NUCLEAR ENGINEERING CALCULATION COVER SHEET
NEPM-QA-0221-1

>2. TYPE: CALC >3. NUMBER: EC-059-1041 >4. REVISION: 1

*>5. UNIT 3 *>6. QUALITY CLASS: Q

>7. DESCRIPTION: Suppression Pool pH post LOCA

8. SUPERSEDED BY:

9. Alternate Number: 10. Cycle:

11. Computer Code/Model used: 12. Discipline: M

>13. Are any results of this calculation described in the Licensing Documents?

☒ Yes, *Refer to NDAP-QA-0730 and NDAP-QA-0731* ☐ No

>14. Is this calculation changing any method of evaluation described in the FSAR and using the results to support or change the FSAR? (Refer to PPL Resource Manual for Definition of FSAR)

☒ Yes, *50.59 screen or evaluation required.* ☐ No

>15. Is this calculation Prepared by an External Organization?

☒ Yes ☐ No

EG771 Qualifications may not be required for individuals from external organizations (see Section 7.4.3).

>16. Prepared by:	Michael Waselus *Print Name(EG771 Qualification Required)*	*Signature*	6/6/05 *Date*
>17. Reviewed by:	Ronald Anderson *Print Name(EG771 Qualification Required)*	R E Anderson *Signature*	6/9/05 *Date*
>18. Verified by:	Ronald Anderson *Print Name(EG771 Qualification Required)*	R E Anderson *Signature*	6/9/05 *Date*
>19. Approved by:	Milt Capiotis *Print Name(Qualified per NEPM-QA-0241 and comply with Section 7.8 of NEPM-QA-0221)*	MS Capiotis *Signature*	6/9/05 *Date*
>20. Accepted by:	Ronald Vazquez *Print Name(EG771 Qualification Required) and comply with Section 7.9 of NEPM-QA-0221*	Ronald Vazquez *Signature*	9/20/05 *Date*

TO BE COMPLETED BY DCS

DCS SIGNATURE/DATE Rosemarie Schaeffer

RECEIVED
SEP 21 2005
NUCLEAR REC. SVS

ADD A NEW COVER PAGE FOR EACH REVISION
FORM NEPM-QA-0221-1, Revision 8, Page 1 of 1. ELECTRONIC FORM

Verified Fields
>REQUIRED FIELDS

ADD A NEW COVER PAGE FOR EACH REVISION
NUCLEAR REC. SVS Verified Fields

CALCULATION REVISION DESCRIPTION SHEET

NEPM-QA-0221-2

REVISION NO: 1	**CALCULATION NUMBER:** EC-059-1041

☒ FULL REVISION ☐ SUPERSEDED

☐ PAGE FOR PAGE ☐ VOIDED

Revised Pages	Add	Rpl	Rmv	Description of Revision on the Listed Pages
All	☐	☒	☐	Complete calculation revision of all pages due to page renumbering.
	☐	☐	☐	Specific revision 1 changes are itemized as follows to aid in the review of Revision 1..
2	☒	☐	☐	Add Calculation Revision Description Sheet.
3	☒	☐	☐	Add Technical Change Summary Page.
5	☐	☒	☐	Add Revision 1 purpose.
6	☐	☒	☐	Add Revision 1 results & EPU assumption. Clarified ESF leakage assumption. Added EPU note to design input 5.
7	☐	☒	☐	Clarified SLC tank volume (design input 7) is available volume above pump suction shutoff level.
10	☐	☒	☐	Add EPU changes for hydriodic acid.
12	☐	☒	☐	Add EPU changes for nitric acid.
15, 16	☐	☒	☐	Correct gamma equation; Add EPU changes for drywell doses.
16	☐	☒	☐	Add EPU changes for hydrochloric acid (HCl) for beta radiation.
18	☐	☒	☐	Change Rev. 0 & Add Rev. 1 EPU HCl for gamma radiation.
19, 20	☐	☒	☐	Correct CsOH equation and Rev. 0 results & add EPU changes .
20, 21	☐	☒	☐	Update Rev. 0 & add EPU changes for summary of acids & bases.
22	☐	☒	☐	Update Rev. 0 unbuffered pool pH values.
23	☐	☒	☐	Add EPU changes for unbuffered pool pH.
25, 26	☐	☒	☐	Update Rev. 0 & add EPU changes for final pool pH values.
27	☐	☒	☐	Update Rev. 0 & add EPU results.
28	☐	☒	☐	Added References 17, 18 and 19 and Technical Specification Bases B3.1.7 to Reference 12.

28 ☐ ☒ ☐ Added References 17, 18 and 19 and Technical Specification Bases B3.1.7 to Reference 12

TECHNICAL CHANGE SUMMARY PAGE
NEPM-QA-0221-5

Calculation: Number: EC-059-1041 **Revision No.** 1

This form shall be used to (1) record the Technical Scope of the revision and (2) record the scope of verification if the calculation was verified. It should not be more than one page. Its purpose is to provide summary information to the reviewer, verifier, approver, and acceptor about the technical purpose of the change. For non-technical revisions, state the purpose or reason for the revision.

Scope of Revision: The scope of this revision is to update the calculation to include the effects of extended power uprate (EPU) conditions on the post LOCA suppression pool pH. The main effect of EPU is an increase in the radiological doses used for radiolysis in the suppression pool and the electrical cables and changes in the total core inventory of iodine and cesium due to the increase in the core thermal power from the Revision 0 analyzed power of 3616 MWt to the proposed EPU power of 4032 MWt.

Scope of Verification (If verification applies): This verification is a review of the technical changes of Revision 1 and the format of the entire document due to the renumbering.

FORM NEPM-QA-0221-5, Revision 0, Page 1 of 1, ELECTRONIC FORM

PP&L CALCULATION SHEET

Dept.	0341 Rad & Eff Tech.	PROJECT	
Date	6/06/2005	Suppression Pool pH post LOCA	Calc. No. EC-059-1041
Designed By	M. Waselus		Sh. No. 4
Checked By	R. Anderson		

TABLE OF CONTENTS

1.0 OBJECTIVE 5
2.0 CONCLUSIONS AND RECOMMENDATIONS 5
3.0 ASSUMPTIONS / INPUT 6
4.0 METHOD 7
4.1 Hydriodic Acid 8
4.2 Nitric Acid 10
4.3 Hydrochloric Acid 12
4.4 Cesium Hydroxide 18
4.5 Summary of Acid and Base Production 20
4.6 Sodium Pentaborate – Suppression Pool Buffered pH 24
5.0 RESULTS 27
6.0 REFERENCES 28
Attachment 1 Cable Data 29
Attachment 2 Cable Drawings 32
Attachment 3 Email from R. Vazquies to M. Waselus SP_pH_Cond.xls 75

1.0 OBJECTIVE

The purpose of this calculation is to evaluate the post LOCA suppression pool pH crediting the injection of a fixed quantity of sodium pentaborate into the pool via the Standby Liquid Control (SLC) system to assure the pool pH is maintained above a value of 7 within 24 hours (Reference 19). Maintaining the suppression pool pH greater than 7.0 post-LOCA precludes the need to consider iodine reevolution from the pool during the LOCA in calculating the potential offsite and control room radiological consequences. This calculation is based on the methodology provided in NUREG/CR-5950 (Reference 1), NUREG-1081 (Reference 2) and NUREG/CR-5732 (Reference 3). Per NUREG/CR-5950 there are a variety of acids and bases produced in containment during a LOCA. These include the following:

- Boric Acid which is not applicable to a BWR and not considered any further herein.
- Hydriodic Acid (HI) is a strong acid introduced into containment with the release of iodine.
- Carbon Dioxide (CO_2) which depresses the pH of water by being absorbed in water from air to form carbonic acid. Carbonic acid is a weak acid the effects of which are insignificant relative to the other acids produced during the LOCA. However, the initial suppression pool pH may be depressed below 7.0 during normal operation by the absorption of CO_2. Section 2.2.3 of Reference 1 states that pure water will attain a pH that approaches 5.65 due to the absorption of CO_2. A conservatively low pH is assumed as the initial condition for this evaluation and as such the effects of CO_2 are not considered further herein.
- Nitric acid (HNO_3) is a strong acid produced by the irradiation of water and air.
- Hydrochloric acid (HCl) is a strong acid produced by the radiolysis or pyrolysis of chlorine bearing materials during the accident. Per section 2.2.5.3 of NUREG/CR-5950, pyrolysis occurs at temperatures around 752 °F which is well above the post LOCA temperatures (maximum drywell temperature < 330 °F). Therefore, only radiolysis is considered in this analysis.
- Cesium Hydroxide (CsOH) is a strong base introduced into containment with the release of cesium during the accident.
- Core-Concrete Aerosols are basic materials released from the interaction of the molten core materials with concrete. Consistent with the course of the postulated accident, core damage is assumed to be terminated after the in-vessel release phase and these chemicals are not considered any further herein.

The purpose of Revision 1 of the calculation is to update the analysis for the effects of extended power uprate (EPU).

2.0 CONCLUSIONS AND RECOMMENDATIONS

The results of the analysis demonstrate that with the injection of the Technical Specification minimum quantity of sodium pentaborate (13.6 weight percent), the 30 day suppression pool pH is greater than 7.0 which precludes the need to include reevolution of iodine from the suppression pool post LOCA. The 30 day suppression pool pH represents the worst case pH. Subsequent to

The results of the analysis demonstrate that with the injection of the Technical Specification

the injection of the sodium pentaborate early in the accident scenario, the pH in the pool will be greater than the 30 day value since the generation of the post LOCA acids reaches its peak values at 30 days.

The conservative 30 day suppression pool pH calculated herein is 8.61 with credit for post LOCA CsOH production in the pool and 8.58 without credit for post LOCA CsOH production in the pool for a reactor power of 3616 MWt.

The conservative 30 day suppression pool pH calculated herein considering the effects of EPU with a reactor power of 4032 MWt is 8.60 with credit for post LOCA CsOH production in the pool and 8.57 without credit for post LOCA CsOH production in the pool.

3.0 ASSUMPTIONS / INPUT

The following assumptions are used in this analysis:

- The impact of ESF leakage is small compared to the suppression pool volume and will be ignored since there will be continuous makeup to the pool to maintain water level.
- The beta dose to cables is reduced by a factor of 2 due to localized shielding effects.
- The gaseous HCl produced by cable radiolysis will be conservatively assumed to be instantly dissolved in the suppression pool.
- Sodium pentaborate will be injected via the SLC system for pH control.
- The suppression pool will be assumed to be well mixed by action of the ECCS systems such that a single pH value can be applied to the entire pool.
- The effect of EPU on this analysis is conservatively modeled as an increase of 25% in the radiation values used herein (See Reference 18, Item 10). The integrated radiation doses used in the radiolysis portions of this calculation are proportional to the core thermal power. The actual increase for EPU is estimated to be 11.5% [4032 MWt/3616 MWt] which is bounded by the 25% assumption.

The following design input data is used in this analysis:

1. Minimum suppression pool pH during normal plant operation (Starting point for post LOCA pool pH transient).
2. Minimum suppression pool volume used in design basis LOCA.
3. Quantity and timing of sodium pentaborate input to the suppression pool.
4. Weight percent of chlorine for the various cable insulations.
5. Post LOCA Gamma and Beta dose rate profiles and energy flux in drywell, wetwell and suppression pool including values from isotopic deposition on surfaces. In accordance with USNRC RG 1.183, section 1.3.5 and SECY-98-154, the TID-14844 Equipment Qualification dose rates previously calculated in the drywell air and suppression pool (beta and gamma) bound those generated by AST. The doses are increased to account for the higher EPU power.

dose rates previously calculated in the drywell air and suppression pool (beta and gamma)

6. Conservative values for the core inventory of cesium and core inventory of iodine in gram moles. These inventories include the stable Cs-133 and I-127 species.
7. Standby Liquid Control Storage (SLCS) tank minimum available capacity ≥ 4587 gallons (Reference 12). This volume is available volume above pump suction shutoff level.
8. The SLCS tank is maintained between a temperature of 75 and 110 °F. (Reference 4, page 68).
9. The concentration of sodium pentaborate in the SLCS tank ≥ 13.6 weight percent (Reference 12).
10. The SLC system pump flow rate is ≥ 41.2 gpm @ ≥ 1224 psig. (Reference 4, page 29).

4.0 METHOD

Through basic chemistry equations, the pH of a solution is directly related to the concentration of H^+ ions by the formulas:

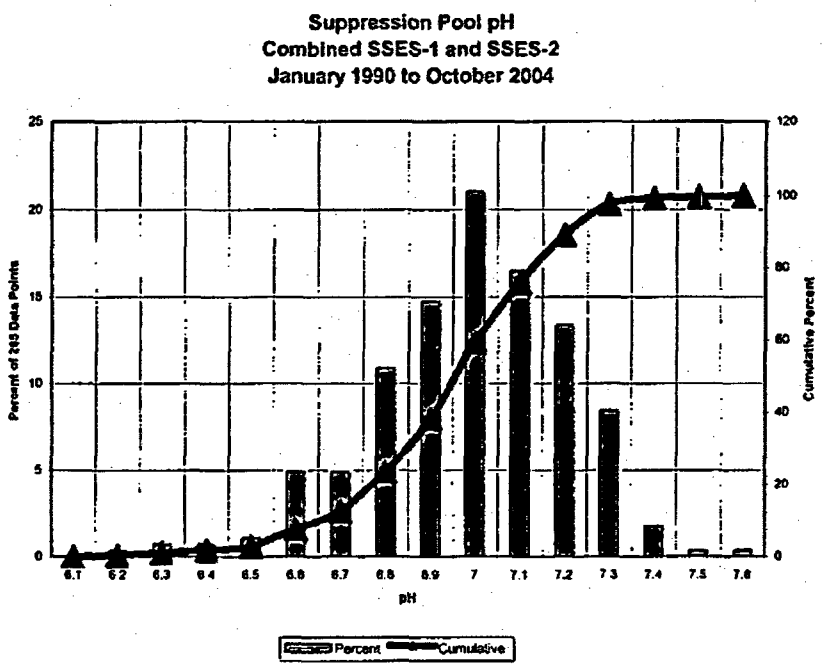
$$pH = -\log[H^+]$$
$$pOH = -\log[OH^-]$$
$$pH + pOH = 14$$
$$-\log[H^+] - \log[OH^-] = 14 \text{ or}$$
$$[H^+][OH^-] = 10^{-14}$$

where:

$[H^+]$ = concentration of H^+ ions (moles/liter)

$[OH^-]$ = concentration of OH^- ions (moles/liter)

The initial suppression pool pH assumed at the start of the accident is 6. This is a conservative value based on the actual pH history at SSES as seen on the following figure (Reference 16).



This corresponds to a value of H^+ = 1E-6 moles/liter

4.1 Hydriodic Acid

Per section 2.2.2 of Reference 1, hydriodic Acid (HI) is a strong acid introduced into containment with the release of iodine, but small amounts are likely in containment.

Table 1 of USNRC Regulatory Guide 1.183 (Reference 5) indicates that 5% of the halogen inventory is released during the gap release phase and an additional 25% is released during the early in-vessel phase. In accordance with Section 3.5 of Reference 5, 95% of the Iodine released should be assumed to be cesium iodide (CsI) 4.85% elemental and 0.15% organic iodine. The basis for this release was NUREG-1465, section 3.5 (Reference 6) wherein it states iodine entering containment is at least 95% CsI with the remaining 5% as I plus HI, with not less than 1% of each as I and HI. This analysis will conservatively assume that all 5% of the release is in the form of HI in order to maximize the acid generation. This release process is assumed to occur at a constant rate over the release period identified in Table 4 of Reference 5.

LOCA Release Phases BWRs Reference 5

Phase	Onset	Duration
Gap Release	2 min	0.5 hr
Early In-Vessel Release	0.5 hr	1.5 hr

LOCA Release Phases BWRs Reference 5

The core iodine inventory used in this evaluation includes stable I127 to maximize the amount of acid produced. Per Reference 7, the total core inventory of iodine is 107 gram atoms at the beginning of cycle and 228.7 gram atoms at the end of cycle. The value of 228.7 gram atoms is conservatively used in this analysis. Note: For a monotonic element gram mole equals gram atom. The following equations are used to describe this release.

During the Gap Release Phase:

d/dt[HI] = [0.05 * 0.05mi] / [Vsp * 0.5 hr]

During the Early In-Vessel Release Phase:

d/dt[HI] = [0.05 * 0.25mi] / [Vsp * 1.5 hr]

where:
mi = gram mole iodine = 228.7
Vsp Suppression pool volume (liters) = 3.738+06 liters [132000 ft^3]

The volume of water in the suppression pool following a LOCA is conservatively assumed to consist of the suppression pool water volume at low water level plus the normal volume of water in the reactor coolant system. From Reference 8, the suppression pool low water volume is 122,410. ft^3 and is based on a low water level in the pool of 22 ft. The mass of water in the reactor coolant system is 610,000. lbm. This mass is obtained from Reference 9, Table A28.1. The coolant water volume is conservatively based on a temperature of 70 °F.
Coolant water volume = 610,000. lbm / 62.4 lb/ft^3 = 9776. ft^3
Pool Volume Post-LOCA = 122,410 ft^3+ 9776 ft^3 = 132186 ft^3 (Use 132000 ft^3)

Integrating the above yields:

During the Gap Release Phase:

[HI](t) = [mi] / [200Vsp] * [t – tgrp]

where tgrp = onset of the gap release phase = 0.0333 hr [2 minutes]

During the Early In-Vessel Release Phase:

[HI](t) = [mi] / [120 Vsp] * [t –(0.5 + tgrp)] + [mi] / [400 Vsp]

The final HI concentration at t = 2.033 hr [1.5 hr+0.5hr+2 min], the end of the iodine release from the core is given as:

The final HI concentration at t = 2.033 hr [1.5 hr+0.5hr+2 min], the end of the iodine release from

[HI](2.033 hr) = [(228.7) / (120*3.738E+06)] * [2.033 –(0.5 + 0.0333)] + [228.7] / [400*3.738E+06]
[HI](2.033 hr) = [5.0985E-07] *[1.5] + 1.5296E-07 = 9.1773E-07 moles/liter

or a total of 3.4 moles [9.1773E-07 moles/liter * 3.7378E6 liters].

where 3.7378E6 liters is the suppression pool volume.

The core iodine and cesium inventory for the EPU core is provided in Reference 17. Reference 17 provides the inventory as grams. The value is converted to gram atoms by dividing each isotope by its atomic number. The values are given as follows.

Isotope	grams Reference 17	gm atoms	Isotope	grams Reference 17	gm atoms
I-127	6.349E+03	4.999E+01			
I-129	2.842E+04	2.203E+02	Cs-133	1.857E+05	1.396E+03
I-130	1.352E+00	1.040E-02	Cs-134	1.780E+04	1.328E+02
I-131	8.633E+02	6.590E+00	Cs-135	7.869E+04	5.829E+02
I-132	1.513E+01	1.146E-01	Cs-136	1.008E+02	7.415E-01
I-133	1.963E+02	1.476E+00	Cs-137	1.994E+05	1.456E+03
I-134	9.244E+00	6.899E-02	Cs-138	4.882E+00	3.538E-02
I-135	5.990E+01	4.437E-01	Cs-139	1.322E+00	9.509E-03
Total	3.591E+04	2.790E+02	Total	4.817E+05	3.568E+03

The final HI concentration for EPU conditions at t = 2.033 hr [1.5 hr+0.5hr+2 min], the end of the iodine release from the core is given as:

[HI](2.033 hr) = [(279) / (120*3.738E+06)] * [2.033 –(0.5 + 0.0333)] + [279] / [400*3.738E+06]
[HI](2.033 hr) = [6.2199E-07] *[1.5] + 1.8660E-07 = 1.1196E-06 moles/liter

or a total of 4.2 moles [1.1196E-06 moles/liter * 3.7378E6 liters].

where 3.7378E6 liters is the suppression pool volume

4.2 Nitric Acid

Radiolytic production of nitric acid is discussed in section 2.2.4 of Reference 1 and section 3.3.1.1 of Reference 3. The nitric acid (HNO_3) is produced by the irradiation of water and air. Both references provide the following constant for nitric acid production based on experimental data.

g(HNO_3) = 0.007 molecules/100ev where the relationship is based on radiation absorption in the aqueous phase. This value is based on a water temperature of 86 °F, which is conservative for use following a LOCA since the solubility of nitrogen reduces with increasing temperatures. Per

Reference 1 section 2.2.4, the equates to a radiation G value of 7.3-E-06 moles HNO_3/ L Megarad which means H^+ and NO_3 increase by 7.3-E-06 moles for each Megarad of dose delivered to the suppression pool water. This is expressed as:

d/dt[HNO_3] = 7.3E-06 moles HNO_3/ L Megarad * DR(t)

where: DR(t) = dose rate as a function of time in the suppression pool (Megarads/hr).

The suppression pool dose values are based on the integrated energy absorption in the suppression pool from References 14.
Reference 14, Page 29 provides the integrated energy absorption in the sump (suppression pool) for a power of 3458 MWt (Reference 14, page 8). The values for 3E+6 seconds (34.7 days) are conservatively used for the 30 day dose required. The values are:

G+B Sump	Iodine Sump
1.575E30 ev	1.691E30 ev

Converting these energy depositions to Mrad yields the following:

$$\frac{[1.575E30\ ev + 1.691E30\ ev] * 1Mev/10^6\ ev * 1\ erg/6.25E5\ Mev * 1Rad\text{-}gm/100\ ergs * 1\ Mrad/10^6\ Rad * 1\ cc/gm}{3.7378E9\ cc}$$

or 13.98 Mrad for 3458 MWt. The current power level being evaluated is 3616 MWt. The activity entering the suppression pool is taken as proportional to the power. Therefore, for the purposes of determining the quantity of nitric acid formed, a 30 day suppression pool integrated dose of 14.62 Mrad is applied [13.98 * 3616/3458].

These dose rates were determined using TID-14844 source terms. In accordance with USNRC RG 1.183, section 1.3.5 and SECY-98-154, the TID-14844 Equipment Qualification dose rates previously calculated in the drywell air and suppression pool (beta and gamma) bound those generated by AST. Therefore, it can be concluded that the dose rates calculated with TID-14844 are conservative and acceptable for use in determining the HNO_3 production herein.

[HNO_3](t) = 7.3E-06 $\int^t$ DR(t) dt where t = time into accident (hrs)
or the nitric acid produced at any point in time is given as

[HNO_3](t) = 7.3E-06 * Integrated Dose at Time t.

[HNO_3](30 days-suppression pool dose) = 7.3E-06 * 14.62 = 1.0673E-04 moles/liter.

or a total of 398.9 moles [1.0673E-04 moles/liter * 3.7378E6 liters].

where 3.7378E6 liters is the suppression pool volume.

or a total of 398.9 moles [1.0673E-04 moles/liter * 3.7378E6 liters].

For EPU conditions this value is conservatively increased by 25% with the resulting 30 day suppression pool integrated dose equal to 18.28 Mrad [14.62 Mrad * 1.25] and

[HNO_3](30 days-suppression pool dose) = 7.3E-06 * 18.28 = 1.3344E-04 moles/liter.

or a total of 498.8 moles [1.3344E-04 moles/liter * 3.7378E6 liters].

4.3 Hydrochloric Acid

The radiolysis of chloride-bearing cable jacketing will result in the production of HCl vapor as documented in Section 2.2.5.2 of NUREG/CR-5950 (Reference 1). It should be noted that a significant portion of the HCl vapor produced from cable radiolysis would react with the metal components within the primary containment (e.g., cable trays, gratings, etc.) and never enter the suppression pool. However, for this analysis it is conservatively assumed that all of the gaseous HCl produced is immediately dissolved in the suppression pool water. A model for the production of HCl from cable jacketing is developed below based on the approach given in Appendix B of NUREG/CR-5950.

The absorption of a radiation flux at a radius, r, can be described from basic principles as:

$$\varphi(r) = \varphi(Ro)e^{-\mu(Ro-r)}$$

μ = Linear Absorption Coefficient (cm^{-1}) from Table below.
Ro = Outside cable radius (cm)

Cable and Air Material Properties Reference 2			
Material	Density (gm/cm^3)	Linear Absorption Coefficient (cm^{-1})	
		Beta Radiation	Gamma Radiation
Hypalon	1.55	52.08	0.099
EPR	1.27	42.67	0.081
Air		0.0198	0.0000374

Similar to the approach in Reference 1, Appendix B, the production of HCl from radiolysis is given by:

$$R = G\,(SA)\,\varphi\,A$$

where:

R = HCl production rate (gm moles/sec)

G = Radiation G value for Hypalon (molecules HCl/100 ev)
SA = Cable surface area (cm^2)
φ = Incident radiation energy flux (Mev/cm^2-sec)
A = Absorption fraction of energy flux in Hypalon jacket.

Radiation G value for Hypalon

Note: The radiation G value for Hypalon adopted in Reference 1, Section 2.2.5.2 is 2.115 molecules HCl per 100 eV. This G value is based on the energy absorbed by the polymer consistent with the footnote to Table 3 of NUREG-1081 (Reference 2). As described in Reference 2, this value represents a balance between the increased HCl production at elevated temperatures expected during accidents and the neutralization potential of fillers in the cable. The resulting value is 3.512E-20 moles/Mev (Reference 1, page B.3). This term can also be expressed in terms of moles/Mrad (absorbed dose)-gm (exposed material).

3.512E-20 moles/Mev * 6.25E+5 Mev/erg * 100 ergs/gm-Rad * 1E+6 Rad/Mrad = 2.195E-6 moles/Mrad-gm or 9.97E-4 moles/Mrad-lb. This value is conservative compared to the value of 4.6E-4 moles of HCl per lb of insulation per Megarad listed in Section 2.2.5.2 of Reference 1 since it produces about 2.2 times more HCl per lb of exposed material.

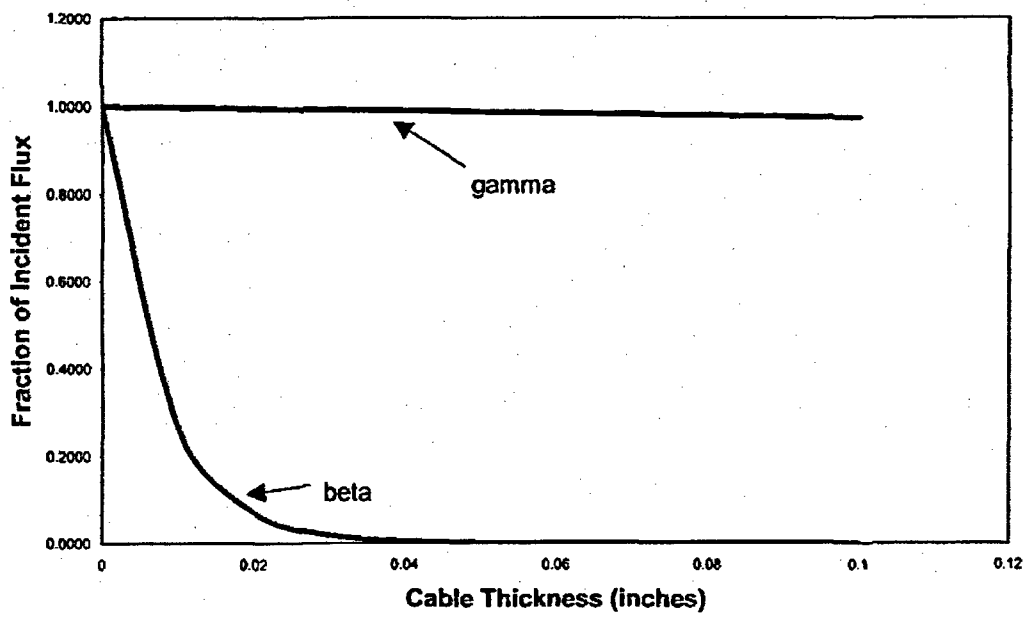
Absorption fraction of energy flux in Hypalon jacket

The absorption fraction is the fraction of incident radiation energy flux absorbed by the Hypalon. As provided in Section 4.2 of NUREG-1081 (Reference 2), the factor is calculated with the following equation (Reference 2, Equation 4-5 – gamma and Equation 4-9 - beta):

$A_{\gamma,H} = 1 - \exp[-\mu\gamma^H * tH]$
where:
$A_{\gamma,H}$ = Absorption of incident gamma radiation
$\mu\gamma^H$ = Linear adsorption coefficient – gamma Hypalon (0.099/cm)
tH = Hypalon thickness (cm)

$A_{\beta,H} = 1 - \exp[-\mu\beta^H * tH]$
where:
$A_{\beta,H}$ = Absorption of incident beta radiation
$\mu\beta^H$ = Linear adsorption coefficient – beta Hypalon (52.08/cm)
tH = Hypalon thickness (cm)

Using the above equations and values the following figure plots the radiation fluxes through Hypalon jacketing. As seen essentially all of the beta energy is completely absorbed even by relatively thin Hypalon cable jacketing while very little of the gamma energy is absorbed. In the subsequent analysis all of the beta energy will be assumed completely absorbed in the jacket.
Using the above equations and values the following figure plots the radiation fluxes through Hypalon jacketing. As seen essentially all of the beta energy is completely absorbed even by



HCl Generation

The HCl generation can be calculated with the above equations as (See Reference 2, Equations 5-7 and 5-8 for gamma and Equations 5-10 and 5-11 for beta).

Gamma: $R = G\,(SA)\,\varphi\,A = G * SA * E_\gamma/V * [(1-\exp(-\mu\gamma air * r))/\ \mu\gamma^{air}] * [1-\exp(-\mu\gamma^{H} * tH)]$
Beta: $R = G\,(SA)\,\varphi\,A = G * SA * E_\beta/V * 1/\mu\beta^{air}$

where:

R	HCl production rate (gram moles/hr)
E_γ/V	Energy release rate / unit volume (Mev/hr-cc) gamma
E_β/V	Energy release rate / unit volume (Mev/hr-cc) beta
$\mu\gamma^{H}$	Linear adsorption coefficient – gamma Hypalon
$\mu\gamma^{air}$	Linear adsorption coefficient – gamma air
r	Distance of air to cable (cm) (252 cm).
$\mu\beta^{air}$	Linear adsorption coefficient – beta air
SA	Cable surface area (cm^2)
tH	Hypalon thickness (cm)
G	3.512E-20 gram moles/Mev (Reference 1, Appendix B)

tH Hypalon thickness (cm)

Using the form for G in terms of absorbed dose [9.97E-4 moles/Mrad-lb (exposed material)], the total HCl generation from an integrated energy release is given as follows:

Gamma: $M_{HCl} = G * W^* * [1- \exp(-\mu\gamma^{-H*}tH)]\int_0^t DR\, dt$

Beta: $M_{HCl} = G * W^* \int_0^t DR\, dt$

where:

M_{HCl}	HCl production (gram moles)
W	Weight of cable jacket material (lbs)
t	Time (hrs)
$[1- \exp(-\mu\gamma^{-H*}tH)]\int$	Fraction of gamma energy absorbed
$\int_0^t DR\, dt$	Integrated dose (Mrad)
G	moles/Mrad-lb

Using G in terms of absorbed dose (Mrad) replaces G (E_γ/V) $[(1-\exp(-\mu\gamma air*r)/\mu\gamma^{air}]$ where the values were in terms of an incident flux and absorbed energy.

The 30 day drywell doses are taken from Reference 10, Tables 2 and 3.

Drywell Doses @ T = 30 days	Dose (Rad)	Dose (Mrad)
Airborne gamma	8.19E+06	8.19
Plateout gamma	1.88E+06	1.88
Airborne beta	2.32E+08	232
Plateout beta	2.67E+08	267

Adjusting these values for EPU conditions using the conservative factor of 1.25 yields the following:

Drywell Doses @ T = 30 days	Dose (Mrad)	Dose (Mrad) * 1.25
Airborne gamma	8.19	10.24
Plateout gamma	1.88	2.35
Airborne beta	232	290
Plateout beta	267	334

Due to the different attenuation properties of beta and gamma radiation they are addressed separately.

Beta:

Beta:

From Attachment 1, the total weight of cable jacket (assumed to be Hypalon properties) is 4855.42 lbs. Also as seen the jacket thickness in almost all cases is equal to or greater than the thickness required for the entire beta energy to be absorbed.

The HCl concentration in the suppression pool is M_{HCl} / Pool Volume (132000 ft^3 or 3.738E+6 liters) or

[HCl] = G * W* Integrated Beta Dose
[HCl] = 9.97E-4 moles/Mrad-lb * 4855.42 lbs * ½[232 Mrad + 267 Mrad] / 3.738E+6 liters
[HCl] = 3.2313E-04 moles/l due to beta

or a total of 1207.8 moles [3.2313E-04 moles/liter * 3.7378E6 liters].
where 3.7378E6 liters is the suppression pool volume and a factor of 2 reduction is taken for the beta dose due to self shielding effects.

The HCl concentration in the suppression pool considering the adjustment for EPU conditions is M_{HCl} / Pool Volume (132000 ft^3 or 3.738E+6 liters) or

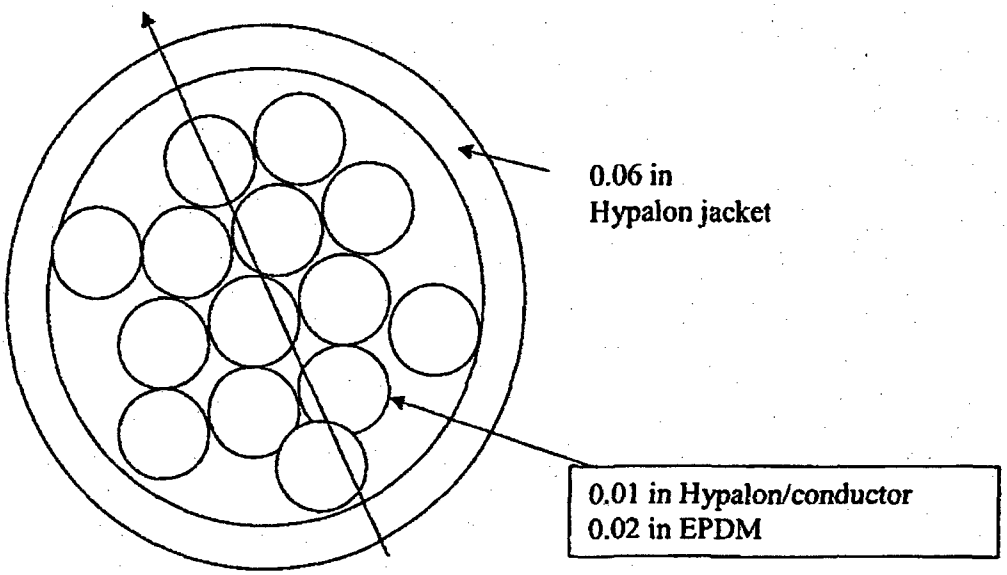
[HCl] = G * W* Integrated Beta Dose
[HCl] = 9.97E-4 moles/Mrad-lb * 4855.42 lbs * ½[290 Mrad + 334 Mrad] / 3.738E+6 liters
[HCl] = 4.0405E-04 moles/l due to beta

or a total of 1510.3 moles [4.0405E-04 moles/liter * 3.7378E6 liters].

Gamma:

Unlike beta radiation, the gamma radiation can penetrate the cable interior and HCl may be generated by interior jackets on individual conductors in multi conductor cables.
Based on a review of the various cable types listed in Attachment 1, a bounding cable type is developed to conservatively determine the potential HCl production. A review of Attachment 1 indicates that type Q11 cable comprises about 45% of the total cable length and 57.9% of the total outside jacket mass. Based on the information in Attachment 2 for type Q11 cable the mass of internal Hypalon and EPDM insulation is determined where the properties for Hypalon are conservatively applied to the EPDM material. The resulting Q11 insulation-jacket mass/ft is conservatively applied to the total length for all cable types from Attachment 1.

Approximate Representation of Type Q11 Cable



Per Attachment 2, there are thirteen 20 gage conductors with 20 mils EPDM and 10 mils Hypalon each.

Per Marks (Reference 15), diameter of 20 AWG conductor equals 0.032 inches. Therefore, the area of insulation-jacket/conductor is:

$\pi[R_2^2 - R_1^2] = \pi[(0.046in/12in/ft)^2 - (0.016in/12in/ft)^2] = 0.0000406\ ft^2/conductor$

The total mass of insulation-jacket is conservatively estimated as:

13 conductors * 0.0000406 ft^2/conductor * 96.7 lb/ft^3 * 79478 ft = 4070 lbs.

Where:
96.7 lb/ft^3 = density of Hypalon
79478 ft = total length of all cable from Attachment 1. By inspection of Attachments 1 and 2, type Q11 cable bounds most types of cable used at SSES and provides a conservative estimate of the material used to generate HCl.

HCl concentration in the suppression pool is M_{HCl} / Pool Volume

$[HCl] = G * W^* * [1- \exp(-\mu\gamma^{-H*}tH)] *$ Integrated Gamma Dose

HCl concentration in the suppression pool is M_{HCl} / Pool Volume

[HCl] = 9.97E-4 moles/Mrad-lb * [4855.42 + 4070]lbs * [(1 – exp- (.099 * 0.681)] * [8.19 Mrad + 1.88 Mrad] / 3.738E+6 liters
[HCl] = 9.97E-4 * 8925.42 lbs * 0.0652 * 10.07 /3.7378E+6
[HCl] = 1.5631E-6 moles/liter due to gamma

or a total of 5.8 moles [1.5631E-6 moles/liter * 3.7378E6 liters].

where 3.7378E6 liters is the suppression pool volume.

Therefore, for 3616 MWt the total gamma + beta HCl equals 5.8 moles + 1207.8 moles = 1213.8 moles.

Using the adjusted EPU values for gamma radiation of 10.24 Mrad airborne and 2.35 Mrad Plateout yields the following:

HCl concentration in the suppression pool is M_{HCl} / Pool Volume

[HCl] = G * W* [1- exp($-\mu\gamma^{-H}$*tH)] * Integrated Gamma Dose
[HCl] = 9.97E-4 moles/Mrad-lb * [4855.42 + 4070]lbs * [(1 – exp- (.099 * 0.681)] * [10.24 Mrad + 2.35 Mrad] / 3.738E+6 liters
[HCl] = 9.97E-4 * 8925.42 lbs * 0.0652 * 12.59 /3.7378E+6
[HCl] = 1.9543E-6 moles/liter due to gamma

or a total of 7.3 moles [1.9543E-6 moles/liter * 3.7378E6 liters].

Therefore, for EPU conditions at 4032 MWt, the total gamma + beta HCl equals 7.3 moles + 1510.3 moles = 1517.6 moles.

4.4 Cesium Hydroxide

Per section 2.3.1 of Reference 1, cesium may be introduced into containment in various forms following an accident. The cesium will form cesium hydroxide and cesium borates which are basic materials

Table 1 of USNRC Regulatory Guide 1.183 (Reference 5) indicates that 5% of the alkali metal inventory (including cesium) is released during the gap release phase and an additional 20% is released during the early in-vessel phase. Table 1 Reference 5 also indicates that 5% of the halogen inventory is released during the gap release phase and an additional 25% is released during the early in-vessel phase. In accordance with Section 3.5 of Reference 5, 95% of the iodine released should be assumed to be cesium iodide (CsI). This release process is assumed to occur at a constant rate over the release period identified in Table 4 of Reference 5.

during the early in-vessel phase. In accordance with Section 3.5 of Reference 5, 95% of the iodine released should be assumed to be cesium iodide (CsI). This release process is assumed

LOCA Release Phases BWRs Reference 1

Phase	Onset	Duration
Gap Release	2 min	0.5 hr
Early In-Vessel Release	0.5 hr	1.5 hr

The core cesium and iodine inventories used in this evaluation include stable Cs-133 and stable I-127. Per Reference 7, the total core inventory of iodine is 107 gram atoms at the beginning of cycle (BOC) and 228.7 gram atoms at the end of cycle (EOC) and the total core inventory of cesium is 1490.9 gram atoms at BOC and 2969.5 gram atoms at EOC. The EOC values are used in this analysis. Although the BOC value for cesium is lower than the EOC value which would result in less CsOH, the EOC values are used consistent with the basis for the radiological calculations and other data input to the analysis which are conservatively based on EOC values. These include the core source terms, pool iodine concentration (HCI), EQ dose rates, etc.
Note: For a monotonic element gram mole equals gram atom. The following equations are used to describe this release.

During the Gap Release Phase:

d/dt[CsOH] = [0.05mcs – (0.95 * 0.05mi)] / [Vsp * 0.5 hr]

During the Early In-Vessel Release Phase:

d/dt[CsOH] = [0.2mcs - (0.95 * 0.25mi)] / [Vsp * 1.5 hr]

where
mi = gram mole iodine = 228.7
mcs = gram mole cesium = 2969.5
Vsp = Suppression pool volume (liters) = 3.738E+06 liters [132000 ft3]

Integrating the above yields:

During the Gap Release Phase:

[CsOH](t) = [0.1mcs – 0.095mi] / [Vsp] * [t – tgrp]

where tgrp = onset of the gap release phase = 0.0333 hr [2 minutes]

During the Early In-Vessel Release Phase:

[CsOH](t) = [0.4mcs – 0.475mi] / [3 Vsp] * [t –(0.5 + tgrp)] + [0.05mcs – 0.0475mi] / [Vsp]
The final CsOH concentration at t = 2.033 hr [1.5 hr+0.5hr+2 min] is given as:
During the Early In-Vessel Release Phase:

[CsOH](2.033 hr) = [0.4 * 2969.5 – 0.475 * 228.7] / [3 * 3.738E+06] * [2.033 –(0.5 + 0.033)] + [0.05 * 2969.5 – 0.0475 * 228.7] / [3.738E+06]

[CsOH](2.033 hr) = [[1187.8 – 108.6]/[1.1214E+07]] * [1.5] + [148.475 – 10.86]/ [3.738E+06]
[CsOH](2.033 hr) = [1.444E-04] + [3.682E-05] moles/liter
[CsOH](2.033 hr) = 1.8122E-04 moles/liter

or a total of 677.4 moles [1.8122E-04 moles/liter * 3.7378E6 liters].

where 3.7378E6 liters is the suppression pool volume.

From section 4.1, for EPU conditions the values for core iodine and cesium are:
mi = gram mole iodine = 279
mcs = gram mole cesium = 3570

The final CsOH concentration for EPU at t = 2.033 hr [1.5 hr+0.5hr+2 min] is given as:

[CsOH](2.033 hr) = [0.4 * 3570 – 0.475 * 279] / [3 * 3.738E+06] * [2.033 –(0.5 + 0.033)] + [0.05 * 3570 – 0.0475 * 279] / [3.738E+06]

[CsOH](2.033 hr) = [1.733E-04] + [4.421E-05] moles/liter
[CsOH](2.033 hr) = 2.1751E-04 moles/liter

or a total of 813 moles [2.1751E-04 moles/liter * 3.7378E6 liters].

4.5 Summary of Acid and Base Production

The following provides a summary of the production of acids and bases in the suppression pool for 3616 MWt.

Material	Concentration in Suppression Pool generated by Beta radiation moles/liter	Concentration in Suppression Pool generated by gamma radiation moles/liter	Concentration in Suppression Pool moles/liter	Reference Section
Hydriodic Acid	NA	NA	9.18E-7	4.1
Nitric Acid	NC	NC	1.07E-4	4.2
Hydrochloric Acid	3.23E-4	1.56E-6	3.25E-4	4.3
Cesium Hydroxide	NA	NA	1.81E-4	4.4

NA: Not Applicable
NC: Not Calculated

Hydrochloric Acid	3.23E-4	1.56E-6	3.25E-4	4.3

Material	Suppression Pool gm-moles	Reference Section
Hydriodic Acid	3.4	4.1
Nitric Acid	399	4.2
Hydrochloric Acid	1214	4.3
Total acid	1616.4	
Cesium Hydroxide	677.4	4.4

The following provides a summary of the production of acids and bases in the suppression pool for EPU conditions at 4032 MWt.

Material	Concentration in Suppression Pool generated by Beta radiation moles/liter	Concentration in Suppression Pool generated by gamma radiation moles/liter	Concentration in Suppression Pool moles/liter	Reference Section
Hydriodic Acid	NA	NA	1.12E-6	4.1
Nitric Acid	NC	NC	1.33E-4	4.2
Hydrochloric Acid	4.04E-4	1.95E-6	4.06E-4	4.3
Cesium Hydroxide	NA	NA	2.18E-4	4.4

NA: Not Applicable
NC: Not Calculated

Material	Suppression Pool gm-moles	Reference Section
Hydriodic Acid	4.2	4.1
Nitric Acid	499	4.2
Hydrochloric Acid	1518	4.3
Total acid	2021.2	
Cesium Hydroxide	813	4.4

Based on the above, the unbuffered pH of the suppression pool at 3616 MWt is 3.6 including credit for CsOH production

	Suppression Pool gm-moles/liter
H^+ for pH = 6	1.00E-06
Hydriodic Acid	9.18E-07
Nitric Acid	1.07E-04
Hydrochloric Acid	3.25E-04
Total Acid	**4.34E-04**
OH^- for pH = 6	1.00E-08
Cesium Hydroxide	1.81E-04
Total Base	**1.81E-04**
Total Acid – Total Base	2.53E-04

pH unbuffered = -log[2.53E-04] = 3.6

Equivalents strong acid = 2.53E-04 gm-moles/liter* 3.7378E+06 liters = 946 gm-moles strong acid

The following provides the unbuffered pH of the suppression pool without credit for CsOH production.

	Suppression Pool gm-moles/liter
H^+ for pH = 6	1.00E-06
Hydriodic Acid	9.18E-07
Nitric Acid	1.07E-04
Hydrochloric Acid	3.25E-04
Total Acid	**4.34E-04**
OH^- for pH = 6	1.00E-08
Cesium Hydroxide	0
Total Base	**1.00E-08**
Total Acid – Total Base	4.34E-04

pH unbuffered = -log[4.34E-04] = 3.36

Equivalents strong acid = 4.34E-04 gm-moles/liter* 3.7378E+06 liters = 1622 gm-moles strong acid

strong acid.

PP&L CALCULATION SHEET

Dept.	0341 Rad & Eff Tech.	PROJECT	
Date	6/06/2005	Suppression Pool pH post LOCA	Calc. No. EC-059-1041
Designed By	M. Waselus		Sh. No. 23
Checked By	R. Anderson		

The following provides the results for EPU conditions at 4032 MWt.
The unbuffered pH of the suppression pool is 3.49 including credit for CsOH production.

	Suppression Pool gm-moles/liter
H^+ for pH = 6	1.00E-06
Hydriodic Acid	1.12E-06
Nitric Acid	1.33E-04
Hydrochloric Acid	4.06E-04
Total Acid	**5.41E-04**
OH^- for pH = 6	1.00E-08
Cesium Hydroxide	2.18E-04
Total Base	**2.18E-04**
Total Acid – Total Base	3.23E-04

pH unbuffered = -log[3.23E-04] = 3.49

Equivalents strong acid = 3.23E-04 gm-moles/liter* 3.7378E+06 liters = 1207 gm-moles strong acid

The unbuffered pH of the suppression pool for EPU without credit for CsOH production is 3.27.

	Suppression Pool gm-moles/liter
H^+ for pH = 6	1.00E-06
Hydriodic Acid	1.12E-06
Nitric Acid	1.33E-04
Hydrochloric Acid	4.06E-04
Total Acid	**5.41E-04**
OH^- for pH = 6	1.00E-08
Cesium Hydroxide	0.00E+00
Total Base	**1.00E-08**
Total Acid – Total Base	5.41E-04

pH unbuffered = -log[5.41E-04] = 3.27

Equivalents strong acid = 5.41E-04 gm-moles/liter* 3.7378E+06 liters = 2022 gm-moles strong acid.

pH unbuffered = -log[5.41E-04] = 3.27

4.6 Sodium Pentaborate – Suppression Pool Buffered pH

In order to maintain the post LOCA suppression pool pH greater than 7 a buffering agent is required to offset the various acid production post LOCA. The chosen method at SSES is to introduce sodium pentaborate (SPB) to the reactor vessel and ultimately the suppression pool via the standby liquid control system (SLCS). The SLCS solution is an aqueous solution of sodium pentaborate ($Na_2B_{10}O_{16}*10H_2O$) which is a mixture of borax and boric acid dissolved in water. The molecular weight is:

Component	No. of Atoms	Atomic Weight	Molecular Weight
Na	2	22.9898	45.9796
B	10	10.811	108.11
O	16	15.99994	255.999
Total			410.09 gm/mole

Using the maximum temperature of 110 °F (DI 8) for the SLCS solution and the minimum SLCS tank volume of 4587 gallons (DI 7) with the minimum concentration of sodium pentaborate of 13.6 weight % (DI 9) the mass of sodium pentaborate is determined as follows:

Solution mass, m = 4587 gallons * [1 ft^3 / 7.4805 gal] * [1 lbm / 0.016165 ft^3] = 37933.5 lbm
Mass of sodium pentaborate (SPB), m_p = 0.136 * 37933.5 lbm = 5158.95 lbm

Converting the mass of sodium pentaborate to gm-moles results in the equivalent of:

5158.95 lbm SPB* 453.59 gm/lbm SPB / 1 mole SPB/ 410.09 gm = 5706.2 gm-moles.

The required quantity for pool pH control is injected early during the postulated LOCA. Per DI 10, the minimum SLC pump capacity is 41.2 gpm. Therefore, the time to inject the contents of the SLC tank is:
Time to Inject = 4587 gallons/41.2 gal/min = 111 minutes for one pump or 56 minutes for two pumps.

This weak acid and its conjugate base will buffer the pool water at a pH corresponding to the following:

$pH = pK_a + \log [anion]/[acid]$

where:

pK_a = negative of the log of the acid dissociation constant = $-\log[K_a]$
K_a = 5.8E-10 for borate buffer (Reference 1, section 2.3.3)
[anion] = borate concentration
[acid] = acid concentration
pK_a = negative of the log of the acid dissociation constant = $-\log[K_a]$

Sodium pentaborate dissolves in water producing boric acid and sodium borate:

$$Na_2B_{10}O_{16} + 16\ H_2O \longrightarrow 2\ Na^+ + 2\ B(OH)^-_4 + 8\ H_3BO_3$$

Therefore, the injection of 5158.95 lbm SPB or 5706.2 gm-moles SPB results in 11412.4 gm-mole equivalent of borate [2* 5706.2] and 45649.6 gm-mole equivalent boric acid [8 * 5706.2] added to the pool.
Summarizing the above equivalents yields the following with credit taken for CsOH production in the suppression pool.

Material in Pool	Sodium Pentaborate gm-moles added to pool	Equivalent strong acid gm-moles Section 4.5	Column 2 – Column 3 gm/moles	Volume pool liters	Final pool concentrations gm-moles/l
Equivalents borate	11412.4	946	10466.4	3737800.0	2.8001E-03
Equivalents boric acid	45649.6	946	44703.6	3737800.0	1.1960E-02

Therefore, the suppression pool pH after addition of the sodium pentaborate equals 8.61:
where:
$pH = pK_a + \log [anion]/[acid]$
$pH = -\log[5.8E-10] + \log [2.8023E-03/1.1962E-02] = 9.24 +(-0.63) = 8.61.$

For the conservative case with no credit for CsOH production in the suppression pool the results are provided as follows.

Material in Pool	Sodium Pentaborate gm-moles added to pool	Equivalent strong acid gm-moles Section 4.5	Column 2 – Column 3 gm/moles	Volume pool liters	Final pool concentrations gm-moles/l
Equivalents borate	11412.4	1622	9790.5	3737800.0	2.6193E-03
Equivalents boric acid	45649.6	1622	44027.7	3737800.0	1.1779E-02

Therefore, the suppression pool pH at 3616 MWt after addition of the sodium pentaborate equals 8.58:
where:

$pH = pK_a + \log [anion]/[acid]$
$pH = -\log[5.8E-10] + \log [2.6213E-03/1.1781+E-02] = 9.237 +(-0.653) = 8.58.$

Similar to the above the following provides the final suppression pool pH for EPU conditions.

Material in Pool	Sodium Pentaborate gm-moles added to pool	Equivalent strong acid gm-moles Section 4.5	Column 2 – Column 3 gm/moles	Volume pool liters	Final pool concentrations gm-moles/l
Equivalents borate	11412.4	1207	10205.4	3737800.0	2.7303E-03
Equivalents boric acid	45649.6	1207	44442.6	3737800.0	1.1890E-02

Therefore, the suppression pool pH after addition of the sodium pentaborate for EPU power equals 8.60:
where:
$pH = pK_a + \log [anion]/[acid]$
$pH = -\log[5.8E-10] + \log [2.7321E-03/1.1892E-02] = 9.24 +(-0.64) = 8.60.$

For the conservative case with no credit for CsOH production in the suppression pool the results are provided as follows.

Material in Pool	Sodium Pentaborate gm-moles added to pool	Equivalent strong acid gm-moles Section 4.5	Column 2 – Column 3 gm/moles	Volume pool liters	Final pool concentrations gm-moles/l
Equivalents borate	11412.4	2022	9390.4	3737800.0	2.5123E-03
Equivalents boric acid	45649.6	2022	43627.6	3737800.0	1.1672E-02

Therefore, the suppression pool pH after addition of the sodium pentaborate equals 8.57:
where:
$pH = pK_a + \log [anion]/[acid]$
$pH = -\log[5.8E-10] + \log [2.5141E-03/1.1674+E-02] = 9.24 +(-0.67) = 8.57.$

5.0 RESULTS

The results of the analysis demonstrate that with the injection of the Technical Specification minimum quantity of sodium pentaborate, the 30 day suppression pool pH is greater than 7.0 which precludes the need to include reevolution of iodine from the suppression pool post LOCA. The 30 day suppression pool pH represents the worst case pH. Subsequent to the injection of the sodium pentaborate early in the accident scenario, the pH in the pool will be greater than the 30 day value since the generation of the post LOCA acids reaches its peak values at 30 days.

The conservative 30 day suppression pool pH calculated herein is 8.61 with credit for post LOCA CsOH production in the pool and 8.58 without credit for post LOCA CsOH production in the pool.

For the case of EPU conditions, the conservative 30 day suppression pool pH calculated herein is 8.60 with credit for post LOCA CsOH production in the pool and 8.57 without credit for post LOCA CsOH production in the pool.

These results are summarized in the following table.

Case	pH @ 3616 MWt	pH @ 4032 MWt
pH with credit for post LOCA CsOH	8.61	8.60
pH without credit for post LOCA CsOH	8.58	8.57

6.0 REFERENCES

1. NUREG/CR-5950, Iodine Evolution and pH Control, Revision 3 (12/92).
2. NUREG-1081, Post-Accident Gas Generation from Radiolysis of Organic Materials, September, 1984.
3. NUREG/CR-5732, Iodine Chemical Forms in LWR Severe Accidents, April, 1992.
4. Design Basis Document for Standby Liquid Control System DBD 042, Revision 2.
5. USNRC Regulatory Guide 1.183, Alternative Radiological Source Terms For Evaluating Design Basis Accidents At Nuclear Power Reactors, July 2000.
6. NUREG-1465, Accident Source Terms for Light-Water Nuclear Power Plants- Final Report, February, 1995.
7. PPL Calculation EC-FUEL-1602, Core Average Source Term for End of Equilibrium 24-month Cycle.
8. PPL Calculation EC-012-0442, Containment Volume & Weights, Revision 0.
9. PPL Calculation EC-PUPC-1001, NEDC-32161P, General Electric Power Uprate Engineering Report For Susquehanna Steam Electric Station, Revision 6, 5/24/04.
10. PPL Calculation EC-RADN-1004, Post Power Uprate Post-LOCA Radiation Levels for Equipment Qualification, Revision 7, 11/21/03.
11. PPL Drawing C206130, Sheet 1, Primary Containment Zones, Revision 4
12. PPL Technical Specification 3.1.7, Amendment 178 and Bases, B3.1.7, Revision 0, Standby Liquid Control System,.
13. PPL Calculation EC-RADN-1005, Post Accident Equipment Qualification Doses for Power Uprate, Revision 1.
14. PPL Calculation EC-073-0006, Hydrogen/Oxygen Generation in an Inerted Containment, Revision 0.
15. Marks Standard Handbook for Mechanical Engineers, 7th Edition.
16. Email from R. Vazquies to M. Waselus, SP_pH_Cond.xls, 12/09/04 included as Attachment 3.
17. EC-FUEL-1615, "AREVA Alternate Source Term (AST) Fission Product Inventory For Atrium-10 Fuel", Revision 0, 4/25/05.
18. PLE-23866, Inputs for Alternate Source Term Analysis, May 3, 2005.
19. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 145 to Facility Operating License No. NPF-29 Entergy Operations, Inc., et. al., Grand Gulf Nuclear Station, Unit 1, Docket No. 50-416, March, 2001.

Attachment 1 Cable Data
Received from PPL (R. Vazquies) 12/7/04

FIREZONE	Cable Code	Sum Of Length	Outside Diameter (inch)	NUMCON	CONDSIZE	WPFT	Outside Jacket Thickness	Outside Jacket Thickness	OR inch	OR-OJT	Hypalon 1.55g/cc density	mH lb/ft	SA sq cm/ft	SA sq cm/lb	Total wt jacket lbs	% wt
1 -4F	D11	70	0.225	1	AWG 10	0.05	0.015	0.015	0.1125	0.0975	96.7	0.0066	54.7245	8234.868	0.47	0.01
1 -4F	D12	145	0.507	2	AWG 10	0.17	0.045	0.045	0.2535	0.2085	96.7	0.0439	123.3126	2811.501	6.36	0.13
1 -4F	D13	252	0.63	3	AWG 10	0.26	0.06	0.06	0.315	0.255	96.7	0.0722	153.2287	2123.729	18.18	0.37
1 -4F	D14	56	0.685	4	AWG 10	0.32	0.06	0.06	0.3425	0.2825	96.7	0.0791	166.6058	2105.930	4.43	0.09
1 -4F	D62	10	0.9	2	AWG 6	0.44	0.08	0.08	0.45	0.37	96.7	0.1384	218.8981	1581.697	1.38	0.03
1 -4F	D83	20	0.825	3	AWG 8	0.45	0.06	0.06	0.4125	0.3525	96.7	0.0968	200.6566	2072.173	1.94	0.04
1 -4F	FB14	162	0.445	8	N/A	0.12			0.2225	0.2225	96.7	0.0000	108.2330		0.00	0.00
1 -4F	L02	1775	0.434	2	AWG 14	0.1	0.045	0.045	0.217	0.172	96.7	0.0369	105.5575	2858.330	65.55	1.35
1 -4F	L03	151	0.505	3	AWG 14	0.14	0.045	0.045	0.2525	0.2075	96.7	0.0437	122.8262	2812.585	6.59	0.14
1 -4F	L05	256	0.625	5	AWG 14	0.24	0.06	0.06	0.3125	0.2525	96.7	0.0715	152.0126	2125.519	18.31	0.38
1 -4F	L07	116	0.675	7	AWG 14	0.3	0.06	0.06	0.3375	0.2775	96.7	0.0778	164.1736	2108.930	9.03	0.19
1 -4F	N09	771	0.674	10	AWG 16	0.22	0.06	0.06	0.337	0.277	96.7	0.0777	163.9304	2109.235	59.92	1.23
1 -4F	Q11	17422	0.681	14	AWG 20	0.19	0.06	0.06	0.3405	0.2805	96.7	0.0786	165.6329	2107.118	1369.48	28.21
1 -4F	Q20	212	0.859	28	AWG 20	0.31	0.06	0.06	0.4295	0.3695	96.7	0.1011	208.9261	2065.760	21.44	0.44
1 -4F	Q24	1343	0.376	3	AWG 18	0.07	0.045	0.045	0.188	0.143	96.7	0.0314	91.4508	2910.262	42.20	0.87
1 -4F	Q24A	910	0.343	3	AWG 18	0.05	0.045	0.045	0.1715	0.1265	96.7	0.0283	83.4245	2948.832	25.74	0.53
1 -4F	Q26	71	0.685	9	AWG 16	0.22	0.06	0.06	0.3425	0.2825	96.7	0.0791	166.6058	2105.930	5.62	0.12
1 -4F	Q27	382	0.888	21	AWG 16	0.45	0.06	0.06	0.444	0.384	96.7	0.1048	215.9795	2060.706	40.04	0.82
1 -4F	Q28	8982	0.397	4	AWG 16	0.08	0.045	0.045	0.1985	0.1535	96.7	0.0334	96.5584	2889.482	300.15	6.18
1 -4F	Q29	124	0.753	12	AWG 18	0.27	0.06	0.06	0.3765	0.3165	96.7	0.0877	183.1448	2087.830	10.88	0.22
1 -4F	Q30	1658	0.482	5	AWG 18	0.11	0.045	0.045	0.241	0.196	96.7	0.0415	117.2321	2825.776	68.78	1.42
1 -4F	R04	34	0.735	1	AWG-4/0	0.35	0.065	0.065 CSPE	0.3675	0.3025	96.7	0.0919	178.7668	1945.736	3.12	0.06
1 -4F	TQ5	620	0.362	3	AWG 16	0.07	0.045	0.045	0.181	0.136	96.7	0.0301	88.0457	2925.644	18.66	0.38
1 -4F	TQ6	71	1.132	36	AWG 16	0.65	0.08	0.08	0.566	0.486	96.7	0.1775	275.3252	1550.691	12.61	0.26
1 -4F	TQ8	192	0.324	3	AWG 20	0.05	0.045	0.045	0.162	0.117	96.7	0.0265	78.8033	2975.178	5.09	0.10
1 -4F	U07	25	0.55	7	AWG 14	0.19	0.045	0.045 CSPE	0.275	0.23	96.7	0.0479	133.7711	2790.252	1.20	0.02
1 -4F	U63	28	0.79	6	AWG 6	0.5	0.06	0.060 CSPE	0.395	0.335	96.7	0.0924	192.1439	2079.398	2.68	0.06
1 -4F	Z02	2563	0.475	2	AWG 14	0.12	0.045	0.045 CSPE	0.2375	0.1925	96.7	0.0406	115.5296	2830.071	104.63	2.15
1 -4F	Z03	417	0.505	3	AWG 14	0.13	0.045	0.045 CSPE	0.2525	0.2075	96.7	0.0437	122.8262	2812.585	18.21	0.38
1 -4F	Z05	107	0.625	5	AWG 14	0.21	0.06	0.060 CSPE	0.3125	0.2525	96.7	0.0715	152.0126	2125.519	7.65	0.16
1 -4F	Z07	494	0.675	7	AWG 14	0.27	0.06	0.060 CSPE	0.3375	0.2775	96.7	0.0778	164.1736	2108.930	38.46	0.79
1 -4F	Z12	27	0.86	12	AWG 14	0.46	0.08	0.080 CSPE	0.43	0.35	96.7	0.1316	209.1693	1588.907	3.55	0.07
1 -4F	Z13	288	0.63	3	AWG 10	0.23	0.06	0.060 CSPE	0.315	0.255	96.7	0.0722	153.2287	2123.729	20.78	0.43
1 -4F	Z61	103	0.345	1	AWG 6	0.13	0.03	0.030 CSPE	0.1725	0.1425	96.7	0.0199	83.9110	4208.933	2.05	0.04
1 -4F	Z63	77	0.955	3	AWG 6	0.54	0.08	0.080 CSPE	0.4775	0.3975	96.7	0.1477	232.2753	1572.880	11.37	0.23
1 -4F	Z83	1340	0.825	3	AWG 8	0.36	0.06	0.060 CSPE	0.4125	0.3525	96.7	0.0968	200.6566	2072.173	129.76	2.67
2 -4F	B12	208	0.6	2	AWG 10	0.19	0.045	0.045	0.3	0.256	96.7	0.0527	145.9321	2769.685	11.01	0.23
2 -4F	D12	38	0.507	2	AWG 10	0.17	0.045	0.045	0.2535	0.2085	96.7	0.0439	123.3126	2811.501	1.67	0.03
2 -4F	D13	262	0.63	3	AWG 10	0.26	0.06	0.06	0.315	0.255	96.7	0.0722	153.2287	2123.729	18.90	0.39
2 -4F	D14	56	0.685	4	AWG 10	0.32	0.06	0.06	0.3425	0.2825	96.7	0.0791	166.6058	2105.930	4.43	0.09
2 -4F	D62	30	0.9	2	AWG 6	0.44	0.08	0.08	0.45	0.37	96.7	0.1384	218.8981	1581.697	4.15	0.09
2 -4F	D83	19	0.825	3	AWG 8	0.45	0.06	0.06	0.4125	0.3525	96.7	0.0968	200.6566	2072.173	1.84	0.04
2 -4F	L02	1191	0.434	2	AWG 14	0.1	0.045	0.045	0.217	0.172	96.7	0.0369	105.5575	2858.330	43.98	0.91
2 -4F	L03	119	0.505	3	AWG 14	0.14	0.045	0.045	0.2525	0.2075	96.7	0.0437	122.8262	2812.585	5.20	0.11
2 -4F	L05	224	0.625	5	AWG 14	0.24	0.06	0.06	0.3125	0.2525	96.7	0.0715	152.0126	2125.519	16.02	0.33
2 -4F	L07	100	0.675	7	AWG 14	0.3	0.06	0.06	0.3375	0.2775	96.7	0.0778	164.1736	2108.930	7.78	0.16
2 -4F	N09	657	0.674	10	AWG 16	0.22	0.06	0.06	0.337	0.277	96.7	0.0777	163.9304	2109.235	51.06	1.05
2 -4F	Q11	18338	0.681	14	AWG 20	0.19	0.06	0.06	0.3405	0.2805	96.7	0.0786	165.6329	2107.118	1441.48	29.69
2 -4F	Q20	189	0.859	28	AWG 20	0.31	0.06	0.06	0.4295	0.3695	96.7	0.1011	208.9261	2065.760	19.12	0.39

FIREZONE	Cable Code	Sum Of Length	Outside Diameter (inch)	NUMCON	CONDSIZE	WPFT	Outside Jacket Thickness	Outside Jacket Thickness	OR inch	OR-OJT	density	lb/ft	sq cm/ft	sq cm/lb	jacket lbs	
2-4F	Q24	2480	0.376	3	AWG 16	0.07	0.045	0.045	0.188	0.143	96.7	0.0314	91.4508	2910.262	77.93	1.61
2-4F	Q25	26	0.621	6	AWG 16	0.17	0.06	0.06	0.3105	0.2505	96.7	0.0710	151.0397	2126.974	1.85	0.04
2-4F	Q27	358	0.888	21	AWG 16	0.45	0.06	0.06	0.444	0.384	96.7	0.1048	215.9795	2060.706	37.52	0.77
2-4F	Q28	5960	0.397	4	AWG 16	0.06	0.045	0.045	0.1985	0.1535	96.7	0.0334	96.5584	2889.482	199.17	4.10
2-4F	Q29	345	0.753	12	AWG 16	0.27	0.06	0.06	0.3765	0.3165	96.7	0.0877	183.1446	2087.830	30.26	0.62
2-4F	Q30	1368	0.482	5	AWG 16	0.11	0.045	0.045	0.241	0.196	96.7	0.0415	117.2321	2825.776	56.75	1.17
2-4F	R04	36	0.735	1	AWG-4/0	0.35	0.065	0.065 CSPE	0.3675	0.3025	96.7	0.0919	178.7668	1945.736	3.31	0.07
2-4F	TQ5	697	0.362	3	AWG 16	0.07	0.045	0.045	0.181	0.136	96.7	0.0301	88.0457	2925.644	20.98	0.43
2-4F	TQ6	78	1.132	36	AWG 16	0.65	0.08	0.08	0.566	0.486	96.7	0.1775	275.3252	1550.691	13.85	0.29
2-4F	TQ8	207	0.324	3	AWG 20	0.05	0.045	0.045	0.162	0.117	96.7	0.0265	78.8033	2975.178	5.48	0.11
2-4F	Z02	2941	0.475	2	AWG 14	0.12	0.045	0.045 CSPE	0.2375	0.1925	96.7	0.0408	115.5296	2830.071	120.06	2.47
2-4F	Z03	460	0.505	3	AWG 14	0.13	0.045	0.045 CSPE	0.2525	0.2075	96.7	0.0437	122.8262	2812.565	20.09	0.41
2-4F	Z05	88	0.625	5	AWG 14	0.21	0.06	0.060 CSPE	0.3125	0.2525	96.7	0.0715	152.0126	2125.519	6.29	0.13
2-4F	Z07	413	0.675	7	AWG 14	0.27	0.06	0.060 CSPE	0.3375	0.2775	96.7	0.0778	164.1736	2108.930	32.15	0.66
2-4F	Z12	21	0.86	12	AWG 14	0.46	0.08	0.080 CSPE	0.43	0.35	96.7	0.1316	209.1693	1588.907	2.76	0.06
2-4F	Z13	280	0.63	3	AWG 10	0.23	0.06	0.060 CSPE	0.315	0.255	96.7	0.0722	153.2287	2123.729	20.20	0.42
2-4F	Z61	54	0.345	1	AWG 6	0.13	0.03	0.030 CSPE	0.1725	0.1425	96.7	0.0199	83.9110	4206.933	1.08	0.02
2-4F	Z63	73	0.955	3	AWG 6	0.54	0.08	0.080 CSPE	0.4775	0.3975	96.7	0.1477	232.2753	1572.860	10.78	0.22
2-4F	Z83	1156	0.825	3	AWG 8	0.36	0.06	0.060 CSPE	0.4125	0.3625	96.7	0.0968	200.6566	2072.173	111.94	2.31
		79748													4855.42	100.00

= ChCSPE = Chlorosulfonated
hylerPolyethylene Jacket

E: NOTE: The portion of the Table highlighted in gray has been modified by the calculation originator to provide additional values for the analysis.

Attachment 2 Cable Drawings

PPL Susquehanna, LLC
Two North Ninth Street
Allentown, PA 18101-1179
Tel. 610.774.7723 Fax 610.774.7782
rravazquez@pplweb.com

December 8, 2004

Mr. Michael Waselus
Parsons Energy & Chemical
2675 Morgantown Road
Reading, PA 19607

SUSQUEHANNA STEAM ELECTRIC STATION
SUPPRESSION POOL pH ANALYSIS
PLE-23745

Dear Mr. Abrams:

The following drawings are attached for your use in determining cable dimensions for the Suppression Pool pH analysis:

1.	For Type B12 Cables	FF103301 Sheet 8901
2.	For Type D11 Cables	FF103301 Sheet 5201
3.	For Type D12 Cables	FF103301 Sheet 5301
4.	For Type D13 Cables	FF103301 Sheet 5401
5.	For Type D14 Cables	FF103301 Sheet 5501
6.	For Type D62 Cables	FF103300 Sheet 5801
7.	For Type D83 Cables	FF103301 Sheet 5701
8.	For Type L02 Cables	FF103301 Sheet 4701
9.	For Type L03 Cables	FF103301 Sheet 4801
10.	For Type L05 Cables	FF103301 Sheet 4901
11.	For Type L07 Cables	FF103301 Sheet 5001
12.	For Type N09 Cables	FF103310 Sheet 0301
13.	For Type Q11 Cables	FF103310 Sheet 2501
14.	For Type Q20 Cables	FF103310 Sheet 0701
15.	For Type Q24 Cables	FF103310 Sheet 1401
16.	For Type Q24A Cables	FF61954 Sheet 44
17.	For Type Q25 Cables	FF103310 Sheet 1501
18.	For Type Q26 Cables	FF103310 Sheet 1601
19.	For Type Q27 Cables	FF103310 Sheet 1701
20.	For Type Q28 Cables	FF103310 Sheet 1801
21.	For Type Q29 Cables	FF103310 Sheet 1901
22.	For Type Q30 Cables	FF103310 Sheet 2001
23.	For Type R04 Cables	FF103500 Sheet 0201
24.	For Type TQ5 Cables	FF103310 Sheet 2601
25.	For Type TQ6 Cables	FF103310 Sheet 4101
26.	For Type TQ8 Cables	FF103310 Sheet 4301
27.	For Type U07 Cables	FF61882 Sheet 5

December 8, 2004
PLE-23745
Page 2 of 2

28.	For Type U63 Cables	FF61882 Sheet 8
29.	For Type Z02 Cables	FF103950 Sheet 1201
30.	For Type Z03 Cables	FF103950 Sheet 1301
31.	For Type Z05 Cables	FF103950 Sheet 0201
32.	For Type Z07 Cables	FF103950 Sheet 1101
33.	For Type Z12 Cables	FF103950 Sheet 1001
34.	For Type Z13 Cables	FF103950 Sheet 0901
35.	For Type Z61 Cables	FF103950 Sheet 0601
36.	For Type Z63 Cables	FF103950 Sheet 0701
37.	For Type Z83 Cables	FF103950 Sheet 0801

Please contact me at 610-774-7723 if you need additional information. My email address is ravazquies@pplweb.com.

Sincerely,

Ronald Vazquies
Senior Engineer – Mechanical Design Engineering

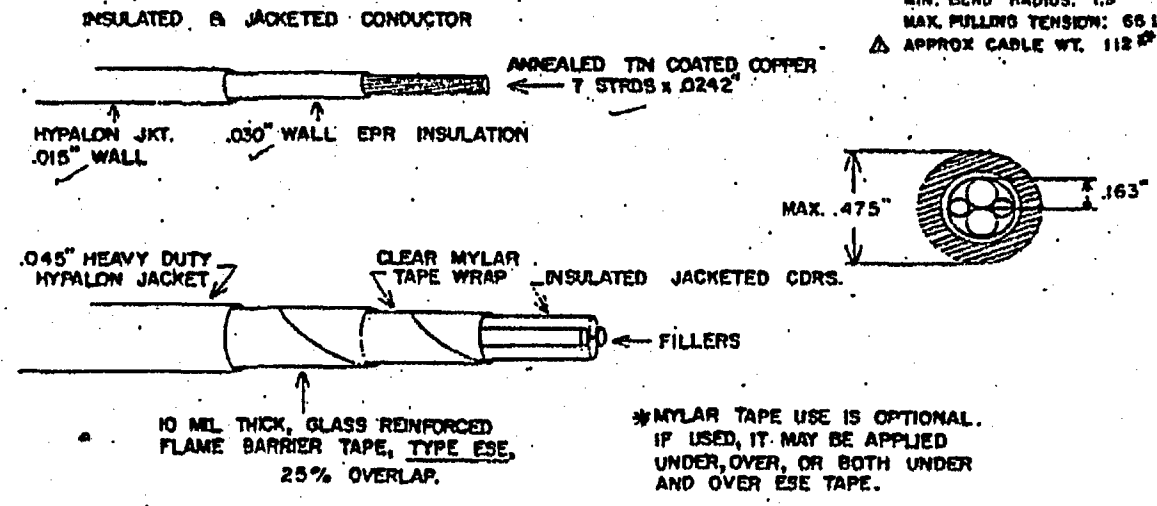
RAV:vlr

cc: w/o att:	T.F. Mackay	GENPL5
	R.L. Doty	GENPL5
	D.G. Kostelnik	GENPL5
	Nuclear Records	GENPL4

B12 FF 103301 Sh. 8901 OCT 27 1980

For Information Only

MIN. BEND RADIUS: 1.9"
MAX. PULLING TENSION: 66 LBS.
△ APPROX CABLE WT. 112 #/M'



*MYLAR TAPE USE IS OPTIONAL. IF USED, IT MAY BE APPLIED UNDER, OVER, OR BOTH UNDER AND OVER ESE TAPE.

NOTE: VOIDS FILLED WITH FLAME RESISTANT FILLERS, WHERE NECESSARY.

SUPPLIER: PAIGE ELECTRIC CORP. UNION, N.J.

ITEM NO DIMENSIONAL DRAWING
14 AWG, 2 CONDUCTOR ROUND
90°C - 600 VOLT POWER & CONTROL CABLE
EPR INSULATION WITH HYPALON JACKET
HYPALON JACKET OVERALL

AMERICAN INSULATED WIRE CORPORATION
PAWTUCKET, RHODE ISLAND

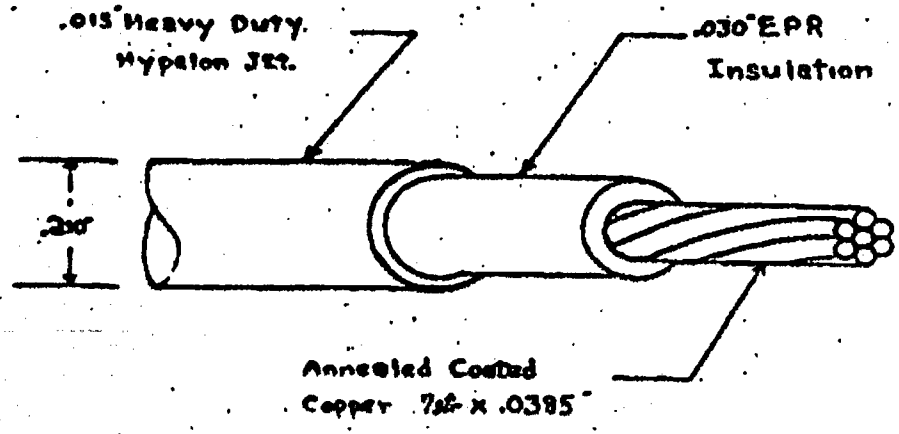
NO	REVISIONS	DWGS.	DATE	ENG. APPR.
△	ADDED CABLE WT.		10-23-80	
0	ORIGINAL ISSUE		4-21-80	

FOR: BECHTEL POWER CORP.
c/o SUSQUEHANNA STEAM ELECTRIC PLANT.
PENNSYLVANIA POWER & PLANT
BECHTEL 8856-E-130

A.I.W. MFG. SPEC. ES-7673-2 RD.

D11 FF 103301 Sh. 5201

For Information Only



8856-E130A-162-1

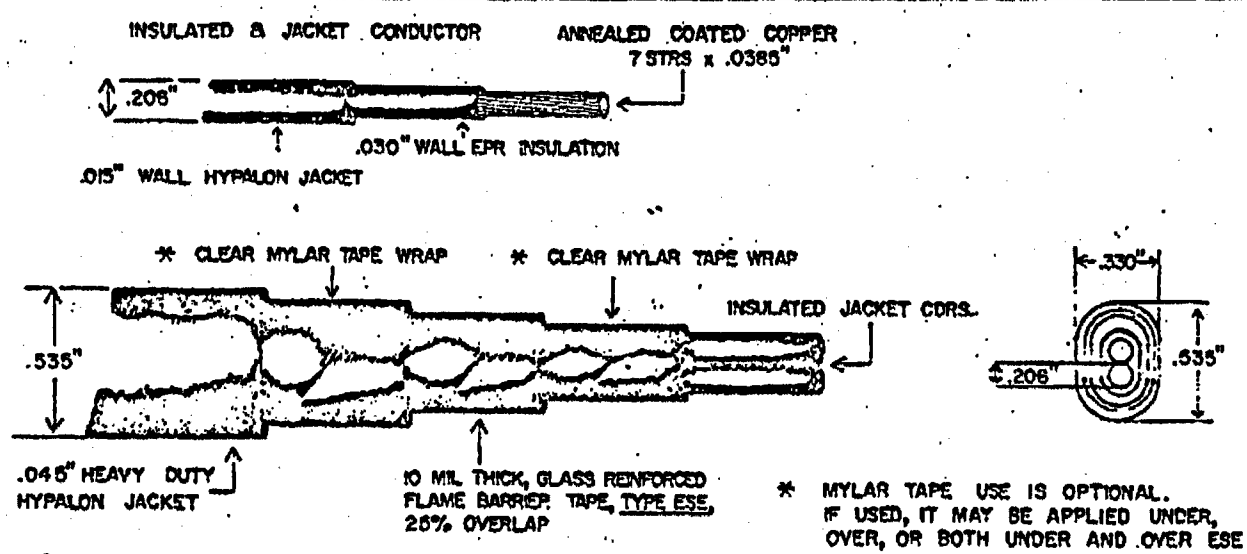
MANUFACTURER: AMERICAN INSULATED WIRE CORP.
SUPPLIER: PAIGE ELECTRIC CORP.

DIMENSIONAL DRAWINGS SUSQUEHANNA STEAM ELECTRIC STATION Units 1 & 2	600 VOLT POWER & CONTROL CABLE SPEC: BECHTEL L1156-E-130 Single Conductor 10AWG Bechtel Item No. 6	PEW 8275 PAGE No. 1 A.I.W. Mfg. Spec. 7000-10-Sta.

Aug 1 3 1979

D12 FF 103301 Sh. 5301

8856-E130A-153-1



* MYLAR TAPE USE IS OPTIONAL. IF USED, IT MAY BE APPLIED UNDER, OVER, OR BOTH UNDER AND OVER ESE TAPE.

NOTE: VOIDS FILLED WITH FLAME RESISTANT FILLERS, WHERE NECESSARY.

SUPPLIER: PAIGE ELECTRIC CORP. UNION, N.J. PO. PEN 8275

ITEM: 7 DIMENSIONAL DRAWING

10 AWG, 2 CONDUCTOR PARALLEL
90°C - 600 VOLT POWER & CONTROL CABLE
EPR INSULATION WITH HYPALON JACKET
HYPALON JACKET OVERALL

"AMERICAN" INSULATED WIRE CORPORATION
PAWTUCKET, RHODE ISLAND

NO	REVISIONS	BY	DATE	ENG APPR.
0	ORIGINAL ISSUE		7-27-79	

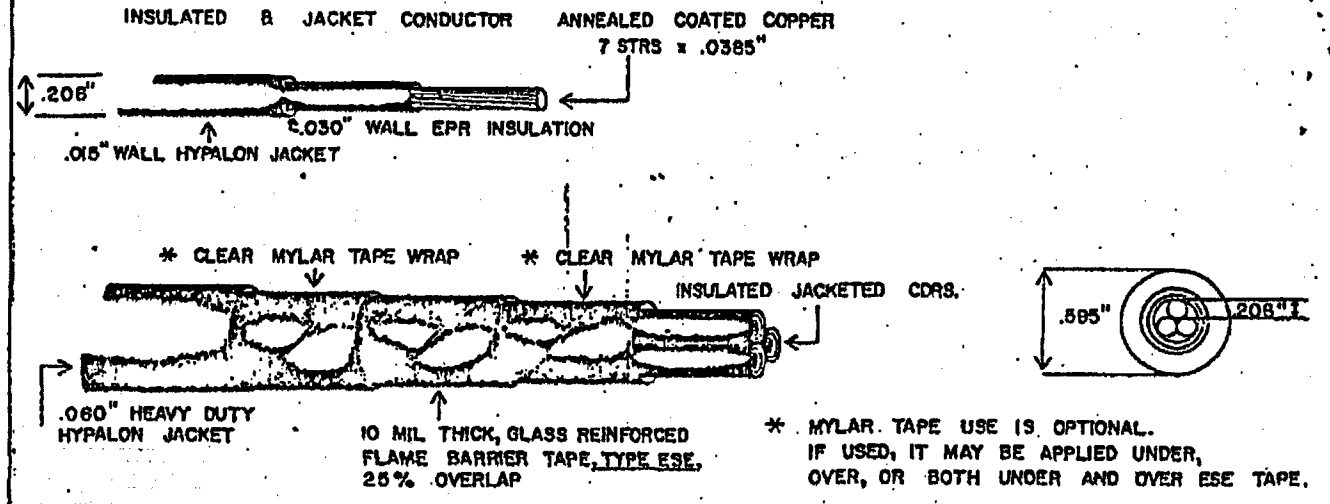
FOR: BECHTEL POWER CORP.
c/o SUSQUEHANNA STEAM ELECTRIC PLANT.
PENNSYLVANIA POWER & LIGHT
BECHTEL 8856-E-130

A.I.W. MFG. SPEC. ES-7676-2 FLT

D13 FF103301 Sh. 5401

8856-E130A-154-1

For Information Only



* MYLAR TAPE USE IS OPTIONAL.
IF USED, IT MAY BE APPLIED UNDER,
OVER, OR BOTH UNDER AND OVER ESE TAPE.

NOTE: VOIDS FILLED WITH FLAME RESISTANT FILLERS, WHERE NECESSARY.

SUPPLIER: PAIGE ELECTRIC CORP, UNION, N.J. PO. PEH 8275

ITEM: 8 DIMENSIONAL DRAWING

10 AWG, 3 CONDUCTOR ROUND
90°C - 600 VOLT POWER & CONTROL CABLE
EPR INSULATION WITH HYPALON JACKET
HYPALON JACKET OVERALL

AMERICAN INSULATED WIRE CORPORATION
PAWTUCKET, RHODE ISLAND

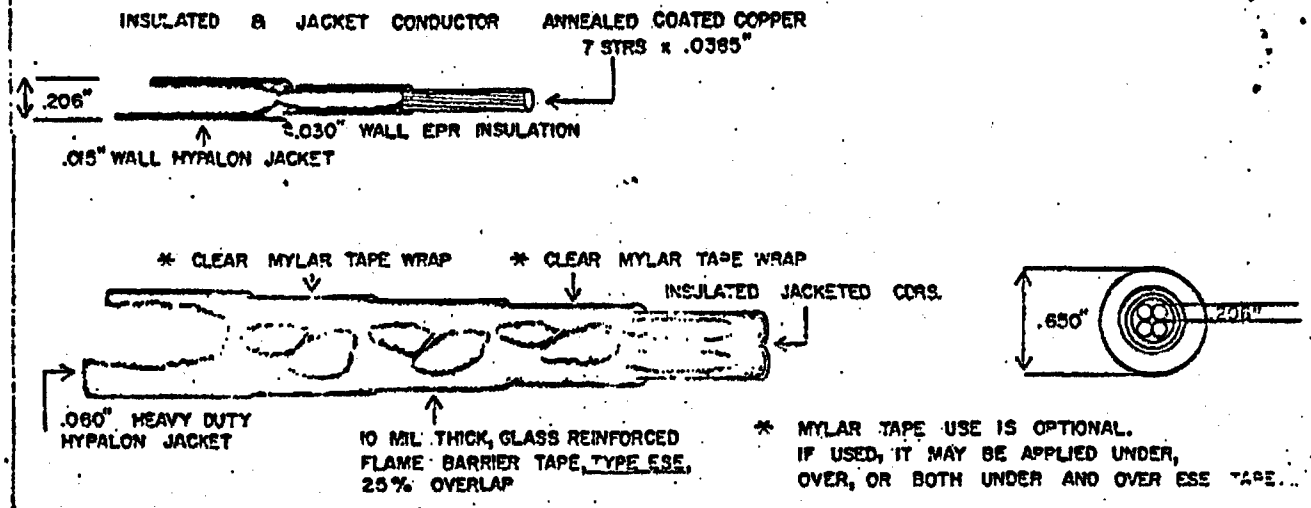
NO	REVISIONS	BY	DATE	ENG APPR.
0	ORIGINAL ISSUE	JH	7-20-79	al

FOR: BECHTEL POWER CORP
c/o SUSQUEHANNA STEAM ELECTRIC PLANT.
PENNSYLVANIA POWER & LIGHT
BECHTEL 8856-E-130
A.I.W. MFG. SPEC. ES-7676-3

D14 FF103501 Sh. 5501

8856. E130A-155-1

For Information Only



* MYLAR TAPE USE IS OPTIONAL. IF USED, IT MAY BE APPLIED UNDER, OVER, OR BOTH UNDER AND OVER ESE TAPE.

NOTE: VOIDS FILLED WITH FLAME RESISTANT FILLERS, WHERE NECESSARY.

SUPPLIER: PAIGE ELECTRIC CORP, UNION, N.J. PO. PEH 8275

ITEM: 9 DIMENSIONAL DRAWING

10 AWG, 4 CONDUCTOR ROUND
90°C - 600 VOLT POWER & CONTROL CABLE
EPR INSULATION WITH HYPALON JACKET
HYPALON JACKET OVERALL

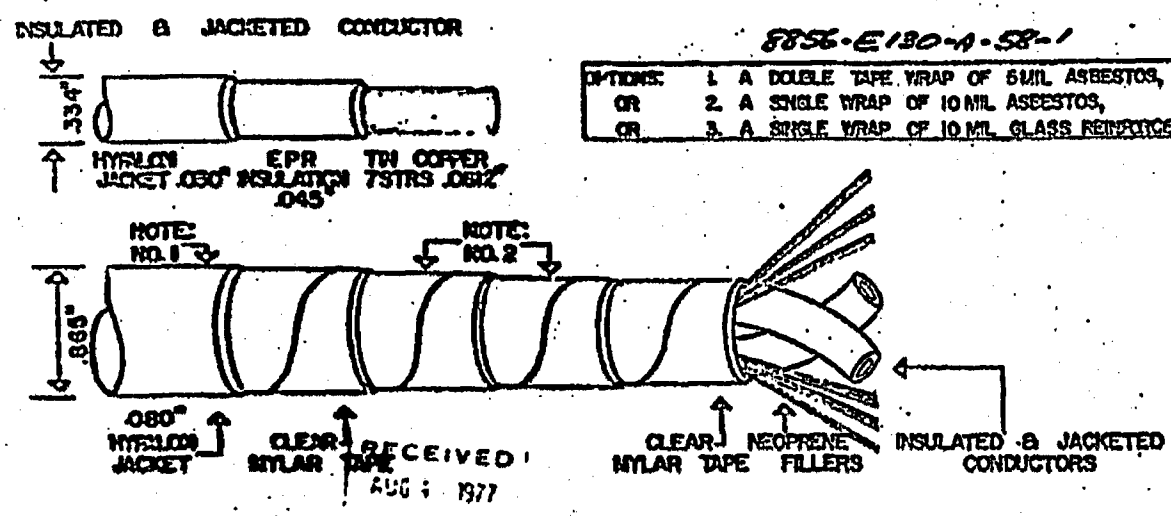
AMERICAN INSULATED WIRE CORPORATION
PAWTUCKET, RHODE ISLAND

NO.	REVISIONS	BY	DATE	ENG APPR.
0	ORIGINAL ISSUE		7-27-79	

FOR: BECHTEL POWER CORP
c/o SUSQUEHANNA STEAM ELECTRIC PLANT.
PENNSYLVANIA POWER & LIGHT
BECHTEL 8856-E-130

A.I.W. MFG. SPEC. ES-7876-4

D62 FF103300 Sh. 5801



8856-E130-A-58-1

OPTIONS: 1. A DOUBLE TAPE WRAP OF 5 MIL ASBESTOS,
OR 2. A SINGLE WRAP OF 10 MIL ASBESTOS,
OR 3. A SINGLE WRAP OF 10 MIL GLASS REINFORCED TAPE

RECEIVED AUG 1 1977

NOTE:
NO.1 MAX GUARANTEE .900"
NO.2 DOUBLE ASBESTOS TAPE WRAP.

RECEIVED AUG 1 1977 SUSQUEHANNA PEDI

NOTE: VOIDS FILLED WITH FLAME RESISTANT FILLERS WHERE NECESSARY.

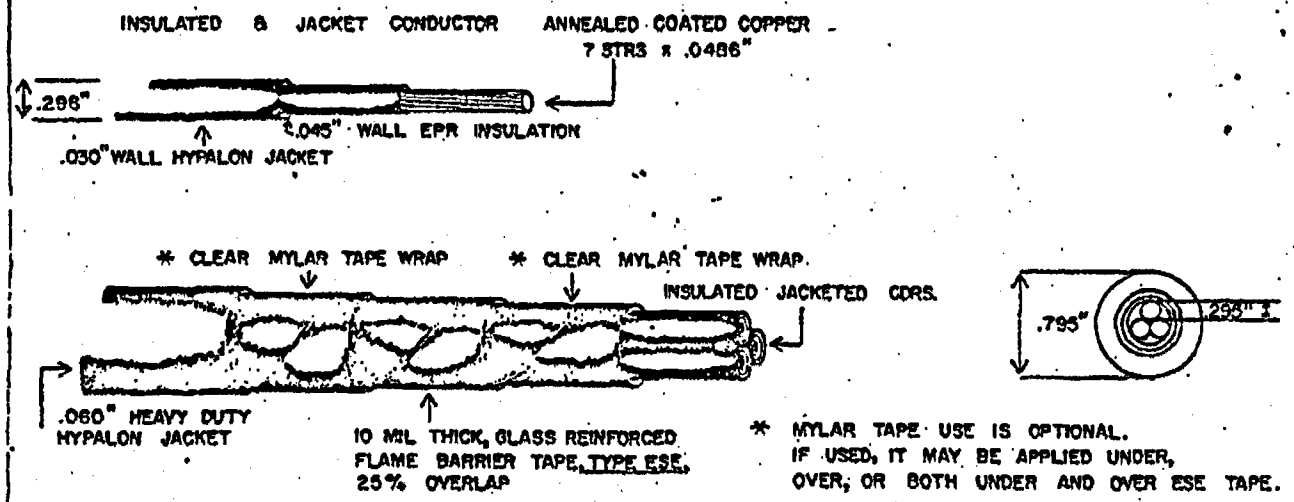
MANUFACTURER: AMERICAN INSULATED WIRE CORP.
SUPPLIER: PAIGE ELECTRIC CORP.

DIMENSIONAL DRAWING FOR: SUSQUEHANNA STEAM ELECTRIC STATION UNIT 1 & 2	600 VOLT POWER & CONTROL CABLE SPEC: BECHTEL 8856-E-130 6 AWG 2/6 ROUND BECHTEL ITEM 37	ES-8037-6/2 DRAWN BY: JM

For Information Only

D83 FF105501 Sh. 5101

8856-E130A-157-1



ITEM: II DIMENSIONAL DRAWING

8 AWG, 3 CONDUCTOR ROUND
90°C - 600 VOLT POWER & CONTROL CABLE
EPR INSULATION WITH HYPALON JACKET
HYPALON JACKET OVERALL

NOTE: VOIDS FILLED WITH FLAME RESISTANT FILLERS WHERE NECESSARY.

SUPPLIER: PAIGE ELECTRIC CORP. UNION, N.J. P.O. PEH 8275

AMERICAN INSULATED WIRE CORPORATION
PAWTUCKET, RHODE ISLAND

NO.	REVISIONS	BY	DATE	ENG APPR.
0	ORIGINAL ISSUE		7-28-79	

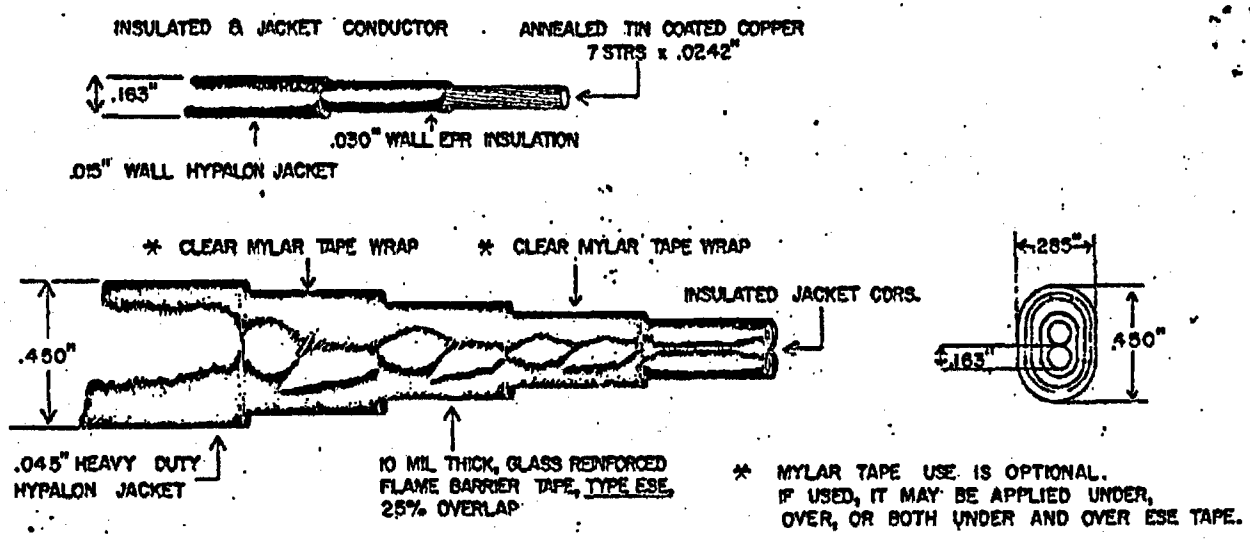
FOR: BECHTEL POWER CORP.
c/o SUSQUEHANNA STEAM ELECTRIC PLANT.
PENNSYLVANIA POWER & LIGHT
BECHTEL 8856-E-130

A.I.W. MFG. SPEC. ES-7677-3

LOZ HH105JUL JH. 7101

8856-E130A-147-1

For Information Only



* MYLAR TAPE USE IS OPTIONAL. IF USED, IT MAY BE APPLIED UNDER, OVER, OR BOTH UNDER AND OVER ESE TAPE.

ITEM: 1 DIMENSIONAL DRAWING

14 AWG, 2 CONDUCTOR PARALLEL
90°C - 600 VOLT POWER & CONTROL CABLE
EPR INSULATION WITH HYPALON JACKET
HYPALON JACKET OVERALL

NOTE: VOIDS FILLED WITH FLAME RESISTANT FILLERS, WHERE NECESSARY.

SUPPLIER: PAIGE ELECTRIC CORP, UNION, N.J. P.O. PEN 8275

AMERICAN INSULATED WIRE CORPORATION

PAWTUCKET, RHODE ISLAND

NO.	REVISIONS	BY	DATE	ENG APPR.
0	ORIGINAL ISSUE		7-23-79	

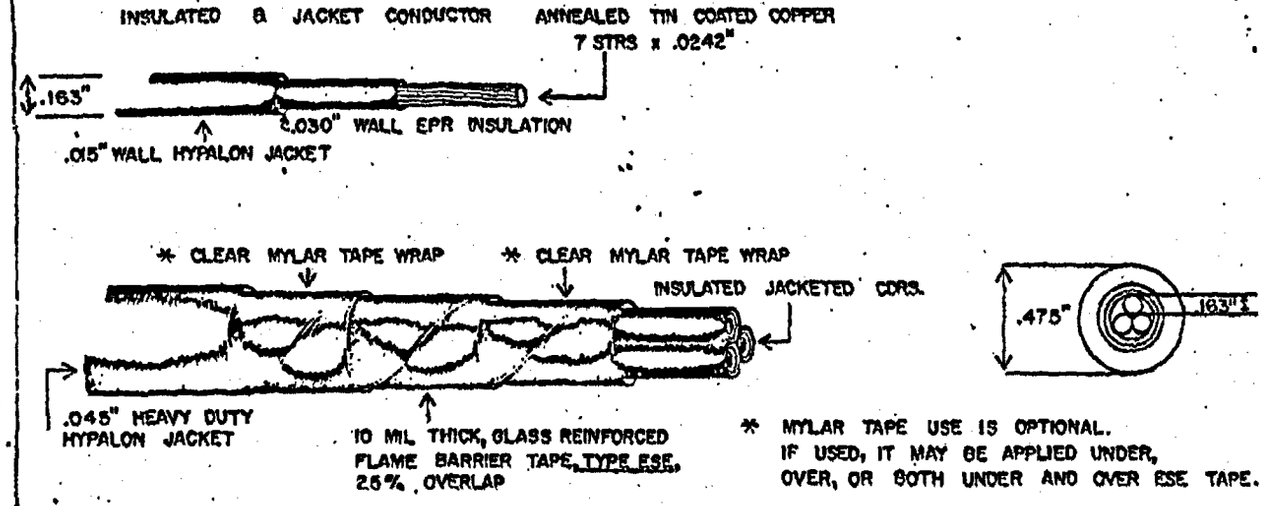
FOR: BECHTEL POWER CORP
c/o SUSQUEHANNA STEAM ELECTRIC PLANT.
PENNSYLVANIA POWER & LIGHT
BECHTEL 8856-E-130

A.I.W. MFG. SPEC. ES-7675-2 FLT

L03 FF105501 Jh. 4801

8856-E130A-148-1

For Information Only



ITEM: 2 DIMENSIONAL DRAWING

14 AWG, 3 CONDUCTOR ROUND
90°C - 600 VOLT POWER & CONTROL CABLE
EPR INSULATION WITH HYPALON JACKET
HYPALON JACKET OVERALL

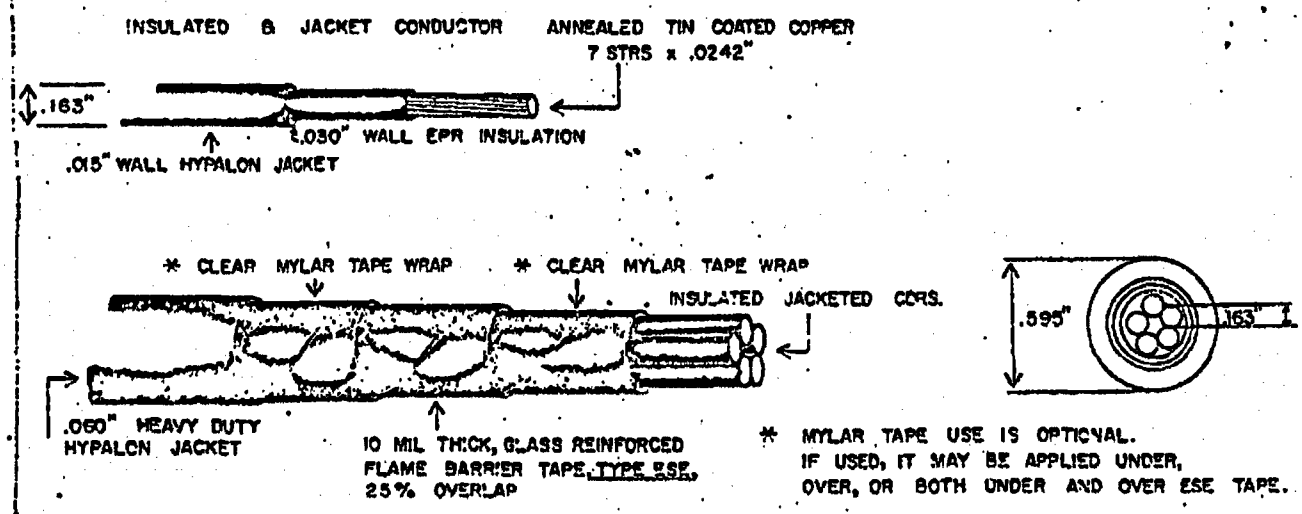
NOTE: VOIDS FILLED WITH FLAME RESISTANT FILLERS, WHERE NECESSARY.

SUPPLIER: PAIGE ELECTRIC CORP. UNION, N.J. P.O. PEH 8275

AMERICAN INSULATED WIRE CORPORATION PAWTUCKET, RHODE ISLAND						FOR: BECHTEL POWER CORP. c/o SUSQUEHANNA STEAM ELECTRIC PLANT. PENNSYLVANIA POWER & LIGHT
	0	ORIGINAL ISSUE	9	7-24-79	ap	BECHTEL 8856-E-130
	NO.	REVISIONS	QTY	DATE	ENG APPR.	A.I.W. MFG. SPEC. ES-7878-3

L05 FF 103301 Sh. 4401

8856-E130A-149-1



ITEM: 3 DIMENSIONAL DRAWING

14 AWG, 5 CONDUCTOR ROUND
90°C - 600 VOLT POWER & CONTROL CABLE
EPR INSULATION WITH HYPALON JACKET
HYPALON JACKET OVERALL

NOTE: VOIDS FILLED WITH FLAME RESISTANT FILLERS, WHERE NECESSARY.

SUPPLIER: PAIGE ELECTRIC CORP. UNION, N.J. RO. REH 8275

AMERICAN INSULATED WIRE CORPORATION
PAWTUCKET, RHODE ISLAND

NO	REVISIONS	BY	DATE	ENG APPR.
0	ORIGINAL ISSUE		7-10-79	

FOR: BECHTEL POWER CORP
c/o SUSQUEHANNA STEAM ELECTRIC PLANT.
PENNSYLVANIA POWER & LIGHT
BECHTEL 8856-E-130

A.I.W. MFG. SPEC. ES-7875-5

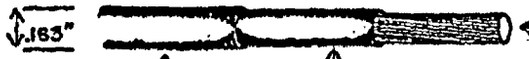
For Information Only

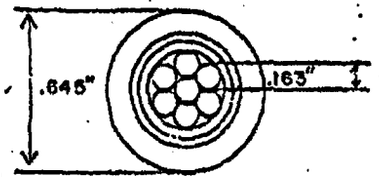
LOT FF103301 Sh. 5001

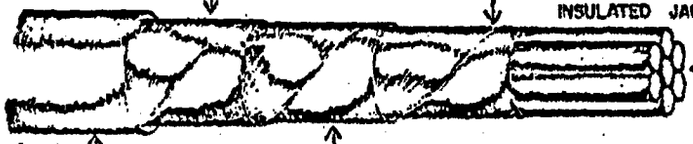
8856-E130A-150-1

For Information Only

INSULATED & JACKET CONDUCTOR ANNEALED TIN COATED COPPER
7 STRS x .0242"







* MYLAR TAPE USE IS OPTIONAL. IF USED, IT MAY BE APPLIED UNDER, OVER, OR BOTH UNDER AND OVER ESE TAPE.

ITEM: 4 DIMENSIONAL DRAWING

14 AWG, 7 CONDUCTOR ROUND
90°C - 600 VOLT POWER & CONTROL CABLE
EPR INSULATION WITH HYPALON JACKET
HYPALON JACKET OVERALL

NOTE: VOIDS FILLED WITH FLAME RESISTANT FILLERS, WHERE NECESSARY.

SUPPLIER: PAIGE ELECTRIC CORP. UNION, N.J. P.O. PEH 8275

AMERICAN INSULATED WIRE CORPORATION PAWTUCKET, RHODE ISLAND					FOR: BECHTEL POWER CORP. c/o SUSQUEHANNA STEAM ELEC. PLANT PENNSYLVANIA POWER & LIGHT
	0	ORIGINAL ISSUE		7-30-79	BECHTEL 8856-E-130
	NO.	REVISIONS	BY	DATE	ENG APPR. A.I.W. MFG. SPEC. ES-7875-7

Information Only
CHANGES REVISION 1

N09 FF103310 Sh. 301

8856-E13/A-3-3

Bechtel Tag Number N09
Item 5

SAMUEL MOORE PART NUMBER 1935-60933-001

Nine (9) conductors of sixteen (16) gauge, seven (7) strand tinned copper with twenty (20) mils EPDM primary insulation and ten (10) mils Hypalon intermediate jacket; color coded per IPCEA, Method #4, all conductors colored white and numbered; a sixteen (16) gauge, seven (7) strand tinned copper drain wire with two (2.0) mils Aluminum/Mylar tape shield and five (5.0) mils silicone rubber fiberglass fire barrier and sixty (60) mils black Hypalon outer jacket.

Maximum O.D.	.674 inches
Net Weight per MFT	217 lbs.
Maximum Length	6,700 feet
Maximum Pulling Tension	196 lbs.

RECEIVED
AUG 1 1977
SUSQUEHANNA PROJ.

Jacket Legend: Dekoron Dekorad Control Cable 1935
Samuel Moore
Aurora, O
1976/Lot Number

FINAL DRAWING MUST SHOW:
CERTIFIED CORRECT FOR:
1935-60933-001
BECHTEL P.O. 8856-131-A
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2
PENNSYLVANIA POWER AND LIGHT COMPANY
Signed [illegible]
Date: 6/16/77

RECEIVED
AUG 9 1977
NQA SECTION

PART NO. 1935-60933-001

SAMUEL MOORE AND CO. Aurora, Ohio	PRODUCT SPECIFICATION		SHEET 1 OF 1
	APPD.	DATE 6/16/77	PART NO. 1935-60933-001

For Information Only

CHANGES REVISION 2

Q11 FF 103310 Sh. 2501

Bechtel Tag Number Q-11
Item 38

8856-E131-A-25-3

SAMUEL MOORE PART NUMBER 1990-90036

Thirteen (13) conductors; one pair of twenty (20) gauge, type KX (chromel alumel) solid conductors with twenty (20) mils EPDM primary insulation and ten (10) mils Hypalon intermediate jacket, color coded per ANSI standards; eleven (11) conductors of twenty (20) gauge, seven (7) strand tinned copper with twenty (20) mils EPDM primary insulation and ten (10) mils Hypalon intermediate jacket, color coded per IPCEA, Method #4, all conductors colored white and numbered; one and five tenths (1.5) mils clear Mylar overwrap with one and seven tenths (1.7) mils copper/Mylar tape shield with a twenty (20) gauge, seven (7) strand bare copper drain wire and five (5.0) mils silicone rubber fiberglass fire barrier overall and sixty (60) mils black Hypalon outer jacket.

Maximum O.D.	.681 inches
Net Weight per MFT	187.3 lbs.
Maximum Length	6,650 feet
Maximum Pulling Tension	116 lbs.

RECEIVED
AUG 1 1977
SUSQUEHANNA PROJ.

Jacket Legend: Dekoron Dekorad 1990
Samuel Moore
Aurora, O
1976/Lot Number

FINAL DRAWING MUST SHOW:

CERTIFIED CORRECT FOR:
1990-90036

BECHTEL P. O. 8856-131-A
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2
PENNSYLVANIA POWER AND LIGHT CO.
Signed [illegible]
Date: 7/1/77

RECEIVED
AUG 9 1977
N.Q.A. SECTION

PART NO. 1990-90036

SAMUEL MOORE AND CO. Aurora, Ohio	PRODUCT DESCRIPTION		SHEET 1 OF 1
	APPD.	DATE 7/1/77	PART NO. 1990-90036

For Information Only
CHANGES REVISION 1
Q20 FF103310 Sh. 701

8856-E131-A-7.3

Bechtel Tag Number Q-20
Item 9

SAMUEL MOORE PART NUMBER 1935-02733-001

Twenty-seven (27) conductors of twenty (20) gauge, seven (7) strand tinned copper with twenty (20) mils EPDM primary insulation and ten (10) mils Hypalon intermediate jacket; color coded per IPCEA, Method #4, all conductors colored white and numbered; a twenty (20) gauge, seven (7) strand tinned copper drain wire with two (2.0) mils Aluminum/Mylar tape shield and five (5.0) mils silicone rubber fiberglass fire barrier and sixty (60) mils black Hypalon outer jacket.

Maximum O.D.	.859 inches
Net Weight per MFT	308.3 lbs.
Maximum Length	3,750 feet
Maximum Pulling Tension	217 lbs.

RECEIVED
AUG 1 1977
SUSQUEHANNA PROJ.

Jacket Legend: Dekoron Dekorad Control Cable 1935
Samuel Moore
Aurora, O
1976/Lot Number

FINAL DRAWING MUST SHOW:
CERTIFIED CORRECT FOR:
1935-02733-001
BECHTEL P.O. 8856-131-A
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2
PENNSYLVANIA POWER AND LIGHT CO.
Signed [illegible]
Date: 6/16/77

RECEIVED
AUG 9 1977
NQA SECTION

PART NO. 1935-02733-001

SAMUEL MOORE AND CO. Aurora, Ohio	PRODUCT DESCRIPTION		SHEET 1 OF 1
	APPD.	DATE 6/16/77	PART NO. 1935-02733-001

For Information Only
CHANGES REVISION 1
Q24 FF 103310 Sh. 1401

8856-E131-A-14-3

Bechtel Tag Number Q-24
Item 18

SAMUEL MOORE PART NUMBER 1952-68340-002

One (1) pair of sixteen (16) gauge, seven (7) strand tinned copper conductors with twenty (20) mils EPDM primary insulation and ten (10) mils Hypalon intermediate jacket; color coded black and white with a sixteen (16) gauge, seven (7) strand tinned copper drain wire; two (2.0) mils Aluminum/Mylar tape shield and forty-five (45) mils black Hypalon outer jacket.

Maximum O.D.	.376 inches
Net Weight per MFT	67.5 lbs.
Maximum Length	10,000 feet
Maximum Pulling Tension	59 lbs.

RECEIVED
AUG 1 1977
SUSQUEHANNA PROJ.

Jacket Legend: Dekoron Dekorad Instrument Wire 1952
Samuel Moore
Aurora, Ohio
1976/Lot Number

FINAL DRAWING MUST SHOW:
CERTIFIED CORRECT FOR:
1952-68340-002
BECHTEL P.O. 8856-131-A
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2
PENNSYLVANIA POWER AND LIGHT CO.
Signed Alan P. Connelly
Date: 6/16/77

RECEIVED
AUG 9 1977
NUCLEAR SECTION

PART NO. 1952-68340-002

SAMUEL MOORE AND CO. Aurora, Ohio	PRODUCT DESCRIPTION		SHEET 1 OF 1
	APPD.	DATE 6/16/77	PART NO. 1952-68340-002

For Information Only

Q24A

PRODUCT SPECIFICATION

DEKORON PART NUMBER 1H52-68340-005

ONE PAIR, 18 AWG, 7 STRAND TINNED COPPER WIRE WITH 25 MIL THICK FR-EPDM (FIRE RETARDANT ETHYLENE PROPYLENE DIENE MONOMER) PRIMARY INSULATION. COLOR CODED BLACK AND WHITE. AN OVERALL 2.0 MIL THICK ALUMINUM/MYLAR SHIELD TAPE AND AN 18 AWG, 7 STRAND TINNED COPPER DRAIN WIRE. A 45 MIL THICK BLACK HYPALON JACKET. 600 VOLT RATED.

JACKET LEGEND: DEKORON ELASTOSET INSTR CABLE 1PR 18AWG CU FREPDM / HYPALON SHLD 600V AURORA, OHIO (YR OF MFG) FURON (LOT #) (SEQ FTG)

MAXIMUM O.D. (INCHES):	0.343
MINIMUM BEND RADIUS (INCHES):	2.058
MAXIMUM PULLING TENSION (LBS):	54.24
NET WEIGHT (LBS/1000 FT):	53.00
CALCULATED MAXIMUM LENGTH (FEET):	10,000

Page 2

FF61954, SH 44

FURON
DEKORON
JUNE 21, 1990

For Information Only REVISION 2
CHANGES

Q25 FF103310 Sh. 1501

Bechtel Tag Number Q-25
Item 19

8856-E18/4-15-3

SAMUEL MOORE PART NUMBER 1974-50233-001

Two (2) pair of sixteen (16) gauge, nineteen (19) strand tinned copper conductors with twenty (20) mils EPDM primary insulation and ten (10) mils Hypalon intermediate jacket; color coded black, white and numbered on the white leg with a sixteen (16) gauge, seven (7) strand tinned copper drain wire; two (2.0) mils aluminum/Mylar tape shield and one and five tenths (1.5) mils Mylar separator tape over each pair; five (5.0) mils silicone rubber fiberglass fire barrier overall and sixty (60) mils black Hypalon outer jacket.

Maximum O.D.	.621 inches
Net Weight per MFT	172.7 lbs.
Maximum Length	7,000 feet
Maximum Pulling Tension	98 lbs.

Jacket Legend: Dekoron Dekorad Instrument Wire 1974
Samuel Moore
Aurora, O
1976/Lot Number

RECEIVED
AUG 1 1977
SUSQUEHANNA PROJ.

FINAL DRAWING MUST SHOW:
CERTIFIED CORRECT FOR:
1974-50233-001

RECEIVED
AUG 9 1977
NOS SECTION

BECHTEL P. O. 8856-131-A
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2
PENNSYLVANIA POWER AND LIGHT CO.
Signed Oscar P. Cornelia
Date: 7/1/77

PART NO. 1974-50233-001

SAMUEL MOORE AND CO. Aurora, Ohio	PRODUCT DESCRIPTION		SHEET 1 OF 1
	APPD.	DATE 7/1/77	PART NO. 1974-50233-001

or Information Only CHANGES REVISION 2

Q26 FF103310 Sh. 1601

Bechtel Tag Number Q-26
Item 20

8856-E131-A-16-3

SAMUEL MOORE PART NUMBER 1974-50333-001

Three (3) pair of sixteen (16) gauge, nineteen (19) strand tinned copper conductors with twenty (20) mils EPDM primary insulation and ten (10) mils Hypalon intermediate jacket; color coded black, white and numbered on the white leg with a sixteen (16) gauge, 7 strand tinned copper drain wire; two (2.0) mils aluminum/Mylar tape shield and one and five tenths (1.5) mils Mylar separator tape over each pair; five (5.0) mils silicone rubber fiberglass fire barrier overall and sixty (60) mils black Hypalon outer jacket.

Maximum O.D.	.685 inches
Net Weight per MFT	221.5 lbs.
Maximum Length	5,500 feet
Maximum Pulling Tension	137 lbs.

Jacket Legend: Dekoron Dekorad Instrument Wire 1974
Samuel Moore
Aurora, O
1976/Lot Number

RECEIVED
AUG 1 1977
SUSQUEHANNA PROJ.

FINAL DRAWING MUST SHOW:
CERTIFIED CORRECT FOR:
1974-50333-001

BECHTEL P. O. 8856-131-A
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2
PENNSYLVANIA POWER AND LIGHT CO.

RECEIVED
AUG 9 1977

Signed [illegible]
Date: 7/1/77

PART NO. 1974-50333-001

SAMUEL MOORE AND CO. Aurora, Ohio	PRODUCT DESCRIPTION		SHEET 1 OF 1
	APPD.	DATE 7/1/77	PART NO. 1974-50333-001

For Information Only

CHANGES REVISION 2

Q27 FF103310 Sh. 1701

8856-E131-A-17-3

Bechtel Tag Number Q-27
Item 21

SAMUEL MOORE PART NUMBER 1974-50733-001

Seven (7) pair of sixteen (16) gauge, nineteen (19) strand tinned copper conductors with twenty (20) mils EPDM primary insulation and ten (10) mils Hypalon intermediate jacket; color coded black, white and numbered on the white leg with a sixteen (16) gauge, seven (7) strand tinned copper drain wire; two (2.0) mils aluminum/Mylar tape shield and one and five tenths (1.5) mils Mylar separator tape over each pair; five (5.0) mils silicone rubber fiberglass fire barrier overall and sixty (60) mils black Hypalon outer jacket.

Maximum O.D.	.888 inches
Net Weight per MFT	451.7 lbs.
Maximum Length	3,000 feet
Maximum Pulling Tension	294 lbs.

Jacket Legend: Dekoron Dekorad Instrument Wire 1974
Samuel Moore
Aurora, O
1976/Lot Number

RECEIVED AUG 1 1977 SUSQUEHANNA PROJ.

FINAL DRAWING MUST SHOW:
CERTIFIED CORRECT FOR:
1974-50733-001

RECEIVED AUG 9 1977 N. SECTION

BECHTEL P. O. 8856-131-A
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2
PENNSYLVANIA POWER AND LIGHT CO.
Signed [illegible]
Date: 7/1/77

PART NO. 1974-50733-001

SAMUEL MOORE AND CO. Aurora, Ohio	PRODUCT DESCRIPTION		SHEET 1 OF 1
	APPD.	DATE 7/1/77	PART NO. 1974-50733-001

For Information Only
CHANGES REVISION 1
Q28 FF103310 Sh. 1801

8856-E131-A-18-B

Bechtel Tag Number Q-28
Item 22

SAMUEL MOORE PART NUMBER 1962-68340-002

Three (3) conductors of sixteen (16) gauge, seven (7) strand tinned copper conductors with twenty (20) mils EPDM primary insulation and ten (10) mils Hypalon intermediate jacket; color coded per IPCEA, Method #4, all conductors colored white and numbered with a sixteen (16) gauge, seven (7) strand tinned copper drain wire; two (2.0) mils Aluminum/Mylar tape shield and forty-five (45) mils black Hypalon outer jacket.

Maximum O.D.	.397 inches
Net Weight per MFT	82.2 lbs.
Maximum Length	9,300 feet
Maximum Pulling Tension	78 lbs.

RECEIVED
AUG 1 1977
SUSQUEHANNA PROJ.

Jacket Legend: Dekoron Dekorad Instrument Wire 1962
Samuel Moore
Aurora, O
1976/Lot Number

FINAL DRAWING MUST SHOW:
CERTIFIED CORRECT FOR:
1962-68340-002
BECHTEL P.O. 8856-131-A
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2
PENNSYLVANIA POWER AND LIGHT CO.
Signed [illegible]
Date: 6/16/77

RECEIVED
AUG 9 1977
N[illegible]

PART NO. 1962-68340-002

SAMUEL MOORE AND CO. Aurora, Ohio	PRODUCT DESCRIPTION		SHEET 1 OF 1
	APPD.	DATE 6/16/77	PART NO. 1962-68340-002

or Information Only

CHANGES REVISION 2

Q29 FF 103310 Sh. 1901

Bechtel Tag Number Q-29
Item 23

8856-E131-A-19-3

SAMUEL MOORE PART NUMBER 1984-50333-001

Three (3) triads of sixteen (16) gauge, nineteen (19) strand tinned copper conductors with twenty (20) mils EPDM primary insulation and ten (10) mils Hypalon intermediate jacket; color coded per IPCEA, Method #4, all conductors white and numbered with a sixteen (16) gauge, seven (7) strand tinned copper drain wire; two (2.0) mils aluminum/Mylar tape shield and one and five tenths (1.5) mil Mylar separator tape over each triad; five (5.0) mils silicone rubber fiberglass fire barrier overall and sixty (60) mils black Hypalon outer jacket.

Maximum O.D.	.753 inches
Net Weight per MFT	274.4 lbs.
Maximum Length	4,500 feet
Maximum Pulling Tension	196 lbs.

Jacket Legend: Dekoron Dekorad Instrument Wire 1984
Samuel Moore
Aurora, O
1976/Lot Number

RECEIVED
AUG 1 1977
SUSQUEHANNA PROJ.

RECEIVED
AUG 9 1977
RC - SECTION

FINAL DRAWING MUST SHOW:
CERTIFIED CORRECT FOR:
1984-50333-001

BECHTEL P. O. 8856-131-A

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2
PENNSYLVANIA POWER AND LIGHT CO.

Signed Allan P. Clements

Date: 7/1/77

PART NO. 1984-50333-001

SAMUEL MOORE AND CO. Aurora, Ohio	PRODUCT DESCRIPTION		SHEET 1 OF 1
	APPD.	DATE 7/1/77	PART NO. 1984-50333-001

For [redacted]rmation Only

CHANGES REVISION 2

Q30 FF103310 Sh. 2001

8856-E131-A-20-3

Bechtel Tag Number Q-30
Item 24

SAMUEL MOORE PART NUMBER 1935-50433-001

Four (4) conductors of sixteen (16) gauge, nineteen (19) strand tinned copper with twenty (20) mils EPDM primary insulation and ten (10) mils Hypalon intermediate jacket; color coded per IPCEA, Method #4, all conductors colored white and numbered with a sixteen (16) gauge, seven (7) strand tinned copper drain wire; two (2.0) mils aluminum/Mylar tape shield and five (5.0) mil silicone rubber fiberglass fire barrier and forty-five (45) mil black Hypalon outer jacket

Maximum O.D.	.482 inches
Net Weight per MFT	110.4 lbs.
Maximum Length	10,000 feet
Maximum Pulling Tension	98 lbs.

Jacket Legend: Dekoron Dekorad Control Cable 1935
Samuel Moore
Aurora, O
1976/Lot Number

RECEIVED
AUG 1 1977
SUSQUEHANNA PROJ.

RECEIVED
AUG 9 1977
N[illegible]

FINAL DRAWING MUST SHOW:
CERTIFIED CORRECT FOR:
1935-50433-001
BECHTEL P. O. 8856-131-A
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2
PENNSYLVANIA POWER AND LIGHT CO.
Signed [illegible]
Date: 7/1/77

PART NO. 1935-50433-001

SAMUEL MOORE AND CO. Aurora, Ohio	PRODUCT DESCRIPTION		SHEET 1 OF 1
	APPD.	DATE 7/1/77	PART NO. 1935-50433-001

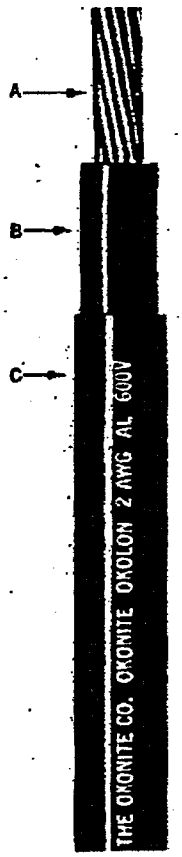
or Information Only

FF103500
Sh. 201

R04

Product Data
Section 3: Sheet 6

Okonite Okolon
Type RHH, RHW, USE
600V Power Cable
One Aluminum Conductor/90C Rating



A Stranded Aluminum Conductor
B Insulation—Okonite—#8 Awg-#2 Awg—45 mils; #1 Awg-#4/0 Awg—55 mils; 250 MCM-500 MCM—65 mils; 750 MCM and 1000 MCM—80 mils
C Jacket—Okolon

Insulation
Okonite® is Okonite's trade name for its heat resistant, mechanically rugged ethylene-propylene based insulating compound. The insulation thickness for wire sizes #6 Awg through #2 Awg is 45 mils; #1 Awg through #4/0 Awg, 55 mils; 250 MCM through 500 MCM, 65 mils, and for 750 MCM and 1000 MCM it is 80 mils.

Jackets and Finishes
The Okolon jacket supplied with this cable is a vulcanized chloro-sulfonated-polyethylene based compound which provides excellent resistance to mechanical abuse, flame, weathering, most oils, acids and alkalies.

Applications
Okonite-Okolon 600 Volt Power Cables are recommended for use in all low voltage circuits where continuity of service is the prime consideration. They can be installed in conduit, underground ducts, approved raceways and direct burial (Sizes #8 Awg and larger). Rated for 75C wet and 90C dry.

Industry Specifications
Conductors: Stranded aluminum conductor per ASTM B-231.
Insulation: Meets or exceeds all requirements of Interim Standard #1 to IPCEA S-68-516 NEMA WC 8 (March 1971) for ethylene propylene rubber insulation and ASTM D 2802-70.
Jacket: Exceeds all requirements of IPCEA S-19-81, (5th Edition) Section 4.13.8 for Heavy Duty, chloro-sulfonated polyethylene.

Product Features
- Extreme heat resistance
  90C continuous rating
  110C hot spot rating
  130C emergency overload rating
  250C short circuit rating
- Exceptional resistance to deformation at high temperature
- Stable electrical properties
- Low SIC and power factor
- Low moisture absorption
- Mechanically rugged
- Resistant to weather, most oils, acids and alkalies

Additional Information
Sizes, Weights and Dimensions are contained on the reverse of this sheet. Price information is presented on separate sheets filed in the back of this section. For additional information contact your local Okonite representative or Service Center Manager.

or ~~Okonite~~ Okolon

Type RHH, RHW, USE

600V Power Cable
One Aluminum Conductor/90C Rating

R04

FF103500
Sh. 201

Product Data
Section 3: Sheet 6

Okonite Insulation: #6 Awg Through #2 Awg, 45 mils; #1 Awg Through #4/0 Awg, 55 mils; 250 MCM Through 500 MCM, 65 mils; 600 MCM Through 1000 MCM, 80 mils.

Catalog Number	Size Awg or MCM	No. of Strands	Jacket Thickness mils	Jacket Thickness mm	Approx. Cable O.D. in.	Approx. Cable O.D. mm	Net Wt. Lbs/M'	Approx. Ship. Wt. Lbs./M'	IPCEA Ampacity ♦	NEC Ampacity ♦♦ 75C Wet	NEC Ampacity ♦♦ 90C Dry
132-11-2221	6	7	30	0.76	.342	8.69	70	100	58	50	65
132-11-2251	4	7	30	0.76	.389	9.88	93	135	76	65	70
132-11-2311	2	7	30	0.76	.448	11.37	128	210	102	90	95
132-11-2331	1	19	45	1.14	.541	13.74	178	294	122	100	110
132-11-2351	1/0	19	45	1.14	.581	14.76	208	325	139	120	125
132-11-2371	2/0	19	45	1.14	.626	15.90	245	363	159	135	145
132-11-2391	3/0	19	45	1.14	.677	17.20	291	409	189	155	165
132-11-2411	4/0	19	45	1.14	.735	18.67	348	505	217	180	185
132-11-2431	250	37	65	1.65	.846	21.49	446	628	249	205	215
132-11-2471	350	37	65	1.65	.950	24.13	574	793	303	250	260
132-11-2531	500	37	65	1.65	1.081	27.46	759	877	381	310	330
132-11-2561	750	61	65	1.65	1.320	33.53	1072	1244	488	385	405
132-11-2651	1000	61	65	1.65	1.473	37.41	1353	1649	578	445	480

Minimum Manufacturing Quantity
Sizes #6 Awg through #2 Awg is 15,000'
Sizes #1 Awg through 1000MCM is 10,000'
Standard Package - #6 Awg-400 MCM – 2500' N. R. Reel, 500 MCM and Larger – 1000' N. R. Reel
Standard Package will be furnished where orders do not specify otherwise

To order a color other than black, change the last digit of the catalog number as follows.

White	2	Orange	5
Red	3	Blue	6
Green	4	Yellow	7

Example: to order #14/Sol – Red, the catalog number would be 112-31-9063

♦ Based on three (3) conductors in a single enclosed or exposed conduit. Current carrying capacities based on 40C air ambient using IPCEA methods. For 30C ambient multiply values by 1.10; for 50C multiply by .90. For other ambients or installation conditions refer to Engineering Data Book

♦♦ Based on NEC Table 310-14. (Not more than three (3) conductors in raceway or cable or direct burial. (Based on Ambient Temperatures of 30C 86F)

THE OKONITE COMPANY
Ramsey, New Jersey 07446

For Information Only
CHANGES REVISION 1
TQ5 FF103310 Sh. 2601

8856-E191-A-26-3

Bechtel Tag Number TQ-5
Item 39

SAMUEL MOORE PART NUMBER 1902-65340-001

One (1) pair of sixteen (16) gauge, type TX (copper constantan) solid conductors with twenty (20) mils EPDM primary insulation and ten (10) mils Hypalon intermediate jacket; color coded per ANSI standards with a sixteen (16) gauge, solid tinned copper drain wire; two (2.0) mils aluminum/Mylar tape shield and forty-five (45) mils blue Hypalon outer jacket.

Maximum O.D.	.362 inches
Net Weight per MFT	68.3 lbs.
Maximum Length	10,000 feet
Maximum Pulling Tension	59 lbs.

Jacket Legend: Dekoron Dekorad Thermocouple Extension Wire 1902
Samuel Moore
Aurora, O
1976/Lot Number

RECEIVED
AUG 1 1977
SUSQUEHANNA PROJ

FINAL DRAWING MUST SHOW:
CERTIFIED CORRECT FOR:
1902-65340-001

BECHTEL P. O. 8856-131-A
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2
PENNSYLVANIA POWER AND LIGHT CO.

RECEIVED
AUG 9 1977
NO. SECTION

Signed [illegible]
Date: 7/1/77

PART NO. 1902-65340-001

SAMUEL MOORE AND CO. Aurora, Ohio	PRODUCT DESCRIPTION		SHEET 1 OF 1
	APPD.	DATE 7/1/77	PART NO. 1902-65340-001

or Information Only

CHANGES REVISION 2

TQ6 FF103510 Sh. 4101

8856-E131-A-41-2

Bechtel Tag Number TQ-6
Item 40

SAMUEL MOORE PART NUMBER 1924-612A3-001

Twelve (12) pair of sixteen (16) gauge, type TX (copper constantan) solid conductors with twenty (20) mils EPDM primary insulation and ten (10) mils Hypalon intermediate jacket; color coded per ANSI standards; each pair shielded with a sixteen (16) gauge, solid tinned copper drain wire and two (2.0) mil aluminum/Mylar tape shield and one and five tenths (1.5) mil Mylar separator; five (5.0) mils silicone rubber fiberglass fire barrier overall and eighty (80) mils blue Hypalon outer jacket.

Maximum O.D.	1.132 inches
Net Weight per MFT	646 lbs.
Maximum Length	2,400 feet
Maximum Pulling Tension	490 lbs.

RECEIVED
AUG 1 1977
SUSQUEHANNA PROJ.

Jacket Legend: Dekoron Dekorad Thermocouple Extension Wire 1924
Samuel Moore
Aurora, O
1976/Lot Number

FINAL DRAWING MUST SHOW:
CERTIFIED CORRECT FOR:
1924-612A3-001
BECHTEL P.O. 8856-131-A
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 AND 2
PENNSYLVANIA POWER AND LIGHT CO.
Signed Oscar P. Camenta
Date: 7/1/77

PART NO. 1924-612A3-001

SAMUEL MOORE AND CO. Aurora, Ohio	PRODUCT DESCRIPTION		SHEET 1 OF 1
	APPD.	DATE 7/1/77	PART NO. 1924-612A3-001

For Information Only
CHANGES REVISION 2

TQ8 FF 103310 Sh. 4301

8856-E131-A-43-2

Bechtel Tag Number TQ-8
Item 47

SAMUEL MOORE PART NUMBER 1902-03340-001

One (1) pair of twenty (20) gauge solid type KX (chromel alumel) conductors with twenty (20) mils EPDM primary insulation and ten (10) mils Hypalon intermediate jacket; color coded per ANSI standards; eighteen gauge, solid tinned copper drain wire; two (2.0) mils aluminum/Mylar tape shield and forty-five (45) mils yellow Hypalon outer jacket.

Maximum O.D.	.324 inches
Net Weight per MFT	45.5 lbs.
Maximum Length	10,000 feet
Maximum Pulling Tension	23 lbs.

RECEIVED
AUG 1 1977
SUSQUEHANNA PROJ.

Jacket Legend: Dekoron Dekorad Thermocouple Extension Wire 1902
Samuel Moore
Aurora, O
1976/Lot Number

FINAL DRAWING MUST SHOW:
CERTIFIED CORRECT FOR:
1902-03340-001
BECHTEL P.O. 8856-131-A
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 and 2
PENNSYLVANIA POWER AND LIGHT CO.
Signed [illegible]
Date: 7/1/77

PART NO. 1902-03340-001

SAMUEL MOORE AND CO. Aurora, Ohio	PRODUCT DESCRIPTION		SHEET 1 OF 1
	APPD.	DATE 7/1/77	PART NO. 1902-03340-001

U07

FF 61882 Sh. 5

PRODUCT CODE: C53-0070 CONSTRUCTION DETAILS

DESCRIPTION: 7/C 14 AWG FIREWALL III 600V

MINIMUM BENDING RADIUS (DURING INSTALLATION):	1.25	INCHES
MINIMUM BENDING RADIUS (PERMANENT TRAINING):	.75	INCHES
MAXIMUM PULLING TENSION (STRAIGHT RUNS):	229	LBS
MAXIMUM SIDEWALL PRESSURE:	1000 LBS/FT OF BEND RADIUS	

	INCORPORATE ECN 1				
KEY	DESCRIPTION	DR	CK	APPROVED	DATE

FF61882 5 9

E0785-5 sh 1

THE ROCKBESTOS COMPANY

A MEMBER OF THE HARMON GROUP

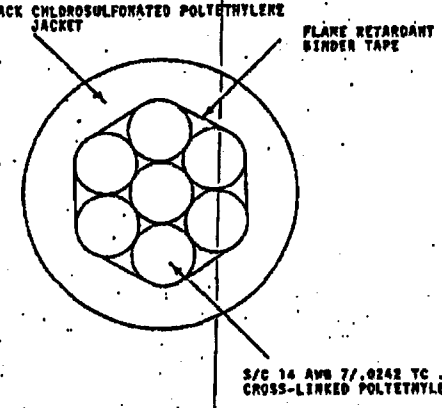
DRAWN: DEM DATE: 8/7/91

REVISION	DATE	INIT.

For Information Only

PRODUCT CODE: C53-0070 CONSTRUCTION DETAILS

PPL CABLE CODE U07



DESCRIPTION: 7/C 14 AWG FIREWALL III 600V

CIRCUIT IDENTIFICATION: ICEA METHOD 1 K1

PRINT LEGEND TO INCLUDE:

"7/C 14 AWG COPPER ROCKBESTOS® 600V 90°C FIREWALL® III XLPE CSPE® YEAR MANUFACTURED, TRACEABILITY NO. & SEQUENTIAL FOOTAGE

DIAMETERS: NOMINAL: .610" MAXIMUM: .880"

NOMINAL WEIGHT: 190 Lbs/M'

THE ROCKBESTOS COMPANY

A MEMBER OF THE HARMON GROUP

DRAWN: DEM DATE: 8/7/91

REVISION	DATE	INIT.

PRODUCT CODE: CS3-0070 CONSTRUCTION DETAILS

DESCRIPTION: 7/C 14 AWG FIREWALL III GOOV

MINIMUM BENDING RADIUS (DURING INSTALLATION): 1.25 INCHES

MINIMUM BENDING RADIUS (PERMANENT TRAINING): .75 INCHES

MAXIMUM PULLING TENSION (STRAIGHT RUNS): 229 LBS

MAXIMUM SIDEWALL PRESSURE: 1000 LBS/FT OF BEND RADIUS

REV	DESCRIPTION	DR	CK	APPROVED	DATE
0					

PPL 61852 5 0

E915-5 sh 1

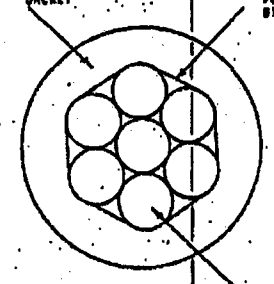
THE ROCKBESTOS COMPANY

A MEMBER OF THE HARNON GROUP

DRAWN	DCN	DATE
REVISION	DATE	INIT.

PRODUCT CODE: CS3-0070 CONSTRUCTION DETAILS

PPL CABLE CODE U07



DESCRIPTION: 7/C 14 AWG FIREWALL III GOOV

CIRCUIT IDENTIFICATION: ICEA METHOD 1 X1

PRINT LEGEND TO INCLUDE:

"7/C 14 AWG COPPER ROCKBESTOS® GOOV 90°C FIREWALL® III ILPE CSP" YEAR MANUFACTURED, TRACEABILITY NO. & SEQUENTIAL FOOTAGE

DIAMETERS: NOMINAL: .610" MAXIMUM: .550"

NOMINAL WEIGHT: 190 Lbs/M'

THE ROCKBESTOS COMPANY

A MEMBER OF THE HARNON GROUP

DRAWN	DCN	DATE
REVISION	DATE	INIT.

PP&L IDCN

Preparer: NA

Reviewer:

Approved:

Description of Change

IDCN Page No. 1 of 1

KP Page No.

Notification Package No.

Drawing No.

Sheet No. 5

Revision No. 0

IDCN No.

System Affected No.

Superseded/Cancelled IDCN/PCN No. NA

For Information Only

U63 FF61882 Sh. 8

PRODUCT CODE: P62-0064 CONSTRUCTION DETAILS

DESCRIPTION: 3/C 6 AWG FIREWALL III 600V WITH 3-12 AWG GROUNDWIRES

MINIMUM BENDING RADIUS (DURING INSTALLATION): 2.50 INCHES

MINIMUM BENDING RADIUS (PERMANENT TRAINING): 1.25 INCHES

MAXIMUM PULLING TENSION (STRAIGHT RUNS): 820 LBS

MAXIMUM SIDEWALL PRESSURE: 1000 LBS/FT OF BEND RADIUS

RE-ISSUED

PRV	DESCRIPTION	DR	CH	APPROVED	DATE
	DYCOMS VOCN 1 (DCP 91-3014-1)				

FF61882 8 D

E915-9 Sh. 1

CONSTRUCTION MATERIAL WT. - 200 LBS/KFT

HEAT OF CONSTRUCTION - 1000 BTU/FT

THE ROCKBESTOS COMPANY

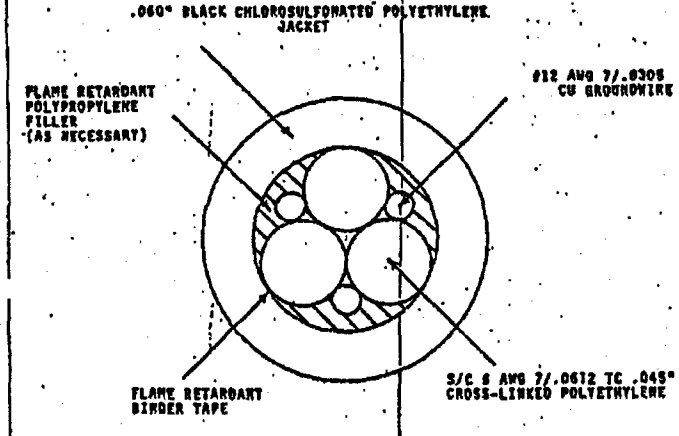
A MEMBER OF THE HARVEY GROUP

DRAWN: DCA DATE: 8/7/91

REVISION	DATE	INIT.

PRODUCT CODE: P62-0064 CONSTRUCTION DETAILS

PPIL CABLE CODE U63



DESCRIPTION: 3/C 6 AWG FIREWALL III 600V WITH 3-12 AWG GROUNDWIRES

CIRCUIT IDENTIFICATION: ICEA METHOD 4

PRINT LEGEND TO INCLUDE:

"3/C 6 AWG COPPER ROCKBESTOS® 600V FIREWALL®III XHHW-2 90°C SUN RES OIR BUR OIL RES II REC TYPE TC (UL) FR XLPE CSPE" YEAR MANUFACTURED, TRACEABILITY NO. & SEQ FOOTAGE

DIAMETERS: NOMINAL: .740" MAXIMUM: .790"

NOMINAL WEIGHT: 504 LBS/M'

THE ROCKBESTOS COMPANY

A MEMBER OF THE HARVEY GROUP

DRAWN: BRM DATE: 8/7/91

REVISION	DATE	INIT.

FOR INTERNAL USE ONLY

Attachment 2 to EC-059-1041

U63 FF61882 Sh. 8

PRODUCT CODE: P62-0064 CONSTRUCTION DETAILS

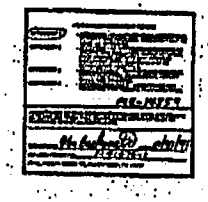
DESCRIPTION: 3/C 6 AWG FIREWALL III 600V WITH 3-12 AWG GROUNDWIRES

MINIMUM BENDING RADIUS (DURING INSTALLATION): 5.50 INCHES

MINIMUM BENDING RADIUS (PERMANENT TRAINING): 1.25 INCHES

MAXIMUM PULLING TENSION (STRAIGHT RUNS): 829 LBS

MAXIMUM SIDEWALL PRESSURE: 1000 LBS/FT OF BEND RADIUS



REV	DESCRIPTION	DR	CK	APPROVED	DATE
0					

FF61882 8 0

E915-9 Sh 1.

THE ROCKBESTOS COMPANY

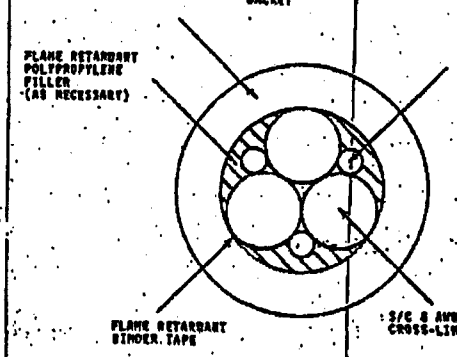
A MEMBER OF THE HUBBELL GROUP

DRAWN: DGM DATE: 6/7/93

REVISION DATE INIT.

PRODUCT CODE: P62-0064 CONSTRUCTION DETAILS

TPIL CABLE CODE U63



DESCRIPTION: 3/C 6 AWG FIREWALL III 600V WITH 3-12 AWG GROUNDWIRES

CIRCUIT IDENTIFICATION: ICEA METHOD 4

PRINT LEGEND TO INCLUDE:

"3/C 6 AWG COPPER ROCKBESTOS® 600V FIREWALL® III XHHW-2 90°C SUN RES DIR BUR OIL RES II NEC TYPE TC (UL) FR XLPE CSPE" YEAR MANUFACTURED, TRACEABILITY NO. & SEQ FOOTAGE

DIAMETERS: NOMINAL: .740" MAXIMUM: .790"

NOMINAL WEIGHT: 506 Lbs/M'

THE ROCKBESTOS COMPANY

A MEMBER OF THE HUBBELL GROUP

DRAWN: DGM DATE: 6/7/93

REVISION DATE INIT.

PPAL IDCN

Security Design Change Notice

Preparer: MA

Reviewer: AC Lipinski

Description of Change

IDCN Page No. 1 of 1

NP Page No. 18

Modification Package No. 91-20NED P1

Drawing No. FF61882 Sh 8

Sheet No. 8

Revision No. 0

IDCN No. 1

System Affected No. 1E1A-1E1A

Supersedes/Cancels IDCN/PCN No. NA

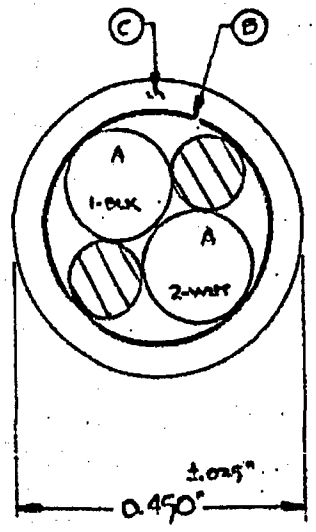
For Information Only

For Information Only

E401_12_2

BIW PART # 13231-H-002

PENNSYLVANIA POWER & LIGHT CO.
BECHTEL SPEC 8856-E-401
P.O. #8856-E-401-AC, ITEM 1 (C02)



A, 2 x BIW #12199-H-614 (#14 AWG, 7/.0242" TINNED COPPER, ETHYLENE PROPYLENE RUBBER WITH CHLOROSULFONATED POLYETHYLENE JACKET, .030"/.015" WALLS, PRINTED COLOR CODE, OD 0.169".
B, FLAME RETARDANT NEOPRENE-GLASS TAPE.
C, CHLOROSULFONATED POLYETHYLENE JACKET, .045" WALL, JACKET PRINT: "BIW CABLE SYSTEMS INC. (YEAR), 2/C #14 AWG, 600 VOLT, SEQUENTIAL FOOTAGE".
D, GLASS FIBER FILLER.

Certified correct JR Shaw 6/11/81

The subject matter of this print is strictly confidential and shall be used for any purpose other than to manufacture and deliver Boston Insulated Wire & Cable Co. products. All rights herein are reserved and no print may be copied or distributed in part or in whole without specific permission from the Boston Insulated Wire & Cable Co.

COPYRIGHT 1981
BOSTON INSULATED
WIRE & CABLE CO.

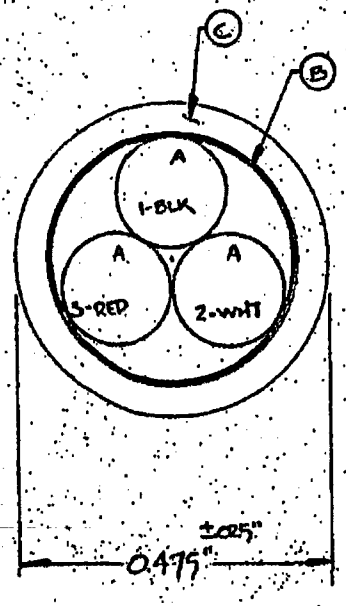
SCALE —A—	DO NOT SCALE DWG.	FINISH	No.	CHANGE	DATE / BY
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED				REVISIONS	
DIMENSION TOLERANCES UNLESS OTHERWISE SPECIFIED		DR'N GP DATE 5-11-81	TITLE 2/C #14 AWG BIW Part #13231-H-002 Pennsylvania Power & Light Co. Bechtel Spec 8856-E-401 P.O. #8856-E-401-AC, Item 1 (C02)		PART NO.
FRACTIONAL DIMENSIONS ±		CHK'D DATE 5/11/81			
DECIMAL DIMENSIONS ±		APR'D DATE 6/10/81			DRAWING NO.
ANGULAR DIMENSIONS ±		BIW BOSTON INSULATED WIRE & CABLE CO.			

Z02 FF103950 Sh. 1Z01

E401-13-2

BIW PART # 13232-H-003

PENNSYLVANIA POWER & LIGHT CO.
BECHTEL SPEC. 8856-E-401
P.O. # 8856-E-401-AC, ITEM 2 (L03)



A, 3 - BIW #12199-H-G14 (#14 AWG, 7/.0242" TINNED COPPER, ETHYLENE PROPYLENE RUBBER WITH CHLOROSULFONATED POLYETHYLENE JACKET, .030/.015" WALLS, PRINTED COLOR CODE, OD 0.169".
B, FLAME RETARDANT NEOPRENE-GLASS TAPE.
C, CHLOROSULFONATED POLYETHYLENE JACKET, .045" WALL, JACKET PRINT: "BIW CABLE SYSTEMS INC. (YEAR) 3/C-#14 AWG, 600 VOLT, SEQUENTIAL FOOTAGE".

Certified correct
J.R. Bam
6/11/81

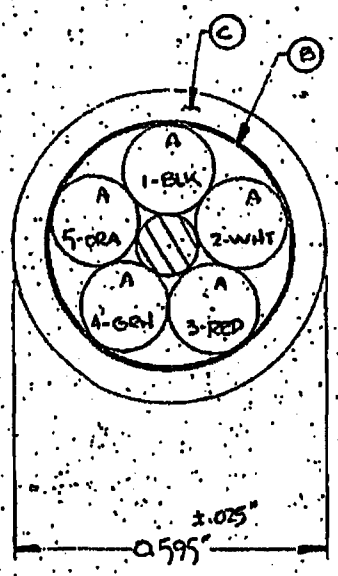
COPYRIGHT 1981
BOSTON INSULATED
WIRE & CABLE CO.

SCALE —	DO NOT SCALE DWG.	FINISH	No.	CHANGE	DATE / BY
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED				REVISIONS	
DIMENSION TOLERANCES UNLESS OTHERWISE SPECIFIED		DRN DATE 5-11-81	TITLE 3/C #14 AWG BIW Part #13232-H-003 Pennsylvania Power & Light Co. Bechtel Spec 8856-E-401 P.O. #8856-E-401-AC, Item 2 (L03)		PART NO.
FRACTIONAL DIMENSIONS ±		CHK DATE 6/11/81			
DECIMAL DIMENSIONS ±		APR DATE 6/11/81			DRAWING NO.
ANGULAR DIMENSIONS ±		BIW BOSTON INSULATED WIRE & CABLE CO.			

E401-2-2

BIW PART # 13234-H-005

PENNSYLVANIA POWER & LIGHT CO.
BECHTEL SPEC 8856-E-401
P.O. # 8856-E-401-AC, ITEM 3 (L05)



A, 5 - BIW # 12199-H-G14 (#14 AWG, 7/.0242" TINNED COPPER, ETHYLENE PROPYLENE RUBBER WITH CHLOROSULFONATED POLYETHYLENE JACKET .030/.015" WALLS, PRINTED COLOR CODE, OD 0.169"
B, FLAME RETARDANT NEOPRENE-GLASS TAPE.
C, CHLOROSULFONATED POLYETHYLENE JACKET, .060" WALL, JACKET PRINT: "BIW CABLE SYSTEMS INC (YEAR) 5/C #14 AWG, 600 VOLT, SEQUENTIAL FOOTAGE".
D GLASS FIBER FILLER.

Certified Correct
JR Lowe
6/15/81

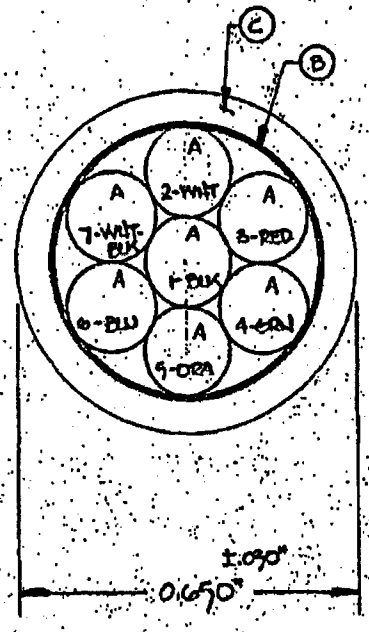
COPYRIGHT 1981
BOSTON INSULATED
WIRE & CABLE CO.

SCALE —#—	DO NOT SCALE DWG	FINISH	No.	CHANGE	DATE	BY
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED			REVISIONS			
DIMENSION TOLERANCES UNLESS OTHERWISE SPECIFIED		DR'N GP DATE 5-11-81	TITLE 5/C #14 AWG BIW Part # 13234-H-005 Pennsylvania Power & Light Co. Bechtel Spec 8856-E-401 P.O. #8856-E-401-AC, Item 3 (L05)		PART NO.	
FRACTIONAL DIMENSIONS ±		CH'K DATE 5/11/81				
		APR DATE 6/15/81				
DECIMAL DIMENSIONS ±		BIW BOSTON INSULATED WIRE & CABLE CO.			DRAWING NO.	
ANGULAR DIMENSIONS ±						

EL01-11-2

BIW PART # 13235-H-007

PENNSYLVANIA POWER & LIGHT CO.
BECHTEL SPEC 8856-E-401
P.O. #8856-E-401-AC, ITEM4 (L07)



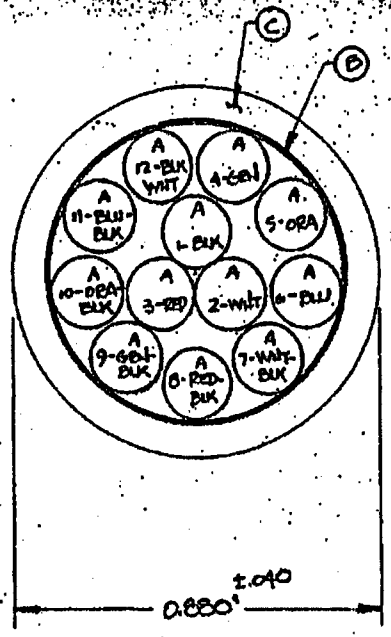
A, 7 x BIW #12199-H-GIA (#14 AWG, 7/.0242" TINNED COPPER, ETHYLENE PROPYLENE RUBBER, WITH CHLOROSULFONATED POLYETHYLENE JACKET, .030/.015" WALLS, PRINTED COLOR CODE, OD 0.169".
B, FLAME RETARDANT NEOPRENE-GLASS TAPE.
C, CHLOROSULFONATED POLYETHYLENE JACKET .060" WALL, JACKET PRINT: "BIW CABLE SYSTEMS INC. (YEAR) 7/C #14 AWG, 600 VOLT, SEQUENTIAL FOOTAGE".

Certified Correct
JR Lam
6/15/81

COPYRIGHT 1981
BOSTON INSULATED
WIRE & CABLE CO.

SCALE —N—	DO NOT SCALE DWG.	FINISH	No.	CHANGE	DATE / BY
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED				REVISIONS	
DIMENSION TOLERANCES UNLESS OTHERWISE SPECIFIED		DR'N DP DATE 5/11/81	TITLE 7/C #14 AWG BIW Part #13235-H-007 Pennsylvania Power & Light Co. Bechtel Spec 8856-E-401 P.O. #8856-E-401-AC, Item 4 (L07)		PART NO.
FRACTIONAL DIMENSIONS ±		CH'K JJ DATE 5/11/81			
DECIMAL DIMENSIONS ±		APR JJ DATE 5/11/81			DRAWING NO.
ANGULAR DIMENSIONS ±		BIW BOSTON INSULATED WIRE & CABLE CO.			

For Information Only



BIW PART # 13237-H-012

PENNSYLVANIA POWER & LIGHT CO.
BECHTEL SPEC 8856-E-401
P.O. 8856-E-401-AC ITEM 5 (L12)

A, 12 x BIW # 12199-H-G14 (#14 AWG, 7/.0242" TINNED COPPER, ETHYLENE PROPYLENE RUBBER WITH CHLOROSULFONATED POLYETHYLENE JACKET, .030/.015" WALLS, PRINTED COLOR CODE OD 0.169".
B, FLAME RETARDANT NEOPRENE-GLASS TAPE.
C, CHLOROSULFONATED POLYETHYLENE JACKET, .080" WALL, JACKET PRINT: "BIW CABLE SYSTEM INC, (YEAR) 12/C #14 AWG, 600 VOLT SEQUENTIAL FOOTAGE".

Certified correct
J.R. Stern 6/19/81

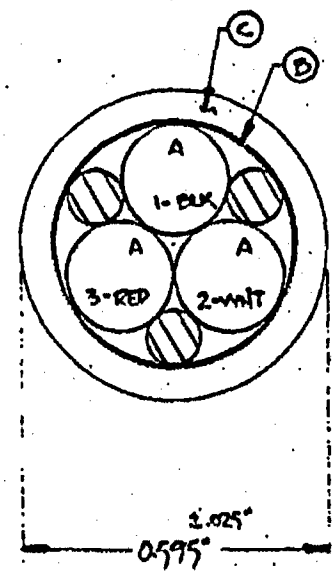
The subject matter of this print is strictly confidential and cannot be used for any purpose other than in connection with Boston Insulated Wire & Cable Co. Products. All rights herein are reserved and no part can be copied or disclosed in part or in whole without specific prior written consent of the Boston Insulated Wire & Cable Co.

COPYRIGHT 1981
BOSTON INSULATED
WIRE & CABLE CO.

SCALE —0—	DO NOT SCALE DWG.	FINISH	No.	CHANGE	DATE / BY
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED			REVISIONS		
DIMENSION TOLERANCES UNLESS OTHERWISE SPECIFIED	DR'N GG DATE 5-11-81	TITLE 12/C #14 AWG BIW Part # 13237-H-012 Pennsylvania Power & Light Co. Bechtel Spec 8856-E-401 P.O. 8856-E-401-AC Item 5 (L12)			PART NO.
FRACTIONAL DIMENSIONS ±	CH'K DATE				
DECIMAL DIMENSIONS ±	APP'D DATE				DRAWING NO.
ANGULAR DIMENSIONS ±	BIW BOSTON INSULATED WIRE & CABLE CO.				

Z12 FF 103950 Sh. 1001

Z13 FF103950 Sh. 901



BIW PART # 14007-H-003

PENNSYLVANIA POWER & LIGHT CO.
BECHTEL SPEC 8856-E-401
P.O. #8856-E-401-AC, ITEM 8 (D13)

A, 3x BIW # 6413-H-610 (#10 AWG, 7/.0385" TINNED COPPER, ETHYLENE PROPYLENE RUBBER WITH CHLOROSULFONATED POLYETHYLENE JACKET, .030/.015" WALLS, PRINTED COLOR CODE, OD 0.212".
B, FLAME RETARDANT NEOPRENE-GLASS TAPE.
C, CHLOROSULFONATED POLYETHYLENE JACKET, .060" WALL, JACKET PRINT: "BIW CABLE SYSTEMS INC, (YEAR) 3/C #10 AWG, 600 VOLT, SEQUENTIAL FOOTAGE".
D GLASS FIBER FILLER.

CABLE CODE Z13

Certified correct
JR Stamm 10/15/81

For information only

The original design of this product is exclusive property of Boston Insulated Wire & Cable Co. Product may not be used for any purpose other than to manufacture BIW products. Any other use, reproduction, or distribution, in part or in whole without written permission from the Boston Insulated Wire & Cable Co.

COPYRIGHT 1981
BOSTON INSULATED
WIRE & CABLE CO.

No.	CHANGE	DATE	BY
2	SCN 11210	10-8-81	
1	SCN 9550	7-31-81	

REVISIONS

SCALE —/—/— | DO NOT SCALE DWG. | FINISH

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED

DIMENSION TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONAL DIMENSIONS ±
DECIMAL DIMENSIONS ±
ANGULAR DIMENSIONS ±

DR'N DATE 5-11-81
CHK DATE 5/11/81
APR DATE 6/5/81

BIW BOSTON INSULATED WIRE & CABLE CO.

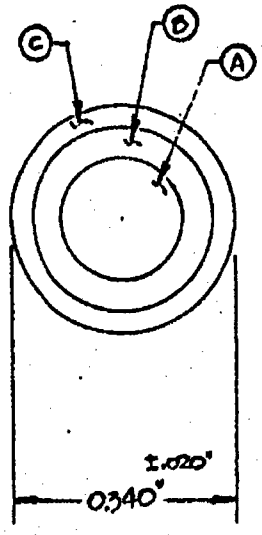
TITLE 3/C #10 AWG
BIW Part # 14007-H-003
Pennsylvania Power & Light Co.
Bechtel Spec 8856-E-401
P.O. #8856-E-401-AC, Item 8 (D13)

For Information Only

E-601-6-2

BIW PART #14009-H-G06

PENNSYLVANIA POWER & LIGHT CO.
BECHTEL SPEC 8856-E-401
P.O. #8856-E-401-AC, ITEM 12 (D61)



A, 1x#6AWG, 7/.0612" TINNED COPPER.
B, ETHYLENE PROPLYNE RUBBER INSULATION, .045 WALL.
C, CHLOROSULFONATED POLYETHYLENE JACKET, .020 WALL, JACKET PRINT: "BIW CABLE SYSTEMS INC, (YEAR) 1/C #6AWG, 600 VOLT, SEQUENTIAL FOOTAGE".

Certified correct
J.R. Lemm
6/15/81

The subject matter of this print is strictly confidential and must be used for purposes other than to manufacture this cable. Boston Insulated Wire & Cable Co. Products. All rights, title, and interest in and to this cable subject matter, patents, trade or trade secrets, copyrights, and other proprietary rights are reserved by Boston Insulated Wire & Cable Co.

COPYRIGHT 1981
BOSTON INSULATED
WIRE & CABLE CO.

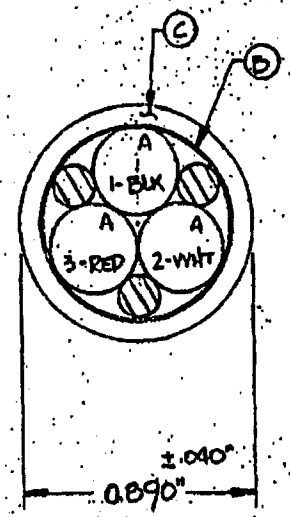
SCALE —#—	DO NOT SCALE DWG.	FINISH	No.	CHANGE	DATE / BY
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED				REVISIONS	
DIMENSION TOLERANCES UNLESS OTHERWISE SPECIFIED		DR'N COP DATE 5-11-81	TITLE 1/C #6 AWG BIW Part #14009-H-G06 Pennsylvania Power & Light Co. Bechtel Spec 8856-E-401 P.O. # 8856-E-401-AC, Item 12 (D61)		PART NO.
FRACTIONAL DIMENSIONS ±		CH'K DATE 5-11-81			
DECIMAL DIMENSIONS ±		APR DATE 6/15/81			DRAWING NO.
ANGULAR DIMENSIONS ±		BIW BOSTON INSULATED WIRE & CABLE CO.			

Z61 FF 103950 Sh. 601

E401-7-2

BIW PART # 14016-H-003

PENNSYLVANIA POWER & LIGHT CO.
BECHTEL SPEC 8856-E-401
P.O. 8856-E-401-AC ITEM 13 (D63)



A, 3 x BIW # 14489-H-006 (#6 AWG, 7/.0612" TINNED COPPER, ETHYLENE PROPYLENE RUBBER WITH CHLOROSULFONATED POLYETHYLENE JACKET, .045/.025" WALLS, PRINTER COLOR CODE, OD 0.330".
B FLAME RETARDANT NEOPRENE-GLASS TAPE.
C, CHLOROSULFONATED POLYETHYLENE JACKET, .080" WALL, JACKET PRINT: "BIW CABLE SYSTEMS INC, (YEAR) 3/C #6 AWG, 600 VOLT, SEQUENTIAL FOOTAGE".
D GLASS FIBER FILLER.

Certified Correct
J.R. Lemon
6/15/81

The subject matter of this notice is strictly confidential and cannot be used for any purpose other than to execute the job for which it was intended. The B Cable Co. Products and Services Division and to prior use be made of public knowledge nor reproduced in part or in whole without written consent of Boston Insulated Wire & Cable Co.

COPYRIGHT 1981
BOSTON INSULATED
WIRE & CABLE CO.

SCALE —#—	DO NOT SCALE DWG.	FINISH	No.	CHANGE	DATE / BY
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED				REVISIONS	
DIMENSION TOLERANCES UNLESS OTHERWISE SPECIFIED		DRN. DATE 5-4-81	TITLE 3/C #6 AWG		PART NO.
FRACTIONAL DIMENSIONS ±		CH'K. DATE 5/14/81	BIW Part # 14016-H-003		
DECIMAL DIMENSIONS ±		APR. DATE 6/15/81	Pennsylvania Power & Light Co.		DRAWING NO.
ANGULAR DIMENSIONS ±		BIW BOSTON INSULATED WIRE & CABLE CO.	Bechtel Spec 8856-E-401		
			P.O. 8856-E-401-AC, Item 13 (D63)		

Blue Print

Z63 FF 103950 Sh. 701

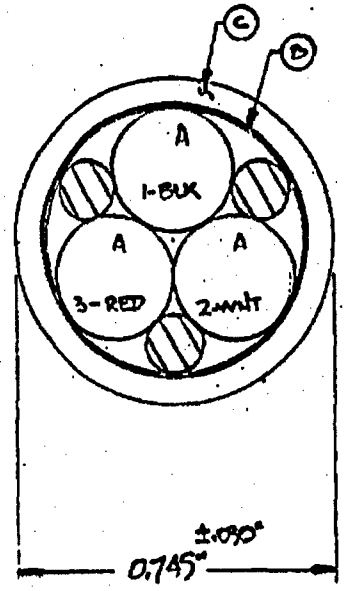
For Information Only

Z83 FF103950 Sh. 801

E-401-8-2

BIW PART # 14013-H-003

PENNSYLVANIA POWER & LIGHT CO.
BECHTEL SPEC 8856-E-401
P.O. # 8856-E-401-AC, ITEM 11 (D83)



A, 3x BIW #12565-H-008 (#8 AWG, 7/.0486" TINNED COPPER, ETHYLENE PROPYLENE RUBBER WITH CHLOROSULFONATED POLYETHYLENE JACKET, .045/.015" WALLS, PRINTED COLOR CODE, OD 0.280"
B, FLAME RETARDANT NEOPRENE-GLASS TAPE.
C, CHLOROSULFONATED POLYETHYLENE JACKET, .060 WALL, JACKET PRINT: "BIW CABLE SYSTEMS INC, (YEAR) 3/C # 8 AWG, 600 VOLT, SEQUENTIAL FOOTAGE".
D GLASS FIBER FILLER.

Certified correct
JR Lam
6/15/81

SCALE — DO NOT SCALE DWG.	FINISH	No.	CHANGE	DATE	BY
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED		REVISIONS			
DIMENSION TOLERANCES UNLESS OTHERWISE SPECIFIED	DR'N DATE 5.11.81	TITLE 3/C #8 AWG BIW Part # 14013-H-003 Pennsylvania Power & Light Co. Bechtel Spec 8856-E-401 P.O. # 8856-E-401-AC, Item 11 (D83)		PART NO.	
FRACTIONAL DIMENSIONS ±	CH'K DATE 5/11/81				
DECIMAL DIMENSIONS ±	APR DATE 6/15/81			DRAWING NO.	
ANGULAR DIMENSIONS ±	BIW BOSTON INSULATED WIRE & CABLE CO.				

For Information Only

Attachment 3 Email from R. Vazquies to M. Waselus SP_pH_Cond.xls

Wasclus, Michael M.

From: Vazquez, Ronald Allen [ravazquez@pplweb.com]
Sent: Thursday, December 09, 2004 2:06 PM
To: Wasclus, Michael M.
Subject: FW: SP_pH_Cond.xls

SP_pH_Cond.xls

This is the information for the suppression pool pH value. Do you need more information?

-----Original Message-----
From: Morgan, David J

Sent: Wednesday, December 08, 2004 5:03 PM
To: Vazquez, Ronald Allen
Subject: FW: SP_pH_Cond.xls

Ron

For the individual SSES Suppression Pools and for the Combined data, the Mean - 3 Sigma value is 6.3. There is one measurement out of 285 at 6.2, the rest are 6.3 or higher. Depending on how critical the initial pH is, I believe that we could support a minimum value of 6.3. It is likely that 99.6% of the measurements will be 6.3 or higher. If it's not critical and we can live with it, then a conservative value to use would be 6.0.

Note that the suppression pool water is of relatively high purity. This means that it has little buffering capacity and the pH will be sensitive to relatively small additions of acid or base. Again, I don't know how the calculations work, but we're not in the same league as PWR's that may store trisodium phosphate in the containment to raise pH in the event of a CDA, or inject NaOH to the same effect. If we inject SLC, we will be injecting a basic buffer solution into the suppression pool water, which will help prevent the pH from going acidic.

Dave

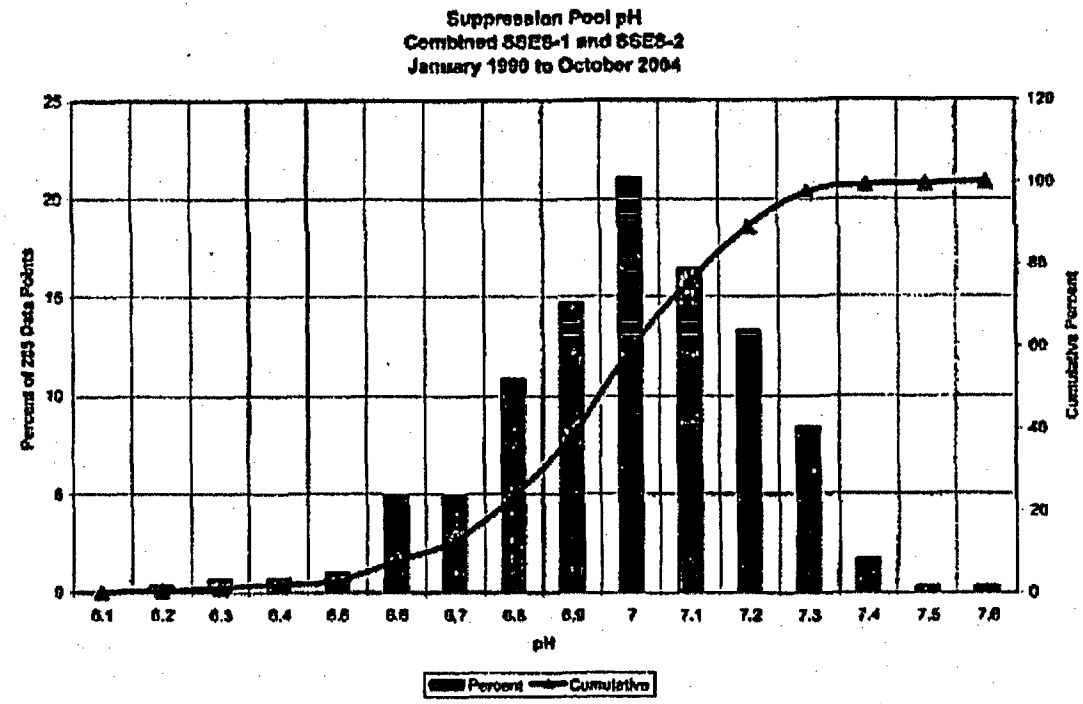
-----Original Message-----
From: Morgan, David J

Sent: Wednesday, December 08, 2004 10:30 AM
To: Vazquez, Ronald Allen
Subject: SP_pH_Cond.xls

Ron

Haven't found the words yet, but I think I sent you this plot.

Dave
<<SP_pH_Cond.xls>>


Suppression Pool pH
Combined SSES-1 and SSES-2
January 1990 to October 2004
Percent of 213 Data Points
Cumulative Percent
pH
Percent
Cumulative