BEFORE THE UNITED STATES NUCLEAR REGULATORY COMMISSION

In the matter of SOUTHERN CALIFORNIA EDISON COMPANY and SAN DIEGO GAS & ELECTRIC COMPANY San Onofre Nuclear Generating Station, Units 2 and 3	)	DOCKET NO. 50-361 UNIT 2 DOCKET NO. 50-362 UNIT 3 Amendment No. 2 to Application for a Special Nuclear Material License

SOUTHERN CALIFORNIA EDISON COMPANY and SAN DIEGO GAS & ELECTRIC COMPANY hereby amend the above-numbered Application by submitting herewith Amendment No. 2 to the application for a Special Nuclear Material License.

This amendment consists of information to provide for revised new fuel storage conditions.

In the event of a conflict, the information in this Amendment No. 2 to the Application for a Special Nuclear Material License supersedes the information previously submitted.

Subscribed on this 20th day of October, 1980.

Respectfully submitted,

SOUTHERN CALIFORNIA EDISON COMPANY

By Robert Dietch

Charles R. Kocher
James A. Beoletto
Attorneys for Southern
California Edison Company

By James A. Beoletto

OFFICIAL SEAL
AGNES CRABTREE
NOTARY PUBLIC - CALIFORNIA
PRINCIPAL OFFICE IN
LOS ANGELES COUNTY
My Commission Exp. Aug. 27, 1982

Subscribed and sworn to before me this
20th day of October, 1980.

Agnes Crabtree
Notary Public in and for the County of
Los Angeles, State of California

SAN DIEGO GAS & ELECTRIC COMPANY

By Gary D. Cotton

David R. Pigott
Frank S. Bayley, III
Samuel B. Casey
Chickering & Gregory
Attorneys for San Diego
Gas & Electric Company

By David R Pigott
David R. Pigott

OFFICIAL SEAL
ANNE R. SCHMIDT
NOTARY PUBLIC - CALIFORNIA
Principal Office in San Diego County
My Commission Exp. Oct. '' 1983

Subscribed and sworn to before me
this 23 day of October 1980.

Anne R. Schmidt
Notary Public in and for the City and
County of San Diego, California

SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3
APPLICATION FOR LICENSE, AMENDMENT 2
FOR
STORAGE ONLY OF UNIRRADIATED
REACTOR FUEL AND ASSOCIATED RADIOACTIVE MATERIAL

Southern California Edison Company and San Diego Gas & Electric Company (hereinafter called "Applicants"), pursuant to Title 10, Code of Federal Regulations Part 70, hereby apply for a license to permit the receipt, possession and storage of special nuclear material of unirradiated nuclear fuel assemblies, fission chambers, calibration sources, and startup sources as herein described for San Onofre Nuclear Generating Station, Units 2 and 3. The term of the license requested is for the period beginning December 1, 1980, until such time as it may be supplemented by a permanent operating license. 2

Southern California Edison Company is a public utility incorporated under the laws of the State of California, with its principal office in Rosemead, California, and is engaged in the generation, distribution, and sale of electricity. The names, addresses, and citizenship of its principal officers are listed in Appendix A of this application. Southern California Edison Company is not owned, controlled or dominated by an alien, foreign corporation, or foreign government.

San Diego Gas and Electric Company is a public utility incorporated under the laws of the State of California, with its principal office in San Diego, California, and is engaged in the generation, distribution, and sale of electricity. The names, addresses, and citizenship of its principal officers are listed in Appendix B of this application. San Diego Gas and Electric Company is not owned, controlled, or dominated by an alien, foreign corporation, or foreign government.

Applicants make this application pursuant to authorization by their board of directors and are acting on their behalf and not as agent or representative of any other person.

Applicants request exemption from the requirements of Title 10 CFR Section 70.24 as provided in Subsection 70.24(d). As described herein, the fuel assemblies will be stored in critically safe storage racks. In addition, other administrative procedures as discussed herein preclude the achievement of conditions which could cause criticality.

1.0 GENERAL INFORMATION

1.1 Reactor and Fuel

The special nuclear materials provided for in this license application will be stored at the San Onofre Nuclear Generating Station, Units 2 and 3 reactor site located on the

Southern California Coast in San Diego County. The site is 2.5 kilometers southeast of the City of San Clemente, California. Construction of these units was authorized under Permit CPPR-97 and 98 issued October 18, 1973, in response to the Southern California Edison and San Diego Gas and Electric Company application of May 28, 1970 (Docket 50-361 and 50-362).

The fuel assemblies requiring storage are constructed of fuel rods arranged in a square array with 16 rod locations per side and a fuel rod pitch of 0.506 inches. The fuel assembly arrangement (Figure 1) consists of 236 fuel rod positions, 5 Zircaloy-4 CEA guide tubes (each guide tube displaces 4 rod locations), 11 Zircaloy-4 spacer grids, 1 Inconel 625 spacer grid (lower end), stainless steel upper end and lower end fittings and a holddown device. The holddown device consists of the upper cast plate (one of two plates in the upper end fitting) and five helical Inconel X-750 springs.

The fuel rods (Figure 2) contained in a fuel assembly consist of sintered uranium dioxide pellets encased in a cold worked and stress relief annealed Zircaloy-4 tube. During assembly, the fuel pellets are stacked in the cladding tube to the required fuel height. A round wire type 302 stainless steel compression spring and an aluminum spacer disc are inserted at each end of the fuel column. The end plugs are installed and welded into the clad tubing. The fuel rod is internally pressurized with helium during this assembly.

The total weight of U-235 which is to be covered by this application is approximately 4,260 kilograms in 434 fuel assemblies (217 assemblies per core). The core design calls for three regions. Region 1 will contain 73 assemblies with a design enrichment of 1.87% U-235 by weight. Region 2 will contain 80 assemblies with an average enrichment of 2.38% U-235 by weight (with a maximum of 2.41% U-235 by weight). Region 3 will contain 64 assemblies with an average enrichment of 2.88% by weight (with a maximum of 2.91% U-235 by weight). The total weight of each fuel assembly is 1,451 lbs. Table 1.1-1 summarizes the characteristics of the fuel rods with respect to dimensions, materials, quantities, and other pertinent parameters. 2

1.2 Storage Conditions

The new fuel storage racks consist of vertical cells grouped in parallel rows to form structural units that are anchored to the floor of the new fuel storage area. The new fuel will be stored dry in these racks which are designed to provide storage for at least 73 fuel assemblies (one-third of a core).

The arrangment results in a k_{eff} of 0.98 or less for dry storage of fuel with the highest anticipated enrichment assuming optimum moderation. The new fuel storage racks are designed to protect the stored assemblies against possible impact loading due to handling of neighboring assemblies and to prevent insertion of assemblies into spaces other than the prescribed locations. Structural deformations are limited and centerline-to-centerline spacing is maintained to preclude the possibility of criticality under all anticipated loading conditions, including the design basis earthquake (DBE). Lateral movement is restricted to maintain safe geometry margins and to preclude the reduction of the space between the fuel assembly cavities.

The new fuel racks, except for access platforms, are constructed entirely of stainless steel. The access platforms are constructed of galvanized carbon steel and do not come in contact with fuel assemblies.

The new fuel storage facility is part of the fuel-handling building, a Seismic Category I structure. A separate fuel handling building is provided for each reactor unit. The new fuel storage facility is located to permit ready access to new fuel assemblies and to facilitate expeditious transfer of the assemblies into the containment during reactor refueling operations.

Figures 3, 4, and 5 show the general arrangements and locations of the new fuel storage facilities in the station complex. The new fuel storage facility is designed in compliance with ANSI N18.2, Nuclear Safety Criteria for Design of Stationary Pressurized Water Reactor Plants.

The normal storage location for new unirradiated fuel is the new fuel storage facility. However, since the new fuel storage facility can accommodate only 73 assemblies, the remainder of the first core, 144 assemblies, will be stored dry in the spent fuel storage facility.

The spent fuel storage racks consist of vertical cells grouped to form structural units that are anchored to the floor of the spent fuel pool. The spent fuel storage racks and pool are designed to provide storage for at least 800 fuel assemblies (three and two-thirds cores). New fuel assemblies will be stored using every other storage row and column. The arrangement results in a k_{eff} of 0.98 or less with the highest anticipated enrichment, assuming an infinite array of fuel storage locations, and flooding with unborated water. 2

The spent fuel storage facility is part of the fuel-handling building, a Seismic Category I structure. The spent fuel storage facility is designed consistent with ANSI N18.2, Nuclear Safety Criteria for Design of Stationary Pressurized Water Reactor Plants, and Regulatory Guide 1.13, Spent Fuel Storage Facility Design Bases, dated March 10, 1977, as reflected in Part C, Regulatory Position.

The equipment to be used during transfer of new fuel from the shipping containers to the storage racks are the new fuel handling tool, the new fuel handling crane, and the spent fuel handling machine. The new fuel handling crane is a single girder, underhung bridge crane spanning the new fuel storage area. The crane is equipped with a mechanically operated, interlocking device that allows the bridge to be interlocked with a stationary monorail. The interlocking device provides for a positive lock between the bridge and monorail and allows for the safe travel of the hoist between the bridge and the monorail. The interlocking device also prevents the hoist from traveling off of either the bridge or monorail when the bridge and monorail are disengaged. The hoist is an electric hoist and the new fuel handling tool is suspended from the hoist. The new fuel handling tool (Figure 6) is operated manually for safe transfer of the fuel assemblies. The spent fuel handling machine (Figure 7) is a traveling bridge and trolley that rides on rails over the spent fuel pool, fuel transfer pool, and cask loading pit. The spent fuel handling machine hoist assembly contains a grappling device which, when rotated by the actuator mechanism, engages the fuel assembly to be moved. Once the assembly is grappled, a cable and hoist winch raise the fuel assembly. Interlocks are installed so that movement of the spent fuel handling machine is not possible when the hoist is withdrawing or inserting an assembly.

Detailed descriptions and scale drawings of the fuel handling areas and associated equipment are given in the San Onofre Nuclear Generating Station Units 2 and 3 Final Safety Analysis Report (FSAR), Section 9.1.

Before fuel is stored in the fuel-handling building, all construction cranes located close enough to the fuel-handling building will be removed permanently from the area. As shown in Figures 3 and 4, the two fuel handling buildings are located on the east side of the containment buildings and are thus isolated from the turbine areas, intake structure, transformers, and diesel generator buildings. These areas are likely to contain the majority of personnel equipment activity. The area directly east of the fuel handling buildings is a high grade to the switchyard. Thus, the buildings are located in a low activity area which will leave little construction activity and discourages the congregation of men and equipment.

The fire protection system in the new fuel area and spent fuel area consists of detection devices, alarms, and suppression systems. The detection devices, smoke, and fix-temperature-rate-of-rise heat detectors will activate alarms locally and in the control room in case of a fire. The primary means of suppressing the fire will be through portable CO_2 extinguishers and portable dry chemical extinguishers. A more detailed description of the San Onofre Nuclear Generating Station, Units 2 and 3 FSAR, Section 9.5.1.

When fuel assemblies are stored in the new and spent fuel storage areas, access to the storage area will be restricted to authorized personnel. The only means of access to the new or spent fuel storage areas will be through doors that are alarmed and locked with keys administered by the Security Supervisor. Operation of the new fuel handling crane and the spent fuel handling crane will be administratively controlled by locking out power to the cranes except when authorized personnel request their use.

1.3 Physical Protection

The new fuel storage facility and the spent fuel storage facility are both located in the fuel handling building which is a controlled access area. A description of the physical security program for San Onofre Nuclear Generating Station, Units 2 and 3 has been provided to the NRC and has been withheld from public disclosure pursuant to paragraph 2.790(d), 10CFR Part 2, Rule of Practice.

The fuel assemblies furnished for the first core at San Onofre Nuclear Generating Station, Units 2 and 3, contain no materials enriched in U-235 in greater than 2.91% by weight. The assemblies contain no U-233 nor plutonium. The protective requirements of 10CFR Part 73.47 will apply to the San Onofre Nuclear Generating Station, Units 2 and 3, first core new fuel storage. 2

1.4 Transfer of Special Nuclear Material

Transportation of the new fuel assemblies from the fabrication location to the San Onofre Nuclear Generating Station, Units 2 and 3, will be the responsibility of the fuel fabricator, Combustion Engineering, Inc., 1000 Prospect Hill Road, Windsor, Connecticut 06095. The fuel assemblies will be delivered to the plant site in shipping containers which are the property of the fuel fabricator, Combustion Engineering, Inc. The shipping container is a steel structure capable of storing or transporting one or two fuel assemblies. Combustion has been licensed by the U.S. Nuclear Regulatory Commission in License SNM-1067 to package and transport fuel assemblies in such shipping containers. As soon as practical after their arrival, the assemblies will be removed individually from their shipping containers and placed in the fuel storage racks.

1.5 Financial Protection and Indemnity

The proof of financial protection furnished under Section 140.15 of 10CFR Part 140 for San Onofre Unit 1 (DPR-13) also applies to San Onofre Units 2 and 3.

2.0 HEALTH AND SAFETY

2.1 Radiation Control

1. The persons responsible for radiation safety at San Onofre Units 2 and 3 are the Chemical and Radiation Protection Engineer (This position is currently vacant and will be filled by January 1, 1981. John P. Albers, the Assistant Radiation Protection Engineer, is 2
currently responsible.), and Stephen P. Corey, the Chemical and Radiation Protection Foreman. The training and experience of these persons are shown in Tables 2.1-1 through 2.1-4.

2. Each sealed source will be tested for contamination prior to initial use or storage excluding 100 μCi or less beta and/or gamma emitting materials and 5 μCi or less alpha emitting materials. Monitoring of each source for removable contamination will occur at six month intervals.

   The Chemical and Radiation Protection Engineer will directly supervise leak testing of sealed sources. The sources will be smear tested. If the test reveals the presence of 0.005 μC or more of removable contamination, the source will be withdrawn from use and either decontaminated and repaired, or disposed of in accordance with NRC regulations.

3. Calibration of most ranges of the gamma and beta-gamma detection instruments is performed inside a shielded calibrator. Neutron sources are used to check neutron monitoring instruments. Additional smaller alpha, beta, and gamma sources can be used as necessary to calibrate or check the lower ranges of the various

instruments. Background and a check source are counted prior to the use of each instrument to verify that the instrument has not changed significantly. The instruments are calibrated quarterly. The sources used for calibration are traceable to the National Bureau of Standards or other standards laboratory. At least daily prior to use, the instrument response is checked with an internal or external source to verify that the instrument is functioning properly.

2.2 Nuclear Safety

1. The nuclear fuel assemblies will be transferred individually from their shipping containers for storage in the fuel storage racks.

2. The nuclear safety analysis for storage of fuel in the new fuel and spent fuel storage racks is discussed in Appendix C of this application. 2

3. The fuel handling equipment and activities will be limited during receipt of the initial core to that required for new fuel inspection and storage. The equipment to be used for new fuel transfer from their containers to the racks are the fuel handling tool, new fuel handling crane, spent fuel handling machine, and such fuel inspection tools as required by procedure.

   After arrival of the new fuel shipping containers, the container covers are removed and the fuel assembly strongback raised to the vertical position and locked. The new fuel handling tool, attached to the new fuel handling crane, is then locked to the fuel assembly, the fuel assembly clamping fixtures removed, and the fuel assembly removed from the container. Next, the protective wrapping is removed and the fuel assembly is visually inspected. The fuel assembly is then moved over to the new fuel storage racks where it is placed into its designated cavity. The fuel handling tool is unlocked from the assembly and the operation repeated until the specified number of assemblies are placed in the racks. The remaining assemblies (144) will be placed in the spent fuel assembly storage racks according to a similar procedure. In this case, the spent fuel handling machine is used in place of the new fuel handling crane. During fuel assembly movement to and from storage, only one assembly will be allowed out of a shipping container or storage location at one time in the fuel storage area.

4. Applicants have requested an exemption from the requirements of Title 10CFR Section 70.24 as provided in Subsection 70.24(d) previously in this application.

2.3 Accident Analysis

The possibility of a fuel handling accident is remote because of the many administrative controls and physical limitations imposed on the fuel handling operations. However, it is postulated that a fuel assembly is dropped breaching the cladding of the fuel. In the event of such an occurrence, the associated operation would be halted. The radiation protection personnel would then evaluate the health hazard. The fuel supplier, Combustion Engineering, would be notified of the situation and requested to aid the Plant Staff in evaluating the damage to the affected fuel assemblies.

The possibility of a criticality accident is considered remote due to the design of the fuel-handling and storage equipment and the administrative controls.

The possibility of fuel damage due to fire in the fuel storage area is considered remote due to the limited supply of combustible materials and lack of ignition source.

Design basis fuel handling accidents are discussed in San Onofre Nuclear Generating Station Units 2 and 3 FSAR Section 15.7.3.4.

3.0 OTHER MATERIALS REQUIRING NRC LICENSE

1. Other special nuclear material for which a license is requested consists of uranium-235 and plutonium-238 in the following forms and quantities.

a) Uranium-235

Form	Amount	Capsule Type	Amount/Chamber	
93% U-235	35 gm of U235*	Fission chambers manufactured by Reuter-Stokes Model No. RS-C3-2540-102 (24 chambers, 12 per unit)	0.85 gm of U	1

*35 gm of U-235 authorized by Amendment 1 to Special Nuclear Material License No. SNM-1844 (NRC letter to SCE dated January 28, 1980). 2

The fission chambers will be used in the ex-core detector system for San Onofre Units 2 and 3.

b) Plutonium-238

Form	Amount	Capsule Type	Source Strength
4 doubly encapsulated Pu-Be sources	80 curies (20 curies/source 1.15 gm Pu-238 per source)	Monsanto Research Corp. Model number will be supplied by October, 1979, 4 months prior to delivery	4.4 x 107 neutrons per second ±10%

Two sources will be supplied per unit to be used as startup sources. A complete description of the source assembly is contained in CE Drawing No. E-STD-165-220, Rev. 01, attached to this application.

c) Plutonium-238

Form	Amount	Capsule Type
1 doubly encapsulated Pu-Be source	20 curies	Monsanto Research Corp. Model No. 2727B

The source will be contained in the J. L. Shepherd Model 149 neutron calibration facility. The source is fixed to the end of a shielded operating rod which is remotely moved by means of an operating handle-cable assembly. The source position is indicated by lights built into the control box. The dimensions of the calibrator are 33 inches in diameter and 36 inches in height. The external radiation level is less than 5 mrem/hr at one foot from any surface with source in "off" position.

A complete description of the control assembly, source assembly, and container is shown in J. L. Shepherd Drawing Nos. A-0149-3, A-0149-6, and A-0149-7 attached in this application.

2. Storage Conditions

The material described above will be stored at San Onofre Unit 1 (DPR-13) until the health physics area at Units 2 and 3 is complete. The radiation monitoring system, health physics and laboratory equipment, and radioactive source materials safety at San Onofre Unit 1 are described in the San Onofre Unit 1 Final Safety Analysis Report (FSAR) Sections 5.7, 5.8 and 5.9, respectively. These materials will be under the jurisdiction of the Radiation Protection Group. Individual storage conditions for the above material is as follows:

a) The fission chambers will be stored in locked cabinets in the health physics area until installation.

b) The neutron startup sources will be shipped at the time of fuel shipment. They will be stored in their shipping containers in the fuel storage area.

c) The 20 curie Pu-Be calibration source is contained in the J. L. Shepherd Model 149 calibration facility which will be stored in the health physics area.

Table 1.1-1

Mechanical Design Parameters

Fuel Rods		
Fuel Material	UO_2 sintered	
Pellet diameter, in.	.325	
Pellet length, in.	.390	
Pellet density, g/cm3	10.38	
Pellet theoretical density, g/cm3	10.96	
Pellet density (% theoretical)	94.75	
Stack height density, g/cm3	10.061	
Clad material	Zircaloy - 4	
Clad OD, in.	0.382	2
Clad ID, in.	0.332	
Clad thickness, in.	0.025	
Diametral gap, in.	0.007	
Active length, in.	150	
Plenum length, in.	10.0	
Fuel Assembly		
Rod array, square	16 x 16	
Rod positions	236	
Rod pitch, in.	0.506	
Weight	1451	
Spacer grids	12	
Outside dimensions		
Fuel rod to fuel rod, in.	7.972 x 7.972	
Number per core	217	

Table 2.1-1

TRAINING

John P. Albers 2

Type of Training	Where Trained	Duration	On The Job	Formal Course	
1. Principles and Practices of Radiation Protection	a. San Diego State University M.S. Degree Radiological Health Physics	2 years		X	
	b. Argonne National Laboratory: University of Chicago Graduate Student Research Participation Program: TLD studies	3 months	X	X	
	c. Rockwell International Health Physics	80 hours		X	
	d. Oak Ridge National Laboratory Emergency Handling of Radiation Accidents	40 hours		X	2
	e. Los Alamos Scientific Laboratory Respiratory Protection	40 hours		X	
	f. San Diego Chapter Health Physics Society: Health Physics Certifiction Course	17 weeks		X	
	g. Rockwell International Reactor Operations	40 hours		X	
	h. Pacific Gas and Electric Company Dept. of Engineering Research	6 months	X		
	i. San Onofre Nuclear Generating Station	3 years	X		
2. Radioactivity Measurement Standardization and Monitoring Techniques and Instruments	Same as above				

Table 2.1-1

Type of Training	Where Trained
3. Mathematics and Calculations basic to the use and measurement of radioactivity	Same as above
4. Biological effects of radiation	Same as above

2

Table 2.1-2

EXPERIENCE WITH RADIATION

John P. Albers

1. Isotope - Cs - 137
   Maximum Amount - 130 Ci
   Experience at San Onofre Nuclear Generating Station Unit 1
   Duration - 3 years
   Type of Use - Calibration

2. Isotope - Ra - 226
   Maximum Amount - 50 mCi
   Experience at San Onofre Nuclear Generation Station Unit 1 2
   Duration - 3 years
   Type of Use - Calibration

3. Material - Mixed Fussion Products and Activated Corrosion Products
   Maximum Amount 150 Ci
   Experience at San Onofre Nuclear Generating Station Unit 1
   Duration - 3 years
   Type of Use - Solid Waste Shipments

4. Material - Cs-137
   Maximum Amount - 5 mCi
   Experience at Pacific Gas & Electric Company/Department of Engineering Research
   Duration - 6 months

Table 2.1-3

TRAINING

Stephen P. Corey 2

Type of Training	Where Trained	Duration	On The Job	Formal Course
1. Principles and Practices of Radiation Protection	a. Rockwell International Energy Systems Group	40 hours		X
	b. Southern California Edison Division Laboratory	6 months	X	
	c. San Onofre Nuclear Generating Station	5 years	X	2
2. Radioactivity Measurement Standardization and Monitoring Techniques and Instruments	Same as above			
3. Mathematics and Calculations basic to the use and measurement of radioactivity	Same as above			
4. Biological Effects of Radiation	Same as above			

Table 2.1-4

EXPERIENCE WITH RADIATION

Stephen P. Corey

1. Isotope - Cs - 137
   Maximum Amount - 130 Ci
   Experience at San Onofre Nuclear Generating Station Unit 1
   Duration - 3 years
   Type of Use - Calibration

2. Isotope - Ra - 226 2
   Maximum Amount - 50 mCi
   Experience at San Onofre Nuclear Generating Station Unit 1
   Duration - 3 years
   Type of Use - Calibration

3. Material - Mixed Fission Products
   Maximum Amount - 120-150 Ci
   Experience at San Onofre Nuclear Generating Station Unit 1
   Duration - 3 years
   Type of Use - Spent Resin Shipments

Appendix A

The names of SCE's principal officers, all of whom are citizens of the United States, are as follows:

Name	Position	
William R. Gould	Chairman of the Board	
Howard P. Allen	President	
H. Fred Christie	Executive Vice President and Chief Financial Officer	
David J. Fogarty	Senior Vice President	
A. Arenal	Vice President	
G. J. Bjorklund	Vice President	
Robert Dietch	Vice President	2
C. E. Hathaway	Vice President	
Joe T. Head, Jr.	Vice President	
P. L. Martin	Vice President	
A. L. Maxwell	Vice President and Comptroller	
Edward A. Myers, Jr.	Vice President	
Michael L. Noel	Vice President and Treasurer	
L. T. Papay	Vice President	
William H. Seaman	Vice President	
Robert L. Umbaugh	Vice President	
D. Bunte	Vice President	
John R. Bury	General Counsel	
Honor Muller	Secretary	

The address of all the foregoing principal officers of SCE is:

2244 Walnut Grove Avenue 2
Post Office Box 800
Rosemead, California 91770

Appendix B

The names of SDG&E's principal officers, all of whom are citizens of the United States, are as follows:

Name	Position	
Robert E. Morris	President and Chief Executive Officer	
Thomas A. Page	Executive Vice President and Chief Operating Officer	
Gordon Pearce	Vice President and General Counsel	
J. Robert Belt	Vice President	
Gary D. Cotton	Vice President	
Alton T. Davis	Vice President	2
Frank W. DeVore	Vice President	
David W. Gilman	Vice President	
John E. Hamrick	Vice President	
James J. Holley	Vice President	
William J. Karnes	Secretary	
Richard Korpan	Vice President and Treasurer	
Ralph L. Meyer	Vice President	
Robert E. Parsley	Controller	
R. Denis Richter	Vice President	
Ronald W. Watkins	Vice President	
Jack E. Thomas	Vice President	

The address of all the foregoing principal officers of SDG&E is:

101 Ash Street
San Diego, California 92101

Appendix C

New Fuel Storage Safety Evaluation

1. New Fuel Storage Racks

A multiplication factor of less than 0.98 is maintained in the new fuel storage racks under the following conditions:

A. The fuel rack is infinite in lateral extent. Vertical buckling properties are taken into account by representing the fuel at its nominal active length, and placing concrete slabs above and below the rack to provide reflection due to the floor and ceiling. 2

B. Water vapor within the rack can assume any density up to 1.0 gm/cm^3; thus the entire range of moderation is taken into account.

C. The rack is fully loaded with 3.7 w/o Combustion Engineering 16 x 16 fuel (the most reactive fuel available).

D. The temperature is 68°F.

E. No burnable poison rods or CEA's are present.

F. Structural support members are neglected for conservatism.

The computer codes employed in the criticality analysis of the new fuel storage racks are as follows:

A. The KENO-IV Code

KENO-IV is a three dimensional, multi-group Monte Carlo criticality code which solves the Boltzmann transport equation to determine k_{eff} values. KENO-IV contains its own 16-group Hansen Roach cross section library.

B. The HAMMER Code

HAMMER is a multi-group integral transport theory code which is used to calculate lattice cell cross sections and k_{inf} values. This code has been extensively benchmarked against D_2O and light water moderated lattices with good results. To check the accuracy of KENO, fuel pin k_{inf} values were determined using both KENO-IV and HAMMER and then compared to assure their agreement to within 1%. Thus HAMMER was used only to check accuracy.

Parametric variations affecting nuclear characteristics of the racks were studied. These variations result from events which may be categorized as normal and abnormal. Normal variations include variation of H_2O densities, fuel eccentrically positioned within a storage cell, fuel enrichment variation, storage cell pitch variation, and the cumulative effect of all of the above, the worst case normal configuration. Abnormal variations include effects of fuel handling incidents, large moderator density variations, dropped or compacted fuel, and cell displacement due to seismic events.

The abnormal variation resulting in the highest increase in the magnitude of k_{eff} is chosen to represent the worst case abnormal configuration. A margin of error resulting from calculational uncertainty is added to the numerical results.

Results

The k_{eff} values determined for the new fuel storage racks may be summarized as follows:

K_{eff} of the new fuel storage rack dry at 68°F at nominal dimensions	0.55	
K_{eff} of the new fuel storage rack including effects of normal variations and calculational uncertainty	0.72	2
Final k_{eff} of the new fuel storage rack including normal variations and calculational uncertainty in worst cast abnormal configuration	0.81	

II. Spent Fuel Storage Racks

A multiplication factor less than 0.98 is maintained in the spent fuel storage racks for new fuel assemblies stored dry under the following conditions:

A. Every other storage row and column in the spent fuel storage rack is left vacant (1/4 loading of the storage rack).

B. The fuel rack is infinite in lateral extent. Vertical buckling properties are taken into account by representing the fuel at its nominal active length, and placing concrete slabs above and below the rack to provide reflection due to the floor and ceiling.

C. Water vapor within the rack can assume any density up to 1.0 gm/cm^3; thus, the entire range of moderation is taken into account.

D. The rack is 1/4 loaded (see A. above) with 3.7 w/o Combustion Engineering 16 x 16 fuel (the most reactive fuel available).

E. The temperature is 68°F.

F. No burnable poison rods or CEA's are present.

G. Structural support members are neglected for conservatism.

The computer code employed in the criticality analysis of new fuel stored dry in the spent fuel storage racks is as follows:

The KENO-IV Code 2

KENO-IV is a three dimensional, multi-group Monte Carlo criticality code which solves the Boltzmann transport equation to determine k_{eff} values. KENO-IV contains its own 16-group Hansen Roach cross section library.

The most significant abnormal configuration parameter affecting fuel in dry storage is the moderator density variation which could occur if the storage area were flooded or, in the case of fire, filled with foam or steam.

The entire range of water densities from 1.0 x 10-6 gms/cm3 to 1.0 gms/cm3 was considered by performing multiple calculations at different water densities for each storage pattern under consideration.

Other normal design and fabrication variations, such as pitch, eccentricity of fuel, etc., are insignificantly small ($\Delta k < 0.001$) for fuel in dry storage and need not be considered.

Other abnormal occurrences such as fuel drop and improper positioning of fuel result in substantially smaller keff values than those obtained from the moderator density variations, and therefore, can be ignored.

Results

The pattern in which the rack is loaded to one-quarter capacity results in a maximum k_{eff} value of 0.87 at a water density of 1.0 gms/cm3. To this already conservative k_{eff} value, a k_{eff} = 0.01 margin of uncertainty can be added to arrive at a final value of 0.88 for the maximum k_{eff}. 2

1???3

Form NM-3A

NSTF Physical Inventory Record

Item Control Area Three Only

(Subcritical Reactor)

Date: ____________________

Inventoried by: ______________________

Piece count on Fuel Slugs = ______________________

Number of Pu-Be Sources in tank = ________________

Reported on__________________

By: _________________________