

ASSESSING ECONOMIC CONSEQUENCES OF RADIATION ACCIDENTS

by

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SUMMARY

BNL--39915

DE87 012485

Introduction

The objectives of this project were:

- To review the literature on economic consequences of accidents to determine the availability of assessment methods and data and their applicability to the high-level radioactive waste (HLW) disposal system before closure;
- To determine needs for expansion, revision, or adaptation of methods and data for modeling economic consequences of accidents of the scale projected for the disposal system; and
- To gather data that might be useful for the needed revisions.

Description of Work

Detailed reviews and critical evaluations of the literature and methods for assessing economic consequences of radiation accidents were completed for all applicable assessment codes including the reactor accident assessment codes CRAC2¹ and MELCOR², the HLW transport accident code RADTRAN III³, the economic impact assessment codes ECONO-MARC⁴, RIMS-II⁵, and MASTER⁶, and the decontamination and health cost estimation codes DECON⁷, HECOM⁸. In addition, the literature on accident consequences, particularly those from the Three Mile Island reactor accident and chemical spills requiring evacuation, was reviewed to determine the availability of specific data on measured economic consequences. Emphasis was on accidents severe

MASTER

enough to require evacuation but smaller than those normally modeled for reactor accidents.

Results

Potential economic consequences of radiation accidents at a HLW repository are identified and characterized in Table 1. In general, existing accident assessment codes (CRAC2, MELCOR, ECONO-HARC, RADTRAN-III) are capable of assessing most of these consequences. Except for RADTRAN-III, however, significant additions and revisions of parameters will be required to make them responsive to the small releases projected for accidents in the HLW waste disposal system. DECON and HECOM can estimate decontamination and health costs with few changes, but they are specifically designed to use contamination and health effects estimates from CRAC2 and MELCOR.

RIMS II and MASTER are designed to assess regional and national economic consequences of accident-induced economic changes. RIMS II uses regional input-output relationships to convert changes in final demands into regional changes in economic output, earnings, and employment. Effects of actual contamination or fears of contamination can be included as changes in final demand. MASTER estimates economic consequences by comparing alternative forecasts made from a set of econometric equations driven by national variables and regional construction and energy prices. For accidents of the size projected in the HLW waste disposal system, the changes in these variables are too small to be assessed with the MASTER model.

The most important deficiency of the models available is that they make no attempt to address "perceptually mediated" responses -- those responses or consequences related to fears rather than actual contamination

or risk of contamination. These consequences are not directly related to the kinds of physical phenomena normally modeled such as radiation releases, environmental dispersion, concentrations, pathways to man, etc. Instead, they are linked to the level of knowledge of the population and to opinion-influencing reports from activists, officials, and the mass media. Most assessment codes specifically exclude these effects for lack of data or modeling methods. Although these causal relationships are not easily modeled, data are available indicating their magnitude in a few specific cases.

Another deficiency of existing economic consequence models is that they estimate net societal costs without regard for local or regional distributions and they ignore costs that are offset by compensating benefits. While societal costs provide important information for policy analysis and risk assessment, it is the distribution of those costs and benefits that the affected groups care about and that should be a central issue in policy formation and analysis.

Most literature reviewed on radiation and chemical accidents lacks data on economic costs. Generally the data available are for initial impacts and short-term costs. Little is reported on long-term economic impacts and there may, in fact, not be many. The largest initial costs are from evacuation expenses and loss of income. In many cases evacuation was voluntary and related to perceived rather than real risks. Long-term offsite economic consequences in the Three Mile Island accident were from litigation and insurance costs. No data are reported for long-term consequences of chemical accidents.

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Table 1. Potential economic consequences of a MLW disposal system

Economic impact	Onsite	Offsite directly impacted area*	Indirectly impacted area
Individual			
Income		Lost wages and salaries	Lost wages and salaries; increased income from increased demand of services
Expenditures		Uncovered evacuation and relocation costs	Property devaluation due to perception
Wealth		Property damage and devaluation	
Employment	Loss of employment	Reduction in employment	Reduction in employment in sectors affected by public perception; increase in employment in service sectors
Business/Industry			
Revenue		Loss of sales due to demand and production disruption	Loss of sales due to demand disruptions caused by public perception
Expenditures		Disposal of contaminated inventories; uncovered evacuation costs	Increased costs in MLW management at nuclear power plants
Value of firm/plant		Property losses due to contamination of capital stock, inventories, and inventories; devaluation due to temporary or permanent disruption of barriers	
Government			
Expenditures	Repair costs; decontamination/clean-up costs; worker health effects costs; worker medical care costs; litigation costs	Emergency response costs; evacuation costs; monitoring costs; temporary and permanent relocation costs; interdiction costs; decontamination program costs; public medical care costs; public health effect costs; litigation costs	Costs in regulatory and programmatic changes
Revenue		Loss of revenue from public facility/infrastructure; loss of taxes	

*Area within which post-accident public protection measures are implemented.