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Environmental Protection
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Office Of Enforcement
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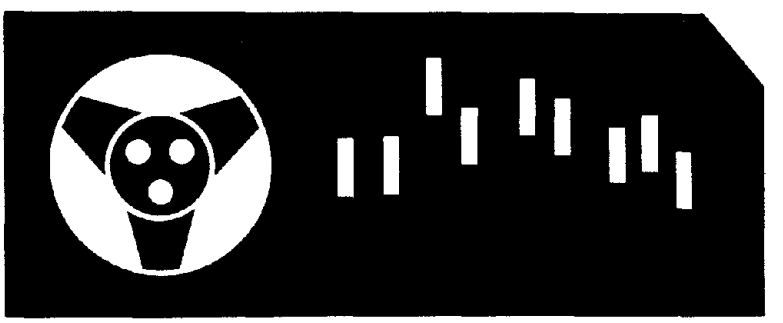
EPA

BEN: A Model To Calculate The Economic Benefits Of Noncompliance

PB94-141652

User's Manual



BEN USER'S MANUAL

Office of Enforcement
United States Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Revised December 1993

ACKNOWLEDGMENTS

This document was prepared under the technical direction of Mr. Jonathan Libber, BEN/ABEL Coordinator, Office of Enforcement, U.S. Environmental Protection Agency (EPA), with additional input provided by Mr. David Hindin, Office of Enforcement, U.S. EPA. Technical assistance was provided to EPA by Industrial Economics, Incorporated (IEc) of Cambridge, Massachusetts under EPA Contract No. 68-W1-0009.

REGISTRATION FORM

Would you like to be placed on the mailing list (Y/N)? ____

Would you like to obtain a PC version of the model (Y/N)? ____

Would you like to acquire a USER ID (Y/N)?* ____

(If yes, to any of these questions, include your name and address below)

NAME AND MAILING ADDRESS: **PHONE NUMBER:**

_____ (___)_____

_____

_____

_____

Please mail to: Jonathan Libber, 2225
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

* Only government enforcement professionals may apply to EPA for USER ID's. Copies of the model and user manual are available to the general public through the National Technical Information Service (NTIS) at (703) 487-4630.

[Please note: the PC version of BEN should be available by February 1, 1994. At that time, EPA will no longer process requests for user ID's.]

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A. OVERVIEW

The Environmental Protection Agency developed the BEN computer model to calculate the economic benefit a violator derives from delaying or avoiding compliance with environmental statutes. In general, the Agency uses the BEN computer model to assist its own staff in developing settlement penalty figures. While the primary purpose of the BEN model is to calculate the economic benefit of noncompliance, the model may also be used to calculate the after-tax net present value of supplemental environmental projects.[1] This document, the BEN User's Manual, contains all the formulas that make up the BEN computer model and is freely available to the public upon request.

Calculating economic benefit using the BEN computer model is generally the first step in developing a civil penalty figure under the Agency's February 16, 1984, generic penalty policy (GM-21 and GM-22) and the related medium-specific policies developed since then to implement the 1984 Policy. The BEN computer model has been developed by the Agency to assist in fulfilling one of the main goals of the generic policy. That goal is to recover, at a minimum, the economic benefit from noncompliance to ensure that members of the regulated community have a strong economic incentive to comply with environmental laws on time.

[1] The instructions for performing such an analysis are contained in Appendix C of this manual. To simplify the calculation, EPA plans to introduce a model specifically tailored to this issue (called PROJECT) in the summer of 1994.

In general, the BEN computer model is used for calculating economic benefit for purposes of developing a settlement penalty. The BEN model is generally not intended for use at trial or in an administrative hearing. If the Agency is going to present economic benefit testimony at trial or in an administrative hearing, the Agency will generally rely on an expert to provide an independent financial analysis of the economic benefit the firm has obtained as a result of its violations. This independent financial analysis, while consistent with the principles of the BEN model, may not necessarily be identical to that set forth in the BEN User's Manual.[2]

An outline of general penalty components and adjustment factors is shown in Exhibit 1-1 below. BEN is designed to calculate the first two categories of the "economic benefit component" listed in Exhibit 1-1: those gained from delaying or avoiding required environmental expenditures. Delayed costs can include capital investments in pollution control equipment, delayed costs to remove unpermitted dredged or fill material and restore wetlands, or one-time expenditures required to comply with environmental regulations (e.g., the cost of setting up a reporting system, or land purchases). Avoided costs include operating and maintenance costs or other recurring costs (e.g., off-site disposal of fluids from injection wells). BEN does not calculate the third category of benefits (i.e., those related to the competitive advantage gained by a violator).[3]

BEN can be used in all cases where there is a measurable benefit from delaying compliance, except for Clean Air Act Section 120 actions, which require the application of a Section 120 specific computer model. BEN is easy to use and has been designed for people with no background in economics, financial analysis, or computers. Because the program contains standard values for many of the variables needed to calculate the economic benefit, BEN can be run with only a small number

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[2] For assistance with the selection of an expert on economic benefit, EPA staff should call Jonathan Libber, the BEN/ABEL coordinator, at (202) 260-6777.

[3] Competitive advantage benefits occur, for example, when a company earns a profit by selling its goods and services, possibly at prices lower than those of its complying competitors, before it obtains an EPA permit or after EPA has prohibited the sale of those goods and services.

of inputs. The program also provides the opportunity to use values other than the standard values. Exhibit 1-2 presents a listing of the inputs to BEN. The optional inputs listed in Exhibit 1-2 are those for which BEN has standard values.

Exhibit 1-1

CIVIL PENALTY POLICY SUMMARY

I. ECONOMIC BENEFIT COMPONENT

- Benefit from delayed costs
- Benefit from avoided costs
- Benefit from competitive advantage

II. GRAVITY COMPONENT

- Actual or possible environmental harm
- Importance to regulatory scheme
- Size of violator
- Severity of violation(s)

III. ADJUSTMENT FACTORS

- Degree of willfulness and/or negligence
- Degree of cooperation/noncooperation
- History of noncompliance
- Ability to pay
- Other unique factors

BEN can be used to estimate economic benefit for many types of organizations: corporations, partnerships, sole proprietorships, not-for-profit organizations, municipalities, and so forth. There are two sets of standard values in BEN: one applies to for-profit business violators and the other applies to not-for-profit organizations. In either case, care must be taken in selecting input values other than the standard values. The BEN inputs listed in Exhibit 1-2 are discussed in detail in Chapter 4 for both for-profit and not-for-profit organizations.

Exhibit 1-2

INPUTS FOR BEN[4]

Required Inputs

1) Case Name, Profit Status, and Filing Status
2) Capital Investment
3) One-Time Nondepreciable Expenditure
4) Annual Expenses
5) Date of Noncompliance
6) Date of Compliance
7) Date of Penalty Payment

Optional Inputs[5]

8) Useful Life of Pollution Control Equipment
9) Marginal Income Tax Rate for 1986 and Before
10) Marginal Income Tax Rate for 1987 to 1992
11) Marginal Income Tax Rate for 1993 and Beyond
12) Inflation Rate
13) Discount Rate

[4] The previous version of BEN also contained a variable that allowed the user to enter low-interest financing, which was potentially appropriate under federal tax laws for violations beginning before and ending after 1986. Because this variable is rarely appropriate in current enforcement cases, it has been removed from the model. If you have a case where it may be appropriate (i.e., the violation spans January 1986 and the firm may have utilized low-interest financing), contact Jonathan Libber at (202) 260-6777.

[5] These are inputs for which Standard Values are available.

B. NATURE OF THE BENEFIT

An organization's decision to comply with environmental regulations usually implies a commitment of financial resources; both initially (in the form of a capital investment or one-time expenditure) and over time (in the form of annual, continuing expenses).[6] These expenditures might result in better protection of public health or environmental quality; however, they are unlikely to yield any direct economic benefit (i.e., net gain) to the organization. If these financial resources were not used for compliance, they presumably would be invested in projects with an expected direct economic benefit to the organization. This concept of alternative investment -- that is, the amount the violator would normally expect to make by not investing in pollution control -- is the basis for calculating the economic benefit of noncompliance.

As part of the Civil Penalty Policy, the Agency uses its penalty authority to remove or neutralize the economic incentive to violate environmental regulations. In the absence of enforcement and appropriate penalties, it is usually in an organization's best economic interest to delay the commitment of funds for compliance with environmental regulations and to avoid certain other associated costs, such as operating and maintenance expenses.

The economic benefit from noncompliance might have any or all of the following three components: (1) the return a violator can earn by delaying the capital costs of pollution control equipment, (2) the return earned by delaying a one-time expenditure, and (3) the return a violator can earn by avoiding annual or one-time costs. The first two components arise because violators have the opportunity to invest their funds in projects other than those required to comply with environmental regulations. These other investments are normally expected to yield a monetary return at the violator's marginal rate of return on capital, whereas environmental expenditures typically yield no direct economic benefit. Thus, by delaying compliance, the violator benefits by the amount of earnings that could be expected from alternative investments.

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[6] Under the Clean Water Act §404 program, a decision to comply with regulations means delaying project start up until the U.S. Army Corps of Engineers issues a permit, which may contain mitigation requirements. BEN does not calculate the economic benefit from completing a development project sooner as a result of avoiding the Corps' permitting process, but the Agency may still choose to recapture this benefit. The Agency calculates the benefit from, for example, delaying the costs of mitigation requirements if the Corps issues an after-the-fact permit or delaying the restoration costs if no permit is issued.

The third component of the benefit from complying late is based on the annual continuing expenses that a violator would have incurred if the facility had complied with environmental regulations on time. These expenses include the costs of labor, raw materials, energy, lease payments and any other expenditures directly associated with the operation and maintenance of the pollution control equipment. Unlike capital and one-time expenditures, which are only postponed, annual expenditures can be avoided altogether. The resulting benefits to the violator are the total avoided annual costs as well as the return that could be expected on these avoided costs.[7]

When calculating the economic benefit of noncompliance, it is necessary to take into account indirect financial impacts associated with environmental expenditures. For example, one important indirect impact of these expenditures is a reduction in income tax liability.[8] Also, depending upon the tax year, the original purchase of equipment might have resulted in an investment tax credit. To account for these indirect tax effects, BEN calculates the economic benefit using after-tax cash flows.

Another indirect impact relates to the timing of the cash flows, since cash flows occurring in different years are not directly comparable. A basic concept of financial theory is "present value." This concept is based on the principle that: "A dollar today is worth more than a dollar a year from now," because today's dollar can be invested immediately to earn a return over the coming year. Therefore, the earlier a cost (or benefit) is incurred, the greater its economic impact. BEN accounts for this "time value of money" effect by reducing all estimated future cash flows to their "present value" equivalents. This widely-used technique is known as "discounting". Appendix A contains a more detailed discussion of discounting and the concept of present value.

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[7] On occasion, a violator may avoid a one-time expenditure or a capital expense as well, gaining the benefit of the avoided cost and the return earned on the avoided expenditure. These special cases are discussed in Appendix B.

[8] Depreciation and annual expenditures serve to reduce taxable income, thereby reducing income taxes.

C. HOW TO USE THE MANUAL

This manual is designed to aid you in using the BEN model, either from the EPA mainframe computer or from a PC diskette. Thus, this manual provides instructions for accessing, operating, and interpreting results from the BEN program. Specifically, Chapter 2 outlines the procedures for accessing BEN from EPA's mainframe computer or from a PC diskette. Chapter 3 describes the structure of the program and discusses the procedures for entering data into the program. Chapter 4 defines each of the inputs you will need in order to calculate the economic benefit. Chapter 5 describes the results and output from BEN, and explains how to change input values for subsequent runs. Chapter 6 discusses a number of issues that often arise when running the program, such as how to obtain and characterize cost information.

This manual also contains three appendices. Appendix A contains a detailed discussion of the economic rationale and the computational methods used in calculating the economic benefit from delayed or avoided compliance. You do not have to be familiar with Appendix A to use BEN or this manual. Appendix B outlines the procedures for using BEN to calculate the economic benefit of noncompliance in special cases, such as cases involving avoided costs, delayed annual expenditures, or municipal grants. Refer to Appendix B if the economic events in your case do not exactly match BEN inputs. Appendix C describes the procedures for using BEN to calculate the after-tax value of a supplemental environmental project.

For users who are already familiar with the program, Exhibit 1-3 provides a printout illustrating the order and procedure for entering data. The inputs for the example are in **bold** print to distinguish user entries from the information and prompts provided by BEN. Help information is available in the program if you need the definition of a variable, sources of information, or the format required for an input entry. To access help for a specific variable, type **HELP** or **H** after the prompt for that variable. After the explanation, BEN will prompt you again for that same variable. If you need assistance in operating the program, understanding the results, or other guidance in effectively using BEN, you may contact Jonathan Libber at (202) 260-6777 or David Hindin at (202) 260-8547.

Exhibit 1-3

DATA ENTRY FOR BEN

```
**********************************************************************
DATE OF MESSAGE: DECEMBER 15, 1993

INTRODUCING BEN VERSION 4.0:

THE RECENTLY PASSED FEDERAL BUDGET BILL CONTAINS MODIFICATIONS TO THE
TAX CODE RETROACTIVE TO JANUARY 1, 1993.  CONSEQUENTLY, BEN HAS BEEN
MODIFIED TO INCLUDE A TAX RATE FOR 1993 AND BEYOND.  ALSO, DUE TO THE
INCREASED DIFFERENTIAL BETWEEN CORPORATE AND PERSONAL FEDERAL INCOME
TAX RATES UNDER THE NEW TAX CODE, BEN NOW APPLIES SEPARATE TAX RATES
FOR C-CORPORATIONS AND OTHER FOR-PROFIT ENTITIES THAT ARE TAXED AT
PERSONAL INCOME TAX RATES.  IN ADDITION, VARIABLE 1B (ENVIRONMENTAL STATUTE
CODE) HAS BEEN ELIMINATED FROM THE MODEL.  ELIMINATING THIS VARIABLE HAS NO
EFFECT ON YOUR BEN RESULT.

**********************************************************************
Strike a key when ready . . .
 loading the program, please wait...


                        BBBBBBB    EEEEEEE   NNN     N
                        B      B   E         N NN    N
                        BBBBBBB    EEEEE     N  NN   N
                        B      B   E         N   NN N N
                        BBBBBBB    EEEEEEE   N    NNN

                        Version 4.0.  December 1993.

    ********************************************************************
                   BEN 4.0 IS VALID UNTIL AUGUST 1, 1994.
    ********************************************************************

    ********************************************************************
    NOTE THAT ALL ENTRIES MUST BE TYPED IN UPPER CASE LETTERS.
    ********************************************************************

    Would you like an introduction? (Y/N)
N

    ENTER TODAY'S DATE (e.g., FEBRUARY 1, 1992)
DECEMBER 1, 1993

     1A. PLEASE ENTER THE CASE NAME:
ENTITY X EXAMPLE
```

Exhibit 1-3

DATA ENTRY FOR BEN
(continued)

```
     1B. PLEASE ENTER THE PROFIT STATUS OF THIS ENTITY:

          1 FOR-PROFIT (e.g., A BUSINESS)
          2 NOT-FOR-PROFIT (e.g., A MUNICIPALITY)

         PROFIT STATUS:
1

     1C. PLEASE ENTER THE FILING STATUS OF THIS ENTITY.  THIS WILL
         DETERMINE THE APPROPRIATE TAX RATE FOR THE VIOLATOR:

          1 C-CORPORATION
          2 OTHER THAN C-CORPORATION
          3 SELECT FOR AN EXPLANATION

         [NOTE: NOT ALL ENTITIES THAT HAVE "INCORPORATED" IN THEIR
         TITLES ARE C-CORPORATIONS.]

     FILING STATUS:
1

     2. INITIAL CAPITAL INVESTMENT IN POLLUTION CONTROL=
        (FOLLOW WITH DOLLAR-YEAR SEPARATED BY BLANK; e.g., 100000 1993)
        (ENTER 0 IF THIS COST CATEGORY IS NOT APPLICABLE)
405000 1994


     IS THE INITIAL INVESTMENT ONE-TIME OR RECURRING?

          1. ONE-TIME
          2. RECURRING

          PLEASE ENTER THE APPROPRIATE CODE:

          [NOTE: MOST CAPITAL COSTS FOR AIR AND WATER CASES
                 ARE RECURRING]
2

     3. ONE-TIME NONDEPRECIABLE EXPENDITURE =
        (FOLLOW WITH DOLLAR-YEAR SEPARATED BY BLANK; e.g., 100000 1993)
        (ENTER 0 IF THIS COST CATEGORY IS NOT APPLICABLE)
210000 1994

        IS THE ONE-TIME EXPENSE TAX-DEDUCTIBLE? (Y/N)

        [NOTE: MOST EXPENSES ARE TAX-DEDUCTIBLE]
Y
```

Exhibit 1-3

DATA ENTRY FOR BEN
(continued)

```
     4. ANNUAL EXPENSE =
        (FOLLOW WITH DOLLAR-YEAR SEPARATED BY BLANK; e.g., 100000 1993)
        (ENTER 0 IF THIS COST CATEGORY IS NOT APPLICABLE)
85750 1994


     5. MONTH AND YEAR WHEN NON-COMPLIANCE BEGAN (e.g., 1,1991)
2,1991


     6. MONTH AND YEAR WHEN COMPLIANCE ACHIEVED (e.g., 1,1993)
8,1994


     7. MONTH AND YEAR WHEN PENALTY PAID (e.g., 6,1994)
4,1995


BEN will use this information to calculate the economic
benefit.  If you select standard values for the remaining
six variables, these standard values will be printed in
your output.  You also have the option of entering your
own values for the remaining variables after Item 7.

    HOW DO YOU WISH TO TREAT REMAINING VARIABLES?
    (1 = USE STANDARD VALUES, 2 = ENTER OWN VALUES)
2

    YOU WILL NOW BE PROMPTED FOR VARIABLES 8 THROUGH 13

     8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT IN YEARS (e.g., 15) =
15

     9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE (e.g., 49.6) =
49.6

    10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 (e.g., 38.6) =
38.6

    11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND (e.g., 39.4) =
39.4

    12. ANNUAL INFLATION RATE (e.g., 1.3) =
1.3

    13. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL (e.g., 11.3) =
11.3
```

A. INTRODUCTION

BEN is an interactive computer program that resides on EPA's IBM computer located in Research Triangle Park (RTP), North Carolina.[9] The program is also available on floppy diskette. This chapter describes how to access (or "execute") either version of the program.[10] Specifically, Section B describes how to access the program on EPA's mainframe computer. Section C describes how to exit the mainframe and how to obtain a printout of your results if you are using BEN on the mainframe. Section D, discusses how to run the program off of a floppy diskette and how to print your results from the diskette version of the model.

Note that the Agency will soon be switching exclusively to the PC version of the model, and after February 1, 1994 will no longer process requests for mainframe access. Instead, the Agency will supply government requestors with the PC version. Non-government users will be able to obtain the PC version through NTIS. Mainframe access will most likely continue until the Spring of 1994. At that time, mainframe access will cease.

B. ACCESSING BEN FROM EPA'S MAINFRAME

In order to gain access to EPA's mainframe system, you must have a current password, account identification number, and account user identification number (FIMAS ID). Government users should contact the ADP coordinator in your region or the Policy Development and Training

[9] Throughout this chapter, the EPA IBM computer will be referred to as the "mainframe".

[10] The PC version of the program is much easier to access and use than the mainframe version for most users.

Branch (PDTB) at EPA headquarters to obtain these (202-260-6777). You might be asked to register with EPA's Time Sharing Services Management System (TSSMS) office at RTP to set up your own authorized account. Any questions concerning the user/account registration procedures as well as general questions regarding use of the EPA computer system should be directed to customer support at RTP at (919) 541-7862 or (800) 334-2504. Non-government users can obtain access through the National Technical Information Service at (703) 487-4630.

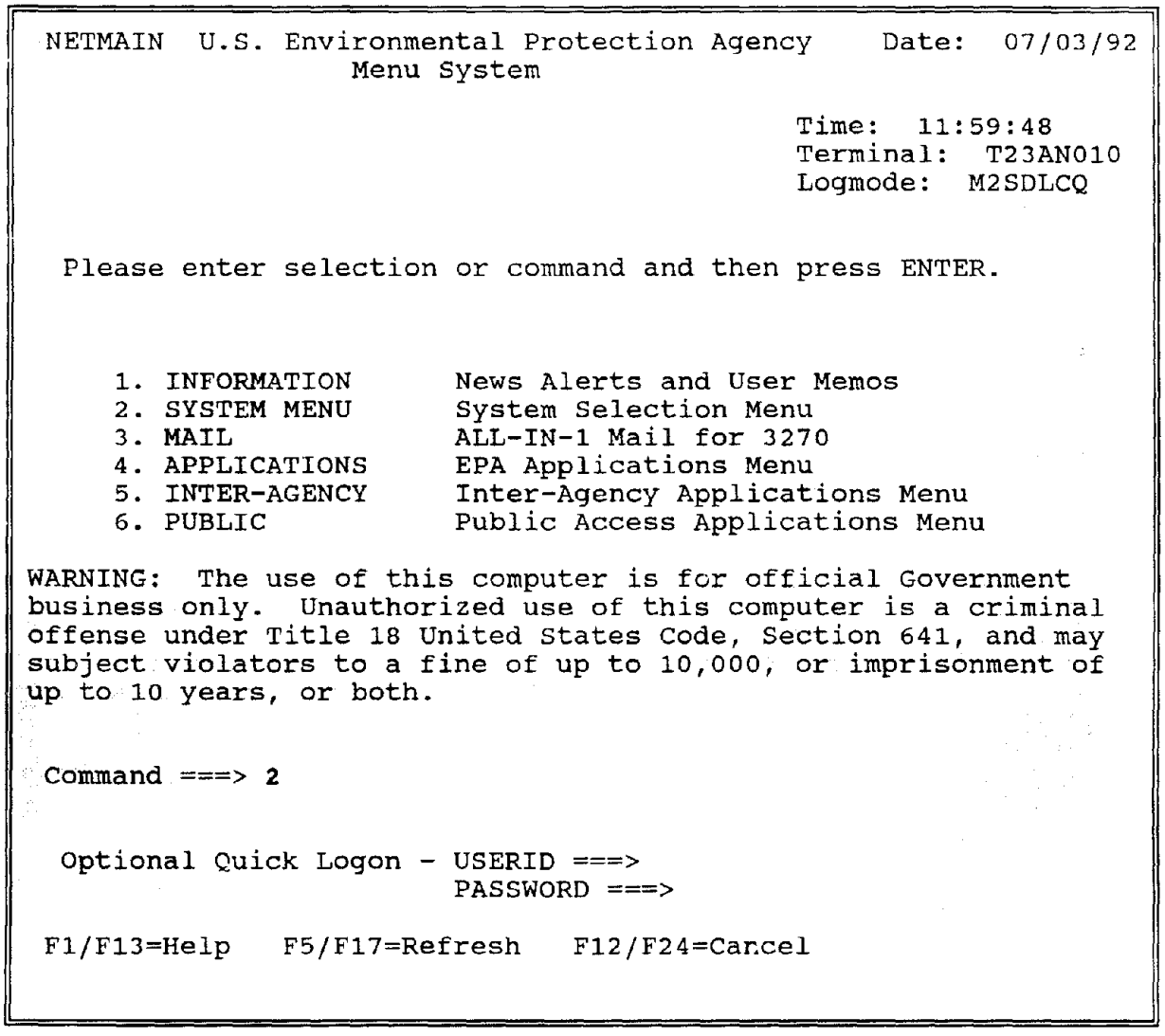
The remainder of this section describes procedures for logging on and accessing the BEN program from EPA's mainframe. The step-by-step instructions illustrate the prompts you receive from the computer and your inputs in response to those prompts. In the examples, the symbol "<" precedes all computer prompts, and the required responses are shown in **bold, underlined** print. Explanations are given below the computer screens. Note that these logon procedures were current as of this printing, but may change. If you have a question related to logging on to the mainframe contact customer support at RTP at (919) 541-7862 or (800) 334-2504.

1. Procedures for Federal Users

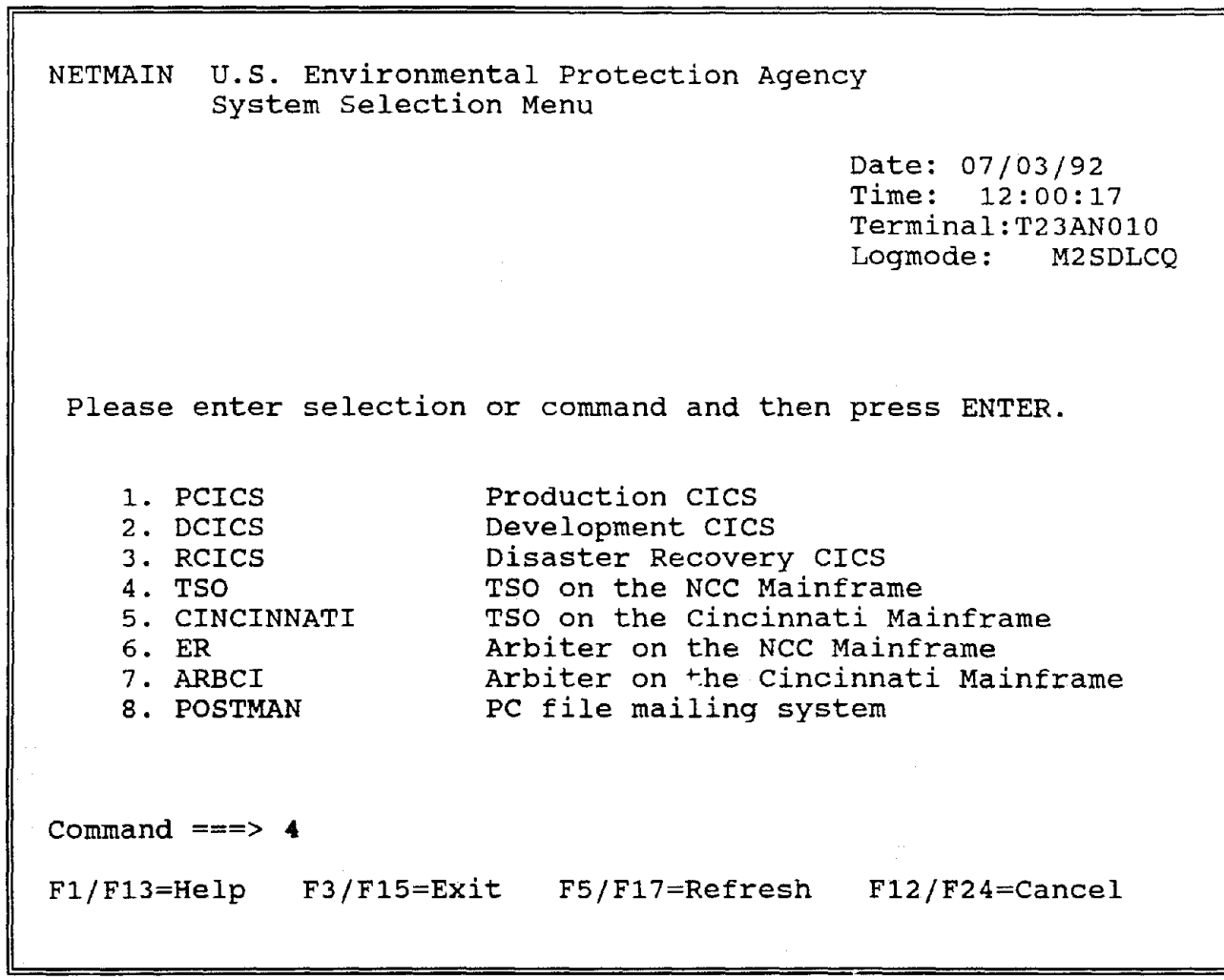
Federal users can use either hard wired or non-hard wired terminals to access the BEN computer program. Although both will access the program, the terminals show different prompts on the screen and require different inputs from the user. The following sections describe the user inputs necessary for each terminal type. Please note that these logon procedures are frequently modified without notice. Most users can usually determine how to respond to the new procedures. If you cannot logon, please contact PDTB at (202) 260-6777.

a. Hard Wired Terminals

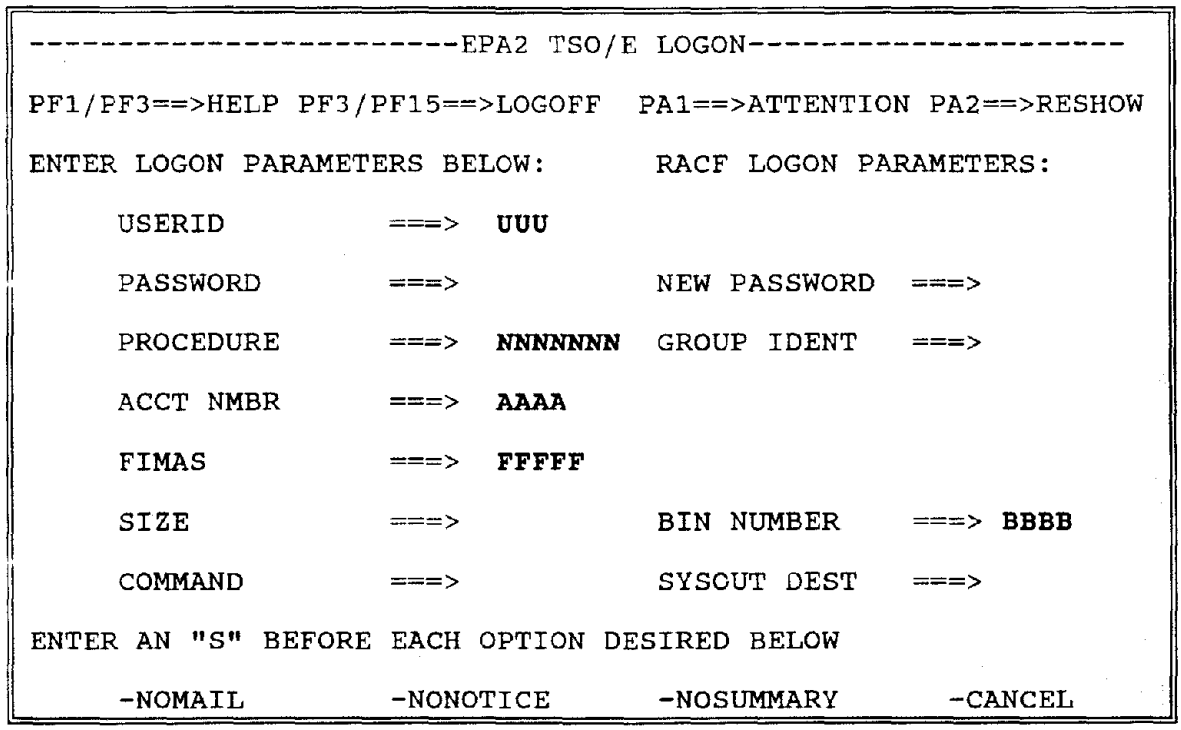
As soon as you turn a hard wired terminal on, the following screen will appear:



The cursor will move to the "Command ===>" line. Enter a 2, and the following screen will appear:



Select TSO by typing a **4** (TSO). The next screen will prompt you for your user ID and password.



The cursor will be located at the USERID prompt. Enter your user ID. The cursor will then move to the PASSWORD prompt. Enter your current password. Your password will not appear on the screen, but will be read by the computer. Your password must be six to eight characters in length, and include at least one letter and one numeric value. Remember that you must change your password every 90 days. Note that you cannot use the same password again for ten change iterations. If your current password has expired, the cursor will move to the NEW PASSWORD prompt. You should then enter a new password.

After entering your password, the following screen will appear:

```
                LEGAL RESEARCH SYSTEMS

     1.  Enforcement Documents Retrieval System        (EDRS)
     2.  Superfund Records of Decision System          (RODS)
     3.  BEN - Penalty Model
     4.  ABEL - Penalty Model
     5.  CASHOUT - Penalty Model

     COMMAND Selections

     R   Remarks
     X   Exit to TSO
     L   Logoff computer


< ENTER SELECTION  >3
```

Enter **3** to access the BEN computer program. If the Legal Research Systems menu does not appear, you will instead get the READY prompt.

```
< READY
PROFILE CHAR (BS)
```

The ready prompt signals that the logon has been successfully completed. Before using your account for the first time, you should set up the backspace key as the delete key for correcting data entry errors. This is accomplished by typing **PROFILE CHAR (BS)** followed by a carriage return (or **enter** key). If capital letters cannot be used on your terminal, type this command with lower-case letters. Having done this, you can then delete any characters that you have typed incorrectly by pressing the backspace key before pressing the carriage return (or **enter** key) for that entry. You only need to perform this procedure once, the first time you use your account.

Note that by accessing the mainframe in this manner, you will be in the TCP mode. In this mode the terminal screen will not scroll during your BEN session. Each prompt remains on the screen after the user enters the appropriate input. Thus, the series of prompts and responses fill up the terminal screen. When "***" appears, the computer will not accept any more inputs. You must hit the carriage return (the **enter** key) to move to another page and continue your session.[11] Until you move to the next page, the computer will not accept any data inputs.

To run BEN from the READY prompt type **EXEC 'BOHMSEE.BEN.CLIST'**. Note that the command BOHMSEE.BEN.CLIST must be enclosed in single quotation marks and must not include any blank spaces between the words. You may type the command in upper or lower case letters. If you have not accessed the program recently through your account, you may experience some delay while the mainframe recalls the files needed to run the program. The file retrieval process usually takes three to five minutes, but may vary depending on when you last accessed the program. You are now ready to do your BEN calculation.

```
< READY
EXEC 'BOHMSEE.BEN.CLIST'
```

b. Non-Hard Wired Terminals

Federal users working at headquarters or regional offices who do not have hard wired terminals may sign on through a Local Area Network (LAN). This is generally accomplished by selecting the "communications" option on the original LAN screen, and accessing the program through a computer data switch (such as SNA Gateway). These procedures vary from region to region, so you should contact your local computer specialist for exact details.

---

[11] In certain regions, the "Ctrl" key serves as the enter key; see your local computer specialist if you are having difficulty at this point.

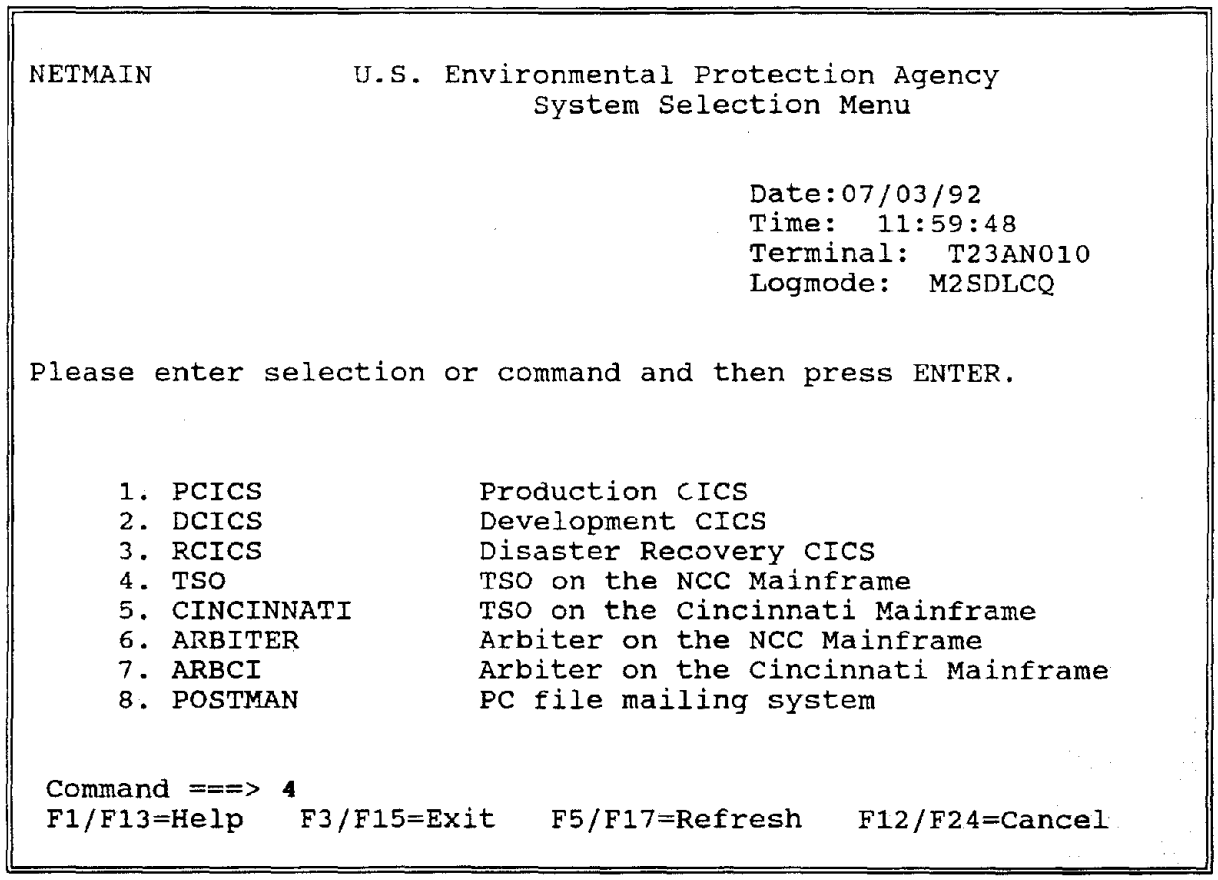
After you have been connected to the mainframe through a data switch, you will see the following screen:[12]

```
NETMAIN          U.S. Environmental Protection Agency
                                Menu System

                              Date:07/03/92
                              Time:  11:59:48
                              Terminal:T23AN010
                              Logmode:M2SDLCQ

 Please enter selection or command and then press ENTER.


    1. INFORMATION       News Alerts and User Memos
    2. SYSTEM MENU       System Selection Menu
    3. MAIL              ALL-IN-1 Mail for 3270
    4. APPLICATIONS      EPA Applications Menu
    5. INTER-AGENCY      Inter-Agency Applications Menu
    6. PUBLIC            Public Access Applications Menu

WARNING:  The use of this computer is for official Government
business only.  Unauthorized use of this computer is a criminal
offense under Title 18 United States Code, Section 641, and may
subject violators to a fine of up to 10,000, or imprisonment of up
to 10 years, or both.


 Command ===> 2

  Optional Quick Logon - USERID ===>
                         PASSWORD ===>

 F1/F13=Help   F5/F17=Refresh   F12/F24=Cancel
```

The cursor will move to the "Command ===>" line. Enter a 2, and the following screen will appear:

---

[12] After accessing the mainframe through a data switch (such as SNA gateway), you will often return to the LAN menu. To "jump" to the mainframe, you must hit a "hot key". In many regions, "jumping" to the mainframe is accomplished by hitting the "alt" key and the "scroll lock" key simultaneously.



Select TSO by typing a 4 (TSO). The next screen will prompt you for your user ID and password.

```
------------------------EPA2 TSO/E LOGON--------------------
PF1/PF3==>HELP PF3/PF15==>LOGOFF  PA1==>ATTENTION PA2==>RESHOW
ENTER LOGON PARAMETERS BELOW:      RACF LOGON PARAMETERS:
     USERID          ===>  UUU
     PASSWORD        ===>            NEW PASSWORD  ===>
     PROCEDURE       ===>  NNNNNNN   GROUP IDENT   ===>
     ACCT NMBR       ===>  AAAA
     FIMAS           ===>  FFFFF
     SIZE            ===>            BIN NUMBER    ===> BBBB
     COMMAND         ===>            SYSOUT DEST   ===>
ENTER AN "S" BEFORE EACH OPTION DESIRED BELOW
     -NOMAIL         -NONOTICE       -NOSUMMARY      -CANCEL
```

As for a hard wired terminal, the cursor will be located at the USERID prompt. Enter your user ID. The cursor will then move to the PASSWORD prompt. Enter your current password. Your password will not appear on the screen, but will be read by the computer. The format for your password should follow the guidelines discussed earlier.

After some initial messages, the next prompt will either be the Legal Research Systems menu or the READY prompt. Respond to your particular prompt as described earlier. The READY prompt on the screen signals that the logon has been successfully completed. At this time, you can set up the backspace key as the delete key as outlined earlier.

Note that by accessing the mainframe in this manner, you will be in the TCP mode. In this mode the terminal screen will not scroll during your BEN session. Each prompt remains on the screen after the user enters the appropriate input. Thus, the series of prompts and responses fill

up the terminal screen. When "***" appears, the computer will not accept any more inputs. You must hit the carriage return (the **enter** key) to move to another page and continue your session.[13] Until you move to the next page, the computer will not accept any data inputs.

```
< READY
EXEC 'BOHMSEE.BEN.CLIST'
```

To run BEN from the READY prompt type **EXEC 'BOHMSEE.BEN.CLIST'**. Note that the command BOHMSEE.BEN.CLIST must be enclosed in single quotation marks and must not include any blank spaces between the words. You may type the command in upper or lower case letters. If you have not accessed BEN recently through your account, you may experience some delay while the mainframe recalls the files needed to run the program. The file retrieval process usually takes three to five minutes, but may vary depending on when you last accessed the program. You are now ready to proceed with your BEN calculation.

2. Procedures for State and Local Government Users

State and local government users may logon to the mainframe through a modem. The logon process for nonfederal government users is as follows: If you are not directly linked to the mainframe (e.g., state people) and you are not within the local calling area of an EPA Regional Office, you can dial in using a modem: (800) 445-2795. If you are not directly linked to the mainframe and you are within the local calling area of one of the following phone numbers, you will not be allowed access to the mainframe via the toll-free (800) number. Use one of the local numbers listed in the following table.

[13] In certain regions, the "Ctrl" key serves as the enter key; see your local computer specialist if you are having difficulty at this point.

EPA Mainframe - Modem Access Phone Numbers	
National EPA Number	(800) 445-2795
HQ Washington	(202) 488-3671
Region 1 Boston	(617) 565-9084
Region 2 New York	(212) 264-1554
Region 3 Philadelphia	(215) 597-0103
Region 4 Atlanta	(404) 347-2919
Region 5 Chicago	(312) 886-5143
Region 6 Dallas	(214) 655-7350
Region 7 Kansas City	(913) 236-2830
Region 8 Denver	(303) 293-1400
Region 9 San Francisco	(415) 744-1010
Region 10 Seattle	(206)-553-0383
ERC Research Triangle Park	(919) 541-4642
ERC Cincinnati	(513) 569-7700
ERC Las Vegas	(702) 798-3294
NEIC Denver	(303) 236-4975

If you have any questions, check with the help desk of the National Computer Center (919) 541-7862. Note that modems will operate up to 9600 bits per second and require the settings listed below:

- -- Even Parity
- -- Full Duplex Transmission (for TCP or 3270 emulation)
- -- Half Duplex Transmission (for IBMPSI)
- -- 7 Data Bits
- -- 1 Stop Bit

When you have reached EPA's mainframe, you will see the following screen:

```
Connected.
```

At this point in the logon procedure, the nonfederal user must enter the appropriate selection corresponding to the interface desired with the mainframe computer. This selection will determine which prompts and user inputs are required for the remainder of the logon procedure. The following sections describe the different prompts and user inputs necessary to access the BEN computer program using the IBMPSI and TCP selections.

a. The IBMPSI Selection

With the IBMPSI selection, your session will scroll as it proceeds. Your input will be at the bottom of the computer screen, so that you will always see a full screen of your earlier work. To select this option, type **IBMPSI** and enter it.[14]

```
< Welcome to the Environmental Protection Agency National Computer
Center

     < Please enter one of the following selections:

          IBMPSI for IBM
          TCP for IBM 3270 EMLATION
          VAXA for VAX SYS A
          VAXB for VAX SYS B
          MAIL for ALL-IN-1

< Enter selection:  IBMPSI
```

[14] Whatever you type might appear twice because of the half duplex transmission mode. However, press each key only once.

You will then see the following screen:

```
< Connected

< U.S. EPA (TTY-X25-IBM)

   A TSO - NCC
   B WIC
   C CINCINNATI
   D ARBITER NCC
   E ARBITER CINCY
   F EPA OLS

 < SELECTION ?  A
```

Type **A** for TSO-NCC and enter it.

```
< EPA200 ENTER USERID -
UUU
```

Type your user identification code and enter it.

```
< EPA202 ENTER CURRENT PASSWORD FOR UUU -
PPPPPP
```

Type your password and enter it. Your password must be six to eight characters in length, and include at least one letter and one numeric value. Remember that you must change your password every 90 days. Note that you cannot use the same password again for ten change iterations. If your current password has expired, the cursor will prompt you to enter a new password. You should then enter a new password.

```
< :EPA207  LAST ACCESS AT 10:00:00  ON MONDAY, JUNE 25, 1992
< ENTER ACCOUNT NUMBER - OR "*" FOR AAAA
*
< EPA209 ENTER PROCEDURE NAME - OR "*" FOR NNNNNNN
*
< ENTER FIMAS ID - OR "*" FOR FFFFF
*
< ENTER BIN NUMBER - OR "*" FOR BBBB
*
```

Enter * or your appropriate response to these prompts. When your are issued your User ID, you will be given your Account Number, Procedure Name, and Fimas ID. You should enter your bin number if you are planning on having your output sent to your bin.[15] Then, the computer will print a number of messages listing news items available for review. After these initial messages, the next screen to appear will either be the Legal Research Systems menu or the READY prompt.

[15] You can obtain a bin and a bin number from the Washington Information Center (WIC) in the lower level of Waterside Mall (where the bins are located). The output will usually be delivered to your bin within two to three hours after you end your session. If you are not in Washington, your copy will be mailed to you at the address of record associated with your EPA computer user ID, after you indicate your mail box number. Your mail box number is simply your user identification number preceded by the letter M. You should receive your output in three to five days.

```
                LEGAL RESEARCH SYSTEMS

     1.  Enforcement Documents Retrieval System          (EDRS)
     2.  Superfund Records of Decision System            (RODS)
     3.  BEN - Penalty Model
     4.  ABEL - Penalty Model
     5.  CASHOUT - Penalty Model

     COMMAND Selections

     R   Remarks
     X   Exit to TSO
     L   Logoff computer


< ENTER SELECTION  3
```

Enter 3 to access the BEN computer program. If the Legal Research Systems menu does not appear, you will instead get the READY prompt.

```
< READY
PROFILE CHAR (BS)
```

The ready prompt signals that the logon has been successfully completed. Before using your account for the first time, you should set up the backspace key as the delete key for correcting data entry errors. This is accomplished by typing **PROFILE CHAR (BS)** followed by a carriage return (or **enter** key). If capital letters cannot be used on your terminal, type this command with lower-case letters. Having done this, you can then delete any characters that you have typed incorrectly by pressing the backspace key before pressing the carriage return (or **enter** key) for that entry. You only need to perform this procedure once, when you first use your account.

```
< READY
EXEC 'BOHMSEE.BEN.CLIST'
```

To run BEN from the READY prompt type **EXEC 'BOHMSEE.BEN.CLIST'**. Note that the command BOHMSEE.BEN.CLIST must be enclosed in single quotation marks and must not include any blank spaces between the words. You may type the command in upper or lower case letters. If you have not accessed BEN recently through your account, you may experience some delay while the mainframe recalls the files needed to run the program. The file retrieval process usually takes three to five minutes, but may vary depending on when you last accessed the program. You are now ready to do your BEN calculation.

b. The TCP Selection

If you select the TCP mode, the terminal screen will not scroll during your BEN session. Each prompt remains on the screen after the user enters the appropriate input and the series of prompts and responses fill up the terminal screen. When "***" appears, the computer will not accept any more inputs. You must hit the carriage return (or **enter** key) to move to another page and continue your session. Until you move to the next page, the computer will not accept any data inputs. The initial screen has been reproduced below substituting the TCP selection for IBMPSI.

```
< Welcome to the Environmental Protection Agency National
Computer Center
     < Please enter one of the following selections:

          IBMPSI for IBM
          TCP for IBM 3270 EMLATION
          VAXA for VAX SYS A
          VAXB for VAX SYS B
          MAIL for ALL-IN-1

< Enter selection:  TCP
```

Type TCP and enter it.

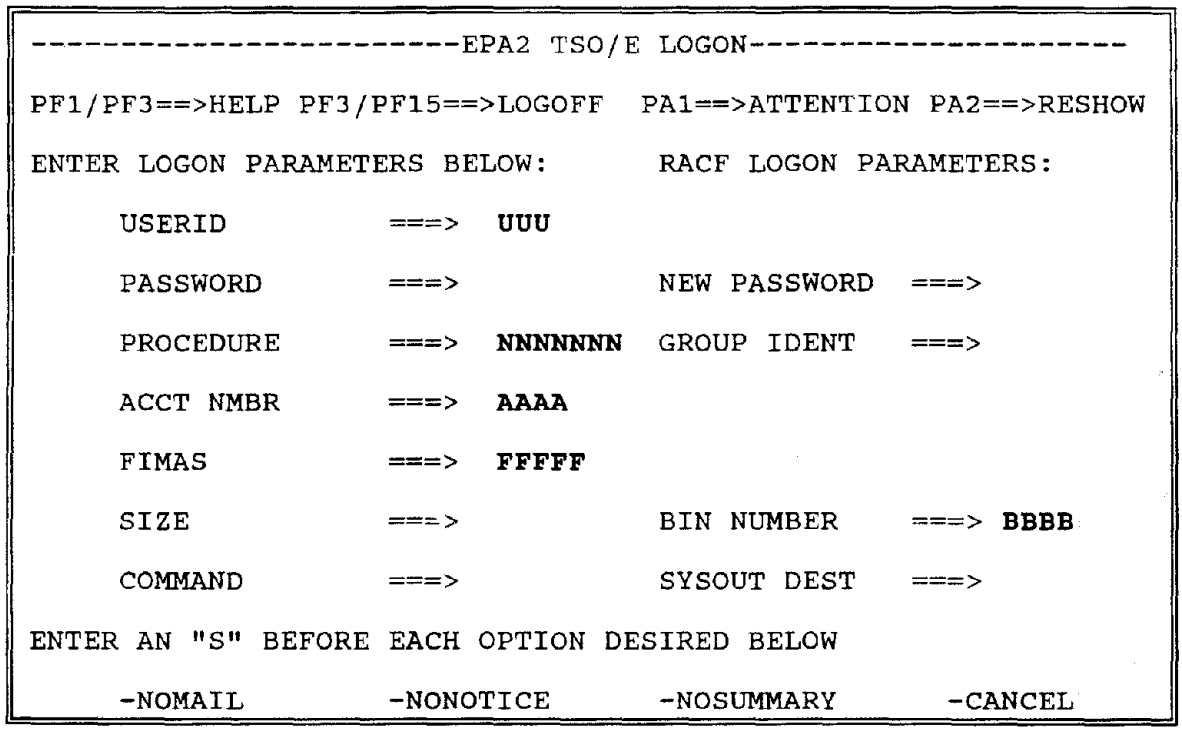
```
< Connected.  (Hit your Enter Key.)

< ENTER YOUR TERMINAL'S Cx-80 DEVICE TYPE IF YOU
< ALREADY KNOW IT.  IF NOT, TYPE 'H' FOR HELP.

?68
```

Type your terminal's appropriate device type and enter it. If you do not know it, enter **H** for help to assist you in determining what device you have. If you still need help, call NCC telecommunications at (800) 334-0741. You may also want to check with your local computer specialist if you are unsure of the proper entry.

```
                    *** Cx-80 Ver. 04.83 ***
```

```
                          WELCOME TO THE
                  U.S. ENVIRONMENTAL PROTECTION AGENCY
                       TELECOMMUNICATIONS NETWORK

                          TERMINAL ID:  T1234567

<                         ENTER COMMAND TO LOGON

TSO
```

Type **TSO** and enter it.



As with the IBMPSI mode, the cursor will be located at the USERID prompt. Enter it. Then the cursor will move to the PASSWORD prompt. Enter your current password. Your password will not appear on the screen, but will be read by the computer. The format for your password should follow the guidelines outlined earlier in the section on the IBMPSI selection.

After some initial messages, the next prompt will either be the Legal Research Systems menu or the READY prompt. The rest of the procedure is the same as for the IBMPSI selection outlined earlier. The READY prompt on the screen signals that the logon has been successfully completed. At this time, you can set up the backspace key as the delete key as outlined earlier in the section on the IBMPSI selection.

```
< READY
EXEC 'BOHMSEE.BEN.CLIST'
```

To run BEN from the READY prompt type **EXEC 'BOHMSEE.BEN.CLIST'**. Note that the command BOHMSEE.BEN.CLIST must be enclosed in single quotation marks and must not include any blank spaces between the words. You may type the command in upper or lower case letters. If you have not accessed BEN recently through your account, you may experience some delay while the mainframe recalls the files needed to run the program. The file retrieval process usually takes three to five minutes, but may vary depending on when you last accessed the program. You are now ready to do your BEN calculation.

C. MAINFRAME LOGOFF AND PRINTING PROCEDURES

1. Exiting from BEN

The following procedures for logging off the mainframe apply to both federal and nonfederal users. Once BEN has completed a calculation and directed the output for printing, you can either end the session or continue with further calculations. See Chapter 5 for an explanation of the procedures for changing variables and making additional calculations. If you have completed your BEN calculations, typing 0 (zero) ends the session:

```
 DO YOU WISH TO DO ANOTHER ECONOMIC SAVINGS CALCULATION?
 (0=NO; 1=YES, USING STANDARD VALUES; 2=YES, USING OWN
 INPUTS)
0

 DO YOU REALLY WANT TO LEAVE BEN?
 (0=NO; 1=YES)
1
```

2. Printing Directly from BEN

After you type 0 (zero) and confirm termination by typing 1, BEN will notify you that output from all of the calculations in the session has been saved temporarily in a computer file. At this point, you have the opportunity to receive a printed hardcopy. BEN will only prompt you for a printout of the run after you have exited the program. If you want a printout from EPA's mainframe computer, simply respond to the prompt by typing Y to indicate yes:

```
  ALL OF YOUR OUTPUT HAS BEEN SAVED IN A FILE. DO YOU WISH
  TO RECEIVE A PRINTED COPY OF THIS OUTPUT? (Y=YES, N=NO)
Y
```

BEN then asks you for additional information. If you are in Washington, BEN will ask you for your bin number:

```
     PLEASE SUPPLY THE FOLLOWING INFORMATION:
     ARE YOU WORKING AT A TERMINAL IN THE WASHINGTON D.C.
     AREA?
     (Y=YES, N=NO)
Y

     ENTER YOUR BIN NUMBER
     (THE FORMAT SHOULD BE A LETTER D FOLLOWED BY
     THREE NUMBERS.  E.G., D099)
D099
```

You can obtain a bin (and number) at the Washington Information Center (WIC) in the lower level of Waterside Mall. The output will generally be delivered to your bin within two or three hours. If you are outside Washington, BEN will ask for your mailing box number:

```
    ENTER YOUR MAILING BOX NUMBER
    (THE FORMAT SHOULD BE YOUR USER IDENTIFICATION NUMBER
    PRECEDED BY THE LETTER M, e.g. MXXX.)
MXXX
```

This number is your user identification number preceded by the letter M (e.g., MXXX). Your output will be mailed to you at the address recorded with your account information. You should receive your output in three to five days. BEN will then notify you that your output will be printed and delivered or mailed:

```
  YOUR OUTPUT WILL BE PRINTED AT THE COMPUTER CENTER AND
  ROUTED TO YOUR BIN OR MAILED TO YOU.
```

3. Printing BEN's Output on Your Local Printer

BEN has recently been modified to include an alternate way of getting a printout of your results. Some users will find this method is a faster and easier way to get a hard copy of their calculation. After exiting the program, indicate that you do not want a mainframe printout.

```
  ALL OF YOUR OUTPUT HAS BEEN SAVED IN A FILE. DO YOU WISH
  TO RECEIVE A PRINTED COPY OF THIS OUTPUT? (Y=YES, N=NO)
N
```

At this point, the computer returns you to the Legal Research Systems screen. Type X to reach the "READY" prompt.[16]

[16] In some cases, you will be returned directly to the "READY" prompt, bypassing the "Legal Research Systems" screen.

```
                LEGAL RESEARCH SYSTEMS

    1.  Enforcement Documents Retrieval System          (EDRS)
    2.  Superfund Records of Decision System            (RODS)
    3.  BEN - Penalty Model
    4.  ABEL - Penalty Model
    5.  CASHOUT - Penalty Model

    COMMAND Selections

    R   Remarks
    X   Exit to TSO
    L   Logoff computer


< ENTER SELECTION  X
```

Once you reach the "READY" prompt, rather than logging off, you can print your results at a local printer. Your BEN results are stored in a file called BENOUT.DAT. Depending on the set up of your computer system and printer, you can either print the file directly or download this file to a floppy (or hard) disk and then print the file. You should contact your local computer specialist for the exact printing (or downloading) procedures.

Note that the file BENOUT.DAT is over-written each time that you complete a BEN session. Thus, if you would like a copy of the printed results using this method, you must print (or download) the file before you access the BEN program again.

4. Logging Off the EPA Mainframe

When you have finished printing your output (using either method described above), the computer returns you to the Legal Research Systems screen or to the "READY" prompt.

a. Logging Off From the Legal Research Systems Screen

If you see the "Legal Research Systems" screen, logoff by selecting the exit choice (L) from the menu. Turn off the terminal, modem, and printer, and the session is over.

```
                LEGAL RESEARCH SYSTEMS

    1.  Enforcement Documents Retrieval System          (EDRS)
    2.  Superfund Records of Decision System            (RODS)
    3.  BEN - Penalty Model
    4.  ABEL - Penalty Model
    5.  CASHOUT - Penalty Model

    COMMAND Selections

    R   Remarks
    X   Exit to TSO
    L   Logoff computer


< ENTER SELECTION  L
```

b. Logging Off from the "READY" Prompt

If you do not get the Legal Research Systems screen, you will instead get the "READY" prompt. You logoff the IBM System by typing **LOGOFF**, followed by a carriage return (or **enter** key). Turn off the terminal, modem, and printer, and the session is over.

```
< READY
LOGOFF
```

D. USING THE PC VERSION OF BEN

1. Introduction

An alternative to accessing BEN through the EPA mainframe is to use the IBM compatible personal computer (PC) version of the program. Government personnel interested in obtaining a PC copy of BEN should contact Jonathan Libber at (202) 260-6777. Private individuals should contact NTIS at (703) 487-4630. This section describes how to install and run BEN on a PC, how to run the program from a floppy drive, and how to print and exit from the PC version of BEN.

2. Starting the Program

a. PC with Hard Drive

If this is your first time using the PC version of BEN, upload the files from the floppy disk that contains the PC version of the program to your hard drive.[17] Uploading the BEN files allows the program to run more efficiently and quickly.

In order to upload BEN onto your hard drive, first turn on your computer. Next, insert the disk containing the BEN files into a floppy drive (probably drive A or B). If your hard drive is the C drive, then you want to copy the BEN files onto this drive. There are four files you need to copy in order to run BEN. As illustrated below, create a directory for your BEN files at the DOS prompt, and then copy the files from the floppy disk to the hard drive.

```
C:\> MKDIR BEN
C:\> COPY A:\BEN\*.* C:\BEN
```

You only need to perform this procedure once, unless something happens to your hard drive. If you have any questions about this procedure contact your local computer specialist.

[17] This floppy disk should contain four files: (1) BENMODEL.EXE, (2) DOC.DAT, (3) ASK.COM, and (4)PSTAT.COM. Make sure you have all four files or the program will not operate correctly.

Once BEN has been loaded onto your hard drive, go to the BEN directory and start the program simply by typing **BEN** at the prompt, followed by a carriage return.[18] Make sure that the "caps lock" key on your keyboard is on. The PC version of BEN only accepts capital letters.

```
C:\>CD\BEN

C:\BEN\>BEN

*****************************************************************

DATE OF MESSAGE:  DECEMBER 15, 1993

INTRODUCING BEN VERSION 4.0:

THE RECENTLY PASSED FEDERAL BUDGET BILL CONTAINS MODIFICATIONS TO THE
TAX CODE RETROACTIVE TO JANUARY 1, 1993.  CONSEQUENTLY, BEN HAS BEEN
MODIFIED TO INCLUDE A TAX RATE FOR 1993 AND BEYOND.  ALSO, DUE TO THE
INCREASED DIFFERENTIAL BETWEEN CORPORATE AND PERSONAL FEDERAL INCOME
TAX RATES UNDER THE NEW TAX CODE, BEN NOW APPLIES SEPARATE TAX RATES FOR
C-CORPORATIONS AND OTHER FOR-PROFIT ENTITIES THAT ARE TAXED AT PERSONAL
INCOME TAX RATES.  IN ADDITION, VARIABLE 1B (ENVIRONMENTAL STATUTE CODE)
HAS BEEN ELIMINATED FROM THE MODEL.  ELIMINATING THIS VARIABLE HAS NO
EFFECT ON YOUR BEN RESULTS.

*****************************************************************
Strike a key when ready . . .
loading the program, please wait...

                    BBBBBBB    EEEEEEE   NNN     N
                    B     B    E         N NN    N
                    BBBBBBB    EEEEE     N  NN   N
                    B     B    E         N   NN  N
                    BBBBBBB    EEEEEEE   N    NNN

                         Version 4.0.  December 1993.

    ***************************************************************
                  BEN 4.0 IS VALID UNTIL AUGUST 1, 1994.
    ***************************************************************

    ***************************************************************
    NOTE THAT ALL ENTRIES MUST BE TYPED IN UPPER CASE LETTERS.
    ***************************************************************

    Would you like an introduction?  (Y/N)
```

[18] There will be a several second delay while your computer loads the BEN program.

b. Running BEN From a Floppy Drive

If you choose not to upload the BEN files onto your hard drive, you must enter the BEN diskette into your disk drive each time you use the model. Type BEN at the disk drive prompt, followed by a carriage return. In the following example, the user is running BEN from a floppy disk in drive A:

```
C:\>A:\

A:\>CD BEN

A:\BEN\>BEN

*********************************************************************

DATE OF MESSAGE:  DECEMBER 15, 1993

INTRODUCING BEN VERSION 4.0:

THE RECENTLY PASSED FEDERAL BUDGET BILL CONTAINS MODIFICATIONS TO THE
TAX CODE RETROACTIVE TO JANUARY 1, 1993.  CONSEQUENTLY, BEN HAS BEEN
MODIFIED TO INCLUDE A TAX RATE FOR 1993 AND BEYOND.  ALSO, DUE TO THE
INCREASED DIFFERENTIAL BETWEEN CORPORATE AND PERSONAL FEDERAL INCOME
TAX RATES UNDER THE NEW TAX CODE, BEN NOW APPLIES SEPARATE TAX RATES
FOR C-CORPORATIONS AND OTHER FOR-PROFIT ENTITIES THAT ARE TAXED AT
PERSONAL INCOME TAX RATES.  IN ADDITION, VARIABLE 1B (ENVIRONMENTAL
STATUTE CODE) HAS BEEN ELIMINATED FROM THE MODEL.  ELIMINATING THIS
VARIABLE HAS NO EFFECT ON YOUR BEN RESULTS.

*********************************************************************
Strike a key when ready . . .
loading the program, please wait...

                        BBBBBBB    EEEEEEE   NNN     N
                        B      B   E         N NN    N
                        BBBBBBB    EEEEE     N  NN   N
                        B      B   E         N    NN N
                        BBBBBBB    EEEEEEE   N     NNN


                              Version 4.0.  December 1993.

   *****************************************************************
              BEN 4.0 IS VALID UNTIL AUGUST 1, 1994.
   *****************************************************************

   *****************************************************************
      NOTE THAT ALL ENTRIES MUST BE TYPED IN UPPER CASE LETTERS.
   *****************************************************************

   Would you like an introduction?  (Y/N)
```

When running BEN from a floppy drive of a PC, you must leave the disk containing the BEN files in the drive for the duration of the program. In addition, you may want to make a copy of this disk before executing the program, as a back-up in case anything happens to the original disk. Make sure that the "caps lock" key on your keyboard is on. The PC version of BEN only accepts capital letters.

3. Exiting from BEN

After performing an economic benefit calculation, BEN provides a menu asking if you wish to evaluate another case or exit from the program. If you choose the option that exits you from the program and confirm this choice when prompted to do so, the program will end.

4. Printing from a PC

a. PC with Printer Attached

Chapter 5 will discuss the four different output options of the BEN model. Once you have selected an output option, BEN creates a file on your disk drive that contains the output. This file is called BENOUT.DAT. When you have completed your analysis (or analyses) and exit the BEN program, you will see the following screen:

```
All of your output has been saved in a file.
Do you want the output to be printed (Y-yes, N=No)?
```

Type Y for yes and your output will be printed to the printer attached to your computer.[19] In addition, you can print the contents of your screen by pressing the "print screen" key on your keyboard.

[19] The output is sent to the first printer port (LPT1). Thus, if your computer can access more than one printer, the output will be sent to the printer designated as LPT1.

b. **PC without Printer Attached**

If you wish to print your output but there is no printer attached to the PC you are working on, you will need to print from another PC. If you ran BEN from a hard drive, then your output file is saved onto the hard drive and you will need to copy it to a floppy. In order to copy the file to a floppy disk, you should insert a floppy disk in the floppy drive of your computer, and type **COPY BENOUT.DAT A:**, followed by a carriage return. In this example, the floppy disk is in drive A, and you are in the BEN directory on drive C.[20]

```
C:\BEN>COPY BENOUT.DAT A:
   1 File(s) copied
```

Take this disk to a computer that is attached to a printer and insert the disk into the A drive. You may then print the output file from any DOS prompt. To print from DOS simply type **PRINT A:\BENOUT.DAT**, followed by a carriage return.

```
A:\>PRINT A:\BENOUT.DAT
```

Note that you may experience problems printing if the floppy is too full. You should make sure your disk contains only the files necessary to run BEN, in order to leave enough space to save the output file. In addition, the file BENOUT.DAT is overwritten each time you do a BEN analysis. Thus, you must print BENOUT.DAT after each BEN analysis if you want a hard copy of the results.[21]

---

[20] If you ran BEN from a floppy, the output file will automatically be saved on the floppy disk that contains the BEN files.

[21] You could also change the name of the file and/or transfer it to another diskette to keep a copy on disk.

This chapter provides information that is essential for using BEN effectively to calculate economic benefit. Section A describes how the computer program is structured, and provides an overview of the choices that BEN presents during program execution. Section B provides data format requirements and additional helpful hints for entering data at your computer terminal. This section also illustrates the error messages provided by BEN if you fail to enter data properly.

A. STRUCTURE OF THE PROGRAM

BEN provides you with a number of choices for running the model. The first choice is whether to read an introduction to BEN. This introduction explains what BEN does, how it will prompt you for information, and the proper format for data inputs to the program.

A series of prompts for your input values follows the introductory question. You enter the requested information after each prompt. The economic benefit calculation involves a total of 13 variables, which are numbered 1 through 13. You must initially provide a name and some descriptive information for the penalty case. The values for variables 2 through 7 require information on the cost of compliance and the dates reflecting the period of noncompliance. BEN then gives you a choice between entering case-specific data for the remaining six variables, or using the standard values available in BEN. If you choose to enter case-specific values, the program automatically prompts you for variables 8 through 13. When you are finished entering data, BEN then calculates the economic benefit of noncompliance.

To access an explanation of the information required for a particular variable, simply type the word **HELP**, or the letter **H**, after the prompt for that variable. BEN will display a few sentences which define the variable, give sources of information, and provide a brief reminder of the format required. This information aids the user who has not read Chapters 3 and 4 of the user manual, or does not have access to a copy of the manual for reference during program operation. After the complete help explanation has been printed, BEN will prompt you again for the variable entry. You can then enter the required information.

When you have made all of your input selections, you can then choose from among three output options, each of which provides a different level of detail. No matter which output option you choose, BEN will include a list of the inputs used in the calculation as part of the output. BEN displays the results of your economic benefit calculation at your terminal and also temporarily saves the output in a computer file for printing. When you are finished with a calculation, you can choose to run the program again or end the program session. If you run the program again, you can change one or more of your entries from the previous run. You can then recalculate the economic benefit without having to reenter all variable values. The procedure for making changes depends on whether you used standard values in the previous calculation, and whether you plan to use standard values in the new calculation. These procedures are described in more detail in Chapter 5.

When you have finished performing economic benefit calculations and have ended the program session, BEN gives you the opportunity to order a printed copy of your output. Procedures for obtaining a printout are discussed in Chapter 2.

B. ENTERING THE DATA

BEN is an interactive computer program. The terminal prints or displays a question and then waits for you to type an answer. Sometimes the prompt for information will be a description of the data to be entered instead of a question. In both cases, the cursor (or print head) returns to the beginning of the next line after printing each prompt.[22]

[22] If you are using a TTY, you should wait until the entire prompt is printed and the print head has returned to the next line before entering data.

Be aware that if you are using the mainframe version of BEN, there may be slight hesitations in the computer's response because of the time-sharing mode. Messages sent to and from the computer are interspersed with messages to and from other time-sharing users in your local area. A larger number of users puts a greater time demand on the transmission facilities because more terminals are sending messages over the same local telephone line. The incidence of many long hesitations indicates that there are more local users than usual using the time-sharing mode of the IBM computer. You will have to be patient in waiting for the entire prompt to be displayed before entering data.[23]

Also, note that BEN is different from most PC software programs (such as Lotus 123 or Wordperfect) in that its user interaction is linear, as opposed to page oriented. This characteristic of BEN means that you cannot "back-up," or move around the screen, in order to edit an entry which you have already made.

1. Introduction

```
Would you like an introduction? (Y/N)
```

You need only type **Y** to represent yes, or **N** to represent no. BEN will also recognize your answer if you type the full word for your response. If you answer **N**, BEN will skip the introduction and take you to the next step in the program.

The introduction contains four video-screen size pages. To aid PC users in reading the text, BEN stops scrolling at the end of each page. Press the carriage return (or **enter** key) to read the next page. The introduction screens read as follows:

[23] Another type of delay can occur if you have not used the program in the previous two weeks. In this case, the mainframe will need to pull information from archives, and you will be put "on hold" until this procedure is completed. The computer will let you know that this is occurring by giving you a prompt preceded by "ARC."

This program calculates the economic benefit an entity gains by delaying expenditures necessary for compliance with environmental regulations or permits. This economic benefit is one component of a civil penalty.

The economic benefit calculation involves 13 variables. You must provide a name for the penalty case and respond to six prompts for information about compliance costs and the dates involved in the case. BEN then gives you a choice between providing values for the remaining six variables yourself or allowing BEN to use standard values.

BEN contains standard values according to the profit status and filing status of the entity. When you use BEN to calculate the economic benefit for a case, you will identify the type of entity involved, BEN can then select the appropriate set of standard values.

Press the carriage return (or ENTER key) for the next page of text.

After each economic benefit calculation, you can change some or all of the values you provide and perform another calculation without leaving the program.

If you need additional information, call EPA Headquarters:

202-260-6777

BEN allows only certain data formats for numerical values and dates: Numerical values (costs, rates, percentages, years) should be entered without commas, dollar signs, or percent signs. For example, enter a $10,000 cost as 10000 and enter 20% as 20. Use decimals only for fractional values, such as 10000.50 dollars or 20.1 percent. Be careful to use only the number keys. A common mistake is typing the lowercase letter L instead of the number 1. Another error is typing the letter O instead of the number 0.

Press the carriage return (or ENTER key) for the next page of text.

Dates entered for compliance and payment periods should be in numerical form, with the month separated from the year by a comma, as in: 6,1984. Note that the year must contain four digits.

Shown below is one example of a data prompt, and a response in the correct format. Notice that BEN gives you an example of the required format for data entry following the data prompt, enclosed in parentheses. Also note that the response (1,1991) begins at the left margin.

5. MONTH AND YEAR WHEN NONCOMPLIANCE BEGAN (e.g., 1,1991)
1,1991

You can obtain help in entering any of the variables 1 through 13 by typing HELP, or simply the letter H after BEN prompts you for the variable. The help statements in BEN include a definition of the variable, possible sources for related information, and the format required for entry. After providing the HELP explanation, BEN will prompt you again for the same variable.

Press the carriage return (or ENTER key) for the next page of text.

Before you enter any of the input values for your first calculation, you will enter today's date. BEN prints this date and the penalty case name at the top of the output for each calculation. This date may be entered in any format (e.g., Sept. 1, 1989; 9/1/89; or 1 September 1989; and so on). The case name can be up to 40 characters long, including spaces.

You may leave the BEN program without leaving the main computer system at any point during the input process. To do this, simply type "QUIT" (without quotation marks) in response to any prompt. BEN will warn you that quitting the program will mean losing all work done in that session (i.e., your output will not be printed), and will ask you if you are sure you want to "QUIT." Answering "Y" (yes) will terminate the program immediately, and take you back to the main computer system.

Press the carriage return (or ENTER key) when you are ready to begin.

2. Format of the Data Entries

BEN data entries require specific data formats. Numerical values should be entered without commas, dollar signs, or percent signs. For example, a $10,000 capital investment in pollution control equipment is entered as **10000**. The same is true for all other cost inputs. Each cost entry must include both the dollar amount and the year in which the dollars are expressed. Throughout this manual and in BEN itself, we refer to the year of the dollars in which an expenditure is expressed as the "dollar-year."[24] The dollar-year must contain four digits. If you do not enter a year, BEN assumes costs are expressed as of the compliance date. Rates or percentages should be entered as a number without a percent symbol, e.g., enter 20 to represent 20 percent. Decimal numbers need only be used where fractional values occur, such as 10000.50 dollars or 20.1 percent.

Be careful to use only number keys to enter numerical values. A common mistake is typing the lowercase letter **L** instead of a number 1. Another error occurs when the letter **O** is typed instead of the number 0 (zero).

Dates entered for compliance and payment periods must be in numerical form, with the month separated from the year by a comma, e.g., 6,1989. The year must contain four digits.

An example of the required format for data entry follows each data prompt, enclosed in parentheses. If the exact format is not followed, BEN prints an explanatory error message and then reprompts you for the correct entry. After your entry has been correctly typed, press the carriage return (or **enter** key) to transmit the data and signal to the computer that you are ready for the next prompt.

3. Correcting Typing Errors

After typing your entry you might discover that you have typed an incorrect letter or number. If you have not yet pressed the carriage return (or **enter** key), correcting the mistake is straightforward. Simply press the **backspace** key for each character that you wish to delete, and type

---

[24] In calculating the economic benefit, BEN converts all dollar inputs (initial capital investment, one-time expenditure, and annual expenses) into dollars of the year in which noncompliance began. This dollar-year conversion is necessary to make the costs comparable.

in the correct information. If you are using the mainframe version, the cursor will not erase each character as you press the backspace key, and you will need to press the space bar to delete unwanted characters. If you are using a PC, the cursor will erase each figure as you press the backspace key, and your corrected entry will appear on the screen. Since you corrected the mistake before hitting the carriage return (or **enter** key), the terminal sends the corrected entry to the computer.

If you discover the error after you have pressed the carriage return (or **enter** key), the terminal will send the incorrect entry to the computer. If your entry contains an unacceptable character, BEN will print an error message and reprompt you for a corrected input. BEN will not detect an error if you simply enter an incorrect value. For instance, if you type 10244 instead of the intended value of 10234, your calculation will be based on an erroneous input. In this case, you can only correct the error after you have entered all of the other variables (immediately before you run BEN). After you have completed your data entry, BEN will ask if you would like to review your inputs.

```
   DO YOU WISH TO SEE A LISTING OF CURRENT VALUES? (Y/N)
Y
```

If you are unsure of an entry or want to correct a mistake, answer Y. BEN will show you the data you have entered and give you an opportunity to make changes. Type a Y to indicate you want to make a change. Then enter the number of the variables(s) you wish to change. After you have corrected all errors, type 0 for no change. See Chapter 5 for more information on changing input values.

4. Error Messages

Occasionally, you might forget to follow the format rules when typing data entries, or you might select an option number that does not exist. In such instances, rather than continuing with the calculation, BEN temporarily interrupts the regular prompting sequence to print an error message alerting you to the mistake. After displaying the error message, BEN reprompts you for the correct information for that variable.

Error messages can be general or variable-specific. General messages apply to all prompts. Variable-specific errors occur for a particular variable when BEN checks for the correct relationships between variables, and for logical errors. Variable-specific messages are fully described in the case example which is covered in Chapter 4.

There are three general types of mistakes that generate error messages -- out-of-range input values, format errors, and illegal characters. BEN's error messages will help you locate the mistyped character, and allow you to re-enter the data before proceeding with your next input or beginning the calculation. Each of these error messages is described below. Examples from BEN sessions illustrate each error message and its related correction procedure. User entries are shown in bold-face print.

The error-checking mechanism will not recognize the types of errors caused by mistyping; for example, a 3 instead of a 2, misspelling the case name, or entering the wrong date in response to the "today's date" prompt. Therefore, you should write down each input before running BEN, and then carefully check the typed data against each item on your written list. To do this, you can use the BEN Data Entry Form (see Exhibit 4-2).

a. Unavailable or Out-of-Range

The first type of error involves choosing an option that was either not presented (e.g., typing a number when a letter is required), or is not in the allowable range (e.g., entering a compliance date that is before 1971). In some cases, BEN prints a message telling you that your entry is not an available option for that input, and in others, it simply repeats the data prompt.

For example, the choice between printing an introduction to BEN or skipping over the introduction requires a yes (Y) or no (N) answer. In the following example, the user mistakenly typed I to indicate the first letter choice instead of simply typing the letter Y to signify yes.

```
    Would you like an introduction? (Y/N)
1
ERROR:    ENTRY  1  IS NOT AN AVAILABLE OPTION. ENTER AGAIN:
    Would you like an introduction? (Y/N)
Y
```

BEN recognizes the error, prints an error message that repeats the incorrect entry value, and reprompts the user for the correct information with the same question. The user then correctly typed **Y**, which is one of the available response options, and execution of the program continued as usual. The error message shown will appear whenever you type anything other than **Y** or **N** to the above question.

The following example illustrates a response which is out-of-range because the user asks to change Variable **14**, when in fact there are only 13 variables. The same error message appears.

```
    TYPE NUMBER OF VARIABLE TO BE CHANGED
    (TYPE 0 FOR NO CHANGE)

14

ERROR:    ENTRY  14  IS NOT AN AVAILABLE OPTION. ENTER AGAIN:
```

The next response is out-of-range because BEN will not accept a negative value for the initial capital investment. In cases such as this one, BEN simply repeats the prompt without printing an error message.

```
 2. INITIAL CAPITAL INVESTMENT IN POLLUTION CONTROL =
    (FOLLOW WITH DOLLAR-YEAR SEPARATED BY BLANK; e.g., 100000
1990)
    (ENTER 0 IF THIS COST CATEGORY IS NOT APPLICABLE)

-150000

 2. INITIAL CAPITAL INVESTMENT IN POLLUTION CONTROL =
    (FOLLOW WITH DOLLAR-YEAR SEPARATED BY BLANK; e.g., 100000
1990)
    (ENTER 0 IF THIS COST CATEGORY IS NOT APPLICABLE)
```

A special out-of-range error message appears during the first calculation in a BEN session if you press the carriage return (or **enter** key) without entering any data in response to a variable prompt.[25] BEN prints the following error message, and prompts you again for the variable:

```
ERROR:    YOU MUST ENTER A VALUE FOR THE FIRST
          CALCULATION.  TRY AGAIN.
```

b. Format Error

The second type of general error message involves a format error. After each data prompt, BEN provides an example of the format in which the data should be entered. These format examples are enclosed in parentheses. If you enter the data in an unacceptable format, an error message results. The user in the example below incorrectly typed commas in the cost input:

```
YOU HAVE ENTERED THE FOLLOWING: 100,000

ERROR:  NUMERICAL VALUES SHOULD BE INPUT
        WITHOUT COMMAS (e.g., 10000 TO REPRESENT 10,000).
        ENTER AGAIN.
```

[25] BEN allows you to press the carriage return without entering data in each subsequent BEN analysis. This means that the program will use the existing value in the next calculation. See Chapter 5 for further explanation.

In the next example, the user entered a slash (/) to separate the month from the year instead of the required comma.

```
YOU HAVE ENTERED THE FOLLOWING:  9/1989

ERROR:  MONTH SHOULD BE SEPARATED FROM YEAR
        BY A COMMA (e.g., 6, 1990).
        ENTER AGAIN.
```

c. Illegal Character

The third general error message indicates that you have entered an illegal character. In this case, you have typed a character that does not belong to the same alphanumeric category as the rest of the entry. For example, typing **$10000** as a cost entry generates the error message because a dollar sign is not an acceptable numerical digit. Similarly, typing **20%** to enter "20 percent" is not acceptable because **20%** contains the nonnumeric percent sign. A very common mistake is to type the lowercase letter **L** instead of the number **1** when entering numeric values. The related error message will repeat your entry to show your error as follows:

```
YOU HAVE ENTERED THE FOLLOWING:  l20000

ERROR:  AN ILLEGAL CHARACTER EXISTS IN THE ABOVE ENTRY.
        ENTER AGAIN.
```

Another common mistake is typing the letter **O** instead of the number **0** (zero) when entering numeric values. As in the above example, the incorrect entry is repeated with the error message before BEN reprompts for the correct information.

```
YOU HAVE ENTERED THE FOLLOWING:  l20000

ERROR:  AN ILLEGAL CHARACTER EXISTS IN THE ABOVE ENTRY.
        ENTER AGAIN.
```

The illegal character message occurs whenever the entry to any question contains a character that is nonnumeric in response to a prompt for a numeric value, including cases when a key might have been pressed by mistake, and a numeric entry contains an asterisk, bracket, quotation mark, or other non-alphanumeric symbol.

BEN calculates the benefit a violator accrues from delaying a capital investment, delaying a one-time expenditure, and avoiding any annual costs over the period of noncompliance. BEN requires 13 data items to calculate the economic benefit of delay, including the case name and certain other information about the case (see Exhibit 1-2 in Chapter 1).[27] You must supply the case name and Variables 2 through 7. For the remaining six variables, you can either use standard values or specify your own values. Standard values for these remaining six variables are contained in BEN for both for-profit entities (e.g., C-corporations, S-corporations, partnerships, and sole proprietorships), and not-for-profit organizations (e.g. municipalities), and should be used for your computation if you do not have data specific to the violator. You should change a standard value only if you have reliable information substantiating the change. The economic benefit calculation is performed in the same manner whether you use the standard values or specify your own values for the six optional inputs.

This chapter explains each of the variables, in the order in which you enter them in BEN. Sections A and B define the seven required variables detailing the case being analyzed. Sections C and D define the six variables for which standard values are available and explain how the standard values are calculated. Because the standard values differ depending on the profit status and tax filing status of the entity, Section C describes "for-profit" values for both C-corporations and other for-profit entities, and Section D describes "not-for-profit" values. The examples which accompany the explanations are based on a hypothetical "Entity X" and recreate the prompting sequence, item by item, as it appears on your computer screen when you run BEN. An example of

[27] As discussed in Chapter 1, previous versions of BEN contained a variable to account for low-interest financing. Since this variable was only applicable to violations that occurred prior to 1986, this variable has been removed from the current version of BEN.

a prompt and a user response follows each variable title in a shaded box. The user response is shown in **bold** print. The explanations include a brief description of the criteria you should use in developing the first six input values and the basis for each of the standard values. Each explanation also contains a statement regarding how a change in the value of each variable will affect the economic benefit of delay (e.g., increase it or decrease it). Exhibit 4-1 summarizes these effects by showing the direction of the change in economic benefit caused by a change in each variable, holding all other variables constant.

Exhibit 4-1

EFFECT OF VARIABLE CHANGES ON ECONOMIC BENEFIT[28]

Variable Name	Direction of Variable Change	Change in Economic Benefit
2. Initial Capital Investment:		
- Recurring	Increase	Increase
- Non-recurring	Increase	Increase
3. One-Time Nondepreciable Expenditure	Increase	Increase
- Tax-Deductible	Yes	Decrease[29]
	No	Increase
4. Annual Expenses	Increase	Increase
5. Date of Noncompliance	Later	Decrease
6. Date of Compliance	Later	Increase
7. Date of Penalty Payment	Later	Increase
8. Useful Life of Pollution Control Equipment	Increase	Decrease
9. Marginal Income Tax Rate 1986 and Before	Increase	Decrease
10. Marginal Income Tax Rate 1987 to 1992	Increase	Decrease[30]
11. Marginal Income Tax Rate 1993 and Beyond	Increase	Decrease
12. Inflation Rate	Increase	Decrease[31]
13. Discount Rate	Increase	Increase

[28] Holding all other variables constant.

[29] Tax deductibility of the one-time expense will reduce the economic benefit from what it would be if the expense were not tax deductible.

[30] Except in cases as outlined in Footnote 40 on p. 4-14.

[31] With rare exceptions, as explained under Inflation Rate.

To simplify and aid data entry, you might find it helpful to use the Data Entry Form presented in Exhibit 4-2. The form provides space for organizing multiple BEN runs, thus allowing you to plan in advance which inputs you want to vary. To facilitate future BEN analyses, we suggest that you photocopy this page so that you will have a sufficient supply when the need arises.

Before you input the 13 data items, BEN asks you to enter the current date:

```
ENTER TODAY'S DATE (e.g., FEBRUARY 1, 1992)
December 1, 1993
```

For this first date, any format may be used. For example, BEN accepts **12/1/93** just as easily as it does **December 1, 1993**. This date will be printed on each page of the results for each calculation you make. You enter the date only <u>once</u> each time you use BEN, even if you make economic benefit calculations for several cases during a single session. If you use the program more than once during the same day, you can add the time of day after the date to differentiate between sessions. Be sure to press the carriage return (or **enter** key) after correctly typing your entry.

BEN then begins prompting you to enter data specific to the penalty case you are analyzing.

Exhibit 4-2

BEN DATA ENTRY FORM

1.	A. Case Name:			
	B. Profitability Status (Check One):	For Profit: ____	Not-for-Profit: ____	
	C. Filing Status (Check One):	C-corporation: ____	Other than C-corporation: ____	
		Initial Run	**2nd Run**	**3rd Run**
2.	Initial Capital Investment			
	Dollar-Year			
	One-Time or Recurring?			
3.	One-Time Nondepreciable Expenditure			
	Dollar-Year			
	Tax Deductible?			
4.	Annual Expenses			
	Dollar-Year			
5.	Month, Year of Noncompliance			
6.	Month, Year of Compliance			
7.	Month, Year of Penalty Payment			
	USE STANDARD VALUES? (Yes/No) If No, complete the following:			
8.	Useful Life of Capital Investment (years)			
9.	Marginal Tax Rate for 1986 and Before			
10.	Marginal Tax Rate for 1987 to 1992			
11.	Marginal Tax Rate for 1993 and Beyond			
12.	Inflation Rate			
13.	Discount Rate			
	BEN RESULT			

A. REQUIRED VARIABLES (FOR-PROFIT ENTITIES)

1. Case Name, Profitability Status and Filing Status

a. Case Name

```
     1A.  PLEASE ENTER THE CASE NAME:
ENTITY X EXAMPLE
```

After requesting the date, BEN asks for the penalty case name. This name can contain up to 40 characters, including spaces, and will appear along with the date on each page of the results. Since its sole purpose is for your own documentation, this label can contain anything you choose. The label can reflect the violator's name; the name of a specific source, pollution control project, or environmental requirement; or a characteristic of the specific BEN run (e.g., "Compliance in January 1992"). If you are doing multiple runs for the same case, you might find it helpful to vary the case name for each run so that you can more easily distinguish among the various runs. For example, you might title your runs "ABC Corp.: Outfall 1", "ABC Corp.: Outfall 2"; etc.

If you enter nothing for the case name, nothing will be printed where the label normally appears on your results. Be sure to check for misspellings or incorrect dates before pressing the carriage return (or **enter** key), since BEN will accept and print whatever you type for this label.

b. **Profitability Status**

```
1B.  PLEASE ENTER THE PROFIT STATUS OF THIS ENTITY:

     1  FOR-PROFIT (e.g., A BUSINESS)
     2  NOT-FOR-PROFIT (e.g., A MUNICIPALITY)

     PROFIT STATUS:
1
```

Enter 1 if the violator is a profit-making entity or 2 if the violator is not-for-profit. Profit-making organizations can be corporations, partnerships or sole proprietorships. Typical not-for-profit entities include towns, school districts, sewer or water districts, and counties. Your determination will direct BEN's application of the tax rates and the discount rate.

c. **Filing Status**

```
1C.  PLEASE ENTER THE FILING STATUS OF THIS ENTITY.  THIS WILL
     DETERMINE THE APPROPRIATE TAX RATE FOR THE VIOLATOR:

     1  C-CORPORATION
     2  OTHER THAN C-CORPORATION
     3  SELECT FOR AN EXPLANATION

     [NOTE: NOT ALL ENTITIES THAT HAVE "INCORPORATED" IN THEIR
     TITLES ARE C-CORPORATIONS.]

FILING STATUS:
1
```

If you select 1, for-profit, for Variable 1B, BEN will ask you to enter the filing status of the entity under Variable 1C.[32] If you are uncertain of the entity's filing status, type 3, and BEN will provide the following explanation, and then repeat the data prompt:

[32] Not-for-profit entities are tax-exempt and therefore do not file Federal or State tax returns. Thus, BEN skips Variable 1C if you select "not-for-profit" for Variable 1B.

```
A C-corporation files a Federal tax Form 1120 or Form 1120-A.  Income
of these companies is taxed at corporate income tax rates.  All
publicly-traded companies are C-corporations; small private firms can
also be C-corporations.

For-profit entities may also be S-corporations, partnerships, or sole
proprietorships (e.g., a corner grocery store).  These entities file
Federal tax returns other than 1120 or 1120-A, (e.g., an S-corporation
files a Form 1120-S and a Schedule K for each shareholder). The income
and expenses of these organizations are divided among the shareholders
and reported on their individual income tax returns.  Income is
therefore taxed at the individual income tax rate.

If you are uncertain of the filing status of this entity, default to
the C-corporation rate.
```

As noted in the above explanation, a for-profit entity's filing status determines the appropriate tax rate. Later in the data entry process, if you choose the standard value option for Variables 8 through 13, BEN automatically adjusts the tax rate values (Variables 9, 10, and 11) to reflect the filing status of the entity.

2. Initial Capital Investment

a. Cost Data

```
2.  INITIAL CAPITAL INVESTMENT IN POLLUTION CONTROL =
    (FOLLOW WITH DOLLAR-YEAR SEPARATED BY BLANK; e.g., 100000 1993)
    (ENTER 0 IF THIS COST CATEGORY IS NOT APPLICABLE)

405000 1994
```

Enter the initial capital investment in pollution control equipment, without commas or dollar signs. The initial capital investment entry is the cost of designing, purchasing, and installing the pollution control equipment necessary to remedy the violations; these are expenditures the violator delayed making. The cost should be followed by a blank, and the year in which the dollars are expressed. Express the dollar-year in four digits. If you do not enter a dollar-year the first time through the program, BEN assumes that the cost is in compliance-year dollars (i.e., the year compliance was achieved). Enter a zero if there is no initial capital investment.

There is an eight-character limit on cost amounts BEN will accept. If your entry exceeds this limit, BEN prints the following error message and reprompts you for a correct input:

```
ERROR:  INPUT VALUE EXCEEDS THE 8-DIGIT LIMIT.  ENTER AGAIN.
```

In the unlikely case that your costs are greater than $99,999,999 dollars, you should give BEN all of your costs divided by a factor of 1,000 and rounded to the nearest whole number. You can then multiply the BEN result by 1,000 to determine the total economic benefit.[33]

The initial capital investment should include all depreciable investment outlays necessary to achieve compliance with the environmental regulation or permit. Depreciable capital investments are usually made for things that wear out such as buildings, equipment, or other long-lived assets.[34] Typical environmental capital investments include ground-water monitoring wells, stack scrubbers, and wastewater treatment systems.

In estimating capital cost, keep in mind this includes all costs associated with designing, installing, shipping, and purchasing the necessary equipment (including sales tax) and associated facilities to remedy the violations. However, costs clearly not associated with remedying the violations should not be included in this cost input. For example, if the violator is adding additional capacity to handle a waste stream from a new production line, the incremental costs associated with treating the new waste stream should not be included in the BEN run (based on the assumption that the additional capacity for treatment of wastes from new production was not needed to achieve compliance under previous levels of production). Further, if the capital costs involved are avoided (i.e., the violator is not just delaying making the investment, but will never make the investment) you must use the procedure presented in Appendix B.

---

[33] This result will not be exact, but will be sufficiently precise given BEN's rounding constraints.

[34] Land is not a depreciable capital investment. Land costs should be input as a one-time non-depreciable cost (Variable 3).

You also must provide the "dollar-year" for the investment, which is the year the capital cost was incurred or estimated (e.g., the year of a feasibility study detailing environmental compliance costs). If you do not provide a dollar-year, BEN will assume that the costs are in compliance-year dollars (see Variable 6). If you have initial capital investment costs with different dollar-years, you should do separate BEN calculations for each.[35] Holding all other inputs constant, the economic benefit from delay will be greater for larger capital investment outlays (See Exhibit 4-1).

b. Type of Costs

```
IS THE INITIAL INVESTMENT ONE-TIME OR RECURRING?

    1.  ONE-TIME
    2.  RECURRING

    PLEASE ENTER THE APPROPRIATE CODE:
    [NOTE:  MOST CAPITAL COSTS FOR AIR AND WATER CASES
    ARE RECURRING]
2
```

BEN next asks you whether the investment is one-time or recurring. Enter 1 if the capital expenditure is a one-time cost, or 2 if the cost is recurring (i.e., the entity will need to repeat the investment at the end of the asset's useful life). Examples of one-time depreciable expenditures include groundwater monitoring wells or purchase of other equipment to close a RCRA site. In identifying equipment as a one-time purchase, you should be convinced that the equipment will not require future replacement.

Water and air pollution-control equipment are capital investments that are typically assumed to be replaced at the end of their useful lives, since this equipment generally is needed to support the entity's manufacturing activities for the foreseeable future. Recurring capital costs will result

[35] You can sum the separate BEN calculations to determine total economic benefit, as long as your penalty payment date (Variable 7) is the same in each run. For detailed instructions on combining multiple runs, see Appendix B.

in higher BEN results than will one-time capital costs, if all other inputs are the same. Note that the entire capital cost usually recurs. This is because when the equipment needs to be replaced, design and installation costs will be incurred again as will the cost of new equipment.

If some of your capital investments are one-time and others are recurring, you will need to categorize them as such and make separate BEN calculations for the two categories. You can add together the results from the two calculations to determine the total economic benefit. (See Appendix B.)

3. One-Time Nondepreciable Expenditures

a. Cost Data

Enter one-time, nondepreciable delayed expenditures followed by the appropriate dollar-year. Enter a zero if there is no one-time expenditure.

```
3.  ONE-TIME NONDEPRECIABLE EXPENDITURE =
      (FOLLOW WITH DOLLAR-YEAR SEPARATED BY BLANK; e.g., 100000 1993)
      (ENTER 0 IF THIS COST CATEGORY IS NOT APPLICABLE)

210000 1994
```

The entry for this variable includes delayed expenditures the violator should have made earlier (to prevent the violations) which need only be made once and are non-depreciable (i.e., do not wear out). Such an expenditure could be purchasing land, setting up a record-keeping system, removing illegal discharges of dredged and fill material, disposing of soil from a hazardous-waste site, or initial training of employees.[36] As in the case of the initial capital investment, BEN will use the compliance year if you do not provide a dollar-year. The economic benefit increases as the value for this variable increases because the violator has delayed paying a larger amount of money. If the one-time nondepreciable costs are avoided, rather than delayed, you must use the procedures outlined in Appendix B to calculate economic benefit.

---

[36] If training or record keeping must occur over time and regularly, rather than as a one-time effort, these costs should be included in Annual Expenses (Variable 4).

b. Tax Deductibility

BEN then asks whether the one-time nondepreciable expenditure is tax deductible:

```
     IS THE ONE-TIME EXPENSE TAX-DEDUCTIBLE?  (Y/N)
     [NOTE:  MOST EXPENSES ARE TAX-DEDUCTIBLE]
Y
```

You should answer yes (**Y**) or no (**N**). Most one-time expenditures are tax-deductible; with the primary exception being purchases of land.[37] For any expenditure amount, the economic benefit will be smaller if the expenditure is tax-deductible (see Exhibit 4-1).

4. Annual Expenses

```
4.  ANNUAL EXPENSE =
    (FOLLOW WITH DOLLAR-YEAR SEPARATED BY BLANK; e.g., 100000 1993)
    (ENTER 0 IF THIS COST CATEGORY IS NOT APPLICABLE)

85750 1994
```

Enter the annual, recurring costs associated with operating and maintaining the required pollution control equipment which the violator avoided during the period of violation, followed by the year in which the dollars are expressed. Enter a zero if there are no (additional) annual costs associated with operating the new or improved pollution control equipment. If no dollar-year is entered, BEN assumes that the costs are in compliance-year dollars. The same format and eight character limitation apply to the annual expenditure as to the other cost inputs.

[37] Land is an asset and, therefore, cannot be deducted as an expense from taxable income.

The annual, recurring expense is an estimate of the average annual incremental cost of operating and/or maintaining the required environmental control measures. These expenditures should include any changes (both decreases and increases) in the cost of labor, power, water, raw materials and supplies, recurring training of employees, and any change in annual property taxes associated with operating the new or improved pollution control equipment.[38] In other words, the annual expense is the net change in the violator's annual expenditures from noncompliance to compliance.

The value of operating and maintenance (O&M) credits (or cost savings) should also be considered in estimating the incremental annual costs. O&M credits may represent actual O&M cost savings: heat recovery, product or byproduct recovery, and so forth.[39] For example, the installation of new pollution control equipment may reduce certain costs (such as sludge disposal) that were associated with operations during the period of noncompliance. If the resulting incremental O&M cost is negative (i.e., there is a net cost savings from the new pollution control equipment), the negative figures may be used in Variable 4. Credit is only given for annual, recurring expenses that were both paid and legal (e.g., no credit is given for costs associated with illegal disposal of hazardous waste). Credit should only be included to the extent the cost savings was directly related to the installation and operation of the compliance system needed to remedy the violation.

The annual costs should also reflect any annual lease payments for pollution control equipment. However, the annual costs should not include annualized capital recovery, interest payments, or depreciation. The economic benefit figure increases with greater avoided annual, recurring costs (See Exhibit 4-1).

---

[38] In the case of underground injection wells, the cost of alternative disposal of injection fluids is the avoided operation cost. Similarly, the required treatment, storage or disposal of PCBs or other toxic wastes is an avoided operation cost. The avoided costs must be equal for each year of the violation in order to enter them into BEN as an annual continuing expense. If the avoided costs are different for each year of violation, you have two choices. You can run a separate BEN analysis for each year the costs were avoided, or you can treat them as avoided one-time nondepreciable costs according to the methodology set out in Appendix B. In this situation, you should also perform separate calculations for each year that the costs were avoided.

[39] To be included, such savings must be proven by the violator, not just asserted.

5. Noncompliance Date

```
5.    MONTH AND YEAR WHEN NONCOMPLIANCE BEGAN  (e.g., 1,1991)
2,1991
```

The noncompliance date is the date when the first violation of the environmental requirement occurred.[40] Type in the month and the year, separated by a comma. The month is a number between 1 and 12, and cannot be omitted. The year must contain four digits (e.g., do not shorten the input to read 93 instead of 1993). If you fail to enter four digits for the year the following error message occurs:

```
YEAR MUST BE 4 DIGITS.
```

There is one more limitation on all year entries: BEN will not accept years before 1971 or after 2050. The error message generated if the noncompliance year entered is earlier than 1971 is as follows:[41]

```
YEAR MUST BE 1971 OR LATER.
```

[40] The model uses this as the date by when the violator should have completed installation of the necessary pollution control equipment and had such equipment fully operational.

[41] Although there may be an applicable statute of limitations in your case, it should generally only affect the maximum penalty you can assess (i.e., the statutory cap). Since you are only trying to calculate the amount the violator gained by violating the law, you may go beyond any statute of limitations, as long as you do not exceed the statutory cap. Should your case go to trial or hearing, you should consult your legal staff before going forward with a benefit amount based on the earlier violations.

If you vary the date of noncompliance (holding all other variables constant), BEN automatically adjusts the cost of complying as of the new noncompliance date by discounting the costs to the revised date. The benefit from delayed and/or avoided expenditures generally increases with the length of the delay period. An earlier noncompliance date (holding the compliance date constant) will, in virtually all cases, increase the benefit figure.[42]

6. Compliance Date

```
6.  MONTH AND YEAR WHEN COMPLIANCE ACHIEVED (e.g., 1,1993)
8,1994
```

Enter the date when the violator came into compliance with environmental requirements or the date you expect the violator to achieve compliance. Note that the date when the equipment was installed is not sufficient; the violator needs to be in compliance. The format and range limitations which apply to the noncompliance date also apply to the compliance date. In nearly all instances, the compliance date will occur after the noncompliance date. Therefore, if the user inputs a compliance date which is earlier than the noncompliance date, BEN prints a warning message. The warning message below is printed after you have finished inputting all values, but prior to asking you whether you would like to see a listing of current values. If you have accidentally switched the two dates, you are given the opportunity to correct the dates once entering **Y** to see a list of current values. Otherwise, the dates will be left as they have been entered.

---

[42] In cases where the delay period straddles January 1, 1987, lengthening the period of non-compliance will decrease and possibly eliminate the benefit. This phenomenon is due to the reduction in marginal tax rates in 1987. These reductions decrease the value of the firm's tax deductions. Because the violator is complying late, it must deduct its pollution control expenditures at the lower tax rate. Thus it may cost more to comply late than to comply on time. Although tax rates changed again as of January 1993, the marginal rate increased at this time. Consequently, economic benefit figures for violations spanning January 1993 are greater than they would have been had the tax rates remained the same.

```
WARNING:  YOUR COMPLIANCE DATE IS EARLIER OR THE SAME AS
THE NONCOMPLIANCE DATE.  WHILE THIS MAY BE APPROPRIATE IN
CERTAIN CIRCUMSTANCES (E.G., CALCULATING SUPERFUND
CASHOUTS), IT IS INAPPROPRIATE FOR MOST TYPICAL BEN
APPLICATIONS.  PLEASE CHECK YOUR NONCOMPLIANCE AND
COMPLIANCE DATES.
```

Remember that BEN assumes that dollar amounts for Variables 2, 3 and 4 are in compliance-year dollars if you do not enter the dollar-year along with the amount. If you have not entered a specific dollar-year and you vary the compliance date, BEN will automatically change the dollar-year for the cost inputs. In general, it is best to include the dollar-year with your cost inputs.

7. **Penalty Payment Date**

```
7.  MONTH AND YEAR WHEN PENALTY PAID  (e.g., 6,1994)
4,1995
```

Enter the date the violator is expected to pay the civil penalty. Keep ir mind that there often is a considerable time lag between when the violator signs the consent decree and when it actually pays the penalty.[43] As with the previous dates, the month should be entered with the year, separated by a comma. The year must contain four digits. The penalty payment date may be before, after, or the same as the expected compliance date.

BEN states the economic benefit figure as of the penalty payment date and assumes that the violator earns a return on the benefit until that date. Therefore, the benefit figure increases for later penalty payment dates, holding all other variables constant (see Exhibit 4-1).

[43] If the violator is willing to transfer the entire penalty figure to an interest bearing escrow account on a date before entry of the consent decree, this escrow date may be used as the penalty payment date. Upon entry of the consent decree, the escrowed penalty plus any interest is paid to the U.S. Treasury.

B. REQUIRED VARIABLES (GOVERNMENT ENTITIES AND NOT-FOR-PROFIT ORGANIZATIONS)

BEN can be used to estimate the economic benefit of delayed compliance for many types of not-for-profit organizations. With two exceptions you should treat Variables 1 through 7 in the same fashion as for for-profit organizations. The two required variables where characteristics differ between for-profit and not-for-profit entities are the "profit status" input and the cost inputs (if the entity received (or could have received) a grant for pollution abatement expenditures). Each item is discussed below.

1. Profit-Status Variable

Variable 1C requests the profit status of the organization under analysis. If you are making an economic benefit calculation for a not-for-profit organization, answer 2 as illustrated below. This response affects BEN's "standard variables" as discussed later in this chapter.

```
1B.  PLEASE ENTER THE PROFIT STATUS OF THIS ENTITY:

     1  FOR-PROFIT (e.g., A BUSINESS)
     2  NOT-FOR-PROFIT (e.g., A MUNICIPALITY)

     PROFIT STATUS:
2
```

2. Cost Variables

In certain cases, not-for-profit organizations may qualify for state or federal grants that cover a portion of pollution abatement expenditures. In these instances, the cost variables (Variables 2 through 4) requested by BEN may need to be adjusted to account for these grants. Such grants usually will support only an initial expenditure (e.g., one-time federal grant). For a detailed discussion of the procedures for incorporating grants into a BEN analysis, see Appendix B.

C. VARIABLES WITH STANDARD VALUES (FOR-PROFIT ENTITIES)

BEN uses 13 inputs to calculate the economic benefit of delayed compliance. At this point in the program you have already entered seven of the inputs. For the remaining six inputs, you can use the default values (these "standard values" are programmed into the BEN model and are updated annually) or you can override the standard values and enter your own information. The BEN model uses different standard values for for-profit and not-for profit entities. This section defines the for-profit standard values. (Section D of this chapter defines the "not-for-profit" standard values.)

The first time you run the program, the BEN model displays a short message outlining the choices available:

```
BEN will use this information to estimate the economic
benefit.  If you select standard values for the remaining
six variables, these standard values will be printed in
your output.  You also have the option of entering your
own values for the remaining variables after Item 7.

HOW DO YOU WISH TO TREAT REMAINING VARIABLES?
(1 = USE STANDARD VALUES, 2 = ENTER OWN VALUES)

1
```

If you select the first choice, BEN will use the standard values that it has stored in its memory. You need only type **1** followed by a carriage return (or **enter** key), and BEN will calculate the economic benefit using these stored standard values.

The standard values in BEN are updated annually to reflect changes in interest rates, tax law, and so forth. While these values are updated, the assumptions upon which they are based remain the same.[44] If the case you are analyzing is significantly different from that represented by the standard values, you might wish to specify values for some of the optional inputs. In particularly complicated cases, you might also want to consult a financial analyst or an economist.

If you want to enter your own values for Variable 8 through 13, type 2 followed by a carriage return (or **enter** key). BEN then prompts you, beginning with Variable 8, for each nonstandard variable value.[45]

The variables for which there are standard values are numbered from 8 to 13. (Recall that Variables 1 through 7 are the case name and the six inputs discussed in the previous sections.) Exhibit 4-3 lists the assumptions that support the standard values for for-profit entities.

---

[44] The one exception here regards the change in the standard value for BEN's discount rate (Variable 13). A previous version of BEN assumed that the pollution control investment would be financed by equity capital. The current version of BEN assumes that the investment would be financed at the weighted average cost of capital, including both debt and equity financing. This change is discussed in more detail later in this section.

[45] If you select standard values on your first BEN calculation of a session and decide to manually input Variables 8 through 13 for your second calculation, you will be prompted for each variable individually on the second run. To save time, you may simply hit the carriage return (or **Enter** key) for each variable you want to keep standard during the second run.

Exhibit 4-3

STANDARD VALUE CHARACTERISTICS FOR-PROFIT VIOLATORS

Variable		Characteristic Assumed for Standard Value
8.	Useful Life of Pollution Control Equipment	The violator is installing typical pollution control equipment, for example: air pollution control equipment, including an electrostatic precipitator, FGD scrubber, fabric filter, solvent recovery system, and incinerator; or water pollution treatment systems including activated sludge, screening, filtration, chemical treatment, and aerated lagoons.
9.	Marginal Tax Rate 1986 and Before 10. Marginal Tax Rate 1987 to 1992 11. Marginal Tax Rate 1993 and Beyond	The for-profit violator's highest dollar of income is taxed on the margin at the highest corporate income tax rate (federal and state) for C-corporations, and at the highest individual income tax rate for other for-profit entities. The model assumes that the violator is located in a state whose highest marginal corporate or individual income tax rate is equal to the average across all states. BEN uses three tax rates for each type of for-profit entity, one for 1986 and before, one for 1987 to 1992, and one for 1993 and beyond, to take into account the changes in the federal marginal income tax rates made by Congress in 1986 and 1993.
12.	Inflation Rate	The rate of increase in the violator's cost of compliance is equal to the average annual rate of increase in the Chemical Engineering Plant Cost Index over the most recent ten-year period.
13.	Discount Rate	The discount rate is based on the cost of capital for pollution control investments. The model assumes that pollution control investment is of average risk, and financed by a combination of debt and equity capital. The standard value is equal to the average corporate long term weighted-average cost of capital over the past ten years. The model further assumes that the entity earned a return on these delayed and avoided costs at this same rate.

1. Useful Life of Pollution Control Equipment

```
8.  USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT IN YEARS
    (e.g., 15) =

15
```

Enter the useful life in years followed by a carriage return (or **enter** key). The useful life is the number of years that the equipment can be operated before it must be replaced. The program only accepts integer values, and will not accept a zero. A fractional value, such as 15.6 years, must be rounded to the nearest integer value (i.e., 16). If compliance does not involve investment in capital equipment, use the standard value.[46] The standard value is 15 years, which is the assumed average life of a water or air pollution control system. Do not enter a useful life greater than 50 years or BEN will print the following error message and then repeat the data prompt:

```
ERROR: USEFUL LIFE CANNOT EXCEED 50 YEARS.
       ENTER AGAIN.
```

BEN uses the useful life figure to calculate the total cost of investing in and maintaining pollution control equipment over future replacement cycles.[47] Equipment with a long useful life is replaced less frequently than equipment with a short useful life. Assuming the same investment cost per replacement cycle of each, the total present value of the costs of continual replacement for the longer-lived equipment would be lower (since you would have to buy fewer of them, with each subsequent investment occurring later). Therefore, a longer useful life reduces the benefit of delaying compliance, holding all other inputs constant (see Exhibit 4-1).

---

[46] The useful life value does not affect the economic benefit result if your calculation does not involve a recurring capital expenditure. This choice does, however, define the number of years of data presented in Output Option 3.

[47] A violator who delays installing pollution control equipment for five years benefits not only by delaying the initial expenditure five years but also by postponing the second and all subsequent replacement cycles five years.

2. Marginal Income Tax Rate for 1986 and Before

```
 9.  MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE (e.g.,
     49.6) =

49.6
```

3. Marginal Income Tax Rate for 1987 to 1992

```
10.  MARGINAL INCOME TAX RATE FOR 1987 TO 1992 (e.g.,
     38.6) =

38.6
```

4. Marginal Income Tax Rate for 1993 and Beyond

```
11.  MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND (e.g.,
     39.4) =

39.4
```

Enter the marginal income tax rates in percentage terms followed by a carriage return (or enter key). The program will accept any positive value less than 90 percent. The standard values reflect the marginal federal tax rate on the highest dollar of income and the average of the marginal state tax rates on the highest dollar of income. BEN has three tax-rate inputs for both C-corporations and other for-profit entities because of the major changes to the federal tax code made by Congress in 1986 and 1993. The set of tax rates selected by the model depends on your answer to Variable 1C, the tax filing status of the violator. The appropriate standard values for C-corporations are displayed in the above boxes. The appropriate standard values for for-profit entities other than C-corporations are 50.0, 31.0, and 39.6. State-specific rates for both C-corporations and other for-profit entities are displayed in Exhibits 4-4 and 4-5.

The marginal income tax rate is the fraction of the last dollar of taxable income that a violator should pay to federal, state, and local governments. It is the statutory tax rate and it reflects the amount by which taxes would increase or decrease if taxable income were to increase or decrease. It is important to use the marginal tax rate, not the average tax rate (i.e., total tax divided by total taxable income), because the marginal tax rate is the rate which applies to incremental changes in the violator's tax-deductible expenses.

When there is a state or local income tax, the state and local tax rates must be adjusted to reflect the fact that state and local income taxes are deductible expenses in computing federal taxes. The standard values for these variables (a nationwide average of state marginal income tax rates) will produce a reasonable result. However, the preferable approach is to use state-specific values in place of the standard values in your BEN runs. The total corporate marginal tax rates, used for calculations involving C-corporations, are calculated for you by state in Exhibit 4-4 and the individual marginal tax rates, used for other for-profit entities, are shown in Exhibit 4-5.[48] The figures in these exhibits represent the federal marginal tax rate on the highest dollar of income and the marginal state rates on the highest dollar of income. Select the values for the state where the affected facility is located or incorporated.

---

[48] The adjustment is made by multiplying the state rates by a factor equal to one minus the marginal federal tax rate, as shown in the following formula:

$$MTR_{TOTAL} = MTR_{FEDERAL} + [MTR_{STATE} \times (1 - MTR_{FEDERAL})]$$

where: $MTR_{FEDERAL}$ = the marginal tax rate on the last dollar earned at the federal level; and

MTR_{STATE} = the marginal tax rate at the state level

Therefore, if you were to calculate the total corporate marginal tax rate for 1987 and beyond, based on a marginal state tax rate of 10% for example, the result would be 40.6 percent:

$$\begin{aligned} MTR_{TOTAL} &= .34 + [.10 \times (1 - .34)] \\ &= .34 + (.10 \times .66) \\ &= .34 + .066 \\ &= .406 \\ &= 40.6\% \end{aligned}$$

Exhibit 4-4

TOTAL CORPORATE MARGINAL TAX RATES BY STATE: FOR USE IN CASES INVOLVING C-CORPORATIONS (Percent)

	1986 and Before[49]	1987 to 1992[50]	1993 and Beyond[51]
Alabama	48.7	37.3	38.3
Alaska	51.1	40.2	41.1
Arizona	51.7	40.1	41.0
Arkansas	49.2	38.3	39.2
California	51.2	40.1	41.0
Colorado	48.7	37.5	38.3
Connecticut	52.2	42.3	42.5
Delaware	50.7	39.7	40.7
Florida	49.0	37.6	38.6
Georgia	49.2	38.0	38.9
Hawaii	49.5	38.2	39.2
Idaho	50.2	39.3	40.2
Illinois	48.2	38.8	39.7
Indiana	47.6	39.2	40.1
Iowa	52.5	41.9	42.8
Kansas	49.6	37.0	37.6
Kentucky	49.9	39.4	40.4
Louisiana	50.3	39.3	40.2
Maine	50.8	40.5	40.8
Maryland	49.8	38.6	39.6
Massachusetts	51.1	40.3	41.2
Michigan	47.3	34.0	35.0

[49] Based on a federal marginal corporate income tax rate of 46% and state marginal corporate income tax rates for 1986 from the 1986-87 edition of The Book of The States.

[50] Based on a federal marginal corporate income tax rate of 34% and state marginal corporate income tax rates for 1992 provided by the Federation of Tax Administrators (FTA) in Washington, D.C.

[51] Based on federal marginal corporate income tax rate of 35% and state marginal corporate income tax rates for 1993 provided by the Federation of Tax Administrators (FTA) in Washington, D.C.

Exhibit 4-4
(continued)

TOTAL CORPORATE MARGINAL TAX RATES BY STATE: FOR USE IN CASES INVOLVING C-CORPORATIONS
(Percent)

	1986 and Before	1987 to 1992	1993 and Beyond
Minnesota	52.5	40.5	41.4
Mississippi	48.7	37.3	38.3
Missouri	48.7	38.3	39.1
Montana	49.6	38.5	39.4
Nebraska	49.6	39.2	40.1
Nevada	46.0	34.0	35.0
New Hampshire	50.5	39.3	40.2
New Jersey	50.9	39.9	40.9
New Mexico	49.9	39.0	39.9
New York	51.4	39.9	40.9
North Carolina	49.2	39.3	40.0
North Dakota	51.7	40.9	41.8
Ohio	51.0	39.9	40.8
Oklahoma	48.7	38.0	38.9
Oregon	50.1	38.4	39.3
Pennsylvania	51.1	42.1	43.0
Rhode Island	50.3	40.6	40.9
South Carolina	49.2	37.3	38.3
South Dakota	46.0	34.0	35.0
Tennessee	49.2	38.0	38.9
Texas	46.0	34.0	35.0
Utah	48.7	37.3	38.3
Vermont	50.9	39.4	40.4
Virginia	49.2	38.0	38.9
Washington	46.0	34.0	35.0
West Virginia	49.8	40.1	40.9
Wisconsin	50.3	39.2	40.1
Wyoming	46.0	34.0	35.0
Standard Value:	49.6	38.6	39.4

Exhibit 4-5
TOTAL INDIVIDUAL MARGINAL TAX RATES BY STATE
FOR USE IN CASES INVOLVING FOR-PROFIT ENTITIES
OTHER THAN C-CORPORATIONS
(Percent)

	1986 and Before[52]	1987 to 1992[53]	1993 and Beyond[54]
Alabama	52.5	34.5	42.6
Alaska	50.0	31.0	39.6
Arizona	54.0	35.8	43.8
Arkansas	53.5	35.8	43.8
California	55.5	38.6	46.2
Colorado	54.0	34.5	42.6
Connecticut	52.3	34.1	42.3
Delaware	54.9	36.3	44.3
Florida	50.0	31.0	39.6
Georgia	53.0	35.1	43.2
Hawaii	55.5	37.9	45.6
Idaho	53.8	36.7	44.6
Illinois	51.3	33.1	41.4
Indiana	51.5	33.3	41.7
Iowa	56.5	37.9	45.6
Kansas	54.5	35.1	44.3
Kentucky	53.0	35.1	43.2
Louisiana	53.0	35.1	43.2
Maine	55.0	36.9	45.6
Maryland	52.5	34.5	43.2
Massachusetts	52.6	35.1	43.2
Michigan	52.6	34.2	42.4

[52] Based on a federal marginal personal income tax rate of 50% and state marginal personal income tax rates for 1986 from the 1986-87 edition of The Book of The States.

[53] Based on a federal marginal personal income tax rate of 31% and state marginal personal income tax rates for 1992 provided by the Federation of Tax Administrators (FTA) in Washington, D.C.

[54] Based on a federal marginal personal income tax rate of 39.6% and state marginal personal income tax rates for 1993 provided by the Federation of Tax Administrators (FTA) in Washington, D.C.

Exhibit 4-5
(continued)

TOTAL INDIVIDUAL MARGINAL TAX RATES BY STATE FOR USE IN CASES INVOLVING FOR-PROFIT ENTITIES OTHER THAN C-CORPORATIONS
(Percent)

	1986 and Before	1987 to 1992	1993 and Beyond
Minnesota	55.0	36.9	44.7
Mississippi	52.5	34.5	42.6
Missouri	53.0	35.1	43.2
Montana	55.5	38.6	46.2
Nebraska	54.8	35.8	43.8
Nevada	50.0	31.0	39.6
New Hampshire	50.0	31.0	39.6
New Jersey	51.8	35.8	43.8
New Mexico	54.3	36.9	44.7
New York	56.8	36.4	44.2
North Carolina	53.5	36.3	44.3
North Dakota	54.5	39.3	46.8
Ohio	54.3	35.8	44.1
Oklahoma	53.0	35.8	43.8
Oregon	55.0	37.2	45.0
Pennsylvania	51.1	33.1	41.3
Rhode Island	55.6	38.5	47.3
South Carolina	53.5	35.8	43.8
South Dakota	50.0	31.0	39.6
Tennessee	50.0	31.0	39.6
Texas	50.0	31.0	39.6
Utah	53.9	36.0	43.9
Vermont	56.5	40.3	47.7
Virginia	52.9	35.0	43.1
Washington	50.0	31.0	39.6
West Virginia	56.5	35.5	43.5
Wisconsin	54.0	35.8	43.8
Wyoming	50.0	31.0	39.6
Standard Value:	50.0	31.0	39.6

State and local income taxes do not include sales tax, inventory tax, charter tax, or taxes on property. One-time tax payments, such as taxes on the purchase of equipment, should be included in the investment cost. If the tax recurs regularly, then it should be included in the annual expenditures. For example, as mentioned above, sales tax is included in the investment outlay while property tax is included in annual expenses.

BEN uses the marginal tax rate to account for the tax effects of compliance expenditures. Because tax-deductible expenses and depreciation associated with capital investments reduce taxable income, they result in tax savings. A lower marginal tax rate reduces this tax savings, thereby increasing the cost of compliance. Thus, a lower tax rate results in a higher benefit from delay (see Exhibit 4-1).[55]

5. **Inflation Rate**

```
11.  ANNUAL INFLATION RATE (e.g., 1.3) =
1.3
```

Enter the inflation rate as a percent, followed by a carriage return (or **enter** key). Be certain that you enter an annual rate and not a monthly or semiannual rate.

The inflation rate variable in BEN is the annual rate at which the costs of environmental control measures have grown and are expected to grow over time. These cost increases are the result of various factors affecting supply and demand for particular products and services, as well as general inflationary pressures in the economy.

[55] As mentioned above, the tax rate changes may cause a lower than expected BEN value, especially if the noncompliance and compliance dates straddle the 1986 tax code changes. BEN values may be lower than expected because lower tax rates reduce the tax savings (and increase the cost) associated with delayed compliance.

BEN uses the inflation rate to adjust the cost of compliance into noncompliance year-dollars and then into future-year costs. When the inflation rate is higher, the costs increase more quickly over time. An increase in the future cost of pollution controls reduces the economic benefit of delaying compliance, because the equipment would have cost less had it been purchased on time. Thus, in general, the economic benefit figure decreases for higher inflation rates (see Exhibit 4-1). There are rare exceptions to this relationship, depending on the year in which annual costs are expressed and the relative size of annual expenditures to capital and one-time expenditures.

The standard value of the inflation rate in BEN is an average of inflationary trends over the last ten years, as reported by the "Plant Cost Index" (PCI) published in Chemical Engineering magazine.[56] The Chemical Engineering Plant Cost Index is used rather than another index (e.g., the Consumer Price Index or the GNP Deflator), because it more accurately reflects the costs of activities associated with pollution-control expenditures. The PCI is based on cost changes in typical components of pollution control, including equipment, construction labor, buildings, and engineering and supervision. Exhibit 4-6 presents the annual Plant Cost Index for 1982 through 1992. Over the ten-year period between 1982 and 1992, inflation related to plant costs averaged 1.3 percent.[57] This

---

[56] Chemical Engineering, McGraw Hill, Inc., biweekly issues. The Plant Cost In dex is normally located on the page labeled "Economic Indicators."

[57] In general, an annual inflation rate is calculated as follows:

$$\left[\left[\frac{\textit{Index in final year}}{\textit{Index in initial year}} \right]^{1/N} - 1 \right] x\ 100$$

Where: N = Final year - Initial year

To obtain the standard value, the index values for 1992 and 1982 (358.3 and 314.0, respectively) were used to calculate the ten-year average. The calculation is:

$$\left[\left[\frac{358.3}{314.0} \right]^{1/10} - 1 \right] x\ 100$$

= (1.01329 - 1) x 100
= 1.3 percent

value is reasonable for most BEN calculations. If you have some reason to believe that a better inflation forecast for your purposes is available, contact EPA Headquarters or an economist to discuss the use of a nonstandard input.

Exhibit 4-6

CHEMICAL ENGINEERING PLANT COST INDEX
1982-1992

Year	Index
1982	314.0
1983	316.9
1984	322.7
1985	325.3
1986	318.4
1987	323.8
1988	342.5
1989	355.4
1990	357.6
1991	361.3
1992	358.3

Source: Chemical Engineering, McGraw Hill, Inc., biweekly issues, 1982-1992.

6. Discount Rate

```
12.      DISCOUNT RATE:  WEIGHTED-AVERAGE COST OF CAPITAL
         (e.g., 11.3) =

11.3
```

Enter the discount rate as a percent followed by a carriage return (or **enter** key). Be certain that the discount rate is greater than the inflation rate. Otherwise, after all entries have been made, BEN will identify the error and will reprompt you for both the inflation rate and the discount rate. In the example below, the user entered an inflation rate of 9 percent and a discount rate of 7.5 percent:

```
ERROR:     THE INFLATION RATE      9.00%
           MUST BE LESS THAN THE DISCOUNT RATE      7.50%
           ENTER BOTH RATES AGAIN:
```

To calculate the economic benefit of delay as of the noncompliance date for all for-profit entities, BEN uses the weighted-average cost of capital to discount the relevant cash flows. The weighted-average cost of capital represents the average cost, after taxes, of capital to the violator, assuming constant risk and constant capital structure. In the case of pollution control expenditures, BEN assumes that the investment is financed using both debt and equity, in a mix representing the entity's existing mix of debt and equity financing. BEN also assumes that the pollution control expenditure is neither safer nor riskier, from an investment perspective, than the average firm's typical investments. BEN also uses the weighted-average cost of capital rate to bring the initial economic benefit forward to the penalty payment date.

The standard value in BEN is based on the weighted-average cost of long-term debt and equity capital over the most recent ten years for a firm of average risk.[58] The calculation of the discount rate is shown in Exhibit 4-7. A higher discount rate increases the return from delaying compliance, thereby increasing the economic benefit (See Exhibit 4-1).

Violators may occasionally request an adjustment in the discount rate to more precisely reflect their financial condition. If you want to make any changes to the discount rate, it is strongly recommended that you consult EPA Headquarters and/or an economis. or financial analyst. Should EPA headquarters or your financial analyst agree to employ a more specific discount rate, you must make the violator aware that a corporate-specific analysis could yield a higher discount rate than the standard value. Thus, the new economic benefit calculated in the analysis would be correspondingly higher.

---

[58] The weighted-average cost of capital (WACC) is calculated according to the following formula:

$$WACC = \left[[CBA * (1.0 - TR)] * W_D \right] + \left[[TB + R] * W_E \right]$$

where:

CBA	=	Ten-year average return on corporate bonds
TR	=	Marginal corporate tax rate
W_D	=	Fraction of total financing made up of debt
TB	=	Ten-year average return on treasury bonds
R	=	Equity risk premium
W_E	=	Fraction of total financing made up of equity

The calculation of the discount rate is shown in Exhibit 4-7.

Exhibit 4-7

WEIGHTED-AVERAGE COST OF CAPITAL CALCULATIONS

YEAR	CORPORATE BOND AVERAGE[1]	TAX RATE[2]	DEBT COST[3]	FRACTION OF DEBT[4]	TEN YEAR T BOND[5]	RISK PREMIUM[6]	EQUITY COST[7]	FRACTION OF EQUITY[4]	WACC[8]
1983	12.78	0.496	6.44	0.48	11.10	7.3	18.40	0.52	12.66
1984	13.49	0.496	6.80	0.50	12.44	7.3	19.74	0.50	13.27
1985	12.05	0.496	6.07	0.50	10.62	7.3	17.92	0.50	12.00
1986	9.71	0.496	4.89	0.46	7.67	7.3	14.97	0.54	10.33
1987	9.91	0.384	6.10	0.43	8.39	7.3	15.69	0.57	11.57
1988	10.18	0.384	6.27	0.52	8.85	7.3	16.15	0.48	11.01
1989	9.66	0.384	5.95	0.49	8.49	7.3	15.79	0.51	10.97
1990	9.77	0.385	6.01	0.50	8.55	7.3	15.85	0.50	10.93
1991	9.23	0.386	5.67	0.49	7.86	7.3	15.16	0.51	10.51
1992	8.55	0.386	5.25	0.49	7.01	7.3	14.31	0.51	9.87
10 YEAR AVERAGE	10.533		5.95		9.10		16.40		**11.31**

[1] This is the average interest rate paid on corporate bonds. Moody's Bond Record, January 1982 - January 1989, and Table 1.35, Federal Reserve Bulletin, March 1990 - March 1993

[2] Tax rates from the All States Handbook and the Book of the States, various years.

[3] Corporate bond average x (1- tax rate).

[4] These weights represent the fraction of financing that is made up of debt or equity. The weights were constructed using data from Standard and Poor's Stock Analyst's Handbook. The equity indexes are adjusted to reflect their market value.

[5] Treasury bond data from Table 1.35, Federal Reserve Bulletin, March 1993 and earlier issues.

[6] This is the arithmetic mean of the long-term equity risk premium for 1926-1992 calculated by Ibbotson Associates.

[7] Equity cost data from Standard and Poor's Analyst's Handbook, various years.

[8] (Debt cost x fraction of debt) + (Equity cost x fraction of equity).

D. VARIABLES WITH STANDARD VALUES (GOVERNMENT ENTITIES AND NOT-FOR-PROFIT ORGANIZATIONS)

If the violator is a not-for-profit entity, BEN will use different standard values for Variables 9, 10, 11, and 13 described in section C of this chapter. Exhibit 4-8 lists the assumptions that support the standard values for not-for-profit organizations.

Exhibit 4-8

STANDARD VALUE CHARACTERISTICS
NOT-FOR-PROFIT VIOLATORS

Variable	Characteristic Assumed for Standard Value
8. Useful Life of Pollution Control Equipment	The violator is installing typical pollution control equipment, such as air or water pollution control equipment. The standard value for useful life is 15 years.
9. Marginal Tax Rate 1986 and Before 10. Marginal Tax Rate 1987 to 1992 11. Marginal Tax Rate 1993 and Beyond	The not-for-profit violator does not pay taxes; therefore its marginal tax rate is 0 percent.
12. Inflation Rate	The rate of increase in the violator's cost of compliance is equal to the average annual rate of increase in the Chemical Engineering Plant Cost Index over the most recent ten year period.
13. Discount Rate	The discount rate is equal to the average annual cost of debt to municipalities over the last ten years.

The two areas where not-for-profit standard values differ from for-profit standard values (the tax variables and the discount rate) are discussed in more detail below.

1. Marginal Income Tax Rates for All Years

Not-for-profit entities have a tax-exempt status. When you indicate that the violator is a not-for-profit entity, BEN automatically sets the marginal income tax rates to zero for Variables 9 through 11. Thus, at a zero marginal tax rate, BEN need not calculate the tax consequences associated with depreciating or expensing pollution control abatement expenditures. Note that the model will only accept a tax rate of zero when running BEN for a not-for-profit entity.

2. Discount Rate

The economic benefit calculations in BEN for not-for-profit organizations use the cost of municipal debt as the basis for the discount rate. When you indicate that the violator is a not-for-profit entity, BEN automatically defines the discount rate for a not-for-profit entity based on the cost of average municipal bond yields as reported by Moody's over the last ten years.

If you want to modify this standard value, you should enter the cost of debt most applicable to the violator. This is particularly important when the violator is not a municipality. The municipal bond yield can be estimated by the interest rates for municipal bonds issued during the noncompliance period. Alternatively, you can use the reported yield on municipal debt having the quality rating assigned to the violator's bonds, or when the rating is not known, the reported average municipal bond yield.

Municipal bond yields are reported monthly in Moody's Municipal and Government Manual for specific municipalities and as averages for each bond quality rating. Bonds are rated by Moody's according to their riskiness, the higher quality ratings denoting lower risk bonds. The ratings range from "Aaa", the highest quality, to a low of "C". Average bond yields are reported for only the highest four ratings: "Aaa," Aa," A," and "Baa". The municipal bond yields over the past sixteen years are shown in Exhibit 4-9.

The standard value for the cost of municipal debt is based on the average municipal bond yield across all four bond ratings from 1983 to 1992, and is equal to 7.8%.

Exhibit 4-9

MUNICIPAL BOND YIELD AVERAGES
1974-1992

	Average	Aaa	Aa	A	Baa
1974	6.19	5.89	6.04	6.27	6.53
1975	7.05	6.42	6.77	7.37	7.62
1976	6.61	5.65	6.12	7.17	7.49
1977	5.64	5.20	5.39	5.86	6.12
1978	5.86	5.51	5.68	5.99	6.27
1979	6.28	5.89	6.11	6.34	6.76
1980	8.34	7.85	8.06	8.44	9.01
1981	11.10	10.42	10.89	11.31	11.75
1982	11.63	10.88	11.30	11.84	12.48
1983	9.45	8.80	9.20	9.64	10.17
1984	10.00	9.61	9.88	10.15	10.37
1985	9.08	8.60	8.93	9.20	9.59
1986	7.33	6.95	7.16	7.42	7.75
1987	7.59	7.12	7.39	7.76	8.20
1988	7.57	7.36	7.49	7.59	7.84
1989	7.18	7.00	7.10	7.22	7.40
1990	7.12	6.96	7.06	7.15	7.29
1991	6.78	6.56	6.69	6.84	6.99
1992	6.27	6.07	6.20	6.34	6.46

Source: Moody's Municipal and Government Manual.

This chapter describes the output provided by BEN and the procedures used to revise data inputs. The chapter is divided into two sections. Section A describes the three levels of detail available for output. Output examples for each option are provided and explained. Section B explains how to re-run the program, changing some or all of the variables. The different procedures for calculations using standard values and calculations using user-specified values are described. Also shown are error messages specific to changing standard and user-specified values.

A. OUTPUT OPTIONS

1. Selecting Output

When BEN has finished its calculations, it asks how the output should be presented. The first time through the program, BEN describes the four output choices in detail:

```
BEN is ready to provide output.  You have 4 choices:

  1.   Display only the economic benefit of delayed
       compliance.  No intermediate calculations are
       printed.  All of the inputs used in the
       calculations are shown.

  2.   Display the economic benefit of delayed compliance
       plus the present values of delayed and on time
       cash flows.  All of the inputs used in the
       calculations are shown.

  3.   Display Option 2 plus 2 tables of annual cash flows
       for the useful life of the initial pollution control
       equipment.  All of the inputs used in the
       calculations are shown.

  4.   Do not display results.  Use this option if a data entry
       error is discovered.

CHOOSE OUTPUT OPTION 1, 2, 3, OR 4.
```

All output options are designed to fit on standard letter-size paper with top, bottom, and side margins on each page. For identification purposes, each page is marked with the date of the case run and the case name. All values are rounded to the nearest dollar for printing in the output tables.

When one or more of the expenditure inputs is a large dollar amount (i.e., any of the cost inputs exceed $500,000), BEN converts all dollar amounts to thousands. When this conversion occurs, BEN provides a message alerting you that the results are in thousands of dollars. The message appears in parentheses under the economic benefit result in output Options 1, 2, and 3 and also under the table headings in Option 3.

In all of the output options, the variables used in the calculation are printed below the results. The costs in this listing are the original cost inputs: that is, they are not converted to thousands even if conversion to thousands is made in the output.

Select one of the output options by typing the number 1, 2, or 3; you can avoid printing output by choosing 4. BEN will respond with the prompt below if you choose Option 1, 2, or 3:

```
POSITION PAPER ON BOTTOM LINE OF THIS PAGE,
THEN PRESS CARRIAGE RETURN
```

If you are using a PC without a printer, you can simply press the carriage return (or enter key) to display the output on the screen. After you have finished all of your desired economic benefit calculations, BEN will provide you the option to receive a printed copy of the output as described in Chapter 2.

2. Output Option 1

Option 1 is the shortest form of output. Option 1 reports the economic benefit of delayed compliance and the input values used in the calculation. The economic benefit is expressed as of the penalty payment date. Exhibit 5-1 shows the output under Option 1. Note that the number of months of delay between the initial date of noncompliance and the compliance date is printed in a label next to the economic benefit result. The label also states the number of months from the initial noncompliance date until the date the penalty is to be paid.

Exhibit 5-1

OUTPUT OPTION 1

```
  ENTITY X EXAMPLE                          BEN VERSION 4.0 DECEMBER 1, 1993


    THE ECONOMIC BENEFIT OF A  42 MONTH DELAY
    DATE,    50 MONTHS AFTER NONCOMPLIANCE          $      453194
                                                           =========


PLEASE PRESS CARRIAGE RETURN FOR MORE OUTPUT

    ->->->->->->  THE ECONOMIC BENEFIT CALCULATION ABOVE  <-<-<-<-<-<-
                      USED THE FOLLOWING VARIABLES:
        USER SPECIFIED VALUES
        ---------------------
     1A. CASE NAME =                                ENTITY X EXAMPLE
     1B. PROFIT STATUS =                                  FOR-PROFIT
     1C. FILING STATUS =                                C-CORPORATION
     2. INITIAL CAPITAL INVESTMENT (RECURRING)= $      405000  1994 DOLLARS
     3. ONE-TIME NONDEPRECIABLE EXPENDITURE =   $      210000  1994 DOLLARS
        (TAX-DEDUCTIBLE EXPENSE)
     4. ANNUAL EXPENSE =                        $       85750  1994 DOLLARS
     5. FIRST MONTH OF NONCOMPLIANCE =                     2, 1991
     6. COMPLIANCE DATE =                                  8, 1994
     7. PENALTY PAYMENT DATE =                             4, 1995
     8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =      15 YEARS
     9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =    49.60 %
    10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =       38.60 %
    11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =    39.40 %
    12. ANNUAL INFLATION RATE =                            1.30 %
    13. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL   11.30 %
```

3. Output Option 2

Option 2 presents the final economic benefit calculation as in Option 1, but also adds intermediate steps in the development of this calculation. Option 2 provides more information and can help users understand the effect of changes in the inputs on the economic benefit. Exhibit 5-2 shows an example of output Option 2.

Exhibit 5-2

OUTPUT OPTION 2

```
  ENTITY X EXAMPLE                              BEN VERSION 4.0 DECEMBER 1, 1993


A.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE IN 1991 DOLLARS $       804906

B.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $      1023472

C.  VALUE OF DELAYING EMPLOYMENT OF POLLUTION
    CONTROL EQUIPMENT BY 42 MONTHS PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $       733367

D.  ECONOMIC BENEFIT OF A  42 MONTH DELAY
    IN 1991 DOLLARS (EQUALS B MINUS C)               $       290104

E.  THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT
    DATE,   50 MONTHS AFTER NONCOMPLIANCE            $       453194
                                                              =========


PLEASE PRESS CARRIAGE RETURN FOR MORE OUTPUT

    ->->->->->->->  THE ECONOMIC BENEFIT CALCULATION ABOVE  <-<-<-<-<-<-<-
                    USED THE FOLLOWING VARIABLES:
       USER SPECIFIED VALUES
       ---------------------
     1A. CASE NAME =                                  ENTITY X EXAMPLE
     1B. PROFIT STATUS =                                    FOR-PROFIT
     1C. FILING STATUS =                                 C-CORPORATION
     2. INITIAL CAPITAL INVESTMENT (RECURRING)= $      405000  1994 DOLLARS
     3. ONE-TIME NONDEPRECIABLE EXPENDITURE =   $      210000  1994 DOLLARS
        (TAX-DEDUCTIBLE EXPENSE)
     4. ANNUAL EXPENSE =                        $       85750  1994 DOLLARS
     5. FIRST MONTH OF NONCOMPLIANCE =                     2, 1991
     6. COMPLIANCE DATE =                                  8, 1994
     7. PENALTY PAYMENT DATE =                             4, 1995
     8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =       15 YEARS
     9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =     49.60 %
    10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =        38.60 %
    11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =     39.4 %
    12. ANNUAL INFLATION RATE =                             1.30 %
    13. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL    11.30 %
```

As illustrated in Exhibit 5-2, the top half of output Option 2 presents intermediate steps of the BEN calculation in addition to total economic benefit as of the penalty payment date:

- **Calculation A** is the present value of the costs that would have been associated with the timely purchase, installation, and operation of pollution control equipment over one useful life. This figure is expressed in noncompliance-year dollars.

- **Calculation B** includes the present value of the costs associated with subsequent replacement and operation of equipment, in addition to the total of the one-time expenditure and the first useful life period costs expressed in A. This figure is the present value cost that the violator would have paid had it complied on time, expressed in noncompliance year dollars.

- **Calculation C** expresses the present value costs of delayed compliance as of the noncompliance date including all subsequent replacements of equipment, if any. This value is usually less than B, and represents the actual cost to the violator of delayed compliance with environmental requirements.

- **Calculation D**, the initial economic benefit, is obtained by subtracting C from B. The initial economic benefit in D is expressed in dollars as of the noncompliance date. In some cases D may not exactly equal B minus C because of rounding.

- **Calculation E** adjusts D to the value of the economic benefit as of the expected penalty payment date. This adjustment reflects the violator's earnings on the initial economic benefit between the noncompliance date and the penalty payment date.

4. Output Option 3

Option 3 shows the detailed calculations behind the final BEN values and is most helpful to financial analysts wanting to understand the program's calculations. Option 3 provides two tables showing annual cash flows over the first useful life of the pollution control equipment. The first table contains the cash flows that would have occurred had the violator complied on time. The second table contains the cash flows estimated to occur when the violator actually complies. The last page of output for Option 3 is identical to the one-page Option 2 output. Exhibit 5-3 presents an example of output Option 3.

In the two tables of annual cash flows in Option 3, the header displays the initial capital investment plus any non-deductible one-time expenditures. For the on-time case, this value is expressed in noncompliance-year dollars and for the delay case, this value is inflated to compliance-year dollars. Note that this figure in either table might differ from the sum of the initial capital investment and non-deductible one-time expenditure printed in the variable value listing at the end of the second page. This difference occurs because you might have entered the costs in dollars of another year (or by default, in compliance-year dollars) and the figures in the table are adjusted for inflation to the noncompliance or compliance year.

The first column in each cash flow table lists the years of the cash flow analysis beginning with year zero: when compliance should have been achieved for the on-time case table and when compliance was achieved for the delay case table. The years printed after the zero correspond to the number of years in the useful life of the pollution control equipment. In Exhibit 5-3 there is a fifteen-year useful life.

The remaining columns in the cash flow tables contain the types of cash flows and factors used to arrive at a present value. The top half of the table displays capital and one-time non-deductible costs. The bottom half contains annual expenses, one-time deductible expenses, and the total of the present values of capital investment, depreciation tax benefit, and after-tax O&M expenditures. The last column in the bottom half of the table sums all present value calculations for each year. All cash outflows are listed as negative values, and the tax savings as positive values (because they represent a benefit to the firm).

The second column, "Investment Net of ITC," is the capital cost plus any one-time non-deductible expenditures, less any investment tax credits. This net expenditure is assumed to occur in year zero and is stated in noncompliance-year dollars. This cost figure is lower than the investment figure listed in the table header by the amount of the investment tax credit (ITC) taken by the violator. For for-profit entities, BEN uses a ten-percent ITC for investments made before 1986 and a zero-percent ITC for investments made in 1986 and later.[59] For not-for-profit organizations, BEN uses a zero-percent ITC rate for all years.

The third column, "Depreciation," lists the depreciation expenses that the firm is allowed to deduct from taxable income, thereby reducing its taxes. BEN uses a five-year straight-line method of depreciation for investments made before 1987. For investments made in 1987 and later, the model uses the double-declining balance (with half-year convention) for years one to four and converts to a straight-line method in year five. This method is prescribed by the revised tax law's Modified Accelerated Cost Recovery System (MACRS) and uses a seven year depreciation life.

[59] BEN's treatment of the phase-out of the ITC applies to a typical firm's situation. In certain instances, the ITC was applicable for qualifying property following December 31, 1985. Qualifying property includes buildings or plants where over five percent of the cost of the project was incurred by the end of 1985. If you are evaluating a violator's situation where this is the case, consult with an economist or financial analyst for assistance in completing an "off-line" calculation.

Exhibit 5-3

OUTPUT OPTION 3 (page 1)

ENTITY X EXAMPLE BEN VERSION 4.0 DECEMBER 1, 1993

ON-TIME CASE CASH FLOWS
FIRST CYCLE CASH FLOWS BASED ON
A TOTAL INITIAL OUTLAY OF $ 389607
AS OF THE BEGINNING OF THE PERIOD OF NON-COMPLIANCE

YEAR	INVESTMENT NET OF ITC ($)	DEPRECIATION ($)	DEPRECIATION TAX SAVINGS ($)	DEPREC DISCOUNT FACTOR	PRESENT VALUE OF DEPREC TAX SAVINGS ($)
0	-389607	0	0	1.0000	0
1	0	55659	21484	.9479	20365
2	0	95415	36830	.8516	31366
3	0	68154	26853	.7652	20547
4	0	48681	19180	.6875	13186
5	0	34771	13700	.6177	8462
6	0	34771	13700	.5550	7603
7	0	34771	13700	.4986	6831
8	0	17385	6850	.4480	3069
9	0	0	0	.4025	0
10	0	0	0	.3617	0
11	0	0	0	.3249	0
12	0	0	0	.2919	0
13	0	0	0	.2623	0
14	0	0	0	.2357	0
15	0	0	0	.2117	0

YEAR	ANNUAL EXPENSES	AFTER-TAX ANNUAL COST	PROJECT DISCOUNT FACTOR	PRESENT VALUE AFTER-TAX O&M ($)	TOTAL PRESENT VALUE ($)
0	-202018	-124039	1.0000	-124039	-513646
1	-83025	-50978	.9479	-48320	-27956
2	-84105	-51640	.8516	-43979	-12613
3	-85198	-51630	.7652	-39506	-18959
4	-86306	-52301	.6875	-35957	-22770
5	-87428	-52981	.6177	-32726	-24264
6	-88564	-53670	.5550	-29786	-22183
7	-89715	-54368	.4986	-27109	-20278
8	-90882	-55074	.4480	-24674	-21605
9	-92063	-55790	.4025	-22457	-22457
10	-93260	-56516	.3617	-20439	-20439
11	-94472	-57250	.3249	-18603	-18603
12	-95701	-57995	.2919	-16931	-16931
13	-96945	-58748	.2623	-15410	-15410
14	-98205	-59512	.2357	-14026	-14026
15	-99482	-60286	.2117	-12765	-12765

PRESENT VALUE OF PURCHASING THE INITIAL POLLUTION CONTROL EQUIPMENT ON-TIME AND OPERATING IT THROUGHOUT ONE USEFUL LIFE $ -804906

Exhibit 5-3 (continued)

OUTPUT OPTION 3 (page 2)

ENTITY X EXAMPLE BEN VERSION 4.0 DECEMBER 1, 1993

DELAY CASE CASH FLOWS
FIRST CYCLE CASH FLOWS BASED ON
A TOTAL INITIAL OUTLAY OF $ 407624
AS OF THE END OF THE PERIOD OF NON-COMPLIANCE

YEAR	INVESTMENT NET OF ITC ($)	DEPRECIATION ($)	DEPRECIATION TAX SAVINGS ($)	DEPREC DISCOUNT FACTOR	PRESENT VALUE OF DEPREC TAX SAVINGS ($)
0	-407624	0	0	1.0000	0
1	0	58233	22944	.9479	21748
2	0	99827	39332	.8516	33497
3	0	71306	28094	.7652	21497
4	0	50933	20067	.6875	13796
5	0	36379	14333	.6177	8853
6	0	36379	14333	.5550	7955
7	0	36379	14333	.4986	7147
8	0	18189	7167	.4480	3211
9	0	0	0	.4025	0
10	0	0	0	.3617	0
11	0	0	0	.3249	0
12	0	0	0	.2919	0
13	0	0	0	.2623	0
14	0	0	0	.2357	0
15	0	0	0	.2117	0

YEAR	ANNUAL EXPENSES	AFTER-TAX ANNUAL COST	PROJECT DISCOUNT FACTOR	PRESENT VALUE AFTER-TAX O&M ($)	TOTAL PRESENT VALUE ($)
0	-211361	-128085	1.0000	-128085	-535709
1	-86865	-52640	.9479	-49896	-28148
2	-87994	-53324	.8516	-45413	-11917
3	-89138	-54018	.7652	-41333	-19836
4	-90297	-54720	.6875	-37619	-23823
5	-91471	-55431	.6177	-34239	-25386
6	-92660	-56152	.5550	-31163	-23208
7	-93864	-56882	.4986	-28363	-21216
8	-95084	-57621	.4480	-25815	-22604
9	-96321	-58370	.4025	-23495	-23495
10	-97573	-59129	.3617	-21384	-21384
11	-98841	-59898	.3249	-19463	-19463
12	-100126	-60676	.2919	-17714	-17714
13	-101428	-61465	.2623	-16123	-16123
14	-102746	-62264	.2357	-14674	-14674
15	-104082	-63074	.2117	-13356	-13356

PRESENT VALUE OF DELAYING THE PURCHASE
OF THE INITIAL POLLUTION CONTROL EQUIPMENT
AND OPERATING IT THROUGHOUT ITS USEFUL LIFE $ -838057

Exhibit 5-3 (continued)

OUTPUT OPTION 3 (page 3)

```
  ENTITY X EXAMPLE                          BEN Version 4.0 DECEMBER 1, 1993


A.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE IN 1991 DOLLARS $      804906

B.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $     1023472

C.  VALUE OF DELAYING EMPLOYMENT OF POLLUTION
    CONTROL EQUIPMENT BY 42 MONTHS PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $      733367

D.  ECONOMIC BENEFIT OF A  42 MONTH DELAY
    IN 1991 DOLLARS (EQUALS B MINUS C)               $      290104

E.  THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT
    DATE,   50 MONTHS AFTER NONCOMPLIANCE            $      453194
                                                          =========


PLEASE PRESS CARRIAGE RETURN FOR MORE OUTPUT

    ->->->->->->  THE ECONOMIC BENEFIT CALCULATION ABOVE  <-<-<-<-<-<-
                  USED THE FOLLOWING VARIABLES:
       USER SPECIFIED VALUES
       ---------------------
     1A. CASE NAME =                                  ENTITY X EXAMPLE
     1B. PROFIT STATUS =                                   FOR-PROFIT
     1C. FILING STATUS =                                C-CORPORATION
     2. INITIAL CAPITAL INVESTMENT (RECURRING)= $      405000  1994 DOLLARS
     3. ONE-TIME NONDEPRECIABLE EXPENDITURE =   $      210000  1994 DOLLARS
        (TAX-DEDUCTIBLE EXPENSE)
     4. ANNUAL EXPENSE =                        $       85750  1994 DOLLARS
     5. FIRST MONTH OF NONCOMPLIANCE =                     2, 1991
     6. COMPLIANCE DATE =                                  8, 1994
     7. PENALTY PAYMENT DATE =                             4, 1995
     8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =              15 YEARS
     9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =         49.60 %
    10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =            38.60 %
    11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =         39.4 %
    12. ANNUAL INFLATION RATE =                                 1.30 %
    13. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL        11.30 %
```

To calculate the depreciation tax benefit, the depreciation amount is multiplied by the marginal tax rate. These figures must be adjusted to reflect the time period in which they occur (e.g., the further in the future they occur, the lower their present value). The discount factor related to depreciation cash flows is listed in column 5. This discount factor is the same as the weighted-average cost of capital described in Chapter 4. Multiplying this discount factor by the depreciation tax benefit yields the present values listed in column 6.

The bottom half of the Option 3 cash flow table mainly details the annual expenditures. Annual costs begin in year 1 and are inflated yearly to reflect the rising prices of labor and materials. These costs appear in the second column. If you have entered a tax-deductible one-time expenditure, its value will appear in year 0 (zero) in this column. Annual costs are tax-deductible and must be adjusted to reflect this benefit. Multiplying the annual expenses by one minus the tax rate adjusts them to reflect the actual cash outflow from the firm, net of the tax benefit that arises from deducting the original annual expenditure. The present value of these annual costs net of the tax benefit is computed by multiplying the figures in column 3 by the weighted-average cost of capital discount rate described in Chapter 4. The last column in the bottom half of the table sums the present values of capital investment, depreciation tax benefit, and after-tax annual expenditures.

The total of the annual present values appears at the very bottom of the page, next to the label: "PRESENT VALUE OF PURCHASING THE INITIAL POLLUTION CONTROL EQUIPMENT ON-TIME AND OPERATING IT THROUGHOUT ONE USEFUL LIFE." This figure is the same as the value shown as Calculation A in Output Option 2 (see Exhibit 5-2).

Output Option 3 produces a similar table for the delay case. These calculations are in compliance-year dollars. The output sums the cost of compliance at the bottom of the page next to the label: "PRESENT VALUE OF DELAYING THE PURCHASE OF THE INITIAL POLLUTION CONTROL EQUIPMENT AND OPERATING IT THROUGHOUT ITS USEFUL LIFE." This value does not match Calculation C in Option 2 because the delay case table is in compliance-year dollars rather than noncompliance-year dollars, and because it only includes the cash flows from one useful life whereas Calculation C includes all additional replacement cycles.

5. Other Information

The first three output options described above for a user-specified calculation are the same for a standard value calculation with one exception: in a standard value calculation, the variable listing displays user-specified inputs and standard values separately (see Exhibit 5-4).

Option 4 allows you to skip printing the output. This option should be used if you have discovered an error in your entry values. BEN will then ask if you wish to make any further changes so that you can correct the error. Type 0 (zero) after you have made all necessary changes. BEN then asks if you would like to see a listing of the current variable values to review your changes. If you answer N, for no, BEN again lists the four output options.

Exhibit 5-4

INPUT LISTING FOR CALCULATION USING STANDARD VALUES

```
        ->->->->->  THE ECONOMIC SAVINGS CALCULATION ABOVE  <-<-<-<-<-
                          USED THE FOLLOWING VARIABLES:


USER SPECIFIED VALUES
      1A. CASE NAME =                                          COMPANY X EXAMPLE
      1B. PROFIT STATUS =                                            FOR-PROFIT
      1C. FILING STATUS =                                          C-CORPORATION
      2.  INITIAL CAPITAL INVESTMENT (RECURRING) =       $ 405000 1994 DOLLARS
      3.  ONE-TIME NONDEPRECIABLE EXPENDITURE =          $ 210000 1994 DOLLARS
          (TAX-DEDUCTIBLE EXPENSE)
      4.  ANNUAL EXPENSE =                                $ 85750 1994 DOLLARS
      5.  FIRST MONTH OF NONCOMPLIANCE =                                2, 1991
      6.  COMPLIANCE DATE =                                             8, 1994
      7.  PENALTY PAYMENT DATE =                                        4, 1995

      PLEASE PRESS CARRIAGE RETURN FOR MORE OUTPUT

STANDARD VALUES
      8.  USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =                 15 YEARS
      9.  MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =               49.60 %
      10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =                  38.60 %
      11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =               39.40 %
      12. ANNUAL INFLATION RATE =                                       1.30 %
      13. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL =            11.30 %
```

B. CHANGING INPUT VALUES

Once BEN has completed a calculation you can alter your inputs to perform another BEN run or you can end the session in order to receive a printout of your calculation. This section outlines the procedure for changing variable values after you complete your initial run. This feature allows you to recalculate the economic benefit without having to re-enter new information for all variables.

```
DO YOU WISH TO DO ANOTHER ECONOMIC SAVINGS CALCULATION?
(0=NO; 1=YES, USING STANDARD VALUES; 2=YES; USING OWN INPUTS)
```

If you want to do another calculation, you must choose between a calculation using the standard values for variables 8 through 13 or a calculation in which you specify all inputs. Typing 1 indicates that you wish to use the standard values in the subsequent calculation; typing 2 indicates that all values will be user-specified. BEN then prompts you for the variable(s) you wish to change. The next two subsections outline procedures for changing variable values.

1. Changing Values in the Standard Value Mode

```
DO YOU WISH TO DO ANOTHER ECONOMIC SAVINGS CALCULATION?
(0=NO; 1=YES, USING STANDARD VALUES; 2=YES, USING OWN INPUTS)
1
```

This section outlines the procedures for changing variable values when BEN assigns standard values to variables 8 through 13. Type **1** to indicate that you wish to use standard values.

BEN will only allow you to change variables 1 through 7, since standard values will be used for the remaining variables. You can, however, change any or all of variables 1 through 7 one or more times during the change procedure. In the following example, the user wants to change variable 4.

```
    TYPE NUMBER OF VARIABLE BETWEEN 1 AND 7 TO BE CHANGED
    (TYPE 0 FOR NO CHANGE)
4
```

BEN responds with a prompt for the new variable value:

```
4.     ANNUAL EXPENSE =
 (FOLLOW WITH DOLLAR-YEAR SEPARATED BY BLANK; e.g., 100000 1993)
 (ENTER 0 IF THIS COST CATEGORY IS NOT APPLICABLE)
 OLD VALUE = 85750.00 IN 1994 DOLLARS; ENTER NEW VALUE:
```

The former value is displayed to help you decide whether to change the value or keep the former value. Simply enter the new value according to the required format and press the carriage return (or **enter** key). If you decide not to change the former value, simply press the carriage return (or **enter** key) without typing any other keys and BEN will keep the former value in its memory. In the case of a cost and year entry, BEN uses both former values. If you want to change a variable, and the prompt requires the dollar-year in addition to the cost entry, enter both values. If you omit the dollar-year entry and enter only the cost, BEN will use the former value for the dollar-year, which is displayed with the former cost value.

If you attempt to change any of the variables between 8 and 13, BEN will print the following message:

```
    ERROR:     STANDARD VALUES 8 THROUGH 13 CANNOT BE CHANGED
               WITH THE STANDARD VALUE OPTION, ENTER AGAIN:

    TYPE NUMBER OF VARIABLE BETWEEN 1 AND 7 TO BE CHANGED
    (TYPE 0 FOR NO CHANGE)
0
```

When you have made all of your changes, type **0** (zero). BEN then asks if you wish to see a listing of the current values for all the variables. This option allows a final check for incorrect entries before recalculating the economic benefit.

```
    DO YOU WISH TO SEE A LISTING OF CURRENT VALUES? (Y/N)
Y
```

Typing **N** signals BEN to calculate the economic benefit. Typing **Y** results in a variable listing similar in format to that provided with the output, but including the new entries. After the listing, BEN asks if you want to make any further changes. This option provides the opportunity to correct entries or enter new values that were missed during the first round of changes.

```
    DO YOU WISH TO MAKE ANY FURTHER CHANGES? (Y/N)
N
```

Typing **N** signals BEN to calculate the economic benefit. Typing **Y** cycles the program back to the change procedure, after which BEN prompts you for the number of the variable to be changed. When you have made all of the changes, type **0** (zero). BEN will again ask if you desire a variable listing and if you want to make any further changes. A negative response to both questions signals BEN to calculate the economic benefit.

After completing the calculation, BEN prompts you to select the output format from the following choices:

```
    PLEASE CHOOSE FORMAT:

    1 = ANSWER
    2 = ANSWER PLUS PRESENT VALUE CALCULATIONS
    3 = FULL OUTPUT WITH CASH FLOW TABLES
    4 = OMIT OUTPUT
    5 = DESCRIBE OUTPUT OPTIONS IN DETAIL
```

This menu is an abbreviated version of the menu presented during the first run. The added Option 5 allows you to see the detailed version shown on page 5-2 before selecting an output format. Selecting options 1, 2, or 3 begins another output printing session. Option 4 skips over the printing. BEN then offers you the opportunity to do another economic benefit calculation.

2. Changing Values in the User-Specified Mode

```
 DO YOU WISH TO DO ANOTHER ECONOMIC SAVINGS CALCULATION?
 (0=NO; 1=YES, USING STANDARD VALUES; 2=YES, USING OWN INPUTS)
2
```

This section outlines the procedures for changing variable values when variables 8 through 13 are user specified. Type 2 to indicate that you wish to use nonstandard values.

If your last run employed user-specified inputs, you can change any or all of the thirteen variables. You can make as many changes as desired. If your last run used standard values, BEN first asks for changes to be made to any of the variables between 1 and 7.

```
    TYPE NUMBER OF VARIABLE BETWEEN 1 AND 7 TO BE CHANGED
    (TYPE 0 FOR NO CHANGE)
0
```

When all changes to variables 1 through 7 have been completed, type 0 (zero) to signal BEN that no further changes to these 7 variables are needed. Do not attempt to change variables 8 through 13 at this time or the following error message will occur:

```
    ERROR:     CHANGE ONLY VARIABLES 1 THROUGH 7 AT THIS TIME.

    YOU WILL AUTOMATICALLY BE PROMPTED FOR VARIABLES 8
    THROUGH 13 LATER

    TYPE NUMBER OF VARIABLE BETWEEN 1 AND 7 TO BE CHANGED
    (TYPE 0 FOR NO CHANGE)
0
```

A response of **0** (zero) indicates that BEN should begin prompting for the remaining variables:

```
   YOU WILL NOW BE PROMPTED FOR VARIABLES 8 THROUGH 13

   8.    USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT IN YEARS (e.g., 15)
         OLD VALUE = 15 YEARS; ENTER NEW VALUE:
15
```

Enter the new value for Variable 8 followed by a carriage return (or enter key). If the old value printed under the prompt is the desired value, press only the carriage return (or **enter** key) and BEN will keep this value in memory. Note that in most cases where the previous run used standard values, the old values shown in the prompts are the standard values.

```
   9.    MARGINAL INCOME TAX RATE FOR 1986 ANL BEFORE (e.g., 49.6) =
         OLD VALUE = 49.60%; ENTER NEW VALUE:
49.6

   10.   MARGINAL INCOME TAX RATE FOR 1987 TO 1992 (e.g., 38.6) =
         OLD VALUE = 38.6%; ENTER NEW VALUE:
38.6

   11.   MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND (e.g., 39.4) =
         OLD VALUE = 39.4%; ENTER NEW VALUE:
39.4

   12.   ANNUAL INFLATION RATE (e.g., 1.3) =
         OLD VALUE = 1.3%; ENTER NEW VALUE:
1.3

   13.   DISCOUNT RATE:  WEIGHTED-AVERAGE COST OF CAPITAL (e.g., 11.3) =
         OLD VALUE = 11.3%; ENTER NEW VALUE:
11.3
```

Continue entering new values in response to each prompt, or simply press the carriage return (or **enter** key) to retain the old values.

Be sure to maintain the required relationships between variables. For example, the inflation rate cannot exceed the discount rate. BEN checks for these types of errors after all changes have been made. See Chapter 3 for examples of the error messages that BEN provides.

```
    DO YOU WISH TO SEE A LISTING OF CURRENT VALUES? (Y/N)
Y
```

After you have entered all the information and BEN has checked for errors, BEN asks whether you desire a listing of the variables and their current values.

```
    DO YOU WISH TO MAKE ANY FURTHER CHANGES? (Y/N)
N
```

Typing **N** signals BEN to begin recalculating the economic benefit. Typing **Y** yields a listing of the former values that were left unchanged and the new values you just entered. BEN then asks if any further changes are desired.

```
    TYPE THE NUMBER OF VARIABLE TO BE CHANGED
    (TYPE 0 FOR NO CHANGE)
0
```

After all changes have been made (by either entering new values or by pressing the carriage return (or **enter** key) to use the former values), enter **0** (zero) to end the change session. BEN again checks for errors, asks if you want a variable listing, and asks if you want to make further changes. A response of **N** to both questions signals BEN to recalculate the economic benefit using the new values.

A. INTRODUCTION

While BEN's structure and basic financial assumptions are given and fixed, its input variables (such as costs and compliance dates) are often subject to your judgment. For instance, your analysis of the facts might change as new information is supplied by the violator, changing the BEN calculation accordingly. Regardless of whether you are working on an initial or subsequent analysis, it is important to think through the basis for these various inputs, keeping in mind that the BEN results might ultimately be presented in settlement negotiations. As discussed in Chapter 1, BEN is intended solely for use in negotiation. In general, benefit calculations for trial or hearing before an ALJ should be presented by a financial expert. Nevertheless, the basis you develop for settlement negotiations will be helpful to an expert should a trial or hearing be necessary.

Most issues in a BEN analysis center around the costs, the dates, and the discount rate. The remainder of this chapter provides guidance on how to determine the appropriate inputs to use in a BEN calculation.

B. OBTAINING COST INFORMATION

One question that frequently arises in calculating economic benefit is where to find cost information. One possible source is the engineers and technical staff in your enforcement program because they are usually aware of what reasonable costs might be for most pollution control technologies and remedial activities. They might also know of standard cost information that exists in publications.

Another potential source of information is the violator. The violator might willingly give you the data you need. Otherwise, there are a number of legal approaches you can take to get the data from the violator. The EPA has authority under several of its statutes to request the necessary information, regardless of the status of the enforcement action. In addition, this information may be obtained under judicial or administrative discovery. In any event, with a legal issue such as this one, you should consult with the appropriate attorney in your organization.

C. DETERMINING COMPLIANCE COST INPUTS

In order to determine the cost inputs needed to run the BEN model, you must have a defensible theory of on-time compliance (i.e., knowledge of the pollution control system or measures the violator should have installed and operated earlier to have prevented the violations at issue in the case). There are two general rules:

General Rule 1: The best evidence of what the violator should have done to prevent the violations is what it eventually does (or will do) to achieve compliance. This rule is instructive in those cases where the violator may appear to be installing a more expensive pollution control system than EPA staff believe is necessary to achieve compliance. In such situations, the proper cost inputs in the BEN model are still based on the actual (more expensive) system being installed. This is because EPA should not second-guess the business decisions of a violator. A violator often will have sound business reasons to install a more expensive compliance system. For example, the violator may believe:

- the system is more reliable, easier to operate or maintain, or has a longer useful-life;
- the system will be less expensive to operate in the long-run;
- the system works well with other systems at the facility; the system fits within an existing building; or

- the violator has an existing relationship with the manufacturer or trusts the manufacturer to build a high quality product.

In short, EPA assumes a company selects the most appropriate method of compliance for its business, which may not always be the method with the lowest initial capital cost.

General Rule 2: Costs truly not associated with pollution control efforts to remedy the violations alleged in the complaint are excluded from the BEN model inputs. But the violator must present convincing evidence that the costs were not associated with the operation of the pollution control system.

The following scenarios illustrate the interactions of these two general rules. Common arguments by violators to reduce the benefit are shown in bold, followed by the proper response:

1. **The cost of the roof on the new treatment building should not be included since the roof is not needed to operate the treatment system.** In virtually all cases the cost of the roof should be included in the BEN inputs unless the violator can conclusively prove the treatment system would operate just as effectively and efficiently without the roof (without any modifications to the systems) and the roof is not a customary part of such treatment systems. This is often an impossible argument for a company to make as it must essentially argue that putting a roof on was a waste of money (i.e., it served no legitimate business purpose).

2. **The cost of the paint on the walls and the landscaping around the treatment building should not be included since they are not necessary to achieve compliance.** While such items may not be directly necessary to achieve compliance, if these items are normally part of such construction projects, they should be included in the initial capital cost input. Further, such expenditures often provide intangible and tangible benefits, such as improving the appearance of the facility, reducing erosion and dust, preserving the building, and creating a more attractive environment for employees, visitors and customers. The assumption is that if the company had complied on time, it would have made these very same expenditures and, thus it benefitted by delaying them.

3. **The cost of an extra (backup) pump should not be included since it is unlikely to ever be used.** While the pump may never be used, if reasonable engineering practice would include an extra pump (or any other backup systems), then its cost should be included in the initial capital cost input in the BEN model. Given that the company purchased the extra pump, the burden is on the company to show that it is not necessary to achieve and consistently maintain compliance. Further, if the cost of the extra pump was subtracted from the initial capital cost input, annual operation and maintenance costs might need to be increased to reflect the greater importance of maintaining the existing pumps.

4. **The cost of building the second floor above the treatment plant should not be included since it is used exclusively for purposes unrelated to compliance.** If the second floor is not being used to support the pollution control system and appears not likely to be used in the foreseeable future, then the incremental cost of building the second floor may be subtracted from the initial capital cost input.

5. **The cost of building the tertiary treatment system should not be included since only the primary and secondary treatment systems were necessary to remedy the violations.** If the tertiary treatment system was, in fact, not necessary to prevent the violations alleged in the complaint, but rather is necessary for achieving compliance with new standards or treating new flows, then its cost should be subtracted from the initial capital cost. Recall that the initial capital cost should reflect the pollution control system that was necessary to have remedied the violations at the time and under the conditions alleged in the complaint. The key point here is that the violator must convince EPA that the additional expense does not have any practical business motive related to remedying the violations alleged in the complaint. (See examples of such motivation in General Rule 1, above.)

6. **No additional labor is necessary to operate the new pollution control system since existing employees operating the old system will do the work.** If the existing employees were operating an old pollution control system that is being replaced by the new system, then this claim may be correct and, in fact, if the new system is more efficient to operate, less labor may be required. The assumption here is that the total labor costs associated with the old pollution control system (which is being replaced by the new system) are less than or equal

to the labor costs for the new system. Variable 4 in the BEN model, which represents the net change in annual operating expenses, should reflect these costs.

7. **The labor costs for the new system are really zero because we are reassigning the workers from another part of the plant. Therefore, since we are not hiring any additional workers to run the system, there are no additional incremental labor costs.** This claim is not correct since the employees who will operate the new system are not coming from the old pollution control system that is being replaced. Rather, they are being brought in from another part of the facility. If the company had complied on-time, it would have had to shift these employees to pollution control and given up the work these employees otherwise would have done somewhere else (e.g., the production line) during the period of noncompliance.[60]

D. CHARACTERIZING COSTS

The cost inputs (depreciable investments, one-time expenditures and annual costs) are the most important variables affecting the final BEN result. The following are questions affecting the cost inputs that are likely to come up in settlement discussions or litigation:

- What is the appropriate technology to bring the violator into compliance?
- What will it cost to install the technology?
- How will the violator comply?
- How should a violator's partial or sequenced expenditures be considered in a BEN calculation?

The following scenarios provide guidance on how to handle some typical situations. For each case, we will assume that the violator needs to purchase and install pollution control equipment costing $1,000,000 in order to comply with environmental requirements.

---

[60] This is the concept of opportunity cost. Given a fixed set of resources, the cost of using resources for a particular use should be measured by the benefit lost by not using them in their best alternative use.

1. The violator spends $100,000 on a system that does not work. The violator should have spent $1,000,000 in order to get a satisfactory system in place; but, instead it spent $100,000 on-time for a system that did not work. The correct entry for the capital cost is $1,000,000. The basic argument for this approach is that the Agency wants the regulated entity to do the job correctly the first time. If the BEN calculation included a reduction in the cost entries for the "cheap fix," then the Agency would be encouraging this type of unacceptable behavior.

   The enforcement team might find that the violator had some reasonable basis or justification for selecting the inexpensive technology. If the violator went to a reputable firm, the firm recommended the system that failed, and the violator's reliance on the recommendation was reasonable, then a substantial adjustment is probably appropriate. In that case, the team must make a judgment about how large a credit it will give the violator, based on the reasonableness of the violator's position. The lowest capital cost entry in BEN would be $900,000 in this scenario, which would allow a full recognition of the $100,000 already spent. But the litigation team could easily decide to credit only a portion of the $100,000.

2. The system works, but is too small. The violator spent $100,000 on-time for a system that was too small to solve the pollution problem. The existing system can be incorporated into the final, fully-sized system. In this case, it is appropriate for the Agency to subtract from the total required investment the $100,000 already spent; the BEN capital cost input would be $900,000. The reason for this treatment is that the violator gained a benefit on only the $900,000 that it did not spend and not the $100,000 it did spend.

3. Same case as 2, but the violator has a letter from an appropriate government official approving the system. While the violator has a reason for being out of compliance, it still had the benefit of using the $900,000 for other purposes while it was in violation. Thus, the capital cost entry for BEN is $900,000. Keep in mind that BEN is "no-fault" in nature. Regardless of how good the violator's excuse is, it still had the use of the $900,000 over the period of the violation. The primary difference between this and the scenario in case 2 above is the existence of at least an arguable approval by the regulatory agency. This is a legal distinction, not an economic one.

4. The violator complies in stages. The violator puts part of the pollution system into operation (with actual pollution reduction) one year after the non-compliance date at a cost of $200,000. One year later (and two years after the non-compliance date), the violator puts a second piece of the system costing $300,000 into operation (which results in additional pollution reduction). Three years later the entire system is in operation, and the final piece cost $500,000.

In order to calculate the economic benefit, you should make three separate BEN runs, each with the same non-compliance date and the same penalty payment date:

a. $200,000 initial investment, and a one-year period of non-compliance;

b. $300,000 initial investment, and a two-year period of non-compliance;

c. $500,000 initial investment, and a three-year period of non-compliance.

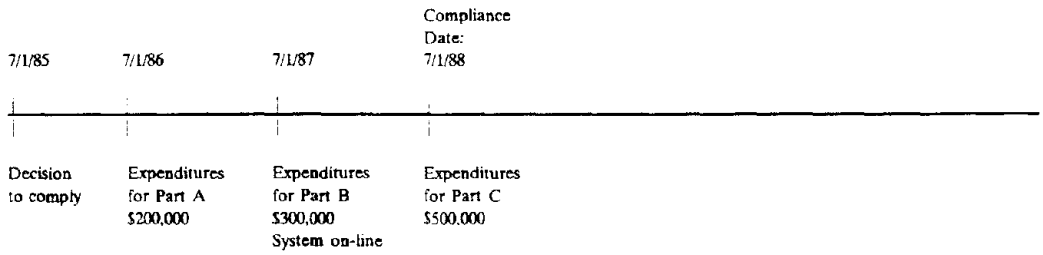
In this case, as each component of the system became operational, the violator was no longer gaining any economic benefit from delaying that segment of the investment. When the three calculations are finished, you add the results from the three runs to determine the total economic benefit.

5. The system is operational at the conclusion of a series of expenditures. This scenario is similar to case 4 above (where the violator purchased and installed the various system components over three years), except that in this case the system is put into operation only after all of its components are installed, instead of sequentially.

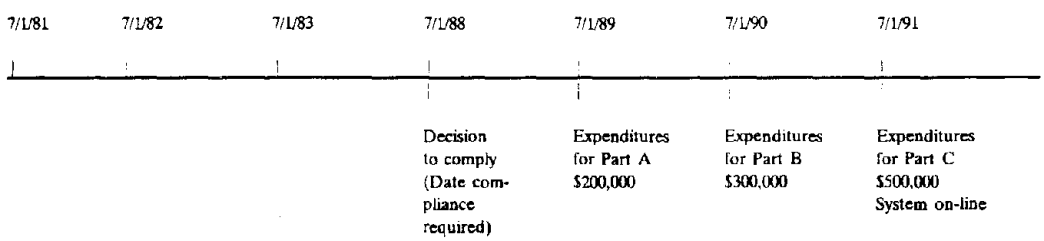
The proper handling for BEN is to enter $1,000,000 as a capital cost with a non-compliance period of three years. This treatment is based on the assumption that the pattern of expenditures would generally have been the same if the violator had complied on-time as it was when the violator complied late. In either case, the violator required three years to comply. In order to comply on-time, it would have had to have started three years before the compliance date. This situation is illustrated in Exhibit 4-1 below. The timelines show the effect of the violator's decision to delay compliance by three years.

EXHIBIT 6-1

Complying Firm's Time Line (assume all dollars are of equal value)



Noncomplying Firm's Time Line (assume all dollars are of equal value)



Despite the fact that the violator spent money for the system over three years, we assume that it was all spent on the date compliance was achieved. This assumption is made for simplicity's sake, and to balance the assumption that all the money should have been spent on the first day of noncompliance (when in fact, it would need to have been spent over a period of three years earlier in order to prevent the violations). The alternative would be to determine the amount and date of each of the violator's expenditures, and then do a separate BEN calculation for each expenditure. The alternative approach would require a lot more effort to do the BEN calculations and in most cases it would result in only a slightly higher benefit amount.

6. The pollution control equipment will be leased rather than purchased. The enforcement team finds out that the violator has been leasing the equipment it needs to comply for $125,000 per year. Rather than entering the $1,000,000 as a capital cost, you should enter a zero for capital cost and $125,000 as an annual cost.

7. Compliance is cheaper than non-compliance. The violator comes into compliance late and finds that it has been saving money since it installed the new technology. This is probably occurring because the new complying technology allows the violator to recover materials and/or reduce operation and maintenance costs. The BEN analysis produces a negative value, confirming that the violator would have been better off had it complied on-time.

The benefit component of the penalty is zero. It is likely that there were other factors causing the violator to delay compliance. For example, the violator might have felt that the new processes and technology needed to comply would have adversely affected its product quality. In situations such as these, the enforcement team should carefully consider the appropriate gravity component of the penalty. The violator intentionally delayed compliance and thus should be subject to an appropriate penalty.

E. PERIOD OF VIOLATION

A major consideration in the BEN analysis is the definition of the violation period. As this interval increases, the economic benefit generally increases. For each month that the violator delays complying, it delays capital and one-time investments, and avoids operation and maintenance expenses. In practice, the period of violation is sometimes not clear. There might be evidentiary problems proving the entire period of violation. It might be helpful to run several different BEN calculations to show the impact of different violation periods on economic benefit.

Another point to keep in mind is that as of the date the BEN analysis is performed, the violator might not be in compliance. Therefore, you must make an assumption regarding the date of compliance. In discussions with the violator about the BEN calculation, you should be explicit about your compliance date assumption. You should then make clear to the violator that further delays in compliance will yield a higher economic benefit, and thus a higher penalty. Conversely,

earlier compliance will yield a lower penalty. By conveying this information up front, you will give the violator added incentive to comply early, and will also avoid having to give the violator any "unpleasant surprises" should you have to increase the benefit component of the penalty.

F. PENALTY PAYMENT DATE

The economic benefit increases as the penalty payment date extends further into the future. You should be certain that the violator knows: (1) the penalty payment date you used in your economic benefit calculation; and, (2) that if the date is actually later than you have assumed, the economic benefit will be higher. On the other hand, if the violator settles the case and pays its penalty prior to the date you used in your calculation, the benefit component of the penalty will be lower. By conveying this information, you will give the violator added incentive to settle promptly. In addition, as with the compliance date issue, this approach will allow you to avoid giving the violator any "unpleasant surprises" should you need to increase the benefit component as a result of a delay in the settlement. See Footnote 43 on the use of escrow accounts.

G. SELECTING THE DISCOUNT RATE

The violator might argue that a different discount rate should be used in the economic benefit analysis. In general, you should involve a financial analyst or call the Office of Enforcement help number (202-260-6777) if the violator raises questions about the discount rate. In 1992, the rate that BEN uses, the weighted-average cost of capital, was changed from the equity cost of capital after an in-depth review and analysis. The procedure used to calculate the weighted-average cost of capital is described in Chapter 3.

The violator may suggest a calculation of the equity tailored to the firm or affected facility. For example, defendants often request an adjustment in the discount rate to more precisely reflect their financial condition. If you want to make any changes to the discount rate, it is strongly recommended that you consult EPA headquarters and/or an economist or financial analyst. Should EPA headquarters or your financial analyst agree to employ a more specific discount rate, you must make the violator aware that a corporate-specific analysis could yield either a higher or a lower discount rate than the standard value. Thus, the new economic benefit figure could be higher than the benefit figure computed using the standard value.

Appendix A

TECHNICAL APPENDIX

METHODOLOGY FOR COMPUTING THE ECONOMIC BENEFIT OF NONCOMPLIANCE

METHODOLOGY FOR COMPUTING THE ECONOMIC BENEFIT OF NONCOMPLIANCE

APPENDIX A

A. INTRODUCTION

This technical appendix explains the methodology used in the BEN computer program to calculate the economic benefit from delaying compliance with environmental regulations. This first section is an introduction to the methodology followed in the economic benefit calculation. Underlying assumptions are discussed in the second section, and the third section presents and explains the mathematical formulae used in BEN. The final section provides a sample economic benefit calculation.

BEN follows a four-step procedure to compute the economic benefit of delayed compliance. First, BEN calculates the incremental after-tax cash flows that the violator would have experienced had it made the expenditures necessary to come into compliance on time. BEN includes the present value of cash flows attributable to future replacements of pollution control equipment as well as those associated with complying initially. BEN converts these cash flows to their "present value" as of the noncompliance date. This is the hypothetical "on-time" case. Second, BEN calculates the present value (as of the noncompliance date) of the cash flows that the violator experiences when it makes the expenditures necessary to come into compliance after the delay. This calculation also takes into account the replacement of pollution control equipment at the end of its useful life. This is the "delay" case. Third, BEN calculates the difference between the present values of the cash flows associated with complying on-time and the cash flows associated with complying after the period of delay. This difference is the initial economic benefit. Finally, BEN calculates the earnings accrued by the violator on the initial economic benefit between the noncompliance date and the penalty payment date: this represents the violator's economic benefit as of the penalty payment date.

In BEN, we are calculating the economic benefit a firm earned from noncompliance. BEN is not calculating "damages." In a damages calculation, the aggrieved party is attempting to retrieve losses that were incurred as a result of the accused's actions. In an environmental violation, damages may or may not have occurred, but that is not what the BEN calculation is attempting to capture. Instead, BEN attempts to assess the amount of money that the company expected to earn from its savings in pollution control costs.

1. Cash Flows Resulting from Complying On-Time

The BEN model requires users to identify the month and year when noncompliance began and the month and year when compliance was (or will be) achieved. The former is referred to as the "noncompliance date," and the latter as the "compliance date." BEN assumes that all capital and one-time expenditures should have been made by the noncompliance date, and that annual expenditures should have begun at the same time.

In estimating the cash flows that would have resulted from complying on time, BEN first expresses all cost inputs in dollars of the noncompliance year. These costs are grouped by the user into three categories: capital investments, one-time nondepreciable expenditures and annual costs. BEN then converts these costs into cash flows beginning at the noncompliance date. Each cost category is described separately below. More detailed discussions of the three types of cost inputs appear in Chapter 4.

a. Capital-Related Cash Flows

Capital-related cash flows include the direct costs and indirect financial impacts associated with a capital investment, both initially and over time. Initially, the violator makes a capital outlay to purchase and install pollution control equipment. At the same time, the amount of any applicable investment tax credit serves to reduce the initial cash outflow.[1] There are also indirect annual impacts associated with depreciating pollution control equipment. Depreciation does not itself involve a cash outflow; however, its effect is to reduce pre-tax income and hence to reduce income

[1] BEN applies the Investment Tax Credit to capital investments made in 1985 and before.

tax payments. The tax benefit associated with depreciation in subsequent years are cash inflows that reduce the net cost of the equipment.

BEN allows you to specify whether the capital cost is a one-time or recurring cost. One-time capital investments will have a lower present value than will recurring capital costs.

b. One-Time Nondepreciable Expenditure

A one-time nondepreciable expenditure occurs initially and is not repeated. If the expenditure is tax-deductible, the tax benefit is subtracted from the expenditure amount to arrive at the net cash outflow. If the expenditure is not tax-deductible, the cash outflow equals the entire expenditure amount.

c. Annual Costs

The third category of cash flows consists of those resulting from annual expenditures. The most typical annual costs are for operation and maintenance of pollution control equipment. Other annual costs include the leasing of equipment or monitoring of pollution clean-ups. Annual expenses are tax deductible, and BEN calculates their after-tax value in each year. These cash outflows are assumed to increase each year because of inflation.

2. Present Value of Cash Flows

After all present and future direct costs and indirect financial impacts have been determined and arrayed over time, they are converted into a present-value figure as of the noncompliance date. This conversion is necessary because two cash flows of equal dollar values occurring in different years would not have equal financial impacts on the violator. This differential arises because there is a "time value of money." In other words, assuming that the violator can invest its funds at some positive rate of return, if a dollar of expenditure can be postponed for one year, that dollar can be invested in the interim. At the end of that year, the expenditure can be made; and the return on the investment during the intervening period accrues as a benefit to the violator.

The technique used to compensate for this effect is called "discounting". Discounting converts the value of future cash flows to amounts that are equivalent in terms of constant-year dollars. For example, suppose that a firm wants to make a $100 investment next year. If the firm's investment alternatives today are such that it can earn a 12 percent annual return, the firm could invest $89.29 today and that amount would grow to $100 in one year.[2] Thus, $89.29 is called the "present value," at 12 percent, of a $100 cash flow one year in the future. Similarly, if $79.72 were invested at 12 percent, it would grow to $89.29 in one year, and to $100 by the end of the second year. Thus, $79.72 is the present value, at 12 percent, of a $100 cash flow two years hence. The rate used in determining present values, 12 percent in this case, is called the "discount rate."

The general formula for discounting is:

$$\text{Present Value (PV)} = \frac{F_j}{(1 + E)^j}$$

where:

F_j	=	the "future value" cash flow expected in year j
E	=	the annual discount rate in decimal form (e.g., .12 for 12 percent)
j	=	the number of years in the future in which the cash flow occurs; and j = 0 is the year to which you are discounting.

Applying this technique to each year's cash flows converts them into their present-value equivalents. The sum of these individual values represents the equivalent after-tax cost, in terms of a single present value, of the cash flows arising out of the requirement to comply with environmental regulations.

[2] Twelve percent of $89.29 = $10.71, and $89.29 + $10.71 = $100.00

Except for any one-time expenditures, the cash flows associated with investing in and operating pollution control equipment are repeated continually in the future, as the equipment is replaced after each useful life. All of these cash flows associated with future replacements are also discounted back to a present-value equivalent.

3. Present Value of Cash Flows Associated with Delayed Compliance

BEN calculates the present value of the cash flows associated with complying at the end of the delay period, based on the following assumptions:

1. The delayed cash flows will be similar to the on-time cash flows in that they will have the same sequence of capital expenditures, one-time nondepreciable expenditures, and annual cost flows. The after-tax cash flow amounts might differ, however, because tax provisions in effect during the years following the compliance date might differ from those in effect during the years following the noncompliance date.

2. Each delayed cash flow will be separated in time from the corresponding on-time cash flow by the number of months of noncompliance.

3. The nominal value of each delayed cash flow will be greater than the corresponding on-time cash flow because of the impact of inflation over the period of delay.

4. Economic Benefit of Delayed Compliance

The present values of both sets of cash flows (i.e. those associated with the "on-time" case and those associated with the "delay" case) are then compared. The present value of the second set will usually be lower, reflecting the fact that delaying compliance yields a financial benefit to the violator. The initial economic benefit the violator gains from delaying compliance is the difference between the present values of the first set of cash flows and the second set of cash flows. To obtain

the economic benefit as of the penalty payment date, the economic benefit as of the noncompliance date is increased at the discount rate for the number of months between the noncompliance date and the penalty payment date. This is done to account for the amount of money the violator earned on the economic benefit gained as of the noncompliance date, compounded monthly over time until the penalty payment date. BEN assumes that the violator invested the net economic benefit in plant and equipment similar to the violator's existing investments in terms of risk and financing. In addition, because we assume that the violator is an average company, BEN applies the weighted-average rate of earnings that corporations expect to earn over the long-term to cover the cost of both debt and equity capital.

B. UNDERLYING ASSUMPTIONS

Several important assumptions are made in calculating the economic benefit of delay as described in this appendix. Many of these assumptions were only implicit in the discussion in the previous section. Each major assumption is identified and explained below.

1. Discounting Assumptions

The cash flows in BEN are generally discounted at a rate that reflect their overall risk. As described above, the standard value discount rate used in BEN is the weighted-average cost of capital. Chapter 4 of the manual contains a description of how this value is calculated.

2. Application of the Inflation Rate

The inflation rate input (either the standard value or a user-specified value) is used to convert all dollar inputs -- the capital investment, one-time expenditure, and annual operating and maintenance costs -- into dollars of the noncompliance year.

Annual costs and future replacement cycle expenditures are also inflated using the annual inflation rate. BEN also uses this same inflation rate to derive the delayed costs from the on-time costs (i.e., investment, one-time, and annual costs).

3. Mid-Year Cash Flow Occurrence

BEN calculates periodic cash flows, such as annual costs and depreciation tax benefits, as if they occur once each year at mid-year. These mid-year cash flows begin six months after the capital investment and one-time expenditure are incurred. By assuming that these costs occur at mid-year, BEN averages the costs across the year.

4. Non-Deductibility of the Civil Penalty

In calculating the cash flows from which the economic benefit of delayed compliance is computed, BEN takes into account the normal tax consequences of expenses, depreciation, and so forth. On the other hand, BEN assumes that the total penalty being calculated, including the economic benefit component, is not deducted from the violator's income for tax purposes. This comports with current IRS policies.

5. Continuous Sequence of Replacement Cycles

The model assumes that pollution control equipment is replaced at the end of its useful life, at a cost that reflects the rate of inflation. This process continues repeatedly, implying that the underlying source of pollution is never eliminated and that the cost of the pollution control remains the same taking inflation into account. In BEN, recurring capital and annual cash flows associated with pollution control equipment are incurred over an infinite number of replacement cycles in both the delay and the on-time cases. The one-time capital or nondepreciable expenditure, however, is incurred only once.

C. DERIVATION OF MATHEMATICAL FORMULAE

This section describes the procedure for calculating the economic benefit of delayed compliance. The explanation is fairly detailed, including some of the mathematical formulae used in the BEN model. Not all of the variables described below are actually used in BEN, since the program combines some steps for the sake of efficiency. A separate subsection explains the procedures used to calculate the values in the detailed cash flow table provided in output Option 3. All symbols are listed and defined in Exhibit A-1.

Exhibit A-1

DEFINITION OF SYMBOLS

COST	=	Cost of compliance with environmental regulations as entered
$COST_{DEF}$	=	Cost of compliance with environmental regulations in noncompliance-year dollars
DEP_j	=	the amount of depreciation in year j
DF_j	=	the factor used to discount after-tax annual expenses and depreciation tax savings
d_j	=	the fraction of the original asset value depreciated in year j
E	=	the annual discount rate
E_m	=	the monthly discount rate
EC_{BEN}	=	the present value of the economic benefit from delay as of noncompliance date
EXP	=	the one-time nondepreciable expenditure incurred to comply with environmental requirements
FV_{BEN}	=	the future value of the economic benefit
I	=	the annual rate of inflation for expenditure made to comply with environmental requirements
I_m	=	the monthly inflation rate
IDFLT	=	the number of years between the noncompliance year and year in which the cost is expressed
II	=	the initial capital investment for pollution control
II_{ADJ}	=	the depreciation basis of the initial capital investment
INV	=	investment cash flow

Exhibit A-1

DEFINITION OF SYMBOLS
(continued)

ITC	=	the investment tax credit
i,j	=	indices, usually indicating the year in which a cash flow occurs
L	=	the number of months of delayed compliance
MTR_j	=	the marginal income tax rate (federal & state) in year j
N	=	the useful life of pollution control equipment in years
OM_j	=	the annual (operating and maintenance) expense in year j
ONE_0	=	the after-tax cash flow associated with the one-time expenditure
$PRIN_j$	=	the principal repayment in year j
PV	=	the present value of a cash flow or cash flows
PV^1_{PCE}	=	present value of all cash flows in first cycle
PV^2_{PCE}	=	present value of all cash flows in second cycle
PV_{PCE}	=	present value of all cash flows in all cycles
t_{ITC}	=	the investment tax credit rate
$TXSVDP_j$	=	the tax savings associated with depreciation expense in year j
$TXSVOM_j$	=	the after-tax cash flow from operating and maintenance expenses in year j

Note that BEN converts all rates (e.g., marginal tax rates, discount rate), which the user must enter as percentages, to a decimal format by dividing by 100. The decimal form (e.g., .12 for 12 percent) is required in all of the formulae used in calculating the economic benefit. All of the rates used in the formulae below are expressed in decimal form.

1. Cash Flows as of Required Compliance Date

This section describes the cash flows associated with complying on-time (as of the noncompliance date). The costs of compliance with environmental regulations can be categorized into three types of cash flows: those associated with an initial capital investment, annual costs, and an initial one-time non depreciable expenditure. Subsections 1, 2 and 3 below explain each of these.

Before any of these costs are used in the formulae, BEN first converts the costs into dollars of the year compliance should have been achieved (i.e., the noncompliance year). The model performs this adjustment using the dollar-year entered with the cost figure. If the dollar-year is later than the noncompliance year, the cost is deflated as follows:

(1)
$$COST_{DEF} = \frac{COST}{(1 + I)^{IDFLT}}$$

where:

$COST_{DEF}$	=	the cost expressed in noncompliance-year dollars
COST	=	the cost as entered
I	=	the annual inflation rate
IDFLT	=	the number of years between the noncompliance year and the cost's dollar-year

When the dollar-year occurs before the noncompliance date, the cost must be inflated as follows:

(2) $$COST_{DEF} = COST \times (1 + I)^{IDFLT}$$

No adjustment is necessary when the dollar-year is the same as the year of the noncompliance date.

Each of the values discussed below is expressed in noncompliance-year dollars. Assume that BEN has already performed the appropriate deflating or inflating.

a. Capital Investment

The initial cash outflow resulting from the capital investment is the total capital cost of the pollution control equipment. This capital cost, denoted by II, is in noncompliance-year dollars. The investment tax credit (ITC), if applicable, is a cash inflow which must be subtracted from the initial investment. The ITC is equal to the product of the investment tax credit rate applicable in that year and the capital cost:

(3) $$ITC = II \times t_{ITC}$$

where: t_{ITC} = investment tax credit rate

In this model, the ITC rate is set at 10 percent for investments made in 1985 and before, and at 0 percent for investments made in 1986 and after. For not-for-profit entities, the ITC is set at 0 percent regardless of the year.

Also associated with the capital investment are tax benefits resulting from depreciation. Annual depreciation is the product of the capital cost, adjusted for any ITC taken, and the depreciation fraction in year j:

(4) $$DEP_j = II_{ADJ} \times d_j$$

where:

DEP_j	=	amount of depreciation in year j
II_{ADJ}	=	the depreciation basis; equal to the original initial investment adjusted, if necessary, for any ITC taken
d_j	=	the fraction of the adjusted initial investment cost depreciated in year j

For investments made before 1987, the model sets the depreciation life at five years and uses a straight-line depreciation schedule, so the depreciation percentage in each year is constant at 20 percent. Thus, d_j = .20 for the first five years of the equipment's useful life, and d_j = 0.0 for the remainder of the useful life. This assumption was made to approximate the two possible depreciation schedules that could be applied to pollution control investments during the pre-1987 period: (1) the Accelerated Cost Recovery System's (ACRS) five-year schedule that applies to most types of equipment, and (2) the 60-month rapid amortization procedure, which could be used for certain pollution control investments.

For investments made in 1987 and later, the model uses the double-declining balance depreciation method (with half-year convention) for years one to four and converts to straight-line depreciation for years five to seven. This method is prescribed by the revised tax law's Modified Accelerated Cost Recovery System (MACRS) and uses a seven year depreciation life.

The depreciation basis, II_{ADJ}, is equal to 100 percent of the original initial investment, II, in all years except 1983 through 1985. In those years, as was required then by tax law, the basis is reduced by one-half of the ITC taken.[3]

[3] Since BEN assumes a 10% ITC on investments made in years including 1983 through 1985, the depreciation basis during this period equals 95% of the original initial investment.

The cash flow impact from depreciation is the reduced income tax liability that results from deducting depreciation as an expense. These deductions are assumed to occur annually at mid-year. The tax benefit from depreciation is calculated by multiplying the depreciation expense for each year by the marginal tax rate in effect in that year. The tax benefits are cash inflows that reduce the cost of compliance. The model calculates the tax benefit from depreciation later in the program when the cash flows are discounted (see Equation 10).

b. One-Time Non Depreciable Expenditure

The one-time nondepreciable expenditure, like the capital investment, occurs initially. Expressed in noncompliance-year dollars, it is denoted as EXP. If the user indicates that the nondepreciable expenditure is not tax-deductible, the initial cash outflow (ONE_0) is equal to the one-time expenditure:

(5)
$$ONE_0 = EXP$$

If the one-time nondepreciable expenditure is tax-deductible, meaning that it serves to reduce the violator's taxable income and consequently its tax liability, the expenditure must be adjusted to an after-tax basis. This adjustment is accomplished by multiplying the expenditure amount by one minus the marginal tax rate.

(6)
$$ONE_0 = EXP \times (1 - MTR_j)$$

where: MTR_j = the violator's marginal income tax rate in effect in year j

c. **Annual Costs**

The initial annual cost, expressed in noncompliance-year dollars, is denoted by OM_0. Annual costs in the model increase at the rate of inflation. As with depreciation cash flows, annual cash flows are assumed to occur at mid-year. The first annual cash flow (OM_1) occurs in the middle of the first year, six months after the initial capital cost. The inflation rate is thus applied for half a year:

$$OM_1 = OM_0 \times (1 + I)^{1/2}$$

where: I = the annual inflation rate

This equation can be generalized for any year j, for j equal to or greater than 1:

(7)
$$OM_j = OM_0 \times (1 + I)^{(j-1/2)}$$

Since the annual costs are tax deductible, the after-tax cash flow associated with an annual expense is the product of the annual cost and a factor equal to one minus the marginal tax rate. The model adjusts the annual cash flow to after-tax dollars later in the program when the cash flows are discounted (see Equation 12).

2. <u>Discounting Cash Flows</u>

The cash flows associated with the on-time case, as calculated above, are then discounted to the present value as of the noncompliance date. Those cash flows occurring at the noncompliance date are already expressed in present-value terms; thus, no discounting of these is necessary. Each cash flow occurring annually, such as the depreciation tax benefit and after-tax annual costs, must be discounted. The following explanation is divided into two parts: The first discusses all the cash flows associated with capital and annual expenditures; the second discusses cash flows associated with the one-time nondepreciable expenditure.

a. Capital and Annual Expenditure Cash Flows

The net initial cash flow associated with a capital investment in pollution control equipment is the capital cost minus the investment tax credit:

(8)
$$PV_{IN} = II - ITC$$

Using equation (3), this can be restated:

(9)
$$PV_{IN} = (II - (II \times t_{ITC})$$
$$= II \times (1 - t_{ITC})$$

The present value of depreciation-related cash flows for any year j is:

(10)
$$PV_{DEPj} = \frac{DEP_j \times MTR_j}{(1 + E)^{(j-1/2)}}$$

where:
- DEP_j = depreciation in year j
- MTR_j = marginal tax rate in year j
- E = the annual discount rate

The marginal tax rate in effect in that year is applied to depreciation in that year to calculate the depreciation tax benefit. In discounting the annual tax benefit for year j, the exponent is "j - 1/2" because each cash flow in the model occurs at mid-year. The present value of all the annual depreciation tax benefit cash flows (PV_{DEPj}) over the N-year useful life is calculated by summing:

(11)

$$PV_{DEP} = \sum_{j=1}^{N} PV_{DEPj}$$

where: PV_{DEP} = the present value of all depreciation-related cash flows

Similarly, the present value of after-tax annual cash flows for any year j is:

(12)

$$PV_{OMj} = \frac{OM_j \times (1 - MTR_j)}{(1 + E)^{(j-1/2)}}$$

where: E = the annual discount rate

The present value of annual expenditures over the equipment's useful life of N years is the sum of the present values for each year:

(13)

$$PV_{OM} = \sum_{j=1}^{N} PV_{OMj}$$

The present value of all cash flows resulting from the capital and annual O&M expenditures required to comply with environmental regulations throughout the initial useful life cycle of the controls is equal to the combination of the present values of the three associated cash flows: the initial capital investment net of ITC, the depreciation tax benefit, and the after-tax annual O&M costs, taken from equations (9), (11), and (13), respectively:

(14)

$$PV^{1}_{PCE} = PV_{IN} - PV_{DEP} + PV_{OM}$$

The present value of all cash flows associated with the initial useful life cycle of the pollution control equipment must next be expanded to include the present value of cash flows in all future replacement cycles. This can be accomplished by first calculating the second cycle of cash flows,

which is the first replacement cycle. The BEN model assumes that the most recent tax law provisions apply to the cash flows in every year of this second cycle, and in all subsequent replacement cycles. Therefore, BEN calculates cash flows for the second cycle by inflating all investment and annual costs to the end of the first useful life and applying the new tax law provisions. The present value of this second cycle of cash flows as of year N, when the original equipment wears out, is denoted PV^2_{PCE}.

The present value of the cash flows from the second cycle and all future replacement cycles is calculated by summing:

(15a)

$$PV_{REP} = PV^2_{PCE} + PV^2_{PCE} \times \left[\frac{(1+I)^N}{(1+E)^N}\right] + PV^2_{PCE} \times \left[\frac{(1+I)^{2N}}{(1+E)^{2N}}\right] + \ldots$$

$$= PV^2_{PCE} \times \left[\frac{1}{1 - \left[\frac{1+I}{1+E}\right]^N}\right] \qquad \text{FOR } E > I$$

where: N = the useful life of the equipment (in years).

The present value of these replacement-cycle cash flows as of the noncompliance date is then determined by discounting:

(15b)

$$PV^*_{REP} = \frac{PV_{REP}}{(1+E)^N}$$

Where the capital investment is a one-time, not a recurring investment, PV^*_{REP} only includes future annual expenditure cash flows. Capital investment and depreciation cash flows are zero.

The present value of the cash flows from the original cycle and all future replacement cycles is calculated by summing:

$$PV_{PCE} = PV^{1}_{PCE} + PV^{*}_{REP}$$

b. The One-Time Nondepreciable Expenditure Cash Flow

The present value of the cash flow associated with a one-time nondepreciable expenditure is simply the initial after-tax cash flow as expressed in equation (5) or (6):

(16)
$$PV_{ONE} + ONE_0$$

This one-time cash flow is not repeated in subsequent years. Therefore, the calculations of equations (15a), (15b) and (15c) are not required for this cash flow.

c. Total Cash Flow

The total present value of cash flows associated with the pollution control-related capital investment, annual O&M expenditures, and a one-time nondepreciable expenditure is:

(17)
$$PV = PV_{PCE} + PV_{ONE}$$

This is the total present value of complying on time, as of the date compliance was required.

3. The Economic Benefit of Delayed Compliance

The economic benefit of delayed compliance is the difference between the present value of complying on-time and the present value of complying at the end of the delay period. The total figure calculated in (17) above is the total present value of complying on-time, as of the noncompliance date. The cash flows associated with complying after the delay period are similar to those associated with complying on-time, as explained in the above two sections. However, the delay case cash flows differ from the on-time cash flows for two reasons: (1) inflation, and (2) differential tax provisions. Each of these reasons is discussed below.

The cost of complying after the delay period is generally higher (in nominal terms) than the cost of complying on-time because of the impact of inflation. Each cost of delayed compliance, as of the day on which compliance is actually achieved, is inflated over the delay period from the on-time compliance cost. For example, the one-time expenditure in the delay case is given by:

(18)

$$ONE^{*}_{DELAY} = ONE_0 \times (1 + I_m)^L$$

where: I_m = the monthly inflation rate (derived from I, the annual inflation rate)

L = the number of months of delay

The other two cost categories are similarly inflated.

BEN then calculates the delay case cash flows from these inflated costs according to the tax law provisions that apply to each year of the first cycle of the delay case. Because the first cycle of the delay case covers different years than the first cycle of the on-time case, the application of different tax law provisions might create a different pattern of tax impacts. BEN calculates the present value of the delay case cash flows and adds the replacement cycle cash flows, calculated as described above for the on-time case. The total present value of the delay case cash flows as of the compliance date is denoted PV^{*}_{DELAY}.

The present value of the delayed cash flows, as of the day on which compliance should have been achieved (i.e., the "noncompliance" date), is given by discounting:

(19)

$$PV_{DLA} = \frac{PV^{*}_{DELAY}}{(1 + E_m)^{L}}$$

where: E_m = the monthly discount rate (derived from E, the annual discount rate)

The economic benefit from delay is thus the difference between these two present values:

(20)

$$EC_{BEN} = PV - PV_{DLA}$$

This economic benefit figure is then valued as of the expected penalty payment date, reflecting the fact that the violator is earning a rate return on the savings until the penalty is paid. This future value of the benefit is given as:

(21)

$$FV_{BEN} = EC_{BEN} \times (1 + E_m)^{P}$$

where: P = the number of months between the noncompliance date and the penalty payment date

4. Calculations for the Cash Flow Table for Output Option 3

The model employs the procedures described above to calculate the economic benefit from delayed compliance as reported in the summary results in output Options 1 and 2 and the last page of Option 3. Slightly different procedures are used to calculate the values in the detailed cash flow tables provided for Option 3. The table illustrates tax effects and discounting in a sequence that is

different from that used by the program to create the summary. The following discussion explains the additional calculations used to create the tables. Note that the difference between the delay case cash flows and the on-time case cash flows derive from inflation and differential tax impacts.

a. Annual Cash Flows and Tax Effects

Each table presents annual, undiscounted expenses both before and after tax effects for each year. After-tax annual costs are calculated as follows:

(22) $$TXSVOM_j = -OM_j \times (1 - MTR_j)$$

The negative sign associated with the annual expenditure denotes a cash outflow.

For each year the tables also present the depreciation amount and the undiscounted depreciation tax benefit. The tax benefit is calculated as follows:

(23) $$TXSVDP_j = DEP_j \times MTR_j$$

The depreciation tax savings is positive because it is a cash inflow.

b. Treatment of the One-Time Nondepreciable Expenditure

If the one-time nondepreciable expenditure is not tax-deductible, it appears as part of the investment net of ITC at year zero:

(24) $$INV = -EXP - (PV_{II} - ITC)$$

Note again that negative signs are used to denote cash outflows.

If the one-time nondepreciable expenditure is tax-deductible, it appears in the annual cost column at year zero and its after-tax value appears as after-tax annual cost. Thus,

(25)
$$TXSVOM_0 = -EXP \times (1 - MTR_j)$$

and
$$INV = -(PV_{it} - ITC)$$

C. Discounting

Each table shows the present value of the after-tax annual cash flows. The table also lists the discount factors used in calculating each present value. For each year j, the discount factor is calculated as follows:

(26)
$$DF_j = \frac{1}{(1 + E)^{(j-1/2)}}$$

where: DF_j = the project discount factor applied to after-tax annual cash flows and depreciation tax savings in year j

E = the annual discount rate

The discount factor equals 1.0 for year zero, since this is the year to which you are discounting and cash flows occurring in this year are already in present-value terms.

The table displays the discounted value of each annual cash flow. These are calculated by applying the discount factors to the appropriate cash flows for each year j:

(27)
$$PV1_j = TXSVOM_j \times DF_j$$

(28)

$$PV2_j - TXSVDP_j \times DF_j$$

where: $PV1_j$ = the present value of after-tax annual costs in year j

and: $PV2_j$ = the present value of the depreciation tax savings in year j

d. Aggregating Present Values

For each year, the tables list the annual present value, which is the sum of (1) the investment net of ITC, (2) the present value of after-tax annual costs, and (3) the present value of depreciation tax savings. A negative figure denotes a net cash outflow or cost; a positive figure is a net cash inflow or savings:

(29)

$$PV_j - INV + PV1_j + PV2_j$$

The final figure at the bottom of the cash flow table represents the sum of all the annual present value totals. This sum is equal to the total present value of compliance from equation (14). In each cash flow table, the negative sign is used to indicate that this present value represents a net cash outflow. In the on-time case table, the present value is expressed as of the noncompliance date, and in the delay case table, the present value is expressed as of the compliance date.

D. SAMPLE CALCULATION OF ECONOMIC BENEFIT

This section illustrates BEN's calculation of the economic benefit of delayed compliance for a hypothetical noncomplying firm. The inputs are as follows:

1)	A. Case Name	Entity X Example
	B. Statute	2. Clean Air Act - Mobile Source
	C. Profitability Status	1. For-Profit
	D. Filing Status	1. C-Corporation
2)	Capital Investment	$405,000, 1994 dollars, recurring
3)	One-Time Nondepreciable Expenditure	$210,000, 1994, tax-deductible
4)	Annual Expense	$85,750, 1994 dollars
5)	Date of Noncompliance	February 1991
6)	Date of Compliance	August 1994
7)	Penalty Payment Date	April 1995
8)	Useful Life	15 years
9)	Marginal Tax Rate - 1986 and Before	49.6 percent
10)	Marginal Tax Rate - 1987 to 1992	38.6 percent
11)	Marginal Tax Rate - 1993 and Beyond	39.4 percent
12)	Inflation Rate	1.3 percent
13)	Discount Rate: WACC	11.3 percent

1. First Cycle Cash Flows

The initial step in calculating the economic benefit of delayed compliance is to lay out all the cash flows that result from on-time compliance, including both direct costs and indirect financial impacts. First, BEN deflates the dollar input amounts -- capital investment, one-time nondepreciable expenditure, and annual cost -- from 1994 dollars to 1991 dollars (noncompliance-year dollars) using the 1.3 percent inflation rate. The amounts are deflated over three years by dividing by 1.039509 (one plus the inflation rate, to the third power) as indicated in equation (1).

The inputs and the deflated amounts are given in the following table:

Input	Input Dollar Amounts (Delay Case) (1994 dollars)	Deflated Values (On-Time Case) (1991 dollars)
Capital Investment	405,000	389,607
One-Time Nondepreciable Expenditure	210,000	202,018
Annual Expense	85,750	82,491 *

* Although this figure is deflated to year zero, BEN assumes annual expenses occur mid-year. The 6 month inflation calculation is shown on page A-29.

BEN then calculates the on-time cash flows associated with these inputs, expressed in noncompliance-year dollars, and the delay case cash flows associated with these inputs expressed in compliance-year dollars. Exhibit A-2 reports the cash flows on both a before-tax and an after-tax basis, and also on a present value basis. BEN displays the cash-flow table shown in Exhibit A-2 as part of output Option 3. Each table is divided into two halves, and the years of the useful life of the capital investment are printed in the first column of each half.

The second column of the top half of each table includes the investment outlay ($389,607 for the on-time case; $407,624 for the delay case) net of the investment tax credit. In this example, since both the on-time and delay cases occur after 1985, the investment tax credit (ITC) is zero for both cases. Thus, the investment net of ITC in the second column is the sum of the one-time nondepreciable expenditure (zero) and the capital investment net of the ITC. This total is reported as a negative cash flow, as are all other cash outflows shown in the tables.

Exhibit A-2

OUTPUT OPTION 3 (page 1)

ENTITY X EXAMPLE BEN VERSION 4.0 DECEMBER 1, 1993

ON-TIME CASE CASH FLOWS
FIRST CYCLE CASH FLOWS BASED ON
A TOTAL INITIAL OUTLAY OF $ 389607
AS OF THE BEGINNING OF THE PERIOD OF NONCOMPLIANCE

YEAR	INVESTMENT NET OF ITC ($)	DEPRECIATION ($)	DEPRECIATION TAX SAVINGS ($)	DEPREC DISCOUNT FACTOR	PRESENT VALUE OF DEPREC TAX SAVINGS ($)
0	-389607	0	0	1.0000	0
1	0	55659	21484	0.9479	20365
2	0	95415	36830	0.8516	31366
3	0	68154	26853	0.7652	20547
4	0	48681	19180	0.6875	13186
5	0	34771	13700	0.6177	8462
6	0	34771	13700	0.5550	7603
7	0	34771	13700	0.4986	6831
8	0	17385	6850	0.4480	3069
9	0	0	0	0.4025	0
10	0	0	0	0.3617	0
11	0	0	0	0.3249	0
12	0	0	0	0.2919	0
13	0	0	0	0.2623	0
14	0	0	0	0.2357	0
15	0	0	0	0.2117	0

YEAR	ANNUAL EXPENSES	AFTER-TAX ANNUAL COST	PROJECT DISCOUNT FACTOR	PRESENT VALUE AFTER-TAX O&M ($)	TOTAL PRESENT VALUE ($)
0	-202018	-124039	1.0000	-124039	-513646
1	-83025	-50978	0.9479	-48320	-27956
2	-84105	-51640	0.8516	-43979	-12613
3	-85198	-51630	0.7652	-39506	-18959
4	-86306	-52301	0.6875	-35957	-22770
5	-87428	-52981	0.6177	-32726	-24264
6	-88564	-53670	0.5550	-29786	-22183
7	-89715	-54368	0.4986	-27109	-20278
8	-90882	-55074	0.4480	-24674	-21605
9	-92063	-55790	0.4025	-22457	-22457
10	-93260	-56516	0.3617	-20439	-20439
11	-94472	-57250	0.3249	-18603	-18603
12	-95701	-57995	0.2919	-16931	-16931
13	-96945	-58748	0.2623	-15410	-15410
14	-98205	-59512	0.2357	-14026	-14026
15	-99482	-60286	0.2117	-12765	-12765

PRESENT VALUE OF PURCHASING THE INITIAL POLLUTION CONTROL EQUIPMENT ON-TIME AND OPERATING IT THROUGHOUT ONE USEFUL LIFE $ -804906

Exhibit A-2 (Continued)

OUTPUT OPTION 3 (page 2)

ENTITY X EXAMPLE BEN VERSION 4.0 DECEMBER 1, 1993

DELAY CASE CASH FLOWS
FIRST CYCLE CASH FLOWS BASED ON
A TOTAL INITIAL OUTLAY OF $ 407624
AS OF THE END OF THE PERIOD OF NONCOMPLIANCE

YEAR	INVESTMENT NET OF ITC ($)	DEPRECIATION ($)	DEPRECIATION TAX SAVINGS ($)	DEPREC DISCOUNT FACTOR	PRESENT VALUE OF DEPREC TAX SAVINGS ($)
0	-407624	0	0	1.0000	0
1	0	58233	22944	0.9479	21748
2	0	99827	39332	0.8516	33497
3	0	71306	28094	0.7652	21497
4	0	50933	20067	0.6875	13796
5	0	36379	14333	0.6177	8853
6	0	36379	14333	0.5550	7955
7	0	36379	14333	0.4986	7147
8	0	18189	7167	0.4480	3211
9	0	0	0	0.4025	0
10	0	0	0	0.3617	0
11	0	0	0	0.3249	0
12	0	0	0	0.2919	0
13	0	0	0	0.2623	0
14	0	0	0	0.2357	0
15	0	0	0	0.2117	0

YEAR	ANNUAL EXPENSES	AFTER-TAX ANNUAL COST	PROJECT DISCOUNT FACTOR	PRESENT VALUE AFTER-TAX O&M ($)	TOTAL PRESENT VALUE ($)
0	-211361	-128085	1.0000	-128085	-535709
1	-86865	-52640	0.9479	-49896	-28148
2	-87994	-53324	0.8516	-45413	-11917
3	-89138	-54018	0.7652	-41333	-19836
4	-90297	-54720	0.6875	-37619	-23823
5	-91471	-55431	0.6177	-34239	-25386
6	-92660	-56152	0.5550	-31163	-23208
7	-93864	-56882	0.4986	-28363	-21216
8	-95084	-57621	0.4480	-25815	-22604
9	-96321	-58370	0.4025	-23495	-23495
10	-97573	-59129	0.3617	-21384	-21384
11	-98841	-59898	0.3249	-19463	-19463
12	-100126	-60676	0.2919	-17714	-17714
13	-101428	-61465	0.2623	-16123	-16123
14	-102746	-62264	0.2357	-14674	-14674
15	-104082	-63074	0.2117	-13356	-13356

PRESENT VALUE OF DELAYING THE PURCHASE
OF THE INITIAL POLLUTION CONTROL EQUIPMENT
AND OPERATING IT THROUGHOUT ITS USEFUL LIFE $ -838057

The third column of the top half presents the annual depreciation in years 1 through 8. The depreciation amount is based on the double declining depreciation method (with half-year convention). The tax savings from each depreciation amount, which is in the fourth column, is calculated using equation (23). It equals the product of the depreciation amount and the applicable marginal tax rate. The depreciation discount factors in the fifth column are based on an annual discount rate of 11.3 percent, the rate used for all cash flows. Since annual cash flows occur at mid-year in the model, their values are discounted from the middle of the year. For example, the discount factor in year 1 is equal to:

$$\frac{1}{(1.113)^{1/2}} = 0.94788$$

The sixth column presents the present value of the depreciation tax savings, obtained by multiplying the depreciation tax savings (column 4) and the discount factor (column 5).

The second column in the bottom half of the table lists the annual costs, inflated by 1.3 percent per year. Since annual expenses occur at mid-year in the model, the annual amount for year 1 for the on-time case is calculated by inflating the annual amount in noncompliance-year dollars for one-half year (see Equation 7):

$$\$82{,}491 \times (1.013)^{1/2} = \$83{,}025$$

The one-time nondepreciable expenditures, because they are tax-deductible, are reported in this column at year 0 ($202,018 for the on-time case, and $211,361 for the delay case).

The after-tax annual and one-time nondepreciable expenses are in the third column. The figures in this column are calculated by multiplying the annual costs by a factor equal to one minus the marginal tax rate. The discount factors in the fourth column are based on a discount rate of 11.3 percent. These discount rates are identical to those applied to the depreciation tax savings.

The fifth column, which is calculated using equation (28), contains the present value of the annual cash flows (column 3 times column 4). The last column provides the totals of the present values of the investment net of ITC (if applicable), depreciation tax savings, and after-tax annual costs for each year.

The last dollar figure in each table (negative $804,906 for the on-time case, and negative $838,057 for the delay case) is the sum of the annual present-value cash flows for one useful life. BEN reports the value for the on-time case as the first figure (A) in the output shown in Exhibit A-3. This output is provided for output Option 2 and as the last page of Option 3. Note that costs and benefits are both shown as positive numbers in Exhibit A-3.

2. Including Replacement Cycles

The present value of purchasing and operating pollution control equipment must include future replacement of the equipment. BEN uses equations (15a), (15b), and (15c) to compute the present value cost of all replacement cycles from the second cycle of cash flows. In this example, the marginal income tax rate changes in 1993, which is during the first useful life of the pollution control equipment for the "on-time" case. The tax rate affects the after tax value of depreciation and annual expenses. During the second replacement cycle (from year 2005-2020), the Marginal Income Tax Rate for 1993 and Beyond applies to all years. Therefore, to calculate the second cycle of cash flows, BEN performs the same calculations as presented at the beginning of this section except the one-time, nondepreciable expenditure is $0 and the marginal tax rate is 39.4 percent for all years. BEN then inflates this figure ($678,591 in our example) forward 15 years to the date when the equipment will require replacement.

$$
\begin{aligned}
&= \quad \$678{,}591 \times (1.013)^{15} \\
&= \quad \$678{,}591 \times 1.2137848 \\
&= \quad \$823{,}663
\end{aligned}
$$

Next BEN calculates the cash flows for all replacement cycles based on this "second cycle" figure.

$$= \$823{,}663 \times \frac{1}{1 - \left\{\frac{1.013}{1.113}\right\}^{15}}$$

$$= \$823{,}663 \times 1.322088$$

$$= \$1{,}088{,}955$$

The total present value cost of complying with environmental regulations on time is the present value of the original cycle cash flows plus the present value of all replacement cycle cash flows, as of the noncompliance date:

$$= \$804{,}906 + \frac{\$1{,}088{,}955}{(1.113)^{15}}$$

$$= \$804{,}906 + \frac{\$1{,}088{,}955}{4.9822724}$$

$$= \$804{,}906 + \$218{,}566$$

$$= \$1{,}023{,}472$$

This is the second figure (B) reported in Exhibit A-3. The on-time compliance cost total is equal to the sum of (1) the total present value cost of investing in and operating pollution control equipment over the initial useful life cycle and all future replacement cycles and (2) the one-time expenditure.

Exhibit A-3

OUTPUT OPTION 2

```
  ENTITY X EXAMPLE                          BEN VERSION 4.0 DECEMBER 1, 1993


A.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE IN 1991 DOLLARS $      804906

B.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $     1023472

C.  VALUE OF DELAYING EMPLOYMENT OF POLLUTION
    CONTROL EQUIPMENT BY 42 MONTHS PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $      733367

D.  ECONOMIC BENEFIT OF A  42 MONTH DELAY
    IN 1991 DOLLARS (EQUALS B MINUS C)               $      290104

E.  THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT
    DATE,   50 MONTHS AFTER NONCOMPLIANCE            $      453194
                                                          =========

PLEASE PRESS CARRIAGE RETURN FOR MORE OUTPUT

    ->->->->->->->  THE ECONOMIC BENEFIT CALCULATION ABOVE  <-<-<-<-<-<-<-
                     USED THE FOLLOWING VARIABLES:
        USER SPECIFIED VALUES
        ---------------------
     1A. CASE NAME =                                          ENTITY X EXAMPLE
     1B. PROFIT STATUS =                                           FOR-PROFIT
     1C. FILING STATUS =                                      C-CORPORATION
     2. INITIAL CAPITAL INVESTMENT (RECURRING)= $     405000  1994 DOLLARS
     3. ONE-TIME NONDEPRECIABLE EXPENDITURE =   $     210000  1994 DOLLARS
        (TAX-DEDUCTIBLE EXPENSE)
     4. ANNUAL EXPENSE =                        $      85750  1994 DOLLARS
     5. FIRST MONTH OF NONCOMPLIANCE =                              2, 1991
     6. COMPLIANCE DATE =                                           8, 1994
     7. PENALTY PAYMENT DATE =                                      4, 1995
     8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =               15 YEARS
     9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =              49.60 %
    10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =                 38.60 %
    11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =              39.40 %
    12. ANNUAL INFLATION RATE =                                      1.30 %
    13. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL             11.30 %
```

3. Cost of Delayed Compliance

The present value cost of delayed compliance is derived from the delay case cash flow table. The replacement cycle cash flows are calculated using the same formulae as the replacement cycle analysis in Section 2:

$$= \$709,972 \times (1.013)^{15}$$
$$= \$709,972 \times 1.2137848$$
$$= \$861,753$$

The replacement cycle cash flows thus total:

$$= \$861,753 \times \frac{1}{1 - \left\{\frac{1.013}{1.113}\right\}^{15}}$$

$$= \$861,753 \times 1.322088$$
$$= \$1,139,313$$

The total present value of delayed compliance (as of the compliance date) is the present value of the original cycle cash flows plus the present value of all replacement cycles' cash flows:

$$= \$838,057 + \frac{\$1,139,313}{(1.113)^{15}}$$

$$= \$838,057 + \frac{\$1,139,313}{4.9822724}$$

$$= \$838,057 + \$228,673$$
$$= \$1,066,730$$

A monthly discount rate is used to discount the delay case present value total to the noncompliance date. The discount rate is converted to monthly equivalents as follows:

$$E_m = (1 + E)^{1/12} - 1$$
$$= (1 + 0.113)^{1/12} - 1$$
$$= 0.0089615$$

In this example, compliance was delayed 42 months from February 1991 to August 1994. BEN uses equation (19) to calculate the present value cost of delayed compliance for the 42 month delay as of the noncompliance date:

$$= \frac{\$1,066,730}{(1.0089615)^{42}}$$

$$= \frac{\$1,066,730}{1.4545645}$$

$$= \$733,367$$

This is the third figure (C) reported in the output shown in Exhibit A-3.

4. **Economic Benefit of Delay**

The economic benefit of the 12-month delay, valued as of the noncompliance date, is simply the difference between the present value costs of complying on time and complying after the delay:

$$= \$1,023,472 - \$733,367$$
$$= \$290,104^{4}$$

[4] This figure is $290,104 (not $290,105) due to rounding.

This is the fourth figure (D) reported in Exhibit A-3. It is the difference between the two preceding figures (B and C) in the output.

Finally, the economic benefit is valued as of the penalty payment date of April 1995, which is 50 months after the noncompliance date. The economic benefit is brought forward using the discount rate, which is compounded monthly from the noncompliance date to the penalty payment date.

This value of the benefit at the time the penalty is paid is calculated as in equation (21):

$$
\begin{aligned}
&= \quad \$290{,}104 \times (1 + E_M)^{50} \\
&= \quad \$290{,}104 \times (1 + 0.0089615)^{50} \\
&= \quad \$290{,}104 \times 1.5621752 \\
&= \quad \$453{,}194
\end{aligned}
$$

Appendix B

SPECIAL CASES

December 1993

INTRODUCTION

This appendix discusses special cases that might arise where a simple BEN analysis is inappropriate. Section A addresses situations in which multiple BEN runs are required, such as cases with more than one capital cost occurring at different dates. Section B addresses cases involving avoided one-time costs, including capital costs that are avoided when the government requires closure of a facility. Section C describes methods for calculating the benefit from delayed annual expenditures, as opposed to avoided annual expenditures, such as a required period of monitoring. Finally, Section D discusses how to use BEN to calculate the economic benefit of noncompliance in cases involving municipal grants, when the grant is available in the on-time and the delay case, when the grant is no longer available when compliance is eventually achieved, and when the grant becomes available during the period of noncompliance.

A. COMBINING MULTIPLE RUNS

1. Introduction

In some cases it may be necessary to perform more than one BEN calculation and combine the results in order to determine the total benefit earned from delayed compliance. Such situations are likely to occur, for example, when there are two completely independent costs occurring at different times. This could happen when the violator failed to comply with more than one

requirement (e.g., violation of a NESHAPS and failure to install monitoring equipment).[1] This section gives examples of situations in which multiple runs may be required and explains how to combine the results of separate BEN runs.

2. Procedure for Economic Benefit Calculation

As a general rule, multiple runs can be combined to determine total benefit so long as the penalty payment dates are the same for each calculation. The user must perform a separate run for each expenditure, whether a capital investment, one-time nondepreciable expenditure, or annual expense, whenever the noncompliance dates or compliance dates of the violations differ. It is essential that the penalty payment date remain the same when these separate calculations are conducted.

3. Example Combining Multiple Runs

For example, assume that for on-time compliance, the following expenditures were required:

- $300,000 for the removal of hazardous waste in February 1990;
- $405,000 for pollution control equipment in February 1991; and
- $210,000 for the purchase of land in February 1991.

Instead, the company is expected to comply with all three requirements at the same time (in August 1994). The expected penalty payment date is April 1995.

For the first BEN run, input the variables as follows:

- Variable 3 (one-time nondepreciable expenditure) = $300,000;
- Variable 5 (date of noncompliance) = February 1990;

[1] This is in contrast with the very common situation where the violator must make a series of expenditures to comply with one requirement, but compliance is not achieved until the final expenditure is made. We assume that the sequence of expenditures is the same for both the delay and the on-time cases in these instances and all the expenditures are considered in one BEN run.

- Variable 6 (date of compliance) = August 1994; and
- Variable 7 (penalty payment date) = April 1995.

This first run will determine the benefit of delaying the expenditure for hazardous waste removal.

For the second BEN run, input the variables as follows:

- Variable 2 (initial capital investment) = $405,000;
- Variable 3 (one-time nondepreciable expenditure) = $210,000;
- Variable 5 (date of noncompliance) = February 1991;
- Variable 6 (date of compliance) = August 1994; and
- Variable 7 (penalty payment date) = April 1995.

This second run will determine the benefit of delaying pollution control equipment purchase and the expenditure for the purchase of land.

Example inputs are displayed in Exhibit B-1. You would then add the results of these two runs to determine the total economic benefit of $358,551. The results are shown in Exhibit B-2.

Exhibit B-1

DATA INPUTS FOR EXAMPLE COMBINING MULTIPLE RUNS

FIRST RUN

1)	A. Case Name B. Profitability Status C. Filing Status	ENTITY X EXAMPLE 1. For-Profit 1. C-Corporation
2)	Capital Investment	$ 0
3)	One-Time Nondepreciable Expenditure	$300,000, 1994 dollars, tax-deductible
4)	Annual Expense	$ 0
5)	Date of Noncompliance	February 1990
6)	Date of Compliance	August 1994
7)	Penalty Payment Date	April 1995
8)	Useful Life	15 Years
9)	Marginal Tax Rate - 1986 and Before	49.6 percent
10)	Marginal Tax Rate - 1987 to 1992	38.6 percent
11)	Marginal Tax Rate - 1993 and Beyond	39.4 percent
12)	Inflation Rate	1.3 percent
13)	Discount Rate: WACC	11.3 percent

Exhibit B-1
(continued)

DATA INPUTS FOR EXAMPLE COMBINING MULTIPLE RUNS

SECOND RUN

1)	A. Case Name	ENTITY X EXAMPLE
	B. Profitability Status	1. For-Profit
	C. Filing Status	1. C-Corporation
2)	Capital Investment	$ 405,000, 1994 dollars RECURRING
3)	One-Time Nondepreciable Expenditure	$210,000, 1994 dollars
4)	Annual Expense	$ 0
5)	Date of Noncompliance	February 1991
6)	Date of Compliance	August 1994
7)	Penalty Payment Date	April 1995
8)	Useful Life	15 Years
9)	Marginal Tax Rate - 1986 and Before	49.6 percent
10)	Marginal Tax Rate - 1987 to 1992	38.6 percent
11)	Marginal Tax Rate-1993 and Beyond	39.4
12)	Inflation Rate	1.3 percent
13)	Discount Rate: WACC	11.3 percent

Exhibit B-2

EXAMPLE OF BEN CALCULATION COMBINING MULTIPLE RUNS OUTPUT OPTION 2

FIRST RUN

```
  ENTITY X EXAMPLE                          BEN VERSION 4.0 December 1, 1993


A.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE IN 1990 DOLLARS $       174925

B.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1990 DOLLARS               $       174925

C.  VALUE OF DELAYING EMPLOYMENT OF POLLUTION
    CONTROL EQUIPMENT BY 54 MONTHS PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1990 DOLLARS               $       113024

D.  ECONOMIC BENEFIT OF A  54 MONTH DELAY
    IN 1990 DOLLARS (EQUALS B MINUS C)               $        61901

E.  THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT
    DATE,   62 MONTHS AFTER NONCOMPLIANCE            $       107627
                                                             =========

PLEASE PRESS CARRIAGE RETURN FOR MORE OUTPUT

    ->->->->->->  THE ECONOMIC BENEFIT CALCULATION ABOVE  <-<-<-<-<-<-
                  USED THE FOLLOWING VARIABLES:
       USER SPECIFIED VALUES
       ---------------------
     1A. CASE NAME = ENTITY X EXAMPLE
     1B. PROFIT STATUS =                  FOR-PROFIT
     1C. FILING STATUS =                  C-CORPORATION
     2. INITIAL CAPITAL INVESTMENT              = $          0
     3. ONE-TIME NONDEPRECIABLE EXPENDITURE =   $     300000  1994 DOLLARS
        (TAX-DEDUCTIBLE EXPENSE)
     4. ANNUAL EXPENSE =                        $          0
     5. FIRST MONTH OF NONCOMPLIANCE =                     2, 1990
     6. COMPLIANCE DATE =                                  8, 1994
     7. PENALTY PAYMENT DATE =                             4, 1995
     8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =      15 YEARS
     9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =    49.60 %
    10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =       38.60 %
    11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =    39.4  %
    11. ANNUAL INFLATION RATE =                            1.30 %
    12. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL   11.30 %
```

Exhibit B-2
(continued)

EXAMPLE OF BEN CALCULATION COMBINING MULTIPLE RUNS
OUTPUT OPTION 2

SECOND RUN

```
  ENTITY X EXAMPLE                          BEN VERSION 4.0 DECEMBER 1, 1993


A.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE IN 1991 DOLLARS $       480196

B.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $       569448

C.  VALUE OF DELAYING EMPLOYMENT OF POLLUTION
    CONTROL EQUIPMENT BY 42 MONTHS PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $       408824

D.  ECONOMIC BENEFIT OF A 42 MONTH DELAY
    IN 1991 DOLLARS (EQUALS B MINUS C)               $       160625

E.  THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT
    DATE,    50 MONTHS AFTER NONCOMPLIANCE           $       250924
                                                             =========


    ->->->->->->->  THE ECONOMIC BENEFIT CALCULATION ABOVE  <-<-<-<-<-<-<-
                    USED THE FOLLOWING VARIABLES:
       USER SPECIFIED VALUES
       ---------------------
     1A. CASE NAME = ENTITY X EXAMPLE
     1B. PROFIT STATUS =                  FOR-PROFIT
     1C. FILING STATUS =                  C-CORPORATION
     2. INITIAL CAPITAL INVESTMENT (RECURRING) = $     405000  1994 DOLLARS
     3. ONE-TIME NONDEPRECIABLE EXPENDITURE =    $     210000  1994 DOLLARS
        (EXPENSE IS NOT TAX-DEDUCTIBLE)
     4. ANNUAL EXPENSE =                         $          0
     5. FIRST MONTH OF NONCOMPLIANCE =                      2, 1991
     6. COMPLIANCE DATE =                                   8, 1994
     7. PENALTY PAYMENT DATE =                              4, 1995

     STANDARD VALUES
     ---------------
     8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =       15 YEARS
     9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =     49.6 %
    10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =        38.6 %
    11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =     39.4 %
    11. ANNUAL INFLATION RATE =                             1.3 %
    12. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL    11.3 %
```

B. AVOIDED ONE-TIME COST CALCULATIONS

1. Introduction

In some cases, often involving a RCRA violation, a violator can completely avoid one-time capital expenditures or nondepreciable costs. This sometimes occurs when the violator delayed pollution control expenditures and the government is now seeking to close the violator's operation. Thus, the violator will never have to incur certain costs. BEN is not designed to directly address this situation. You can use BEN to accurately calculate the economic benefit by using some of the model's intermediate calculations, however. The following discussion shows how you can use BEN to evaluate economic benefit in this type of situation.

2. Procedure for Economic Benefit Calculation

The first step is to run BEN including only the avoided cost, be it a capital expenditure (enter as Variable 2 and select one-time) or an avoided one-time nondepreciable expense (enter as Variable 3).[2] The model will assume that it is a delayed expense, but you will use BEN's intermediate calculations to arrive at the correct answer. When you select the output option for your BEN analysis, select output Option 2. The value shown in both (A) and (B) will be the after-tax one-time capital expenditure or nondepreciable expense in noncompliance year dollars. This is the amount that the violator initially saved.

This amount, however, does not reflect the fact that the violator had use of this money from the time it should have spent the money (the noncompliance date) until it pays the civil penalty (the penalty payment date). In order to determine the total benefit, we want to multiply the value in Item (A) or (B) by the discount rate for the number of months between the noncompliance date and the penalty payment date. This calculation accounts for the appreciation of value as a result of investing the money in alternative uses.

---

[2] For annual expenses, you should complete a separate BEN calculation in the usual manner and combine the results of the two runs as detailed in Section A of this appendix.

You can do this easily by using two other values presented in output Option 2. Apply the percentage increase between items (D) and (E) to the value in item (A) and (B). Thus, first determine the ratio of (E) to (D):

$$\frac{E}{D} = I$$

Then, multiply the value in (A) by I;

Economic benefit as of penalty payment date = A x I.

3. Example of an Avoided One-Time Capital Expenditure Calculation

Assume, for example, that on-time compliance would have required a capital cost of $405,000 in February 1991. However, closure of the plant is required and the capital expenditure is avoided. The penalty payment is expected in April 1995. (The compliance date does not affect BEN's calculation in this instance.) In this case, you only enter a capital cost (Variable 2) and select "one-time". Example inputs are displayed in Exhibit B-3.

Once you have entered your inputs into BEN, select Output Option 2. The results are shown in Exhibit B-4. Note that the value for items (A) and (B) is $278,178. The violator avoided this amount (after-tax) in noncompliance year dollars.

Exhibit B-3

DATA INPUTS FOR EXAMPLE OF AN AVOIDED ONE-TIME CAPITAL EXPENDITURE CALCULATION

1)	A. Case Name B. Profitability Status D. Filing Status	ENTITY X EXAMPLE 1. For-Profit 1. C-Corporation
2)	Capital Investment	$ 405,000 1994 dollars
3)	One-Time Nondepreciable Expenditure	$ 0
4)	Annual Expense	$ 0
5)	Date of Noncompliance	February 1991
6)	Date of Compliance	August 1994
7)	Penalty Payment Date	April 1995
8)	Useful Life	15 Years
9)	Marginal Tax Rate - 1986 and Before	49.6 percent
10)	Marginal Tax Rate - 1987 to 1992	38.6 percent
11)	Marginal Tax Rate - 1993 and Beyond	39.4 percent
12)	Inflation Rate	1.3 percent
13)	Discount Rate: WACC	11.3 percent

Exhibit B-4

EXAMPLE OF AN AVOIDED ONE-TIME CAPITAL EXPENDITURE CALCULATION
OUTPUT OPTION 2

```
  ENTITY X EXAMPLE                          BEN VERSION 4.0 DECEMBER 1, 1993


A.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE IN 1991 DOLLARS $      278178

B.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $      278178

C.  VALUE OF DELAYING EMPLOYMENT OF POLLUTION
    CONTROL EQUIPMENT BY 42 MONTHS PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $      199317

D.  ECONOMIC BENEFIT OF A  42 MONTH DELAY
    IN 1991 DOLLARS (EQUALS B MINUS C)               $       78860

E.  THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT
    DATE,   50 MONTHS AFTER NONCOMPLIANCE            $      123194
                                                          ========



    ->->->->->->->  THE ECONOMIC BENEFIT CALCULATION ABOVE  <-<-<-<-<-<-<-
                      USED THE FOLLOWING VARIABLES:
       USER SPECIFIED VALUES
       ---------------------
     1A. CASE NAME = ENTITY X EXAMPLE
     1B. PROFIT STATUS =                  FOR-PROFIT
     1C. FILING STATUS =                  C-CORPORATION
     2. INITIAL CAPITAL INVESTMENT (ONE TIME) = $     405000  1994 DOLLARS
     3. ONE-TIME NONDEPRECIABLE EXPENDITURE =   $          0
     4. ANNUAL EXPENSE =                        $          0
     5. FIRST MONTH OF NONCOMPLIANCE =                     2, 1991
     6. COMPLIANCE DATE =                                  9, 1994
     7. PENALTY PAYMENT DATE =                             4, 1995

     STANDARD VALUES
     ---------------
     8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =          15 YEARS
     9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =      49.6 %
    10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =         38.6 %
    11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =      39.4 %
    12. ANNUAL INFLATION RATE =                              1.3 %
    13. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL     11.3 %
```

To compute the economic benefit as of the penalty payment date, first calculate the ratio of (E) to (D):

$$I = \frac{E}{D} = \frac{\$123,194}{\$78,860} = 1.5622$$

Multiply this result by the value in (A):

$$A \times I = \$278,178 \times 1.5622 = \$434,570$$

Thus, the economic benefit resulting from the avoided one-time capital expenditure is $434,570.

4. Example of an Avoided One-Time Nondepreciable Cost Calculation

In this example, the capital and annual costs are set to zero. The one time avoided nondepreciable expenditure (Variable 3), (for employee training, for example), is $210,000. Example inputs are displayed in Exhibit B-5.

Once you have completed your inputs, select Output Option 2. The results are shown in Exhibit B-6. Note that the value for items (A) and (B) is $124,039. The violator avoided an on-time after-tax cost of this amount in noncompliance year dollars.

To compute the economic benefit as of the penalty payment date, first calculate the ratio of (E) to (D):

$$I = \frac{E}{D} = \frac{\$56,211}{\$35,982} = 1.5622$$

Multiply this result by the value in (A) and (B):

$$A \times I = \$124,039 \times 1.5622 = \$193,774$$

Thus, the economic benefit resulting from the avoided nondepreciable expenditure is $193,774.

Exhibit B-5

DATA INPUTS FOR EXAMPLE OF AN AVOIDED ONE-TIME NONDEPRECIABLE COST CALCULATION

1)	A. Case Name B. Profitability Status C. Filing Status	ENTITY X EXAMPLE 1. For-Profit 1. C-Corporation
2)	Capital Investment	$ 0
3)	One-Time Nondepreciable Expenditure	$210,000, 1994 dollars, tax-deductible
4)	Annual Expense	$ 0
5)	Date of Noncompliance	February 1991
6)	Date of Compliance	August 1994
7)	Penalty Payment Date	April 1995
8)	Useful Life	15 Years
9)	Marginal Tax Rate - 1986 and Before	49.6 percent
10)	Marginal Tax Rate - 1987 to 1992	38.6 percent
11)	Marginal Tax Rate - 1993 and Beyond	39.4 percent
12)	Inflation Rate	1.3 percent
13)	Discount Rate: WACC	11.3 percent

Exhibit B-6

EXAMPLE OF AN AVOIDED ONE-TIME NONDEPRECIABLE COST CALCULATION OPTION OUTPUT 2

```
  ENTITY X EXAMPLE                          BEN VERSION 4.0 DECEMBER 1, 1993
A.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE IN 1991 DOLLARS $       124039

B.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $       124039

C.  VALUE OF DELAYING EMPLOYMENT OF POLLUTION
    CONTROL EQUIPMENT BY 42 MONTHS PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $        88057

D.  ECONOMIC BENEFIT OF A  42 MONTH DELAY
    IN 1991 DOLLARS (EQUALS B MINUS C)               $        35982

E.  THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT
    DATE,   50 MONTHS AFTER NONCOMPLIANCE            $        56211
                                                              =========



    ->->->->->->  THE ECONOMIC BENEFIT CALCULATION ABOVE  <-<-<-<-<-<-
                  USED THE FOLLOWING VARIABLES:
       USER SPECIFIED VALUES
       ---------------------
     1A. CASE NAME = ENTITY X EXAMPLE
     1B. PROFIT STATUS =                FOR-PROFIT
     1C. FILING STATUS =                C-CORPORATION
     2. INITIAL CAPITAL INVESTMENT              = $          0
     3. ONE-TIME NONDEPRECIABLE EXPENDITURE =   $     210000  1994 DOLLARS
        (TAX-DEDUCTIBLE EXPENSE)
     4. ANNUAL EXPENSE =                        $          0
     5. FIRST MONTH OF NONCOMPLIANCE =                     2, 1991
     6. COMPLIANCE DATE =                                  8, 1994
     7. PENALTY PAYMENT DATE =                             4, 1995

       STANDARD VALUES
       ---------------
     8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =       15 YEARS
     9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =      49.6 %
    10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =         38.6 %
    11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =      39.4 %
    12. ANNUAL INFLATION RATE =                              1.3 %
    13. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL     11.3 %
```

C. DELAYED ANNUAL EXPENDITURES

1. Introduction

In some cases, compliance may require a violator to undertake an activity for a certain period of time, such as monitoring groundwater for five years after the installation of a ground water monitoring well. Consequently, delayed compliance results in delayed, not avoided, annual expenditures in these instances. This section explains how to use BEN to determine benefit in these cases, using the guidance on combining multiple runs presented in Section A of this appendix.

2. Procedure for Economic Benefit Calculation

In order to determine economic benefit, a separate BEN run must be performed for each annual cost. Because the cost is delayed and not avoided, it will be entered as a one-time nondepreciable expenditure (Variable 3). Again, as long as the date of penalty payment is the same in each BEN run, the resulting benefits can be added together to arrive at a total benefit figure.

3. Example of a Delayed Annual Expenditure

For example, assume that compliance requires five years of ground-water monitoring at $20,000 per year (in 1994 dollars). The penalty is to be paid in April 1995. The date of noncompliance is February 1991 and the expected date of compliance is February 1994. Consequently, expenditures that were supposed to have taken place in 1991, 1992, 1993, 1994, and 1995 actually occur in 1994, 1995, 1996, 1997, and 1998. In each case, there is a three-year delay in compliance. Therefore, in the first run, set Variable 3, one-time nondepreciable expenditure, at $20,000. The noncompliance date (Variable 5) is February 1991 and the compliance date (Variable 6) is February 1994. The penalty payment date (Variable 7) is April 1995 in each run. You repeat this run five times, adding one year to Variables 5 and 6 each time and leaving the other variables the same. The second run would therefore have a noncompliance date of February 1992 and a compliance date of February 1995; the third run would have a noncompliance date of February 1993 and a compliance date of February 1996; and so on. Exhibit B-7 shows inputs for the first run

of this example. You can then add these five results to arrive at the total economic benefit of delaying these five annual expenditures for three years. The total economic benefit is:

$$\$4,722 + \$4,298 + \$3,712 + \$3,379 + \$3,075 = \$19,186.$$

The outputs of the five runs are displayed in Exhibit B-8.

Exhibit B-7

DATA INPUTS FOR EXAMPLE OF A DELAYED ANNUAL EXPENDITURE

FIRST RUN

1)	A. Case Name B. Profitability Status C. Filing Status	ENTITY X EXAMPLE 1. For-Profit 1. C-Corporation
2)	Capital Investment	$ 0
3)	One-Time Nondepreciable Expenditure	$20,000, 1994 dollars, tax-deductible
4)	Annual Expense	$ 0
5)	Date of Noncompliance	February 1991
6)	Date of Compliance	February 1994
7)	Penalty Payment Date	April 1995
8)	Useful Life	15 Years
9)	Marginal Tax Rate - 1986 and Before	49.6 percent
10)	Marginal Tax Rate - 1987 to 1992	38.6 percent
11)	Marginal Tax Rate - 1993 and Beyond	39.4 percent
12)	Inflation Rate	1.3 percent
13)	Discount Rate: WACC	11.3 percent

Exhibit B-8

EXAMPLE OF A DELAYED ANNUAL EXPENDITURE
OUTPUT OPTION 2

FIRST RUN

```
  ENTITY X EXAMPLE                          BEN VERSION 4.0 DECEMBER 1, 1993

A.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE IN 1991 DOLLARS $        11813

B.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $        11813

C.  VALUE OF DELAYING EMPLOYMENT OF POLLUTION
    CONTROL EQUIPMENT BY 36 MONTHS PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $         8791

D.  ECONOMIC BENEFIT OF A  36 MONTH DELAY
    IN 1991 DOLLARS (EQUALS B MINUS C)               $         3023

E.  THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT
    DATE,   62 MONTHS AFTER NONCOMPLIANCE            $         4722
                                                              ========


    ->->->->->->->  THE ECONOMIC BENEFIT CALCULATION ABOVE  <-<-<-<-<-<-<-
                    USED THE FOLLOWING VARIABLES:
       USER SPECIFIED VALUES
       ---------------------
     1A. CASE NAME = ENTITY X EXAMPLE
     1B. PROFIT STATUS =                FOR-PROFIT
     1C. FILING STATUS                  C-CORPORATION
     2. INITIAL CAPITAL INVESTMENT              = $          0
     3. ONE-TIME NONDEPRECIABLE EXPENDITURE =     $      20000  1994 DOLLARS
     4. ANNUAL EXPENSE =                          $          0
     5. FIRST MONTH OF NONCOMPLIANCE =                       2, 1991
     6. COMPLIANCE DATE =                                    2, 1994
     7. PENALTY PAYMENT DATE =                               4, 1995

       STANDARD VALUES
       ---------------
     8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =          15 YEARS
     9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =        49.6 %
    10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =           38.6 %
    11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =        39.4 %
    12. ANNUAL INFLATION RATE =                                1.3 %
    13. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL       11.3 %
```

Exhibit B-8
(continued)

EXAMPLE OF DELAYED ANNUAL EXPENDITURE
OUTPUT OPTION 2

SECOND RUN

ENTITY X EXAMPLE BEN VERSION 4.0 DECEMBER 1, 1993

A.	VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND OPERATING IT FOR ONE USEFUL LIFE IN 1992 DOLLARS	$	11967
B.	VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE REPLACEMENT CYCLES IN 1992 DOLLARS	$	11967
C.	VALUE OF DELAYING EMPLOYMENT OF POLLUTION CONTROL EQUIPMENT BY 36 MONTHS PLUS ALL FUTURE REPLACEMENT CYCLES IN 1992 DOLLARS	$	8905
D.	ECONOMIC BENEFIT OF A 36 MONTH DELAY IN 1992 DOLLARS (EQUALS B MINUS C)	$	3062
E.	THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT DATE, 50 MONTHS AFTER NONCOMPLIANCE	$	4298

->->->->->-> THE ECONOMIC BENEFIT CALCULATION ABOVE <-<-<-<-<-<-
USED THE FOLLOWING VARIABLES:

USER SPECIFIED VALUES

1A.	CASE NAME = ENTITY X EXAMPLE			
1B.	PROFIT STATUS =	FOR-PROFIT		
1C.	FILING STATUS =	C-CORPORATION		
2.	INITIAL CAPITAL INVESTMENT =	$	0	
3.	ONE-TIME NONDEPRECIABLE EXPENDITURE =	$	20000	1994 DOLLARS
4.	ANNUAL EXPENSE =	$	0	
5.	FIRST MONTH OF NONCOMPLIANCE =		2, 1992	
6.	COMPLIANCE DATE =		2, 1995	
7.	PENALTY PAYMENT DATE =		4, 1995	

STANDARD VALUES

8.	USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =	15 YEARS
9.	MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =	49.6 %
10.	MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =	38.6 %
11.	MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =	39.4 %
12.	ANNUAL INFLATION RATE =	1.3 %
13.	DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL	11.3 %

Exhibit B-8
(continued)

EXAMPLE OF DELAYED ANNUAL EXPENDITURE
OUTPUT OPTION 2

THIRD RUN

ENTITY X EXAMPLE BEN VERSION 4.0 DECEMBER 1, 1993

A.	VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND OPERATING IT FOR ONE USEFUL LIFE IN 1993 DOLLARS	$	11964
B.	VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE REPLACEMENT CYCLES IN 1993 DOLLARS	$	11964
C.	VALUE OF DELAYING EMPLOYMENT OF POLLUTION CONTROL EQUIPMENT BY 36 MONTHS PLUS ALL FUTURE REPLACEMENT CYCLES IN 1993 DOLLARS	$	9021
D.	ECONOMIC BENEFIT OF A 36 MONTH DELAY IN 1993 DOLLARS (EQUALS B MINUS C)	$	2944
E.	THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT DATE, 38 MONTHS AFTER NONCOMPLIANCE	$	3712

->->->->->-> THE ECONOMIC BENEFIT CALCULATION ABOVE <-<-<-<-<-<-
USED THE FOLLOWING VARIABLES:

USER SPECIFIED VALUES

1A.	CASE NAME = ENTITY X EXAMPLE			
1B.	PROFIT STATUS =	FOR-PROFIT		
1C.	FILING STATUS =	C-CORPORATION		
2.	INITIAL CAPITAL INVESTMENT =	$	0	
3.	ONE-TIME NONDEPRECIABLE EXPENDITURE =	$	20000	1994 DOLLARS
4.	ANNUAL EXPENSE =	$	0	
5.	FIRST MONTH OF NONCOMPLIANCE =		2, 1993	
6.	COMPLIANCE DATE =		2, 1996	
7.	PENALTY PAYMENT DATE =		4, 1995	

STANDARD VALUES

8.	USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =	15 YEARS
9.	MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =	49.6 %
10.	MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =	38.6 %
11.	MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =	39.4 %
12.	ANNUAL INFLATION RATE =	1.3 %
13.	DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL	11.3 %

Exhibit B-8
(continued)

EXAMPLE OF DELAYED ANNUAL EXPENDITURE
OUTPUT OPTION 2

FOURTH RUN

```
  ENTITY X EXAMPLE                        BEN VERSION 4.0 DECEMBER 1, 1993


A.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE IN 1994 DOLLARS $        12120

B.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1994 DOLLARS               $        12120

C.  VALUE OF DELAYING EMPLOYMENT OF POLLUTION
    CONTROL EQUIPMENT BY 36 MONTHS PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1994 DOLLARS               $         9138

D.  ECONOMIC BENEFIT OF A  36 MONTH DELAY
    IN 1994 DOLLARS (EQUALS B MINUS C)               $         2982

E.  THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT
    DATE,   26 MONTHS AFTER NONCOMPLIANCE            $         3379
                                                              =========


    ->->->->->->  THE ECONOMIC BENEFIT CALCULATION ABOVE  <-<-<-<-<-<-
                      USED THE FOLLOWING VARIABLES:
       USER SPECIFIED VALUES
       ---------------------
     1A. CASE NAME = ENTITY X EXAMPLE
     1B. PROFIT STATUS =                  FOR-PROFIT
     1C. FILING STATUS =                  C-CORPORATION
     2. INITIAL CAPITAL INVESTMENT              = $          0
     3. ONE-TIME NONDEPRECIABLE EXPENDITURE =     $      20000  1994 DOLLARS
     4. ANNUAL EXPENSE =                          $          0
     5. FIRST MONTH OF NONCOMPLIANCE =                       2, 1994
     6. COMPLIANCE DATE =                                    2, 1997
     7. PENALTY PAYMENT DATE =                               4, 1995

       STANDARD VALUES
       ---------------
     8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =        15 YEARS
     9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =      49.6 %
    10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =         38.6 %
    11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =      39.4 %
    12. ANNUAL INFLATION RATE =                              1.3 %
    13. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL     11.3 %
```

Exhibit B-8
(continued)

EXAMPLE OF DELAYED ANNUAL EXPENDITURE
OUTPUT OPTION 2

FIFTH RUN

```
  ENTITY X EXAMPLE                        BEN VERSION 4.0 DECEMBER 1, 1993

A.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE IN 1995 DOLLARS $        12278

B.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1995 DOLLARS               $        12278

C.  VALUE OF DELAYING EMPLOYMENT OF POLLUTION
    CONTROL EQUIPMENT BY 36 MONTHS PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1995 DOLLARS               $         9257

D.  ECONOMIC BENEFIT OF A  36 MONTH DELAY
    IN 1995 DOLLARS (EQUALS B MINUS C)               $         3021

E.  THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT
    DATE,   14 MONTHS AFTER NONCOMPLIANCE            $         3075
                                                              =========



->->->->->->  THE ECONOMIC BENEFIT CALCULATION ABOVE  <-<-<-<-<-<-<-
                  USED THE FOLLOWING VARIABLES:
    USER SPECIFIED VALUES
    ---------------------
 1A. CASE NAME = ENTITY X EXAMPLE
 1B. PROFIT STATUS =                FOR-PROFIT
 1C. FILING STATUS =                C-CORPORATION
 2. INITIAL CAPITAL INVESTMENT              = $          0
 3. ONE-TIME NONDEPRECIABLE EXPENDITURE =     $      20000   1994 DOLLARS
 4. ANNUAL EXPENSE =                          $          0
 5. FIRST MONTH OF NONCOMPLIANCE =                       2, 1995
 6. COMPLIANCE DATE =                                    2, 1998
 7. PENALTY PAYMENT DATE =                               4, 1995

    STANDARD VALUES
    ---------------
 8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =          15 YEARS
 9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =        49.6 %
10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =           38.6 %
11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =        39.4 %
12. ANNUAL INFLATION RATE =                                1.3 %
13. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL       11.3 %
```

D. HANDLING MUNICIPAL GRANTS

1. Introduction

In some cases involving government entities or not-for-profit organizations, municipal grants are available to defer the cost of pollution control equipment or other compliance expenditures. Cost figures in BEN should be adjusted to account for any portion covered by federal or state grants. Such grants are most likely to support only an initial expenditure (a one-time grant).[3] In some cases, by failing to comply on-time, an entity may have missed a grant opportunity because the funds are not available in the delay case. This section describes how to address cases involving municipal grants. There are three possible scenarios: 1) the grant was available in both the delay and the on-time case; 2) the grant was available only in the on-time case; 3) the grant was available only in the delay case. Note that in order to consider a grant available in the on-time case, the violator must conclusively demonstrate that the grant money was available, and that the violator would have received it had it applied.

2. One-Time Grant Available in Both the On-Time and the Delay Cases

If the grant supports an initial capital investment (Variable 2) or a one-time nondepreciable expenditure (Variable 3), you must make the adjustment to the one-time nondepreciable expenditure value. Enter the difference between the total one-time nondepreciable costs and the amount of the grant as the adjusted one-time nondepreciable expenditure value. The difference will be negative if the original one-time expenditure is less than the grant amount or is zero. BEN will accept a negative value for Variable 3.

For example, suppose a project requires an immediate expenditure of $350,000; $275,000 to construct pollution control equipment and $75,000 to purchase land. You would normally enter $275,000 as the initial capital investment (Variable 2) and $75,000 as the one-time nondepreciable expenditure (Variable 3). Suppose, however, that a $100,000 construction grant will be made

[3] In the event that the grant includes provisions for supporting future replacement cycles of equipment, the user should contact Jonathan Libber at the EPA Office of Enforcement for assistance.

available to support the initial expenditure.[4] You would adjust Variable 3 to account for this one-time grant by subtracting the grant amount of $100,000 from the original one-time expenditure of $75,000. Thus, you would enter a negative $25,000 for Variable 3.[5] The inputs for this example are shown in Exhibit B-9. Exhibit B-10 shows the BEN output for this one-time grant case. The economic benefit is $115,234.

[4] This assumes that the grant would have been available in the on-time case also. If not, see Section 4.

[5] If no one-time expenditure were required, you would enter a negative $100,000, the difference between zero and the $100,000 grant, as the value for Variable 3.

Exhibit B-9

DATA INPUTS FOR EXAMPLE INVOLVING A ONE-TIME GRANT

1)	A. Case Name B. Profitability Status C. Filing Status	ENTITY X EXAMPLE 1. For-Profit 1. C-Corporation
2)	Capital Investment	$ 275,000 1994 dollars recurring
3)	One-Time Nondepreciable Expenditure	$ -25,000
4)	Annual Expense	$ 0
5)	Date of Noncompliance	February 1991
6)	Date of Compliance	August 1994
7)	Penalty Payment Date	April 1995
8)	Useful Life	15 Years
9)	Marginal Tax Rate - 1986 and Before	49.6 percent
10)	Marginal Tax Rate - 1987 to 1992	38.6 percent
11)	Marginal Tax Rate - 1993 and Beyond	39.4 percent
12)	Inflation Rate	1.3 percent
13)	Discount Rate: WACC	11.3 percent

Exhibit B-10

OUTPUT FOR EXAMPLE INVOLVING A ONE-TIME GRANT
OUTPUT OPTION 2

```
  ENTITY X EXAMPLE                        BEN VERSION 4.0 DECEMBER 1, 1993


A.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE IN 1991 DOLLARS $       174119

B.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $       234723

C.  VALUE OF DELAYING EMPLOYMENT OF POLLUTION
    CONTROL EQUIPMENT BY 36 MONTHS PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS               $       168447

D.  ECONOMIC BENEFIT OF A  42 MONTH DELAY
    IN 1991 DOLLARS (EQUALS B MINUS C)               $        66276

E.  THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT
    DATE,   62 MONTHS AFTER NONCOMPLIANCE            $       115234
                                                             ========


    ->->->->->->->  THE ECONOMIC BENEFIT CALCULATION ABOVE  <-<-<-<-<-<-<-
                    USED THE FOLLOWING VARIABLES:
       USER SPECIFIED VALUES
       ---------------------
     1A. CASE NAME = ENTITY X EXAMPLE
     1B. PROFIT STATUS =                FOR-PROFIT
     1C. FILING STATUS =                C-CORPORATION
     2. INITIAL CAPITAL INVESTMENT (RECURRING)= $     275000  1994 DOLLARS
     3. ONE-TIME NONDEPRECIABLE EXPENDITURE =   $     -25000  1994 DOLLARS
        (TAX-DEDUCTIBLE EXPENSE)
     4. ANNUAL EXPENSE =                        $          0
     5. FIRST MONTH OF NONCOMPLIANCE =                     2, 1991
     6. COMPLIANCE DATE =                                  8, 1994
     7. PENALTY PAYMENT DATE =                             4, 1995

       STANDARD VALUES
       ---------------
     8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =       15 YEARS
     9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =      49.6 %
    10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =         38.6 %
    11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =      39.4 %
    12. ANNUAL INFLATION RATE =                              1.3 %
    13. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL     11.3 %
```

3. Grant Available in "On-Time" Case Only

In some cases, grants may have been available if the violator had complied on time, but are not available in the delay case. Again, BEN is not designed to determine benefit in this instance, but you can use the outputs of the model to account for an expired grants program.

In the event that the grant would have been available only once, first follow the procedure for determining BEN when no grant is available (i.e., conduct a normal BEN run). Second, to calculate the economic benefit lost as a result of the missed grant opportunity, you must determine the value of the grant as of the penalty payment date. To do this, calculate the ratio of output (E) to output (D). Then multiply the result, I, by the original grant amount. This translates the value of the grant in the noncompliance year to its value as of the penalty payment date. Third, subtract the value of the grant from the economic benefit to calculate the total benefit of delayed compliance.

For example, assume that compliance requires a recurring $405,000 capital expenditure on equipment, as well as a $210,000 one-time cost and annual costs of $85,750. Further, had the violator complied on time, he or she would have received a $100,000 grant for the initial purchase of the equipment. However, due to the expiration of the grant program, this money is no longer available. The dates of noncompliance, compliance, and penalty payment are the same as in the preceding examples. The inputs are shown in Exhibit B-11. The outputs in Exhibit B-12 show that the economic benefit of the delay without a grant program is $453,194. In order to adjust that benefit for the missed grant opportunity, determine the ratio of (E) to (D):

$$I = \frac{E}{D} = \frac{\$453,194}{\$290,104} = 1.5622.$$

Multiply this result by the value of the grant:

$$A \times I = \$100,000 \times 1.5622 = \$156,220.$$

Thus the economic benefit is the difference between:

$453,194 - $156,220 - $296,974

It is possible for the effect of the missed grant opportunity to outweigh a positive economic benefit, making the total economic benefit negative. In the case above, however, the economic benefit of the delay is more valuable than the expired grant opportunity.

Exhibit B-11

DATA INPUTS FOR EXAMPLE OF MISSED GRANT OPPORTUNITY

1)	A. Case Name B. Profitability Status C. Filing Status	ENTITY X EXAMPLE 1. For-Profit 1. C-Corporation
2)	Capital Investment	$405,000 1994 dollars, recurring
3)	One-Time Nondepreciable Expenditure	$210,000 1994 dollars tax deductible
4)	Annual Expense	$85,750 1994 dollars
5)	Date of Noncompliance	February 1991
6)	Date of Compliance	August 1994
7)	Penalty Payment Date	April 1995
8)	Useful Life	15 Years
9)	Marginal Tax Rate - 1986 and Before	49.6 percent
10)	Marginal Tax Rate - 1987 to 1992	38.6 percent
11)	Marginal Tax Rate - 1993 and Beyond	39.4 percent
11)	Inflation Rate	1.3 percent
12)	Discount Rate: WACC	11.3 percent

Exhibit B-12

OUTPUT FOR EXAMPLE INVOLVING A MISSED GRANT OPPORTUNITY

OUTPUT OPTION 2

```
  ENTITY X EXAMPLE                          BEN VERSION 4.0 DECEMBER 1, 1993

A.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE IN 1991 DOLLARS  $      804906

B.  VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND
    OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS                $     1023472

C.  VALUE OF DELAYING EMPLOYMENT OF POLLUTION
    CONTROL EQUIPMENT BY 42 MONTHS PLUS ALL FUTURE
    REPLACEMENT CYCLES IN 1991 DOLLARS                $      733367

D.  ECONOMIC BENEFIT OF A  42 MONTH DELAY
    IN 1991 DOLLARS (EQUALS B MINUS C)                $      290104

E.  THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT
    DATE,   62 MONTHS AFTER NONCOMPLIANCE             $      453194
                                                           =========


    ->->->->->->->  THE ECONOMIC BENEFIT CALCULATION ABOVE  <-<-<-<-<-<-<-
                    USED THE FOLLOWING VARIABLES:
       USER SPECIFIED VALUES
       ---------------------
     1A. CASE NAME = ENTITY X EXAMPLE
     1B. PROFIT STATUS =                  FOR-PROFIT
     1C. FILING STATUS                    C-CORPORATION
     2. INITIAL CAPITAL INVESTMENT (RECURRING)= $     405000  1994 DOLLARS
     3. ONE-TIME NONDEPRECIABLE EXPENDITURE =   $     210000  1994 DOLLARS
        (TAX-DEDUCTIBLE EXPENSE)
     4. ANNUAL EXPENSE =                        $      85750  1994 DOLLARS
     5. FIRST MONTH OF NONCOMPLIANCE =                   2, 1991
     6. COMPLIANCE DATE =                                8, 1994
     7. PENALTY PAYMENT DATE =                           4, 1995

       STANDARD VALUES
       ---------------
     8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =          15 YEARS
     9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =      49.6 %
    10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =         38.6 %
    11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =      39.4 %
    12. ANNUAL INFLATION RATE =                              1.3 %
    13. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL     11.3 %
```

4. Grant Available in "Delay" Case Only

Cases may arise in which a grant is available in the delay case that would not have been available had the violator complied on time. In such instances, the economic benefit will be larger than it would have been without the grant program. The violator earns two types of benefit from delaying compliance. The first component is the economic benefit associated with delaying expenditures that is calculated in typical BEN analyses. The second component is the value of the grant which, although it is spent on compliance, is a net benefit to the violator relative to the expenditures it would have been required to make in the on-time scenario.

These situations are most likely to arise when a municipality is aware of an impending grant program, and delays compliance in order to benefit from that program. These violators have no incentive to apprise the Agency of the grant opportunity, and the Agency will be largely responsible for determining when such opportunities are available and for considering them in the economic benefit calculation.

In order to calculate the first component of the economic benefit in these instances, BEN should be run as in a typical analysis to determine the benefit from delaying and avoiding capital, nondepreciable, and annual expenses. However, BEN cannot be used to determine the value of the grant opportunity (i.e., the second component of the municipality's benefit in these cases). In order to calculate this second component, the value of the grant should be compounded or discounted at the appropriate discount rate to the penalty payment date (depending on whether the compliance date is before or after the penalty payment date) and added to the economic benefit as calculated by BEN. The user should contact the Office of Enforcement at (202) 260-6777 or consult a financial analyst for assistance in these cases.

Appendix C:

SUPPLEMENTAL ENVIRONMENTAL PROJECT COST CALCULATION INSTRUCTIONS

December 1993

INSTRUCTIONS FOR USING BEN TO CALCULATE THE VALUE OF A SUPPLEMENTAL ENVIRONMENTAL PROJECT — APPENDIX C

A. INTRODUCTION

In certain environmental enforcement cases, the defendant/respondent will be allowed to perform a "Supplemental Environmental Project" in exchange for a reduction in the proposed monetary penalty.[1] Five categories of projects are considered as potential Supplemental Environmental Projects: 1) pollution prevention projects, 2) pollution reduction projects, 3) environmental restoration projects, 4) environmental auditing projects, and 5) enforcement related public awareness projects. The final assessed penalty may be reduced to reflect a commitment to undertake environmentally beneficial expenditures. In particular, the penalty may be reduced by no more than the after-tax amount the violator spends on the project.[2] According to EPA guidance:

> "EPA should calculate the net present after tax value of the supplemental project at the time that the assessed penalty is being calculated. If a supplemental project is approved, a portion of the gravity component of the penalty may be mitigated by an amount up to the net present after-tax cost of the supplemental project, depending on the level of environmental benefits to the public."[3]

---

[1] See memorandum from James K. Strock, "Policy on the Use of Supplemental Environmental Projects in EPA Settlements" dated February 12, 1991 for details on acceptable projects. The memorandum amends the section on "Alternative Payments" in GM-22 (pages 24-27).

[2] Note that it is important to compare the after-tax costs of the project to the penalty. Project costs are tax-deductible while penalties are not. If you use before-tax costs of the project, you will compute an excessive credit. BEN automatically converts costs to an after-tax basis.

[3] SEP Policy, Feb. 1991, page 10.

You can use EPA's BEN computer model to calculate the amount of money that the government could reduce the penalty to compensate for a supplemental environmental project. The following instructions describe the steps you can take to obtain this value.[4] The process described below calculates the Net Present Value (NPV) of the after-tax costs as of the date the penalty will be paid.[5] Note that a model is currently being developed to directly calculate the value of a Supplemental Environmental Project. This model, called PROJECT, will be available in the summer of 1994.

B. PROCEDURE FOR CALCULATING THE VALUE OF A SUPPLEMENTAL ENVIRONMENTAL PROJECT AS OF THE SETTLEMENT DATE

To use BEN to calculate the NPV of a supplemental environmental project, respond to the BEN inputs as shown in Exhibit C-1. Once you have completed your data inputs, select Output Option 2. **Calculation C in Output Option 2 expresses the project's NPV as of the settlement date** (input as the Noncompliance Date).

In determining your inputs for the BEN run, there are a couple of points to keep in mind:

1. If the project involves a capital cost, you should assume that the capital cost is one-time rather than recurring. This is because future replacement of capital equipment is speculative. There is no practical way for the Agency to assure that the violator will replace the equipment ten to twenty years in the future.

2. Use the same discount and inflation rate you used in computing the economic benefit for the violation. In other words, if you modified the discount rate or inflation rate in your BEN analysis, use those adjusted values to evaluate the supplemental project.

---

[4] This guidance updates the instructions provided in the memorandum from Thomas L. Adams, "Guidance on Calculating After Tax Net Present Value of Alternative Payments" dated October 28, 1986.

[5] See Chapter 1 and Appendix A for an explanation of the concept of net present value.

Exhibit C-1

DATA INPUTS FOR SUPPLEMENTAL ENVIRONMENTAL PROJECT CALCULATION

Data Input	User Entry
1.A. Case Name	The name of the violator
1.B. Profit Status	Enter for-profit or not-for-profit, depending on type of organization
1.C. Filing Status	Enter C-corporation or other than C-corporation, depending on income tax filing status of violator
2. Depreciable Costs One-time/Recurring	Any equipment purchases or building construction costs Generally one-time
3. One-time Nondepreciable Costs	Any expenditures for recordkeeping, training, land or other one-time expenses
4. Annual Costs	Enter zero (see pg. C-4)
5. Noncompliance Date	The expected settlement or penalty payment date
6. Compliance Date	The date the costs of the supplemental environmental project is installed and operating
7. Penalty Payment Date	Same as the Compliance Date (Variable 6)
Use Standard Values?	Yes, if used for economic benefit calculation. Adjust only if you used a different inflation rate or discount rate in your economic benefit analysis.
8. Useful Life	BEN standard value
9. Marginal tax rate for 1986 and before	BEN standard value
10. Marginal tax rate for 1987 to 1992	BEN standard value
11. Marginal tax rate for 1993 and beyond	BEN standard value
12. Inflation	BEN standard value
13. Discount Rate	BEN standard value

3. In general, do not calculate an NPV for annual costs. BEN is not an appropriate method for calculating an annual cost credit because it assumes that annual costs continue infinitely, and computes the net present value of those after tax costs. This will result in too large a credit. Note that this guidance differs from that in Thomas Adam's memo of October 28, 1986, which does consider annual cost credits. After reconsidering this approach, however, it is strongly recommended that you not use BEN in evaluating credits for annual costs, because the credit could be excessive. Please consult with EPA headquarters (phone number below) if you want to consider an annual cost credit. Headquarters personnel can assist you in performing a manual net present value calculation, if appropriate.

If you have any questions or concerns, please call Jonathan Libber at (202) 260-6777.

C. SUPPLEMENTAL ENVIRONMENTAL PROJECT EXAMPLE

Assume that the defendant/respondent in a Clean Air Act/Stationary Source case has proposed to perform a supplemental environmental project to reduce its penalty. The case is expected to settle in September 1994. The project involves the addition of state-of-the-art stack emissions control technology in addition to the emission controls necessary to remain in compliance. This project would reduce emissions significantly below permit requirements. The costs of the project are estimated in a document dated December 1993. The project, which will be initiated on January 1, 1995, involves a capital investment of $475,000 for equipment which you assume will not be replaced. You do not expect any additional annual costs. You decide to use BEN standard values for the remaining inputs. Your inputs to BEN are shown in Exhibit C-2.

Once you complete your inputs, select Output Option 2. The results are shown in Exhibit C-3. The net after-tax present value of these expenditures as of the settlement date, September 1994, is $331,660 shown as Calculation C. (For your convenience, this is highlighted.) This is the maximum amount by which you should reduce the penalty to account for the supplemental environmental project. You can reduce the penalty less than this amount; this is a judgment for the litigation team. At the bottom of the page, BEN reiterates the inputs that you have used to make this calculation.

Exhibit C-2

INPUTS FOR SUPPLEMENTAL ENVIRONMENTAL PROJECT EXAMPLE

1.A.	Case Name	Violator
1.B.	Profit Status	1 (For Profit)
1.C.	Filing Status	1 (C-Corporation)
2.	Depreciable Costs One-Time/Recurring	$475,000 1993 dollars One-Time
3.	One-time Nondepreciable Costs	None
4.	Annual Costs	None
5.	Noncompliance Date	September 1994
6.	Compliance Date	January 1995
7.	Penalty Payment Date	January 1995
8.	Useful Life	15 years
9.	Tax rate (1986 and before)	49.6%
10.	Tax rate (1987 to 1992)	38.6%
11.	Tax rate (1993 and beyond)	39.4%
12.	Inflation	1.3%
13.	Discount rate	11.3%

Exhibit C-3

BEN OUTPUT FOR SUPPLEMENTAL ENVIRONMENTAL PROJECT EXAMPLE

VIOLATOR BEN VERSION 4.0 DECEMBER 1, 1993

A.	VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND OPERATING IT FOR ONE USEFUL LIFE IN 1993 DOLLARS	$	342233
B.	VALUE OF EMPLOYING POLLUTION CONTROL ON-TIME AND OPERATING IT FOR ONE USEFUL LIFE PLUS ALL FUTURE REPLACEMENT CYCLES IN 1993 DOLLARS	$	342233
C.	**VALUE OF DELAYING EMPLOYMENT OF POLLUTION CONTROL EQUIPMENT BY 4 MONTHS PLUS ALL FUTURE REPLACEMENT CYCLES IN 1993 DOLLARS**	**$**	**331660**
D.	ECONOMIC BENEFIT OF A 4 MONTH DELAY IN 1993 DOLLARS (EQUALS B MINUS C)	$	10573
E.	THE ECONOMIC BENEFIT AS OF THE PENALTY PAYMENT DATE, 4 MONTHS AFTER NONCOMPLIANCE	$	10957

->->->->->-> THE ECONOMIC BENEFIT CALCULATION ABOVE <-<-<-<-<-<-
USED THE FOLLOWING VARIABLES:

USER SPECIFIED VALUES

1A.	CASE NAME =		VIOLATOR
1B.	PROFIT STATUS =		FOR-PROFIT
1C.	FILING STATUS =		C-CORPORATION
2.	INITIAL CAPITAL INVESTMENT (ONE TIME) =	$	475000 1993 DOLLARS
3.	ONE-TIME NONDEPRECIABLE EXPENDITURE =	$	0
4.	ANNUAL EXPENSE =	$	0
5.	FIRST MONTH OF NONCOMPLIANCE =		9, 1994
6.	COMPLIANCE DATE =		1, 1995
7.	PENALTY PAYMENT DATE =		1, 1995

STANDARD VALUES

8.	USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT =	15 YEARS
9.	MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE =	49.6 %
10.	MARGINAL INCOME TAX RATE FOR 1987 TO 1992 =	38.6 %
11.	MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND =	39.4 %
12.	ANNUAL INFLATION RATE =	1.3 %
13.	DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL	11.3 %