Staff Exhibit 53-M

Decommissioning Funding

NUREG-0586, "Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (1981)

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Draft Generic Environmental Impact Statement

on decommissioning of nuclear facilities

U.S. Nuclear Regulatory Commission

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OVERVIEW

At the end of a commercial nuclear facility's useful life, termination of its license by the Nuclear Regulatory Commission (NRC) is a desired objective. Such termination requires that the facility be decommissioned. In decommissioning, radioactively contaminated materials present in the facility at the end of its useful life are appropriately removed such that the level of any residual radioactivity remaining after completion of decommissioning is low enough to allow unrestricted use of the facility and site. It is the objective of NRC regulatory activities in protecting public health and safety to provide to the applicant or licensee appropriate regulation and guidance for the implementation and accomplishment of nuclear facility decommissioning.

While decommissioning of most operating existing nuclear facilities is not imminent, it is anticipated that decommissioning of certain facilities may occur in the near future. Accordingly, the NRC is reevaluating its regulatory requirements concerning decommissioning policy. This draft generic environmental impact statement is part of this reevaluation since implementation of resultant regulations may have a significant impact on the environment.

PAST ACTIVITIES

In support of this reevaluation, a data base on the technology, safety, and cost of decommissioning various nuclear facilities by alternative methods is being completed for the NRC by Battelle Pacific Northwest Laboratory (PNL). Concurrent with these activities, a dialogue with the States, the public, and other government agencies has been maintained for critical commentary on the shaping and implementation of NRC decommissioning policy and its supportive technical information base. Based on such dialogue, NRC has modified and amplified its policy considerations and data base requirements in a manner responsive to comments received. Staff papers have been issued in two key areas of concern: (1) assurance that funds will be available for decommissioning, and (2) establishment of acceptable levels of residual radioactivity for release of facilities for unrestricted use. A third area of concern is the generic applicability of the data base for specific facility types. This has been addressed through expansion of the PNL facility reports to include sensitivity analyses for a variety of parameters potentially affecting safety and cost considerations.

SCOPE OF THE EIS

Regulatory changes are being considered for both fuel cycle and non-fuel-cycle nuclear facilities. The fuel cycle facilities are pressurized (PWR) and boiling water (BWR) light water reactors (LWRs) for both single and multiple reactor sites, fuel reprocessing plants (FRPs) (currently, use of FRPs has been indefinitely deferred in the commercial sector), small mixed oxide (MOX) fuel fabrication plants, uranium fuel fabrication plants (U-fab), uranium hexaflouride conversion plants (UF_6), and away-from-reactor independent spent fuel storage installations (ISFSI). Under non-fuel-cycle facilities, consideration is given to major types such as radiopharmaceutical or industrial radioisotope supplier facilities, various research radioisotope laboratories, and rare metal ore processing plants where uranium and thorium are concentrated in the tailings.

This EIS addresses only those issues involved in the activities carried out at the end of a nuclear facility's useful life which lead to unrestricted use of a facility. It does not address the considerations involved in extending the life of a nuclear facility. If a licensee makes an application for extending a facility license, it would be reviewed as an amendment to the existing license under appropriate existing regulations. This is not considered to be decommissioning and therefore is outside the scope of this EIS.

High-level waste repositories, low-level waste burial grounds, and uranium mills and their associated mill tailings piles are being covered in separate rulemaking activities and are not included here. The first two items are being considered in Title 10 of the Code of Federal Regulations (10 CFR) Parts 60 and 61. The last item is covered in a separate EIS and subsequent rulemaking proceedings.

Decommissioning that occurs as a result of premature closure due to accidents may involve technical and cost considerations not yet completely evaluated. Studies to develop a complete data base for this subject will begin in fiscal year 1981 and a detailed report on decommissioning following a postulated accident, similar to the report prepared for the facilities in this EIS, is expected to be issued in fiscal year 1982. While the basic purpose and objectives for decommissioning facilities involved in accidents would be the same as for routine decommissioning, some of the specific aspects of the techology, safety, and costs of decommissioning may differ. Nevertheless, in many instances, the specific aspects would have similarities between accident and routine decommissionings, in particular in areas such as decommissioning alternatives and timing, planning and facilitation, financial assurance, and residual radioactivity limits. It is not expected that major changes in the conclusions of this EIS will result from the technical studies on accident decommissioning, although there may be some differences in specific criteria. These items will be considered upon completion of the studies initiated in 1981.

REGULATORY OBJECTIVE

It is the responsibility of the NRC to insure, through regulations and other guidance, that appropriate procedures are followed in decommissioning such that the health and safety of the public is protected. Present regulatory requirements and guidance are not specific enough in many critical areas to ensure that potential problems are properly considered. Those areas include timeliness, financial assurance, planning, and residual radioactivity levels as discussed below:

Timeliness. It is the responsibility of the NRC, in protecting public health and safety, to ensure that after a nuclear facility ceases operation its license is terminated in a timely manner. Such termination requires decommissioning. From the analysis of the technical data base, it is clear that decommissioning can be accomplished safely and at modest cost shortly after cessation of facility operation and it is considered reasonable that decommissioning should be completed at this time. Completing decommissioning and releasing the facility for unrestricted use eliminates the potential problems of increased numbers of sites used for the confinement of radioactively contaminated materials, as well as potential health, safety, regulatory and economic problems associated with maintaining the site. Delay in the completion of decommissioning would be primarily for reasons of health and safety considerations, since it is recognized that with delay there may be reduction in occupational dose and radioactive waste volume for some facility types due to radioactive decay. Delay for such reduction would require additional justification since the amount of such reduction is of marginal significance in its effect on health and safety. For example, use of such delay may be justified at a multiple facility site where phased decommissioning may be appropriate. Even for this situation, decommissioning should be accomplished in as short a time as is reasonable. For this example, for a reactor at a multiple facility site where radioactive cobalt is the principle contaminant, there would be little dose reduction due to decay after a delay of 30 years. Therefore, it is recommended that the maximum delay for the reactor in this example be 30 years. For other facilities, the maximum delay considered reasonable will depend on the facility type and the contaminant isotopes involved.

Financial Assurance. Consistent with the regulatory objective of decommissioning as described above, a high degree of assurance is required from the nuclear facility licensee that adequate funds are available to decommission the facility. Because of the possibility of premature closure, a funding mechanism provided by the licensee must be in place which would pay for the full cost of decommissioning at any time during facility operation. The funding mechanisms considered reasonable for providing the necessary assurance include (singly or in combination)

prepayment of funds into a segregated account, insurance, surety bonds, letters of credit, and a sinking fund deposited into a segregated account. Another funding mechanism that has drawn considerable interest, especially for reactors, is an internal reserve which uses negative net salvage value depreciation, and which generally is considered less expensive than other alternative funding mechanisms. However, the problem with such a mechanism is the lack of assurance it provides, by itself, that funds will be available for decommissioning. Moreover, while other funding mechanisms, such as prepayment or a sinking fund coupled with insurance, may be more costly on a net present worth basis, their economic impact is still small in terms of the total cost to the consumer or licensee. Therefore, under NRC's responsibility to protect public health and safety by assuring that funds are available for a safe decommissioning, the internal reserve would be considered an adequate funding mechanism only if it were supplemented by substantial additional funding mechanisms (such as insurance or some other surety arrangement) to increase the level of assurance.

Planning. Ensuring that decommissioning is appropriately accomplished requires careful planning. Decommissioning is affected by factors involved in the design and operation of a nuclear facility, as well as the actual operations carried out during the active decommissioning phase. Accordingly, it is important that the licensee decommissioning plan be developed and approved prior to commissioning of the facility. While such initial plan need not present the full details for the actual decommissioning, it should contain sufficient detail on the cost of decommissioning and the method of funding. Moreover, it should address what will be done to facilitate decommissioning in terms of design and operation of the facility. While such considerations must include cost effectiveness, the emphasis should be on health and safety rather than economics. Certain aspects of decommissioning facilitation (such as those that have impact on reducing occupational dose during facility operation) can reduce operational costs. However, even those aspects of facilitation that are questionable in terms of reducing operational costs but can have significant impact on decommissioning health and safety aspects must be considered. Implementation of such possible facilitation at the design and construction stage can be much more cost effective than at the operational or active decommissioning stages.

Periodic updating of the initial decommissioning plan is required because of changes in factors affecting technology and cost. A final detailed decommissioning plan is required for review and approval by the NRC, and agreement states where applicable, prior to cessation of facility operation or shortly thereafter. Besides the technically detailed description of procedures, schedules, and work plans for the decommissioning alternative which will be used, the final plan should include a description of the termination survey required to certify that sufficient radioactively contaminated materials have been removed and that the facility can be released for unrestricted use. The plan should include an estimate of the cost required to accomplish the decommissioning.

Residual Radioactivity Levels. An important and technically difficult issue is the problem of determining acceptable residual radioactivity levels required for release of property for unrestricted use. It is the responsibility of the Environmental Protection Agency (EPA) to establish such a standard but it is not scheduled to do so until 1984. Discussions have been held with the EPA relative to providing preliminary guidance for NRC in establishing limits which are consistent with eventual EPA requirements. Due to the variety of facility types and radionuclides involved it is not feasible to set a single dose limit that would be valid under all conditions for all facilities. It is necessary to assess the radiological impact in terms of the radionuclides and pathways involved and the costs and benefits which result. Based on the considerations, on discussions with the EPA, and on considerations that the level of residual radioactivity selected must be safe and consistent with existing guidance and be measurable and cost effective, the following results were determined:

(1) A residual radioactivity level for permitting release of a nuclear facility for unrestricted use should be ALARA. Guidance in establishing such a limiting level is best expressed in terms of a value which bounds the dose for the majority of facilities discussed in this report. This value is determined to be 10 mrem/yr whole-body dose equivalent, but could be lower for specific facilities. The 10 mrem/yr limit

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15.1.2.2 Final Plans

Final decommissioning plans should contain much greater detail than initial plans. Such plans should be submitted in a timely way to the NRC for review and approval prior to the initiation of any decommissioning activity to avoid delay of decommissioning after facility shutdown. For a major power reactor such review and approval could take on the order of a year. Final plans should include the following:

(1) Decommissioning Alternative - A detailed description of the alternative to be used for decommissioning the facility should be presented. Such description should include major procedures and techniques utilized that are related to health and safety during the decommissioning operations (which continue until radioactivity levels permitting unrestricted access are achieved).

Plans for processing and disposing of all radioactive waste should also be included. Such plans should realistically assess the availability of permanent waste burial grounds. If such space is unavailable, then contingency plans should be presented which address use of available temporary above-ground waste storage. Depending on a variety of circumstances, such temporary waste storage may be accomplished offsite or onsite and would require NRC review and approval on an individual case basis.

A detailed certification plan for a final termination survey should also be presented to ensure that remaining residual radioactivity is within NRC-approved levels for releasing the facility for unrestricted use. Although the SAFSTOR or ENTOMB alternatives may have been selected, which would require a complete termination survey at some future time, unrestricted access to portions of a facility/site may be desirable prior to full decommissioning.

A detailed cost estimate should be included based on the alternative selected to ensure that appropriate decommissioning funds will be available prior to active initiation of the decommissioning operations.

(2) Schedule - Detailed schedules for completion of all decommissioning activities (related to work plans) should be submitted.

(3) Administrative Controls - Detailed plans describing the organization and procedures required for accomplishing decommissioning should be submitted. Such plans should include a delineation of responsibilities and requirements for review, audit, and reporting. Details of the quality assurance program to be used should also be submitted.

(4) Specifications - Proposed specifications by the licensee on controls and limits for procedures and equipment to ensure occupational and public safety, to accomplish decommissioning, should be submitted.

(5) Training - Details of a program for training employees and contractor personnel for required decommissioning should be submitted.

15.1.3 Financial Assurance

The primary objective of the NRC with respect to decommissioning is to protect the health and safety of the public. An important aspect of this objective is to assure that, at the time of termination of facility operations (including premature closure of the facility), that adequate funds are available to decommission the facility resulting in its release for unrestricted use. Assurance of this availability of funds ensures that decommissioning can be accomplished in a safe and timely manner and that lack of funds does not result in delays

in decommissioning that may cause potential health and safety problems for the public. The need to provide this assurance arises from the fact that there are uncertainties concerning the availability of funds at the time of decommissioning. These uncertainties are of two general types. The first is that the financial solvency of a particular organization is difficult to predict several years into the future when decommissioning of a specific facility is likely to occur. The second type of certainty is that, potentially, a facility could be forced to shut down prematurely.

The nuclear facility licensee has the responsibility for completing decommissioning in a manner which protects public health and safety. Satisfaction of this objective requires that the licensee provide a high degree of assurance that adequate funds for performing decommissioning will be available at the end of facility operation. Because of the possibility of premature closure of the facility, financial assurance provided by the licensee must also contain a mechanism enabling funds for the full cost of decommissioning to be made available at any time during facility operation.

In providing the high degree of assurance necessary that funds are available for decommissioning, there are several possible financing mechanisms which are available to applicants and licensees. The wide diversity in different types of nuclear facilities necessitates that the NRC allow a wide latitude in the implementation of these financing mechanisms. A preliminary NRC staff analysis[14] for providing guidance as to what funding mechanisms provide adequate assurance has led to the following major classification of funding alternatives (used singly or in combination):

(1) Prepayment - Cash or other liquid assets that will retain their value for the projected operating life of the facility are deposited into an account prior to facility startup. This account would be segregated from other company funds.

(2) Decommissioning insurance, surety bonds, letters of credit, and lines of credit - Insurance, most likely for the larger facilities, which could potentially provide for all decommissioning expenses, including potential premature decommissioning, or insurance to cover only costs of premature decommissioning, may be used. The surety bond or credit mechanisms guarantee that the decommissioning costs will be paid should the bond purchaser default. The bond holder still must provide funding for decommissioning through some other method. It appears questionable that bonds of the size necessary and for the time involved with power reactors will be available. However, they appear to be available for facilities that involve smaller costs and time periods. The contractual arrangement guaranteeing the suretys must include a provisions for noncancelability, preferably over the projected operating life of the facility. Sufficient time for NRC notification of surety cancellation must be guaranteed, in any case, to allow for consideration of termination of operating license and required decommissioning. Such forced decommissioning would result if the NRC determined that a loss of surety by the licensee resulted in an unviable financial assurance condition. It should be kept in mind that sureties would be called only if, at the time of cessation of facility operation (or impending loss of surety), licensee decommissioning funds were inadequate or unavailable.

(3) Sinking funds - The sinking fund or funded reserve approach requires that a prescribed amount of funds, subject to periodic revision, be set aside annually in an account, segregated from other company funds, such that the fund plus accumulated interest would be sufficient to pay for decommissioning costs at the time of termination of facility operation. The fund could be invested in high-grade corporate securities, in State or municipal tax-free securities, in Federal debt obligations or other assets. The disadvantage of the sinking fund approach is that in the event of premature closure of a facility the decommissioning fund would be insufficient Therefore, the sinking fund would have to be supplemented by decommissioning insurance, or other mechanisms of item (2), which would pay the difference.

Another funding mechanism which has drawn considerable interest and discussion, especially among electric utilities, is that referred to as internal reserve or unsegregated sinking fund. This mechanism usually uses negative net salvage value depreciation which allows estimated decommissioning costs to be accumulated over the life of the facility In this mechanism, the funds are not segregated from the utility's assets, rather they are invested in utility plant assets and at the end of life bonds are issued against such plant assets and the funds raised are used to pay for decommissioning. Such a mechanism is generally favored by utilities because it is considered to be less expensive in terms of net present value than the options listed above, although, as discussed in Section 2.6, whichever funding mechanism is used should not have a significant impact on the revenue requirements. The problem with the internal or unsegregated funding method is the lack of assurance that funds will be available to pay for decommissioning. Because this method depends on financing internal to the licensee, the unfunded reserve is vulnerable to any event or situation that undermines the financial solvency of a utility. A utility with serious financial troubles would have difficulty raising capital against its decommissioning reserve. In addition, in the event of financial distress of a utility, an internal reserve may not be available to pay for decommissioning costs, but may have to be paid instead to satisfy claims of superior creditors. Under the NRC's responsibility to protect public health and safety by assuring that funds are available for a safe decommissioning, the internal reserve would be considered an adequate funding mechanism only if it were supplemented by substantial additional financing mechanisms (such as insurance or other surety arrangements) that overcome the assurance deficiencies.

A financial assurance plan should be submitted by an applicant prior to licensing the facility. The costs for decommissioning various nuclear facilities is not well established because there has been limited decommissioning experience. Battelle PNL, under contract to NRC, has made detailed cost estimates of most nuclear facilities to provide a data base for licensee cost estimation. The PNL estimates include sensitivity analysis to include licensee situations that may differ from the reference facility cost estimates. The PNL cost estimates, with suitable adjustments to account for licensee facility differences, can be used by an applicant for initial financial assurance plan cost estimates. Information on technology improvements, enhanced decommissioning experience, and inflationary/deflationary cost factors is expected to evolve with time. Consequently, resulting cost estimate improvements of the licensee's financial plan will be periodically required and reviewed. In this way, it is expected that the decommissioning fund available at the time of facility shutdown will not differ significantly from the actual costs of decommissioning.

15.1.4 Residual Radioactivity Levels for Unrestricted Use of a Facility

The objective of selecting residual radioactivity levels for unrestricted use of a facility is to provide a terminal level of radioactivity that will allow unrestricted access to a decommissioned facility and consequent NRC license termination. A selected level at which a facility can be released for unrestricted use, must, of course, be safe and consistent with the ALARA (as low as is reasonably achievable) principle. In addition, selected levels for unrestricted facility use must be verifiable through actual detailed survey measurements of the facility and site, and be within reasonable bounds regarding state-of-the-art survey detection methodology and costs. Risk from radioactivity is measured in terms of potential exposure or related dose to a potentially exposed individual. Therefore, a meaningful representation of a residual radioactivity level can be given in terms of a dose limit (i.e., mrem) or range. Such representation is generic and thus, does not have to specify radionuclide spectra for specific facilities and associated dose receptor pathways. For actual certification survey measurements, the contaminant radioactivity in terms of specific nuclide surface or volumetric concentrations must be specified. Use of appropriate pathway (and receptor usage) analyses provides the method for converting the selected dose value to an equivalent radionuclide specific contaminant concentration (based on existing facility spectra analysis).