Enclosure 3

HANFORD 2

POWER GENERATION CONTROL COMPLEX (PGCC)

FLOOR PLATE DESIGN

C. W. Hart, Manager
Panel and Assembly Design Engineering

Approved: E. C. Spencer, Manager
Product Engineering

Approved: LSF R. Artigas, Manager
BWR Projects Licensing

September 1983

NUCLEAR ENERGY BUSINESS OPERATIONS • GENERAL ELECTRIC COMPANY
SAN JOSE CALIFORNIA 95125

GENERAL ELECTRIC

CONTENTS

INTRODUCTION

The NRC-approved GE Licensing Topical Report for PGCC states that the floor plates are composed of steel and aluminum and will satisfactorily withstand a design basis fire, as described in the LTR. A small percentage (~4%) of floor plates at Hanford 2 are of a non-metallic material, namely Richlite, in order to accommodate irregular shapes and close tolerance fitting at the plant site. The NRC Office of Inspection and Enforcement has requested more information concerning the fire protection capability of the Richlite floor plates. This report responds to this NRC request on behalf of the Hanford 2 project. It includes the accepted licensing design basis, a design description, and a safety evaluation that demonstrates the acceptability of the Hanford 2 PGCC floor plate design.

PGCC LICENSING BASIS

General Electric Company documented the safety evaluation of the Power Generation Control Complex (PGCC) in the Licensing Topical Report (LTR) NEDO-10466[1]. This evaluation addressed the fire protection issue. The LTR described how the PGCC design provides defense in depth by preventing fires from starting, detecting and suppressing any started fire, and safely withstanding a fire that is not detected or suppressed. The NRC approved the LTR in July 1978[2] as an acceptable reference to be used in specific license applications.

The LTR assessment of the PGCC capability to safely withstand the unlikely event of an undetected fire in a cableway beneath the control room used a conservative design basis fire (DBF) which was agreed upon by the NRC, GE, and an independent agency (University of California, Berkeley). The DBF assumes a localized accumulation of trash in a normally covered cableway. The Hanford 2 plant fire protection program should prevent such a trash accumulation from ever occurring.

In conducting fire tests on the PGCC design, the University of California found that the PGCC design inherently limits the availability of air in the cableways such that the design basis trash fire would quickly self-extinguish with only a small fraction (~15%) of the trash being burned. Therefore, in order to get complete combustion of the trash for the design basis fire some tests were performed with a control room configuration differing from the PGCC design, i.e., with the floor plates at both ends of a cableway removed in order to allow combustion to continue. The PGCC DBF tests conducted by the University of California met all of the acceptance criteria, e.g., containment of the fire to the fire duct and acceptable smoke production, for each of the three types of cable coverings that were tested.

DESIGN DESCRIPTION

In the fabrication of the PGCC floor area special consideration must be made for complex shapes and non-standard sizes resulting from construction tolerances in the concrete control structure. Nearly all (96%) of the

area in the PGCC is covered with pre-determined sizes of floor plates fabricated of aluminum honeycomb with steel sheets on the top and bottom and with aluminum channel closures on the peripheral edges. These assemblies cannot be readily modified in the field to fit special cases or close tolerance fit needs.

In order to accommodate the need for special site fit-up, General Electric Company recognized the need for an alternate floor plate design which would provide for flexibility of installation while meeting the other floor plate requirements. A material with the trade name "Richlite" was selected for this application. Figures 1 and 2 show the Hanford 2 floor plate layout and identify the limited use of Richlite.

A fiber laminate 1-1/16" thick Richlite sheet was selected by General Electric engineers based upon its physical and chemical properties. Additionally, it was decided to add a coating of intumescent paint (Albi 107A) on the cable tray side of the Richlite to reduce the Richlite exposure temperature in case of a DBF. Published data from Underwriters Laboratory testing gave credible evidence that the fire characteristics would improve with the Albi 107A coating.

SAFETY EVALUATION

RICHLITE FLOOR PLATE TESTING

Verification fire tests were performed to the ASTM E-84 standard test requirements[3]. This test was selected since it uses a similar configuration and has higher temperature and heat releases when compared to the DBF of the LTR.

Figure 3 shows the heat release used in ASTM E-84 as compared to the Licensing Topical Report DBF. From Figure 3 it can be seen that the temperature near the specimen is much greater for a longer period of time in the ASTM test as compared to the DBF test.

The ASTM tests utilized an intense flame originated in a furnace made of fire brick which was closed at the top with the Richlite sample. All of the energy released by the fire was subjected to the sample. Whereas in the actual floor section design, carbon steel constitutes three sides of the cable ways, thereby conducting much of the energy produced by the fire out of the cableway duct.

Two ASTM E-84 tests were conducted; one on the base Richlite material and the other on Richlite coated on the under side with the intumescent coating, Albi 107A. These tests were performed at the Underwriters Laboratory in Santa Clara, California.

The results were:

Material	Index Value
Uncoated Richlite	
Flame spread	25
Fuel contribution	0
Smoke developed	40
Intumescent Coated Richlite	
Flame spread	13
Fuel contribution	0
Smoke developed	80

FLAME SPREAD AND FUEL CONTRIBUTION

The test results show that the coated and uncoated Richlite flame spread and fuel contribution are clearly acceptable, e.g., one common criterion is to have flame spread and fuel contribution ratings not higher than 25.

SMOKE PRODUCTION

The important factor in the smoke developed is the contribution of this smoke to the total smoke developed during a design basis fire. The smoke index is based upon smoke developed from red oak as being 100. This index of 100 represents approximately 15% attenuation of the light source

in the fire tunnel. The intumescent coated Richlite test showed 80% of the standard smoke generated from red oak, or 12% light attenuation. The DBF tests of the LTR showed more smoke from the cable insulation than would be developed by the Richlite.

The fire test results of the University of California tests, as reported in NEDO 10466, characterized the smoke generated from 1) Vulkene/Geoprene, 2) Raychem and 3) Tefzel cable insulation. The test configuration required that the floor plates be left off the end of the cableways to allow ventilation to support the fire. In all three cases, the smoke generated was determined to be acceptable[2] for the PGCC design.

A curve, Figure 4, which shows the smoke generated in another Underwriters Laboratory test[4] on Tefzel cable and cross-linked polyethylene (Vulkene) as compared to the ASTM standard (red oak) and Richlite helps to quantify the smoke contribution from Richlite. As can be seen from Figure 4, the smoke characteristics of coated Richlite are superior to the already acceptable smoke characteristics of the cable insulation materials. Uncoated Richlite produces even less smoke. Considering that only a small portion of the Richlite would be affected by the DBF (0.125 inch penetration in the uncoated ASTM E-84 test) and the other Richlite characteristics as determined by tests, the total contribution of Richlite to the smoke from a postulated DBF would be insignificant.

SMOKE CHARACTERIZATION

Richlite is composed of 65% fiber laminate (cellulose) impregnated with 17.5% phenol and 17.5% formaldehyde, thus forming a phenolic ($C_{15}H_{12}O_2$). Any localized combustion of this compound as a result of the DBF would produce mainly CO_2, H_2O and CO. The gases which evolve during the intumescent process were measured at the U.S. Testing Laboratory using mass spectroscopy as the gas analyzer.[5] The principal gases identified were: N_2, O_2, A, CO_2 and H_2. Trace quantities (less than 0.05% concentration by volume) of methane, benzane and carbonyl sulfide were also identified. These products of the Albi intumescence and any combustion of Richlite are a minor quantity in comparison to those produced by the cable insulation.

STRUCTURAL INTEGRITY

The ASTM E-84 tests on the Richlite samples demonstrated that no warping or dimensional change occurred. The mechanical integrity remained well above the load requirements for the control room floor plates. It has also been demonstrated, by test, that the Richlite floor plates have sufficient mass and are positioned such that the fire suppressant, Halon, concentration is not changed.

CONCLUSION

The PGCC Richlite floor plates used in the special fitting situations are considered as an acceptable alternate for aluminum/steel floor plates. This conclusion is valid even when no credit is taken for the protective Albi 107A coating.

REFERENCES

1. H. R. Clay, "Power Generation Control Complex, Design Criteria and Safety Evaluation," General Electric Company, NEDO-10466-A, February 1979 (NRC Approved Revision).

2. Olan D. Parr, NRC letter to Dr. G. G. Sherwood, GE; Review of General Electric Topical Report NEDO-10466," Power Generation Control Complex Design Criteria and Safety Evaluation;" July 13, 1978.

3. ASTM E-84-81a, "Standard Test Method for Surface Burning Characteristics of Building Materials," 1981.

4. Flame Tests, A Report on Tests Conducted by Underwriter Laboratories Inc. at Northbrook, Illinois, September 27-28-29, 1976," E. I. duPont de Nemours Co. (E-12952).

5. William Raines, Vice President and Technical Director, Stan Chem Company, Albi Division; telecon with Charles W. Hart, General Electric Company.

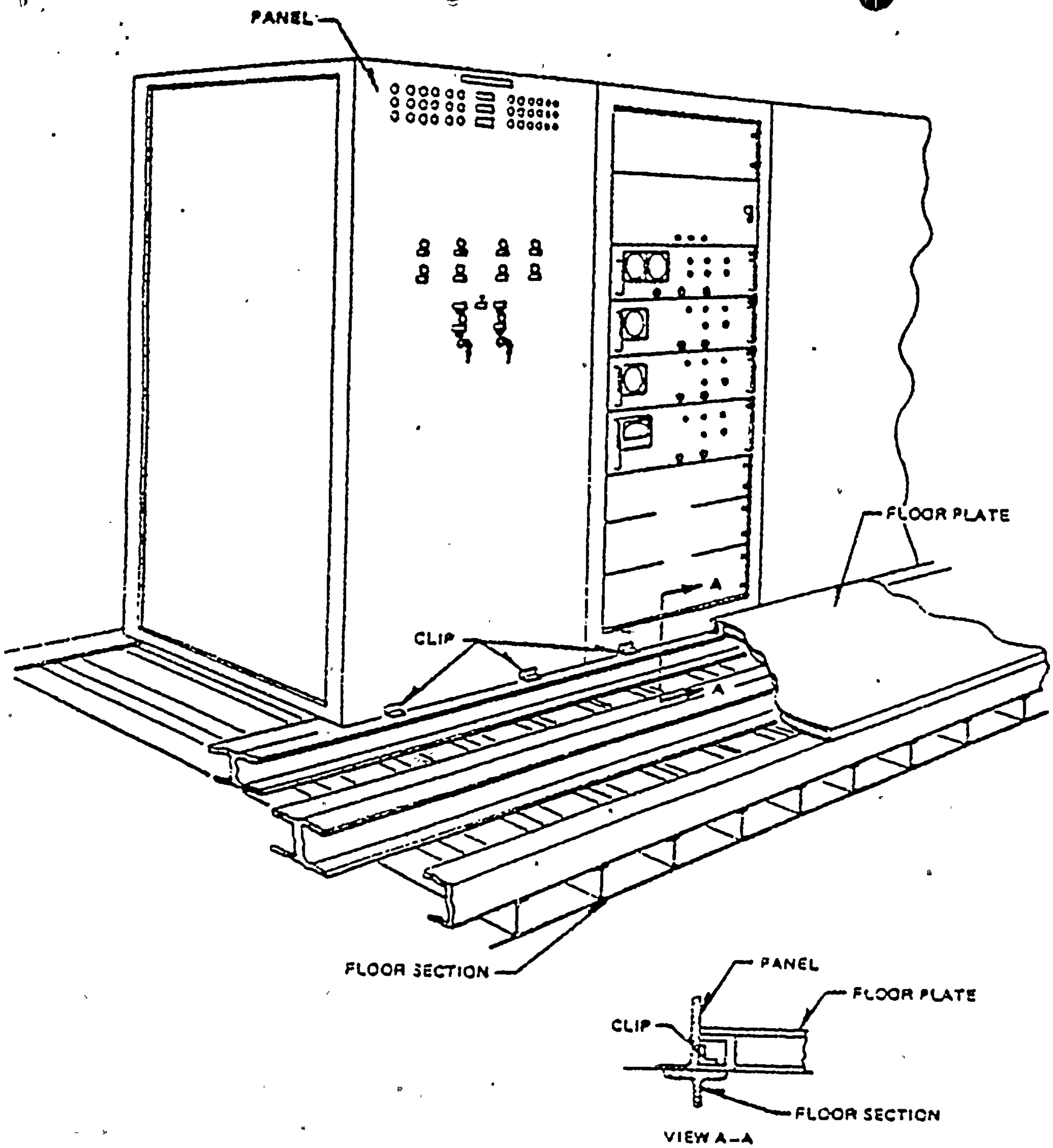

FIGURE 1 PGCC SECTION

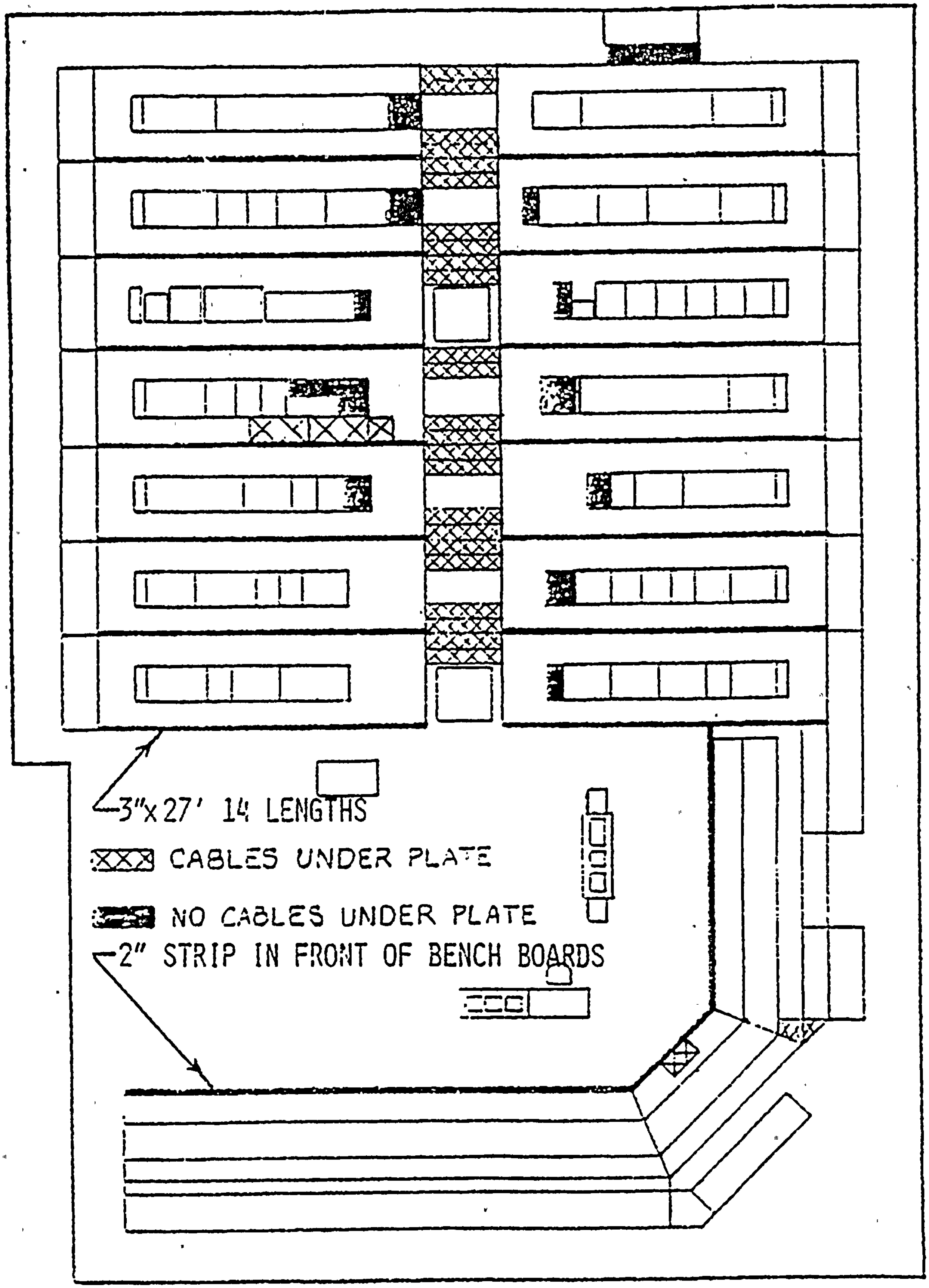

FIGURE 2 CONTROL ROOM LAYOUT.

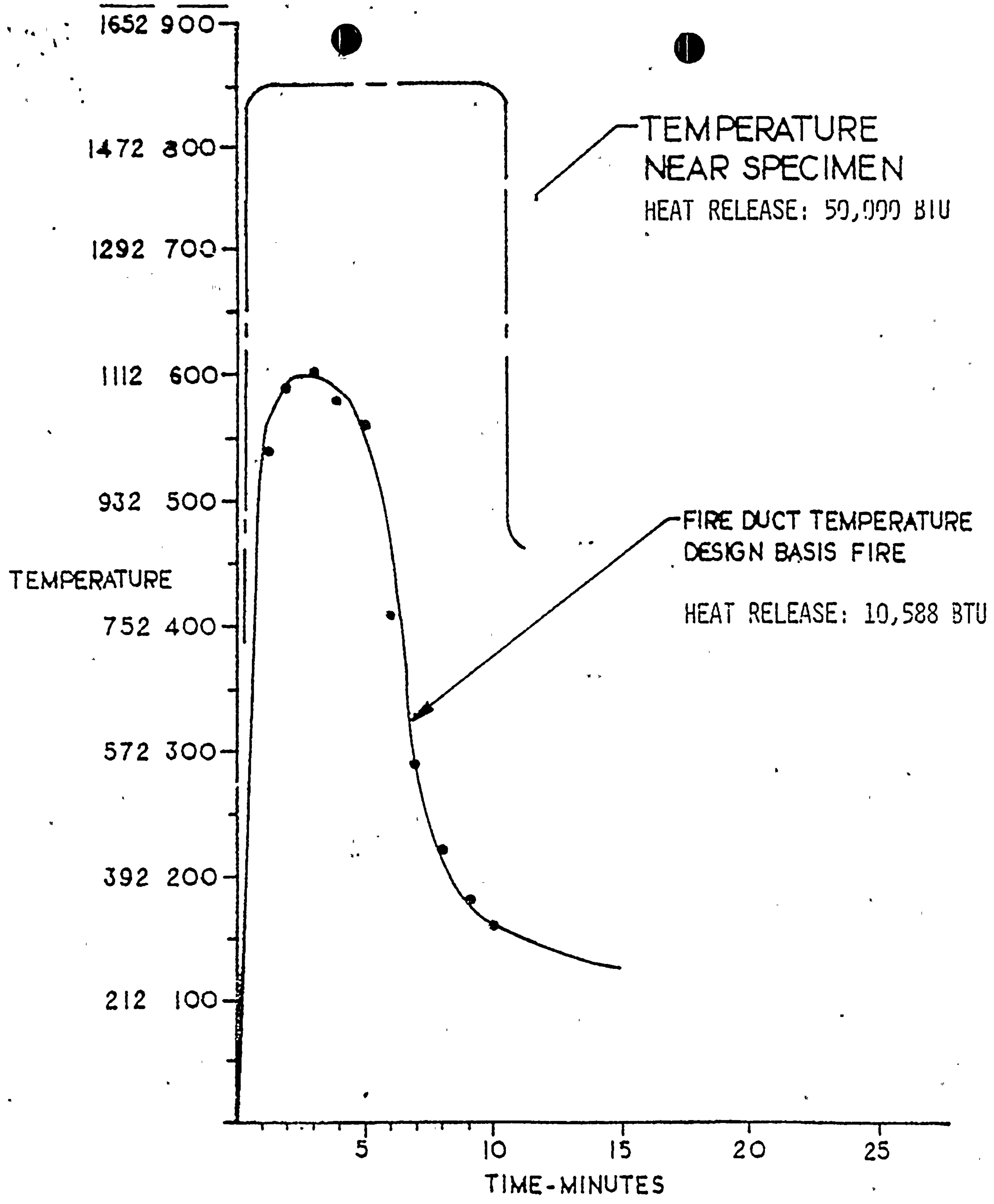

FIGURE 3 TEST FIRE COMPARISON
U.L. SURFACE BURN TEST VS CABLE DUCT

SMOKE INTENSITY. FOR PURPOSE OF COMPARISON, THE RED OAK STANDARD IS SHOWN. NOTE THAT RED OAK TEST IS DISCONTINUED AFTER 10 MINUTES.

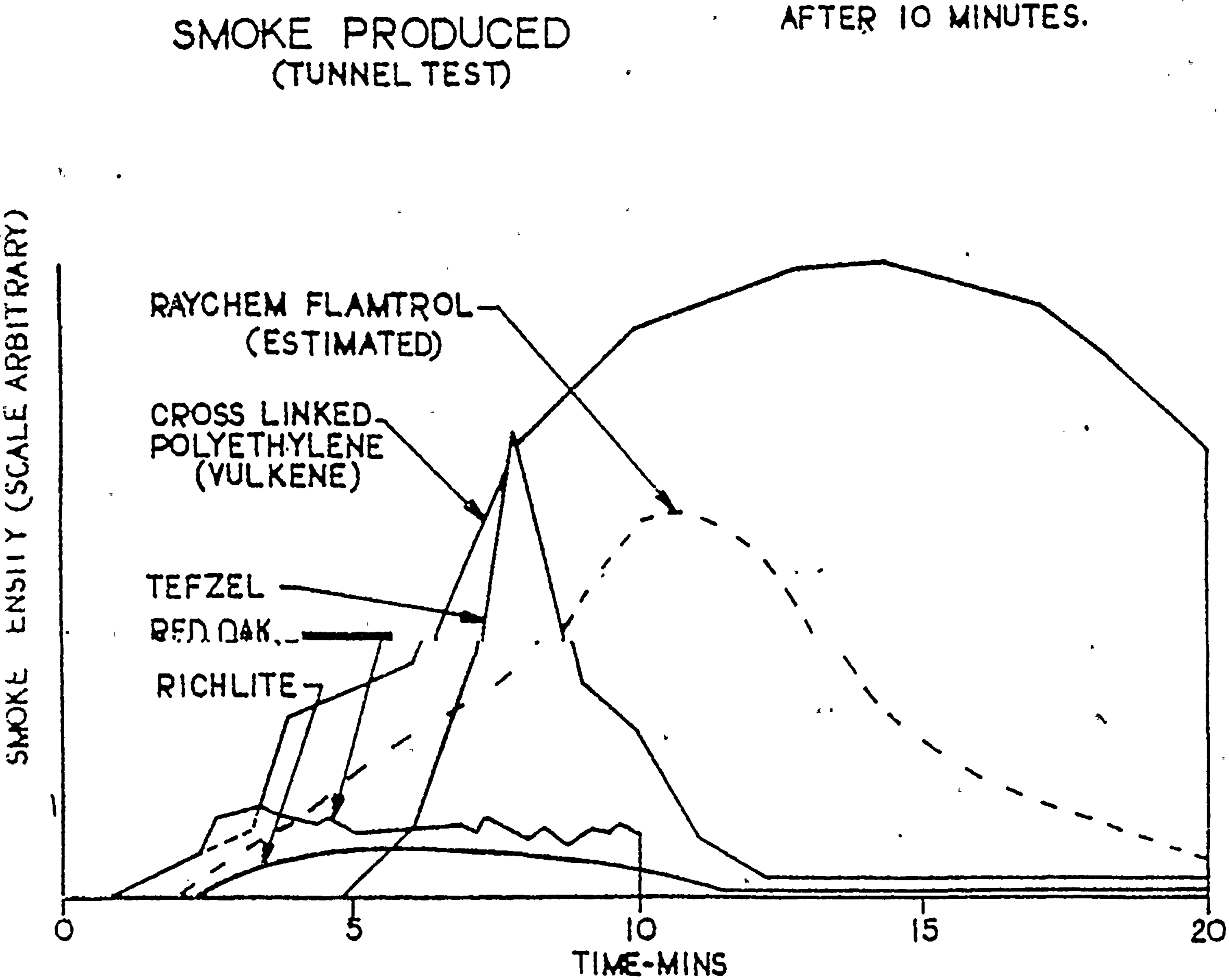

FIGURE 4 SMOKE PROVIDED IN U.L. TUNNEL SURFACE BURN TEST FOR DIFFERENT MATERIALS

Enclosure 4

GENERAL ELECTRIC

NUCLEAR POWER SYSTEMS DIVISION

GENERAL ELECTRIC COMPANY, 175 CURTNER AVE., SAN JOSE, CALIFORNIA 95125
MC 394, (408) 925-3382

Responds to: N/A

September 26, 1983
GEWP-2-83-

RESPONSE REQUESTED BY: N/A

Mr. L. T. Harrold
Assistant Director, WNP-2 Engineering
Washington Public Power Supply System
P.O. Box 200
Mail Drop 906D
Richland, Washington 99352

Attention: B. A. Holmberg
Manager, WNP-2 Engineering

Dear Mr. Harrold:

SUBJECT: W02808
WPPSS HANFORD 2 CONTRACT 2
RICHLITE FLOOR PLATES

Attached is a letter from C. W. Hart to me which provides the information relative to Richlite material requested by the NRC during the telecon with GE and the Supply System on September 15, 1983.

If you feel you need additional information or have any questions, please call Pamela Kingston, Wayne Jones or me.

Very truly yours,

F. A. MacLean

F. A. MacLean
Project Manager
Hanford 2

FAM:rm/A09164*

Attachment

cc: M. M. Allison
H. H. Engelking
J. A. Forrest
J. J. Verderber
J. M. Yatabe
File No. H13.1.1

GENERAL ELECTRIC

NUCLEAR ENERGY BUSINESS OPERATIONS

GENERAL ELECTRIC COMPANY, 175 CURTNER AVE., SAN JOSE, CALIFORNIA 95125
408*925-2595 MC 429

CWH/83/071

September 27, 1983

F.A. MacLean

SUBJECT: HANFORD 2 FLOOR PLATE

Reference: Hanford 2 Floor Plate Design Report by C.W. Hart dated September 1983

This is to certify the General Electric Company position in regard to Richlite used in the floor section of Hanford 2 PGCC.

1. The density of Richlite is 0.0458 lb/in^3. The density of the aluminum honeycomb-steel covered floor plates is 0.0246 lb/in^3.

2. Underwriters Laboratory Test Results ASTM E84 dated August 2, 1983, August 18, 1983 and September 27, 1983 are attached. These results are for Richlite floor plates uncoated and coated with Albi 107A. These results are also documented in General Electric Company Design Record File DRF H13-71 Index 9.

3. The PGCC floor plates are primarily honeycomb (aluminum/steel) with a limited quantity of Richlite. The use of Richlite is limited to irregular floor plate shapes and non standard sizes. General Electric Company does not plan to add any more Richlite in the PGCC floor sections.

4. The limited use of Richlite is the only variation in the Fire Protection System defined in Licensing Topical Report (LTR) NEDO-10466.

5. Figure 2 of the referenced design report has been clarified to identify the location of the Richlite floor plates.

C.W. Hart, Manager
Panel & Assy Design Engineering

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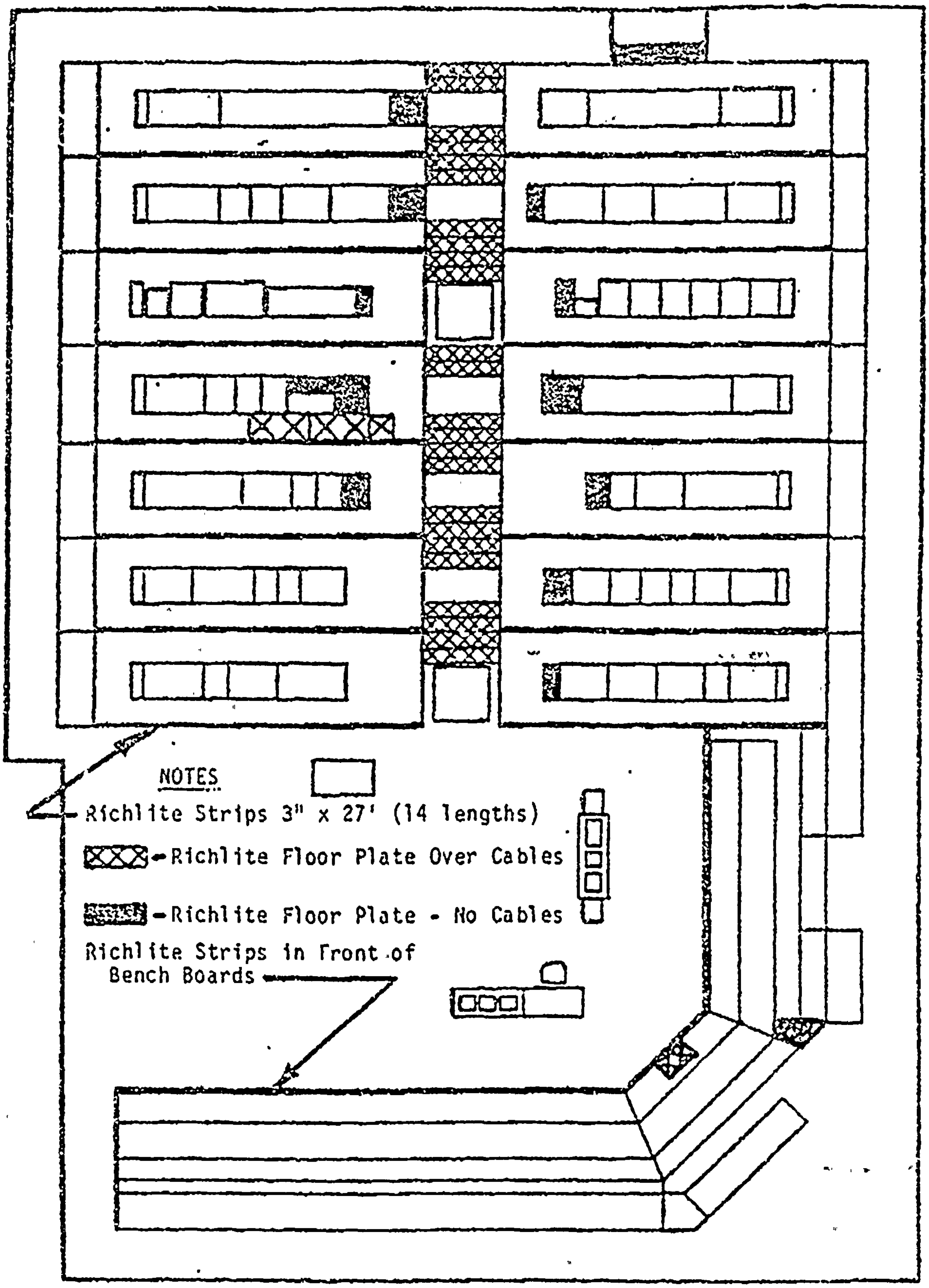


FIGURE 2 CONTROL ROOM LAYOUT

UNDERWRITERS LABORATORIES INC.
1655 SCOTT BLVD. · SANTA CLARA, CALIFORNIA 95050

an independent, not-for-profit organization testing for public safety

R9752 September 27, 1983

General Electric Company
175 Curtner Avenue
San Jose, CA 95123

Attention: Mr. Ray Mercado - Mail Code 429

Subject: Interim Report on Surface Burning Characteristics Tests Conducted on Coated Laminated Boards

Dear Mr. Mercado:

In accordance with your request, we are providing information pertaining to the Surface Burning Characteristics data developed during the testing of the coated laminated boards. The test work is to lead to the establishment of Classification and Follow-Up Service by the Laboratories, under our "Hardboard" category.

METHOD

The fire testing was conducted in accordance with Underwriters Laboratories Inc. "Tests for Surface Burning Characteristics of Building Materials" (UL 723, ASTM E84, NFPA-225 and ASA-A2-5) as part of the testing planned for our full scale investigation of the material in question.

SAMPLES

The samples evaluated consisted of a nominal 1 inch thick phenolic fiber laminated boards coated with a UL Labeled Albi 107A coating applied at 20-25 wet film thickness. Each test consisted of three 24 inch wide by 96 inch long coated boards butt-jointed end to end to provide a continuous test service.

RESULTS

The following Surface Burning Characteristics Test results were developed.

Test Sample Description	Flame Spread	Fuel Contributed	Smoke Developed
1. Coated Laminated Board	12.8	0	87.0
2. Coated Laminated Board	13.7	0	74.1

CONCLUSION

The above data indicates that the following Surface Burning Characteristics will be applicable for labeled material having a surface coating of UL Labeled Albi 107A.

S U R F A C E B U R N I N G C H A R A C T E R I S T I C S

Flame Spread	15
Fuel Contributed	0
Smoke Developed	80

It is understood that these results apply only to those products produced under the Underwriters Laboratories Follow-Up Service Program and that evidence of this is the appearance of the Follow-Up Service Symbol for Classification of Hardboards along with the Surface Burning Characteristics on a label attached to the product.

We are presently in the process of conducting additional tests to establish specifications for use in the Follow-Up Service Program at the Rainier Plywood Company plant in Tacoma, Washington. We will be in a position to prepare the Follow-Up Service Procedure and establish the classification in our published advices, as soon as this additional test work is completed.

The Classification Marking of Underwriters Laboratories Inc. on the product is the only method provided by Underwriters Laboratories Inc. to identify products which have been produced under its Classification and Follow-Up Service Program.

We trust that the information provided will satisfy your needs. However, if questions arise, please feel free to contact us at any time.

Very truly yours,

H. F. Hansen
H. F. HANSEN
Engineering Associate
Fire Protection Department

Reviewed by:

A. A. Briber
ALEX A. BRIBER
Assistant Managing Engineer
Fire Protection Department

HFH:sd
fmltr3

UNDERWRITERS LABORATORIES INC.
1655 SCOTT BLVD SANTA CLARA, CALIFORNIA 95050
an independent, not-for-profit organization testing for public safety

R9752, 83SC7541 August 18, 1983

Nuclear Energy Group
General Electric Company
175 Curtner Avenue
San Jose, CA 95125

Attention: Mr. Ray Mercado
Mail Code 429

Subject: Tunnel Test Results

Dear Ray:

In response to your request the following observations were recorded at the time of the Tunnel Tests on the laminated phenolic boards on July 27, 1983.

The one-inch thick boards exposed to the standard test flame during the UL 723 test procedure were not damaged extensively by the flame. After the tests, there was no great distortion of the boards, in fact, very slight warpage and dimensionally the boards did not change.

The area directly exposed to the flame charred to a depth of about 1/8 inch and further down the test sample the charring diminished. At about seven feet down the test sample the char depth was 1/16 inch and from eight feet to twelve feet down the test sample was only on the surface. Beyond the twelve-foot mark there was only surface discoloration.

The boards retained their heat for quite a long period of time after the test but there was no subsequent flaming or smoldering.

Should you have further questions please let me know.

Very truly yours,

ALEX BRIBER
Assistant Managing Engineer
Fire Protection Department

AB:vv
vvcd

UNDERWRITERS LABORATORIES INC.
1655 SCOTT BLVD. · SANTA CLARA, CALIFORNIA 95050
an independent, not-for-profit organization testing for public safety

AUG 10 1983
PURCHASING

August 2, ~~1931~~ 83 Am

General Electric Company
175 Curtner Avenue
San Jose, CA 95123

Attention: Mr. J. DeBlieux

Subject: Interim Report on Surface Burning Characteristics Tests Conducted on Uncoated Laminated Boards

Dear Mr. DeBlieux:

In accordance with your request , we are providing information pertaining to the Surface Burning Characteristics data developed during the testing of the uncoated laminated boards. The test work is to lead to the establishment of Classification and Follow-Up Service by the Laboratories, under our "Hardboard" category.

METHOD

The fire testing was conducted in accordance with Underwriters Laboratories Inc. "Tests for Surface Burning Characteristics of Building Materials" (UL 723, ASTM E84, NFPA-225 and ASA-A2-5) as part of the testing planned for our full scale investigation of the material in question.

SAMPLES

The samples evaluated consisted of a nominal 1 inch thick phenolic fiber laminated boards. Each test consisted of three 24 inch wide by 96 inch long boards butt-jointed end to end to provide a continuous test service.

RESULTS

The following Surface Burning Characteristics Test results were developed:

Test Sample Description	Flame Spread	Fuel Contributed	Smoke Developed
1. Uncoated Laminated Board	24.9	2.0	37.8
2. Uncoated Laminated Board	25.0	3.0	39.0

CONCLUSION

The above data indicates that the following Surface Burning Characteristics will be applicable for labeled material:

S U R F A C E B U R N I N G

C H A R A C T E R I S T I C S

Flame Spread	25
Fuel Contributed	0
Smoke Developed	40

It is understood that these results apply only to those products produced under the Underwriters Laboratories Follow-Up Service Program and that evidence of this is the appearance of the Follow-Up Service Symbol for Classification of Hardboards along with the Surface Burning Characteristics on a label attached to the product.

We are presently in the process of conducting additional tests to establish specifications for use in the Follow-Up Service Program at the Rainier Plywood Company plant in Tacoma, Washington. We will be in a position to prepare the Follow-Up Service Procedure and establish the classification in our published advices, as soon as this additional test work is completed.

The Classification Marking of Underwriters Laboratories Inc. on the product is the only method provided by Underwriters Laboratories Inc. to identify products which have been produced under its Classification and Follow-Up Service Program.

We trust that the information provided will satisfy your needs. However, if questions arise, please feel free to contact us at any time.

Very truly yours,

H. F. Hansen
H. F. HANSEN
Engineering Associate
Fire Protection Department

Reviewed by:

Alex A Briber
ALEX A. BRIBER
Assistant Managing Engineer
Fire Protection Department

HFH:sd
fmltr3

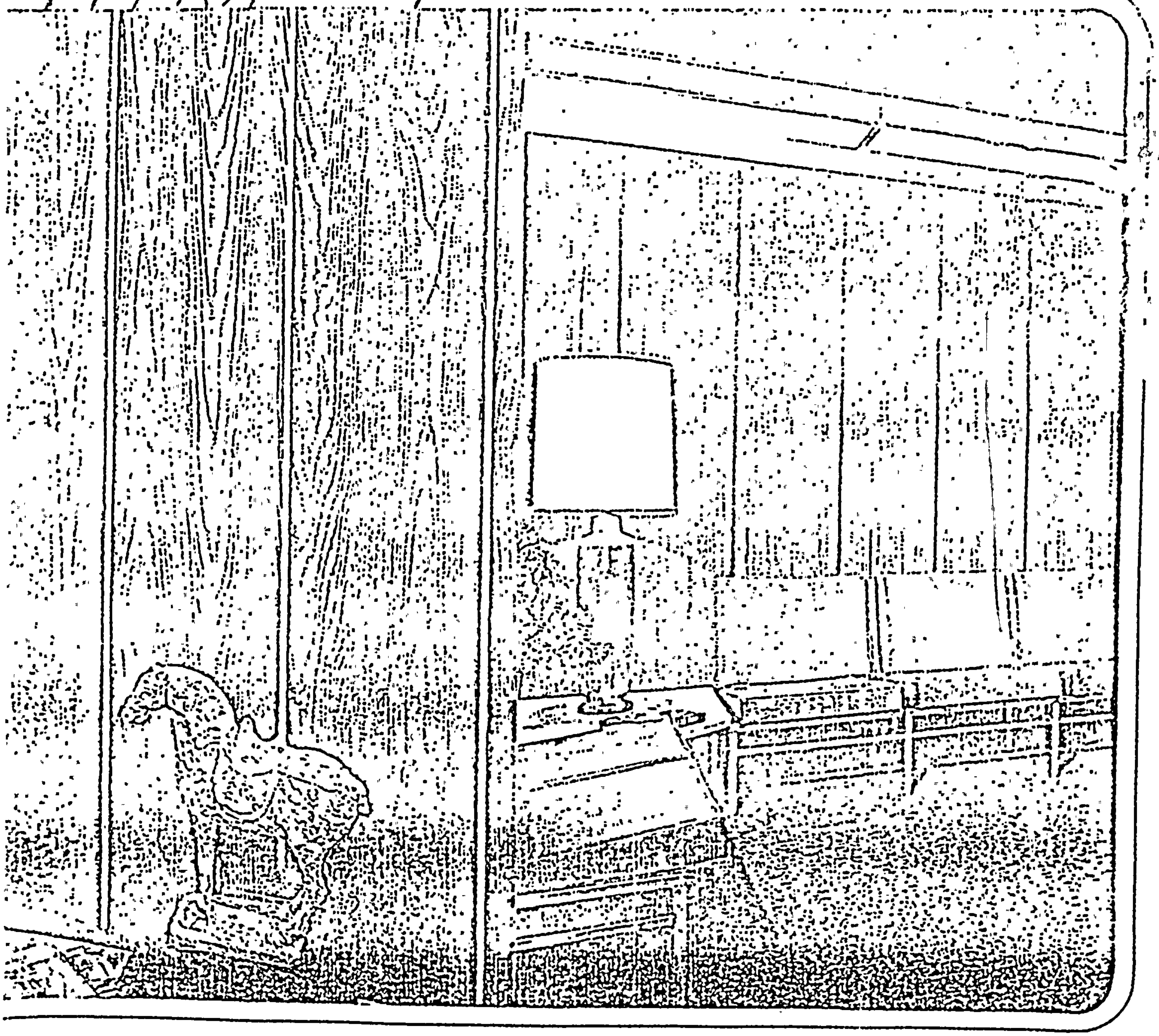
Enclosure 1

Panel Systems 440/550

TMI

IDEAL FOR:

Nursing Homes • Hospitals • Health Care Centers • Schools • Churches • Offices • Motels and Hotels • Restaurants • Banks • Public Buildings



Surfaced with Practical FORMICA® BRAND wall paneling

ELLSTROM MANUFACTURING CO. [illegible]
LAMINATED [illegible]
1540 [illegible]
SE[illegible] [illegible] 3.67

Paneling 1975

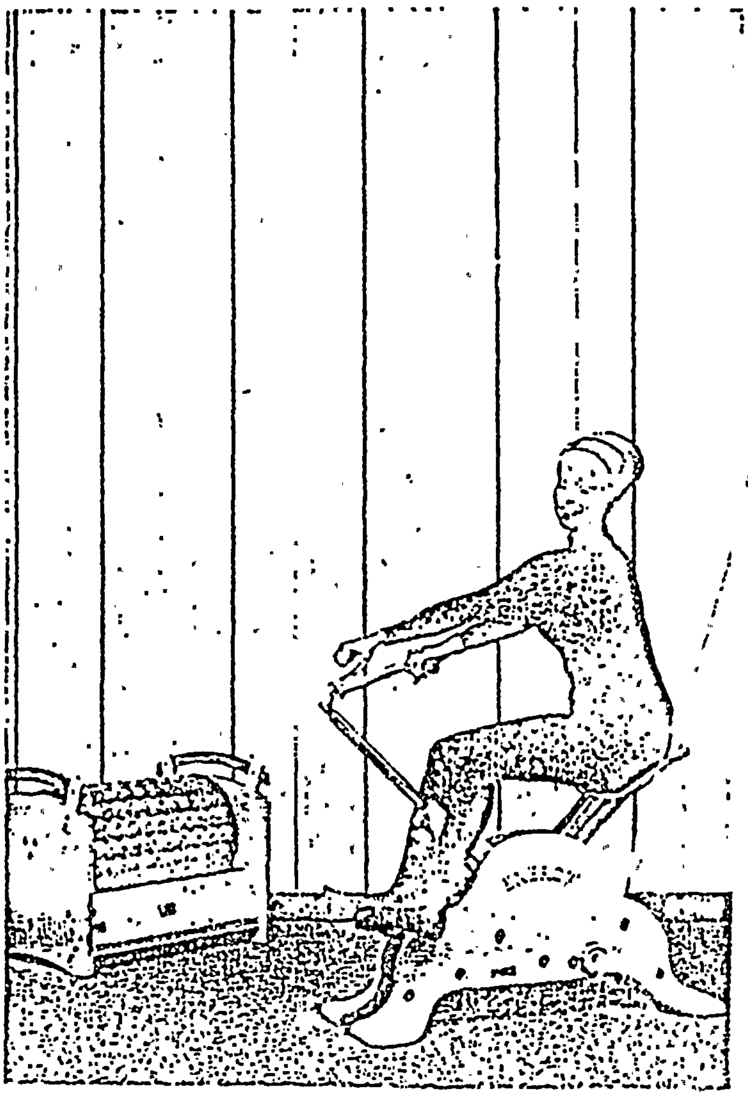
TMI Panel Systems 440/550

FOR INTERIOR APPLICATIONS

TMI Panels Systems 440 and 550, with FORMICA ® laminate decorative surfaces, are installed over any firm subwall. These rigid, preveneered panels — in convenient 16" and 24" modular widths — are available in a wide range of solid colors and warmtone woodgrain designs.

These Panel Systems offer an attractive and practical alternative at a time when woods and other "natural" materials are in short supply and often cost-prohibitive. But most importantly — the alternative choices (TMI Panel Systems 440 and 550) equal or exceed in beauty, function and durability, the traditional materials they replace.

Panel Systems 440 and 550 meet a wide scope of Code requirements — fit a range of construction and design purposes. You can select narrow or wide panels, metal or matching decorative laminate *moldings*, use *splines* concealed or with optical *reveals* — and perfectly match runs of standard panel (System 440) to meet adjacent areas of *fire-rated Class I specification* by using System 550 — and save on cost while maintaining the same visual appeal.



PRODUCT DISCRIPTION

Basic Use: Panel Systems 440 and 550 are m... systems, designed for use as wall surfacing where good appearance, durability and resistance to stain and scratching and heat from ordinary sources are required. System 440 is a standard grade product and System 550 is a fire-retardant grade. These systems are ideal for new or remodeling installations in nursing homes, hospitals, health care centers, ... churches, offices, restaurants, motels and ..., banks and public buildings.

Composition and Materials: Panel Systems 440 and 550 are assembled and installed using these components

Components: (for a 7/16" panel)

Decorative surface: FORMICA ® brand lam... Vertical Surfacing Grade -55.
Core: (440) 3/8" thick untreated particle board; (550) 3/8" thick fire-retardant particleboard.
Adhesive (440) water resistant type 2 glue; (550) U.L. approved Resorcinol.
Backing: FORMICA ® brand backing sheet, Grade -90.

Panel Size: 7/16" thick in nominal sizes of 16 x 96", 24 x 96", 16 x 120" and 24 x 120".

Colors and Designs: FORMICA ® laminate solid colors and woodgrain designs from the Standard Collection (Sweets Arch, File 8.14 Fo).

Finish: Suede-50, a minutely grained texture, with low light-reflective value, imparts a soft, warm pleasing effect that enhances beauty of design.

Accessories: Molding; in the form of Outside Corner, Cap, Ceiling and Casing configurations, are all wood-core and surfaced with FORMICA ® laminate to match the panels. Stained wood Splines and optional laminate Insert Strips complete the package. (See details on facing page).

Installation: Panels are applied with a spline system to furring strips over any subwall. Installation instructions are packed in each carton of panels. (See facing page for 7 basic steps.

Fire hazard Classification Rating: (550) ASTM E84, Flamespread – 25; Smoke developed — 40, as tested on the decorative face. (per ASTM E84 and UL 723 Tunnel Test and covered under UL Classification and Follow-up Service Agreement R-5035).

Applicable Standards: Components of Panel Systems 440 and 550 meet the following performance standard: For Laminates — NEMA Publication LD1-1971 Amended; for Cores — Commercial Standards CS 236-66.

Approvals and Compliances: (440) Los Angeles — (23511); City of New York — Calendar # 28863SM; City and County of San Francisco — General Approval 228 F 9.0 Interior Finish Class 1B. (550) UL Classification File R5035; B.O.C.A. — 6937; I.C.B.O. — 2395.

Limitations: Panel Systems 440 and 550 are not structural and cannot be used on exterior applications.

FOAMGLAS® Cellular Glass Insulation

FOAMGLAS insulation is a rigid insulation material composed entirely of closed glass cells. It is manufactured in a basic block form which is factory-cut and fabricated into blocks and boards of various thicknesses and tapers.

The glass cells which make up FOAMGLAS insulation are continuous with no intervening voids... FOAMGLAS insulation is all cellular glass. It contains no binders or fillers.

It has performed successfully for over forty years in a wide variety of non-residential building applications. The versatility of FOAMGLAS insulation permits it to meet today's most demanding building insulation needs.

Built-Up or Single-Ply. FOAMGLAS insulation's total resistance to moisture in liquid or vapor form, dimensional stability and high compressive strength make it an ideal insulation under built-up roof or single-ply membranes.

Improved "R" Factor. Since its introduction, FOAMGLAS insulation has been continually evaluated through on-the-job performance. The most recent product development has led to an "R" factor improvement of 2.86 per inch (75°F mean).

Cost Versus Value. While FOAMGLAS insulation is considered to initially be a more expensive insulating material than some others, it is quite competitive when it is evaluated on a life-cycle basis. The superior physical properties of FOAMGLAS insulation are what make it cost effective.

The Outstanding Physical Characteristics of FOAMGLAS® Cellular Glass Insulation

PHYSICAL PROPERTIES	USA	METRIC	SI	ASTM TEST
Absorption of moisture (% by volume)	0.2% Non-absorptive. Only moisture retained is that adhering to surface cells after immersion.			C 240
Water-vapor permeability	0.00 perm-in	0.00 perm-cm		C 355
Acid resistance	Impervious to common acids and their fumes except hydrofluoric acid.			
Capillarity	None	None	None	
Combustibility	Noncombustible, will not burn.			E 136
Composition	Pure glass, totally inorganic, contains no binder.			
Compressive strength Average, for standard material	100 psi Strength when surfaces capped with hot asphalt, different cappings will give different values.	7.0 kg/cm²	689 kPa	C 165, C 240
Density average	8.5 lb/ft³	136 kg/m³	136 kg/m³	C 303
Dimensional stability	Excellent—does not shrink, swell or warp.			
Linear coefficient of thermal expansion	4.6×10^{-6}/°F	8.3×10^{-6}/°C	8.3×10^{-6}/K	
Thermal Conductivity	Btu-in/hr-ft²-°F 0.33@50°F 0.35@75°F	kcal/m-h-°C 0.040@ 0°C 0.042@20°C	W/mK-°C 0.047@ 0°C 0.049@20°C	C 177, C 518

Certifications

Underwriters Laboratories

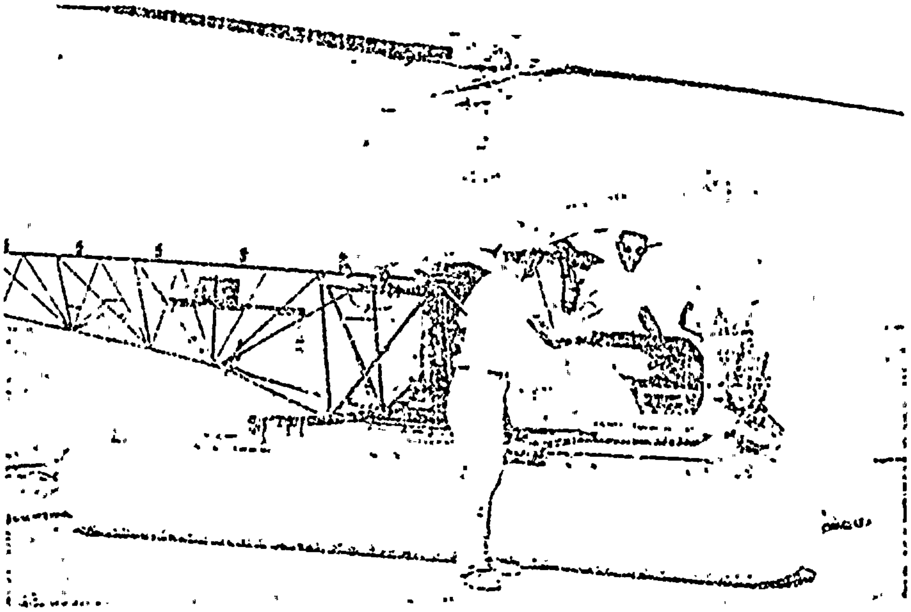
- Fire Hazard Classification
  Flame Spread...5
  Smoke Developed...0
  (See latest UL Building Materials Directory)
- Fire Resistance Classifications
  Roof Ceiling Assemblies
  Design Nos. P227, P508—1½ Hour
  Design No. P801—1 to 2 Hour
  (See latest UL Fire Resistance Directory)
- Acceptable for use in Construction No. 1 and No. 2 (Metal Deck Assemblies, Fire Classified) and No. 171 (Metal Deck Assembly, Wind Uplift Class 30, Fire Classified).
  (See latest UL Building Materials Directory)

Factory Mutual

- Steel Deck Construction
  Acceptable for Class 1 Construction
- Exposed Interior Insulation
  Automatic Sprinkler Protection May Not Be Required: The insulation of itself has been evaluated for its surface flame spread and fuel contribution. The insulation and its recommended installation method meet the requirements as Class 1 material of low fire hazard in noncombustible occupancies not requiring automatic sprinkler protection when applied to noncombustible substrates.
  (See latest FM Approval Guide)

Conductance and Resistance of FOAMGLAS® Insulation

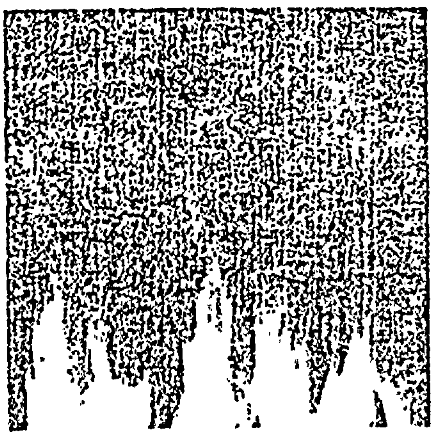
Thickness of FOAMGLAS® Insulation (inches)	75°F (24°C)		50°F (10°C)	
	C Value	R Value	C Value	R Value
1	.350	2.86	.330	3.03
1½	.233	4.29	.220	4.55
2	.175	5.71	.165	6.06
2½	.140	7.14	.132	7.58
3	.117	8.57	.110	9.09
3½	.100	10.00	.094	10.61
4	.038	11.43	.033	12.12
4½	.078	12.86	.073	13.64
5	.070	14.29	.066	15.15



A 2,350 lb. helicopter sits on a built up roof system with FOAMGLAS Insulation. The compressive strength of FOAMGLAS Insulation withstands loads which can crush other insulation materials.

In building applications, it is essential to provide an insulation which will stand up to construction loads, foot traffic and in the case of plazas, parking decks and floors, vehicular traffic. Waterproofing membranes can develop leaks if the insulation beneath it compresses under traffic loads.

The Benefits. There will be no slumping or compressing of the insulation when FOAMGLAS Insulation is specified and properly installed. It has the strength to withstand all normal loads for the life of the application.



FOAMGLAS insulation is all glass and totally noncombustible.

Noncombustible

Glass cannot burn, so FOAMGLAS insulation is totally noncombustible*. During storage and construction, insulation materials are often exposed to sparks and open flames. Many insulation materials are combustible and must be shielded at all times. FOAMGLAS insulation does not require this costly protection.

Insulation should not burn nor help to spread flames if a fire occurs in a completed structure. In actual cases, FOAMGLAS, an inorganic insulation, has contained the fire, preventing it from spreading.

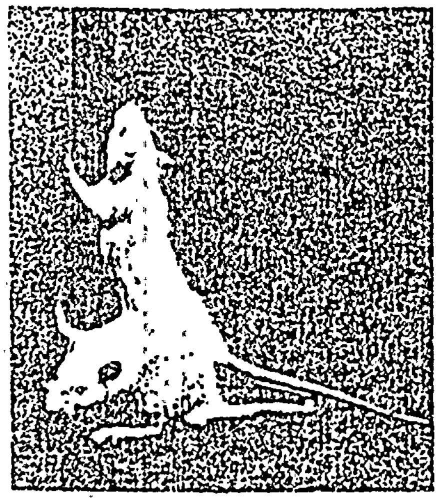
Organic insulations, in contrast, are not only flammable, but often help to spread flames and generate toxic fumes and smoke which compound fire fighting and rescue problems.

*ASTM E-136, "Behavior of Materials in a Vertical Tube Furnace at 750°C

Reduced Insurance Rates. The noncombustibility of FOAMGLAS insulation makes reduced insurance rates and deductibles possible. It can also help to reduce the requirements for expensive fire protection equipment. Pittsburgh Corning recommends that local fire and building codes be checked carefully to determine conditions and restrictions on building materials selection.

Vermine and Rodent Proof

FOAMGLAS insulation is inorganic, so it will not provide rodents and vermin with nesting material or food. Other insulating materials, such as plastic foams, can be destroyed by rodents and expensive wire mesh ratproofing must be installed to protect these materials. FOAMGLAS, unlike other insulations, will not attract or sustain bacteria or mold growth.



FOAMGLAS insulation provides maximum resistance to rodents and vermin

The Benefits. When FOAMGLAS insulation is specified and properly installed in applications such as food and dairy products processing plants, breweries, cold storage warehouses, etc., total resistance to rodents and vermin is assured, state and federal health requirements are satisfied and losses due to infestation are eliminated or dramatically reduced.

ATTACHMENT

Concern

2. To comply with Section C.6.a of BTP CMEB 9.5.1, the fire detection systems should be designed in accordance with NFPA Standard No. 72E. Section 4-3 of the standard stipulates that the location of smoke detectors must anticipate smoke stratification. We observed that in several fire areas, such as RC III adjoining the control and cable spreading rooms, smoke detectors were not installed at each floor elevation. The applicant should verify that the location of smoke detectors in areas that encompass more than one floor elevation will not be compromised by smoke stratification.

Additional Clarification

Control room procedures require that fire brigade members identify which detector goes into alarm and log it in. In areas where the smoke detectors encompass more than one floor, such as the cable chase, the detectors alarm per floor in the control room. Therefore, the fire brigade member will know which floor to respond to and can quickly locate the detector which alarmed and find the cause.

Concern

8. To comply with Section C.5.a of BTP CMEB 9.5.1, interior wall and structural components and thermal insulation material should be noncombustible. The applicant should verify that the laminated wall panels in the control room and the urea-formaldehyde foam insulation observed in several areas of the plant are noncombustible.

Additional Clarification

Attached are copies of the catalog cut for the laminated wall panels in the control room and the Foamglas Cellular Glass Insulation used in the MCC rooms (Enclosure 1). Per the fire test data, both materials are satisfactory for the area and use. Automatic sprinklers have been installed in the control room peripheral areas which will provide the needed protection for this area.

Concern

12. In Amendment 19, the applicant committed to comply with NFPA Standard No. 30, "Flammable and Combustible Liquids Code". In the water filtration building, the diesel fuel day tank is on unstable supports which is contrary to this commitment.

Additional Clarification

The supports for the diesel fuel day tank in the water filtration building will be modified to correct this situation prior to fuel load.

Concern

13. In Amendment 19, the applicant committed to comply with NFPA Standard No. 15 in the design of the water spray fire suppression systems. We observed that the water spray heads and baffle plates protecting the diesel generators and fuel tanks do not provide complete protection (coverage) for the hazards in the area which is not consistent with that commitment.

Additional Clarification

Sprinkler System in the Diesel Generator and HPCS Rooms.

The rooms have ionization detection in the switchgear room and photoelectric smoke detectors at the ceiling in the diesel generator areas for early warning of a fire. These detectors will send an alarm to the control room and the fire brigade will be dispatched. Thermal detectors are located at the ceiling to activate the pre-action sprinkler system. The pre-action sprinkler heads are located 14 feet above the floor with the detectors at the ceiling, approximately 30 feet above the floor. Enclosure 2 provides additional information on the sprinkler head and sprinkler head configuration.

The pre-action sprinkler system is designed as a special hazard system with closed head directional spray sprinklers over the top and sides of the diesel generator. The attached sketch shows that all areas of the diesel generator are covered except for some floor areas next to the wall. Additions are being made to the system to cover these areas.

The glass bulb sprinkler heads have a 12" X 12" heat collector over the head to help collect heat and actuate the sprinkler heads.

There are no interconnecting passages or penetrations between the diesel generator rooms. Therefore, the fire brigade actions to locate and/or fight a fire will not expose the redundant generator to fire, heat or smoke. The redundant diesel generator has the capacity to operate the safety related equipment and bring the plant to safe shutdown.

In the event a diesel generator is inoperable, plant operation is conducted per the technical specification limiting condition for operation (3.8.1.1), effectively verifying redundant diesel generation within one hour of the diesel generator inoperable declaration.

Concern

17. To comply with Section C.7.h of BTP CMEB 9.5.1, fire doors and other penetrations of fire barriers in the Turbine Building should be located so as not to be directly exposed to a turbine oil fire exposure or spill. We observed that there was no curb or floor drain at the fire doors at elevation 441 ft. of the Turbine Generator Building to prevent the possibility of oil leaking from a turbine oil line rupture from passing through the fire doors.

Additional Clarification

Per audit item 17, a recommendation was made to install a curb in the doorway between the Turbine Generator Building and the Reactor Building at door T-114. The purpose of the curb was to prevent an oil spill associated with operations in the Turbine Generator Building from entering the corridor. Because of the general traffic through this door, a curb or ramp would introduce a significant industrial safety hazard and, in the Supply System's opinion, increase the probability of significant injury to employees. On this basis, the door curb or ramp proposed in item 17 will be omitted. The following protection/system design is considered an acceptable substitute:

- The maximum spill for the area considering a single failure would be 700 gallons.

- The Reactor Feedwater Pump Oil Systems are not a major oil system associated with the station turbine generator. They are associated with the turbine driven Reactor Feedwater Pump Systems.

- The piping in the area is schedule 80 welded construction external to the local sample panels. Small diameter stainless steel tubing is used in the panels.

- Design oil temperature and pressure in the piping systems is $160^{\circ}F$ at 120 psig.

- The floor is sloped away from door T-114 toward 5 floor drains in the Turbine Generator Building.

- A hydraulically designed open head deluge system protects the piping and sample panel area. The system is actuated by thermal detectors or a manual pull station. The system is identified as DEL-S2 in the FSAR.

The Supply System is in the process of extending the WNP-2 standpipe system to add an additional hose station adjacent to door T-114 in the Reactor Building corridor. This will allow safe access to fire fighting equipment, in the event it is needed, to protect the opening between the Reactor Building and the Turbine Generator Building.

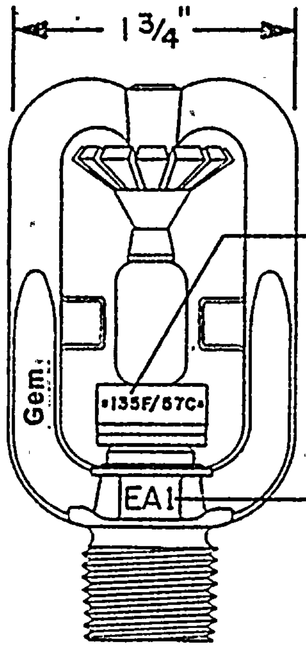
PGCC Floorplates

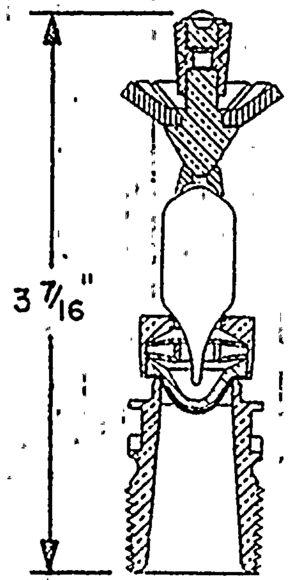
An additional concern recognized by the Supply System is the use of substitute materials used as floor plates in the PGCC. In response to a phone conversation (September 15, 1983) between D. Kubicki (NRC) and Messrs. P. Powell, A. Jones, M. Neel (SS) and C. Hart, R. Artigas, F. MacLean and L. Fleischer (GE), the following information and commitments are provided:

Benelex floor plates currently used on the PGCC modules are being replaced with Richlite floor plates. Richlite has a flame spread of 25 and a smoke evolved of 40 which classifies the material as Class A or noncombustible. The General Electric report entitled "Floor Plate Design", dated September 1983, is attached for your information (Enclosure 2). Additional information forwarding Underwriters Laboratory Test Reports conducted for General Electric are provided in Enclosure 4.

One section of PGCC U-689 uses an insulation "washer" made from Benelex between the PGCC floor frame and the termination cabinet. The termination cabinet and the floor frame enclose approximately 80% of the surface area. The majority of the exposed area will be given two coats of Albi 107A, a flame retardant coating. All other Benelex will be removed from the PGCC.

A question was raised concerning the possibility of floor plates being dislodged during the discharge of Halon in the underfloor sections of the PGCC's. Ten discharge tests have been conducted to date. The tests have been witnessed by Supply System Industrial Safety & Fire Protection personnel and no floor plates were dislodged in any of the tests. The floor plates are designed to have a flush 1/2 turn locking device installed after Halon discharge and concentration tests are completed.





<u>TEMPERATURE RATING:</u>

135°F/57°C	286°F/141°C	400°F/204°C
175°F/79°C	325°F/163°C	500°F/260°C
250°F/121°C	360°F/182°C	

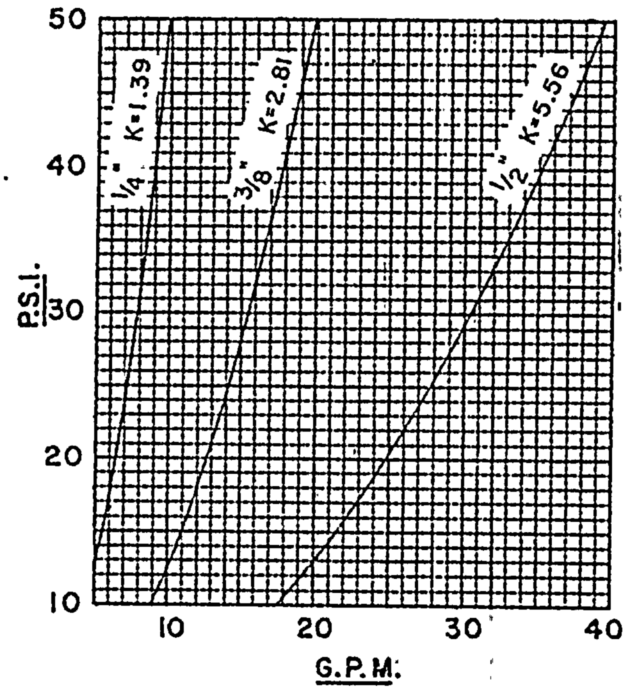
<u>INCLUDED ANGLE OF DISCHARGE PATTERN:</u>

65°	80°	95°	110°
125°	140°	160°	180°

<u>ORIFICE SIZE:</u> 1/2", 3/8" OR 1/4".

<u>PIPE THREAD CONNECTION:</u> 1/2" NPT.

<u>MATERIAL & FINISH:</u> BRASS – PLAIN, LEAD COATED OR CHROME PLATED. FURNISHED WITH PLAIN FINISH UNLESS OTHERWISE SPECIFIED.

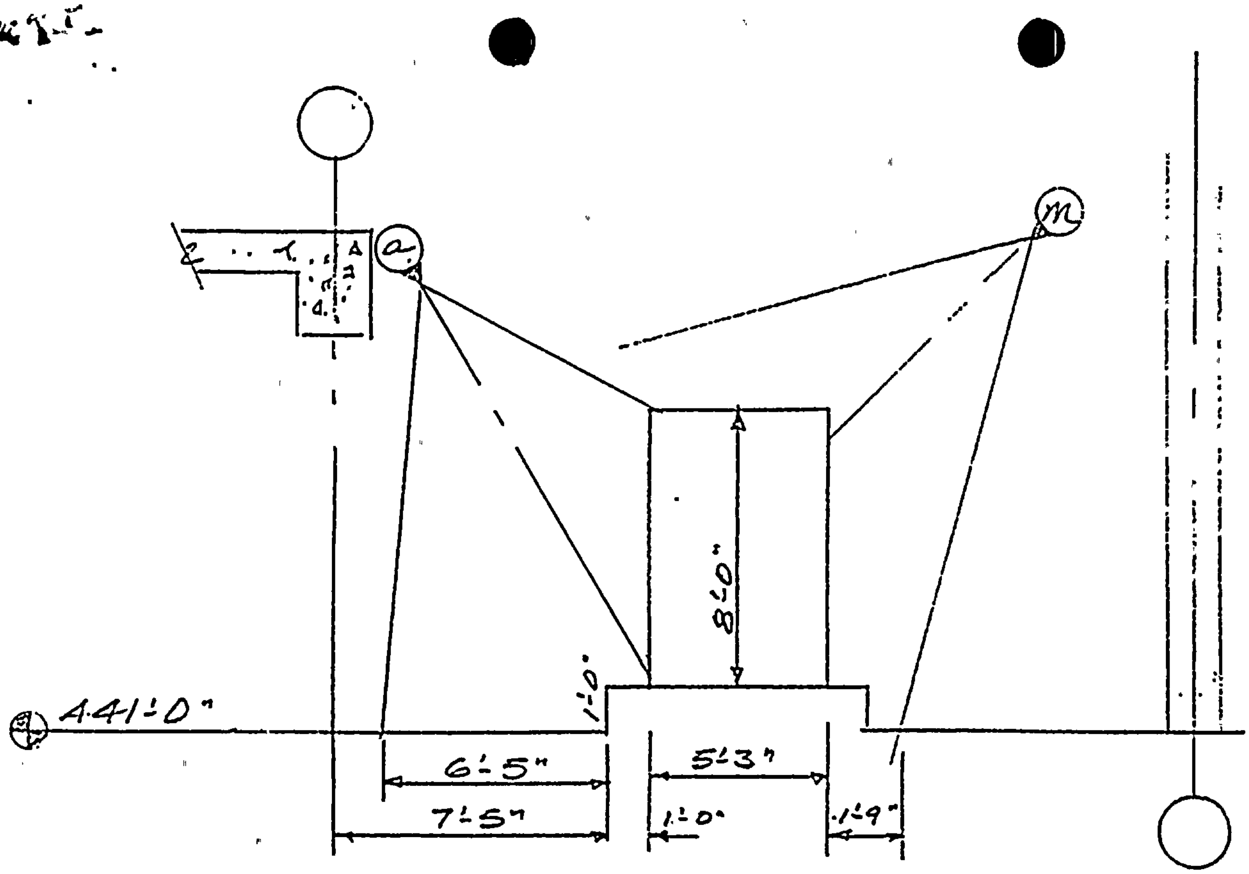


DISCHARGE CURVE

<u>TO ORDER SPECIFY:</u>

GEM (ORIFICE SIZE) (TEMPERATURE RATING) (SPECIFY FINISH IF OTHER THAN PLAIN BRASS IS REQUIRED) PROTECTOSPRAY NOZZLE, TYPE EA-1 (ANGLE OF DISCHARGE PATTERN). ------------------------ (QUANTITY)

GEM PROTECTOSPRAY NOZZLE
TYPE EA-1

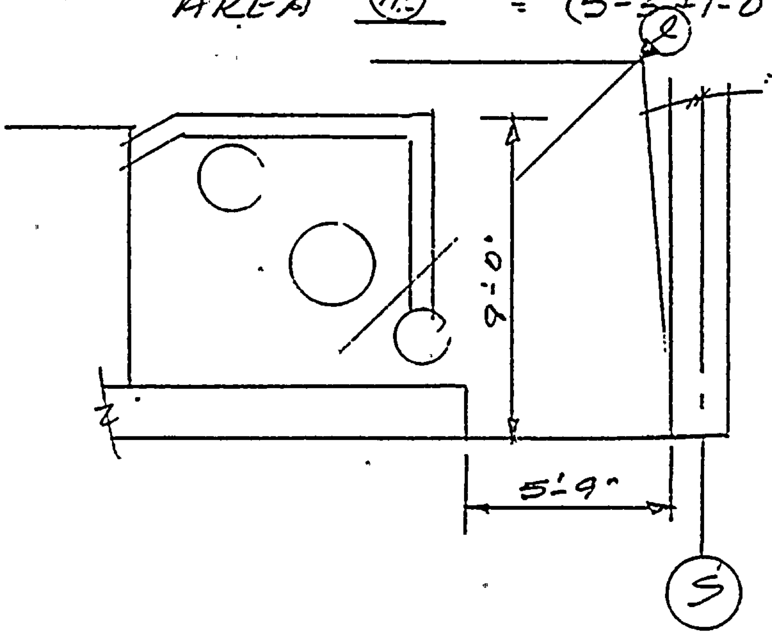


AREA OF NOZZLE PROTECTION CALCULATIONS

1. LGTH. OF PROTECTED SURFACE X DIST. BETWEEN NOZ.

AREA (a) = (6'-5" + 1'-0" + 1'-0" + 8'-0") X 6'-9" = 110.54 #

AREA (m) = (5'-3" + 1'-0" + 1'-9" + 8'-0") X 6'-9" = 108.0 #



2. LGTH. OF PROTECTED SURFACE X WIDTH OF SURFACE.

AREA (l) = (9'-0" + 5'-9") X 7'-3"
= 106.94 #

TYPICAL @ N & S ENDS OF ALL THREE UNITS.

WNP #2 PREACTION SYSTEM #

SENTRY AUTOMATIC SPRINKLER CO.

DATE: ______

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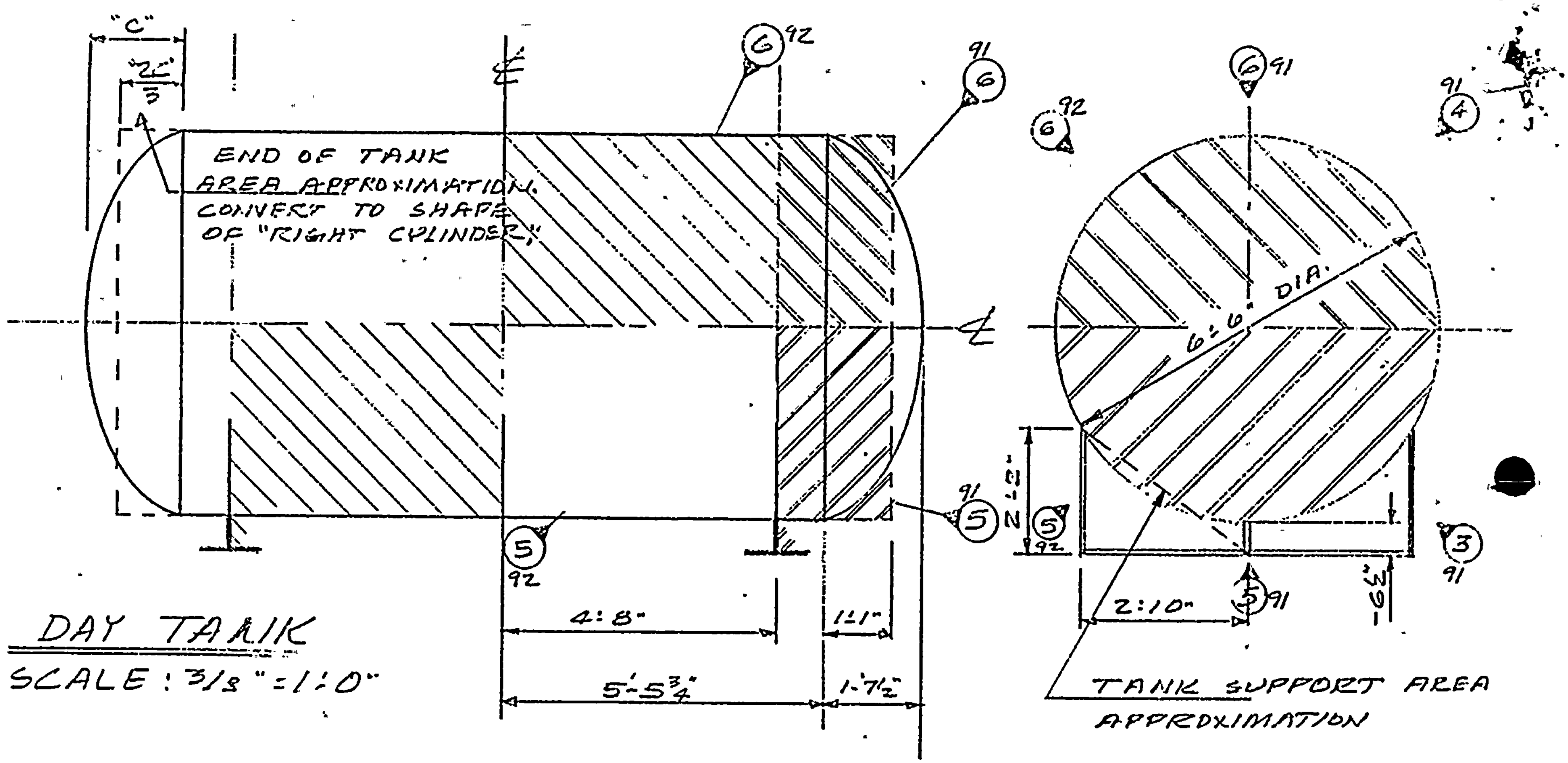

AREA OF NOZZLE PROTECTION CALCULATIONS

1. AREA OF END OF TANK: $\frac{\pi D^2}{4}$ = 33.18 #.
2. AREA OF SUPPORT SADDLE (1 SIDE ONLY) = 2'-2" X 2'-10" = 5.89 #.
3. AREA OF TANK WALL PER FT. OF LGTH. = $\pi \times D$ = 20.42 #.
4. AREA PROTECTED BY NOZZLE "6-92" = 20.42 ÷ 4 × 4'-8" = 23.82 #
5. AREA " " " "5-92" = 23.82 # + ½ SADDLE (5.89÷2) = 26.77 #.
6. AREA " " " "5-91" = END÷2 + (1-10¼ × 20.42÷2) + SADDLE (5.89) = 41.88 #
7. AREA " " " "6-91" = END÷2 + (1-10¼ × 20.42÷2) = 35.99 #.

WNP #2 - PREACTION SYSTEM 3 #
SENTRY AUTOMATIC SPRINKLER CO.

9 DATE: 11-23-81
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