Docket File

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

May 28, 1992

Docket No. 52-002

APPLICANT: Combustion Engineering, Inc. (ABB-CE)

PROJECT: CE System 80+

SUBJECT: SUMMARY OF PUBLIC MEETING ON MECHANICAL DESIGN CRITERIA FOR THE CE SYSTEM 80+

A meeting was held on April 22 and 23, 1992, at the offices of Duke Engineering and Services (DE&S) in Charlotte, North Carolina. Representatives from ABB-CE and DE&S made presentations on seismic design for a site envelope, distributions system design guide, leak-before-break (LBB) applied to System 80+, and design specifications. A demonstration of the PASCE computer-aided-engineering (CAE) program, which can be used to enhance plant design, construction, and operations and maintenance, was also given. Attendees at the meetings are listed in Enclosure 1. The material used for the presentations is provided as Enclosure 2.

The general approach to seismic design for a site envelope was presented by ABB-CE. A discussion on one of the system design bases centered on the System 80+ being designed for a peak ground acceleration of Operating Basis Earthquake (OBE) equal to 0.10 G or 1/3 of the Safe Shutdown Earthquake (SSE) of 0.30 G. This ratio of OBE to SSE is not consistent with the current requirements of 10 CFR Part 100, Appendix A, which specifies that the OBE shall be at least 1/2 the SSE. ABB-CE explained that a limited number of OBE analyses cases were run to confirm the OBE to SSE ratio of 1/3. This resulted in response factors of 0.40 for all frequencies at the Power Generation Complex (PGC) foundation and 0.45 for all frequencies on the Internal Structure (IS) at all elevations. DE&S ran three sample piping analyses utilizing these response factors and calculated the ASME Equation 9 stresses. In one of the three cases, the OBE ratio of calculated stress to allowable stress was the governing condition. For the two other cases, the SSE ratio was the governing condition. Therefore, it cannot be guaranteed that the SSE would always be the governing condition. The staff will continue to evaluate the acceptability of using the 1/3 SSE for OBE. Another topic of discussion was to allow the option for an applicant to use soil subsets of the enveloped soil set for System 80+, or site specific spectra to reduce any excessive seismic effects on equipment and component design. Also discussed were items such as peak broadening vs. peak shifting and the use of a common basemat for the reactor building and the remainder of the structure comprising the nuclear annex. Both the staff and ABB-CE are continuing to work towards a resolution of these issues.

The Distribution System Design Guide (DSDG) will be used by the staff to review design and construction methodologies for the System 80+ in lieu of specific design details that will not be available for staff review at the certification stage. ABB-CE gave a brief presentation on the DSDG, and a draft outline of the document was provided. ABB-CE has committed to providing the staff with a preliminary copy of the analysis section (Section 7.0) of the DSDG by April 30, 1992, and a preliminary copy of the entire DSDG by July 30, 1992.

The staff had a number of questions concerning ABB-CE's LBB program for the System 80+. These included consideration of environmental effects (e.g., erosion/corrosion); choice of piping materials; leak detection capabilities on the main steamlines outside of containment; combination of design loads including thermal stratification loads; and benchmarking calculations. ABB-CE responded satisfactorily to some of these and other questions and has agreed to provide additional information in response to our inquiries by May 8, 1992.

The discussion on design specifications focused on the staff's interest in the methodology that will be employed in developing the form and content of the design specifications for System 80+. ABB-CE presently uses in house procedures and documents to assure that the necessary design requirements are incorporated into the design specifications for which they are responsible. The staff would like to see a formal design specification process for System 80+, and to this end, we are in the process of preparing a list of representative attributes that we feel should be contained in a typical design specification. This list will be forwarded to ABB-CE at a later date, and the staff will keep in close contact with ABB-CE concerning this matter.

The staff received a presentation from DE&S personnel on the CAE program PASCE. The PASCE program can be used for the design, construction, and operation of power plants by utilizing a software platform that integrates information from a number of supporting databases and manages the flow of information through the overall engineering process. ABB-CE and DE&S are using this system in the design of the System 80+. Duke Power is currently using this program at a number of their nuclear plants for plant modifications planning, enhancing as low as reasonably achievable considerations, and electrical circuit simulation.

Original Signed By:

Thomas V. Wambach, Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of Nuclear Reactor Regulation

Enclosures:
As stated

cc w/enclosures:
See next page

DISTRIBUTION:

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NAME:	PShea	TWambach:tz	JNWilson
DATE:	05/ /92	05/27/92	05/ /92

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Enclosure 1

CE SYSTEM 80+

Meeting Attendees

April 22 & 23, 1992

Name	Affiliation
P.T. Kuo	NRC/ESGB
John McIntyre	NRC/ESGB
E.C. Rodabaugh	Consultant/NRC
Goutam Bagchi	NRC/ESGB
David Terao	NRC/ESGB
David Baisley	ABB-CE
Walt Bak	ABB-CE
Dan Peck	ABB-CE
Lyle Gerdes	ABB-CE
Stan R. McDowell	DE&S
Stan Ritterbusch	ABB-CE
Bill Fox	DE&S
Raymond Fabi	ABB-CE
William Urko	ABB-CE
Tom Crom	DE&S
Larry Davis	DE&S
David Perry	DE&S
Sam Lee	NRC/ESGB
David Tang	NRC/ESGB
D.R.Wade	ABB-CE
Tim Murphy	Duke Power Co.
Mike Helms	Duke Power Co.
Steve Burnette	DE&S
Tim Winiger	Duke Power Co.

Enclosure 2

AGENDA FOR NRC AUDIT

April 22-23, 1992
Charlotte, NC

APRIL 22:

10:00 A.M.

INTRODUCTION	(ABB-CE)
SEISMIC INPUT LOADINGS TO PIPING AND EQUIPMENT DESIGN	(ABB-CE)
EFFECT ON THE DESIGN OF MECHANICAL COMPONENTS AND PIPING WITH THE OBE LEVEL AS 1/3RD SSE	(ABB-CE/ DE&S)

LUNCH

1:00 P.M.

DISTRIBUTION SYSTEMS DESIGN GUIDE (DE&S)

- General
- Analysis Requirements (Section 7.0)

PIPING LAYOUT INSIDE AND OUTSIDE REACTOR BLD. (DE&S)

- Main Steam Line
- Feedwater Economizer Line
- Direct Vessel Injection Line
- Surge Line
- Shutdown Cooling Line
- Other Lines

USE OF LEAK-BEFORE-BREAK (ABB-CE)

APRIL 23:

8:00 A.M.

REVIEW OF DESIGN SPECIFICATIONS (DE&S)

10.00 A.M.

PASCE DEMONSTRATION (DE&S)

- Introduction
- PlantView
- PlantPipe
- PlantSchema

EFFECT ON DESIGN

OF

PIPING

AND

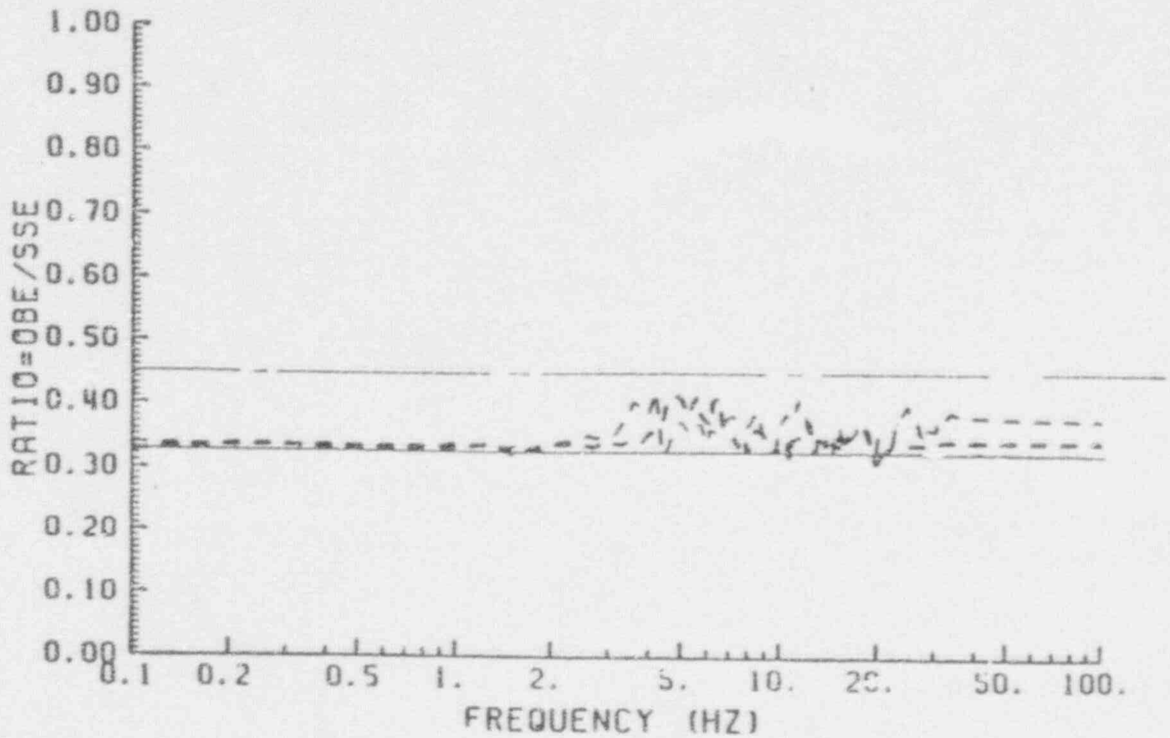
MECHANICAL COMPONENTS

WITH

OBE = 1/3 SSE

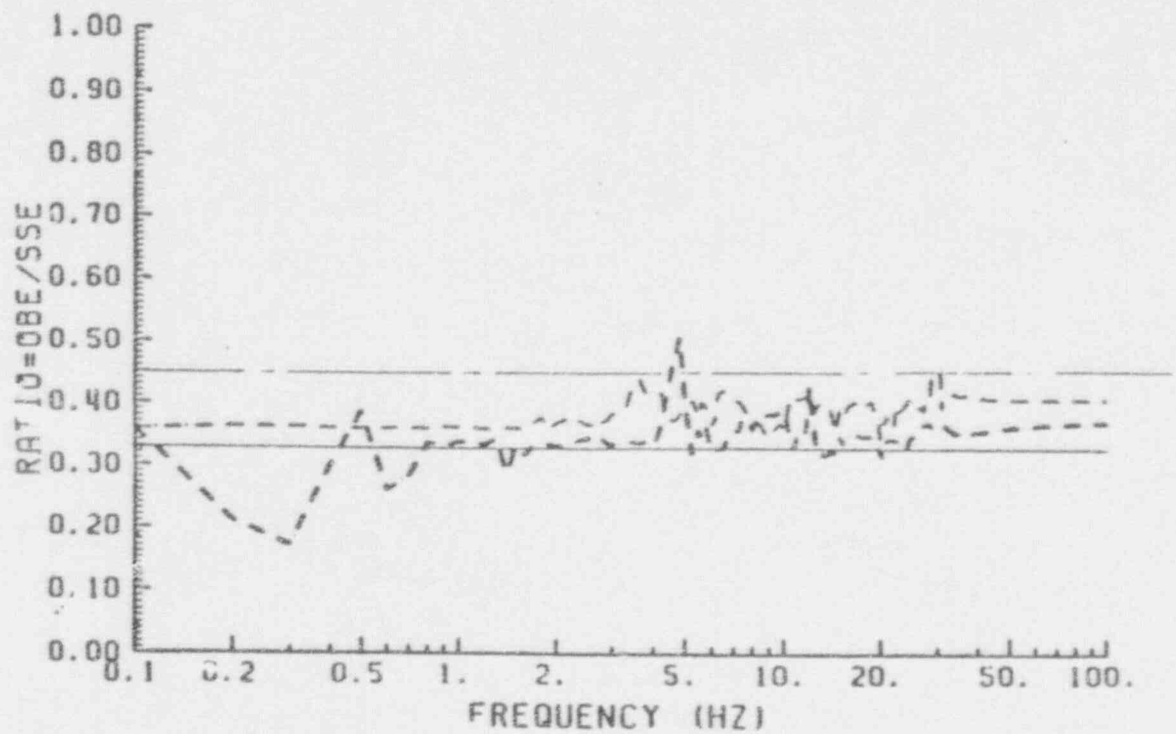
Seismic Analysis Cases

CASE	SSE	OBE
Fixed-Base	Yes	Yes
B1	Yes	No
B1.5	Yes	No
B2	Yes	No
B3.5	Yes	Yes
B4	Yes	Yes
C1	Yes	No
C1.5	Yes	No
C2	Yes	No
C3	Yes	No



CE SYSTEM 80+ SSI OBE-SSE RATIO
DAMPING=2 PER CENT, NODE 131 X-DIR
SOLID=FIXED-BASE, DASH=B3.5, DOUBLE DASH=B4

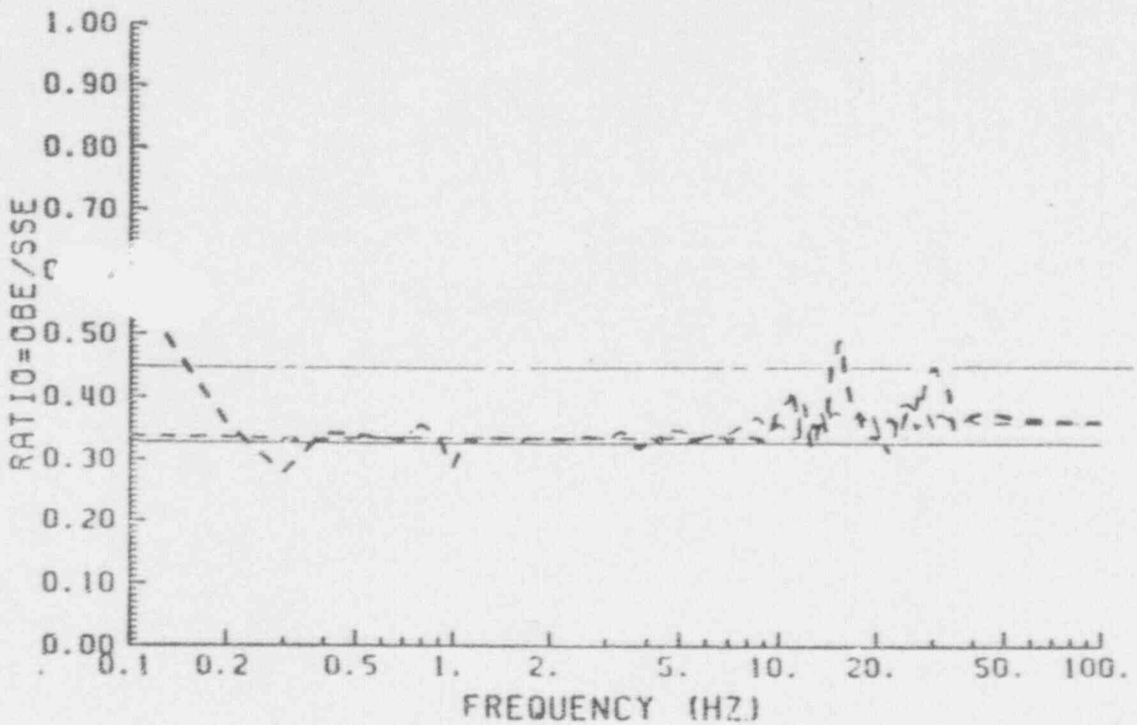
OBE/SSE Spectral Ratio for 2% damping
(RB, Node 131, 0-180 Direction)



CE SYSTEM 80+ SSI OBE-SSE RATIO
DAMPING=2 PER CENT, NODE 131 Y-DIR
SOLID=FIXED-BASE, DASH=B3.5, DOUBLE DASH=B4

OBE/SSE Spectral Ratio for 2% damping
(RB, Node 131, 90-270 Direction)

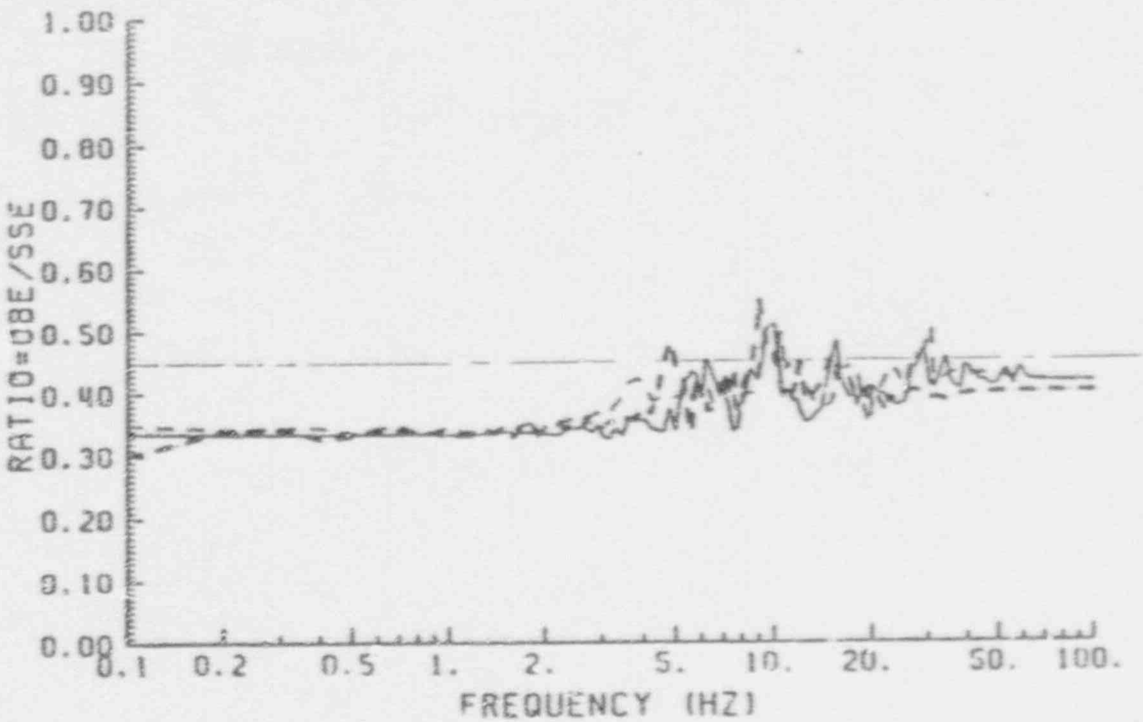
SYSTEM 80+™



CE SYSTEM 80+ SSI OBE-SSE RATIO
DAMPING=2 PER CENT, NODE 131 Z-DIR
SOLID=FIXED-BASE, DASH=B3.5, DOUBLE DASH=B4

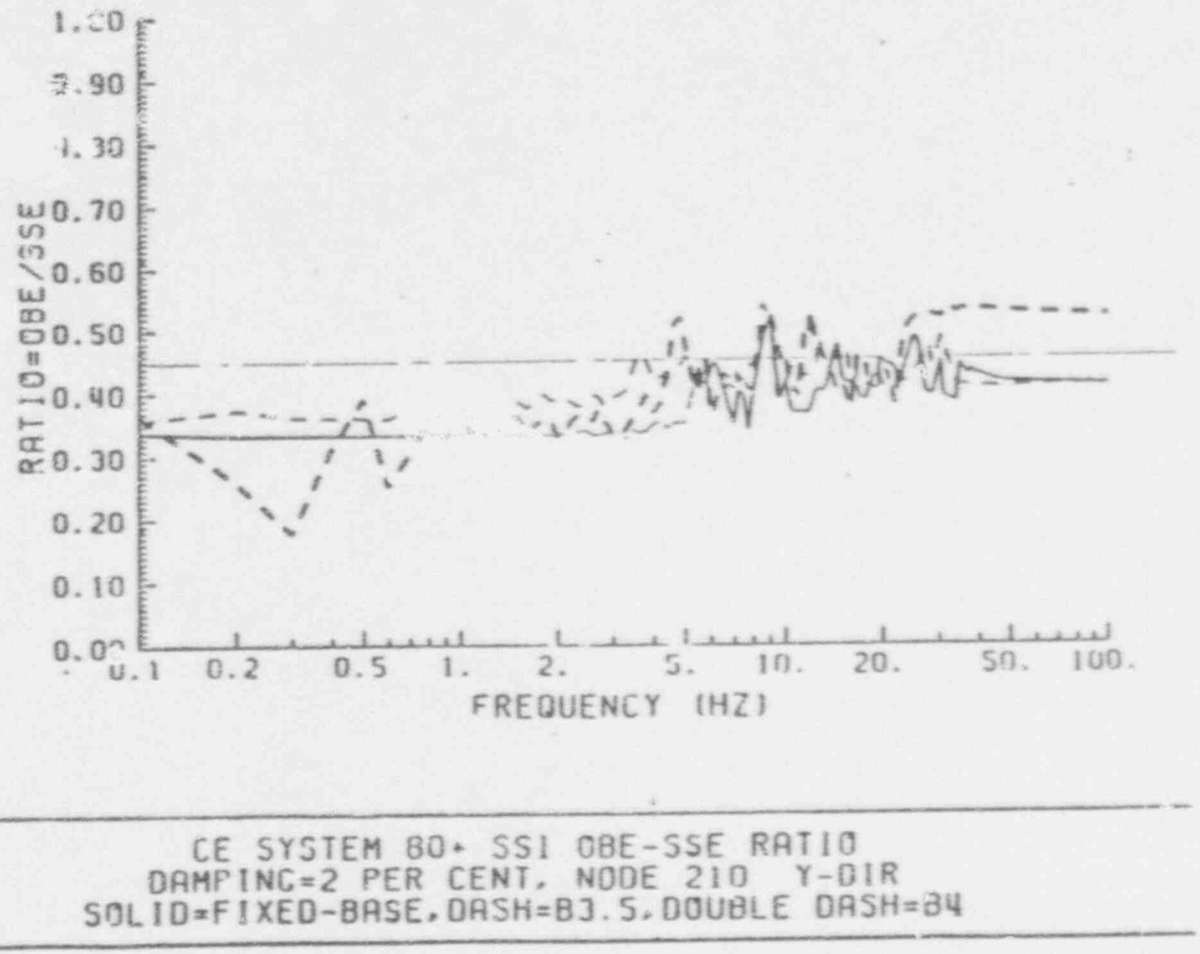
OBE/SSE Spectral Ratio for 2% damping
(RB, Node 131, Vertical Direction)

SYSTEM 80+™



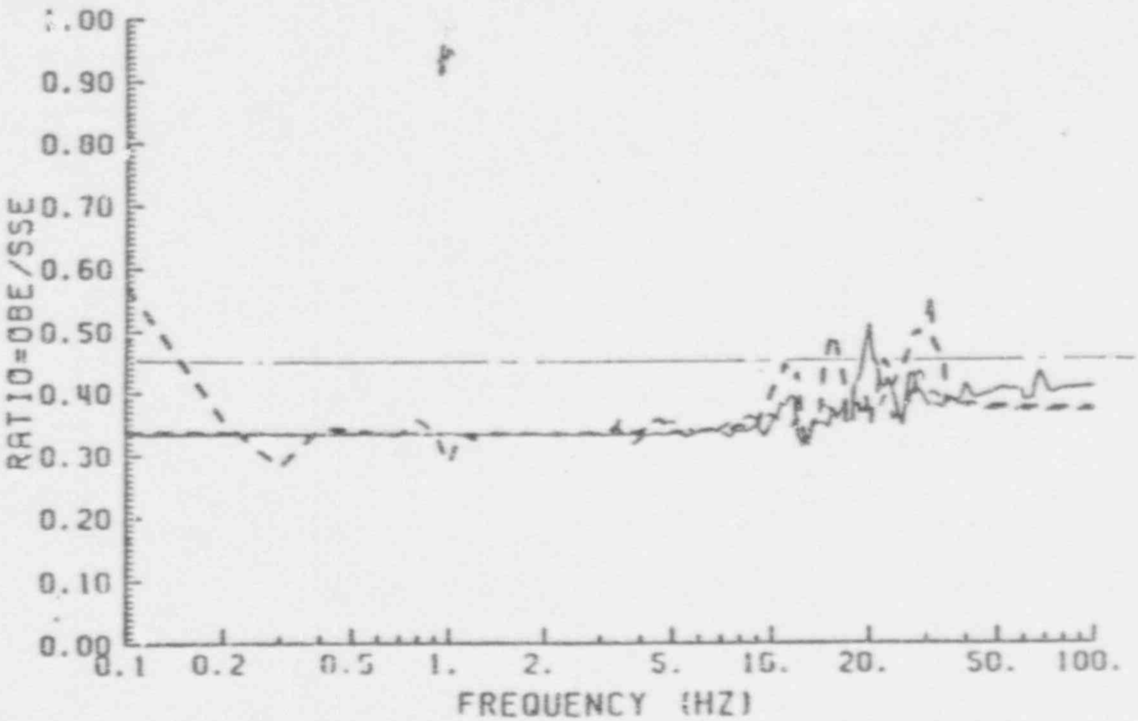
CE SYSTEM 80+ SSI OBE-SSE RATIO
DAMPING=2 PER CENT. NODE 210 X-DIR
SOLID=FIXED-BASE, DASH=A3.5, DOUBLE DASH=A4

OBE/SSE Spectral Ratio for 2% damping
(IS, Node 210, 0-180 Direction)



OBE/SSE Spectral Ratio for 2% damping
(IS, Node 210, 90-270 Direction)

SYSTEM 80+™



CE SYSTEM 80+ SSI OBE-SSE RATIO
DAMPING=2 PER CENT, NODE 210 Z-DIR
SOLID=FIXED-BASE, DASH=B3.5, DOUBLE DASH=B4

OBE/SSE Spectral Ratio for 2% damping
(IS, Node 210, Vertical Direction)

SYSTEM 80+™

Structure	Direction	Factor(s)
PGC Foundation	X, Y, Z	0.4 (all frequencies)
IS (all elevations)	X, Y, Z	0.45 (all frequencies)

OBE/SSE RESPONSE FACTOR FOR PEAK GROUND ACCELERATION FACTOR OF 1/3

4/22/92

DISTRIBUTION SYSTEMS

DESIGN GUIDE

System 80+

Piping Level Of Detail For Design Certification

- BACKGROUND
  - RAI's
  - November NRC Meeting
  - February NRC Meeting

LEVEL OF DETAIL FOR PIPING DESIGN

With The Benefit Of Detailed Design And Analysis Of The Piping Layout, Leak Before Break Evaluations, Pipe Break Analyses and Pipe Whip Restraint Design Are Subject To Revision.

Detailed Piping Evaluations Are Not Appropriate At The Design Certification Stage Because The Meaningfulness And Finality Of The Evaluations Depend On Specific, Detailed Parameters Of The Final Design Or Of As-Builts:

- Fatigue Evaluations
- Stress Surveys To Determine Pipe Break Locations
- Determination Of Locations And Design Of Pipe Whip Restraints
- Leak Before Break Evaluations

Response Approach To Piping Design Level-Of-Detail RAI's

- Preparation Of A Distribution Systems Design Guide
- Preliminary Analyses

Distribution Systems Include;

- Piping
- HVAC Ductwork
- Cable Tray/Conduit

Preparation Of A Distribution Systems Design Guide

This Document Will Provide A Guide For:

- Design Considerations
- Interface Considerations
- Routing guidelines
- Analyses Requirements

SYSTEM 80+™ STANDARD PLANT DESIGN
DISTRIBUTION SYSTEMS DESIGN GUIDE

OUTLINE

The Document Will Further Develop The Criteria Currently in CESSAR-DC Guidelines For Performing Detailed Design And Analysis Of Distribution Systems

The Document will Include Guidelines For Consideration Of Interaction Effects Between Piping And Other Systems And Concerns Such As:

- Arrangements
- HVAC
- Piping-Electrical Interface Requirements
- Constructability
- Fire Protection
- Inservice Inspection and Testing
- Radiation Shielding
- Flooding
- ALARA

Preparation Of Preliminary Analyses

Main Steam Line

Feedwater Economizer Line

Direct Vessel injection Line

Shutdown cooling Drop Line

Surge Line

Main Loop

Schedule

Preliminary Analysis Section Of Distribution Systems Design Guide (Section 7.0)

April 30, 1992

Preliminary Distribution Systems Design Guide

July 30 , 1992

Preliminary Piping Analyses

August 31, 1992

Sample HVAC And Cable Tray Analyses

August 31, 1992

Sample Analysis Specifications

August 31, 1992

4/22/92

SYSTEM 80+™ STANDARD PLANT DESIGN
DISTRIBUTION SYSTEMS DESIGN GUIDE

OUTLINE

Section	Subject
1.0	PURPOSE
2.0	SCOPE
3.0	INTRODUCTION
4.0	DISTRIBUTION SYSTEMS DESIGN CONSIDERATIONS
4.1	GENERAL
4.1.1	SYSTEM REQUIREMENTS

- Safety Classification
- Seismic Classification
- Redundancy/Diversity Requirements
- Separation Requirements
- Capacity Requirements
- Connectivity

Section	Subject
4.2	PIPING
4.2.1	SYSTEM REQUIREMENTS
4.2.1.1	Fluid System Functional Requirements

- Cooling
- Storage
- Purification
- Monitoring

OUTLINE (Cont'd)

Section	Subject
4.2.1.2	Performance Requirements

- Capacity/Flowrate Requirements
- Design Pressure and Temperature
- Piping Layout Requirements
- Instrumentation Requirements (Instrument taps and upstream/downstream piping requirements)
- Water Chemistry Requirements
- Material Selection (Erosion/corrosion susceptibility)

4.2.1.3 Constraints

- Friction Loss (L/D limits)
- NPSH
- Maximum Velocity Based on Noise, Friction Loss and Erosion
- ALARA
- Water/Steam Hammer Prevention

4.2.2 INTERFACING SYSTEM REQUIREMENTS

- Backup Water Supply
- Cross-Connections
- Electrical Requirements
- Steam Supply
- Interfacing System Layout Requirements

4.2.3 HAZARD PROTECTION

4.2.3.1 Fire Protection

- Fire Barriers Between Redundant Components
- Sprinkler System Requirements
- Standpipe System Requirements
- Water Spray Layout Requirements
- Drainage, Collection, and Impounding Requirements for Discharged Water
- Inadvertent Water Intrusion Prevention

Section	Subject
4.2.3.2	Flooding Protection

- Flooding Prevention
- Sump Pump Redundancy
- Sump Hi-Level Alarms
- Potential Flooding Sources
  - Tanks
  - Fire Protection Piping
  - Moderate Energy Piping
- Flooding Isolation
  - Flood Doors
  - Curbs
  - Division/Quadrant Separation

4.2.4 INSPECTION AND TESTING REQUIREMENTS

4.2.4.1 Examination Requirements

- Preoperational (NDE)
- Inservice Inspection (ISI)
- Visual Inspection of Raw Water Piping
- Pipe Wall Thinning Inspections

4.2.4.2 Testing Requirements

- Preoperational (Hydrostatic, operability, pre-critical vibration monitoring)
- Pump and Valve Inservice Testing (IST)
- Leak Tests
- Test Process (Designing test connections/ locations to conform to test process)
- Flushing Requirements

4.2.4.3 Accessibility Provisions

- Clearance for Inspection Equipment
- Pipe Spacing
- Pipe Clearance
- Pipe Chases
- Spool Pieces
- Removable Insulation
- Manway Access for Internal Inspections
- Penetrations

OUTLINE (Cont'd)

Section	Subject
4.2.4.4	Testing Provisions • Accessibility • High Point Vents • Low Point Drains • Bypass/Isolation Provisions • Instrumentation • Full-flow Pump Testing
4.2.5	MAINTENANCE PROVISIONS
4.2.5.1	Bypass/Isolation Provisions
4.2.5.2	Accessibility
4.2.5.3	Vent and Drain Connections
4.2.5.4	Removable Insulation
4.2.5.5	ALARA • System/Equipment Specifications • Sloped Piping • Butt Welded Piping • Crud Trap Minimization
4.3	HVAC DUCTWORK
4.3.1	SYSTEM REQUIREMENTS

4.3.1.1	Functional Requirements
	• Moisture Removal
	• Radioactive Particulate Removal
	• Ventilation
	• Temperature/Humidity Control
	• Pressure Control
	  · Positive
	  · Negative
	• Smoke Removal

OUTLINE (Cont'd)

Section	Subject
4.3.1.2	Air Quantities • Heat Loads · Equipment Heat Generation · Area/Volume Served • Air Change Rate
4.3.1.3	Equipment Selection • Seismic Consideration
4.4	ELECTRICAL CABLE TRAYS/CONDUIT
4.4.1	SYSTEM REQUIREMENTS
4.4.1.1	Equipment Selection • Class 1E/Non-Class 1E • Voltage • Power Rating • Control System Requirements
4.4.1.2	Environmental Requirements • Temperature • Humidity • Radioactivity • Hazardous Environment • Corrosive Environment • Non-Combustible Materials • Inside Environment • Outside Environment • Seismic Requirements
4.4.1.3	Separation Requirements • Physical Separation · Fire Protection • Electrical Separation · Segregation of Voltage Levels · Safety Channels · Safety/Non-Safety

Section	Subject
5.0	**DISTRIBUTION SYSTEMS INTERFACE CONSIDERATIONS**
5.1	GENERAL
5.1.1	SUPPORTABILITY • Seismic/Non-Seismic Considerations • Proximity to Support Structures (Walls, Columns, Ceilings, etc.) • Baseplate Provisions
5.2	PIPING
5.2.1	EQUIPMENT LOCATIONS • Connectivity • Accessibility • Curbs and Raised Base Pads • Labyrinths • Pull Space/Provisions
5.2.2	BUILDING/STRUCTURAL CONSIDERATIONS
5.2.2.1	Divisional/Quadrant Separation
5.2.2.2	Connectivity
5.2.2.3	Elevation Relationships • NPSH • Drains • Sumps
5.2.2.4	Containment of Hazardous Materials • Curbs • Overflow Provisions
5.2.3	PIPE SLEEVES
5.2.3.1	Locations • General • Core Drill
5.2.3.2	Configurations

Section	Subject
5.2.7.3	Evaluation of Water Spray Effects • Requirements • Damage Assessment · Equipment · Instrumentation · Valves
5.2.7.4	Flooding Prevention/Protection • Division/Quadrant Separation • Pipe Routing • Equipment Locations • Sump Pump Redundancy • Sump Hi-Level Alarms • Other Alternatives · Component Qualification · Spray Shields
5.2.7.5	Flooding Isolation • Flood Doors • Curbs
5.2.8	FIRE PROTECTION
5.2.8.1	Guidelines • Plant Layout Using Structure for Fire Barriers • Single Failure Criteria • Standpipe System • Fire Protection Sprinkler System • Fire Protection Valves • Hose Reel Cabinets • Fire Seals · Boot Seal · Fire Seal Foam • Smoke Detection • Drains • Seismic Requirements for Hose Standpipe System • Flushing and Testing Provisions

OUTLINE (Cont'd)

OUTLINE (Cont'd)

Section — **Subject**

5.2.11.2 Interaction Analysis

- Non-Seismic Cable Tray and HVAC Duct
- Hangers
- Mechanical Connections
- Rigid Constraint
- Piping Area of Influence
- Cascade and Rebound
  - Arrest
- Seismic/Non-Seismic Interfaces

5.2.11.3 Targets

5.2.11.4 Damage Assessment

- Pipe
- Valves
- Electrical Equipment and Instrumentation
- Mechanical Equipment

5.2.11.5 Protection

- Piping Rerouting
- Classification of Pipe Supports
- Deflector Shields
- Impact Analysis

5.2.12 POSTULATED PIPE BREAKS (See Section 7.2.2.2)

5.3 HVAC DUCTWORK

5.3.1 HVAC EQUIPMENT LOCATIONS

5.3.1.1 Space Limitations

5.3.1.2 Power Provisions

5.3.1.3 Water Supply/Drain Provisions

5.3.1.4 Accessibility

- Equipment Removal
- Maintenance
- Access for Filter Changeout
- Leakage Tests

OUTLINE (Cont'd)

OUTLINE (Cont'd)

Section	Subject
6.0	**DISTRIBUTION SYSTEMS ROUTING GUIDELINES**
6.1	GENERAL
6.1.1	PIPING/DUCTWORK/CABLE TRAY RELATIVE ELEVATIONS
6.1.2	DIVISIONAL AND QUADRANT SEPARATION
6.1.3	STANDARD COMPONENTS
6.1.4	CONSTRUCTABILITY
6.1.4.1	Tolerances
6.1.4.2	Standard Components • Piping • Fittings • Valves • Pipe Supports • Pipe Support Materials • Fans • Dampers • Cable • Electrical Components
6.1.4.3	Accessibility • Clearance • Testing Provisions
6.1.4.4	Interferences
6.1.5	SEGREGATION • Seismic/Non-seismic • Radioactive/Non-radioactive Piping

OUTLINE (Cont'd)

Section	Subject
6.2	PIPING
6.2.1	EQUIPMENT CONSIDERATIONS
6.2.1.1	Equipment Arrangement

- Accessibility
- Pull Space
- Maintenance

6.2.1.2	Connecting Piping Requirements

- Nozzle Loads
- End Connections
- Interface Requirements With Other Equipment
- Heat Tracing
    - Requirements
    - Steam Tracing of Pipelines
    - Electrical Pipe Heating

6.2.2	VALVES
6.2.2.1	Valve Location Considerations

- Fittings/Arrangement
    - Line Valves
    - Butterfly Valves (36"-up)
    - Control Valves

- Maintenance
    - Location Requirements
    - Removal Requirements
    - Valve Type
        - Gate Valve
        - Globe Valve
        - Check Valve
        - Plug Valve
        - Butterfly Valve
        - Diaphragm Valve
        - Ball Valve
        - Pressure Relief Valve
        - Control Valve
        - Solenoid Valve
        - Pressure Seal Valve

- Operability
- Accident Accessibility

Section	Subject
	• Steam Pipe Condensate Removal • Equipment Proximity
6.2.2.2	Orientation Considerations

- Valve Type
  - Gate Valve
  - Globe Valve
  - Check Valve
  - Plug Valve
  - Butterfly Valve
  - Diaphragm Valve
  - Ball Valve
  - Relief Valve
  - Safety Valve
  - Safety-Relief Valve
  - Control Valve
  - Solenoid Valve

- Valve Body
- Operator
  - Electrohydraulic
  - Electric Motor Operated (EMO)
  - Chain Wheel Operators
  - Pneumatic Piston Operators

- End Connections
- Manufacturer's Instructions
- Valve Function
  - Gate Valve
    - Solid Wedge
    - Flex-Wedge and Split Wedge
    - Double Disc
    - Conduit
  - Globe Valve
    - Horizontal Globe
    - Y-Globe
    - Angle Globe
    - Y-Angle Globe
  - Check Valve
    - Swing Check
    - Lift Check
    - Tilting Disc Check
  - Plug Valve
  - Butterfly Valve
  - Diaphragm Valve
  - Ball Valve
  - Relief Valve

OUTLINE (Cont'd)

Section	Subject
	· Safety Valve · Safety-Relief Valve · Control Valve · Solenoid Valve
6.2.2.3	Seismic Interaction
6.2.2.4	Water/Steam Hammer Prevention
	• Valve Specifications (operating time)
6.2.3	SUPPORT GUIDELINES
6.2.3.1	General Guidelines
	• Grouping and Locations • Clearances • Piping
6.2.3.2	Piping Design by Alternate Analysis
	• General Guidelines • Gravity Support Considerations · Equipment Nozzle · Support Locations · Hanger Spacing · Hanger Span Length · Hydrostatic Testing Provisions For Steam Piping • Seismic Considerations
6.2.3.3	Piping Design by Rigorous Analysis
	• Seismically Supported Pipe • Vertical Supports · Support Locations · Concentrated Loads · Equipment Connections · Terminal Ends · Vertical Piping · Without Lugs • Lateral Supports (seismic) · Concentrated Loads · Support Spacing · Equipment Nozzles

Section	Subject
	• Non-Seismically Supported Pipe • LBB Considerations (See Section 7.2.2.1)
6.2.3.4	Gang Support Criteria
	• Gang Supported Pipe • Routing Gang Supported Pipe
6.2.4	ALARA
6.2.4.1	General
	• Minimization of Time Required in Radiation Area • Maximize Distance Between Source and Personnel • Adequate Shielding • Source Control • Minimize Low Points and Dead Leg Crud Traps
6.2.4.2	Radioactive Pipe Routing

	• Radiation Zones/Personnel Areas
	• Fluid Radiation Intensity
	  · Reactor Coolant Prior to Processing
	    · Pipe Area
	    · Pipe Configuration
	  · Spent Resins
	    · Pipe Area
	    · Pipe Configuration
	  · Diluted and Processed Fluid
	    · Pipe Area
	    · Pipe Configuration
	  · Concentrates
	    · Pipe Area
	    · Pipe Configuration
	  · Post LOCA Fluid
	    · Pipe Area
	    · Pipe Configuration
	• Field Routing

OUTLINE (Cont'd)

Section	Subject
6.2.4.3	Sleeve And Opening Location

- Sleeve Selection
- Scattering Considerations
- Streaming Considerations

6.2.4.4	General Plant Arrangement

- Additional Shielding for High Radiation Components
  - Ion Exchangers
  - Filters
- Labyrinths
- Sleeves
- Isolation of Components
- Pipe Chases
- Sampling Rooms
- Curbing Around Tanks Containing Radioactive Liquid or Slurries

6.2.4.5	Maintenance Considerations

- Vendor-Specified Removal Space
- Accessibility
- Equipment Separation in Compartments
- Non-Radioactive Piping and Components
- Shielding Between Redundant Radioactive Equipment
- Direct Drive Fans

6.2.4.6	Valve Shielding

- Valve Locations in Shielded Areas
- Valve Galleries
- Valve Operator Rooms
- Reach Rod Valve Operators
- Remote Valve Operators

6.2.4.7	Mechanical Components

- Pumps
  - Low Points
  - Leakage
- Heat Exchangers
- Demineralizers
- Tanks

OUTLINE (Cont'd)

Section	Subject
	• Evaporators/Concentrators • Strainers • Filters • Valves
6.2.4.8	Protection
	• Pipe Routing · Radiation Zone Violation · Streaming Problem · Crud Trap
	• Wall Construction or Relocation • Lead Shielding
6.2.5	CONSTRUCTABILITY
6.2.5.1	Standard Components
	• Piping • Fittings • Valves • Pipe Supports • Pipe Support Materials
6.2.5.2	Pipe Assembly
	• Cold Spring • Banked Piping Assemblies · Construction Supported Piping · Pipe in Trenches · Elevations
	• Pipe Bends · Radius Bends · Sloped Pipe · · Socket Weld Pipe · · Butt Weld Pipe · · Arced Pipe · General Bends · · Bend Design · · Bend Deflection

OUTLINE (Cont'd)

OUTLINE (Cont'd)

OUTLINE (Cont'd)

Section	Subject
6.2.10	THERMAL STRATIFICATION MINIMIZATION • Valve Specification • Long Horizontal Runs of Pipe
6.3	HVAC DUCTWORK
6.3.1	GENERAL GUIDELINES
6.3.1.1	Plant Arrangement • Reserve Space for Ductwork Early in Design Process • Minimize Duct Length · Equipment Placement · Utilize Pressure Differential to Eliminate Ductwork
6.3.2	HVAC DUCT DESIGN • System Requirements (See Section 4.3) • Space Limitations • Friction Loss • Velocity Constraints • Sound Level Constraints • Heat/Leakage Losses and Gains
6.3.3	IN-LINE COMPONENT PLACEMENT
6.3.3.1	Standard Components • Fans • Dampers • Ductwork • Supports
6.3.3.2	Access Doors For Inspection or Service of Dampers
6.3.3.3	Adequate Space For Damper Operators and Damper Maintenance
6.3.3.4	Fire Dampers

OUTLINE (Cont'd)

Section	Subject
6.3.4	ALARA • Penetration Design • Exhaust Systems • Utilization of Negative Pressure
6.3.5	SUPPORTS • Seismic • Non-Seismic
6.4	ELECTRICAL CABLE TRAYS/CONDUIT
6.4.1	CABLE TRAYS
6.4.1.1	Types • Safety-Related • Permanent Non-Safety Related • Non-Safety Related
6.4.1.2	Locations • Space Allocation • Space Limitation Constraints • Accessibility for Cable Pulls
6.4.1.3	Separation • Divisional Separation • Fire Protection • Cable Segregation by Voltage Levels
6.4.1.4	Material Limitations • No Aluminum Cable Trays in Containment due to Hydrogen Generation Potential
6.4.2	CONDUIT
6.4.2.1	Conduit Routing • Bend Radius Guidelines • Free Air Space Guidelines

<u>OUTLINE (Cont'd)</u>

Section	Subject
6.4.2.2	Separation • Divisional Separation • Fire Protection • Embedded Conduit
6.4.3	FIBER OPTIC CABLE
6.4.3.1	Applications • Fiber Optic Cable Used Where Practical · Less Interference · Less Cable Required
6.4.3.2	Restrictions • Restricted Use in Containment and Other High Radiation Areas
6.4.4	ALARA • Proximity to Radioactive Piping and Components Requiring Maintenance • Penetration Design
6.4.5	SUPPORTS • Seismic • Non-Seismic

4/22/92

SYSTEM 80+™ STANDARD PLANT DESIGN
DISTRIBUTION SYSTEMS DESIGN GUIDE

TABLE OF CONTENTS

7.3 ELECTRICAL CABLE TRAY/CONDUIT

7.3.1 GENERAL

7.3.2 DESIGN CONSIDERATIONS

7.3.2.1 Dead Weight

7.3.2.2 Seismic

7.3.3 DESIGN LOAD COMBINATIONS

7.3.4.2 Seismic Analysis

7.1.4.3.2.1.2 Response Spectrum

A response spectrum is a curve which represents the peak acceleration response verses frequency of a single degree of freedom spring mass system which is excited by an earthquake motion time history. It is a measure of how a structural system with certain natural frequencies will respond to an earthquake applied at its supports.

The response spectra curves for the System 80+ have been developed using several ground motion time history analyses. These analyses were used to cover a range of possible soil conditions. The resulting floor response spectra may be enveloped or input individually into the seismic analysis to account for the various soil cases.

Most analyses will consist of multiple supports with different characteristic response spectrum. To account for this, the applicable response spectra for all structures and elevations supporting the pipe in the dynamic model shall be enveloped to determine the response spectra for that piping.

7.1.4.3.2.1.3 Spectrum Peak Broadening

To account for possible uncertainties, the initially computed floor response spectra are usually smoothed, and peaks associated with the structural frequencies are widened. The method used to determine the amount of peak widening, associated with the structural frequency, shall be as detailed in **ASME B&PV Code, Section III, Division I, Appendix N, Section N-1226.3**.

7.1.4.3.2.1.4 Damping

Damping values are provided in **CESSAR-DC Section 3.7.1.3** and are summarized below;

	OBE	SSE
Piping diameter ≤ 12"	1%	2%
Piping diameter > 12"	2%	3%

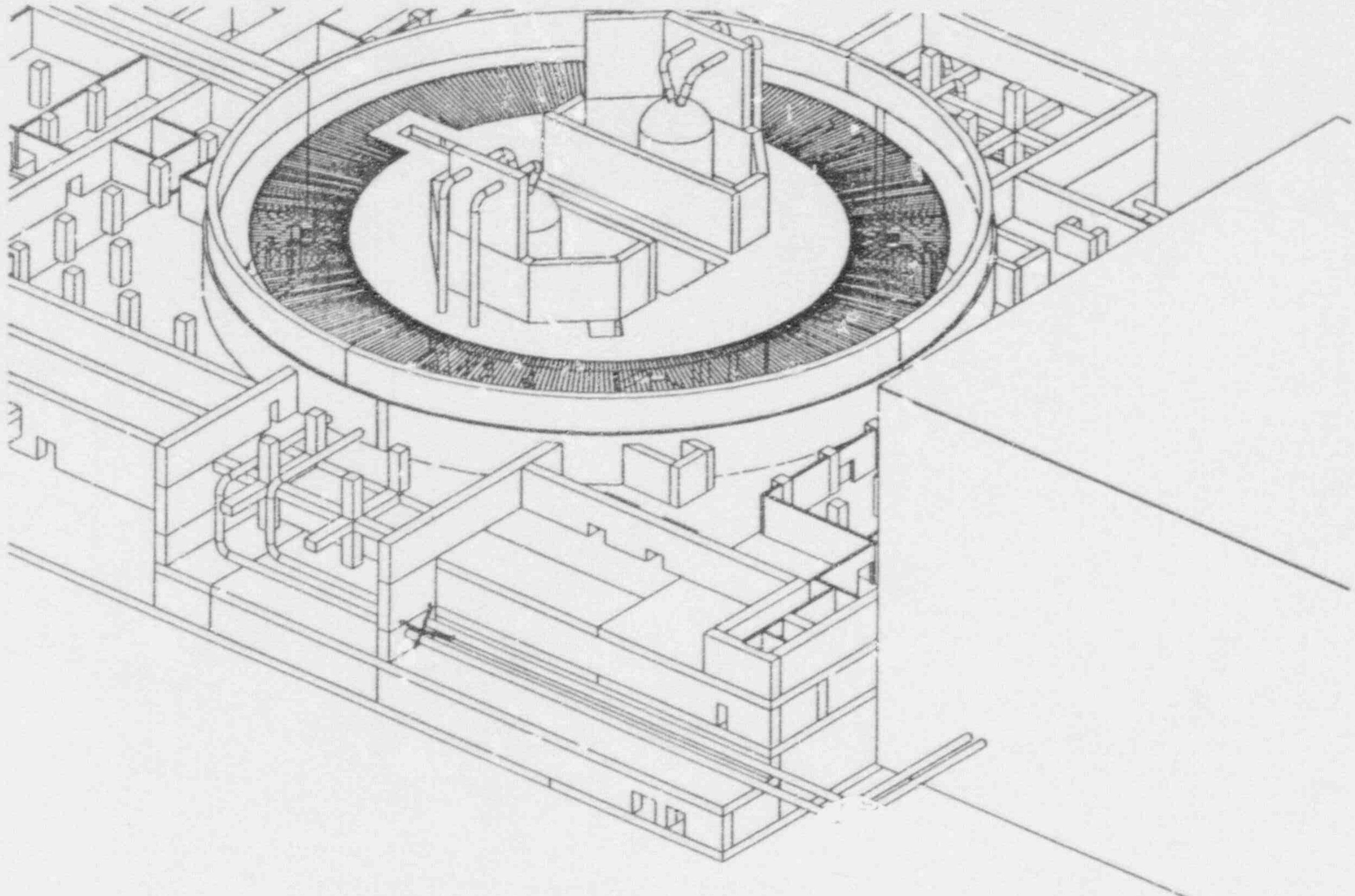
Alternately, when using response spectra analyses, variable damping values per **ASME Code Case N-411-1 "Alternative Damping Values for Response Spectra Analysis of Class 1, 2, and 3 Piping, Section III, Division I"** is acceptable. However, no combination of the two damping criteria is to be used. The variable damping curve is provided in **CESSAR-DC Table 3.7-41**.

TABLE 7.1-3

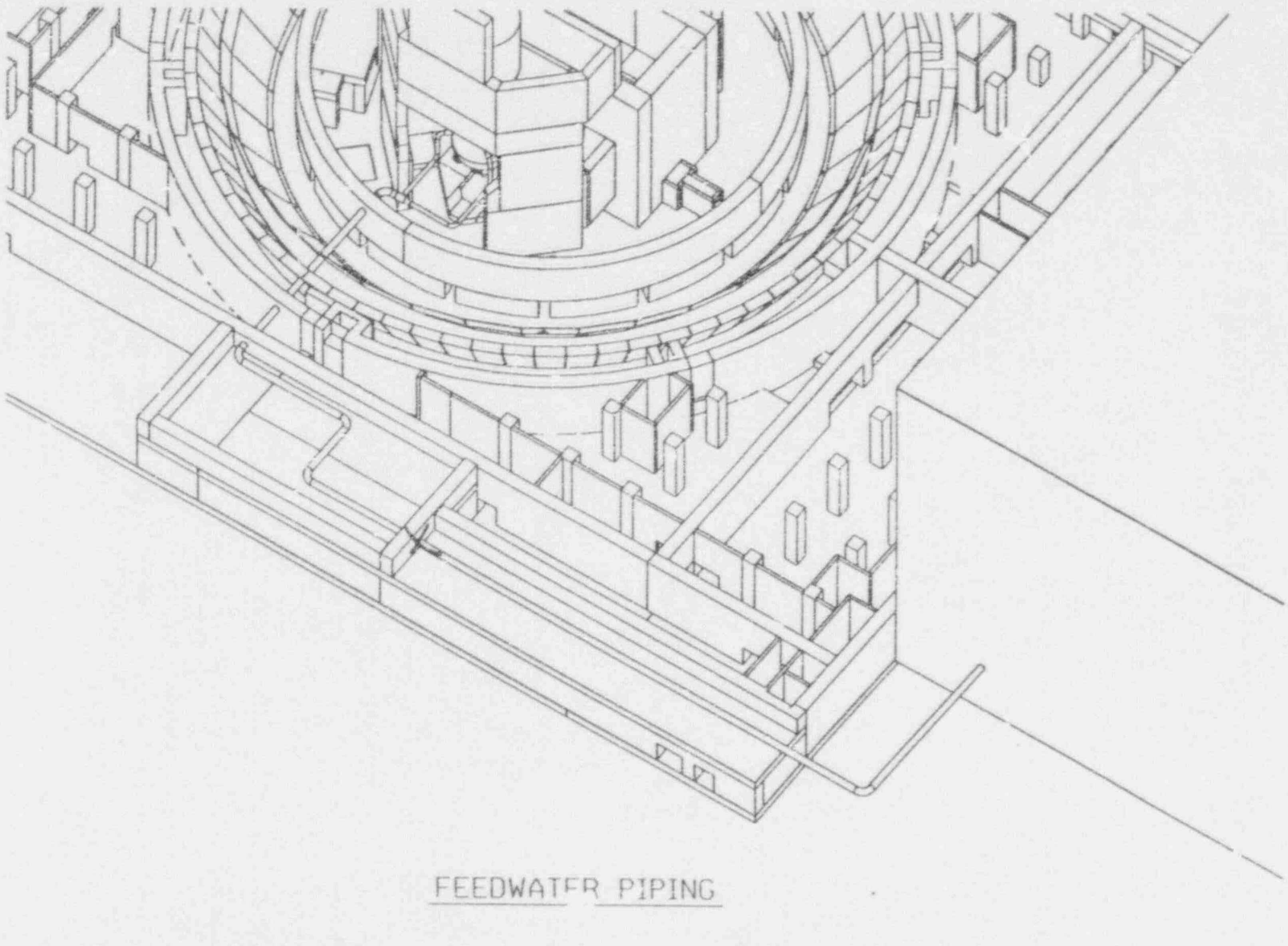
Design Conditions, Load Combinations, and Code Compliance Criteria for ASME Class 2 and 3 Piping

CONDITION	LOADS	CHECK FOR CODE COMPLIANCE PER (7)	ALLOWABLE
1. Normal			
a. Sustained Loads (4)	Pressure Weight (6)	Eq.8, NC/ND 3652	$1.5S_h$
b. Thermal Expansion	Thermal Expansion Thermal Anchor Movements	Eq.10, NC/ND 3653.2	S_A (3)
c. Thermal Expansion + Sustained Loads	Thermal Expansion Thermal Anchor Movements Pressure Weight (6)	Eq.11 NC/ND 3653.2	$S_h + S_A$ (3)
2. Upset	Pressure Weight (6) OBE (Inertia) OBE (Anchor Movements) (1) DFL (2)	Eq.9, NC/ND 3653.1	$1.8\ S_h$ but $\leq 1.5\ S_Y$
3. Emergency	Pressure Weight (6) DFL (2)	Eq.9, NC/ND 3652.1	$2.25\ S_h$ but $\leq 1.8\ S_Y$
4. a. Faulted	Pressure Weight (6) Pipe Rupture (5) SSE (Inertia) DFL (2)	Eq.9, NC/ND 3653.1	$3.0\ S_h$ but $\leq 2.0S_Y$
b. Faulted	Pressure Weight (6) Wind/Tornado	Eq.9, NC/ND 3653.1	$3.0\ S_h$ but $\leq 2.0S_Y$
5. Functional Capability	Pressure Weight (6) SSE (Inertia) DFL (2) Pipe Rupture (5)	See Note 8	

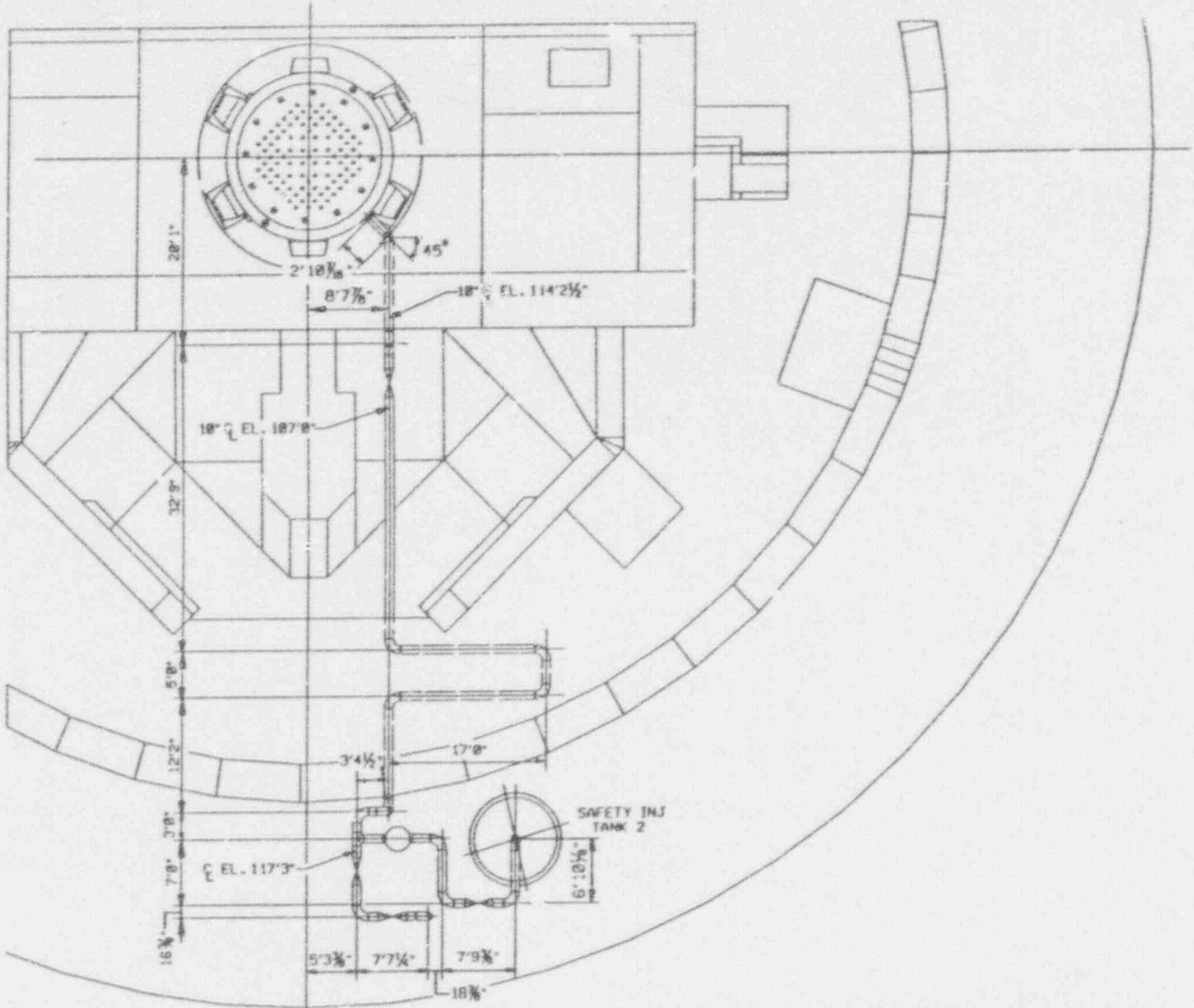
PIPING LAYOUT INSIDE AND OUTSIDE REACTOR BUILDING



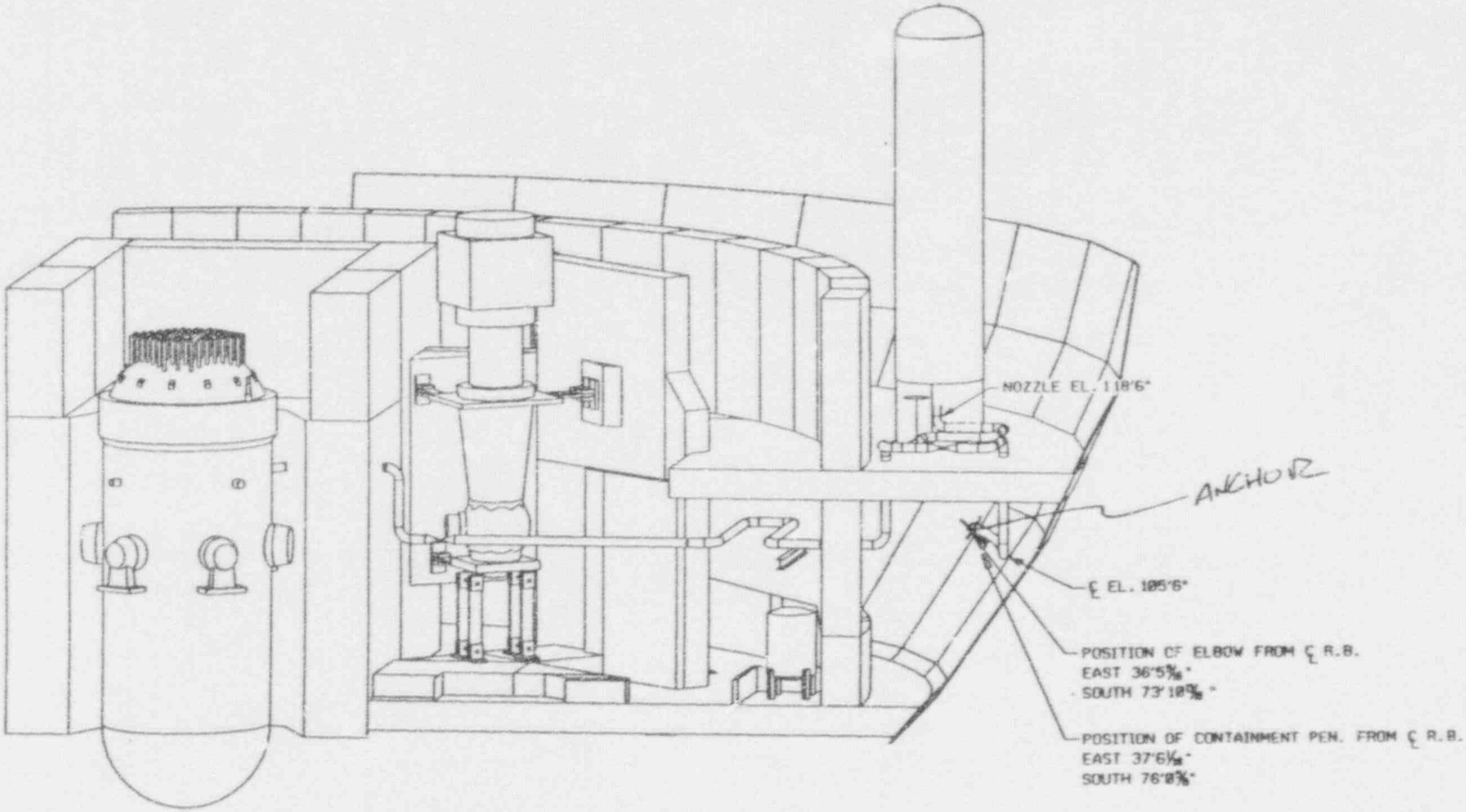
MAIN STEAM PIPING



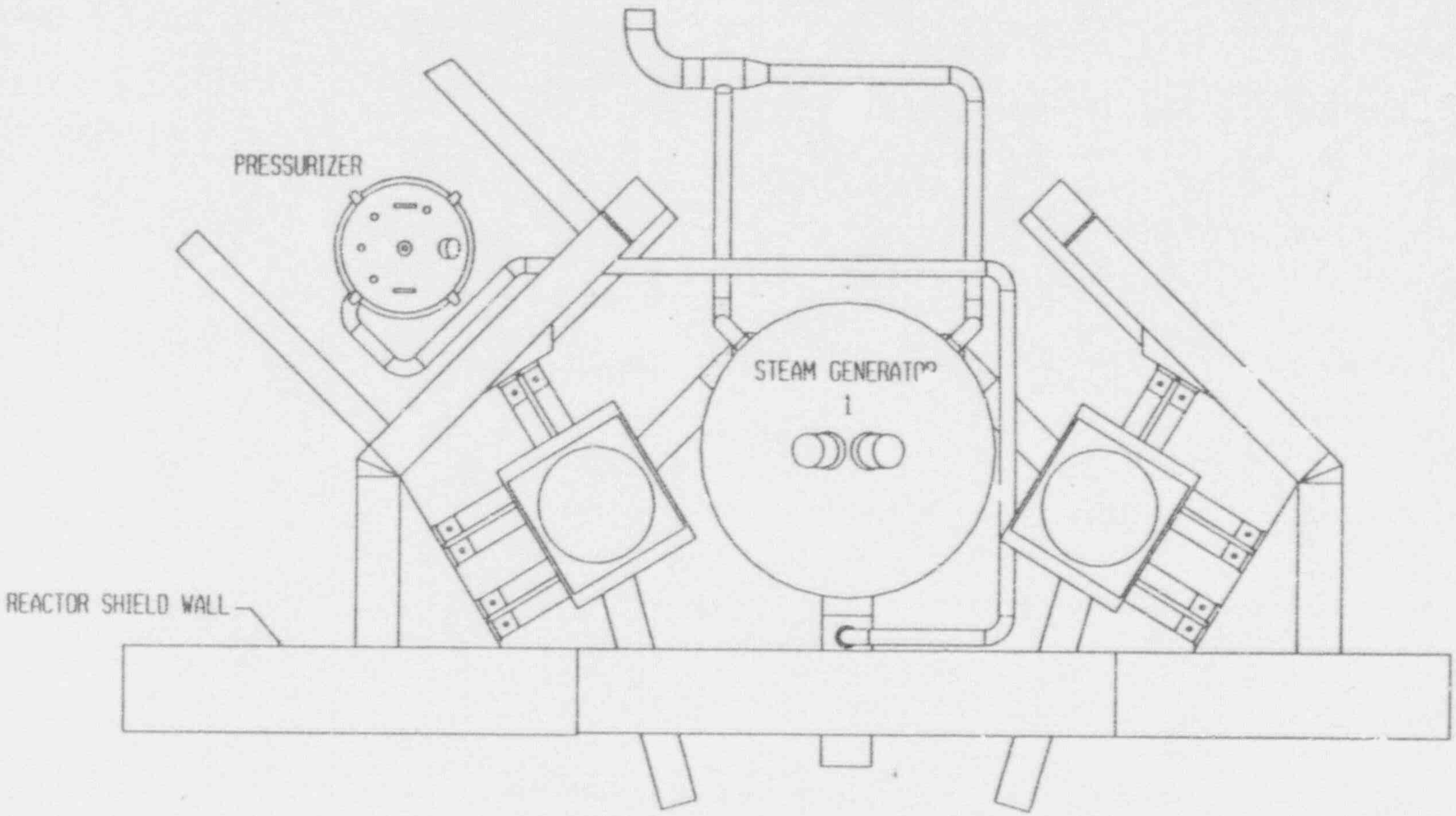
FEEDWATER PIPING



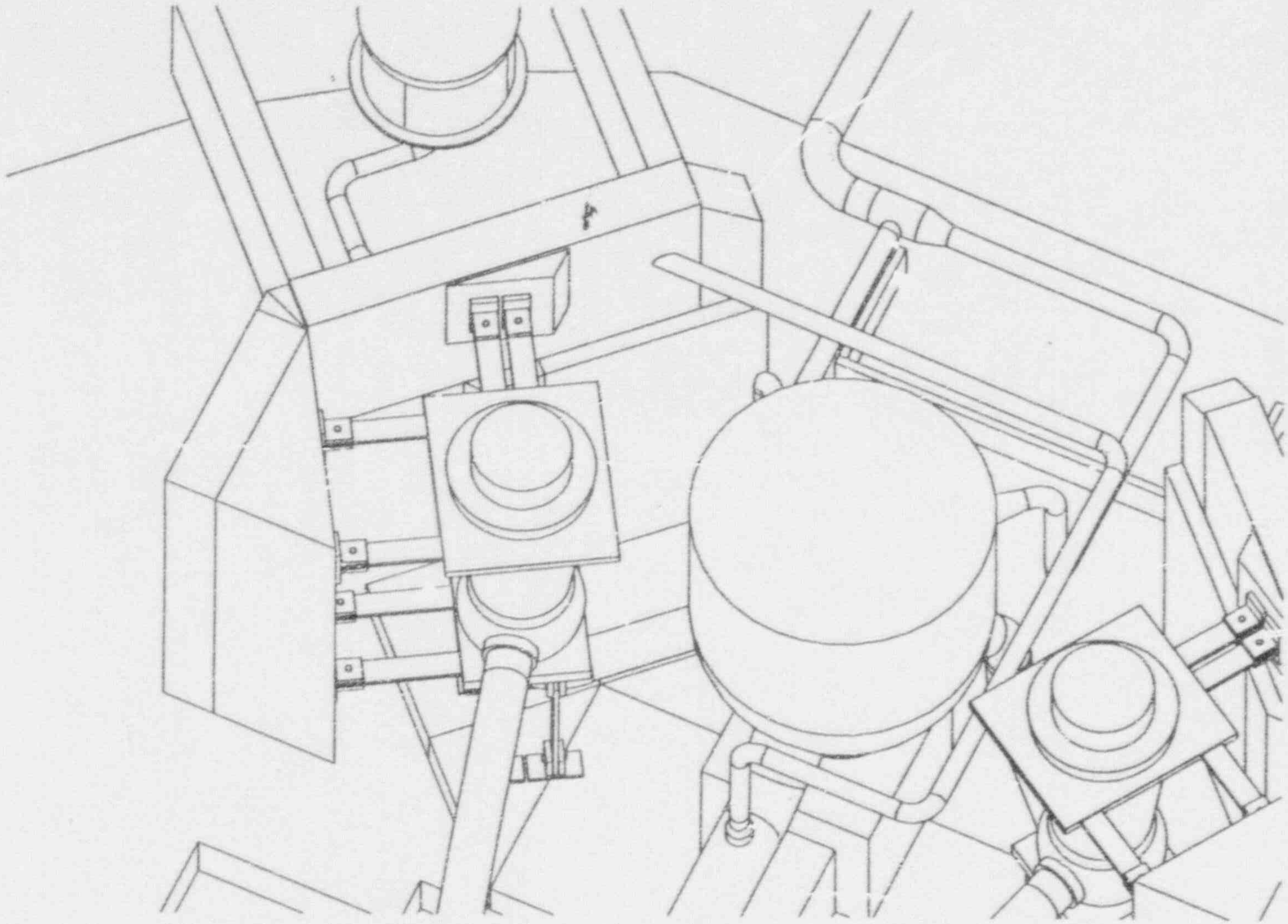
DIRECT VESSEL INJECTION PIPING



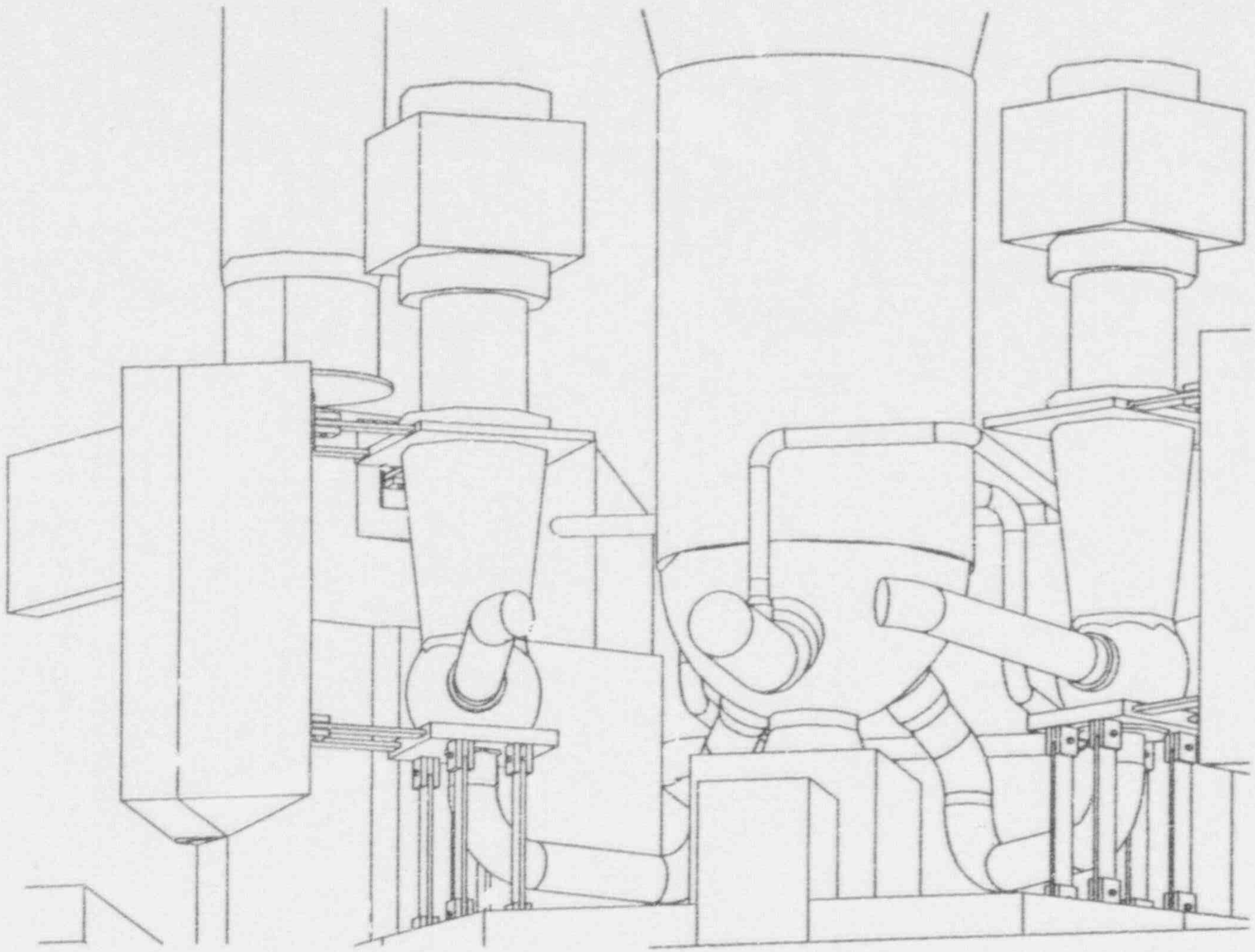
DIRECT VESSEL INJECTION PIPING



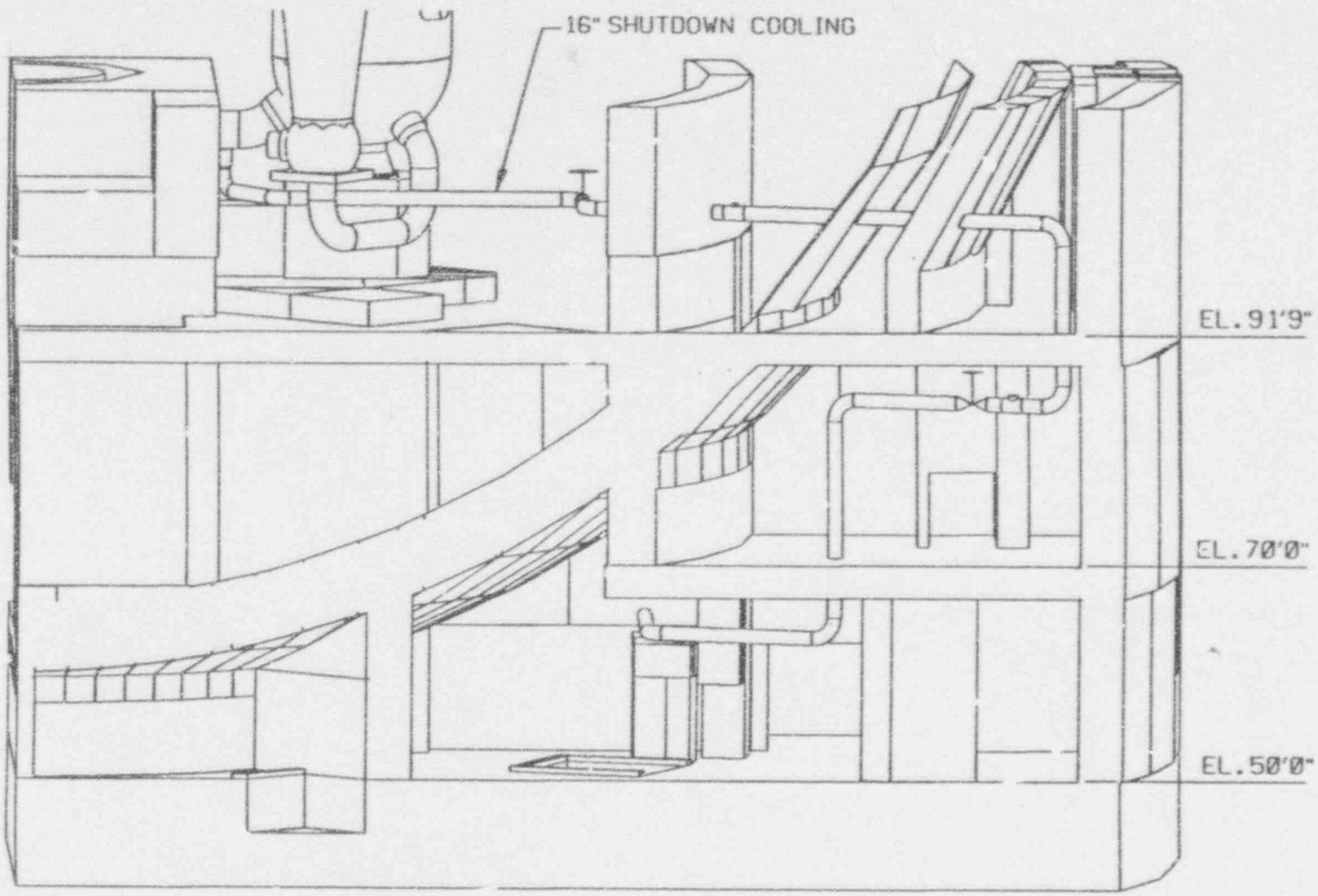
SURGE LINE PIPING



SURGE LINE PIPING



SURGE LINE PIPING



SHUTDOWN COOLING PIPING

LEAK-BEFORE-BREAK (LBB)

APPLIED TO SYSTEM 80+

PIPE LINES FOR WHICH DYNAMIC EFFECTS OF PIPE BREAKS ARE BEING ELIMINATED BY LBB

* MAIN LOOP (HOT LEG , COLD LEG) C.S. (CLAD PIPE)

* MAIN STEAM LINE C.S.

* SHUTDOWN COOLING LINE S.S.

* SURGE LINE (CAST?) STAINLESS

* DIRECT VESSEL INJECTION 316 L CORROSION REST S.S

ABB EXPERIENCE

* MAIN LOOP

* MAIN STEAM

* SURGE LINE

* BENCHMARK ANALYSIS METHOD WITH EXPERIMENTS AND EXTRAPOLATING DATA

* J-INTEGRAL BENCHMARK CALCULATIONS

BATTELLE PROGRAM

VARIABLES AFFECTING LBB EVALUATION

* MATERIALS

* ENVIRONMENT

* LEAK DETECTION CAPABILITIES

* NORMAL OPERATING LOADING CONDITIONS (NOP)

* MAXIMUM DESIGN LOADS (MDL)

    SSE

    DYNAMIC SYSTEM TRANSIENTS

    BENDING DUE TO THERMAL STRATIFICATION

(1)

EVALUATION CRITERIA

* LEAKAGE DETECTION REQUIREMENTS MUST BE SATISFIED - 1 GPM CRACK LIMIT 10 GPM

* LACK OF SUSCEPTIBILITY TO ENVIRONMENTAL DEGRADATION - SUCH AS CORROSION

* LACK OF SUSCEPTIBILITY TO MECHANICAL DEGRADATION - FATIGUE , EROSION ,WATER HAMMER

* THROUGH WALL CRACKS SIZED TO 10 GPM CRACK LENGTH MUST BE STABLE TO $\sqrt{2}$ TIMES SUM OF NOP AND MDL

* THROUGH CRACKS TWICE LENGTH OF 10 GPM CRACK MUST BE STABLE FOR NOP + MDL

LBB ANALYSIS PROCEDURE

STEPS IN TYPICAL ANALYSIS PROCEDURE

* STRESS SURVEY
* DETERMINATION OF LEAKAGE CRACK
* STABILITY ANALYSIS

LEAKAGE CRACK LENGTH

* MARGIN ON LEAK RATE DETECTION TO YIELD 10 GPM CRACK FOR NOP LOADING

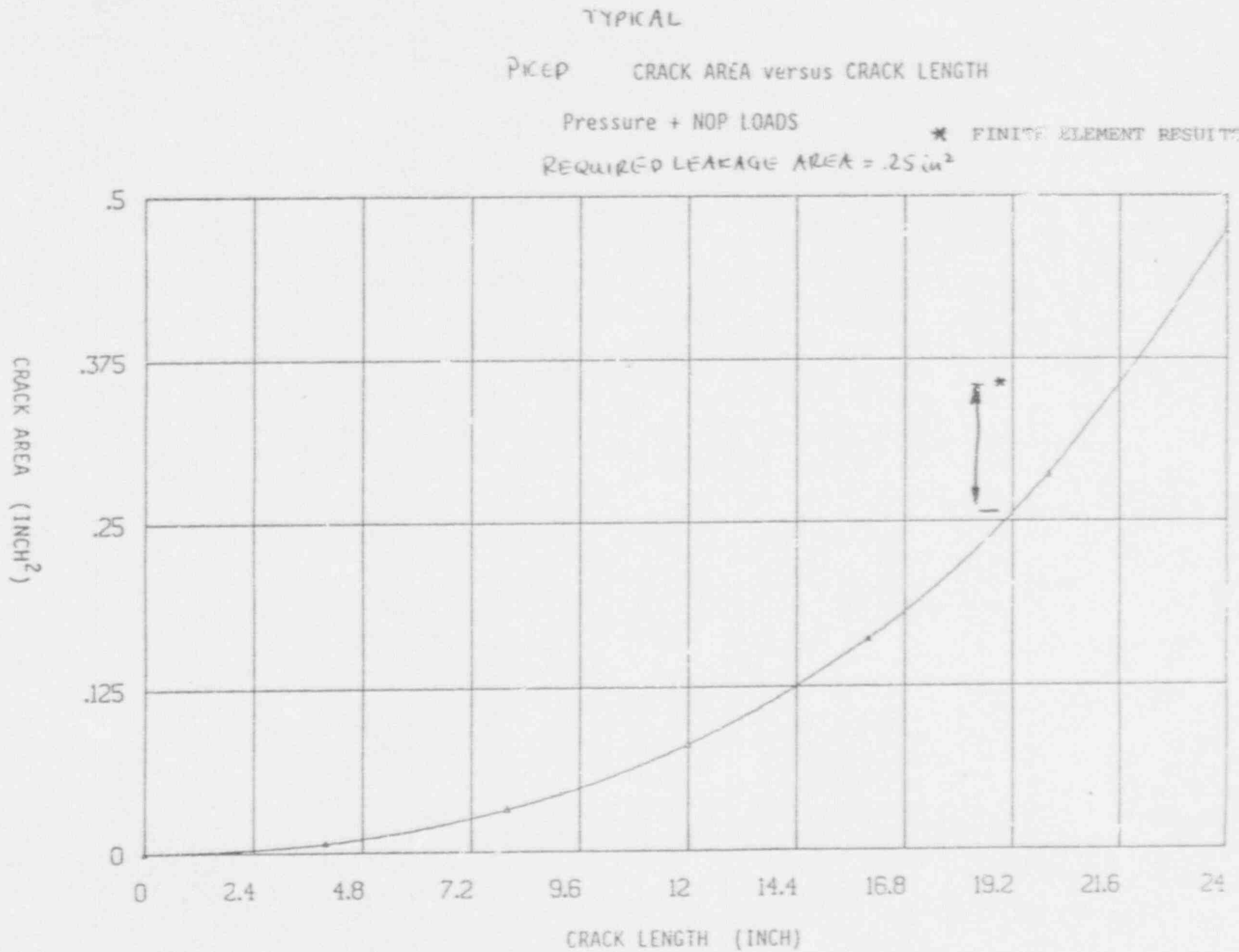
* FLOW CORRELATION - GPM FOR A GIVEN CRACK AREA : 250 GPM/IN^2 (WATER)

  EXAMPLES PRIMARY PIPING AREA = .04 IN^2
  STEAM LINE AREA = .25 IN^2

* AREA CALCULATION

  * GE ESTIMATION FOR CRACK DISP
  * PICEP
  * FINITE ELEMENT VERIFICATION TO ENSURE CONSERVATIVE RESULTS FOR ASSUMED CORRELATION FOR STABILITY CALCULATION!

I

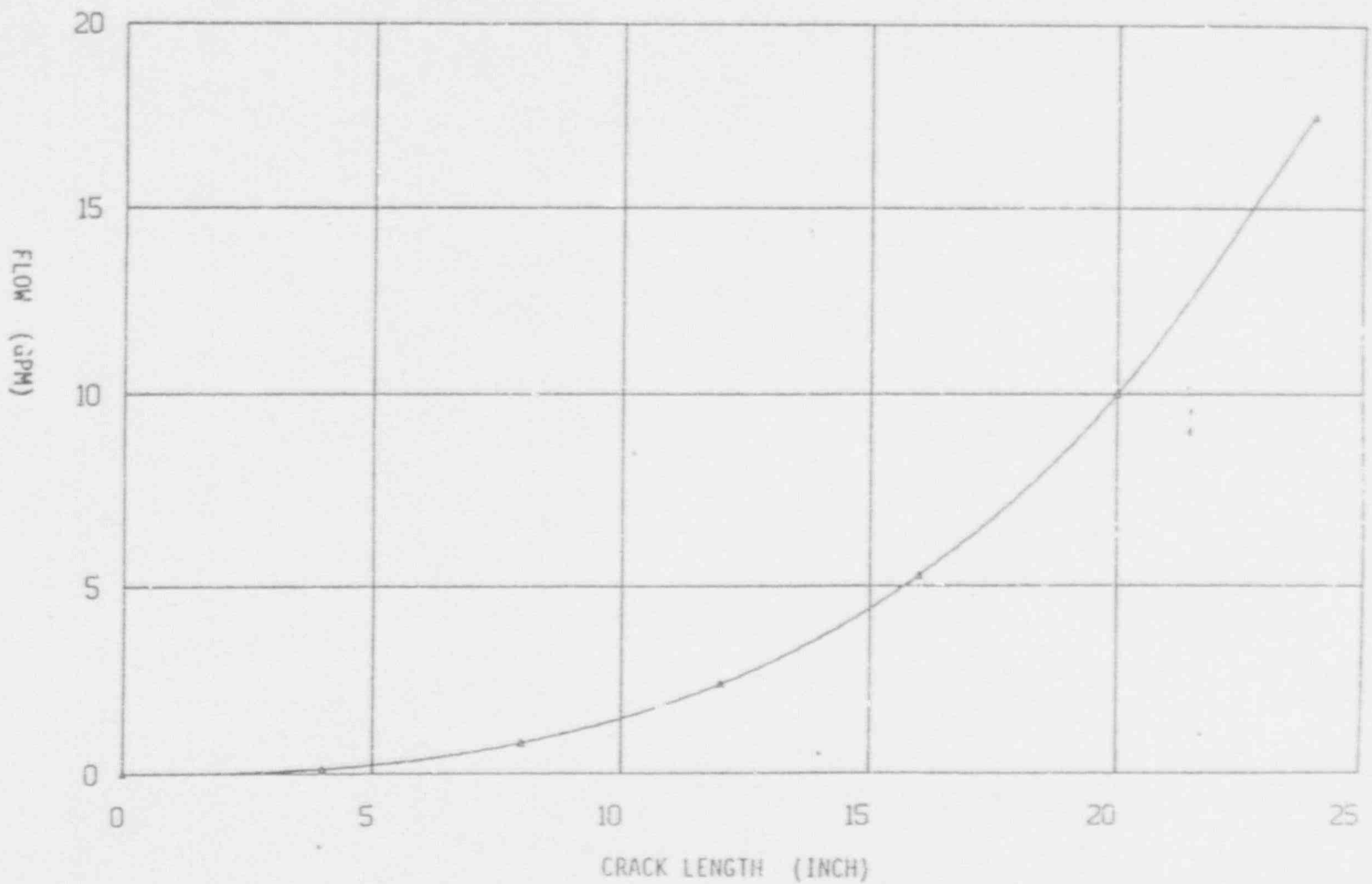


TYPICAL
PKEP CRACK AREA versus CRACK LENGTH
Pressure + NOP LOADS
REQUIRED LEAKAGE AREA = .25 in²
* FINITE ELEMENT RESULTS
CRACK AREA (INCH²)
.5
.375
.25
.125
0
0
2.4
4.8
7.2
9.6
12
14.4
16.8
19.2
21.6
24
CRACK LENGTH (INCH)

TYPICAL

$250\ gpm/in^2$ FLOW versus CRACK LENGTH

Pressure + NOP LOADS



STABILITY ANALYSIS

* NOP + MAXIMUM DESIGN LOAD (NOP + MDL)

* MARGIN ON LOAD $\sqrt{2}$ (NOP + MDL) STABLE FOR A_{LEAK} (LEAKAGE CRACK)

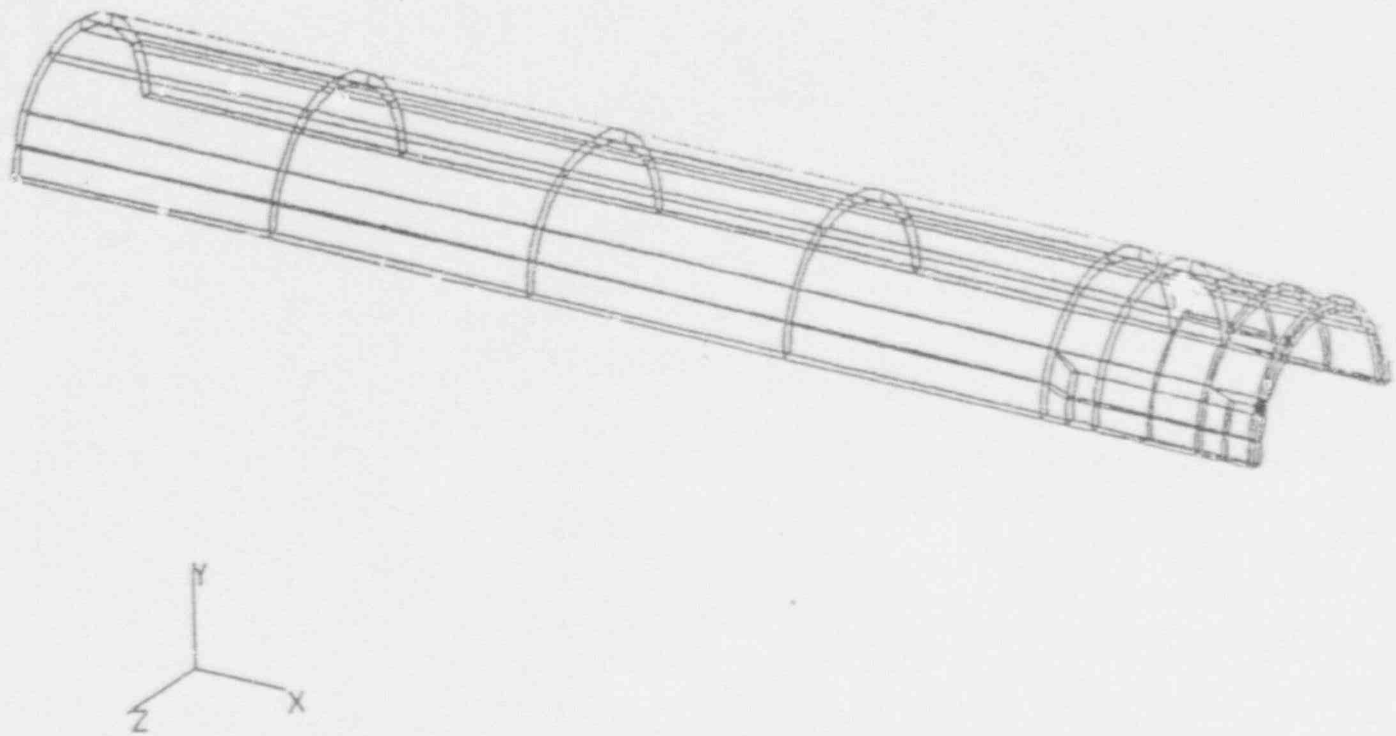
* MARGIN ON CRACK LENGTH (NOP + MDL) FOR $2xA_{LEAK}$

* STABILITY DETERMINED WITH FINITE ELEMENT ANALYSIS FOR LIMITING LOCATION USING BOUNDING MATERIAL PROPERTIES MARK PROGRAM

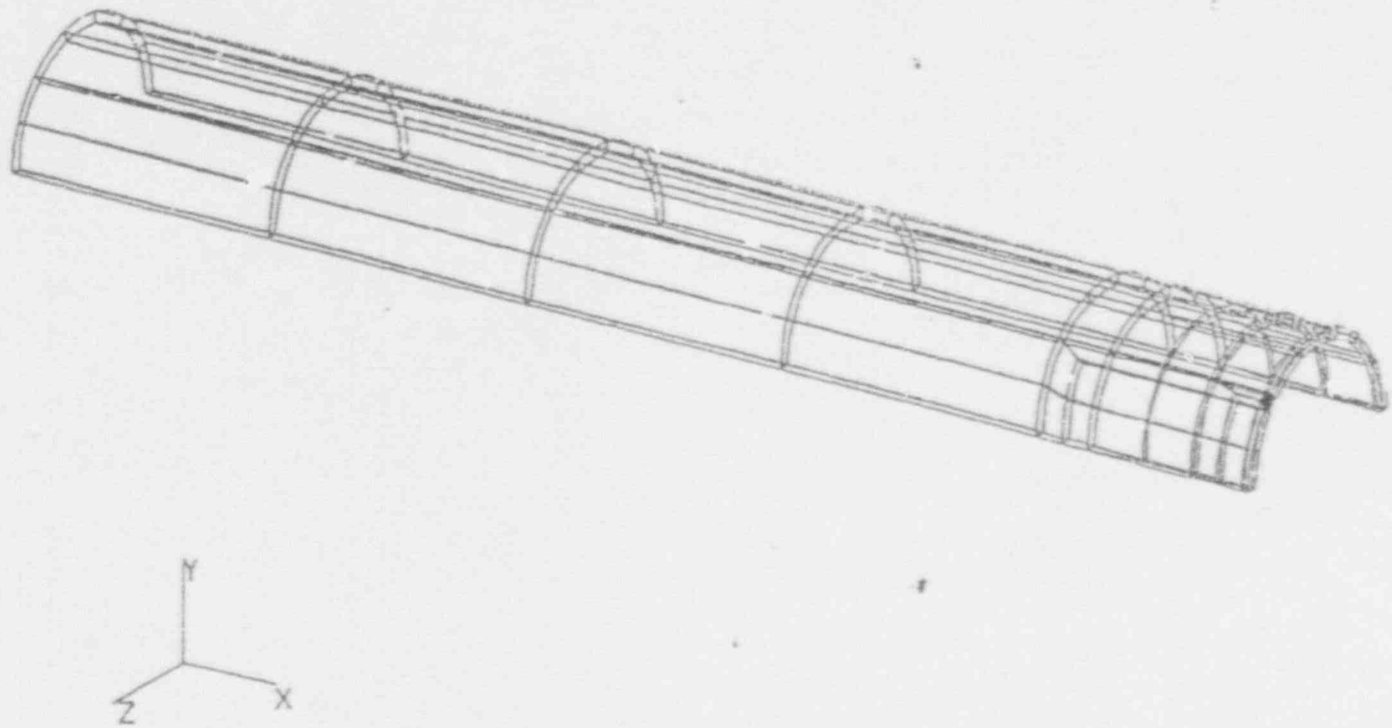
* STABILITY CRITERIA

$$J < J_{MAT} \quad , \quad \frac{\partial J}{\partial a}(LOAD) \leq \frac{\partial J}{\partial a}(MAT)$$

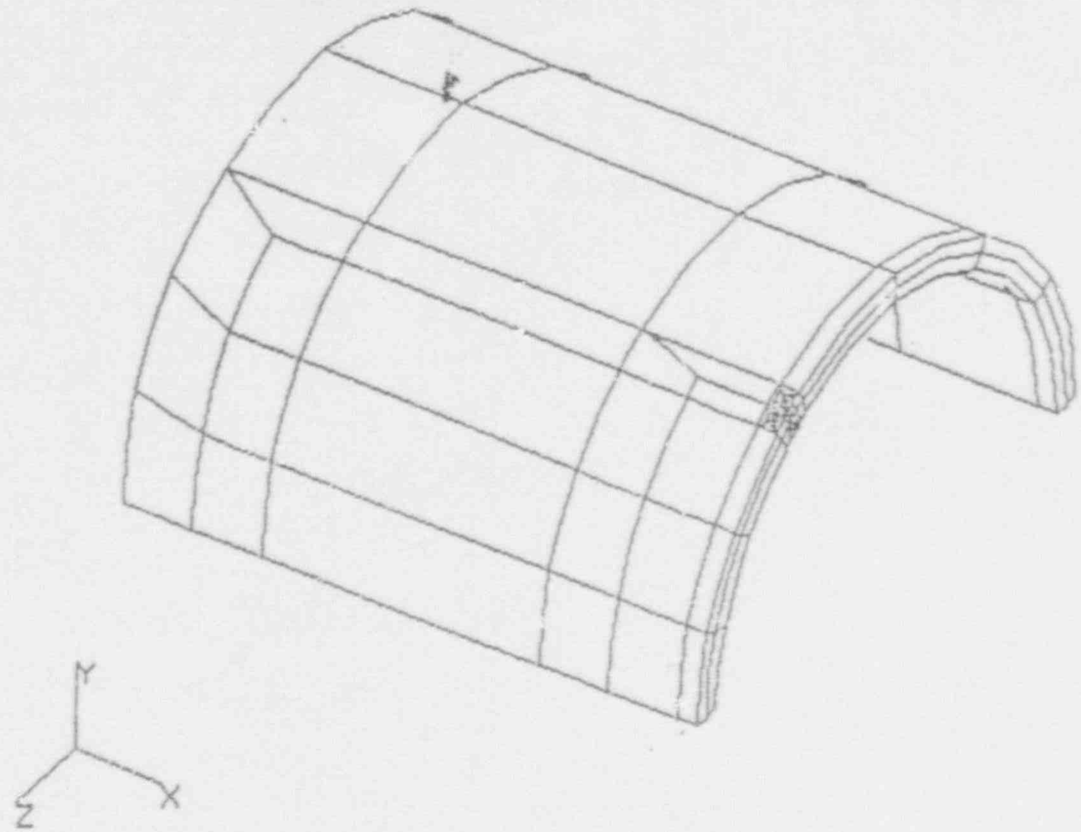
* DIRECT COMPARISON OF LOADING AND MATERIAL CURVE



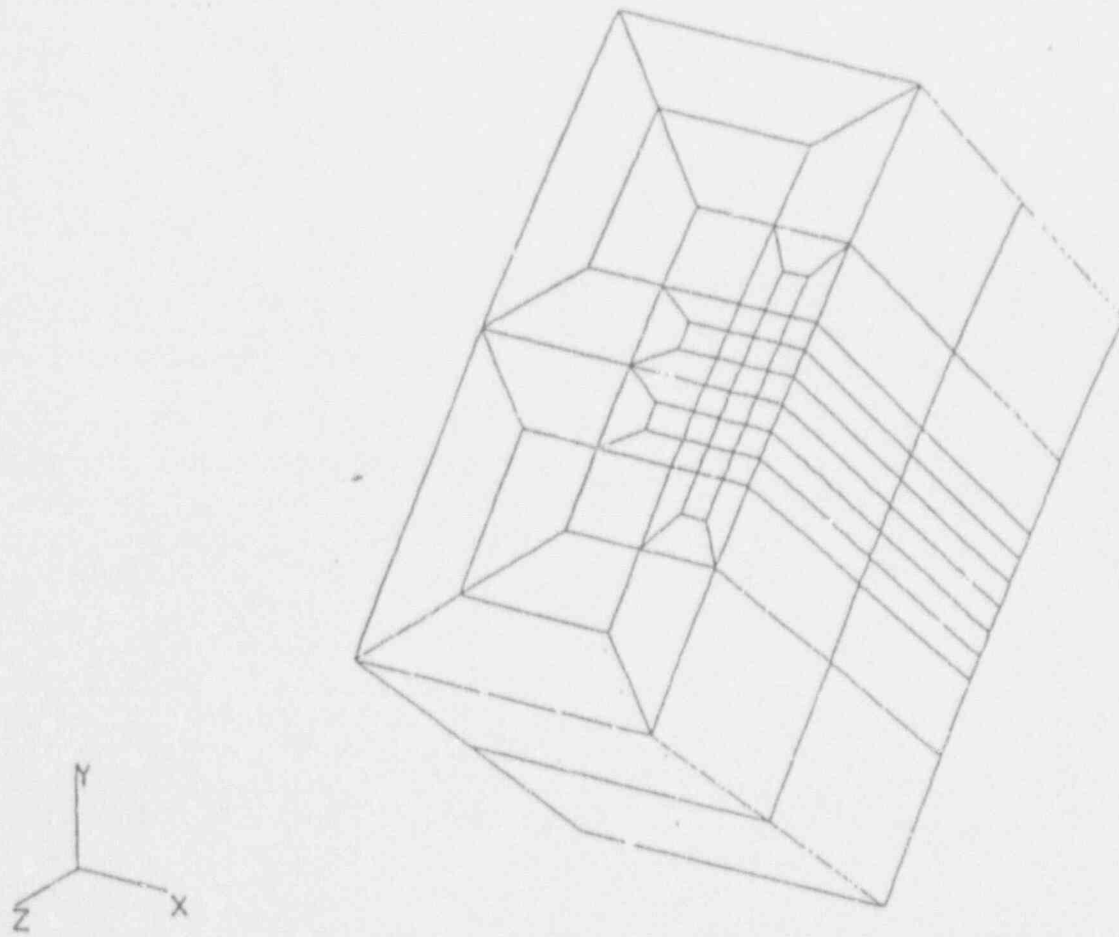
40" O.D. X 2.03" THICK (WITH 20" CRACK)



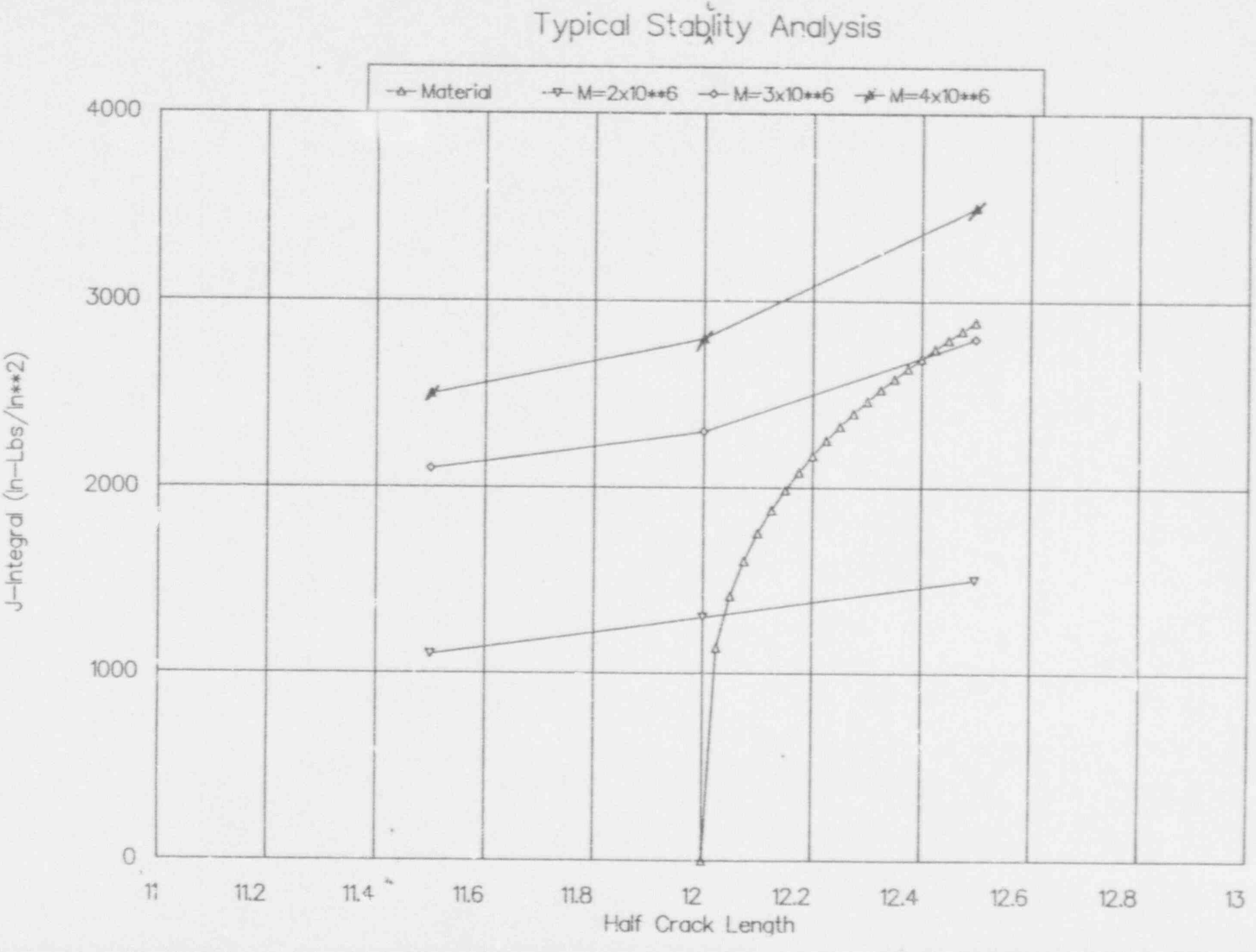
40" O.D. X 2.03" THICK (WITH 30" CRACK)



40" O.D. X 2.03" THICK (WITH 40" CRACK) - DETAIL



TYPICAL CRACK TIP REGION



Typical Stablity Analysis
Material
M=2x10**6
M=3x10**6
M=4x10**6
J-Integral (In-Lbs/In**2)
4000
3000
2000
1000
0
11
11.2
11.4
11.6
11.8
12
12.2
12.4
12.6
12.8
13
Half Crack Length

BATTELLE BENCHMARK EXPERIMENT

* CLOSES ANALYSIS LOOP WITH ACTUAL PIPE BEHAVIOR

* ANALYSIS METHODS USED TO EVALUATE PIPE BREAK EXPERIMENT

* " TYPICAL" TO PIPES FOR WHICH LBB USED

  37" O.D. 3.4" THICK 133 DEG CIRC FLAW
  SA-516 GR 70

* INVOLVED EXTRAPOLATING MATERIAL DATA

* PREDICATION OF INSTABILITY

APPLIED J versus CRACK LENGTH and MATERIAL J versus CRACK LENGTH

BATTELLE BENCHMARK

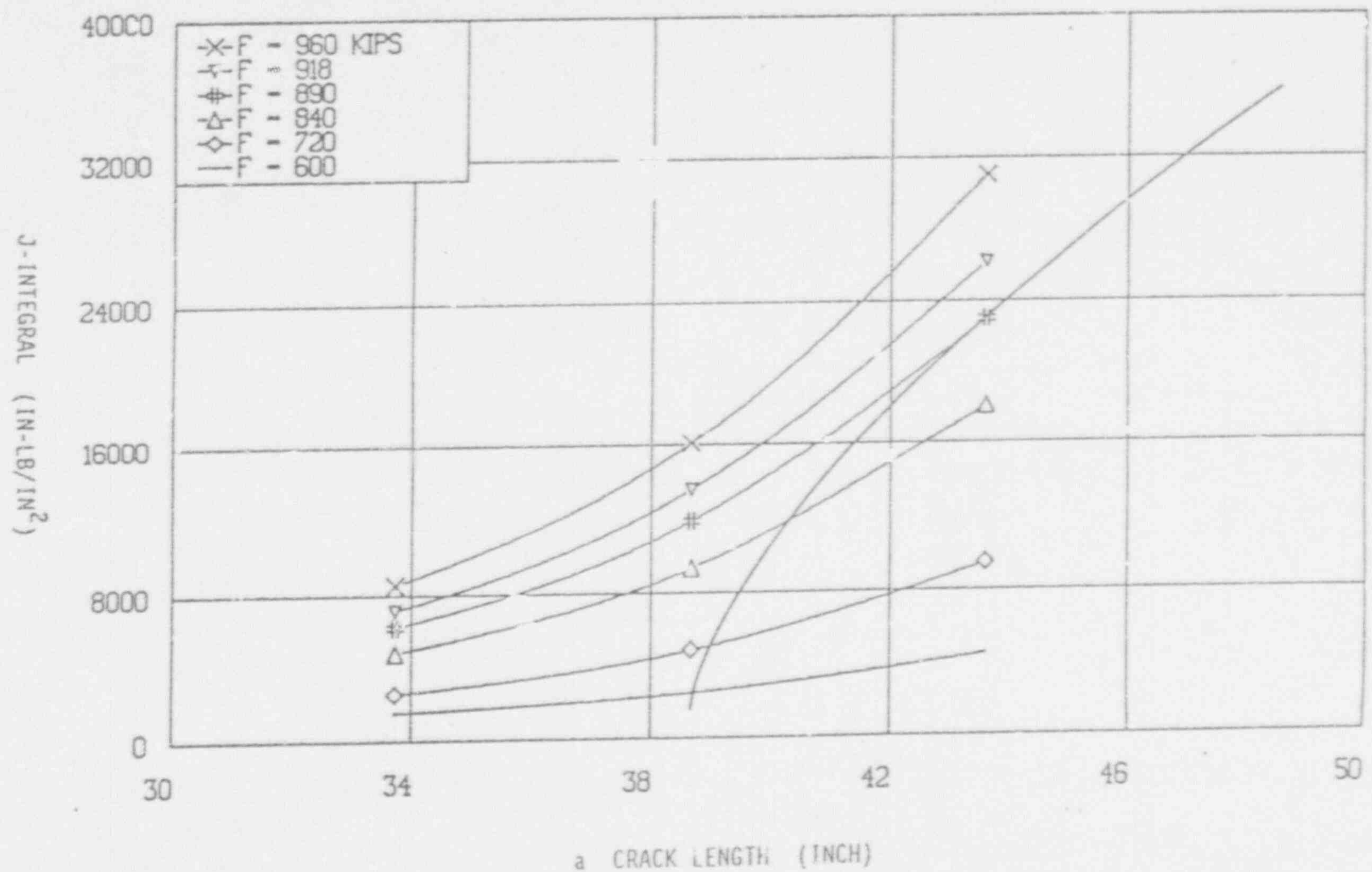


FIGURE B-9

4/23/92

Current System 80+ Status

- System and equipment requirements contained in CESSAR-DC

- Draft System Requirements Documents prepared for most systems

- Draft Equipment Requirements Documents prepared for some safety related equipment and major plant equipment systems

- Requirements Document prepared in accordance with ABB-CE NSSS Engineering Documentation System Manual

Piping/Equipment Specifications

- Procurement specifications for piping/equipment are beyond level-of-detail required for design certification

- Equipment specifications will be based on Equipment Requirements Documents

Piping/Equipment Specification Flowchart

Develop System Requirements

↓

Develop Equipment Requirements
(Pumps, Valves, Heat Exchangers)

↓

Detailed System/Equipment Design

↓

Develop Equipment/Piping Specifications

4/23/92-

REVIEW OF
DESIGN SPECIFICATIONS

- o DESIGN REQUIREMENT AND SOURCES
- o REVIEW AND APPROVAL
- o SPECIFICATION CONTENTS

D. R WADE
CONSULTING ENGINEER
ABB COMBUSTION ENGINEERING NUCLEAR POWER

APRIL 23, 1992

DESIGN REQUIREMENT SOURCES

- ASME BOILER & PRESSURE VESSEL CODE, SECTION III
- CONTRACT REQUIREMENTS
- SYSTEM DESCRIPTION
- DESIGN REQUIREMENTS DOCUMENT
  - CHEMISTRY DESIGN GUIDE
  - RADIATION DESIGN GUIDE
  - ENVIRONMENTAL DESIGN GUIDE
  - THERMAL TRANSIENTS
- QUALITY ASSURANCE PROCEDURES
- US NRC REGULATORY GUIDES
  - REFERENCED ANSI STANDARDS
  - REFERENCED IEEE STANDARDS

draft outline of the document was provided. ABB-CE has committed to providing the staff with a preliminary copy of the analysis section (Section 7.0) of the DSDG by April 30, 1992, and a preliminary copy of the entire DSDG by July 30, 1992.

The staff had a number of questions concerning ABB-CE's LBB program for the System 8 +. These included consideration of environmental effects (e.g., erosion/corrosion); choice of piping materials; leak detection capabilities on the main steamlines outside of containment; combination of design loads including thermal stratification loads; and benchmarking calculations. ABB-CE responded satisfactorily to some of these and other questions and has agreed to provide additional information in response to our inquiries by May 8, 1992.

The discussion on design specifications focused on the staff's interest in the methodology that will be employed in developing the form and content of the design specifications for System 80+. ABB-CE presently uses in house procedures and documents to assure that the necessary design requirements are incorporated into the design specifications for which they are responsible. The staff would like to see a formal design specification process for System 80+, and to this end, we are in the process of preparing a list of representative attributes that we feel should be contained in a typical design specification. This list will be forwarded to ABB-CE at a later date, and the staff will keep in close contact with ABB-CE concerning this matter.

The staff received a presentation from DE&S personnel on the CAE program PASCE. The PASCE program can be used for the design, construction, and operation of power plants by utilizing a software platform that integrates information from a number of supporting databases and manages the flow of information through the overall engineering process. ABB-CE and DE&S are using this system in the design of the System 80+. Duke Power is currently using this program at a number of their nuclear plants for plant modifications planning, enhancing as low as reasonably achievable considerations, and electrical circuit simulation.

Original Signed By:

Thomas V. Wambach, Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of Nuclear Reactor Regulation

Enclosures:
As stated

cc w/enclosures:
See next page

DISTRIBUTION:

Docket File	PDST R/F	DCrutchfield	WTravers
NRC PDR	RPierson	JNWilson	TMurley/FMiraglia, 12G18
TWambach	JMoore, 15B18	ACRS (10)	EJordan, 3701
PShea	RBorchardt	PTKuo, 11F23	JMcIntyre, 7E23
GBagchi, 7H15	DTerao, 7H15	DTang	SLee

OFC:	LA:PDST:ADAR	PM:PDST:ADAR	SC:PDST:ADAR
NAME:	PShea	TWambach:tz	JNWilson
DATE:	05/27/92	05/27/92	05/28/92

OFFICIAL RECORD COPY: CEMTG422.TW

ABB/CE ENGINEERING
SOURCES OF DESIGN REQUIREMENTS

- o REACTOR ENGINEERING
  - DESIGN BASIS
  - RADIATION DATA

- o FLUID SYSTEMS
  - CHEMISTRY DESIGN GUIDE
  - DESIGN REQUIREMENTS (FLUID)
  - ENVIRONMENTAL DESIGN GUIDE
  - THERMAL-HYDRAULIC RESPONSE (TRANSIENTS)

- o MECHANICAL ENGINEERING
  - DESIGN REQUIREMENTS (MECHANICAL
  - SEISMIC DATA

REGULATORY GUIDES

RG 1.29	-	SEISMIC DESIGN CLASSIFICATION
RG 1.31	-	CONTROL OF STAINLESS STEEL WELDING
RG 1.37	-	QUALITY ASSURANCE REQUIREMENTS FOR CLEANING OF FLUID SYSTEMS AND COMPONENTS
RG 1.38	-	QUALITY ASSURANCE REQUIREMENTS FOR PACKAGING, SHIPPING, RECEIVING, STORAGE AND HANDLING
RG 1.43	-	CONTROL OF STAINLESS STEEL WELD CLADDING OF LOW-ALLOY STEEL COMPONENTS
RG 1.44	-	CONTROL OF THE USE OF SENSITIZED STAINLESS STEEL
RG 1.48	-	DESIGN LIMITS AND LOADING COMBINATIONS FOR SEISMIC CATEGORY 1 FLUID SYSTEM COMPONENTS
RG 1.51	-	INSERVICE INSPECTION OF ASME CODE CLASS 2 NUCLEAR POWER COMPONENTS

REGULATORY GUIDES (CONT'D)

RG 1.54 - QUALITY ASSURANCE REQUIREMENTS FOR PROTECTIVE COATINGS APPLIED TO WATER-COOLED NUCLEAR POWER PLANTS

RG 1.61 - DAMPING VALUES FOR SEISMIC DESIGN OF NUCLEAR POWER PLANTS

RG 1.84 - CODE CASE ACCEPTABILITY ASME SECTION III DESIGN AND FABRICATION

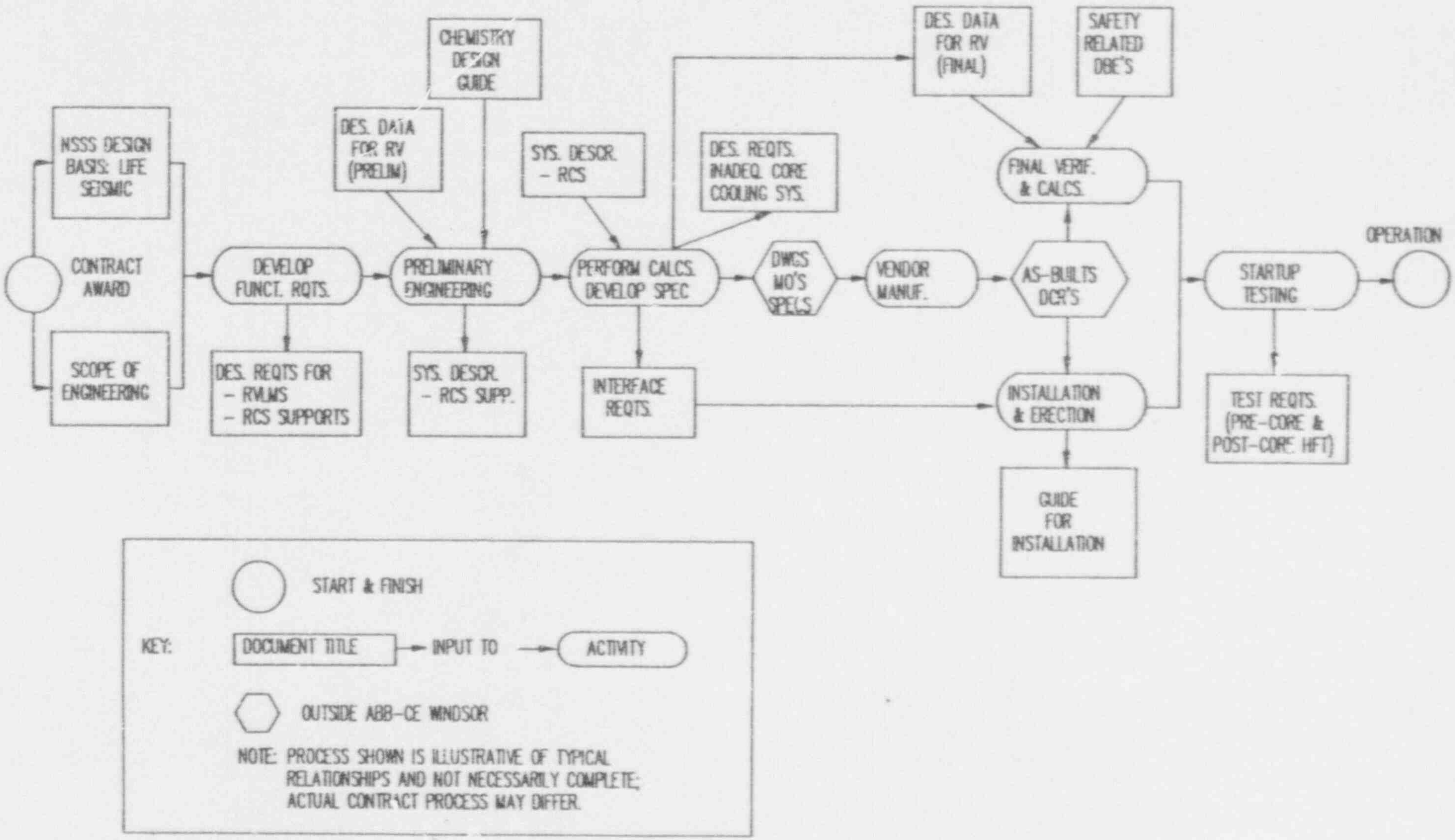
RG 1.85 - CODE CASE ACCEPTABILITY ASME SECTION III MATERIALS

RG 1.89 - QUALIFICATION OF CLASS 1E EQUIPMENT FOR NUCLEAR POWER PLANTS

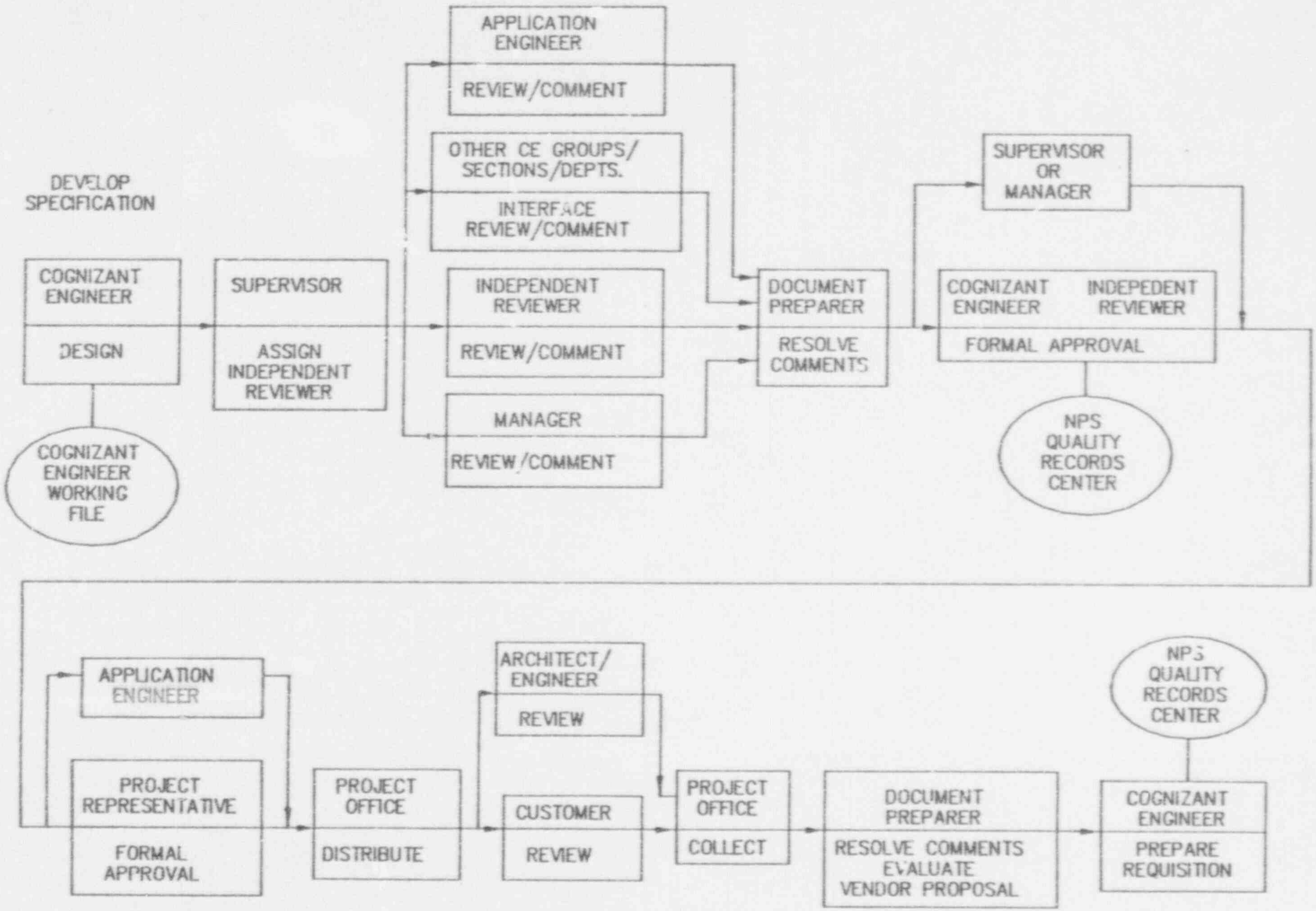
RG 1.92 - COMBINING MODAL RESPONSES AND SPACIAL COMPONENTS IN SEISMIC RESPONSE ANALYSIS

RG 1.100 - SEISMIC QUALIFICATION OF ELECTRIC AND MECHANICAL EQUIPMENT FOR NUCLEAR POWER PLANTS

DESIGN PROCESS FOR REACTOR VESSEL SPECIFCATION



REVIEW AND APPROVAL PROCESS



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APPENDICES

Number Title

EXHIBIT 3.8-3

SAMPLE TEXT OUTLINE

PREFERRED FORMAT, TYPOGRAPHY

1.0 SCOPE

One paragraph statement of what the specification covers including plant and customer or standard system identification as applicable. Statement to define that the manufacturer of the equipment is referred to as the supplier and Combustion Engineering,Inc. as the Purchaser.

2.0 ASSIGNMENT OF RESPONSIBILITY

2.1 GENERAL REQUIREMENTS

This paragraph states what the Supplier is to do and details his responsibilities. Require that non-conformances be approved in writing.

2.2 EQUIPMENT BY SUPPLIER

List all equipment to be provided by Supplier.

2.3 EQUIPMENT BY OTHERS

Where there may be a question of responsibility for providing other equipment, list the equipment which will be supplied by others, including NPB.

3.0 APPLICABLE REFERENCES

Citations of references should be specific, e.g., date of issue and/or revision. Do not list general terms such as ASME Codes, ANSI standards. Where a particular revision, issue, edition or addendum of any reference is intended to be specified, it should be so noted immediately following the reference name. Where the latest issue in effect, or the issue in effect on the date of order is intended, such a note should precede the applicable references.

3.1 COMBUSTION ENGINEERING SPECIFICATIONS

List any CE specification that may be applicable, such as a cleaning specification, for example.

Specification No. Revision Page___of____

EXHIBIT 3.8-4

3.2 CODES

List applicable codes such as the ASME Boiler and Pressure Vessel Code.

3.3 STANDARDS

List applicable standards, such as those developed by ANSI, ASME, ASTM, ANS, IEEE, NEMA, TEMA or other national organizations.

3.4 DESIGN MANUALS

List applicable design manuals, such as the "Design Manual - American Concrete Institute".

3.5 DRAWINGS

List complete drawing number including revision number.

4.0 REQUIREMENTS

4.1 PERFORMANCE

Tell the Supplier where and how the product is to be used and what is expected of the product. Refer to figures, charts, drawings, or other helpful documents. If the product is a system, spell out all the functions which the system is expected to perform. Advise the Supplier of normal and abnormal transient conditions.

Detail additional items such as:

4.1.1 Functional Characteristics
4.1.2 System Effectiveness
4.1.3 Service and Access
4.1.4 Useful Life
4.1.5 Environmental Conditions
4.1.6 Seismic Design
4.1.7 Transportability
4.1.8 Safety

4.2 DESIGN AND FABRICATION

Describe or list all requirements which are pertinent to the design and fabrication of the component. Be sure that the materials of construction are specified and indicate what materials may be used for testing, packaging, etc.

Detail additional requirements such as:

4.2.1 General design features
4.2.2 Design Bases
4.2.3 Materials and Processes
4.2.4 Standard and Commercial Parts
4.2.5 Corrosion
4.2.6 Interchangeability
4.2.7 Workmanship
4.2.8 Identification and Marking
4.2.9 Storage

5. QUALITY ASSURANCE REQUIREMENTS

5.1 QUALITY CONTROL PROGRAM

Define applicable quality assurance documents such as CE specification WQC 11.1 and the Quality Class of each item if different.

5.2 TESTS

Detail all tests that are to be conducted by the Supplier. Clearly define what the test pressures, temperatures, shock loads, voltages, capacities, etc. are to be.

5.3 INSPECTIONS

5.3.1 List only the specific engineering inspection points or test points required beyond the ASME Code or IEEE standard requirements. These points should be kept to a minimum.

5.3.2 The IMQP containing witness and mandatory hold points when required by the CE specification WQC 11.1 is submitted to the appropriate Project/Task Manager for necessary coordination with the Client, Engineering and Supplier Control.

Specification No. Revision Page__ _of____

EXHIBIT 3.8-4 (Cont'd)

5.4 PURCHASER's RIGHTS

Spell out the inspection rights which are being reserved for the Purchaser or his appointed agent. If possible, advise the Supplier of the amount of notice he will be expected to give to CE of an impending test or inspection.

6.0 <u>CLEANING, IDENTIFICATION, AND PREPARATION FOR SHIPMENT</u>

6.1 CLEANING

Refer to standard cleaning specifications. Detail any special attention that may be required.

6.2 IDENTIFICATION

Tell the Supplier how he will identify the component <u>AND</u> how he should identify the shipping container.

6.3 SHIPPING

Give the Supplier shipping instructions or indicate that they will be provided later. Tell the Supplier of any special container requirements.

6.4 PAINTING

If applicable, tell the Supplier how the product shall be painted.

6.5 RECEIVING INSPECTION OR TEST

If special receiving inspection or testing is needed, require the Supplier to submit procedures and attach a copy of the procedures to the shipping container. Such procedures shall identify the results of the receiving inspection or testing which are to be documented.

Specification No. Revision Page ____ of ____

7.0 TECHNICAL DOCUMENTS TO BE FURNISHED BY SUPPLIER

Detail documents and additional items you expect to receive, such as:

7.1 Drawings
7.2 Technical Information
7.3 Schedules and Progress Reports
7.4 Materials, Tests and Inspection Certification
7.5 Operating Instructions and Maintenance Manual
7.6 Photographs
7.7 Shipping Papers
7.8 Requirements for Safe Handling and Storage
7.9 Special Receiving Inspection or Test Procedures, if required.

Tell the Supplier when you expect to receive them.

Specification No. Revision Page____of____

EXHIBIT 3.8-4 (Cont'd)

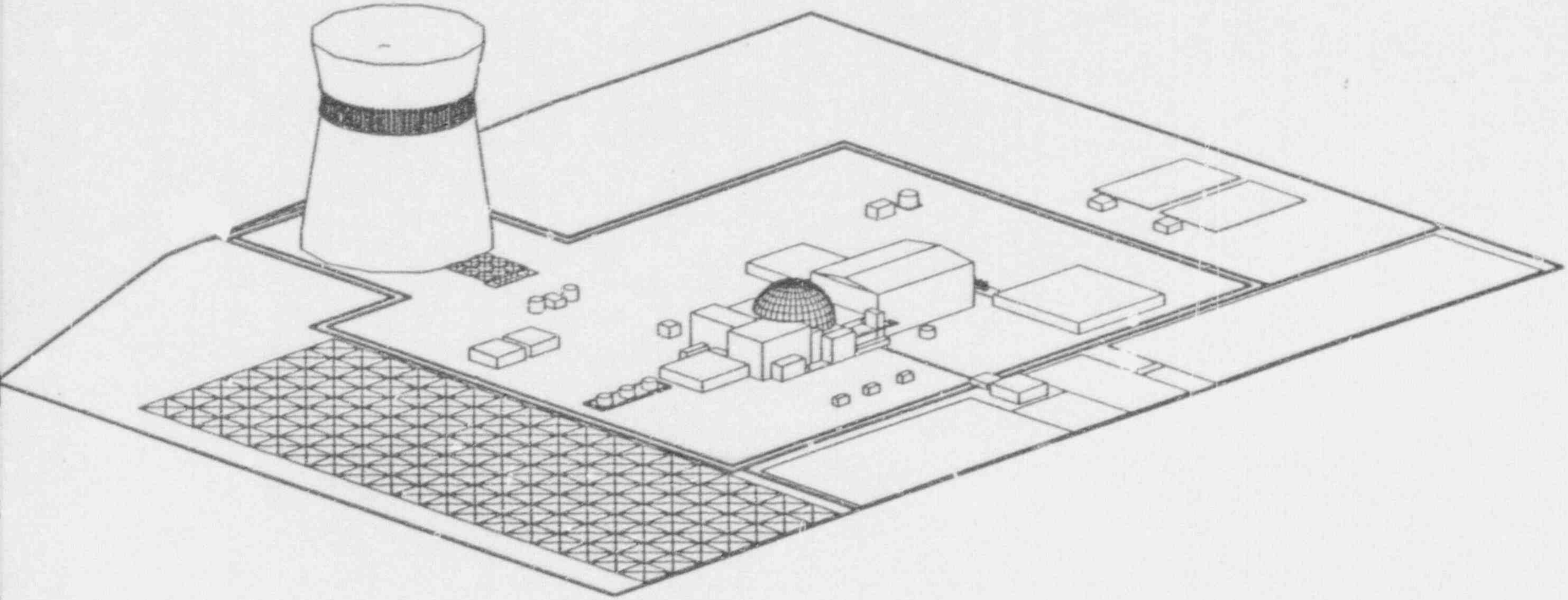
SYSTEM 80+

CAE PASCE DEMONSTRATION

UN. ~D STATES NUCLEAR REGULATORY COMMISSION

APRIL 23, 1992

PARTICIPANTS	ORGANIZATION
BILL FOX	DE&S
TIM MURPHY	D. PWR CO.
STEVE BURNETTE	DE&S
MIKE HELMS	D. PWR CO.
TIM WINIGER	D. PWR CO.



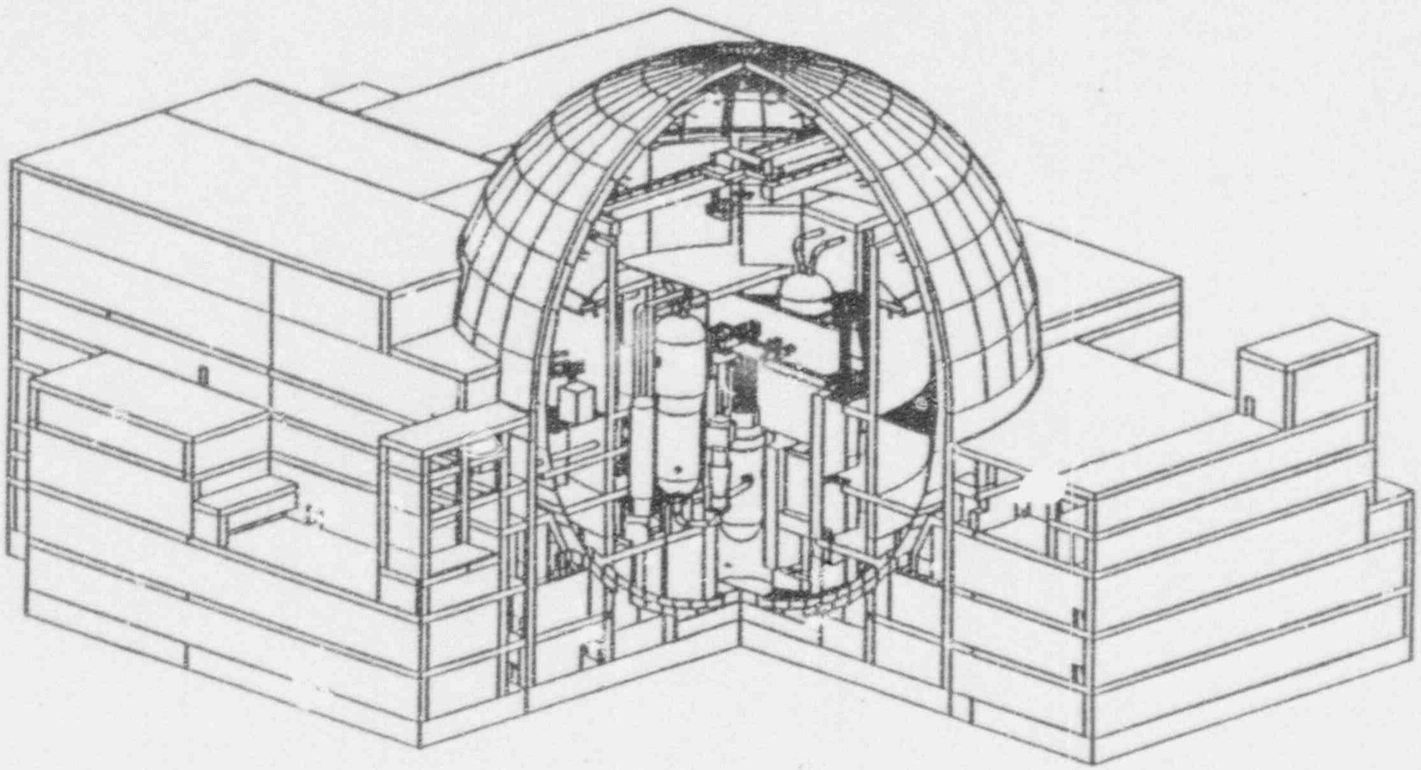
SITE PLAN

The System 80+™ Standard Design

Your Nuclear Option for the 90's... TODAY

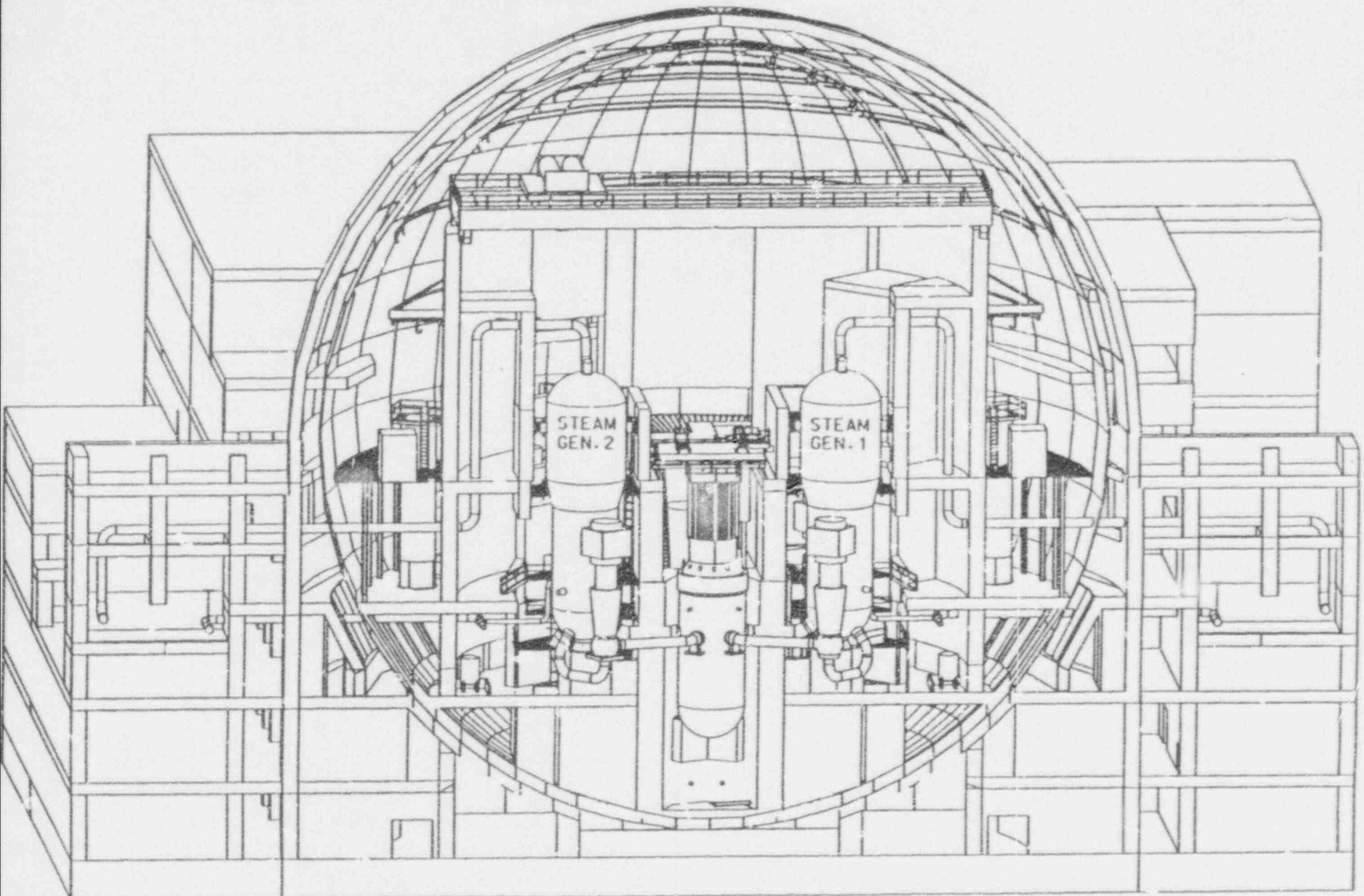
The System 80+™ Standard Design

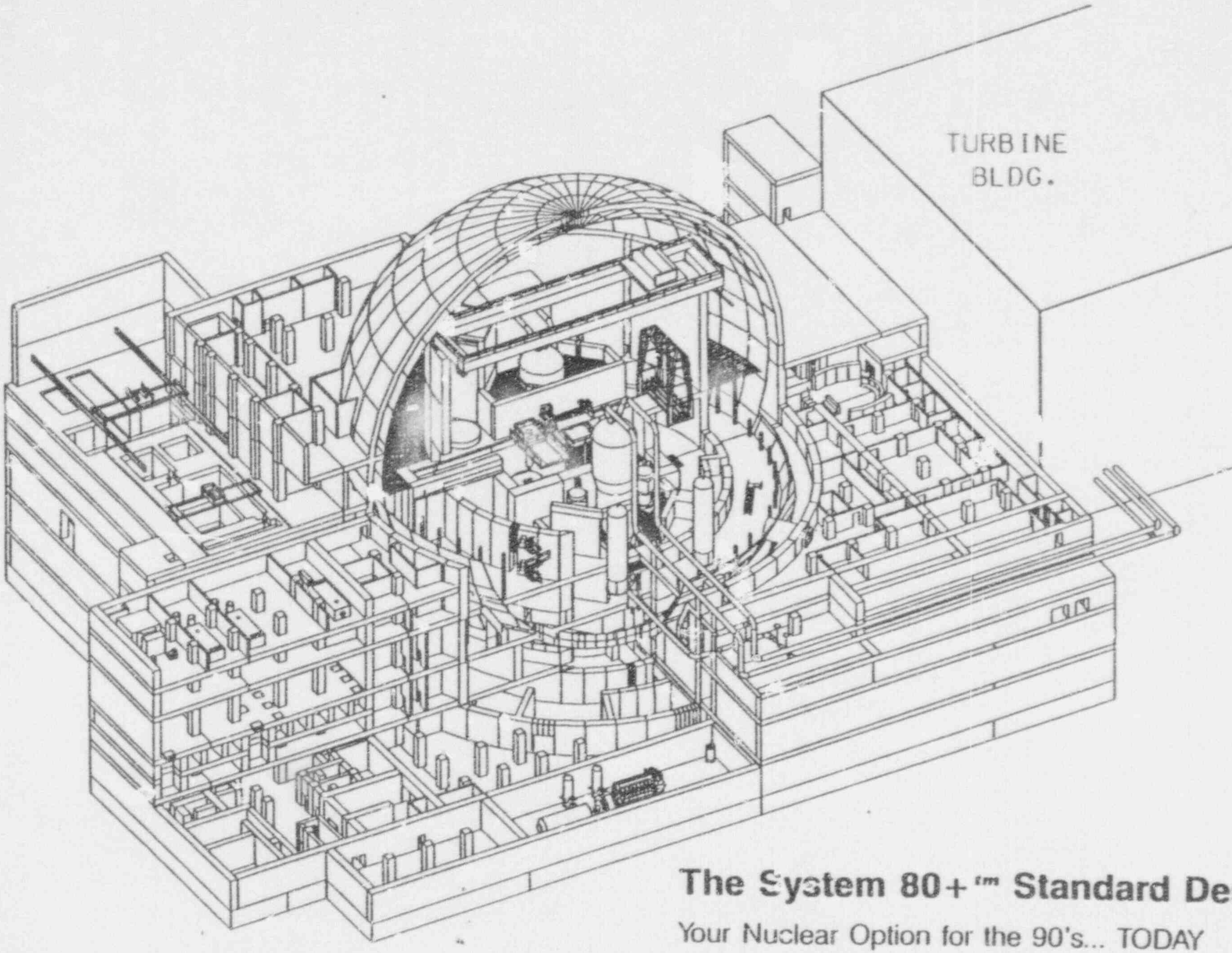
Your Nuclear Option for the 90's... TODAY



The System 80+™ Standard Design

Your Nuclear Option for the 90's... TODAY





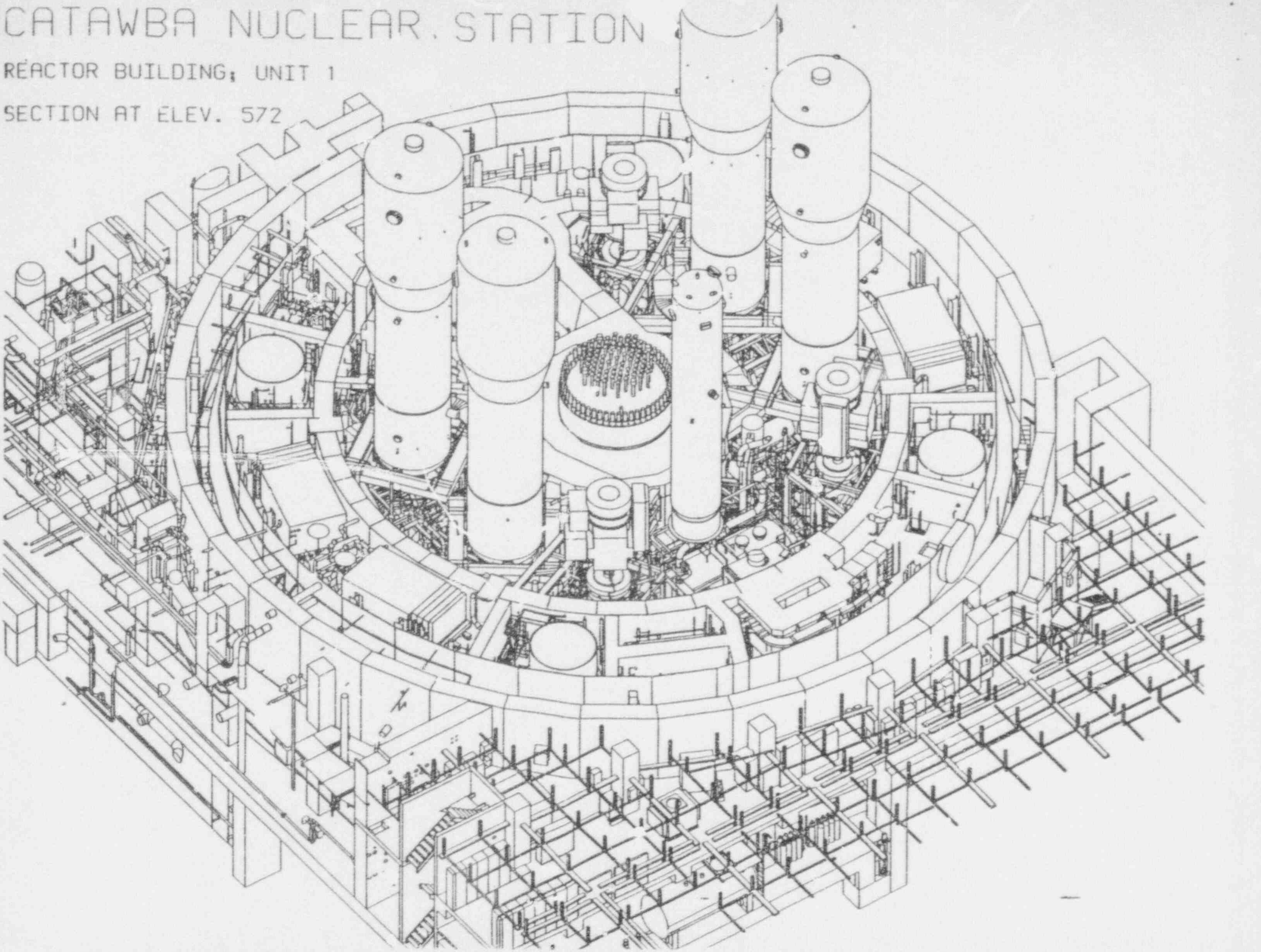
The System 80+™ Standard Design

Your Nuclear Option for the 90's... TODAY

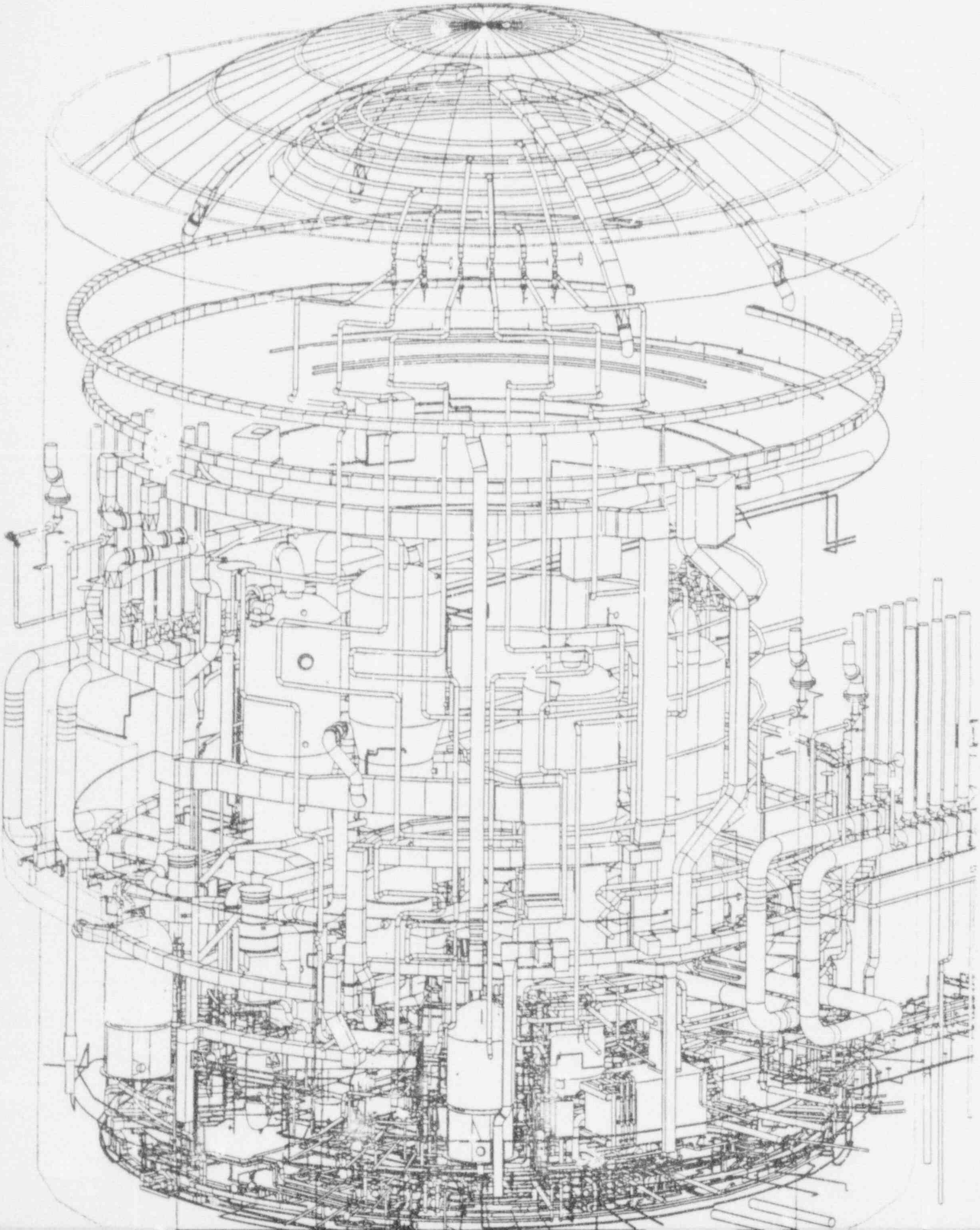
CATAWBA NUCLEAR STATION

REACTOR BUILDING; UNIT 1

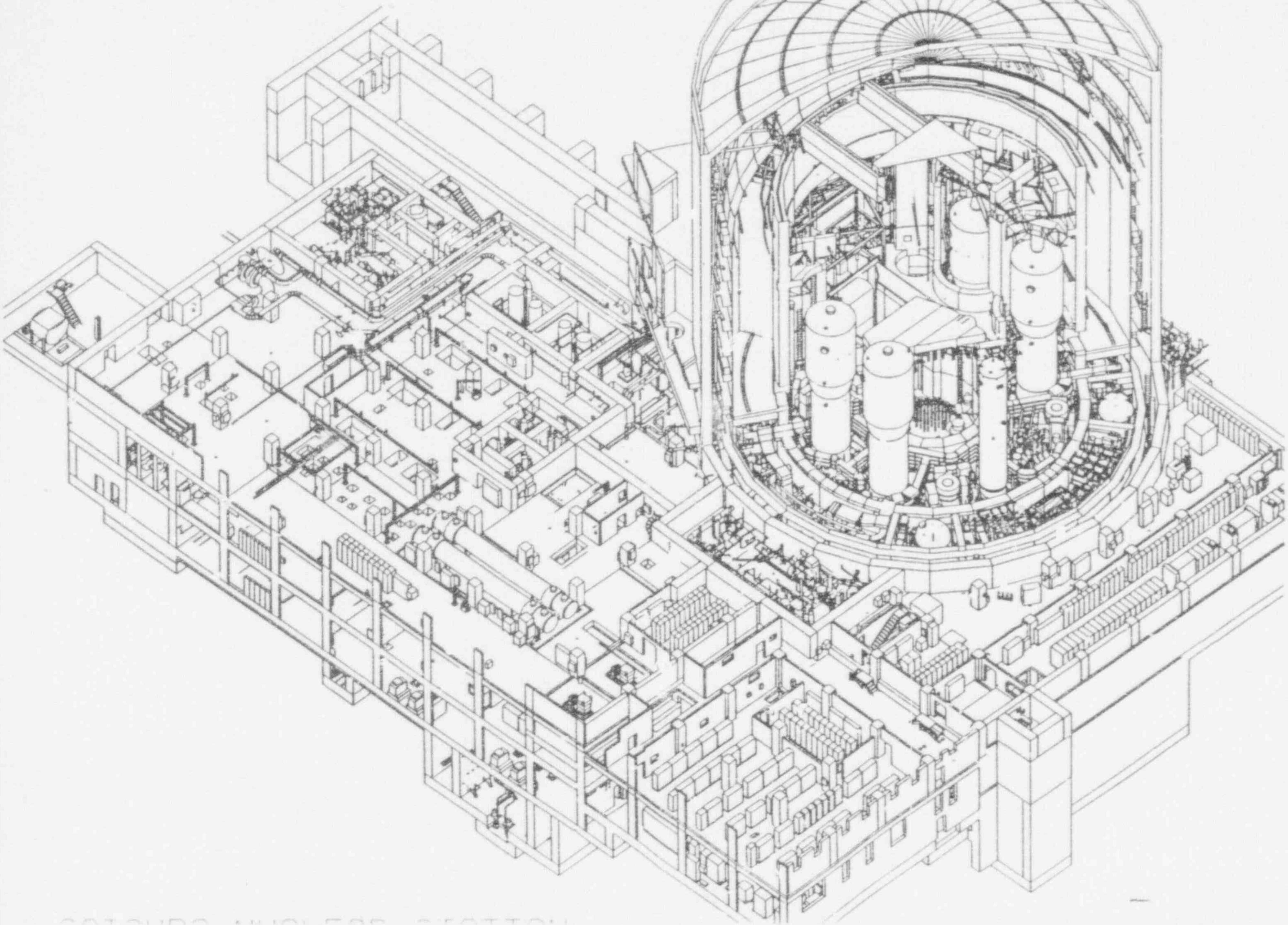
SECTION AT ELEV. 572



CATAWBA NUCLEAR STATION - REACTOR BUILDING ; UNIT 1
MECHANICAL EQUIPMENT, PIPING, AND HVAC



HORIZONTAL SECTION THRU AUX. BLDG. AT ELEV 585
VERTICAL SECTION THRU REACTOR BUILDING



NUCLEAR REGULATORY COMMISSION STAFF

SYSTEM 80+ STANDARD DESIGN

Computer Aided Engineering (CAE) Demonstration

April 23, 1992

AGENDA

SYSTEM 80+ DESIGN OVERVIEW

WHAT IS PASCE?

PLANTVIEW

PLANTPIPE

PLANTSCHEMA

SUMMARY

SYSTEM 80+ STANDARD PLANT

Fox

- **Integrated Design**
- **Design For:**
  - Construction
  - Maintenance
  - Operation
  - . . . Abilities
- **Plant Description**
- **Design Status**

TIM MURPHY

COMPUTER-AIDED ENGINEERING

- **CAE Principles**
  - Interactive computer applications performing engineering activities under the direct control of the engineer.
  - A common supporting data base, integrating data from each activity and managing the flow of information through the overall engineering process for all phases of a plant's life.

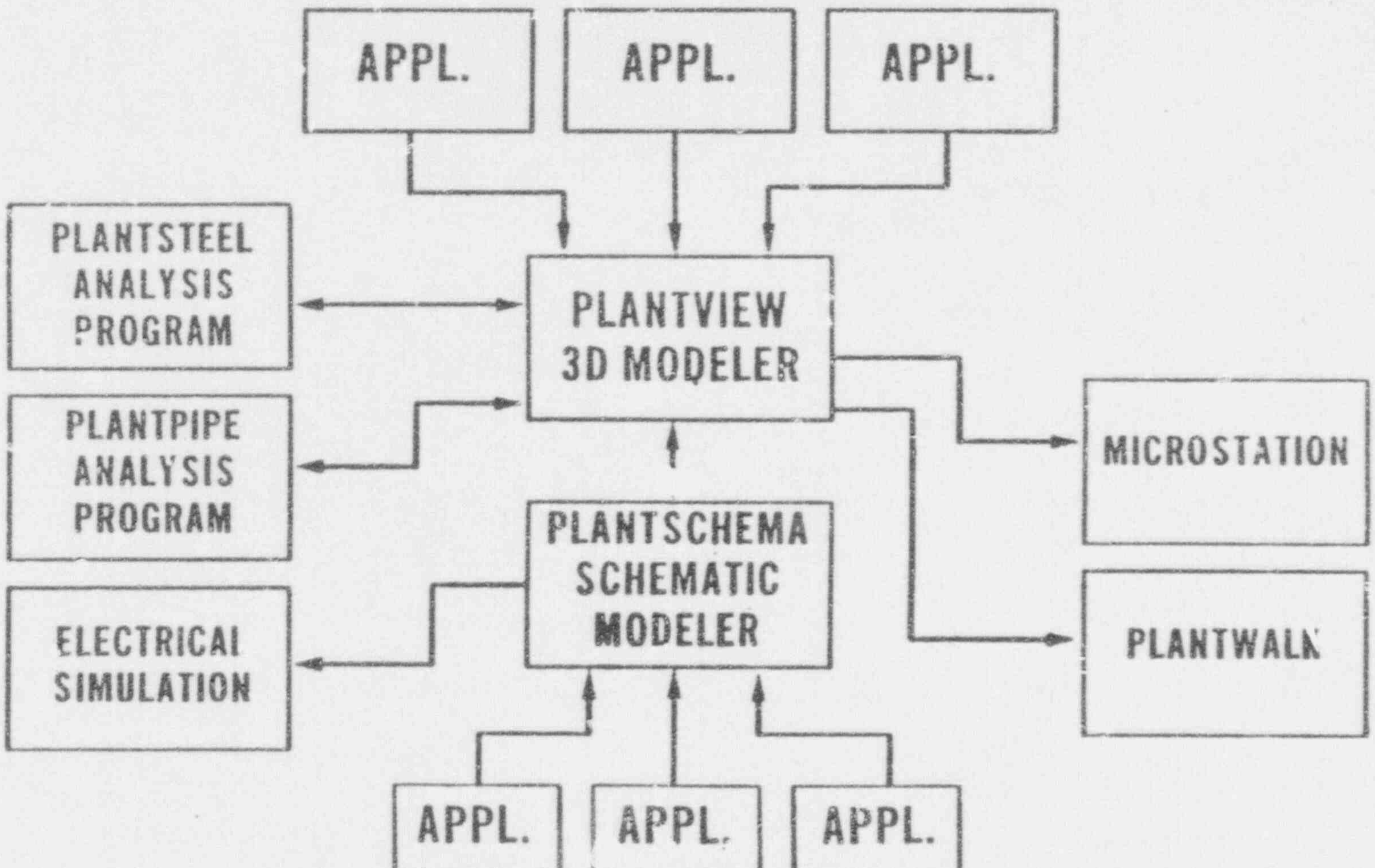
- **CAE Technology**
  - Data base management technology.
  - Computer graphics technology.

- **Industry Strategic Documents**
  - EPRI Report NP-5159M, Guidelines for Specifying Integrated Computer-Aided Engineering Applications for Electric Power Plants.
  - EPRI IMS Requirements for ALWR Plants.

PASCE CAE SYSTEM

- Computer-Aided Engineering System for Design, Construction and Operation of Power and Process Plants
- Marketed and Supported by EA Systems, Inc.
- Jointly Owned by Digital Equipment Corp. and ABB

CAE SYSTEM OVERVIEW
SOFTWARE PLATFORM



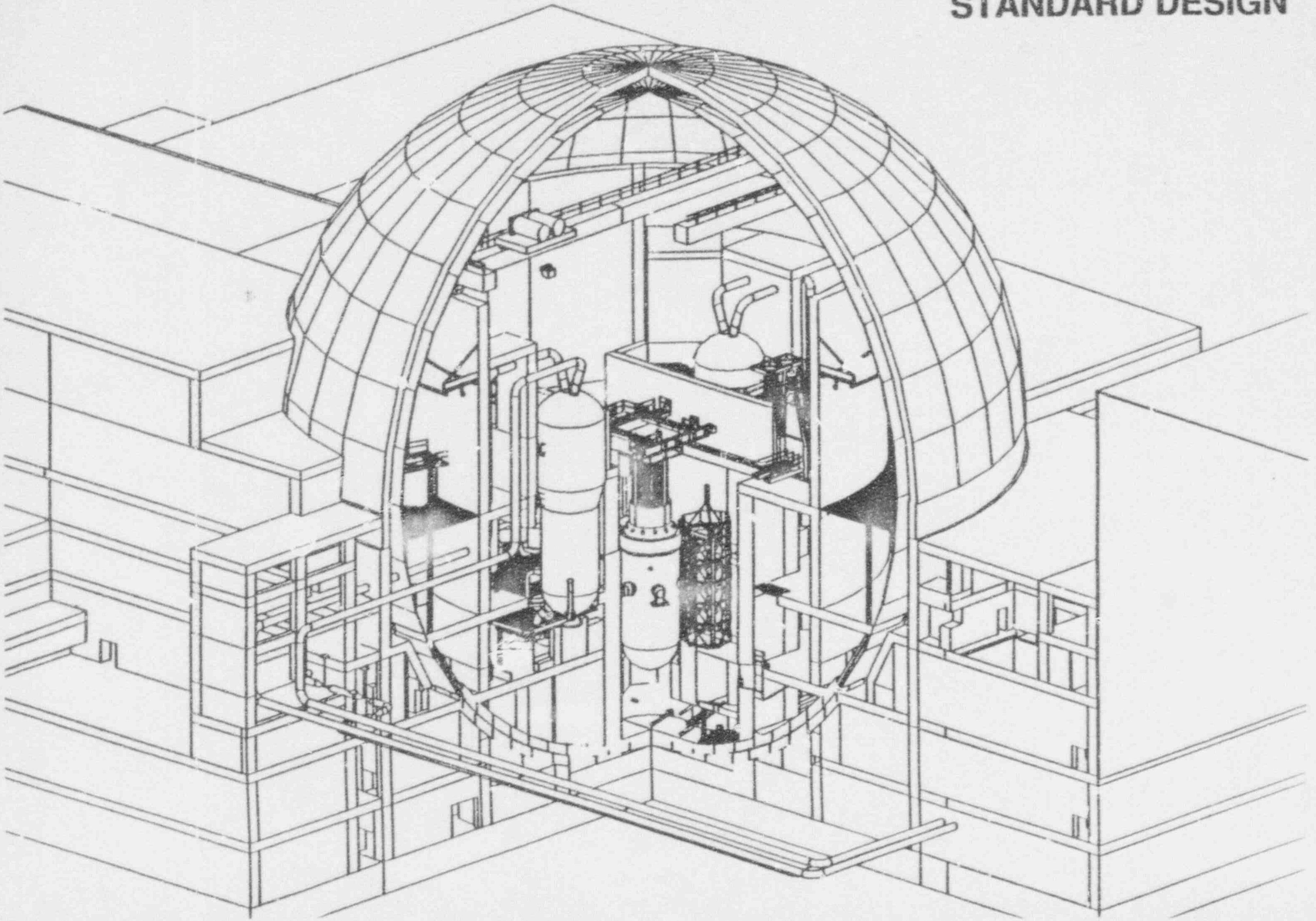
DUKE EXPERIENCE WITH PASCE REPRESENTATIVE PROJECTS

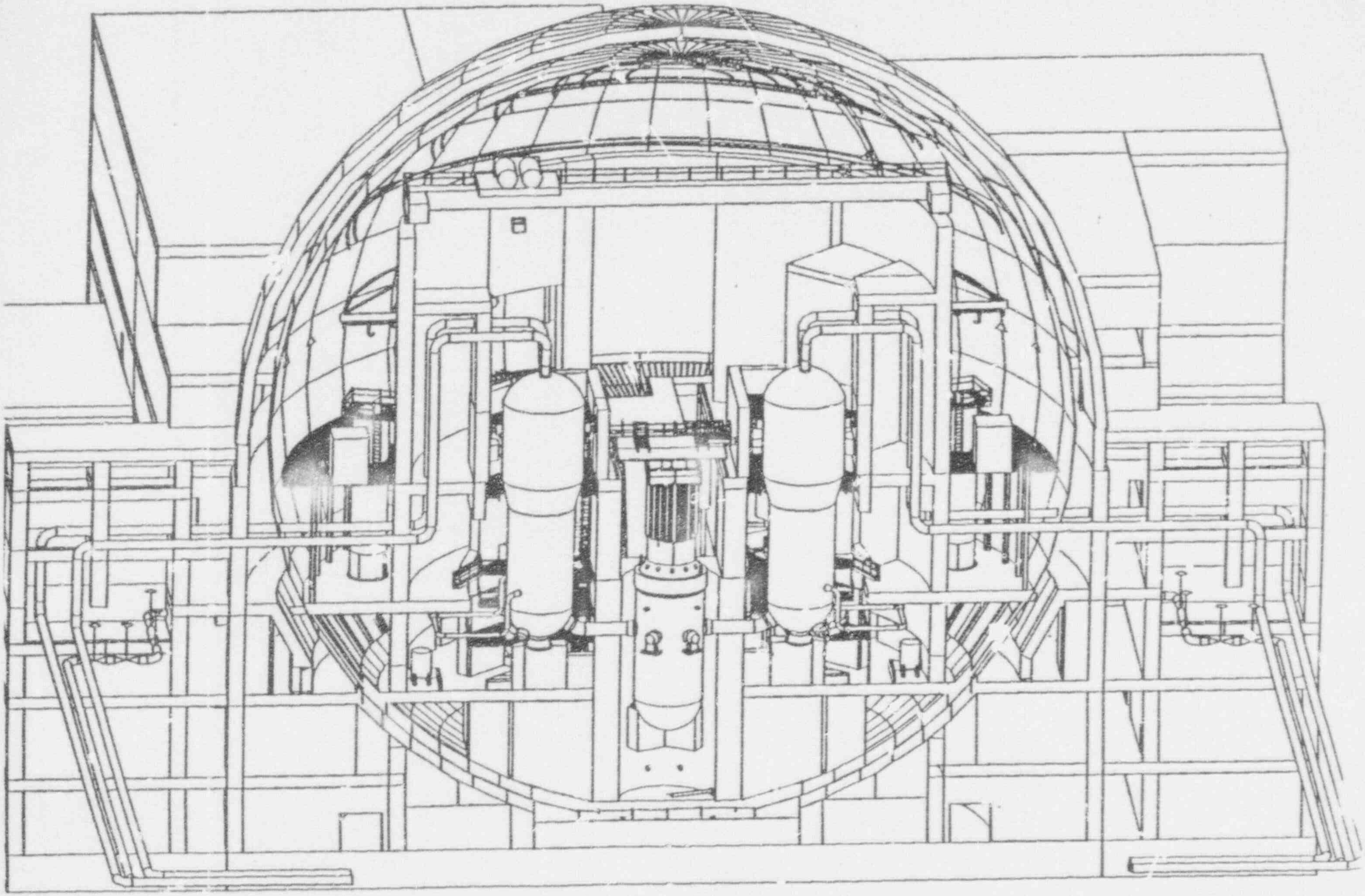
- Catawba Nuclear Station 3D Model for Maintenance and Modification Planning
- Oconee Nuclear Station Breathing Air Piping Modification
- McGuire Nuclear Station Instrument List, Details and Loop Diagrams
- Oconee Nuclear Station EPSL Electrical Circuit Simulation
- McGuire Nuclear Station Integrated Schematic Diagrams
- McGuire Nuclear Station Steam Generator Replacements

```
EQUI () STEAM.GENERATOR.1
DES>Q ATT
TYPE  EQUI
NAME  STEAM.GENERATOR.1
OWNE  RB.MECH.EQUIP.INSIDE.CONTAINMENT
GTYP
SPEC  Unset
RPOS  E300'0 N332'4 U103'1.1/2
TEMP  600.00
PRES  2400.00
MATE  STAINLESS STEEL CLAD SA-508
FUNC
LSPE  Unset
TRAC
STAT  PRELIMINARY 10-2-87
DSCO
PTSP
INSC
DESC  E-9417-87-055 REV.0
WEIG  0.00 0.00
COLO  Magenta
UNIQ  15 19
DES>
```

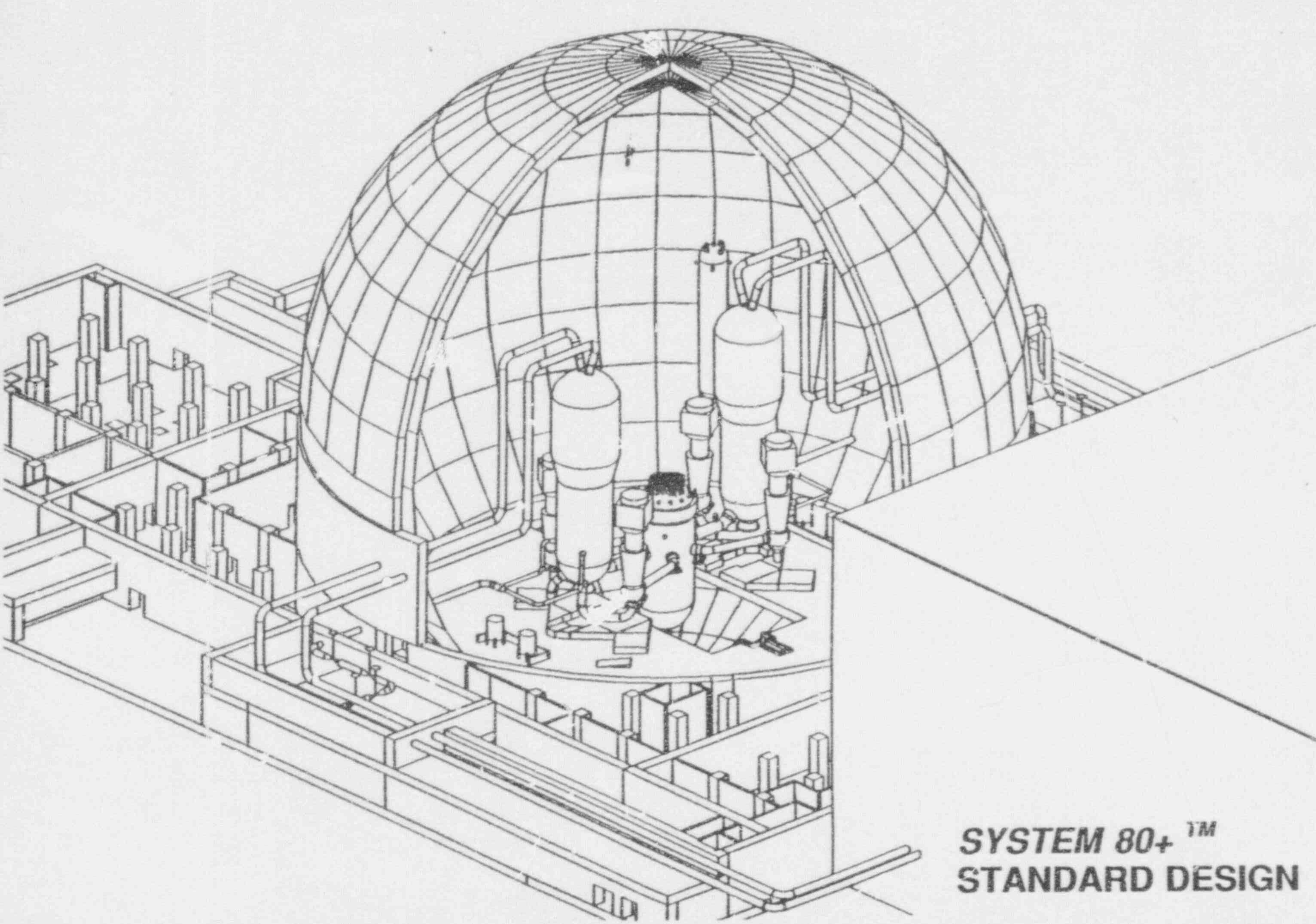
```
CE
PIPE MAIN.STEAM.TO.STM.GEN.1
DES>CLASH
Please give clash report file name
<RET>= report to terminal

Please input group name or <return>
a hard hard clash has been detected
<1669,145>
type STRA
owned by
MAIN.STEAM.TO.STM.GEN.1
clashes with
<1424,403>
type PYRA
owned by
STEAM.GEN.1.SHIELD.WALLS
```

SYSTEM 80+ ™
STANDARD DESIGN

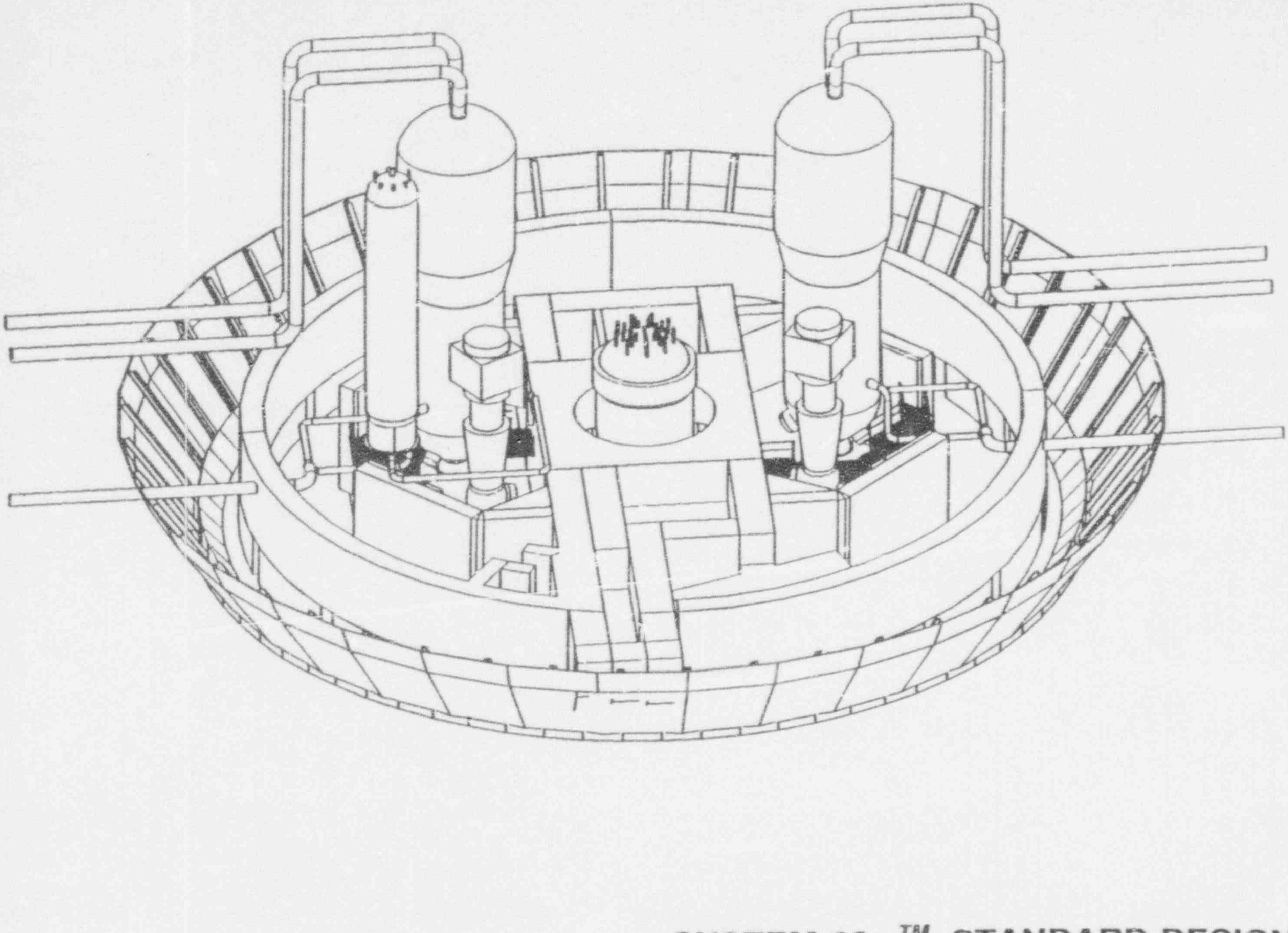




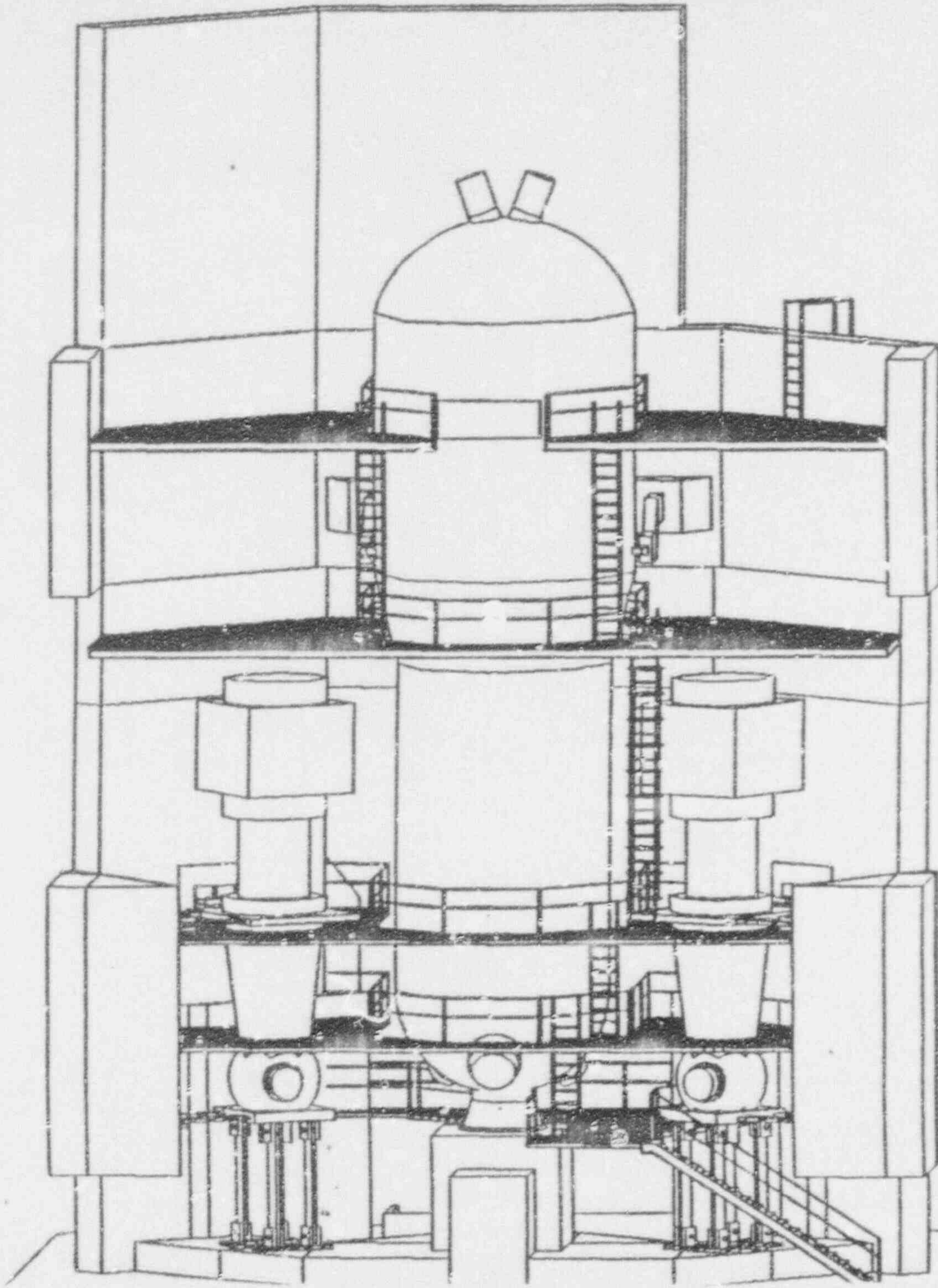
SYSTEM 80+ ™ STANDARD DESIGN



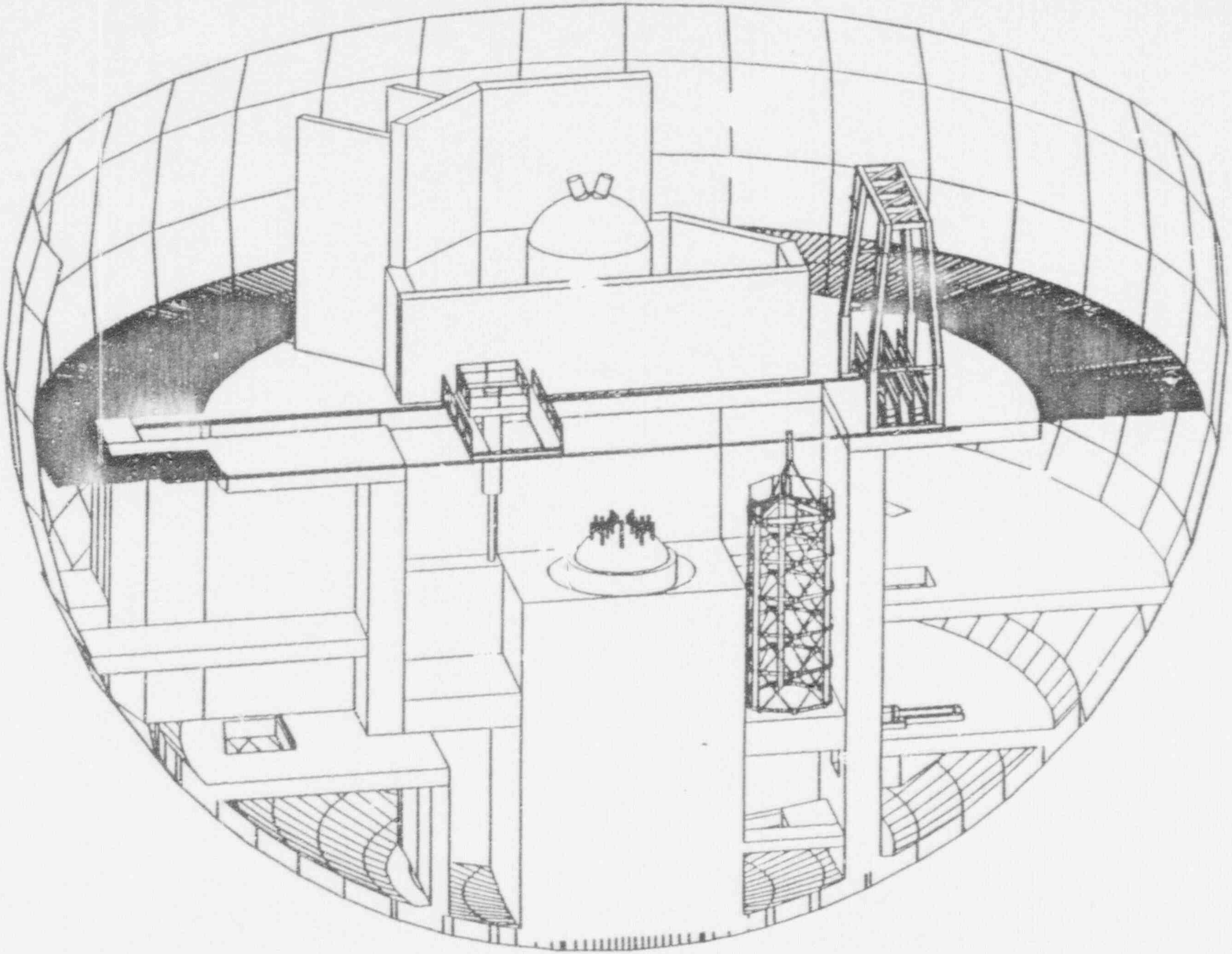
SYSTEM 80+ ™
STANDARD DESIGN



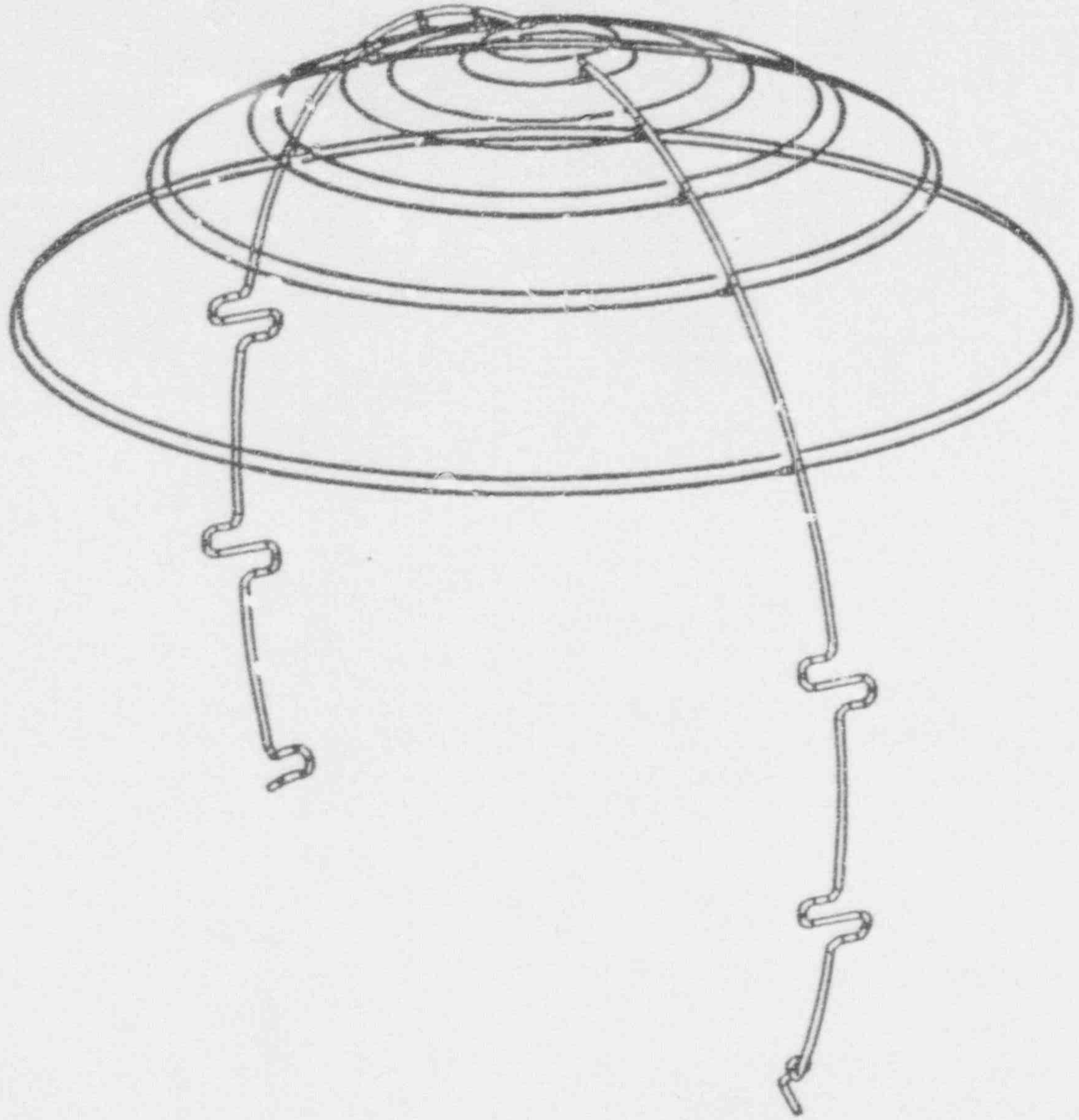
SYSTEM 80+ ™ STANDARD DESIGN



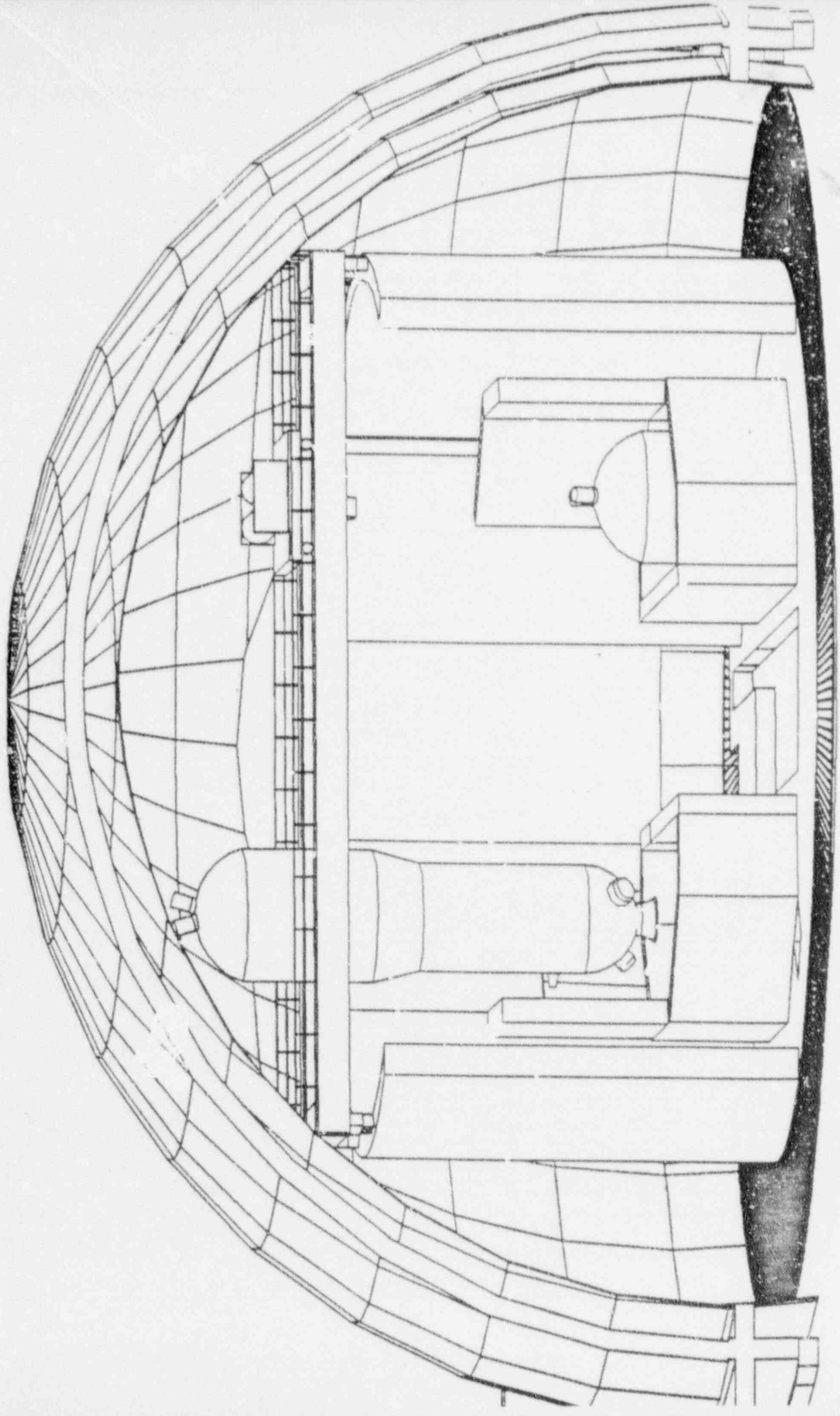
SYSTEM 80+ ™
STANDARD DESIGN

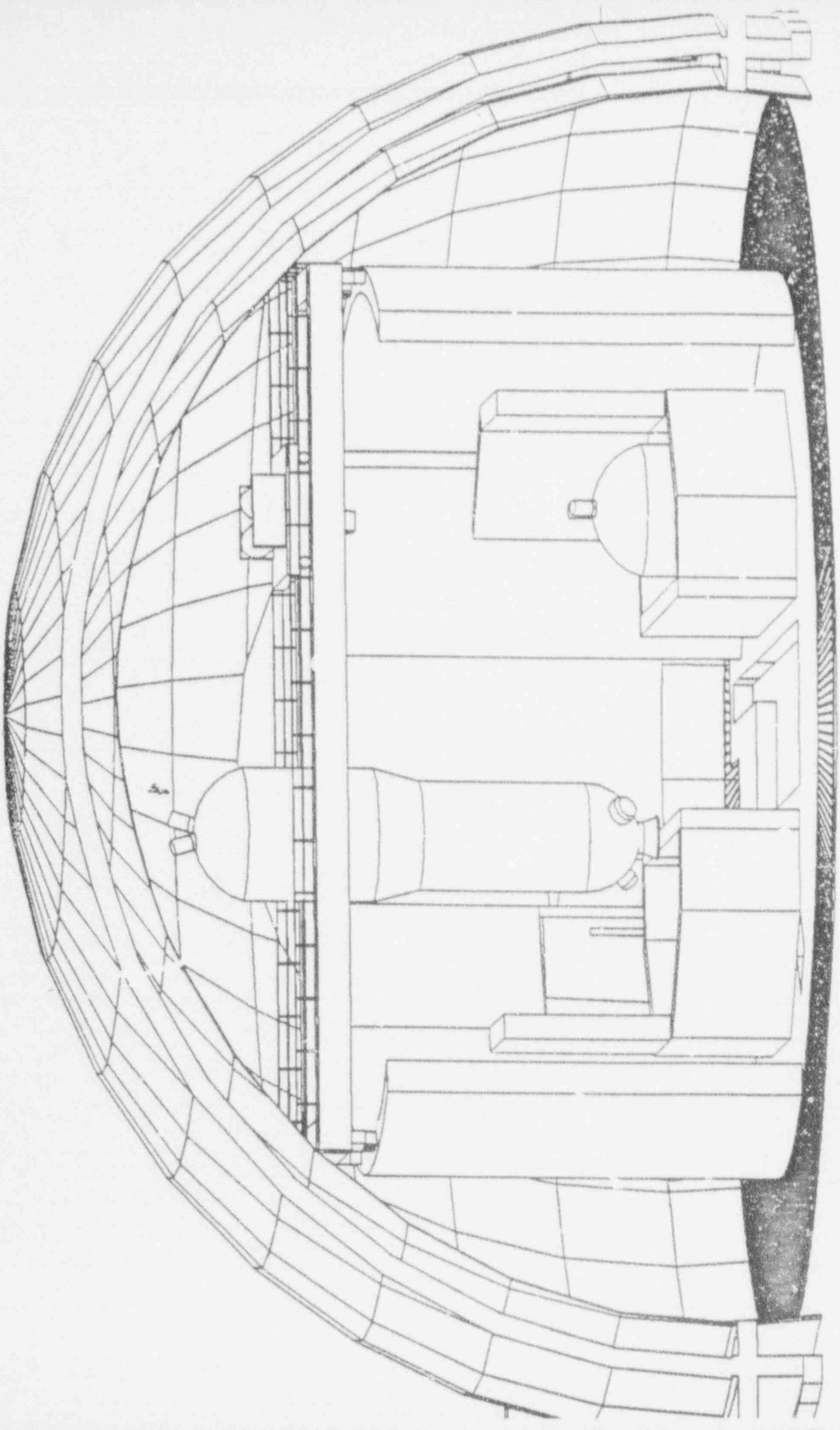


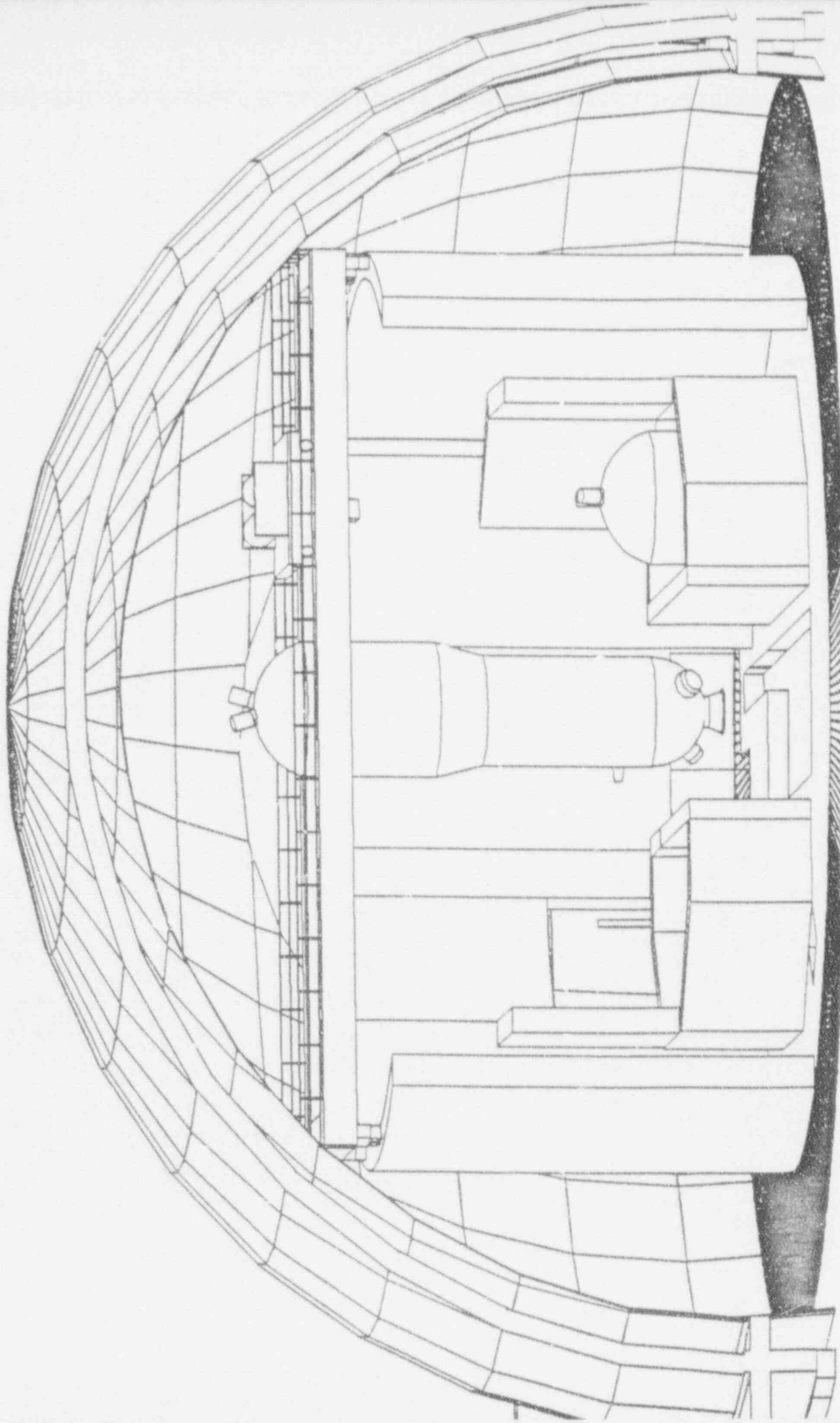
SYSTEM 80+ ™ STANDARD DESIGN

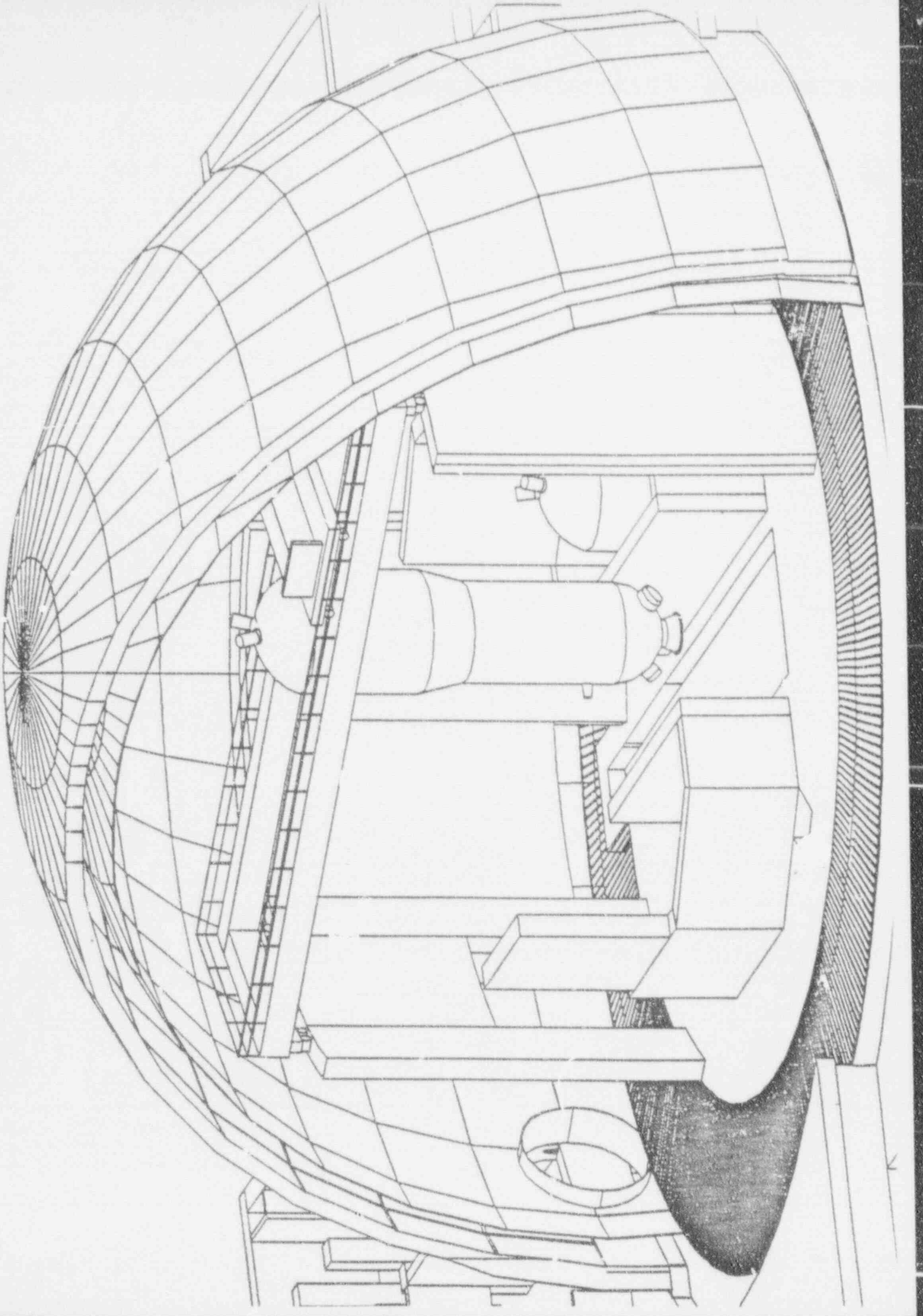


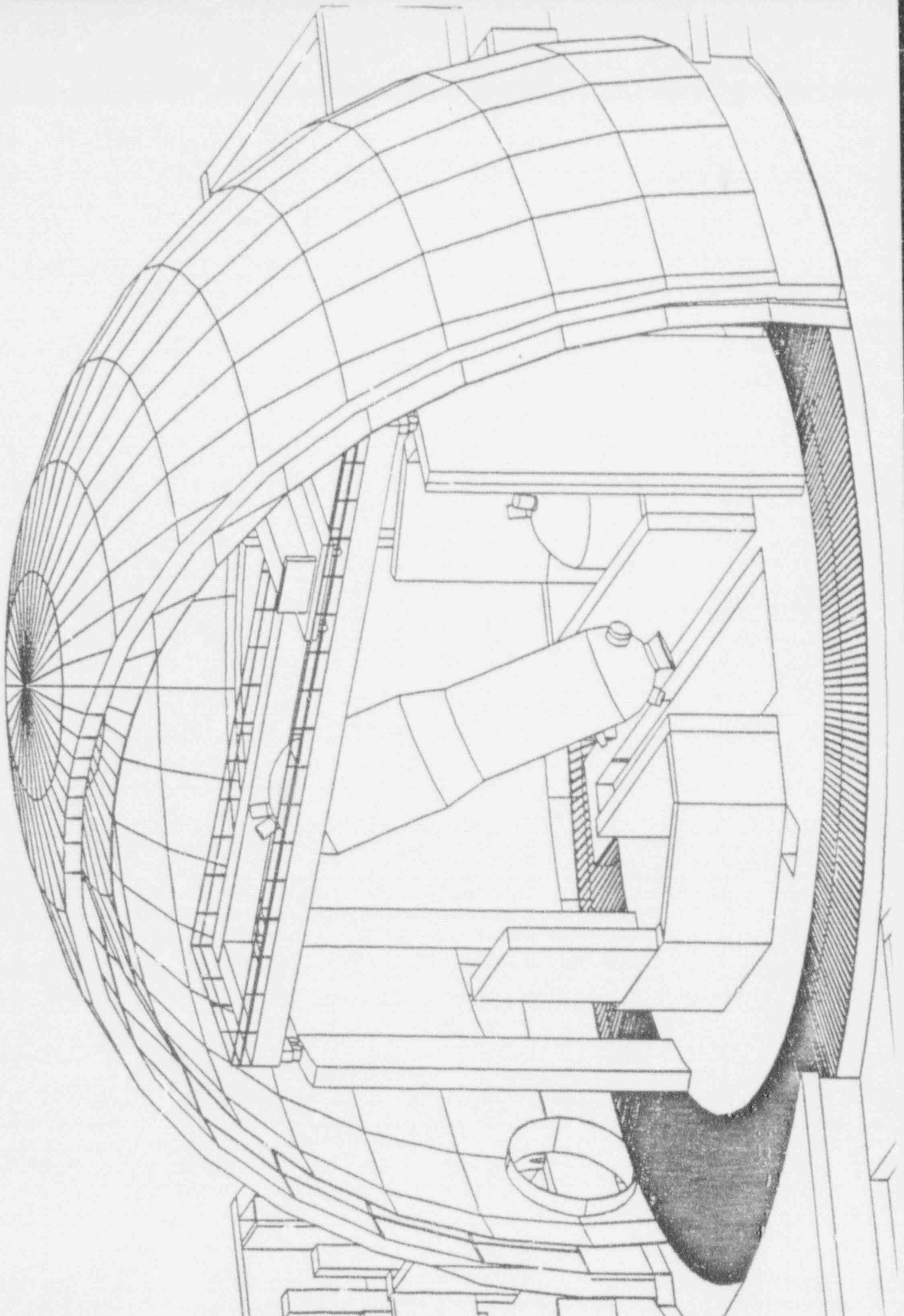
SYSTEM 80+ ™ STANDARD DESIGN

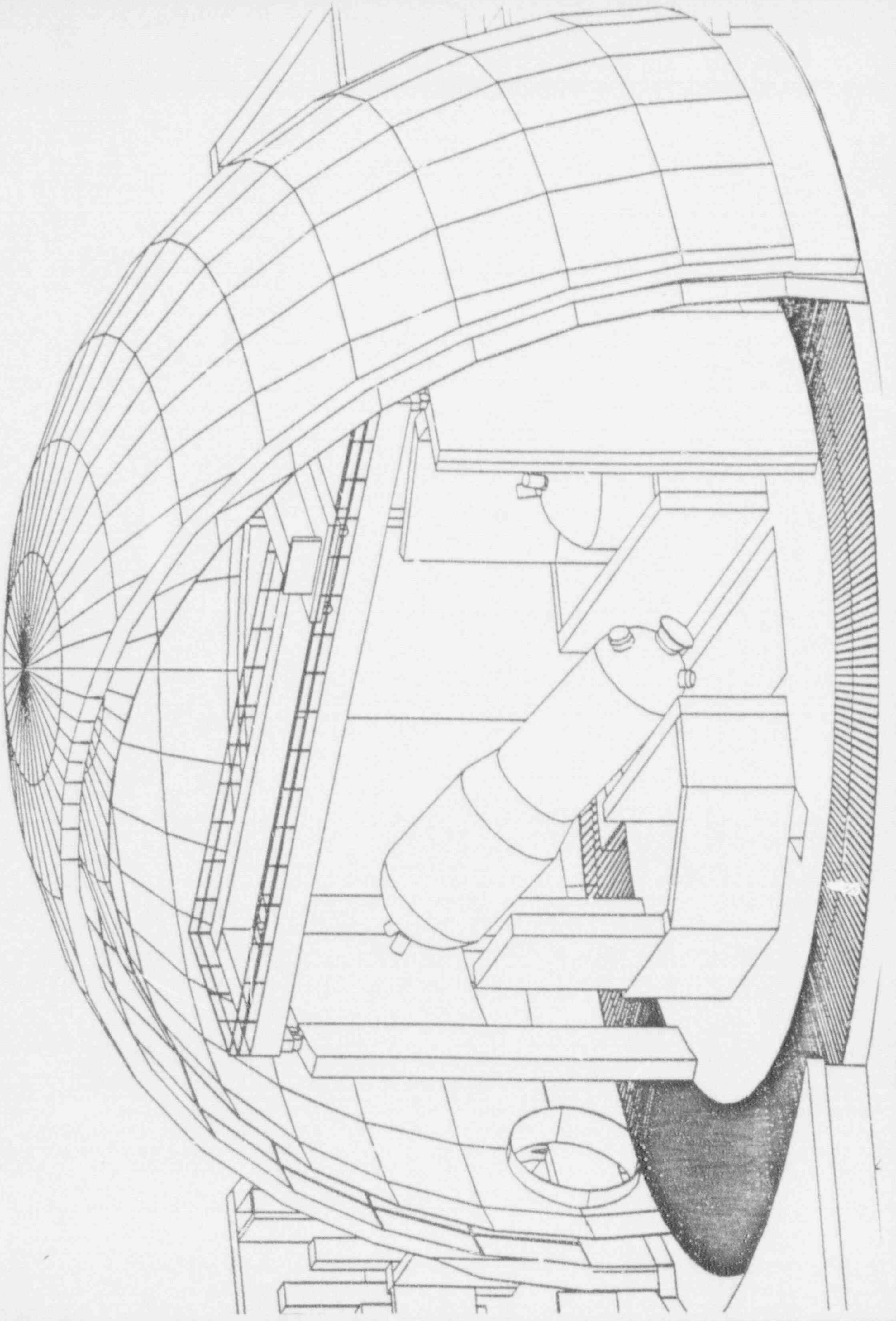


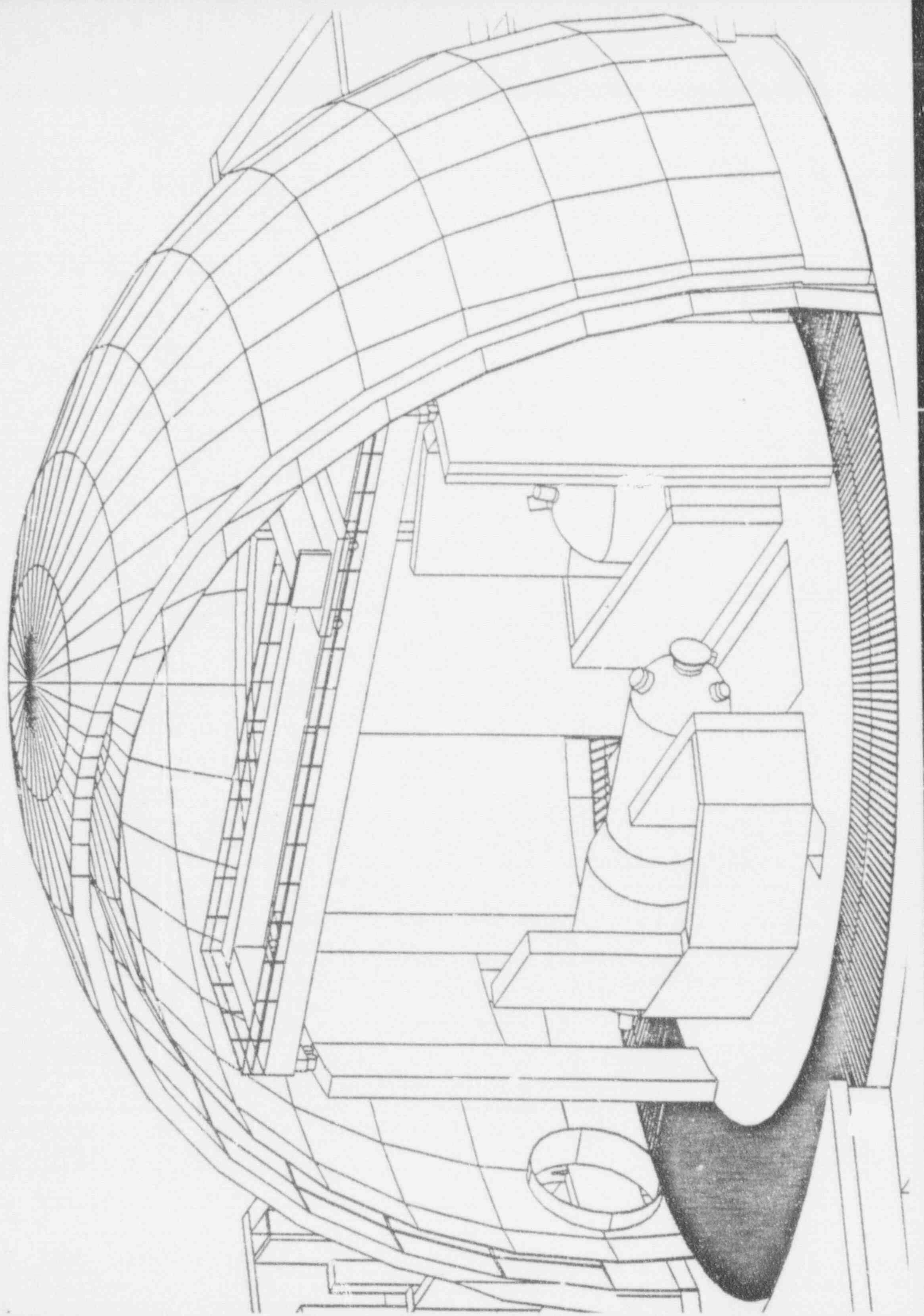


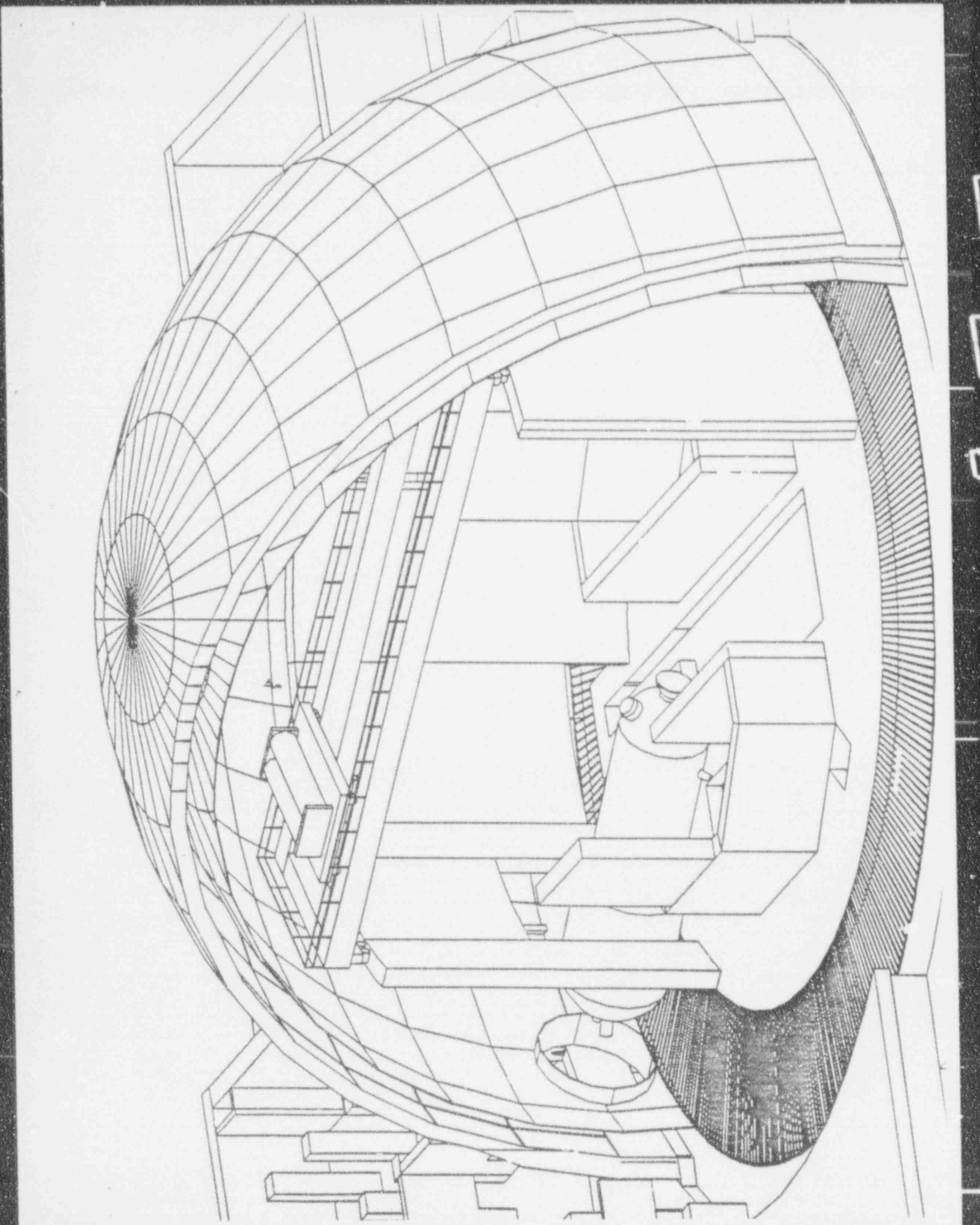


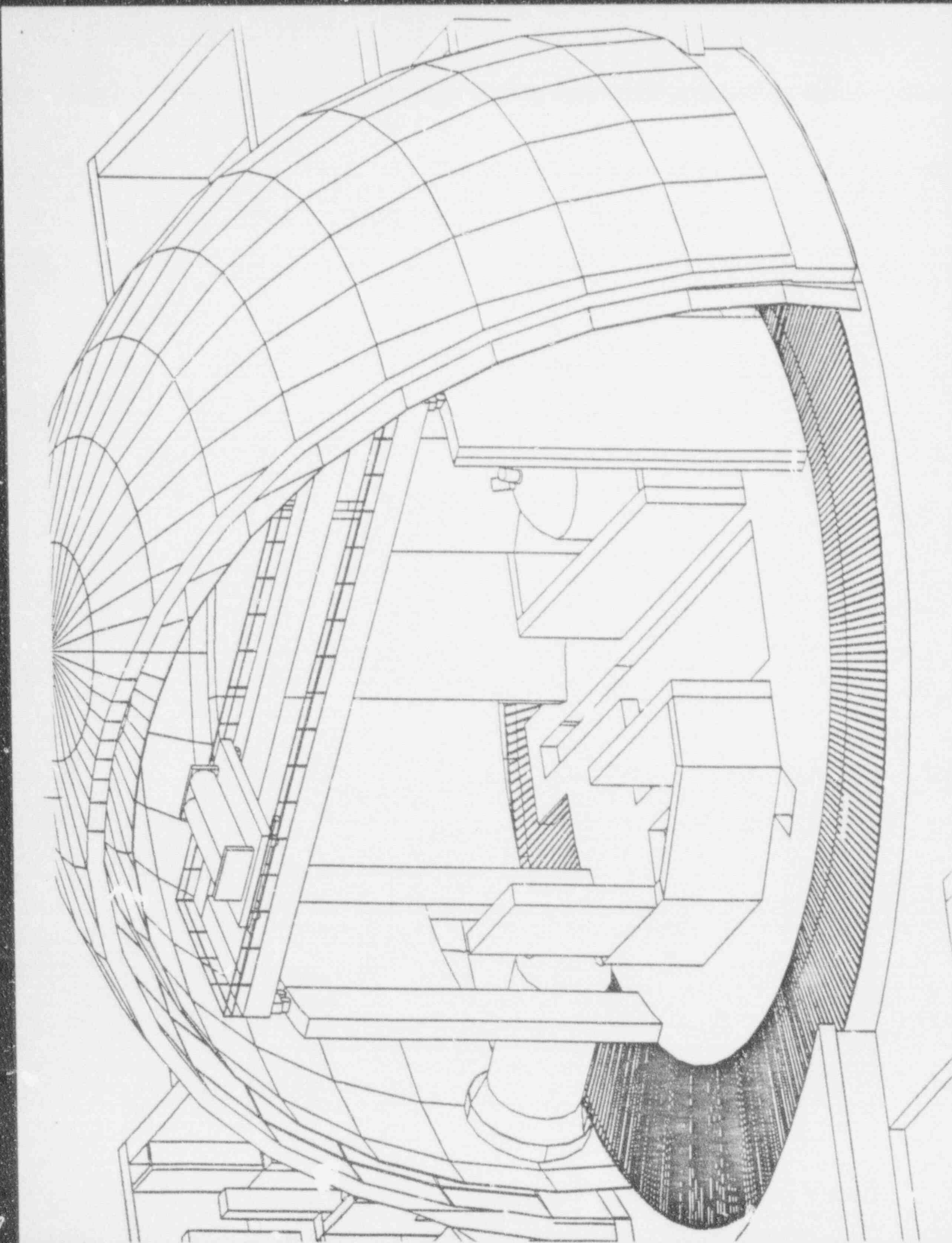


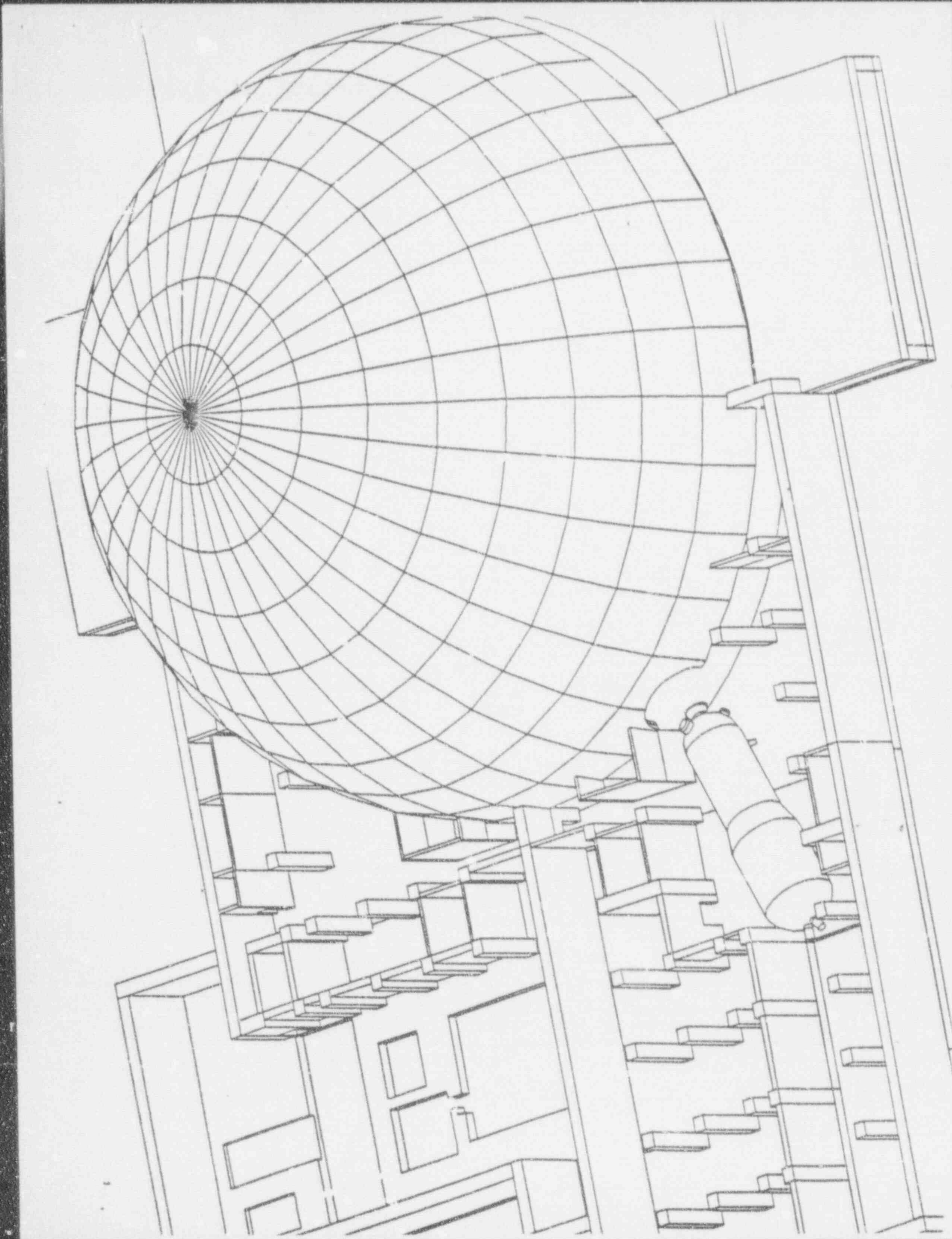


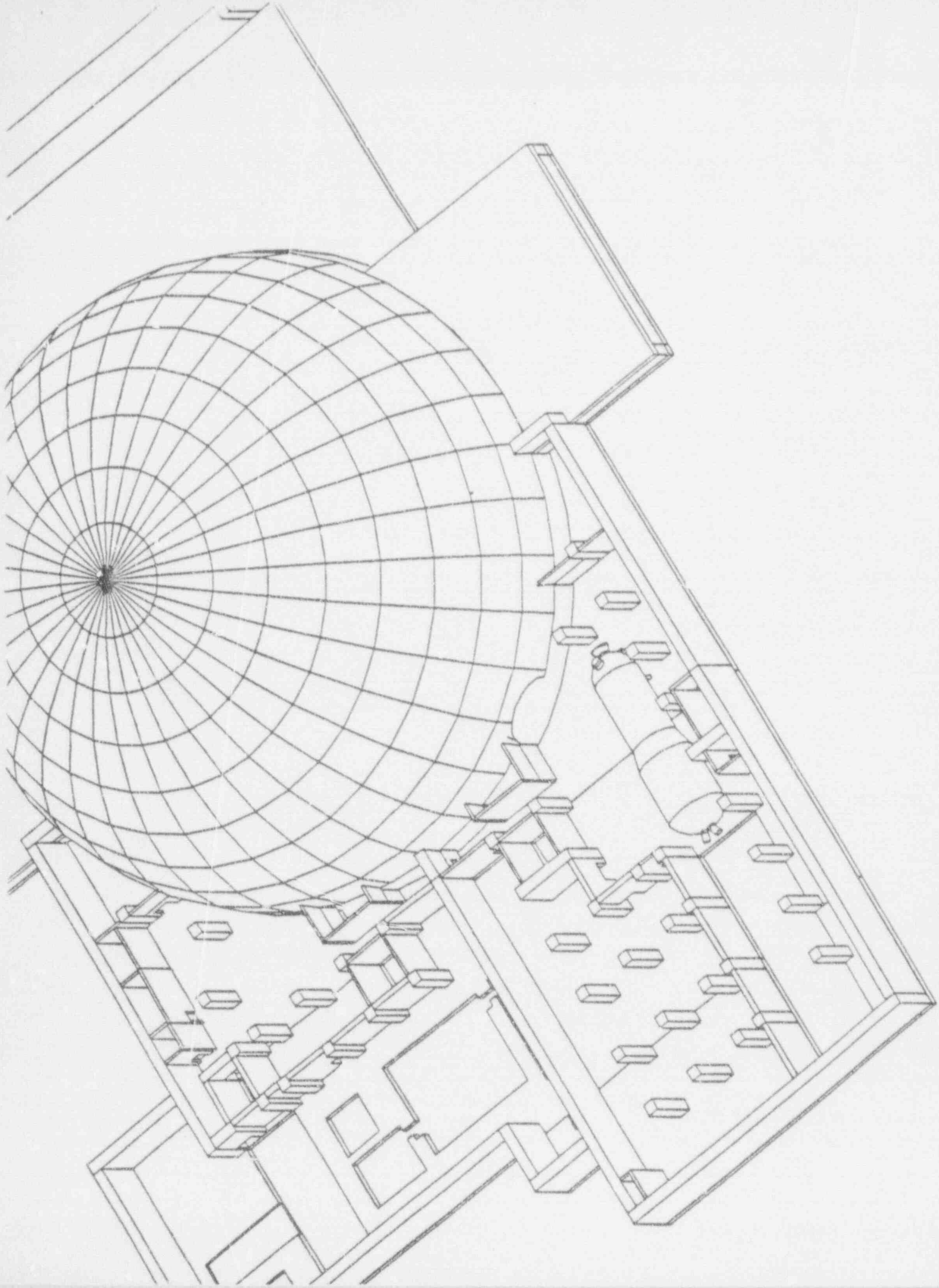


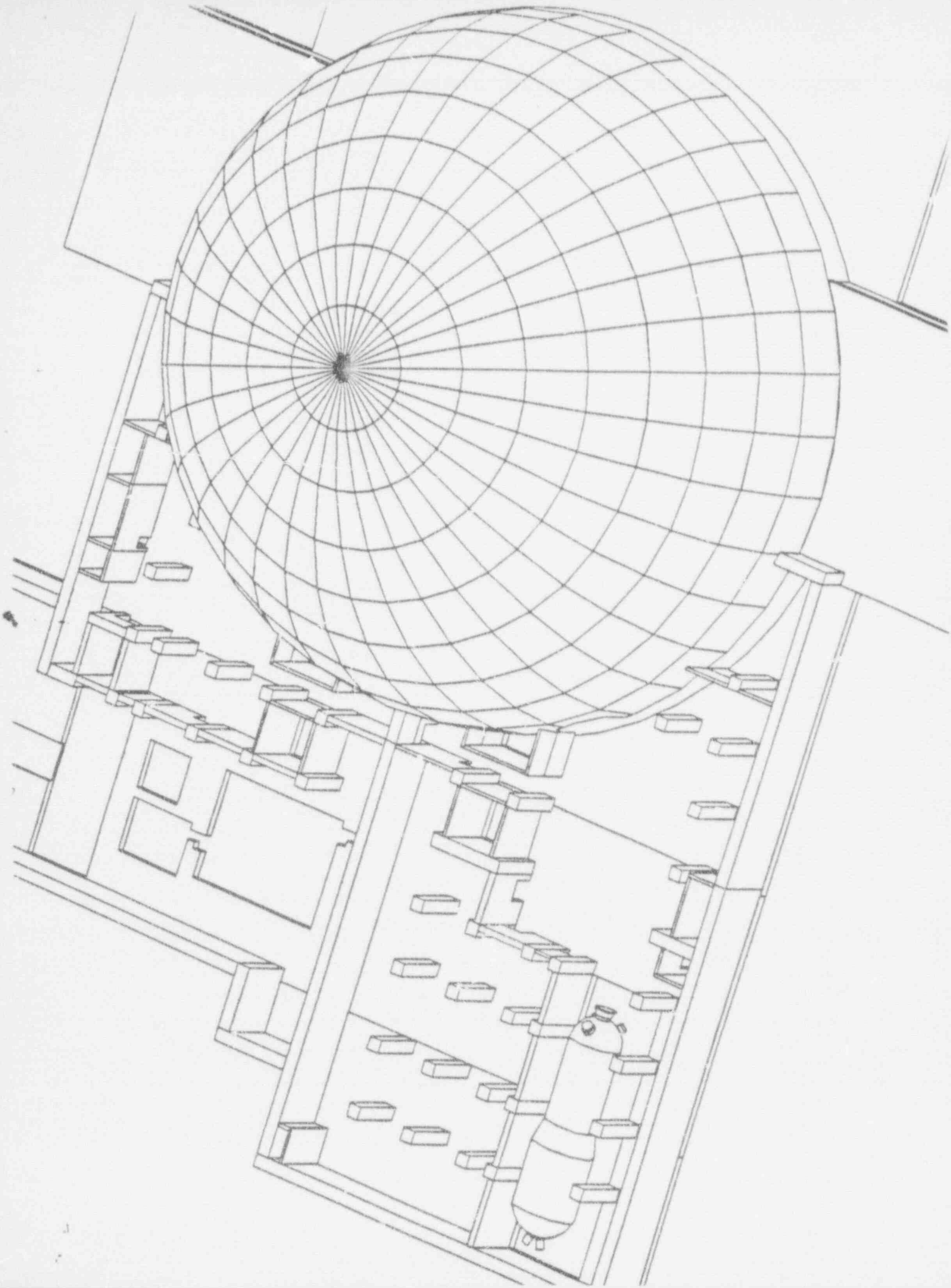












```
C Input generated from PlantVIEW ANAlysis model
C and PlantPIPE version 4.34
C
C  (A) PROBLEM TITLE
C
C
 PASCE MODEL DEMO1
*
C
C  (B1) - DATA STORAGE INDICATORS
C
C
 NOFL
C
C  (B3) - ANALYSIS CONTROL INDICATORS
C
C
 FXEW STAT COMB
C
C  (B4) - UNITS SPECIFICATION
C
C
    F   FT    IN    IN LBIN LBFT LBFT LBIN
C
C  (C1) GEOMETRY DATA CONTROL INFORMATION
C
C
 GEOM    3    0 E-74                     DEMO1
C
C  (D) CONTROL POINTS
C
C
 RN-1 CLS2            PIPE RUN 1
    1                   DIR    -22.62     14.27     -34.27
    2                   OFF               -0.01               1
    3                   OFF               -0.25               2
    4                   OFF               -0.24               3
    5                   OFF               -0.50               4
    6                   OFF               -0.50               5
    7  TNP              TAN                                   6    11
    8  TIP       0.50   OFF              -12.12               6
    9  TNP              TAN                                   6    11
   10  TNP              TAN                                   8    15
   11  TIP       0.50   OFF                          3.00     8
   12  TNP              TAN                                   8    15
   13                   OFF     -2.00                0.00    11
   14  TNP              TAN                                  13    19
   15  TIP       0.50   OFF    -13.89                0.00    13
   16  TNP              TAN                                  13    19
   17                   OFF     -2.12                2.12    15
   18  TNP              TAN                                  17    21
   19  TIP       0.50   OFF     -1.67                1.67    17
   20  TNP              TAN                                  17    21
   21                   OFF                          6.47    19
   22  BRP              OFF                          0.34    21
   23                   OFF                          0.34    22
   24  TNP              TAN                                  23    29
   25  TIP       0.50   OFF                          4.00    23
   26  TNP              TAN                                  23    29
   27                   OFF      8.00                0.00    25
   28  TNP              TAN                                  27    32
   29  TIP       0.50   OFF      2.00                0.00    27
   30  TNP              TAN                                  27    32
   31  TNP              TAN                                  29    35
   32  TIP       0.50   OFF                         -5.00    29
   33  TNP              TAN                                  29    35
   34  TNP              TAN                                  32    38
   35  TIP       0.50   OFF      3.00                        32
   36  TNP              TAN                                  32
   37  TNP              TAN                                  32    38
   38  TIP       0.50   OFF                          5.00    35    43
   39  TNP              TAN                                  35
   40                   OFF      2.00                0.00    35    43
   41                   OFF     10.00                        38
   42  TNP              TAN                                  40
   43  TIP       0.50   OFF      7.38                0.00    41    46
   44  TNP              TAN                                  41
   45                   OFF                          1.50    41    46
   46                   OFF                          7.91    43
   47  BRP              OFF                          0.34    45
                                                             46
```

```
    48              OFF                               0.34   47
    49  TNP         TAN                                      48    52
    50  TIF    0.50 OFF                               2.94   48
    51  TNP         TAN                                      48    52
    52              OFF      0.83                            50
    53              OFF      2.70                            52
    54              OFF      0.46                            53
    55              OFF      0.46                            54
    56              OFF      0.31                            55
    57              OFF      0.23                            56
    58              OFF      0.01                            57
 *
  RN-2 CLS2         PIPE RUN 2
    47  BRP         DUP
    60              OFF      0.34                            47
    61              OFF      0.33                            60
    62              OFF      2.86                            61
    63              OFF      0.46                            62
    64              OFF      0.46                            63
    65              OFF      0.31                            64
    66              OFF      0.23                            65
    67              OFF      0.01                            66
 *
  RN-3 CLS2         PIPE RUN 3
    22  BRP         DUP
    69              OFF               0.34                   22
    70              OFF               0.45                   69
    71              OFF               0.50                   70
    72              OFF               0.50                   71
    73              OFF               0.24                   72
    74              OFF               0.25                   73
    75              OFF               0.01                   74
 *
 *
 C
 C   (E) COMPONENT PROPERTIES
 C
 C
  STRP  STRA-01          4.500     0.237
               MASS     10.80      5.52
  NONS  GASK-02          4.974     0.474
               MASS     10.80      5.52
  NONS  FLAN-03          4.974     0.474
               MASS     10.80      5.52
  VALV  VALV-04          4.974     0.474
               MASS     10.80      5.52
  BELB  ELBO-05          4.500     0.237
               MASS     10.80      5.52
  BELB  ELBO-06          4.500     0.237
               MASS     10.80      5.52
  BTEE  TEE -07          4.500     0.237     4.500     0.237
               MASS     10.80     10.80      5.52      5.52
  BRED  REDU-08          4.500     0.237     3.500     0.216
               MASS      4.92      1.08
  STRP  STRA-09          3.500     0.216
               MASS      7.56      3.24
  VALV  VALV-10          3.932     0.432
               MASS      7.56      3.24
  NONS  FLAN-11          3.932     0.432
               MASS      7.56      3.24
  NONS  GASK-12          3.932     0.432
 *             MASS      7.56      3.24
 C
 C   (F) MATERIAL PROPERTIES
 C
 C
  SA106 B
 *SA105
 C
 C   (G) COMPONENT SEQUENCE
 C
 C
     1 NONS   GASK-02   SA106 B          2
     2 NONS   FLAN-03   SA105            3
     3 STRP   STRA-01   SA106 B          4
     4 VALV   VALV-04   SA106 B          5
     5 VALV   VALV-04   SA106 B          6
     6 STRP   STRA-01   SA106 B          7
     7 BELB   ELBO-05   SA105            9
     8 STRP   STRA-01   SA106 B         10
```

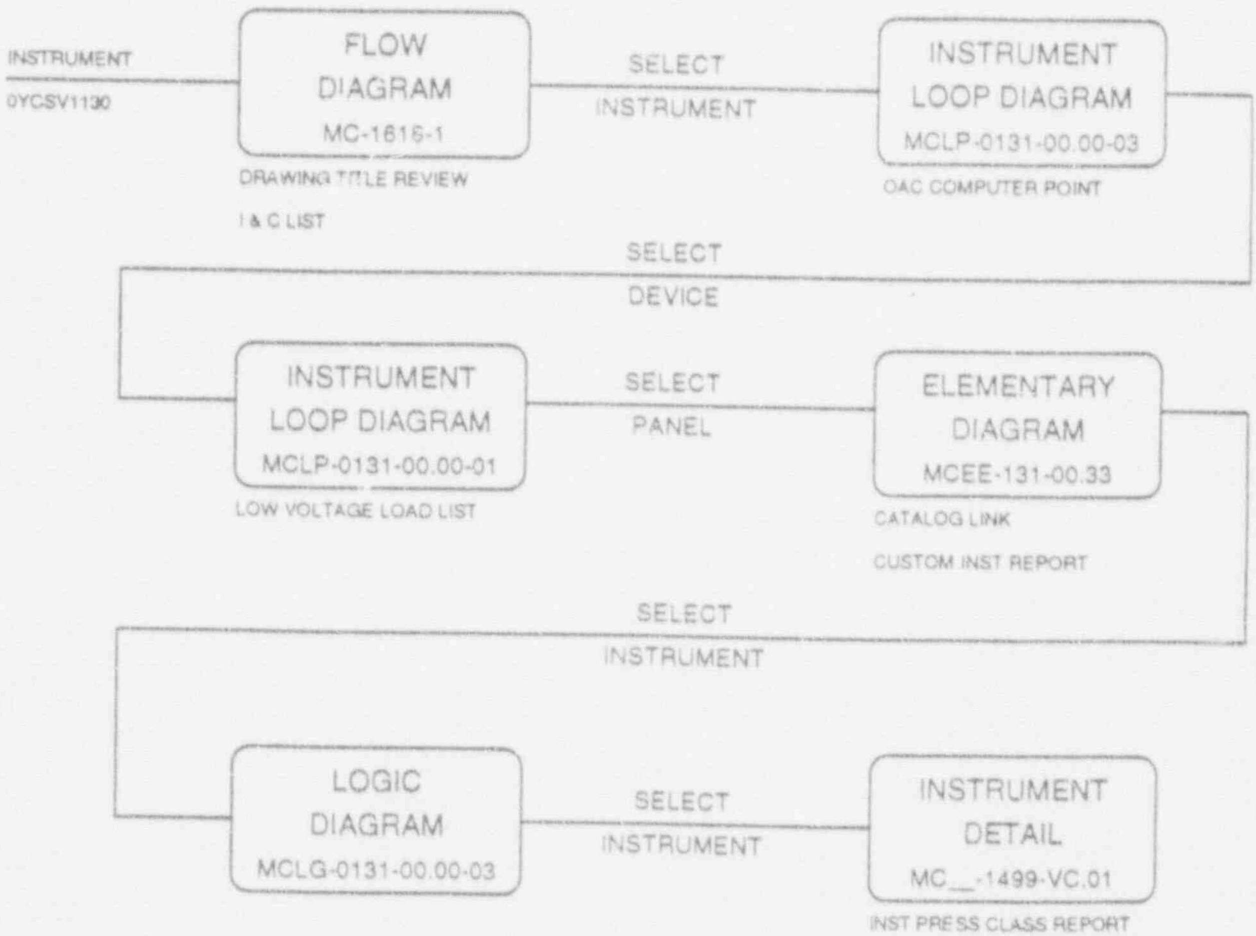
```
      9 BELB  ELBO-05  SA105               12
     10 STRP  STRA-01  SA106 B             14
     11 BELB  ELBO-06  SA105               16
     12 STRP  STRA-01  SA106 B             18
     13 BELB  ELBO-06  SA105               20
     14 STRP  STRA-01  SA106 B             21
     15 BTEER TEE -07  SA105               22
     16 BTEER TEE -07  SA105               23
     17 STRP  STRA-01  SA106 B             24
     18 BELB  ELBO-05  SA105               26
     19 STRP  STRA-01  SA106 B             28
     20 BELB  ELBO-05  SA105               30
     21 STRP  STRA-01  SA106 B             31
     22 BELB  ELBO-05  SA105               33
     23 STRP  STRA-01  SA106 B             34
     24 BELB  ELBO-05  SA105               36
     25 STRP  STRA-01  SA106 B             37
     26 BELB  ELBO-05  SA105               39
     27 STRP  STRA-01  SA106 B             42
     28 BELB  ELBO-05  SA105               44
     29 STRP  STRA-01  SA106 B             46
     30 BTEER TEE -07  SA105               47
     31 BTEER TEE -07  SA105               48
     32 STRP  STRA-01  SA106 B             49
     33 BELB  ELBO-05  SA105               51
     34 BREDR REDU-08  SA105               52
     35 STRP  STRA-09  SA106 B             53
     36 VALV  VALV-10  SA106 B             54
     37 VALV  VALV-10  SA106 B             55
     38 STRP  STRA-09  SA106 B             56
     39 NONS  FLAN-11  SA105               57
*    40 NONS  GASK-12  SA106 B             58
     41 BTEEB TEE -07  SA105               60
     42 BREDR REDU-08  SA105               61
     43 STRP  STRA-09  SA106 B             62
     44 VALV  VALV-10  SA106 B             63
     45 VALV  VALV-10  SA106 B             64
     46 STRP  STRA-09  SA106 B             65
     47 NONS  FLAN-11  SA105               66
*    48 NONS  GASK-12  SA106 B             67
     49 BTEEB TEE -07  SA105               69
     50 STRP  STRA-01  SA106 B             70
     51 VALV  VALV-04  SA106 B             71
     52 VALV  VALV-04  SA106 B             72
     53 STRP  STRA-01  SA106 B             73
     54 NONS  FLAN-03  SA105               74
*    55 NONS  GASK-02  SA106 B             75
C
C    (H) LUMPED WEIGHTS
C
C

     5     5      25.00
    54    54      15.00
    63    63      15.00
*   71    71      25.00
C
C    (I) SUPPORT LOCATION AND PROPERTIES
C
C

     1    13 SNGL TGSD0.9993E+10                                    Y
     2    17 SNGL TGSD0.9993E+10                                    Y
     3    27 SNGL TGSD0.9993E+10                                    Z
     4    40 SNGL TGSD0.9993E+10                                    Y
     5    41 SNGL TGSD0.9993E+10                                    Y
     6    45 SNGL TGSD0.9993E+10                                    Y
     7     1 ANCH TGSD0.0000E+000.0000E+00               SSSSSS GLOB
     8    75 ANCH TGSD0.0000E+000.0000E+00               SSSSSS GLOB
     9    58 ANCH TGSD0.0000E+000.0000E+00               SSSSSS GLOB
*   10    67 ANCH TGSD0.0000E+000.0000E+00               SSSSSS GLOB
C
C    (J) OUTPUT POINT SPECIFICATION
C
C
C
*
C
C    (L) STATIC ANALYSIS
C
C
C

     1 GRAV PRIN
*GRAV           1.0000                        -Y
```

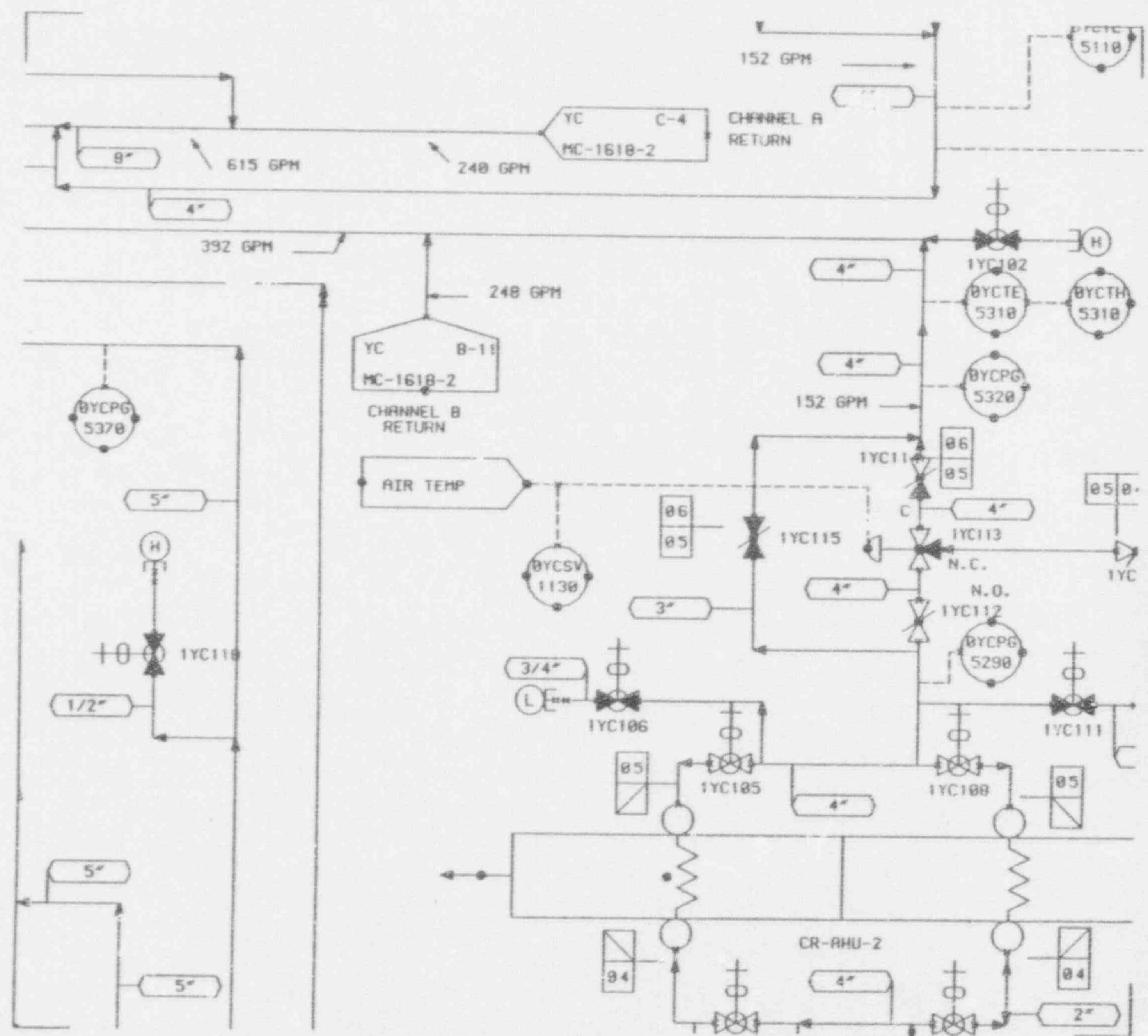
```
    2 THRM PRIN
  RUNL RN-1    399.999     69.998      0.000    1    58
  RUNL RN-2    399.999     69.998      0.000   47    67
 *RUNL RN-3    399.999     69.998      0.000   22    75
    4 DYNM PRIN
 *GRAV           0.6000                                   -X
    5 DYNM PRIN
 *GRAV           0.3500                                   -Y
 *  6 DYNM PRIN
 *GRAV           0.6000                                   -Z
 C
 C  (RA) RESULTS SET COMBINATION
 C
 C
  1015        PRIN      DSUM     1      1.000
  1016        PRIN      DSUM     2      1.000
  1017        PRIN      DSUM     1      1.000     2      1.000
  1007        PRIN      ENVP    17      1.000     1      1.000
  1008        PRIN      ENVN    17      1.000     1      1.000
  1009        PRIN      ASUM     4      1.000     5      1.000      6      1.000
  1010        PRIN      DSUM     9     -1.000
  1011        PRIN      DSUM     7      1.000     9      1.000
  1012        PRIN      DSUM     8      1.000    10      1.000
  1013        PRIN      DSUM     7      1.000     9      1.875
 *1014        PRIN      DSUM     8      1.000    10      1.875
```

PLANTSCHEMA DEMONSTRATION

INSTRUMENT **0YCSV1130** IS AN INSTRUMENT ASSOCIATED WITH A SOLENOID VALVE FOR THE COOLING WATER SUPPLY TO AN AIR HANDLING UNIT IN THE CONTROL ROOM.

WE WILL IDENTIFY THIS INSTRUMENT AND "JUMP" TO OTHER RELATED DRAWINGS TO DEMONSTRATE THE INTEGRATION AVAILABLE BETWEEN PLANTSCHEMA DRAWINGS AND PLANTSCHEMA APPLICATIONS.





152 GPM
5110
YC C-4
MC-1618-2
CHANNEL A
RETURN
8"
615 GPM
240 GPM
4"
392 GPM
1YC102
4"
0YCTE
5310
0YCTH
5310
248 GPM
YC B-18
MC-1618-2
CHANNEL B
RETURN
4"
0YCPG
5320
152 GPM
0YCPG
5370
5"
AIR TEMP
1YC11
06
05
C
4"
1YC113
06
05
1YC115
05 0
0YCSV
1130
N.C.
1YC
4"
N.O.
3"
1YC112
0YCPG
5290
H
1YC110
3/4"
1/2"
L
1YC106
1YC111
05
1YC105
4"
1YC108
05
5"
CR-AHU-2
04
4"
04
5"
2"

START || DWGS || INFO || WIN || IO || ATT || ENTER SCREEN || EXIT || YES || NO

McGuire Station Review

SHEET TITLE INFORMATION

```
****************************************************************
*                                                              *
*    Drawing Number:      MC-1613-1                            *
*                                                              *
*    Revision Number:     26                                   *
*                                                              *
*    Project Name:        MCGUIRE NUCLEAR STATION              *
*                                                              *
*    Drawing Title:       FLOW DIAGRAM OF                      *
*                         CONTROL AREA                         *
*                         CHILLED WATER SYSTEM                 *
*                         (YC)                                 *
*                                                              *
****************************************************************
```

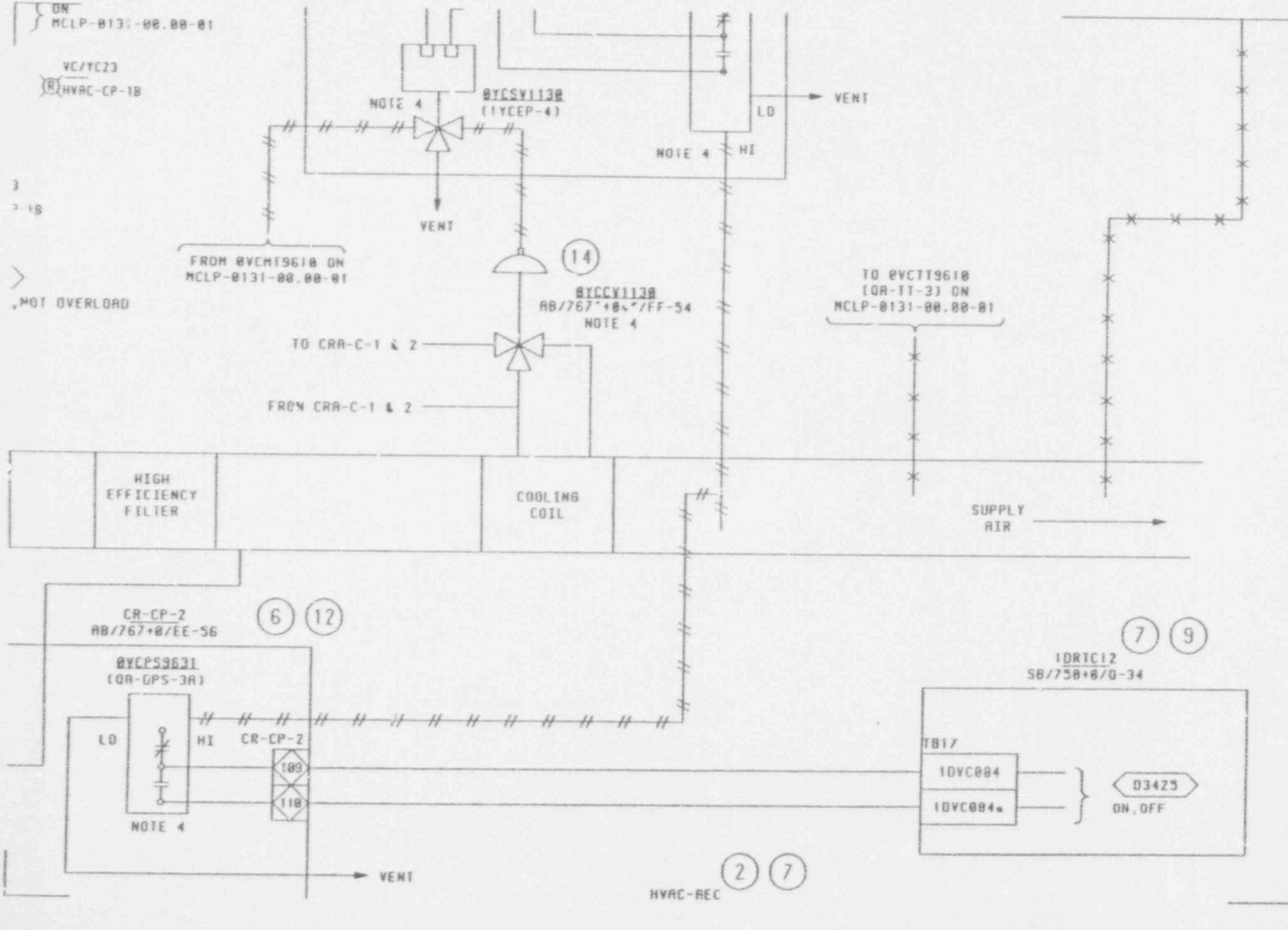
SELECT AN OPTION FROM THE MENU ABOVE:

START || DRWGS || INFO || WIN || ID || ATT || ENTER SCREEN || EXIT || YES || NO

McGuire Station Review

INSTRUMENT INFORMATION

```
Instrument: 0YCSV1130                          Location:  AB/757'+0"/EE-56
Desc Engrav:  INSTRUMENT AIR TO 1YC113 FOR CR-AHU-2
Manufacturer:     ASCO                         Usecodes:          1,9
Catalog No.:      NPK832081V                   Elec Elem No.:   MCEE-131-00.33
MP Order No:      ---                          Elec Conn No.:   MC-1761-01.12
Order Date.       ---                          Flow Diag No.:   MC-1613-1
Purch Req No.:    ---                          Mech Req D/S:    ---
Spec Number:      ---                          Design Press:    ---
MFGR Outline:     ---                          Design Temp:     ---
MFGR I/M:         MCM 1211.00-1617             Process Range:   ---
MFGR Data Sh:     ---                          Input Range:     120 VAC
Vendor P&ID:      MCM 1211.00-0702             Output Range:    ---
Vendor Mark:      1YCEP-4                      Inst Scale:      ---
Inst Detail:      N/A                          Proc Setpt 1:    ---
Calib D/S:        ---                          Proc Setpt 2:    ---
Inst Location:    MC0YCCV1130                  Input Setpt 1:   ---
Tap Location:     PANEL CR-CP-2                Input Setpt 2:   ---
Misc Info:  HAS 1E POWER
            ---

DO YOU WISH TO ENTER ANOTHER INSTRUMENT ?  (YES,<NO>)
```



ON
MCLP-0131-00.00-01
VC/YC23
R HVAC-CP-1B
3
-1B
,MOT OVERLOAD
NOTE 4
0YCSV1130
(1YCEP-4)
VENT
FROM 0VCMT9610 ON
MCLP-0131-00.00-01
14
0YCCV1130
AB/767'+04"/FF-54
NOTE 4
TO CRA-C-1 & 2
FROM CRA-C-1 & 2
LO
VENT
NOTE 4
HI
TO 0VCTT9610
(QA-TT-3) ON
MCLP-0131-00.00-01
HIGH
EFFICIENCY
FILTER
COOLING
COIL
SUPPLY
AIR
CR-CP-2
AB/767+0/EE-56
6
12
0YCPS9631
(QA-DPS-3A)
LO
HI
CR-CP-2
109
110
NOTE 4
VENT
7
9
1DRTC12
SB/750+6/G-34
TB17
1DVC084
1DVC084
D3425
ON,OFF
2
7
HVAC-REC

START | DRWGS | INFO | WIN | ID | ATT | ENTER SCREEN | EXIT | YES | NO

McGuire Station Review

WHAT DO YOU WANT TO D

18

WHAT DO YOU WANT TO D

7

PERFORMING APD EXTRA

Quit

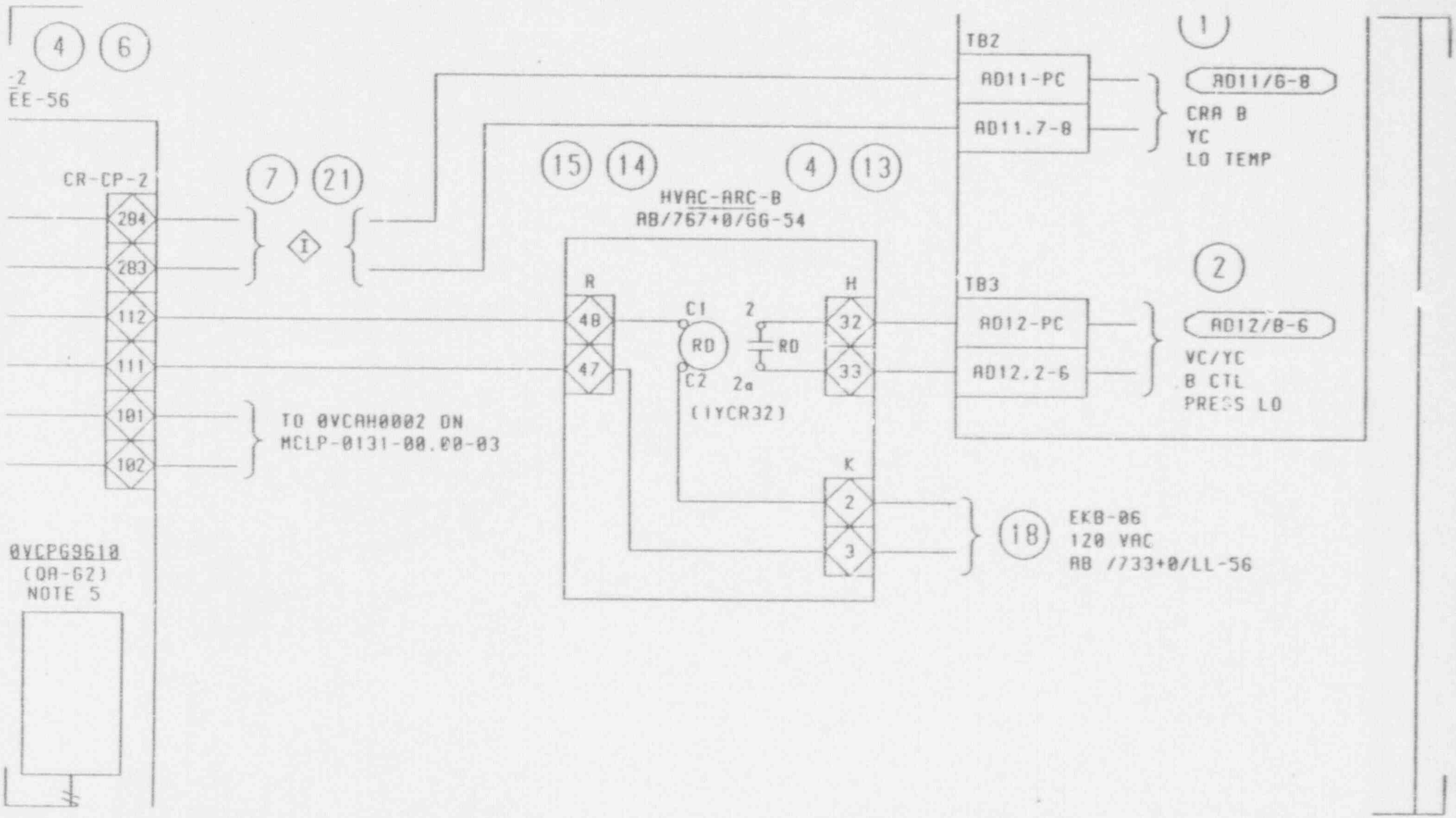
POINT ID	= D3425	
DATE	= 01/10/92	
TIME	= 12:00	
UNIT	= 1	
VALUE	=	0
TEXT	= OFF	
DESCRIPTION	= CONTROL ROOM AIR HANDLING UNIT TRAIN	

FORMATING APD DATA FOR DISPLAY ....

DETAILS OF POINT D3425

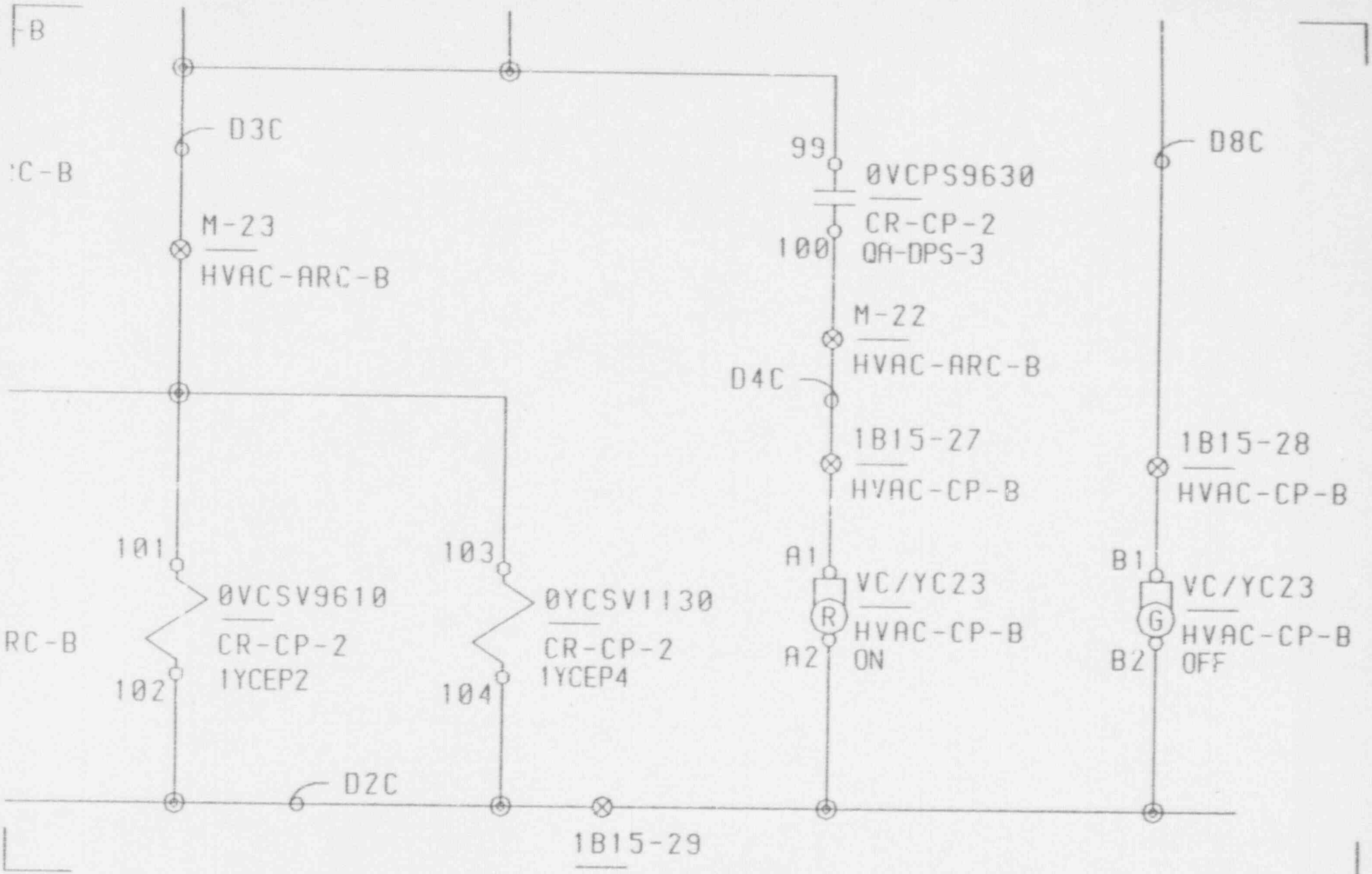
1

THIS IS THE POINT NUMBER FROM THE ALL POINTS DATABASE (APD).



4
6
-2
EE-56
CR-CP-2
284
283
112
111
101
102
7
21
I
15
14
4
13
HVAC-ARC-B
AB/767+0/GG-54
R
48
47
C1
RD
C2
2
RD
2a
(1YCR32)
H
32
33
K
2
3
TO 0VCAH0002 ON
MCLP-0131-00.00-03
18
EKB-06
120 VAC
AB /733+0/LL-56
TB2
AD11-PC
AD11.7-8
1
AD11/G-8
CRA B
YC
LO TEMP
TB3
AD12-PC
AD12.2-6
2
AD12/B-6
VC/YC
B CTL
PRESS LO
0VCPG9610
(QA-G2)
NOTE 5

```
|| START || DRWGS || INFO || WIN || ID || ATT || ENTER SCREEN || EXIT || YES || NO
= McGuire Station Review =====================================================
            *** REVIEW OF "LOW VOLTAGE LOAD LIST" DATA ***

 BUS NO : EKE       COMPT NUMBER: 08                       TYPE UNIT : TDBKR
 UNIT NO: STA       LOAD TITLE 1: UNIT #1 CHILLED          INRUSH AMPS :   26.16
 SYSTEM : YC        LOAD TITLE 2: WATER SYSTEM             F.L. AMPS:       4.34
 SAF CLS: 1E        LOAD TITLE 3: TRAIN B CONTROLS         N.O. AMPS:       4.34
 VOLTS  :   120     COMMENTS 1  :                          *** POST ACCIDENT ***
 PHASE  : 3         COMMENTS 2  : NSM MG-52065/00          0 - 1 MIN:       0.00
 DUTY:    N         COMMENTS 3  :                          1 MIN - 1 HR:    0.00
 BREAKER CONT RATING:   20                                 1 HR - 3 HRS:    0.00
 FUSE SIZE :             0.0                               TRAIN       : B
 BREAKER TYPE :        QNB
 DISTRIBUTION POINT :
 DIST PT LOCATION:
 DUKE WIRING DIAGRAM:                          REV NO:
 EE DRAWING NUMBER   : MCEE- 131-00.22         REV NO: 3
 TERM DRAWING NUMBER: MC   -1761-01.09         REV NO: 20
--- Review data now, then click <ENTER SCREEN> to continue. ---
```



B
C-B
RC-B
D3C
M-23
HVAC-ARC-B
101
102
0VCSV9610
CR-CP-2
1YCEP2
103
104
0YCSV1130
CR-CP-2
1YCEP4
D2C
1B15-29
99
100
0VCPS9630
CR-CP-2
QA-DPS-3
M-22
HVAC-ARC-B
D4C
1B15-27
HVAC-CP-B
A1
A2
R
VC/YC23
HVAC-CP-B
ON
D8C
1B15-28
HVAC-CP-B
B1
B2
G
VC/YC23
HVAC-CP-B
OFF

START || DRWGS || INFO || WIN || ID || ATT || ENTER SCREEN || EXIT || YES || NO

McGuire Station Review

EQUIPMENT CATALOG INFORMATION

```
**************************************************************
*                                                            *
*   Equipment Name:  VC/YC23                                 *
*   Mounted In:      HVAC-CP-B                               *
*   PASCE Name:      HVAC-CP-B-VC/YC23                       *
*                                                            *
*   Manufacturer:    CUTLER-HAMMER                           *
*   Catalog Number:  E30JA                                   *
*   MMIS Number:     03851724N                               *
*   Description:     PUSHBUTTON, TYPE E30, CONSISTING OF:    *
*                    TWO BUTTON OPERATOR WITH DUAL           *
*                    INDICATING LIGHTS, 120 VAC              *
*                                                            *
*   Size -  Height:  1.469                                   *
*           Width:   1.469                                   *
*                                                            *
**************************************************************
```

SELECT AN OPTION FROM THE MENU ABOVE:

|| START || DRWGS || INFO || WIN || ID || ATT || ENTER SCREEN || EXIT || YES || NO

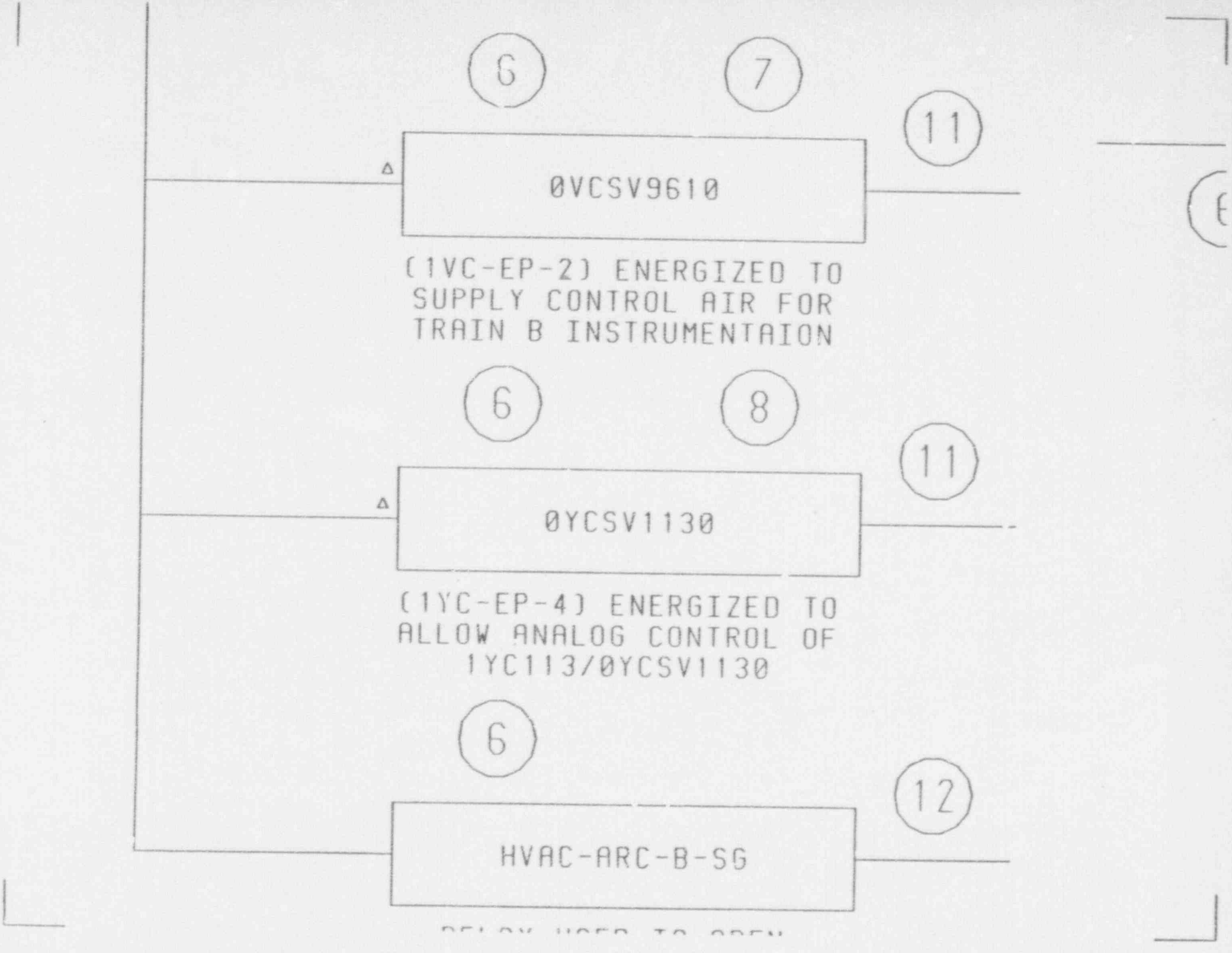
McGuire Station Review

1

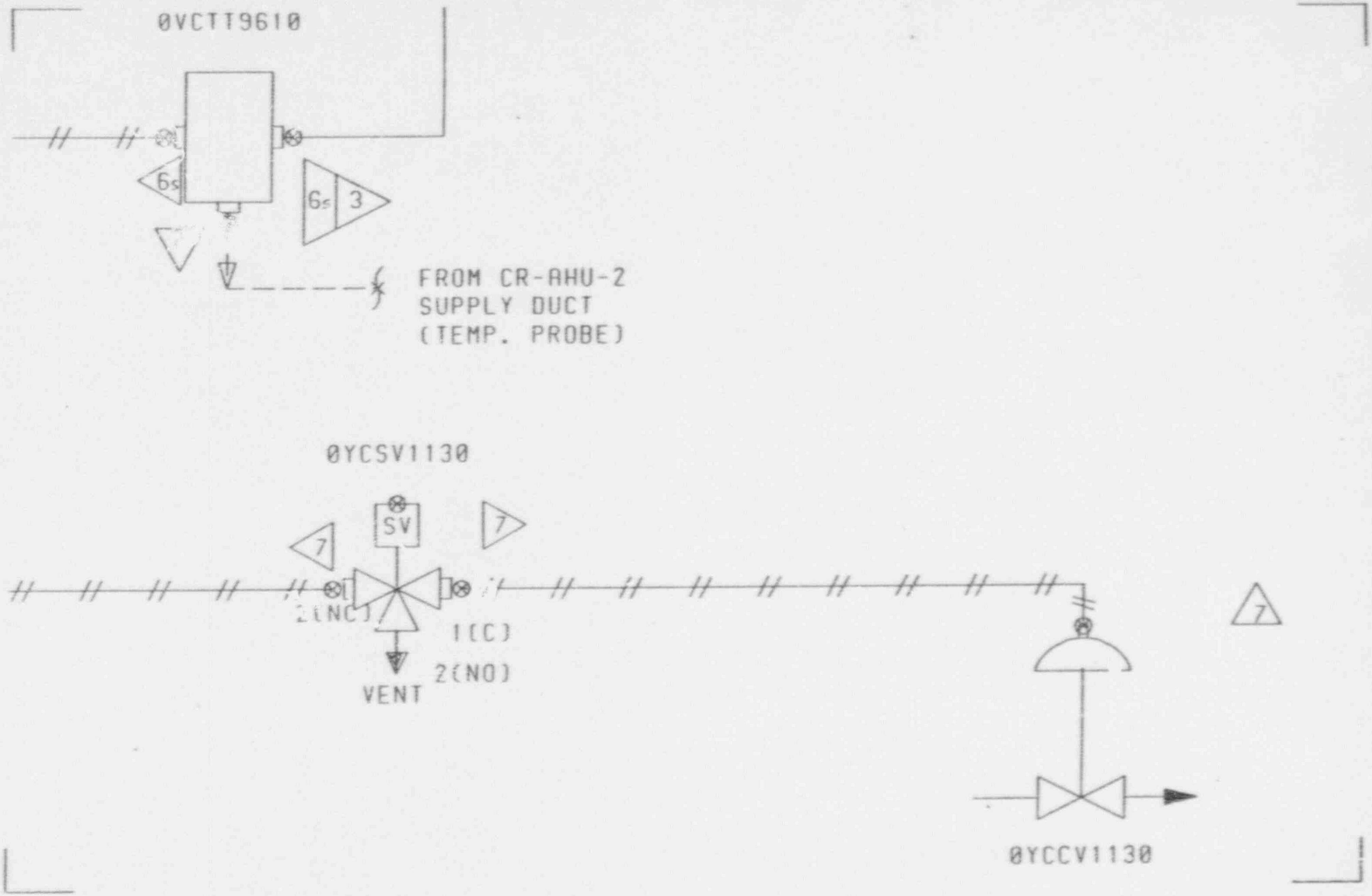
1

PLEASE WAIT, REPORT IS BEING COMPLILED.

NAME	BLDG	ELEV	COLUMN LINE LOCATION	VENDOR	
0VCPS9600	AB	767'+0"	EE-56	--	--
0VCPS0000	AB	767'+0"	GG-56	--	--
0VCTT9610	AB	767'+0"	EE-56	MCC POWERS	MC-
0VCMT9610	AB	767'+0"	EE-56	POWERS	--
0VCPR9610	AB	767'+0"	EE-56	POWERS	--
0VCPG9610	AB	767'+0"	EE-56	ASHCROFT	--
0VCSV9610	AB	767'+0"	EE-56	ASCO	--
0VCTT9010	AB	767'+0"	GG-56	MCC POWERS	



6
7
11
0VCSV9610
(1VC-EP-2) ENERGIZED TO
SUPPLY CONTROL AIR FOR
TRAIN B INSTRUMENTAION
6
8
11
0YCSV1130
(1YC-EP-4) ENERGIZED TO
ALLOW ANALOG CONTROL OF
1YC113/0YCSV1130
6
12
HVAC-ARC-B-SG



0VCTT9610
6s
6s
3
FROM CR-AHU-2
SUPPLY DUCT
(TEMP. PROBE)
0YCSV1130
SV
7
7
2(NC)
1(C)
2(NO)
VENT
7
0YCCV1130

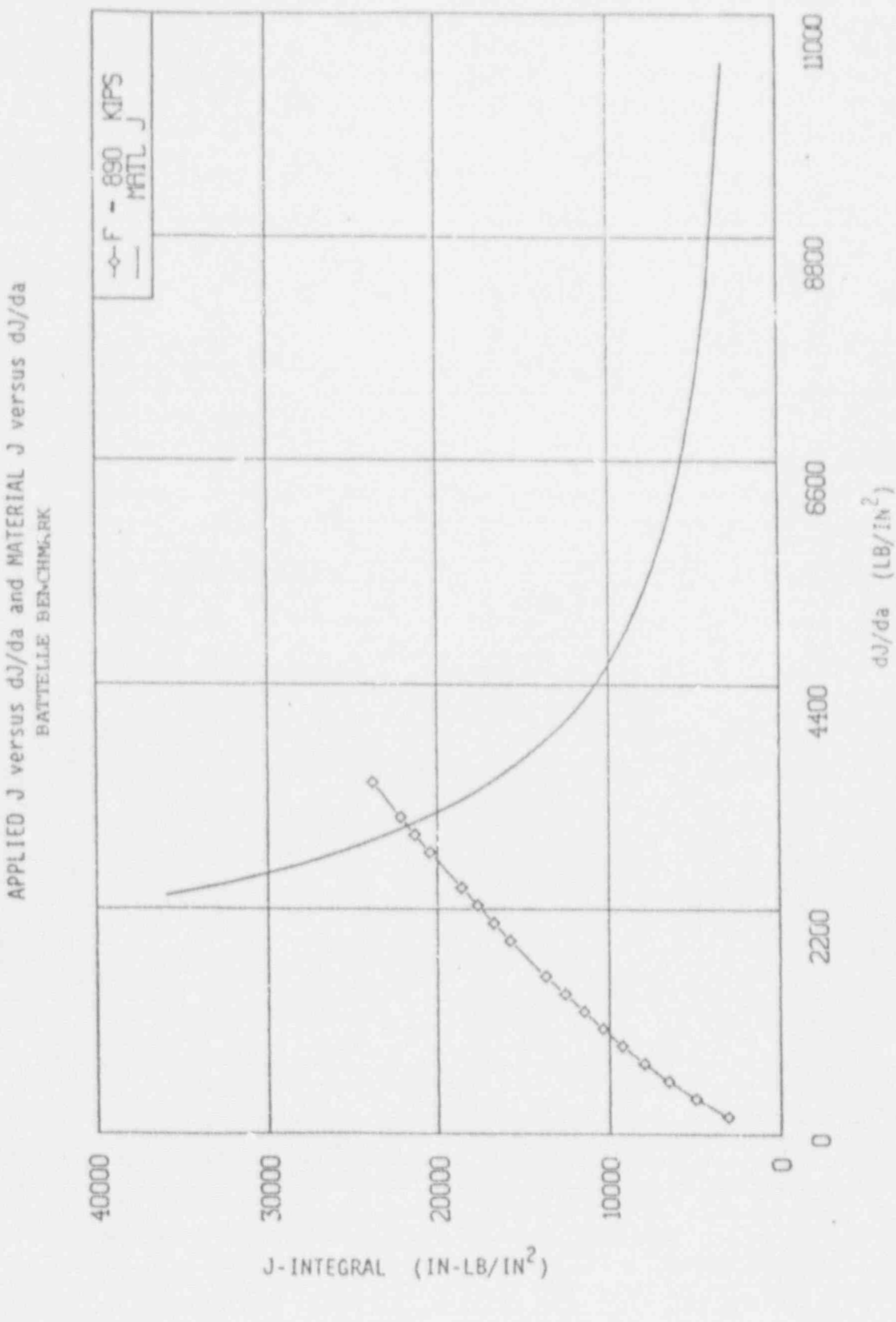
START || DRWGS || INFO || WIN || ID || ATT || ENTER SCREEN || EXIT || YES || NO

McGuire Station Review

PLEASE WAIT. YOUR REPORT IS BEING COMPILED.

NAME	PRESSURE CLASS FOR INST, FITT, INST LINES
0VCFR9610	--
0VCMT9610	[1] 7 [2] 3
0VCPG0610	[1] 6s [2] 3
0VCPR9610	[1] 7 [2] 3
0VCJV9610	[1] 6s [2] 3
0VCTI9610	[1] 6s

FIGURE B-10


APPLIED J versus dJ/da and MATERIAL J versus dJ/da
BATTELLE BENCHMARK
F - 890 KIPS
MATL J
J-INTEGRAL (IN-LB/IN²)
0
10000
20000
30000
40000
dJ/da (LB/IN²)
0
2200
4400
6600
8800
11000