Commonwealth Edison Company
LaSalle County Station - Unit 1

REPORT ON UNIT 1 HIGH DRYWELL TEMPERATURE

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I. INTRODUCTION

The subject of the LaSalle County Station - Unit 1 high drywell temperature problem was discussed among Region III of the NRC, CECo, and S&L during a management meeting held at Region III on Monday, November 21, 1983. An initial briefing on the problem of the degradation of the electrical cables and equipment in the upper levels of the Unit 1 drywell was made by CECo (Reference NRC Region III letter of December 2, 1983 to C. Reed from A. B. Davis). In accordance with commission instructions, page 12 of that letter, this report addresses the short term actions taken to enable restart of LaSalle Unit 1. In addition, though not requested, the report acknowledges the long term corrective actions briefly mentioned at the management meeting.

LaSalle County Unit 1 has experienced excessively high temperatures in the upper areas of the drywell. The safety effect of these high temperatures is to degrade the cabling and the electrical and mechanical components.

The short term plan for Unit 1 restart was presented by CECo at the November meeting. It included:

- investigating the reasons for the high temperatures,
- defining the extent of the problem,
- taking short term corrective actions to eliminate the cause
- evaluating the remaining life of retained equipment
- ensuring through a temperature monitoring program that cabling and components do not exceed their remaining qualified life prior to the end of the first fuel cycle.

CECo's long term solution is intended to preclude possible future high temperatures, thus preventing accelerated degradation of electrical cables, and mechanical and electrical equipment and also ensuring the functional capability of the containment pressure boundary.

II. DISCUSSION OF EVENT

1. Discovery of Results of the High Temperature

During a recent shutdown of the LaSalle Unit 1, visual damage to electrical cables was noted by station personnel. The physical evident was degradation of the insulation and jacketing on some control cables. CECo's outline briefing to Region III on November 21, 1983 was based on these preliminary observations. Since then a systematic inspection of the Unit 1 drywell and equipment was conducted. The inspection consisted of looking for discolored, cracked, or stiff electrical insulation, and cable jacketing. Flexible electrical conduit and equipment were also examined for signs of degradation. Various junction boxes were opened to verify that cables in the conduit was undamaged. The primary containment liner and concrete structures in the upper drywell region were visually inspected for obvious indications of elevated temperature effects.

2. Characterization of Event Conditions

The operating temperature reading from drywell monitors were used to establish a temperature profile for the drywell (See Figure 1). Some additional temporarily installed thermocouples around the safety relief valves were also utilized for temperature indications. A correlation was made of available temperature data and observed visual damage. The bulk high temperature effects appear to be limited to elevation 804 feet and above with some local problems below that level. The degradation problem is caused by excessive heat in the upper drywell regions and at localized hot spots. The local hot spots on some cables coincided with physical contacts on hot piping or high temperature surfaces. Only the upper area of the drywell had a volumetric or bulk overtemperature.

3. Causes of Excessive Temperatures

High drywell temperatures resulted from excessive heat traceable to several conditons:

a) poor air flow distribution within the drywell due to unanticipated heat loads,

b) inadequately sealed penetrations including some uninsulated penetrations in the bioshield wall,

c) numerous gaps in installed thermal metallic reflective insulation including uninsulated components such as open flashing at clamps, gaps at whip restraints, missing flashing at insulation seams,

missing flashing at tap and test connections, missing flashing at valves, and also crushed and damaged insulation,

d) a full perimeter thermal insulation gap around the RPV,

e) and because of the above deficiencies, a greater sensible heat load than anticipated. The original design sensible heat load was equal to approximately 3,627,250 Btu/hr. It was later determined the unanticipated sensible heat load at 100% power was approximately 5,204,100 Btu/hr. which contributed to the high drywell temperature.

III. EVALUATION OF EFFECTS AGAINST PLANT DESIGN

An evaluation of the effects of high temperature against the design basis for LaSalle was made to assure adequacy of the plant features to sustain such an event. The scope of the evaluation included review of the following capabilities:

- the primary containment structure
- the drywell cooling system
- the biological shield
- the electric cable
- mechanical and electrical equipment in the drywell

1. Structural Capability

The primary containment was designed for an operating temperature of 135°F for its internal atmosphere while at power and an accident transient temperature of 340°F. The assumption being that the containment walls could attain thermal equilibrium with the internal atmosphere for the long periods associated with power operations, but that the thermal spike associated with a transient event would not sustain wall temperatures of the magnitude of the atmospheric maximum.

A maximum upper level atmosphere temperature of 351°F was extrapolated from the observed lower elevation temperatures taken from the drywell sensors. Considering an atmospheric temperature of 351°F which conservatively translates to an average wall temperature of 210°F in the conrete, the properties of the LaSalle concrete indicate that less than ten percent strength loss occurs hence,

a) The containment wall has the capability to withstand the effects of that temperature.

b) The containment wall has the capability to withstand all design loadings.

The liner was designed to withstand a design accident temperature of 340°F. The reserve capacity of the liner is such that at an extrapolated temperature of 428°F the calculated strains do not exceed liner plate allowables for factored loads.

2. Drywell Cooling System Capability

The drywell cooling system capability is as stated in paragraph II.3.e. The drywell chiller capacity is 6,600,000 Btu/hr. Adjustment of the drywell airflow is the mechanism to control and obviate drywell overtemperature

3. Biological Shield Capability

The biological shield was designed for a temperature of 275°F. The shield temperatures were less than this design temperature. Therefore, there is no adverse effect on the biological shield wall.

4. Electric Cable Capability

Plant systems' cables whether safety-related or non safety related were puchased to the same specifications (IEEE-383, 1974). The best available cable was selected with a design rating of 90°C (194°F). Specialty cables such as the head vent thermocouples and the vibration monitoring signal cables are uniquely run in separate conduits at high drywell elevations and these are not of concern for this overtemperature event.

The service life for various types of cable was evaluated as a part of the environmental qualification program for LaSalle. That lifetime calculation includes the normal service and the most limiting accident (LOCA or HELB) parameters according to Arrhenium methodology that is acceptable to the Commission for the estimation of component life. In as much as cable applications and lifetimes vary, a specific or a bounding calculation must be made for each type of cable.

5. Equipment Capability

The Mark II containment design approach purposefully removed safety-related equipment from the drywell to improve reliability. Only a few items remain inside

the drywell: the main steam isolation valves, the safety/relief valves, other isolation valves, and control actuators, solenoids, and related switches and cables. Mechanical snubbers are also located inside the drywell.

As was electric cabling, these items of equipment were evaluated for decreased service life (plus bounding accident effects) as a result of the high thermal exposure of the Unit 1 drywell. This review was made in the same context as the NRR approved "Justification for Interim Operation" which recognizes the current qualification status of the equipment and the reliance on functionally independent, physically separated equipment available to perform the intended safety functions. Except for piping snubbers, no safety-related mechanical components were functionally affected.

The following safety-related electrical equipment, while still functional has a decreased service life due to the overtemperature conditions; other equipment with over 40 years remaining life under routine maintenance and surveillance practices is not listed.

Table III-1

Item	Model	Exist. Service Temp.	Remaining Qualified Life	Decision
Valve Motor Operators	SMB1 SMB000	166°F 163°F	30.7 Yrs. 36.3 Yrs.	Retain
SRV Solenoid	IMF-2	173°F	1.5 Yrs.	Retain
SRV Position Switch	LISA	173°F	Alternate capability provided, still being qualified, retain.	
MSIV Solenoids	ASCo-8300	185°F	Not overtemperatured by conditions, retain	
MSIV Limit Switches	EA-740	185°F	3.5 Yrs.	Retain
RPV Head Vent Motor Operators	SMB000	280°F	Mis-classified, Refurbished valves are safety-related but these operators are non safety-related	

Item	Model	Exist. Service Temp.	Remaining Qualified Life	Decision
Misc. Valve Limit Switches	NAMCO EA-180	146°F	Only one limit switch (1B33F019) is safety related. It has 2.0 years remaining life; others are for operator display except for one non safety related function.	Retain
Primary Coolant Sample Solenoid Valve	ASCo HVA 205-852	146°F	5.4 Yrs.	Retain
Testable Check Bypass Solenoid Valves	ASCo HVA-206-852	225°F	Valves normally closed, fail closed. Used only during cold shutdown and leak testing of isolation valve	Retain
Drywell Air Temp. Monitoring Thermocouple	Weed E4B	148F to 173°F	7.2 to 21.7 Yrs. These are part of drywell temp. monitoring program	Retain
Drywell Radiation Detector	RD-23	159°F to 181°F	Alternate monitor, still undergoing qualification	Retain

Some snubbers in the upper elevations have recently been found locked up and subsequently replaced. Based on the latest available temperature projection and this failure experience, upper level snubbers were evaluated for replacement.

The snubbers have a maximum operating temperature limit of 300°F. Those snubbers exposed to greater than 300°F ambient air temperatures, based on extrapolated temperature data, have been replaced and are epected to last through this fuel cycle. In addition snubbers that are in the vicinity of elevation 830 feet, where no temperature data was available, were also replaced because locked up snubbers were discovered in the vicinity. See Table IV-3 for list of replaced snubbers.

IV. CORRECTIVE ACTIONS AND EXPECTED RESULTS

1. Structural Correction Actions

No correction action is required for the primary containment because the structural capability was not affected

by this high drywell temperature event.

2. Decreased Drywell Temperatures

a. Improved Air Flow Distribution

To improve the air ciruclation into the upper drywell levels, four 16 inch flexible steel supply air ducts were installed within the drywell. Normal air flow from colder, lower drywell regions is blown via these ducts into the upper drywell to reduce the local temperatures there. In addition, existing air discharge flow was readjusted to decrease discharge flow resistance due to interferences or to improve the radial flow distribution in the upper drywell. On December 9, 1983, a post-fuel-load modification was issued for the installation of these seismically supported flexible ducts. See Figure 2 for layout of ducts.

b. Penetrations through the Biological Shield

Penetrations through the biological shield were surveyed and corrected to ensure that intended seals are now in place. The neutron curtains and insulation covers for these penetrations inhibit air flow inside the bioshield to external zones and thus decrease radial convective heat transfer.

c. Gaps in Installed Insulation

The gaps in piping insulation and insulation transitions from piping lines to equipment bodies had been documented in the initial drywell thermal survey on November 28, 1983 and in re-survey for corrective fixes on December 2, 1983. The corrective fixes included the following: adding metallic heat shields to upstream piping for three testable check valves to reduce local hot spots; adding metallic insulation to fill gaps on pipeline insulation near hangers, snubbers, clamps, valves, whip restraints and tee-joints; adding flashing at edges of installed insulation at transition joints, equipment interfaces, and tap connections, and replacement of crushed or damaged insulation pieces to close seams in existing metallic insulation. This work on the testable check valves was covered by a modification released on December 15, 1983.

The field corrections on gaps were accomplished under a plant work request utilizing drawings marked up during the cited surveys.

d. Peripheral Gap on the RPV

The peripheral gap on the RPV hood insulation was corrected by adding flashing to inhibit out flow of heat at the top of the cylindrical part of the vessel. This fix should decrease the drywell sensible heat load significantly as it precludes the chimney effect of vessel heating of air which enters at the bottom of the vessel and rises inside the RPV insulation.

Reduction of Sensible Heat Loads

The preceding corrective measures on the insulation for piping, equipment, and the reactor pressure vessel are expected to reduce the senisble heat load to approach the anticipated sensible heat load value previously mentioned.

The net estimated change in average drywell temperature is ± 5 °F based upon decreased heat load through improved insulation and the increased mixing of the upper drywell air with the bulk drywell air. The anticipated temperature in the upper drywell zone, on a volumetric average basis will decrease to about 185°F. Because of variations in radial distribution and because of the uncertainty of the accumulative effect from the augmented vertical ducting, the actual temperature values must be determined by temperature monitoring. There is no safety related equipment located in this area.

3. Electric Cable Replacement

Damaged safety-related cables were removed above drywell elevation 796 feet and new cables were installed. The termination points were junction boxes, penetrations and equipment lugs, i.e., cable segments were replaced to splice points located in junction boxes or at penetrations. The original design criteria was preserved in that no splices were made inside conduits or in cable trays. Cable splices were made near primary containment penetrations; these will be removed during the first refueling outage.
The damaged non-safety-related cables above elevation 796 feet were also replaced with new cables. Exceptions to this replacement criteria were the cables for the plant welding grid, special head vent thermocouple leads inside conduits, test cabling for integrated leak rate test, and special cables for loose parts monitoring systems.

The visual inspection results were used to determine the elevation at which cable replacement would be mandatory. This was validated via the calculation of qualified life for the cable. The replacement elevation of 796 feet is shown to be conservative (minimum of about 11 year) by the following data.

Table No. IV-1

Option	Elev.	Calculated Existing Temp.	Qualified Life at Existing Temp.	Maximum Service Temp. for 18 Mo. Life
Existing Cable	804'-6"	266°F*	None	Replace
New Cable	804'-6"	266°F	151 Days	239°F
Existing Cable	796'-0"	202°F	11 Years	239°F
New Cable	796'-0"	202°F	11.4 Years	239°F

*Highest observed temperature at any azimuth during entire period of drywell overtemperatures

For those cables retained at lower elevations, the remaining cable life was calculated for the postulated overtemperature conditions assumed continuous while at rated power and with the LOCA exposure at the end of life. Conservative calculation indicates the past overtemperature exposure used approximately an equivalent 0.4 years of life. The table below shows the remaining life for some typical cables for the existing drywell temperature.

Table No. IV-2

Retained Cable: Okonite, Rockbestos, Samuel Moore

Elev.	Calculated Existing Service Temp.	Qualified Life After November 1, 1983	Maximum Temp. Allow. for Continuous Service of 18 Months	Maximum Temp. Allow. for Continuous Service of 2 Years
790'	186°F	28.6 Yrs.	239°F	233°F
760'	157°F	>40 Yrs.	239°F	233°F
		Raychem (Coax) Instrument Cable		
790'	186°F	13.0 Yrs.	240°F	232°F
770'	160°F	>40 Yrs.	241°F	233°F

With temperature reductions resulting from the previously enumerated short term fixes, these lifetimes can be increased markedly. This table shows the most pessimistic future condition for retained cables.

The conclusion for the cabling is: first, safety-related cables which were damaged have been replaced as required. Non safety-related cabling on "essential or display" equipment was also replaced. The replacement cable has sufficient life at the expected drywell temperatures

following the enumerated fixes to last beyond the remainder of the current fuel cycle. A temperature monitoring program has been defined to evaluate the results from the short term fixes. A scheduled shutdown after approximately three months will enable a visual appraisal of conditions and possible further air flow adjustments or thermal insulation adjustments for local hot spots.

Secondly, cables were retained inside the drywell on the basis that sufficient life remains to not only complete this fuel cycle but to not markedly affect the long range capability of the initially installed cable. These retained cables will be reinspected and replaced as necessary prior to startup following the first refueling outage.

4. Equipment Replacement

The following mechanical snubbers were replaced as a result of the drywell overtemperature conditions:

Table IV-3

Snubber No.	Elev. (ft.)
MS05-1002S	810
NB13-1001S	832
NB13-1002S	832
NB13-1004S	829
NB13-1006S	828
NB13-1025S	813
NB13-1027S	811
NB13-1028S	814
NB13-1031S	811
NB15-1002S	830
NB15-1005S	828
NB15-1008S	827
NB23-1003S	808
NB-125-H07S	816

Snubber No.	Elev. (ft.)
RI24-1120S	821
RI24-1121S	821
RI24-1122S	821
RI24-1124S	826
RI24-1511S	810

No mechanical equipment has had to be replaced except for snubbers

5. Temperature Monitoring

The need for temperature monitoring has been stated previously with respect to the short term corrective actions. Augmented temperature monitoring will be performed for the following purposes

- to evaluate the effectiveness of the short range fixes
- to monitor actual temperatures to assure safety-related equipment does not degrade beyond pre-defined thresholds
- to evaluate actual degradation rates for drywell cabling and equipment
- to provide volumetric thermal data inputs for the long range fix.

The thermal monitor network is an array of approximately 50 thermocouples located at various elevations and azimuths in the drywell. These are grouped at various elevations to measure the vertical temperature gradient in the drywell to establish temperatures where safety related equipment is installed. Additionally, some thermocouples are in contact with the equipment itself to provide local temperatures. This is the case for one SRV solenoid and one MSIV limit switch. See Tables IV-4 and 5.

TABLE IV-4

EXISTING TEMPERATURE MONITORING SENSORS AND LOCATIONS

Total number of existing sensors = 26

Sensor No.	Elevation	Azimuth	Location
1TE-VP041	817'-4"	45°	Supply duct to Head Area.
1TE-VP042	817'-4"	120°	Supply duct to Head Area.
1TE-VP084	817'-4"	240°	Supply duct to Head Area.
1TE-VP081	804'-6"	65°	Annulus outlet.
1TE-VP082	804'-6"	185°	Annulus outlet.
1TE-VP080	804'-6"	305°	Annulus outlet.
1TE-VP045	801'-6"	15°	Upper Drywell 10' from wall.
1TE-VP046	801'-6"	135°	Upper Drywell 10' from wall.
1TE-VP083	801'-6"	255°	Upper Drywell 10' from wall.
1TE-CM058	776'-9"	50°	13' from wall.
1TE-CM059	776'-9"	152°	13' from wall.
1TE-CM060	776'-9"	320°	13' from wall.
1TE-CM061	77[illegible]'-5"	246°	13' from wall.
1TE-VP077	745'-6"	10°	MSIV 1B 8' from wall.
1TE-VP076	745'-6"	350°	MSIV 1A 8' from wall.
1TE-VP043	745'-6"	30°	Lower Drywell 5' from wall.
1TE-VP044	745'-6"	135°	Lower Drywell 5' from wall.
1TE-VP078	745'-6"	255°	Lower Drywell 5' from wall.
1TE-VP075	776'-6"	135°	Recirc. Area 1B 4' from wall.
1TE-VP074	745'-6"	317°	Recirc. Area 1A 4' from wall.
1TE-VP040	750'-0"	55°	Lower Annulus/Upper CRD Area.
1TE-VP039	750'-0"	319°	Lower Annulus/Upper CRD Area.
1TE-VP079	750'-0"	185°	Lower Annulus/Upper CRD Area.
1TE-VP037	742'-0"	305°	CRD Area.
1TE-VP038	742'-0"	65°	CRD Area.
1TE-VP072	742'-0"	185°	CRD Area.

TABLE IV-5

New Temperature Monitoring Sensors and Locations

Total number of new sensors = 35

Sensor No.	Elevation	Azimuth	Location
1TE-VP200	822'-0"	0°	Head Area
1TE-VP201	807'-0"	350°	Mount on 1E51-F355 limit switch housing (metal temperature)
1TE-VP202	810'-0"	30°	Upper drywell above 1B21-F001, 1B21-F002, 1B21-F005, 1E51-F066 and 1E51-F355
1TE-VP203	804'-6"	135°	Upper drywell 5 ft. from wall
1TE-VP204	795'-0"	30°	Upper drywell above and between 1B21-F013B and 1B21-F013J
1TE-VP205	795'-0"	315°	Upper drywell above 1B21-F013C
1TE-VP206	784'-6"	30°	SRV area above 1B21-F013J, mount sensor approx. 2 ft. from 1TE-VP207
1TE-VP207	784'-6"	30°	Mount on SRV 1B21-F013J solenoid housing (metal temperature)
1TE-VP208	790'-0"	135°	Mount above 1E21-F006, 1E21-F051, 1E51-F063 and 1E51-F076
1TE-VP209	790'-0"	255°	Mount above 1E22-F005, 1E22-F354 and 1E22-F038
1TE-VP210	785'-0"	315°	Mount above SRV 1B21-F013C and 1E21-F013G
1TE-VP211	742'-0"	350°	Mount on MSIV 1B21-F022D, limit switch housing (metal temperature)
1TE-VP212	782'-0"	25°	Inside shield wall, hang through shield door for middle annulus
1TE-VP213	793'-8"	0°	Inside the 30" x 32" duct
1TE-VP214	793'-8"	180°	Inside the 30" x 32" duct
1TE-VP215	780'-0"	80°	SRV "M" (air temperature)-existing
1TE-VP216	780'-0"	300°	SRV "E" (air temperature)-existing
1TE-VP217	815'-0"	30°	2 ft. from containment wall
1TE-VP218	810'-0"	135°	2 ft. from containment wall
1TE-VP219	810'-0"	255°	2 ft. from containment wall
1TE-VP220	804'-6"	255°	2 ft. from containment wall
1TE-VP221	815'-0"	315°	2 ft. from containment wall
1TE-VP222	810'-0"	315°	2 ft. from containment wall
1TE-VP223	815'-0"	185°	2 ft. from containment wall
1TE-VP224	810'-0"	185°	2 ft. from containment wall
1TE-VP225	807'-0"	350°	Mount near limit switch for 1E51-F355(air temperature), mount approximately 2 ft. from 1TE-VP201
1TE-VP226	815'-0"	135°	2 ft. from containment wall
1TE-VP227	815'-0"	255°	2 ft. from containment wall
1TE-VP228	804'-6"	30°	Annulus outlet
1TE-VP229	804'-6"	315°	Annulus Outlet
1TE-VP230	801'-6"	30°	Upper drywell, 5 ft. from wall
1TE-VP231	776'-9"	30°	Mount 13 ft. from wall
1TE-VP232	742'-0"	350°	Mount near MSIV 1B21-F022D limit switch (air temperature) mount approximately 2 ft. from 1TE-VP211
1TE-VP233	745'-6"	30°	Lower drywell 5 ft. from wall
1TE-VP234	776'-6"	135°	Mount 13 ft. from wall

V. UNIT 1 RESTART OPERATING PLAN

1. Justification for Unit 1 Restart

With the short term modifications to the drywell air handling equipment to cool the upper drywell region and with the closure of insulation gaps and the addition of flashing to decrease the sensible heat load into the drywell atmosphere, the Unit 1 drywell cooling capability is configured to preclude a recurrence of the overtemperature in the drywell.

With the replacement of damaged cables and snubbers in the upper drywell and with justification for retention of slightly degraded, though fully operational cables and equipment in the lower drywell regions, LaSalle Unit 1 is configured for restarting. The restart plan presented at the November management meeting included the following provisions:

a. All safety-related cable and components will have a remaining qualified life of 18 months at appropriate temperatures. This has been met for even the worst case where no improvement results from the short term HVAC fixes described herein. With improved drywell temperatures this remaining qualified life will extend considerably for the replaced as well as the retained cables and equipment.

b. A surveillance program will be established to ensure that all cabling and components do not exceed their qualified life prior to the end of the first refueling outage. This has been accomplished two ways: first, by decreasing the heat load in the locations of previous overtemperature, including the physical rerouting of those cables previously experiencing local hot spots; and secondly, by cable and equipment replacement to assure that qualified life remains sufficient to complete this fuel cycle. The temperature monitoring program is a part of this effort to verify by actual operating observations that this goal is met.

c. Should the temperature in an area where safety related equipment is located exceed the limiting temperature on which the 18-month life is based for that equipment, for more than 24 hours, an analysis for continued operation will be completed within seven days or the unit will be temporarily shut down for a visual inspection and correction of the anomalous condition(s). This provision is met through the operation procedures that implement

the temperature monitoring program. (See Annex)

d. A general visual inspection of the safety-related components and cabling will be conducted at approximately three months and nine months after the Unit 1 restart to ensure that thermal degradation of qualified equipment is still within the "remaining qualified life" of the equipment. It is anticipated that air flow and local insulation may need further refinement after the Unit 1 restart. The complexity of the air flow distribution within the drywell lends itself to iterative refinements based on the results of the temperature monitoring efforts. Adjustment within three months is considered to be conservative in consonance with provision C above which covers any immediate need to protect safety-related equipment.

2. Temperature Monitoring Plan

The temperature monitoring plan is based upon observing the vertical temperature profiles in four quadrants of the drywell, then defining characteristic temperatures for those drywell elevations where safety-related equipment is located. This operating plan then cross-correlates these characteristic temperatures to the safety-grade readout, in the control room, of the containment temperature monitors (CM-058, 059, 060 and 061). This correlation enables the operator to reference the drywell characteristic temperatures via safety-grade monitors that have annunciator capability in the control room.

Determination of the drywell temperature profiles and these characteristic temperatures will occur during heat up and attainment of thermal equilibrium for the fully rated power condition via normal operating procedures on Unit 1. Once the correlation of characteristic temperatures to the CMO monitors is made, the basis is established for operational decisions regarding drywell temperature according to the existing technical specification with the CMO monitors.

As experience accrues after the short term fix, and based on the accumulated thermal monitoring history, it will be possible to compute new service life for critical safety-related equipment on the basis of actual temperature histograms. An in-cycle shutdown is planned for approximately 90 days after startup, at which time an evaluation can be made based on visual inspection and accumulated temperature data to project the need for temperature controls during the remainder of the fuel cycle. See Annex A for Technical Specifications applicable to the Temperature Monitoring Plan to ensure equipment qualification.

VI. SUMMARY CONCLUSION FOR UNIT NO. 1 RETURN TO SERVICE

1. Specific Reason for High Temperature Conditions

The primary causes of the high temperature condition were the poor air distribution at the upper level causing air stratification, localized hot spots causing high local temperatures above ambient, and various gaps in the mirror installation around valves, pipe whip restraints, etc. which contributed to the excessive sensible heat.

2. Completion of Short Term Fixes for Temperature Improvement

The various thermal insulation defects discovered via two surveys of the drywell have been repaired. Additional flexible ductwork to bring cooler air to the upper levels has been installed. In addition, changes to HVAC supply air discharges have been made to further enhance the air distribution. The combination of these short term fixes is expected to produce considerable temperature improvements in the drywell. The goal is to bring the maximum mean temperature at the uppermost zone in the drywell to below 185°F.

3. Cable Replacement and Evaluation of Adequacy

Safety-related cables which were visibly damaged have been replaced above drywell elevation 796 feet. At lower drywell elevations, the safety-related cable has been evaluated and determined to have adequate remaining life to complete the first fuel cycle. Also, a few specific cables below elevation 796 feet had to be replaced due to local hot spots. The replacement cables have been rerouted to prevent recurrence of local hot spots. An evaluation of adequacy has been completed to justify retention of cable below 796 feet elevation. The remaining service life (with LOCA included) is sufficient to extend well beyond the first fuel cycle even in the worst case where drywell high temperatures persist in spite of this short term fix.

4. Equipment Evaluation

Safety-related electrical equipment has been evaluated and determined to have sufficient qualified life to permit unit operation to at least complete this fuel cycle. The only mechanical equipment requiring replacement was snubbers in the upper drywell area which had been found locked up due to exposure to the high temperatures. No piping was found unacceptable as a result of the locked up snubbers.

5. Expected Schedule for Return to Service

Based on the repair of insulation defects, additional fixes for improved air distribution for temperature improvement, replacement of affected safety-related cables and affected mechanical snubbers, Unit 1 is ready for restart. The unit is configured for operation through the scheduled first fuel cycle. An interim outage in 1984 will be used to appraise the effectiveness of the short term fixes and the effects of further thermal degradation on safety-related cables and equipment. A temperature monitoring program will be used for appraising remaining equipment life and the success of the short term fixes.

VII. LONG TERM PROGRAM

The corrective actions described previously are primarily short term corrections to enable Unit 1 to return to service. The long term objective is to completely eliminate the high ambient air temperature. The principal approach is to provide adequate air handling (and mixing) in the drywell and to assure that adequate cooling capability exists to absorb the sensible heat load and any latent heat. Additional long term cooling capabilities under consideration include:

1) Additional coolers in the upper area of the drywell. Additional cooling capacity there is limited by the available space and the available cooling capacity of the RBCCW system.

2) Increased fan capacity for general circulation in the drywell to achieve greater cooling capability with existing installed equipment.

3) Adding booster fans in the ductwork to achieve an improved air circulation to certain critical areas.

4) Adding additional cooling coils to the existing main cooling units to increase the cooling capaicity.

Any one or a combination of the described corrections may eventually be used. The temperature measurement program will be used to obtain baseline data to assist in the definition of long term fixes.

There are two additional long term corrections under review. The first covers eliminating snubbers above the 804 feet bulk head and replacing them with struts where possible. Preliminary indications are that adequate design margin exists to allow this. The second is elimination of position switches on certain valves. These switches show valve

position only and are not actually required for a safety function. In fact, on Unit 2 the bypass valving, warm-up valves, and these switches have already been eliminated as non-essential because they are used only during leak testing during shutdown.

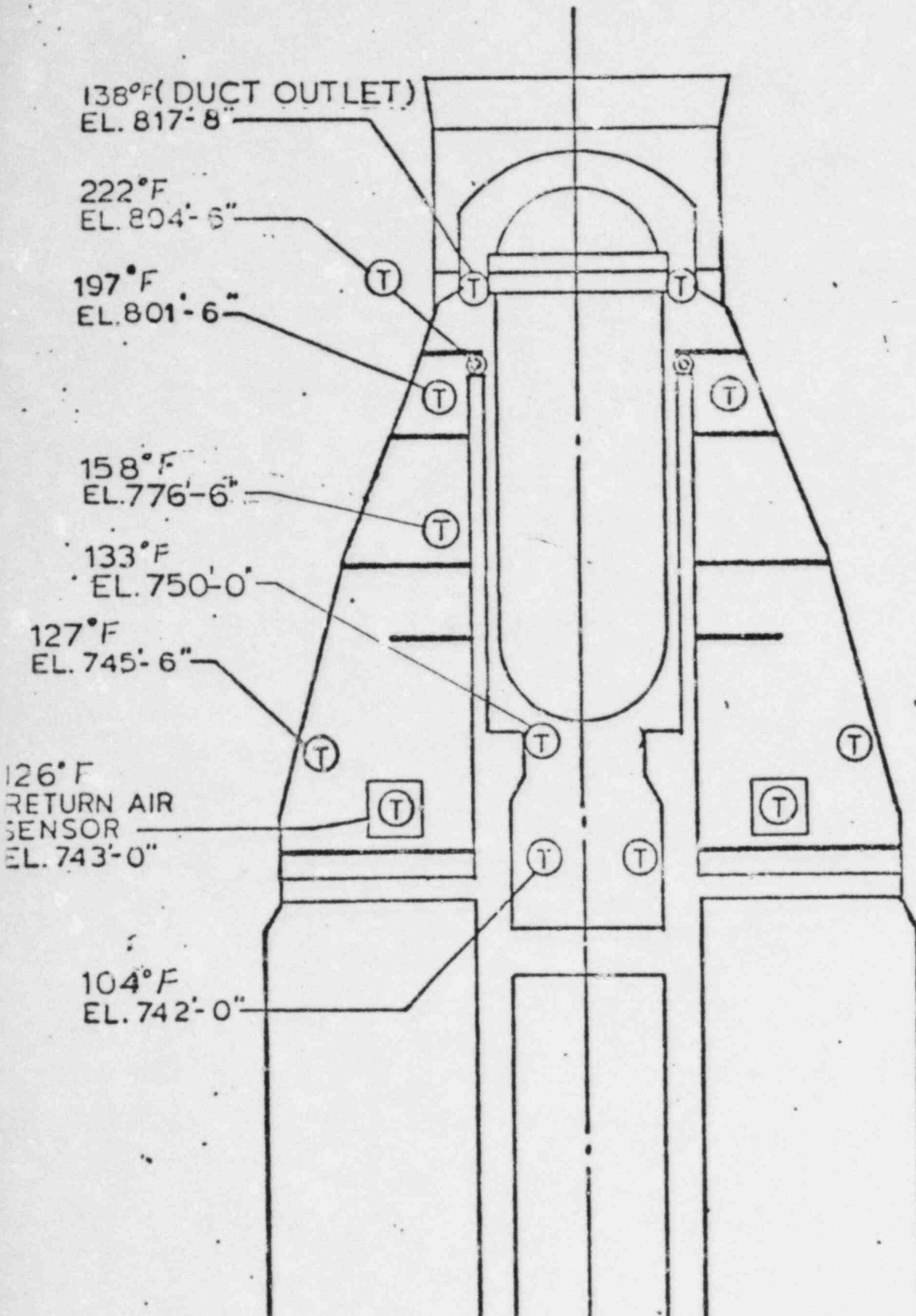

FIGURE 1

AVERAGE VERTICAL TEMPERATURE PROFILE
FROM TEMPERATURE SENSORS

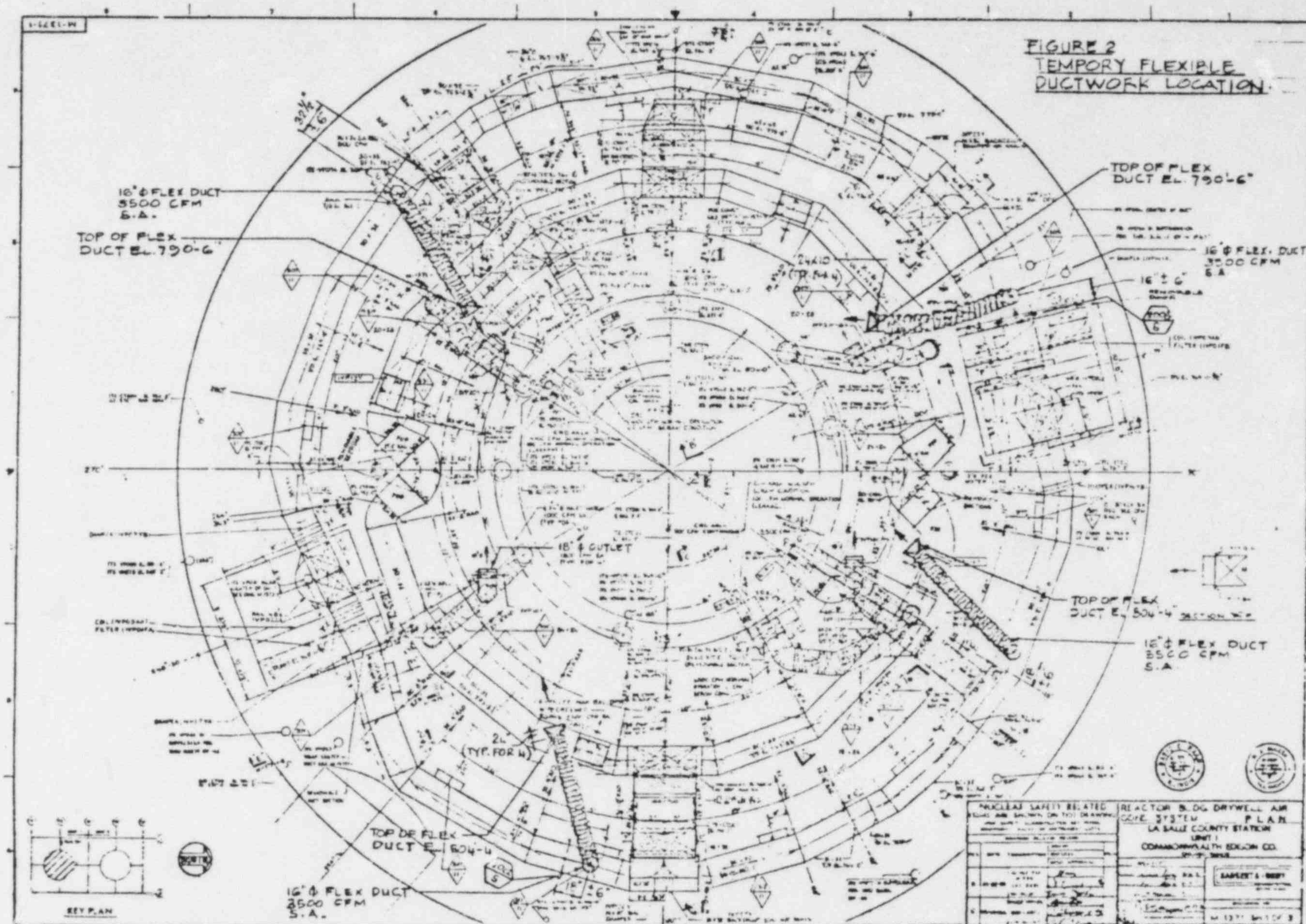
FIGURE 2
TEMPORY FLEXIBLE
DUCTWORK LOCATION
TOP OF FLEX
DUCT EL. 790'-6"
16" Φ FLEX. DUCT
3500 CFM
S.A.
16" Φ FLEX DUCT
3500 CFM
S.A.
TOP OF FLEX
DUCT EL. 790-6
18" Φ OUTLET
TOP OF FLEX
DUCT EL. 804'-4"
16" Φ FLEX DUCT
3500 CFM
S.A.
2"
(TYP. FOR 4)
TOP OF FLEX
DUCT EL. 804-4
16" Φ FLEX DUCT
3500 CFM
S.A.
KEY PLAN
NUCLEAR SAFETY RELATED
REACTOR BLDG DRYWELL AIR
COOL SYSTEM PLAN
LA SALLE COUNTY STATION
UNIT 1
COMMONWEALTH EDISON CO.
SARGENT & LUNDY

Annex A

Technical Specifications

1. Drywell Average Temperature. (3/4.6.1.7) The average Drywell Temperature will be verified to be less than or equal to 135°F as required by this specification. The identified locations for determining compliance withthis specifications and its basis have not changed.

2. Area Temperature Monitoring (3/4.7.7.) This report is submitted as requested in reference (c) and should be considered to fulfill the requirements for a Special Report to the Commission as specified in T.S. 3.7.7.a. The report identifies the previous Temperatures in the Drywell and the methodoly used to demonstrate continued operability. The Temperature locations identified in T.S. 4.6.1.7 will be used to verify compliance with Table 3.7.7.-1 limit of 150°F for item A.6.a Drywell. The temperature limits for safety related equipment are identified in this report and ensures that, as a minimum based on previous thermal exposure and an projected life usage, all equipment will remain qualified through the first cycle. These temperature limits will be considered as the temperature limit referenced in T.S. 3.7.7.b. This action is justified on the basis that this report demonstrates operability as required by T.S. 3.7.7.a. and that the basis for T.S. 3.7.7. is area temperatures for Safety-Related Equipment and not the entire Drywell. The Temperature Monitoring Program will verify that these temperature limits are not exceeded and correlated to Control Room CMO Monitors (4).

The Temperature limits are:

Equipment	Temperature Limit
Valve Motor Operators	+ 227°F
SRV Solenoids	+ 173°F
MSIV Limit Switches	+ 275°F
Primary Coolant Sample Valve Solenoid	+ 170°F
Drywell Air Temp. Monitoring Thermocouple	+ 213°F
Cable	+ 235°F