

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
WILLIAM J. DIRCKS, DIRECTOR

In the Matter of

GENERAL ELECTRIC COMPANY
(Vallecitos Nuclear Center,
License No. SNM-960)

}
} Docket No. 70-754 (10 CFR 2.206)
}

DIRECTOR'S DECISION UNDER 10 CFR 2.206

On December 14, 1978, the Friends of the Earth (FOE), San Francisco, California, requested pursuant to 10 CFR 2.206 that the Director of Nuclear Material Safety and Safeguards suspend activities under License No. SNM-960 at the General Electric Company's Vallecitos Nuclear Center (VNC). In addition to suspension of the license, the FOE also requested that all plutonium be removed from the Vallecitos Nuclear Center and that public hearings be held on future activities at Vallecitos prior to the return of plutonium to the site. The FOE also asked that the Commission provide the FOE with an inventory of radioactive materials at the Vallecitos site and structural analyses of buildings at Vallecitos containing radioactive materials. ^{1/}

Congressmen John Burton and Ronald V. Dellums, California Assemblyman Thomas Bates, and other California residents joined the FOE request. ^{2/} Similar requests to suspend the license based on new seismic interpretations of the site were received from Jan Goldman of North Fork, California, Marion Hill of Belmont,

^{1/} As the FOE requested, NMSS will provide the FOE structural analyses applicable to the Special Nuclear Material License review when the reports are completed. The operating inventories of radioactive materials under License No. SNM-960 in forms conducive to release are listed in General Electric's (GE) submittals to which the FOE referred in its petition. Because GE has committed itself not to exceed these levels, these quantities are the only values which are appropriate for release calculations.

^{2/} Others joining the FOE's request are Janice Delfino, Sally Harris, Lore Kohn, and Hiram Wolch of Castro Valley, California; Louis Bookbinder, Marjorie Koenig, Sherman Lewis, Ann Mocht, Al Murdoch, Jo-Ann Murdoch, and Helen Smith of Haywood, California; Lawrence Evans of San Leandro California; and Barbara Shockley of San Lorenzo, California.

California, and the Tri-City Ecology Center of Fremont, California, and these requests were consolidated with the FOE's request for consideration. Notice of receipt of the FOE's request was published in the Federal Register on January 10, 1979. 44 Fed. Reg. 2209 (1979).

The bases for the FOE's request are essentially that

- (1) the Preliminary Safety Evaluation Report (PSER) issued by the Office of Nuclear Material Safety and Safeguards (NMSS) in November 1977 is deficient in light of new seismic information;
- (2) Nuclear Regulatory Commission (NRC) estimates of plutonium release from the plutonium labs after an earthquake are too low;
- (3) NRC estimates of plutonium toxicity are too low; and
- (4) it is inadvisable to allow the plutonium to remain onsite in light of seismic conditions and the potential consequences of an earthquake at the site.

For the reasons stated in this decision, the petitions to suspend License No. SNM-960 have not presented any new information which would change the PSER under which the Office of Nuclear Material Safety and Safeguards (NMSS) permitted continuation of licensed activities under License No. SNM-960. As this decision describes, NMSS finds that the analysis in its PSER dated November 7, 1977, is essentially sound. Based on current analysis of conditions at VNC and activities under the license, NMSS concludes that continued activities at VNC under License No. SNM-960 do not pose an undue risk to public health and safety. Therefore, the requests to suspend the license are denied. It is unnecessary to consider the FOE's requested removal of plutonium from the site and the associated hearing prior to return of

plutonium to the site.

In the remainder of this decision, NMSS will specifically address the concerns raised in the requests to suspend the license with regard to seismicity of the site, structural integrity of Building 102, the estimated quantities of plutonium released and its impact on the surrounding population, and plutonium toxicity.

Background

As indicated in the Acting Director of Nuclear Reactor Regulation's Order to Show Cause ^{3/}dated October 24, 1977, which suspended activities under Operating License No. TR-1, 42 Fed. Reg. 57,573, the NRC staff met with the GE-VNC staff to discuss all NRC-licensed activities at the site. Although continued operation of the General Electric Test Reactor (GETR) was the subject of the Order to Show Cause, the safety and environmental impact of continuing activities under NRC License No. SNM-960 were of concern to NMSS. The NMSS staff performed an evaluation of the SNM activities in light of the new geologic interpretations. The November 7, 1977, PSER was the product of this effort and was used as the basis for the decision to permit the activities covered under that license to continue. At the NMSS staff's request, General Electric made commitments to restrict the activities covered by the SNM license as a result of the staff's preliminary review and the basis used in the PSER. ^{4/} These commitments included limiting quantities, types,

^{3/} The issues at hand were the then recently revised interpretations of the geologic and seismic characteristics of the site area.

^{4/} The Licensee's commitments are listed in November 7, 1977, PSER cover letter to R. W. Darmitzel, Manager, Irradiation Processing Product Operation, GE VNC, from Clifford V. Smith, Jr., Director, NMSS.

and form of materials used at the site, restricting presence of explosive and flammable materials in all buildings containing special nuclear material, draining of Lake Lee which was located on the site, and restricting operations in Cell No. 3 of the Radioactive Materials Laboratory which involve fission product or radiostope separation.

The staff's evaluation as presented in the PSER was based on consideration of the following information:

1. GE VNC's SMN-960 license renewal application and supporting license renewal documents,^{5/}
2. Oral presentation made by GE staff in Bethesda, Maryland as documented by GE in a November 12, 1977, submittal,^{6/} and
3. The staff's firsthand information and data relative to the then ongoing activities.^{7/}

With respect to the issues specifically raised by the FOE, NMSS believes for the reasons stated in the remainder of this decision that, based on current information, the PSER is a conservative assessment of the consequences of a seismic event of unspecified high magnitude at VNC.

^{5/} At that time the NMSS staff and its consultants were reviewing GE VNC's SMN-960 License Renewal Application and supporting license renewal documents. These documents may be examined at the local reading room set up at the NRC Office of Inspection and Enforcement, Region V Office located at 1990 N. California Boulevard, Suite 202, Walnut Creek, California 94596, and at the NRC Public Document Room located at 1717 H Street, N.W., Washington, D. C. 20555.

^{6/} Letter to Clifford V. Smith, Jr., Director, NMSS from R. W. Darmitzel, Manager Irradiation Processing Product Operation, GE VNC, dated November 12, 1977.

^{7/} The firsthand information and data collection was obtained through a staff site visit on October 25 and 26, 1977. This information was documented through a memorandum to R. W. Starostecki, Chief, FCRR, from W. Burkhardt, FCRR, Subject: "Trip Report - GE Vallecitos Nuclear Center, October 25 and 26, 1977" dated December 12, 1977.

Seismicity of the Site

For purposes of the preliminary safety evaluation the staff based its review on conservative simplifying assumptions which would provide upper bound environmental and safety impacts on the surrounding area. Under the PSER's analysis, a hypothetical seismic event of unspecified magnitude was assumed to occur which would result in structural failure of varying degree to all buildings housing activities covered under the SNM license. Engineering judgment was used to provide the sequence and extent of failure used in the analysis which is described below. This approach provided a mechanism to determine the maximum credible impact of such an event on the surrounding area. Contrary to the FOE's understanding, the PSER is not based on an earthquake at the site which could produce ground acceleration of .75g. Again, the PSER assumed a hypothetical seismic event of unspecified magnitude that resulted in significant structural failure.

Structural Integrity of Building 102

In analyzing activities under the SNM license at VNC the NMSS staff was concerned with the structural failure of the buildings which would result in the potential generation and release of an aerosol composed of particles less than 10 μm aerodynamic equivalent diameter (AED),^{8/} or less. The staff by onsite examination of the SNM activities estimated the quantities of material at risk^{9/} in process as well as total inventories. As stated in the PSER,^{10/} NMSS determined

^{8/} A particle exhibiting the aerodynamic behavior of a unit-density sphere of the stated size.

^{9/} Material at risk is material that is in a location and condition such that it is available for release in the event of breach of confinement.

^{10/} The locations of quantities of materials that could be released during a catastrophic event was discussed in great detail in the PSER, Section III, "Materials At Risk", pages 11-20. This discussion provided the basis for the staff's determination of Building 102 as the only location which could provide a significant source term for material available for release.

620052

that Building 102 was the only building that contained a significant inventory of radioactive material available for dispersion. The quantities of radioactive material housed in other YNC facilities are either small or otherwise contained such that significant dispersal following a seismic event is unlikely.

Building 102 houses the Advance Fuels Laboratory (AFL), the Plutonium Analytical Laboratory (PAL), and the Radioactive Material Laboratory (RML). The PAL and RML activities are essentially located on the first floor of Building 102. The AFL operations are located in the basement of Building 102.

The PSER assumed the following modes of structural failure for those three laboratories:

Advance Fuel Laboratory (AFL)

- Cracks develop in the walls and ceiling with sections of the ceiling falling on glove boxes causing a breach of confinement.
- Glove boxes shift from their normal location and lose their leak-tight integrity.

Plutonium Analytical Laboratory (PAL)

- The walls and ceiling of the PAL, which is located on the first floor of Building 102, collapse.
- Glove boxes are overturned and crushed by falling debris.

Radioactive Material Laboratory (RML)

- The first floor walls and ceiling that surround the four main hot cells collapse.
- Interconnecting ductwork and utilities in the RML collapse.
- In-cell liners remain intact but filters are punctured.

The failure modes were a conservative estimate of the impact of a seismic event of the structures for the following reasons. The analysis assumed total collapse of the PAL. Total collapse of the AFL was not assumed since it is located in the basement and total collapse would result in merely burying the material. Thus, total collapse of the AFL would not provide a pathway for the plutonium to escape from the AFL. In assuming partial collapse from ceiling cracks and sections of concrete falling on glove boxes to breach confinement a path was provided for the material to escape thereby increasing the possibility of release. It should be noted that since the issuance of the PSER, GE-VNC has tied down all glove boxes in the AFL to increase the resistance to the forces of a seismic event.^{11/} Collapse of all RML structures was assumed except the four main hot cells. The hot cells were assumed to maintain their integrity because they are massive structures, with 2-3 feet thick reinforced concrete walls, floors, and ceiling. Approximately 70% of the volume of the below grade box structure (base mat, foundation walls, and cell floor) is concrete. The volume of above grade structure (cell walls and roof slab) is approximately 50% concrete and steel.

The staff developed scenarios and made simplifying assumptions that imposed more catastrophic effects upon the facilities than would be realistically expected if NMSS had completed a full geologic and structural review of the facilities in question. Based on the aforementioned damage scenarios, source terms were derived for use in the calculation of radiological consequences.

^{11/} In developing a source term, NMSS assumed that the glove boxes would overturn, tumble around, load the glove box air with plutonium, and would then be crushed by a large chunk of AFL ceiling. By tying down the glove boxes, GE-VNC has reduced the possibility of this situation occurring and thus reduced the possibility of material release since vibratory motion alone will not significantly load the air with plutonium.

Releases and Doses

The release mechanisms presented in the PSER were first generation material transport models (i.e., puff release and constant continuous release). Engineers use this bounding technique as a first cut at the problem to see whether or not a problem exists and what the controlling features are. In this approach, the assumptions made were simple in nature assuming release not hindered by transportation mechanisms which would reduce the quantities released and projected impact on the surrounding area, such as plutonium deposition within the area and 50% meteorology.

Using the simplified approach as presented in the first generation models, the assumptions used encompassed the suspension mechanisms such as aftershocks and winds although they were not specifically identified in the analysis. In the development of the PSER source terms, NNISS assumed the current working level inventories for the various processes and experiments, and devised release mechanisms based on the aforementioned damage scenarios.^{12/} It was assumed that the glove boxes would overturn, tumble around, load the glove box air with plutonium in concentrations of 300 mg/m³, and then the glove boxes would be crushed by large chunks of the AFL ceiling breaching the glove box and releasing the material.^{13/} This methodology provides suspension mechanisms for release that are greater than one would expect from suspension of material as a result of aftershocks and winds.

^{12/} As noted earlier, GE has committed itself to restrict operations to the current working level inventories.

^{13/} Experimental data shows maximum air loading factors of 100 mg/m³. Thus, the PSER's assumption of 300 mg/m³ air loading within the glove boxes is conservative by a factor of 3. J. M. Celby et al. "Consideration in the Assessment of the Consequences of Effluents from Mixed Oxide Fuel Fabrication Plants", BNWL-1697 Rev. 1. Battelle Pacific Northwest Laboratory at page 76 (June 1975).

With respect to the AFL, aftershocks and winds are not considered a major factor in determining the upper bound material release quantities for the following reasons. Because of the location of the AFL and of the physical properties of plutonium, aftershocks and winds play a minor role in the transport of material out of the AFL rubble after the primary earthquake movement has taken place. ^{14/} The winds would have to follow a torturous path to reach the plutonium in the AFL. Wind speed reduction would occur because of surface drag and directional changes since the wind would have to pass through a hole in the basement ceiling, descend to near the basement floor and find its way through the rubble to reach the bulk of the plutonium. The wind velocity at that point would essentially be zero. Most plutonium would be covered with rubble. Vibratory motion as a result of aftershocks will not suspend a significant amount of material. The glove box has already been crushed after the first earthquake strike. Thus, the potential for additional air loading has been greatly diminished. Considering these factors, suspension of material due to aftershocks and winds would be credited to the initial release as presented in the PSER.

Fire was not considered as a mechanism for dispersion of plutonium since the laboratories did not contain an appreciable amount of flammable material. As explained in the PSER,

"Potential secondary effects including fires, explosions and flooding, were considered by the staff since these events may represent means by which material can become mobilized. The absence of appreciable quantities of flammable material

^{14/} Winds were considered in the analysis of the hot cells and the PAL. For the hot cells the effect of winds were incorporated as part of the breathing rate of the damaged cells; PSER at page 23. For the PAL, the effects of winds were considered in the assumption of plutonium flux from the floor of 1×10^{-8} /sec. for the nitrate and 6×10^{-8} /sec. for the powder, PSER at page 26.

Lessens the potential for fires. This has been verified independently by the staff. Consequently heat sources, such as electrical short circuits, are not likely to result in severe fires. GE has agreed that no additional quantities of flammable materials shall be used or stored in these areas without prior NRC approval.

The license did state the 6 percent pre-mixed hydrogen/inert gas is stored onsite outside Building 102 and is made available through a piping system to the AFL for use in the sintering process. Also, a limited quantity of quenching gas is present. The licensee does not consider these gases as explosive mixtures. The staff agrees. The licensee stated that no explosive mixtures are stored in the RML and AFL. Therefore the staff did not assume this as a credible mechanism for dispersing plutonium. GE has agreed that no such materials shall be used or stored in these areas without prior NRC approval." (PSER, at pages 17-18)

The NMSS release estimates, as calculated for the assumed structural failure, have been recently confirmed by the Pacific Northwest Laboratory (PNL). Following the issuance of the PSER, the staff asked PNL to independently review its estimates of consequences. PNL's findings are contained in a report entitled, "Source Term and Radiation Dose Estimates for Postulated Damage to the 102 Building at the General Electric Vallecitos Nuclear Center", dated February 1979, which is attached to and made part of this Decision.

PNL developed three scenarios representing significant levels of loss of confinement due to moderate, substantial, and major damage to Building 102 at VNC. The damage scenarios were not correlated to any specific level of seismic activity. The three scenarios are:

1. Moderate damage scenario - perforation of the enclosures in and the structure comprising the Plutonium Analytical Laboratory.
2. Substantial damage scenario - complete loss of confinement of the Plutonium Analytical Laboratory and loss of the filters sealing the inlet to the Radioactive Materials Laboratory

hot cells.

3. Major damage scenario - the damage outlined in (2) plus the perforation of enclosures holding a significant inventories of dispersible plutonium in and the structure comprising the Advanced Fuels Laboratory.

The results of the PNL review have shown that for the worst case (major damage scenario) the maximum-exposed individual was estimated to receive 0.7 rem to the lung and 1 rem to the bone, which are comparable to the doses presented in the PSER (PSER Table V-2 at page 31). The calculated 50-year committed dose is equivalent to 50 years of exposure to natural background radiation and medical X-rays.

Releases from the failed structures, if any, are expected to be controlled after any earthquake. Temporary isolation of the material from the environment may be achieved through several methods. For example, large plastic sheets can be drawn over the openings, thereby depriving the material of exposure to driving forces of winds. After the releases are controlled, clean up can proceed in an orderly fashion such that additional releases, if any, will be as low as reasonably achievable and are not expected to exceed levels greater than those specified under 10 CFR Part 20, "Standards for Protection Against Radiation". Once controlled, the clean up at VNC would not pose extraordinary problems that would preclude use of normal procedures for decontamination of the site.

Pre-clean up and decontamination for the offsite area will not pose a health and safety problem as a result of the postulated catastrophic earthquake. PNL's estimates for the worst case scenario indicate that the maximum residual plutonium contamination, as a result of a three day uncontrolled continuous release, are

within EPA's proposed guidelines of $0.2 \mu\text{Ci}/\text{in}^2$. Therefore, there is no indication that offsite clean-up and decontamination will be necessary since the postulated ground contamination is below the proposed EPA standard.

Water contamination will not be a problem, even assuming that the basement floor has developed cracks. Because of the transport properties of plutonium in either the oxide or nitrate form, transportation through the soil into the groundwater is an extremely slow process. Significant groundwater contamination by plutonium migration through the soil is impossible because of the time requirement, plutonium concentration in the soil, the end plutonium concentration in the groundwater, and the dilution factors involved with groundwater motion.

Contamination of the nearby San Antonio reservoir is not considered in the PSER since the dam for the reservoir is located on the considered fault network. If the earthquake destroyed the dam, there would be no reservoir, but assuming dam failure, no flooding of the VNC would occur since the topography of that region would not permit flooding of the site. Even if the dam withstood the earthquake, that reservoir along with the others in the area would not be significantly contaminated due to the volume of water contained in these reservoirs as compared to the quantities of plutonium released. By way of comparison only, and not to establish a guideline for accidental releases, any contamination of bodies of water would be expected to be well below the concentration limits established in 10 CFR Part 20 for releases to unrestricted areas.

As further assurance that the impact of such an event will be minimized, GE VNC has a written emergency control plan for the site. The plan meets the requirements for plutonium handling facilities as set forth in 10 CFR 70.22(i).

Specific plans have been developed for various emergencies including earthquakes. Building emergency teams have been trained in the use of survey instruments, protective apparel and remote manipulation equipment. Periodic drills are conducted to assure adequate personnel response to emergency situations, and responsibilities are designated for maintenance of communication equipment and standby equipment and instruments. Arrangements have been made for hospitals, with supervision by competent nuclear safety personnel, to receive and care for injured who may be contaminated. During an emergency the General Electric Test Reactor (GETR) shift supervisor is assigned control of all emergency operations and insures coordination between the Emergency Control Organization and outside organizations such as law enforcement agencies, fire control agencies and mutual aid organizations. This responsibility includes the operations at the laboratories which house the SNM activities.

Plutonium Toxicity

In the PSER, the Staff compared the calculated dose consequences with annual exposures for occupational workers allowed on a routine basis under 10 CFR Part 20. The doses from the assumed seismic event were found to be of the same magnitude as the aforementioned regulatory dose limits. The use of the regulatory limit was not intended to establish guidelines for accidental releases and the resultant estimated doses. They were used to put into perspective the consequences of such a postulated catastrophic event for which no definitive criteria exist. To the extent the Friends of the Earth challenge the validity of the dose levels given

in 10 CFR Part 20 and postulate greater material toxicity than now assumed by the Commission, that challenge is essentially directed to the Commission's regulations and should be addressed in a petition for rulemaking to the Commission.

Conclusion

Continued operation of activities covered under License No. SNM-960 does not pose a significant health and safety risk to the public. The FOE petition and other requests to suspend License No. SNM-960 have not provided new information that would change NMSS's conclusions as presented in the PSER. Moreover, the plutonium release estimates presented in the PSER were recently confirmed by PNL.

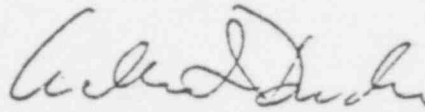
Nonetheless, NMSS is continuing to evaluate the effects of seismic phenomena on the VNC site. Before the Order to Show Cause for the GETR was issued, NMSS had initiated a program of analysis of the effects of abnormal natural phenomena (earthquakes, severe weather and flooding) on existing commercial plutonium research and development and fabrication facilities, ^{15/} including General Electric's Vallecitos facility. This natural phenomena review program will provide a realistic assessment of the range of likelihood of occurrence and credible consequences of natural phenomena. In the course of the analysis of the effects of natural phenomena, NMSS will refine the release calculations on the basis of the structural response to specific seismic events and the risk associated with continued SNM operations.

^{15/} James E. Ayer and Winston Burkhardt, "Analysis of the Effects of Abnormal Natural Phenomena on Existing Plutonium Fabrication Plants", presented at American Nuclear Society Topical Meeting, Bal Harbor, Florida, May 2-4, 1977. The paper dealt with the approach being used to perform the analysis. It does not present the results of the analysis.

These reviews will, of course, take into account the latest evidence regarding the geologic and tectonic conditions at the Vallecitos site.

A copy of this Decision will be placed in the Commission's Public Document Room at 1717 H Street, N.W., Washington, D.C. 20555 and the local reading room for VNC set up at the NRC's Office of Inspection and Enforcement, Region V, located at 1990 N. California Boulevard, Suite 202, Walnut Creek, California 94596. A copy of this decision will also be filed with the Secretary of the Commission for its review in accordance with 10 CFR 2.206(c) of the Commission's regulations.

In accordance with 10 CFR 2.206(c) of the Commission's Rules of Practice, this decision will constitute the final action of the Commission twenty (20) days after the date of issuance, unless the Commission on its own motion institutes review of this decision within that time.



William J. Dircks, Director
Office of Nuclear Material Safety
and Safeguards

Dated at Silver Spring, Maryland
this 24th day of June, 1979.

Enclosure:

PNL Rpt. - "Source Term & Radiation
Dose Estimates for Postulated Damage
to the 102 Building at the General
Electric Vallecitos Nuclear Center",
dated February 1979.

623062