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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO PRIMARY PROPERTY DAMAGE INSURANCE EXEMPTION

DAIRYLAND POWER COOPERATIVE

LA CROSSE BOILING WATER REACTOR

DOCKET NO. 50-409

1.0 INTRODUCTION

By letter dated June 29, 1982, Dairyland Power Cooperative (DPC, the licensee), operator of the La Crosse Boiling Water Reactor (LACBWR), requested an exemption from the provisions of 10 CFR 50.54(w) in excess of 65 million dollars. 10 CFR 50.54 requires the licensee to be insured for (i) property damage and (ii) excess property damage (at that time amounting to $500 million in primary coverage and $68 million in excess property damage coverage). The staff reviewed the exemption request and by letter dated September 12, 1983, granted the licensee an exemption from the requirement to carry excess property damage coverage under 10 CFR 50.54(2)(1)(ii).

By letter dated July 26, 1985, the licensee requested an exemption from the on-site primary property damage insurance requirements of Section 50.54(w)(1)(i) of 10 CFR Part 50. The licensee requested the amount of coverage be changed from the full amount ($500 million) to 180 million dollars. In support of this request for exemption, by letters dated February 7, July 12, November 21, December 16, 1985 and February 19, 1986, DPC submitted estimates of the potential property damage to LACBWR and the recovery costs following (1) a design basis loss-of-coolant accident (LOCA) assuming 100 percent cladding failure without fuel melting, and (2) a second scenario that adds a 50 percent fuel melt criterion. Accident recovery cost estimates are contained in a report titled "Post Accident Recovery Cost Study of the La Crosse Boiling Water Reactor," Document No. 81A1087, Rev. 3 and Rev. 4, prepared by Nuclear Energy Services (NES) of Danbury, Connecticut. The base document (81A1087, Rev. 3) gives an estimate of $152,042,200 in 1984 dollars for accident recovery at LACBWR following a LOCA that results in 100 percent fuel cladding failure without fuel melting. An addendum (81A1087, Rev. 4) gives an estimate of $179,325,150 in 1984 dollars for a second accident scenario that adds a 50 percent fuel melt criterion. The staff received technical assistance from Pacific North-west Laboratory (PNL) in evaluating the licensee's request for exemption.

2.0 DISCUSSION

The LACBWR accident recovery cost study prepared for DPC by NES includes the following elements:

1. DESCRIPTION OF ACCIDENT AND CONSEQUENCES

The base-case LOCA scenario involves a below-core pipe break that is postulated to result in 100 percent fuel cladding failure, but no fuel melting. Plant emergency procedures are implemented which result in rapid flooding of the containment building to a level slightly above core midplane. The radioactive contamination released as a consequence of the accident is presumed to be confined to the containment building.

2. ACCIDENT RECOVERY

The accident recovery scenario is divided into three phases that are described in general terms.

Phase I, postulated to have a duration of 16 months, is the recovery planning phase. Activities postulated for this period include:

- post-accident monitoring and maintenance,
- selection of an engineering support contractor,
- development of a conceptual recovery plan,
- preparation of accident recovery and licensing documentation,
- equipment design and procurement,
- detailed procedure development, and
- design and construction of temporary support facilities.

Phase II, postulated to have a duration of 48 months, is the period during which the actual work of accident cleanup is performed. For a below-core break, access to the containment building would not be possible through existing airlocks since these penetrations would be under water. A new penetration to the containment would need to be constructed at the 701-foot level. Cleanup activities are postulated to begin at the 701-foot level and progress downward to include removal of the damaged fuel and core debris, draining and decontamination of the containment below the 701-foot level, and decontamination of the main airlock at grade level (the 639-foot level).

Phase III, postulated to have a duration of 17 months, is the damaged fuel and core rubble disposal period. During this time, the damaged fuel and core rubble will be loaded into spent fuel casks and shipped off-site. Fuel removal and shipment requires cask access through the main airlock which is decontaminated at the end of Phase II.

3. UNIQUE ACCIDENT RECOVERY ACTIVITIES TO LACBWR

The following accident recovery activities are described in detail:

- construction of containment access airlock at 701-foot level,
- installation of a post-accident containment ventilation system,
- concrete decontamination,

- disassembly and segmentation of reactor internals,
- recirculation nozzle plug installation,
- recirculation pump cubicle decontamination, and
- removal and disposal of damaged fuel and core rubble.

4. COST ESTIMATE FOR RECOVERY

The cost-estimate section of the LACBWR accident recovery study contains the following information:

- general discussion of cost-estimating methodology,
- examples of the application of the cost-estimating methodology,
- list of bases and assumptions used to estimate costs, and
- cost summary tables.

Cost summary tables give total costs for specified recovery tasks. Costs of staff labor, including utility administrative and support staff, operations staff engaged in the actual accident recovery operations, and engineering support staff, are shown as undistributed costs. The cost of packaging, shipment, and disposal of the radioactive waste generated during accident recovery is reported as a single lump-sum amount. Disposal costs for damaged fuel and core rubble are reported in terms of container costs, cask rental charges, transportation costs, and disposal costs.

5. ESTIMATED RECOVERY SCHEDULE

LACBWR post-accident recovery operations are described in terms of 36 tasks ("building blocks") beginning with "post-accident monitoring and maintenance" and concluding with "remove and ship damaged fuel, spent fuel, and core rubble".

6. IMPACT OF LOCA ON LACBWR DECOMMISSIONING

In addition to estimating the cost of accident cleanup, an estimate has been made of the added cost of reactor dismantlement resulting from the postulated LOCA. Factors included in the estimate of the added cost of decommissioning include:

- additional removal costs for contaminated concrete, contaminated structural members, and contaminated systems and equipment;

- costs of dismantlement of temporary structures and facilities used during accident recovery operations;

- the cost impact of the decommissioning schedule increase; and

- increased shipping and waste burial costs.

This increased cost of LACBWR decommissioning is included as part of the total estimated post-accident recovery cost of $152,000,000 for the base-case accident.

7. COMPARISON WITH PRIOR STUDIES

A comparison of the LACBWR cost estimate with PWR cost estimate in NUREG/CR-2601, "Technology, Safety and Cost of Decommissioning Reference Light-Water-Reactors Following Postulated Accidents" was presented. LACBWR study data are made with PWR data reported in NUREG/CR-2601. The stated rationale for comparison of the La Crosse BWR data with NUREG PWR data is that the information detail provided in the NUREG document is much more complete for the PWR than for the BWR. Items for which comparisons are provided include:

- project schedules
- manpower requirements
- accident cleanup costs

It should be noted that LACBWR accident recovery costs are reported in early-1984 dollars whereas NUREG/CR-2601 costs are in early-1981 dollars.

8. ACCIDENT RECOVERY - 50% FUEL MELT

An addendum to the LACBWR "base study" provides an estimate of the increased cost of accident recovery if the accident scenario is modified to include a 50 percent fuel melt criterion as well as 100 percent fuel cladding failure. The added cost of accident cleanup is estimated to be about $27,000,000, an increase of about 18 percent over the base-case cost estimate. This accident scenario is equivalent to the most severe scenario evaluated in NUREG/CR-2601. NUREG/CR-2601 provided the technical bases for the primary property damage insurance rule 10 CFR 50.54(w).

3.0 EVALUATION

3.1 Accident Scenarios

The LOCA that provides the basis for the LACBWR accident recovery cost study is the maximum credible accident (MCA) which could occur for this reactor (Ref. 1). As defined in Reference 1, the hypothetical sequence of events for this accident is:

1. A rupture completely opens one of the 20-inch-diameter forced-recirculation lines.

2. The core is rapidly uncovered after the rupture, and fuel temperature drops due to convective cooling during the blowdown period.

3. Since the reactor will be scrammed on low water level and since loss of moderator would make the reactor subcritical by a large amount, the reactor is assumed to generate only decay heat at the end of the blowdown period.

4. There is a delay of up to 60 seconds after scram until emergency cooling water from the high pressure core-spray pumps reaches the core through the core spray nozzles.

5. Fuel rod temperatures rise from decay heat after the blowdown period.

6. All water from the core spray ring flows through the core spray nozzles and then down the shrouds, with no direct cooling of the core. Each shroud section surrounds a fuel assembly.

LOCA scenarios at LACBWR fall into two distinct types based on the location of the pipe break; either above-core or below-core. For each type, post-accident consequences to the plant are presumed to be generally similar regardless of the exact location or size of the break. Analyses reported in Reference 1 indicate that the containment building is designed to withstand the peak pressures generated as a result of the accident.

The below-core pipe break is the accident for which recovery activities, schedules, and costs are developed in the accident recovery cost study. Since the reactor vessel cannot maintain an inventory of cooling water following a large below-core break, plant emergency procedures dictate rapid flooding of the containment building to a level slightly above core midplane. Before defueling can take place, further flooding of the entire building must be effected. The below-core break scenario requires a more extensive and costly post-accident recovery program than the above-core break, due to the large volume of contaminated water to be processed and the need for installation of a new airlock above the 701-foot elevation to permit entry to the containment to begin accident cleanup operations.

The "base-case" LOCA is postulated to result in 100 percent fuel cladding failure but no fuel melting. A second accident scenario incorporates 100 percent fuel cladding failure and 50 percent fuel melting. The added costs of recovery for this second scenario are presented in an addendum to the main report (81A1087, Rev. 4). The DPC accident scenarios for LACBWR are equivalent to scenarios 2 and 3 in NUREG/CR-2601 (Ref. 2). Scenario 2 in the NUREG study is a small LOCA in which emergency core cooling is delayed, resulting in 50 percent fuel cladding failure and 5 percent fuel melting. Scenario 3 in the NUREG study is a major LOCA in which emergency core cooling is delayed, resulting in 100 percent fuel cladding failure and 50 percent fuel melting, with significant damage to the reactor core internals.

3.2 Accident Recovery Operations

Postulated LACBWR accident recovery operations are divided into three phases as follows:

- Phase I, Recovery Planning
- Phase II, Containment Recovery Activities
- Phase III, Damaged Fuel and Core Rubble Disposal.

Phase I, the recovery planning phase, is the time during which planning and preparation for accident cleanup takes place. The major recovery activities during this phase are shown in Table 1, summarized from Table 4-1 of the LACBWR accident study. Phase I is postulated to have a duration of 16 months and to require the services of 142 utility operations and support staff members and 31 engineering contractor staff members. Manpower requirements for Phase I are shown in Tables 2, 3 and 4. These tables were supplied by NES in response to questions about the assumed composition of the accident recovery staff.

Cleanup of containment and defueling of the reactor takes place during Phase II. The primary goal of the work performed during this phase is to prepare the containment building and associated systems and components for decommissioning. The major recovery activities that take place during this phase are shown in Table 5, summarized from Table 4-1 of the LACBWR accident study. Completion of Phase II is postulated to have a duration of 48 months and to require the services of 241 utility staff members and 38 engineering contractor support staff members. Manpower requirements for Phase II are shown in Tables 2, 3, and 4.

During Phase III, the damaged fuel and core rubble which has been stored temporarily in the spent fuel pool is loaded into spent fuel casks and shipped off-site. These operations require the use of the main entry airlock which is decontaminated at the conclusion of Phase II. Phase III is estimated to have a duration of 17 months. During Phase III, recovery staffing is assumed to be reduced to the pre-accident plant utility staff (see Table 2). Engineering support work will have been completed so there is no requirement for additional engineering support staff.

The accident recovery activities summarized in Tables 1 and 5 and described in more detail in Table 4-1 of the LACBWR study are sufficient to provide an adequate tabulation of the specific tasks required for cleanup of the reactor containment building following the postulated LOCA's. The walls of the containment building are coated with a layer of epoxy paint that was placed there when the facility was constructed. This paint is in a good state of preservation and would facilitate decontamination by high-pressure hose wash.

Provision is made in the study for construction of several temporary facilities such as waste storage facilities, an augmented laundry facility, employee processing and training center, etc. The existing change room at LACBWR would not be adequate for accident cleanup following the postulated LOCA since it is designed for use with the entry airlock at grade level. In response to a question, the staff was advised by NES that a new personnel change room would be part of the structure erected for containment access at the 701-foot level.

A major premise of the LACBWR accident recovery study is that the effects of a design basis LOCA would be limited to the reactor containment building. This received special attention during the visit of PNL staff to LACBWR on October 22, 1985. The probability that the radioactive contamination resulting from an accident would be confined to the containment building was evaluated. In particular, possible pathways for the release of contaminated water from the building were investigated.

Waste water from containment sumps is stored in two 6,000 gallon tanks located inside of containment. Normal operating procedures require for this water to be sampled and diluted with condenser coolant water prior to discharge to the Mississippi River. Discharge lines from the retention tanks have two manual shutoff valves inside of containment and two manual shutoff valves outside of containment. These are locked shut except when water is being discharged from the tanks to the river. There is also an automatic shutoff valve which is activated by abnormal conditions inside of containment.

Based on the staff review of plant drawings, discussion with plant personnel, and a walk down of the containment building and other plant facilities, it is the staff's conclusion that the assumption made in the LACBWR cost study that the contamination resulting from a below-core pipe break would be confined to the containment building is accurate.

A time requirement of 16 months is assumed in the LACBWR study for completion of Phase II (accident cleanup) activities. This may be compared with times of 40 months following a scenario 2 accident and 64 months following a scenario 3 accident for BWR containment building accident cleanup in NUREG/CR-2601. Time requirements for accident cleanup in the LACBWR and NUREG studies are not directly comparable because 1) the LACBWR containment structure is much smaller and far less complex than the reference containment structure used for NUREG/CR-2601, and 2) time requirements for cleanup depend on the number of shifts per day and number of work crews involved in cleanup operations which are different for the LACBWR and NUREG studies.

The LACBWR "base case" study presents a very conservative estimate of the time requirement for cleanup operations. An example of this conservatism is the requirement for scabbling of concrete surfaces within containment. Concrete surfaces are assumed to be scabbled to a depth of 1/2 inch. The time requirement for scabbling is based on the advertised performance rate of a commercially available air-operated scabbling tool. The advertised time is increased by a factor of 3 to take into consideration the difficulty of working in a high radiation environment while dressed in full anti-contamination clothing. A 33-percent contingency is added to account for unscheduled delays, health physics delays, etc. Finally, the time requirement is adjusted to account for work being limited to <u>four hours</u> of effective work inside containment during an eight-hour shift.

Manpower requirements postulated for LACBWR accident cleanup include provision for management and support personnel as well as for those workers actively involved in cleanup operations. As shown in Tables 2, 3, and 4, the basic labor force is the utility staff which presently operates LACBWR, augmented, as necessary, by staff to assist in accident cleanup and support operations. Provision is also made for contractor staff to provide engineering support during Phase I and Phase II operations. For Phase III (damaged fuel and core rubble disposal) the postulated staff is reduced to the normal plant operations staff.

Postulated manpower requirements for LACBWR accident recovery are significantly less than requirements for BWR accident cleanup described in NUREG/CR-2601. For preparations for cleanup, the postulated LACBWR staff is smaller by a factor of 2 than the postulated NUREG study staff following a scenario 2 accident. For the actual cleanup operations, the postulated LACBWR staff is smaller by a factor of 3 than the postulated NUREG study staff. Significant differences exist in the numbers of health physics personnel, security patrolmen, and plant operations and maintenance staff as well as in the number of staff actively involved in cleanup operations. Differences in manpower requirements reflect differences in the size and complexity of the LACBWR and the reference BWR of the NUREG study. Since LACBWR staffing requirements are based on the actual LACBWR operating staff augmented by additional personnel needed to perform specific cleanup activities, the staff has concluded that the postulated LACBWR accident recovery staff requirements are adequate to successfully perform the recovery operations described in the study.

By letter dated December 16, 1985 the licensee provided additional information describing the process used by NES to estimate manpower costs related to worker burn-out and reactor defueling:

> "In the case of the cost impact of occupational radiation exposure, NES applied an average of the adjustment factors shown in Table E.4-9 for Scenario 3 to the efforts associated with the LACBWR containment clean-up. The volume of the LACBWR containment was shown in the base containment volume. However, the LACBWR base cost estimate included 76 percent of the NUREG/CR-2601 Scenario 3 clean-up, as shown in Table 7-1 of the LACBWR base cost estimate.
>
> Similarly, NES chose to base its cost estimate for defueling operations on the NUREG/CR-2601 Scenario 3 basis. For example, LACBWR would have to remove a maximum of 72 fuel assemblies; or 37 percent of the 193 fuel assemblies assumed in NUREG/CR-2601 Scenario 3. However, NES projected a defueling schedule and manpower estimate of 50 percent and 51 percent, respectively, of the amounts included in the NUREG Scenario 3 estimate; as shown in Table 7-2 and Table 7-3 in the LACBWR base cost estimate."

Based on the above additional information, the staff finds that the manpower cost estimates for the "base case" accident are overly conservative and that the manpower cost estimates given in Table 4-1 of the base study are adequate to accomplish reactor defueling and maintain worker exposure at acceptable levels following the postulated 50 percent fuel melt accident.

3.3 Assessment of Accident Recovery Costs

Cost categories for which estimated accident recovery costs are given in the LACBWR study include the following:

- manpower costs
    - utility operating and support staff
    - engineering contractor staff
- construction of temporary facilities
- fabrication, purchase or rental of major equipment items
- miscellaneous supplies
- energy
- licensing and insurance
- consulting fees
- waste management
- other miscellaneous costs
- cost impacts on LACBWR decommissioning.

Costs are reported in 1984 dollars and include a 25 percent contingency.

Basic assumptions used to estimate accident cleanup costs for LACBWR are similar to those in NUREG/CR-2601. Both studies assume "efficient performance" of the work with no allowance for the effects of political or social considerations which could delay the schedule and increase the cost of cleanup activities. In assessing time and manpower requirements for post-accident cleanup, allowance is made for the difficulty of performing certain tasks in a high-radiation environment. Costs of required safety analyses and costs of compliance with applicable regulatory requirements are included.

The LACBWR accident recovery cost estimate utilizes a "building block" approach whereby specific, well-defined work activities are combined to form a recovery scenario. Costs are classified in terms of activity-dependent costs and undistributed, period-dependent, costs. Activity-dependent costs represent costs associated with a particular activity such as decontamination or removal of a contaminated item of equipment. Activity-dependent costs are determined by multiplying the appropriate activity parameter by the corresponding unit cost factor. Period-dependent costs are costs related to a specific phase of the accident cleanup program which may encompass several activities over an extended period of time. Activity-dependent costs and undistributed costs are presented in summary form in the LACBWR study. The total cost of accident cleanup is determined by summing all of the activity-dependent and undistributed costs and adding a 25 percent contingency.

Utility labor rates, including the overhead rate of 34.9 percent, used to determine manpower costs for the LACBWR study were provided by DPC. Labor rates are based on actual manpower costs for LACBWR operating personnel. Reference documents that provided additional accident recovery cost information include NUREG/CR-2601 (Ref. 2), GEND-034 (Ref. 3), and AIF/NESP-009 (Ref. 4). Where cost data from these documents were found to be applicable, they were adjusted for escalation to 1984 dollars.

Waste management costs include the costs of packaging, transportation, and disposal of accident cleanup wastes and of damaged fuel and core rubble. The cost of disposal of accident cleanup wastes was based on meeting the disposal criteria of 10 CFR Part 61. The cost estimate for management of liquid wastes was based upon processing (e.g., evaporation) of liquid wastes, solidification, packaging, and disposal of concentrated liquids. The distillate from the evaporation process was assumed to be controlled such that concentrations of radioactivity remain within existing standards for liquid discharge to the Mississippi River.

Shipping charges were based on the transportation of both accident cleanup wastes and damaged fuel and core rubble to Barnwell, South Carolina. Radwaste burial costs were based on rates in effect as of January 1, 1984 at the Barnwell, South Carolina shallow-land disposal facility. Damaged fuel and core rubble were assumed to be disposed of at a postulated Federal waste repository at the AGNS facility at Barnwell. Fuel disposal costs were based on the methodology used in NUREG/CR-2601, escalated from 1981 to 1984 dollars.

One cost factor that was not considered in connection with waste management costs was the possibility of having to pay an extraordinary disposal charge that might be levied against "decommissioning wastes" or any regional compact surcharge that might also be levied. Currently the Barnwell site is charging a $0.29 per cubic foot regional compact surcharge. The 25 percent contingency which is included in the total cost estimate was intended to cover these types of charges.

The cost of disposal of damaged fuel and core rubble is estimated in the LACBWR study to be approximately 4.5 million dollars, including contingency. This represents an over-estimate of the cost of LACBWR accident recovery. Utilities, including DPC, that operate power reactors are currently assessed a fee intended to pre-pay the cost of disposal of spent fuel at a Federal repository.

Accident recovery costs addressed in the LACBWR study include both the cost of post-accident cleanup to prepare the reactor for decommissioning and the increased cost of decommissioning as a result of the accident. This latter cost is estimated to be approximately 19.2 million dollars, including contingency. Cost impacts of a LOCA on LACBWR decommissioning include (1) the cost of removal of additional contaminated concrete and other contaminated structural material, (2) the added cost of removal of contaminated systems and equipment, (3) the cost of decommissioning temporary structures utilized during accident recovery operations, and (4) increased waste disposal costs.

It is our conclusion that the estimate of 152 million dollars and 179 million dollars, including contingency, presented in the LACBWR study are conservative estimates of the actual cost of accident recovery following the MCA LOCA. Bases and assumptions used to estimate accident recovery costs are consistent with those used in NUREG/CR-2601. The cost estimating methodology used is a standard methodology that has been employed with other decommissioning studies. Costs have been included for all the recovery activities identified in the study. Costs of support services required during the accident recovery are realistic and representative of actual labor, material, waste management, and support services costs.

3.4 Special Circumstances as Related to 50.12(a)

Damage from the worst possible accident at LACBWR would be a small fraction of a similar accident at most larger and newer plants. LACBWR has a tight containment building and contains less coolant in the primary circuit than most larger BWR units. Due to LACBWR's small size, the reactor contains a low inventory of fissionable material and fission products and yields a much smaller and more confined contamination area to be dealt with in the event of the worst case postulated accident. Moreover, since power output is directly related to the amount of possible damage, it is not reasonable to project that the amount of damage for a 50 MW plant would be the same as a much larger plant. Actual conservative analyses of the bounding accidents specifically for LACBWR show that the site-specific recovery and cleanup costs for the relatively small LACBWR facility will be substantially less than those contemplated for the generally larger average power reactors on which the limits in 10 CFR 50.54(w) were based. 10 CFR 50.54(w) provides no provisions for the amount of primary property damage insurance coverage required based on the size of a plant and the postulated clean up cost following an accident. In the circumstances, LACBWR has been required to carry a level of insurance coverage significantly in excess of what is necessary to meet the intent of 10 CFR 50.54(w) and the costs to the licensee for the size of the La Crosse facility are significantly in excess of the relative cost incurred by the much larger facilities covered by the rule. These are special circumstances as described in 10 CFR 50.12(a)(2)(iii) that justify the requested exemption.

4.0 CONCLUSION

The LOCA that provides the basis for the LACBWR accident recovery study is the maximum credible accident identified in the LACBWR safety analysis report. LACBWR accident scenarios are equivalent to scenarios 2 and 3 in NUREG/CR-2601. The staff finds the accidents evaluated by the licensee are sufficient to establish an adequate level of primary property damage insurance as required by 10 CFR 50.54(w).

The accident recovery operations described in the LACBWR study provide an adequate tabulation of required cleanup tasks in the reactor containment building following a LOCA. Time requirements for accident recovery following the "base case" accident are conservative and consistent with time requirements for accident recovery and are based on the actual LACBWR operating staff augmented by additional personnel needed to perform decontamination and defueling operations. Provision is made for additional personnel to provide the support activities needed during recovery operations. The postulated recovery staff is adequate to perform the recovery operations described in the study for the "base case" accident scenario.

Bases and assumptions used to estimate accident recovery costs are consistent with those in NUREG/CR-2601. The cost estimating methodology used is a standard methodology that has been employed with other decommissioning studies. Costs have been included for all of the recovery operations and support services identified in the study. Basic cost data used to develop the cost estimates are realistic and representative of actual labor, material, waste management, and support services costs. The estimate of 152 million dollars, including contingency, is a conservative estimate of the cost of LACBWR accident recovery following the "base case" accident.

The Appendix to the LACBWR accident study provides estimates of the increase in containment building contamination and increase in the cost of accident cleanup following a postulated 50 percent fuel melt accident. The final Addendum 1 cost estimate and schedule does recognize the complete impact of the 50 percent fuel melt accident scenario.

The staff finds that the estimated manpower cost for accident recovery following the "base case" accident is conservative. The staff also finds that manpower costs given in Table 4-1 of the base study are sufficient to accomplish reactor defueling and to maintain worker exposure of acceptable levels following the postulated 50 percent fuel melt accident.

Based on the above evaluations the staff concludes and finds that the accident recovery cost estimates are conservative. Therefore, the licensee's request for exemption from the requirements of 10 CFR 50.54(w)(1) to reduce on-site primary property damage insurance from 500 million dollars to 180 million dollars should be granted.

Principal Contributor: John Stang

Dated: June 26, 1986

REFERENCES

1. LaCrosse Boiling-Water Reactor Safeguards Report for Operating Authorization, ACNP-65544, Revised August 1967.

2. E. S. Murphy and G. M. Holter, Technology, Safety and Costs of Decommissioning Reference Light Water Reactors Following Postulated Accidents, NUREG/CR-2601, Pacific Northwest Laboratory for U.S. Nuclear Regulatory Commission, November 1982.

3. R. Mason, et al., Gross Decontamination Experiment Report, GEND-034, Bechtel National, Inc., July 1983.

4. W. J. Manion and T. S. LaGuardia, An Engineering Evaluation of Nuclear Power Reactor Decommissioning Alternatives, AIF/NESP-009, Nuclear Energy Services, November 1976.

Table 1. LACBWR Post-Accident Recovery: Phase I Activities

1. Post-Accident Monitoring and Maintenance
2. Interface with NRC
3. Evaluate/Select Engineering Support Contractor
4. Construct Temporary Offices
5. Develop Recovery Conceptual Plan
6. Develop Accident Recovery Reports
7. Prepare Integrated Recovery Sequence
8. Design Temporary Support Facilities
9. Design, Fabricate and/or Purchase Recovery Equipment/Systems
10. Develop Activity Specifications, Detailed Procedures, and Radiation Work Permits
11. Perform Plant Preparation/Construct Temporary Facilities

Table 2. Postulated Basic Operations and Support Staff During LACBWR Accident Recovery

STAFF COMPOSITION	NUMBER OF STAFF			
	PRE-LOCA	PHASE I	PHASE II	PHASE III
I. Plant Staff:				
Management				
Superintendent	1	1	1	1
Secretary/Word Processor	5	5	5	5
Site Support				
Health & Safety Supervisor	1	1	1	1
Rad. Protection Eng.	1	1	1	1
Rad. Protection Eng. JPL	1	1	1	1
H.P. Technician	7	7	7	7
Mech. Maintenance Supervisor	1	1	1	1
Assistance to Mech. Maint. Supervisor	1	1	1	1
Mechanical Maintenance	10	10	10	10
Janitors	2	2	2	2
Instr. & Elect. Supervisor	1	1	1	1
Instrument Technicians	4	4	4	4
Electricians	4	4	4	4
Computer Systems Analyst	1	1	1	1
Quality Assurance Supervisor	1	1	1	1
Quality Assurance Technician	4	4	4	4
Engineers	9	9	9	9
Site Security				
Supervisor	1	1	1	1
Shift Supervisor	4	4	[illegible]	4
Patrolman	30	30	30	30
Plant Operations				
Supervisor	1	1	1	1
Assistant to Supervisor and Training	1	1	1	1
Reactor Operations Engineer	1	1	1	1
Reactor Operations Shift Supervisor	5	5	5	5
Senior Reactor Operator	3	3	3	3
Reactor Operator	17	17	17	17
TOTAL PLANT STAFF	117	117	117	117

Table 3. Postulated Additions to Operations and Support Staff During LACBWR Accident Recovery

STAFF COMPOSITION	PRE-LOCA	PHASE I	PHASE II	PHASE III
II. Additional Plant Staff:				
Project Manger		1	1	
Contracts/Acctg. Supervisor		1	1	
Accountant		2	2	
Contracts SPL		2	2	
Insurance SPL		1	1	
Procurement SPL		1	1	
Clerks		2	2	
Warehousemen		2	2	
Tool Crib Attendant		2	2	
Crew Leaders			9	
Utility Operators			35	
Laborer			20	
Craftsman			16	
H.P. Technician			9	
Legal Staff		3	3	
Protective Equipment Attendant		6	6	
NRC/Licensing Engineer		1	1	
Nurse		1	1	
Water Processing				
Utility Operators			3	
Supervisor			1	
Waste Solidification				
Utility Operators			3	
Waste Packaging				
Operators			3	
TOTAL ADDITIONS TO PLANT STAFF	0	25	124	0
TOTAL AUGMENTED PLANT STAFF	117	142	241	117

Table 4. Postulated Engineering Contractor Support Staff During LACBWR Accident Recovery

STAFF COMPOSITION	PRE-LOCA	PHASE I	PHASE II	PHASE III
III. Engineering Support Contractor Staff:				
Management				
Project Manager		1	1	
Admin. Manager		1	1	
QA Manager		1	1	
NRC Liaison/Lic. Engineer		2	2	
Planning/Scheduling Engineer		1	1	
Procurement Manager		1	1	
Cost Tracking Engineer		1	1	
Engineering & Planning				
Project Engineer		1	1	
Field Engineer		4	4	
Field Draftsman		2	2	
Home Office Supervisor Engineer		2	1	
Home Office P.E.		1	1	
Secretarial		2	2	
Environmental Protection Coordinator		1	1	
Home Office Cost Tracking Engineer		1	1	
Recovery Operations				
Manager			1	
Contracts Supervisor			1	
Operations Supervisor			1	
Contracts Administrator		1	1	
Radioactive Mtl. Ship. Supervisor			1	
Radioactive Mtl. Ship. Coordinator			1	
Training Supervisor			1	
Training SPL			2	
Industrial Safety SPL		1	1	
Industrial Safety Tech.		2	2	
Chemist		2	2	
Secretarial		3	3	
TOTAL ENGINEERING SUPPORT CONTRACTOR STAFF	0	31	38	0

Table 5. LACBWR Post-Accident Recovery: Phase II Activities

12. Install Containment Vent System
13. Install Containment Water Processing System
14. Construct Containment Access Structure
15. Enter Containment
16. Perform Manual Decontamination of Operating Floor Evaluation 701-Foot Floor, Walls, and Dome
17. Deliver Special Equipment to Elevation 701-Foot Operating Floor
18. Install Damaged Fuel Racks
19. Remove Reactor Vessel Head
20. Inspect Core
21. Install Reactor Water Cleanup System
22. Prepare for Segmentation of the Core Spray Bundle
23. Segment Core Spray Bundle
24. Conduct Training and Practice on Reactor Vessel Mock-up for Defueling
25. Analyze Core, Reactor Coolant, and Crud in Accordance with 10 CFR 61, 49 CFR, and NRC Requests
26. Remove Damaged Fuel
27. Inspect Core and Perform Debris Removal
28. Prepare for Underwater Segmentation of Internals
29. Segment Internals
30. Install Recirculation Nozzle Plugs
31. Drain Containment
32. Decontaminate Containment Below Elevation 701-Foot
33. Decontaminate Recirculation Pump Cubicles
34. Decontaminate Main Air Lock