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May 30, 1984

Director of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Attn: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing
Washington, DC 20555

Reference: Beaver Valley Power Station
Docket No. 50-334, License No. DPR-66
Appendix R - Revised Exemption Request for Structural Steel

Gentlemen:

Enclosed is a revision to our requested exemption for Structural Steel previously submitted on December 16, 1983 as Attachment VII "Structural Steel, Service Building Elev. 713 area below the Cable Spreading Room (CS-1)". The steel stresses and reserve capacities have been recalculated, as noted on pages 5, 7 and 8 of the attachment, for greater accuracy compared to the more conservative estimates provided in the previous submittal. Since the steelwork supports an area that is normally unoccupied and does not serve as an access/egress route, live loads have been eliminated in the stress calculations. Seismic loads are also totally excluded because the probability of a simultaneous fire and a seismic event need not be postulated per the Appendix R guidelines.

The basis for the requested exemption from III.G.2a remains valid. That is, all the steel beams still show a reserve capacity even though the new calculations show a slight decrease in value. In addition, it can be concluded that the maximum beam stress remains lower than the postulated yield stress at 1100°F.

Please contact my staff if additional information or clarification is necessary.

Very truly yours,

J. J. Carey

J. J. Carey
Vice President, Nuclear

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Enclosures

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EXEMPTION

VII. (Structural Steel) Service Bldg. EL. 713' area below the Cable Spreading Room (CS-1)

Fire Areas:

ES-1 West Emergency Switchgear Room
ES-2 East Emergency Switchgear Room
MG-1 Control Rod Drive Motor Generator Room
CR-3 Communications Equipment and Relay Panel Room
CR-4 Process Instrument and Rod Position Room
(See Attached Figures 11.13-1 and 2)

A. Discussion

The structural steel located in the above fire areas, which helps to support the above floor area cable spreading room (CS-1), is denoted in Figure 11.13-1. Located in these areas are various safe shutdown cabling as discussed in Section D below.

An exemption is requested from III.G.2a which requires that structural steel forming a part of or supporting fire barriers separating redundant trains to have a fire rating equivalent to the fire resistance of the barrier. A fire hazards analysis has been performed and documented within this request for exemption which justifies the acceptability of the present plant design based on equivalent level of protection, and shows the maximum temperature the steel will reach during a fire in these areas and it's ability to carry the required loads.

B. Boundaries

The construction of all of the above listed areas constitutes a 3-hour rated fire [illegible] between each of the adjacent fire areas with the exception of the ceiling slab described below.

1. Walls (Ref. Drawing 11700-RC-8A, -8B)

Reinforced Concrete:

a. North

The north wall faces the 4KV Normal Switchgear Room (NS-1), the pipe chase, and the turbine building and is divided into two sections of different thicknesses.

(1) 2ft.0in reinforced concrete at the pipe chase and NS-1.

(2) 1ft.6in. reinforced concrete at the turbine building.

b. South

The south wall faces an unexcavated area, Primary Auxiliary building (PAB) and the A/C Equipment Room (CR-2) and is divided into two sections of different thicknesses.

(1) 2ft0in. reinforced concrete at that section which parallels the unexcavated area and the PAB.

(2) 1ft.0in. reinforced concrete at that section which parallels CR-2.

c. East

The east wall faces the Cable Tunnel (CV-3) and the A/C Equipment Room (CR-2) and is divided into two sections of different thicknesses.

(1) 2ft.0in. reinforced concrete at that section which parallels CV-3.

(2) 1ft.0in. reinforced concrete at that section which parallels CR-2.

d. West

2ft.0in. parallels an unexcavated area and the normal switchgear room (NS-1).

e. Intermediate walls running north-south between areas ES-1 and ES-2, ES-2 and MG-1, MG-1 and CR-4, and CR-4 and CR-3 are all 1ft.0in. reinforced concrete with qualified 3-hour fire rated penetration seals, as required, which constitutes a 3-hour fire barrier between these rooms.

2. Ceiling (Ref. Drawing 11700-RC-7G)

Reinforced concrete (5 1/2" max., 4" min.) on 1 1/2 inches corrugated metal decking constitutes a minimum 1 1/2-hour fire rated barrier per the fire resistance/concrete thickness curve (Figure 11.13-3)*. See Figure 11.13-6 for details of ceiling slab. (See Exemption Request for CS-1 area, ATTACHMENT XI)

3. Floor (Ref. Drawing 11700-RC-8G,-8H)

Minimum 3 ft. reinforced concrete

4. Room Volumes

ES-1	29,220 cu.ft.
ES-2	28,220 cu.ft.
MG-1	17,160 cu.ft.
CR-4	65,880 cu.ft.
CR-3	10,980 cu.ft.

* Reference. NFPA Fire Protection Handbook; 15th edition, 1983. Figure 5-8R.

C. Ventilation

1. The ventilation supply and exhaust system for ES-1, ES-2 & MG-1 are the same. All areas are exhausted to an outdoor discharge. Venting of any of the areas could be accomplished by resetting the respective fire dampers, all of which are accessible from the Cable Spreading Room (CS-1). The power and controls for this ventilation system are outside the CS-1 area.

2. The air conditioning system is the same for CR-3 and CR-4 as that for CR-1 and CR-2. The system is detailed on Figure 11.13-4.

D. Redundant Safe Shutdown Equipment

ES-1 and ES-2 house redundant safety-related 4KV switchgear and 480V substations and supply power to Class 1E circuits required for safe shutdown.

MG-1 houses both class 1E and non-class 1E equipment and cable. The two rod drive motor generator sets and switchgear supply power to the CRDM's and are located in this area. These power supplies are not required for safe shutdown.

CR-4 consists of the primary and secondary process racks, reactor protection racks and the emergency auxiliary shutdown panel located in CR-4 area.

CR-3 contains the safe shutdown diesel generator protection panels and the relay and communication panels.

E. Fire Protection Existing

1. Fire Detection Systems

Early warning detection system consists of area coverage within each applicable fire area by ionization type detectors provided with local alarm and control room alarm display in the fire detection panel. CR-4 additionally has ionization detectors located in the sub-flooring which alarm locally and in the control room and activates the Halon Suppression System in the event of a cable fire in the subfloor area. (Figure 11.13-5)

2. Fire Extinguishing Systems

a. Portable Carbon Dioxide extinguishers presently exist within all areas, with additional portable Carbon Dioxide extinguishers available in adjacent and nearby areas. Additionally, portable 150-lb. wheeled dry chemical extinguisher units are available in the adjacent area (NS-1) and at the S-4 stairwell entrance. Standpipe hose racks stations are available at both stairwell entrances on this elevation.

b. Halon 1301 Suppression System installed in the subfloor cable area of CR-4. (Figure 11.13-5)

3. Propagation Retardants

All cables installed at Beaver Valley Power Station Unit 1 were fabricated to pass the vertical cable tray flame test with an oil and burlap flame source which was the accepted industry standard during the construction of BV-1 and is comparable to IEEE-383 tests.

F. Fire Hazard Analysis

1. Type/Quantity of combustibles in these areas are all for cable insulation as noted.

Fire Area	Cable Insulation
ES-1	5,920 lbs.
ES-2	5,665 lbs.
MG-1	5,575 lbs.
CR-4	24,060 lbs.
CR-3	4,750 lbs.

2. Heat Release Potential from Cable Insulation

Fire Area	(Btu) Heat Load	(Sq.ft) Area	(Btu/sq.ft.) Heat Release Potential
ES-1	6.31×10^7	2,435	31,660
ES-2	6.23×10^7	2,350	26,380
MG-1	6.13×10^7	1,430	48,420
CR-4	2.65×10^8	5,490	50,200
CR-3	5.22×10^7	915	58,550

Based on the heat release potentials, the required fire ratings for each of the areas is less than one hour.

G. Justification of Area Acceptability

1. The fire loading for each of the areas that contain structural steel was determined to be as noted below. In all cases, the existing walls, floors, ceilings and doors exceed this rating.

Fire Area	Fire Loading Barrier Required	
ES-1	24 min.	Determined from
ES-2	20 min.	the STANDARD TIME-
MG-1	36 min.	TEMPERATURE CURVE
CR-4	38 min.	
CR-3	44 min.	

All the areas noted contain structural steel members supporting the floor above (CS-1). Because of hangers and cable tray supports attached to various beams, the stresses vary. A reserve capacity exists and varies from 39% to 49% (Min. To Max.) under working stress conditions.

Fire Area	Minimum Reserve Capacity
ES-1	49%
ES-2	48%
MG-1	39%
CR-4	46%
CR-3	40%

It is recognized that a rise in temperature reduces the yield stress in steel and that at 1100°F the yield stress may drop to 60% of the value at room temperature. The most highly stressed beam still has not reached the yield point per our calculations. (See Attachment 1)

Because steel has a high thermal conductivity, it can transfer heat away from a localized heat source rather quickly. Heat will be transferred to cooler regions through the grid of steel beams supporting the entire CS-1 floor area. A cushion of time can be anticipated in such large areas of heat dissipation.

2. A margin of safety is provided by the vertical concrete columns that support the horizontal steel beams and the floor-to-ceiling solid 12 inches reinforced concrete walls separating areas ES-1, ES-2, MG-1, CR-4 and CR-3. In the event the horizontal ceiling beams start to weaken, the floor load would be distributed onto the partition concrete walls and the vertical concrete columns in the area.

3. Three hour fire rated doors are installed between each of these areas except CR-3/CR-4 which are 1 1/2 hour fire rated doors, and all penetrations are sealed with a qualified 3-hour fire rated material.

4. Hazardous quantities of transient combustibles would not be expected in this area for the following reasons:

   a) The area is not adjacent to or near any major plant traffic route.

   b) Storage of transient combustibles in this area is prohibited by plant administrative procedures.

   c) Maintenance and operations activities in this area do not involve the use of large quantities of combustible materials.

   d) The accessibility to the switchgear area is restricted due to the security system card-key access.

5. The installed early warning smoke detection system would promptly detect incipient fire conditions in this area and the separation of redundant trains will maintain integrity of the cables and equipment until the fire brigade personnel, responding from the control room area two floors above this switchgear area, respond to extinguish the fire via the southeast stairwell. The brigade should be capable of reaching this area within minutes after an alarm is received in the Control Room.

This exemption request is predicated upon an equivalent level of protection to that required based on the above considerations and modifications.

Sheet 1 of 1

LOCATION SERVICE BUILDING

SUBJECT STEEL FRAMING AT E1.725'-6" COMPILED BY: S. Bose Date 5/29/84

REFERENCES/DESIGN BASIS

Stone & Webster Engr. Corp. (SWEC) calculations #11700-S-5 and #13387.13-S-59 are used to determine the stress levels for the most highly stressed beams for the separate fire areas.

Stresses due to dead load only, including all cable tray and conduit support loads, are derived from the referenced SWEC calculations and listed in the Stress Summary. Since the steelwork supports a floor area that is not normally occupied, live load is neglected.

Yield stress of A36 steel is F_y=36Ksi. Allowable stress per AISC Sec. 1.5.1.4.1 is $F_b = .66F_y = .66x36 = 24$ Ksi
Reserve capacity = $1-f_b/F_b$
Postulated yield stress at 1100°F=$.6F_y = .6x36 = 21.6$ Ksi

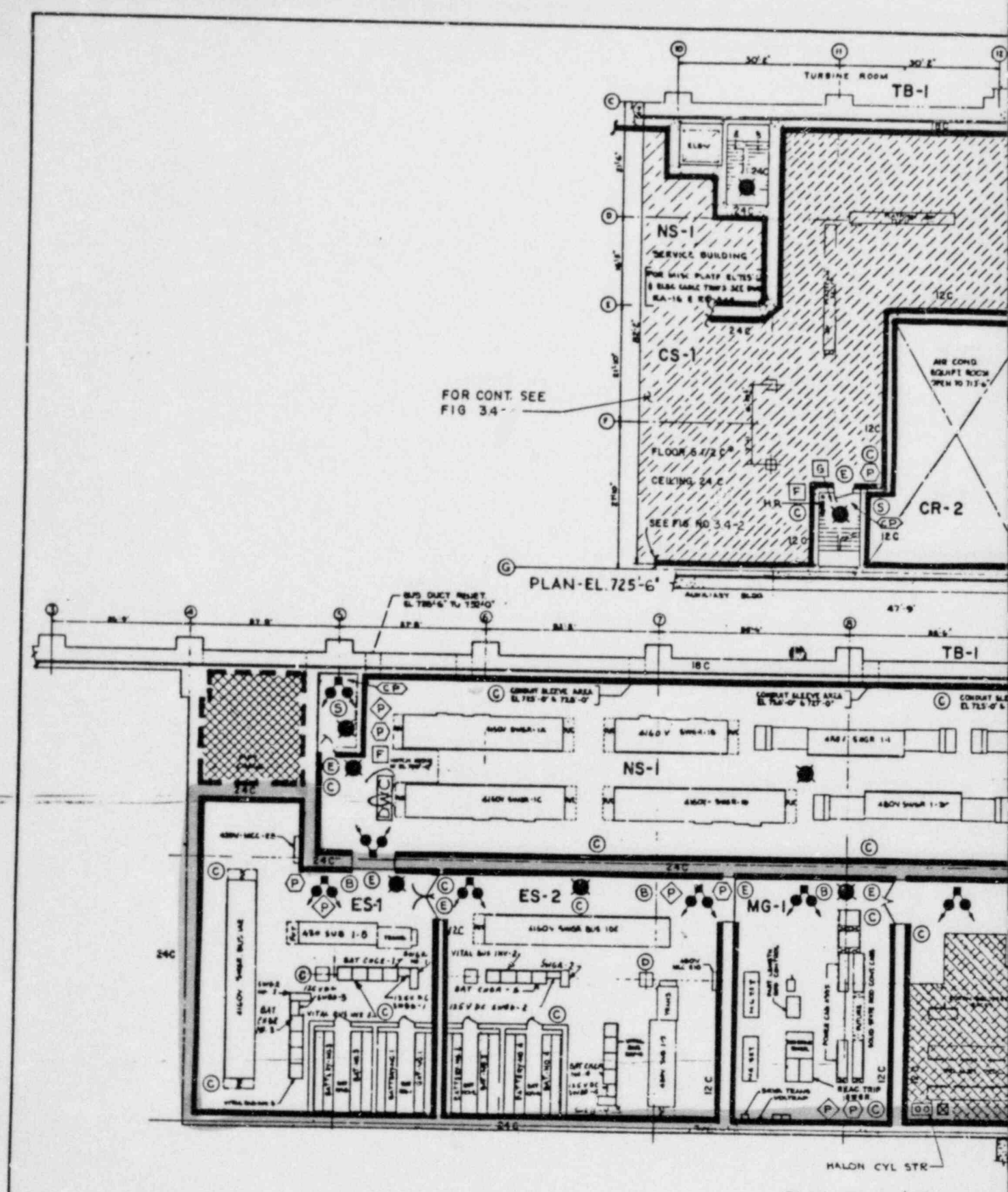
STRESS SUMMARY

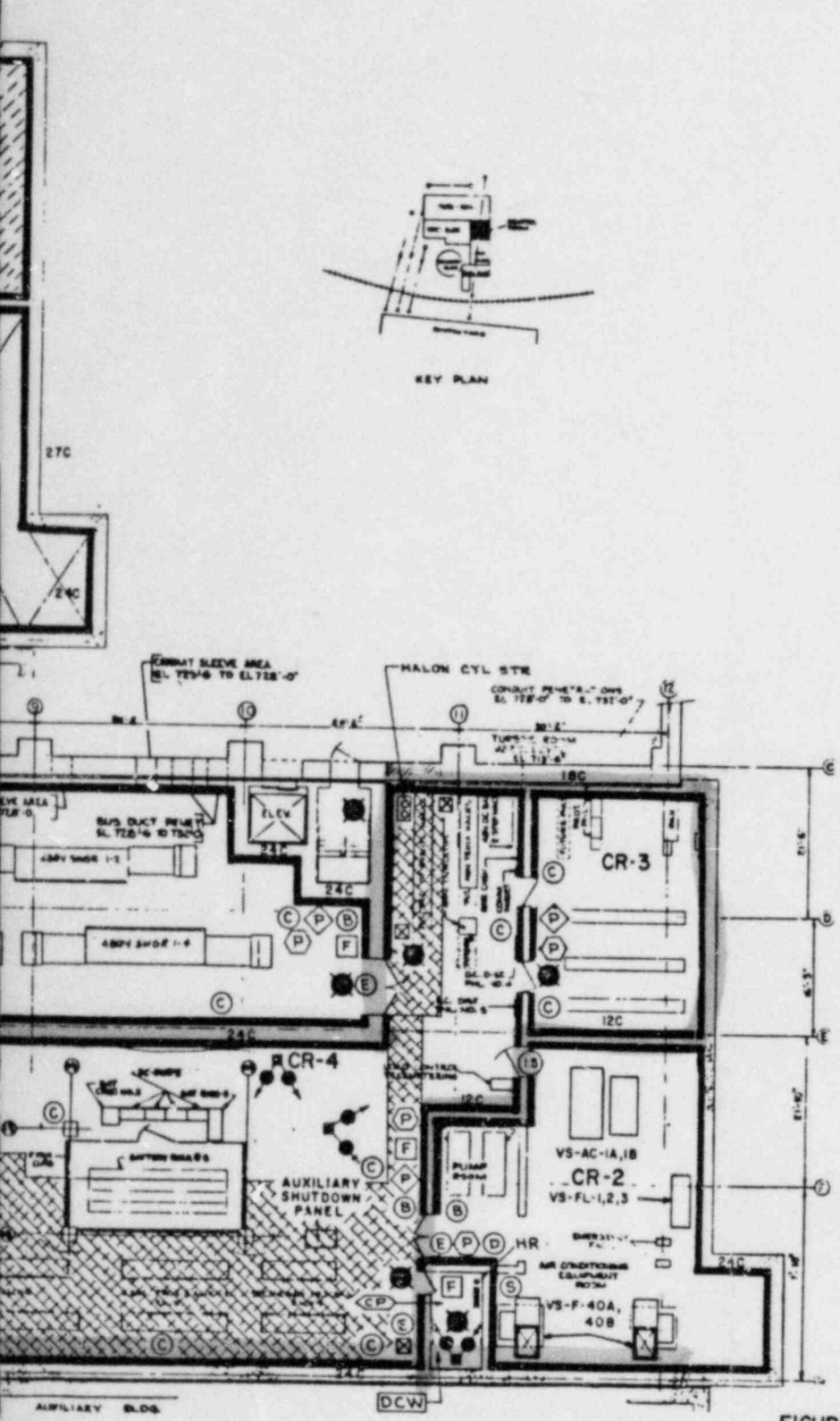
FIRE AREA	MOST HIGHLY STRESSED BEAM PER SWEC CALCS.	MAX. BENDING STRESS f (KSI)	RESERVE CAPACITY
ES-1	B-16.#13387.13-S-59	12.22	1-12.22/24=49%
ES-2	B-15.#13387.13-S-59	12.48	1-12.48/24=48%
MG-1	F-10.#11700-S-5	14.62	1-14.62/24=39%
CR-4	B-12.#13387.13-S-59	12.99	1-12.99/24=46%
CR-3	B-3. #13387.13-S-59	14.41	1-14.41/24=40%

CONCLUSIONS

1. All beams have a reserve capacity.
2. The maximum beam stress (f_b - highest value 14.62) is lower than 21.6 Ksi, the postulated yield stress at 1100°F.

ATTACHMENT 1


TURBINE ROOM
TB-1
NS-1
SERVICE BUILDING
CS-1
FOR CONT. SEE FIG 34-
FLOOR 8 1/2 C.P.
CEILING 24 C
SEE FIG NO. 34-2
AIR COND. EQUIPT. ROOM
CR-2
PLAN-EL. 725'-6"
TB-1
NS-1
ES-1
ES-2
MG-1
HALON CYL STR
PLAN EL 713'-6"
0 5 10 15 20 25 30
SCALE-FEET



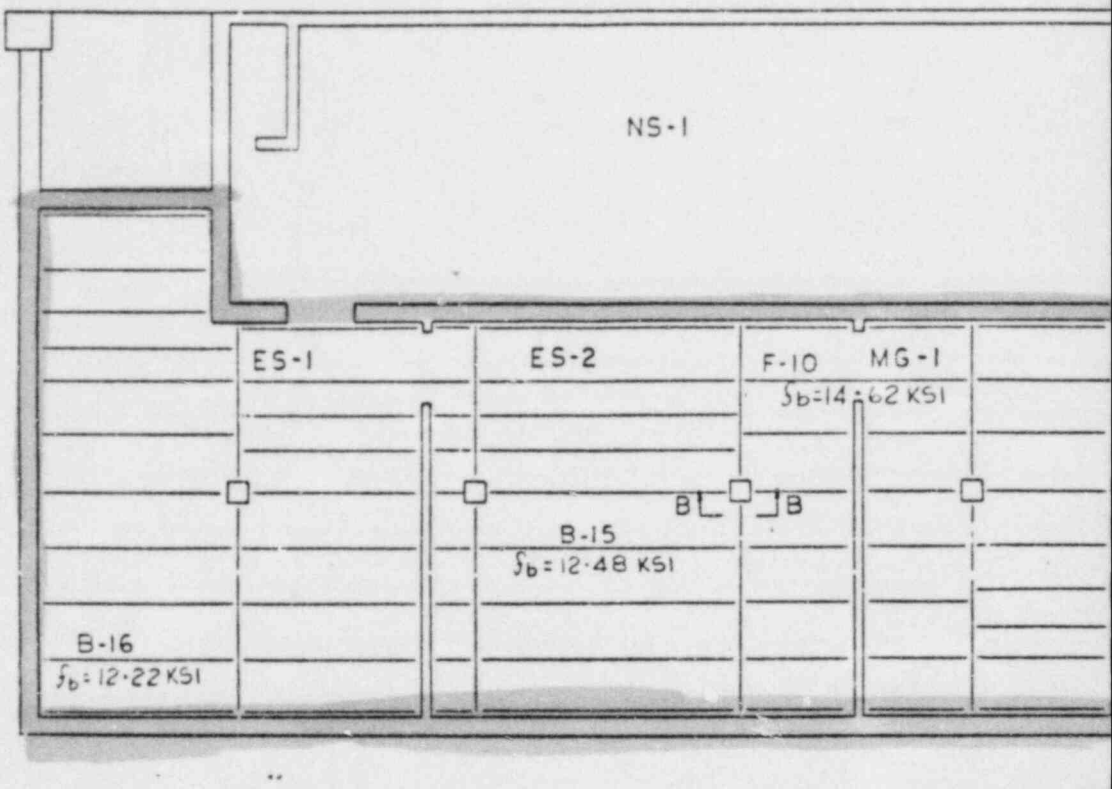
SYMBOLS

- AREA SERVED BY CO_2 SYSTEM
- AREA SERVED BY WATER SPRAY (DEL'G)
- AREA SERVED BY HALON SYSTEM
- HALON ACTUATION PULL BOX
- PAX PHONE
- HOSE RACK
- DCW — DRY CHEMICAL WHEEL UNIT
- CP — COMMAND POST
- W — H_2O FIRE EXT.
- S — STANDPIPE-HOSE RACK
- P — GAITRONICS PHONE
- C — CO_2 CONTROL/ALARM PANEL
- F — FIRE ALARM STATION
- E — EXIT SIGNS
- D — DRY CHEMICAL FIRE EXT.
- C — PORT.FIRE EXT. CO_2-20LBS
- B — FIRE ALARM BELL(APPROX.LOCATION)
- FIRE AREA
- FIRE ZONE
- FIRE BARRIER
- SUB-AREA
- (3) (1.5) — FIRE DOOR RATINGS, (HOURS)
- C — REINFORCED CONCRETE
- B — CONCRETE BLOCK WALL
- MS — INSULATED METAL SIDING
- 125V DC BATTERY EMERGENCY LIGHT
- DC EMERGENCY BATTERY LIGHTING UNIT

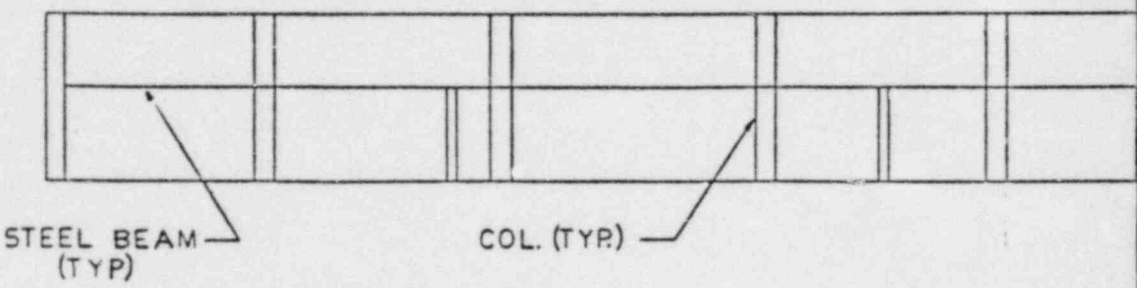
* FLOOR SYSTEM IS 5 1/2" CONCRETE (INC 1 1/2" CORRUGATED METAL DECKING)

FIGURE 11.13-2
CONTROL ROOM, SWITCHGEAR AND CABLE SPREADING AREA
BEAVER VALLEY POWER STATION - UNIT I
FIRE HAZARDS ANALYSIS

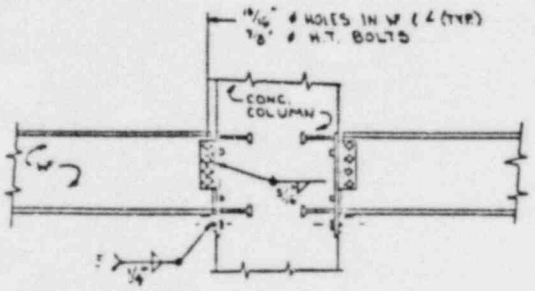
 REVISED 3/1/82



PLAN EL

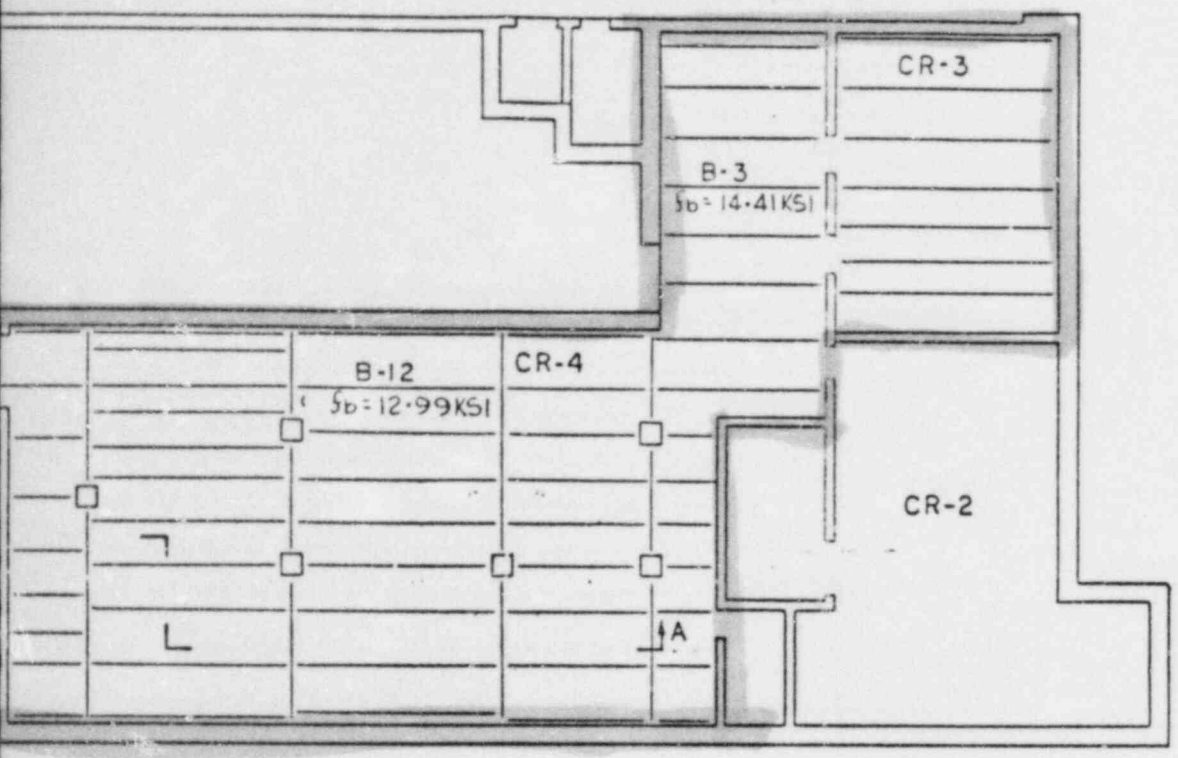


A-



B-B

TYP CONNECTION
WF TO COLUMN



. 713'-6"

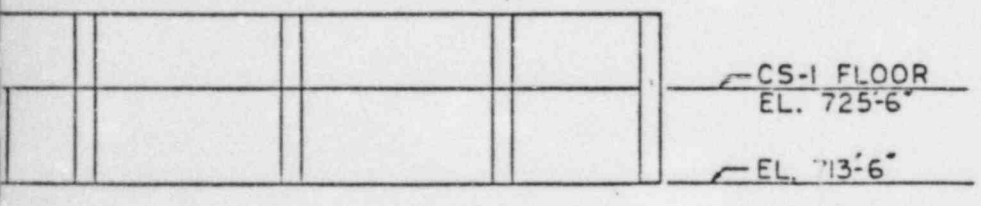


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FIGURE 11.13-1

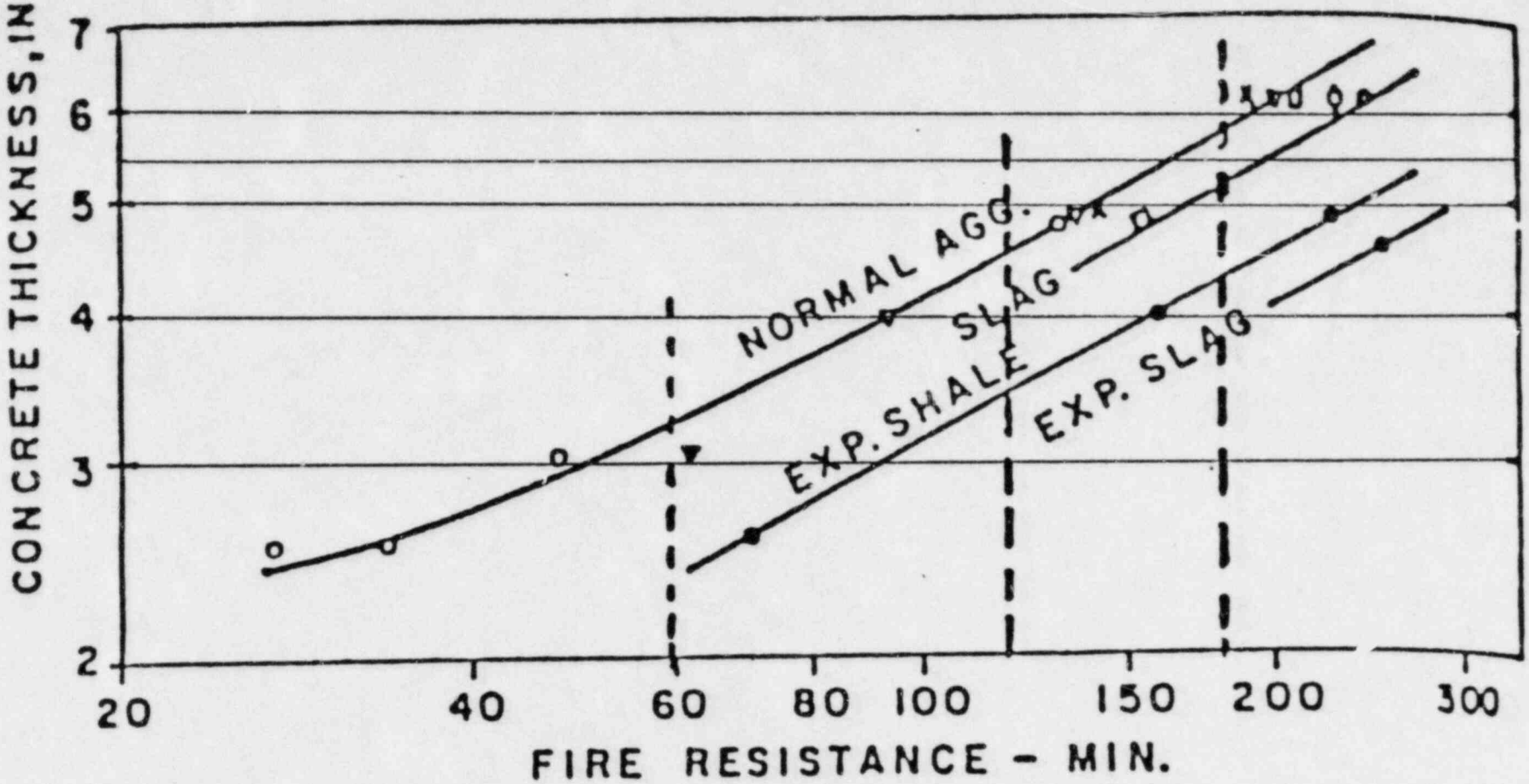
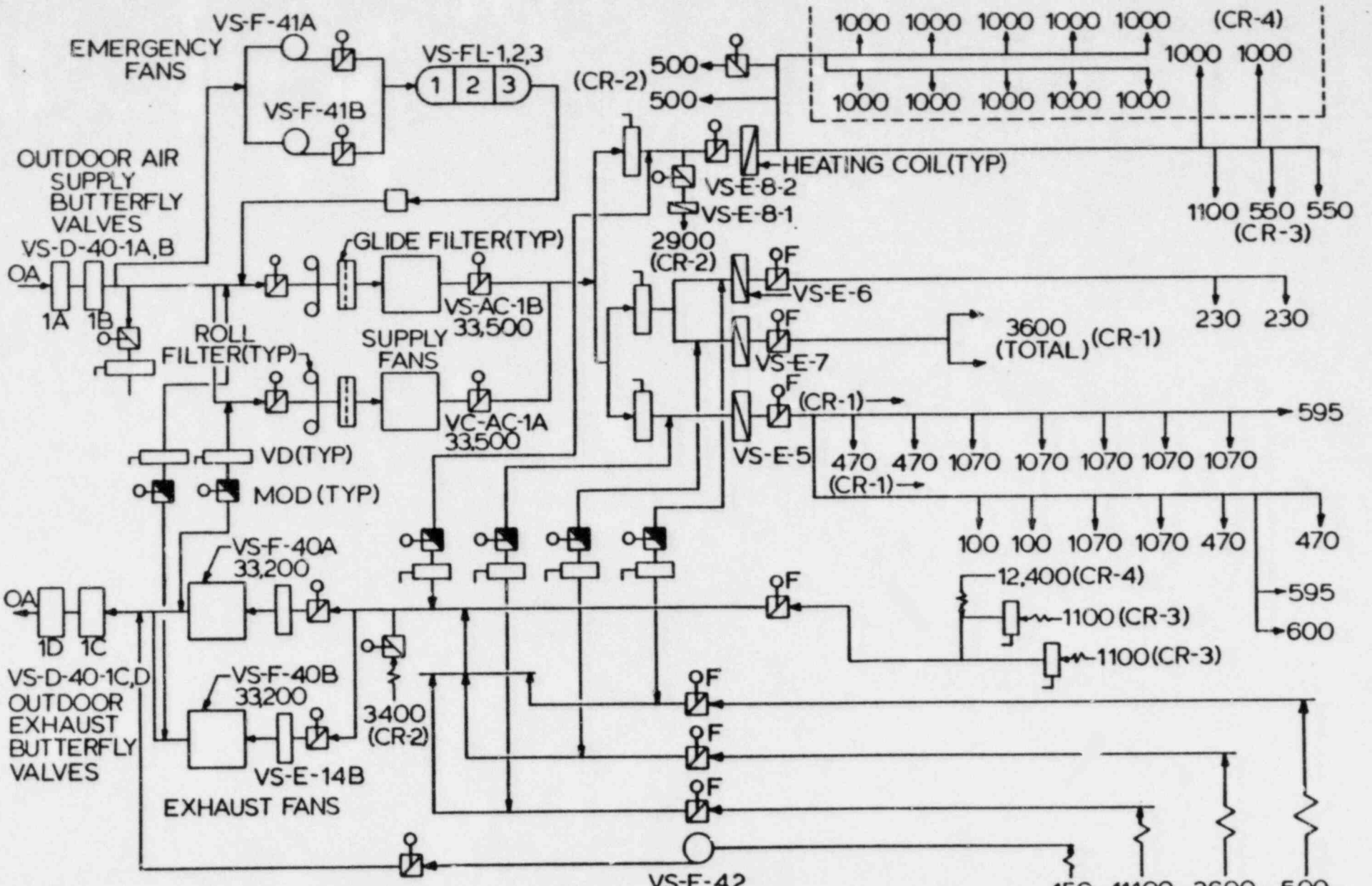


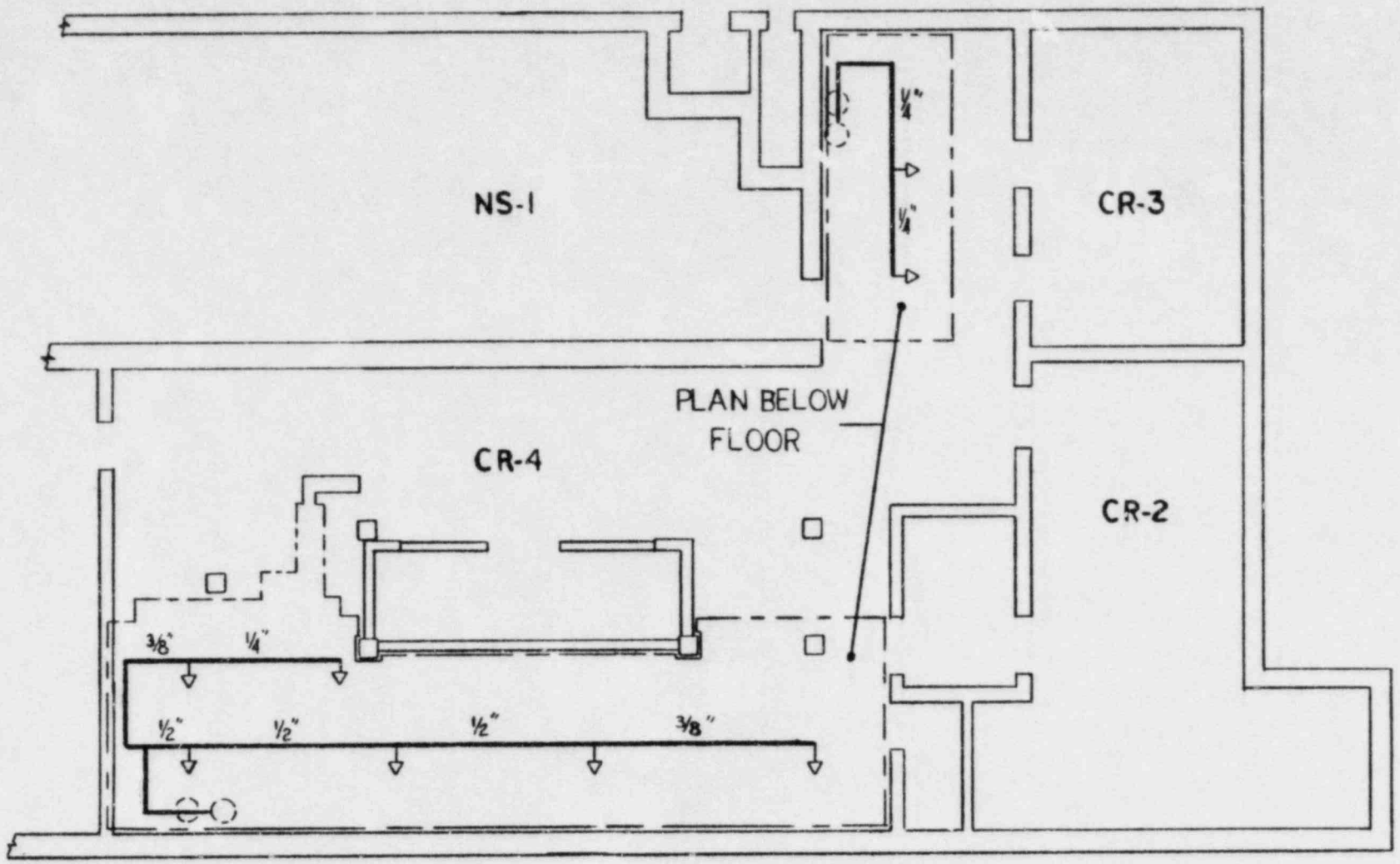
Fig. 5-8R. Relationship of slab thickness and type of aggregate to fire endurance.

FIGURE II.13-3



VENTILATION CR-1,2,3&4
(ALL VALUES CFM)

FIRE AREA CR-1 VENTILATION
FIG 11.13-4



CR-4 HALON SYSTEM
SIMPLIFIED 11700-RB-116E

FIGURE 11.13-5

PLAN - EL. 725'-6"

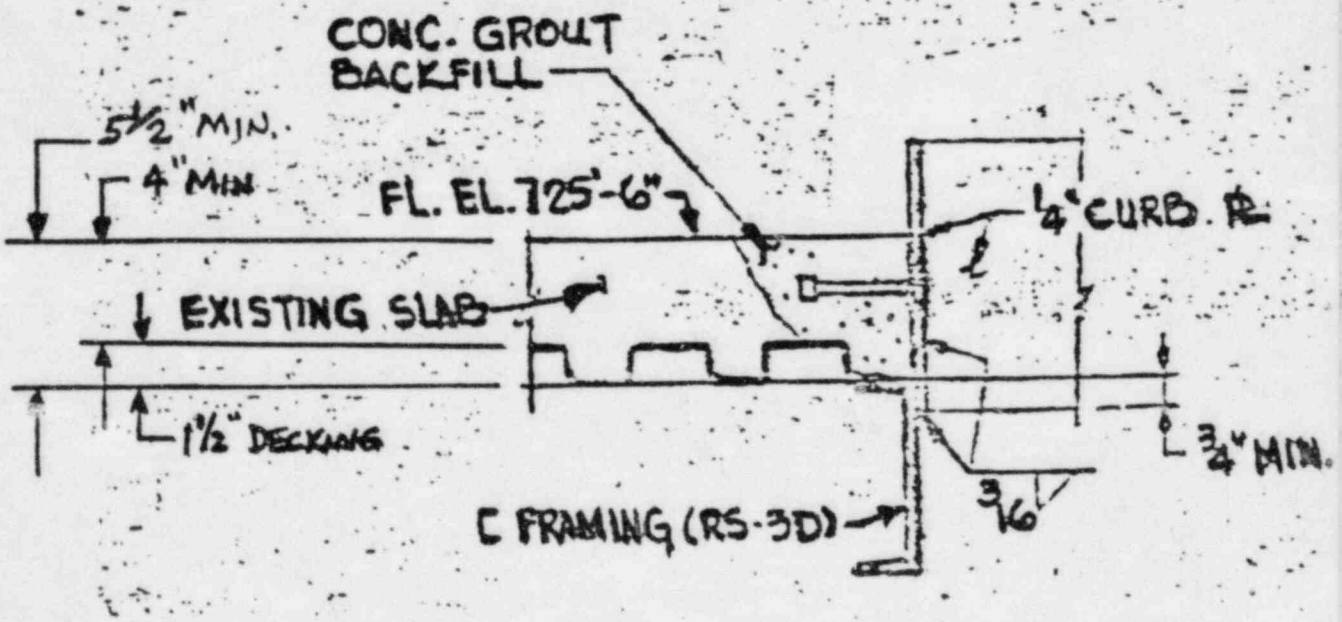
SLAB THICKNESS 5½" OVERALL UNLESS NOTED

LIVE LOAD 40 P.S.F.

MAIN REINF. TO BE #4 @ 12" T. & B. IN N-S DIRECTION. CONT. CUT & BEND AS REQ'D. (TYP. FOR 5½" SLAB)

SECONDARY REINF. AT RIGHT ANGLE TO MAIN REINF. SHALL BE #4 @ 18" T & B. CONT. CUT & BEND AS REQ'D (TYP. FOR 5½" SLAB) SLAB SHALL HAVE MONOLITHIC FLOOR FINISH.

* FLOOR SYSTEM IS 5½" CONCRETE (INC. 1½" CORRUGATED METAL DECKING)



CABLE SPREADING AREA FLOOR

(CS-1) FIGURE 11.13-6