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SUBJECT:
FORWARDING RESPONSE TO INFORMAL STAFF QUESTIONS RE GEOMETRY OF THE REACTOR CORE WHEN SUBJECTED TO SEISMIC AND LOCA LOADS.

PLANT NAME: DIABLO CANYON - UNIT 1
DIABLO CANYON - UNIT 2

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ATTORNEYS

August 3, 1978

Mr. John F. Stolz, Chief
Light Water Reactor Branch No. 1
Division of Project Management
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Re: Docket No. 50-275-OL
Docket No. 50-323-OL
Diablo Canyon Units 1 & 2

Dear Mr. Stolz:

Attached is the reply to informal Staff questions about geometry of the reactor core when subjected to seismic and LOCA loads. This response should allow final resolution and sign-off of this matter in SER Supplement 8.

Five copies of this letter have been sent directly to Mr. Dennis Allison.

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

Very truly yours,

Philip A. Crane, Jr.

Attachment (40)
CC w/attachment: Service List

RESPONSES TO INFORMAL NRC QUESTIONS
ON GRID DEFORMATION

1. The characteristic mode of deformation of a fuel grid when subjected to lateral impact loading of the type calculated for seismic and LOCA conditions is a buckling mode wherein the originally square cells formed by the grid straps become parallelograms in cross section. This can proceed in any row of cells only until the grid straps are firmly closed down onto the rods at the dimples. This condition permits the rods to participate in resisting load and terminates the buckling mode in that row. Thus the reduction of flow area resulting from deformation of an originally square cell into a parallelogram with the sides closed onto the rod is the limit of flow area reduction in any cell from this mode of deformation. A simple calculation of flow area from geometric considerations shows that this reduction is 22%. Thus the maximum reduction in flow area in any channel from lateral impact loadings on grids is 22%, simply because the cells in any row will not close further.

2. a. The pipe breaks used to evaluate fuel grid impact loads were discussed in WCAP 9241 (WCAP 9242 non proprietary), entitled "Evaluation of Reactor Coolant System for Postulated Loss-of-Coolant Accident for the Diablo Canyon Nuclear Power Plant". Three postulated ruptures were separately evaluated in that report. They were: 1) a 115 in^2 break at the reactor vessel inlet, 2) a 76 in^2 break at the vessel outlet nozzle, and 3) a break of full double-ended area at the reactor coolant pump discharge nozzle. All three breaks were postulated to open to their maximum area in one millisecond.

   b. The following table gives the magnitude of a calculated grid impact load for Seismic and LOCA combined by the SRSS method for the three outermost fuel assemblies on each side of the core, nearest and farthest from the postulated break location. The numbers for load are the percentages of the 95/95 deformation loads as determined in the most recent program of testing with the grids at operating temperature. As can be noted from the table, the loads fall off rapidly from the outer assemblies.

Fuel Assembly	Impact Load	
1	0.87	one side of barrel
2	0.68	
3	0.57	
-		
-		
-		
14	0.61	other side of barrel
15	0.72	
16	0.77	

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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Docket No: 50-275
and 50-323

Pacific Gas and Electric Company
ATTN: Mr. John C. Morrissey
Vice President & General Counsel
77 Beale Street
San Francisco, California 94106

Gentlemen:

SUBJECT: MANPOWER REQUIREMENTS FOR OPERATING REACTORS (DIABLO CANYON)

We are enclosing a document entitled, "Manpower Requirements for Operating Reactors." We are using the bases given in this document for allowing the sharing of duties to meet minimum staffing requirements for fire brigades at nuclear power plants. This is being provided for your guidance in meeting NRC requirements in this area.

Sincerely,

D. B. Vassallo, Assistant Director
for Light Water Reactors
Division of Project Management

Enclosure:
Manpower Requirements for
Operating Reactors

cc w/encl:
See next page

MA 4
GD

AUG 2 1978

cc: Pacific Gas and Electric Company
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MANPOWER REQUIREMENTS FOR OPERATING REACTORS

The NRC has established requirements for personnel at operating reactors for purposes of plant operation, industrial security, and fire fighting. The following discussion considers the extent to which plant personnel assigned to either plant operation or security may also be temporarily allowed to man a fire brigade in the event of a fire for a single unit facility and sets forth an acceptable sharing scheme for operating reactors.

Summary of Manpower Requirements

1. Fire Brigade: The staff has concluded that the minimum size of the fire brigade shift should be five persons unless a specific site evaluation has been completed and some other number justified. The five-man team would consist of one leader and four fire fighters and would be expected to provide defense against the fire for an initial 30-minute period. See Attachment A for the basis for the need for a five-man fire brigade.

2. Plant Operation: Standard Review Plan Section 13.1.2 requires that for a station having one licensed unit, each shift crew should have at least three persons at all times, plus two additional persons when the unit is operating. For ease of reference, Attachment B contains a copy of this SRP.

3. Plant Security: The requirements for a guard force are outlined in 10 CFR Part 73.55. In the course of the staff's review of proposed security plans, a required minimum security response force will be established for each specific site. In addition to the response team, two additional members of the security force will be required to continuously man the Central Alarm Station (CAS) and Secondary Alarm Station (SAS). It is expected that many facilities will have a security organization with greater numbers of personnel than the minimum number assumed for purposes of discussion in this paper.

The NRC staff has given consideration to the appropriateness of permitting a limited degree of sharing to satisfy the requirements of plant operation, security and fire protection and has concluded that, (1) subject to certain site and plant specific conditions, the fire brigade staffing could generally be provided through operations and security personnel, and (2) the requirements for operators and the security force should remain uncompromised. Until a site specific review is completed, the following indicates the interim distribution and justification for these dual assignments, and therefore our interim minimum requirements for a typical presently operating commercial single unit facility. The staff believes that manpower for the fire brigade for multi-unit facilities is not now a problem because of the larger numbers of people generally present at the sites. Situations which do pose problems will be reviewed on a case-by-case basis.

1. Plant Operation: The staff has concluded that for most events at a single unit nuclear facility, a minimum of three operators should be available to place the reactor in a safe condition. The two additional operators required to be available at the nuclear facility are generally required to be present to perform routine jobs which can be interrupted to accomodate unusual situations that may arise. That is, there is the potential for the remaining two members of the operating crew to assume other short-term duties such as fire fighting. In light of the original rationale for providing extra plant operators to cope with off-normal conditions, it appears justified to rely on these personnel for this function. The staff recommends that one of the two operators assigned to the fire brigade should be designated as leader of the fire brigade in view of his background in plant operations and overall familiarity with the plant. In this regard, the shift supervisor should not be the fire brigade leader because his presence is necessary elsewhere if fires occur in certain critical areas of the plant.

2. Plant Security: In the event of a fire, a contingency plan and procedures will be used in deploying the security organization to assure that an appropriate level of physical protection is maintained during the event. The staff has determined that it is possible in the planning for site response to a fire, to assign a maximum of three members of the security organization to serve on the fire brigade and still provide an acceptable level of physical protection. While certain security posts must be manned continuously (e.g., CAS, SAS), the personnel in other assignments, including the response force, could be temporarily (i.e., 30 minutes) assigned to the fire brigade. In judging the merits of this allowance the underlying question is whether the minimum security force strength must be maintained continuously in the event of a plant emergency such as a fire. Further examination of this issue leads to two potential rationales for reaching an affirmative decision. First, could there be a causal connection between a fire and the security threat? Second, are there compelling policy reasons to postulate a simultaneous threat and fire?

   The first potential rationale would only be credible if, (1) the insider (posed as part of the threat definition) was an active participant in an assault and started a fire coincident with the attack on the plant or, (2) a diversionary fire was started by an attack force somewhere external to the plant itself where no equipment required for safe shutdown is located. The role of the insider will be discussed first. While 73.55 assigns an active status to the insider, the rule also requires that measures be implemented to contain his activities and thereby reduce his

effectiveness. At present, these measures include background checks on plant employees, limited access to vital plant areas, badging systems and the two-man rule. Here, limited access means that only designated employees are allowed in vital areas and that their entry is controlled by either conventional locks or card-key systems. Also, if separate trains of safety equipment are involved, then either compartmentalization or the two-man rule is required. These measures to contain the insider are presently being implemented and will provide assurance that people of questionable reliability would not be able to gain employee status at a nuclear plant and should they become an employee with unescorted access, significant restraints would be interposed on the ability of such a person to carry out extensive damage to plant vital areas. Recognizing that additional safeguards may still be appropriate, the staff has recommended to the Commission that plant personnel also be required to obtain an NRC security clearance. The staff believes that the attendant background investigation associated with a clearance, in conjunction with the other 73.55 measures, will provide a high degree of assurance that plant personnel will not attempt to take an active sabotage role. If the clearance rule is adopted the staff believes some of the measures, such as the two-man rule, designed to contain the insider can be relaxed. Thus, there does not now appear to be a reasonably credible causative relationship between a fire intentionally set by an insider and the postulated external security threat. For the case of diversionary fires set external to the plant itself, adequate security forces can still be maintained by allowing only part of the fire brigade to respond while both fire fighters and security force armed responders maintain a high degree of alertness for a possible real attack somewhere else on the plant. Thus, the effective number of armed responders required by 73.55 can be maintained for external diversionary fires.

The second potential rationale concerns whether a serious, spontaneous fire should be postulated coincident with an external security threat as a design basis. In evaluating such a requirement it is useful to consider the likelihood of occurrence of this combination of events. While it is difficult to quantify the probability of the 73.55 threat, it is generally accepted that it is small, comparable probably to other design basis type events. The probability of a fire which is spontaneous and located in or in close proximity to a vital area of the plant and is serious enough to pose a significant safety concern is also small. It would appear, therefore, that the random coincidence of these two unlikely events would be sufficiently small to not

require protection against their simultaneous occurrence. In addition, it should be noted that the short time period (30 minutes) for which several members of the security force would be dedicated to the fire brigade would further reduce the likelihood of coincidence.

As neither of the two potential rationales appear to preclude the use of members of the security force in the event of a fire the staff has concluded that the short assignment of security personnel from the armed response force or other available security personnel to the fire brigade under these conditions would be acceptable.

To ensure a timely and effective response to a fire, while still preserving a flexible security response, the staff believes that the fire brigade should operate in the following manner. In the event of an internal fire, all five members of the fire brigade should be dispatched to the scene of the fire to assess the nature and seriousness of the fire. Simultaneously, the plant security force should be actively evaluating the possibility of any security threat to the plant and taking any actions which are necessary to counter that threat. For external fires, a lesser number than the five-man brigade should respond for assessment and fire fighting. As the overall plant situation becomes apparent it would be expected that the most effective distribution of manpower between plant operations, security and fire protection would be made, allowing a balanced utilization of manpower resources until offsite assistance becomes available. The manpower pool provided by the plant operations personnel and security force are adequate to respond to the occurrence of a design basis fire or a security threat equivalent to the 73.55 performance requirements. It is also recognized that other, more likely combinations of postulated fires and security threats of a lesser magnitude than the design basis, could be considered. While the probabilities of these higher likelihood events may be sufficient to warrant protecting against them in combination, the manpower requirements required to cope with each event would be similarly reduced thereby allowing adequate coverage by plant personnel.

Conclusion

The staff believes that it would be reasonable to allow a limited amount of sharing of plant personnel in satisfying the requirements of plant operation, security, and fire protection. An acceptable sharing scheme would entail reliance on two plant operators and three members of the security organization to constitute the fire brigade. Since availability of the full fire brigade would only

be required for fires with potential for serious damage, actual distribution of plant personnel during a plant emergency would be governed by the exigencies of the situation. Of course, all personnel assigned to the fire brigade would have to fulfill all applicable training requirements. It should also be recognized that the diversion of personnel to the fire brigade would be of short duration and that substantial additional offsite assistance would be forthcoming in accordance with the emergency and contingency plan developed for each facility. In evaluating licensee proposals for manpower sharing due consideration will also have to be made of unique facility characteristics, such as terrain and plant lay-out, as well as the overall strengths of the licensee's fire and security plans. Minimum protection levels in either area could preclude the sharing of manpower.

Staff Position

Minimum Fire Brigade Shift Size

INTRODUCTION

Nuclear power plants depend on the response of an onsite fire brigade for defense against the effects of fire on plant safe shutdown capabilities. In some areas, actions by the fire brigade are the only means of fire suppression. In other areas, that are protected by correctly designed automatic detection and suppression systems, manual fire fighting efforts are used to extinguish: (1) fires too small to actuate the automatic system; (2) well developed fires if the automatic system fails to function; and (3) fires that are not completely controlled by the automatic system. Thus, an adequate fire brigade is essential to fulfill the defense in depth requirements which protect safe shutdown systems from the effects of fires and their related combustion by-products.

DISCUSSION

There are a number of factors that should be considered in establishing the minimum fire brigade shift size. They include:

1) plant geometry and size;
2) quantity and quality of detection and suppression systems;
3) fire fighting strategies for postulated fires;
4) fire brigade training;
5) fire brigade equipment; and
6) fire brigade supplements by plant personnel and local fire department(s).

In all plants, the majority of postulated fires are in enclosed windowless structures. In such areas, the working environment of the brigade created by the heat and smoke buildup within the enclosure, will require the use of self-contained breathing apparatus, smoke ventilation equipment, and a personnel replacement capability.

Certain functions must be performed for all fires, i.e., command brigade actions, inform plant management, fire suppression, ventilation control, provide extra equipment, and account for possible injuries. Until a site specific review can be completed, an interim minimum fire brigade size of five persons has been established. This brigade size should provide a minimum working number of personnel to deal with those postulated fires in a typical presently operating commercial nuclear power station.

If the brigade is composed of a smaller number of personnel, the fire attack may be stopped whenever new equipment is needed or a person is injured or fatigued. We note that in the career fire service, the minimum engine company manning considered to be effective for an initial attack on a fire is also five, including one officer and four team members.

It is assumed for the purposes of this position that brigade training and equipment is adequate and that a backup capability of trained individuals exist whether through plant personnel call back or from the local fire department.

POSITION

1. The minimum fire brigade shift size should be justified by an analysis of the plant specific factors stated above for the plant, after modifications are complete.

2. In the interim, the minimum fire brigade shift size shall be five persons. These persons shall be fully qualified to perform their assigned responsibility, and shall include:

   One Supervisor - This individual must have fire tactics training. He will assume all command responsibilities for fighting the fire. During plant emergencies, the brigade supervisor should not have other responsibilities that would detract from his full attention being devoted to the fire. This supervisor should not be actively engaged in the fighting of the fire. His total function should be to survey the fire area, command the brigade, and keep the upper levels of plant management informed.

   Two Hose Men - A 1.5 inch fire hose being handled within a windowless enclosure would require two trained individuals. The two team members are required to physically handle the active hose line and to protect each other while in the adverse environment of the fire.

   Two Additional Team Members - One of these individuals would be required to supply filled air cylinders to the fire fighting members of the brigade and the second to establish smoke ventilation and aid in filling the air cylinder. These two individuals would also act as the first backup to the engaged team.

ATTACHMENT B

4. a. Assignments of personnel meeting ANSI N18.1-1971 qualifications, Section 4.3.1 or Section 4.5.1, should be made to onsite shift operating crews in numbers not less than the following:

For a station having one licensed unit, each shift crew should have at least three persons at all times, plus two additional persons when the unit is operating. For a multi-unit station, each shift crew should have at least three persons per licensed unit at all times, plus one additional person per operating unit.

b. Operator license qualifications of persons assigned to operating shift crews should be as follows:

(1) A licensed senior operator who is also a member of the station supervisory staff should be onsite at all times when at least one unit is loaded with fuel.

(2) For any station with more than one reactor containing fuel, (1) the number of licensed senior operators onsite at all times should not be less than the number of control rooms from which the fueled units are monitored, and (2) the number of licensed senior operators should not be less than the number of reactors operating.

(3) For each reactor containing fuel, there should be at least one licensed operator in the control room at all times. Shift crew compositions should be specified such that this condition can be satisfied independently of licensed senior operators assigned to shift crews to meet the criteria of (1) and (2) above.

(4) For each control room from which one or more reactors are in operation, an additional operator should be onsite and available to serve as relief operator for that control room. Shift crew compositions should be specified such that this condition can be satisfied independently of (1), (2), and (3), and for each such control room.

c. Radiation protection qualifications of at least one person on each operating shift should be as follows:

The management of each station having one or more units containing fuel should either, (1) qualify and designate at least one member of each shift operating crew to implement radiation protection procedures, including routine or special radiation surveys using portable radiation detectors, use of protective barriers and signs, use of protective clothing and breathing apparatus, performance of contamination surveys, checks on radiation monitors, and limits of exposure rates and accumulated dose, or (2) assign a health physics technician to each shift, such assignment to be in addition to those assigned to shift operating crews in accordance with (a) and (b) above.

III. REVIEW PROCEDURES

Selection and emphasis of various aspects of the areas covered by this review plan will be made by the reviewer on each case. The judgment on the areas to be given attention during