

January 31, 1978

UNITED STATES  
NUCLEAR REGULATORY COMMISSION

SECY-78-13A

**POLICY SESSION ITEM**

For: The Commissioners

From: Robert B. Minogue, Director  
Office of Standards Development

Thru: *for* Executive Director for Operations *L. J. Duchs*

Subject: SUPPLEMENTAL INFORMATION TO SECY 78-13 ENTITLED,  
"RECOMMENDATIONS ON COURSE OF ACTION FOR ESTABLISHING  
NUCLEAR FACILITY DECOMMISSIONING REQUIREMENTS"

Category: This paper covers a major policy question.

Issue: Should the Commission initiate separate rulemaking actions  
for each class of nuclear facility or initiate a compre-  
hensive rulemaking action as recommended in SECY 78-13.

Decision  
Criteria:

1. Decommissioning criteria for each separate type nuclear  
facility should be consistent with overall NRC de-  
commissioning criteria and policy.
2. The development of NRC decommissioning policy  
appears to be a major federal action which should be  
supported by a NEPA environmental impact statement.

Alternatives:

1. Use the information being developed at Battelle-PNL to  
initiate separate rulemaking actions for each type  
nuclear facility as soon as each study is completed.
2. Use the information being developed at Battelle-PNL  
to initiate a comprehensive rulemaking action so as to  
develop an overall NRC policy on decommissioning.

Discussion: Background. On January 23, 1978, the Commission was briefed  
on staff's recommendations for an overall NRC course of  
action for establishing nuclear facility decommissioning  
requirements. During the briefing it was indicated that  
more information was desirable on the advisability of  
initiating separate rulemaking actions for each class of  
nuclear facility; particularly with regard to PWRs since  
the Battelle-PNL study on PWR decommissioning is scheduled  
for completion in March, 1978. Subsequently, additional  
information was requested on the details of staff's  
financial review of reactor applicants.

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Analysis.

1. Separate Rulemaking Actions.

In an effort to better demonstrate the relationship of separate rulemaking actions to an overall policy or generic action, the following outline of the principal issues in a separate rulemaking action for PWRs has been developed:

- A. Decommissioning Mode - The mode of decommissioning (i.e., mothballing, protective storage, immediate dismantlement, etc.) would be primarily based on technology, occupational safety, and cost-benefit considerations. Although it is anticipated that this subject could be addressed separately, it appears it would be more responsible to address it in relationship to other types of facilities and to the other subjects identified below.
- B. Residual Contamination Limits - Some form of limits for acceptable levels of residual contamination will be needed unless any and all contaminated materials are removed, a practical impossibility. The residual contamination limits proposed for use must be justified and endorsed by the Environmental Protection Agency and, to some degree, by affected States. These limits could be addressed separately for a PWR on an interim basis. However, later expansion to include consideration of the residues from other licensed operations might discover issues which could change the criteria of acceptability or involve new parties (States) who might not endorse the previously developed limits. Final limits must be generic, consistent, and applicable to all NRC and Agreement States licensing activities.
- C. Timing of Decommissioning - The time interval between the closing of a reactor and its decommissioning would have to be determined based on the variations in cost, radiation exposures, and technical difficulty. It is anticipated that this subject could be addressed separately.
- D. Financial and/or Surety Arrangements - The financial and/or surety arrangements for providing decommissioning funding would have to be determined. It is believed that this subject could be addressed separately.

However, there is a major policy issue involved here. Except as discussed in SECY 78-24 ("NMSS Approach to Decommissioning in General and Renewal of the NFS Erwin Tennessee License in Particular"), NRC has not required surety arrangement by explicit regulation in the past although bonding has been considered from time to time. It is important to note that the surety arrangements connected with mill tailings were first considered in preparing NEPA statements primarily because tailings at closed mills do not constitute licensable material under NRC regulations. Had tailings been licensable material, it is doubtful that surety arrangements would have initially been considered.

- E. Environmental Impact Statement - Establishing decommissioning criteria for each significant class of facility is believed to be a major federal action requiring an environmental impact statement under NEPA. Staff believes that the subject of decommissioning could best be addressed in a single unified overall EIS rather than in a series of such documents.

Therefore, it is possible to develop decommissioning policy and the attendant rules separately for a PWR and separately for other facilities as well. It would not be a notably more rapid proceeding since there would still have to be a painstaking review of the residual activity limits with the EPA and the States and of the financial and/or surety arrangements with the States. The staff estimates that liaison with the States on the PIRG issue alone (Section 50.33 vs. bonds held in escrow) can be completed early in 1978 only because a substantial amount of progress has already been made and the issue is a narrow one. The staff does not believe such a rapid conclusion is possible for review of the full range of financial surety alternatives or for the review of the residual activity limits. Consequently, the staff feels that the conduct of a separate proceeding for the PWR would save little if any time. In addition, the piecemeal approach of separate proceedings entails the risk of confusing the participating agencies and the public.

## II. Financial Reviews

Two financial analyses are performed by staff during the licensing process involving production and utilization facilities. As indicated in SECY 78-13, a determination must be made that an applicant is financially qualified

to operate its facility and to permanently shut the facility down and maintain it in a safe condition. The financial information to be submitted to the NRC by the applicant is specified in Section 50.33(f) of Part 50. Appendix C of Part 50, "A Guide for the Financial Data and Related Information Required to Establish Financial Qualifications for Facility Construction Permits and Operating Licenses," further delineates the financial information to be submitted by applicants. Annex A hereto contains a recent staff analysis pursuant to the provisions of Section 50.33.

The second analysis is the cost-benefit assessment contained in staff's NEPA EISs. Annex B hereto contains a summary of such a cost-benefit analysis. The costs of decommissioning are considered in this generic cost-benefit analysis which is used in all current LWR cases. The generic costs used are based on the recent AIF decommissioning study. The information requested from reactor applicants on decommissioning methods and costs for purposes of preparing environmental impact statements is delineated in Section 5.8 of Regulatory Guide 4.2, "Preparation of Environmental Reports of Nuclear Power Stations."

Recommendation: As stated in SECY 78-13.

Anticipated Scheduling: The week of February 13, 1978.

*Robert B. Minogue*  
Robert B. Minogue, Director  
Office of Standards Development

Enclosures:  
ANNEX A -  
Financial Qualifications  
ANNEX B -  
Generic Section on  
Decommissioning Costs for ES

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## ANNEX A

### 20.0 FINANCIAL QUALIFICATIONS

#### 20.1 Introduction

The Commission's regulations relating to the determination of an applicant's financial qualifications for a facility operating license appear in Section 50.33(f) and Appendix C to 10 CFR Part 50. In accordance with these regulations, the Toledo Edison Company and the Cleveland Electric Illuminating Company have supplied operating and shutdown costs estimates for the Davis Besse Nuclear Power Station, Unit No. 1, as well as providing additional financial information. The following analysis summarizes our review of the financial information and addresses the financial qualifications of the Toledo Edison Company and Cleveland Electric Illuminating Company to operate and, if necessary, to permanently shut down and safely maintain the subject facility. The Toledo Edison Company and the Cleveland Electric Illuminating Company supply electricity to approximately 2.9 million customers over a 4,200 square mile service area in northeastern and northwestern Ohio. Recent financial information for each of the applicants, for the 12 months ended December 31, 1976, is presented in Table 20.1.

Table 20.1

Financial Data for the Toledo Edison Company  
and Cleveland Electric Illuminating Company  
(12 months ended December 31, 1976)

	Toledo Edison Company	Cleveland Electric Illuminating Company
Operating Revenues (millions)	\$224	\$ 523
Net Income (millions)	\$ 39	\$ 82
Total Capitalization (millions)	\$780	\$ 1488
Bond Rating		
(Moody's/Standard & Poor's)	Baa/A	Aa/AA

Toledo Edison Company and the Cleveland Electric Illuminating Company will share in the output of the Davis Besse 1 facility in the same proportion as its ownership percentage: Toledo Edison Company - 48.62 percent; Cleveland Electric Illuminating Company - 51.38 percent. These percentages reflect a transfer of 3.88 percent ownership interest from the Toledo Edison Company to the Cleveland Electric Illuminating Company, which has been completed and for which payment has been made.

20.2 Estimated Operating and Shutdown Costs

For the purpose of estimating the unit's annual operating costs, the Toledo Edison Company and the Cleveland Electric Illuminating Company assumed July 1977 as the startup date for commercial operation of the facility. The estimate of the Toledo Edison Company and the Cleveland Electric Illuminating Company for the total annual cost of operating the unit during each of the first five years of operation is presented in Table 20.2. The unit costs (mills per kilowatt-hour) are based on a net electrical capacity of 906 megawatts electrical. The five year average costs were calculated by annualizing the estimated costs for 1977 in combination with the annual estimates for 1978 through 1981.

Table 20.2  
Operating Cost Estimate  
(First Five Years of Commercial Operation)

	Plant Capacity	Operating Cost Estimate (Thousands)	Mills/Kilowatt-hour
(July-Dec.) 1977	60%	\$ 68,473	28.8
1978	70%	\$ 168,950	30.4
1979	62%	\$ 164,940	33.5
1980	73%	\$ 163,973	28.3
1981	70%	\$ 163,952	29.5
5-year average	67%	\$ 150,752	30.0

In estimating the costs of permanently shutting down the facility, the Toledo Edison Company and the Cleveland Electric Illuminating Company assumed that the plant would be entombed and no longer used as a commercial nuclear power facility. Expenditures for entombment are projected to be \$10 million initially, with an annual surveillance expense of \$90,000 thereafter. Entombment consists of sealing all remaining highly radioactive components within a biologically secure structure after having removed all fuel assemblies and radioactive fluids and waste.

20.3 Source of Funds

The Toledo Edison Company and the Cleveland Electric Illuminating Company expect to cover all operating expenses, including taxes, and interest payments through revenues generated from their system-wide sales of electricity. The applicants have consistently exhibited the ability to cover all operating expenses as evidenced by the ratio of operating revenue to operating and interest expenses as shown in Table 20.3. The staff assumes that shutdown and subsequent maintenance costs will either be expensed in the year incurred or amortized over a period of years, depending on the rate-making policy of the regulatory authorities.

Table 20.3

Ratio of Operating Revenue to  
Operating and Interest Expenses

<u>Year</u>	<u>Toledo Edison Company</u>	<u>Cleveland Electric Illuminating Company</u>
1976	1.08	1.08
(12 Months ended June 30, 1976)		
1975	1.05	1.08
1974	1.05	1.10
1973	1.11	1.13
1972	1.14	1.16
1967 - 1971	1.18	1.17
(Average)		

During 1976, the Toledo Edison Company and the Cleveland Electric Illuminating Company sold electricity for average unit prices (mills per kilowatt-hour) of 30.3 and 29.3, respectively. These unit prices experienced by the companies are above the 1977 estimated unit cost (including a 10 percent return on investment) of generating electricity from the Davis Besse 1 facility.

20.4 Conclusion

In accordance with the regulations cited above, there must be reasonable assurance that the applicant can obtain the necessary funds to cover the estimated costs of the activities contemplated under the license. Based on our analysis, we have concluded that Toledo Edison Company and Cleveland Electric Illuminating Company satisfy this reasonable assurance standard and, therefore, are financially qualified to operate and, if necessary, shut down and safely maintain the Davis Besse Nuclear Power Station, Unit No. 1. Our conclusion is supported by the following factors as discussed above: (1) the applicants' ability to earn revenues sufficient to cover all operating expenses, including taxes, and interest payments; and (2) the projected output of lower unit cost electricity from this facility, as compared with the utilities' present average price of electricity.

GENERIC SECTION ON DECOMMISSIONING COSTS FOR ENVIRONMENTAL STATEMENTS

9.----- Decommissioning

Decommissioning cost for nuclear generating units are discussed in Section 10.-----. Table \_\_\_\_\_ summarizes the cost of decommissioning alternatives and the unit cost (m/kWh) as a function of capacity factor. Decommissioning unit cost for combinations of delayed removal (100 years) and mothballing or entombing are about the same as mothballing or entombing. While the mothballing alternative is the economic choice, the higher cost for prompt removal is shown in Table 9.-----.

TABLE \_\_\_\_\_  
DECOMMISSION COST

	<u>Mothball</u>	<u>Entomb</u>	<u>Prompt Removal</u>
Initial cost, 1975 \$10 <sup>6</sup> *	2.45	7.58	26.3
Annual Post-decommissioning Cost, 1975 \$10 <sup>3</sup>	167**	58	NONE
30-year levelized unit cost, m/kWh:***			
50% capacity factor	0.05	0.07	0.22
60% capacity factor	0.04	0.06	0.18
70% capacity factor	0.03	0.05	0.15

\* costs are for a 1 unit station.

\*\* costs would be \$88,000/yr. if a 24-hr. manned security force is not required. This would reduce the unit cost about 0.01 m/kWh.

\*\*\*based on a 1200 MWe generating unit beginning operation in 1985, an escalation rate of 5%, and a discount rate of 10%.



## GENERIC SECTION ON DECOMMISSIONING COSTS FOR ENVIRONMENTAL STATEMENTS

### 10.--- Decommissioning

Forty years, beginning with the issuance of the construction permit, is the period for which a license to operate a nuclear power plant is issued.<sup>1</sup> At the end of the 40-year period the operator of a nuclear power plant must renew the license for another time period or apply for termination of the license and for authority to dismantle the facility and dispose of its components.<sup>2</sup> If, prior to the expiration of the operating license, technical, economic or other factors are unfavorable to continued operation of the plant, the operator may elect to apply for license termination and dismantling authority at that time. In addition, at the time of applying for a license to operate a nuclear power plant, the applicant must show that he possesses "or has reasonable assurance of obtaining the funds necessary to cover the estimated costs of permanently shutting the facility down and maintaining it in a safe condition."<sup>3</sup> These activities, termination of operation and plant dismantling, are generally referred to as "decommissioning."

NRC regulations do not require the applicant to submit decommissioning plans at the construction permit stage; consequently, no definite plan for the decommissioning of the station has been developed. At the end of the station's useful lifetime, the applicant will prepare a proposed decommissioning plan for review by the Nuclear Regulatory Commission. The plan will comply with NRC rules and regulations then in effect.

The decommissioning of reactors is not new. Since 1960, 5 licensed nuclear plants, 4 demonstration nuclear power plants, 6 licensed test reactors, 28 licensed research reactors and 22 licensed critical facilities have been or are in the process of being decommissioned.<sup>4</sup> The primary methods of decommissioning consist of mothballing, entombing, dismantling, or a combination of these three alternatives. The three primary methods are defined below in terms of the definitions provided in Regulatory Guide 1.86.<sup>5</sup>

Mothballing is the process of placing a facility in a non-operating status. The facility may be left intact except that all reactor fuel, radioactive fluids and non-fixed radioactive wastes such as ion exchange resins, contaminated scrap materials and contaminated chemicals are removed. The existing license is amended to a "possession only" status and continues in effect until residual radioactivity decays to levels acceptable for release to unrestricted access or until residual radioactivity is removed. The "possession only" license is a reactor facility license that permits a licensee to possess the facility but prohibits operation of the facility as a nuclear reactor.

Entombment consists of removing all fuel assemblies, radioactive fluids and wastes followed by the sealing of remaining radioactive material within a structure integral with the biological shield or by some other method to prevent unauthorized access into radiation areas. A program of inspection, facility radiation surveys and environmental sampling is required for a licensed facility that has been entombed.

Dismantling is defined as removal of all fuel, radioactive fluids and waste, and all radioactive structures. Surface contamination levels have been established in Regulatory Guide 1.86 (Table 1) which must be met prior to termination of the facility license. In addition to meeting the surface contamination levels, the acceptability of the presence of materials which have been made radioactive by neutron activation would be evaluated on a case-by-case basis prior to termination of the license. If the facility owner so desires, the remainder of the reactor facility may be dismantled and all vestiges removed and disposed of.

The mothballing alternative cost about \$2.45 million initially plus an annual maintenance and surveillance cost of \$167,000. If a 24 hour manned security force is not required (e.g., a site with continuing operations) the annual cost could be reduced to \$88,000. Translating these costs into unit cost of generating electricity, the 30-year

levelized unit cost\* would be about 0.04 mills/KWh and if a manned security force is not required, about 0.03 mills/KWh.<sup>7</sup>

The entombing alternative costs about \$7.58 million initially plus an annual maintenance and surveillance cost of \$58,000 for the duration of the entombment period. These costs, when translated to a 30-year levelized unit cost\* bases, amount to about 0.06 mills/KWh.

The dismantling alternative costs about \$26.3 million to remove the radioactive structures associated with NRC requirements for terminating a possession only license. An additional \$4.8 million would be needed to remove the non-radioactive structures (cooling towers, administrative buildings, etc.) to below grade. There are no annual costs associated with this alternative. When the dismantling costs are translated to a 30-year levelized unit cost\* bases, this amounts to about 0.18 mills/KWh.

Combinations of mothballing and delayed (about 100 years) dismantling have 30-year levelized unit costs that are about the same as the mothballing alternative costs. Likewise, the costs for the entombing-delayed dismantling combinations are about the same as the entombing cost. In both instances the annual maintenance cost for mothballing and entombing alternatives, when converted to a common basis, is sufficient to cover all the delayed dismantling cost for the mothballing alternative and about 80% for the entombing alternative.

The above costs are for a one-unit station. The savings associated with multi-unit stations is small, thus the unit cost (mills/KWh) is essentially the same for a single unit station or multi-unit station.

Studies of social and environmental effects of decommissioning large commercial power generating units have not identified any significant impacts.

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\*Based on a 1200 MWe generating unit beginning operation in 1985, a capacity factor of 60%, an escalation rate of 5%, and a discount rate of 10%.

Also, studies indicate that occupational radiation doses can be controlled to levels comparable to occupational doses experienced with operating reactors through the use of appropriate work procedures, shielding and remotely controlled equipment.

The applicant may retain the site for power generation purposes indefinitely after the useful life of the station. The degree of dismantlement would be determined by an economic and environmental study involving the value of the land and crop value versus the complete demolition and removal of the complex. In any event, the operation will be controlled by rules and regulations in effect at the time to protect the health and safety of the public.

## REFERENCES

1. U.S. Atomic Energy Commission, Rules and Regulations--Title 10--Atomic Energy--Part 50--"Licensing of Production and Utilization Facilities," §50-51, "Duration of license, renewal."
2. Ibid., §50-82, "Applications for Termination of Licenses."
3. Ibid., §50-33, "Contents of Applications; General Information."
4. "Decommissioning and Decontamination of Licensed Reactors Facilities and Demonstration Nuclear Power Plants" by P. B. Erickson and G. Lear, U.S. NRC, presented at Conference on Decontamination and Decommissioning in Idaho Falls, Idaho, August 19-21, 1975.
5. Regulatory Guide 1.86 "Termination of Operating Licenses for Nuclear Reactors."
6. "An Engineering Evaluation of Nuclear Power Reactor Decommissioning Alternatives" Atomic Industrial Forum, Inc., AIF/NESP-009.
7. "Decommissioning Nuclear Power Generating Units - An Economic Analysis" an NRC unpublished study.