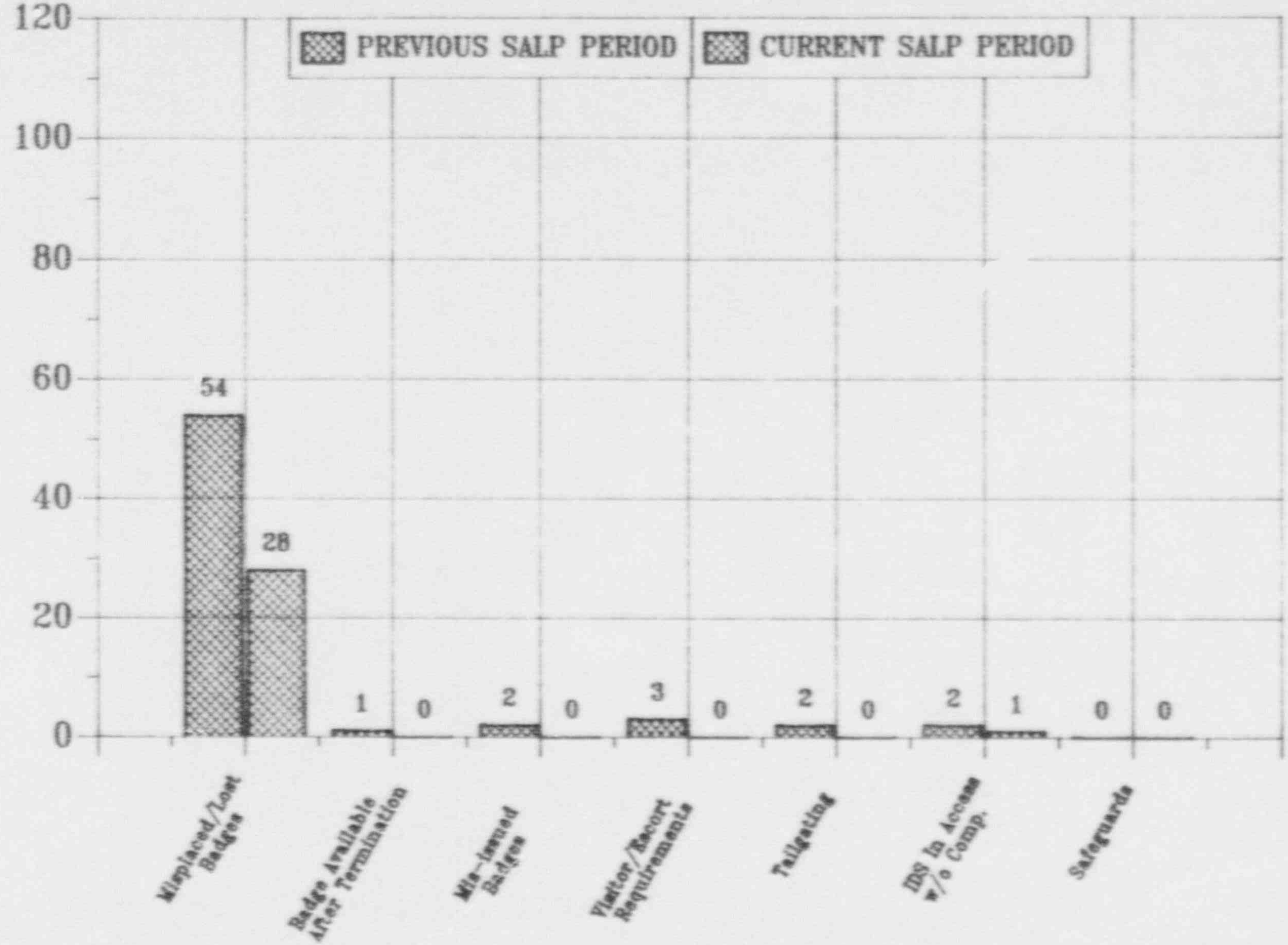
SAFEGUARD EVENT LOG ENTRIES
1988, 1989, 1990, 1991



CATAWBA NUCLEAR STATION
EQUIPMENT ITEMS



CATAWBA NUCLEAR STATION
HUMAN ERROR



Note: Data Current Through 12/31/91

CATAWBA NUCLEAR STATION

DUKE POWER COMPANY

ENGINEERING/TECHNICAL SUPPORT

SELF-ASSESSMENT REPORT

REVIEW PERIOD 2/91 THROUGH 5/92

JANUARY 28, 1992

TABLE OF CONTENTS

T. Low Pressure Service Water (LPSW) Systems
U. Diesel Generator Improvements
V. Security Closed Circuit Television (CCTV)
W. Reactor Coolant System (RCS) Vacuum Backfill Modification
X. Evaluation of the Impact of Moisture Seperator Reheater (MSR) Tube Material on the Steam Generator Secondary Side
Y. Ice Condenser Performance Improvement
Z. Boric Acid Tank (BAT) Recirculation Loop
AA. Utilization of Tempering Flow Alignment to Return Unit 2 to 100% Power
BB. Containment Penetration Overpressure Protection Review
CC. Pressurizer Safety Valve Setpoint Drift
DD. Snubber Reduction Program Update
EE. Steam Generator Replacement
FF. Digital Turbine Control Modification
GG. Digital Feedwater Control Modification
HH. Generator Breaker Testing
II. Probabilistic Risk Assessment
JJ. Safety System Performance Assessment

III. Responsiveness to NRC Initiatives

A. Generic Letter 88-14: Instrument Air
B. Bolting Task Force
C. Response to Weaknesses Found in the NRC Fire Protection Audit
D. Generic Letter 89-10: Motor Operated Valves (MOV)
E. Bulletin 88-11: Thermal Stratification in the Pressurizer Surge Line

IV. Enforcement History

A. Inability to Maintain Control Room Pressure During Loss of Power Events Due to Design Deficiency Resulting in Entry of Technical Specification 3.0.3

V. Staffing

A. Movement of SRO Qualified Personnel Into Engineering

VI. Operational and Construction Events

A. Generator Silicon Rectifier (SCR) Cooling Water Tubes

VII. Training and Qualifications

A. Severe Accident Management Strategies and Training

I. ASSURANCE OF QUALITY

A. System Assessment Program

The System Assessment Program (SAP) provides a mechanism for the review and documentation of important HVAC system design and operational information. This program consists of a review of: (1) design and licensing documents to identify important parameters necessary for the reliable operation of HVAC systems and (2) operation, maintenance, and test procedures to ensure conformance with the specified design and licensing parameters. The major focus of this program is to enhance the understanding of system design bases and assure conformance with licensing commitments.

The Annulus Ventilation (VE) System served as the pilot system for this project. The majority of the reviews associated with this system were completed by December 31, 1990. This meant that any advantages from this program would be seen in 1991. One gauge as to whether Catawba was successful in enhancing the understanding and operation of the VE System can be seen in the decrease in the number of Problem Investigation Reports (PIRs) written in 1990 versus 1991. There were 10 PIRs written against the VE System for Design's review in 1990 and only 1 in 1991.

B. Design Basis Documentation

During 1991, nineteen additional Design Basis Documents (DBDs) were completed for Catawba Nuclear Station. Through two years of the scheduled six year program, 9 plant level (topical DBDs) and 27 system level DBDs have been completed. All work has been done in house by Duke personnel.

DBDs completed during 1991 include:

1) Fire Protection (Plant Level)
2) Tornado, Wind (Plant Level)
3) Seismic (Plant Level)
4) Flood (Plant Level)
5) Component Cooling System
6) Auxiliary Steam System
7) Main Feedwater System
8) Condensate Storage System
9) Nuclear Service Water Pump Ventilation System
10) Fuel Pool Ventilation System
11) Steam Generator Blowdown Recycle System
12) Steam Generator Wet Lay-Up Recirculation System
13) Instrument Air System

14) Station Air System
15) Breathing Air System
16) Diesel Load Sequencing (Class 1E CNS) System
17) 600KV Essential Auxiliary Power System
18) 250/125 VDC Standby Shutdown Facility Auxiliary Power System
19) Standby Shutdown Facility Diesel Controls

Work on the program will continue at approximately the same pace during 1992. By further clarifying system, structure and component design bases, the DBD program will enhance understanding and aid interface between personnel at Catawba, leading to sound decisions in both modification and operation of the station. Design Basis Documents are also now available to all personnel with access to company mainframe computer resources. Both the DBD's and Catawba FSAR are online accessible and can be contextually searched for references.

C. NUMARC Comprehensive Procurement System Initiative

NUMARC approved the Comprehensive Procurement Initiative (CPI) in June 1990, which required utilities to review and assess their procurement programs for needed improvements by July 1, 1991, and implement needed improvements by July 1, 1992. Duke formed a review team to perform the review and assessment phase. This team developed the Nuclear Procurement Engineering Program manual to facilitate implementation. The manual was issued in October of 1991. The Commercial Grade / QA Program will be modified effective April 1992 for use in managing and controlling data associated with both the Commercial Grade and Comprehensive Procurement Initiatives.

D. Improvements to Inservice Inspection Procedures/Planning Process

The construction Hydro procedure required that all instruments within the boundary be disconnected. The process for removing instruments from service has been significantly upgraded. Under the new system, all instruments within the boundary are evaluated against the following criteria:

1) What function does it perform in the system/plant?
2) Does it need to be isolated?
3) What steps must be taken, if any, to prevent an ESF actuation?
4) What are the functional/retest requirements?

If the instrument does not need to be isolated or its output blocked, time and manpower is saved by not sending technicians out in the field. If the instrument must be isolated or blocked, then a method of performing the blocking can be devised which will be adequate for the projected system/plant conditions.

From March through December 1991, 282 instruments were reviewed, of which 245 (87%) did not require isolation.

E. Motor Preventive Maintenance and Scheduling

In 1991, the large motor Preventive Maintenance (PM) program was overhauled. Baseline procedures were completed, or are nearly complete, for certain horizontal and vertical motors that can be easily adapted to apply to the remaining plant motors. In the past, there was one generic motor procedure for all plant motors. The new approach will have a procedure for each motor and will require the measurement and documentation of much more electrical and mechanical data on the motor during its PM. Also in 1991, the schedule for large motor PM's was significantly changed. In the past, all motor PM's were performed during unit outages. This was an unnecessary work load burden. The motor PM's that can be performed non-outage have been moved to a non-outage schedule and all motor PM's have been evenly spread out over the three year PM cycle. In busy outage times, this scheduling change allows more time and effort to be spent on each motor's maintenance. This scheduling change has been implemented in such a way that safety system availability is not affected by performing the motor PMs during non-outage times. Finally, as part of this schedule improvement, certain plant motors that have had poor past performance are torn down completely on a routine basis and re-built. In some cases, the use of spare motors has allowed part of this work to be performed during non-outage times. The motors that are routinely rebuilt are the Heater Drain Motors, Condenser Circulating Water Motors, and the Condensate Booster Motors. Finally, a Technical Support Program was completed in 1991 that formally outlines the motor maintenance program. In addition to the PMs and teardown maintenance, routine vibration and oil analysis is performed to monitor motor condition.

F. Metal Clad Breaker Preventive Maintenance

Currently, all onsite metal clad breaker maintenance is performed by offsite personnel that serve the Duke system. Plans are in place to qualify onsite personnel or to hire qualified onsite personnel to perform this maintenance task. Currently, all breaker work is performed during outage times to fit the schedule of the roving breaker crews. This creates an outage equipment and personnel scheduling complexity that is not necessary. As many as half of all breaker PM's can be performed in non-outage times. This would significantly reduce overtime, plant configuration problems, outage scheduling problems and outage duration. The outage breaker schedule was reorganized in 1991. Breaker PM's that are performed on a three year cycle are now grouped in a particular outage according to tagouts instead of breaker size as in the past. This provides the Operations and Scheduling groups with a predictable and logical equipment tagout for each outage.

G. Locked Valve Study

A comprehensive review and implementation of all administratively controlled and locked valves has been completed for both units this period. The work results in consistency in design documents and station procedures on locked and administratively controlled valves and a brief description of the intent of the controlled valve on design flow diagrams to aid in decisions regarding repositioning of these valves.

H. Electrical Distribution System Functional Inspection Self-Initiated Technical Audit

A Self Initiated Technical Audit (SITA) of the Electrical Distribution System (EDS) at the Catawba Nuclear Station was conducted between August 26 and October 11, 1991. Southern Technical Services, Inc. was contracted by Duke to perform the audit. The audit team was made up of individuals with technical expertise in electrical, instrumentation and controls, and mechanical engineering. The purpose of this assessment was to determine whether the EDS could perform its intended safety function as designed, installed and configured. Also evaluated were the engineering and technical support of EDS activities. Plant walkdowns, technical reviews of calculations and associated documents pertinent to the EDS, and interviews of corporate and plant personnel were conducted.

Based on the audit sample, the team considered the design and implementation of the EDS at Catawba to be generally acceptable. However, several areas of concern were identified that warranted system and/or documentation enhancements. A formal response to the audit has been issued which documents completed actions and provides schedules for disposition of open items.

In addition to the findings and follow-up items, the team identified several strengths. The most notable of these strengths were: (1) the material condition of the plant was considered to be very good, with only minor deficiencies identified during facility walkdown inspections; and (2) the Integrated Safety Assessment Program, which provides senior management with a concise, well focused summary of plant problems (hardware, people, and management).

I. I & C List Upgrade

In recognition of the need to continue improving the quality of design documentation to facilitate safe, reliable operation and maintenance of Instrumentation and Controls systems, a multi-year effort has been initiated to upgrade the present I & C list. This effort will involve the addition of numerous data fields to the present database to facilitate clearer communication of the design information and circumvent misinterpretations that could result in equipment being operated outside the bases and assumptions of design calculations and analyses.

This effort is being closely coordinated with the System Design Basis Document (DBD) effort that is also underway. The upgraded Instrument List for a system with its supporting calculations will clearly depict instrumentation design bases. The instrument bases will be tied directly to the higher level bases identified in the system level DBD's.

To ensure the effort incorporates the latest industry initiatives, the lead engineer for the I & C List Upgrade has become a member of the ISA SP67.15 committee on Setpoints Methodology. The knowledge gained from the participation on this committee is being used directly in the development of a revised Duke Power Company Instrument Loop Uncertainty and Setpoint Procedure.

J. Testing Tailgate Documents

Proper communication prior to the start of a test is necessary to ensure infrequently performed tests (and even frequently performed tests conducted in off normal plant conditions) do not put the plant into unexpected transient conditions. To control this process, Tailgate Documents were written for the infrequently performed tests conducted by the Reactor Group and System Engineering group. These documents describe the test itself, its impact on Technical Specifications, impacts on system configuration (primarily the impact on the Control Room Operator's control of equipment with electrical jumpers placed or sliding links positioned for the test), expected alarms, things to watch out for in the test, and importantly, test termination criteria. The Test Coordinator meets with the Operator at the Controls and the Control Room SRO prior to the test to review the Tailgate Document and to answer any questions that the package of information brings about.

Catawba has used this approach in the last 2 outages and found it effective in preventing transients from the testing process. A good example of its importance was during the recently completed Unit 2 outage. During the ECCS flow balance test, the Safety Injection pumps are started in a cold leg injection alignment. To prevent pump runout, test termination criteria are established in the procedure for high flow and are discussed in the Tailgate Document. The pumps showed high flow at the start of this test. This was immediately recognized by the Control Room Operator, SRO, and Test Coordinator and the pump was secured without damage.

With the positive benefits of Tailgate Documents in outages shown by the reduction in transients generated by these tests as well as "saves" such as the one described above, the Tailgate process is being extended to cover quarterly IWP and IWV testing. At present, over 50% of these tests have written Tailgate documents.

K. System Engineering Teams

In late 1990 it was recognized that the availability of the Auxiliary Feedwater, Emergency Core Cooling, and Emergency A/C Power System was low when compared with the rest of the industry. To understand the impact of this situation on the Station Specific Probabilistic Risk Analysis (PRA) and to improve system availability, five teams of engineers were formed. The teams were chaired by the System Experts in the Performance testing area and were organized to address the Auxiliary Feedwater, Emergency Core Cooling, Emergency A/C Power, Ventilation, and Nuclear Service Water Systems. At Catawba and many other stations, one individual is assigned the lead for a system or group of systems to control preventive and corrective maintenance work, modifications, and testing on those systems. Catawba's enhancement to this process was to recognize that at Catawba several other groups had a significant role in availability and reliability of these systems and that by forming a team of the System Expert and these engineers, the interface that would need to take place could be formalized. Therefore, for these five teams, representatives of Operations, Component Engineering, Projects (system modifications), and Design Engineering, along with the System Expert in the Performance testing area were identified and established as the initial team members.

To coordinate the teams' activities, a Steering Committee was formed consisting of the Section Heads from Performance, Operations, Maintenance, Integrated Scheduling, and Design Engineering. The Steering Committee meets on a monthly basis to provide direction for the team chairman on priority activities and to make decisions on modification activation based on the chairman's input. In addition, the Steering Committee hears a report on team activities in the month and any need for management support in improving system availability.

During the year of 1991, the teams began publishing a monthly newsletter to the station to inform station staff of system availability and of the "top ten" problem areas being addressed by the team. Following the Unit 1 outage in mid 1991, it was recognized that the initial five teams had made significant improvements in safety system availability and were beginning to extend their influence into other aspects of system reliability and operation. Further, by having engineers from different disciplines meet on a monthly basis on the same system or group of systems, long standing problems were being resolved and if one of the group members were to leave the company or be reassigned elsewhere, there was still a continuity in the ongoing work of the team. With this recognition of accomplishment and strength that the team concept provided, additional teams were formed in the areas of Condensate and Feedwater Systems, Main Steam System, Primary Coolant System, Fire Protection, Radiation Monitoring System, and Closed Loop Cooling Water Systems in June 1991. Also, Catawba formed a Safe Shutdown Facility (SSF) Team within weeks after a Probabilistic Risk Assessment study was presented to station management. This study concluded that additional emphasis needed to be placed on SSF reliability due to the potential consequences of a loss of Component Cooling (KC) directly or indirectly caused by the loss of Nuclear Service Water (RN) System. This team is looking ar methods to ensure the SSF is highly reliable and alternate methods to provide cooling to the centrifugal charging pumps on a loss of component cooling. The Catawba

System Engineering area is using its resources to ensure safe and reliable operation of the station. Additional teams will be formed after Duke's reorganization is completed in April of this year.

The System Teams and Steering Committee approach at Catawba has proved to be successful in improving safety system availability. An example is the improvement in the Auxiliary Feedwater System availability.

System		1990	1991
Auxiliary Feedwater:	Unit 1	5.1%	2.5%
	Unit 2	5.6%	4.17%

L. Post Modification Testing

The Post Modification Testing Program (PMT) at Catawba continues to receive a high level of attention by all parties involved in the design, planning, and implementation of modifications. PMT test plans are developed and performed to verify that the modification is installed and operates properly, has no adverse impact on other systems, and functions as intended. The tests are developed with input from Mechanical, I & E, Civil Engineering, Component Engineering, and System Engineering. There are meetings scheduled at different phases of the design process that provide a forum for these groups to discuss PMT requirements. Then each modification, whether a minor Exempt Change (EVN) or a complex Nuclear Station Modification (NSM), receives a final review by the engineering staff in System Engineering. This review provides assurance that all aspects of the PMT program at Catawba are met by providing a single focus point.

M. Local Area Network and Wide Area Network Tools

As Duke's LAN/WAN network topology continues to grow; the software tools to make it more powerful also have developed and grown. One of the more powerful tools is an application entitled "Phantom" that was developed by the Catawba Electrical Engineering group for use on Catawba.

"Phantom" is user friendly tool to permit users to navigate between and query almost all of the engineering data base files. Previously, these files were only accessible either via hard copy records or via mainframe screens. The difficulty involved in quickly locating the record of interest was overwhelming. While this tool is not a substitute for controlled engineering data, it is invaluable in providing access to that data. While "Phantom" greatly simplifies the access to the Engineering data, it also makes it possible and convenient to standardize the formatting, spelling, spacing, etc. of the data that currently exists in these fields. Also, comparing data across files for inconsistencies and errors becomes possible, greatly improving data quality. Once identified, then these errors and inconsistencies can be reconciled and updated on the mainframe via established methods of control.

N. **Zero Defect Fuel Reliability Program**

Core Mechanical & Thermal Hydraulic Analysis provides core thermal hydraulic and fuel rod performance analyses and is responsible for implementation of Duke's corporate fuel reliability program. During 1991 Duke transitioned to a zero defect fuel reliability program. Core Mechanical & Thermal Hydraulic Analysis group is responsible for helping to define this program and for the program's implementation. This work activity includes program definition; fuel reliability monitoring; analysis; fuel assembly design changes; and onsite fuel inspections, repairs, and root cause exams. This group works closely with the station reactor groups to accomplish these functional responsibilities.

O. **Nuclear Plant Reliability Data System**

The Nuclear Plant Reliability Data System is maintained by reviewing work requests for reportable failures, and modifications for updates to engineering records. Frequent reviews are done to insure data quality. NPRDS engineering and failure data is used when applicable for solutions to equipment problems, Commercial Grade Evaluations and new equipment purchases.

During 1991, Catawba received a completeness review rating of 91.7%. There were many upgrades including the completion of Revision 3 (RPS & ESDAS). Components in the NIS, SSPS, & Westinghouse 7300 system were reviewed for reportability and function codes were added. All systems were reviewed for vent and drain valves to be added. All NPRDS manuals have been revised per the Nuclear Network Messages from INPO.

P. **EPRI Research Project Involvement**

Engineers from the Civil Engineering Section of the Catawba Engineering Division are leading an engineering team to develop guidelines and criteria for nuclear piping and pipe support system operability. This research program is being sponsored by the Electric Power Research Institute (EPRI). This program recognizes the difference between old and new plants, the different approaches and criteria used for different problems at the plants, the available literature data, and research results and analytical models. Task areas that have been investigated as part of this phase of the project include: piping system operability for piping and supports outside design basis, concrete expansion anchor bolt capacity under dynamic loadings, behavior and failure modes of standard support components, seismic/non-seismic interfaces, support stiffness criteria, effects of support design on nozzle loads, and integral welded attachments. The findings and recommendations of the piping operability task have been presented to the ASME for consideration for inclusion in the ASME Code or O&M Standards. The reports for each investigation area have been reviewed by utility and A&E experts throughout the industry. The final report, due out in 1992 for this phase, will tie the results of the research areas together to form a usable criteria for operability evaluations and design guidance. The areas for investigation in the next phase includes: documentation of small bore piping, gang support evaluation design by rule, and loading and loading combinations.

II. IDENTIFICATION AND RESOLUTION OF TECHNICAL ISSUES

A. Cooling Tower Starter Assembly Replacement

Catawba replaced the starter assemblies used in the Cooling Tower fan power circuits on Unit 1 (1A tower) and Unit 2 (2A tower) with Joslyn Clark Vacuum Switch starter assemblies. Due to duty cycle requirements, the starters which were installed have experienced numerous breaker trips as well as high rates of main contact pitting and burning. In addition, the computer logic monitored from the auxiliary switches has experienced a large number of failures due to the vibration caused by the magnetic field induced in the armature lamination. The new vacuum starters were field designed to physically interchange with the ones currently installed and are designed to provide frequent switching duties without main contact pitting or burning. An auxiliary relay was added to provide reliable computer graphic indication. Since the installation of the new starters in Unit 1 (1A tower), July 1, 1991, no failures have occurred which can be attributed to the starters, breakers or computer graphics. As an additional trending means, a digital counter was added to each vacuum starter fan circuit to record the number of operations.

B. Molded-case Circuit Breaker Testing Program Implementation

Catawba implemented a molded-case circuit breaker testing program which encompasses various parameters such as: pole resistance, megger testing, instantaneous trip values, trip times, overcurrent trip testing and infrared thermography testing. This program allows trending of tripping characteristics, breaker coordination, thermal degradation, etc. Breaker performance trending will aid in establishment of testing frequency. Additional testing will include DC breakers and Balance of the Plant breakers, both safety and non-safety. Data bases have been established to maintain historical breaker data for future trending and analysis.

C. Replacement of Copper Knife Switches in Generator Breakers and Disconnect Switches

Catawba replaced the copper knife switches with nickel plated copper switches after failure trending of the Generator breakers and Generator Breaker Motor Operated Disconnect Switches indicated a problem with corrosion build-up at the knife blade contact points. This change has eliminated failures due to corrosion related problems. Approximately 140 knife switch terminal blocks have been replaced. This change has eliminated the problems with closing the generator breakers and motor operated disconnects. In addition, the reliability of the protective relaying associated with the Main and Auxiliary transformers, which utilize knife switches, has been increased.

D. **Piping Erosion Control Program**

The Piping Erosion Control Program is an aggressive ongoing interdepartmental piping inspection and analysis program that continues to prove an effective tool in managing erosion in both single and two phase piping systems. The primary goal of this program is to locate, inspect, analyze, repair/replace, and monitor all problem areas in order to establish a high level of confidence in the integrity of the piping systems and to assure the safety of personnel working in the plant.

The updated EPRI Checmate Program is used to predict erosion wear rates and wear locations. This program was used to choose the original 4 test locations in the Unit 2 Auxiliary Feedwater (CA) system which resulted in the replacement of 90 feet of piping and several fittings.

The Unit 1 EOC-5 outage resulted in 88 inspections to the various secondary side systems in the erosion program at Catawba. Of these, there were 10 replacements made, 7 of which were previously predicted. The three replacements which were [illegible] expected did not impact the outage and were replaced in a timely manner.

For the Unit 2 EOC-4 outage, fourteen susceptible high energy piping systems were evaluated, and 132 inspection points were selected. While performing these inspections, problems were discovered which resulted in replacing four 4" and two 10" Main Feedwater lines and one 18" bleed piping section. This unscheduled amount of work was accomplished without extending the outage and without compromising the originally scheduled erosion inspections and replacements. As a result of these findings, the total number of inspections was increased by 98 inspection points for a total of 230 for the outage. This brings the number of inspection points on Unit 2 to 733.

E. **Piping Corrosion Program**

February 1991 marked the completion of Design Study 171, "Corrosion of Service Water Systems" for Catawba. This study established a program to continue monitoring the service water systems at Catawba for corrosion and recommended actions to be taken to assure continued reliable operation of those systems. Significant recommendations included the replacement of all carbon steel piping 2" or less in diameter with stainless material, gradual replacement of larger diameter piping as needed, valve replacements and continued monitoring. A visual inspection was performed on both supply trains of 42" buried piping which showed little or no significant degradation of pipe wall thickness due to corrosion effects. "The Service Water Pipe Corrosion Inspection Guidelines" were issued in December to provide a means of documenting inspection data taken at Catawba. "The Service Water System Program Manual" was also released in '91 which covers the entire effort being expended at Catawba to control corrosion. This manual includes sections on Intake Structure inspections, Biocide additions, flushing requirements, testing, water chemistry, and licensing concerns.

F. Reactor Trip Breaker Response Time Trending

Analysis of the response time trending data base, following Unit 1 EOC5, revealed a step increase of approximately 41 msec (i.e. increase from 83 to 124 msec) for reactor trip breaker B. Although the time was below the Technical Specification limit of 150 msec, Engineering initiated a work request to investigate and repair the step increase prior to the unit returning to power operations. Subsequent investigation discovered a degraded undervoltage trip coil mechanism. After replacement, the measured response time decreased to approximately 68 msec. This action vastly increased equipment reliability and plant safety margin. A similar occurrence was recently identified following the required surveillance on the unit 1 reactor trip breaker A.

Although the response time had remained within allowable limits, Duke contracted Westinghouse to perform an investigation to determine the root cause of the degradation. The results of the tests and inspections determined the most probable cause of the slow response time was a slightly bent latch arm on the UVTA reset bracket. The problem is not considered generic since the response time remained within allowable limits, the degradation was detected through routine standard testing and the cause of the slower response time is not attributed to wear or breaker cycles.

G. Nuclear Instrumentation Cable Quality Degradation

While performing the preventative maintenance (PM) activity for trending the Nuclear Instrumentation cable quality for degradation during the Unit 1 EOC5, a change in the Time Domain Reflectometer signal trace was discovered. Extensive followup activities revealed an intermittent open in a detector connector for a power range channel. The detector was immediately replaced. This expedient action most likely prevented an outage extension and/or a forced outage to replace the detector. Equipment reliability and safety system availability were greatly enhanced.

H. Nuclear Instrumentation Setpoint Trending

Setpoint trending databases established by the Engineering group have identified erratic responses from various components associated with the setpoint circuitry due to normal aging. An example of this is the level trip bistable and the remote equipment isolation amplifier adjustment potentiometers. For a given parameter, the potentiometer wiper is continually positioned in a certain area on the windings. This eventually causes a 'dead spot' for the adjustment, thereby creating an erratic output and/or setpoint voltage. Action taken to replace these components prior to complete failure precluded reduced plant margin of safety due to safety system unavailability.

I. **Reactor Vessel Level Instrumentation System/Inadequate Core Cooling Monitor Software Upgrade**

System software deficiencies in the original design were identified by Engineering. Software upgrades were obtained from the manufacturer (Westinghouse). These enhancements were implemented during the refueling outages this past year. Although these improvements were mostly cosmetic in nature, human factors were improved in the areas of ease of operation and understanding. Some changes were provided to improve equipment reliability. A few examples are:

- Normal delta pressure (Δp) values were defined generically based on how many reactor coolant pumps were running. In reality, the normal Δp value is different for a pump running in a particular loop (e.g. the Δp generated with a pump running on a loop with a Reactor Vessel Level Instrumentation System (RVLIS) process tap is much greater than the Δp in a non-RVLIS loop). This was corrected in the software upgrade.

- Subcooling alarms are now based on the highest of the hot leg temperatures or the incore thermocouples. The original software generated the alarms based exclusively on the incore thermocouples.

- When reactor coolant pumps are running, the lower range transmitters are driven off-scale due to the large Δp generated by the flow. The original software generated an alarm due to an off-scale sensor, when in reality, this was an expected occurrence. This is no longer the case with the upgraded software.

- If one of the three thermocouple reference junction RTDs failed, the original software would not compensate the indicated incore temperature for the temperature of the reference junction. The upgraded software disregards a failed RTD and uses the remaining good RTDs to compensate for the reference junction.

J. **Radiation Monitoring System Upgrade**

Catawba is in the first phase of a radiation monitoring (EMF) system upgrade. Production Technical Support designed digital output modules to replace the analog output modules currently installed at Catawba. The analog equipment has become increasingly time consuming to repair, and spare parts are becoming more difficult and more expensive to procure. The new output modules have been designed as a direct replacement for the analog modules, and will therefore work with the existing detectors and sample delivery systems. All the preliminary work has been completed for the modification, and installation is scheduled to begin in February of 1992. All EMF system procedures are being reviewed and upgraded in conjunction with this modification. The digital output modules will make it possible to connect the monitors to a token ring and use a centralized computer system to display status, generate reports, and log historical data.

K. Post Accident Sampling

Increased attention has been focused on the Post Accident Liquid Sampling (PALS) and Post Accident Containment Air Sampling (PACS) systems in 1990 and 1991. Both systems were experiencing a high unavailability due to failed performance tests. During investigation of problems with the PALS Panels, it was noted that the Programmable Logic Controller was a major contributor to the problems. The decision was made to replace the PALS panel with one that was "manually" operated. This provided greater accuracy in taking samples, and provided more diagnostic tools to aid in troubleshooting. The panels for both Unit 1 and 2 were replaced in mid 1991, and have been exhibiting an increase in successful tests.

As investigations began on the PACS Panels, a lack of detailed, accurate documentation was discovered. New manuals were researched and issued, containing additional information to aid in problem solving. Additionally, all the drawings were verified and moved from the manual and made stand alone drawings. After maintenance was complete on both panels, Radiation Protection personnel designed more rigorous test procedures for these panels. These improvements are aimed at increasing the availability of the panels.

L. Watts Type B-20 Filter Regulators

Watts type B-20 Filter Regulators started to exhibit a high failure rate which eventually caused a unit shutdown. The failure was attributed to mechanical failure of the plastic spring cage assembly on the top of the regulators. A task group was initiated to identify and replace all plastic spring cages on Watts type B-20 regulators with a Metal spring cage assembly. The majority of the Unit 2 critical to operation valve regulators have been reworked either prior to or during the last outage. Unit 1 critical to operation valves are on the trip list to be done if the unit trips or when the unit comes down for refueling in June of 1992.

M. Refurbishment of all Nuclear Service Water (RN) Pumps and the Shaft Tube Modifications

There has been a joint effort underway with Maintenance personnel and Design Engineering personnel to improve RN pump operation and availability. One of the main improvements for the spare RN pumps was the deletion of the external bearing lube injection line requirements. This enhancement allows the pumps to provide their own bearing lube injection without external lube lines. Loss of lube injection flow to the original pumps resulted in RN pump inoperability, thus reducing pump availability.

Prior to the modification mentioned above, RN pump maintenance required that both pumps on a particular train be tagged inoperable since the pumps share a common lube injection strainer. Isolation valves installed as part of this modification will enable the unaffected pump to remain operable while the other RN pump is out of service. This will increase the RN system availability by allowing continued operation of the particular train to support station cooling water requirements.

Also, due to the length of service for the Nuclear Service Water Pumps, all the pumps have been completely rebuilt. During the rebuilds, the pump columns showed signs of pitting and corrosion. Details were worked out with Engineering to coat the inside of the pumps.

N. Auxiliary Feedwater Turbine

Due to the potential for the vendor supplied stem to corrode, the vendor was requested to provide chrome plated stems for use in the governor valves. The stems have been provided and have been installed in the governor valves on both units. Drain valves that were installed for class breaks would usually clog up and stop leakoff from the turbine valves. They have now been deleted from the system to provide unobstructed flow paths for the leak-off lines. This will reduce overspeed trips due to better operation of the valve.

O. Steam Generator Work

Catawba has done a lot of extra work during the past year to extend the life of Catawba's Steam Generators (S/Gs), improve their reliability, and support ALARA.

Some examples of the increased testing used to locate damage and learn more about each type of indication are as follows:

- Performed 100% Code ECT versus the EPRI recommended 20%.
- Performed a 100% MRPC inspection of the tubesheets and have used MRPC extensively in other locations of tube defects/indications.
- Used tube pulls and extensive testing to further the understanding of tube OD attack.
- To assure reliability and extend the S/G life, Catawba has replaced all of the old Inconel 600 tube plugs with Inconel 690 and has begun sleeving tube defects instead of plugging them.
- Catawba has continued to support ALARA in every aspect of S/G maintenance. Of particular note is the use of robotics to install the nozzle dams during the Unit 2 EOC4 refueling outage which saved approximately 3 manREM over the manual installation.

P. Ultrasonic Level Measurement System (ULMS)

The Merlin Gerin ULMS was installed during the last outages for Unit 1 and 2. It accurately measures the level in the Reactor Coolant System (NC) Hot Legs between 0 and 7.25% with the use of Ultrasonic signals. This is a critical measurement during mid-loop operations because it helps in avoiding a loss of suction to the Residual Heat Removal (ND) pumps. Since the sensors are mounted external to the NC piping, dynamic changes to the NC system, such as those occurring during vacuum backfill, do not affect them like other pressure measuring level devices.

Q. Diesel Generator (D/G) Control System Replacements

Because of numerous problems with the pneumatic control system for the D/Gs, the safety related trip functions were replaced with electronic devices during U1EOC4 and U2EOC3. There have been no valid failures caused by a safety related trip function since this change. Also, during U1EOC6 and U2EOC5 outages, the pneumatic non-emergency trip functions will be replaced with electronic devices. This should eliminate the numerous problems seen with the pneumatic components.

R. Diesel Generator Engine Starting Air System (VG) Dryer Tubing Keroutes

The VG dryer control valves had experienced failures over the past several years. A change was made to reroute the tubing line for the control air connection from the outlet of the dryer skid to the inlet. Since this change was made, no further failures have occurred. In addition, a station modification has been initiated to add a filter/dryer to the input of the control air supply to prevent any moisture related problems from occurring.

S. Protective Relay Silicon Controlled Rectifier (SCR) Failures

In recent years there has been a problem with silicon controlled rectifiers (SCR's) found in some protective relays. These SCR's are located in the relay trip circuits and act the same as a dry contact to pick up the relay. A manufacturers problem with a specific batch of these SCR's has made them susceptible to firing erroneously which picks up the associated relay and actuates the protective devices. A conservative go / no go test was developed and Catawba is in the process of checking all protective relay SCR's for erroneous firing potential. Suspect SCR's are replaced with SCR's that have been screened on site and by the manufacturer. All stock SCR's were returned to the manufacturer and replaced with a newer batch that does not have the misfiring problem. The go / no go SCR check has been added to the relay preventive maintenance procedure which is performed every two years in most cases. This periodic check will follow the 100% check and will provide adequate assurance that no further problems occur.

T. Low Pressure Service Water (LPSW) Systems

In an effort to improve the availability and reliability of the Low Pressure Service Water Systems, a review of all instrumentation in these systems was conducted to ensure proper operation and identify instrumentation "important to plant operation". This instrumentation was considered for inclusion into the station preventive maintenance (PM) program. Instrumentation included in this category, "important to plant operation", are instruments that perform control and interlock functions or instruments that are used for monitoring critical plant parameters.

i. Preventive Maintenance Program

Instruments were segmented into two classes; instruments that require calibration; and instruments that require calibration and are susceptible to impulse line clogging. PM work requests were then generated for these instruments and a baseline frequency or a frequency based on past experience was determined for each activity. These frequencies will be periodically reviewed and revised as necessary as trends are identified.

ii. System Modifications

Several instruments required system modifications for proper operation.

Due to the current configuration of the LPSW system, the normal operating pressure in the intake backwash headers is reduced. To compensate for this reduced operating pressure, the backwash intake screen pressure switch setpoints were lowered from 50 PSIG to 40 PSIG. This allows proper operation of the drive motor which rotates the screens during the backwash sequence.

The original LPSW compressor which senses differential pressure (Δp) across the intake screens and starts the backwash sequence on high Δp was found to be inoperable. The compressor was replaced with suitable substitute which allows proper automatic operation of the backwash cycle. Also, a PM will be established which includes checking the compressor for proper operation.

U. Diesel Generator Improvements

The following are some of the improvements made on Catawba's Diesel Generators:

- Fuel oil polishing skids were specified and purchased to be permanently installed on the fuel oil tank farm. Installation is scheduled to begin on Unit 1 in mid January and Unit 2 will follow. Sampling technique for fuel oil delivery was also revised to detect for free water in fuel trucks.

- The lubricating oil was changed to a synthetic oil in all four engines. The synthetic oil is expected to reduce the effects of carbon build-up in valve guides and piston rings. Improved lubrication is also expected to reduce wear, especially during fast starts.

- A connecting rod tensioning system has been requisitioned. The tensioning system will assure proper fastener pre-load, reduce the chance of galling, and should speed assembly and minimize diesel generator unavailability during outages. The first tensioning system is scheduled to be installed on one of Unit 1's engines during the End of Cycle 6 refueling outage.

V. Security Closed Circuit Television (CCTV)

The Security CCTV system is currently being upgraded from a tube camera (Burle TC1030) to a digital camera (Burle 301E). The current switcher is also being pursued for change out to provide the system with a digital processing and image capture capabilitie s. These upgrades will increase the reliability and availability of the Security System in making assessments of intrusion alarms in a timely manner. The upgrades reduce overall maintenance cost and equipment down time due to obsolete parts.

W. Reactor Coolant System (RCS) Vacuum Backfill Modification

Catawba Unit 2 was the first U. S. Nuclear plant to successfully implement the vacuum backfill technique to perform RCS fill and vent. Overall, the RCS Vacuum Backfill improves chemistry, RCS Pump performance and reduces fill and vent time. Additional improvements are being planned to further enhance vacuum skid operation and overall fill and vent operation when it is installed in Unit 1 in 1992. Post modification and start up were enhanced by use of the Infrequently Performed Test procedure (SOER 91-1).

X. Evaluation of the Impact of Moisture Separator Reheater (MSR) Tube Material on the Steam Generator Secondary Side

Steam Generator outside diameter (OD) tube defects were identified by eddy current testing during U1EOC4 (March 1990). Subsequent evaluation of a Steam Generator tube sample performed by B&W confirmed that defects were caused by IGSCC (Intergranular Stress Corrosion Cracking). Copper was present in the caustic tube deposits at support plate locations. A design study was initiated in February 1991 to evaluate the effects of copper on Steam Generator tubes. This design study documented earlier transport studies performed by Chemistry that identified MSR tube bundles as the major source of copper. Although a specific corrosion rate could not be attributed to copper, the design study concluded that copper accelerated IGSCC in alloy 600 (mill annealed) Steam Generator tubes. This conclusion was based primarily on a statistical study of operating plants with copper in the secondary system performed by Dominion Engineering and several EPRI laboratory tests which suggested that copper raises the electrochemical potential of a caustic solution to levels that accelerate IGSCC. Because laboratory and field data to date indicated an aggressive corrosion rate, Engineering recommended that the Catawba Unit 2 MSR tube bundles be replaced (with stainless steel) as soon as possible (Unit 2 EOC5). Catawba Unit 1 MSR tube bundle replacement is scheduled for U1EOC8.

Y. Ice Condenser Performance Improvement

The ice condenser has several activities underway for improving its operability and performance. These projects are a joint effort between McGuire and Catawba Nuclear Stations. Support for these activities involves the Component, Civil and Mechanical Engineering groups from both stations and Safety Analysis and Maintenance Engineering Support from the General Offices.

Duke Power has begun developing block ice to improve ice basket replenishment. Initial testing at Catawba shows that the cable cruciforms allow quicker basket replenishment, and also that block ice has a lower rate of sublimation than flake ice. The denser ice of the blocks allows longer operating cycles. In 1991, Catawba used performance data to extend the Technical Specification ice weight surveillance from 9 months to 18 months. In addition, Catawba Civil Engineering worked with Westinghouse to increase the allowable ice basket weight to allow for denser block ice to be used in the future.

A swivel bracket to replace the U-bolts that hold the ice baskets in place during a LOCA has been developed by Duke Power and piloted with great success at McGuire 1. The swivel bracket allows 360 degrees of rotation about the basket's vertical axis and more vertical lift before engagement. These features will allow periodic rotation of the baskets to decrease frost build up and assist in on-line weighing.

Sublimation of ice is the source of most of the ice condenser maintenance requirements. A modification has been completed in unit 2 to redirect some of the glycol from the Air Handling Units to the floor cooling coils. Investigation has been initiated into insulating the lower inlet doors, the wall to the accumulator room and the wall near the steam generators. Investigation into a sublimation shielding to go around the ice after the baskets are loaded has been initiated.

An International Ice Condenser User's Group was chartered in 1991 for information exchange. A symposium was hosted by Duke Power Co. last April in Charlotte. In addition, several other efforts are in progress under design study CNDS-0046.

Z. Boric Acid Tank (BAT) Recirculation Loop

A station Problem Investigation Report (PIR) documented problems encountered when trying to obtain a representative sample of boron concentration in the boric acid storage system per requirements of Technical Specification 3.1.2.5 and 3.1.2.6. A minimum boron concentration of 7000 ppm is required by these specifications and it is a limiting condition for operation of the unit. Station chemistry further confirmed poor recirculation of the BAT in a recirculation time test. The recirculation problem was attributed to a "short circuiting" of the flow from the safety boric acid transfer pump that provides thermal equilibrium and mixing of the tank.

The poor mixing of the BAT was solved by adding a new boric acid recirculation loop to the tank. A dedicated recirculation pump employing existing suction and discharge connections that are 135 degrees apart provides approximately 110 - 120 gpm of recirculation and mixing flow. The use of this new recirculation pump provides the chemistry personnel at the station with a properly mixed BAT for the twice weekly sampling of the tank. This assures a representative sample of boric acid concentration while minimizing the time required to obtain the sample.

AA. Utilization of Tempering Flow Alignment to Return Unit 2 to 100% Power

Station Performance and Design personnel performed testing and analytical modeling evaluation to develop a change in station operating procedures allowing the use of Main Feedwater (CF) tempering flow. The addition of bypass tempering flow to the normal Unit 2 Feedwater alignment allows for better control position at the main feedwater control valves and thus enhances the systems ability to handle transients as well as obtain rated plant capacity. This is accomplished while maintaining the required feedwater isolation and total feedwater flow measurement capabilities.

BB. Containment Penetration Overpressure Protection Review

As a result of a locked valve study, a problem was identified affecting the overpressure protection flow path required for Post-Accident penetration qualification. Design Engineering conducted a comprehensive review of this problem. The Locked Valve Study effort coupled within enhanced Design Basis Document input for the penetrations provide enhanced documentation and awareness of these relief paths to prevent the possibility of future misalignments.

CC. Pressurizer Safety Valve Setpoint Drift

Duke's Engineering/Technical staff performed an extensive evaluation of the problems associated with Pressurizer Safety Valve (PSV) setpoint drift at Catawba and Oconee Nuclear Stations. During the 1991 refueling outages setpoint drift was unusually high, with several valves in the +6 to +7% range. Historical data revealed that deviations in the +1 to +3% were typical. Consequently, Duke set up a meeting with both the PSV manufacturer (Dresser Industries) and the PSV test facility administrator (Wyle Labs) in an effort to better understand PSV drift and its causes.

During these discussions, Duke's attention was directed to the actual test/setup procedures for these valves. Previous industry focus had been on the differences between the tested and installed configurations. Duke's evaluation of this problem is summarized below:

- Test facility personnel did not understand how their procedures influenced PSV performance, and the valve manufacturer did not make any real attempts to educate the test facility personnel on PSV operating characteristics. Consequently, Duke came to the conclusion that a greater level of utility involvement was needed in order to ensure an adequate test program for the PSV's.

- Existing test procedures emphasized seat leakage prevention to the point where setpoint repeatability had actually become a secondary concern. The existing test/setup procedures were potentially introducing large amounts of error into the setpoint verification process.

As a result of these findings, a number of procedure enhancements were incorporated to reduce PSV setpoint drift. Although seat leakage prevention remains a high priority, the emphasis of the test program is now geared towards setpoint accuracy and repeatability.

Several industry notifications have been generated as a result of Duke's investigation. INPO has distributed a Nuclear Network Notice. Also, Duke's Engineering staff held a technical meeting for the Region to inform them about the setpoint drift problem, and the steps that Duke Power was taking to address the problem.

DD. Snubber Reduction Program Update

The Catawba Engineering Division (CED) has technical leadership on a program to reduce the number of seismic snubbers on piping systems at Catawba. Using ASME Code Case N411, this program is being undertaken with in-house resources. The problems with piping snubbers are well known throughout the industry. Some problems with snubbers are: low reliability, high maintenance and testing, added congestion in the plant, and the potential to cause forced or extended outages.

The scope of the piping under review for snubber reduction includes all seismically designed piping which have at least five snubbers in the analysis boundary. This includes piping containing 1200 snubbers on Unit 1 and 700 snubbers on Unit 2. This represents 63 percent of the total snubber population.

The review of piping containing 950 snubbers of the total 1200 snubbers to be reviewed on Unit 1 has been completed. Of these, 437 have been removed and 262 snubbers are now scheduled for removal. Piping containing 700 snubbers has been evaluated for Unit 2. Of these, 239 have been removed and 290 snubbers are scheduled for removal.

The implementation of snubber removal began with the EOC4 outage for Unit 1 and EOC3 outage for Unit 2. Completion of the entire program should occur during the Unit 1 EOC7 outage in 1993.

EE. Steam Generator Replacement

Due to high tube degradation in the Westinghouse Model D steam generators, Duke has implemented an extensive inspection and repair program at Catawba. In view of the high cost of this program and the likelihood that full load generation capability will steadily decline as tubes are removed from service, a steam generator replacement project has been initiated. In early 1990, a study team was formed to examine the technical and economic factors associated with replacing steam generators. In this process a computer model was utilized to account for the numerous variables involved. The results of this study indicated that replacement would be necessary before the end of presently licensed life of plant on Catawba Unit 1 and that early replacement would be the most cost beneficial choice. Due to some improved design features on Catawba Unit 2, it appears that replacement for this unit is a longer range issue.

In February 1991, a project team was established to continue the evaluation process and to prepare for early steam generator replacement. The team has now completed a procurement bid specification which has been issued to select vendors. Proposals are expected by mid-March of 1992 with placement of an order as early as July of 1992.

The new steam generators will incorporate a number of design features to mitigate tube degradation such as stainless steel support plates that minimize tube intersection crevices, improved tube metallurgy, low stress tube to tube sheet joints and improved anti-vibration bars. They will also be designed with substantially increased heat transfer surface in order to provide additional plugging margin as well as the flexibility to reduce primary inlet water temperature to uprate unit generating capacity in the future.

The project team is presently engaging in various planning and scoping activities involving engineering and safety analyses, licensing, replacement methodologies, interference identification and plant site logistics.

FF. Digital Turbine Control Modification

The decision was made to replace the turbine control systems supplied initially with the Catawba turbine generators. Both the Unit 1 and 2 analog electrohydraulic control systems were replaced during the scheduled 1991 unit outages with state-of-the-art digital electrohydraulic control systems using Bailey Network 90 System hardware.

The pre-existing control systems were not well suited for other than a steady-state set of operating conditions. The new turbine control system provides for greater future unit reliability, flexibility, ease of operation, ease of maintenance, ease of valve calibration and allows for system expansion. Also, with implementation of the digital turbine control modification, this will allow the plant to better withstand plant transient conditions which will result in less challenges to plant safety systems.

The man/machine interface offered by the new turbine control systems are greatly enhanced through the use of a dedicated control board mounted 19" color CRT and keyboard panel through which all operating and operator initiated testing functions are entered. The enhanced systems diagnostics capability offered by the new control systems also allows the maintenance personnel to view all current on-line parameters and retrieve past data through the trending capability.

GG. Digital Feedwater Control Modification

The Unit 1 and Unit 2 feedwater control systems were replaced with new Digital Feedwater Control Systems during the 1991 refueling outages. These are Westinghouse WDPF systems. The old systems had been the cause of numerous reactor trips due to card failures, field device failures, and poor automatic steam generator level control at low power. The new systems, through the added sophistication of digital techniques, allow for single input transmitter failures and internal card failures without any affect upon the output signals. Also, a more sophisticated control strategy provides better control at low power and better response to plant transients. This will result in fewer reactor trips and fewer challenges to safety systems.

Although not safety systems, these systems were subjected to extensive Post-Modification Testing, including the plant transients of a Trip of a Main Feedwater Pump from 100% Power and a Generator Load Rejection from 65% Power. The Unit 1 Trip of a Main Feedwater Pump Test did not go as well as expected, and the Operator took manual control to prevent a Reactor Trip. Investigation yielded a small error in the software. This was changed for the Unit 2 test, and the Unit survived a Trip of a Feedpump from 100 % power on 1-4-92, with all systems remaining in automatic control.

HH. Generator Breaker Testing

The generator breakers are PM'd each outage and are usually completed early in the outage. These breakers then sit in the open position for weeks until the outage is completed. At the end of most outages, the breakers usually fail to close and further work is required at the last minute thus extending the unit outage. This was because of the long wait between the completion of the breaker PM and the end of the outage in conjunction with the fact that these breakers are designed to sit closed and open on demand as opposed to sitting open for long periods of time and closing on demand. The generator breakers are air operated 22,000 amp breakers and have and have no other breakers similar to them on site.

To help with this problem, the decision was made to hold the PM work request open until the week before the outage is scheduled to end, then perform a functional test on the breaker by cycling it. Any closure failures would be found at that time and could be corrected without extending the outage. At the end of unit 1 EOC5 refueling outage, this changed proved successful because the 1A breaker did not close. The problem took three days to fix but it did not require an extension to the outage. When the time came to close the breakers, both worked as expected. This additional functional test on these breakers is now part of the routine PM.

II. Probabilistic Risk Assessment

Until recently, individual plant examinations for severe accident vulnerabilities have not been required. However, at its own initiative, Duke has completed full-scope PRAs for each nuclear station and has pursued applications of the PRAs. These applications include design changes resulting directly from the PRA results and insights, improvements to emergency and operating procedures, development of risk-based simulator training scenarios, accident precursor studies, and technical support for emergency preparedness.

JJ. Safety System Performance Assessment

It has been recognized that several of the plant systems at Catawba tend to exhibit somewhat larger unavailabilities due to test and maintenance activities. A number of programs with the objective of reducing the system unavailabilities have been implemented at the site, and some improvement has been made. More recently, the PRA techniques have been used to determine the sensitivity of the plant core damage probabilistic to various degrees of system unavailability. These results have been used to establish and/or to refine target values for unavailabilities of important plant systems.

Thus, PRA techniques and the IPE insights are being used to assess plant system unavailabilities and to focus the reliability improvement efforts to these areas of greater safety benefit

III. RESPONSIVENESS TO NRC INITIATIVES

A. Generic Letter 88-14: Instrument Air

1. The Instrument Air (VI) Preventive Maintenance (PM) program was enhanced to include valves and dampers that were identified by Design Engineering in response to GL 88-14.

2. The VI Task group identified a number of items that affected the reliability and quality of the VI System. The major item identified was the reciprocating air compressors. These are now scheduled to be replaced in 1993. The major item identified as an air quality problem was the refrigerant air driers. These are also scheduled to be replaced in 1993.

B. Bolting Task Force

The Bolting Task Force continues to make progress in their evaluation of all the QA condition bolting. This Task Force was established to implement the Company's recommendations in response to PIRs on misapplied fasteners and industry and NRC concerns (IEB 87-02) with misrepresented and fraudulent bolting materials. Initial tasks included development and publication of a fastener manual. This manual provides the criteria for proper fastener specification and procurement. It is currently in use throughout Duke Power Company and has received very favorable comments from system wide users. Standard procedures have been developed at all the nuclear stations so that all bolting is properly identified in a work request before material is issued. Standard procedures have also been developed for QA receipt inspection of fastener materials. A physical inventory inspection has been performed on all QA condition fasteners. The resulting inspection forms were forwarded to Design Engineering for review and evaluation. This review is essentially complete and no evidence of fraudulent or misapplied materials has been found.

C. Response to Weaknesses Found in the NRC Fire Protection Audit

I&E Inspection Report 50-413/91-22 and 50-414/91-22 - Fire Protection Weaknesses

As a result of the NRC I&E inspection, four weaknesses were identified in the fire protection program as follows:

1) No centralized fire protection coordinator exists
2) Restoration of fire protection impairments are not always performed in a timely manner.
3) Diesel Generator Room housekeeping was not satisfactory.
4) The Auxiliary Feedwater (CA) Pump Room manual fire fighting system was impractical.

Duke has taken the following actions to correct the identified weaknesses:

1) A Fire Protection Specialist has been assigned to the Fire Protection Group to coordinate and implement the fire protection program.
2) The Fire Protection Specialist has developed an impairment tracking program which will improve the timeliness of fire protection restoration.
3) Emphasis has been placed on the need for good housekeeping in the Diesel Generator Rooms and the periodic housekeeping tours of this area are being conducted.
4) A request for modification of the CA Pump Room manual fire fighting system has been submitted for review and approval.

The actions taken on the identified weaknesses are a part of the continuing improvement in the fire protection program.

D. Generic Letter 89-10: Motor Operated Valves (MOV)

In response to GL 89-10 Duke has established an aggressive corporate program to implement the requirements of the generic letter. Catawba has been and continues to be an integral part of this program. The Duke program scheduled baseline diagnostic and differential pressure testing (to the extent practicable) of all valves that are active, contribute to core melt scenarios or are significant from an accident analysis scenario within five years. The balance of applicable GL MOV's will be baseline and differential pressure tested within eight years. The following activities have occurred in the past year.

- Development of design basis documents for 89-10 valves is in process. This includes documenting the system application requirements (i.e. pressure, flow, position, etc.) for normal and accident conditions. Includes evaluating the valve operating thrust/torque requirements using conservative valve factors. Includes evaluating the operator capabilities and limitations and comparing to valve requirements.

- Completed an undervoltage analysis to provide worst case expected undervoltage at each valve motor operator.

- Developed a "state of the art" gate valve specification to incorporate the lessons learned from INEL and other testing. The specification will be used to procure the next generation of valves as required for 89-10 replacements. Specification has been used as a model for the B&W Owners valve replacement specification program.

- Completed a corporate test program to evaluate and extend the operating ranges of both Limitorque and Rotork operators. Further testing is planned in this area in conjunction with other utilities.

- Initiated a test program to perform full scale differential testing of a large family (single vendor) of small globe valves at a Duke fossil station test loop to generically qualify the valves and reduce test challenges to the operating stations.

- Completed instrumented baseline setup to current 89-10 evaluation criteria of approximately 160 of the 542 valves in the 89-10 program.

- Completed installation of 32 Auxiliary Feedwater (CA) and Steam Generator Blowdown Recycle (BB) (Units 1 & 2) replacement valves as a result of previous problems identified during differential pressure tests.

E. Bulletin 88-11: Thermal Stratification in the Pressurizer Surge Line

Duke has completed all work relating to the requirements of IEB 88-11. This involved satisfying certain applicability requirements related to WCAP 12639. This report is a summary of work performed by Westinghouse which qualifies the surge line provided these applicability requirements are satisfied. Applicability requirements include:

- Review of operating records to ensure that system ΔT limits assumed in the analysis were not exceeded.

- Verification of operational methods to ensure that they are consistent with the methods assumed in the analysis. Limits on system ΔT for future operation are recommended.

- Verification of applicability of seismic OBE bending moments used in the fatigue analysis and combined deadweight and OBE moments at the hot leg nozzle.

Additional plant specific evaluations were also performed including:

- Evaluation of adequacy of pipe support [s for] loads and displacements.

- Evaluation of effects of stratification on stress and fatigue of the pressurizer nozzle.

- A review of the effects of predicted contact between rupture restraint devices and the piping.

- A review of the effects of changes in hot gaps at rupture devices.

All piping, supports and restraints have been qualified considering thermal stratification and all requirements of IEB 88-11 have been satisfied.

IV. ENFORCEMENT HISTORY

A. Inability to Maintain Control Room Pressure During Loss of Power Events Due to Design Deficiency Resulting in Entry of Technical Specification 3.0.3

Summary
As a result of the ongoing HVAC Review being performed at Catawba, a Failure Mode and Effects Analysis FMEA was performed on the Control Room Ventilation System. As a result of this FMEA, it was discovered on February 25 that an emergency generator trip following a Loss Of Cooling Accident and a LOOP event, would result in closed intake valves that could not be opened within the required time frame. PIR 0-C91-0086 was initiated at 1605 hours entering the station into Technical Specification (T/S) 3.0.3, Limiting Conditions for Operation. T/S 3.0.3 was exited when a waiver of T/S was received, allowing the intakes to be opened and de-energized. This incident has been attributed to a Design Deficiency in that as the system was designed, the required time frame to reopen the valves was not analyzed. The isolation circuits have been removed from the VC system and the intake valves were energized.

Background
Catawba was licensed with the understanding that under certain conditions both intakes could be closed. This was discussed in some detail in the original FSAR.

Station Actions
The FMEA identified that a potential failure condition involving a LOOP/LOCA followed by a diesel trip could render the both trains of Control Room Ventilation inoperable due to an inability to pressurize the Control Room (with both intakes closed). Both VC trains were declared inoperable but functional. PIR 0-C91-0086 was initiated and T/S 3.0.3 was entered. Discussions began on the request of a Waiver Of Compliance for T/S related to closure of the intakes. The waiver would allow for the intakes to be placed in the open position with the power removed. Until a modification could be made which would eliminate the potential for a design basis event to isolate both intakes.

On February 27, Urgent Modification CN-50422 was initiated to remove the smoke detector and radiation monitor isolation circuits from the VC system. The modification began on February 28, per Work Request 13782 NSM and was completed on March 6, 1991.

Root Cause
The original error which was made in this event was that the connection was not made between the fact that both intakes could be isolated as discussed in the FSAR and the impact this had on the Dose Analysis.

V. STAFFING

A. Movement of SRO Qualified Personnel Into Engineering

During the recent reorganization (to a site organization), two SRO qualified engineering supervisors were moved into the Mechanical Nuclear Design Group from their previous plant operations assignments. This provides a better perspective of station needs and the benefit of operating experience. These assignments will enhance the quality of modification designs and technical support to the station. Two SRO's were also moved into the System Engineering Section of the new Engineering group.

VI. OPERATIONAL AND CONSTRUCTION EVENTS

A. Generator Silicon Controlled Rectifier (SCR) Cooling Water Tubes

In December of 1990, a ground occurred on the Unit 1 generator. The ground could not be located since it was initially intermittent in nature. Eventually the ground became continuous and the unit was taken off line. The cause of the ground was determined to be copper particle build up in the cooling water tubes used in excitation system scr's. These cooling water tubes are made of teflon and also serve to electrically isolate the scr's from ground. The tubes carry demineralized water through the scr's for cooling. The problem with them is that copper particles from the rest of the generator that is cooled by the same water were building up on the tubes creating an electrical path to ground. After cleaning the tubes there was no path to ground. New tubes have been placed in both generators that are less susceptible to the copper plating and the tubes will be inspected and cleaned as needed periodically. Also, the generator cooling water chemistry will be better maintained as it was a contributing factor in this problem.

VII. TRAINING AND QUALIFICATIONS

A. Severe Accident Management Strategies and Training

Although not required at this time, Duke has begun preparations for the severe accident management strategies and training. A training module of 4-hour duration has been developed, and in 1991, training sessions were conducted at Charlotte, McGuire, Catawba, and Oconee encompassing some 150 CMC/TSC personnel. This severe accident management training has facilitated improved understanding of severe accident behavior, important accident sequences, and mitigation strategies of interest.

CATAWBA NUCLEAR STATION

DUKE POWER COMPANY

QUALITY VERIFICATION/SAFETY ASSESSMENT

SELF-ASSESSMENT REPORT

REVIEW PERIOD 02/91 THROUGH 05/92

JANUARY 1992

TABLE OF CONTENTS

I. NRC COMMUNICATIONS

A. Verbal

Formal Meetings

1) Pressurizer Code Safety Valves

A meeting was held on July 2, 1991 to discuss setpoint drift which had been discovered on the pressurizer safety valves. This meeting was held to inform the NRC of Duke Power's position, and corrective actions relative to the industry problem of setpoint drift on this type of valve. The Catawba valves are sent to an outside laboratory for lift pressure setpoint testing and many of the as-found setpoints were noted to be outside of the nominal lift pressure range. It was determined that the cause of the drift might be related to the procedure used for repairing minor seat leakage, which was done following setpoint testing. Corrective actions were implemented to correct the identified deficiencies and as found setpoint values will be trended to determine if the problem was corrected.

2) B&W Reload Technical Specification Submittal

On January 16, 1991, the NRC review kickoff meeting was held at the NRC offices in Rockville. This meeting was held to aid in the review of the extensive changes to the Technical Specifications necesitated by Catawba's transition to B&W fuel. Although this meeting was not actually held during the current SALP period, it is being included because the Catawba Unit 1 Cycle 6 reload project overlapped more than one period. Most of the NRC review effort occurred during the current period. Items discussed at this meeting included technical specification, FSAR, and Core Operating Limit Report revisions, Duke Power's core power monitoring philosophy, the reload's impact on safety margins, and administrative control of technical specification changes.

3) Duke/NRC Interface Meetings

Duke Power has continued to hold this regularly-scheduled series of meetings to keep the NRC informed of important issues and has found them valuable in promoting open communication.

4) Enforcement Conferences

The following enforcement conferences were held for Catawba during the SALP period:

Control Room Ventilation - On April 11, 1991, a conference was held to discuss issues concerning the design of the Catawba and McGuire control room ventilation systems and the habitability of the control rooms following a design basis accident. It was determined that all outside air intakes could automatically isolate under certain conditions, resulting in a loss of control room pressurization. Also, time requirements to manually reopen the intakes were not in conformance with the assumptions of the control room dose analyses. These problems were self-identified and have since been corrected. This issue resulted in a Level IV violation for Catawba.

Overtemperature Delta-T Circuits - On September 6, 1991, a conference was held to discuss the improper gain settings for the overtemperature delta-T reactor protection system trip setpoints for Catawba and McGuire. As a result of the improper settings, the setpoint hardware would not function properly above a temperature of 592.5 F. No violation was issued for Catawba as a result of this incident.

Configuration Control Problems - On January 15, 1992, a conference was held to discuss examples of various configuration control problems at Catawba. A decision regarding enforcement action is still pending for this issue.

Informal Communication

Communications with NRC personnel, both Region II and NRR, have been open and honest. Regulatory Compliance maintains a good working relationship with the resident inspectors and the NRR Catawba Project Manager. Where involvement of NRC personnel is required, as in review and approval of license amendment submittals or granting of waivers of compliance, effort has been made to involve NRC personnel in issues as early as possible.

B. Written

1) License Amendment Submittals

During the last SALP period, a number of changes to the Catawba Technical Specifications were submitted for processing by the NRC staff. The most significant of these was the reload package governing the use of B&W fuel at Catawba. Additional reload submittals will be made over the next several years until both Catawba units have completely transitioned to B&W fuel. Additional significant license amendment submittals made during the last SALP period include a change revising the carbon adsorber test method for the Control Room Area Ventilation, Annulus Ventilation, Containment Purge, Auxiliary Building Filtered Exhaust, and Fuel Handling Ventilation Exhaust Systems, as well as additional changes pertaining to the Control Room Area Ventilation System.

2) Requests for Waivers of Compliance

Two temporary waivers of compliance were granted by the NRC for Catawba during the SALP period. In each of these instances, the interests of the public were served by the granting of these waivers.

On February 26, 1991, a waiver of compliance from certain technical specifications pertaining to the control room ventilation system was requested. Duke Power identified design inconsistencies where under certain accident conditions, the air intake isolation valves would close and could not be reopened in a timely manner to enable meeting the GDC 19 design basis accident analysis dose limit, thereby rendering both system trains inoperable. The waiver enabled the isolation valves to be maintained open by removing power from their actuators.

On October 2, 1991, a request for a waiver of compliance was made to allow Unit 1 to proceed from Mode 3 to Mode 1 with an inoperable hydrogen monitor. This was necessary because Unit 1 tripped while monitor 1A was inoperable and Technical Specification 3.0.4 prohibited a mode change, thereby preventing restart of the unit. This waiver of compliance did not affect safety because of operating procedures which were already in place.

3) Responses to Bulletins/Generic Letters

Catawba has taken a proactive and thorough approach to responding to NRC bulletins and generic letters. Following is a brief discussion of the most significant bulletin and generic letter responses submitted or actions performed during the last SALP period:

Bulletin 88-08 - Duke Power recently submitted an action plan that addressed the potential problem of showing a 40-year life for piping components affected by temperature-induced thermal stresses. Basically, the action plan is to incorporate data collected and reevaluate all transients for excessive conservatism, then reanalyze using less conservative methods. If this is not successful in reducing predicted fatigue to acceptable levels, then efforts will be directed toward plant physical changes. Finally, if plant changes are necessary, monitoring will continue until it is concluded that the changes have achieved the desired effect.

Bulletin 88-11 - Duke Power has received notification from Westinghouse stating that the pressurizer surge line nozzles are acceptable and meet all stress and fatigue requirements. Duke Power completed all work and is in the process of closing out documentation pertaining to this bulletin.

Generic Letter 88-14 - Duke Power has stepped up its efforts to close out items resulting from this generic letter. During the initial design review, not all of the affected components operated by instrument air were identified. Also, the submittal of information to the NRC was not as timely as it should have been. In an effort to close out this issue, the original response to the generic letter was reviewed and the scope of components included in the review was increased. Duke Power submitted a revised response which identified additional components warranting functional verification to ensure they fail properly upon loss of instrument air. Duke Power has recently begun taking a more aggressive approach in keeping the NRC fully informed concerning the status of this generic letter.

Generic Letter 90-06 - Catawba has taken steps to improve both the availability and reliability of its pressurizer power operated relief valves and block valves as a result of this generic letter. Enhancements were made to maintenance and testing practices and improved technical specifications were submitted for the PORVs, block valves, and low-temperature overpressure protection (LTOP) systems.

Generic Letter 90-09 - As a result of this generic letter, Duke Power submitted a technical specification amendment request to change the schedule for snubber visual inspections in accordance with the letter's guidance. The schedule will be recalculated by taking the number of inoperable snubbers found during the previous inspection and applying new surveillance criteria. Implementation of this amendment will result in significant reduction in both radiological exposure to plant personnel and allocation of plant resources.

Generic Letter 91-06 - As a result of this generic letter, Duke Power provided a response to a series of questions asked by the NRC concerning the design, operation, maintenance, and testing of safety-related DC power systems. For both safety-related DC systems at Catawba (125 Volt Vital Instrumentation and Control Power System and 125 Volt Essential Diesel Auxiliary Power System), detailed information was provided regarding system design and operation, as well as specifics pertaining to Catawba's maintenance, testing, and surveillance program.

Generic Letter 91-14 - This generic letter resulted in the submittal of Duke Power's implementation plan for the Emergency Response Data System (ERDS). This system will provide for communication with NRC using the protocol described in NUREG 1394, Revision 1 Appendix B.

C. Reorganization of Regulatory Compliance Functions

In conjunction with the recent reorganization of Duke Power Company's Power Group into the Power Generation Group, a number of organizational changes were made to the

Catawba Compliance and General Office Regulatory Compliance sections.

The most significant of these changes is that work activities of a station specific nature which were previously the responsibility of the General Office were transferred to the station. Examples of these types of work activities include license amendment requests, responses to NRC bulletins and generic letters (where the response is station specific), replies to NRC inspection report violations, security-related issues, and letters and reports of a routine nature. Several individuals relocated from the General Office to Catawba in support of this organizational change. In addition, the Environmental Management and Emergency Planning organizations have been separated from the new Regulatory Compliance organization at Catawba.

Under the new organization, the Manager of Regulatory Compliance reports to the Safety Assurance Manager, who in turn reports to the Catawba Site Vice President. These organizational changes became effective November 1, 1991.

II. INDUSTRY PARTICIPATION

One of the most significant aspects of Catawba's participation in industry initiatives has been the development of new proposed Standard Technical Specifications for Westinghouse plants. One of the Catawba Regulatory Compliance engineers is a member of the Westinghouse Owners Group Technical Specification Subcommittee and provided input into the development of the proposed STS. When implemented, the new STS will enhance safety for all Westinghouse reactors as a result of its improved format and consistency throughout the industry.

III. SELF-INITIATED TECHNICAL AUDITS (SITA) AND CONSOLIDATED PERFORMANCE AUDITS (CPA)

The SITA process is Duke Power's method of conducting assessments of the operational readiness of safety systems, components, and structures. This is accomplished through direct participation of individuals from many departments, thereby allowing the utilization of a diverse technical group to provide accurate and meaningful assessments. Management response to SITA findings includes consideration of the generic implications of the concerns identified. This is an inherent strength of the SITA process.

A. Auxiliary Feedwater System

SITA-90-02(CN) was conducted to determine the operational readiness and functionality of the Catawba auxiliary feedwater system. (Although the audit began prior to the start of the SALP period, the audit findings and responses to those findings were documented during the period; hence, this audit is being discussed in conjunction with this pre-SALP assessment.) Some of the most significant results from this audit were:

- Auxiliary feedwater pump damage could occur when utilizing the hotwell as a condensate grade water source under the provisions of the loss of feedwater procedure. This was due to miscommunication concerning the low suction pressure limit and inadequate suction pressure gauge readibility. This resulted in a proposed resolution to add a second set of suction pressure switches and to revise the subject procedure to specify the hotwell level gauge as the primary indication for pump suction pressure.

- Improvement was found to be needed in the technical adequacy of procedures at all three stations. This resulted in a number of procedure upgrades being performed at Catawba and also in the establishment of a method to ensure system engineers are properly informed of any changes to relevant design documentation.

- There was no design basis for the turbine and motor driven pump sump pumps. There were no calculations or testing programs to ensure their capacity. In order to resolve this problem, design basis documentation is being generated for all sump pumps.

- Loop accuracies for pump discharge pressure loops have not been documented or reviewed for acceptance. Corrective action was to originate a calculation during the Instrumentation and Controls List Upgrade to document the actual loop uncertainties and to provide data sheets for required accuracy values for the pressure switches.

- A follow-up item pertaining to nuclear service water to auxiliary feedwater flushing indicated that the flush may not achieve the desired results due to design weaknesses and procedure inadequacies. The need for this flushing was established as a result of the asiatic clam infestation problems in early 1988. The item recommended establishment of test acceptance criteria for clam flushes. It was the belief of the SITA team that sufficient research and data have been gathered to adequately address the flush results.

B. Electrical Distribution System Functional Inspection (EDSFI)

A SITA of the Catawba EDS was conducted by Southern Technical Services, Inc. as a prerequisite to the NRC EDSFI. The purpose of the assessment was to determine whether the EDS could perform its intended safety function as designed, installed, and configured. Also, the engineering and technical support of EDS activities was evaluated. Plant walkdowns, technical reviews of calculations and associated documents pertinent to the EDS, and interviews of General Office and Catawba personnel were conducted.

The audit team considered the design and implementation of the Catawba EDS to be acceptable. In the functional areas of electrical systems design, mechanical systems design, system configuration and testing, and engineering and technical support, items were identified that warranted further evaluation to ensure that equipment is able to perform its design safety function. The audit team also found that the design and plant technical support organizations were adequately structured to fulfill their assigned responsibilities. In addition, the team identified several strengths, the most notable of which were the material condition of the plant and the Integrated Safety Assessment Program.

Consolidated Performance Audits at Catawba are providing an optimum focus on performance based evaluations and decisions that emphasize verification activities in areas that make a difference and are important to plant reliability and safety. This approach, considered synergistic in effect, recently took advantage of the consolidated activities in process during the Unit 2 end-of-cycle 4 refueling outage, providing an opportunity to conduct one audit versus smaller individual audits over time.

The utilization of an integrated team involving specialists from supporting organizations maximized technical capabilities, allowing an opportunity to focus considerable attention on refueling operations, plant maintenance and testing, inservice inspection, plant modifications, and corrective action. This manner of focus more efficiently identifies opportunities for programmatic and performance enhancement while minimizing impact on station personnel and activities. 28 audit items were identified that when corrected, investigated, or considered will increase the level of quality at Catawba. Previous CPAs have been given high ratings by the NRC Maintenance Inspection Team in its exit. The results of the most recent CPA considered most notable were:

- The identification of a post-modification testing deficiency related to the lack of a pressure relief path verification associated with an urgent modification

- The identification of procedural inadherences associated with modification installation activities
- The identification of core configuration differences in various documents, requiring evaluation of document control practices in Nuclear Design.

IV. QUALITY ASSURANCE VERIFICATION AND SAFETY ASSESSMENT

A. Reorganization of Quality Verification/Safety Review Groups

The Catawba Nuclear Site has maintained an active self assessment program during this SALP period. The principal onsite elements of the program were carried out by the Catawba Quality Verification Group (CQVG) and the Catawba Safety Review Group (CSRG). As a result of the Power Group reorganization, these two groups were combined into a single organization known as the Safety Review Group. The functions and responsibilities of the combined group encompass those of the preceding CQVG and CSRG. Carried out on a combined basis, these activities will enhance and strengthen the onsite self assessment function at Catawba.

B. Personnel Qualifications

The CQVG was comprised of seven dedicated full-time staff members during 1991. Collectively, the group possessed 106 years of nuclear power plant experience. The entire staff has received operations, systems, simulator, performance based observation, and root cause analysis training. Additionally, staff members have received specialized training in the areas of performance, instrumentation and electrical (IAE), chemistry, and radiation protection.

The CSRG is composed of a supervisor, clerk, and six full-time staff members. Three of the members are degreed engineers and collectively, the group possesses 83 years of nuclear power plant experience. CSRG members serve two-year rotating assignments and are drawn from various areas of the site organization. Currently, the group is composed of individuals with experience and expertise in nuclear instrumentation and controls, radiation protection, operations, quality assurance, and mechanical maintenance and construction.

The CSRG carries out the functions prescribed by NUREG 0737. The group is involved in the Operating Experience Program and reviews reports from numerous sources of operating experience including NRC Information Notices, INPO SEE-IN Program reports, vendor information letters, and reports from Oconee and McGuire. The CSRG performs in-plant reviews of plant activities and makes recommendations to plant management for improvements in safety and reliability. These reviews encompass work in progress, program implementation, and system equipment performance. In addition to these prescribed activities, the CSRG investigates and prepares reports of significant plant events, including Licensee Event Report (LER) reportable occurrences. In this activity, the group performs root cause investigations, recommends corrective actions, and evaluates the significance of the event. All members of the CSRG have received training on investigative techniques and root cause analysis. The use of a dedicated group for this activity significantly enhances continuity and the level of expertise available, and contributes to an effective assessment program.

C. Activities

During 1991, the CQVG performed routine independent assessments of the Operations, Performance, IAE, Radiation Protection, Chemistry, and Security groups per procedure QA-500, Quality Assurance Surveillance Program. Station management also requested assessments in the areas of radiological work practices, Operations Management Procedures (OMPs), emergency procedures (EPs), administrative procedures (APs), Final Safety Analysis Report (FSAR), and Regulatory Guideline requirements. The trend of management requested surveillances continued to increase in 1991.

The CQVG utilized performance based observations to provide station management with an actual view of in-progress station activities. A unique approach in this effort was utilized by the group in the form of the Tour Surveillance Program. In this program, staff members observe in-progress plant activities (i.e., control room activities, maintenance activities, equipment operation, etc.) during backshift and weekend hours.

In addition to routine, procedurally required verification activities, the CQVG provided technical experts to the Quality Assurance Audit Group on technical specification mandated audits. The CQVG also initiated special reviews of plant activities which were identified as potential problem areas. These areas included positioning of sliding links, electrical circuit isolations, defective piping, material condition, mode change during outages, indicator light operability, and emergency lighting.

Significant items identified by the CQVG were identified and corrected by management through the Problem Investigation Report (PIR) program. Significant items which were identified included the use of incorrect fuses in several terminal cabinets and distribution center compartments, orifice plates installed in the reverse direction, failure to notify Operations concerning the installation of a nuclear station modification (NSM), numerous flex conduits not secured to their connectors, and a valve gagged open without a temporary station modification (TSM) being implemented.

Less significant items with a potential impact on plant and personnel safety and unit operability were identified to management through corrective action requests (CARs). A computer generated listing of corrective action requests, along with in-plant followup activities, was utilized to ensure potential and actual problems were corrected.

During 1991, the CSRG completed 47 LERs, 4 Special Reports, 15 Station Reports, and 24 In-Plant Reviews (IPRs). All of the LERs were submitted to the NRC within the required thirty-day period; no extensions were necessary. One report was initially classified as an LER, but was later determined to be a Station Report as a result of a CSRG member thoroughly investigating the reportability of the incident.

During this period, one of the resident NRC inspectors reported that an example of the throughness of the CSRG evaluations was the investigation of PIR 0-C91-0178 (failures of radiation monitor EMF-49). The CSRG investigation determined that the failures were due to a problem that was different than initially concluded by station staff. The CSRG investigators proposed alternate corrective actions that were adopted by the station and are being implemented to provide enhanced protection from the consequences of radiation monitor failures.

The NRC inspector attended one of the CSRG LER review meetings in which the CSRG members critique the report in open discussion. The inspector noted that the openness of the meeting encouraged participation and resulted in a high quality product.

Of the 24 in-plant reviews that were completed, the CSRG made more than 27 recommendations to the station to improve plant performance and safety. None of these recommendations has been rejected and 4 have already been implemented. The IPRs included reviews or evaluations of areas directly related to plant and personnel safety, as well as plant reliability and the reduction of shutdown events. Examples of the IPRs include a review of containment penetration relief paths, a review of Operating Experience Program commitment status, an evaluation of controls to prevent boron dilution accidents, a review of the role of Independent Verification in valve mispositioning events, a review of the pipe erosion program, a review of the fire plan for a reactor building fire, and a review of the Unit 1 end-of-cycle 5 and Unit 2 end-of-cycle 4 outage schedules.

The comprehensive reviews of the outage schedules resulted in the implementation of five CSRG recommendations for 1EOC5 and the implementation of two recommendations for 2EOC4 to enhance safety by providing additional safety margin.

D. Operating Experience Management

Duke Power Company strives to be proactive in the use of operating experience. This includes both in-house as well as external industry experience. The Operating Experience Program serves as the focal point for the evaluation and dissemination of much of this experience. Examples of the types of operating experience documents processed under this program include Problem Investigation Reports (internal), Licensee Event Reports (internal), NRC Information Notices (external), and various INPO documents (external). Problems that are identified through the Operating Experience Program are tracked from their initial determination through the implementation of corrective actions. In support of the company's strategic plan, improvements to the Operating Experience Program are placing added emphasis on safety system availability, events during shutdown, human performance, and reactivity management. Several major areas pertaining to Duke Power's overall management of operating experience are briefly discussed in the paragraphs that follow.

1) Problem Investigation Process (PIP)

During this SALP period, the former Problem Investigation Report (PIR) program underwent a major revision. NRC and INPO expressed concern that not all problems were being captured by the program and that issues of lower significance were not being trended to provide management with notification of developing adverse trends.

In an effort to solve these problems, the PIP was developed. This process allows all station personnel to document any problem regardless of its significance. The problem is then evaluated for significance by a trained person. Any item deemed significant is treated as an "upper tier" problem and is resolved via a system similar to the former PIR program. Problems that are not as significant are treated as "lower tier" problems. "Lower tier" problems are typically identified situations that prevent specific site sections from attaining their desired level of performance or excellence. Each section manages the analysis and resolution of its problems. Trend analysis is done to assure root causes are correctly identified and adequate resolutions are designed to eliminate future similar causes. Trending data is continuously available to management.

During this SALP period, approximately a 25% increase in the number of "upper tier" problems has occurred, indicating a better understanding by station personnel of the type of problem needing evaluation.

2) Industry Experience

Evaluation of industry operating experience is an important part of the OEP. Most of the lessons learned from industry experience are the result of evaluation of NRC Information Notices, INPO Significant Event Reports and Significant Operating Experience Reports, and vendor information.

Occasionally, a significant operational event occurs at another plant which results in extensive corrective actions being taken at Duke Power stations. The loss of AC power and decay heat removal capability that occurred during midloop operation at Vogtle Unit 1 (which was the subject of NUREG 1410) was reviewed for internal applicability. A significant corrective action resulting from this review was the development of both a station directive and FSAR Chapter 16 Selected Licensee Commitment (SLC) governing midloop operation at Catawba. Major areas of concern addressed include ensuring emergency power and reactor coolant makeup source availability and containment penetration closure.

E. Significant Event Investigation Team (SEIT)

In order to provide a more detailed and comprehensive analysis of significant plant events, Duke Power commissioned the Significant Event Investigation Team. The role of the SEIT is to function as the authoritative investigation team for the company. The SEIT ensures that a significant operational event is investigated in a timely, systematic, and technically sound manner, and that a complete understanding of the event and lessons learned is achieved.

The SEIT was dispatched to Catawba following the blackout on Unit 1 essential bus 1ETB on September 6, 1991. The team spent approximately one week examining the event in detail and formulated a number of conclusions pertaining to work practices, equipment configuration, training, and other areas.

F. Integrated Safety Assessment

The Integrated Safety Assessment is a systematic process for assessing plant performance from the point of view of nuclear safety. In addition, it provides for management involvement in formulating actions to address identified station specific and generic problems. This program was implemented in 1990 and is conducted semi-annually. Assessment results are formulated for three areas; plant hardware issues, people issues, and management issues. Finally, a nuclear safety indicator is calculated to provide an overall result of the assessment process.

1) Diversity of Inputs

The assessment considers input from a variety of sources, thereby providing a diverse perspective of nuclear safety issues. Eleven areas are examined in detail as indicated below:

- Precursor/Significant Shutdown Events
- Safety Systems Unavailability
- NRC Violations/Enforcement Conferences/Perspectives
- Nuclear Plant Reliability Data System (NPRDS)
- INPO Performance Indicators
- NRC Performance Indicators
- Licensee Event Reports (LERs)
- Problem Investigation Reports (PIRs)
- Quality Assurance Perspective
- Station Safety Review Group Perspective
- Significant Operating Experience Reports (SOERs)

2) Focus Areas for Improvement

The assessment for the first half of 1991 identified several areas where improvement was desired at Catawba. In the area of people performance, inappropriate action due to failure to follow procedures and lack of attention to detail was identified as requiring followup action. In the area of management performance, safety system unavailability and configuration control problems resulted in the development of corrective action. Overall, the nuclear safety assessment for the first half of 1991 for Catawba was classified as "Good with Opportunity for Improvement".