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October 27, 1999

ComEd

United States Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Braidwood Station, Units 1 and 2
Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Byron Station, Units 1 and 2
Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

Subject: Supplemental Information Regarding a Request for Additional Information Related to NRC Generic Letter 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions"

References:

(1) Letter from J. Hosmer (ComEd) to USNRC, "ComEd response to NRC Generic Letter 96-06, 'Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions,'" dated May 2, 1997

(2) NRC Generic Letter 96-06, Supplement 1: "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions," dated November 13, 1997

(3) Letter from J. B. Hickman (NRC) to O. D. Kingsley (ComEd), "Request for Additional Information Related to the Generic Letter (GL) 96-06 Response for Byron Station, Units 1 and 2 and Braidwood Station, Units 1 and 2," dated May 1, 1998

(4) Letter from R. M. Krich (ComEd) to USNRC, "Response to Request for Additional Information Generic Letter 96-06: 'Assurance of Equipment Operability and Containment Integrity during Design-Basis Accident Conditions,'" dated August 27, 1998

(5) Letter from B. A. Wetzel (NRC) to K. J. Modeen (Nuclear Energy Institute), "Review of EPRI Technical Report TR-108812," dated October 1, 1998

(6) Letter from R. M. Krich (ComEd) to USNRC, "Deferral of Supplemental Information for Request for Additional Information, Generic Letter 96-06, 'Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions,'" dated February 26, 1999

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PDR ADOCK

In Reference 1, Commonwealth Edison (ComEd) Company provided the initial response to NRC Generic Letter 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions." Generic Letter 96-06, Supplement 1 (i.e., Reference 2) was issued by the NRC on November 13, 1997, which allowed the use of acceptance criteria defined in the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section III, "Rules for Construction of Nuclear Power Plant Components," Appendix F, "Rules for Evaluation of Service Loadings with Level D Service Limits." In Reference 3, the NRC requested that ComEd provide additional information. Reference 4 provided some of the requested additional information. However, we noted that our response would be supplemented by February 26, 1999, in order that analytical solutions employing the permanent use of the acceptance criteria contained in the ASME B&PV Code, Section III, Appendix F may be pursued, consistent with the NRC guidance of Reference 2. Reference 6 notified the NRC that the supplemental information would be delayed until October 27, 1999, as the ASME B&PV Code, Section III, Appendix F analysis work for containment penetrations P-5, P-8, P-37, P-55, P-70 and P-71, was delayed in order to address further questions raised by the NRC in Reference 5.

The attachment to this letter provides the information for the ASME B&PV Code, Appendix F analyses. Additionally, this response provides a summary update of the activities that have been undertaken to assure containment integrity as previously described in Reference 4.

Should you have any questions regarding this matter, please contact Mr. J. A. Bauer at (630) 663-7287.

Respectfully,

R. M. Krich
Vice President – Regulatory Services

Attachment

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Braidwood Station
NRC Senior Resident Inspector – Byron Station

bcc: NRC Project Manager – NRR – Byron and Braidwood Stations
Office of Nuclear Facility Safety – IDNS
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Director, Licensing and Compliance – Braidwood and Byron Stations
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Attachment

Supplemental Information Regarding a Request for Additional Information NRC Generic Letter 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions" Byron and Braidwood Stations

In the Commonwealth Edison (ComEd) Company submittal dated May 2, 1997 the following containment penetrations were identified as being susceptible to the overpressurization conditions discussed in Generic Letter (GL) 96-06. The penetrations and associated system descriptions are as follows.

- P-5, P-6, P-8 and P-10 – Containment Chilled Water System
- P-11 – Reactor Coolant Drain Tank Pump Discharge
- P-24 – Component Cooling Water Return From the Reactor Coolant Pump Thermal Barrier Heat Exchanger
- P-30 – Containment Demineralized Water Supply
- P-32 – Fuel Pool Cooling Return to Refueling Cavity
- P-34 – Containment Fire Protection Supply
- P-37 – Reactor Coolant System Loop Fill Header
- P-44 – Primary Water Supply to Reactor Coolant Pump Seal # 3 and Pressurizer Relief Tank
- P-47 – Containment Floor Drain Sump Pump Discharge
- P-55 – Safety Injection Accumulator Fill Line
- P-57 – Fuel Pool Cooling Suction from Refueling Cavity
- P-70 – Process Sampling
- P-71 – Chemical and Volume Control System Normal Charging Flow Path

These penetrations generally have a containment isolation valve on each side of the containment wall which is closed during normal operation (i.e., P-30, P-32, P37, P-55, P-57 and P-70) or automatically closes on a containment isolation signal (i.e., P-5, P-6, P-8, P-10, P-11, P-24, P-34, P-44, P-47, and P-71). These penetrations could be potentially heated during a Loss of Coolant Accident (LOCA) or a Main Steam Line Break (MSLB) inside containment, either of which would provide the containment isolation signal.

The overpressure mitigation methodologies for these penetrations susceptible to overpressurization fall into three categories as listed below.

A. Design changes are required to mitigate thermally induced overpressure conditions. Nine penetrations fall into this category (i.e., P-5, P-6, P-8, P-10, P-11, P-24, P-34, P-44, and P-47).

B. Overpressure conditions that are intended to be mitigated by either procedural changes for valve lineups or penetration draining. Three penetrations fall into this category (i.e., P-30, P-32 and P-57).

C. Pursue analytical solution employing American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PV), Section III, "Rules for Construction of Nuclear Power Plant Components," Appendix F, "Rules for Evaluation of Service Loadings with

Level D Service Limits," to qualify the penetrations for overpressure conditions. Four penetrations fall into this category (i.e., P-37, P-55, P-70 and P-71).

A summary of each of these mitigation methodologies is provided below.

A. Design Changes

(Note there are no differences in the design changes for the four Byron and Braidwood Units. Unit 1 component numbers are used; Unit 2 component numbers are similar.)

Penetrations P-6 and P-10 – Containment Chilled Water System

- Relief valves are being installed inside containment on the downstream side of the inner containment isolation check valves, 1WO007A (i.e., penetration P-6) and 1WO007B (i.e., penetration P-10). This configuration will allow pressure relief through these check valves into the containment and still maintain the valves' containment isolation function. The size of the relief valves to be installed are 1" x 1 1/2". Drawings for these penetrations will be updated and are located in the Updated Final Safety Analysis Report (UFSAR), Figure 9.2-16, Sheet 2.
- These modifications have been installed in Braidwood Station, Units 1 and 2, and Byron Station, Unit 1. For Byron Unit 2, this modification is currently scheduled to be installed during the refueling outage in the fall of 1999.

Penetrations P-5 and P-8 – Containment Chilled Water System

- In our May 2, 1997 submittal, we stated that an analytical solution employing ASME Section III Appendix F was being pursued for these penetrations. Based on the results of the analyses, we have determined that these penetrations could not be qualified under the Appendix F criteria, consequently, design changes are being planned for these penetrations.
- Relief valves are being installed inside containment between containment isolation valves 1WO056A and 1WO020A (i.e., penetration P-5), and 1WO056B and 1WO020B (i.e., penetration P-8). This configuration will allow for thermal pressure relief of the isolated piping section through the relief valve. The size of the relief valves to be installed are 3/4" x 1". Drawings for these penetrations will be updated and are located in the UFSAR, Figure 9.2-16, Sheet 2.
- For Braidwood Station, these modifications are currently scheduled to be installed during Unit 1 refueling outage in the spring of 2000, and the Unit 2 refueling outage in the fall of 2000. For Byron Station, these modifications are currently scheduled to be installed during the Unit 1 refueling outage in the fall of 2000, and the Unit 2 refueling outage in the spring of 2001.

Penetration P-11 – Reactor Coolant Drain Tank Pump Discharge

- A relief valve is being installed inside containment between isolation valves 1RE1003 and 1RE9170. This configuration will allow for thermal pressure relief of the isolated piping section through the relief valve. The size of the relief valve to be installed is 3/4" x 1". The attached Piping and Instrumentation Diagram (P&ID) M-70, Sheet 1, will be updated and shows the configuration for this penetration.
- These modifications have been installed in Braidwood Station Unit 2 and Byron Station Unit 1. For Braidwood Station Unit 1, the modification is currently scheduled to be

installed during the spring 2000 refueling outage. For Byron Station Unit 2, the modification is currently scheduled to be installed during the fall 1999 refueling outage.

Penetration P-24 – Component Cooling Water Return From the Reactor Coolant Pump Thermal Barrier Heat Exchanger

- This penetration has been evaluated as having adequate overpressure protection based on the existing configuration of the installed piping system. The 3/4" bypass line, 1CC52B, installed on the penetration piping allows pressure to be released into containment. This drawing is located in the UFSAR, Figure 9.2-3, Sheet 1.
- The modifications originally planned were to ensure that motor operated valve, 1CC685, (i.e., the outside containment isolation valve for P-24) would be capable of opening against the maximum possible pressure of 2485 psig. It has since been determined that, based on the actuator upgraded to address GL 89-10 concerns, valve 1CC685 is capable of opening against the worst-case pressure condition. Therefore, no modification of the piping associated with containment penetration P-24 will be made.

Penetration P-34 – Containment Fire Protection Supply

- A relief valve is being installed inside containment on the downstream side of the inner containment isolation check valve, 1FP345. This configuration will allow pressure relief through the check valve into containment and still maintain the valve's containment isolation function. The size of the relief valve to be installed is 3/4" x 1". The drawing for this penetration is located in the Byron/Braidwood Station Fire Protection Report, Appendix 5.0, Figure M52, Sheet 1, and will be updated to reflect this modification.
- These modifications have been installed in Braidwood Station Units 1 and 2, and Byron Station, Unit 1. For Byron Station, Unit 2, this modification is currently scheduled to be installed during the refueling outage in the fall of 1999.

Penetration P-44 – Primary Water Supply to Reactor Coolant Pump Seal # 3 and Pressurizer Relief Tank

- A 1/2" by-pass line with a spring loaded check valve is being installed inside containment around diaphragm valve, 1RY8030, which is downstream of containment isolation check valve, 1RY8046. Note that valve 1RY8030 is not a containment isolation valve, but is normally closed and can consequently result in pressure buildup in the isolated section of piping between inside containment isolation check valve,1RY8046, and outside containment isolation valve, 1RY8028. This configuration will allow pressure relief into the Pressurizer Relief Tank (PRT) and assure the integrity of the penetration piping. The drawing for this penetration is located in UFSAR, Figure 5.1-1, Sheet 8, and will be updated to reflect this modification.
- These modifications have been installed in Braidwood Station Units 1 and 2, and Byron Station Unit 1. For Byron Station Unit 2, this modification is currently scheduled to be installed during the refueling outage in the fall of 1999.

Penetration P-47 – Containment Floor Drain Sump Pump Discharge

- A relief valve is being installed inside containment between containment isolation valves 1RF026 and 1RF027. This configuration will allow for thermal pressure relief of the isolated containment piping section through the relief valve into containment. The size of the relief valve to be installed is a 3/4" x 1". Drawings for this penetration are located in UFSAR, Figure 11.2-7, Sheets 1 and 2, and will be updated to reflect this modification.

- These modifications have been installed in Braidwood Station Unit 2 and Byron Station Unit 1. For Braidwood Station Unit 1, the modification is currently scheduled to be installed during the refueling outage in the spring of 2000. For Byron Station Unit 2, the modification is currently scheduled to be installed during the refueling outage in the fall of 1999.

B. Procedural Changes or Draining

Note: Unit 1 component numbers are listed; the Unit 2 component numbers are similar.

Penetration P-30 – Containment Demineralized Water Supply

- For Braidwood Station, valve 1WM192A will be left open during normal operation. This valve is located inside containment and provides a path from the demineralized water (WM) system, which is isolated to the containment during normal operation, to the containment atmosphere. This configuration will allow pressure relief through containment isolation check valve, 1WM191, into containment and still maintain the check valve's containment isolation function. The Braidwood Station operating mechanical lineup procedure for the WM system has been revised to require valve 1WM192A to be left in the open position during normal power operation. This methodology has been employed at Braidwood Station since return-to-service from the Unit 1 refueling outage in the spring of 1997, and the Unit 2 refueling outage in the fall 1997.
- Byron Station has chosen to procedurally drain the WM penetrations. The Unit 1 penetration was drained during the refueling outage in February 1998, and the Unit 2 penetration was drained during the refueling outage in May 1998, using Byron special process procedures. The Byron Station operating procedures have been revised and are currently used to drain the WM penetrations after each refueling.
- Note that the Braidwood Station and Byron Station methodologies are different; however, the end result in both cases is acceptable because penetration P-30 is precluded from thermal overpressurization. UFSAR, Figure 9.2-4, Sheet 1 shows the configuration for this penetration.

Penetrations P-32 and P-57 – Fuel Pool Cooling Return to/from Refueling Cavity

- These penetrations are used only during refueling activities when the refueling cavity in containment is filled. Thermal overpressure mitigation for these penetrations is accomplished by draining the penetrations after refueling activities are completed and the containment refueling cavity has been drained.
- At both Braidwood and Byron Stations, procedural controls have been implemented to ensure draining of penetrations P-32 and P-57 after use during outage periods prior to returning the plant to power operations. Draining activities for these penetrations have been implemented at Braidwood Station since the return-to-service from the 1997 refueling outages for Units 1 and 2, and at Byron Station since the return-to-service from the 1998 refueling outages for Units 1 and 2. UFSAR, Figures 9.1-8, Sheet 2 and Sheet 1, show the configurations for these penetrations, respectively.

C. Analytical Solution Employing ASME B&PV Code, Section III, Appendix F Criteria

The following provides the available information for each penetration. Braidwood Station, Unit 1 information is provided. This information is considered to be typical of the four Braidwood Station and Byron Station units. All four units have similar configurations.

Penetration 37 – Reactor Coolant System Loop Fill Header

- This penetration contains one process line, 1CV43A-2", between isolation valves 1CV8346 and 1CV8348. Drawings are located in the UFSAR, Figure 9.3-4, Sheet 5.

Penetration 55 – Safety Injection Accumulator Fill Line

- This penetration contains two process lines, 1SI49B-3/4" and 1SI23B-3/4", bounded by isolation valves 1SI8871, 1SI8964, 1SI8961, 1SI011 and 1SI8888. Drawings are located in the UFSAR, Figure 6.3-1, Sheets 4 and 6.
  Note that a nitrogen supply line, 1SI71C-1", also passes through this penetration. This line is not affected by the thermal overpressure condition.

Penetration 70 – Process Sampling

- This penetration contains four process lines: 1PS183A-3/8", 1PS184A-3/8", 1PS185A-3/8", and 1PS186A-3/8".
- Only process line 1PS185A-3/8", sampling line from the accumulator tanks, is susceptible to thermal overpressurization. At Braidwood Station this is a 3/8" tubing line. At Byron Station, there is a section of 1" pipe, 1PS185C-1" and 1PS185D-1", adjacent to each of the containment isolation valves prior to the beginning of the 3/8" tubing. Byron Station Unit 1 has the longest run of piping and tubing which make Byron Unit 1 more susceptible to thermally induced overpressure. This line is bounded by isolation valves 1PS9357A and 1PS9357B. See attached drawing M-68, Sheet 1B for the more limiting Byron Unit 1 configuration.
- The other three lines are: 1PS183A-3/8", sampling line from pressurizer steam; 1PS 184A-3/8", sampling line from the pressurizer liquid; and 1PS186A-3/8", sampling line from Reactor Coolant System Hot and Cold Legs. The normal process fluid temperatures for these lines are higher than the containment ambient temperature under design basis accident conditions and therefore thermally induced overpressure is not an issue.

Penetration 71 – Chemical and Volume Control System Normal Charging Flow Path

- This penetration contains one process line, 1CV09D-3", bounded by isolation valves 1CV8105, 1CV8324A and 1CV8324B. Note that this process line is also labeled as 1CV09E-3" inside the containment. Drawings are located in the UFSAR, Figures 9.3-4, Sheets 5 and 8.

<u>Design Criteria</u>
All the lines, between and including the respective containment isolation valves, are classified as ASME Section III Class 2.

Loading Combinations
The following loads are combined in the evaluation.

For Piping: Pressure caused by thermal overpressurization + Dead Weight (DW)
For Pipe Supports: Weight + Thermal Expansion (Normal Condition) + LOCA (Pipe Rupture or Dynamic Effects)
For Penetrations: Thermal Overpressurization + Weight + Safe Shutdown Seismic (SSE)

The design data for these process lines are listed in the following table.

Penetration	Pipeline Number	Size – Schedule	Design Temperature (°F)	Design Pressure (Psig)	Applicable Drawing # (drawings attached)
P-37	1CV43A	2" – 160	200	2485	PG-2546A-98, PG-2546C-32
P-55	1SI49B 1SI23B	3/4" – 160 3/4" – 160	200 200	2485 2485	PG-2539A-29, PG-2539C-33A PG-2539A-31, PG-2539A-23 PG-2539A-38, PG-2539A-28
P-70	1PS185A 1PS185C 1PS185D	3/8" – * 1" – 160 1" – 160	300 300 300	700 700 700	 S-PS-001-14 S-PS-001-17
P-71	1CV09D 1CV09E	3" – 160 3" – 160	200 200	2485 2485	1A-CV-2 1C-CV-41, 1C-CV-38

* The 3/8" tubing is 16BWG tubing.

Pipe Size and Material and Valve requirements

- 3" Piping: Schedule 160, ASME SA-376, Gr. TP304 and/or SA-312, Gr. TP304.
- 1/2" to 2" Piping: Schedule 160, ASME SA-376, Gr. TP304 and/or SA-312, Gr. TP304
- Valves:
  - Sizes 8 in. and smaller: Body and Bonnet Material – forged or cast alloy steel; ASME SA-182, Gr. F304 or F316 or SA-351, Gr. CF8 or CF8M
  - Pressure Rating: 1500 lb. Rating
- Fittings:
  - Sizes 2 in. and smaller: Socket-weld, 6000 lb. Std. ASME SA-182, Gr. F304
  - Sizes 2 1/2 in. through 8 in.: Butt-weld, ASME SA-403, Gr. WP304 or WP316
- 3/8" size tubing:
  - Tubing: Stainless Steel, SA-213, Gr.. TP316, the wall thickness is 0.065" (16 BWG)
  - Fittings: Forged or wrought. ASME SA-182, SA-403, or SA-469, Type 316
  - Valves: Type 316 stainless steel, ASME SA-182, Gr. F316 or SA-351 Gr. CF8M

Calculations

Four calculations were performed to evaluate the structural adequacy of the pipe segments in these penetrations to withstand the overpressure condition. The first calculation determined the magnitude of temperature increase in the isolated pipe during a LOCA or a MSLB. The second calculation developed true stress – true strain curves for A106B and TP304 materials based on the NRC's Piping Fracture Mechanics (i.e., PIFRAC) Database. The stress-strain properties developed were used in the next two calculations. The third calculation developed a 2D-thick shell finite element model and validated the model against the Electric Power Research Institute (EPRI) analysis report, TR-108812,"Response of Isolated Piping to Thermally Induced Overpressurization During a Loss of Coolant Accident (GL 96-06)", dated December 1997, which was developed specifically to address GL 96-06 issues. The 2D-thick shell finite element model is then used, in the next calculation, to determine the volumetric expansion of the pipe segments under pressure and temperature. The fourth calculation evaluated the penetration areas (i.e., piping, valves, fittings and penetrations) for thermal overpressurization following a LOCA or MSLB. This calculation determined the equilibrium pressure within the isolated pipe segments and calculated the piping stresses. The pressure stresses are combined with other concurrent loads and compared to the requirements of ASME B&PV Code, Section III for level D (i.e., faulted) conditions using ASME B&PV Code, Section III, Appendix F acceptance criteria.

Detailed descriptions for each of these four calculations are provided below.

Calculation 1 – Thermal Heat-up of Isolated Pipe Running Through Penetrations

This calculation determined the temperature increase that occurred in the isolated pipe in containment for P-5, P-8, P-37, P-55, P-70 and P-71 during a LOCA or MSLB. The transient thermal-hydraulic software package, RELAP5/MOD3.2, was used in this analysis to determine the amount of temperature increase in the isolated sections of pipe during a LOCA or MSLB scenario. Different RELAP models were developed to represent each of the six penetrations. Review of the piping configurations for all four Byron and Braidwood Station units showed there are no significant differences among the units except for the pipe running through penetration P-70. For configurations with no significant differences, the Braidwood Station, Unit 1 geometries were used in the RELAP models. The pipe running through P-70 at Byron Station, Unit 1 has a substantially greater length inside the containment than the other three units. The geometry of the pipe running through P-70 in Byron Station, Unit 1 is used in the RELAP models.

The main component in all of these models represents the pipeline that goes through the penetration. The pipe component follows the geometry of the pipe section from the isolation valve immediately outside of the containment penetration to the isolation valve immediately inside the containment penetration. The changes in orientation of the pipe were modeled as was the resistance associated with the individual elbows.

The next major component of the RELAP models is the time dependent volume representing the environment inside the containment during the LOCA/MSLB. The temperature versus time curves used to describe the LOCA and the MSLB scenarios are the steam temperature curves shown the UFSAR, Figure 6.2-8 and Figure 6.2-14b, respectively. The containment was modeled as an all steam environment at saturation conditions in order to maximize the heat transfer to the isolated pipes. The other time dependent volume in the models represents the areas outside of containment in which the outboard sides of the pipes that pass through the subject penetrations are located. The temperature for these outside containment environments was set to the maximum Environmental Qualification (EQ) temperature of 118°F. This environment was also modeled as an all steam environment.

The last major components of the RELAP models are the heat structures through which heat is transferred from the time dependent volumes representing the LOCA and MSLB environments to the isolated pipe component. The first heat structure represents the pipe wall and the insulation on the isolated portion of the pipe outside of the containment. The second heat structure represents the pipe wall and the insulation on the isolated portion of the pipe inside the containment. In all cases the geometry of the heat structures follow the geometry of the pipe component. With the exception of P-5 and P-8, all the isolated pipe segments are non-insulated stainless steel pipe. Isolated pipe associated with P5 and P8 are carbon steel pipe with antisweat insulation. Four materials are used in the heat structures through which heat is conducted from the LOCA and MSLB environments to the section of the isolated pipe. These are 304 stainless steel, 316 stainless steel, 106 carbon steel, and high density fiberglass (i.e., antisweat) insulation.

The convective heat transfer correlations and the condensation heat transfer correlations built into RELAP were used in the calculation. These condensation correlations have conservatively predicted heat transfer coefficients as high as 600 BTU/hr-ft^2-^{0}F in these models. This is higher than the heat transfer coefficients from the coefficients predicted by the well-established and commonly used Uchida heat transfer correlation.

The resulting maximum temperatures that the isolated pipes experience during the LOCA and MSLB scenarios are summarized below.

Penetration	Initial Temperature (°F)	Maximum Normal Operating Pressure (psig)	Maximum Volumetrically Averaged Temperature (°F) (MSLB)	Maximum Volumetrically Averaged Temperature (°F) (LOCA)
P-5	47	100	49	145
P-8	47	100	49	141
P-37	78	2600	215	241
P-55	47	1600	173	165
P-70	65	700	290	249
P-71	92	2600	234	262

Note that penetrations P-5 and P-8 were originally included in the group of penetrations to be evaluated in accordance with ASME B&PV Code, Section III, Appendix F criteria. Based on the results of the thermal heat up calculation and some preliminary pipe stress evaluation based on the increased pressure, it was determined that penetrations P-5 and P-8 could not be qualified under the Appendix F criteria. As discussed in the "Design Changes" section of this response, relief valves will be installed on the isolated pipe segments for these penetrations.

<u>Calculation 2 – Development of True Stress / True Strain Curves for A106B and TP304 Materials</u>

The Byron and Braidwood Stations Certified Piping Design Specifications permit the use of the 1977 Edition of ASME B&PV Code, Section III with Addenda through Summer 1979. Appendix F is a non-mandatory appendix to this Code and discusses rules for evaluation of Level D service limits. Loads in Appendix F can be evaluated on an elastic or inelastic system basis. For an inelastic system analysis, Appendix F provides rules in Paragraph F-1324 for accepting the resulting stresses. However, Appendix F also permits an alternative set of rules to be used for piping as noted in Paragraph F-1360, which refers back to the Class 1 rules of ASME Section III, Subsection NB, "Class 1 Components." (Note that Appendix F was originally written for Class 1 vessels.) There were two evaluations required, one for allowable pressure and the other for general piping stresses.

An inelastic system analysis was used due to the fact that the pipe was allowed to yield. The yielding of the pipe was also used to predict the final equilibrium pressure between the pipe and the water, as shown in Calculation # 4. In order to perform an elastic-plastic analysis, stress-strain properties were needed. As required in Appendix F, Paragraph F-1322, the stress-strain curve used must be documented. As also required in the same paragraph, the allowable stresses must be based on the published Code minimum values. In reality, materials are typically stronger than the Code minimums. In order to meet Code requirements, the analysis used a realistic stress-strain curve to predict the final pressure and then conservatively used Code allowables at temperature as acceptance criteria.

Since actual stress-strain data for the piping was not available, data was obtained from the NRC PIFRAC database. This database provided stress-strain properties at ~76°F and ~300°F for carbon steel (i.e., A106B) and stainless steel (i.e., TP304), based on tensile tests done for the NRC Piping Fracture Mechanics Database. The desired properties were at various temperatures; therefore, linear interpolation was used to obtain the properties at the desired temperature. Since yield strength for 304SS changes significantly between room temperature and 200°F (i.e., changes approximately 15%), and more slowly between 200 °F and 300°F, the use of linear interpolation resulted in raising the stress-strain curve (i.e., making the material stiffer), which was conservative. Note that since the material properties for TP304 and TP316 are similar, the strain-stress properties for material TP304 were applied to TP316.

<u>Calculation # 3 – Benchmark of ANSYS Finite Element Model</u>

In the EPRI response to the NRC concerns about the use of strain criteria without considering all concurrent loads (i.e., EPRI Analysis Report TR-108812), a simplified bounding analysis based on thin wall shell theory was used with axial compression loads equivalent to 0, 6 and 10 ksi superimposed. EPRI concluded that axial compression will have the greatest impact on plastic hoop strains (i.e., produces higher strains). ComEd decided to pursue an Appendix F analytical solution to the overpressurization issue, but use the accepted stress criteria in Appendix F, rather than a strain criteria. To validate the EPRI analysis, the ANSYS computer code was used to generate a three-dimensional (3-D) finite element model of a thin shell cylinder. This model utilized elastic-plastic analysis including large deflection and large strain effects. This model was used to run three loading conditions: pressure alone; pressure with axial compression; and pressure with bending. The closed form solution for plastic hoop strain under internal pressure with and without a sustained axial stress was used to benchmark the finite element model. The closed form solution was taken from Chapter 5 of a textbook by Jack A. Collins, "Failure of Materials in Mechanical Design," Second Edition. Plastic hoop strains were determined at incremental pressures and compared to the closed form solution at the same pressures. Once the benchmark was completed, a sustained bending stress of 10 ksi was applied to the ANSYS model, and a third analysis was made to determine the effects of bending on the plastic hoop strain.

Two additional evaluations were performed using the 3-D shell model. First, hoop strains were calculated at various pressures using the closed form solution with a 10 ksi axial compression stress, a 10 ksi axial tension stress, and no axial stress. This showed that the hoop strains, due to bending, fall between those due to pure compression (i.e., the maximum strain) and pure tension (i.e., the minimum strain). Second, the displaced area was calculated for bending stress superimposed with internal pressure. This was done to ensure that the displaced cross-sectional area did not significantly change due to bending. This conclusion was utilized in the piping qualification calculation as shown in Calculation # 4.

An ANSYS two-dimensional (2-D) axisymmetric model was also developed in order to evaluate thick shell cylinders. This model also used elastic-plastic analysis with large deflection and large strain effects. Plastic hoop strains were determined from the 2-D axisymmetric model. Since the results of the 2-D axisymmetric model matched closely to those from the 3-D thin shell model, the 2-D model was used in subsequent analyses.

The results of these evaluations are as follows:

- Very good correlation was shown between the closed form solution and the ANSYS benchmark solution for hoop strain with and without an axial compressive stress. This allowed for an axial vs. bending stress check to be performed using the ANSYS model.
- Applying 10 ksi of axial compression had the worst effect on hoop strains compared to axial tension or bending.
- The change in cross sectional area due to adding a bending stress to the internal pressure was negligible (i.e., increased less than 3% at 5000 psi). In addition, as pressure was increased to 8000 psi, the change in deformed area due to bending decreased. This result showed that using standard section properties in the piping qualification was appropriate.

Note that the pressure vs. hoop strain comparison was performed for a 10 ksi applied stress or lower. A review of the detailed piping analyses for Byron and Braidwood Stations penetrations P-37, P-55, P-70 and P-71, showed that the maximum pressure plus dead weight stresses are 10 ksi or less. Therefore, the benchmark conclusions are valid. Also note that the conclusions above are valid up to 6.5% membrane hoop strain, the maximum reached in the ANSYS model. The maximum membrane hoop strain reached under the equilibrium pressure was shown to be below 6.5%, which ensures the equilibrium pressure stress calculations are within the validity limits of the benchmark calculation.

<u>Calculation # 4 – Evaluation of Penetration Areas for Thermal Overpressurization</u>

This calculation was performed to show that the pressure in the isolated piping when combined with other concurrent loads meets the requirements of the ASME B&PV Code Section III for Level D (i.e., faulted) conditions. The calculation was based on the accepted stress criteria in Appendix F, rather than the strain criteria. The evaluation encompasses the piping itself, the fittings, including the isolation valves, and the penetrations.

An inelastic system analysis was used because the pipe is allowed to yield to determine the final equilibrium pressure between the pipe and the water. The method used to determine the increase in pressure with temperature in the pipe is based on equating the pressure in the piping system, at a particular temperature, to the pressure needed to maintain the water in thermodynamic equilibrium. First, an equation was derived that provided the volumetric expansion of a piping system under pressure and temperature. This derivation was based on a simple cylinder, capped at both ends. The length of the cylinder was based on the total length of the isolated volume. However, the length, which will plastically deform was taken as less than the total length of the isolated volume because "thinner" materials will yield first. Therefore, the uniform volume increase under pressure was modified to account for the stiffer regions of piping (i.e., the valve bodies and the penetration head fitting). The next step was to calculate the volumetric expansion of the isolated volume of water. From the initial pressure and temperature of the fluid, shown in the Calculation # 1 discussion, the initial specific volume was determined using the ASME Steam Tables. The Maximum Volumetrically Averaged Temperature, from the thermal transient analysis in Calculation #1, was used to iterate on the final pressure so that the change in specific volume, divided by the initial specific volume of the fluid, was equal to the change in the volume of the expanding pipe divided by its initial volume. This equilibrium point was calculated as the final internal pressure within the isolated volume. Once the final equilibrium pressure was determined, the appropriate piping equations were checked to ensure the piping was acceptable. The pipe fittings, valves and penetration head fitting were also accepted by comparison to the piping or available qualification data.

The acceptance criteria for the piping, shown below, were taken from the ASME B&PV Code, Section III, Paragraph F-1360(a) for pressure and Paragraph NC-3611.2(C)(4) for axial stresses:

1. The allowable pressure shall not exceed 2.0 times the pressure calculated in accordance with Equation 2 of NB-3641.1.

2. The conditions of Equation 9 of NC-3652.2 shall be satisfied using a stress limit of $2.4S_h$.

For piping and components, which did not meet the alternative simplified pressure criterion above, the results from the previously mentioned system inelastic analysis were used to verify the following criteria.

1. For pressure design, the primary stress limits of NB-3221 are satisfied using an S_m value equal to the higher of 0.70 S_u and $[S_y + (S_u - S_y) / 3]$ at temperature.

2. The conditions of Equation 9 of NC-3652.2 shall be satisfied using a stress limit of $2.4S_h$.

For piping, the pressure loads were combined with deadweight loads. The only other piping load during a LOCA or MSLB is thermal expansion, a self-limiting load. Paragraph NC-3650 clearly shows that thermal expansion is considered separately from other stresses. This is also consistent with the use of Appendix F, Paragraph F-1310(c), which states that only primary loads are considered.

Since the valves are part of the piping, they were evaluated using the same load combination as the piping (i.e., pressure + deadweight). Calculations were performed to check the most critical components within the valve body and to ensure that these weak link components can withstand the pressure due to the fluid thermal expansion. For the Air Operated Valves (AOVs) on Penetration P-71, the lifting pressure was calculated to show that these AOVs would lift before they reach the system equilibrium pressure. These P-71 lines were then evaluated using this lift pressure.

For the penetrations, the pressure load is combined with SSE loads. Thus, the load combination considered for the penetrations is: Pressure + Weight + SSE. The resulting stresses from the new loads were calculated and found to be less than the faulted condition allowable stress.

For penetrations P-37, P-55, P-70 and P-71, the results of the evaluations are summarized as follows.

1. Pipe stress due to the predicted overpressure was shown to be less than Service Level D limits provided in Appendix F, Paragraphs F-1360(a), F-1324.6, and Table 1322.2-1.

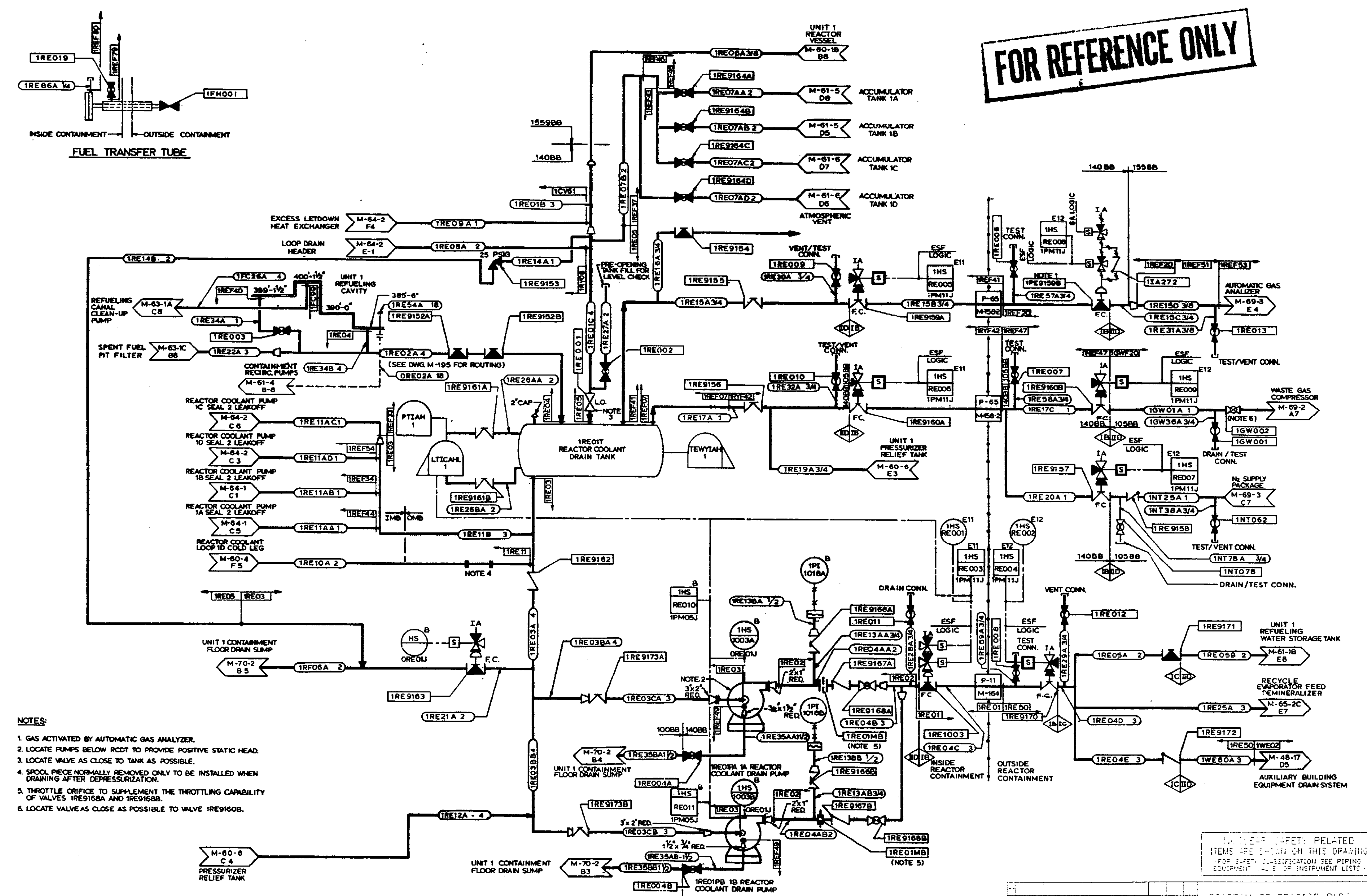
2. Pipe stress due to the predicted overpressure plus weight was shown to be less than Service Level D limits ($2.4S_h$) provided in the ASME Code, Section III, Subsection NC.
3. Pipe fittings were shown to be acceptable by comparison to piping with comparable thicknesses.

4. Valve components were shown to be able to withstand the predicted overpressure.

5. The penetration stress intensity, including the effect of process pipe overpressure, was shown to be within allowable limits.

Based on these results, it is concluded that the overpressure condition described in NRC GL 96-06 has been evaluated and piping systems associated with penetrations P-37, P-55, P-70 and P-71 for Byron and Braidwood Units 1 and 2 meet Appendix F acceptance criteria for the Level D condition.

M-70 SH. 1



NOTES:

1. GAS ACTIVATED BY AUTOMATIC GAS ANALYZER.
2. LOCATE PUMPS BELOW RCDT TO PROVIDE POSITIVE STATIC HEAD.
3. LOCATE VALVE AS CLOSE TO TANK AS POSSIBLE.
4. SPOOL PIECE NORMALLY REMOVED ONLY TO BE INSTALLED WHEN DRAINING AFTER DEPRESSURIZATION.
5. THROTTLE ORIFICE TO SUPPLEMENT THE THROTTLING CAPABILITY OF VALVES 1RE9168A AND 1RE9168B.
6. LOCATE VALVE AS CLOSE AS POSSIBLE TO VALVE 1RE9160B.

NUCLEAR SAFETY RELATED ITEMS ARE SHOWN ON THIS DRAWING (FOR SAFETY CLASSIFICATION SEE PIPING EQUIPMENT & INSTRUMENT LISTS)

DRAWING RELEASE RECORD

REV.	SPEC. NO.	DATE	DESIGN	CHECKED	DESCRIPTION
AE	—	13-11-88			L-2739 FOR RECORD

DIAGRAM OF REACTOR BLDG. & CONTAINMENT EQUIP. DRAINS & VENTS TO RADWASTE UNIT 1

ComEd
Chicago, Illinois
Braidwood Station 20

M-70

SHEET NO. 1

DIAG. OF REAC. BLDG. & CONTAINMENT EQUIP. DRAINS & VENTS TO RADWA

NOTES:

1. ALL WESTINGHOUSE FURNISHED VALVES (F-2702) INSTALLED WITH FLOW UNDER SEAT EXCEPT AS NOTED.
2. ALL CHECK VALVES SHOULD BE "Y" TYPE LIFT CHECK.
3. DELAY COIL-40FT. X 3/8" O.D., TUBING X 0.245" I.D. (PIPING SPECIALTY DATA SHEET S-0087).
4. ALL TUBING EXCEPT WHERE OTHERWISE INDICATED IS PER P.O.T 15598B.
5. FOR SAMPLE COOLER PANEL SEE F-2810 DWG. 151-12-012-4.
6. LOCATE SAMPLE VALVE AS CLOSE TO PROCESS LINE AS POSSIBLE.
7. THE INTERNALS OF 1PS167 ARE TO BE REMOVED.

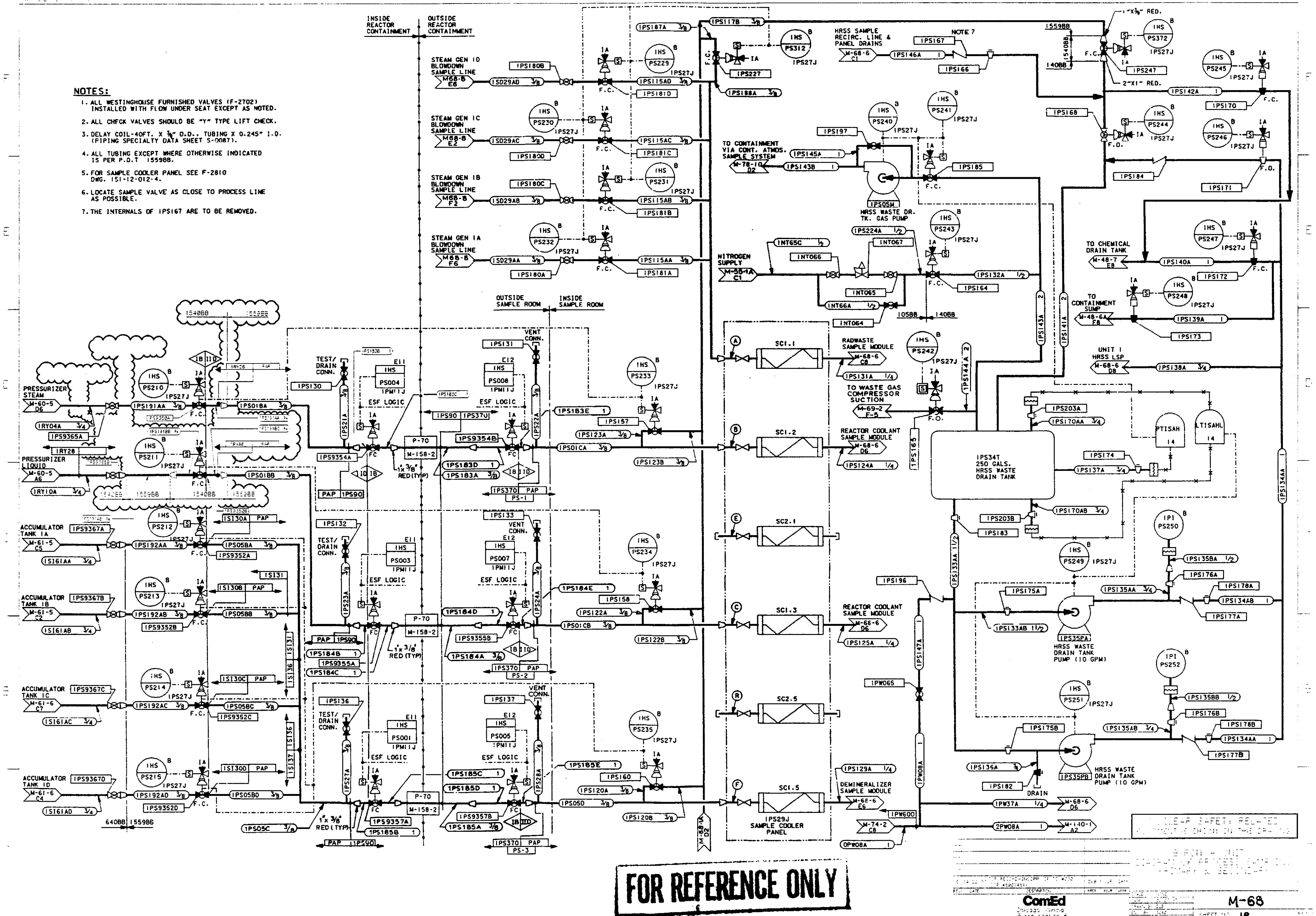
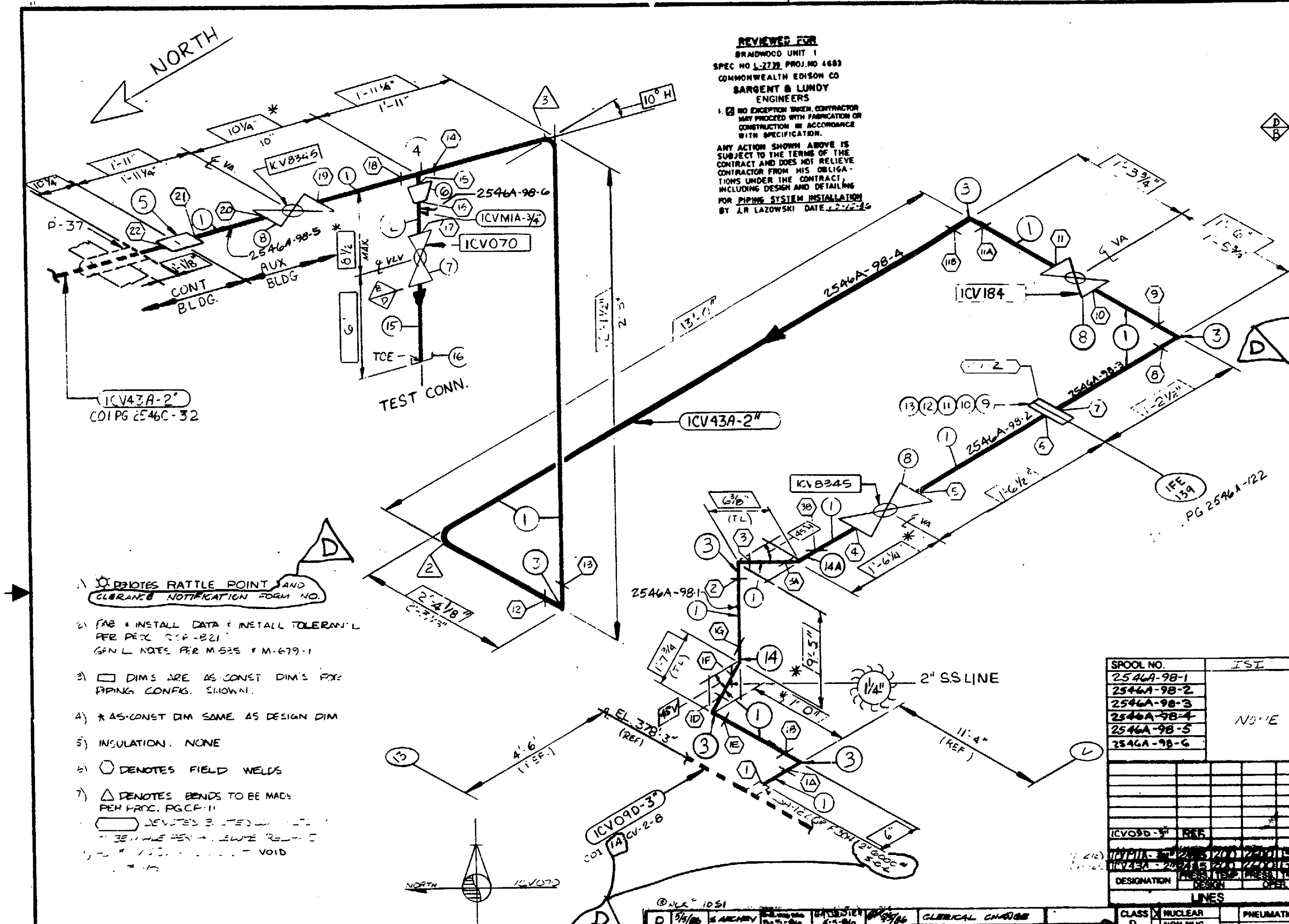


DIAGRAM OF PROCESS SAMPLING (PRIMARY & SECONDARY) UNIT 1



REVIEWED FOR
BRAIDWOOD UNIT 1
SPEC NO L-2739 PROJ.NO 4683
COMMONWEALTH EDISON CO
SARGENT & LUNDY ENGINEERS
1. ☒ NO EXCEPTION TAKEN, CONTRACTOR MAY PROCEED WITH FABRICATION OR CONSTRUCTION IN ACCORDANCE WITH SPECIFICATION.
ANY ACTION SHOWN ABOVE IS SUBJECT TO THE TERMS OF THE CONTRACT AND DOES NOT RELIEVE CONTRACTOR FROM HIS OBLIGATIONS UNDER THE CONTRACT, INCLUDING DESIGN AND DETAILING
FOR PIPING SYSTEM INSTALLATION
BY J.R LAZOWSKI DATE 2-2-86

1) ☼ DENOTES RATTLE POINT AND CLEARANCE NOTIFICATION FORM NO.
2) FAB & INSTALL DATA & INSTALL TOLERANCES PER PROC. GCP-821. GEN'L NOTES PER M-535 & M-679-1
3) ▭ DIMS ARE AS CONST DIM'S FOR PIPING CONFIG. SHOWN.
4) * AS-CONST DIM SAME AS DESIGN DIM
5) INSULATION. NONE
6) ◯ DENOTES FIELD WELDS
7) △ DENOTES BENDS TO BE MADE PER PROC. PGCP-11
⬭ DENOTES ...
... VOID

ITEM	QUAN	DESCRIPTION
16	1	3/4" 6000# A-182 GR. F-304 S.S. SCREWED CAP
15	1'-0"	3/4" S/160 A-376 GR. TP-304 SMLS SS PIPE
14		2" 6000# SA-182 GR. F-304 S.S. SW 45° ELBOWS HT.# UC ; 14A HT.# PY
13	2	2" 1500# FLEXITALLIC GASKETS
12	1	S.S. ORIFICE PLATE IFE 139 HT.# K51292
11	16	7/8" SA 194 GR. 4. NUTS MRR# 17656
10	8	7/8" X 6 1/4" SA-193 GR. B16 BOLTS MRR# 18359
9	2	2" 1500# S/160 SA-182 GR. F 316 S.S. ORIF FLANGES HT# M6TAJ
8	3	2" 1500# SA-182 GR. F-316 S.S. SW GLOBE VALVES ICV184 SER.# T3109528B-267-1 ICV8346 SER.# KP6-7 ICV8345 SER.# KP6-18
7	1	3/4" 1500# SA-182 GR. F 316 S.S. SW GLOBE VALVE ICV070 SER# 6124
6	1	2" x 3/4" 6000# SA-182 GR. F304 S.S. SW RED. INSERT HT# 5661
5	1	2" 6000# SA-182 GR F 304 S.S. SW COUPLING HT# TL
4	1	2" 6000# SA-182 GR. F 304 S.S. SW TEE HT# 50
3	6	2" 6000# SA-182 GR F 304 S.S. SW 90° ELL HT# UO
2	0-6	3/4" S/160 SA-376 GR TP-304 SMLS SS PIPE HT# 462017
1	49'-0"	2" S/160 SA-376 GR TP-304 SMLS SS PIPE HT# 462843

BILL OF MATERIAL

SPOOL NO.	ISI
2546A-98-1	NONE
2546A-98-2	
2546A-98-3	
2546A-98-4	
2546A-98-5	
2546A-98-6	

DESIGNATION	PRESS	TEMP	PRESS	TEMP
ICV09D-3"	REF.			
ICVMIA-3/4"				
ICV43A-2"				

LINES

REV	DATE	DRAWN	CHECKED	QC APP	SM APP	DESCRIPTION	REF DWG
D	3/5/86	S. ARCHEY				CLERICAL CHANGE	M-197-1
C	12-19-85	H. LEBERTS				FCO# ICV-2524	
B	10-7-85	S-6-85				AS-CONST. PENETRATION	M-64-38 (E3)
A	4-21-83	M. WILLS				AS-CONSTRUCTED	M-546-2
0		J. KEITH				FOR FAB & INSTALL	M2546A-98

CLASS B ☒ NUCLEAR / NON NUC
DESIGN TABLE 1540EB
WELD PROC
SCALE NONE
PNEUMATIC / RADIOGRAPH / MAG PART / DYE PEN ☒ / HYDRO ☒ / HEAT TREAT

PHILLIPS, GETSCHOW CO
BRAIDWOOD STATION SPEC L-2739
UNIT 1 BLDG AUX W.O No. 1000
CHEM. FEED & VOL CONTROL
DWG No PG-2546A-98 REV C

DRAWING RELEASE RECORD

REV.	DATE REL'D	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM

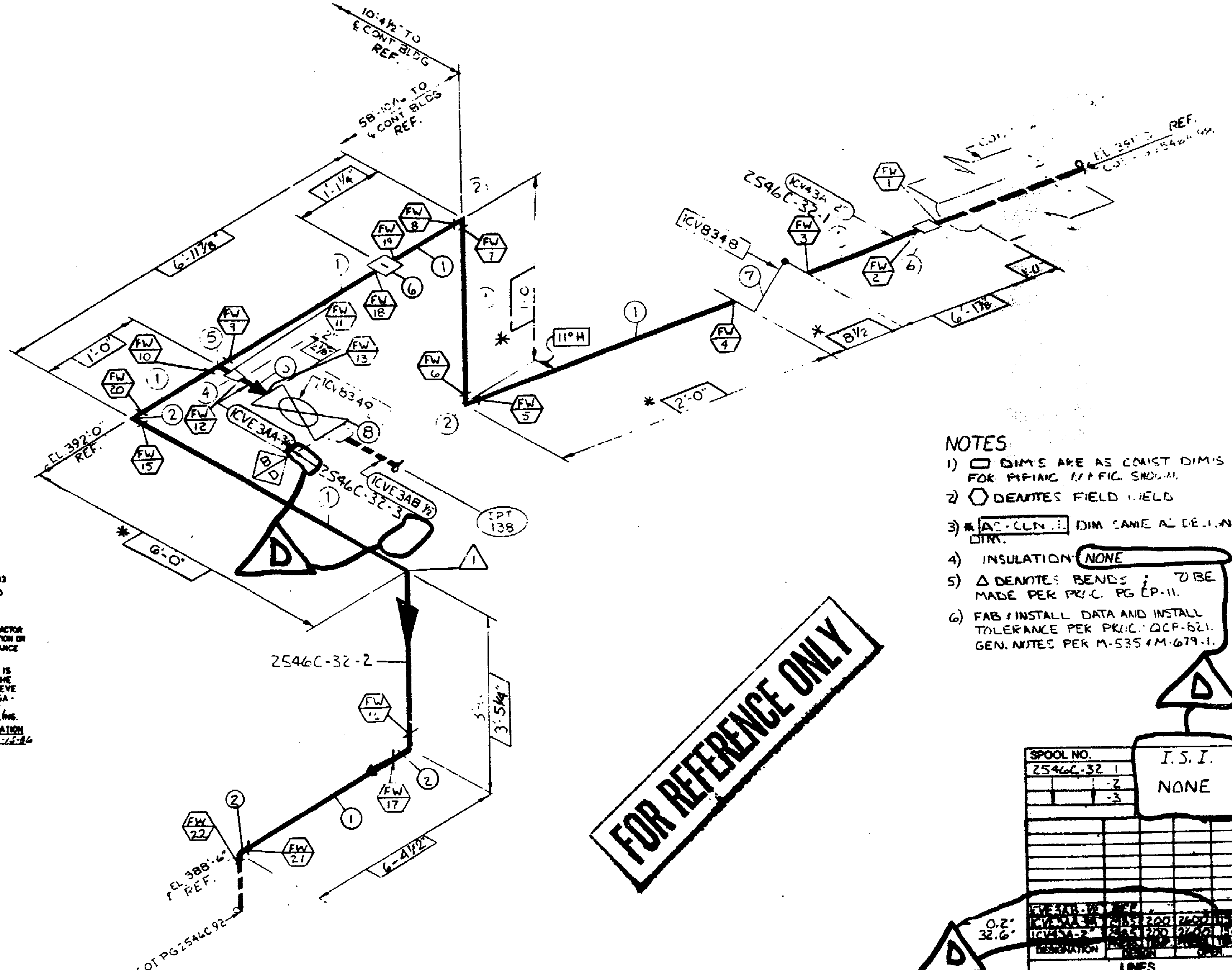
FOR REFERENCE ONLY

SCALE
PROJECT NUMBER

A.S.M.E. SECTION XI

DOC STA "3"
SARGENT & LUNDY CHICAGO
DRAWING NO. M 2546A REV. F
SHEET 98 OF

ROBERT TAGLE



REVIEWED FOR
BRAIDWOOD UNIT 1
SPEC. NO L-2739 PROJ NO. 4683
COMMONWEALTH EDISON CO
SARGENT & LUNDY
ENGINEERS
1. ☒ NO EXCEPTION TAKEN. CONTRACTOR MAY PROCEED WITH FABRICATION OR CONSTRUCTION IN ACCORDANCE WITH SPECIFICATION
ANY ACTION SHOWN ABOVE IS SUBJECT TO THE TERMS OF THE CONTRACT AND DOES NOT RELIEVE CONTRACTOR FROM HIS OBLIGATIONS UNDER THE CONTRACT, INCLUDING DESIGN AND DETAILING.
FOR PIPING SYSTEM INSTALLATION
BY J.R. LAZOWSKI DATE 12-15-86

FOR REFERENCE ONLY

NOTES
1) ▭ DIM'S ARE AS CONST DIM'S FOR PIPING ... FIG. SHOWN.
2) ⬡ DENOTES FIELD WELD
3) * AS-CLN DIM SAME AS DESIGN DIM.
4) INSULATION: NONE
5) △ DENOTES BENDS TO BE MADE PER PROC. PG CP-11.
6) FAB & INSTALL DATA AND INSTALL TOLERANCE PER PROC. QCP-621. GEN. NOTES PER M-535 & M-679-1.

I.S.I.
NONE

SPOOL NO.
2546C-32-1
-2
-3

ITEM	QUAN	DESCRIPTION
8	1	3/4" 1500# SA 182 GR F 316 SW GLOBE VALVE 1CV8349 SER# TKA3-15
7	1	2" 1500# SA-182 GR F316 S.W. CHECK VALVE 1CV8348 SER# 08C2-19
6	2	2" 6000# SA-182, GR F304 SW COUPLING S.S. HT# TL
5	1	2" 6000# SA-182 GR F304 S.W TEE S.S. HT# MM
4	1	2"x3/4" 6000# SA-182 GR F304 S.W. RED. INSERT S.S. HT# EPF
3	6"	3/4" S/160 SA-376 GR TP304 SMLS. SS PIPE HT# 483245
2	5	2" 6000# SA-182 GR F304 S.W 90° ELL'S S.S. HT# OB
1	32'-0"	2" S/160 SA-376 GR TP304 SMLS. SS PIPE HT# 462897

BILL OF MATERIAL

DESIGNATION	DESIGN	OPER.
1CVE3AB-¾"	[illegible]	[illegible]
1CVE34A-2"	2485 200	2600 150
1CV43A-2"	2485 200	2600 150

LINES

0.2'
32.6'

REV	DATE	DRAWN	CHECKED	QC APP	SM APP	DESCRIPTION	REF DWG
D	7/29/86	KT 7-25-86	[illegible]	[illegible]	7/29/86	CLERICAL CHANGE	
C	12/30/85	12-18-85	[illegible]	12-23-85	12/30/85	RE AS CONST SEQ. LTRS. No. #48	
B	11-4-83	BR	[illegible]	[illegible]	11-25-83	AS CONSTRUCTED FOR SPS. TCV14	ECN 4111
A	2-17-83	J. KEITH	[illegible]	[illegible]	2-23-83	ECN-3675	M-64-3B (F-2)
0	3-8-82	VANCE	[illegible]	[illegible]	[illegible]	FOR FAB & INSTALL	M2546-32

CLASS B ☒ NUCLEAR ☐ NON NUC
DESIGN TABLE 1540BB
WELD PROC
SCALE N.T.S
PNEUMATIC
RADIOGRAPH
MAG PART
DYE PEN ☒
HYDRO ☒
HEAT TREAT

PHILLIPS, GETSCHOW CO
BRAIDWOOD STATION SPEC L-2739
UNIT 1 BLDG CONT W O No 1000
CHEM FEED & VOLUME CONTROL
DWG No. PG 2546C-32 REV D

DRAWING RELEASE RECORD

REV.	DATE REL'D	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM

SCALE
PROJECT NUMBER

A.S.M.E.
SECTION XI

DOC. STA. 2
SARGENT & LUNDY ENGINEERS CHICAGO
DRAWING NO. M-2546C REV.
SHEET OF

R. TAGLE

NOTES:

1.) FABRICATION AND INSTALLATION DATA AND INSTALLATION TOLERANCE PER PROC. QCP-B21. GENERAL NOTES PER M-535 AND M-679-1.

2.) BOLT-UP CONNS. TO BE MADE PER PROC. PGCP-15.

3.) ⊖ - DENOTES FIELD WELD.

4.) ⊂⊃ - DENOTES BOLT-UP CONN.

5.) INSULATION - NONE

6.) MAG PART TEST C.S PIPE CL."B" WELDS ONLY. DYE PEN TEST S.S. PIPE CL."B" WELDS ONLY.

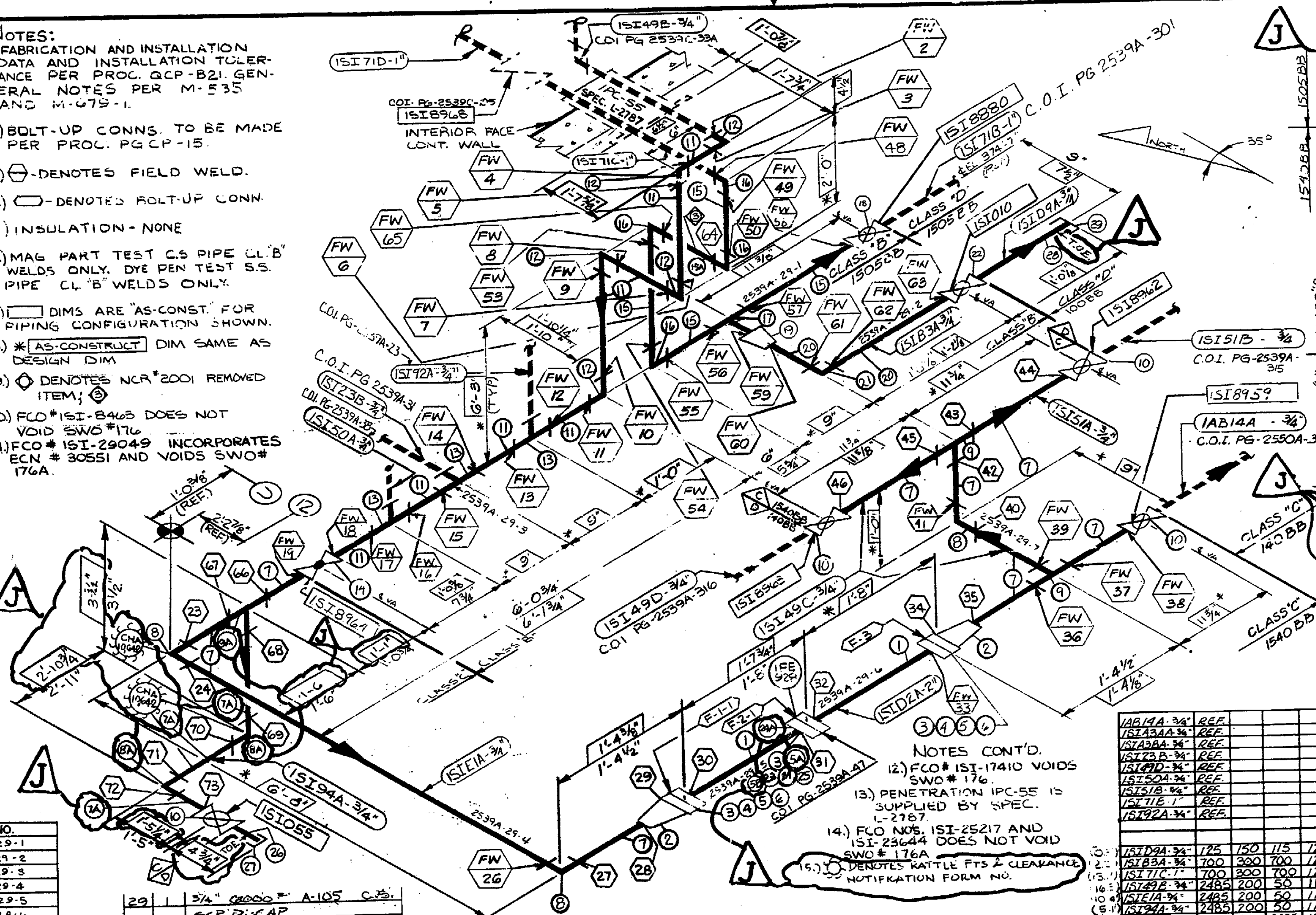
7.) ▭ DIMS ARE "AS-CONST." FOR PIPING CONFIGURATION SHOWN.

8.) ✱ AS-CONSTRUCT DIM SAME AS DESIGN DIM

9.) ◇ DENOTES NCR#2001 REMOVED ITEM; ⑧

10.) FCO#ISI-8463 DOES NOT VOID SWO#176

11.) FCO# ISI-29049 INCORPORATES ECN # 30551 AND VOIDS SWO# 176A.



NOTES CONT'D.

12.) FCO# ISI-17410 VOIDS SWO# 176.

13.) PENETRATION IPC-55 IS SUPPLIED BY SPEC. L-2787.

14.) FCO NOS. ISI-25217 AND ISI-23644 DOES NOT VOID SWO# 176A

15.) ◯ DENOTES KATTLE FTS & CLEARANCE NOTIFICATION FORM NO.

SPOOL NO.
2539A-29-1
2539A-29-2
2539A-29-3
2539A-29-4
2539A-29-5
2539A-29-6
2539A-29-7

29	1	3/4" 6000# A-105 C.S. SCR'D CAP

22.	1	3/4" 1500# SA-105 S.W C.S. GLOBE VA. 1SI010 . SER# A3294.
21.	1	3/4" 6000# SA SA-105 S.W. C.S. 90° ELL. HT# M-562
20.	1'-6"	3/4" S/160 SA-106 GR.B SML'S C.S. PIPE HT.# KD 7589
19	1	1"X3/4" 6000# SA105 S.W.C.S. RED. INSERT HT# B561
18	1	1" 1500# SA-105 GR.II S.W. C.S. GLOBE VALVE 1SI 8880 SER.# 7310-95288-210-1
17	1	1" 6000# SA105 S.W. TEE C.S. HT# M-294

28	0'-6"	3/4" S/160 A-106 GR-B SML'S C.S. PIPE
27	1	3/4" 6000# A-182 GR-F304 SCR'D CAP S.S.
26	0'-6"	3/4" S/160 A-376 GR-TP304 SML'S SS PIPE
25	2	2" 1500# SA-182 GR.F316 SW ORIFICE S.S. FLANGE HT.# M6TAJ (S/160)
24.	7	7/8" X6 1/2" SA-193 GR. B-16 BOLTS
24A	1	HT# MRR15261, 24A/HT# K9
23.	1	2", ORIFICE PLATE 1FE928 HT# K51292

REV	DATE	DRAWN	CHECKED	QC APP	SM APP	DESCRIPTION	REF DWG
J	5-6-86	MAGAYA 4-25-86	JAMPION 4-28-86	DBROWN II 5-5-86	MRY 5-6-86	RE-AS-CONST. SWO 176B	
H	4-8-86	4-3-86 O. M...	NB 4-7-86	DBROWN II 4-7-86	MRY 4-8-86	FCO# ISI-29049 SEE NOTE # 11	
G	1-2-86	LEYDENS	12-17-85	DBROWN II 1-2-86	1-2-86	FCO# ISI-25217 SEE NOTE #14	
F	12-2-85	B.ZAJDA 11-13-85	SCAVO 11-15-85	DBROWN II 11-27-85	12-2-85	FCO# ISI-23644 DR D-07164 SEE NOTE	
E	9-19-85	M.WILLS 8-19-85	9/19/85	9-13-85	9-19-85	RE-AS-CONSTRUCTED SWO# 176A	
D	6-21-85	B.GOSS 4-4-85	6-14-85	2085	6-21-85	FCO # ISI-17410 SEE NOTE #12	NCR# 3513
C	9-18-84	9-12-84 O. M...	9-12-84	DBROWN 9-17-84	MRY 9-18-84	FCO# ISI-8463 SEE NOTE #10	MG1-G (A-3) (F-3)
B	5-5-83	FAZ SRH	JKEITH 11-9-83	JRH 11-18-83	11-25-83	AS-CONST. PIPING	M-2539A-29

DESIGNATION	PRESS. (DESIGN)	TEMP. (DESIGN)	PRESS. (OPER.)	TEMP. (OPER.)
1AB14A-3/4" REF.				
1SI43AA-3/4" REF.				
1SI43BA-3/4" REF.				
1SI23B-3/4" REF.				
1SI49D-3/4" REF.				
1SI50A-3/4" REF.				
1SI51B-3/4" REF.				
1SI71E-1" REF.				
1SI92A-3/4" REF.				
(5.2) 1SID9A-3/4"	125	150	115	120
(2.2) 1SIB3A-3/4"	700	300	700	120
(3.1) 1SI71C-1"	700	300	700	120
(16.2) 1SI49B-3/4"	2485	200	50	114
(10.4) 1SIE1A-3/4"	2485	200	50	114
(5.1) 1SI94A-3/4"	2485	200	50	114
(1.2) 1SI51A-3/4"	2485	200	2485	130
(55) 1SI49C-3/4"	2485	200	50	114
(3.3) 1SID2A-2"	2485	200	50	114

LINES

ITEM	QUAN	DESCRIPTION
16	4	1" 6000# SA-105 C.S. SW 90° ELL HT# M-591
15	11-0"	1" S/160 SA-106 GR B SML'S CS PIPE HT# KD-7115 15A HT# 256021
15A	2'-0"	
14	1	3/4" 1500# SA-182 GR.F316 SW S.S. GLOBE VALVE 1SI8964 SER# 7310-95288-230-3
13	3	3/4" 6000# SA-182 GR F304 SW TEE S.S. HT# HU
12	5	3/4" 6000# SA-182 GR F304 SW 90° ELL S.S. HT# OU
11	15'-0"	3/4" S/160 SA-376 GR.TP 304 SML'S SS PIPE HT# 462017
10	4	3/4" 1500# SA-182 F316 SW GLOBE VALVES S.S. 1SI8963 SER# TNF2-11 1SI8962 SER# TNF2-10 1SI8959 SER# TNF2-16 1SI055 SER# 67570
9	2	3/4" 6000# SA-182 GR.F304 SW TEE S.S.
9A	1	HT# MW, 9A/HT# HU
8	3	3/4" 6000# SA-182 GR.F304 SW 90° ELL S.S.
8A	2	HT# OU, 8A/HT# JI
7	16'-6"	3/4" S/160 SA-376 GR.TP 304 SML'S SS PIPE HT# 462017
7A	5'-0"	7A, HT# M7591
6	4	2" 1500# S/160 SA182 GR F316 SS SW RF FLANGE HT# HK-655
5	32	7/8" SA-194 GR 4 NUTS HT# MRR7464
5A	14	HT# MRR 15187
5B	2	HT# 4015
4	16	7/8" x 6" SA-193 GR.B16 BOLTS HT.# MRR8220
3	4	2" 1500# FLEXITALLIC GASKETS
2	2	2"x3/4" 6000# SA-182 GRF304 SW RED INSERT S.S. HT# 566A
1	3'-6"	2" S/160 SA376 GR.TP304 SMLS SS PIPE HT# 462843

BILL OF MATERIAL

CLASS B/C/D ☒ NUCLEAR ☐ NON NUC

DESIGN TABLE 1008B 1505/1540BB

WELD PROC SEE WELD DATA SHTS

SCALE NONE

☐ PNEUMATIC
☐ RADIOGRAPH
☒ SEE NOTE #6 MAG PART
☒ SEE NOTE #6 DYE PEN
☒ HYDRO
☐ HEAT TREAT

PHILLIPS, GETSCHOW CO

BRAIDWOOD STATION SPEC L-2739

UNIT 1 BLDG AUX. WO No 1000

SAFETY INJECTION

DWG No PG-2539A-29 REV J

DRAWING RELEASE RECORD

REV.	DATE REL'D	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM

FOR REFERENCE ONLY

IST

1SIB3A-3/4" VISUAL EXAM
1SI71C-1" VISUAL EXAM
1SI49B-3/4" VISUAL EXAM
1SI94A-3/4" VISUAL EXAM
1SI51A-3/4" VISUAL EXAM
1SIE1A-3/4" VISUAL EXAM
1SI49C-3/4" VISUAL EXAM
1SID2A-3/4" VISUAL EXAM

SCALE

PROJECT NUMBER

A.S.M.E. SECTION XI

Doc SA#3

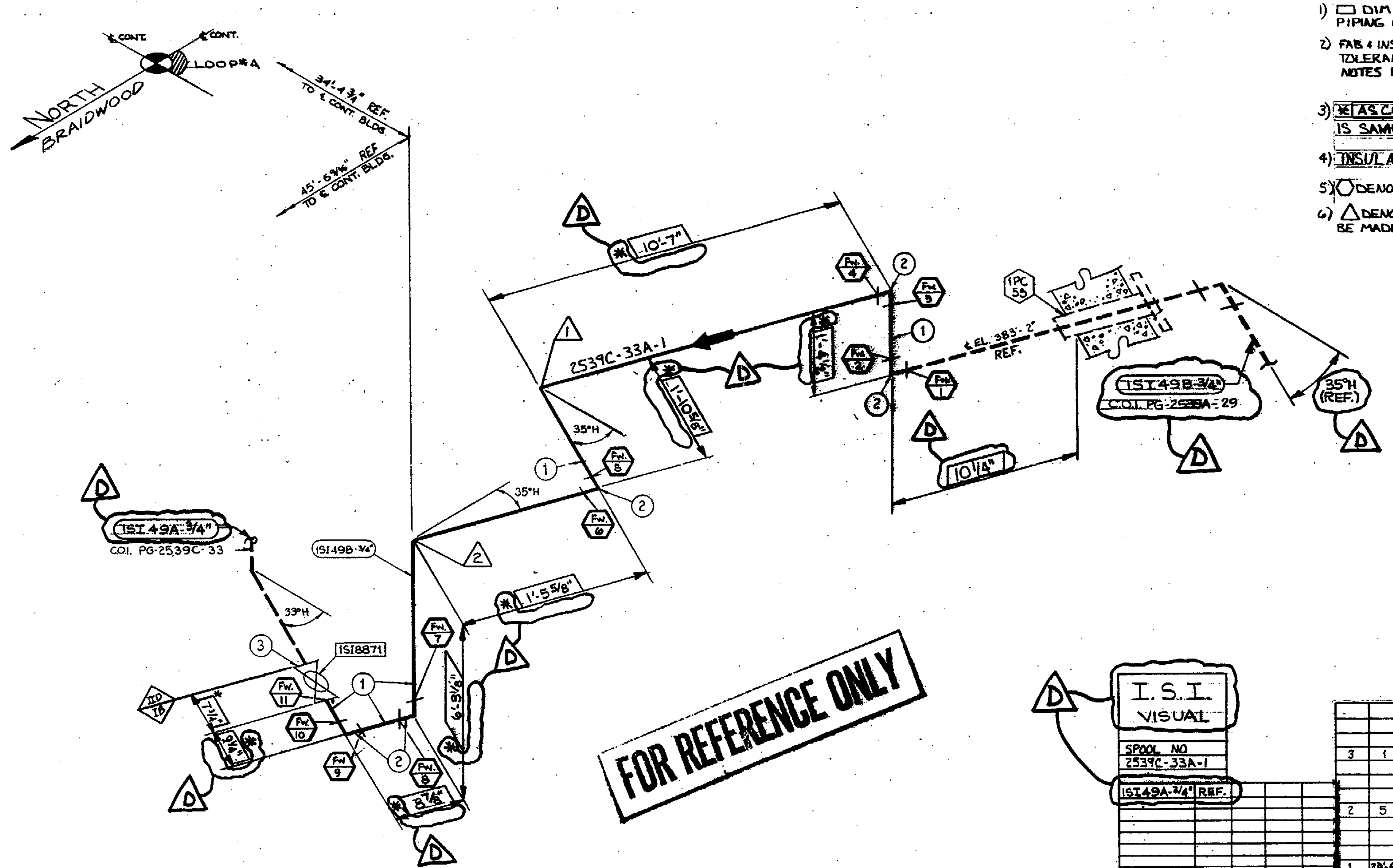
SARGENT & LUNDY ENGINEERS CHICAGO

DRAWING NO. M-25... REV. F

SHEET 29 OF

FORM GDB2.6.3(4-78)

R.C.L.-82



FOR REFERENCE ONLY

NOTES:

1) ☐ DIM'S ARE AS CONST. DIM'S FOR PIPING CONFIG SHOWN.
2) FAB & INSTALL DATA AND INSTALL TOLERANCE PER PROC.: QCP-B21. GEN. NOTES PER M-535 & M-679-1.
3) * AS CONSTRUCTED DIMENSIONS IS SAME AS DESIGN DIMENSIONS.
4) INSULATION - NONE
5) ⬡ DENOTES FIELD WELD NO'S.
6) △ DENOTES BEND NO'S. BENDS TO BE MADE PER PROC.: PG CP-11

I.S.I.
VISUAL

SPOOL NO
2539C-33A-1

ITEM	QUAN	DESCRIPTION
3	1	3/4" 1500# SA-182 GR. F304 SW. GLOBE VALVE 1SI8871 SER.# 7310-95288-230-1
2	5	3/4" 6000# SA-182 GR. F304 (S.S.) SW. 90° ELL HT.# OU
1	28'-6"	3/4" S/160 SA-376 GR. TP304 SML'S S.S. PIPE HT.# B14864

BILL OF MATERIAL

LINES

DESIGNATION	DESIGN PRESS.	DESIGN TEMP.	OPER. PRESS.	OPER. TEMP.
1SI49A-3/4" REF.				
1SI49B-3/4"	2485	200	50	114

23.1'

CLASS FB. | NUCLEAR ☒ | NON NUC
DESIGN TABLE 154088
WELD PROC
SCALE NONE

PNEUMATIC	
RADIOGRAPH	
MAG PART	
DYE PEN	X
HYDRO	X
HEAT TREAT	

REV	DATE	DRAWN	CHECKED	QC APP	SM APP	DESCRIPTION	REF DWG
D	5/6/86	5-2-86	R.R. HUGHES 5-6-86	5-6-86	5/6/86	FIELD RE-VERIFICATION	ECN# 25401
C	12/13/85	12-12-85	12-12-85	12-13-85	12/13/85	CLERICAL CHANGE	M-454 6(MC)
B	4-18-83			JCS 4-18-83		AS-CONSTRUCTED	M-2539C-33
A	8-10-82	CMALY	8-11-82	8-11-82		ECN-2797	

PHILLIPS, GETSCHOW CO
BRAIDWOOD STATION SPEC L-2790
UNIT 1 BLDG CONT. W.O. [redacted]
SAFETY INJECTION
DWG No PG-2539C-33A REV D

DRAWING RELEASE RECORD

REV.	DATE REL'D	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM

SCALE
PROJECT NUMBER

A.S.M.E. SECTION XI

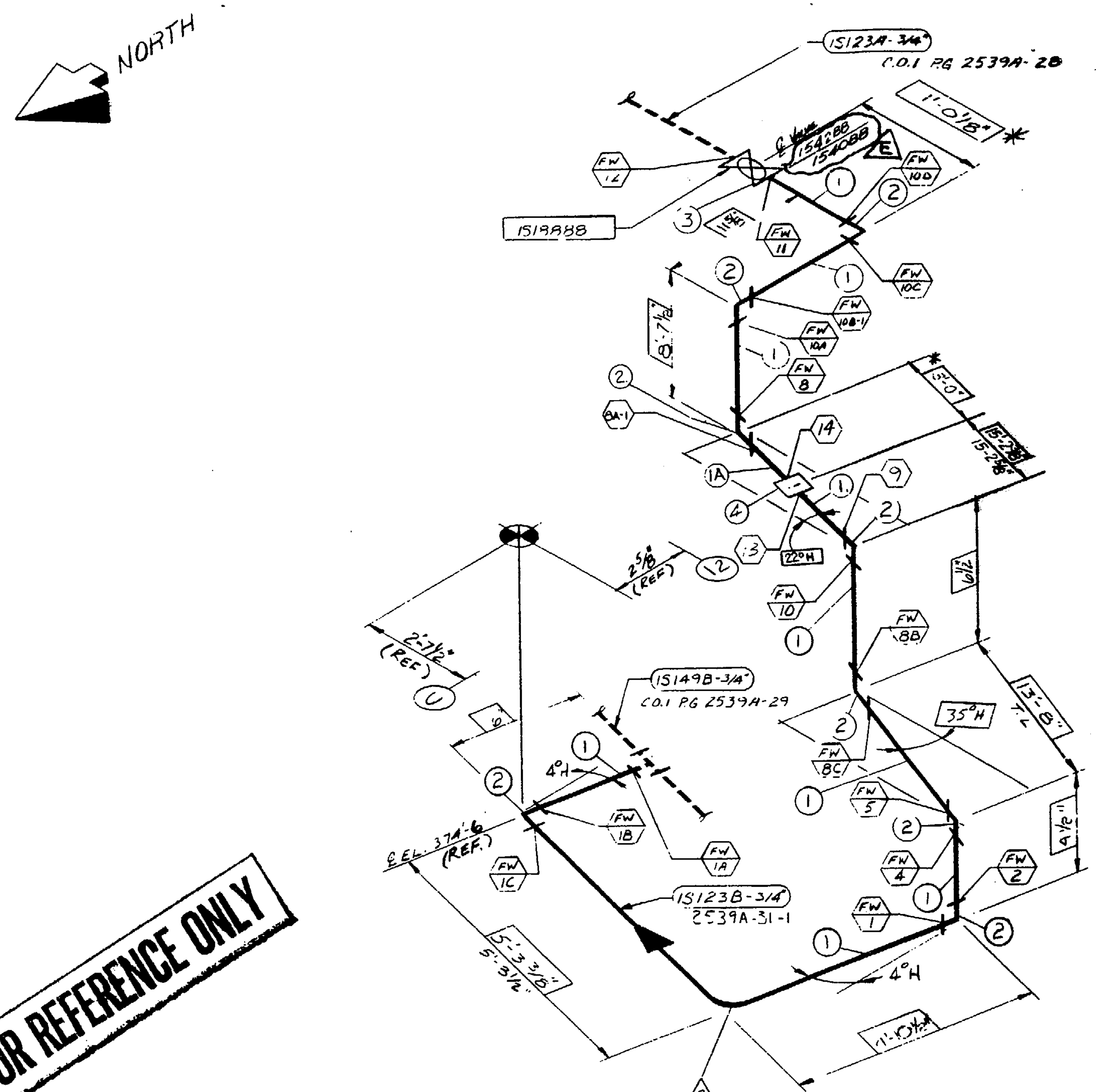
DOC. STA. 2
SARGENT & LUNDY ENGINEERS CHICAGO
DRAWING NO. M-2539C REV. D
SHEET 33 OF

R.C.L. — 82

NOTES

1) ☐ Dimensions are As-Const Dimensions for piping configuration shown.
2) Fabrication and installation data, and installation tolerances are per Procedure QCP-B21, General Notes per M-535 and M G... 1
3) ☐ * As-Const dimension same as-design dimension.
4) ⬡ Denotes field weld ; △ Denotes field bend
5) Bends to be made per procedure PGCV-11.
6) FCO# 1SI-1324S Resolves NCR# 2003.

7) Insulation - None
8) FCO# 1SI-1324S Voids SWO# 159



FOR REFERENCE ONLY

REVIEWED FOR
BRAIDWOOD UNIT 1
SPEC NO L-2739 PROJ NO 4683
COMMONWEALTH EDISON CO
SARGENT & LUNDY ENGINEERS
1 ☒ NO EXCEPTION TAKEN CONTRACTOR MAY PROCEED WITH FABRICATION OR CONSTRUCTION IN ACCORDANCE WITH SPECIFICATION
ANY ACTION SHOWN ABOVE IS SUBJECT TO THE TERMS OF THE CONTRACT AND DOES NOT RELIEVE CONTRACTOR FROM HIS OBLIGATIONS UNDER THE CONTRACT, INCLUDING DESIGN AND DETAILING FOR PIPING SYSTEM INSTALLATION
BY J.R. LAZOWSKI DATE 12-12-86

BILL OF MATERIAL

ITEM	QUAN	DESCRIPTION
4	1	3/4" - 6000# ... S.W. Coupling (SS) HT# EQG
3	1	3/4" 1500# SA-182 GR. F316 S.W. Globe Valve 1S19888 SER# 7310-...
2	8	3/4" - 6000# SA-182 GR F304 (SS) S.W. 90° ELBOW HT# OU
1	51'-0"	3/4" - S/160 SA-376 GR. TP304 SMLS. S.S. PIPE HT# 462017 / 1A HT# B14564
1A	3'-0"	

(54.0')

SPOOL NO.	
2539A-31-1	1S1 N/A

LINES: DESIGNATION / DESIGN PRESS / DESIGN TEMP / OPER.

REV	DATE	DRAWN	CHECKED	QC APP	SM APP	DESCRIPTION	REF DWG
E	4/30/86					CLERICAL CHANGE	
D	3/10/86		12-10-85	12-10-85	12/11/85	CLERICAL CHANGE	
C	7-30-85	5-18-85	5-23-85			RE-AS CONST. S.W.O. 159A FCO No. 1SI-1324S	M-61-6
B	2-27-85					See Notes 4 + 8	M-61-3
A	4-9-85				3-13-83	AS-CONST	

CLASS B — NUCLEAR / NON NUC
DESIGN TABLE 1540BB
WELD PROC
SCALE N.T.S
PNEUMATIC / RADIOGRAPH / MAG PART / DYE PEN ✓ / HYDRO ✓ / HEAT TREAT

PHILLIPS, GETSCHOW CO
BRAIDWOOD STATION SPEC L-2739
UNIT 1 BLDG AUX W O No 000
SAFETY INJECTION
DWG No PG. 2539A-31 REV E

DRAWING RELEASE RECORD

REV.	DATE REL'D	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM

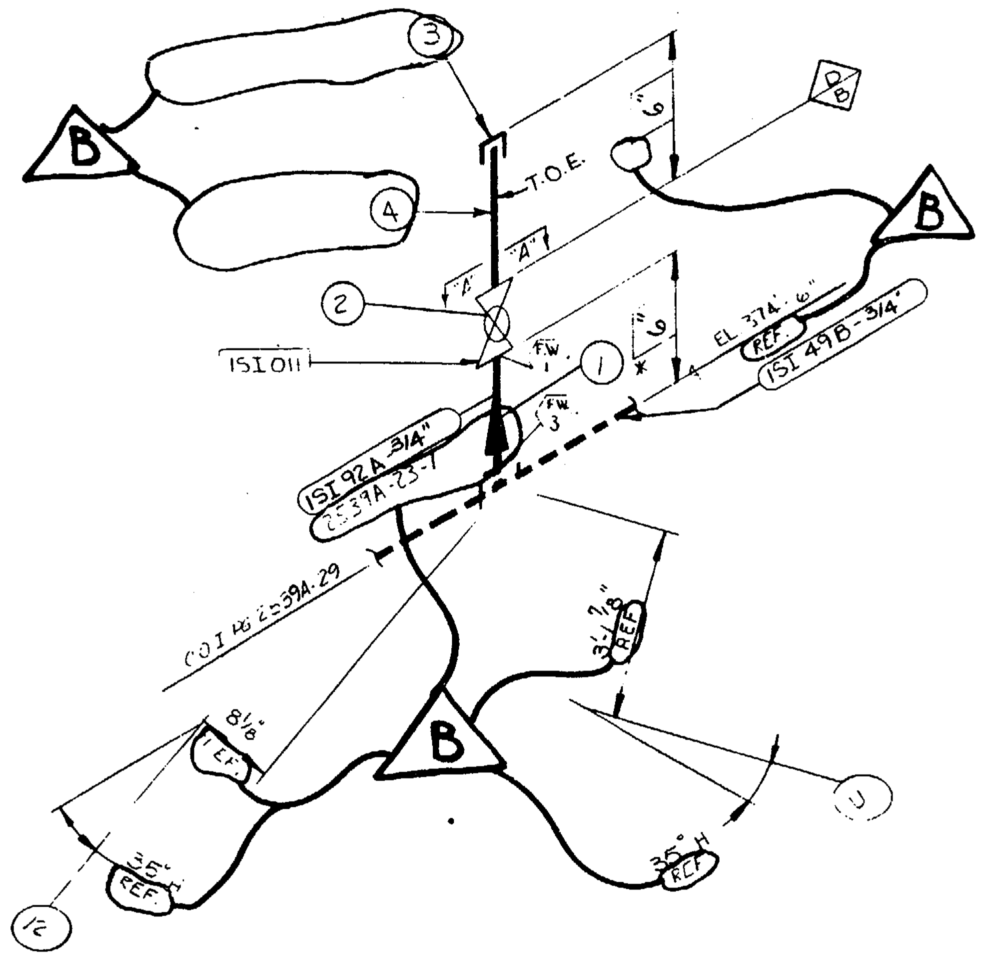
FORM GDS2.6.3(4-78)
R.C.L.-82

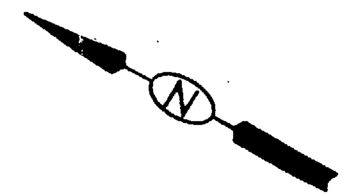
SCALE
PROJECT NUMBER
SEAL

A.S.M.E. SECTION XI

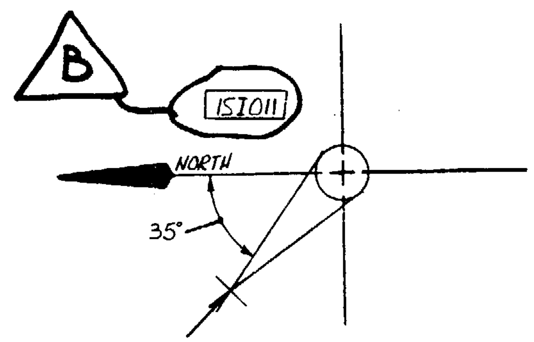
Poc Sta 3
SARGENT & LUNDY ENGINEERS CHICAGO

DRAWING NO. M253- REV. E
SHEET 31 OF





SECTION -"A-A"



NOTES :

1) ▭ DIM'S ARE AS CONST DIM'S FOR PIPING CONFIG. SHOWN.
2) ⬡ DENOTES FIELD WELD NO'S
3) INSULATION : NONE
4) * A.-CONSTRUCTED DIM. SAME AS DESIGN DIM
5) FAB & INSTALL DATA AND INSTALL TOLERANCE PER PROC GLF-B21. GEN. NOTES PER M-530 & M-671-1.

B

REVIEWED FOR
BRAIDWOOD UNIT 1
SPEC NO L-2739 PROJ NO 4683
COMMONWEALTH EDISON CO
SARGENT & LUNDY
ENGINEERS
1 ☒ NO EXCEPTION TAKEN CONTRACTOR MAY PROCEED WITH FABRICATION OR CONSTRUCTION IN ACCORDANCE WITH SPECIFICATION
ANY ACTION SHOWN ABOVE IS SUBJECT TO THE TERMS OF THE CONTRACT AND DOES NOT RELIEVE CONTRACTOR FROM HIS OBLIGATIONS UNDER THE CONTRACT, INCLUDING DESIGN AND DETAILING
FOR PIPING SYSTEM INSTALLATION
BY J R LAZOWSKI DATE 12-12-86

FOR REFERENCE ONLY

SPOOL NO. 2539A-23-1

CLASS "D"
CLASS "B"

DESIGNATION	DESIGN PRESS.	DESIGN TEMP.	OPER. PRESS.	OPER. TEMP
ISI49B-3/4"	REF.			
ISI92A-3/4"	2485	400	50	114

LINES

B

1.4'

ITEM	QUAN	DESCRIPTION
4	6"	3/4" S/160 A-376 GR TP-304 SMLS SS PIPE
3	1	3/4" 6000# A-182 GR F304 SCR'D. CAP
2	1	3/4 1500# SA182 F316 S.W. GLOBE VALVE ISI 011 SER # 26922
1	6"	3/4" S/160 SA-376 GR TP304 SMLS SS PIPE HT # 462017

BILL OF MATERIAL

REV	DATE	DRAWN	CHECKED	QC APP	SM APP	DESCRIPTION	REF DWG
B	12/17/85	12-16-85	12-16-85	12-16-85	12/17/85	CLERICAL CHANGE	
A	9-2-83	DJB		JRH 9-13-83		AS-CONST. PIPING	M-61-6 (3-A)
O	9-10	MIKLOS				FOR FAB & INSTALL.	M-2539A-29

CLASS ☒ NUCLEAR
B/D NON NUC
DESIGN TABLE 1540 BB
WELD PROC
SCALE NTS

PNEUMATIC
RADIOGRAPH
MAG PART
☒ DYE PEN
☒ HYDRO
HEAT TREAT

PHILLIPS, GETSCHOW CO
BRAIDWOOD STATION SPEC L-2739
UNIT 1 BLDG AUX. W O No 1000
SAFETY INJECTION
DWG No PG 2539A-23 REV B

DRAWING RELEASE RECORD

REV.	DATE REL'D	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM

SCALE

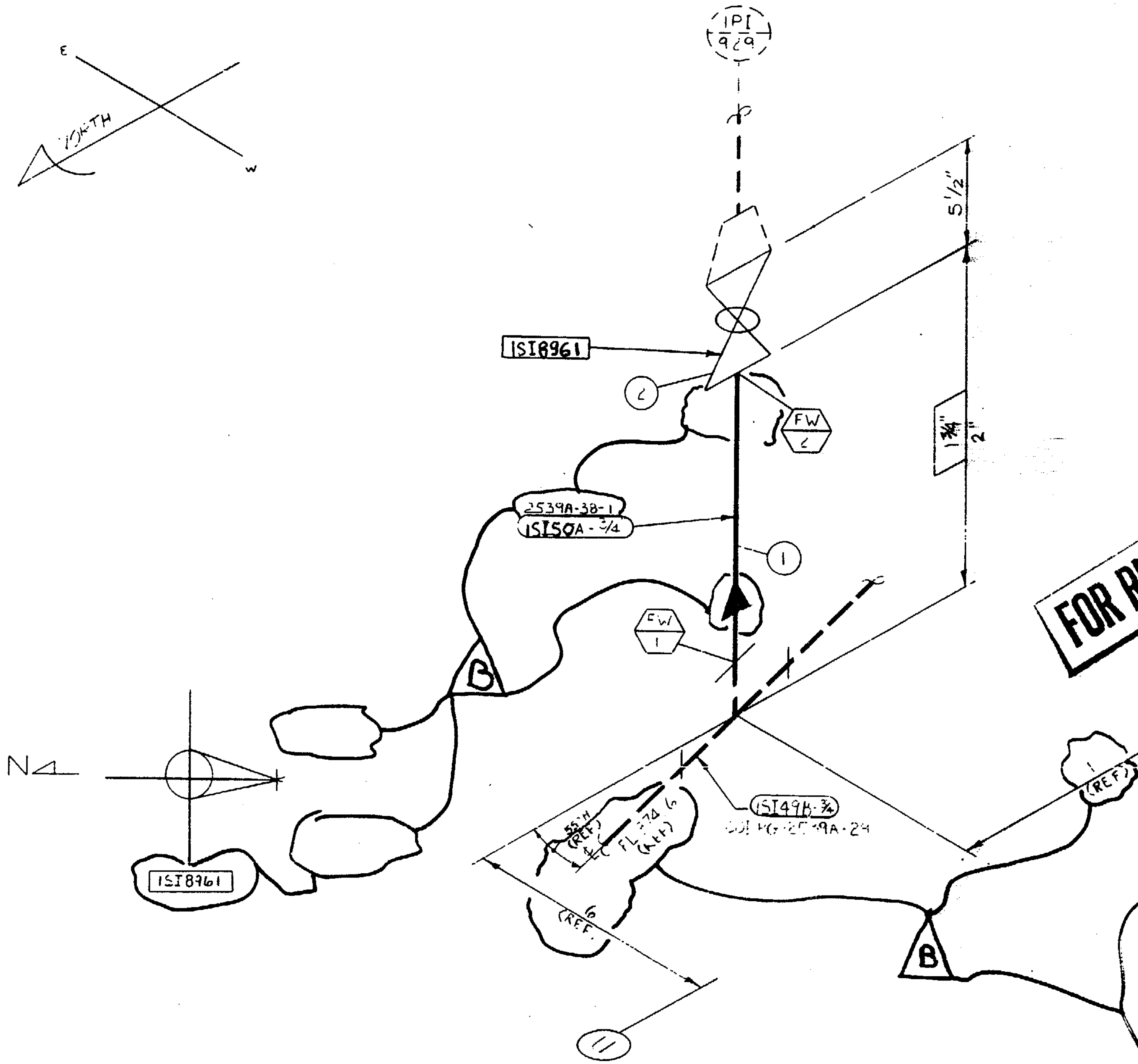
PROJECT NUMBER

A.S.M.E. SECTION XI

DOC. STA. 3

SARGENT & LUNDY ENGINEERS CHICAGO

DRAWING NO.	REV.
M2539A	D
SHEET 23 OF	



NOTES:

1) ▭ DIMS ARE AS-CONSTRUCT. DIMS. FOR PIPING CONFIGURATION SHOWN

2) INSULATION - NONE

3) ◯ DENOTES FIELD WELDS

4) FAB & INSTALL. DATA & INSTALL. TOLERANCE PER PROCEDURE QCP-B21. GEN NOTES PER M535 & M-679-1.

FOR REFERENCE ONLY

REVIEWED FOR
BRAIDWOOD UNIT 1
SPEC NO L-2739, PROJ NO 4683
COMMONWEALTH EDISON CO.
SARGENT & LUNDY ENGINEERS
1 ☒ NO EXCEPTION TAKEN. CONTRACTOR MAY PROCEED WITH FABRICATION OR CONSTRUCTION IN ACCORDANCE WITH SUBMITTAL DATA.
ANY ACTION SHOWN ABOVE IS SUBJECT TO THE TERMS OF THE CONTRACT AND DOES NOT RELIEVE CONTRACTOR FROM HIS OBLIGATIONS UNDER THE CONTRACT, INCLUDING DESIGN AND DETAILING
FOR PIPING SYSTEM INSTALLATION
BY J.R. LAZOWSKI DATE

ISI
VISUAL

SPOOL NO.
2539A-38-1

DESIGNATION	PRESS DESIGN	TEMP DESIGN	PRESS OPER.	TEMP OPER.
1SI49B-3/4	REF.			
1SI50A-3/4	2485	200	2485	130

LINES

ITEM	QUAN	DESCRIPTION
2	1	3/4" 1500# SA-182 GR F316 SW GLOBE VALVE 1SI 8961 SER # TAAI-R
1	6"	3/4" S/160 SA-376 GR TP-304 SMLS SS PIPE HT # 462017

BILL OF MATERIAL

REV	DATE	DRAWN	CHECKED	QC APP	SM APP	DESCRIPTION	REF DWG
B	2/18/86	2-17-86 GRF	S.R. HUGHES 2-18-86	G.R. DANIELI 2-19-86	2/18/86	CLERICAL CHANGE	M 61-6 C-3
A	4-22-83	J Keith	4-26-83	4-24-83	4-26-83	AS-CONSTRUCTED	M2539A-38A

CLASS B ☒ NUCLEAR ☐ NON NUC
DESIGN TABLE 1540 BB
WELD PROC
SCALE NONE

	PNEUMATIC
	RADIOGRAPH
	MAG PART
☒	DYE PEN
☒	HYDRO
	HEAT TREAT

PHILLIPS, GETSCHOW CO
BRAIDWOOD STATION SPEC L-2739
UNIT 1 BLDG AUX W O No 1000
SAFETY INJECTION
DWG No PG 2539A-38 REV B

DRAWING RELEASE RECORD

REV.	DATE REL'D	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM

SEAL

SCALE

PROJECT NUMBER

A.S.M.E. SECTION XI

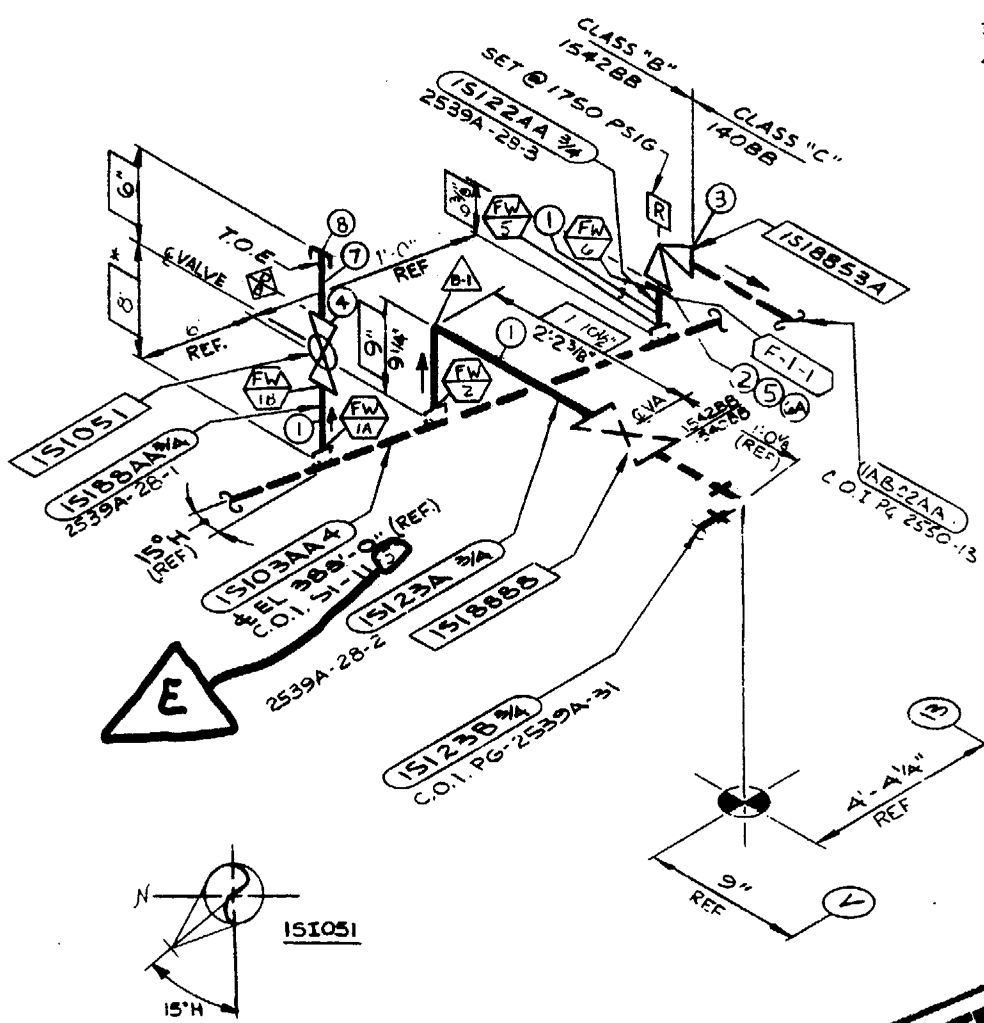
DOC. STA. #4

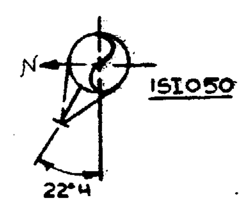
SARGENT & LUNDY
ENGINEERS
CHICAGO

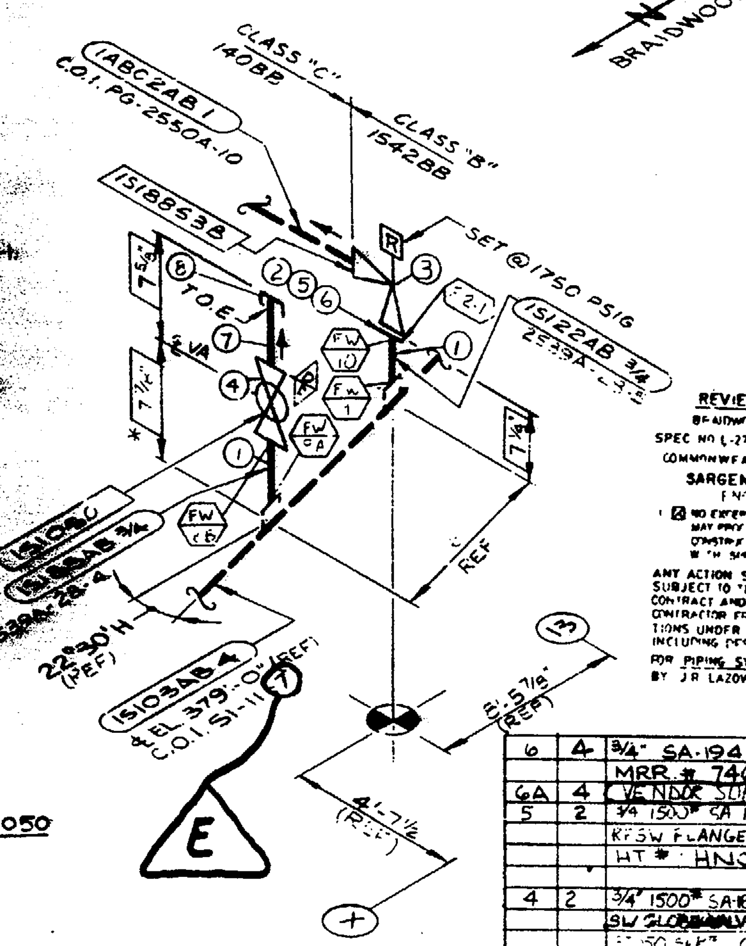
DRAWING NO. M 2539A
REV. A
SHEET 38 OF

FORM GDS2.6.3(4-76)
RCL-82

NOTES:
1) DIMS. ARE AS-CONST' DIM'S FOR PIPING CONFIGURATION SHOWN.
2) INSULATION - NONE
3.) ⊖ DENOTES FIELD WELD
4) △-DENOTES BEND. TO BE MADE PER PROC. PGCP-11.
5.) FAB & INSTALL. DATA AND INSTALL. TOLERANCE PER PROC. QCP-B21. GENERAL NOTES PER M-535 & M-679.
6.) * AS-CONST. DIM. SAME AS DESIGN.
7.) ⬭ - DENOTES BOLTED CONN. TO BE MADE PER PROC. PGCP-15.
8.) ECN # 29101 DOES NOT REQUIRE REWORK TO THIS DWG. AND DOES NOT VOID SWO # 177.
9) FCO # 1SI-28607 DOES NOT VOID SWO # 177







REVIEWED FOR
BRAIDWOOD UNIT 1
SPEC NO L-2739 PROJ NO 4683
COMMONWEALTH EDISON CO
SARGENT & LUNDY
ENGINEERS
☒ NO EXCEPTION TAKEN CONTRACTOR MAY PROCEED WITH FABRICATION OR CONSTRUCTION IN ACCORDANCE WITH SPECIFICATION
ANY ACTION SHOWN ABOVE IS SUBJECT TO THE TERMS OF THE CONTRACT AND DOES NOT RELIEVE CONTRACTOR FROM HIS OBLIGATIONS UNDER THE CONTRACT, INCLUDING DESIGN AND DETAILING FOR PIPING SYSTEM INSTALLATION
BY J R LAZOWSKI DATE [illegible]

FOR REFERENCE ONLY

ITEM	QUAN	DESCRIPTION
6	4	3/4" SA-194 GR.4, NUTS
		MRR. # 7464
6A	4	VENDOR SUPPLIED
5	2	3/4 1500# SA 182 GR F304 (5.6)
		RFSW FLANGE
		HT # HN060
4	2	3/4" 1500# SA-182 GR F316
		SW GLOBE VALVE
		SI050 SER# 67584
		SI051 SER# 67611
3	2	3/4" 1500# X 1" 150# A-351 GR CF8M
		RELIEF VALVE
		1SI8853A SER# N56826-00-0020
		1SI8853B SER# N56826-00-0021
2	2	3/4" 1500# FLEXITALLIC
		GASKET
1	6'-0"	3/4 S/80S SA-312 GR TP-304
		SMLS SS PIPE
		HT # M0019

BILL OF MATERIAL

SPOOL NO.	ITEM	QUAN.	DESCRIPTION
2539A-28-1			
-2	8	2	3/4" 3000# A-182 GR F304
-3			SCRD. CAP
-4			
-5	7	1'-6"	3/4" S/80 A-312 GR TP304
			SMLS. S.S. PIPE

I.S.I. VISUAL

CLASS "D" BILL OF MATERIAL

	DESIGNATION	DESIGN PRESS.	DESIGN TEMP	OPER PRESS	OPER TEMP
	1SI03AA-4"	REF.			
	1SI03AB-4"	REF.			
	1SIC2AA-1"	REF.			
	1SIC2AB-1"	REF.			
	1SI23B-3/4"	REF.			
(07')	1SI22AA-3/4"	1750	300	1740	114
(08')	1SI22AB-3/4"	↓	↓	↓	↓
(30')	1SI23A-3/4"	↓	↓	↓	↓
(13')	1SI88AA-3/4"	↓	↓	↓	↓
(12)	1SI88AB-3/4"	↓	↓	↓	↓

LINES

REV	DATE	DRAWN	CHECKED	QC APP	SM APP	DESCRIPTION	REF DWG
E	5/13/86	K 5-13-86	[illegible] 5-13-86	G.H. Daniell 6-13-86	5/13/86	CLERICAL CHANGE	
D	3-24-86	B. Zolecki 3-24-86	3-24-86	3-24-86	MRY 3-24-86	FCO # 1SI-28607 SEE NOTE # 9	
C	2-28-86	2-26-86	[illegible]	2-27-86	MRY 2-28-86	ECN # 29101 SEE NOTE # 8	M-61-3
B	2-24-84	[illegible]	TB 1-17-84	[illegible]	2-24-84	AS-CONST. SWO 177	M2539A-28

CLASS B ☒ NUCLEAR ☐ NON NUC
DESIGN TABLE 1542BB
WELD PROC
SCALE NONE
PNEUMATIC | RADIOGRAPH | MAG PART | ☒ DYE PEN | ☒ HYDRO | HEAT TREAT

PHILLIPS, GETSCHOW CO
BRAIDWOOD STATION SPEC L-2739
UNIT 1 BLDG AUX W O No 1000
SAFETY INJECTION
DWG No PG-2539A-28 REV E

DRAWING RELEASE RECORD

REV.	DATE REL'D	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM

SCALE

PROJECT NUMBER 4683

A.S.M.E. SECTION XI

DOC STA #3

SARGENT & LUNDY ENGINEERS CHICAGO

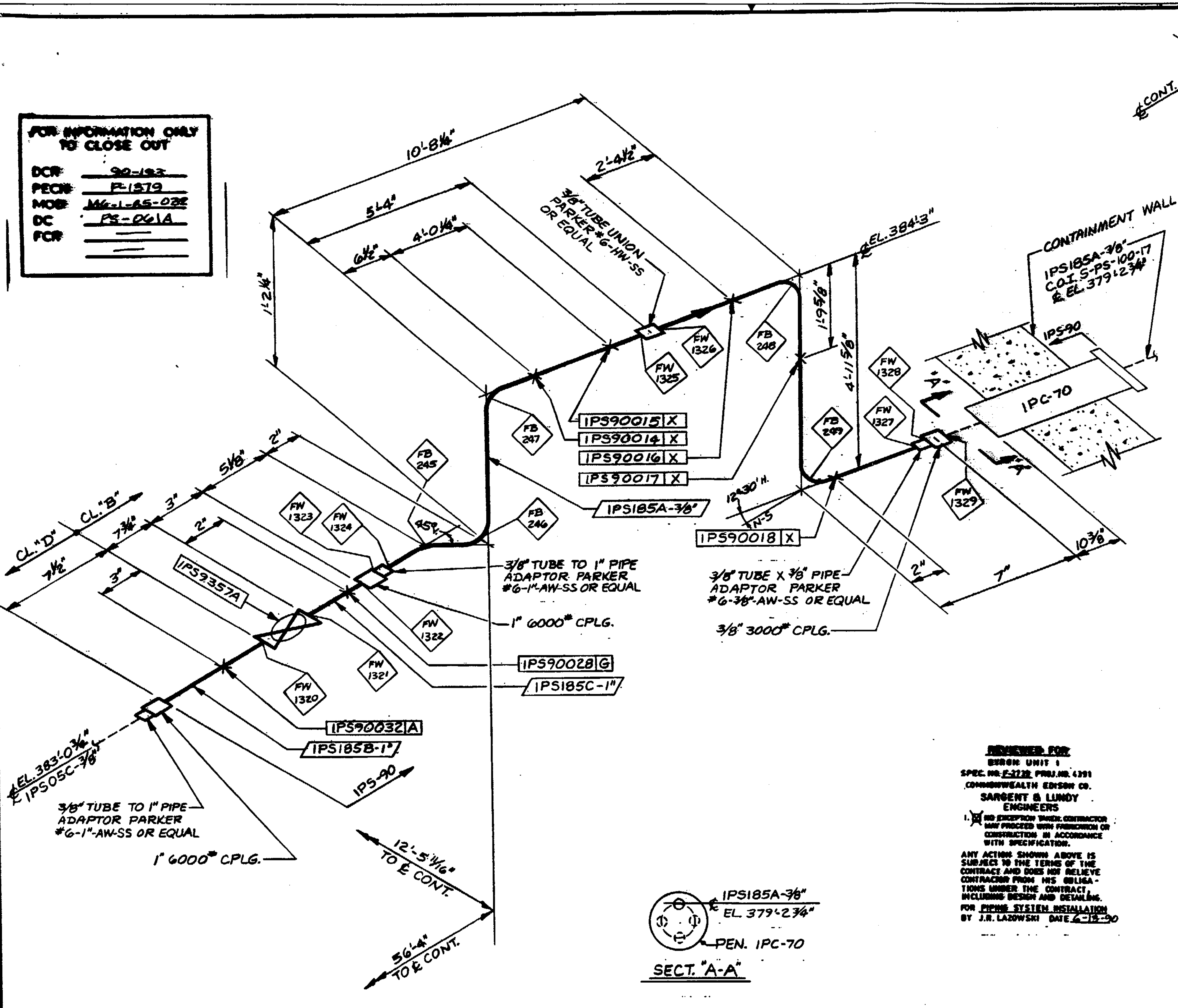
DRAWING NO. M 2539A REV. E

SHEET 28 OF

FORM GDS2.8.3(4-76)
H.C.L.-82
SEAL

FOR INFORMATION ONLY
TO CLOSE OUT

DCR	90-193
PECN	P-1379
MOD	M6-1-65-038
DC	PS-061A
FCR	—



FOR REFERENCE ONLY

REVIEWED FOR
BYRON UNIT 1
SPEC. NO. F-2739 PROJ. NO. 4391
COMMONWEALTH EDISON CO.
SARGENT & LUNDY
ENGINEERS

1. [X] NO EXCEPTION TAKEN. CONTRACTOR MAY PROCEED WITH FABRICATION OR CONSTRUCTION IN ACCORDANCE WITH SPECIFICATION.

ANY ACTION SHOWN ABOVE IS SUBJECT TO THE TERMS OF THE CONTRACT AND DOES NOT RELIEVE CONTRACTOR FROM HIS OBLIGATIONS UNDER THE CONTRACT, INCLUDING DESIGN AND DETAILING.
FOR PIPING SYSTEM INSTALLATION
BY J.R. LAZOWSKI DATE 6-13-90

QA	DATE	ANI	DATE	REV.	BY	DATE	DESCRIPTION OF REVISION	APP'D.
				4.	[illegible]	11-9-89	REDRAWN, REVISED PER ECN P-1379 NWR 871908 [illegible]	JY
				3G	BSG	12-18-84	ADD PIPING AS-BUILT INFO, TRANSFER PENETRATION AS-BUILT INFO TO IPC-70	JAC
				3F	LMB	2-21-84	ADDITION TO 100% HGR. AS-BUILT FOR SUB-SYS. 1PS-90	[illegible]
				3E	DB	8-9-83	ADDED MJ 5 & NOTE BY IPS9357A PER DR. ENG-IPS-001-008	DC
				3D	CS	5-4-83	DELETED FSDS 029	[illegible]
				3C	CAL	3-17-83	ADD FSDS 029	[illegible]
				3B	LMB	[illegible]/83	100% HGR. AS-BUILT FOR SUBSYSTEM IPS-90	[illegible]
				3A	GR	[illegible]-82	70% HGR. AS-BUILT FOR SUB SYSTEM IPS-90	[illegible]
				3	LMC	8-6-82	ADDED PIPING AS BUILT DWG'S.	[illegible]
				2	JP	7-17-82	DELETE [illegible] AND ADD NOTE "BY OTHERS"	[illegible]
				1	BAC	2-8-82	REVISE FITTING SIZES	[illegible]
				0	LJK	[illegible]	RELEASED FOR CONST.	[illegible]

DESIGN ENG. DRG. REF.	M-68-1-M-2616C-14	REV.	L-A
FABRICATORS ISO. REF.	N/A	REV.	
LINE NO. SYSTEM	[illegible] 1PS185B-1" 1PS185C-1"	PIPING DESIGN TABLE 1537BB 1540BB	REV. E C
ASME CODE SECTION III DIV. I CLASS			2
DESIGN SPECIFICATION QUALITY CLASS			B, D
WPS 808-1	PREH. 60	PWHT.	N/A
DESIGN TEMP. 300	DESIGN PRESS.		700
NDE REQUIREMENT	SEE PROCESS SHEETS		

TITLE: PROCESS SAMPLING

SCALE NONE
DRAWN L. [illegible]
DATE 1-27-82
CHK'D GR

BYRON STATION
BYRON, ILLINOIS

W.A. POPE CO.-J.V.

ISO./SPOOL NO.
S-PS
001-14

DRAWING RELEASE RECORD

REV.	DATE REL'D	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM

SCALE

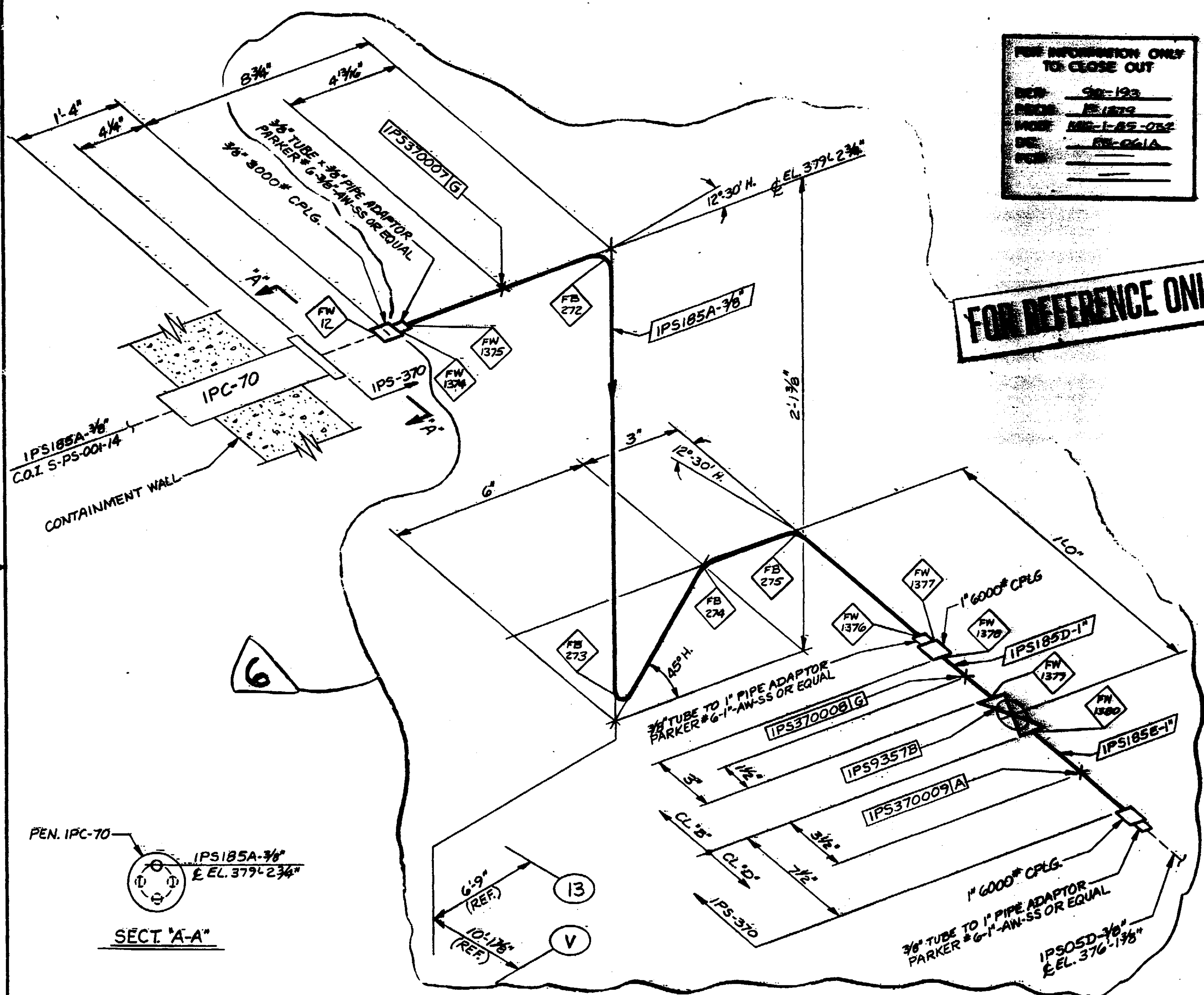
PROJECT NUMBER

DOCUMENT #

SARGENT & LUNDY
ENGINEERS
CHICAGO

DRAWING NO.	REV.
M-2616C	
SHEET 14 OF	

FORM GDS 2 8 3 (4-76)



FOR INFORMATION ONLY TO CLOSE OUT

ECN: 9D-193
DRCN: F-1379
NCR: [illegible]
DC: [illegible]

FOR REFERENCE ONLY

REVIEWED FOR
BYRON UNIT 1
SPEC. NO. F-2739 PROJ. NO. 4391
COMMONWEALTH EDISON CO.
SARGENT & LUNDY ENGINEERS

1. NO EXCEPTION TAKEN, CONTRACTOR MAY PROCEED WITH FABRICATION OR CONSTRUCTION IN ACCORDANCE WITH SPECIFICATIONS.

ANY ACTION SHOWN ABOVE IS SUBJECT TO THE TERMS OF THE CONTRACT AND DOES NOT RELIEVE CONTRACTOR FROM HIS OBLIGATIONS UNDER THE CONTRACT, INCLUDING DESIGN AND DETAILS.

FOR: PIPING SYSTEM INSTALLATION
BY: J.R. LAZOWSKI DATE [illegible]

REV.	BY	DATE	DESCRIPTION OF REVISION	APP'D.
6	[illegible]	11-14-89	REDRAWN, REVISED PER ECN F-1379 NWR-8719A, DCR [illegible]	JJ
5D	JSG	12-18-86	ADD PIPING AS-BUILT INFO TRANSFER PENETRATION AS-BUILT INFO TO IPC-70	JAC
5C	DB	8-9-83	ADDED M.J. 8 & NOTE FOR IPS9357B PER DR ENG S-PS-100-006	DC
5B	LMB	7-15-83	100% HGR. AS-BUILT FOR SUB-SYS IPS-370	[illegible]
5A	LMB	9-23-83	70% HGR. AS-BUILT FOR SUB-SYS IPS-370	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]
4	LMC	[illegible]	ADDED PIPING AS-BUILT DIMS.	[illegible]
3	BAC	[illegible]	DELETE FW #13 ADD [illegible]	[illegible]
2	BAC	[illegible]	REVISE FITTING SIZES	[illegible]
1	GR	[illegible]	ADD [illegible] FIELD CONDITION	[illegible]
0	BAC	[illegible]	RELEASED FOR CONST.	[illegible]

DESIGN DWG. REF.: M-2616A-17 / M-68-1
FABRICATION DWG. REF.: N/A
LINE NO. / SYSTEM — PIPING DESIGN TABLE: [illegible]
ASME CODE SECTION III DIV. I CLASS: 2
DESIGN SPECIFICATION QUALITY CLASS: B.D
OPER. TEMP.: 60
DESIGN TEMP.: 300
DESIGN PRESS.: 700
SEE PROCESS SHEETS

TITLE: PROCESS SAMPLING

BYRON STATION
BYRON, ILLINOIS
W.A. POPE CO.-J.V.

S-PS 100-17

DRAWING RELEASE RECORD

REV.	DATE REL'D	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM

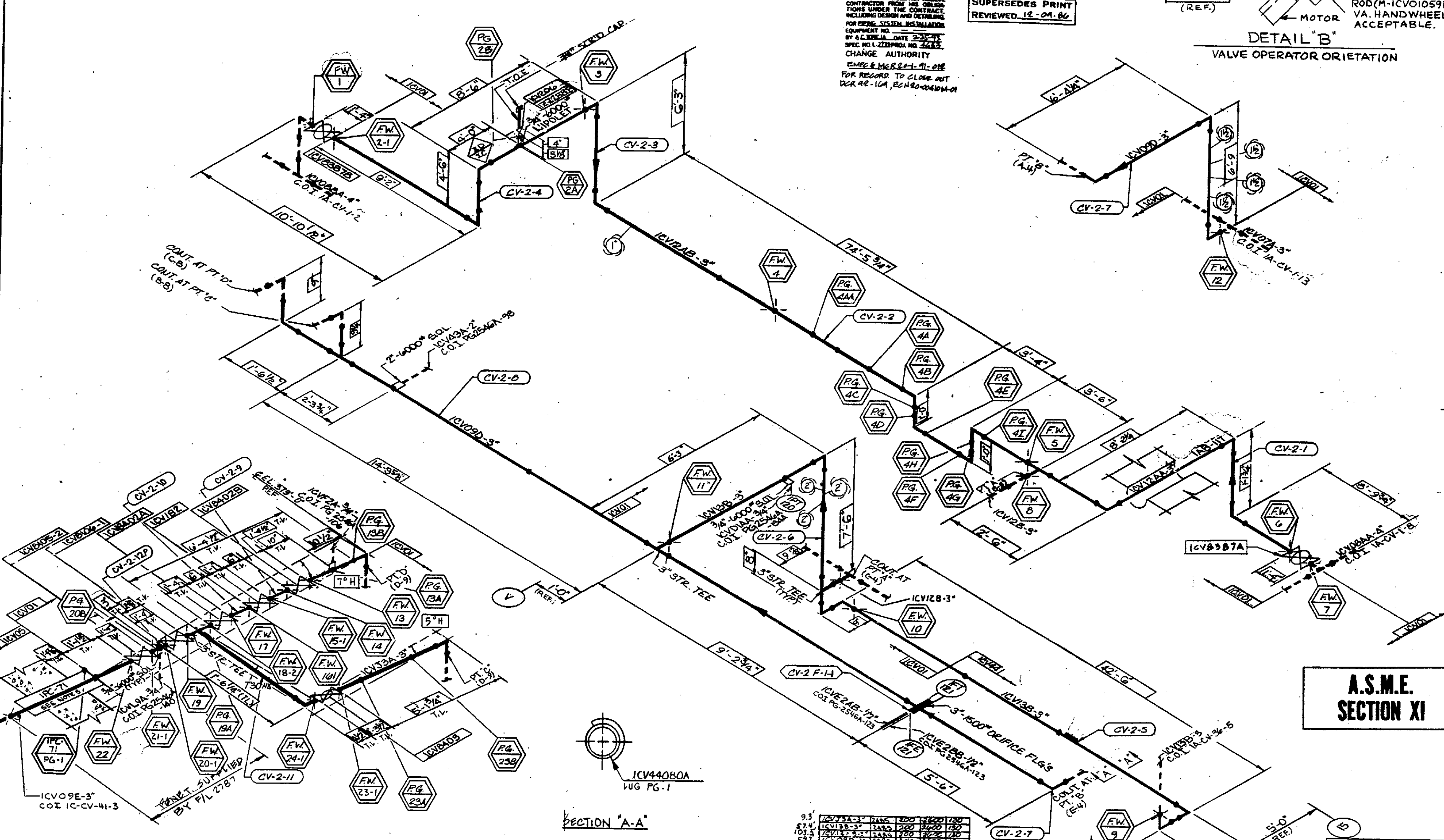
SCALE
PROJECT NUMBER

DOCUMENT #

SARGENT & LUNDY ENGINEERS CHICAGO

DRAWING NO. M-2616A
REV.
SHEET 17 OF

FOR REFERENCE ONLY



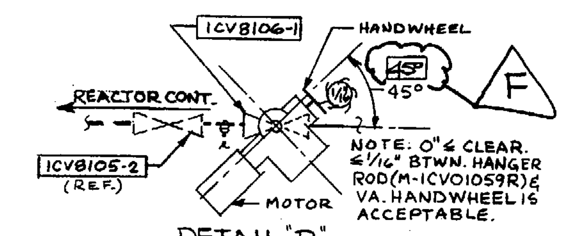
REVIEWED FOR BRAIDWOOD UNIT 1 ☒ UNIT 2 ☐
COMMONWEALTH EDISON CO.
SARGENT & LUNDY ENGINEERS

ANY ACTION SHOWN ABOVE IS SUBJECT TO THE TERMS OF THE CONTRACT AND DOES NOT RELIEVE CONTRACTOR FROM HIS OBLIGATIONS UNDER THE CONTRACT, INCLUDING DESIGN AND DETAILING.

CHANGE AUTHORITY

FOR RECORD. TO CLOSE OUT DCR AR-164, ECN 20-006104-01

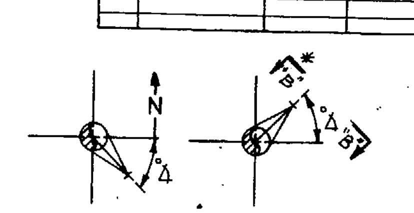
SUPERSEDES PRINT
REVIEWED 12-09-86



DETAIL "B"
VALVE OPERATOR ORIETATION

NOTES:
1) THIS DRAWING IS TO SERVE AS AN AS-CONSTRUCTED PIPING DRAWING TO REPLACE ORIGINAL P.G. 190 CV-2
2) ☐ DIMS ARE "AS-CONST." FOR PIPING CONFIGURATION SHOWN. ALL OTHER DIM. ARE FOR REFER ONLY.
3) ○ DENOTES SYMBOL FOR RATTLE CLEARANCE AND CLEARANCE NOTIFICATION FORM NO
4) REFER TO SWO# 7522.
5) FOR INFORMATION ON PENETRATION REFER TO PG DWG. IPC-71A
6) AS-CONST. SUBSYSTEMS ICV01, ICV44 & ICV05.
7) WELD MADE BY GULF & WESTERN. REFER TO F/L 2787.

SPOOL LIST			
QUAN.	SPOOL NO.	SW. SHT. NO.	FCO NO.
1	CV-2-1	17	3108
1	2	18	3746
1	3	19	1708-1(A)
1	4	20	ICV240
1	5	21	
1	6	22	
1	7	23	
1	8	23	ICV345
1	9	24	
1	10	25	
1	11	26	3125
1	12	27	2802
1	CV-2-12P		ICV-17681



DETAIL D
VERT. VALVE

DETAIL A
HORTZ. VALVE

* DETAIL "B" FOR ICV8106-1 ONLY

VALVE ORIENTATION			
VALVE NUMBER	DETAIL	VIEWED LOOKING	ANGLE ∡
* ICV8106-1	A	SOUTH	58°
ICV8105-2	A	NORTH	90°
ICV182	A	SOUTH	47°
ICV8402A	A	NORTH	90°
ICV8402B	A	SOUTH	49°
ICV8403	A	SOUTH	46°
ICV8387A	A	EAST	90°
ICV8387B	A	EAST	90°
ICV206	D	DOWN	90°

A.S.M.E.
SECTION XI

ITEM	QUAN	DESCRIPTION
	1	ICV182 SER.# 7310-95288-219-2
	1	ICV8402B SER# 0285
	1	ICV8402A SER# 0287
	1	ICV8106-1 SER# 0017
	1	ICV8105 SER# 0018
	1	ICV8403 SER# 68
	1	ICV8387A SER# 43
	1	ICV8387B SER# 42
	1	ICV206 SER.# 65714

BILL OF MATERIAL

	DESIGNATION	PRESS.	TEMP.	PRESS.	TEMP.
9.3'	ICV33A-3"	2485	200	2600	130
57.4'	ICV13B-3"	2485	200	2400	130
103.5'	ICV12AB-3"	2485	200	2020	130
59.7'	ICV09D-3"	2485	200	2600	130
15.5'	ICV17AA-3"	2485	200	2632	130
0.8'	ICV12B-3"	2485	200	2400	130
	ICVL9A-3/4"	REF.			
	ICVE2AC-1/2"	REF			
	ICVE2BB-1/2"	REF			
	ICVD1AA-3/4"	REF			
	ICV43A-2"	REF.			
	ICV07A-3"	REF			
	ICV08BA-4"	REF.			
	ICV08AA-4"	REF.			

LINES (DESIGNATION; DESIGN PRESS./TEMP.; OPER. PRESS./TEMP.)

PIPE: SPEC 1540BB; SIZE 3"; SCHED/WALL 160; ASTM SPECIFICATIONS SA-376-TP304 SMLS
FITTINGS: SA-403-WP304/316
FLANGES: RATE 1500; FACE RF-W.N.; ASTM SA-182-F316
BOLTS & NUTS: SA-193; SA-194 GR 8; GEB-16; HVY HEX; CLASS 2A FIT; CLASS 2B FIT
GASKETS: 1/16"; FLEXITALLIC STYLE "CG"

REV	DATE	DRAWN	CHECKED	QC APP	SM APP	DESCRIPTION	REF DWG
F	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	AS CONSTRUCT.	M64-3A(AU)
E	8/1/86	B.R. HUGHES 8-1-86	K 8-1-86	8-1-86	8/1/86	CLERICAL CHANGE	M64-3B(AR)
D	2-5-86	KCP 2/4/86	2/5/86	2-5-86	2-5-86	AS-AS CONSTRUCT SS ICV05 & ICV01	DR#02065
C	12/3/85	12-3-85	S.R. HUGHES 12-3-85	G.A. DANIELL 12-3-85	12/3/85	CLERICAL CHANGE	
B	4-11-85	2-28-85	4/10/85	RH 4-10-85	4-11-85	RE-AS-CONST/PENET	M546-2(U)
A	3-20-85	JER	KM 10-1-83	JRH 11-4-83	PB 11-4-83	SEE NOTE 6	M546-3(A)

SUB-SYSTEMS ICV01, ICV44, ICV05
ASME SECTION III, 1974 W/ADDENDA THRU SUMMER 1975, CLASS 2
STAINLESS STEEL

CLASS B ☒ NUCLEAR ☐ NON NUC
DESIGN TABLE 1540BB
WELD PROC N/A
SCALE NONE

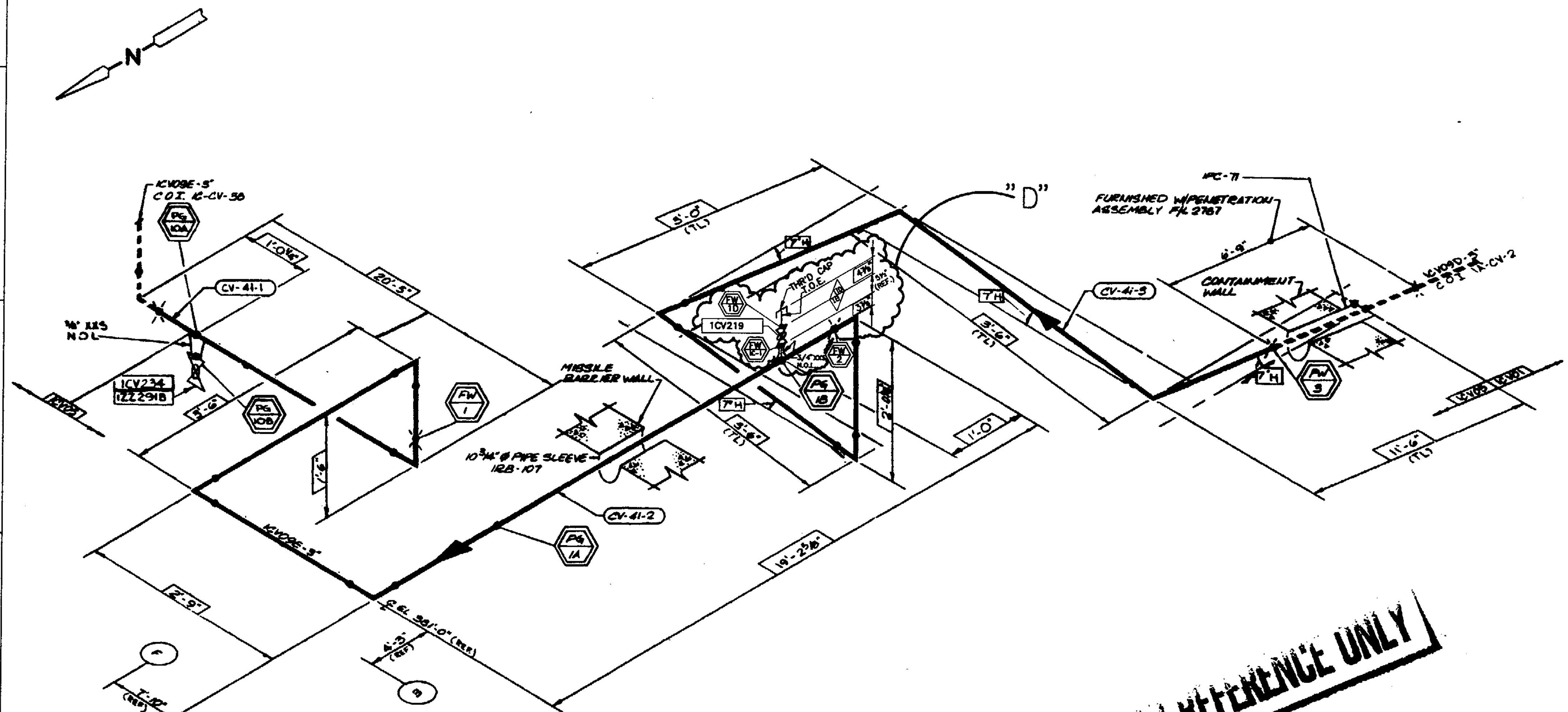
☐ PNEUMATIC
☒ RADIOGRAPH
☐ MAG PART
☐ DYE PEN
☒ HYDRO
☐ HEAT TREAT

PHILLIPS, GETSCHOW CO
BRAIDWOOD STATION SPEC L-2739
UNIT 1 BLDG AUX W O No N/A
CHEM. FEED & VOLUME CONTROL
DWG No 1A-CV-2

1C-CV-41

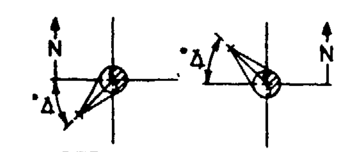
NOTES:
1) THIS DRAWING IS TO SERVE AS AN AS-CONSTRUCTED PIPING DRAWING TO REPLACE ORIGINAL S.W. ISO. CV-41
2) ☐ DIMS. ARE AS-CONST. DIMS. FOR PIPING CONFIGURATION SHOWN. ALL OTHER DIM. ARE FOR REF. ONLY.
3) REFER TO SWO #8
4) PER FIELD CLARIFICATION AND ENG. CORRECTION OF ORIENTATION OF NORTH ARROW
5) * VALVE HANDLE ORIENTATION FOR 1CV219 MAY VARY TO SUIT

"D"



FOR REFERENCE ONLY

SPOOL LIST			
QUAN	SPOOL NO.	SW SHT.NO.	ECO NO
1	CV-41-1	257	1CV-35 ,
1	-2	286	7655
1	-3	259	1137 R/A



DETAIL E
VERT VALVE

DETAIL F
VERT VALVE

VALVE ORIENTATION			
VALVE NUMBER	DETAIL	VIEWED LOOKING	ANGLE °∡
1CV219	E	DOWN	90° *
1CV234	F	DOWN	0°

"D"

"D"

ITEM	QUAN	DESCRIPTION	
		1CV234	65753
		1CV219	
		VALVE NO	SERIAL NO

BILL OF MATERIAL

PIPE				FITTINGS	FLANGES	BOLTS & NUTS	GASKETS	LINES					
SPEC.	SIZE	SCHED./WALL	ASTM SPECIFICATIONS	LRE, SRE, 45, TEE, STUB, CAP (BUTT WELDING) SPECIFICATIONS	RATE, FACE, ASTM, S.O., SCD., L.J., SOCK, BLD.	MACH., STUD SETS, BOLTS, NUTS SPECIFICATIONS	RF, FF, RTJ, GAP, DESCRIPTIONS	DESIGNATION	PRESS. (DESIGN)	TEMP. (DESIGN)	PRESS. (OPER.)	TEMP. (OPER.)	
154088	3"	160	SA376 TP304 SML'S	SA403 WP304 SML'S									
							66.3'	1CV09D-3"	REF.				
								1CV09E-3"	2735	200	2600	130	

SUB-SYSTEM 1CV05

ASME SECTION III, 1974 W/ADDENDA THRU SUMMER, 1975 CLASS 2 (STAINLESS STEEL)

A.S.M.E. SECTION XI

S&L SEQ. LTR. #3	CLASS B ☒ NUCLEAR ☐ NON NUC		PNEUMATIC
M-64-38		☒	RADIOGRAPH
M-64-5	DESIGN TABLE 154088		MAG PART
M-546-27	WELD PROC N/A		DYE PEN
M-546-29		☒	HYDRO
REF. DWG.	SCALE NONE		HEAT TREAT

REV	DATE	DESCRIPTION	PREP.	REVW.	APPR.
D	05/30/97	FOR RECORD T/O# 0000000030 E20-1-93-221 ECN 20-000520M	R.J.	JDK	BJA
C	12/16/85	RE-AS CONST SS 1CV05 & S&L SEQ. LTR #46	P212	P212	P212

ComEd
Chicago, Illinois
Braidwood Station 20

CHEMICAL FEED & VOLUME CONTROL SYSTEM CONTAINMENT BUILDING UNIT 1

SCALE : NONE
DATE : 6/28/83
DRAWN BY : P212
ENG. BY : P212
FILENAME : P212

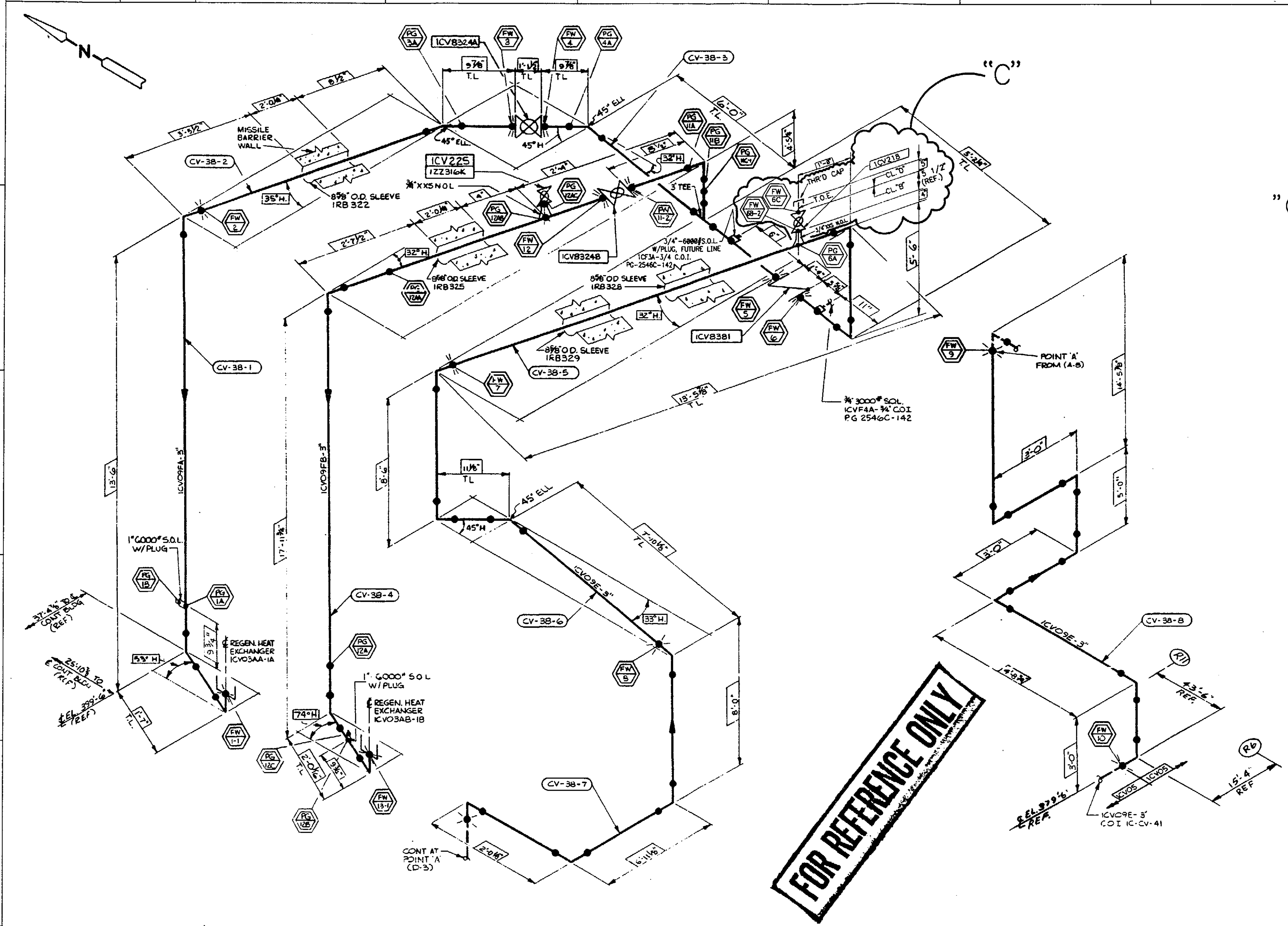
1C-CV-41

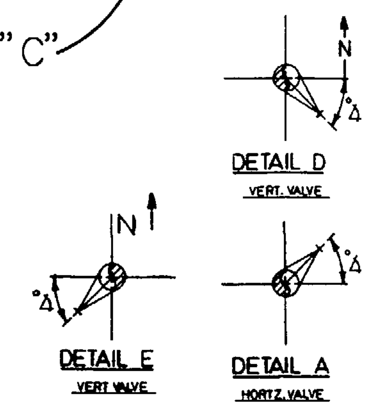
SHEET NO. M10

1C-CV-38

NOTES:
1) THIS DRAWING IS TO SERVE AS AN AS-CONSTRUCTED PIPING DRAWING TO REPLACE ORIGINAL S.W. ISO. CV-38
2) ☐ DIMS. ARE AS-CONST. DIMS. FOR PIPING CONFIGURATION SHOWN. ALL OTHER DIM. ARE FOR REF. ONLY
3) REFER TO SWO #08
4) ✻ VALVE HANDLE ORIENTATION FOR 1CV218 MAY VARY TO SUIT

"C"





VALVE ORIENTATION			
VALVE NUMBER	DETAIL	VIEWED LOOKING	ANGLE ∡
1CV8324A	A	SE	[illegible]
1CV8324B	A	NW	[illegible]
1CV8381	N/A	N/A	N/A
1CV225	E	DOWN	74°
1CV218	D	[illegible]	32° ✻

"C"

SPOOL LIST

QUAN.	SPOOL NO.	SW. SHT. NO.	FCO NO.
1	CV-38-1	20-	[illegible]
1	CV-38-2	210	[illegible]
1	CV-38-3	211	1CV-107
1	CV-38-4	212	[illegible]
1	CV-38-5	213	[illegible]
1	CV-38-6	214	–
1	CV-38-7	215	–
1	CV-38-8	216	–

"C"

ITEM	QUAN	VALVE NO	SERIAL NO.
		1CV8381	0261
		1CV8324B	7310-95288-261-2
		1CV8324A	7310-95288-261-1
		1CV225	TAI-20
		1CV218	

DESCRIPTION

BILL OF MATERIAL

SPEC.	SIZE	SCHED./WALL	ASTM SPECIFICATIONS (PIPE)	FITTINGS: BUTT WELDING SPECIFICATIONS	LINES: DESIGNATION	DESIGN PRESS.	DESIGN TEMP.	OPER. PRESS.	OPER. TEMP.
154088	3"	160	SA376 TP304 SML'S	SA403 WP304 SML'S					
					1CVF3A-3/4"	REF.			
					1CVF4A-3/4"	REF.			
					(60.2') 1CV09E-3"	2735	200	2600	130
					(29.0') 1CV09FA-3"	2735	130	2600	130
					(32.5') 1CV09FB-3"	2735	130	2600	130

PIPE | FITTINGS (LRE, SRE, 45, TEE, STUB, CAP) | FLANGES (RATE, FACE, ASTM, S.O., SCD., L.J., SOCK, BLD.) | BOLTS & NUTS (MACH., STUD SETS, BOLTS, NUTS SPECIFICATIONS) | GASKETS (RF, FF, RTJ, GAP, DESCRIPTIONS) | LINES

REF DWG
M-64-5(M)
M546-29(M)
M546-2E(J)
M546-27(P)

SUBSYSTEM 1CV05

ASME SECT III 1974 W/ADD THRU SUMMER 1975 CL 2 STAIN STEEL

CLASS B ☒ NUCLEAR ☐ NON NJC

DESIGN TABLE 1540BB

WELD PROC SEE WELD DATA SHEETS

SCALE NONE

☐ PNEUMATIC ☒ RADIOGRAPH ☐ MAG PART ☒ DYE PEN ☒ HYDRO ☐ HEAT TREAT

A.S.M.E. SECTION XI

REV	DATE	DESCRIPTION	PREP.	REVW.	APPR.
C	05/30/97	FOR RECORD T/O# 0000000030 E20-1-93-221 ECN 20-000520M	R.J.	JDK	BJA
B	7/27/89	NWR# A12394	P212	P212	P212

ComEd
Chicago, Illinois
Braidwood Station 20

SCALE : NONE
DATE : 6-23-83
DRAWN BY : P212
ENG. BY : P212
FILENAME : IOIMS

CHEMICAL FEED & VOLUME CONTROL SYSTEM CONTAINMENT BUILDING UNIT 1

1C-CV-38

SHEET NO.

M10