FORECAST: Regulatory Effects Cost Analysis Software Manual

Version 4.1

RECEIVED

AUG 9 2 1996

OSTI

Prepared by
B. Lopez, F. W. Sciacca

Science and Engineering Associates, Inc.

Prepared for
U.S. Nuclear Regulatory Commission

ds
DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

MASTER

AVAILABILITY NOTICE

Availability of Reference Materials Cited in NRC Publications

Most documents cited in NRC publications will be available from one of the following sources:

1. The NRC Public Document Room, 2120 L Street, NW., Lower Level, Washington, DC 20555-0001
2. The Superintendent of Documents, U.S. Government Printing Office, P. O. Box 37082, Washington, DC 20402-9328
3. The National Technical Information Service, Springfield, VA 22161-0002

Although the listing that follows represents the majority of documents cited in NRC publications, it is not intended to be exhaustive.

Referenced documents available for inspection and copying for a fee from the NRC Public Document Room include NRC correspondence and internal NRC memoranda; NRC bulletins, circulars, information notices, inspection and investigation notices; licensee event reports; vendor reports and correspondence; Commission papers; and applicant and licensee documents and correspondence.

The following documents in the NUREG series are available for purchase from the Government Printing Office: formal NRC staff and contractor reports, NRC-sponsored conference proceedings, international agreement reports, grantee reports, and NRC booklets and brochures. Also available are regulatory guides, NRC regulations in the *Code of Federal Regulations*, and *Nuclear Regulatory Commission Issuances*.

Documents available from the National Technical Information Service include NUREG-series reports and technical reports prepared by other Federal agencies and reports prepared by the Atomic Energy Commission, forerunner agency to the Nuclear Regulatory Commission.

Documents available from public and special technical libraries include all open literature items, such as books, journal articles, and transactions. *Federal Register* notices, Federal and State legislation, and congressional reports can usually be obtained from these libraries.

Documents such as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings are available for purchase from the organization sponsoring the publication cited.

Single copies of NRC draft reports are available free, to the extent of supply, upon written request to the Office of Administration, Distribution and Mail Services Section, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at the NRC Library, Two White Flint North, 11545 Rockville Pike, Rockville, MD 20852-2738, for use by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from the American National Standards Institute, 1430 Broadway, New York, NY 10018-3308.

DISCLAIMER NOTICE

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any third party's use, or the results of such use, of any information, apparatus, product, or process disclosed in this report, or represents that its use by such third party would not infringe privately owned rights.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

FORECAST: Regulatory Effects Cost Analysis Software Manual

Version 4.1

Manuscript Completed: June 1996
Date Published: July 1996

Prepared by
B. Lopez, F. W. Sciacca

Science and Engineering Associates, Inc.
P.O. Box 3722
Albuquerque, NM 87190

Under Subcontract to
S. Cohen and Associates
1355 Beverly Road, Suite 250
McLean, VA 22101

S. Feld, NRC Project Manager

Prepared for
Division of Regulatory Applications
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
NRC FIN L1946

Abstract

The FORECAST program was developed to facilitate the preparation of the value-impact portion of NRC regulatory analyses. This PC program integrates the major cost and benefit considerations that may result from a proposed regulatory change. FORECAST automates much of the calculations typically needed in a regulatory analysis and thus reduces the time and labor required to perform these analyses. More importantly, its integrated and consistent treatment of the different value-impact considerations should help assure comprehensiveness, uniformity, and accuracy in the preparation of NRC regulatory analyses. The Current FORECAST Version 4.1 has been upgraded from the previous version and now includes an uncertainty package, an automatic cost escalation package, and other improvements. In addition, it now explicitly addresses public health impacts, occupational health impacts, onsite property damage, and government costs. Thus, FORECAST Version 4.1 can treat all attributes normally quantified in a regulatory analysis.

Forecast

Regulatory Effects Cost Analysis Software

Version 4.1

The U.S. Nuclear Regulatory Commission (NRC) and Science and Engineering Associates, Inc., provide this manual and accompanying software "as is", without warranty of any kind, either expressed or implied. Both the NRC and Science and Engineering Associates, Inc., reserve the right to make revisions and/or changes to the product(s) and/or the program(s) described herein at any time without obligation to notify anyone of such revisions or changes.

Table of Contents

Abstract	iii
Acknowledgments.....	vii
About the Manual	vii
List of Figures.....	ix
Chapter 1. Introduction	1
About Forecast.....	6
Chapter 2. Using <i>Forecast</i>	9
Requirements	9
Getting Started	9
Running the Forecast Software.....	10
How to Use Forecast.....	11
Attribute Definitions	12
Cost Categories	15
Using the Uncertainty Distribution Dialog	17
Chapter 3. Physical Modification Case Study	19
Chapter 4. <i>Forecast</i> Menus.....	55
Control Menu.....	56
Chapter 5. File Menu	57
New	58
Open	59
Save	60
Save As	60
Print	61
Exit	62
Chapter 6. Edit Menu.....	63
Value Factors	64
Discount Rate.....	66
Remaining Life	67
Labor Wages	68
Cost Factor	69
Recalculate Automatically	70
Recalculate Now	71
Set Uncertainties to Point Estimates.....	72
Chapter 7. Value Menu	73
Accident/Event Frequency.....	74
Averted Exposures	75
Public Health (Accident).....	75
Public Health (Routine)	76

Occupational Health (Accident).....	77
Occupational Health (Routine)	79
Chapter 8. System Menu.....	81
New System	82
Environment.....	83
Account.....	85
Account Information.....	86
Costs.....	87
Factors.....	89
Chapter 9. Impacts Menu.....	93
Shutdown Required.....	94
Unscheduled Reactor Shutdown	95
Reactor Defiling/Refueling.....	96
Replacement Energy	97
Waste Disposal.....	99
Licensee Procedural/Administrative/Analytical Costs	100
Licensee Tech Spec Change Costs.....	101
Licensee Writing Procedures Costs	102
Licensee Staff Training Costs.....	103
Licensee Recordkeeping Costs	104
Licensee Other Technical Costs.....	105
NRC Procedural/Administrative/ Analytical Costs	106
NRC Tech Spec Change Costs	107
NRC Implementation Costs	108
NRC Other Technical Costs.....	109
Licensee Recurring Costs	110
NRC Recurring Costs	111
Averted Onsite Property Costs.....	112
Averted Offsite Non-Health Costs.....	115
Other Government	116
Chapter 10. Window Menu.....	117
Attributes Summary	118
System Information.....	119
System Costs.....	120
Calculated Costs.....	121
Histogram.....	122
Net Value	123
Chapter 11. Help Menu.....	125
About Forecast.....	126
Appendix A. Sensitivity and Uncertainty	127
Appendix B. Using Windows™	131

Acknowledgments

Forecast was developed by Science and Engineering Associates, Inc. (SEA) for the U.S. Nuclear Regulatory Commission. Members of the Regulation Development Branch who sponsored and guided this project were Sidney Feld, Clark Prichard, and Brian Richter. The guidance they provided and their review and trial use of the preliminary versions of the code contributed significantly toward making the code a practical and effective tool for NRC use.

The SEA design team included Frank Sciacca, Barbara Lopez, Nancy Ruiz, and Bob Walsh. The software development in this version was led by Barbara Lopez of SEA. The manual was updated and revised by Frank Sciacca and Barbara Lopez.

About the Manual

Chapter 1 provides an overview of the software and its use. Chapter 2 includes information about computer system requirements and system configurations. Chapter 3 guides you through a case study analyzing the cost impact of a retrofit at three power plants. The remaining chapters describe the *Forecast* menus in the order in which they appear on the menu bar.

Appendix A provides information about the uncertainty methodology used in all of the *Forecast* calculations. Appendix B contains information about the Windows environment including terms, key combinations, mouse actions, etc.

Notational Conventions

To minimize confusion, this manual uses the following conventions for terms and labels. The notational conventions are as follows:

input	Input that the user must provide is shown in bold type and must be entered exactly as shown.
--------------	--

<i>Menu Name</i>	Text shown in italic type indicates an item that can be found on the screen.
------------------	--

KEY+NAMES	Special combinations of key strokes appear in capital letters.
-----------	--

List of Figures

1. Uncertainty Distribution Dialog Box.....	17
2. File New Dialog Box	22
3. Remaining Life Dialog Box.....	23
4. Accident/Event Frequency Dialog Box	24
5. Averted Exposures Dialog Box	25
6. Environment Dialog Box	27
7. Major Removal/Replacement Activity Dialog Box.....	27
8. Account Dialog Box	28
9. Account Information Dialog Box	29
10. EEDB Costs Dialog Box.....	30
11. Factors Dialog Box	31
12. General Cost Factor Help Dialog Box.....	32
13. Radiation Help Dialog Box.....	32
14. System Window	34
15. Unscheduled Reactor Shutdown Dialog Box	36
16. Reactor Defueling/Refueling Dialog Box.....	37
17. Replacement Energy Dialog Box.....	38
18. Waste Disposal Dialog Box	40
19. Licensee Tech Spec Change Costs Dialog Box.....	41
20. NRC Tech Spec Change Costs Dialog Box.....	42
21. NRC Other Technical Costs Dialog Box.....	43
22. Licensee Recurring Costs Dialog Box.....	44
23. NRC Recurring Costs Dialog Box.....	45
24. Averted Onsite Property Costs Dialog Box	46
25. Averted Offsite Non-Health Costs Dialog Box	47
26. Other Government Costs Dialog Box	48
27. Save As Dialog Box.....	49
28. Attributes Summary Window	50
29. Net Value Distribution.....	51
30. Calculated Costs Window.....	52
31. Print Dialog Box	53
32. New Dialog Box	58
33. Open Dialog Box	59
34. Save/Save As Dialog Box.....	60
35. Print Dialog Box	61
36. Value Factors Dialog Box.....	64
37. Uncertainty Distribution Dialog Box.....	64

38. Discount Rate Dialog Box	66
39. Remaining Life Dialog Box.....	67
40. Labor Wages Dialog Box.....	68
41. Costs Factors Dialog Box	69
42. Set Uncertainties to Point Estimates Warning Box	72
43. Accident/Event Frequency Dialog Box	74
44. Averted Exposures Dialog Box	75
45. Environment Dialog Box	83
46. Learning Curve Factors Dialog Box	84
47. Account Dialog Box	85
48. Account Information Dialog Box	86
49. EEDB Costs Dialog Box.....	88
50. Factors Dialog Box	89
51. General Cost Factor Help Dialog Box	90
52. Radiation Help Dialog Box.....	91
53. Unscheduled Reactor Shutdown Dialog Box	95
54. Reactor Defueling/Refueling Dialog Box.....	96
55. Replacement Energy Dialog Box.....	97
56. Waste Disposal Dialog Box.....	99
57. Licensee Tech Spec Change Costs Dialog Box.....	101
58. Licensee Writing Procedures Costs Dialog Box.....	102
59. Licensee Staff Training Costs Dialog Box	103
60. Licensee Recordkeeping Costs Dialog Box.....	104
61. Licensee Other Technical Costs Dialog Box	105
62. NRC Tech Spec Change Costs Dialog Box.....	107
63. NRC Implementation Costs Dialog Box	108
64. NRC Other Technical Costs Dialog Box	109
65. Licensee Recurring Costs Dialog Box.....	110
66. NRC Recurring Costs Dialog Box.....	111
67. Averted Onsite Property Costs.....	112
68. Averted Offsite Non- Health Costs Dialog Box	115
69. Other Government Dialog Box.....	116
70. Attributes Summary Window	118
71. System Information Window.....	119
72. System Costs Window	120
73. Calculated Costs Window.....	121
74. Histogram Window.....	122
75. Net Value Window	123

Chapter 1. Introduction

The NRC has developed a generic estimating methodology for the quantification of values and impacts applicable to the evaluation of new or revised regulatory requirements. This methodology has been developed to aid NRC analysts in preparing Regulatory Impact Analyses (RIAs). These generic methods can be useful in quantifying values and impacts to both industry and the NRC.

The *Forecast* code was developed to facilitate the use of the generic estimation methodology by NRC. This PC-based program operates in the Windows™ environment, and Version 4.1 is compatible with Windows™ 3.1 and Windows™ 95. Prior versions of *Forecast* integrated the major cost considerations that are applicable to most nuclear plant physical modifications and/or procedural (administrative and analytical) changes associated with regulatory changes.

Version 4.1 of *Forecast* represents a significant expansion of the code's capabilities. Whereas earlier versions provided a tool to assist analysts in developing estimates of cost impacts associated with regulatory changes, this version has been expanded to quantify all attributes typically assessed in regulatory analyses, and to estimate the net values associated with the proposed action. Further, release 4.1 of *Forecast* also provides a tool that analysts can use to treat uncertainties in a mathematically correct and consistent manner.

The specific improvements and additions made to *Forecast* Version 4.1 relative to prior releases are as follows:

- Treatment of all attributes typically quantified in NRC regulatory analyses
- Display of net total regulatory impact values
- Treatment of license renewal effects
- Treatment of replacement energy costs by reactor classes as well as by individual reactors
- Treatment of uncertainties in individual attributes and overall net value
- Compatibility with Windows™ 3.1 and Windows™ 95
- Updating of EEDB and replacement energy cost databases

- Enhanced file-save features

Valuation of Regulatory Analysis Attributes

The regulatory analysis attributes (values and impacts) that can now be quantified in *Forecast* include the following:

Values

Public health (accident)
Public health (routine)
Occupational health (accident)
Occupational health (routine)

Impacts

Onsite property
Offsite Non-Health
Industry implementation
Industry operation
NRC implementation
NRC operation
Other government

Guidance for the evaluation and quantification of these parameters was drawn from the most recent version of the draft Regulatory Analysis Technical Evaluation Handbook (NUREG/CR-3568). The code also calculates the Net Value (sum of values and impacts). For each attribute, and for the Net Value, the 5th percentile, mean value, and 95th percentile are calculated and displayed.

Treatment of License Renewal Effects

Forecast has been modified to allow a consistent treatment of nuclear plant license renewal effects. License renewal of nuclear power plants is an important consideration in evaluating regulatory change impacts. Essentially all values and impacts typically quantified in a regulatory analysis are effected by license renewal. Some of the attributes are affected essentially linearly with years of plant operation or remaining plant life. For other attributes, however, consideration of the potential for an additional 20 years of plant operation allowed with license renewal translates into a step change in the value or impact.

Replacement Energy Costs by Reactor Classes

Many regulatory changes affect classes of reactors, e.g. all BWRs or all PWRs. *Forecast* has been expanded to provide replacement energy costs on a reactor class basis. Specifically, the code has been modified to estimate the replacement energy cost impacts

on the following classes of reactors: all BWRs, all PWRs, all BWRs <500 MWe, BWRs >500 MWe but <1000 MWe, all BWRs > 1000 MWe, all PWRs <500 MWe, all PWRs >500 MWe but <1000 MWe, and all PWRs > 1000 MWe. The most recent information available regarding replacement energy costs for nuclear electricity-generating units in the United States was used. Users can now select the class of reactors of interest. The option of determining costs on a reactor specific basis has also been retained.

Treatment of Uncertainties

NRC's Regulatory Analysis Guidelines (NUREG/BR-0058, Rev. 2, draft-August, 1993) notes that uncertainties are an important element to consider in regulatory analyses. Uncertainties and sensitivities should be assessed whenever the values of key attributes can vary widely. Specific mathematical routines have been developed and implemented into *Forecast* to allow users to specify the type and magnitude of uncertainties associated with key parameters, and to combine the uncertainty distributions using convolution integral techniques. The solution routines employed are much faster than alternative approaches such as Monte Carlo sampling of parameter distributions. The appendix to this manual provides a discussion of the important elements of evaluating uncertainties, and of sensitivity and uncertainty analyses.

WindowsTM Compliance

Previous versions of *Forecast* were developed for older versions of WindowsTM. This version of *Forecast* was tested for WindowsTM 3.1 and WindowsTM 95 compliance and was modified to assure that the program is fully functional within those versions of WindowsTM.

Provision for Saving User-edited Files

Forecast users can edit many variables and parameters used in estimating values and impacts associated with proposed regulatory changes. However, earlier versions did not save edited parameters for future use. *Forecast* has been modified so that user input made through the Edit menu options is stored in the cost analysis file.

Updated EEDB and Replacement Energy Cost Databases

Forecast currently includes the Cost Factor Data Base (CFDB) which contains the complete Energy Economic Data Base (EEDB), supplemented with default dose rates and ranges, and labor productivity factors for all systems. In addition, the code has plant-specific data regarding replacement energy costs. The EEDB data files in *Forecast* represent nuclear plant greenfield (new plant) construction costs as of 1989. However, the code now automatically updates all cost figures drawn from the EEDB and displays them in current year dollars. The updating is based on appropriate government cost indices for the commodities of interest. Separate indices have been developed for utility labor, contractor labor, materials and equipment. Similarly, the most recent information

available regarding replacement energy costs for nuclear electricity-generating units in the United States has been incorporated into *Forecast's* data bases.

Forecast was originally designed to assist in the evaluation of regulatory impacts affecting nuclear power plants. For example, the EEDB and CFDB are based on nuclear power plant characteristics, replacement energy costs relate specifically to these plants, and the models for labor productivity were specifically developed for application to nuclear power plants. However, *Forecast* is sufficiently flexible that it can be useful for evaluating regulatory values and impacts for non-reactor NRC licensees. The user must provide more of the input in such cases, and the code can serve as a tool for aggregating overall values and impacts, and for assessing uncertainties in a consistent manner.

Forecast automates much of the calculations typically needed in a regulatory impact analysis and thus reduces the time and labor required to perform these analyses. More importantly, however, its integrated and consistent treatment of the different cost elements should help assure comprehensiveness, uniformity, and accuracy in the preparation of needed value and impact estimates.

Forecast includes complete nuclear plant cost breakdowns for both pressurized water reactors (PWRs) and boiling water reactors (BWRs). These costs are drawn directly from the Energy Economic Data Base (EEDB) CONCISE reports and are updated to current year cost values. Labor hours, labor costs, and material/equipment (greenfield) costs are shown for each account within the EEDB. The NRC's generic cost analysis methodology typically uses the EEDB greenfield costs as a starting point and modifies or adds to these costs to account for the particular situation being evaluated. *Forecast* utilizes a data base called the Cost Factor Data Base (CFDB) that contains the complete EEDB cost data base, supplemented with default dose rates and ranges and labor productivity factors for all systems.

All cost, labor productivity factor, and radiation data included in the CFDB are organized according to the EEDB code of accounts. The major accounts are as follows:

<u>Acct. No.</u>	<u>Description</u>
21	Structures and Improvements
22	Reactor Plant Equipment
23	Turbine Plant Equipment
24	Electric Plant Equipment
25	Miscellaneous Plant Equipment
26	Main Condenser Heat Rejection System

Forecast also allows you to evaluate costs of physical modifications to several different systems (or different subsystems) essentially simultaneously. This is particularly useful when each of these systems or subsystems has its own unique set of characteristics or working environment, and where a different set of labor productivity

factors must be considered for each system or subsystem. As many as five separate systems can be treated in a single analysis.

Another feature of *Forecast* is that most of the variables are user editable. This gives you greater control over any particular analysis, and allows for tailoring of input data to best fit a particular situation. As with previous versions, default values of most variables are presented.

About *Forecast*

The *Forecast* menu allows you to access all options necessary to perform an analysis. The main window contains a summary of costs related to the modeled situation. These costs are successively added to the main window as you address additional cost impact elements. *Forecast* analyzes costs for both physical modifications and procedural or analytical modifications. The software will insure that you select the modules required for an analysis in successive order. All modules are accessible (ungrayed) when you open an existing file or cancel from the *Open* option. All these costs may be computed or changed independently of each other.

Forecast accesses data bases specific to the different cost categories. These include industry labor rates, shutdown/startup costs, replacement energy costs, and defueling and refueling costs. The program also includes cost data from the Energy Economic Data Base (EEDB). This data base contains information about specific systems based on the EEDB account numbers for both Pressurized Water Reactors (PWRs) and Boiling Water Reactors (BWRs). This information is used as a starting point for determining cost factors related to an account and has been supplemented with other data to produce the Cost Factor Data Base (CFDB). The information associated with the accounts in the CFDB includes:

- EEDB Account Number
- The name or description of the account
- Labor hours and labor costs associated with the original (greenfield) construction
- Site and factory material/equipment costs for installation of all EEDB accounts
- A set of cost factors pertinent to each account including:
 - Access Factor
 - Congestion Factor
 - Manageability Factor
 - Specific Dose Rate associated with removal/replacement

Forecast makes several basic assumptions about data being input to the program. All costs entered by the user are assumed to be in dollars for the year on the computer's internal clock (base year). It is the user's responsibility to adjust costs to the base year prior to entering them into the program. Costs computed by *Forecast* generally show "high end costs". For example, costs computed for Reactor Shutdown/Startup and Defueling/Refueling use a geographical adjustment for high cost areas and therefore high end costs for these cost categories are computed by *Forecast*. Note that since *Forecast* assumes all costs to be in base year dollars, cost data may not agree with the base documents and studies from which they were drawn.

Although *Forecast* uses the computer's internal clock year as the base year for all costs presented, you can select alternative target years. For example, a user may wish to

estimate the costs of actions to be taken five years hence, and to have *Forecast's* cost results reflect the expenditures/savings appropriate to that target year. User-provided cost data would be in today's dollars, but *Forecast's* results would be adjusted to reflect anticipated inflationary effects between the current time and the target year selected for the analysis, which in this example would be five years into the future. All summary costs will then be adjusted based on projections of both inflation and real escalation specific to particular cost elements so that the results are presented in target year dollars. Note, however, that all user-supplied costs must still be in base year dollars in order for *Forecast* to properly escalate to other target years.

Chapter 2. Using *Forecast*

Before installing *Forecast* you should verify that your system meets the minimum hardware, software, and network requirements, and back up your *Forecast* diskettes. This chapter consists of hardware and software specifications and directions for software use.

Requirements

Forecast is written for the IBM PC and true compatibles. DOS 3.xx is required to run Microsoft Windows™ version 3.1. A mouse may be used but is not required. The minimum hardware requirements to run *Forecast* are:

- 640K of memory
- A hard disk and one high density 3.5 inch floppy drive
- A standard IBM Color Graphics Adapter (CGA) and functional graphics monitor (monochrome or color) (Enhanced Graphics Adapter (EGA) highly recommended)

Getting Started

Before using *Forecast*, you should be familiar with your computer and its user's manual. You should also back up your original *Forecast* disks and create working disks. You may do this either at the DOS level or through Windows™.

Refer to the Windows™ User's Guide for installing Windows™ on your system. Once Microsoft Windows™ is installed on your computer and c:\windows is in your path, *Forecast* may be run in the same manner as any other Windows™ program.

Once you have installed Windows™ on your system, you can copy the *Forecast* program onto your hard disk as follows:

1. Turn on your computer.
2. Insert the disk labeled *Forecast* Disk 1 of 2 into the disk drive.
3. At the DOS prompt, switch to the drive containing the disk (type **A:** or **B:** as appropriate).
4. Type **install <drive> <\pathname>** to load the *Forecast* executable, replacing **<drive>** with the drive letter where *Forecast* will reside and replacing **<\pathname>** with the pathname of the directory where you wish to install *Forecast*.

Example: **install c: \forecast**

5. When prompted, insert the disk labeled *Forecast* Disk 2 of 2 into your disk drive.
6. Type **install** to load the Cost Factor Data Base.

Running the *Forecast* Software

To run *Forecast* from Windows™, perform the following steps:

1. Run the File Manager.
2. Open the directory in which you installed *Forecast*.
3. Select FORECAST.EXE.
4. Choose Open from the File menu.

Alternatively, you can create a Windows™ Program Group containing a *Forecast* program item and then run *Forecast* from the Windows™ Program Manager by choosing the *Forecast* program group and then choosing the *Forecast* program item. Refer to your Windows™ User's Guide for information on creating program groups and items.

How to Use *Forecast*

The *Forecast* menu was designed in a manner that allows for a logical progression through the steps necessary to perform a complete analysis.

Beginning with the *File* option on the left side of the menu, you can begin a new analysis, open a previously saved analysis file, save the current analysis, print the results of the currently displayed analysis, or exit *Forecast*. *File New* is the first step taken to begin inputting information about the analysis to be performed. The water reactor type (BWR or PWR) and the number of plants to be analyzed are defined through *File New*. Until the *File New* options are made, the *System*, *Impacts*, and *Escalate* menu options are grayed and are not available.

The next option on the menu is *Edit* which allows you to edit the parameters (such as cost factors and wage rates) that will be used to generate the results of a new analysis.

The *Values* option allows you to set the Accident/Event Frequency parameters and then set Averted Exposures.

For cases where licensees may need to perform physical modifications to their facilities to comply with proposed regulations, the *System* option allows you to define up to five separate systems or subsystems, each having its own unique set of characteristics or working environment. At this point in the analysis you will identify the appropriate EEDB account number applicable to each system or component of interest to the analysis; define, as applicable, the environment under which the physical modifications will be carried out; enter cost information if this is needed; and specify the labor productivity factors appropriate to the modification of concern.

The *Impacts* menu contains additional options that allow you to define costs that apply to entire plants for either Analytical/Procedural or Physical Modification analyses. These costs include shutdown/startup costs, waste disposal costs, and analytical/procedural costs. Under *Impacts* you can also define recurring costs such as those that may be associated with periodic inspections, maintenance, testing, or analyses. Onsite Property Costs, Offsite Non-Health Costs, and Other Government Costs can be set under the *Impacts* menu also.

The remaining two options on the menu, *Window* and *Help*, provide informational items about analysis results and the *Forecast* program. You are not required to use these features in completing an analysis, but may wish to use them to view the analysis results in a variety of ways, or obtain help information about *Forecast* topics, data sources and cost calculations.

Attribute Definitions

The following definitions and explanations are taken from NUREG/BR-0184, Draft, August 1993.

Public Health (Accident)

This attribute is a value which measures expected changes in radiation exposures to the public within 50 miles of a facility due to changes in accident frequencies or accident consequences associated with the proposed action. In most cases, the effect of the proposed action would be to decrease public exposure. A decrease in public exposure (given in person-rem) assumes a positive sign. Therefore, this decrease multiplied by the monetary conversion factor (\$/person-rem) will give a positive monetary value.

It is possible that a proposed action could increase public exposure due to potential accidents. In this case, the increase in public exposure (person-rem) assumes a negative sign. When this increase is multiplied by the monetary conversion factor (\$/person-rem), the resulting monetary term is interpreted as negative.

Public Health (Routine)

This attribute is a value which accounts for changes in radiation exposures to the public during normal facility operations (i.e., non-accident situations). It is expected that this attribute would not be affected by most of the actions considered and would, therefore, be used infrequently. When used, this attribute would employ an actual estimate; accident probabilities are not involved.

Similar to the attribute for public health (accident), a decrease in public exposure would be positive. Therefore, the product of a decrease in exposure and the monetary conversion factor [assumed to be the same factor as that for public health (accident)] would be taken as positive. The product of an increase in public exposure and the monetary conversion factor would be taken as negative.

Occupational Health (Accident)

This attribute is a value which measures health effects, both immediate and long-term, associated with site workers as a result of changes in accident frequency or accident mitigation. A decrease in worker radiological exposures is taken as positive; an increase in worker exposures is considered negative.

As is the case for public exposure, the directly calculated effects of a particular action are given in person-rem. A monetary conversion factor is used to convert the effect into dollars.

Occupational Health (Routine)

This attribute is a value which accounts for radiological exposures to workers during normal facility operations (i.e., non-accident situations). For many types of proposed actions, there will be an increase in worker exposures; sometimes this will be a one-time effect (e.g., installation or modifications of equipment in a hot area), and sometimes it will be an ongoing effect (e.g., routine surveillance or maintenance of contaminated equipment or equipment in a radiation area). Some actions may involve a one-time increase with an offsetting lowering of future exposures.

A net decrease in worker exposures is taken as positive; a net increase in worker exposures is taken as negative. The monetary conversion factor is the same as discussed under occupational health for accident conditions.

Onsite Property

This attribute is an impact which measures the expected monetary effects on onsite property, including replacement power (specifically for power reactors), decontamination, and refurbishment costs, from the proposed action. This attribute is typically the product of the change in accident frequency and the consequences given that an accident were to occur. A reduction in expected onsite property damage is taken as positive; an increase in onsite property damage is considered negative.

Offsite Non-Health

This attribute is an impact which measures the offsite costs, exclusive of public health effects, such as protective emergency actions (evacuation and relocation), decontamination and interdiction of property, disposal of contaminated food and milk, and long term relocation of people and interdiction/condemnation of property.

Industry Implementation

This attribute is an impact which accounts for the projected net economic effect on the affected licensees to install or implement mandated changes. Costs will include equipment, labor, materials, and shutdown costs, including the cost of replacement power (power reactors only), as appropriate. Additional costs above the status quo are considered negative; cost savings would be considered positive.

Industry Operation

This attribute is an impact which measures the projected net economic effect due to routine and recurring activities required by the proposed action on all affected licensees. If applicable, replacement power costs (power reactors only) directly attributable to the proposed action will be included. Additional costs above the status quo are taken to be negative; cost savings are taken to be positive.

Costs falling in this category, and those associated with NRC operational considerations, generally occur over long periods of time (the facility lifetime). These costs are particularly sensitive to the discount factor used.

NRC Implementation

This attribute is an impact which measures the projected net economic effect on the NRC to place the proposed action into operation. However, costs already incurred, including all pre-decisional activities performed by the NRC, are viewed as "sunk" costs and are not to be included. Additional costs above the status quo are taken to be negative, cost savings are taken to be positive.

NRC Operation

This attribute is an impact which measures the projected net economic effect on the NRC after the proposed action is implemented. Additional inspection, evaluation, or enforcement activities would be examples of such costs. Additional costs above the status quo are taken to be negative; cost savings are taken to be positive. As with industry operation costs, NRC operation costs generally occur over long periods of time and are sensitive to the assumed discount factor.

The NRC may seek compensation from the licensee to provide needed services; any compensation received should not be subtracted from the cost to the NRC. If the cost is subtracted here, then it would have to be added under industry operation costs, which would inaccurately account for the source of the cost.

Other Government

This attribute is an impact which measures the net economic effect of the proposed action on the federal government (other than the NRC) and state and local governments resulting from the action's implementation or operation. Additional costs above the status quo are taken to be negative; cost savings are taken to be positive.

This attribute will be affected less often than its counterparts, but can be material in certain types of actions (e.g., changes to offsite emergency planning, provision of offsite services, new requirements that are an issue of compliance with Agreement States). The government entities may seek compensation from the licensee to provide the needed services; any compensation received should not be subtracted from the cost to the government units. If the cost is subtracted here, then it would have to be added under the appropriate industry costs, which would inaccurately account for the source of the cost.

Cost Categories

A major part of Forecast involves calculating costs for Industry and NRC implementation and operation. The following cost categories make up the Calculated Costs portion of a *Forecast* cost analysis. They are listed in alphabetical order.

CATEGORY	EXPLANATION
Engineering QA-QC	Provide generic cost factors for engineering and quality assurance costs as a percentage of the direct cost (equipment, materials, and labor) based on whether the plant is operating or under construction.
Hardware and Equipment	These costs are derived from the Cost Factor Data Base (CFDB) or entered directly by the user
Health Physics	Estimate costs of providing comprehensive health physics-related support during plant modifications or repairs. The estimates account for costs of anti-contamination clothing, health physics personnel, shielding, and all related costs.
Installation Labor	Estimate installation labor costs associated with new physical modifications to operating or partially complete nuclear power reactors allowing for such factors as working in a radiation environment, poor access, congestion, etc.
Licensee Procedural/ Analytical	Set industry procedural, administrative, and analytical costs for activities such as technical specification change, writing procedures, staff training, recordkeeping, and other technical costs.
Licensee Recurring Costs	Set equivalent annual recurring costs for industry.
NRC Procedural/Analytical	Set NRC procedural, administrative, and analytical costs such as those for reviewing licensee technical specification changes, implementation of new requirements, and other technical costs.
NRC Recurring Costs	Set equivalent annual recurring costs for NRC.
Radiation Exposure	Estimate radiation exposure (in person-rem) for plant modifications, including, where applicable, reactor shutdown and startup, reactor defueling/refueling, and exposure relating to the plant modification or repair. This value is also used in calculating health physics costs.

Radioactive Waste Disposal	Estimate generic costs of disposing of low-level radioactive wastes generated as a result of modifications or repairs to nuclear facilities.
Reactor Defueling/Refueling	Estimate costs and plant downtime for activities associated with preparation for removal, removal of fuel and reactor internals, and recovery so that reactor operations can be resumed. This cost is calculated based on the crafts required to perform each task of this operation.
Reactor Shutdown and Startup	Generate cost estimates for activities required to shutdown the reactor and restart the reactor following the repair or modification activity. This cost is calculated based on the crafts required to perform each task of this operation.
Removal Labor	Estimate labor costs associated with the removal of hardware, materials, and structures from nuclear power plants.
Replacement Energy	Estimate replacement energy costs for nuclear power plants when retrofitting or safety modification of nuclear reactors necessitate unscheduled shutdowns (or extend normal refueling and maintenance shutdown periods) while changes are implemented. These costs are derived from a data base lookup of all the power plants in the United States.

Using the Uncertainty Distribution Dialog

Forecast provides a default uncertainty distribution type for each of the parameters in the program that involve uncertainty. You can review and modify the default for a parameter by accessing the dialog box on which the parameter appears, selecting the edit field containing the parameter, and then clicking on the Uncertainty button. The Uncertainty Distribution dialog box appears.

Figure 1. Uncertainty Distribution Dialog Box

The Uncertainty Distribution dialog box shows the default distribution type and factors which characterize the uncertainty for the selected parameter. *Forecast* can treat four types of uncertainty characterization. The first is point estimate, which the code treats as having no uncertainty. The second type is uniform, wherein the actual value of a parameter is assumed to be equally likely to be found anywhere within the range specified by the user. The third type of uncertainty treated by the code is characterized by a log normal distribution and an error factor. The fourth type is general which allows you to specify any distribution by providing its mean, 5th percentile, median, 95th percentile, and Standard Deviation.

It is recommended that the user select Point Estimate or Log Normal for most parameters. For Log Normal, the Error Factor is the ratio of the 95th percentile to the 50th percentile, which is equal to the ratio of the 50th percentile to the 5th percentile. That is, the logarithm of the parameter is assigned a normal probability distribution.

For small values of the Error Factor, a log-normal is nearly symmetric, but for large values of the Error Factor it becomes skewed to stay above zero. The user should be aware that the mean tends to be larger than the median. For a mean of 3 and an Error Factor of 10, the 5th and 95th percentiles are about 0.1 and 10. In fact, the 95th percentile is never more than about three times the mean. Large values of the Error Factor affect the 5th percentile more than the 95th percentile.

The General input should only be used to enter a distribution that has been calculated with some precision. It is quite easy to enter an impossible distribution, which will be rejected.

The Uncertainty Distribution dialog box displays the mean value of the selected parameter and presents the four distribution types, with the default for that parameter indicated. You can modify the distribution type and uncertainty characteristics as appropriate to the analysis being performed. Note that the "Mean" is presented in an edit box, but editing the mean value on this screen has no effect, i.e., the code will use the mean value established in the dialog box used to access the Uncertainty Distribution dialog box.

Press ENTER to return to the previous dialog box.

If a dialog box does not contain an Uncertainty push button, uncertainty is not being used in the calculations on that dialog. Some dialog boxes contain a button labeled *Uncertainty on Total*. This means that uncertainty will be set on the resulting total on the dialog box and not for each parameter in the calculation.

Note that the numbers on the *Forecast* dialogs which are treated with uncertainty are not being added or multiplied directly but that the uncertainty distributions for each number in a calculation are used to produce a resulting distribution. The mean of the resulting distribution is displayed on the screen, and it may not exactly match the value that would be obtained by simply performing the associated mathematical manipulations on the means alone. This is especially apparent on the Attributes Summary and Calculated Costs windows where columns of numbers appear for summation, but the bottom line is not exactly the sum of the numbers displayed. Similarly, for the Attributes Summary screen the simple summation of the columns of numbers displayed for the 5th or 95th percentiles of the individual distributions will not equal the 5th or 95th percentiles for the Net Values as calculated by *Forecast* and as displayed on the Net Value distribution screen.

Chapter 3. Physical Modification Case Study

This chapter leads you through a sample analysis, starting with the problem definition, continuing with user input, and finally producing the net value estimate. The chapter covers values and impacts associated with the given scenario; it does not treat all possible attributes that might arise in an analysis.

This chapter explains what each part of the analysis does and gives information and tips that will facilitate the use of *Forecast*. You can also follow the steps in this chapter to estimate values and impacts other than those suggested here.

Background Information

Assume that NRC is evaluating whether or not to amend regulations that could impact the primary system designs of a certain class of pressurized water reactors. In particular, the revised regulation could require replacement of the pressurizers at this class of PWRs. The replacement would have to be conducted immediately and all plants must undergo an unscheduled shutdown. The following facts are known about the replacement and will be input to the analysis:

• Reactor Type:	PWR
• Number of Plants:	10
• Accident/Event Frequency:
(average for plants in class)	0.0006/yr
• Expected Change in Accident Frequency
due to Change in Regulation:	-0.00005/yr
• Public Exposure per Severe Accident:
(equivalent overall dose effect)	8.5E+5 person-rem
• Change in Public Exposure per accident
due to Proposed Action:	none
• Modification Environment: • Outage Activity• Removal of Non-Target components is required.• Major Modification is Required and• Activity was performed twice previously	
• EEDB Account number	222.1431

The following information is provided by *Forecast* when the EEDB Account number is selected:

• Labor Hours (EEDB greenfield installation)	3300 labor hours
• Labor Rate:	\$30.63/hr (\$1995)
• Site Material Costs:	\$9,856 (\$1995)
• Factory Equipment Costs:	\$0

In addition to the costs provided by the EEDB, the following cost was supplied by a major utility:

- Factory Equipment Costs: \$1,900,000

There will be other impacts associated with the analysis as described below. All information is on a per-reactor basis:

- Refueling/Defueling Activity:
The reactors must be drained, the fuel removed, and the system decontaminated to accomplish these repairs.
- Waste Disposal Information:
 - Non-Compactible Trash volume: 1,800 ft³
 - Compactible Trash volume: 10,000 ft³
 - Ion Exchange Resins volume: 250 ft³
- Licensee Procedural:
 - Technical Specification Change: 1 complex change
- NRC Procedural:
 - Technical Specification Change: 1 complex change
 - Other Technical Costs: 40 staff hours
- Onsite Property Costs Major LOCA, Delayed ECCS
- Offsite Non-Health Costs per severe accident \$25,000,000,000
- Other Government Costs: None
- License Renewal. The impacted plants are all expected to seek renewal of their licenses. This means that each plant will be assumed to operate for an additional 20 years beyond the expiration of the current licensing period.

The following sections give instructions for entering this information into a *Forecast* cost analysis.

File New

We begin entering data for the analysis in the *New* dialog box. Select *New* from the *File* menu. The *New* dialog box appears. Notice the focus is set on *PWR* when the *New* dialog box is first shown. The arrow keys change the focus from one button to another in a grouped box, and TAB changes the focus from one grouped box to another (i.e. *Water Reactor Type* to *Number of Plants...* to the year field to *OK* and *Cancel* and back again.) We are analyzing 10 plants so we enter that in the edit field for *Number of Plants of Type Selected*. These selections can also be made with a mouse. The default year presented is obtained from the system clock on your computer. We will run the costs for the current year. Press ENTER or select *OK* to set these changes and exit this dialog box.

Figure 2. File New Dialog Box

Edit Remaining Life

Select *Remaining Life* from the *Edit* menu. The dialog box that appears presents the average remaining life of the US reactor population, which is 22 years in 1995. Since license renewal is to be considered, change the remaining life to 42 to allow for the 20 years of additional operation allowed with license renewal. Press ENTER or select *OK* to set these changes and exit this dialog box.

Figure 3. Remaining Life Dialog Box

Values Accident/Event Frequency

The next step in the analysis is to set the Values. Select *Accident/Event Frequency* from the *Values* menu. The Accident/Event Frequency dialog box appears.

Enter the value 0.0006 in the *Current Accident Frequency* box. Move the cursor to the *Uncertainty* button and click the mouse button or type Alt+u. The *Uncertainty Distribution* window for the reference accident frequency should appear. Its mean value is shown. The default uncertainty distribution for this parameter is log normal with an error factor of 10.0. This factor is judged to be appropriate. Press ENTER or select *OK* to return to the *Accident/Event Frequency* window. Tab to the *Change in Accident Frequency* box. Enter -0.00005. Select the *Uncertainty* button again. The *Uncertainty Distribution* window for the change in accident frequency appears. The impact on the change in accident frequency due to the regulatory change and the resulting physical modifications are better known than the overall accident frequency. The change is known with an error factor of 3. Enter the value 3.0 in the *Error Factor* box. Press ENTER to return to the *Accident/Event Frequency* box. Note that in this process the uncertainty parameters were separately set for Reference Accident Frequency and for the Change in Accident Frequency. Press ENTER to return to the main window.

Accident/Event Frequency

Current Accident Frequency: /year

[For uncertainty analysis, include all sources of uncertainty.]

Change In Frequency

☒ As a Single Value

Change in Accident Frequency: /year

☐ As a Difference in Two Frequencies

Current Accident Frequency: /year

[For uncertainty analysis, include only uncertainties from failure modes unique to the current case.]

Alternate Accident Frequency: /year

[For uncertainty analysis, include only uncertainties from failure modes unique to the alternate case.]

OK Cancel Uncertainty...

Figure 4. Accident/Event Frequency Dialog Box

Values Averted Exposures

Now select *Averted Exposures* from the *Values* menu. The Averted Exposures dialog box appears.

Tab to the Public Exposure per Event/Accident box. Enter the value 8.5e5. Next click on the Uncertainty button; the Uncertainty Distribution window for Public Exposure per Event/Accident will appear. Since overall public exposure for severe accidents are not well-known, we accept the log normal distribution with an Error Factor of 10. Press ENTER. The physical modifications called for by this regulatory change would not impact the anticipated public exposure given that a severe accident occurs. This might not be the case if modifications to the reactor containment systems was also called for. Also, there is no exposure to the public due to routine operation of the plants. Press ENTER to leave the Averted Exposures dialog box.

Averted Exposures

Years Before Facility Begins Operating:

☒ Public Health ☐ Occupational Health

Public Health

Accident	Reference Exposure	Change in Exposure
Public Exposure per Event/Accident:	<input type="text" value="8.5e5"/>	<input type="text" value="0.000000"/>
Discounted monetary value of reduction in accident public exposure per facility due to implementation of proposed action:		\$ 10,213,899
Net Public Exposure Change: (person-rem)		0

Routine

	Implementation Phase	Operational Phase
Changes in Estimated Routine Public Exposure:	<input type="text" value="0.000000"/>	<input type="text" value="0.000000"/>
Discounted Monetary Value of Combined Overall Routine Public Exposure:		\$ 0

Figure 5. Averted Exposures Dialog Box

System

The next step in the analysis is to set the System costs. Select *New System* from the *System* menu. The System window appears. We can now enter the data specific to the system we are analyzing.

Environment

Select the *Environment* button on the System Window. The *Environment* dialog box appears. Five of the categories shown in the *Physical Modification Environment* dialog box apply to our sample case. As a default, *Installation (I)* and *Removal (R)* are already selected when we enter this dialog box. Since the replacement of pressurizers may only be performed while the plant is shutdown, we select the *Outage Activity* box with the mouse or press the letter **O**. Press the SPACE BAR to check or uncheck this box. A check means the statement applies to the analysis. If it is unchecked, it will not add any factors to the analysis. Next press **N** to select *Removal of Non-Target Components Required*. Also select *Major Removal/Replacement Activity* by pressing **M**.

Figure 6. Environment Dialog Box

As soon as Major Removal/Replacement Activity is selected, a dialog box appears where you can set the Learning Curve Factor. Since the work has been performed twice previously, we choose that option (press **T**). Choose **OK** to return to the Environment dialog box. Choose **OK** again to exit the Environment dialog box.

Figure 7. Major Removal/Replacement Activity Dialog Box

Account

Select the *Account* button on the System Window. The *Account* dialog box is now displayed for selection of the EEDB account number. Use the ARROW keys or single click on account number 22 to highlight it and display its associated labor hours, labor rate, and factory/site material costs. Then type ALT+N or click on the *Next* button to view sublevel accounts associated with the selected account. An alternate method for selecting an account is to double click on the account number in the list box in order to display the labor hours, labor rate, factory/site material costs and sublevel accounts. Select the 222 and subsequent account numbers in the same manner until account number 222.1431 is displayed at the top of the dialog box.

Labor Hours	Labor Rate (\$/hr)	Factory/Site Material Costs
3,300	\$30.63	\$9,856

222.1431 PRESSURIZER
222.1432 PRESSURIZER RELIEF TANK

Figure 8. Account Dialog Box

Within the *Account* dialog box, a button is provided for obtaining more information about the account selected. Click on *More Info* or type ALT+I to display the following window. The costs shown are the original EEDB data base values and will not reflect any changes made by you in the *Costs* window.

Note that the default costs shown are only for site materials and that you must input any factory costs for this particular account using the *Costs* dialog box. Press ENTER or click on *OK* to return to the *Account* dialog box. Exit the *Account* dialog box in the same manner.

Account Information

ORIGINAL EEDB UNLOADED BASE COST

Account Number: 222.1431

Description: PRESSURIZER

Site Costs

Quantity	Labor Hours	Labor Cost	Material Cost
1 LT	3,300	\$101,083	\$9,856

Factory Costs

Quantity	Cost
1 EA	

Total Cost

\$110,939

OK

Figure 9. Account Information Dialog Box

Labor/Material/Equipment Costs

Next we will assign the costs associated with labor and materials. Select the *Costs* button on the System Window. The *EEDB Costs* dialog box appears. The value 3300 is automatically entered for the EEDB Labor Hours (this is new plant or greenfield cost as presented in the EEDB). Tab to the EEDB Labor Hours box. Click on the *Uncertainty* button and the *Uncertainty Distribution* window will appear. The uncertainty on the EEDB labor hours defaults to a log normal distribution with an error factor of 1.25. This uncertainty treatment is judged appropriate. Press ENTER to return to the *EEDB Costs* dialog box. Values for Labor Rate and Material Costs are also automatically displayed in the *EEDB Costs* dialog box if this information is available in the EEDB. In this case the EEDB data has to be supplemented by the cost of the replacement pressurizer units. As noted previously, these costs are \$1,900,000, and this amount must be entered in the "equipment cost" field. Uncertainty distributions on Labor Rate, Material Costs, and Equipment Costs can be separately accessed and viewed by selecting the appropriate value box and then clicking on the *Uncertainty* button. *Forecast* defaults the uncertainty of each parameter on the *EEDB Costs* dialog box to Log Normal with an Error Factor of 1.25. The uncertainty can be separately set for each of these parameters. For the current analysis these uncertainties are judged to be appropriate.

At this point you can also choose to use a multiple or a fraction of the base costs by modifying the 100% default value for percentage of original costs to include. This may be appropriate where only a portion of a system is affected by a physical modification. All values in the edit boxes are user editable. Press the ENTER key or select *OK* using the mouse to exit this dialog box.

EEDB Costs		
	Original Values	Amounts to Include
EEDB Labor Hours:	3300	3,298
Labor Rate (w/fringe): \$/hour	30.63	
Loaded Labor Cost:		\$ 159,875
Material Costs:	\$ 9856	\$ 9,849
Equipment Costs:	\$ 1900000	\$ 1,898,669
Percentage of Original Costs to Include:		100 %

Figure 10. EEDB Costs Dialog Box

Factors

Select the *Factors* button on the System Window. The *Factors* dialog box appears. Note that the same Account Number appears in the cost factor dialog box as that in the EEDB Account Number dialog box. This means we found information about that specific account in the CFDB (Cost Factor Data Base). The factors displayed are based on the modification environment and the system to be analyzed. The default values presented represent average values pertinent to the system, subsystem, or component of interest (as identified by the EEDB account). All values can be changed as deemed appropriate to the analysis being performed.

The screenshot shows a dialog box titled "Factors" with a subtitle "COST FACTORS FOR PWR Plant - ACCOUNT 222.1431". It contains two main sections: "Labor Productivity Factors" and "Removal Factors".

Labor Productivity Factors		Removal Factors	
Access and handling:	0.4	Structural:	0.00
Congestion:	0.4	Impingement:	0.60
Radiation:	14.5		
Manageability:	0.4		
Total Productivity Factor for Installation:	16.71	Total Productivity Factor for Removal:	1.00

At the top, "Dose Rate:" is set to "95 mrem/hr". At the bottom are buttons for "OK", "Cancel", "Uncertainty...", "General Help...", and "Radiation Help...".

Figure 11. Factors Dialog Box

These factors can be changed directly through the edit fields or through either of the two help boxes: *General Help* and *Radiation Help*. TAB through all the fields to select the *General Help* button and press the SPACEBAR to view that dialog box. The inferred environment (access, congestion & radiation) will be shown and may be changed at this level by selecting buttons appropriate to the scenario. As these buttons are selected with the ARROW and TAB keys, the associated cost factors may be seen on the right side of the screen. These changes will also be reflected in the Cost Factor dialog box, but are not set until *OK* in the Cost Factor screen is chosen. Press *ESC* to exit this dialog box and notice that none of the changes made to the cost factors have been saved.

General Cost Factor Help

COST FACTORS FOR PWR Plant - ACCOUNT 222.1431

Access

- ☐ Outside Containment (Easy)
- ☐ Close Proximity to Containment
- ☒ Containment Area (Difficult)

Congestion

- ☐ Open area
- ☐ Congested Work Area
- ☒ Severely Congested Area

Radiation

- ☐ None
- ☐ Moderate
- ☐ High
- ☐ High + Temp(2hr)
- ☒ High + Temp(1hr)
- ☐ High + Temp(.5hr)

Cost Factors

Labor Productivity

- 0.4 Access and handling
- 0.4 Congestion
- 14.5 Radiation
- 0.4 Manageability

Removal

- 0.00 Structural Factor
- 0.60 Impingement Factor

OK **Cancel**

Figure 12. General Cost Factor Help Dialog Box

Now select *Radiation Help* from the cost factors dialog box to view the Radiation Help dialog box. The focus in this dialog box is set to the *Dose Rate* edit field. A dose rate may be entered directly to set the radiation level or else TAB until the buttons are highlighted. This dialog box works in a manner similar to the General Help Screen in that you can change values, but they are not set until *OK* is selected.

Radiation Help

COST FACTORS FOR PWR Plant - ACCOUNT 222.1431

Modification Radiation Level

- ☐ No Radiation (0)
- ☐ Minimal Equipment Requirements (1-10 mrem/hr)
- ☐ Full Protective Equipment (11-30 mrem/hr)
- ☐ High Radiation, high temperature (31-50 mrem/hr, 2 hr stay time)
- ☒ High Radiation, high temperature (51-100 mrem/hr, 1 hr stay time)
- ☐ High Radiation, high temperature (> 100 mrem/hr, 1/2 hr stay time)

Dose Rate: (mrem/hr)

Dose Rate Range for System

2 - 5100

Radiation Labor Productivity Factor

OK **Cancel**

Figure 13. Radiation Help Dialog Box

Cancel or ESC will revert to previous values. Note that if you change the dose rate directly, the radiation level and radiation labor productivity factor will be set. If you change the modification radiation level by the buttons on the left side of the screen, the dose rate level for that system and the radiation labor productivity factor will be modified.

The radiation labor productivity factor may also be set directly, but note that it will not change the dose rate.

A range of reasonable dose rates for the given system is provided, but any dose rate may be entered. The default dose rate displayed is based on average conditions for that system. These conditions are based on surveys from several power plants. They are representative of conditions wherein the plant has been shut down for several days. The default values do not account for any ALARA actions taken to reduce the dose rates or exposures.

We now return to the *Factors* dialog box by pressing ESC. On this dialog box we can set uncertainty on the Dose Rate, Total Productivity Factor for Installation, and Total Productivity Factor for Removal, but not on the individual labor Productivity Factors or the individual Removal Factors. Select Access and handling. Note that the Uncertainty button is grayed and non-functional. Select the Dose Rate box. The Uncertainty button is now ungrayed, meaning that we can view and change the uncertainty on this overall factor if so desired. Choose the Uncertainty button with the mouse. Select Uniform distribution, and enter 35 for the Minimum Value.

We now return to the *Factors* dialog box by choosing OK and see that now all the labor productivity factors and radiation factors have been set according to radiation, access and congestion considerations. At this point the knowledgeable user could directly set any of these values. Press ENTER to exit this dialog box and continue with the case study.

System Window

The System window displays information about the environment options you have selected and the environment factors retrieved from the CFDB for the selected account. When you are finished reviewing the System information, select the *Done* button to exit the System window. (Note that the *Done* button is not available until an environment has been set.) The background Attributes Summary window displays the values calculated thus far.

The screenshot shows a window titled "System". At the top left, there is a "System Name:" label followed by a text box containing "Subsystem 1". To the right of this text box is a "Done" button. Below the text box, there are two main sections. The first section is titled "Environment Options" and contains a list of five items: "Operating Plant, Outage Activity", "Installation Activity, Removal Activity", "Structural Modification Not Required", "Impingement on Surrounding Structures", and "Activity Performed Twice Previously". The second section is titled "Environment Factors" and contains a list of three items: "Containment Area, Restricted Laydown", "Severely Congested Work Area", and "High Radiation, High Temperature, 1-hr Stay Time". To the right of these two sections, there are four buttons stacked vertically: "Environment...", "Account...", "Costs...", and "Factors...".

Figure 14. System Window

Impacts

The *Impacts* menu allows entry of costs associated with reactor shutdown, waste disposal, procedural/analytical analyses, recurring costs, averted onsite property, averted offsite non-health, and other governments.

Unscheduled Reactor Shutdown

From the *Impacts* menu select *Shutdown Required*. A cascading menu appears to one side of the Shutdown Required option. Select *Unscheduled Reactor Shutdown*. The Unscheduled Reactor Shutdown dialog box appears.

The dialog box is titled "Unscheduled Reactor Shutdown". It contains a "Shutdown Type" section with two radio buttons: "To Hot Standby" and "To Cold Shutdown". The "To Cold Shutdown" option is selected. To the right of these buttons are the labels "PWR" and "PLANT". Below the shutdown type section, there is a label "Critical Path Outage Time:" followed by a text box containing the number "99" and the word "Hours". At the bottom left, there is a label "Cost:" followed by the value "\$31078". On the right side of the dialog box, there are two buttons: "OK" and "Cancel".

Figure 15. Unscheduled Reactor Shutdown Dialog Box

The default shutdown type is to cold shutdown and the default critical path time is 99 hours. These hours may be changed and the cost will be recomputed. Press ENTER to accept all these values.

Reactor Defueling/Refueling

From the *Impacts* menu select *Shutdown Required*. A cascading menu appears to one side of the Shutdown Required option. Select *Reactor Defueling/Refueling*. The Reactor Defueling/Refueling dialog box appears.

Items in list boxes may be selected by typing the first letter of the item. If more than one item begins with the letter, the first item in the list beginning with the letter is selected. Type **d** to select *Drain & Decontaminate*. Note that by doing so, all previous activities are also selected. The total cost as well as critical path time are calculated. The critical path time is used by *Forecast* as a default outage time for calculating replacement energy costs. Since *Fuel Sipping* was not specified, we need not add those costs in and may leave this dialog via the *OK* button or ENTER.

PWR	DEFUELING/REFUELING ACTIVITY	CP HOURS
	Containment Preparation/Decontamination	62
	RPV Head Equip., Conn. & Insul. Removal/Re-inst.	27
	RPV Head Removal/Re-installation	54
	Upper Internals Removal/Re-installation	39
	Fuel Removal/Reload	236
	Drain & Decontaminate	16
	Vessel Surveillance & Inspection	35

☐ Fuel Sipping Required

Outage Time (Critical Hours): 434

Total Costs: \$168492

OK Cancel

Figure 16. Reactor Defueling/Refueling Dialog Box

Replacement Energy

From the *Impacts* menu select *Shutdown Required*. A cascading menu appears to one side of the Shutdown Required option. Select *Replacement Energy*. The Replacement Energy dialog box appears.

The default is to set Replacement Energy costs using Reactor Average. The plants of concern are all in the range of 500 to 1000 MWe, so we select the *Average for plants from 500 to 1000 megawatts* button on the Replacement Energy dialog box. TAB to the Outage Duration box. The outage duration of 22 days shows time required for shutdown/startup and defueling/refueling only. The time for the modification must be added to the base time shown. Assume 30 days, bringing the total to 52. The screen shows that, in 1995, the average replacement energy cost per day for the PWRs in the range of 500 to 1000 MWe is \$272,000, and the total replacement energy cost for the 52 days is \$14,117,000 per plant. Note that the uncertainty can be separately set on both the outage duration and the cost per day.

Replacement Energy

Outage Information

Year: 1995 Duration: 52 Days Cost per day: (\$000) 272 Total Costs(\$000): \$ 14117

☒ Reactor Average for PWRs
☐ All PWRs
☐ Average for plants from 0 to 500 megawatts
☒ Average for plants from 500 to 1000 megawatts
☐ Average for plants > 1000 megawatts

☐ Plant Specific

Arkansas Nuclear 2
 Beaver Valley 1
 Beaver Valley 2
 Big Rock Point
 Braidwood 1

Add Remove

SELECTED Unit Name	Year	Days	Cost(\$000)

OK Cancel Uncertainty Restore Default Cost

Figure 17. Replacement Energy Dialog Box

TAB to the *OK* button and press ENTER to continue with the case study.

If we had chosen to do so, we could have selected the *Plant Specific* button and then specifically identified each of the affected plants. For example, if the first plant in our case study was the first plant in the list box: Arkansas Nuclear One Unit 1, we could enter 52 and TAB to the *Add* button and press the SPACE BAR. This plant would be included in the selected list of plants requiring replacement energy. Then we could TAB to the *Reactor Unit* list box and select Salem 1 by typing s. This advances the selection bar to that part of the alphabet. We would choose the *Add* button to include this plant.

Outage duration may differ for each plant selected. This process could be repeated until all 10 of the affected plants were selected and added to the analysis.

Waste Disposal

From the *Impacts* menu select *Waste Disposal*. The Waste Disposal dialog box is now displayed for entry of costs related to waste disposal.

Enter the volume for *Non-Compactible Trash*: ..1800

Enter the volume for *Compactible Trash*:10000

Enter the volume for *Ion Exchange Resins*:250

Waste Disposal			
WASTE DISPOSAL COST FOR PWR Plant - ACCOUNT 222.1431			
(Refer to Abstract 6.1 for estimating volumes.)			
	Volume (ft ³)	Cost/1000 ft ³	COST (\$)
Dry Wastes			
Non-Compactible Trash	1800	316905	561897
Compactible Trash	10000	18627	183484
Wet Wastes			
Ion Exchange Resins	250	178154	43872
Concentrated Liquids		122630	
Filter Sludge		239171	
TOTAL COST: \$		775386	

OK
Cancel
Uncertainty

Figure 18. Waste Disposal Dialog Box

Note that the volumes entered are as-shipped values, i.e., the volumes of wastes after packaging or processing to reduce their volume. For information on estimating radioactive waste generation volumes, refer to Abstract 6.1 of NUREG/CR-4627, Generic Cost Estimates.

No other costs apply so press ENTER or click on *OK* to continue.

Licensee Procedural/Administrative/Analytical Costs

From the *Impacts* menu select *Licensee Procedural*. The Licensee Procedural/Administrative/Analytical Costs dialog box appears. There are five categories of costs addressed in this dialog box. Each may be accessed by pressing the corresponding radio button. When a radio button is selected, the lower half of the dialog box changes and requests information corresponding to that cost category. Since the *OK* button exits the *Licensee Procedural/Administrative/Analytical Costs* dialog box completely, do not use it until all the required categories have been addressed. We will only include costs associated with *Tech Spec Changes* for this analysis.

Technical Specification Change

Make sure the *Tech Spec Change* button is selected. TAB to the number field on the *Complex* line and enter 1 to indicate one complex change is required. Notice that the cost is automatically calculated. No routine changes will be required so we will not enter any data on that line. TAB to the *Tech Spec Change* button and use the DOWN ARROW to select another category of costs. Notice how the body of the dialog box changes for each category of costs. This analysis does not include costs for other categories so press ENTER or click on *OK* with the mouse to exit this dialog box.

Licensee Proced/Admin/Analytical Costs

**LICENSEE
PROCEDURAL/ADMINISTRATIVE/ANALYTICAL COSTS**

☒ **Tech Spec Change**
☐ **Recordkeeping**
☐ **Writing Procedures**
☐ **Other Technical**
☐ **Staff Training**

Technical Specification Change

Type of Change	Number	Staff Hours	Hourly Rate	Cost
Complex	1	640	70.63	\$45203
Routine	0	320	70.63	\$0
Total Cost				\$45182

Figure 19. Licensee Tech Spec Change Costs Dialog Box

NRC Procedural/Administrative/Analytical Cost

From the *Impacts* menu select *NRC Procedural*. The NRC Procedural/Administrative/Analytical Costs dialog box appears. This dialog box is similar to the *Licensee* dialog box discussed above. There are three categories of costs addressed in this dialog box. We will include *Tech Spec Change* and *Other Technical* costs in this analysis. Since the *OK* button exits the *NRC Procedural/Administrative/Analytical Costs* dialog box completely, do not use it until all the required categories have been addressed.

Tech Spec Change

Upon entering this dialog box, the *Tech Spec Change* button is already selected. The *Number* field on the *Complex* line defaults to 1 (since that is what we entered on the *Licensee Tech Spec* dialog) to indicate one complex change is required. Notice that the cost is already calculated.

Do not click on *OK* upon completion of this section, as we will also be entering *Other Technical* costs. TAB to the *Tech Spec Change* button and use the DOWN ARROW to select the *Other Technical* button or use the mouse to click on it.

NRC Proced/Admin/Analytical Costs
NRC PROCEDURAL/ADMINISTRATIVE/ANALYTICAL

☒ **Tech Spec Change** ☐ **Other Technical**
☐ **Implementation**

Technical Specification Change

Type of Change	Number	Staff Hours	Hourly Rate	Cost
Complex	1	512	51.83	\$26537
Routine	0	268	51.83	\$0
Total Cost				\$26518

OK **Cancel** **Uncertainty on Total...**

Figure 20. NRC Tech Spec Change Costs Dialog Box

Other Technical

Make sure the *Other Technical* button is selected by using the TAB key to move to the button area and then moving to that button with the DOWN ARROW or using the mouse to click on it. TAB to *Technical Staff Hours* and enter **40**. Notice the total cost now contains an amount. Press ENTER or click on *OK* to continue the case study.

NRC Proced/Admin/Analytical Costs	
NRC PROCEDURAL/ADMINISTRATIVE/ANALYTICAL	
☐ Tech Spec Change	☒ Other Technical
☐ Implementation	
Other Technical Costs To Include In-Depth Technical Analyses, Computations and Scientific Analyses, and Other Administrative Duties.	
Technical Staff Hours	40
Hourly Rate	51.83
Other Costs	0
Total Cost \$2072	
<input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Uncertainty on Total..."/>	

Figure 21. NRC Other Technical Costs Dialog Box

Equivalent Annual Recurring Costs

From the *Impacts* menu select *Licensee Recurring Costs*. The Licensee Recurring Costs dialog box appears. If there are incremental recurring costs associated with the modification or the NRC requirements, they are entered here. These should be costs over and above the normal plant operational costs. Press ENTER or click on *OK* to continue since no licensee recurring costs will be included.

Licensee Recurring Costs		
Number of years until recurring activities start:	<input type="text" value="0"/>	<input type="button" value="OK"/>
Number of years activities recur:	<input type="text" value="22"/>	<input type="button" value="Cancel"/>
		<input type="button" value="Enter"/>
	Equivalent Annual Cost	Cost
Labor Cost:	<input type="text" value="0"/>	
Materials Cost:	<input type="text" value="0"/>	
Replacement Energy Cost:	<input type="text" value="0"/>	
Other Costs:	<input type="text" value="0"/>	
Occupational Exposure (person-rem/year):	<input type="text" value="0"/>	
Health Physics Costs:		
TOTAL RECURRING COSTS:		

Figure 22. Licensee Recurring Costs Dialog Box

From the *Impacts* menu select *NRC Recurring Costs*. The NRC Recurring Costs dialog box appears. NRC recurring costs also do not apply to this example so no values are entered. Press ENTER or click on *OK* to continue.

	Equivalent Annual Labor Hours	Cost
Number of years until recurring activities start:	0	
Number of years activities recur:	42	
Labor Hours:	0	
Labor Rate:	51.83	
Labor Cost:		
Other NRC Costs:	0	
TOTAL RECURRING COSTS:		

Figure 23. NRC Recurring Costs Dialog Box

Averted Onsite Property Costs

From the *Impacts* menu select *Averted Onsite Property Costs*. The Averted Onsite Property Costs dialog box appears. Select *Major LOCA, Delayed ECCS* from the Scenarios group box. The default values for Cleanup and Decontamination Costs and Long Term Replacement Energy Costs are deemed to be acceptable, as are the default uncertainty distributions for these parameters. Press ENTER or click on *OK* to continue.

Averted Onsite Property Costs

Averted Cleanup and Decontamination Costs

Scenarios

☐ Small LOCA, ECCS OK

☐ Small LOCA, Delayed ECCS

☒ Major LOCA, Delayed ECCS

Cleanup and Decontamination Costs per plant: 15388466176

Averted Replacement Power

Long Term Replacement Energy Costs per plant: 16932564992

Discounted monetary value of reduction in overall costs or impacts related to onsite cleanup and decontamination, and long-term replacement energy for all plants: \$ 15,599,218

Buttons: OK, Cancel, Uncertainty..., Restore Defaults

Figure 24. Averted Onsite Property Costs Dialog Box

Averted Offsite Non-Health Costs

From the *Impacts* menu select *Averted Offsite Non-Health Costs*. The Averted Offsite Non-Health Costs dialog box appears. Enter **25e9** in the edit box to set the costs for this category. Press ENTER or click on *OK* to continue.

Averted Offsite Non-Health Costs	
Averted Offsite Non-Health Costs per Event/Accident:	25e9
TOTAL:	\$166,177,904

Buttons: OK, Cancel, Uncertainty

Figure 25. Averted Offsite Non-Health Costs Dialog Box

Other Government Costs

From the *Impacts* menu select *Other Government*. The Other Government dialog box appears. No government agencies other than the NRC are expected to be impacted by the proposed action. Press ENTER or click on *OK* to continue.

Other Government	
Number of years until recurring activities start:	<input type="text" value="0"/>
Number of years activities recur:	<input type="text" value="22"/>
<div>Equivalent Annual Costs</div> <div>Recurring Costs: <input type="text" value="0"/></div> <div>Implementation Costs: <input type="text" value="0"/></div> <div>TOTAL OTHER GOVERNMENT COSTS:</div>	
<div>OK</div> <div>Cancel</div> <div>Uncertainty on Total...</div>	

Figure 26. Other Government Costs Dialog Box

Save

When *Forecast* is first loaded, the document is 'Untitled' (displayed in the Title Bar). Although the entire analysis could be performed without a title, we will introduce you to the *Save* option. From the *File* menu select *Save*. The Save As dialog box appears. The default name 'DEFAULT.CAM' is displayed initially.

Figure 27. Save As Dialog Box

You are encouraged to use a meaningful name that will help describe the analysis. While the file name is highlighted, simply begin typing and the old file name will be replaced. Up to eight characters may be used in the title with an additional three characters as an extension. Type in **TUTOR** and press the ENTER key. A file named TUTOR.CAM is created, and all the current information is saved. At any point during the analysis, the file may be quickly saved by pressing CTRL+S. You are encouraged to save documents often during an analysis to insure against unforeseen problems. Notice that the file name now appears in the *Forecast* title bar.

If you do not supply an extension for the file name, *Forecast* will automatically add '.CAM'. You may, however, supply any extension.

Attributes Summary

The analysis of the sample case is now complete. Results for all values and impacts categories are displayed on the screen.

ATTRIBUTES SUMMARY 1995 DOLLARS			
Values	Incremental Value		
	5th Percentile	Mean	95th Percentile
Public Health (Accident)	195,000	10,214,000	50,584,000
Public Health (Routine)	0	0	0
Occupational Health (Accident)	0	0	0
Occupational Health (Routine)	-5,521,000	-1,635,000	-208,000
Impacts			
Onsite Property	3,867,000	15,599,000	40,418,000
Averted Offsite Non-Health	42,210,000	166,178,000	426,596,000
Industry Implementation	-328,975,000	-271,924,000	-221,641,000
Industry Operation	0	0	0
NRC Implementation	-351,000	-286,000	-229,000
NRC Operation	0	0	0
Other Government	0	0	0
Net Value:		-81,854,000	
Recalculate On			

Figure 28. Attributes Summary Window

In the Attributes Summary window shown above, the very large negative Net Value indicates that the proposed regulatory action cannot be justified on the basis of the Attribute valuations. The bottom line estimate indicates that the action is most likely to

result in increased costs of almost \$81 million (mean). A review of the Attributes shows that the major contributor to the increased costs is Industry Implementation, and most of the costs here are attributable to the replacement energy costs incurred because of the plant shutdown required to accomplish the physical modifications. (Figure 30 below shows greater detail of Industry Implementation costs.) The Net Value distribution displayed in Figure 29 indicates that the costs are known to within factors of 2 to 3, based on the uncertainty distributions input for the evaluation. The Net Value distribution from Figure 29 also suggests that the Net Value is expected to be negative (net costs rather than net savings) with a probability of about 80%. Conversely, there is about a 20% change that the proposed actions would result in a cost savings.

NET VALUE [with uncertainty]	
	1995 DOLLARS
5th percentile	-231,543,000
23rd percentile	-175,176,000
50th percentile	-112,863,000
77th percentile	-26,011,000
95th percentile	183,275,000
WARNING: Percentiles are approximate. Interpolation or extrapolation may not be meaningful.	

Figure 29. Net Value Distribution

You can view the cost analysis data in a variety of formats by choosing any of the options on the Window menu. Specifically, the Calculated Costs window provides a breakdown of the Industry and NRC Implementation and Operation cost categories. Choose *Calculated Costs* from the *Window* menu.

CATEGORY	CALCULATED COSTS		1995 DOLLARS	
	COST PER PLANT		TOTAL COST	
Hardware and Equipment	\$	1,908,600	\$	19,085,900
Installation Labor	\$	2,855,500	\$	28,554,600
Removal Labor	\$	1,710,700	\$	17,107,200
Engineering/QA-QC	\$	1,315,900	\$	13,158,800
Health Physics	\$	4,287,800	\$	42,878,500
Reactor Shutdown and Startup	\$	31,100	\$	310,800
Reactor Defueling/Refueling	\$	168,500	\$	1,684,900
Replacement Energy	\$	14,117,400	\$	141,174,300
Radioactive Waste Disposal	\$	775,400	\$	7,753,900
Licensee Procedural/Analytical	\$	45,200	\$	451,800
TOTAL LICENSEE ONETIME COSTS	\$	27,106,000	\$	271,924,000
LICENSEE RECURRING COSTS	\$	0	\$	0
Radiation Exposure (Rem)		418		4,175
NRC ONETIME COSTS	\$	29,000	\$	286,000
NRC RECURRING COSTS	\$	0	\$	0
Recalculate On				

Figure 30. Calculated Costs Window

Note that radiation exposure, which is displayed in person-rem, gives a direct indication of the radiation exposure associated with the physical or procedural modifications being evaluated. The exposure values include both the doses incurred in the one-time implementation activities and those due to recurring activities.

Print

For a complete report of cost breakdown by categories, a report file can be generated through the *Print* option on the *File* menu or by typing CTRL+P.

Figure 31. Print Dialog Box

Chapter 4. *Forecast* Menus

The remaining chapters of the manual describe each menu and menu item found in *Forecast*. The function and requirements for each menu item and related dialog boxes are discussed. These are presented in the order in which they appear on the menu bar to minimize the search for information. Background information for the regulatory analysis attributes and cost algorithms is also given, but for a complete understanding of the attributes or generic costing methods, the original documents on which the methodology is based should be used.

The *Forecast* main menu contains all the options needed to complete an analysis. The following items appear on the *Forecast* main menu. The discussion indicates where the major Attributes can be accessed.

- File Operations to create, save and retrieve files.
- Edit Allows edit of important parameters such as discount rate, remaining life of the facilities of interest, and value and cost factors and labor wages. In addition, you can toggle the state of recalculation so that results are recalculated automatically every time a value is changed or not recalculated every time.
- Values Defines the public values that the NRC is directed by Congress to seek including protection of the public health and safety against the hazards of radiation. Specifically, this menu item allows the user to set the reference accident frequency, and any change in this frequency expected to result from the implementation of the regulatory change of concern. It also provides access to the *Averted Exposures* dialog box, where both reference (baseline) values and change in public radiation exposure and occupational radiation exposure due to accidents can be set.
- System Defines specific physical plant system(s) to be modeled for cases where physical modifications to licensee facilities may result from the regulatory change(s) being evaluated in the regulatory analysis. Any impacts, including costs and occupational radiation exposure, related to physical modifications are included in the attribute of *Licensee Implementation*.

- **Impacts** Defines elements related to the attributes of *Licensee Implementation*, *Licensee Operation*, *NRC Implementation*, *NRC Operation*, *Averted On-site Property costs*, *Averted Off-site Non-Health costs*, and *Other Government costs*.
- **Window** Displays cost information in a variety of formats.
- **Help** Provides information on cost categories, *Forecast*, and Windows.

Control Menu

All Windows applications have a "Control Menu" located in the upper left corner of the screen. The Control Menu provides commands for controlling the size and position of the window. This menu can be accessed by double clicking on the bar located in the upper left hand corner of the window or by pressing ALT+SPACEBAR. The options under the Control Menu are:

- **Restore** Restores a window to the size it was before it was altered
- **Move** Moves a window to another position on the screen
- **Size** Changes the size of the window
- **Minimize** Shrinks the selected window to an icon
- **Maximize** Enlarges the selected window to its maximum size
- **Close** Closes the application window and exits the program.

Chapter 5. File Menu

The *File* menu provides all the functions necessary to create, retrieve, save, and print files and also allows you to Exit the *Forecast* program. These functions are:

- New
- Open
- Save
- Save As
- Print
- Exit

Each option is discussed in detail on the following pages.

New

Figure 32. New Dialog Box

New clears the work area in order to allow you to begin a new, untitled analysis. If you choose *New* while an analysis is being performed, you will be queried to save the current analysis.

New requires you to describe the water reactor type and the number of plants to be analyzed. Until these options are made, the *Values*, *System*, and *Impacts* menu options are grayed and are not available. You should also verify that the year presented is correct. This year is obtained from your personal computer's system clock. This year is used to determine in which year the default costs will be presented by *Forecast*. Any costs you enter should also apply to that year. You can change the year should the value presented be incorrect or should you desire to have *Forecast's* results presented in dollars appropriate to some future year.

Forecast was designed primarily to evaluate regulatory changes effecting water-cooled nuclear power plants. You must choose one of the two reactor types presented (or accept the default type presented by the code). The *Water Reactor Type* can be either a Pressurized Water Reactor (PWR) or a Boiling Water Reactor (BWR). This selection tells the code which internal data base of nuclear plant systems and system characteristics to have available for the analysis. The *Number of plants of type selected to be analyzed* is also entered via this dialog box. The default is one plant. Note that once you exit this dialog box by selecting OK or by pressing ENTER, you cannot return to it to change either the reactor type, the default year, or the number of facilities affected unless you start a new analysis.

While *Forecast* is primarily geared for water reactor analysis cases, other types of facilities can also be evaluated. For non-nuclear plant applications, either PWR or BWR can be selected. The code allows sufficient flexibility for the user to enter data pertinent to the type of facility of interest, and to override any reactor-related data presented by the code.

Open

Figure 33. Open Dialog Box

The *Open* dialog box displays documents previously stored on disk. Different drives and directories may be accessed by selecting them from the *Directories* list box. By selecting a document name and choosing *OK* (or by double-clicking on the document name), that document will be opened. Note that although *Forecast* saves documents with the .CAM extension as a default, documents may have any extension, but must be created by *Forecast* to be opened. CAM is an acronym for Cost Analysis Module.

Save

The *Save* command stores the current analysis document onto disk for permanent storage. If the current analysis is untitled, a dialog box asks you to name it. If the analysis is already named and saved on disk, the *Save* command replaces the old version on the disk with a copy of the current one. *Save* may also be activated by pressing CTRL+S.

Save As

Figure 34. Save/Save As Dialog Box

The *Save As* command displays a dialog box that lets you save another copy of the current analysis under a different name. For example, if a new analysis is desired that requires only minor changes to a previous analysis, you could open the old document, make the changes, then use the *Save As* command. In this way, the old document remains unchanged and a new document is created without having to re-enter the same data.

Options are also available to save the analysis data in text files for use with other software such as dBase, Lotus, and Excel. These text files are delimited ASCII files in a format expected by the spreadsheets and database program. These files have a '.TXT' extension in the file name. Note that text files are not readable by *Forecast* and therefore, you should also save the analysis as a normal *Forecast* file in order to use it at a later date within the *Forecast* program.

Print

Print

Report Categories

- ☐ Factors
- ☐ Averted Exposures
- ☐ Systems Costs
- ☐ Shutdown Costs
- ☐ Defueling Costs
- ☐ Replacement Energy Costs
- ☐ Waste Disposal Costs
- ☐ Procedural Costs
- ☐ Recurring Costs
- ☐ Averted Onsite Property Costs
- ☐ Other Government
- ☐ Averted Offsite Non-Health Costs

Print Type

☐ Summary

☒ Report

Output Device

☒ Printer

☐ File

OK Cancel Report Title

Figure 35. Print Dialog Box

Use the *Print* command to generate hard copies of an analysis. The reports can be generated in two levels of detail: *Summary* and *Report*. The Summary printout includes the information presented on the Attribute Summary and Calculated Cost screens of *Forecast*. Detailed reports contain information about the cost categories selected by you on the *Categories for Report* group box. Use the mouse to check each category for which detailed information is desired or TAB to each category and use the SPACEBAR to select the category.

The *Report Title* button leads to a dialog box where you can label the cost analysis report. The eight-character file name under which the cost analysis was saved is automatically shown on printouts, however, using the *Report Title* feature allows you to also include a longer, more meaningful name for describing the cost analysis.

The report may be sent directly to a printer or to a file. The file will have the same name as the current analysis, but with a ".CAR" extension (Cost Analysis Report).

Exit

The *Exit* command allows you to exit *Forecast*. If a document is in use at the time, you are prompted to save the file. Using the CTRL+X accelerator also exits *Forecast*.

Chapter 6. Edit Menu

The *Edit* menu provides you with the ability to edit key parameters that are used in the quantification of the various attributes. You can also toggle Recalculate Automatically and Recalculate Now. These functions are discussed in detail below.

- Value Factors
- Discount Rate
- Remaining Life
- Labor Wages
- Cost Factors
- Recalculate Automatically
- Recalculate Now
- Set Uncertainties to Point Estimate

Value Factors

Edit Value Factors

Monetary Conversion Factors

Occupational Exposure: 2000 \$/person-rem

Public Exposure: 2000 \$/person-rem

OK Cancel Uncertainty...

Figure 36. Value Factors Dialog Box

When *Value Factors* is selected, a dialog box displays the Monetary Conversion Factor for Occupational Exposure and the Monetary Conversion Factor for Public Exposure. You can edit these values as desired. These values are used in calculating Averted Exposures (described in a later chapter). The default values presented are both \$2000/person-rem. *Forecast* does not automatically escalate these values for years beyond 1995 as it does most of the other cost data.

Note that you can review and modify the uncertainty distributions on the public and occupational values factors. This is accomplished by selecting the factor of interest and then clicking on the Uncertainty button. The Uncertainty Distribution dialog box appears.

Uncertainty Distribution

Mean: 2000.000000

Uncertainty Distribution Type

☐ Point Estimate (No Uncertainty)

☐ Uniform

Minimum Value:

☒ Log Normal

Error Factor: 2.0000000

☐ General

5th Percentile:

50th Percentile:

95th Percentile:

Standard Deviation:

OK Cancel

Figure 37. Uncertainty Distribution Dialog Box

The Uncertainty Distribution dialog box shows the default distribution type and factors which characterize the uncertainty for the selected parameter. You can modify the distribution type and uncertainty characteristics as appropriate. Note that the "Mean" is presented in an edit box, but editing the mean value on this screen has no effect, i.e., the code will use the mean value established in the dialog box used to access the Uncertainty Distribution dialog box.

Press ENTER to return to the Edit Value Factors dialog box.

Discount Rate

Discount Rate

Discount Rate: 7.000000 %

OK

Cancel

☒ Discount Monetary Values of Radiation Exposures

Figure 38. Discount Rate Dialog Box

Discount Rate displays a dialog box where you can edit the discount rate. The discount rate is used in calculating Averted Exposures, Averted On-site Cost, and other attributes involving recurring costs. The default value is 7%. Note that the rate is displayed (and entered) as a percent, not as a fraction. A checkbox is provided to allow you to decide whether to discount monetary values of radiation exposures. The default is to discount (checkbox is checked), as recommended by the NRC's latest revision of the NRC's Regulatory Analysis Guidelines (NUREG/BR-0058, Rev. 2).

Remaining Life

Figure 39. Remaining Life Dialog Box

Remaining Life displays a dialog box where you can edit the Years of Remaining Facility Life. This value is used in calculating Averted Exposures, On-site Property Costs, and Recurring Costs. The default value presented is the average remaining life for the U.S. nuclear power plant population (22 in 1995). This default value is set based on the year indicated by the computer's clock. If nuclear plant license renewal is to be considered, you should change the value presented so that it reflects the number of years of remaining life including license renewal. Also, if the target year chosen for the analysis is other than that established by the computer's clock, the default remaining life is adjusted accordingly.

Labor Wages

Labor Wages		
Base Wage Rates	Hourly Wage Rate	OK
Analyst Technician	Analyst Technician	Cancel
Assistant Technician	20.43 \$42,494/year	All
Backup Operator		Restore Default
Chemical Analyst		
Crane Operator		
Electrician		
Fuel Operator		
Fuel Technician		
Health Physicist		
Instrument Mechanic	45.76 \$95,187/year	

Figure 40. Labor Wages Dialog Box

When *Labor Wages* is selected, a dialog box displays the wage rate associated with the currently highlighted labor category. You can edit the rates for any labor category. Alternatively, all rates may be modified by a user-specified factor by selecting *All*. The changes you have made can be discarded by choosing *Restore Default*. The hourly wage rates shown are basic wages exclusive of any loading. The loaded rate includes allowance for fringe benefit costs, general overheads, and geographic cost variations. *Forecast* applies these loading factors when selected wage rates are applied to a particular analysis.

Cost Factors

By selecting *Cost Factors* from the *Edit* menu, you can change other factors. These include the values assigned to learning curve factors, the overhead to be applied to all labor rates, the cost of providing comprehensive health-physics related services, and the factors defining engineering/QA costs relative to total direct costs. The changes you have made can be discarded by choosing *Restore Default*.

Cost Factors	
Learning Curve Factors No Previous Experience: 2.60 1 Previous Experience: 1.50 2 Previous Experiences: 0.40 3 or More Experiences: 0.00	Cost of Providing Comprehensive Health-Physics Related Services Cost \$/person-rem: 10270
Labor Loading Factors Geographic Variation: 1.12 EEDB Labor Factor: 1.59 General Labor: 2.00	Engineering Q/A Factors Operating Environment: 0.25 New Plant Construction: 0.35
<input type="button" value="Restore Default"/> <input type="button" value="Uncertainty..."/> <input type="button" value="OK"/> <input type="button" value="Cancel"/>	

Figure 41. Cost Factors Dialog Box

Note that each of the cost factors presented on this screen can be separately edited. Each is also treated with uncertainty, and you can review the default selections and modify them as appropriate to the analysis being performed.

Recalculate Automatically

Recalculate Automatically toggles the state of recalculation. If this option is preceded by a check mark, results are calculated automatically every time a number used in arriving at a calculated cost is changed. If this menu item is not checked, you must choose Recalculate Now (described below) to obtain up-to-date results. The default for this option is to Recalculate Automatically.

Recalculate Now

Recalculate Now recalculates all calculated costs and updates the Attributes Summary and Calculated Costs summary windows.

Set Uncertainties to Point Estimates

This command will set all uncertainties to point estimates (no uncertainty) and recalculate all values. All default and user defined uncertainty types will be changed to point estimate. A warning box is displayed which allows you to verify that you really want to proceed. Note that you can set uncertainty to point estimate on individual parameters on the appropriate dialog boxes.

Fig 42. Set Uncertainties to Point Estimates Warning Box

Chapter 7. Values Menu

The Values menu provides you with the ability to calculate the public values that the NRC is directed to seek by Congress, including protection of the public health and safety against the hazards of radiation. The input and selections made here determine the valuation of the attributes of Averted Public Exposure (accident), Averted Public Exposure (routine), and Averted Occupational Exposure (accident). In addition, the baseline or reference accident frequency, and any changes therein due to proposed regulatory changes and the resulting licensee actions, are used in the quantification of Averted Onsite Property cost.

The options on the Values menu are:

- Accident/Event Frequency
- Averted Exposures

Accident/Event Frequency

The Accident/Event Frequency dialog is used for entering and editing the reference Accident/Event Frequency and the change in Accident/Event Frequency. There is no default for these values; you must provide a value. However, default uncertainties have been provided on both of these parameters. You can view the uncertainty selections and change the defaults by selecting the parameter of interest and then clicking on the Uncertainty button. Note that the default error factors provided are quite large, reflecting the typically large uncertainty associated with estimating accident frequencies. These values are used in calculating Averted Exposures, Averted Onsite Property Costs, and Averted Offsite Non-Health Costs.

Accident/Event Frequency

Current Accident Frequency: /year

[For uncertainty analysis, include all sources of uncertainty.]

Change In Frequency

☒ As a Single Value

Change in Accident Frequency: /year

☐ As a Difference in Two Frequencies

Current Accident Frequency: /year

[For uncertainty analysis, include only uncertainties from failure modes unique to the current case.]

Alternate Accident Frequency: /year

[For uncertainty analysis, include only uncertainties from failure modes unique to the alternate case.]

OK Cancel Uncertainty...

Figure 43. Accident/Event Frequency Dialog Box

You can choose to set the change in frequency by entering a single value for the change or by entering the current accident frequency and an alternate accident frequency and allowing *Forecast* to calculate the change as a difference in the two frequencies. Uncertainty is set separately for the current accident frequency for use in calculating the difference.

Averted Exposures

The Averted Exposures dialog is used for entering the necessary values to calculate Public Health (Accident and Routine) and Occupational Health (Accident and Routine).

Averted Exposures

Years Before Facility Begins Operating:

☒ Public Health ☐ Occupational Health

Public Health

Accident	Reference Exposure	Change in Exposure
Public Exposure per Event/Accident:	<input type="text" value="0.000000"/>	<input type="text" value="0.000000"/>
Discounted monetary value of reduction in accident public exposure per facility due to implementation of proposed action:		\$ 0
Net Public Exposure Change: (person-rem)		0

Routine	Implementation Phase	Operational Phase
Changes in Estimated Routine Public Exposure:	<input type="text" value="0.000000"/>	<input type="text" value="0.000000"/>
Discounted Monetary Value of Combined Overall Routine Public Exposure:		\$ 0

Figure 44. Averted Exposures Dialog Box

Public Health (Accident)

Public Health (Accident) is calculated in terms of Avoided Public Dose, which is quantified by evaluating the change in accident frequency and any changes in anticipated radiological exposure to the public (public dose) due to postulated accidents and their associated radiological releases. The changes in accident frequency and public exposure are those expected to result from implementation of the proposed regulatory change(s) being evaluated. The formulation of accident-related Public Health effects implemented in *Forecast* is taken from Section 5.7.1 of the Regulatory Analysis Technical Evaluation Handbook. The analyst must evaluate the change in accident frequency and/or any expected changes in the resulting exposures to the public. *Forecast* accepts single values for the reference accident frequency, the frequency changes, the reference equivalent public exposure, and the change in public exposure due to the accidents of concern. Uncertainties on each of these parameters can be separately defined by the user. Public exposure in person-rem is converted to a monetary value through a user-editable

monetary conversion factor for public health effects (\$ per person-rem) which you can view and edit from the Edit menu. The results presented by *Forecast* are developed as discounted monetized values of accident-related public health effects. Overall exposure estimates are also calculated and shown in person-rem. The person-rem estimates are not discounted.

To obtain estimates of accident-related public health effects, the user must enter the following:

- Reference or baseline estimated public exposure per event or accident (person-rem/event). This dose is the equivalent overall dose resulting from the various types of radiological releases from postulated accidents.
- Reference or baseline estimated event/accident frequency (events/facility-year). This input is provided on a per-facility basis on the Accident/Event Frequency dialog box.
- Change, if any, in estimated public exposure per event or accident (person-rem/event) due to implementation of proposed rule change;
- Change, if any, in event/accident frequency (events/facility-year) due to implementation of proposed rule change being evaluated, entered on Accident/Event Frequency dialog box.

The default monetary conversion factor used in *Forecast* for converting from public exposure in person-rem to dollars is \$2000/person-rem of exposure in 1995\$.

The discounting formula used in *Forecast* provides a factor which represents the present value of a stream of potential losses extending over the remaining lifetime of the facility. It accounts for the possibility that an accident could occur in each year of remaining facility life.

Public Health (Routine)

Environmental assessments of nuclear power plants show that the public does not receive any measurable radiation exposure from routine operation of the plants. However, it is conceivable that routine public health effects might need to be evaluated for particular issues affecting non-power reactor facilities. *Forecast* includes models that can be used to perform such evaluations. The calculational method implemented in *Forecast* for evaluating avoided Public Health (Routine) effects takes into account both implementation and operational impacts on routine public exposures. To account for any possible routine public health effects, tab to the Implementation Phase edit field.

Implementation:

To obtain estimates of implementation phase public health effects associated with routine operation of a facility, the user must enter the estimated public exposure change associated with the implementation of the proposed action (person-rem/facility)

As previously noted, the default monetary conversion factor used in *Forecast* for converting from public exposure in person-rem to dollars is \$2000/person-rem of exposure in 1995\$, and is user-editable through the Edit menu.

The discounting formula associated with routine, implementation phase public exposure allows for the possibilities that the proposed action takes place either immediately or at some point in the future. The assumption is made that the implementation effects occur at a single point in time.

Operation:

To obtain estimates of public health effects associated with routine operation of a facility, the user must enter the estimated annual public exposure reduction associated with the operation of the affected facilities following implementation of the proposed action (person-rem/facility-year)

The discounting formula used in *Forecast* provides a factor which present-values the annual routine public exposure reductions extending over the remaining lifetime of the facility. The formulation also allows for the possibility that the facility or facilities of concern have not yet been placed in operation. The associated remaining lifetime is the expected operational life, and should not include any period before the facility begins operation.

Occupational Health (Accident)

The *Forecast* calculation for avoided Occupational Health (Accident) Effects takes into account both immediate and long term exposures. The immediate effects are those due to worker exposure during and immediately following an accident involving radiological releases. The long term exposures are those associated with cleanup and decontamination activities.

Immediate Doses:

To obtain estimates of immediate occupational health effects associated with an accident, the user must enter the following:

- Reference or baseline estimated immediate occupational exposure per event or accident (person-rem/event). This input is provided on a per-facility basis. This

dose is the equivalent overall dose resulting from the various types of radiological releases from postulated accidents.

- Change, if any, in estimated immediate occupational exposure per event or accident (person-rem/event) due to implementation of proposed rule change;

The calculation of occupational exposures due to accidents uses the reference or baseline estimated event/accident frequency (events/facility-year) and the change, if any, in event/accident frequency due to implementation of proposed rule change being evaluated.

The default monetary conversion factor used in *Forecast* for converting from occupational exposure in person-rem to dollars is \$2000/person-rem of exposure in 1995\$. This value is user-editable through the Edit menu.

The discounting formula used provides a factor which represents the present value of a stream of potential exposures extending over the remaining lifetime of the facility. It accounts for the possibility that an accident could occur in each year of remaining facility life.

Long Term Occupational Exposure Doses:

Long term occupational doses are those associated with decontamination and cleanup of the facility following a severe accident.

To obtain estimates of long term occupational health effects associated with an accident, the you must enter the reference or baseline estimated long term occupational exposure per event or accident (person-rem/event) associated with cleanup and decontamination activities. This input is provided on a per-facility basis. This dose is the equivalent overall dose resulting from the various types of radiological releases from postulated accidents. As with the previous calculations, *Forecast* uses the baseline estimated event/accident frequency and/or any change, if any, in estimated long term occupational exposure per event or accident (person-rem/event) due to implementation of proposed rule changes in the valuation of long term occupational exposure due to accidents.

Representative values for long term occupational exposure due to accidents at nuclear power plants are presented in the draft Handbook. These values are based in part on the TMI cleanup experience to date and on projections of further exposures.

The discounting formula applied to long term occupational exposure assumes that the cleanup activities, and thus the dose accrual period, extend over a period of 10 years.

Forecast does not separately account for health physics costs associated with accident-related occupational exposures. These costs are assumed to be included in the accident cleanup and decontamination costs.

Occupational Health (Routine)

Forecast automatically calculates routine occupational exposure associated with Industry Implementation activities. The basic approach estimates the exposures by multiplying in-field hours by the average dose rate prevalent at the worksite. The in-radiation-field labor hours are a fraction of the combined productive plus non-productive labor hours. The factors which impact labor productivity and which effect in-field hours are those that actually hamper work-place activities. These are the factors such as access, congestion, and management effectiveness. Other factors, those for radiation, learning curve effects, and engineering and quality assurance, primarily influence the amount of time spent outside the radiation field.

Routine occupational exposures may also be incurred on a recurring basis. The user can specify the equivalent annual occupational dose per facility (or the reduction therein) expected from the proposed rule change. This estimate is entered by selecting Licensee Recurring Costs from the Impacts menu. *Forecast* takes this annual exposure and multiplies it by the number of years of remaining plant lifetime and the number of affected facilities to estimate total exposure due to recurring activities.

Once the total person-rem exposure changes due to changes in requirements is estimated, a dollar value can be assigned to account for this impact in monetary terms. For most NRC work, a value of \$2,000/person-rem is typically assigned, and this value is recommended in the Guidelines and Handbook as of 1995. Equivalent monetary impacts are estimated using appropriate discounting formulae.

Forecast also assumes that all occupational exposures result in additional costs due to the associated health physics (HP) service costs. These costs are automatically calculated based on given costs per person-rem incurred. The user can modify the default value provided for HP services cost (\$/person-rem) through the Edit menu.

Chapter 8. System Menu

The System menu should be used for those cases wherein NRC licensees may have to implement physical modifications due to new rules or rule changes. This feature of *Forecast* assists in evaluating these physical modification requirements in terms of dollar costs and possible routine occupational exposure incurred by licensees because of the rule changes. *Forecast* provides you with the ability to define modifications in up to five separate systems. When the *System* menu option is initially selected from the main menu the only menu item that appears is *New System*. As systems are defined, the *System* menu changes to reflect new systems on the menu as *Subsystem X*, where *X* increases from 1 to 5 for each system added. The options on the System menu are:

- New System
- Subsystem 1
- Subsystem 2

.
. .
.

Costs and occupational radiation exposure associated with physical modifications are part of the attribute of Licensee Implementation.

New System

Up to five separate systems or subsystems can be dealt with in a single *Forecast* analysis. Each can have its own name and account number and will be treated with cost factors specific to that system or subsystem. When either *New System* or *Subsystem X* is chosen, the *System* dialog box appears and provides buttons for defining the specific system(s) being modeled. The Environment must be set for the analysis before the *Done* button is available to leave this dialog box. The *Environment*, *Account*, *Costs*, and *Factors* buttons are described in the following sections.

Environment

The *Environment* button on the System dialog box leads to a dialog box that allows you to specify the condition under which the modification will take place. See Abstracts 2.1.7, 2.1.8, and 6.5 for general guidance and advice on making these selections.

Figure 45. Environment Dialog Box

Physical Modification Environment must be set for any scenario that involves the addition, removal, or alteration of any of the systems of a reactor plant. The check boxes in the *Physical Modification Environment* dialog box affect the access factor, congestion factor, manageability factor and radiation factors for the analysis.

Outage Activity must be selected if the modification requires the plant to be shutdown in order to perform the modification. This selection does not automatically define the costs associated with the shutdown. It does affect certain of the labor productivity factors associated with the modification.

Plant Under Construction must be set if the work is to be performed on new plants that have not yet operated but that are at least 70% complete.

Installation indicates that equipment, hardware, and/or structural materials are to be installed as part of the physical modification activity.

Removal indicates that items of interest are to be removed as part of the physical modification activity.

Structural Modification Required must be chosen if there will be modifications to structural elements of the plant, such as requiring the removal of walls or doors. This also affects the labor productivity factor.

Removal of Non-Target Components Required indicates that the system cannot be accessed without the removal of other ancillary components. In order to select this box, the *Removal* box must be selected.

Major Removal/Replacement Activity - If a major activity has not been performed many times before, a learning curve factor will alter the costs associated with the modification. A major activity is defined as one that requires several thousand hours to complete and that is unusual and complex.

When Major Removal/Replacement Activity is chosen, a dialog box is displayed where you can enter the learning curve factor. The default factors applied for each choice are as follows:

Number of Times Activity Performed	Cost Factor
0	3.6
1	2.5
2	1.4
3	1.0

Major Removal/Replacement Activity

Learning Curve Factors

Utility Industry has Performed Same Type of Modification Previously:

☒ Never ☐ Once

☐ Twice ☐ Three Times or More

OK Cancel

Figure 46. Learning Curve Factors Dialog Box

Account

The *Account* button leads to dialog box where you specifically define the EEDB account to be analyzed. *Forecast* contains EEDB accounts and their installation labor hours, labor costs, and material/equipment costs as well as account name and description, and a set of cost factors pertinent to each account.

The type of plant displayed in the upper right area of the screen (PWR or BWR) was specified by you in the *File New* dialog box.

The *More Info* button on this screen activates a dialog box (see Figure 45) that breaks down the factory and site costs and gives quantities, units, etc., for the selected account.

The EEDB default values for labor/material costs can be edited through the *Costs* dialog box which is accessible through the *System* menu.

Labor Hours	Labor Rate (\$/hr)	Factory/Site Material Costs
3,300	\$30.63	\$9,856

222.1431 PRESSURIZER
222.1432 PRESSURIZER RELIEF TANK

Figure 47. Account Dialog Box

Account Information

The *Account Information* dialog box displays the original EEDB information for the account selected in the *Account* dialog box. Any changes you have made to these costs can be viewed in the *Costs* dialog box.

ORIGINAL EEDB UNLOADED BASE COST			
Account Number: 222.1431			
Description: PRESSURIZER			
Site Costs			
Quantity	Labor Hours	Labor Cost	Material Cost
1 LT	3,300	\$101,083	\$9,856
Factory Costs		Total Cost	
Quantity	Cost	\$110,939	
1 EA			

OK

Figure 48. Account Information Dialog

Costs

Figure 49 shows the *EEDB Costs* dialog box. All labor/material costs are entered through the *EEDB Costs* dialog box. These costs are normally obtained from the EEDB and the defaulted values are shown on the screen by *Forecast*. If you have applicable cost information from sources other than the EEDB, then these may be used. Note that the EEDB does not give costs for some accounts, or at least not down to the level of detail that may be needed for a particular analysis. In these instances you must obtain costs from other sources and enter these in *Forecast*.

The *EEDB Labor Hours* are the Greenfield labor hours.

The *Labor Rate* includes the costs of wages and fringe benefits paid to the craftsmen who erect, fabricate, and install the factory equipment and site material. The labor rates used in the EEDB are formulated based on composite crew rates. They are derived by multiplying the percent of project effort of particular crafts by their respective wage rates.

These costs do not include any overtime because EEDB construction schedules are based on a straight time, eight-hour day and forty hour week. If a source of labor rates other than the EEDB is used, fringe must be included to make these values consistent with those from the EEDB.

The *Material Costs* are the site material replacement costs and may or may not be found in the EEDB. You may have to find another source, such as the utility itself. These costs should also reflect the quality for nuclear standard material.

The *Equipment Costs* are the factory equipment costs and also may or may not be found in the EEDB.

EEDB Costs		
	Original Values	Amounts to Include
EEDB Labor Hours:	<input type="text" value="3300"/>	3,298
Labor Rate (w/fringe): \$/hour	<input type="text" value="30.63"/>	
Loaded Labor Cost:		\$ 159,875
Material Costs:	\$ <input type="text" value="9856"/>	\$ 9,849
Equipment Costs:	\$ <input type="text"/>	\$
Percentage of Original Costs to Include:		<input type="text" value="100"/> %

OK
Cancel
Uncertainty...

Figure 49. EEDB Costs Dialog Box

Factors

While the EEDB estimates reflect costs incurred in a new construction environment, adjustments here allow for additional factors found in construction tasks at operating reactors such as working in a radiation environment, poor access, congestion and interference.

The *Factors* dialog box represents a compilation of the default values found in the CFDB data base for the selected system, and the values set up in the *Physical Modification* Environment. The factors found here, *Access and Handling*, *Congestion*, *Radiation*, and *Manageability* can be changed in the edit fields. They may also be viewed and edited through either of the help dialog boxes accessed through the help buttons in the lower left corner of the *Cost Factor* dialog box.

The removal factors can only be edited if a removal activity has been specified in the environment dialog box.

Factors	
COST FACTORS FOR PWR Plant - ACCOUNT 222.1431	
Dose Rate:	95 mrem/hr
Labor Productivity Factors	
Access and handling:	0.4
Congestion:	0.4
Radiation:	14.5
Manageability:	0.4
Total Productivity Factor for Installation:	16.71
Removal Factors	
Structural:	0.00
Impingement:	0.60
Total Productivity Factor for Removal:	1.00
<input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Uncertainty..."/> <input type="button" value="General Help..."/> <input type="button" value="Radiation Help..."/>	

Figure 50. Factors Dialog Box

Uncertainty for the Costs factors can be set for Dose Rate and on the total for each area, not on each number used in arriving at the total.

The *General Help* dialog box (Figure 51) allows you to see what the factors actually mean in terms of location of the system (access), difficulty associated with the modification of the system (congestion), and the radiation environment. The radio buttons for each category may be alternatively selected to see the dependencies between the cost factors. Choices are not set until the *OK* button is selected.

The dialog box is titled "General Cost Factor Help" and contains the subtitle "COST FACTORS FOR PWR Plant - ACCOUNT 222.1431". It is divided into three main sections: "Access", "Congestion", and "Radiation", each with radio button options. To the right, under "Cost Factors", are two sub-sections: "Labor Productivity" and "Removal", each listing numerical values for different factors. At the bottom right are "OK" and "Cancel" buttons.

Category	Option	Value
Access	☐ Outside Containment (Easy)	
	☐ Close Proximity to Containment	
	☒ Containment Area (Difficult)	
Congestion	☐ Open area	
	☐ Congested Work Area	
	☒ Severely Congested Area	
Radiation	☐ None	
	☐ Moderate	
	☐ High	
	☒ High + Temp(1hr)	
Labor Productivity	0.4 Access and handling	
	0.4 Congestion	
Removal	14.5 Radiation	
	0.4 Manageability	
	0.00 Structural Factor	
	0.60 Impingement Factor	

Figure 51. General Cost Factor Help Dialog Box

The *Radiation Help* dialog box allows you to see how the dose rate affects the labor productivity factor for radiation. When a radiation level is chosen from the radio buttons, an average dose rate for that range is supplied. Conversely, you can enter dose rate data directly. The productivity factors will be adjusted consistent with the values entered.

Radiation Help

COST FACTORS FOR PWR Plant - ACCOUNT 222.1431

Modification Radiation Level

- ☐ No Radiation (0)
- ☐ Minimal Equipment Requirements (1-10 mrem/hr)
- ☐ Full Protective Equipment (11-30 mrem/hr)
- ☐ High Radiation, high temperature (31-50 mrem/hr, 2 hr stay time)
- ☒ High Radiation, high temperature (51-100 mrem/hr, 1 hr stay time)
- ☐ High Radiation, high temperature (> 100 mrem/hr, 1/2 hr stay time)

Dose Rate:
(mrem/hr)

Dose Rate Range for System
2 - 5100

Radiation Labor Productivity Factor

Figure 52. Radiation Help Dialog Box

Chapter 9. Impacts Menu

The *Impacts* menu covers several cost/impact categories that contribute to the overall quantification of key regulatory analysis attributes. The options on the *Impacts* menu, and the attributes they contribute to, are as follows:

<u>Cost Element</u>	<u>Attribute</u>
• Shutdown Required	Industry Implementation
• Unscheduled Reactor Shutdown	
• Reactor Defueling/Refueling	
• Replacement Energy	Industry Impl. or Operation
• Waste Disposal	Industry Impl. or Operation
• Licensee Procedural	Industry Implementation
• NRC Procedural	NRC Implementation
• Licensee Recurring	Industry Operation
• NRC Recurring	NRC Operation
• Averted Onsite Property Costs	Onsite Property
• Averted Offsite Non-Health Costs	Averted Offsite Non-Health
• Other Government	Other Government

If you do not specifically access these topics, they are assumed to have no costs. That is, the default costs or valuation for these topics are assumed to be zero.

Shutdown Required

A cascading pull-down menu appears to one side of the Shutdown Required menu item displaying the three costs related to shutting down a reactor. These are:

- Unscheduled Reactor Shutdown
- Reactor Defueling/Refueling
- Replacement Energy Costs

These costs are applied when a shutdown is mandated by a regulatory change that may impose physical or procedural modifications to licensee facilities. These costs could be taken into account for those changes that must be accomplished with the plant shutdown, and that cannot be accomplished within the normally-scheduled refueling/maintenance outage time. In addition, replacement energy costs are also relevant if the length of the normally-scheduled outage is extended because of the modification work. In this case you must supply the time beyond the normally-scheduled shutdown in order to properly account for replacement energy costs.

Unscheduled Reactor Shutdown

There are two types of shutdown: shutdown to hot standby and cold shutdown. These costs are calculated by the crafts involved in a shutdown based on the default critical path outage time. This time may be altered, and the time and costs required for each craft to complete the shutdown is scaled by the ratio of the user-specified critical path outage time to the default time.

As indicated previously, shutdown costs need not be addressed unless the modification of concern requires a special plant shutdown.

The dialog box is titled "Unscheduled Reactor Shutdown". It contains a "Shutdown Type" section with two radio buttons: "To Hot Standby" and "To Cold Shutdown". The "To Cold Shutdown" option is selected. To the right of these buttons are two stacked buttons labeled "PWR" and "PLANT". Below the "Shutdown Type" section, there is a label "Critical Path Outage Time:" followed by a text input field containing the number "99" and the word "Hours". At the bottom, there is a label "Cost:" followed by the value "\$31078".

Figure 53. Unscheduled Reactor Shutdown Dialog Box

Reactor Defueling/Refueling

The *Reactor Defueling/Refueling* dialog box contains costs for all the activities performed during defueling and refueling for either PWRs or BWRs. Any activity choice selected from the list box will sum all the activities required to complete that activity. For example, if the discrete task were Fuel Removal, the costs would be:

Containment Prep + RPV Head Equip. Removal +
RPV Head Removal + Upper Internals Removal+ Fuel Removal.

Fuel sipping may or may not be required for these activities. To include these costs, select the *Fuel Sipping Required* check box. Costs displayed are for both defueling and refueling. Refer to the cost basis for Refueling/Defueling in *Forecast Help* for a detailed listing of crafts involved in this operation.

PWR	DEFUELING/REFUELING ACTIVITY	CP HOURS
	Containment Preparation/Decontamination	62
	RPV Head Equip., Conn. & Insul. Removal/Re-inst.	27
	RPV Head Removal/Re-installation	54
	Upper Internals Removal/Re-installation	39
	Fuel Removal/Reload	236
	Drain & Decontaminate	16
	Vessel Surveillance & Inspection	35

☐ Fuel Sipping Required

Outage Time (Critical Hours): 0

Total Costs: \$0

Figure 54. Reactor Defueling/Refueling Dialog Box

Refueling/defueling costs need be considered only for those activities that involve work within the reactor vessel, work where fuel must be removed because the outage required will be lengthy, or when work in close proximity to the vessel mandates that fuel be removed to allow the work to proceed.

Replacement Energy

Replacement Energy

Outage Information

Year: 1995 Duration: 0 Days Cost per day: (\$000) 306 Total Costs(\$000): \$ 0

☒ **Reactor Average for PWRs**

☒ All PWRs

☐ Average for plants from 0 to 500 megawatts

☐ Average for plants from 500 to 1000 megawatts

☐ Average for plants > 1000 megawatts

☐ **Plant Specific**

SELECTED Unit Name	Year	Days	Cost(\$000)

Buttons: OK, Cancel, Help..., Restore Default Cost

Figure 55. Replacement Energy Dialog Box

The default method for setting replacement energy costs is to use reactor average costs for the specified plant type (BWR or PWR) by capacity. However, you may choose to set costs specifically for each plant being analyzed. Replacement energy cost data is available for all 116 nuclear power plants in the U.S. This data is stored for each power plant based on the outage year. When a particular plant is selected from the list box, the replacement energy cost is shown for the number of days displayed in *Outage Duration*. The default number of outage days is based on the known outage time calculated in *Unscheduled Reactor Shutdown* and *Defueling/Refueling*. You must supply any additional outage time required for modifications.

Plant Specific costs are computed by selecting a plant from the list box, entering the year the replacement energy will be required, adjusting the outage duration to include the modification and selecting the *Add* button or double clicking with the mouse on the desired reactor unit. The plants will accumulate in the *Selected Unit* box each time the *Add* button is used. *Remove* allows you to remove a plant from the box. The number of plants to be analyzed as set in the *File New* dialog box determines the number of plants that can be selected for calculating replacement energy costs. Outage duration can be set separately for each plant. Note that replacement energy costs are treated with uncertainty.

Note that once a plant has been added, to make any subsequent changes you must first "remove" the original entry for that plant. Any desired changes can then be made. Then use the *Add* button to add the plant again. Note also that the Outage Year should be entered before using the *Add* button. A different year may be entered for each plant.

Forecast uses the average daily replacement energy costs set in the foregoing dialog box to calculate long term replacement energy costs associated with permanent reactor shutdown due to a severe accident. This value contributes to the Averted Onsite Property cost attribute.

As indicated in the dialog box, the user can choose to use average replacement energy costs rather than plant-specific costs. The choices provided include all plants of a particular type (all BWRs or all PWRs) and three size ranges for each reactor type.

Waste Disposal

Costs for Radioactive *Waste Disposal* are based on a 1000 mile transport distance from the plant to the waste disposal site. The disposal costs presented account for the costs of processing, volume reduction, shipping, and burial of wastes. You must specify the volume of each type of waste that is likely to be generated in a physical modification activity. The volume input is the as-shipped waste volume (i.e., the volume following any volume reduction efforts, packaging, etc.) on a per-reactor basis.

Default costs per 1000 cubic feet of waste are provided for each type of waste. You may edit these amounts if you have different data.

Guidance is provided in Abstract 2.1.4 of NUREG/CR-4627, "Generic Cost Estimates". Also, NUREG-1307, Rev. 5, "Report on Waste Burial Charges, Escalation of Decommissioning Waste Disposal Costs at Low-Level Waste Burial Facilities", August, 1995, provides information on the costs of disposing of a wide range of nuclear plant components. That information can be substituted for *Forecast*'s default disposal costs if you desire.

Waste Disposal			
WASTE DISPOSAL COST FOR PWR Plant - ACCOUNT 222.1431			
(Refer to Abstract 6.1 for estimating volumes.)			
	Volume (ft ³)	Cost/1000 ft ³	COST (\$)
Dry Wastes			
Non-Compactible Trash	1800	316905	561897
Compactible Trash	10000	18627	183484
Wet Wastes			
Ion Exchange Resins	250	178154	43872
Concentrated Liquids		122630	
Filter Sludge		239171	
TOTAL COST: \$		775386	

Figure 56. Waste Disposal Dialog Box

Both the waste volumes and disposal costs associated with each waste type have uncertainty treatment.

Licensee Procedural/Administrative/Analytical Costs

The *Licensee Procedural/Administrative/Analytical Costs* option allows you to enter costs in the following categories:

- Tech Spec Change
- Writing Procedures
- Staff Training
- Recordkeeping
- Other Technical

Each of the five Licensee Procedural/Administrative/Analytical cost categories noted above are all accessed from one window. *Forecast* presents information and user-editable fields in the center of the screen that are pertinent to the area selected by the radio buttons at the top of the screen. For example, Figure 54 shows information and options pertinent to a technical specification change. Default values are presented, but you can edit these values.

To access the windows pertinent to writing procedures, staff training, recordkeeping, or other technical cost areas simply use the mouse to click on the appropriate radio button or TAB to the button area and use the UP and DOWN ARROWS to select the appropriate radio button. Each of the five procedural/administrative/analytical cost areas should be selected and costs set as appropriate prior to choosing *OK*. Pressing *OK* brings the program back to the main summary cost screen.

All entries associated with procedural/administrative/analytical costs are entered or presented on a per-reactor or per-facility basis.

Note that all labor rates applicable to procedural/administrative/ analytical costs are assumed to be fully burdened. That is, they include allowances for fringe benefits, general overheads, and other possible adders. Any user-supplied wage rates must also be fully burdened.

Licensee Tech Spec Change Costs

Licensee technical specification changes may result from many NRC-mandated physical or procedural modifications. *Forecast* gives choices for either routine or complex technical specification changes. Enter the number of each type applicable to the analysis being performed. Default staff hours and hourly rates are presented by the code, both of which you can change. The numbers you enter for number of Licensee Tech Spec complex and routine changes become the defaults when the NRC Tech Spec change dialog box is displayed. Uncertainties are treated at the level of the overall total for each type of procedural/administrative/analytical cost rather than on the individual elements contributing to the total.

Licensee Proced/Admin/Analytical Costs

LICENSEE PROCEDURAL/ADMINISTRATIVE/ANALYTICAL COSTS

☒ **Tech Spec Change**
☐ **Recordkeeping**
☐ **Writing Procedures**
☐ **Other Technical**
☐ **Staff Training**

Technical Specification Change

Type of Change	Number	Staff Hours	Hourly Rate	Cost
Complex	1	640	70.63	\$45203
Routine	0	320	70.63	\$0
Total Cost				\$45182

Figure 57. Licensee Tech Spec Change Costs Dialog Box

Licensee Writing Procedures Costs

Many proposed regulatory requirements involve revising (rewriting) existing procedures or writing new procedures. This module handles estimates of the cost incurred by the industry in writing or rewriting procedures. The rate is assumed to be \$48.40 per hour. The assumed time required to write or rewrite procedures is as follows:

Cost Information:

Routine Change Costs Complex Change Costs

Operating Procedure		
Point Estimate	23 hrs	90 hrs
Maintenance Procedure		
Point Estimate	23 hrs	90 hrs
Health Physics		
Point Estimate	10 hrs	74 hrs

Licensee Proced/Admin/Analytical Costs

**LICENSEE
PROCEDURAL/ADMINISTRATIVE/ANALYTICAL COSTS**

☐ Tech Spec Change
☒ **Writing Procedures**
☐ Staff Training

☐ Recordkeeping
☐ Other Technical

Writing or Rewriting Procedures

TYPE OF PROCEDURE	NUMBER OF CHANGES		COST	
	Routine	Complex	Routine	Complex
Operating	0	0	1062	4355
Maintenance	0	0	1062	4355
Health Physics	0	0	425	3611
Total Cost:			\$0	

Figure 58. Licensee Writing Procedures Costs Dialog Box

Licensee Staff Training Costs

Many proposed regulatory requirements involve training/retraining. These costs should include hours required for instructors, simulators, and man hours required by attendees.

Enter the number of hours per student for each of the three training categories. The cost/hour shown reflects cost of facilities, instructors, and classroom materials. No values are shown for total costs until the number of students is entered.

If the wages of the students are to be included in the costs, a student hourly rate must be entered.

The code also presents default costs for writing/rewriting training manuals. You must estimate the number of pages of the manual that might be changed due to an NRC requirement.

Licensee Proced/Admin/Analytical Costs				
LICENSEE PROCEDURAL/ADMINISTRATIVE/ANALYTICAL COSTS				
☐ Tech Spec Change			☐ Recordkeeping	
☐ Writing Procedures			☐ Other Technical	
☒ Staff Training				
Training or Retraining Nuclear Power Plant Personnel				
	Hours/Student	Cost/Hour	Number of Students	Student Hourly Rate
SIMULATOR	<input type="text" value="0"/>	46.73		
CLASSROOM	<input type="text" value="0"/>	27.62	<input type="text" value="0"/>	<input type="text" value="0.00"/>
ON THE JOB	<input type="text" value="0"/>	8.50		
Write/Rewrite Training Manual	<input type="text" value="0"/>	118.96		
	Pages	\$/Page	Total Cost	\$0
<input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Uncertainty on Total.."/>				

Figure 59. Licensee Staff Training Costs Dialog Box

Licensee Recordkeeping Costs

Many proposed regulatory requirements involve recordkeeping and reporting revisions. The costs to perform these activities must be entered here. Defaults are provided for the first four of the five cost elements shown for complicated changes. Provision is made so that you can separately account for complex versus routine changes. Abstract 2.2.4 in NUREG/CR-4627, Generic Cost Estimates, provides guidance on costs related to recordkeeping changes.

Note that values can be entered in the cost boxes, but these will not be entered in the total unless the checkbox is activated for that cost element.

Licensee Proced/Admin/Analytical Costs		
LICENSEE PROCEDURAL/ADMINISTRATIVE/ANALYTICAL COSTS		
☐ Tech Spec Change	☒ Recordkeeping	
☐ Writing Procedures	☐ Other Technical	
☐ Staff Training		
Recordkeeping and/or Reporting Costs		
Type of Change ☒ Complicated ☐ Routine	☐ Evaluate Change	Cost
	☐ Revise Procedures	
	☐ Review Procedures	
	☐ Training	
	☐ Hardware/Software Change	
Total		\$0
<input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Uncertain on Total"/>		

Figure 60. Licensee Recordkeeping Costs Dialog Box

Licensee Other Technical Costs

This module allows for other technical costs to the licensee. It can be used to capture other costs not reported in the other categories. The only default provided is the hourly wage rate.

Licensee Proced/Admin/Analytical Costs		
LICENSEE PROCEDURAL/ADMINISTRATIVE/ANALYTICAL COSTS		
☐ <u>T</u> ech Spec Change	☐ <u>R</u> ecordkeeping	
☐ <u>W</u> riting Procedures	☒ Other Technical	
☐ <u>S</u> taff Training		
Other Technical Costs To Include In-Depth Technical Analyses, Computations and Scientific Analyses, and Other Administrative Duties.		
Technical Staff Hours	<input type="text" value="0"/>	Total Cost \$0
Hourly Rate	<input type="text" value="70.63"/>	
Other Costs	<input type="text" value="0"/>	
<input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Get Default Data"/>		

Figure 61. Licensee Other Technical Costs Dialog Box

NRC Procedural/Administrative/Analytical Costs

The *NRC Procedural/Administrative/Analytical Costs* option allows costs to be entered in the following categories:

- Tech Spec Change
- Implementation
- Other Technical

As with the similar costs for the licensee, all three categories of costs should be set before choosing *OK* in the window presented.

All NRC wage rates used are assumed to be fully burdened.

In defining NRC Procedural/Administrative/Analytical Costs, *Forecast* treats all entries on a per reactor basis. Where the overall NRC costs are known for actions affecting a number of plants, those costs should be divided by the number of plants impacted to arrive at the per reactor costs. For example, in developing a new rule or requirement the NRC will incur certain costs. Such rules typically apply to a whole class of nuclear plants. Therefore, these development costs, if they are to be included in the *Forecast* cost analysis, must first be defined on a unit reactor basis.

In the final summary these per reactor costs are multiplied by the number of plants being analyzed to arrive at the total costs.

Note that the default labor rates provided for NRC labor are based on the assumption that NRC costs associated with most regulatory actions are incremental costs and, as such, are partially burdened rather than fully burdened.

NRC Tech Spec Change Costs

The default costs presented are drawn from Abstract 5.1 (see NUREG/CR-4627, Generic Cost Estimates).

To include these NRC costs, simply enter the number of each type of change applicable to the analysis being performed. Both the number of staff hours and the hourly rate can be changed as needed.

NRC Proced/Admin/Analytical Costs
NRC PROCEDURAL/ADMINISTRATIVE/ANALYTICAL

☒ **Tech Spec Change**
☐ **Other Technical**
☐ **Implementation**

Technical Specification Change

Type of Change	Number	Staff Hours	Hourly Rate	Cost
Complex	1	512	51.83	\$26537
Routine	0	268	51.83	\$0
Total Cost				\$26518

Figure 62. NRC Tech Spec Change Costs Dialog Box

NRC Implementation Costs

Implementation costs are costs that might arise from developing procedures, preparing aids, and taking other actions to assure compliance with the proposed action. Example costs:

- a) Develop guidelines for interpreting the proposed action and develop enforcement procedures.
- b) Prepare handbooks for use by utilities and NRC staff responsible for compliance and enforcement respectively.
- c) Conduct initial plant inspections to validate implementation.

NRC Proced/Admin/Analytical Costs			
NRC PROCEDURAL/ADMINISTRATIVE/ANALYTICAL			
☐ Tech Spec Change		☐ Other Technical	
☒ Implementation			
Implementation Costs			
CATEGORY	STAFF HOURS		COSTS
- Developing Guidelines & Enforcement Procedures	<input type="text" value="0"/>	Hourly Rate	\$0
- Preparing Handbooks	<input type="text" value="0"/>		\$0
- Initial Plant Inspections	<input type="text" value="0"/>	<input type="text" value="51.83"/>	\$0
- Other Related Costs			<input type="text" value="0"/>
Total Cost:			\$0
<input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Uncertainty on Total.."/>			

Figure 63. NRC Implementation Costs Dialog Box

The only default provided is the hourly rate. The rate provided is adjusted by *Forecast* to the reference year selected for the analysis.

NRC Other Technical Costs

This module allows for other Technical costs to the NRC. This module can be used to capture any other one-time costs to the NRC appropriate to a given analysis.

The default labor rate provided is a value approximate to 1989. This rate can be adjusted as needed.

NRC Proced/Admin/Analytical Costs	
NRC PROCEDURAL/ADMINISTRATIVE/ANALYTICAL	
☐ Tech Spec Change	☒ Other Technical
☐ Implementation	
Other Technical Costs To Include In-Depth Technical Analyses, Computations and Scientific Analyses, and Other Administrative Duties.	
Technical Staff Hours	40
Hourly Rate	51.83
Other Costs	0
Total Cost \$2072	
OK Cancel Uncertainty in Total...	

Figure 64. NRC Other Technical Costs Dialog Box

Licensee Recurring Costs

Many regulatory actions may necessitate that both the licensee and the NRC undertake actions that recur throughout the life of the nuclear plants. The recurring cost dialog boxes allow for the treatment of such actions.

Note that any recurring costs must be entered as the equivalent annual cost per facility. The *Number of years until recurring activities start* defaults to 0, but you can change this if desired. The *Number of years activities recur* is defaulted to Remaining Life (set in the Edit menu). You can also change this if desired. When the recurring costs start in other than the current year, the value of the uniform series of expenditures is first determined for the start year. This amount is then present-valued back to the base year chosen for the calculations (default base year is the current year in the computer's clock). The calculations also account for different escalation rates applicable to the different categories treated.

All costs entered are discounted to the present value using the discount rate chosen. Recurring occupational exposure in person-rem is not discounted, but the associated health physics costs and Averted Occupational Exposure costs are discounted.

	Equivalent Annual Cost	Cost
Labor Cost:	0	
Materials Cost:	0	
Replacement Energy Cost:	0	
Other Costs:	0	
Occupational Exposure (person-rem/year):	0	
Health Physics Costs:		
TOTAL RECURRING COSTS:		

Figure 65. Licensee Recurring Costs Dialog Box

The number of years until recurring activities start is relative to the target year established at the beginning of the analysis.

NRC Recurring Costs

NRC recurring costs are treated in an analogous manner to those of the licensee. In this case, however, NRC equivalent annual labor hours are entered. Costs are based on the loaded labor rate displayed, which is also editable.

Costs for NRC operation include costs for periodic inspections of nuclear facilities to assure compliance with regulations and standards.

NRC Recurring Costs		
Number of years until recurring activities start:	<input type="text" value="0"/>	<input type="button" value="OK"/>
Number of years activities recur:	<input type="text" value="42"/>	<input type="button" value="Cancel"/>
		<input type="button" value="Uncertainty"/>
	Equivalent Annual Labor Hours	Cost
Labor Hours:	<input type="text" value="0"/>	
Labor Rate:	<input type="text" value="51.83"/>	
Labor Cost:		
Other NRC Costs:	<input type="text" value="0"/>	
TOTAL RECURRING COSTS:		

Figure 66. NRC Recurring Costs Dialog Box

All costs and data entered here must be on a per reactor basis.

Averted Onsite Property Costs

Forecast's treatment of this attribute accounts for averted costs associated with nuclear facility cleanup and decontamination, and replacement energy costs, due to accidents. The accidents may result in permanent shutdown of the facility. The replacement energy cost calculation in *Forecast* is based on the assumption that the facility will be permanently shut down if a severe accident occurs in that facility.

The formulations and default values in *Forecast* currently apply only to power reactors. For non-power facility evaluations, the user will have to input the necessary values for Onsite Property costs.

Forecast does not currently treat repair and refurbishment costs or replacement energy costs for cases of postulated less severe accidents for which the facility can be repaired. Repair and refurbishment is considered to be possible only for small-scale accidents, not large or severe reactor accidents.

Averted Onsite Property Costs

Averted Cleanup and Decontamination Costs

Scenarios

☒ Small LOCA, ECCS OK

☐ Small LOCA, Delayed ECCS

☐ Major LOCA, Delayed ECCS

Cleanup and Decontamination Costs per plant:

4354935808

Averted Replacement Power

Long Term Replacement Energy Costs per plant:

16932564992

Discounted monetary value of reduction in overall costs or impacts related to onsite cleanup and decontamination, and long-term replacement energy for all plants:

\$ 10,456,666

OK

Cancel

Uncertainty...

Restore Defaults

Figure 67. Averted Onsite Property Costs

Costs Associated with Cleanup and Decontamination

The method used by *Forecast* to calculate cleanup and decontamination costs incurred due to an accident are dependent on accident scenario (severity), the discount rate, and the period of assumed accident occurrence. They are not dependent on reactor type. Default cleanup and decontamination costs for three accident scenarios are represented in *Forecast*. The user must select the accident type which is most likely to be impacted by the rule change of interest. If desired, the user can edit the default values presented and input what he considers to be more appropriate values.

The three types of reactor plant accident cases represented by Forecast for the evaluation of cleanup and decontamination costs are as follows:

- Accident Scenario 1 is equivalent to a small LOCA in which ECCS functions as intended. Some fuel cladding ruptures, but no fuel melts. The containment building is moderately contaminated, but there is minimal physical damage.
- Accident Scenario 2 is equivalent to a small LOCA in which ECCS is delayed. Half of the fuel cladding ruptures, and some fuel melts. The containment building is extensively contaminated, but there is minimal physical damage.
- Accident Scenario 3 is equivalent to a major LOCA in which ECCS is delayed. All of the fuel cladding ruptures, and there is extensive fuel melting. The containment building is extensively contaminated and physically damaged. The auxiliary building undergoes some contamination.

The default calculations in Forecast are based on assessments of impacts at nuclear power plants. The user can edit the default values presented to evaluate cleanup and decontamination costs associated with accidents at non-reactor facilities.

Costs Associated with Long Term Replacement Energy

Replacement energy costs associated with permanent reactor shutdown are based on the normal (short term) replacement energy costs for the reactor or group of reactors selected by the user, and on the remaining life of the plant or plants. The remaining life of the plant(s) is defaulted to the average remaining life of the current US nuclear power plant population exclusive of license renewal considerations. The code automatically changes the default value for remaining life based on the year identified by the computer's clock. The remaining life can be edited by the user by access through the Edit menu. If the user wishes to consider nuclear plant license renewal effects, the remaining life should be increased by a maximum of 20 years.

Replacement energy costs used in this permanent reactor shutdown calculation are specified by the user through the Impacts/Shutdown Required/Replacement Energy menu selections. The code presents the user with default costs per unit in thousands of dollars per day for replacement energy costs. The default values are included in Forecast's cost factor data base (CFDB), and are taken from "Replacement Energy Costs for Nuclear Electricity-Generating Units in the United States: 1992-1996," NUREG/CR-4012, Sept., 1992. When a group or class of reactors is specified, the code presents the user with the average replacement energy costs for the group of reactors chosen. The user can change the daily replacement energy costs by editing the values presented in the edit box. If you do not set replacement energy costs through the Impacts/Shutdown Required/Replacement Energy menu selections or if you set the daily replacement energy costs to zero, Forecast uses the average replacement energy cost for the plant type chosen.

The replacement energy costs associated with permanent reactor shutdown due to accidents are assumed to be proportional to the number of facilities impacted and the change in accident frequency estimated to occur as a result of the regulatory changes under consideration.

The discounting formula used in calculating these long term replacement energy costs calculates the present value of a stream of potential expenditures for replacement energy extending over the remaining lifetime of the facility. It accounts for the possibility that an accident could occur in each year of remaining facility life.

Averted Offsite Non-Health Costs

The offsite costs, exclusive of public health effects, would account for aspects such as protective emergency actions (evacuation, sheltering and relocation), decontamination and interdiction of property, disposal of contaminated food and milk, and long-term relocation of people and interdiction/condemnation of property. The economic data sets in codes such as MACCS contain information (described in NUREG/CR-3672) which make it a suitable code system to evaluate offsite costs of a reactor accident within the continental United States.

Non-health offsite costs due to an accident at a nuclear facility can vary widely and depend on factors such as meteorological conditions, extent of contaminated areas, interdiction criteria assumed, economic value of lost production from contaminated land areas, etc. Values in the tens of billions of dollars have been estimated. Accident related offsite costs are also dependent on the severity of the accident and the effectiveness of containment or confinement systems.

Averted Offsite Non-Health Costs

Averted Offsite Non-Health Costs: C

TOTAL:

OK

Cancel

Uncertainty

Figure 68. Averted Offsite Non-Health Costs Dialog Box

The value entered on this screen is multiplied by the change in accident frequency. The user-supplied value should account for any site-specific offsite non-health costs and for any changes in the conditional containment failure probability or changes in containment performance which would impact offsite releases.

Other Government

Other Government allows you to enter costs for other government agencies or entities. This could include costs which states or local governments might incur. Both one-time (implementation) and recurring costs can be treated. Recurring costs must be input on an equivalent annual basis. All entries should be on a per licensee or facility basis, and should account for all "other government" costs anticipated, e.g., both state and local agency costs.

Other Government	
Number of years until recurring activities start:	<input type="text" value="0"/>
Number of years activities recur:	<input type="text" value="22"/>
<div>Equivalent Annual Costs</div>	
Recurring Costs:	<input type="text" value="0"/>
Implementation Costs:	<input type="text" value="0"/>
TOTAL OTHER GOVERNMENT COSTS:	
<div>OK</div>	
<div>Cancel</div>	
<div>Uncertainty on Total...</div>	

Figure 69. Other Government Dialog Box

Chapter 10. Window Menu

The *Window* menu provides you with several formats for viewing the cost analysis information. The options for this category are:

- Attributes Summary
- System Information
- System Costs
- Calculated Costs
- Histogram
- Net Value

Attributes Summary

The Attributes Summary window provides you with information about all of the values and impacts calculated by Forecast. A final Net Value is also provided.

ATTRIBUTES SUMMARY 1995 DOLLARS			
Values	Incremental Value		
	5th Percentile	Mean	95th Percentile
Public Health (Accident)	195,000	10,214,000	50,584,000
Public Health (Routine)	0	0	0
Occupational Health (Accident)	0	0	0
Occupational Health (Routine)	-5,521,000	-1,635,000	-208,000
Impacts			
Onsite Property	3,867,000	15,599,000	40,418,000
Averted Offsite Non-Health	42,210,000	166,178,000	426,596,000
Industry Implementation	-328,975,000	-271,924,000	-221,641,000
Industry Operation	0	0	0
NRC Implementation	-351,000	-286,000	-229,000
NRC Operation	0	0	0
Other Government	0	0	0
Net Value:	-81,854,000		
Recalculate On			

Figure 70. Attributes Summary Window

System Information

The System Information window provides you with information about the currently active system. The currently active system is usually the last system defined or viewed in the Account option of the System window, but can be determined by selecting System from the main menu in order to view the System drop down menu. The system name preceded by a check mark is the currently active system.

The account number and description of the user-selected account and its parent accounts are displayed in the upper left area of the window. The plant type (PWR or BWR) is displayed in the upper right area of the window.

The labor hours and dollar amounts displayed for the account have been modified by the percentage shown in the upper right area of the screen. (This percentage can be changed in the Costs dialog box.) The original EEDB amounts can be viewed through the More Info button of the Account dialog box.

This screen also displays the total productivity factors that have been used to adjust the removal and installation labor associated with the subsystem modifications.

ACCT.# DESCRIPTION		Physical Modification	
22.	REACTOR PLANT EQUIPMENT	10 PWR Plants	
222.	MAIN HEAT XFER XPORT SYS.	1994 Dollars	
222.1	REACTOR CORE COOLANT SYS.		
222.14	PRESSURIZING SYSTEM	Costs are 100% of EEDB	
222.143	TANKS AND PRESSURE VESSELS		
222.1431	PRESSURIZER		
FACTORY		SITE	
Quantity:	1	Quantity:	1
Unit:	EA	Unit:	LT
Cost:	\$1,900,000	Cost:	\$8,465
GREENFIELD SITE LABOR		TOTAL PRODUCTIVITY FACTORS	
Hours:	3,300	Installation:	16.700
Cost:	\$107,217	Removal:	1.000
		Learning Curve:	0.400
Dose Rate: 95 mrem/hr			
Dose Rate Range for System: 2 - 5100			

Figure 71. System Information Window

System Costs

The System Costs window provides you with a spreadsheet displaying the five cost categories and the radiation exposure pertaining to individual systems or subsystems. Up to three systems may be displayed at one time. Use the scroll bar at the bottom of the window to view additional systems, if any have been defined.

The user-defined or default system name is used as the column heading for that system.

COST ESTIMATES FOR SUBSYSTEMS IN 1994 DOLLARS			
CATEGORY	Subsystem 1		
Hardware and Equipment	\$ 1,907,200		
Installation Labor	\$ 2,197,000		
Removal Labor	\$ 1,316,000		
Engineering/QA-QC	\$ 1,116,900		
Health Physics	\$ 3,606,600		
TOTAL	\$ 10,144,000		
Radiation Exposure (Rem)	331		

Figure 72. System Costs Window

Note that the labor costs presented are fully burdened (i.e., they include base wages, fringe benefits, overhead, and fee) and they include an allowance for geographical variations in wage rates.

Calculated Costs

The Calculated Costs window displays the results for the current analysis for the areas of Industry and NRC Implementation and Operation. Costs are displayed to the nearest hundred dollars for both per plant and all plant costs. Grand totals are broken down by Licensee and NRC onetime costs and Licensee and NRC recurring costs.

Note that radiation exposure is shown in person-rem.

CATEGORY	CALCULATED COSTS		1994 DOLLARS	
		COST PER PLANT		TOTAL COST
Hardware and Equipment	\$	1,907,200	\$	19,071,800
Installation Labor	\$	2,197,000	\$	21,969,800
Removal Labor	\$	1,316,000	\$	13,160,500
Engineering/QA-QC	\$	1,116,900	\$	11,168,700
Health Physics	\$	4,548,400	\$	45,484,300
Reactor Shutdown and Startup	\$	33,000	\$	329,700
Reactor Defueling/Refueling	\$	178,700	\$	1,787,300
Replacement Energy	\$	13,806,000	\$	138,060,200
Radioactive Waste Disposal	\$	754,300	\$	7,543,400
Licensee Procedural/Analytical	\$	47,600	\$	475,700
TOTAL LICENSEE ONETIME COSTS	\$	25,834,000	\$	259,252,000
LICENSEE RECURRING COSTS	\$	0	\$	0
Radiation Exposure (Rem)		418		4,175
NRC ONETIME COSTS	\$	29,000	\$	289,000
NRC RECURRING COSTS	\$	0	\$	0
Recalculate On				
Ready				

Figure 73. Calculated Costs Window

As with the System Costs window, all labor costs shown are fully burdened. Note that the costs in this table do not reflect dollar valuations for occupational exposures.

Histogram

The Histogram window provides you with an alternate means of viewing the calculated costs. The costs used are the per plant summary costs.

The cost category with the largest dollar amount is used to determine the scale for the histogram. Costs are displayed in thousands of dollars.

In many cases one of the cost categories, such as replacement energy, will dominate the overall costs. To more clearly view the other categories, the dominant costs can be temporarily reduced or deleted in the respective dialogs and then re-entered later.

Figure 74. Histogram Window

Net Value

The Net Value window provides you with information about the net value of the analysis. Five percentiles are provided which are approximate. Interpolation or extrapolation may not be meaningful.

NET VALUE [with uncertainty]	
	1995 DOLLARS
5th percentile	-231,543,000
23rd percentile	-175,176,000
50th percentile	-112,863,000
77th percentile	-26,011,000
95th percentile	183,275,000
WARNING: Percentiles are approximate. Interpolation or extrapolation may not be meaningful.	

Figure 75. Net Value Window

Note that the numbers on the *Forecast* dialogs which are treated with uncertainty are not being added or multiplied directly but that the uncertainty distributions for each number in a calculation are used to produce a resulting distribution. The mean of the resulting distribution is displayed on the screen, and it may not exactly match the value that would be obtained by simply performing the associated mathematical manipulations on the means alone. This is especially apparent on the Attributes Summary and Calculated Costs windows where columns of numbers appear for summation, but the bottom line is not exactly the sum of the numbers displayed. Similarly, for the Attributes Summary screen the simple summation of the columns of numbers displayed for the 5th or 95th percentiles of the individual distributions will not equal the 5th or 95th percentiles for the Net Values as calculated by *Forecast* and as displayed on the Net Value distribution screen.

The Net Value distribution as displayed in the Net Value Window provides an indication of the likelihood that the overall results will be positive or negative. For example, the values presented in Figure 75 suggest that there is only about a 20% chance that the proposed actions will be cost effective (have a positive net value).

The number of significant figures displayed in this window are obviously much higher than is warranted by the overall uncertainty portrayed. However, the format used helps retain meaningful information in cases where the overall Net Value is less than one million dollars.

Chapter 11. Help Menu

Forecast Help is provided using the standard Windows help system. The first five items on the Help menu create a window containing help navigation commands and icons. The main body of the window contains the Help text itself. Refer to the Windows User's Guide for more information on Help. The Tutorial and About Forecast menu items are described in the following sections.

The Help menu items are:

- Index
- Topics
- Commands
- Procedures
- Using Help
- About Forecast

About Forecast

The About Forecast option gives the software version number for the Forecast package:

Appendix A. Sensitivity and Uncertainty Analysis

The NRC has released the proposed Regulatory Analysis Guidelines (the proposed Guidelines) for public comment. Among the elements to be included in a regulatory analysis document are identification of alternative approaches to the problem and estimation and evaluation of the values and impacts for selected alternatives, including consideration of the uncertainties affecting the estimates. When possible, value and impact estimates should be best estimates made in terms of the mean or expected-value.

The proposed Guidelines state that all regulatory analyses should discuss the sources and magnitudes of uncertainties in value and impact estimates and the methods used to quantify uncertainty estimates. It is recognized that formal uncertainty analysis typically would require computer calculations.

The NRC Staff has also sponsored the revision of NUREG/CR-3568, "A Handbook for Value Impact Assessment." The draft Regulatory Analysis Technical Evaluation Handbook (the draft Handbook) provides guidance to the regulatory analyst to promote preparation of high-quality regulatory decision-making documents and to implement the policies of the proposed Guidelines. Chapter 5 of the draft Handbook presents detailed guidance on the performance of a value-impact analysis.

The draft Handbook provides high and low values for selected best estimates in the attribute evaluation. It notes that where the analyst has access to a computerized assessment, he or she may incorporate the uncertainty analysis results obtainable via computer into the standard analysis.

Sensitivity Analysis

The proposed Guidelines state that sensitivity analysis can be used in lieu of formal uncertainty analysis when uncertainty analysis is impractical or exceedingly complicated and costly.

In the development of a regulatory analysis, hypothetical best and worst case values and impacts can be estimated for sensitivity analyses. The models and assumptions are varied and the effect of these variations on the results and conclusions is studied. The most common approach is to define a best estimate, establish a range of interest for each factor, and then systematically vary the factors one at a time. The results are then expressed as a range (low value, best estimate, high value) which indicates the effect on the output of variations in the factor, and thus provides some insight concerning uncertainties and their effects.

There are two shortcomings to sensitivity analysis. One difficulty stems from the fact that "best estimate" is not a well-defined concept. Most analysts think of the best estimate as the "most likely" value, the value for which the probability density function is at a maximum. For most simple probability distributions the most likely value is also the "median," such that half the time the actual value is above the best estimate and half the time it is below the best estimate.

The proposed Guidelines state that best estimates should be made in terms of the "mean" or "expected value" when possible. As discussed below, mean values for costs and accident frequencies are generally larger than the medians and are more representative of the effects of regulatory actions. However, the calculation of mean values requires a full uncertainty analysis.

The second difficulty is that sensitivity analysis does not provide a clear understanding of the uncertainty in the final result. Varying only one attribute tends to underestimate the uncertainty, but varying all of them simultaneously would overstate the uncertainty.

The Difference Between the Mean and the Median

Formal uncertainty analysis requires that each best estimate for a parameter be supplemented by an uncertainty distribution for that parameter. The uncertainty distribution indicates, for various possible values of the parameter, the probability that the actual value will not be greater. This could be expressed, for example, as a table of percentiles for that parameter. The 5th percentile and the 95th percentile would be low and high estimates; the actual value should fall between them 90% of the time. The 50th percentile would be the median; in the long run about half of the actual values would be lower than their median and half would be higher.

Because most of the parameters cannot have negative values, they tend to have skewed uncertainty distributions. The 95th percentile may be more than double the median, but the 5th percentile cannot be negative. Therefore, the instances of the actual value being above the median tend to have greater significance than the occasions when the actual value is below the median. Consequently, the expected value (the mean) of the parameter tends to be larger than the median.

For example, the median value for Industry Implementation might be \$100,000,000 and the uncertainty might be represented by a "log normal" distribution with an "error factor" of 2. This would mean that the logarithm of Industry Implementation had a normal probability distribution and that the 5th and 95th percentiles for Industry Implementation were \$50,000,000 and \$200,000,000, respectively, one error factor away from the median. Because a log normal distribution is skewed, the "expected value" or "mean" of the Industry Implementation estimate would be approximately \$109,000,000, not the same as the median.

The significance of the mean may be understood more clearly in the context of multiple NRC regulatory actions. Suppose the regulatory analyses for ten actions all concluded that Industry Implementation would have a median value of \$100,000,000 with an error factor of two. Suppose further that the ten actual values turned out to be equally spaced percentiles of the distribution, the 5th, 15th, 25th, 35th, 45th, 55th, 65th, 75th, 85th, and 95th. Then the actual costs of industry implementation would be found to have varied from \$50,000,000 to \$200,000,000, with a total cost of \$1,090,000,000 and an average of \$109,000,000 per action. Industry representatives would find that the \$90,000,000 difference between the ten means and the ten medians is a real cost, not just a mathematical artifice.

The Combined Effects of Uncertainties in Multiple Parameters

If NRC Implementation also had a log normal distribution with a mean of \$109,000,000 and an error factor of 2, one could compute the uncertainty distribution for the total implementation cost (Industry + NRC). The exact distribution for the sum is a particular integral, called a convolution integral, of the distributions for the separate elements. The integration can be approximated very accurately by a numerical process. It turns out that the uncertainty distribution for the sum does not have a simple form.

Furthermore, there is no procedure for estimating the parameters of the distribution without performing the integration. The median for the sum is \$213,000,000, which is \$13,000,000 more than the sum of the medians. The mean is \$223,000,000, which is \$5,000,000 more than the sum of the means.

It is particularly misleading to estimate the low and high values by summing the low and high values for the individual items. The 5th and 95th percentiles for the sum are \$133,000,000 and \$343,000,000, each about a factor of 1.6 from the median. The "low estimate" and "high estimate" obtained by adding the 5th and 95th percentiles for the two components would be \$100,000,000 and \$400,000,000, corresponding to the 0.4th percentile and the 98.5th percentile. Use of these more readily calculated estimates would exaggerate the uncertainty, with the level of exaggeration increasing as more and more terms are included in the sum.

Formal uncertainty analysis not only provides a more realistic picture of the uncertainty in the result, but it also permits calculation of the expected value (mean) of each attribute and the mean of the net value.

Appendix B. Using Windows

Windows Terms

Some Windows terms used in this manual are:

• Dialog box	A window that appears when information is required, usually for input.
• Scroll bar	Gray bar on the right side or bottom of a box or window that allows the user to move through a list of information by selecting one of its arrows.
• List box	A box containing a list of names from which one or more names may be chosen, usually having a vertical scroll bar on the right side.
• Size box	A box which allows the user to change the size of the active window.
• Check box	A small square box within a dialog box that is associated with an option that can be set. This can be activated or deactivated by pressing the underlined character associated with the box.
• Accelerator
Key	Keys that allow quick access to a menu item from the keyboard when a dialog box is not selected.
• Directional
Button	Keys that shift the view from the current window to the next and previous window (e.g. >> & <<).
• Edit Box	A box in which text may be entered and edited.
• Push Button	A button that executes a particular command when selected (e.g. OK, Cancel, Add).
• Radio Button	One of a set of buttons, only one of which may be selected at a time.

- Arrow The arrow used to select items on the screen (only if a mouse is installed).
- Mouse button In *Forecast*, the left-most button on the mouse.
- Click A quick press and release of the mouse button.
- Drag Pressing the mouse button and holding it down while moving the mouse.
- Double-click Pressing and releasing the mouse button twice in rapid succession.

Getting Around in Windows

Certain key combinations and mouse actions allow you to access the controls, dialog boxes and Windows on the screen. An explanation of some of the more useful keys and mouse actions is provided below.

KEYSTROKE	RESULT
ALT+SPACEBAR	Make the Control Menu of the current active window drop down.
ALT+F4	Close current application and window.
ALT+F5	Restore a minimized or maximized window to its previous state.
ALT+F7	Move the window. The cursor keys will cause the window to move around until ENTER is pressed.
ALT+F8	Size the window. The cursor will change the size of the window until ENTER is pressed.
ALT+F9	Minimize the window to an icon. If the window is already an icon, return it to its previous size.
ALT+F10	Maximize the window to full screen. If the window is full screen, return it to its previous size.
ALT+<letter>	Select the first menu item whose name begins with <letter>.

WHEN A MENU IS DROPPED DOWN

LEFT ARROW	Move to the next menu to the left of the current menu.
RIGHT ARROW	Move to the next menu to the right of the current menu.
UP ARROW	Move the highlight to the item above the one it is currently selecting.
DOWN ARROW	Move the highlight to the item below the one it is currently selecting.
ENTER	Select the highlighted menu item and execute the function associated with it.

ESC	Cancel menu operation.
<letter>	Select the menu item that contains the underlined letter.

WHEN A DIALOG BOX IS DISPLAYED

TAB	Select the next active item in the dialog box, moving from left to right and top to bottom.
SHIFT+TAB	Select the next active item in the dialog box, moving from right to left and bottom to top (i.e. reverse of the TAB).
SPACEBAR	Toggles state of a check box between checked and unchecked, or activates the currently selected button.
ENTER	Activates the default operation (usually the <i>OK</i> button) associated with the default button.
ESC	Cancel dialog-box operation and return to the menu.
Mouse movement	Moves pointer around the screen.
BUTTON 1:	(Left-most Button on the mouse) Click selects item under the arrow. Double-click selects item and performs default action.

WHEN A LISTBOX IS ACTIVE

UP ARROW	Move the highlight to the item above the one it is currently selecting.
DOWN ARROW	Move the highlight to the item below the one it is currently selecting.
<letter>	Select the first list box item that begins with the letter.
Mouse click on up arrow of scroll bar	View items in the list above the currently displayed items

Mouse click on down arrow of scroll bar	View items in the list below the currently displayed items
Drag elevator up and down	Scroll up and down through list box items

CHANGING THE SIZE AND SHAPE OF WINDOWS

You may change the size and shape of windows by directly moving the borders with the mouse or using the Size command on the Control Menu. To change the size using the mouse, point to a border or corner of the window to be moved. The mouse pointer becomes a two-headed arrow. Drag the corner or border until the window is the desired size, then release the mouse button.

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER
(Assigned by NRC. Add Vol., Supp., Rev.,
and Addendum Numbers, if any.)

NUREG/CR-5595

Rev. 1

SEA 95-2755-010-A:1

2. TITLE AND SUBTITLE

FORECAST:

Regulatory Effects Cost Analysis Software Manual

Version 4.1

3. DATE REPORT PUBLISHED

MONTH

YEAR

July

1996

4. FIN OR GRANT NUMBER

L1946

5. AUTHOR(S)

B. Lopez, F. W. Sciacca

6. TYPE OF REPORT

Technical

7. PERIOD COVERED (Inclusive Dates)

8. PERFORMING ORGANIZATION — NAME AND ADDRESS (If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)

Science and Engineering Associates, Inc.
P.O. Box 3722
Albuquerque, NM 87190

Under Subcontract to
S. Cohen and Associates
1355 Beverly Road, Suite 250
McLean, VA 22101

9. SPONSORING ORGANIZATION — NAME AND ADDRESS (If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)

Division of Regulatory Applications
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

10. SUPPLEMENTARY NOTES

S. Feld, NRC Project Manager

11. ABSTRACT (200 words or less)

The FORECAST program was developed to facilitate the preparation of the value-impact portion of NRC regulatory analyses. This PC program integrates the major cost and benefit considerations that may result from a proposed regulatory change. FORECAST automates much of the calculations typically needed in a regulatory analysis and thus reduces the time and labor required to perform these analyses. More importantly, its integrated and consistent treatment of the different value impact considerations should help assure comprehensiveness, uniformity, and accuracy in the preparation of NRC regulatory analyses. The current FORECAST version 4.1 has been upgraded from the previous version and now includes an uncertainty package and an automatic cost escalation package. In addition, it now explicitly addresses public health impacts, occupational health impacts, onsite property damage, and government costs.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

Value-Impact Analysis
Regulatory Analysis
Cost Benefit Analysis
FORECAST Computer Code
Backfit Analysis

13. AVAILABILITY STATEMENT

Unlimited

14. SECURITY CLASSIFICATION

(This Page)

Unclassified

(This Report)

Unclassified

15. NUMBER OF PAGES

16. PRICE