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December 3, 1988

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Subject: Docket No. 50-206
Transshipment of Spent Fuel
San Onofre Nuclear Generating Station
Unit 1

As a result of discussions with the NRC staff on December 3, 1988, SCE was requested to provide additional information to resolve the issues resulting from the error in our submittal of April 25, 1988 on the subject of Transshipment. The purpose of this letter is to provide this information.

As discussed in our submittal of April 28, 1988 (Amendment Application No. 148) the areas of greatest concern with respect to establishing a safe load path for Transshipment at San Onofre Unit 1 are the North Turbine Building Extension and the Decontamination Pad. Safety-related equipment required to maintain plant shutdown in Modes 5 and 6 is located under these areas. The program implemented to protect the shutdown equipment is described in Amendment Application No. 148 in Sections C, D, and E, starting on Pages 6, 7, and 9 respectively. Sections C and E specifically discussed the use of the impact limiter to prevent a cask drop from affecting shutdown equipment located under these areas. Based on this program, following a drop of the spent fuel cask in these areas or following a Design Basis Earthquake with the cask located on the decontamination pad, at least one train of shutdown equipment will remain available (in fact neither train will be affected).

Another feature which will be utilized to provide additional safety should a cask drop occur on the decontamination pad is a protective shield made of 11 gauge chain-link fence installed under the pad to protect shutdown equipment from potential concrete spalling. A description of this feature is also provided in Section C referenced above. We have confirmed that this safety feature has been installed and is an integral part of the procedures and precautions used for Transshipment.

Since an error was discovered in our submittal of April 25, 1988 which affected the NRC determinations regarding the acceptability of our plans for Transshipment, a detailed review of our previous submittals on the subject has been conducted. A listing of submittals reviewed, the results of this review and the corresponding corrections and clarifications are provided in the enclosure.

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The major conclusion of our review is that in addition to the inadvertent inclusion of an incorrect statement regarding the availability of redundant shutdown equipment, the April 25, 1988 submittal did not clearly identify a change in our approach for protecting shutdown equipment for a cask drop on the North Turbine Building Extension and the Decontamination Pad. Our previous submittals provided on December 24, 1987 and February 4, 1988 had indicated that following a cask drop which penetrates into the lower level of the Turbine Building, redundant safe shutdown equipment would be available for continued shutdown operation. This was based on the assumption that the affected cables would be sheared upon impact as a result of the cask drop. Subsequent to the February 4, 1988 letter it was determined that if a dropped cask penetrates into the lower level of the Turbine Building, the cables may not shear and the actual failure mechanism could not be predicted. For example it was postulated that the cables could pull on termination points including switchgear and potentially affect redundant equipment. This approach was therefore abandoned and contrary to the plans described in our February 4, 1988 letter, only the impact limiter was credited for protecting shutdown equipment because it precludes cask penetration of the Turbine Building. Therefore, as explained in our December 2, 1988 letter, the April 25, 1988 letter (which provided a revision to the Transshipment Report originally provided on December 24, 1987) inadvertently included an incorrect sentence indicating reliance on redundant shutdown equipment when in fact our plans were to use the impact limiter to prevent damage to the safe shutdown equipment.

In summary, the April 25, 1988 letter should have clearly indicated that we were no longer relying on the availability of one train of shutdown equipment when the other train may have been damaged by a cask drop which penetrated into the lower level of the turbine building. The letter should have clearly indicated that we are relying on the impact limiter and other safety features discussed in the letter to preclude cask penetration into the lower level and thereby prevent damage to shutdown equipment.

If you have any question of desire additional information regarding this subject, please contact me.

Very truly yours,

FR Nandy
for M O Medford.

Enclosure

cc: C. M. Trammell, NRR Project Manager, San Onofre Unit 1
J. B. Martin, Regional Administrator, NRC Region V
F. R. Huey, NRC Senior Resident Inspector, San Onofre Units 1, 2 and 3

Enclosure

The following submittals to the NRC regarding transshipment have been reviewed:

April 25, 1988

April 28, 1988

June 10, 1988

September 23, 1988

October 18, 1988

November 10, 1988

December 1, 1988

December 2, 1988

The following corrections and clarifications have been identified:

1. The Table of Contents and Pages 8, 17, 18, 20, 22, and 39 of the enclosure to the April 25, 1988 letter.

2. Page 3 of the enclosure, and Pages 3, 4, 5, and 6 in Attachment 1 of the same enclosure to the April 28, 1988 letter.

3. Pages 1, 5, 6, 10, and 11 of the enclosure to the June 10, 1988 letter.

4. The cover letter and Page 4 of the enclosure to the September 23, 1988 letter.

5. Pages 3, 4, and 5 of the enclosure to the October 18, 1988 letter.

THIS SECTION INCLUDES THE CORRECTIONS AND CLARIFICATIONS FOR THE TABLE OF CONTENTS AND PAGES 8, 17, 18, 20, 22, AND 39 OF THE ENCLOSURE TO THE APRIL 25, 1988 LETTER.

<u>TABLE OF CONTENTS</u>

it is in transit outside the protected area. The tractor trailer will reenter the protected area through the Units 2 and 3 gate (Figure 4).

8. The tractor trailer will then proceed to the Unit 2 or Unit 3 Fuel Handling Building truck bay (Figure 4).

9. The Unit 2 or 3 cask handling crane will lift and transport the cask to the decon area, where the cask will be prepared to be placed in the cask pool. The cask crane will then move the cask to the cask pool for unloading (Figure 5).

10. After unloading, the cask crane will return the empty cask to the decon area for decontamination and preparation for transport back to Unit 1 where the process is repeated.

The transshipment process will be controlled by one procedure, SO123-X-9, Transshipment of Spent Fuel Using the IF-300 Cask, that ties in the Maintenance activities of cask handling, the Health Physics responsibilities of decontamination and operational radiation surveys, the administrative and technical responsibilities for control of the fuel movement and the Quality Assurance and Quality Control responsibilities for overseeing the evolution. The activities will be supervised by a Maintenance Supervisor. The project will be coordinated by a Refueling Engineer. The lifts of the cask will be controlled by SO123-I-1.13, "Turbine Gantry Crane Checkout and Operation" and SO1-I-7.27, "Cranes, Rigging, and Lifting Controls".

gantry crane and down the turbine deck. This load path is chosen due to its direct nature, accessibility, and to follow, to the extent practical, structural members. Along the load path, equipment required for maintaining shutdown is located in the area of the decontamination pad. Between the crane West A-frame leg and the decontamination pad, cable trays containing circuits for equipment which may be used during shutdown are located below the turbine deck in the turbine building. The shutdown equipment which has circuits located in these cable trays include a residual heat removal pump, component cooling water pumps and a salt water cooling pump. Lifts of the cask in the decontamination pad area will be done using an impact limiter. The impact limiter will prevent the cask from penetrating the decontamination pad and affecting the cables ~~It has been determined that without this equipment safe shutdown can be maintained with redundant equipment~~. This is discussed in Section H, Decontamination Pad. Spent fuel assemblies are not located within the load path for the spent fuel cask. The illustration of this load path will be included in the spent fuel cask handling procedure. Since any floor markings of the load path would be obscured by the cask during the lifting process, it is not appropriate to have any deck or floor markings, but consistent with the SE, TER and SCE's procedures, as a minimum a second person will be assigned to walk down the lifts and be in contact with the crane operator.

Guideline No. 2

"Procedures should be developed to cover load handling operations for heavy loads that are or could be handled over or in proximity to irradiated fuel or safe shutdown equipment. At a minimum, procedures should cover handling of those loads listed in Table 3-1 of NUREG-0612.

Discussed and clarified in the December 2, 1988 letter to the NRC

These procedures should include: identification of required equipment; inspections and acceptance criteria required before movement of load; the steps and proper sequence to be followed in handling the load; defining the safe path; and other special precautions."

SCE Evaluation

As indicated in past SCE correspondence, there exists a heavy load handling program at San Onofre Unit 1 that addresses the general prerequisites, precautions, inspections and acceptance criteria required before movement of a heavy load. The procedure S0123-X-9, "Transshipment of Spent Fuel Using the IF-300 Cask", covers the handling of the spent fuel cask~~s~~ at San Onofre Unit 1 and this procedure will be developed to account for the new cask, the revised cask handling process, the safe load path, additional or different inspection requirements for the cask lift rig, and any other special precautions.

Guideline No. 3

"Crane operators should be trained, qualified and conduct themselves in accordance with Chapter 2-3 of ANSI B30.2-1976, 'Overhead and Gantry Cranes' [12]."

SCE Evaluation

The new spent fuel cask lifting device will meet the guidelines of ANSI N14.6-1978, "Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500kg) or More for Nuclear Materials." As previously stated in SCE's August 29, 1985 letter to the NRC, after the initial 150% proof load test, SCE may opt to perform NDE in lieu of periodic (every 5 years) load testing. The choice will be dependent upon SCE's availability of test options. It is noted that the initial proof load test of the lifting device will be a 150% proof load test.

OMISSION

Regarding the Guideline No. 4 discussion of the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 being based upon the combined maximum static and dynamic loads that could be imparted on the handling device based upon the characteristics of the crane which will be used, refer to the information discussed under the NRC review of Guideline No. 5 in the TER. The TER indicates that the dynamic load induced by the San Onofre Unit 1 turbine gantry crane is sufficiently small so as to remove it from consideration. This is based upon the already required 3 to 1 maximum yield strength to weight ratio and 5 to 1 ultimate strength to weight ratio required by Section 3.2.1.1 of ANSI N14.6-1978, and the consideration that the maximum expected dynamic load induced by the turbine gantry crane is only 3.7% of the static load. Therefore, only the weight (static load) of the load and intervening components of the spent fuel cask lift rig need be ~~considered.~~

Clarification of the lifting devices and commitments for 150% load testing are provided in the December 1, 1988 letter to the NRC refueling operations, and is generally not accessible during power operation. ANSI B30.2, however, calls for certain inspections to be performed daily or monthly. For such cranes having limited usage, the inspections, test, and maintenance should be performed prior to their use)."

SCE Evaluation

The crane inspection, testing and maintenance was reviewed as part of the TER and SE and an additional review for the purposes of determining the acceptability of the spent fuel cask handling methodology is not necessary. The new spent fuel cask is a lesser weight (70 tons) than the existing largest load (108 tons), so the existing proof load tests of the turbine gantry crane are acceptable. All other inspection, testing and maintenance issues associated with the turbine gantry crane remain applicable to the new spent fuel cask handling methodology. Handling of the cask and use of the turbine gantry crane at San Onofre Unit 1 and the cask handling crane at San Onofre Units 2 and 3 will be controlled by SO1-I-7.27, "Turbine Gantry Crane Checkout and Operation", ~~and a~~ SO123-I-1.13, "Cranes, Rigging, and Lifting Controls," and SO23-I-3.32, "Cask Handling Crane Checkout and Operation".

Included for completeness

L. CONCLUSION

The San Onofre Unit 1 spent fuel pool will be essentially full following the Cycle X refueling outage in late 1988. Unless the spent fuel is shipped to the adjacent San Onofre Units 2 and 3 spent fuel pools, operation of the unit will cease in 1990. It is proposed that transshipping of the spent fuel should begin as soon as possible.

In order to transship the spent fuel the turbine gantry crane at San Onofre Unit 1 will be used to lift and transport the spent fuel shipping cask. A procedure has been developed for the transshipment methodology, SO123-X, Transshipment of Spent Fuel. Procedures SO123-I-1.13, Turbine Gantry Crane Checkout and Operation, ~~and~~ SO1-I-7.27, Cranes, Rigging, and Lifting Controls, will be used to control the cask, lift rigs, lifts and inspections. With all the necessary procedural precautions taken, the movement and lift of the spent fuel cask will be conducted in a safe manner.

and SO23-I-3.32, Cask Handling Crane Checkout and Operation

The seismic design of the turbine building did not include the turbine gantry crane with a spent fuel cask located on the north turbine deck extension. In order to minimize the possibility of a seismic event concurrent with the crane on the turbine building, the use of the turbine gantry crane with a load in excess of the turbine building design is being limited to 1% (or 87 hours) per year. This limit provides assurance that the cask will be on the crane for a minimum amount of time while the crane is on the north turbine building extension. In addition all transshipments will only be performed during Unit 1 plant shutdowns (Modes 5 or 6).

Included for completeness

THIS SECTION INCLUDES THE CORRECTIONS AND CLARIFICATIONS FOR PAGE 3 OF THE ENCLOSURE AND PAGES 3, 4, 5, AND 6 IN ATTACHMENT 1 OF THE SAME ENCLOSURE TO THE APRIL 28, 1988 LETTER.

The Unit 1 spent fuel being shipped is bounded by the GE IF-300 Consolidated Safety Analysis Report (CSAR) NEDO-10084-3 (see Table 1). The CSAR contains the structural analysis, thermal analysis, criticality analysis, shielding analysis, fission product release, fuels and contents acceptability. The fuel shipments will be conducted entirely onsite and do not fall under 10 CFR 71. It is specifically stated in 10 CFR 71.0(c) that "The regulations in this part apply to any licensee authorized by specific license issued by the Commission to receive, possess, use or transfer licensed material if the licensee delivers that material to a carrier for transport or transports the material outside the confines of the licensee's facility, plant or other authorized place of use." As long as the shipments remain within the owner controlled area at San Onofre, they are within an authorized place of use. This does not alleviate licensees from transporting radioactive material in a safe manner. Therefore, an NRC licensed cask is being utilized for the transshipment. The shipments will be done in a safe manner in accordance with the cask's certificate of compliance with the following deviation~~s~~. ~~These~~ This deviation~~s~~ ~~are~~ is the only exception~~s~~ which may be taken to the cask certification and ~~have~~ has been concurred in by the cask vendor.

Lifting Trunnions and Valve Covers

The lifting trunnions must be removed and the valve box covers must be in place for the cask to be certified to withstand potential impact accidents that could occur during over-the-road shipment at highway speeds. These accidents will not occur because the loaded cask will be traveling only on site at five miles per hour. This procedure is consistent with onsite cask handling operations at other nuclear plants. The IF-300 cask will be lifted using supplied trunnions and then secured in its companion skid atop a wheeled trailer. No single failure of the companion skid/trailer will cause the cask to fall from the trailer.

This deviation is considered acceptable since the shipments will be conducted entirely on site. Cask drops are addressed in the areas where lifts of the cask are discussed. Transport accidents with the cask are precluded by shipping entirely onsite and by the fact that the tractor trailer will not travel at speeds greater than 5 mph onsite. The transport path is such that the cask will be outside the protected area in the owner controlled area for a very short distance (approximately 200 yards). It is anticipated that the travel time from the Unit 1 Turbine Building area to the Unit 2 or Unit 3 Fuel Handling Building will be less than 1/2 hour. The transport speed of the cask will be less than five miles per hour, and other traffic in the area will be less than ten miles per hour. Station security will accompany the cask during

Clarified in the response to item 1 of the June 10, 1988 letter to the NRC. Only one deviation is being taken.

gantry crane and down the turbine deck. This load path is chosen due to its direct nature, accessibility, and to follow, to the extent practical, structural members. Along the load path, cables required for maintaining shutdown are located below the decontamination pad. Lifts of the cask in decontamination pad area will be done using an impact limiter. The impact limiter will prevent the cask from penetrating the decontamination pad and affecting the cables. Spent fuel assemblies are not located within the load path for the spent fuel cask. The illustration of this load path will be included in the spent fuel cask handling procedure. Since any floor markings of the load path would be obscured by the cask during the lifting process, it is not appropriate to have any deck or floor markings, but consistent with the SE, TER and SCE's procedures. as a minimum a second person will be assigned to walk down the lifts and be in contact with the crane operator.

Guideline No. 2

"Procedures should be developed to cover load handling operations for heavy loads that are or could be handled over or in proximity to irradiated fuel or safe shutdown equipment. At a minimum, procedures should cover handling of those loads listed in Table 3-1 of NUREG-0612. These procedures should include: identification of required equipment; inspections and acceptance criteria required before movement of load; the steps and proper sequence to be followed in handling the load; defining the safe path; and other special precautions."

OMISSION

SCE Evaluation

As indicated in past SCE correspondence, there exists a Heavy Load Congrol Program at San Onofre Unit 1 that addresses the general prerequisites, precautions, inspections and acceptance criteria required before movement of a heavy load. The procedure SO123-X-9.0, "Transshipment of Spent Fuel Using the IF-300 Cask", covers the handling of the spent fuel casks at San Onofre Unit 1 and this procedure will account for the 70 ton cask, the revised cask handling process, the safe load path, and additional or different inspection requirements for the cask lift rig.

Guideline No. 3

"Crane operators should be trained, qualified and conduct themselves in accordance with Chapter 2-3 of ANSI B30.2-1976, 'Overhead and Gantry Cranes' [12]."

SCE Evaluation

The crane operator training was reviewed as part of the TER and SE, therefore an additional review for the purposes of determining the acceptability of the spent fuel cask handling methodology is not necessary. The crane operators will be trained on any special requirements of the new spent fuel cask handling methodology.

Guideline No. 4

"Special lifting devices should satisfy the guidelines of ANSI N14.6-1978, 'Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500kg) or More for Nuclear Materials' [13]. This standard should apply to all special lifting devices which carry heavy loads in areas as defined above. For operating plants certain inspections and load tests may be accepted in lieu of certain material requirements in the standard. In addition, the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 should be based on the combined maximum static and dynamic loads that could be imparted on the handling device based on characteristics of the crane which will be used. This is in lieu of the guideline in Section 3.2.1.1 of ANSI N14.6 which bases the stress design factor on only the weight (static load) of the load and of the intervening components of the ~~special handling device~~."

Clarification of the lifting devices and commitment for 150% load testing are provided in the December 1, 1988 letter to the NRC

SCE Evaluation

The new spent fuel cask ~~lifting~~ devices will meet the guidelines of ANSI N14.6-1978, "Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500kg) or More for Nuclear Materials." As previously stated in SCE's August 29, 1985 letter to the NRC, after the initial 150% proof load test, SCE may opt to perform NDE in lieu of periodic (every 5 years) load testing. The choice will be dependent upon SCE's availability of test options. It is noted that the initial proof load test of the lifting device will be a 150% proof load test.

Regarding the Guideline No. 4 discussion of the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 being based upon the combined maximum static and dynamic loads that could be imparted on the handling device based upon the characteristics of the crane which will be used, refer to the information discussed under the NRC review of Guideline No. 5 in the TER. The TER indicates that the dynamic load induced by the San Onofre Unit 1 turbine gantry crane is sufficiently small so as to remove it from consideration. This is based upon the already required 3 to 1 maximum yield strength to weight ratio and 5 to 1 ultimate strength to weight ratio required by Section 3.2.1.1 of ANSI N14.6-1978, and the consideration that the maximum expected dynamic load induced by the turbine gantry crane is only 3.7% of the static load. Therefore, only the weight (static load) of the load and intervening components of the spent fuel cask lift rig need be considered.

OMISSION

Guideline No. 5

"Lifting devices that are not specifically designed should be installed and used in accordance with the guidelines of ANSI B30.9-1971, 'Slings' [14]. However, in selecting the proper sling, the load used should be the sum of the static and maximum dynamic load. The rating identified on the sling should be in terms of the 'static load' which produces the maximum static and dynamic load. Where this restricts slings to use on only certain cranes, the slings should be clearly marked as to the cranes with which they may be used."

THIS SECTION INCLUDES THE CLARIFICATIONS FOR PAGES 1, 5, 6, 10, AND 11 OF THE ENCLOSURE TO THE JUNE 10, 1988 LETTER.

1. Identify which cask will be used for the transshipment.

RESPONSE

A GE IF-300 cask will be used for spent fuel movement. The weight of the cask is 136 kips which includes 7 spent fuel assemblies and water in the event wet shipments are required. The total lifted weight is 141 kips for the cask and rigging.

The cask has a Certificate of Compliance for Radioactive Material (Number 9001) which expires May 30, 1990. It is bounded by the Consolidated Safety Analysis Report NEDO-10084-3. Originally, SCE was planning to use the cask with four deviations from the certificate of compliance. Currently, SCE will be using the cask with one deviation which has been discussed in the April 25, 1988 submittal. That is, the cask will be transported between sites with the lifting trunnions installed and the valve cover boxes removed. The remaining deviations have been removed since SCE does not plan to ship fuel wet, will not ship fuel with a burnup greater than 35,000 MWD/MTU and will utilize a certified inspector to perform the helium leak test on the cask.

2. In the event wet shipments are done, is the weight of the water included in the cask?

RESPONSE

The weight of water is included in the cask weight for analysis and is estimated to be 4,000 pounds.

3. If procedures, standards or NUREGs are referenced for some specific action or content, provide a copy of the procedure or section referenced and reference the specific section of the standard or NUREG.

RESPONSE

Procedures are referenced to indicate that the actions necessary to transship fuel are controlled. The contents of the procedures are generally not relevant to the discussion. In the event the contents are important, a copy of the procedure or the section referenced will be provided. In the case of industry standards and NUREGs, more specific references will be provided when they are discussed.

4. With regard to the NUREG-0612 Guidelines evaluation, can more specific detail be provided since a cask has been selected?

RESPONSE

The NUREG-0612 evaluation remains valid for the selected cask. The turbine gantry crane is designed and tested to 150% of the cask weight and, as previously stated, so will the cask lifting device. The other NUREG-0612 issues relate to design issues, inspection, training and other items not related specifically to the cask weight.

Commitment regarding testing of the lifting devices is provided in the December 1, 1988 letter to the NRC.

Clarified in the response to Question [illegible] in the September 23, 1988 letter to the NRC that the membrane goes to plant elevation 12 feet, which in some cases is below grade

7. Provide a detailed discussion of the drop of the cask in the spent fuel pool. It should include the consequences of the drop, effect on the structural integrity of the pool and the stainless steel plate. Sufficient information should be provided for the NRC to reach a similar conclusion.

RESPONSE

The cask is postulated to drop from plant elevation 42 feet 6 inches (corresponds to 6 inches above the elevation of the decontamination pad) and impact the floor at plant elevation 2 feet 2 1/4 inches. The cask will fall 2 feet 3 inches through the air before hitting water at plant elevation 40 feet 3 inches (corresponds to the lowest water level per Technical Specifications).

A 2-1/4 inch stainless steel protector plate is installed over the existing 11 gauge stainless steel liner plate to protect the liner from perforation. Locally, the required thickness of the concrete basemat to prevent perforation is 11.8 inches. The basemat is 4 feet 9 inches thick.

Verification of the basemat integrity was performed by determining that the maximum deflection of the basemat will be 0.44 inches during the impact. The deflection was conservatively calculated using a model where slab and soil were treated independently. Although the basemat may yield locally, no leaks will occur through the basemat even if a crack is developed because of the "Nob-Lock" waterproof membrane between the concrete and soil. See Figure 2. This membrane envelopes the bottom of the basemat and extends to grade elevation.

In the event of a tilted drop due to a trunnion failure, the cask could potentially impact the east and west walls. The maximum angle of cask tilt in the west direction is 11 degrees. As such, the drop will be essentially vertical. The walls will not suffer any structural damage.

If the cask tips while in the pool, the impact on the walls will be negligible because of the pool geometry and the distance between the cask and the walls. The maximum distance between the pool wall and cask is 4 feet 5 inches. The cask will not be able to impact the north wall which is located at the narrow end of the trapezoidal cask laydown area of the pool. See Figure 3.

8. With regards to the ANSI N14.6 load test required to be performed every 5 years on the lifting device, will a 150 ton load test be performed? In addition, are we complying with the standard as part of an NRC requirement or an industry requirement?

RESPONSE

Per the requirements of ANSI N14.6-1978, periodic testing of the cask lifting device will be performed to verify continuing compliance. It is expected that a 150% load test will be performed, but may be substituted

Commitments regarding the testing of the lifting devices is provided in the December 1, 1988 letter to the NRC with the NDE, dimensional test and visual inspection Section 5.3.1 of ANSI N14.6 1978. It is noted that the heavy loads evaluation in the April 25, 1988 submittal indicated a 5-year 150% load test would be performed. It has been determined that it is necessary to perform the load test annually since this lifting device for the cask is used frequently.

9. The following information should be provided on the turbine gantry crane:

   a. Analysis of the crane support frame for 70 tons.
   b. Dynamic load factors considered in carrying the cask.
   c. Effect of the tiedown cables on the cask and the crane.
   d. Any differences noted between the cranes for all three units.
   e. Details of the cable supports, cask platform and shear ring.
   f. Description of the counterweight.
   g. Additional details on the cranes safety factors such as the ultimate crane rope capacity and the overturning moment.

   RESPONSE

   Turbine Gantry Crane Data.

   a. The turbine gantry crane frame was analyzed for a 100 ton load on the horizontal beam of the west A-frame. It was determined that no reinforcement of the frame was required. The maximum combined axial and bending stress ratio is 0.57 which is less than the allowable ratio of 1.0.

   b. Seismic Category B loads were considered when the crane carries the cask (vertical acceleration-0.13g and horizontal acceleration-0.2g).

      In addition, vertical impact allowance, lateral load due to acceleration and deceleration, and wind loads were considered per CMAA Specification #70 "Specifications for Electric Overhead Traveling Cranes."

   c. The cask tiedown cables will be attached to the cask through two existing holes which are located approximately 13 feet 8 inches from the bottom of the cask (Figure 5). These holes are used for holddown pins when the cask is transported on the shipping cradle.

      The load at each tiedown is 20 kips. The turbine gantry crane was analyzed for the cask load on the horizontal beam of the west A-frame in combination with the 20 kips tiedown load on the legs of the crane. The maximum combined bending and axial stress ratio for the structural elements of the crane is 0.57 which is less than the allowable ratio of 1.0.

      If one of the cask tiedown cables breaks, the cask will not fall from the crane cask platform because the cask rests on the platform and is still attached to the crane main hook.

RESPONSE

The spent fuel pool is provided with a leak chase system that has a monitoring well. The well is supplied with a threaded cap. The make up capacity for the spent fuel pool consists of the Boric Acid Storage Tank (7,000 gal. and two pumps at 45 gpm each), the Primary Makeup Water Tank (150,000 gallons and two pumps at 100 gpm each), and the Refueling Water Storage Tank (240,000 gallons and one pump at 80 gpm).

a,b. Leakage through the stainless steel spent fuel pool liner was insignificant prior to 1986. In 1986 water was discovered to be leaking through some vertical shrinkage cracks and a horizontal construction joint of the pool walls. Samples of the leaks and pool water were taken for chemical analysis and compared. The chemical analysis results were that the boron to iron ratio was comparable to the existing ratio in the spent fuel pool water. Thus, it was concluded that there was no significant rebar corrosion and the leaking liner does not compromise the structural integrity of the spent fuel pool. The leaks through the walls were caused by lack of drainage of the monitoring wells.

Drainage of the monitoring wells is performed by operations weekly and logged to prevent recurrence of water leakage through the walls. The average daily discharge from the well is less than 10 gallons per day.

c. The postulated cask drops in the spent fuel pool will not amplify the leakage and will not cause water leakage into the environment. Leakage will not occur because a waterproof membrane envelopes the basemat and extends up to grade elevation. In addition, the liner protector plate has been installed in the cask laydown area of the pool to prevent perforation of the liner and thus additional leakage through the liner.

18. Provide sufficient detail that demonstrates a drop of the cask in the areas of the decon pad and the south end of the turbine building will not affect safe shutdown systems.

RESPONSE

Cask drops in the area of the decon pad are discussed in the response to Item 6. Cask drops at the area of the south end of the turbine building will not impact any safe shutdown systems since no such systems or their components are located in the vicinity of the cask lifts.

19. The leak that currently exists in the spent fuel pool liner should be included in the evaluation of the cask drop in the cask handling area (i.e., is the leak amplified).

RESPONSE

See response to Item 17c.

Clarified in the response to Question 1 in the September 23, 1988 letter to the NRC that the membrane goes to plant elevation 12 feet which in some cases is below grade

20. What is the resultant affect in the event that while the cask is transported on the turbine gantry crane, one of the restraining cables breaks? How are the platform, the shear ring and the remaining cable affected? In the event the cask will fall, what safe shutdown systems will be impacted?

RESPONSE

See response to Item 9.

21. Indicate that the procedure and operator training has been completed.

RESPONSE

The procedure, SO123-X-9.0, "Transshipment of Spent Fuel Using the IF-300 Cask" has been completed. The operator training will be completed with the dry run of the transshipment process at Unit 1 with the cask. This dry run will be performed once the NRC has approved the transshipment process. In addition, some of the previous classroom and hands-on training with the cask may be redone with the operators.

22. There is no NRC guidance that will allow the use of NDE in lieu of the 5 year load test. The actual load test must be performed every 5 years. However, if SCE is proposing that an NDE will be performed instead of the load test, the NRC will review that for acceptability.

RESPONSE

Section 5.3.1(2) of ANSI N14.6-1978, the standard referenced in Section 5.1.1 of NUREG-0612, states that NDE, dimensional testing and visual inspection in accordance with Section 5.5 may be substituted for periodic (annual) load testing. This is the same as that required in Section 6.3.1 of ANSI N14.6-1986. At the current time, it is not known if these types of inspections will be performed in lieu of the periodic 150% load test, but, if performed, it will be performed in accordance with Section 5.5 of ANSI N14.6-1978.

23. In the case where the cask is located on the decon pad during a seismic event, will the cask fall through the floor and damage cable? If so, what assurances are there that the unaffected train of safe shutdown equipment will be operable.

RESPONSE

As stated in response to Item 5, the decon pad will support the cask during a .67g seismic event.

Commitment regarding the testing of the lifting devices is provided in the December 1, 1988 letter to the NRC

THIS SECTION INCLUDES THE CLARIFICATIONS FOR THE COVER LETTER AND PAGE 4 OF THE ENCLOSURE TO THE SEPTEMBER 23, 1988 LETTER.

September 23, 1988

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Subject: Docket No. 50-206
Spent Fuel Transshipment
San Onofre Nuclear Generating Station
Unit 1

In order to alleviate the accumulation of spent fuel in the spent fuel pool at San Onofre Unit 1, SCE has proposed a method for shipment of the spent fuel to San Onofre Units 2 and 3. On August 12, 1988, representatives from SCE met with members of the NRC staff to discuss the NRC reviewer's questions regarding the transshipment of spent fuel. These questions were provided to SCE by letter dated August 11, 1988. During the meeting, verbal responses were provided to the NRC questions. Detailed responses to the questions are provided in Enclosure 1. In addition, during the meeting, five open items remained which required additional information that is provided herein. Those items are resolved as follows.

1. The NRC reviewer requested that the loads on the walls and the basemat should be provided for the postulated drops of the spent fuel cask. This information is provided as Enclosure 2.

2. It was requested that secondary missiles resulting from the spent fuel cask falling into walls should be addressed. This should include the possible damage to equipment and spent fuel. With regards to the affect on spent fuel, criticality should be addressed. The response to this concern is provided in the response to Question 5 in Enclosure 1.

3. The NRC requested SCE's plans for repair of the spent fuel pool liner. SCE's plans for repair of the spent fuel pool liner leakage are provided in the response to Question 9 in Enclosure 1.

4. The NRC reviewers also requested that SCE provide the plans for the 5 year load testing of the spent fuel cask lift rig. The spent fuel cask and its appurtenances are the property of Pacific Nuclear Systems and are under lease to SCE for the transshipment of spent fuel during the Cycle X refueling outage. Certification of the cask and its appurtenances

Commitments regarding the testing and a clarification of the three lifting devices is provided in the December 1, 1988 letter to the NRC including the lift rig is provided to SCE for verification of use of the equipment to ship spent fuel. As part of this verification, it is determined that the lift rig is certified to ANSI N14.6. Correspondence on the load test and inspection of the lift rig is provided as Enclosure 3.

5. The NRC reviewer requested that SCE provide the status of the procedure and training of individuals that will be used to perform the fuel shipment. The procedure under which the fuel movement will be done, SO123-X-9, Transshipment of Spent Fuel Using the IF-300 Cask, is completed, approved and in place for use. SCE personnel involved in the transshipment have received classroom training, and performed the evolutions under the instruction of the cask vendor representative during a dry run at Units 2 and 3. Key aspects, such as head removal and installation, were repeated for maximum training of personnel. Due to the length of time that has elapsed since this training, the classroom training and the dry run will be repeated prior to the start of the transshipment program.

At the conclusion of the meeting, it was indicated that the NRC staff would proceed with the review and development of the safety evaluation. If there are any additional concerns regarding this issue or this information, please let me know.

Very truly yours,

for M. O. Medford
Manager of Nuclear Engineering
and Licensing

cc: J. B. Martin, Regional Administrator, NRC Region V
F. R. Huey, NRC Senior Resident Inspector, San Onofre Units 1, 2 and 3

The cask impact forces on the decontamination pad, north turbine deck extension and the spent fuel pool cask handling area are provided in Enclosure 2.

Question 5

Figure 4 shows a 3-D view of the impact limiter. However, it doesn't convey dimensional values of the limiter. Additional information is needed to fully describe the impact limiter and the various cask impact scenarios identified in your previous responses. Also, in the second paragraph of item 2 for the response to Question 6, you state conclusions with respect to portions of a postulated damaged wall falling in the new fuel areas. However, you do not provide analytical results supporting your conclusion that the new fuel racks will not be affected.

Response

The dimensions of the impact limiter are shown in Figure 1.

The new fuel racks will not be impacted in the event of the postulated drops or tipping due to the physical location of the new fuel racks and the masonry wall. The racks are approximately 20 feet away from the wall. In the worst case, the cask would strike the wall at a height of about 10 feet, the wall would be locally damaged and potential secondary missiles (i.e., concrete blocks) would be created. Since the blocks could travel approximately 10 feet and the separation between the racks and wall is 20 feet, the new fuel will not be affected.

The other critical direction of cask tipping is toward the spent fuel pool. The closest point to the spent fuel racks that the cask could strike the northern reinforced masonry wall of the decontamination pad is at a height of about 10' above the floor elevation. The corner of the spent fuel rack is horizontally 10' away from this point and 27' below the operating floor level (Elev. 42'). Therefore, the spent fuel is far enough away to not be adversely affected by potential wall fragments.

Question 6

Your responses to Question 7 and 10 address the postulated cask drop in the spent fuel pool. More information with regard to the details of this analysis are required to allow the staff to reach the same conclusions. This information should include: material properties, modeling, computational models, analysis procedures and results for the evaluation of the pool walls, slab, and liners. Also, you should address the drop orientations considered and the controlling drop orientation.

Response

The north, south and east walls of the cask laydown area of the pool are 4 feet thick. The west wall that separates the cask laydown area from the upender is 2'-6" thick. The base mat is 4'-9" thick. The stainless steel liner thickness is 11 ga below Elevation 4'-0" and 16 ga above Elevation 4'-0". The 2 1/4" thick liner protector plate is placed on top of the basemat liner. The concrete strength is 4500 psi and reinforcement details are shown in the drawings provided in response to Question 1. Also see the response to Question 4.

Question 7

In your response to Question 12, you describe the requirements for the turbine deck load bearing test. The loads address the previous mode of fuel movement (air pallet). State why the new load should not be the 105 tons resulting from the new load (70-tons) increased by the dynamic factor.

Response

The turbine deck load bearing test was performed to verify the continued adequacy of the turbine post-tensioned concrete deck and the supporting members for spent fuel movement utilizing the air pallet system. The air pallet system loads the concrete deck and the supporting beams. When using the gantry crane for the spent fuel movement, no loads are transmitted to the concrete deck and the deck supporting beams. The loads are transmitted from the crane directly to the crane rail girders and then to the columns. The girders and the columns stresses were verified to be within allowable limits as shown in Table 3 of the June 10, 1988 submittal. Therefore, no new load test is being introduced or required for the proposed transshipment method.

Question 8

In your response to Questions 9 and 10, you address several staff concerns. We request the following clarifications:

- State the criteria that established the value of the 100 ton load used on the analysis of the gantry crane.

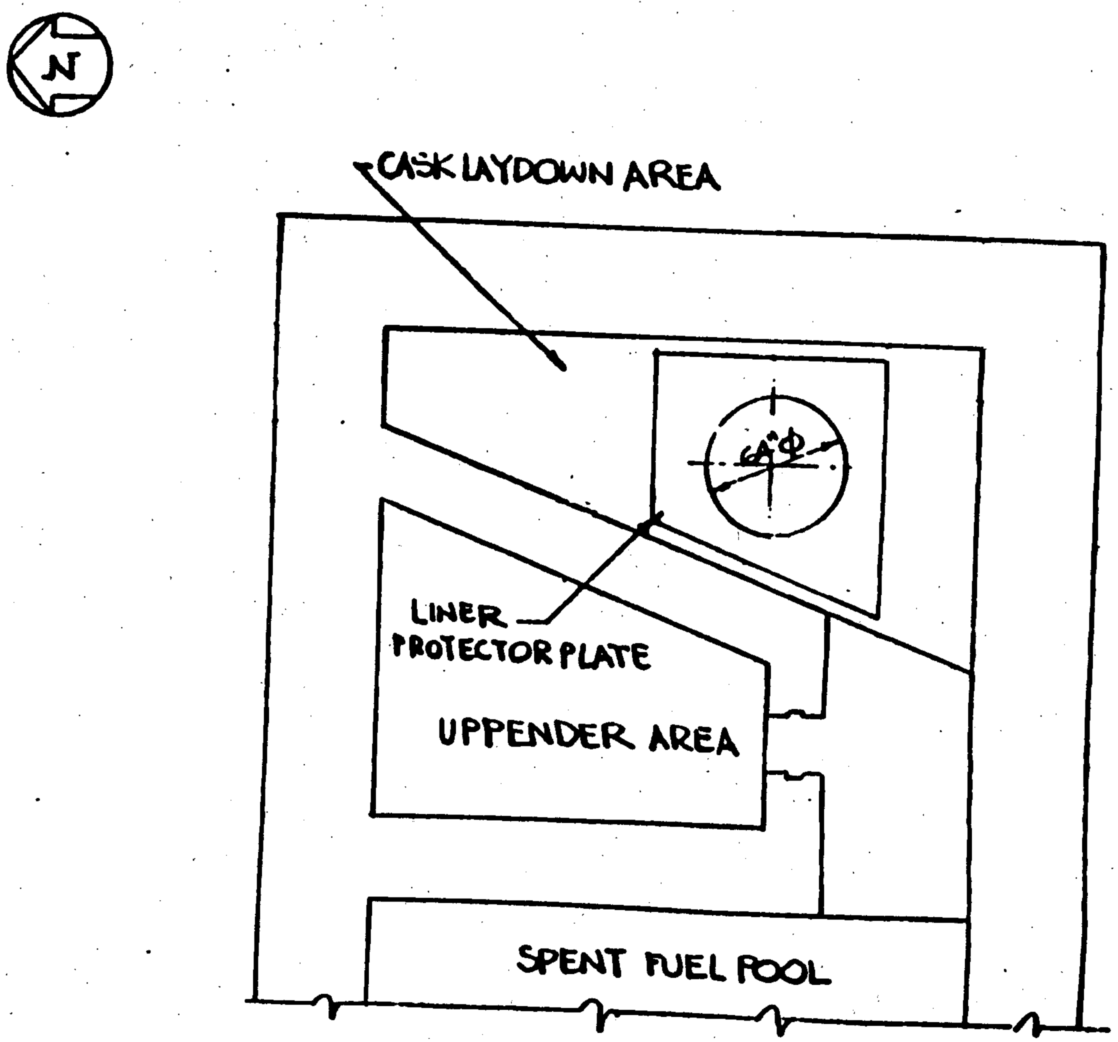
- The seismic accelerations considered for Seismic Category B loads (0.13g and 0.2g) are considerably different then the 0.67g identified in your response to Question 5. Address these differences.

- The 20 kips load on the crane identified in Item (c) fails to state if its direction was considered. Also, the rope capacity in item (e) is identified as 9 tons while the load on the crane is established as 20 kips. Discuss these staff concerns.

This response should have indicated that detailed information was being prepared and would be available at a later date. The information was submitted to the NRC by letter dated October 18, 1988

THIS SECTION INCLUDES THE CORRECTIONS FOR PAGES 3, 4, AND 5 OF THE ENCLOSURE TO THE OCTOBER 18, 1988 LETTER.

CASK IN SPENT FUEL POOL. UNIT 1



PARTIAL PLAN
Figure 1

-3-

OMISSION

Concrete Basemat

The reinforced concrete basemat is 4'-9" thick and has an average span of 9'-8" at the point of cask laydown (see Figure 2). The ability of the basemat to withstand the cask impact force was evaluated by considering the basemat as a beam spanning between the pool walls and also as a footing.

In conservatively assuming one-way beam action and no soil resistance under the basemat, the maximum moments are 9667 k-ft at the center and -16,971 k-ft at the support ends. Since the cracking moment capacity of 4358 k-ft is exceeded, cracking can be presumed to occur in areas of exceedence as shown in Figure 2.

Due to the aspect ratio of shear span to concrete depth, the basemat will behave as a deep beam after some flexural yielding has occurred. Thus, the cask impact force must be resisted in shear by the basemat. When considering the basemat as a footing, the calculated impact shear stress is .267 ksi which is less than the allowable shear stress of .295 ksi for impactive loads. The allowable shear stress was determined by $4\sqrt{f'c}$ times 1.10 which is the Dynamic Increase Factor for shear.

Concrete crushing under the cask will not happen because the computed bearing stress is 5092 psi which is less than the allowable impactive compressive stress of 5625 psi (f'c x 1.25). After the impact, the moments for the dead load of the cask are 83 k-ft at the center and -146 k-ft at the support ends. The corresponding moment capacities when only considering the rebars for tension are 1710 k-ft and -2311 k-ft.

The impact soil bearing pressure is 65 ksf which is less than the allowable of 100 ksf. A basemat deflection of .44 inch due to soil settlement at impact will cause the rebars in tension to yield. The strain is conservatively calculated assuming the yielding only occurs over a 12 inch length. The strain is .036 in/in which is less than the ultimate strain of .200 in/in for Grade 40 rebar.

Therefore, some flexural cracking may result from the cask impact force, but the basemat has the shear capacity and the soil has the bearing capacity to withstand the cask drop without adversely affecting the structural integrity of the Fuel Storage Building.

The cracking in the concrete will not allow water leakage into the soil because there is a waterproof membrane encompassing the entire basemat up to Elevation 12 feet. In addition, any water leakage will follow the path of least resistance which is the leak chase system.

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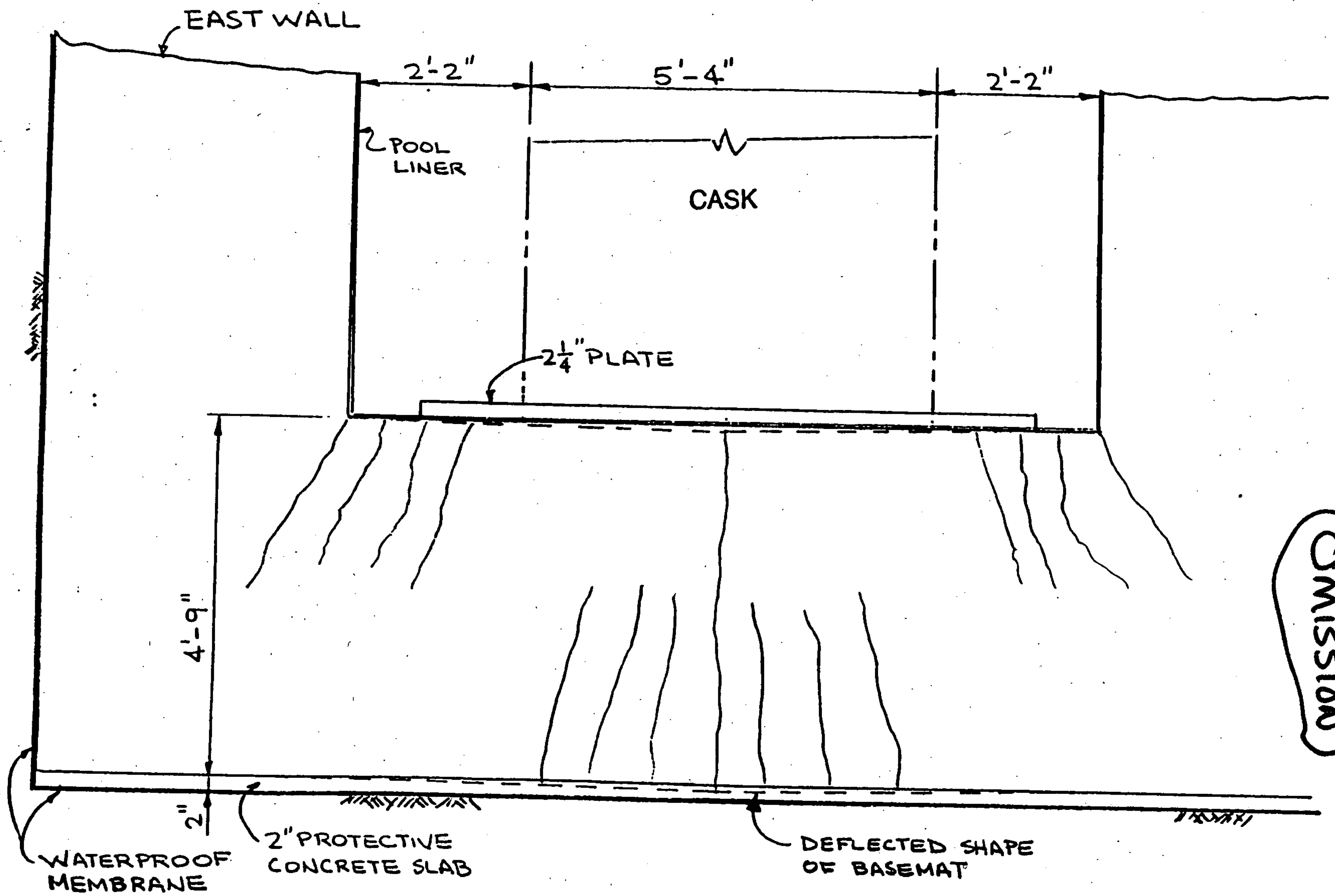
CASK LAYDOWN AREA OF SPENT FUEL POOL



SECTION
LOOKING SOUTH

Figure 2

-5-

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30 of 30