

POTENTIAL ECONOMIC IMPACT OF 10 CFR 61  
ON THE COSTS OF  
NUCLEAR POWER PLANT DECOMMISSIONING

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ABSTRACT

The regulations described in 10 CFR 61 became effective in December 1983. These regulations will apply to the disposal of radioactive wastes that will result from decommissioning nuclear power plants. A reference boiling water reactor (BWR) was used as a model to estimate the potential impact of 10 CFR 61 upon the costs of decommissioning. The analyses indicate that these additional costs are related to waste disposal costs, special equipment needs, and additional contractor support costs. The potential cost impact of 10 CFR 61 is shown to amount to approximately 6% of the 1984 total decommissioning cost estimate for the reference BWR.

BACKGROUND AND HISTORICAL OVERVIEW

Numerous generic studies have been prepared to analyze programmatic plans and estimated costs of decommissioning nuclear power plants. Also, many site specific decommissioning cost estimates have been prepared to establish levels of monies to be recovered through electric rate bases. In all of these cases, it was a basic assumption that all radioactive decommissioning wastes (other than spent fuel) would be shipped to a licensed shallow-land disposal facility.

In December 1983, a new regulation, 10 CFR 61, became effective for the operations of shallow-land disposal sites. This regulation requires the classification of all radioactive wastes in terms of the specific physical, chemical, and radiological characteristics of the packaged wastes.

COST ESTIMATING MODEL

For purposes of approximating the potential impact of 10 CFR 61 upon the costs of decommissioning, the reference boiling water reactor plant developed in NUREG/CR-0672 was used.

Table I lists the major elements of prompt dismantlement decommissioning costs, in 1978 and 1984 dollars.

Cost Item	1978 Estimated Costs (\$ Millions)	1984 Estimated Costs (\$ Millions)
Disposal Costs	8.678	33.91
Staff Labor	17.561	28.62
Energy	3.519	5.74
Special Tools & Equipment	2.016	3.29
Misc. Supplies	1.859	3.05
Specialty Contractors	0.356	0.58
Nuclear Insurance	0.800	1.30
License Fees	0.051	0.08
Totals	34.840	76.57

TABLE I.

Summary of Estimated  
Costs for Prompt Dismantlement  
(Excluding the Effects of 10 CFR 61).

Except for the disposal costs, all other costs were updated from 1978 to 1984 using the U.S. Bureau of Labor Statistics data to determine the overall rate of inflation for the United States for the period. This cumulative inflation amounted to 63%.

Disposal costs were updated by separating the costs for burial from the total disposal costs. Disposal costs, other than burial costs, were updated using the 63% inflation factor. Burial costs were updated using the change in actual burial rates at the Barnwell, SC disposal site. The basic volumetric burial rates for low specific activity (LSA) wastes were \$2.10 per cu. ft. and \$21.50 per cu. ft., respectively for 1978 and 1984. These burial rates reflect an increase of over 900% for the five year period.

ANALYSES OF POTENTIAL COST  
IMPACT OF 10 CFR 61

Analyses of the potential cost impact of 10 CFR 61 indicate that four major cost elements of prompt dismantlement of a boiling water reactor are likely to be affected. These are, disposal costs, special tools and equipment, miscellaneous supplies, and specialty contractors.

Disposal Costs

The breakdown of activated and contaminated radioactive materials provided the basis for segregating these wastes in accordance with the radiological criteria of 10 CFR 61.55. Table II presents a listing of the approximate percentage of disposable radwaste for each of the specified regulatory classifications.

10 CFR 61 Classification	Approximate % of Total Waste Volume	NUREG/CR-0672 Waste Volume (ft <sup>3</sup> )
Class A	90	585,000
Class B	5	32,500
Class C	2	13,000
Class D	3	19,500
Totals	100	650,000

TABLE II.

Approximate Percentage of  
Waste Volumes per 10 CFR 61.

Except for those wastes classified as Class D, it was assumed that costs for packaging and transportation would not be substantially affected by the implementation of 10 CFR 61. These packaging and transportation costs are estimated at \$9,194,000 in 1984 dollars.

The radiological content of radwaste is the most dominant factor in determining burial costs. Table III shows the total estimated burial costs for the classified radwaste.

10 CFR 61 Classification	Waste Volume (ft <sup>3</sup> )	Unit Cost (\$/ft <sup>3</sup> )	Total Estimated Cost (\$)
Class A	585,000	21.50	\$12,576,000
Class B	32,500	45.50	1,479,000
Class C	13,000	170.00	2,210,000
Class D	19,500	605.00	11,798,000
Totals	650,000		\$28,063,000

TABLE III.

Total Estimated Burial Costs.

The unit cost for burial of Class D wastes is based upon the estimated costs for deep geological disposal. The analysis of disposal costs therefore suggests that the 1984 costs for disposal of radwastes from prompt dismantlement of the reference BWR plant, in compliance with 10 CFR 61, would be \$37,257,000.

#### Special Tools and Equipment

The radiological condition of the reference BWR, at shutdown, may not be reflective in nature to that experienced during normal operations. Historical plant operating data related to process waste characterization may not be adequate for proper waste classification after shutdown. Therefore, it was assumed that direct isotopic analysis of each waste package would provide the necessary data for radwaste classification and thus reflect the maximum potential cost impact on waste disposal. NUREG/CR-0672 established that approximately 13,000 containers would be required to ship decommissioning wastes to a shallow-land disposal site.

The equipment required to perform direct isotopic analysis of the radwaste would include a multi-channel analyzer (MCA), detector, sample analysis chamber, and miscellaneous attachments. The costs for this equipment was estimated to be approximately \$100,000. Equipment will be required to obtain sample materials from activated metal components, contaminated piping and plant equipment, and contaminated rubble from plant structures. This equipment was estimated to cost approximately

\$75,000. Thus the total estimated cost for special equipment is \$175,000.

#### Miscellaneous Supplies

The direct isotopic analysis classification program included the maintenance of a library of material samples until all radwaste has been shipped for disposal. This sample library will require certain packaging and shielding containers. It was anticipated that these items would be disposed of as radwaste. The estimated costs of these supplies, based upon an average cost per container of disposed radwaste of \$25, is \$325,000.

#### Specialty Contractors

The NUREG/CR-0672 cost estimate included only one staff member to be responsible for radwaste disposal. Thus, it was assumed that additional support for radwaste disposal to comply with 10 CFR 61 would be provided by an outside specialty contractor. These contractor services included one supervisor and two technicians for a period of 3.5 years. These specialty contractor costs were estimated to be \$532,000.

#### SUMMARY OF POTENTIAL COST IMPACT OF 10 CFR 61 ON PROMPT DISMANTLEMENT OF A REFERENCE BWR

Table IV shows the summary of the estimated potential impact of 10 CFR 61 upon the current costs of prompt dismantlement of a reference boiling water reactor.

Cost Item	NUREG-CR-0672 Estimated 1984 Costs (\$M)	10 CFR 61 Estimated 1984 Costs (\$M)	Cost Difference (\$M)
Disposal Costs	33.91	37.26	3.35
Staff Labor	28.62	28.62	-
Energy	5.74	5.74	-
Special Tools & Equipment	3.29	3.47	0.18
Misc. Supplies	3.05	3.38	0.33
Specialty Contractors	0.58	1.11	0.53
Nuclear Insurance	1.30	1.30	-
Licensee Fees	0.08	0.08	-
Totals	76.57	80.96	4.39

TABLE IV.

Summary of Potential  
Cost Impact of 10 CFR 61.

The data shows that the potential impact of 10 CFR 61 upon the costs of prompt dismantlement of a reference BWR is \$4,390,000; or approximately 6% of the total decommissioning costs.

#### CONCLUSIONS

Efforts to establish implementation programs to meet the requirements of 10 CFR 61 for radwaste disposal are still underway at operating nuclear power plants. The Nuclear Regulatory Commission published guidelines in May 1983 to assist plant operators in establishing these programs at each power reactor. This paper attempted to approximate the potential decommissioning cost impact of 10 CFR 61 for a generic