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TECHNICAL INFORMATION
SERVICE

FREEDOM OF INFORMATION
ACT REQUEST
FOIA-92-171
Rec'd 4-1-92

April 1, 1992

Mr. Donnie Grimsley
Nuclear Regulatory Commission
Washington, DC 20555

fax=301-492-4874

Dear Mr. Grimsley:

I would like to obtain a copy of NUREG-CR-5148. I understand that this report has not yet been released.

Would you please send me a copy under the provisions of the Freedom of Information Act?

The complete details about the report are:

NUREG-CR-5148
PNL-6350
"Property related costs of radiological accidents"
authors: JJ Tawil and FC Bold
Pacific Northwest Lab, Richland, WA

Please ship the report to my attention at:

Technical Information Service
Krannert Library, Rm 209
Purdue University
West Lafayette, IN 47907-1340

Thank you very much.

Yours sincerely,

Suzanne Ward

Suzanne Ward
Manager

U.S. NUCLEAR REGULATORY COMMISSION

RESPONSE TO FREEDOM OF INFORMATION ACT (FOIA) REQUEST

NRC FOIA REQUEST NUMBER(S): FOIA — 92-171

RESPONSE TYPE: XXX FINAL ☐ PARTIAL

DATE: APR 20 1992

DOCKET NUMBER(S) *(If applicable)*

REQUESTER: Suzanne Ward

PART I.—AGENCY RECORDS RELEASED OR NOT LOCATED *(See checked boxes)*

	No agency records subject to the request have been located
	No additional agency records subject to the request have been located.
	Requested records are available through another public distribution program. See Comments section.
	Agency records subject to the request that are identified in Appendix(es) ______ are already available for public inspection and copying at the NRC Public Document Room, 2120 L Street, N.W., Washington, DC.
X	Agency records subject to the request that are identified in Appendix(es) below are being made available for public inspection and copying at the NRC Public Document Room, 2120 L Street, N.W., Washington, DC, in a folder under this FOIA number.
	The nonproprietary version of the proposal(s) that you agreed to accept in a telephone conversation with a member of my staff is now being made available for public inspection and copying at the NRC Public Document Room, 2120 L Street, N.W., Washington, DC, in a folder under this FOIA number.
	Agency records subject to the request that are identified in Appendix(es) ______ may be inspected and copied at the NRC Local Public Document Room identified in the Comments section.
X	Enclosed is information on how you may obtain access to and the charges for copying records located at the NRC Public Document Room, 2120 L Street, N.W., Washington, DC
X	Agency records subject to the request are enclosed (First 100 pages you are entitled to free of charge)
	Records subject to the request have been referred to another Federal agency(ies) for review and direct response to you.
X	Fees NONE
	☐ You will be billed by the NRC for fees totaling $ ______.
	☐ You will receive a refund from the NRC in the amount of $ ______
	In view of NRC's response to this request, no further action is being taken on appeal letter dated ______ No ______

PART II. A—INFORMATION WITHHELD FROM PUBLIC DISCLOSURE

	Certain information in the requested records is being withheld from public disclosure pursuant to the exemptions described in and for the reasons stated in Part II, B, C, and D. Any released portions of the documents for which only part of the record is being withheld are being made available for public inspection and copying in the NRC Public Document Room, 2120 L Street, N.W., Washington, DC in a folder under this FOIA number.

COMMENTS

A copy of NUREG/CR-5148, PNL-6350, "Property-Related Costs of Radiological Accidents" dated 2/90 is being placed in the NRC's Public Document Room. A copy of the first 100 pages of this document is enclosed, for which you are entitled to free of charge.

SIGNATURE, DIRECTOR, DIVISION OF FREEDOM OF INFORMATION AND PUBLICATIONS SERVICES

Donnie H. Grimsley

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PDR FOIA
WARD92-171 PDR

NUREG/CR-5148
PNL-6350

PROPERTY-RELATED COSTS OF RADIOLOGICAL ACCIDENTS

J. J. Tawil
F. C. Bold

February 1990

Prepared for
Division of Safety Review and Oversight
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
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Pacific Northwest Laboratory
Richland, Washington 99352

ABSTRACT

This report provides documentation for a database and a set of computer programs used to evaluate the property-related costs of a severe accident at a nuclear power plant. The database, which was compiled largely through interviews with knowledgeable persons both in the public and private sectors, consists of the costs, physical inputs, rates and contaminant removal efficiencies of a large number of decontamination procedures. The computer programs utilize this database along with information specific to the contaminated site. The output of the program consists of detailed information that includes the least costly method for effectively decontaminating each surface at the site, various types of property losses associated with the contamination, the time at which each subarea within the site should be decontaminated to minimize these property losses, the collective dose to radiation workers, the costs for surveying and monitoring activities, the costs to dispose of the radiological waste generated during cleanup, and the quantity of various types of labor and equipment necessary to carry out the indicated decontamination program. The capabilities of these computer codes and the associated database are demonstrated with a sequence of hypothetical accident scenarios at the Indian Point reactor site in New York State.

EXECUTIVE SUMMARY

This report is an extensive revision of an earlier report, *Off-Site Consequences of Radiological Accidents: Methods, Costs, and Schedules for Decontamination*, (NUREG/CR-3413 1985). The earlier report, produced by the Pacific Northwest Laboratory (PNL) for the United States Nuclear Regulatory Commission (NRC), was motivated by the accident at Three Mile Island, which focused increased attention by the public and by regulators on the off-site consequences of severe radiological accidents. Since that report was published, the much more serious Chernobyl accident took place in April, 1986. This accident, near Kiev in the Soviet Union, has had international repercussions and has raised interest in reactor accident consequences and site restoration issues.

One of the major findings of PNL's earlier research on radiological accident consequences was that decontamination costs and property losses resulting from a severe accident could easily run into the billions of dollars, accounting for the majority of the off-site accident costs. Prior to PNL's research into these issues, only very limited means were available for assessing these costs. In addition, these earlier estimates made little use of site-specific information, and it seemed likely that decontamination costs and property losses should be sensitive to site-specific factors, such as the land use of the affected property and its value. A final concern was that the evaluation of the decontamination costs was based on approximations of the cost to decontaminate just a few types of property.

In view of the apparent shortcomings of these evaluation techniques and the major contribution of decontamination costs and property losses to accident risk, PNL's original research effort was undertaken. At the beginning of this effort, a search was conducted to determine the type of information that was available on decontamination procedures. It soon became clear that information on well-documented procedures for decontaminating various materials was very limited. Some tests had been done with respect to active products from nuclear weapons, but these results were not completely applicable, due to substantial differences in the nature of the contaminants. There were also documented procedures for using very powerful, but also very costly, techniques to decontaminate laboratory facilities and other small areas. However, because of the relatively high costs of these procedures and the specialized equipment used, they would be totally inappropriate for restoring an area of several hundred or several thousand square miles.

From these findings, several objectives were formulated to guide the earlier study. These were:

- to collect information from both published and unpublished sources relating to decontamination procedures and to identify the circumstances favorable to the application of each.

- to develop sufficient information to describe the relationship between the physical inputs and the output of a production technique. This permits the types of manpower and equipment required to carry out the decontamination efforts to be identified. Additionally, acquiring the costs of these inputs allows the cost of applying each of the procedures to be specified.

- to develop a methodology that uses data commonly available by political subdivision and that facilitates mapping these data to the area elements of any type of accident grid. Without such a methodology, the difficulty of adapting published data to a useful analytical framework can be a major disincentive to using site-specific information.

- to develop a computer program to evaluate decontamination and other property-related costs attributable to the accident. The program was also to have the capability to consider and evaluate a variety of cost-reducing site restoration strategies.

In meeting these objectives, PNL developed three major resources to evaluate off-site accident consequences and to develop site-restoration strategies. These were: 1) a Reference Database; 2) a set of procedures and analytical tools for preparing a Site Database; and 3) a computer program, called DECON, that would utilize the information in the two databases to produce the desired analyses.

The Reference Database contains information on applying decontamination methods to surfaces. Currently, 457 methods have been defined for use on 30 different surfaces, of which about 100 methods and 8 surfaces have been added since our original report. For each method, the Reference Database includes the following information:

- the cost of applying each method

- the efficiency with which the exposure level to an individual is reduced

- the rate at which the method is applied
- the quantity and type of labor required
- the quantity and type of equipment required
- the quantity and type of major materials required
- the costs for labor, equipment, fuel and materials
- the quantity of contaminated material requiring disposal

All of these data are contained in computer files. In addition, the sources from whom the information was obtained have been compiled and are included in Appendix C to facilitate updating of this database.

The second resource consists of procedures and analytical tools for preparing a Site Database. This resource facilitates the use of site-specific information. Two computer programs are available for this purpose. One, called *SD-INPUT*, is user-friendly; it produces menus and prompts the user for all of the site data required to conduct an analysis. However, this program will not map data from, say, political subdivisions to grid elements. SD-INPUT is particularly useful for smaller accidents which do not span several townships or counties.

The second program, called *IR-GRID*, is less user-friendly than SD-INPUT. However, it does allow the user to rely primarily on published data sources, since it will map data to grid elements. For this reason, IR-GRID may be more useful than SD-INPUT if the radiological accident extends over several townships or counties, thus facilitating the use of published data. IR-GRID also produces estimates of evacuation costs and temporary and permanent relocation costs, which SD-INPUT does not.

Both SD-INPUT and IR-GRID assemble the site-specific data into a form that can be used directly by DECON.

Other software tools are also provided as a part of the Site Database resource. These include programs for 1) plotting isopleths on a map of the accident site; 2) computing the dose at almost any point within the accident site; and 3) generating a set of dose-related information required by DECON for accidents in which radioactive decay and weathering can affect site restoration decisions.

The third resource is called *DECON*, the computer program for actually performing the site restoration analysis. This program has been designed to facilitate the planning of site restoration activities as well as to provide estimates of decontamination costs and other property losses. The structure and features of DECON are described in this report, and its capabilities are demonstrated by applying it to several hypothetical radiological accidents at the Indian Point site in New York State.

Among the information produced by DECON are the following:

- the cost-effective decontamination method used on each surface
- the rate at which the decontamination method is applied
- the types of labor used by the method
- the types of equipment used by the method
- the major materials required
- the efficiency of the method in reducing inhalation or external dose
- the collective dose to radiation workers
- the dose commitment from exposure to decontaminated surfaces
- the year to decontaminate each grid element in order to minimize total property losses
- potential social benefits from a government buy-out of contaminated property.

The capabilities of DECON include evaluating strategies 1) to prohibit specific operations on selected surfaces, 2) to require prespecified methods on selected surfaces, 3) to evaluate the tradeoff between cleanup standards and other variables, such as latent cancer fatalities, decontamination costs, property losses, radiological waste generated, etc., 4) to transport radiological wastes to disposal areas at different distances from the site or to an on-site disposal pit, 5) to impose different cleanup standards and/or restrictions on subareas within the accident site, and 6) to impose different cleanup standards on different surfaces according to the expected level of health risk posed by the surface. These capabilities can be used alone or in combination to explore a virtually unlimited number of cleanup strategies.

ACKNOWLEDGMENTS

Many individuals made important contributions to the original report, and we again acknowledge their invaluable assistance without mentioning them by name. For this revision, the following people were especially helpful. R.L. Darwin and R.W. Schultz gathered and systematically organized the data for the Indian Point case study. This was a substantial effort that they efficiently organized and executed. D.L. Strenge provided support on matters and questions relating to health physics.

We also thank the large number of individuals whom we contacted for the new information in this volume. They were highly cooperative and generous with their information and expertise.

We thank Marlene Hale and her word processing crew for their work on this volume, and Judy Danko who coordinated the typing. Also to be thanked is Wendy Owen for her assistance with intermediate drafts.

In the spirit of tradition, we, the authors accept full responsibility for the errors that remain, as well as the new ones that have been introduced since the original version.

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APPENDIX TABLES