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U.S. NUCLEAR REGULATORY COMMISSION

# REGULATORY GUIDE

OFFICE OF STANDARDS DEVELOPMENT

## REGULATORY GUIDE 4.10

### IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF MATERIAL RESOURCES

#### A. INTRODUCTION

In accordance with 10 CFR Part 51, "Licensing and Regulatory Policy and Procedures for Environmental Protection," applicants are required to discuss any irreversible and irretreivable commitments of resources that would be involved in a proposed action, should it be implemented. The construction and operation of nuclear power stations involves commitments of such resources as water, fuel, and materials. This guide identifies a report on material resources that forms a basis acceptable to the NRC staff for required discussions of irreversible and irretreivable commitments of material resources involved in the construction of a 1000 MWe pressurized water reactor.

#### B. DISCUSSION

A discussion of material resources acceptable to the NRC staff is presently described in Section 4.3 of Regulatory Guide 4.2, "Preparation of Environmental Reports for Nuclear Power Plants." In addition, a discussion of such commitments relating to alternative energy sources is described in Section 9.3 and to alternative plant designs in Chapter 10 of the same guide. This guide describes numerical estimates useful in all such discussions. It also provides methods of computation that may be referenced in paragraph 6, "Supporting Details," of Chapter 10 of Regulatory Guide 4.2. This paragraph treats supporting details for the consideration of plant design alternatives; it does not, however, provide a basis for a discussion of resource commitments required for fossil plant alternatives.

Oak Ridge National Laboratory has published a report (Ref. 1) based on work carried out under contract with the Atomic Energy Commission's Directorates of Regulatory Standards and Licensing on the problem of

material resource commitment. This report gives a detailed estimate of the materials contained in a typical 1000-MWe pressurized water reactor power plant, where typical parameters are defined in terms of a referenced model plant (estimates of materials contained in boiling water reactors, high-temperature gas-cooled reactors, and cooling towers were not discussed in the report). Reference plant features, methods used in making the estimate, accuracy of the estimates, and the accounting system employed are discussed in the report. Estimated quantities of the composite materials and their constituents are summarized and presented in detail for each portion of the power plant.

The estimates given in Tables 1 and 2 of Reference 1 can be utilized to assess approximate maximum use (assuming no recycling) of material resources for plants of the type studied and for other sizes or types of plants by using appropriate scaling factors, where feasible, or other reasonable adjustment assumptions. For PWRs sufficiently similar to the model, a linear scale factor is acceptable.

It is desirable to augment the required discussion by comparing materials used at one station to total U.S. consumption, U.S. reserves, and world production, as reported in standard references such as Reference 2.

#### C. REGULATORY POSITION

Reference 1 forms a basis acceptable to the NRC staff for required discussions of irreversible and irretreivable commitments of material resources involved in plant construction.

\*Lines indicate substantive changes from previous issue.

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Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, to accommodate comments and to reflect new information or experience. This guide was revised as a result of substantive comments received from the public and additional staff review.

Comments should be sent to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Docketing and Service Section.

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Material quantity estimates should be judged by comparison with the reference plant model described in Section 2 of Reference 1, a typical PWR power plant rated at 1000 MWe net output with once-through cooling. Not all materials connected with the construction of a nuclear power station were included in the model. It should be especially noted that electric power transmission systems, switchyards, shipping casks, and fuel element and absorber materials were not included in the analysis as part of the reference plant model and may require separate discussion; a fuller description of systems excluded or included in the reference plant is given in Section 4 of Reference 1.

Appropriate modifications should be made for differences between the reference plant model and the plant design proposed by the applicant. Such deviations from the model plant and site definitions should be treated in a way consistent with Section 3 of Reference 1, using the standardized accounting system described in Appendices A, B, and D of the report and identifying the incremental amount of materials involved. Assumed basic constituents of composite materials should be taken from Appendix C of Reference 1.

The numerical estimates of basic constituent material resource commitments given in Table 1 for the 1000-MWe PWR model plant are acceptable to the NRC staff.

#### D. IMPLEMENTATION

The guidance presented herein on the discussion of irreversible and irretrievable commitments of material

resources required by 10 CFR Part 51 may be used by any person submitting an application for a license to construct a nuclear power station. Other effective means of providing the required discussion of the commitment of material resources may also be used.

Table 1  
Numerical Estimates of Material Resource  
Commitments for 1000 MWe PWR Model Plant

Material	Total estimated quantity (metric tons, except where noted)
Aluminum	18
Antimony	Negligible
Asbestos	138
Chromium	415
Copper	726
Iron	34,662
Lead	47
Manganese	467
Molybdenum	164
Nickel	484
Silver	<1
Tin	2
Titanium	Negligible
Zinc	2
Magnesia	783
Cement	30,133
Aggregate (coarse)	90,361
Aggregate (fine)	45,855
Wood	4.8 x 10 <sup>6</sup> (board feet)

#### REFERENCES

1. R.H. Bryan and I.T. Dudley, "Estimated Quantities of Materials Contained in a 1000-MW(e) PWR Plant," ORNL-TM-4515, June 1974. Copies may be obtained from the Oak Ridge National Laboratory or from the ERDA Technical Information Center, P.O. Box E, Oak Ridge, Tennessee 37830.

2. U.S. Bureau of Mines, *Mineral Facts and Problems and Minerals Yearbook*; copies may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (published yearly).

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