Catawba Nuclear Station

Polyethylene Piping Use for Safety Related Buried Service Water Piping

ATTACHMENT 2

Agenda

- Meeting Purpose and Expectations
- Polyethylene Piping Use by Catawba
- Polyethylene Materials
- Joining Polyethylene
- Seismic Analysis
- NDE Technique Evaluation
- Relief Request
- Overall Strategy for Service Water System
- Questions (questions encouraged during presentation)

Meeting Purpose

- Nuclear service water systems have been designed using codes that specify only metallic materials.

- Polyethylene (HDPE) material has demonstrated superior corrosion and fouling resistance in non safety related cooling water system service.

Meeting Purpose

- Provide information on use of Polyethylene Piping in non safety related service water system at Catawba Nuclear Station

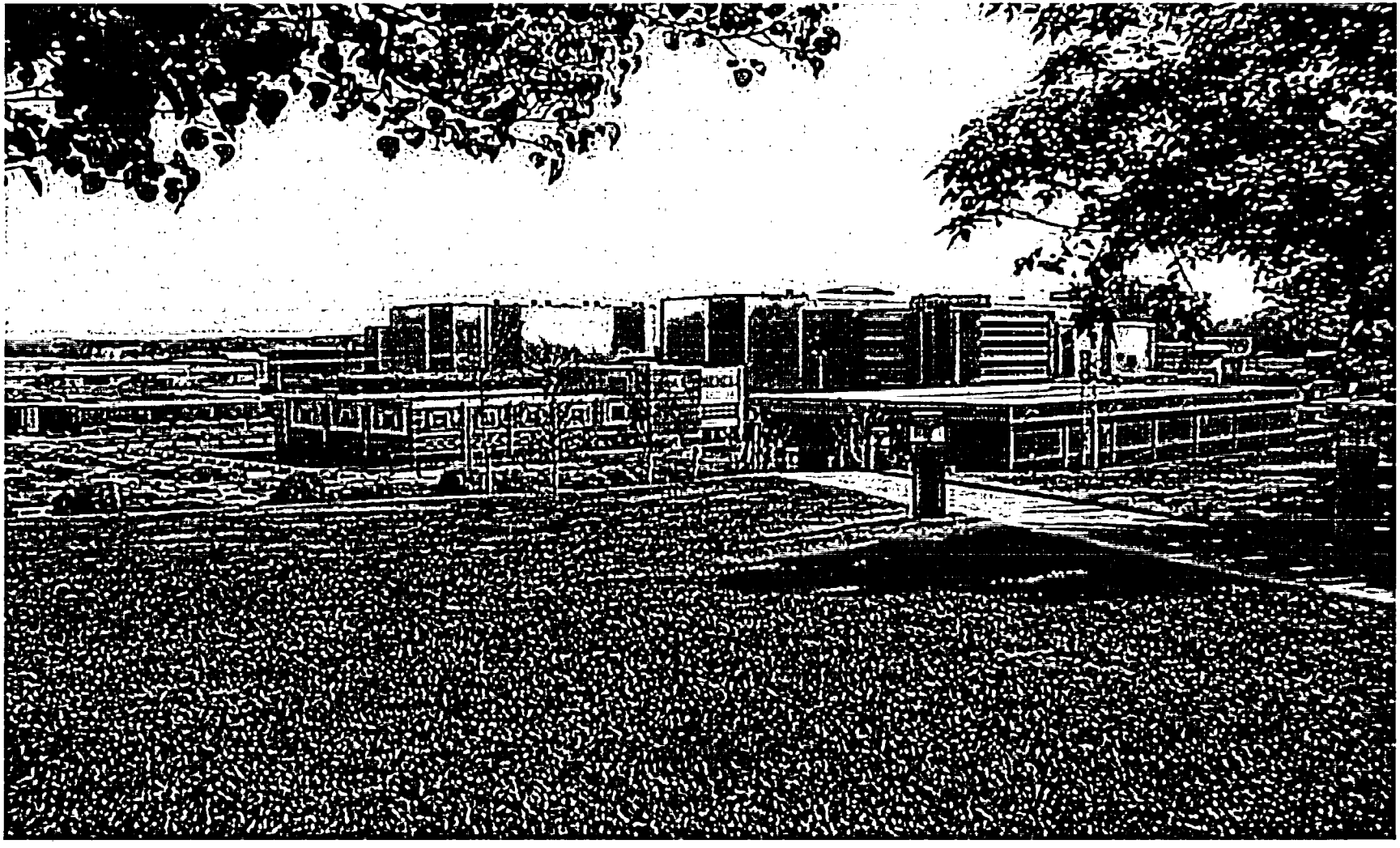
- Provide information on development of relief request for replacement of safety related piping with high density polyethylene (HDPE) in buried service water applications

Meeting Expectations

- Information presented in the 6-27-05 meeting is expected to be useful for future review of Duke Relief Request.

- NRC comments and questions during the 6-27-05 meeting will be used to focus efforts to develop and prepare the Duke Relief Request.

Catawba Nuclear Station
Polyethylene Pipe Use

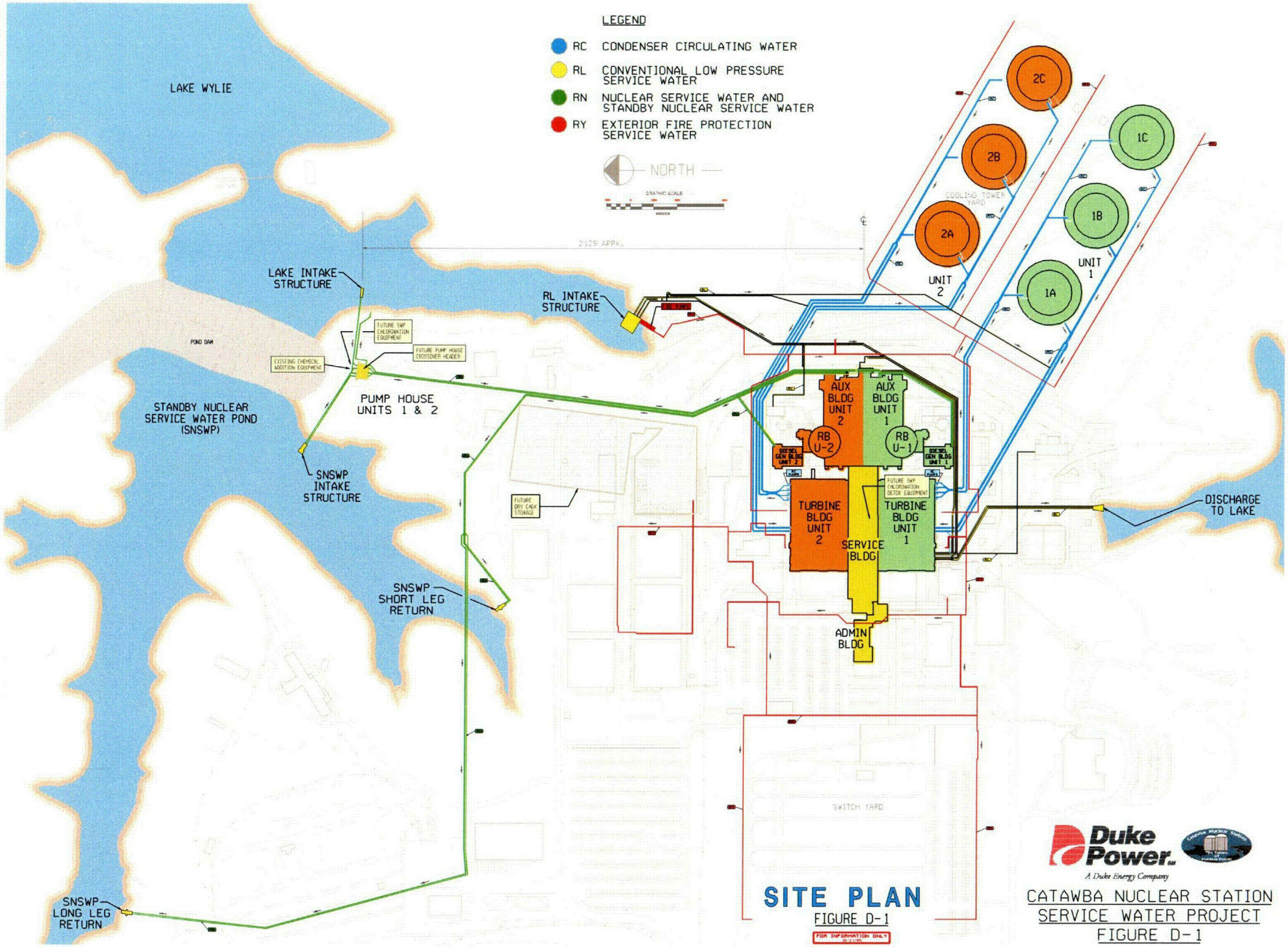


Catawba Nuclear Station

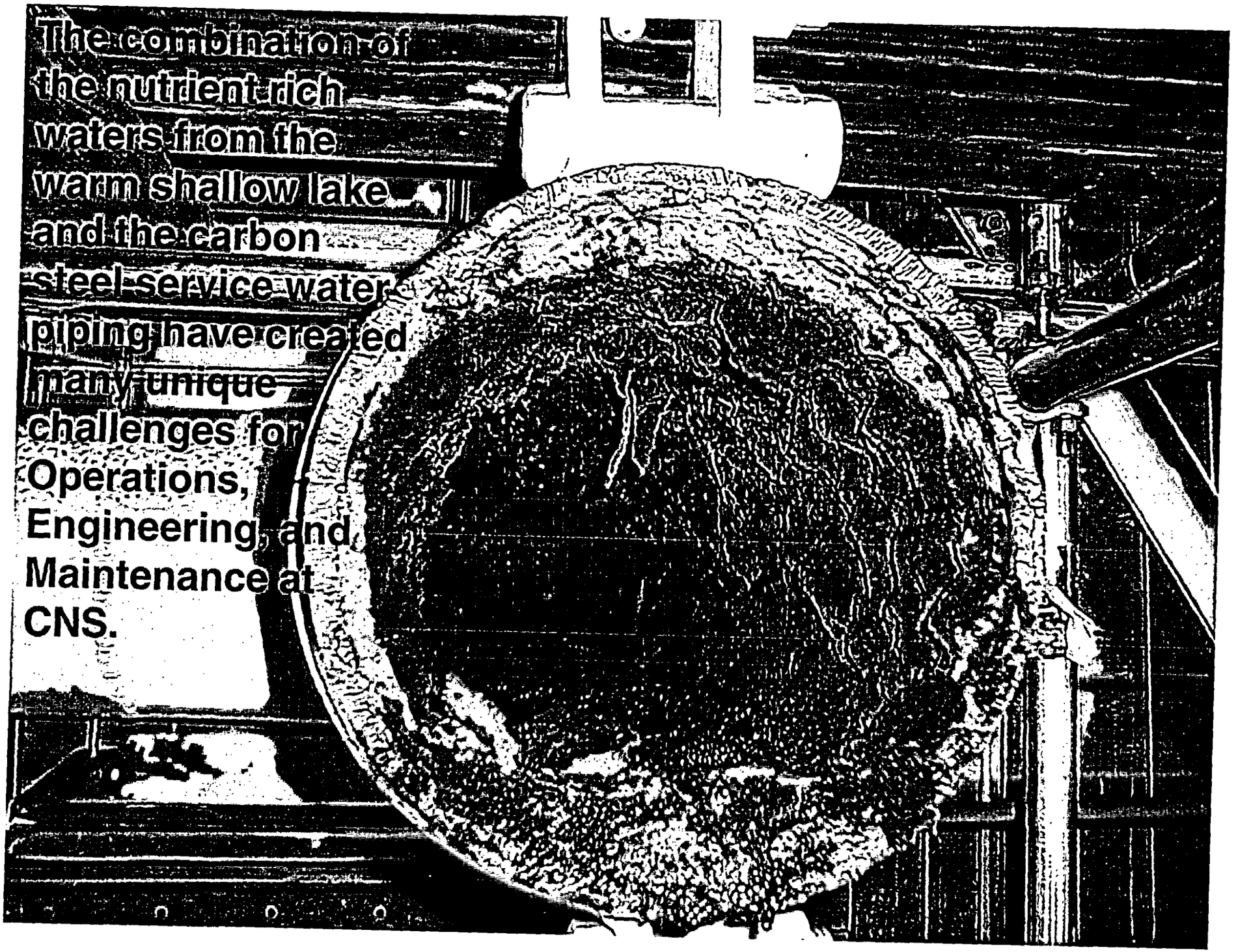
- Located 19 miles southwest of Charlotte, NC on the shores of Lake Wylie
- Two Unit 1208 MW Westinghouse PWR
- Main condenser cooling provided by closed loop cooling tower system
- Commercial operation in 1985 & 1986 respectively

Water Systems

- Nuclear Service Water System cooling to nuclear safety related components. Piping material: SA155, Class 1, KC 70 & SA106 CS plain carbon steels
- Low Pressure Service Water System secondary cooling and cooling tower makeup. Piping material: A106 CS & API5L carbon steel
- Both systems combined total approximately 45,000-50,000 feet of piping


LEGEND
RC CONDENSER CIRCULATING WATER
RL CONVENTIONAL LOW PRESSURE SERVICE WATER
RN NUCLEAR SERVICE WATER AND STANDBY NUCLEAR SERVICE WATER
RY EXTERIOR FIRE PROTECTION SERVICE WATER
NORTH
LAKE WYLIE
LAKE INTAKE STRUCTURE
RL INTAKE STRUCTURE
POND DAM
FUTURE SWP CHLORINATION EQUIPMENT
FUTURE PUMP HOUSE CROSSOVER HEADER
EXISTING CHEMICAL ADDITION EQUIPMENT
PUMP HOUSE UNITS 1 & 2
STANDBY NUCLEAR SERVICE WATER POND (SNSWP)
SNSWP INTAKE STRUCTURE
FUTURE DRY CASK STORAGE
SNSWP SHORT LEG RETURN
SNSWP LONG LEG RETURN
2C
2B
2A
1C
1B
1A
UNIT 2
UNIT 1
COOLING TOWER YARD
AUX BLDG UNIT 2
AUX BLDG UNIT 1
RB U-2
RB U-1
DIESEL GEN BLDG UNIT 2
DIESEL GEN BLDG UNIT 1
TURBINE BLDG UNIT 2
TURBINE BLDG UNIT 1
SERVICE BLDG
FUTURE SWP CHLORINATION DETOX EQUIPMENT
ADMIN BLDG
SWITCH YARD
DISCHARGE TO LAKE
SITE PLAN
FIGURE D-1
FOR INFORMATION ONLY
Duke Power
A Duke Energy Company
CATAWBA NUCLEAR STATION
SERVICE WATER PROJECT
FIGURE D-1

C01


The combination of the nutrient rich waters from the warm shallow lake and the carbon steel service water piping have created many unique challenges for Operations, Engineering, and Maintenance at CNS.

Service Water Problems

- Potential loss of adequate cooling due to flow restrictions
- Concern for Foreign Material Exclusion (FME) from the corrosion products, sedimentation, biological growth, and clams fouling components within the system
- Localized through wall pitting

Problems Addressed by System Monitoring

- UT corrosion rate monitoring to address structural integrity issues

- Systems Engineers trend flows, temperatures, equipment performance, and set maintenance equipment PM frequencies

Problems Addressed by System Cleaning

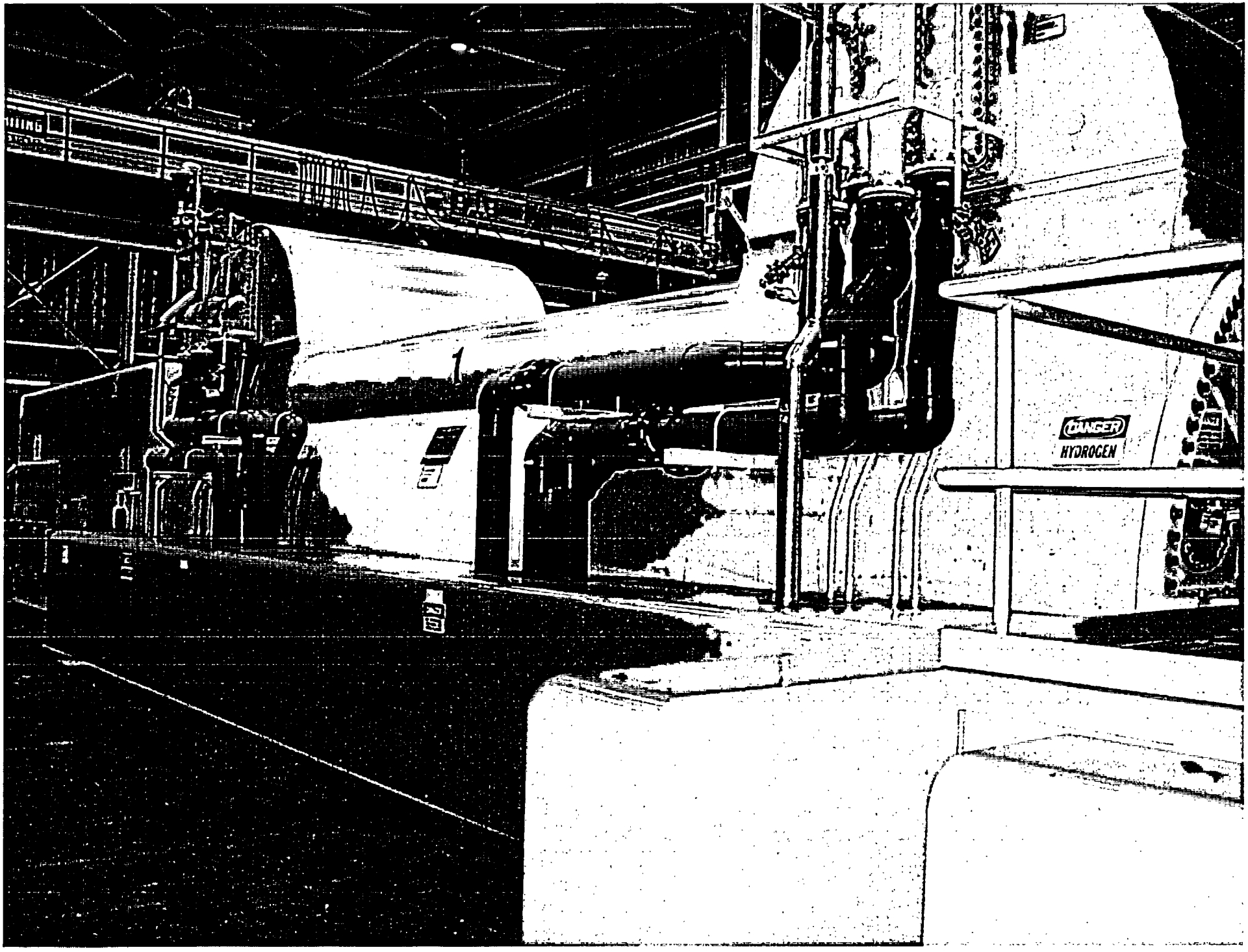
- In 2000, CNS cleaned and inspected over 8,000 feet of Nuclear Service Water System piping.
- The primary methods used for this operation were "Pigging" and Hydrolazing (High Pressure Wash) with Turbo Vacuum Trucks to remove the debris.
- Chemical treatment was added to the safety related service water system after the cleaning to help control the biological growth. Currently monitoring actual results of treatment

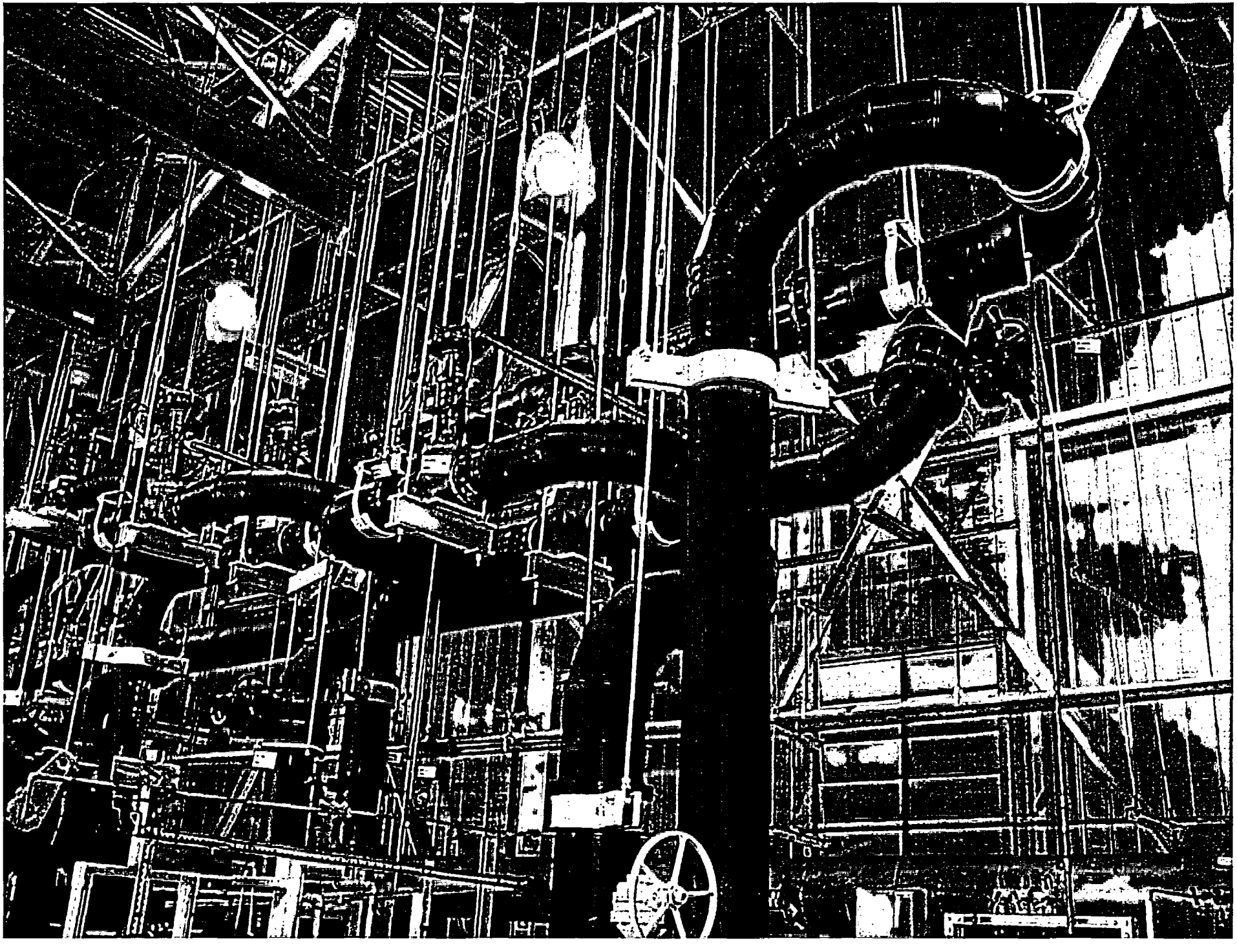
Polyethylene

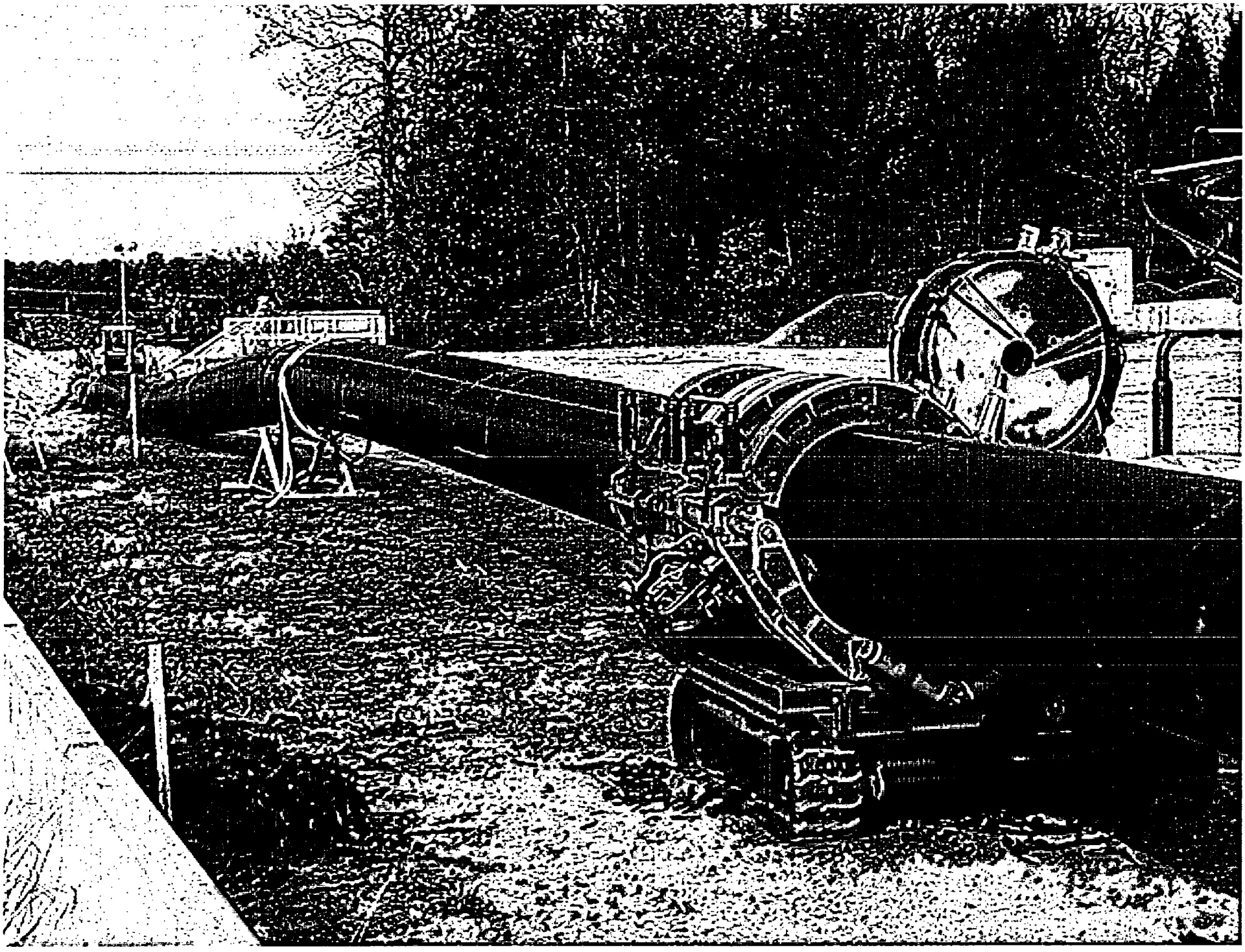
- 1985 CNS began experimenting with Polyethylene piping materials as a replacement for Polybutylene
- Further testing of the Polyethylene piping began in 1991-1992
- The test proved conclusively that Polyethylene was very compatible with the system design parameters and water chemistry

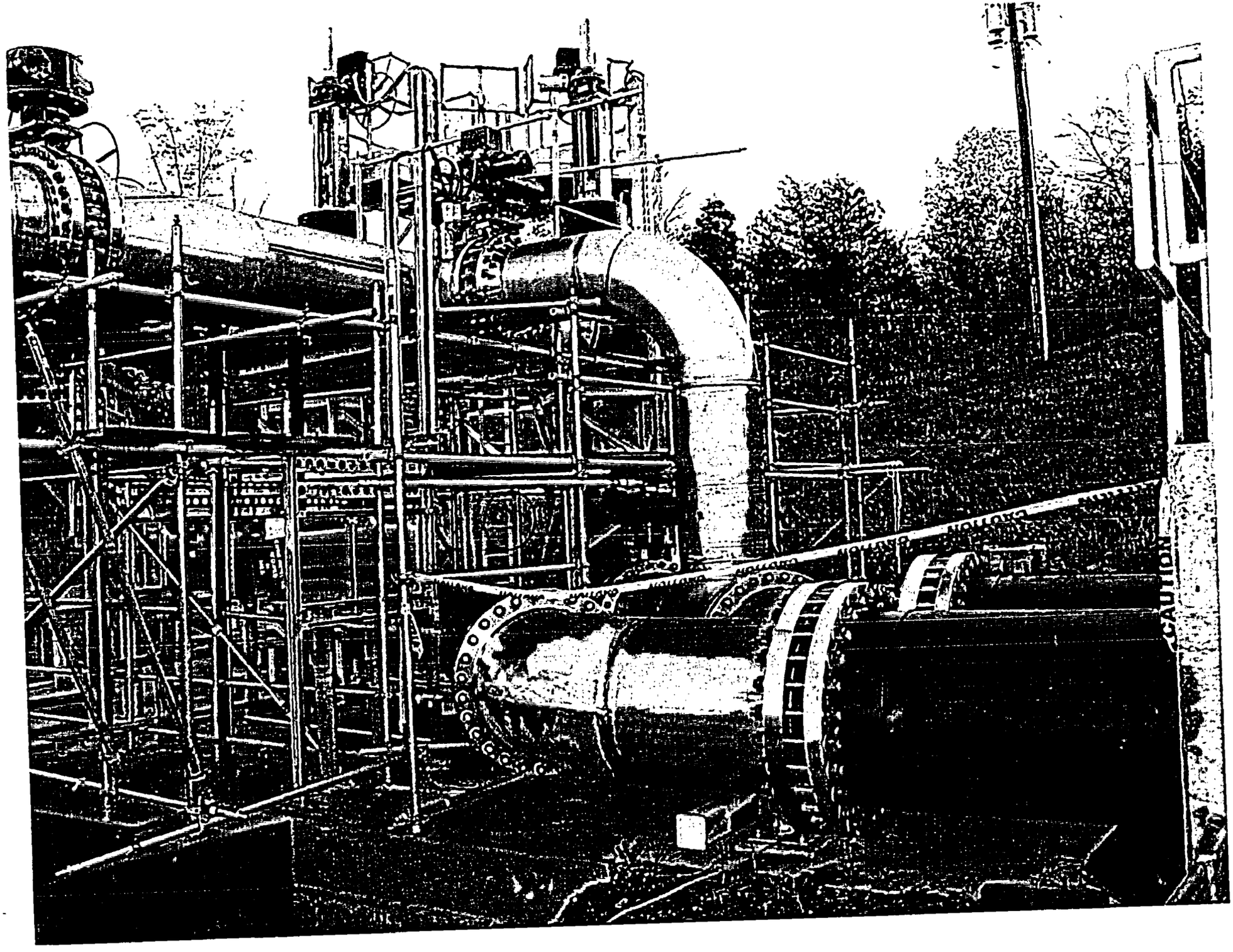
Polyethylene Piping Replacement

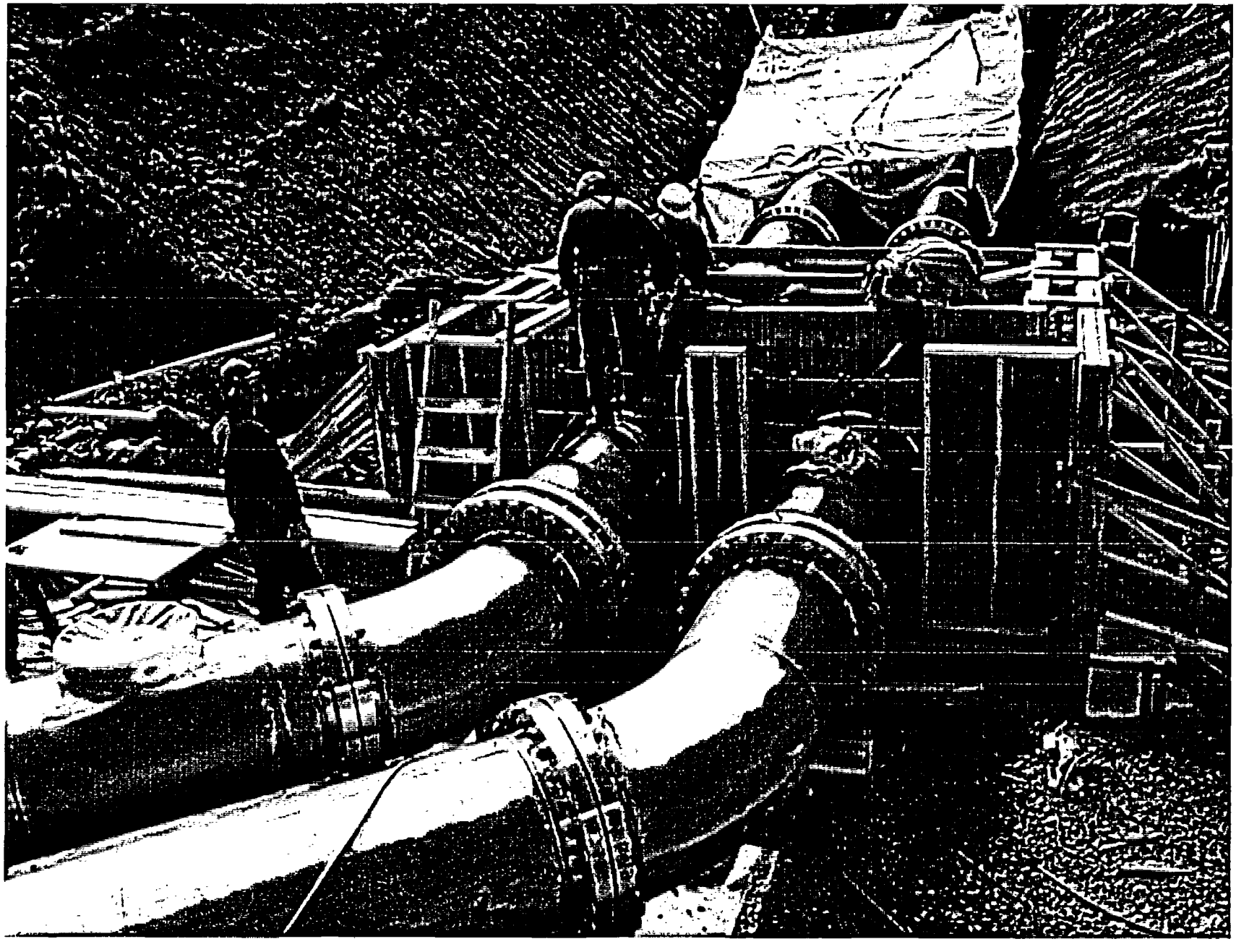
- After six years of actual in service application, there was no corrosion or biological material buildup on the inside of the pipe walls
- In 1998, the existing A-106 carbon steel supply and return piping to the Unit 2 generator hydrogen coolers was replaced with 500-600 feet of 6" & 8" HDPE, SDR-11, polyethylene piping
- Inspection results and performance of this piping since installation have been flawless (No degradation and no measurable fouling)

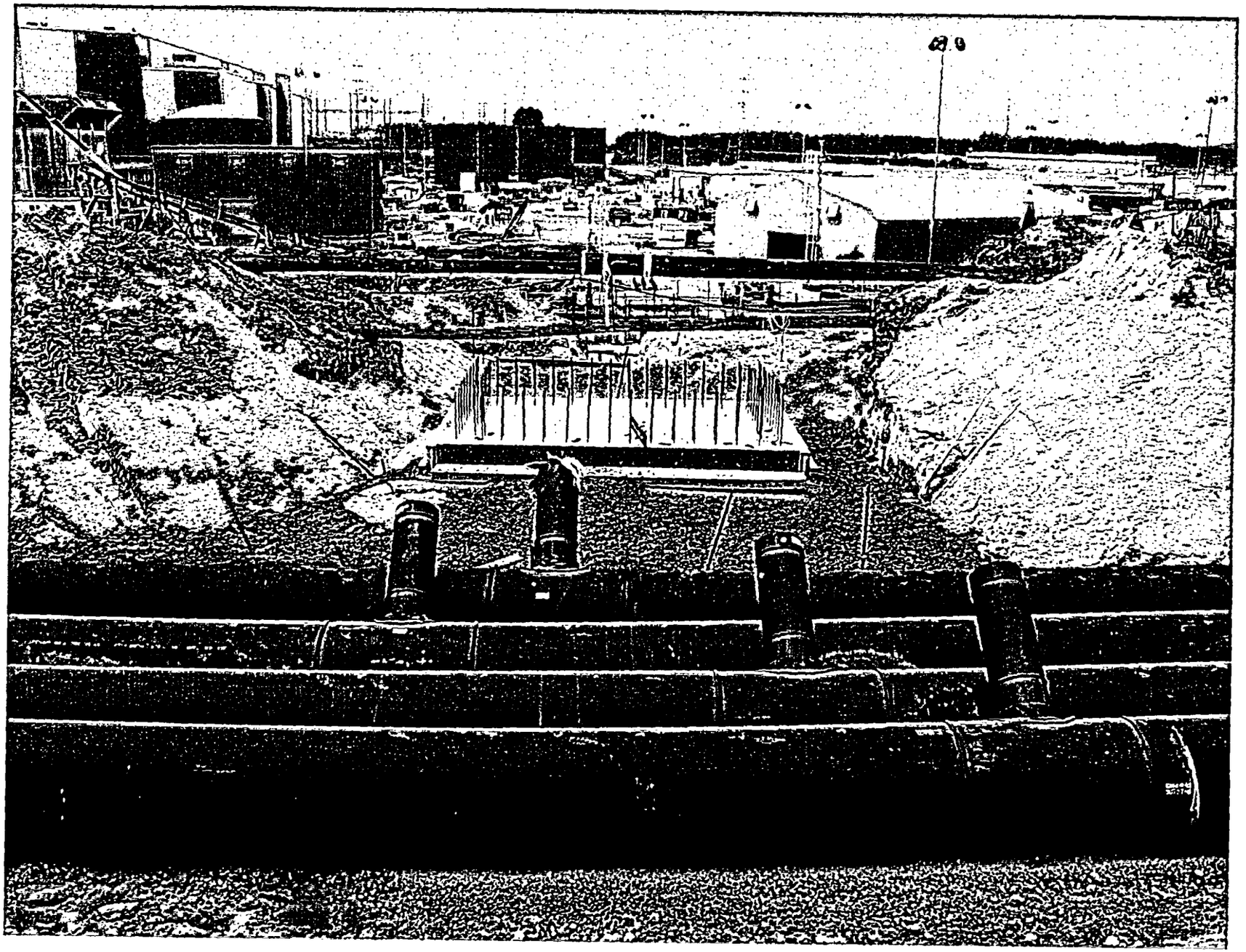

DANGER
HYDROGEN






CAUTION





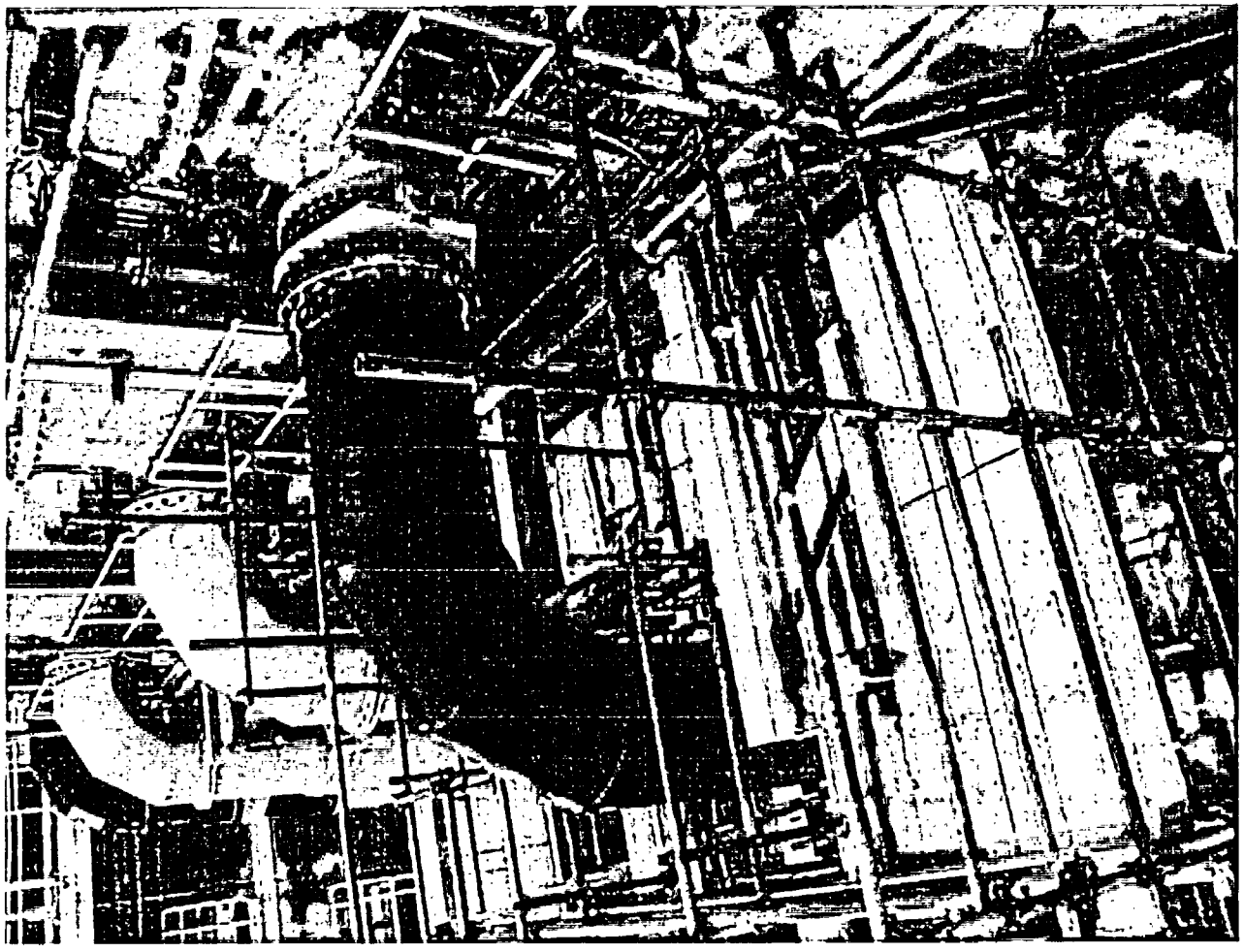
Conclusions - Non Safety Related Service Water Piping Experience

HDPE Piping has not exhibited any corrosion or degradation or significant fouling in over 10 years of service at Catawba Nuclear Station.

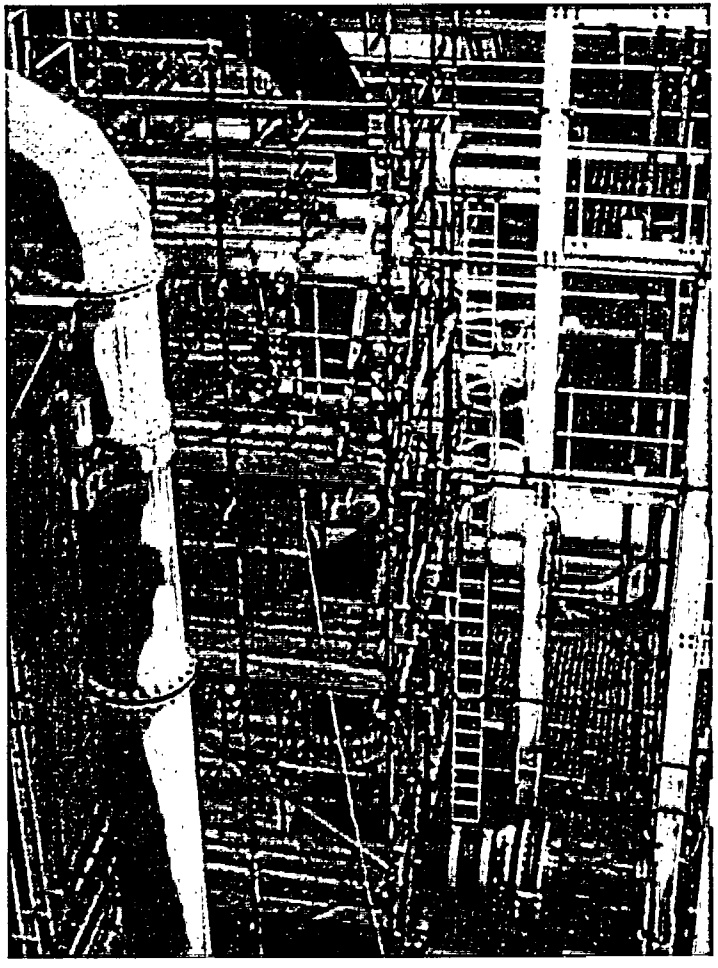
HDPE USE by British Energy

- Coordinated efforts with British Energy Sizewell B Plant to use HDPE Piping
- Monthly teleconference meetings
- PE Training organized in September/2004
- HDPE Piping installed by Sizewell B in Spring 2005 in the ASME Section III Class 3 emergency service water system.

HDPE USE by British Energy



HDPE USE by British Energy

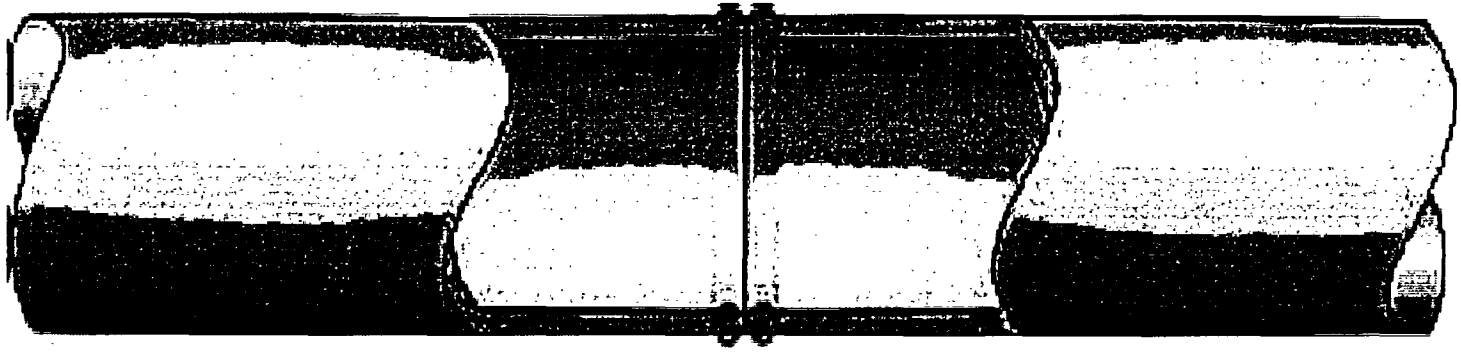


Polyethylene Piping Materials

ASTM Material Specifications Used:

- **ASTM D-3350** Standard Specification for PE Plastic Pipe & Fittings Material
- **ASTM D-3035** Standard Specification for PE Plastic Pipe based on controlled outside diameter
- **ASTM D-2837** Standard Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Material or Pressure Design Basis for Thermoplastic Pipe Products

HDPE Butt Fusion

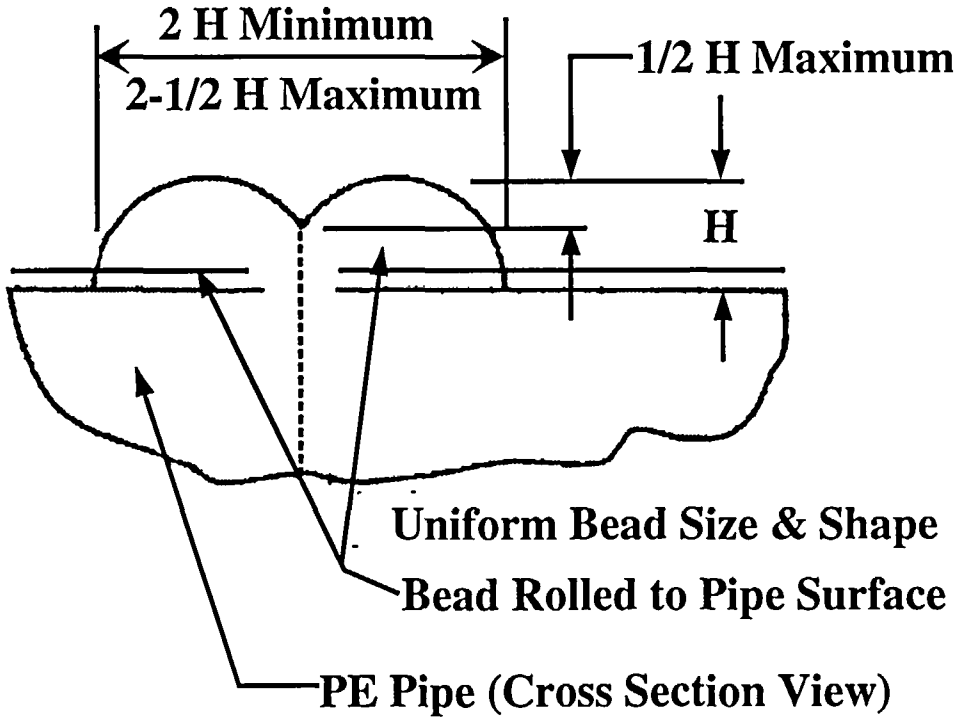


HDPE Butt Fusion

Joints made by trained and qualified operators in accordance with a qualified procedures

Essential parameters by data logger as a permanent record

HDPE Butt Fusion

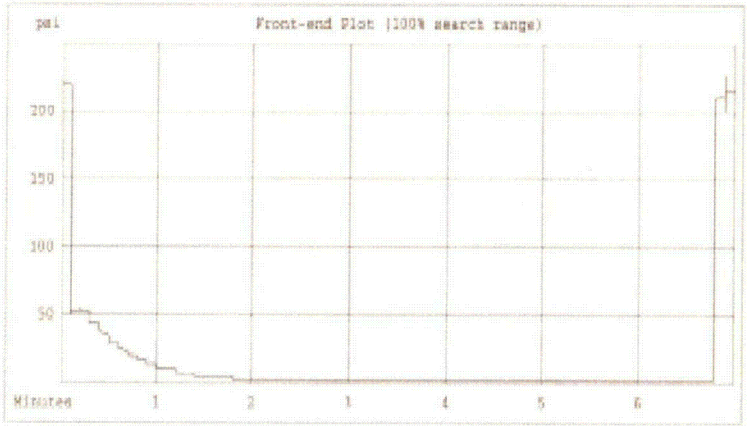


HDPE Butt Fusion

Data Logger Report Data

McElroy Joint Report

1. Date and Time:	12/14/04 11:45:26	Recommended Gauge Pressures:	
2. Joint Number :	4	18. Heat :	220 psi
3. Job Number :	20066	19. Soak :	40 psi
4. Employee Num.:	151122	20. Fuse :	220 psi
5. Machine I.D. :	CO955	21. Cool :	220 psi
6. Machine Model:	MMI 618 Standard		
7. Piston Area :	11.78 in²	Recorded data:	
8. Pipe Material:	Plexco PE 3408	24. Drag Pressure:	40 psi
9. Pipe Size :	12" IPS SDR 17	25. DataLogger Probe:	435°F
		26. External Probe:	0°F
Interfacial Pressures:			
12. Heat :	75 psi		
13. Soak :	0 psi		
14. Fuse :	75 psi		
15. Cool :	75 psi		



C02

Polyethylene Replacement Pipe Project Seismic Analysis

Jack Spanner

EPRI NDE Center

June 27, 2005

USNRC Offices-White Flint

Objectives

This project will provide a seismic analysis methodology for the technical justification to accompany the relief request and a Code Case to allow utilities to repair or replace safety related piping with polyethylene

Contract deliverables:

- Task 1-Develop a general methodology for buried HDPE pipe
- Task 2-Analyze a buried system at Catawba NPP
  - Piping to diesel heat exchanger
- Task 3-Prepare Code case for Section III/XI

Status

- Seismic analysis scheduled for completion by August 1, 2005
- Obtained HDPE and seismic performance data from Gas Technology Institute
- Catawba staff will also provide information necessary for seismic analysis-soil type, ground accelerations, drawings, etc.
- Contractor provided analysis for buried HDPE pipe at a DOE facility

Polyethylene Replacement Pipe Project
NDE Technique Evaluation

Jack Spanner
EPRI NDE Center
June 27, 2005
USNRC Offices-White Flint

Objectives of EPRI PE Pipe Project

This project will develop a technical justification to accompany a Code Case to allow utilities to repair or replace safety related piping that has degraded, usually due to corrosion. It was decided to also evaluate NDE techniques for qualifying joining procedures.

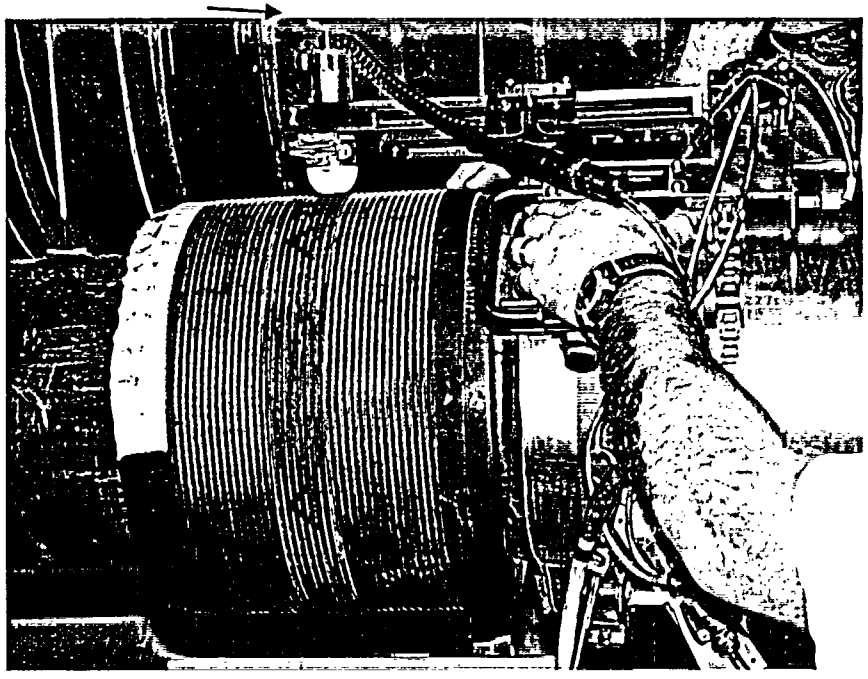
- Task 1- Evaluate NDE techniques for HDPE joints.
- Task 2-Develop and publish a technical report that provides the technical justification for the Code case and Relief Request
- Task 3-Submit a Code case to the Code for implementation.
  - Buried pipe Code case first
  - Above ground Code case later

NDE Techniques to Evaluate

- Visual Inspection of joint and bead
- Microwave Inspection-Evisive
- Ultrasonic Phased Array
- Ultrasonic Time of Flight Diffraction (TOFD)
- Radiography

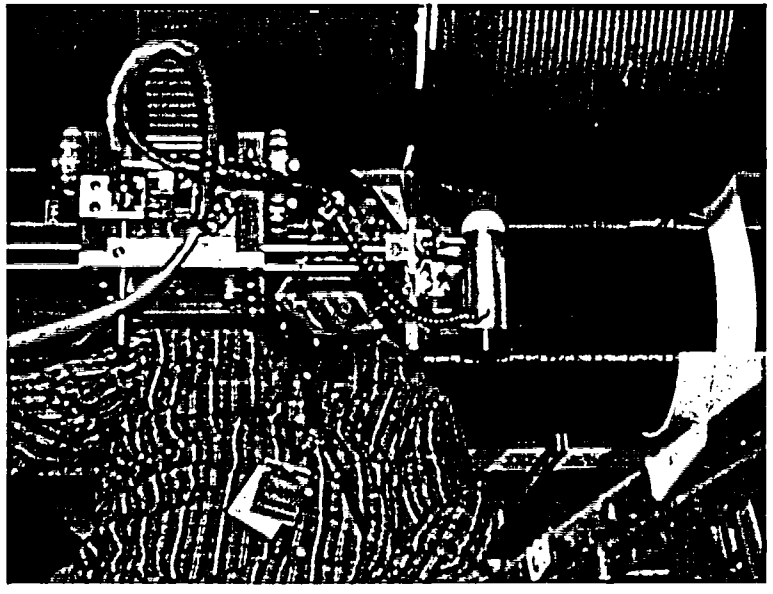
Microwave Inspection at Catawba NPP

Waveguide

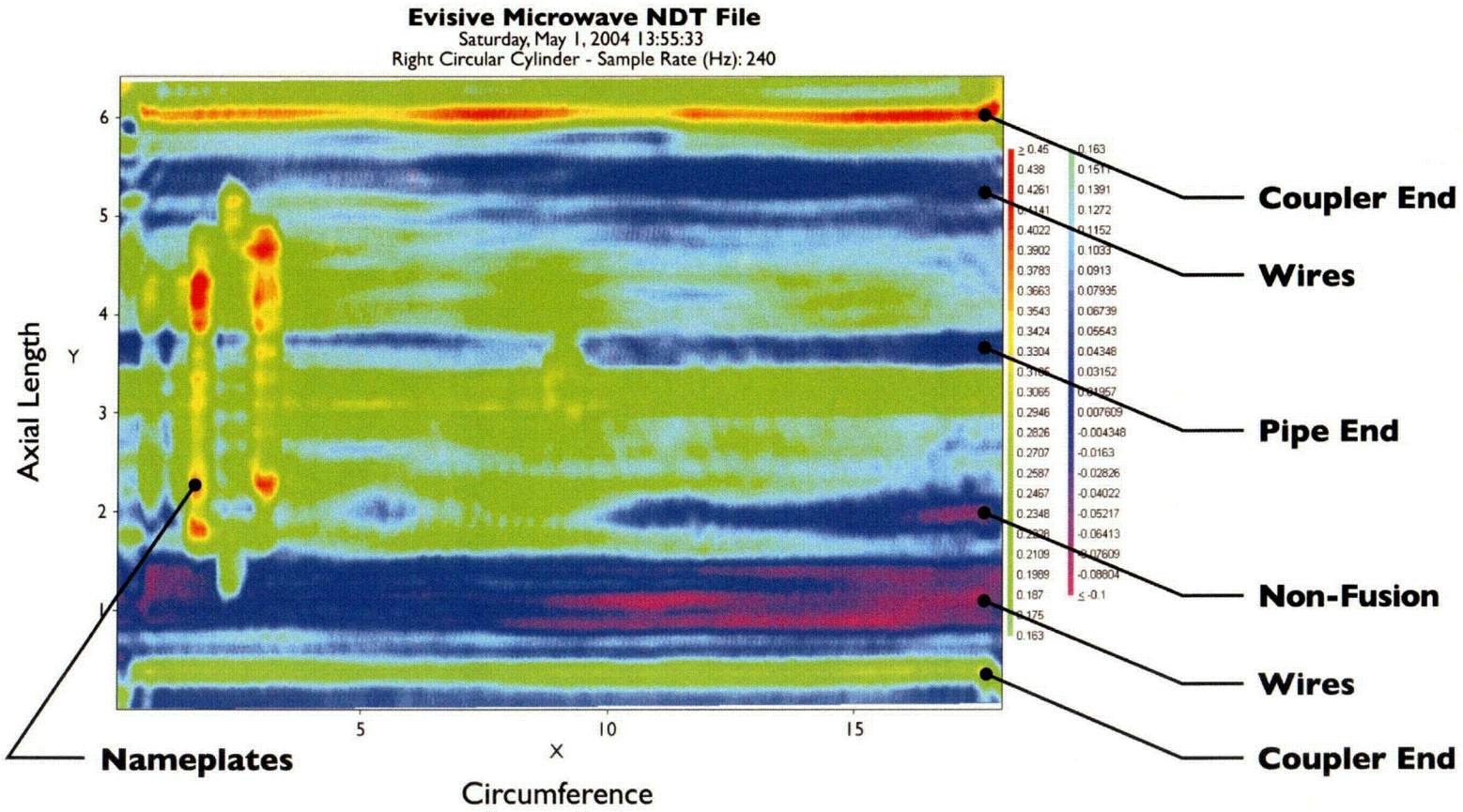


PScanner

Evisive Manual Scanner



Microwave Inspection of EF Coupling Joint RG&E Mockup



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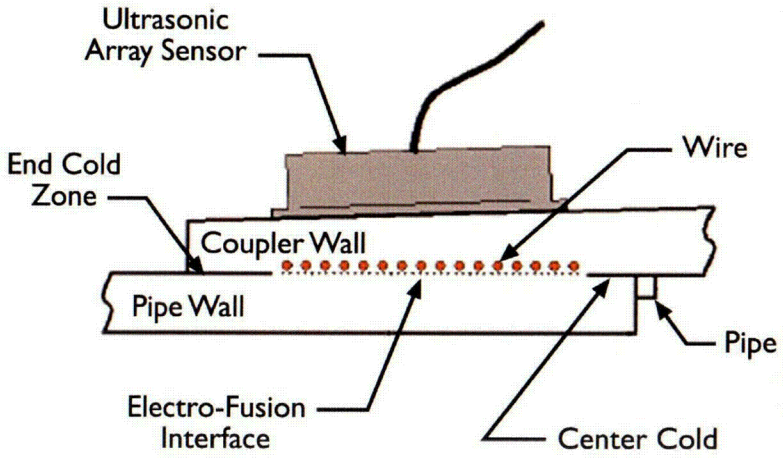
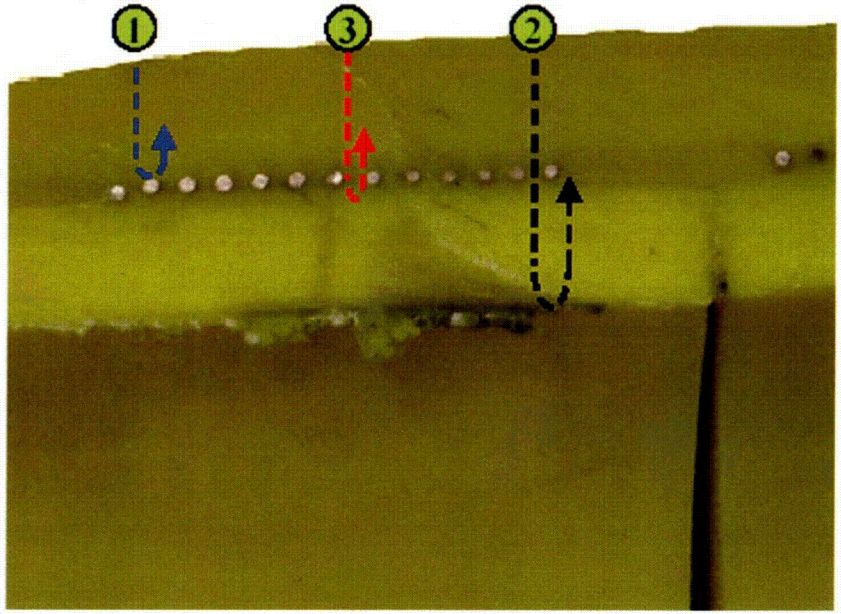
Phased Array UT of EF Coupling Joint

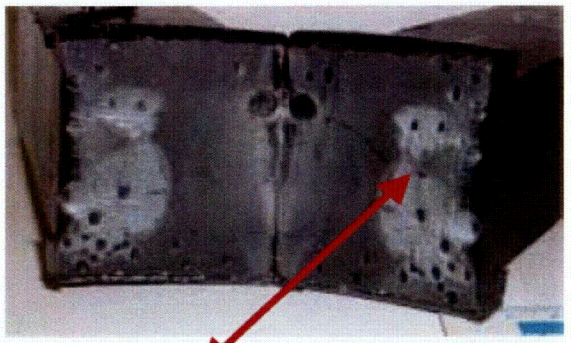
- **Assumed Signals in Linear Array Ultrasonic Inspection for PE Coupler Joining**



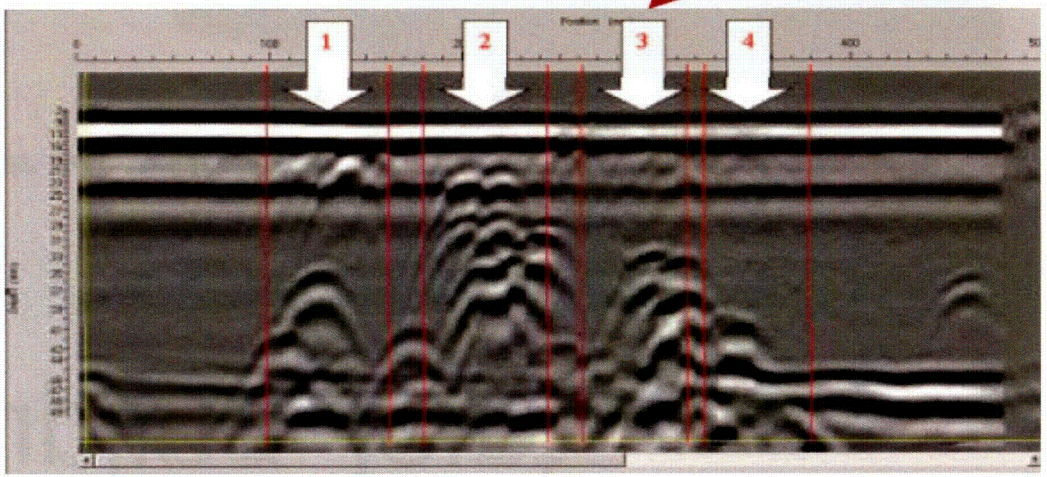


Time of Flight Diffraction (TOFD) UT Technique-Cold fusion in butt joint

- **Stage 3 - correlation UT-TOFD vs. destructive examination**
  - Lab test spools
  - Field welds



Field Sample & Scan



- **Results**
  - Strong positive correlation of NDE indications to actual flaws

FLUOR.

Status

- Evaluating NDE techniques
  - RG&E, Duke and EPRI mockups
  - Microwave system interfaced with UT pipe scanner and used at Catawba and on mockups
  - Ultrasonic time of flight demonstrations in progress
  - Tried phosphor plate RT techniques-not successful
    - NE Gas Assoc. had better success
- Collaborating with others like British Energy (Sizewell), NorthEast Gas Assoc., RG&E, etc.

Relief Request - Scope

- Catawba Nuclear Service Water System - Buried Piping (ASME Section III Class 3)
- Buried Supply Piping to the heat exchangers that reject heat for the main emergency diesel generators
- Existing 10 inch Carbon Steel NPS Piping to be replaced with HDPE
- Approximately 1700 feet of piping for Catawba Units 1 and 2

Relief Request - Development

- EPRI Project for code case development began in 2004.
- Code case concept introduced at ASME Section XI Committee in February, 2004.
- Code case and relief request work compliment one another.
- Duke Power made decision to pursue relief request since piping replacement will be required before code case is approved.
- Target date to submit relief request is Fall, 2005.

Relief Request - Development

- Relief Request will address:
  - Design
  - Installation
  - Inspection
  - Testing
  - Procurement

Service Water Piping Refurbishment Plan

NSW Plan (2006-2010)

- Replace portions of auxiliary building piping
- Install NSW pump house header crossover
- Install NSW auxiliary building header crossover
- Replace EDG cooling supply headers
- Remove selective cooling loads from NSW
- Move isolation valves to reduce lake water exposure
- Submit LAR for single header operation

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