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EISENHUT,D.G. Division of Licensing

SUBJECT: Forwards addl info re CO2 fire protection for emergency diesel generators. Lists two possible effects of inadvertent actuation. Return receipt requested.

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J. O. SCHUYLER
VICE PRESIDENT
NUCLEAR POWER GENERATION

May 22, 1984

PGandE Letter No.: DCL-84-192

Mr. Darrell G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: Docket No. 50-275, OL-DPR-76
Diablo Canyon Unit 1
Additional Information on Cardox System

Dear Mr. Eisenhut:

As requested by the NRC Staff, PGandE is providing the enclosed additional information regarding that portion of the Cardox System which may inadvertently discharge into the diesel generator rooms due to a seismic event.

Two possible effects of inadvertent actuation were identified and reviewed, (1) diesel engine and/or generator cooling; and (2) dilution of the engine combustion air quality. From this review, it was determined that the operability of diesels would be maintained for these two effects.

Kindly acknowledge the receipt of this material in the enclosed copy of this letter and return it in the enclosed addressed envelope.

Sincerely,

J. O. Schuyler

Enclosure

cc: Service List

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ENCLOSURE

ADDITIONAL INFORMATION ON CO2 FIRE PROTECTION FOR EMERGENCY DIESEL GENERATORS

DIABLO CANYON UNIT 1

Introduction

An inadvertent discharge of the Class II carbon dioxide (CO_2) system which might affect diesel engine operability has been reviewed. In this review, two postulated modes of discharge were identified: (1) an inadvertent discharge of CO_2 affecting diesel engine and/or generator cooling; and (2) an inadvertent discharge of CO_2 contaminating the diesel engine combustion air.

Plant Description

A total flooding carbon dioxide system provides fire suppression for the emergency diesel generators at Diablo Canyon. The diesel generators are located in vaults at the northwest end of the Unit 1 Turbine Building and at the southwest end of the Unit 2 Turbine Building. The generators are each cooled by a fan driven radiator located in a separate compartment which communicates with the plant yard on the west side through a grated missile barrier. Each diesel generator is separated from the radiator compartment by two three-hour rated rolling fire doors.

The cooling air for each generator is drawn into the diesel generator vault through two air ducts located by the radiator fan. The cooling air for the radiator consists of air drawn through the grated missile barrier and generator cooling air drawn through the diesel vault. The radiator discharge is directed to elevation 104' and out of the north end of the turbine building for Unit 1 and the south end for Unit 2. The diesel engine combustion air intake is located in the radiator compartment 5 feet above the radiator and 16'-6" above the floor level.

Analysis

1. Diesel Engine/Generator Cooling

   The effects of an inadvertent CO_2 discharge are discussed below:

   The diesel engine is cooled by water circulating through the fan driven radiator. Since the radiator is located outside the protected diesel generator vault and communicates with the plant yard, the cooling of the radiator is maintained. In the event of an inadvertent discharge of the CO_2, the CO_2 will be drawn through the radiator. However, since CO_2 is an effective heat transfer medium, the cooling of the diesel engine will not be significantly affected. In addition, cooling air will be drawn continually into the radiator during the short period that the CO_2 gas may be present.

The cooling of the generators is assured by maintaining ventilation flow through the diesel generator vaults by air ducts. Rolling fire doors located between the diesel vault and the radiator compartment control the cooling air to the generator and are designed to remain open except in the event of a fire. When a fire occurs, the doors will close with the melting of a fusible link or by fire detection of a Class I thermal detection circuit. (The thermal detectors actuate the fire door linkage through use of an electrically operated frangible link.)

The rolling fire door and the associated mechanical linkages have been seismically qualified. The rolling fire doors will not close following a design basis earthquake and will maintain ventilation to the generator unless there is a fire affecting that diesel generator.

2. Diesel Engine Combustion Air Quality

The effects of an inadvertent CO_2 discharge on the diesel engine combustion air was examined for the two operating conditions: (a) prior to diesel start; and (b) during diesel engine operation.

a. Prior to Diesel Start

For an inadvertent discharge prior to start of the diesel engine, CO_2 will flow from the diesel vault into the radiator compartment and dissipate into the plant yard through the missile barrier. With a relative density of approximately one and one-half times that of air, the CO_2 will flow near the floor. Since the diesel combustion air intake is located 16'-6" above the floor, the air intake will be exposed to clean air. When the engine starts, it will draw clean combustion air from above the CO_2 and from the yard through the missile barrier. The radiator fan will discharge the remaining CO_2 from the diesel vault and radiator compartment to the plant yard away from the combustion air intake.

b. During Diesel Operation

For an inadvertent discharge with the diesel generator operating, the CO_2 will be drawn from the diesel vault into the radiator compartment and discharged to the yard by the radiator fan.

The gas drawn into the radiator has been determined to be a mixture of approximately 77% outside air and 23% generator cooling gas. The generator cooling gas which consists of outside air is drawn into the vault and mixed with CO_2 discharged into the diesel vault. Utilizing the most conservative assumption that all of the generator cooling gas is CO_2, the resulting mixture of outside air and cooling air will be 77% air and 23% CO_2. This gas mixture provides an O_2 level in excess of the diesel engine manufacturer's minimum value for operation which correspond to 74% air and 26% CO_2 gas. Since the radiator discharges on the north end on the Turbine Building (Unit 1), there will be minimal recirculation to the radiator intake at the missile barrier. Therefore, the diesel will continue to operate in the most conservative scenario.

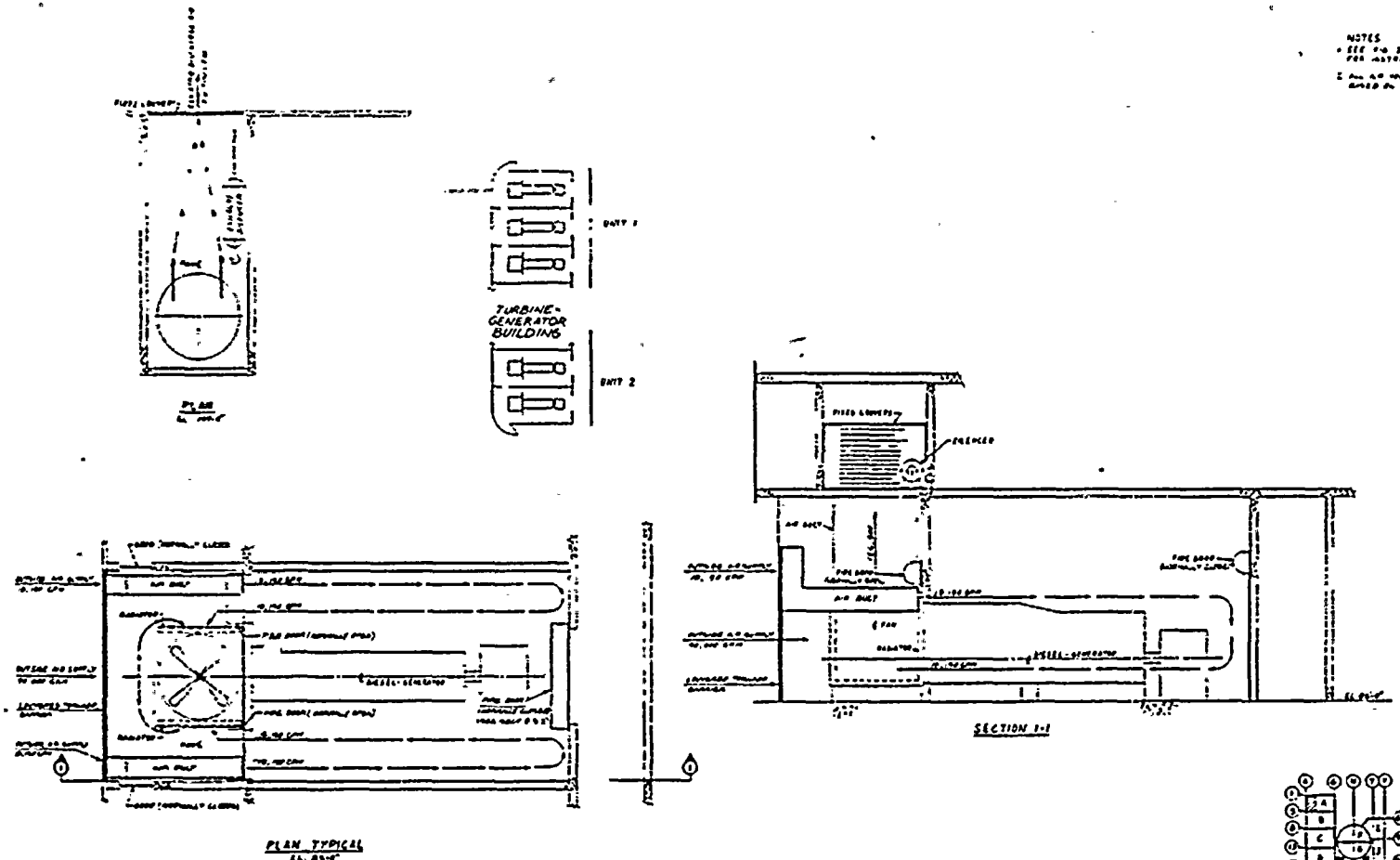
The actual concentration of the CO_2 in the generator cooling gas will be less for the following reasons: (1) The concentration of CO_2 in the generator cooling gas is determined by the rate of discharge into the diesel vault. The maximum rate of CO_2 discharge into the diesel vault is less than 1/3 of the total cooling gas flow rate. Since the CO_2 will not accumulate in the vault with the open rolling fire doors, the contribution of CO_2 to the total generator cooling gas flow rate is constrained by the CO_2 discharge rate. (2) Another factor reducing the CO_2 dilution of the diesel combustion air is that the CO_2 discharging in the vault will fall to the floor as "snow". According to the NFPA Fire Protection Handbook, 14th Edition, pages 13-18, for liquid CO_2 stored at 0°F, approximately 45 percent is converted to "snow" upon discharge. This "snow" must then sublime into CO_2 gas reducing the effective CO_2 gas discharge rate.

Conclusion

Although the CO_2 system protecting the diesel generator rooms is seismic category II, in accordance with FSAR Amendment 81, this system has been reviewed to assure that a seismically induced failure would not affect diesel generator operability, consistent with the Staff's acceptance in Safety Evaluation Report, Supplement No. 8. Carbon dioxide piping which may affect safe-shutdown components is seismically supported so that the piping cannot fall and jeopardize the safe-shutdown of the plant. Seismically qualified rolling fire doors which regulate cooling air to the generators are actuated by a seismically qualified fire detector system. The rolling fire doors on the west end of the diesel generator vaults will only close in the event of a fire in the specific vault or through manual action. Accordingly, CO_2 bleed from the diesel engine vault on inadvertent discharge will not significantly affect the diesel engine combustion air quality. Further, the radiator cooling of the diesel engine would be unaffected by an inadvertent discharge of CO_2.

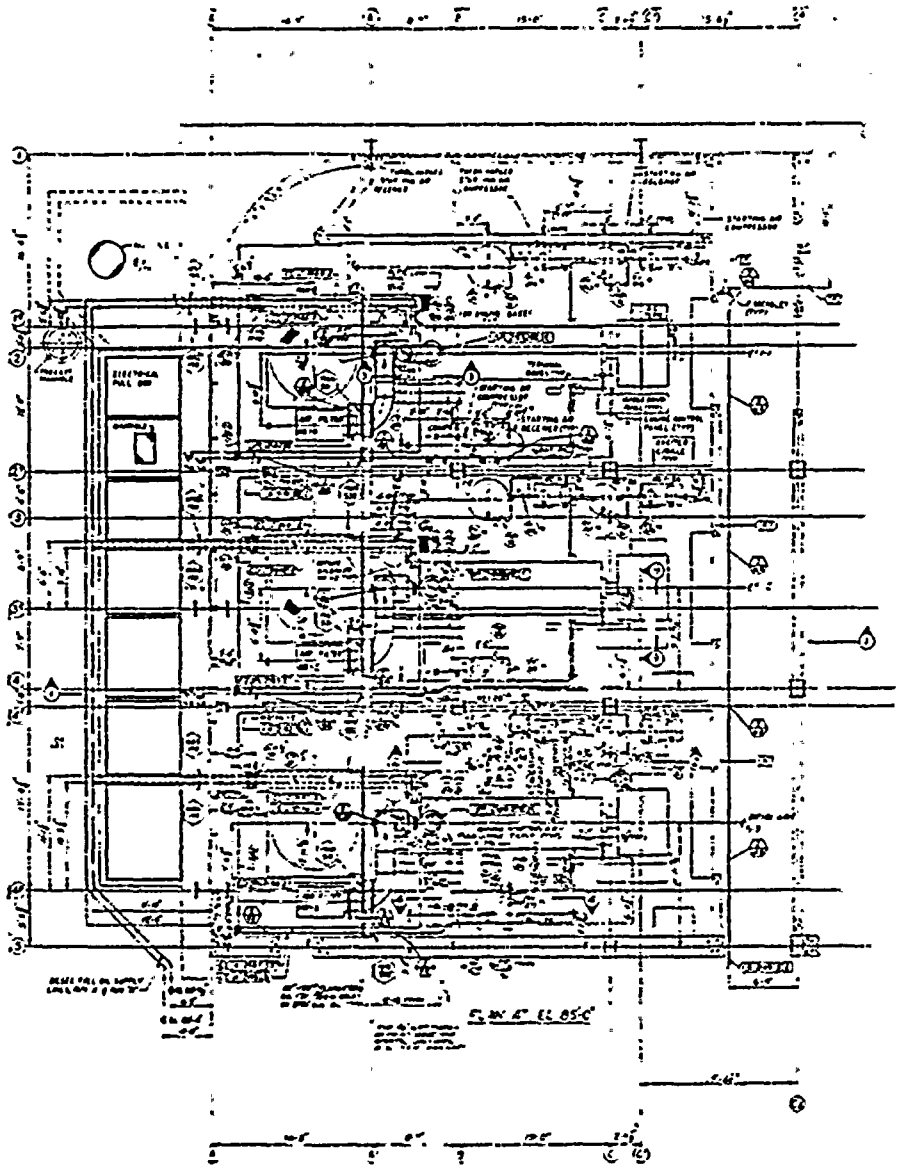
REFERENCES

FSAR Figure 9.4-6 Diesel Generator Ventilation
9.5-8 Diesel-Generator Arrangement Plan
9.5-9 Diesel Generator Arrangement Sections
9.5-10 Diesel Engine Generator



UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.4-6
DIESEL GENERATOR VENTILATION SYSTEM



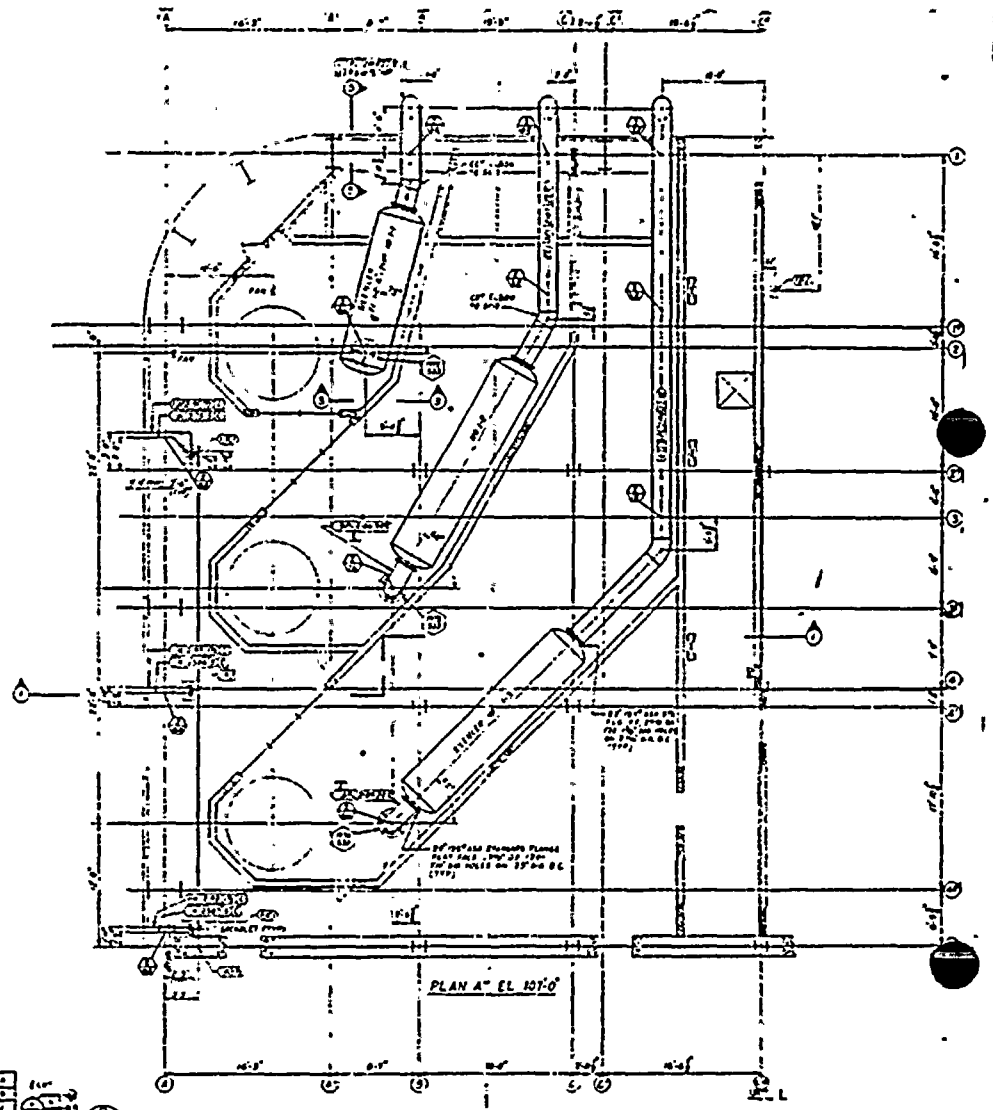


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FIGURE 9.5-8

DIESEL-GENERATOR ARRANGEMENT PLAN

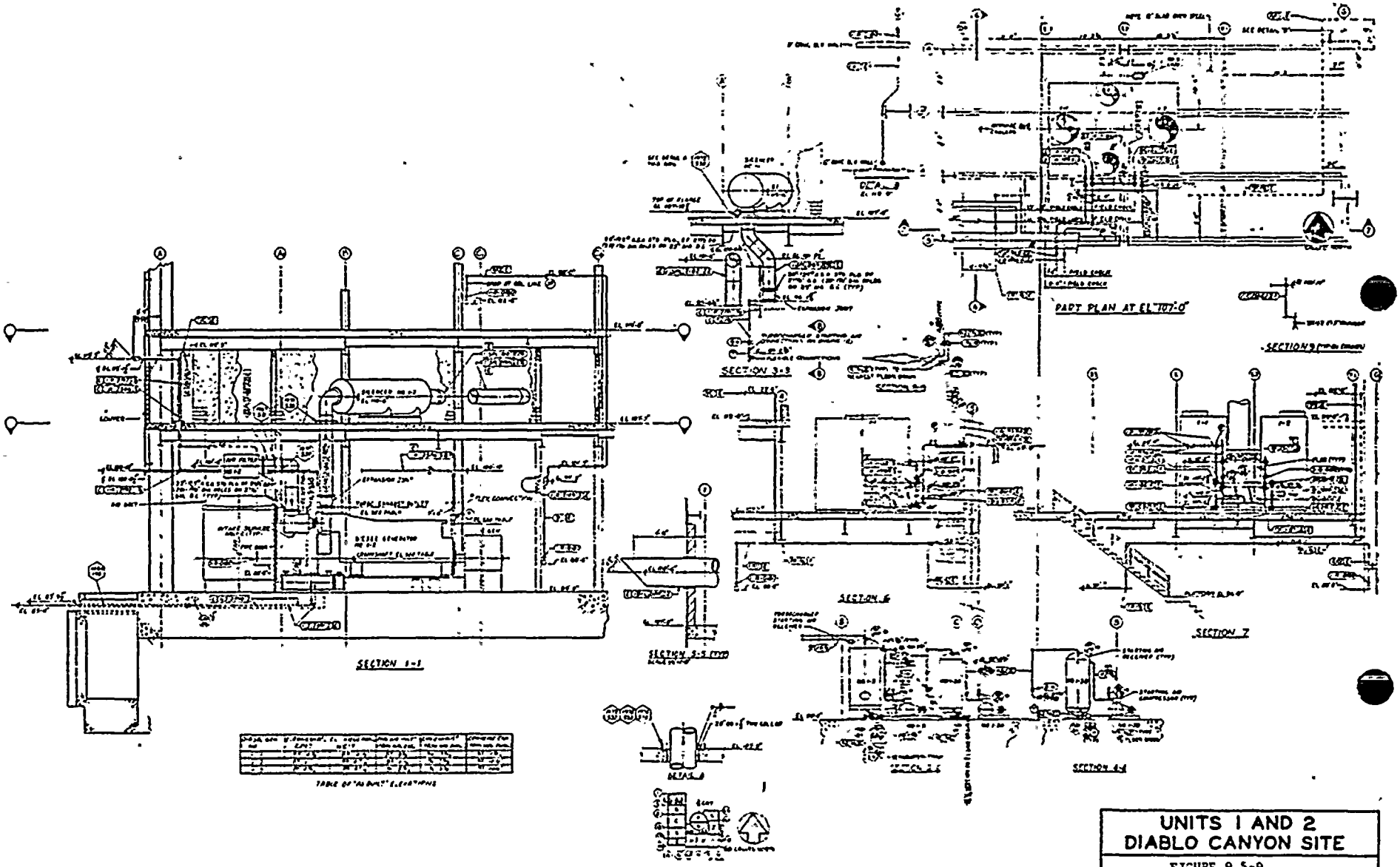

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FIGURE 9.5-9
DIESEL-GENERATOR ARRANGEMENT
SECTIONS

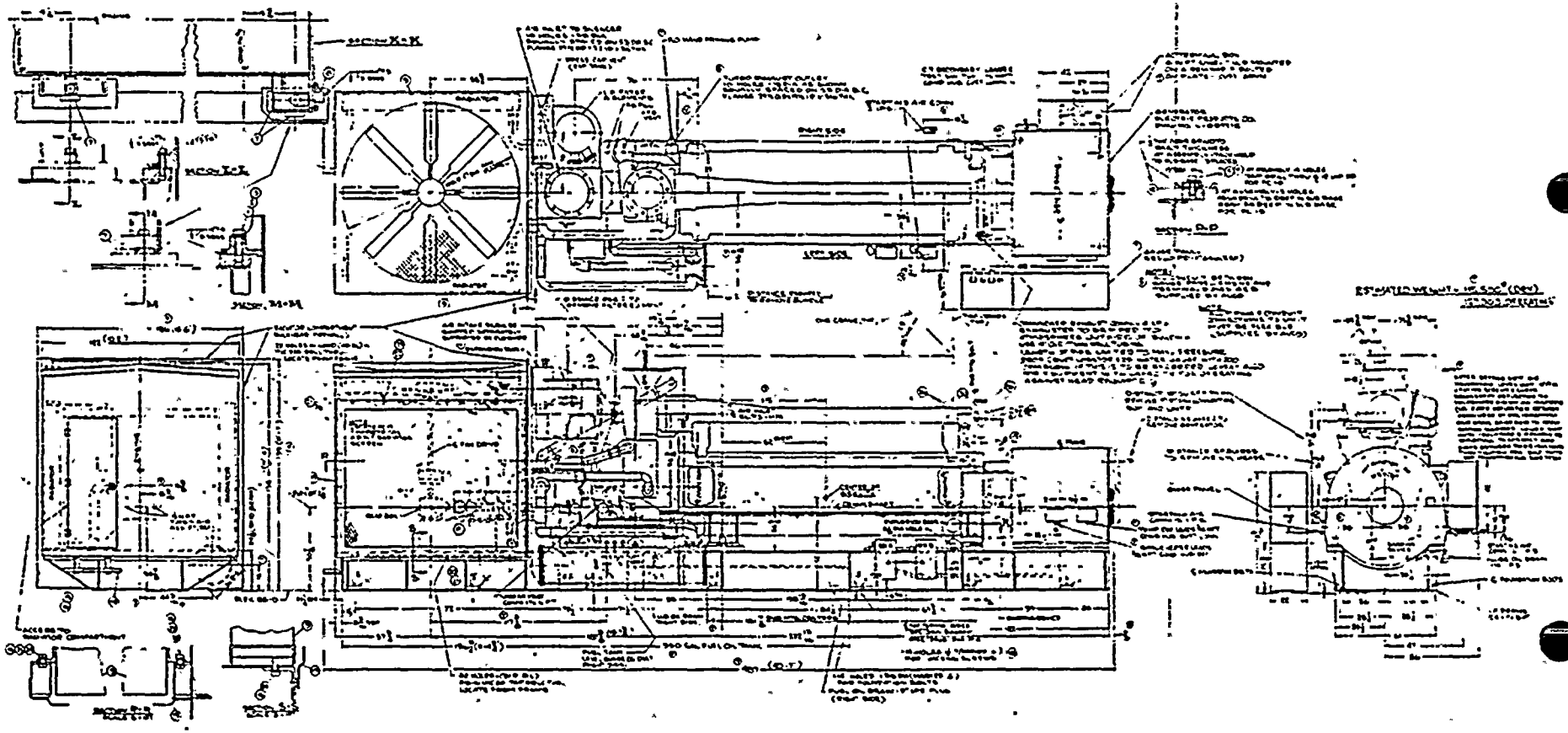

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FIGURE 9.5-10
DIESEL ENGINE GENERATOR

Amendment 4 February 1974