



UNITED STATES
NUCLEAR REGULATORY COMMISSION

REGION IV

611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-8064

DEC 17 1996

C. Randy Hutchinson, Vice President
Operations
Arkansas Nuclear One
Entergy Operations, Inc.
1448 S.R. 333
Russellville, Arkansas 72801-0967

Dear Mr. Hutchison:

SUBJECT: MANAGEMENT MEETING TO DISCUSS SERVICE WATER SYSTEM
PERFORMANCE

This refers to the meeting conducted in the Region IV office on December 10, 1996. This meeting related to service water system performance.

At the meeting, the licensee summarized the impact of zebra mussels on plant operation. Significant increases in zebra mussel population were experienced in 1996 for the first time. For the conditions experienced, the licensee concluded that the unit service water systems had remained operable and that the impact on the emergency cooling pond inventory control from sluice gate leakage was limited. The licensee also summarized their monitoring and treatment programs and their corrective actions. Additionally, plans for future inspections were presented. The licensee's presentation is included as Attachment 2 to this letter.

In accordance with Section 2.790 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter will be placed in the NRC's Public Document Room.

Should you have any questions concerning this matter, we will be pleased to discuss them with you.

Sincerely,

J. E. Dyer, Director
Division of Reactor Projects

Enclosures:

1. Attendance List
2. Licensee Presentation

961224013B 961217
PDR ADOCK 05000313
P PDR

cc:

Executive Vice President
& Chief Operating Officer
Entergy Operations, Inc.
P.O. Box 31995
Jackson, Mississippi 39286-1995

Vice President
Operations Support
Entergy Operations, Inc.
P.O. Box 31995
Jackson, Mississippi 39286

Manager, Washington Nuclear Operations
ABB Combustion Engineering Nuclear
Power
12300 Twinbrook Parkway, Suite 330
Rockville, Maryland 20852

County Judge of Pope County
Pope County Courthouse
Russellville, Arkansas 72801

Winston & Strawn
1400 L Street, N.W.
Washington, D.C. 20005-3502

Bernard Bevill, Acting Director
Division of Radiation Control and
Emergency Management
Arkansas Department of Health
4815 West Markham Street, Slot 30
Little Rock, Arkansas 72205-3867

Manager
Rockville Nuclear Licensing
Framatome Technologies
1700 Rockville Pike, Suite 525
Rockville, Maryland 20852

DEC 17 1996

bcc to DMB (IE45)

bcc distrib. by RIV:

L. J. Callan

DRP Director

Branch Chief (DRP/C)

Project Engineer (DRP/C)

Branch Chief (DRP\TSS)

Resident Inspector

MIS System

RIV File

DRS-PSB

Leah Tremper (OC/LFDCB, MS: TWFN 9E10)

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12/17/96		12/17/96						

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Agenda

- Introduction..... Dwight Mims
Director, Nuclear Safety
- Overview..... Charlie Zimmerman
Plant Manager, Unit 1
- Zebra Mussels..... ReNae Partridge
Supervisor, Chemistry
- Condition & Corrective Actions..... Bobby Day
Manager, Engineering Support
- Recent Inspections & Future Plans.. Tim Mitchell
Manager, Unit 2 System Engr
- Service Water Integrity Program..... Chris Shively
Sr. Lead Engineer
- Closing..... Charlie Zimmerman
Plant Manager, Unit 1

Introduction

Dwight Mims
Director, Nuclear Safety

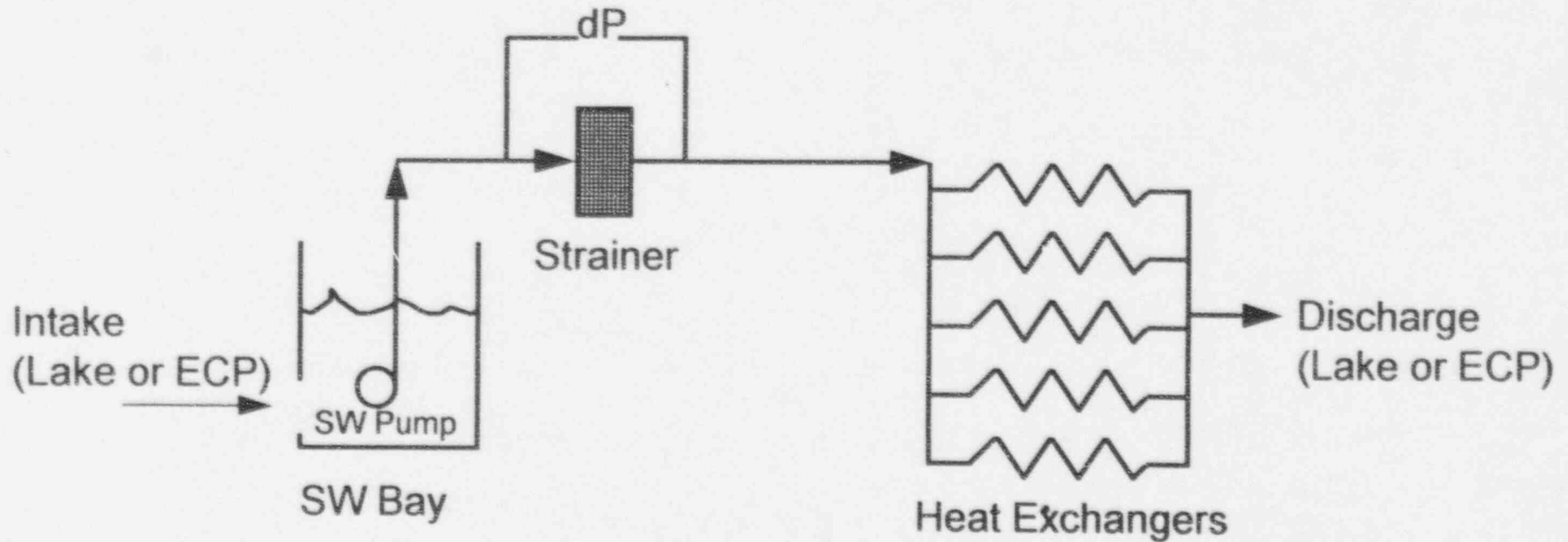
Overview

Charlie Zimmerman
Plant Manager, Unit 1

Overview

- September 1992 - Zebra mussels detected in Lake Dardanelle
- September 1993 - Zebra mussels noted in Unit 1 CW bays
- No significant increase noted until March 1996
- July 1996 - High dP alarm on Unit 1 SW strainers
- September 1996 - Inspections confirmed that the numbers of zebra mussels had increased and excessive sluice gate leakage noted

Service Water Strainer



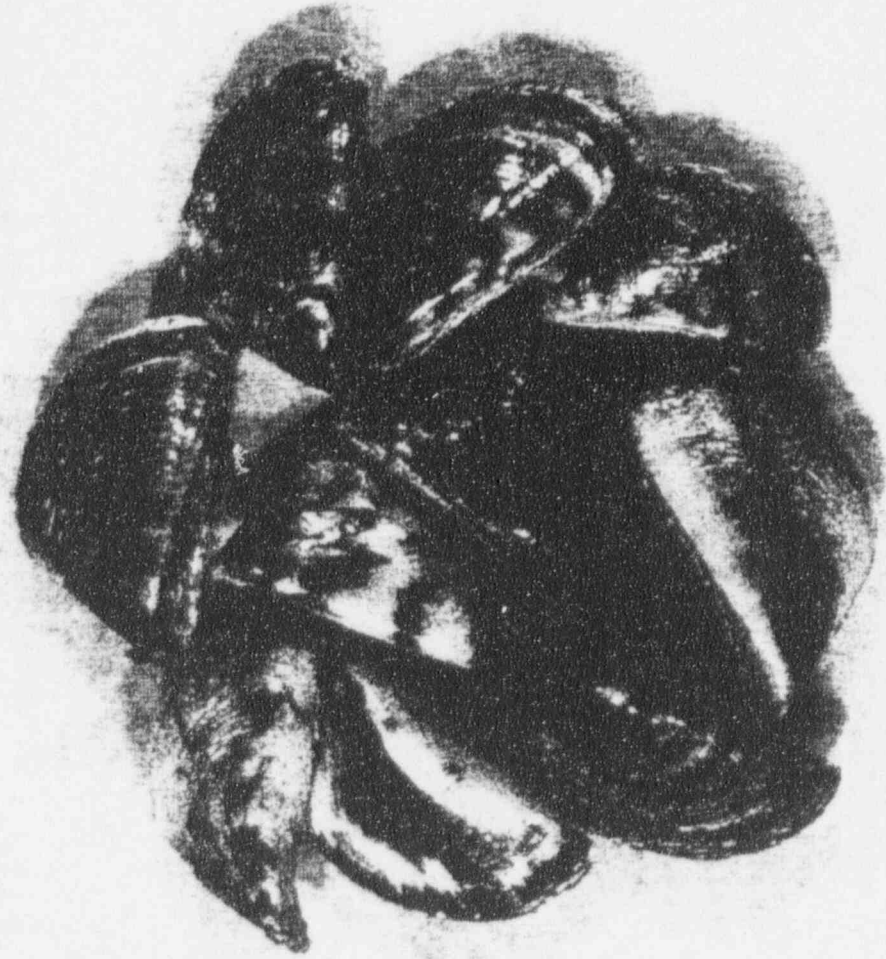
Safety Relevance

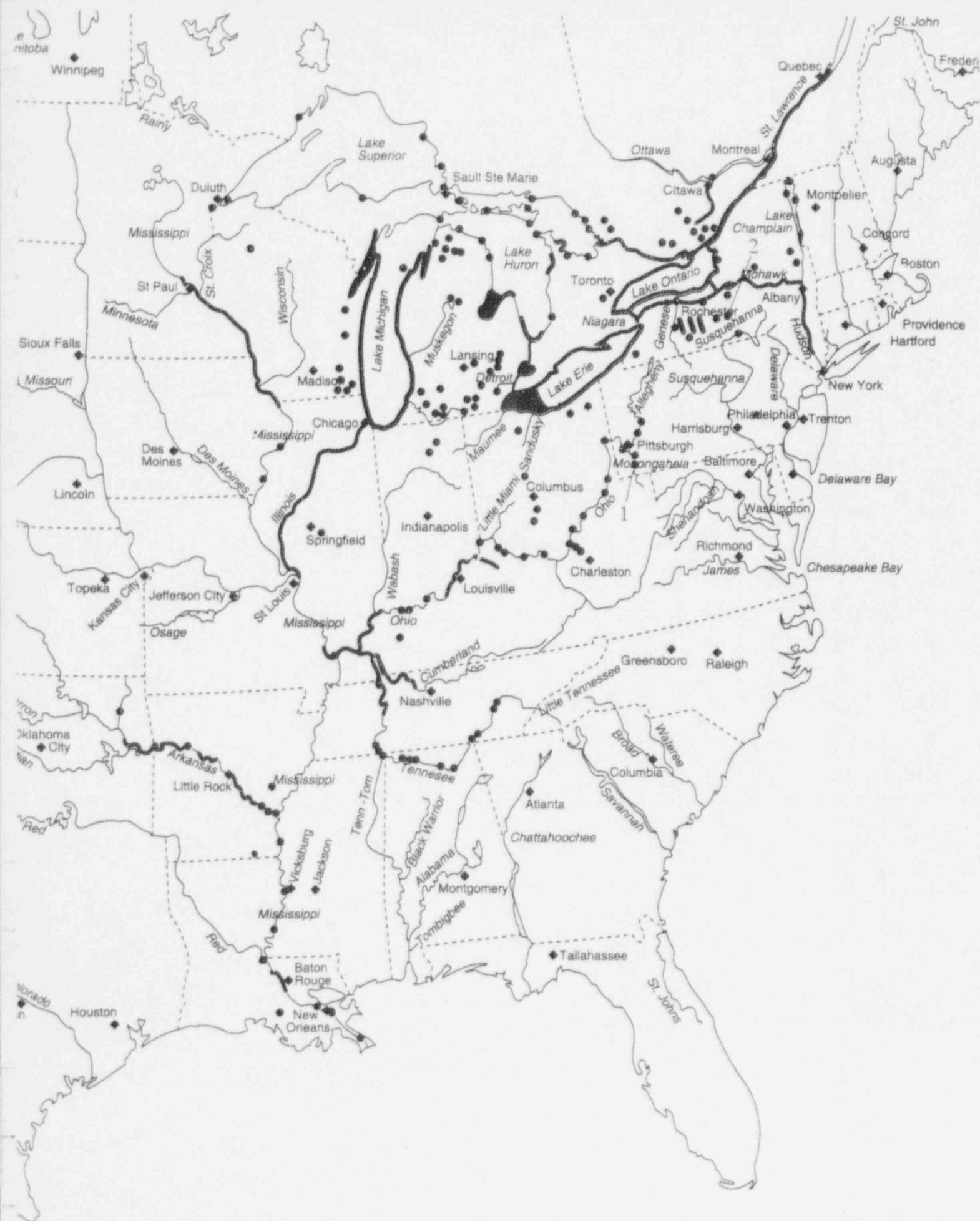
- Sluice gate leakage
 - » Impact on ECP inventory control from sluice gate leakage was limited
- SW strainer dP
 - » SW system performance impact from pump discharge strainer delta P due to sediment deposits in the service water bays
 - Zebra mussel shell fragments are primary concern
 - Strainer dP setpoint conservatively set
 - Post event reviews show no operability concern

Zebra Mussels

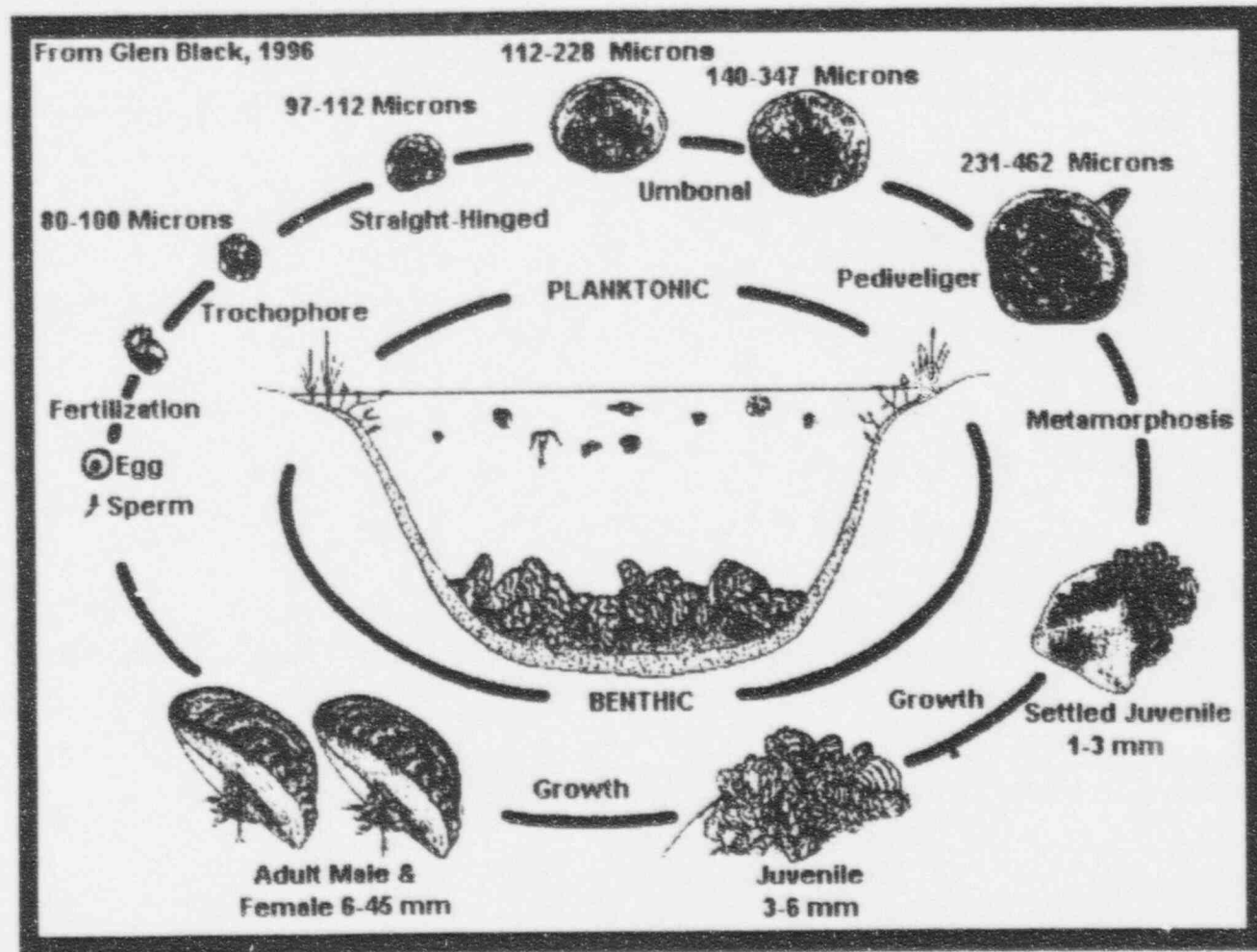
ReNae Partridge
Supervisor, Chemistry

Zebra Mussels





Zebra Mussel Lifecycle



Zebra Mussel Monitoring Program

- Lake Dardanelle
 - » Monitoring program was initiated in 1993
 - » Samples are collected and analyzed in accordance with the EPRI guideline
 - » Population (At the intake)
 - Veligers - 18/liter
 - Juveniles - 600,000/m²
 - Adults (>4mm) - 23,000/m² shoreline
- Service Water
 - » Bioboxes were installed in the mid-1980's to monitor the effectiveness of chemical treatment
 - » To date no living zebra mussels have been found in the bioboxes or SW system
 - » In August 1996, a control biobox was installed to monitor raw water in the intake

Current Treatment Program

- Service Water
 - » Sodium hypochlorite fed continuously to the inservice bays
 - » Combination of sodium hypochlorite and sodium bromide fed continuously during summer months when lake pH is high (>8.0)
 - » A nonoxidizing biocide is available to use as needed
 - Idle SW bays
 - ECP
- Unit 1 Circulating Water
 - » Application is restricted by environmental permit
 - » Two bays are treated at that same time each day with sodium hypochlorite/sodium bromide for 20 minutes
 - » Followed by treatment of the other two bays each day with sodium hypochlorite/sodium bromide for 20 minutes
 - » Treatment is designed to control microbiological growth in the Condenser

Zebra Mussel Control Methods

- Antifouling Coatings
- Chemical Treatment
- Hot Water Treatment
- Electrical Control Strategies
- Physical Removal

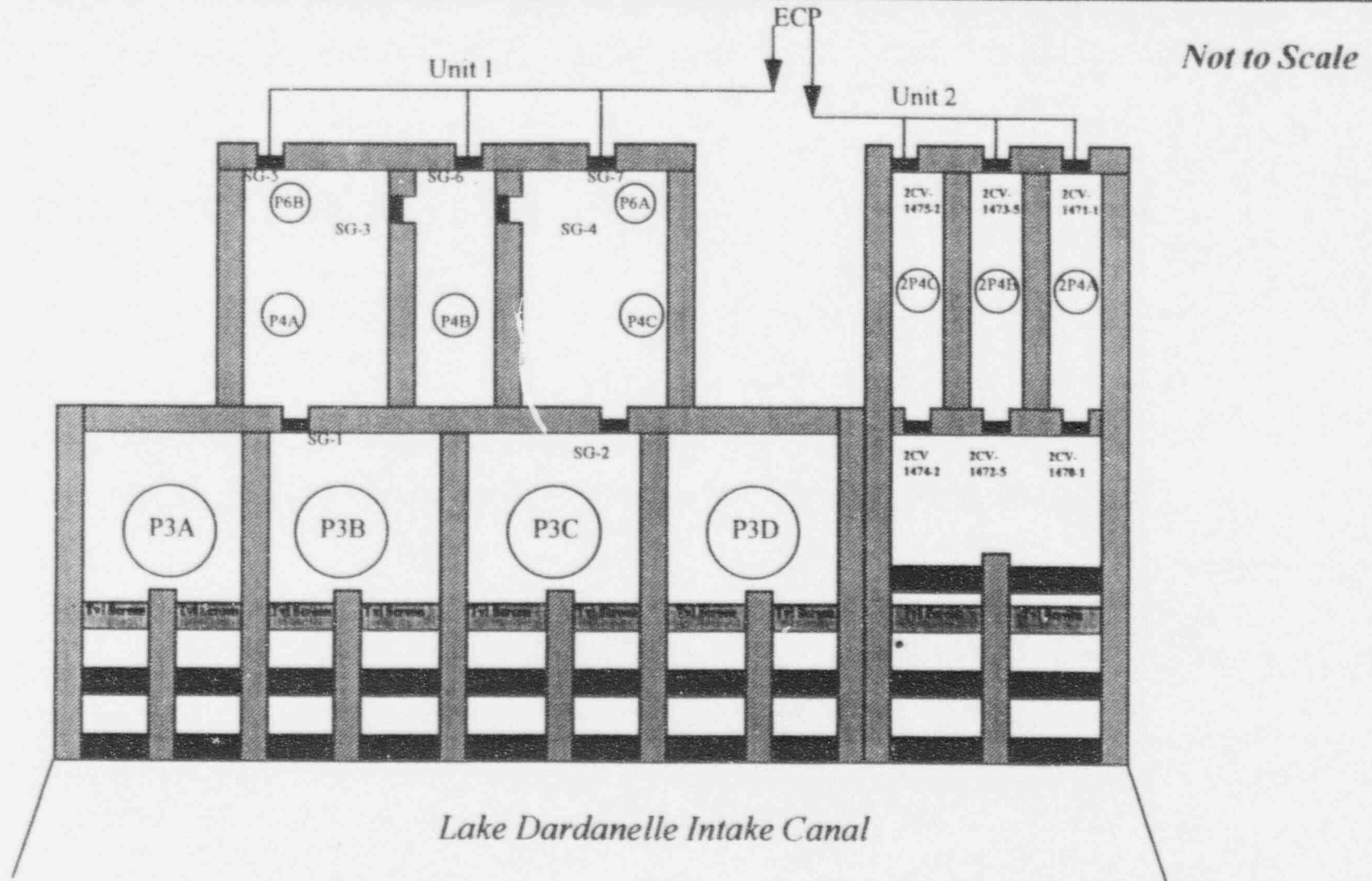
Condition Description and Corrective Actions

Bobby Day
Manager, Engineering Support

Conditions

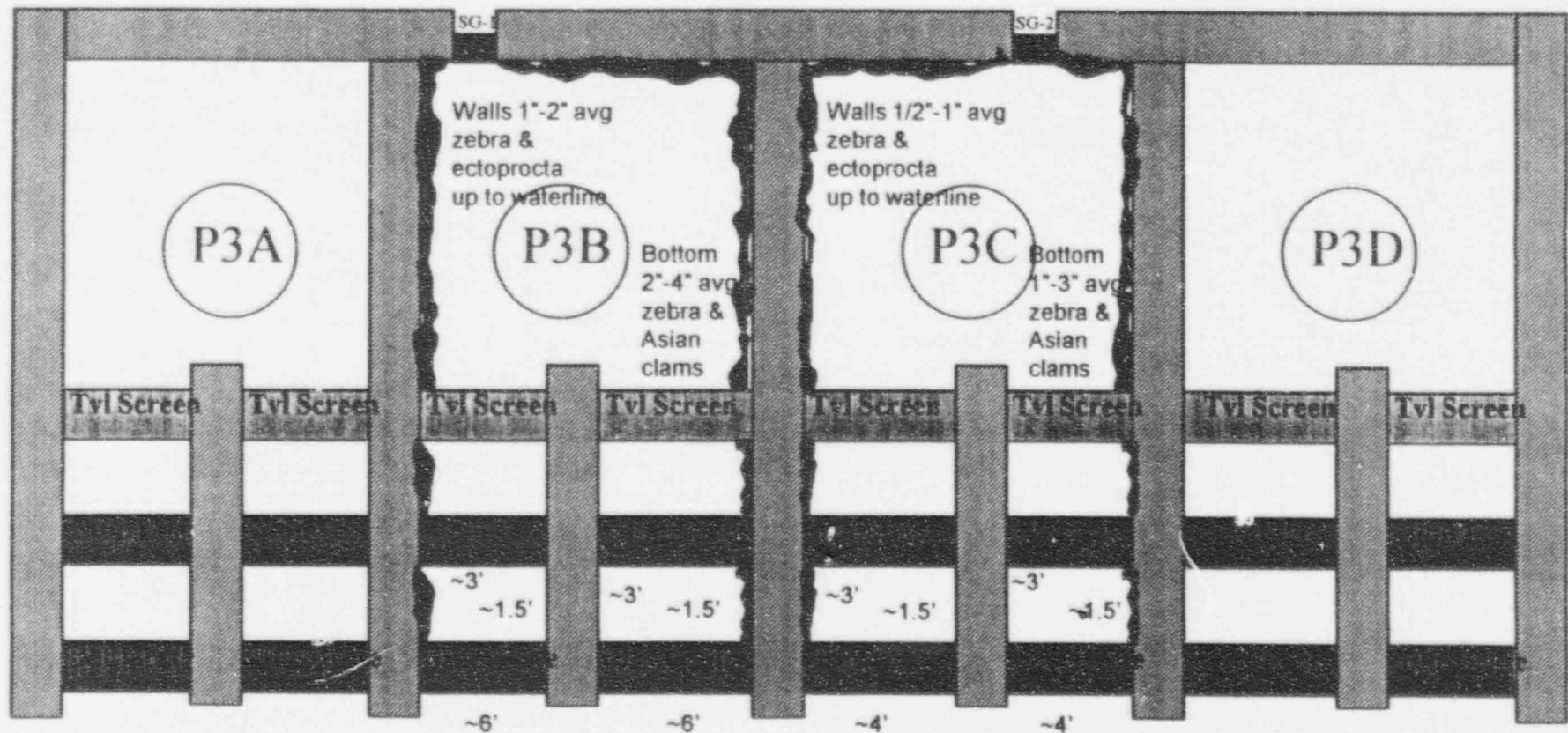
- A zebra mussel infestation of the circulating water (CW) system bays on Unit 1 and of the intake structure forebays on Unit 2
 - » The degree of infestation was graduated from very heavy on Unit 1 "B" CW to light in front of Unit 2
 - » No live marine growth observed in the SW system or established live marine growth in structures downstream of the service water (SW) bay inlets
 - Verified by component inspections and Unit 1 emergency cooling pond (ECP) suction line video inspection
 - Routine monitoring and treatment for zebra mussels in the ECP
 - SW bay inspections
- Silt deposits in the intake canal settling basin area immediately in front of the intake structure and in SW bays

Unit 1 and Unit 2 Intake Structure

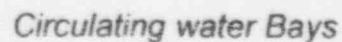


Initial Unit 1 Circulating Water Bay Mappings

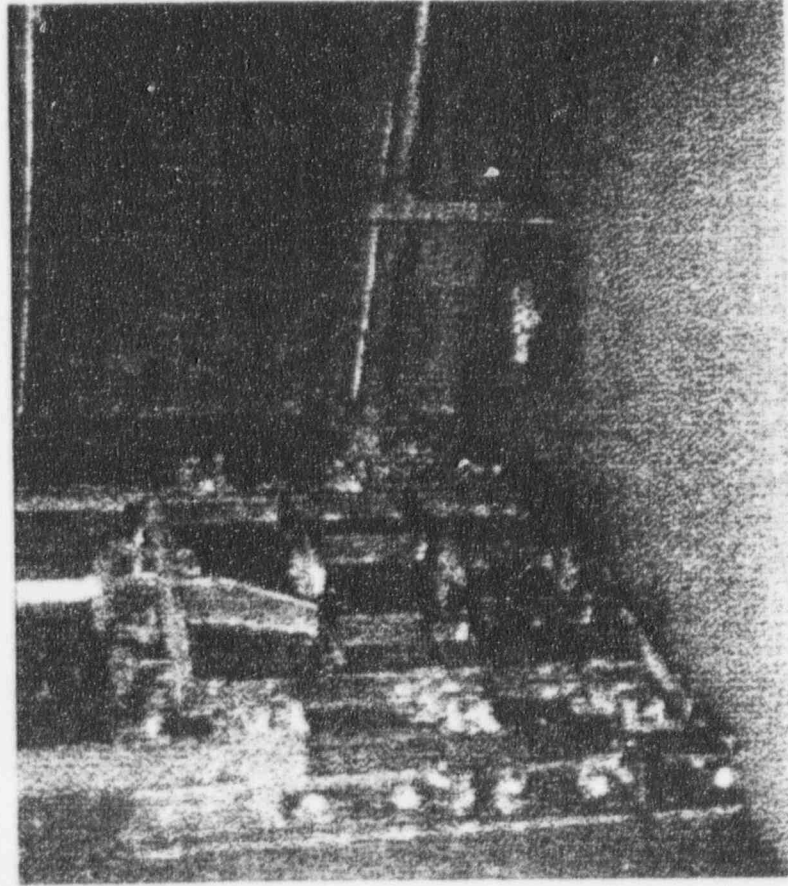
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Inspections

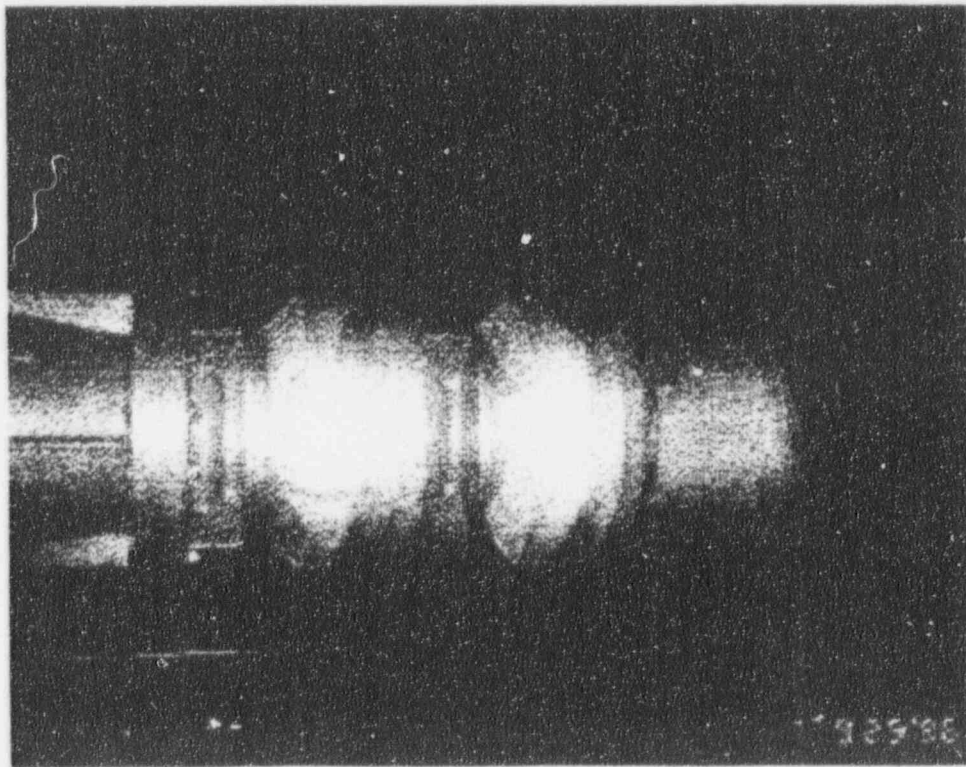


"B" Service Water Bay sluice gate
(Treated Area)

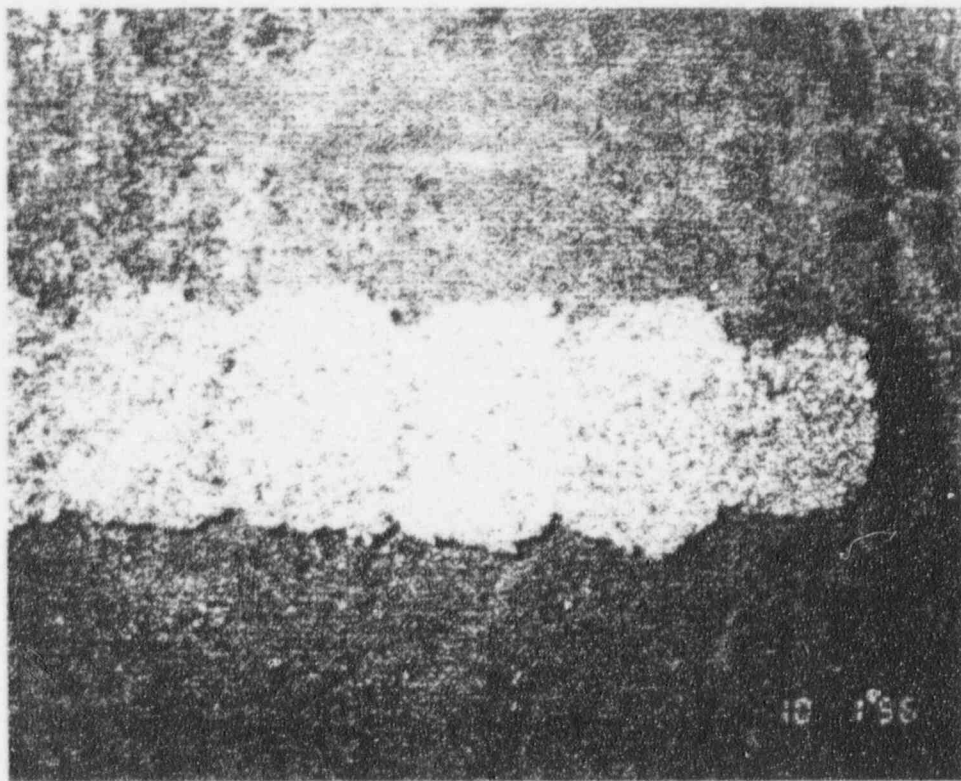


"B" Circulating Water Bay sluice gate
(Untreated Area)

Inspections



"B" Service Water Pump
(Treated Area)



"C" Circulating Water Bay Screen Wash Pump
(Untreated Area)

Corrective Actions

- Improve conditions
- Limit recurrence of conditions
- Cope with conditions
- Reduce plant sensitivity to conditions
- Review other systems for impact of conditions
- Use/share industry operating experience
- Review SAR for impact from conditions

Improve Conditions

- Drained and cleaned all Unit 1 SW bays during 1R13
- Inspected and cleaned all Unit 2 SW bays with divers
- Drained and cleaned Unit 1 "B" and "C" CW bays during 1R13
- Cleaned loose material from Unit 2 forebays with divers
- Cleaned sediment basin twelve feet in front of Unit 1 intake structure with sloping transition to remaining sediment deposits
- Scheduled dredging of entire sediment basin in first quarter 1997

Limit Recurrence of Condition

- Established intake structure inspection schedule to monitor mussel development and initiate future cleaning as required
- Continue ECP and connecting piping monitoring
- Implemented strainer trending program
- Evaluating:
 - » Chemical injection relocation in Unit 2 forebays
 - » Chemical injection relocation in Unit 1 SW alcoves
 - » Coatings
 - Test patch installed in Unit 1 CW bay
 - » Flotsam skimmer wall at lake edge
 - » Heating
 - » Electrical measures (Cathodic protection)

Cope with Conditions

- Demonstrated effectiveness and feasibility of timely operator action in reducing sluice gate leakage
- Demonstrated effectiveness and feasibility of timely operator action in addressing strainer dP
- Refine criteria for strainer dP operability
- Pre-staged equipment for strainer cleaning
- Revised Unit 2 traveling screen cleaning frequency

Reduce Plant Sensitivity to Conditions

- Increased Unit 1 strainer area
 - » Holes in Basket Bottom
- Evaluate strainer basket redesign to increase area
- Evaluate strainer redesign
- Evaluate hydraulic modifications to SW bays to limit availability of strainer clogging material
 - » Experiment currently running at Alden Labs
- Evaluate modifying sluice gate operation to minimize turbulence on transfer from lake to pond
- Evaluate adding internal lake side sluice gates
- Evaluate revising sluice gate leakage test to demonstrate effectiveness of operator action
- Evaluate provision of ECP make-up possibilities
- Evaluate traveling screen and traveling screen wash system improvements

November Inspection Results

Tim Mitchell

Manager, Unit 2 System Engineering

Unit 1 Follow-up Inspection Results

- Service Water Bays - November 1-11, 1996
 - » Small localized area of sediment
 - Ectoprocta in alcove
 - Small rocks in "C" bay
 - Fine silt
 - » No live marine growth in chemically treated areas
 - » No cleaning performed due to minimal accumulation
- "C" Circulating Water Bay - November 1, 1996
 - » Area is chemically treated for approximately 20 minutes per day
 - » Approximately 1 inch accumulation near traveling screens
 - » A couple of zebra mussel shells and light sediment observed on lower rubber seal of open sluice gate
 - » Fine coating of silt on floor

Unit 2 Follow-up Inspection Results

- Service Water Bays - November 5-6, 1996
 - » Zebra mussels attached to inside of sluice gate (area not accessible during previous cleaning and inspection efforts)
 - » Small clumps of unattached zebra mussels on floor
 - » Approximately 4 gallons total of material removed from all 3 bays during cleaning
- Forebay - November 6, 1996
 - » Outside chemically treated area
 - » Approximately 5% coverage of zebra mussels on floor, primarily in one corner of the traveling screens with a few clumps
 - » A few Asian clams on floor
 - » Wall coverage of zebra mussels (same conditions as original inspections)
 - » Approximately 6 1/2 gallons of material removed from floor

Emergency Cooling Pond Inspections

- Quarterly
 - » Inspections for biological or marine growth
- Annually
 - » Biological chemical treatment of ECP
 - » Fish eradication to limit maximum growth

Conclusions

- Only minor sediment and zebra mussel accumulations noted
- Some silt amounts discovered could be the result of traveling screen carryover or zebra mussels detaching from the forebay walls
- Chemical treatment appears effective in the SW bays
- Inspections and cleaning are an effective means of preventing recurrence

Future Inspection Plans

- January 1997

- » Unit 2 SW bays
- » Unit 2 Forebay
- » Intake Canal

- March 1997

- » Unit 1 "B" CW Bay
- » Unit 1 SW Bays

- April 1997

- » Unit 2 Outage
 - Unit 2 Forebay
 - Unit 2 SW bays
 - ECP lines
 - Enhanced biological and sediment controls implemented as available
- » Unit 1 CW bays
 - Drain and inspect
 - Enhanced biological and sediment controls implemented as available

Future Inspection Plans

- July 1997
 - » Unit 1 "B" and "C" CW bay inspections in an outage of sufficient duration
 - » Unit 1 SW bays as determined prudent with summer pump operation
 - » Unit 2 inspections will be evaluated based on corrective actions taken in Spring 1997
- October 1997
 - » Extensive evaluation and cleaning similar to Spring 1997
- November 1997
 - » Draindown inspection and cleaning of Unit 1 "A" and "D" CW bays
- 1998 Inspections
 - » Inspections will be similar to 1997
 - » Recurring maintenance activities will be developed



Chris Shively
Lead Sr. Engineer .

SWIP Development

- 1980 - Biofouling of heat exchangers (IEB 81-03)
- Initial SW system action plan
- 1982 - Study of long term options completed
 - » Repair / replacement program chosen
- 1987 - Evolution into SWIP
- 1988 - Full-time system engineer assigned
- 1991 - SWIP coordinator assigned
- Application of GL 89-13 requirements

SWIP Status

- Active and evolving
- Transformation from reactive to proactive actions
- Formal program supported by procedures
- Management involvement

Service Water Successes

- System condition is known and improving through monitoring
- Pipe condition has significantly improved
- Specific obstacles addressed
 - » Early 1980's
 - » Continued through the 1990's

Service Water Challenges

- Open loop lake water cooled design provides continuous challenges to all system functions
- Current action item list
 - » Unit 1
 - System boundary valve reliability
 - Decay heat cooler capacity margin
 - » Unit 2
 - System pipe cleaning
 - » Common
 - Chemical control program enhancements
 - Pump discharge strainer evolutions
 - Evaluate expansion to include associated systems

SWIP Summary

- 16 years of program evolution
- Accomplished significant programmatic and specific system issues
- Continually challenged by the water source
- SWIP has proven to be a cost effective, efficient program to address these challenges

Closing Remarks

Charlie Zimmerman
Plant Manager, Unit 1