UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 2, 1999

Mr. Paul Gunter
Nuclear Information Resource Service
1424 16th Street, NW
Suite 404
Washington, DC 20036

Dear Mr. Gunter:

I am writing to convey my thanks for your attendance and participation at the April 13, 1999, Reactor Decommissioning Public Meeting and to address some of your comments. During this meeting you stated that in the seismic area we need to take into account the new information coming out of the Kobe and Northridge earthquakes. I am pleased to inform you that the NRC has already spent a significant amount of time studying these events. The exact comment you made at the meeting was:

> I guess I'd like to direct my questions to the seismological review for this risk-informed process. And first of all, did any of the NUREGs that you look at take into account new information coming out of the Kobe and Northridge events? I think that what we need to be concerned with is dated information. Particularly as we are learning more about risks associated with those two particular seismological events that were never even considered when plants were sited, particularly though I can't frame it in the seismological language, from a lay understanding, it's clear that new information was gained out of Kobe and Northridge events suggesting that you can have seismological effects of greater consequence farther afield than at the epicenter of the event.

The two NUREGs you referred to were written in the middle and late 1980s and used probabilistic seismic hazard analyses performed for the NRC by Lawrence Livermore National Laboratory (LLNL) for nuclear power plants in the central and eastern United States (U.S.). The results of more recent studies indicated lower seismic hazards for nuclear plants than the earlier studies estimated. Due to (1) the new methods of eliciting information, (2) newer methods of sampling hazard parameters uncertainties, (3) better information on ground motion attenuation in the U.S., and (4) a more certain understanding of the seismicity of the central and eastern U.S., if the probabilistic hazard studies were to be performed again, the hazard estimates for most nuclear power plant sites would probably be reduced still further.

1/0
DF03

99-105

The design basis for each U.S. nuclear power plant takes into account the effects of earthquake ground motion. The seismic design basis, called the Safe Shutdown Earthquake (SSE), defines the maximum ground motion for which certain structures, systems, and components necessary for safe shutdown are designed to remain functional. Applicants for reactor construction permits are required to obtain the geologic and seismic information necessary to determine site suitability and demonstrate reasonable assurance that a nuclear power plant can be constructed and operated at a site without undue risk to the health and safety of the public.

R+D-16-6
x ID+R-5 Dr Commissio
x O+M-6 Com Mtg

The information collected by nuclear power plant applicants was used to determine the earthquake ground motion at the site assuming that the epicenters of the earthquakes are situated at the point on the tectonic structures or in the tectonic provinces nearest to the site. The earthquake that could cause the maximum vibratory ground motion at the site was designated the SSE. This ground motion was used in the design and analysis of the plant.

The determination of SSEs was made following the criteria and procedures required by NRC regulations and using a multiple hypothesis approach in which several different methods were used to determine each parameter, and sensitivity studies were performed to account for the uncertainties in the geophysical phenomena. In addition, nuclear power plants have design margins (capability) well beyond the demands of the SSE. The ability of a nuclear power plant to resist the forces generated by the ground motion during an earthquake is incorporated in its design and construction. As a result, nuclear power plants are able to resist earthquake ground motions well beyond their design basis and far above the ground motion that would result in severe damage to residential and commercial buildings designed and built to standard building codes. Operating reactors that shut down permanently and enter decommissioning are required to continue to maintain their seismic design features that protect the public from release of radioactive material in the permanently defueled mode.

Following large, damaging earthquakes such as the Kobe and Northridge events, the NRC staff reviews the seismological and engineering information obtained from these events to determine if the new information challenges previous design and licensing decisions. The Kobe and Northridge earthquakes were tectonic plate boundary events that occurred in regions of very active tectonics. The operating U.S. nuclear power plants (except for San Onofre and Diablo Canyon) are located in the stable interior portion of the North American tectonic plate. This is a region of relatively low seismicity and seismic hazard. Earthquakes with the characteristics of the Kobe and Northridge events will not occur near central and eastern U.S. nuclear power plant sites.

The ground motion from an earthquake at a particular site is a function of the earthquake source characteristics, the magnitude, and focal mechanism. It is also a function of the distance of the facility to the fault and the geology along the travel path of the seismic waves and the geology immediately under the facility site. There are two operating nuclear power plant sites in the U.S. that can be considered as having the potential to be subjected to the near field ground motion of moderate to large earthquakes. These are the San Onofre Nuclear Generating Station (SONGS) near San Clemente and the Diablo Canyon Power Plant (DCPP) near San Luis Obispo. The seismic design of SONGS Units 2 and 3 is based on the assumed occurrence of a magnitude 7 earthquake on the Offshore Zone of Deformation, a fault zone approximately 8 kilometers from the site. The design of DCPP has been analyzed for the postulated occurrence of a magnitude 7.5 earthquake on the Hosgri Fault Zone approximately 4 kilometers from the site. The response spectra used for both the SONGS and the DCPP were evaluated against the actual spectra of near field ground motions of a suite of earthquakes gathered on a world-wide basis.

At the April 13, 1999, meeting, you also commented,

> ... it's clear that new information was gained out of Kobe and Northridge events suggesting that you can have seismological effects of greater consequence farther afield than at the epicenter of the event.

The NRC's review of the strong motion data and the damage resulting from these events indicates otherwise. We assume you are referring to the fact that the amplitudes of the ground motion from the 1994 Northridge earthquake were larger in Santa Monica than those at similar and lesser distances from the earthquake source. The cause of the larger ground motions in the Santa Monica area is believed to be the subsurface geology along the travel path of the waves. Some experts believe that the anomalous ground motion in Santa Monica is explained by focusing due to a deep convex structure (several kilometers beneath the surface) that focuses the ground motion in mid-Santa Monica. Other experts believe that the large amplitudes of the ground motions in Santa Monica from the Northridge earthquake are caused by the shallow basin-edge structure (1 kilometer deep) at the northern edge of the Los Angeles Basin. This theory suggests that the large amplification results from constructive interference of direct waves with the basin-edge generated surface waves.

Earthquake recordings at the SONGS and DCPP sites did not indicate anomalous amplification of ground motion. In addition, there have been numerous seismic reflection and refraction studies performed for the evaluations of these nuclear power plant sites, and also for petroleum exploration and geophysical research. They, along with other well-proven methods, were used to determine the nature of the geologic structure in the vicinity of these sites, the location of any faults, and the nature of the faults. None of these studies has indicated anomalous conditions, like those postulated for Santa Monica, at either SONGS or DCPP. In addition, the empirical ground motion data base used to develop the ground motion attenuation relationships contains events recorded at sites with anomalous as well as typical ground motion amplitudes. The design-basis ground motion for both SONGS and DCPP were compared to the 84th percentile level of ground motion obtained using the attenuation relationships and the appropriate earthquake magnitude, distance, and geology for each site. The geology of the SONGS and DCPP sites does not cause anomalous amplification; therefore, there is no "new information gained from the Kobe and Northridge events" that raises safety concerns or changes seismic safety margins for operating or permanently shutdown U. S. nuclear power plants. Also, structural engineering of earthquake-resistant design is well understood and effective; for example, the old Kobe City Hall building sustained severe damage but the new Kobe City Hall building (designed to newer codes) suffered no damage. The experience from a study of the damage due to these earthquakes indicates that seismic capacity of existing structures, especially those made primarily of shear walls, can be evaluated with confidence.

In summary, earthquakes of the type that occurred in Kobe and Northridge are different than those that can occur near nuclear power plants in the central and eastern U. S. The higher ground motions recorded in the Santa Monica area from the Northridge earthquake were due to the specific geology through which the waves traveled. Improvements in our understanding of central and eastern U. S. geology, seismic wave attenuation, seismicity, and seismic hazard calculation methodology would result in less uncertainty and lower seismic hazard estimates today than those obtained from the previous studies that were used to establish seismic criteria for U.S. nuclear power plants.

I would like to thank you again for participating in our April 13, 1999, Reactor Decommissioning Public Meeting. I hope this letter is responsive to your comments. If you would like to further discuss these topics, please contact Goutam Bagchi at (301) 415-3298.

Sincerely,

ORIGINAL SIGNED BY:

John A. Zwolinski, Director
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

DISTRIBUTION:
Docket File
PUBLIC
PDIV/D Reading
OGC
ACRS
G.Bagchi
*SEE PREVIOUS CONCURRENCE

DOCUMENT NAME: G:\PDIV-3\SONGS1\ltrGunter.wpd

To receive a copy of this document, indicate in the box C=Copy w/o attachment/enclosure E=Copy with attachment/enclosure N = No copy

OFFICE	LPM*		PM/PDIV-3	E	LA/PDIV-3	E	SC/PDIV-3		PD/PDIV&D	C
NAME	SWeiss:db		DDudley		CJamerson		MMasnik MTM		SRichards SAR	
DATE	05/13/99		5/26 /99		5/26 /99		5/26 /99		6/2 /99	

OFFICE	DD/DE	E	D/LPM	
NAME	RWessman		JZwolinski	
DATE	6/2 /99		6/6 /99	

with changes

OFFICIAL RECORD COPY

I would like to thank you again for participating in our April 13, 1999, Reactor Decommissioning Public Meeting. I hope this letter is responsive to your comments. If you would like to further discuss these topics, please contact Goutam Bagchi at (301) 415-3298.

Sincerely,

John A. Zwolinski, Director
Division of Licensing Project Management
Office of Nuclear Reactor Regulation