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Docket Nos. 50-275
and 50-323

APPLICANT: Pacific Gas and Electric Company

FACILITY: Diablo Canyon Nuclear Plant, Units 1 and 2

SUBJECT: SUMMARY OF JUNE 17-19, 1980 ONSITE AUDIT OF DIABLO CANYON SEISMIC SYSTEMS INTERACTION PROGRAM FOR SEISMICALLY-INDUCED EVENTS

On June 17-19, 1980, representatives of the Office of Nuclear Reactor Regulation's Systems Interaction Branch (SIB) accompanied by the Office of Inspection and Enforcement Resident Inspector and representatives of the Mechanical Engineering Branch and Lawrence Livermore Laboratory (the latter two organizations are assisting the SIB in its review of this matter) conducted an onsite audit of Pacific Gas and Electric Company's (PG&E's) Seismic Systems Interaction Program for its Diablo Canyon Nuclear Plant, which is located near San Luis Obispo, California. The objectives of the audit were to: (1) continue our discussions with PG&E related to our review of its program, (2) review the progress made to date by PG&E, (3) observe PG&E's walkdown technique and examples of postulated interactions identified during previous walkdowns, and (4) conduct independent walkdowns of selected portions of some of the systems required to achieve and maintain the plant in a safe shutdown condition and certain accident mitigating systems. An attendance list is provided as Enclosure 1.

On the first day of the audit, we toured the plant to familiarize ourselves with the layout of the major plant structures, systems and components. Following the plant tour, PG&E representatives described briefly their Seismic Systems Interaction Program (a detailed description of the program is provided in PG&E's "Description of the Systems Interaction Program for Seismically-Induced Events," dated June 10, 1980) and summarized the progress made to date. Included in PG&E's presentation was a discussion of the responses of certain fossil power plant and industrial facility equipment to several past earthquakes. Finally, PG&E representatives demonstrated how the interaction information is documented and then stored in their computerized data base. They also demonstrated the information search and retrieval capabilities of the system.

PG&E has completed essentially all of its walkdown effort inside the Unit 1 containment building and essentially all of its walkdown effort associated with piping inside the Unit 1 auxiliary building. To date, a total of 391 interactions have been postulated. Most of these interactions involve piping; structural grates, platforms and handrails; and electrical light fixtures. Other postulated interactions involve pipe supports, HVAC ducts, ladders, pipe whip restraints, service

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hoists, and conduit and wire. Of the 391 postulated interactions, 106 were resolved by the walkdown team; the remaining 285 postulated interactions were deemed to require further resolution effort. Of the 391 postulated interactions, 114 are expected to require plant modifications.

On the second day of the audit, PG&E representatives demonstrated their walkdown technique and pointed out examples of postulated interactions identified during previous walkdowns. The example postulated interactions were representative of each of the types of postulated interactions discussed above. PG&E representatives also discussed with us the resolution of those example interactions that had already been resolved. The resolutions were in the form of statements to the effect that either (1) no further action is necessary, (2) further analysis is required or (3) specified modifications should be implemented.

During the remainder of the second day and most of the third day of the audit, we conducted independent walkdowns of selected portions of some of the systems required to achieve and maintain the plant in a safe shutdown condition and certain accident mitigating systems. The portions of systems selected for our independent walkdowns included (1) the turbine steam supply piping, electrical power supply to the turbine motor-operated throttle valve and the pump discharge piping associated with the turbine-driven auxiliary feedwater system; (2) the pressurizer relief tank rupture disks; (3) the primary water, condensate, refueling water and fire water storage tanks; (4) the seven day onsite diesel fuel oil storage tanks; (5) the containment ventilation and purge isolation valves; and (6) one 125-volt vital battery room. A description of our independent walkdowns of these structures, systems and components is presented in Enclosure 2. The results of our independent walkdowns were consistent with those of PG&E; that is, we identified all of the interactions postulated by PG&E during its walkdowns and no others.

During the remainder of the third day of the audit, we discussed several outstanding matters with PG&E representatives. We advised them that based on our review to date of their documentation and our observations made during the audit, we believe that their Seismic Systems Interaction Program is sound and, pending the satisfactory resolution of the outstanding matters, can be completed in an acceptable manner. PG&E representatives advised us that they expect to have completed the implementation of all of the required modifications inside the containment building and all of the walkdowns for Unit 1 by September 1, 1980 and that they expect to be able to submit their final report for those structures, systems and components inside the containment building prior to Unit 1 fuel loading. We advised the PG&E representatives that we expect to have completed our review of the documentation they have submitted to date and the information obtained during the audit in approximately two weeks and at that time we expect to be able to discuss any outstanding matters prior to the preparation of our safety evaluation

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report on their Seismic Systems Interaction Program. We further advised the PG&E representatives that we expect that the Office of Inspection and Enforcement will follow upon the implementation of the program including the modifications made as a result of the program.

Original signed by
Cecil Thomas

Cecil O. Thomas, Systems Engineer
Systems Interaction Branch
Division of Systems Integration

Enclosures:
As stated

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ENCLOSURE 1

ATTENDANCE LIST

JUNE 17-19, 1980 ONSITE AUDIT OF DIABLO CANYON SEISMIC SYSTEMS INTERACTION PROGRAM

PACIFIC GAS AND ELECTRIC COMPANY

L. Killpak
H. Hanson
M. Sweeny
D. Hagstrom
P. Teames
E. Valeriano
J. Grant
R. Young
P. Burgess
A. Walther
O. Crass
J. VanVynckt
T. Crawford
J. Hoch
F. de Vriarte
S. Hanusiak
R. Reymers (EDS)
J. LeClair (EDS)
W. Gangloff (Westinghouse)
R. Cloud (Cloud Associates)
M. Jones (Cloud Associates)
R. Eschenburg (Kaiser)

Nuclear Regulatory Commission

C. Thomas
D. Lasher
J. Page
T. Young (Resident Inspector, IE)
T. Chuang (Consultant, LLL)

Other

G. Silver (Intervenor)
S. Mendes (Intervenor)

ENCLOSURE 2

DESCRIPTION OF NRC INDEPENDENT WALKDOWNS OF SELECTED STRUCTURES, SYSTEMS AND COMPONENTS

On Wednesday afternoon, June 18, 1980 and Thursday morning, June 19, 1980 we conducted independent walkdowns of selected portions of some of the systems required to achieve and maintain the plant in safe shutdown condition and certain accident mitigating systems. We were aided in this effort by access to system drawings and by the presence of knowledgeable PG&E plant personnel when walking down and identifying pipes, conduits and equipment elements. The portions of systems selected for our independent walkdowns included the following:

(1) The turbine steam supply piping, the electrical power supply to turbine motor-operated throttle valve FCV-95, and the pump discharge piping associated with the turbine-driven auxiliary feedwater system;

(2) The pressurizer relief tank rupture discs;

(3) The primary water, condensate, refueling water and fire water storage tank;

(4) The seven-day onsite diesel fuel oil storage tanks;

(5) The containment ventilation and purge isolation valves; and

(6) One 125-volt vital battery room.

These portions of systems were walked down (investigated) in an effort to identify potential sources of seismically-induced interactions. The walkdowns consisted of physically investigating the routing and installation of all piping, conduit and discrete equipment units that formed the portions of the systems under consideration. At each point during this process, the safety-related system was viewed as the target. All non-safety-related systems that either joined the target, were located nearby or were located such that their failure could affect the ability of the safety-related system to perform its intended function were assumed to be potential sources of interaction. For this review, any other safety-related system located nearby was assumed to be adequately physically separated and anchored or supported so that seismically-induced interactions were considered incredible. During the course of their program however, PG&E noted a few potential interactions involving only safety-related systems. These potential interactions either have been or will be eliminated.

(1a) The turbine-driven auxiliary feedwater pump turbine steam supply piping was walked down from its connections to main steam supply lines 2 and 3 to the turbine itself. Six interactions with this piping were postulated. An example of a postulated interaction involved a stub drain line from the turbine steam supply line from main steam supply line 2. The stub drain line was found to extend over a steam drain line in such a manner that it could be either impacted by the non-seismically-qualified steam drain line or be struck from above and be broken off. PG&E's recommended resolution was to cut off and cap the stub drain line since these lines were deemed not to be needed for plant operation.

(1b) The electrical power supply to turbine motor-operated throttle valve FCV-95, routed in safety-related Conduit K-6764, was walked down from the valve to its point of entrance into the motor control center in the 480-volt essential switchgear room. We postulated some fifteen interactions, most of which involved non-safety-related conduits crossing Conduit K-6764 with minimal physical separation. In these cases, the non-safety conduits either were or will be seismically supported. The most glaring postulated interaction involved a two-inch plant air supply line that loops around component cooling water train "A" header surge line and runs vertically between Conduit K-6764 and the compartment walls with about one-inch separation between them. The air supply line was not restrained over any of its length in the vicinity of the crossover and was observed to impact heavily on Conduit K-6764 when the pipe was shaken by hand. PG&E's recommended resolution was to seismically support and restrain the piping to prevent this motion.

(1c) We walked down the turbine-driven auxiliary feedwater pump discharge piping from its connection at the pump to its connection to the main feedwater lines. Nine interactions with this line and its valving were postulated. An example of such a postulated interaction was the seismically-induced movement of the discharge leg (Line 570) that feeds steam generator 2 into an angle bracket pipe support for a 3/4-inch test line. The resolution recommended by PG&E was to cut out the angle bracket to increase the clearance for Line 570 from 3/16 to 2-inches, thus providing adequate allowance for motion of Line 570.

(2) We investigated the location and construction of the pressurizer relief tank rupture disks. The two disks, approximately twelve inches in diameter were located on top of the pressurizer relief tank. We postulated that rupture of these disks could affect four Class IE conduits and associated pull or junction boxes that were located on the ceiling about eight feet above the top of the tank. Upon further investigation, we found that these disks were designed to rupture in a tearing mode into pie-shaped sections resembling the opening of flower petals at a maximum pressure of 112 psig. No missiles or shrapnel would be formed by this mode of failure and the maximum temperature of 118 degrees Fahrenheit would not pose a thermal hazard to the cabling in the conduits and boxes. Three of the boxes were pull boxes with the cabling insulation intact. The fourth box contained a splice which was made using environmentally-qualified Raychem splicing materials. We concluded that this postulated interaction does not require further action.

(3) During PG&E's presentation on Tuesday afternoon, considerable information was presented concerning failure modes of tanks undergoing seismic excitation. Since most of this information related to the failure of tanks containing liquids, we investigated the primary water, condensate, refueling water,

and fire water storage tanks. These tanks are all above ground, located along the rear of the fuel handling building, and have a high potential for overturning under seismic motion because of their large height-to-diameter ratio. Also we believed there could be a possibility of their suffering buckling or implosion damage due to the sloshing of the tank contents covering the tank vents and causing a vacuum to be formed in the tops of the tanks. We found that the tanks are supported on concrete bases that extend down to bedrock to eliminate problems resulting from soil liquifaction. Further, the tanks are anchored to bedrock with tensioned cables to resist overturning. The tanks have floating tops to reduce the sloshing and aeration of the contents. These floating tops preclude buckling or implosion damage due to the sloshing of the contained liquid. In addition, all the tanks except the primary water storage tank have their walls further reinforced by an outer jacket of twelve inches of reinforced concrete that is bonded to the tank by studs welded to the tank and to the reinforcing steel. The thickness of this concrete reinforcement has been increased to 36 inches over the lower five feet of the tank height. No interaction problems were postulated.

(4) A question arose regarding the storage of diesel fuel oil onsite in tanks which could rupture during a seismic event causing both loss of fuel for the diesel generators and flooding portions of the plant with fuel oil causing a fire hazard. An examination showed that a seven-day oil supply for each diesel-generator is housed in underground tanks that are embedded in concrete dug into bedrock, are small enough, and that the wall thickness is sufficient to ensure that seismically-induced sloshing of the contents will not cause rupture of the tanks. These tanks do not appear to present an interaction problem.

(5) We investigated potential interactions involving the containment ventilation and purge system isolation valves. These are large (48-inch) butterfly valves that close upon deenergization of the control air supply. We were particularly interested in whether potential interactions could damage the solenoid air control valves preventing them from venting the air from the actuator thus preventing the valves from closing to isolate the containment. An inspection of the valves and the surrounding area did not reveal any postulated interactions.

(6) Our review of one of the 125-volt vital battery rooms revealed only one postulated interaction. The overhead lighting fixtures were not seismically supported. We postulated that these fixtures could fall onto the battery racks and either short out cells, ground the battery or break the cell containers. PG&E's recommended resolution was to seismically support the fixtures.

We found that our method of conducting a walkdown was nearly identical to PG&E's earlier efforts in that our philosophy of considering the safety-related system as the target and the non-safety-related systems as sources were the same. PG&E has subsequently refined their data gathering and recording system to the point where each postulated interaction is uniquely identified and described. This information along with information about its resolution is documented in retrievable form in a computer based data management system.

After our walkdowns were completed, we compared our results to those of PG&E that contained the same elements. The comparison was limited in extent because PG&E had not completed their walkdown of the containment ventilation and purge systems isolation valves or the electrical power supply to turbine throttle valve FCV-95. We found that we identified all the interactions identified by PG&E during their walkdowns but found none in addition.