

APR 29 1994

*Aug 3 113030*

License No.: 20-19808-01  
Docket No.: 30-19268  
Control No.: 113030

Biogen Research Corporation  
ATTN: Frederic A. Eustis III  
Vice President-General Counsel  
14 Cambridge Center  
Cambridge, Massachusetts 02142

Dear Mr. Eustis:

Subject: Financial Assurance

This is in reference to your submittals dated July 27, 1990, July 30, 1990, January 27, 1992, Decommissioning Funding Plan dated September 22, 1993 and letter dated April 8, 1994 with attached, Letter of Credit and Standby Trust Agreement to establish financial assurance for NRC License No. 20-19808-01. We have reviewed your submittals and within the scope of our review, no further deficiencies were identified.

Based on our review of your submittals, you are now in compliance with the requirements of 10 CFR 30.35. Please note that financial assurance certification and all associated documentation are required to be updated with significant changes in your operation and with each application for license renewal.

If you have any questions regarding this letter, please call David Everhart at (610) 337-6936. Thank you for your cooperation in this matter.

Sincerely,

Original Signed By:  
Mohamed M. Shanbaky

Mohamed M. Shanbaky, Chief  
Research and Development Section  
Division of Radiation Safety  
and Safeguards

9405260091 940429  
PDR ADOCK 03019268  
C PDR

OFFICIAL RECORD COPY - C:\DOC\DECOMM\BIOGEN.APP - 04/21/94

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ML 10

Biogen

2

bcc:

M. Shanbaky, RI

D. Everhart, RI

DRSS:RI  
Everhart

4/21/94

DRI:RI  
Shanbaky

MS  
4/28/94



030-19268

BIOGEN

April 8, 1994

Via Airborne

Mr. David Everhart  
Research & Development and Decommissioning Section  
Division of Radiation Safety and Safeguards  
Mail Control No. 113030  
United States Nuclear Regulatory Commission  
Region 1  
475 Allendale Road  
King of Prussia, PA 19406-1415

Re: Biogen, Inc. - Decommissioning Funding Plan; License No. 20-19808-01

Dear Mr. Everhart:

In connection with the above-referenced license, as you requested, I enclose for your files an original of the Standby Letter of Credit Amendment and Amendment No. 1 to Trust Agreement.

If you need any further information, please do not hesitate to call.

Sincerely,



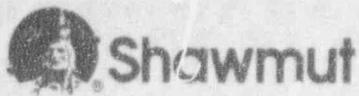
Anne Marie Cook  
Assistant General Counsel

cook.lct.nrcorig

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113030  
APR 11 1994



International Department  
Telex: W.U.I 6817133  
Cable: SHAWMUT  
S.W.I.F.T. ADDRESS: NASH US 33

Shawmut Bank, N.A.  
P.O. Box 2176, Boston, MA 02211-2176, Tel. 617-292-2000

DUPLICATE COPY OF:  
JANUARY 30, 1994  
PAGE 01

STANDARD LETTER OF CREDIT AMENDMENT  
30407854 310

ADVISED BY MAIL DIRECT

U.S. NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20455  
REF: LICENSE # 2041-BCS-01, 02-1403-03

GENTLEMEN

THE ABOVE MENTIONED LETTER OF CREDIT, ISSUED BY ORDER AND FOR ACCOUNT OF BILSON, INC. IS AMENDED AS FOLLOWS:

CREDIT AMOUNT INCREASED BY FIFTY THOUSAND AND NO/100 DOLLARS UNITED STATES CURRENCY (USD 50,000.00) TO A NEW AVAILABLE AMOUNT OF SEVENTY-TWO THOUSAND AND NO/100 DOLLARS UNITED STATES CURRENCY (USD 72,000.00)

DELETE

WE WILL ENDEAVOR TO GIVE PROMPT NOTICE TO THE LICENSEE AND THE DEPARTMENT OF A NOTICE RECEIVED OR ACTION FILED ALLEGING THE INSOLVENCY OR BANKRUPTCY OF THE BANK OR ALLEGING ANY VIOLATIONS OF REGULATORY REQUIREMENTS, WHICH SHALL RESULT IN SUSPENSION OR REVOCATION OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS.

INSERT AND SUBSTITUTE

"THE BANK SHALL GIVE IMMEDIATE NOTICE TO THE APPLICANT AND THE NRC OF ANY NOTICE RECEIVED OR ACTION FILED ALLEGING (1) THE INSOLVENCY OR BANKRUPTCY OF THE FINANCIAL INSTITUTION OR (2) ANY VIOLATIONS OF REGULATORY REQUIREMENTS THAT COULD RESULT IN SUSPENSION OR REVOCATION OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS. THE FINANCIAL INSTITUTION ALSO SHALL GIVE IMMEDIATE NOTICE IF THE BANK, FOR ANY REASONS BECOMES UNABLE TO FULFILL ITS OBLIGATION UNDER THE LETTER OF CREDIT."

THIS AMENDMENT IS TO BE CONSIDERED AS PART OF THE ABOVE MENTIONED LETTER OF CREDIT.

\*\*\* ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED \*\*\*

*James Cook*  
AUTHORIZED SIGNATURE

"This credit is subject to the Uniform Customs and Practice for Documentary Credits' (1993 Revision), International Chamber of Commerce, Publication No. 400"

ABOVE MENTIONED LETTER OF CREDIT, ISSUED BY ORDER AND FOR  
AMOUNT OF BIDGEN, INC. IS AMENDED AS FOLLOWS \* ORDER AND FOR  
D STATES CURRENCY BY FIFTY THOUSAND AND NO/100 DOLLARS  
NEW AVAILABLE AMOUNT OF: SEVENTY-FIVE THOUSAND AND NO/100  
S UNITED STATES CURRENCY (USD 75,000.00)

L ENDEAVOR TO GIVE PROMPT NOTICE TO THE APPLICANT AND THE  
MENT OF A NOTICE RECEIVED OR ACTION TAKEN BY THE APPLICANT  
ENCY OR BANKRUPTCY OF THE BANK OF ALABAMA IN VIOLATIONS  
LATORY REQUIREMENTS OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS.  
TION OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS.

ND SUBSTITUTE  
I SHALL GIVE PROMPT NOTICE TO THE APPLICANT AND THE  
ANY NOTICE RECEIVED OR ACTION TAKEN BY THE APPLICANT  
CY OF BANKRUPTCY OF THE BANK OF ALABAMA IN VIOLATIONS  
S OF REGULATORY REQUIREMENTS OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS.  
ON OF REVOCATION OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS.  
THE FINANCIAL INSTITUTION OR (2) THE  
TION UNDER THE BANK'S CHARTER OR LICENSE TO DO BUSINESS.  
ALSO SHALL GIVE IMMEDIATE  
BECOMES UNABLE TO FULFILL

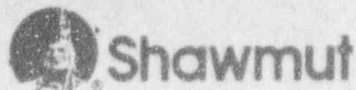
ENT IS TO BE CONSIDERED AS PART OF THE ABOVE MENTIONED  
REDIT

**NOT NEGOTIABLE**

OTHER TERMS AND CONDITIONS REMAIN UNCHANGED \*\*\*

NATURE

original advice



Shawmut

Shawmut Bank, N.A.  
P.O. Box 2176, Boston, MA 02211-2176, Tel. 617-292-2000

International Department  
Telex: W.U.1 681713  
Cable: SHAWMUT  
S.W.I.F.T. ADDRESS: NASH US 33

ADVISING BANK'S COPY

DUPLICATE COPY OF:  
JANUARY 10, 1994  
PAGE 01

STANDBY LETTER OF CREDIT AMENDMENT  
5040785W 010

ADVISED BY MAIL DIRECT:

U.S. NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555  
REF: LICENSE # 20-19809-01, 02-19808-02

GENTLEMEN:

THE ABOVE MENTIONED LETTER OF CREDIT, ISSUED BY ORDER AND FOR  
ACCOUNT OF BIOGEN, INC. IS AMENDED AS FOLLOWS:

CREDIT AMOUNT INCREASED BY FIFTY THOUSAND AND NO/100 DOLLARS  
UNITED STATES CURRENCY (USD 50,000.00)  
TO A NEW AVAILABLE AMOUNT OF: SEVENTY-FIVE THOUSAND AND NO/100  
DOLLARS UNITED STATES CURRENCY (USD 75,000.00)

DELETE:

"WE WILL ENDEAVOR TO GIVE PROMPT NOTICE TO THE APPLICANT AND THE  
DEPARTMENT OF A NOTICE RECEIVED OR ACTION FILED ALLEGING THE  
INSOLVENCY OR BANKRUPTCY OF THE BANK OR ALLEGING ANY VIOLATIONS  
OF REGULATORY REQUIREMENTS WHICH SHALL RESULT IN SUSPENSION OR  
REVOCAION OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS."

INSERT AND SUBSTITUTE:

"THE BANK SHALL GIVE IMMEDIATE NOTICE TO THE APPLICANT AND THE  
NRC OF ANY NOTICE RECEIVED OR ACTION FILED ALLEGING (1) THE  
INSOLVENCY OR BANKRUPTCY OF THE FINANCIAL INSTITUTION OR (2) ANY  
VIOLATIONS OF REGULATORY REQUIREMENTS THAT COULD RESULT IN  
SUSPENSION OR REVOCAION OF THE BANK'S CHARTER OR LICENSE TO DO  
BUSINESS. THE FINANCIAL INSTITUTION ALSO SHALL GIVE IMMEDIATE  
NOTICE IF THE BANK, FOR ANY REASON, BECOMES UNABLE TO FULFILL  
ITS OBLIGATION UNDER THE LETTER OF CREDIT."

THIS AMENDMENT IS TO BE CONSIDERED AS PART OF THE ABOVE MENTIONED  
LETTER OF CREDIT.

\*\*\* ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED \*\*\*

VERY TRULY YOURS,

AUTHORIZED SIGNATURE

INSTRUCTIONS TO THE ADVISING BANK

Please complete and forward to beneficiary the attached original advice  
without adding your confirmation.

NOT NEGOTIABLE  
COPY



## AMENDMENT NO.1 TO TRUST AGREEMENT

THIS AMENDMENT NO. 1 TO TRUST AGREEMENT is entered into as of this 11th day of January, 1994 by and between Biogen, Inc., a Massachusetts corporation (the "Grantor") and the Shawmut Bank, N.A., a national banking association (the "Trustee")

WHEREAS, the U.S. Nuclear Regulatory Commission (the "NRC") has requested that Grantor modify a certain Trust Agreement between Grantor and Trustee dated July 20, 1990 (the "Trust Agreement") to conform to the applicable decommissioning regulatory guide; and

WHEREAS, the Grantor and the Trustee desire to amend the Trust Agreement as set forth herein as requested by the NRC.

NOW THEREFORE, the Grantor and the Trustee agree as follows:

1. Amendment to Trust Agreement.

The Trust Agreement is hereby amended as follows:

- (a) Section 4. The last sentence of Section 4 of the Trust Agreement is deleted in its entirety.
- (b) Section 7. The second sentence of Section 7 of the Trust Agreement is replaced in its entirety with the following:

"The Grantor's certificate presented pursuant to this Section shall not request a withdrawal from the Fund which exceeds 10% of the outstanding balance of the Fund, unless NRC approval is attached."
- (c) Section 10. The last sentence of Section 10 of the Trust Agreement is deleted in its entirety.
- (d) Section 12. The last sentence of Section 12 of the Trust Agreement is deleted in its entirety.
- (e) Section 15. Section 15 of the Trust Agreement is amended by changing the number 30 to the number 90 in the two places in which the number appears in the Section.
- (f) Section 19. Section 19 of the Trust Agreement is replaced in its entirety with the following:

"In investing, reinvesting, exchanging, selling, and managing the Fund, the Trustee shall discharge its duties with respect to the Fund solely in the interest of the beneficiary and with the care, skill, prudence, and diligence under the circumstances

then prevailing which persons of prudence, acting in a like capacity and familiar with such matters, would use in the conduct of an enterprise of a like character and with like aims; except that:

- (i) Securities or other obligations of the Grantor, or any other owner or operator of the facilities, or any of their affiliates as defined in the Investment Company Act of 1940, as amended (15 U.S.C. 80a-2(a)), shall not be acquired or held, unless they are securities or other obligations of the Federal or a State government;
- (ii) The Trustee is authorized to invest the Fund in time or demand deposits of the Trustee, to the extent insured by an agency of the Federal Government, and in obligations of the Federal Government such as GNMA, FNMA, and FHLM bonds and certificates or State and Municipal bonds rated BBB or higher by Standard and Poors or Baa or higher by Moody's Investment Services; and
- (iii) For a reasonable time, not to exceed 60 days, the Trustee is authorized to hold uninvested cash, awaiting investment or distribution, without liability for the payment of interest thereon.

The Trustee shall not incur personal liability of any nature in connection with any act in the administration of this trust or in carrying out any directions of Grantor, the NRC or any state agency issued in accordance with this Agreement other than those liabilities arising out of Trustee's failure to use the standard of care set forth above. The Trustee shall be indemnified by the Grantor from and against any personal liability to which the Trustee may be subjected by reason of any act or conduct in its official capacity, including all expenses reasonably incurred in its defense in the event the Grantor fails to provide such defense, other than those liabilities arising out of Trustee's failure to use the standard of care set forth in this Section."

- (g) Schedule A Schedule A to the Trust Agreement is replaced in its entirety with a revised Schedule A in the form attached as Exhibit A hereto.
- (h) Schedule B Schedule B to the Trust Agreement is replaced in its entirety with a revised Schedule B in the form attached as Exhibit B hereto.
- (i) Specimen Certificate of Events The Specimen Certificate of Events attached to the Trust Agreement is amended by attaching thereto specimen resolutions in the form attached as Exhibit C hereto.

## 2. Effective Date of Trust Agreement.

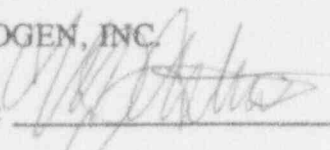
The parties acknowledge that the Trust Agreement became effective on July 20, 1990 and remains in full force and effect on the date hereof.



IN WITNESS WHEREOF, the parties have executed this Agreement as of this 11th day of January 1994.

GRANTOR:

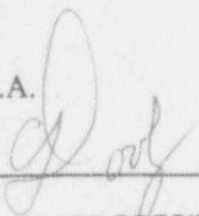
BIOGEN, INC.

By: 

Title: Vice President - General Counsel

TRUSTEE:

SHAWMUT N.A.

By: 

Title: ASSISTANT VICE PRESIDENT

ACKNOWLEDGEMENT

Commonwealth of Massachusetts

County of: Middlesex

On this 11<sup>th</sup> day of January 1994, before me, a notary public in and for the county and State aforesaid, personally appeared Michael J. Atkins, and he did depose that he is the Vice President General Counsel, of Biogen, Inc., which executed the above instrument, that he knows the seal of said company; that the seal affixed to such instrument is such corporate seal; that it was so affixed by order of such company; and that he signed his name thereto by like order.

Barbara A. Murphy  
[Signature of notary public]

My Commission Expires 4-25-97  
[Date]

ACKNOWLEDGEMENT

Commonwealth of Massachusetts

County of: SUFFOLK

On this 13<sup>th</sup> day of January, 1994, before me, a notary public in and for the county and State aforesaid, personally appeared CHARLES E. DOOLEY and he did depose that he is the ASSISTANT VICE PRESIDENT, of Shawmut, N.A., which executed the above instrument, that he knows the seal of said entity; that the seal affixed to such instrument is such corporate seal; that it was so affixed by order of such entity; and that he signed his name thereto by like order.

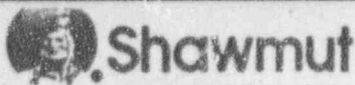
James H. Reynolds  
[Signature of notary public]

My Commission Expires 01-24-97  
[Date]

SCHEDULE A

NRC Licenses of Biogen, Inc.

<u>Location</u>	<u>License Number</u>	<u>Estimated Percentage of Total Cost</u>
14 Cambridge Center	20-19808-01 20-19808-02	87%
215 Bent Street	20-19808-01	1%
241 Binney Street	20-19808-01	10%
345 Vassar Street	20-19808-01	2%



Shawmut Bank, N.A.  
 P.O. Box 2176, Boston, MA 02211-2176, Tel. 617-292-2000

international Department  
 Telex: W.U.I 6817133  
 Cable: SHAWMUT  
 S.W.I.F.T. ADDRESS: SHUS33

APPLICANT'S COPY

EXHIBIT B

STANDBY LETTER OF CREDIT AMENDMENT  
 S040785W 010

JANUARY 10, 1994  
 PAGE 01

ADVISED BY MAIL DIRECT:

U.S. NUCLEAR REGULATORY COMMISSION  
 WASHINGTON, D.C. 20555  
 REF: LICENSE # 20-19808-01, 02-19808-02

GENTLEMEN:

THE ABOVE MENTIONED LETTER OF CREDIT, ISSUED BY ORDER AND FOR  
 ACCOUNT OF BIOGEN, INC. IS AMENDED AS FOLLOWS:

CREDIT AMOUNT INCREASED BY: FIFTY THOUSAND AND NO/100 DOLLARS  
 UNITED STATES CURRENCY (USD 50,000.00)  
 TO A NEW AVAILABLE AMOUNT OF: SEVENTY-FIVE THOUSAND AND NO/100  
 DOLLARS UNITED STATES CURRENCY (USD 75,000.00)

DELETE:

"WE WILL ENDEAVOR TO GIVE PROMPT NOTICE TO THE LICENSEE AND THE  
 DEPARTMENT OF A NOTICE RECEIVED OR ACTION FILED ALLEGING THE  
 INSOLVENCY OR BANKRUPTCY OF THE BANK OR ALLEGING ANY VIOLATIONS  
 OF REGULATORY REQUIREMENTS WHICH SHALL RESULT IN SUSPENSION OR  
 REVOCATION OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS."

INSERT AND SUBSTITUTE:

"THE BANK SHALL GIVE IMMEDIATE NOTICE TO THE APPLICANT AND THE  
 NRC OF ANY NOTICE RECEIVED OR ACTION FILED ALLEGING (1) THE  
 INSOLVENCY OR BANKRUPTCY OF THE FINANCIAL INSTITUTION OR (2) ANY  
 VIOLATIONS OF REGULATORY REQUIREMENTS THAT COULD RESULT IN  
 SUSPENSION OR REVOCATION OF THE BANK'S CHARTER OR LICENSE TO DO  
 BUSINESS. THE FINANCIAL INSTITUTION ALSO SHALL GIVE IMMEDIATE  
 NOTICE IF THE BANK, FOR ANY REASON, BECOMES UNABLE TO FULFILL  
 ITS OBLIGATION UNDER THE LETTER OF CREDIT."

THIS AMENDMENT IS TO BE CONSIDERED AS PART OF THE ABOVE MENTIONED  
 LETTER OF CREDIT.

\*\*\* ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED \*\*\*

VERY TRULY YOURS,

AUTHORIZED SIGNATURE

"This credit is subject to the 'Uniform Customs and Practice for Documentary Credits' (1983 Revision), International Chamber of Commerce, Publication No. 400"

NOT NEGOTIABLE  
 COPY





Shawmut Bank, N.A.

P.O. Box 2176, Boston, MA 02211-2176, Tel. 617-292-2000

EXHIBIT B

International Department  
Telex: W.U.16817133  
Cable: SHAWMUT  
S.W.I.F.T. ADDRESS: NASH US 33

ADVISING BANK'S COPY

IRREVOCABLE STANDBY LETTER OF CREDIT

JULY 26, 1990

S040785W

PAGE 01

U.S. NUCLEAR REGULATORY COMMISSION  
WASHINGTON, DC 20555  
REF: LICENSE # 20-19808-01, 02-19808-02

DEAR SIR OR MADAM:

WE HEREBY, ESTABLISH OUR IRREVOCABLE STANDBY LETTER OF CREDIT IN YOUR FAVOR, AT THE REQUEST AND FOR THE ACCOUNT OF BIOGEN, INC., 14 CAMBRIDGE CTR., CAMBRIDGE, MA 02142, UP TO THE AGGREGATE AMOUNT OF TWENTY FIVE THOUSAND AND 00/100 U.S. DOLLARS \*\*\*\*\*\$25,000.00 AVAILABLE UPON PRESENTATION BY YOU OR YOUR DESIGNEE OF

(1) YOUR SIGHT DRAFT, BEARING REFERENCE TO THIS LETTER OF CREDIT NUMBER S040785W

AND

(2) YOUR SIGNED STATEMENT READING AS FOLLOWS:

"I CERTIFY THAT THE AMOUNT OF THE DRAFT IS PAYABLE PURSUANT TO REGULATIONS ISSUED UNDER AUTHORITY OF THE U.S. NUCLEAR REGULATORY COMMISSION (NRC), AN AGENCY OF THE U.S. GOVERNMENT, PURSUANT TO THE ATOMIC ENERGY ACT OF 1954, AS AMENDED AND THE ENERGY REORGANIZATION ACT OF 1974."

THIS LETTER OF CREDIT IS ISSUED IN ACCORDANCE WITH REGULATIONS ISSUED UNDER THE AUTHORITY OF THE U.S. NUCLEAR REGULATORY COMMISSION (NRC), AN AGENCY OF THE U.S. GOVERNMENT, PURSUANT TO THE ATOMIC ENERGY ACT OF 1954, AS AMENDED, AND THE ENERGY REORGANIZATION ACT OF 1974. THE NRC HAS PROMULGATED REGULATIONS IN TITLE 10, CHAPTER 1 OF THE CODE OF FEDERAL REGULATIONS, PART 30, WHICH REQUIRE THAT A HOLDER OF, OR AN APPLICANT FOR, A LICENSE ISSUED UNDER 10 CFR PART 30, PROVIDE ASSURANCE THAT FUNDS WILL BE AVAILABLE WHEN NEEDED FOR DECOMMISSIONING.

THIS LETTER OF CREDIT IS EFFECTIVE AS OF JULY 26, 1990 AND SHALL EXPIRE ON JULY 26, 1991, BUT SUCH EXPIRATION DATE SHALL BE AUTOMATICALLY EXTENDED FOR A PERIOD OF ONE YEAR ON JULY 26, 1991 AND ON EACH SUCCESSIVE EXPIRATION DATE, UNLESS, AT LEAST 90 DAYS BEFORE THE CURRENT EXPIRATION DATE, WE NOTIFY BOTH YOU AND BIOGEN, INC. BY RETURN RECEIPT THAT WE HAVE DECIDED NOT TO EXTEND THIS LETTER OF CREDIT BEYOND THE CURRENT EXPIRATION DATE. IN THE EVENT YOU ARE SO NOTIFIED, ANY UNUSED PORTION OF THE CREDIT SHALL BE AVAILABLE UPON PRESENTATION OF YOUR SIGHT DRAFT WITHIN 90 DAYS AFTER THE DATE OF RECEIPT OF NOTIFICATION BY BOTH YOU AND BIOGEN, INC. AS SHOWN ON THE LATER OF THE SIGNED RETURN RECEIPTS AND READING AS FOLLOWS:

INSTRUCTIONS TO THE ADVISING BANK

Please complete and forward to beneficiary the attached original advice without adding your confirmation

CONTINUED

NOT NEGOTIABLE  
COPY

7/2/91 (4/87)





Shawmut Bank, N.A.

P.O. Box 2176, Boston, MA 02211-2176, Tel 617 292-2000

EXHIBIT B

International Department  
Telex: W.U.I 6817133  
Cable: SHAWMUT  
S.W.I.F.T. ADDRESS: NASH US 33

ADVISING BANK'S COPY

IRREVOCABLE STANDBY LETTER OF CREDIT

JULY 26, 1990

5040785W

PAGE 02

U.S. NUCLEAR REGULATORY COMMISSION  
WASHINGTON, DC 20555  
REF: LICENSE # 20-19808-01, 02-19808-02

"WE CERTIFY THAT THE LICENSEE HAS FAILED TO REPLACE THIS LETTER OF CREDIT WITH OTHER COLLATERAL ACCEPTABLE TO THE DEPARTMENT WITHIN 30 DAYS OF THE BANK'S NOTICE TO TERMINATE THE LETTER OF CREDIT."

WHENEVER THIS LETTER OF CREDIT IS DRAWN ON, UNDER, AND IN COMPLIANCE WITH THE TERMS OF THIS CREDIT, WE SHALL DULY HONOR SUCH DRAFT UPON PRESENTATION TO US, AND WE SHALL DEPOSIT THE AMOUNT OF THE DRAFT DIRECTLY INTO THE STANDBY TRUST OF BIOGEN, INC. IN ACCORDANCE WITH YOUR INSTRUCTIONS.

WE WILL ENDEAVOR TO GIVE PROMPT NOTICE TO THE LICENSEE AND THE DEPARTMENT OF A NOTICE RECEIVED OR ACTION FILED ALLEGING THE INSOLVENCY OR BANKRUPTCY OF THE BANK OR ALLEGING ANY VIOLATIONS OF REGULATORY REQUIREMENTS WHICH SHALL RESULT IN SUSPENSION OR REVOCATION OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS.

DRAFTS DRAWN HEREUNDER MUST BE MARKED "DRAWN UNDER SHAWMUT BANK, N.A., CREDIT NO. 5040785W DATED JULY 26, 1990".

D.C. PENNYBAKER ASSISTANT VICE PRESIDENT JULY 26, 1990

THIS CREDIT IS SUBJECT TO THE UNIFORM CUSTOMS AND PRACTICE FOR DOCUMENTARY CREDITS (1983 REVISION) INTERNATIONAL CHAMBER OF COMMERCE, PUBLICATION NO 400.

NOT NEGOTIABLE COPY

INSTRUCTIONS TO THE ADVISING BANK

Please complete and forward to beneficiary the attached original advice without adding your confirmation

72711 (4/87)

SPECIMEN CERTIFICATE OF RESOLUTION

I, \_\_\_\_\_, do hereby certify that I am Secretary of Biogen, Inc., a Massachusetts corporation, and that the resolution listed below was duly adopted at a meeting of this Corporation's Board of Directors on \_\_\_\_\_, 19 \_\_\_\_.

IN WITNESS WHEREOF, I have hereunto signed my name and affixed the seal of this Corporation this \_\_\_\_ day of \_\_\_\_\_, 19 \_\_\_\_.

\_\_\_\_\_  
Secretary

RESOLVED, that this Board of Directors hereby authorizes the President, or such other employee of the Company as he may designate, to commence decommissioning activities at [insert name of facility] in accordance with the terms and conditions described to this Board of Directors at this meeting and with such other terms and conditions as the President shall approve with and upon the advice of counsel.

**Arthur D Little**

**Biogen, Inc.  
Decommissioning  
Cost Estimate**

Final Report to  
Biogen, Inc.  
14 Cambridge Center  
Cambridge, MA 02142

September 22, 1993

Arthur D. Little, Inc.  
Acorn Park  
Cambridge, Massachusetts  
02140-2390

Reference 44806-01

OFFICIAL RECORD COPY

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JAN 21 1994

Notice

This report was prepared by Arthur D. Little, Inc., at the request of Biogen, Inc. The material in this report reflects Arthur D. Little's best judgement in light of the information available at the time of preparation. Any use that a third party makes of this report, or reliance on, or any decisions to be made based on it, is the responsibility of such third party. Arthur D. Little, Inc., accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

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As a part of the Nuclear Regulatory Commission (NRC) radioactive materials license regulations, Biogen has submitted a decommissioning funding plan as specified in Part 30.35 "Financial Assurance and Recordkeeping for Decommissioning," Title 10 of the Code of Federal Regulations (CFR). In preparing a decommissioning funding plan, a site-specific decommissioning cost estimate must be prepared. Biogen must assure that financial resources are in place to decommission its licensed operations, and also provide for the estimated costs of handling, transport, and ultimate disposal of material contaminated with radioactivity.

This report provides a best estimate of the cost of decommissioning Biogen facilities based on currently available waste disposal facilities and costs, and NRC guidance documents (as referenced).

### Structure of this report

Sections 1 through 5 of this report correspond to the five separate tasks involved in preparing the decommissioning cost estimate. A summary of the decommissioning cost estimate is presented in Section 6 and references are included in Section 7. Brief descriptions of the contents of the report are as follows:

- **Section 1: Estimate of Time Required for Planning and Preparation of the Decommissioning Plan**  
The decommissioning cost estimate begins with estimates of time allowances required for a period of planning and preparation before the decommissioning of a facility or a site can begin. Planning and preparation includes activities to ensure that the decommissioning effort is performed in a safe and cost-effective manner in accordance with all applicable federal, state and local regulations.
- **Section 2: Estimate of Decontamination and Dismantling Costs**  
Decontamination and dismantling cost estimates for Biogen facilities where radionuclides are used in an unsealed form are projected for decommissioning activities. Since Biogen is involved in low-level radionuclide studies and uses proper contamination control techniques, it is expected that all facility components will be decontaminated to unrestricted release levels (with the exception of sink traps and drains which will require dismantling). In fact, according to the NRC,<sup>1</sup> decontamination of facility components is typically the best alternative for decommissioning radionuclide laboratory facilities. It should also be noted that Biogen uses one sealed source however, because this radioactive material is in a sealed form, the source will be returned to its manufacturer or properly disposed of and decontamination of the facilities would not be necessary. The components investigated included laboratory benches, fume hoods, floors, walls, sinks and refrigerators. This estimate also includes an additional allowance of drums for

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<sup>1</sup> NUREG/CR-1754, Addendum 1, "Technology, Safety and Costs of Decommissioning Reference Non-Fuel-Cycle Nuclear Facilities, a Compendium of Current Information," p. iii, October 1989.

disposal of miscellaneous small equipment such as centrifuges, balances, etc.

- **Section 3: Estimate of Packaging, Shipping, and Disposal Costs**

Projecting the types and quantities of radioactive wastes generated during decommissioning is necessary in estimating the costs of packaging, shipping and disposal. Waste generated during the decommissioning of Biogen facilities is expected to contain very low-level radioactive contamination. Examples of types of waste generated as a result of cleanup operations include paper, rubber gloves, protective clothing, non-hazardous decontamination solutions and wash solutions. The greater the volume of radioactive waste produced, the higher the associated costs for packaging, shipping and disposal. To minimize waste disposal costs, Biogen will continue to practice NRC approved sewer disposal of liquid wastes generated in accordance with regulatory requirements.<sup>2</sup> In addition, waste volume minimization techniques such as compaction and incineration will be considered, whenever possible, to reduce the total volume of waste for packaging, shipping and disposal.

Shallow-land burial in Barnwell, South Carolina low-level waste burial site is the current disposal method used by Biogen. As the waste broker, U.S. Ecology packages and ships the radioactive waste to the burial site, in accordance with all applicable state and federal regulations. Packaging, shipping, and disposal cost estimates are projected for low-level radioactive waste generated during decommissioning activities other than liquid waste which will be sewered.

- **Section 4: Estimate of Remediation Costs**

Biogen has no sites where soil contamination may have occurred. However, this section contains an overview of what is required in site remediation in the event that it becomes necessary in the future.

- **Section 5: Estimate Final Radiation Survey Cost**

An NRC radioactive materials license can not be terminated and the premises released for unrestricted use until a licensee performs a radiological survey to verify that levels of radiological contamination are below currently accepted NRC contamination release limits.<sup>3</sup> As such, a comprehensive final radiation survey is performed after decommissioning activities have been completed to verify that any residual radioactive contamination is below such unrestricted release limits.

- **Section 6: Summary and Conclusions of Decommissioning Cost Estimate**

A summary of the cost of each of the five steps involved in the decommissioning cost estimate is presented with a total cost of decommissioning (including a 25% contingency factor recommended by the NRC).

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<sup>2</sup> 10 CFR 20.303 "Disposal by release into sanitary sewerage systems."

<sup>3</sup> NRC Regulatory Guide 8.23, op cit, p. 8.23-9.



## • Section 7: References

All references used and referred to in this decommissioning cost estimate are presented in this section.

### Regulatory Background

In 1988, the NRC established technical and financial regulations for decommissioning licensed radiological facilities. The purpose of these new regulations was to ensure payment for the safe and timely decommissioning of all facilities after licensed activities ceased. Facilities holding licenses under 10 CFR 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material" were required to address decommissioning planning needs, timing, funding methods, and environmental reviews.

According to the NRC,<sup>4</sup> there are thousands of licensed non-fuel-cycle facilities in the United States that handle radioactive material. Operations at these facilities range from occasional use of short-lived radionuclides by a physician to those with large-scale processing of radioactive materials. Because of the diversity in type and size of facilities licensed to handle radioactive materials, the level of effort required to decommission them varies greatly. Necessary actions can range from simple, relatively inexpensive administrative procedures to extensive decontamination and/or dismantling activities.

Biogen is a company possessing a specific NRC radioactive materials license under 10 CFR 30. Currently, Biogen has approximately sixteen low-level radioactive material use laboratories and low-level radioactive waste storage areas spread among the following four facilities in Massachusetts that are licensed to use radioactive materials: 14 Cambridge Center, 215 Bent Street (a.k.a., 190 Fifth Street), 241 Binney Street, and 345 Vassar Street. As required under the 1988 regulations, Biogen must address the decommissioning planning needs of these facilities.

A primary goal of decommissioning is to terminate the radioactive material license and release the facility for unrestricted use. Once released for unrestricted use, access to the facilities and sites will no longer be limited or controlled by the licensee.<sup>5</sup> Currently accepted NRC residual radioactivity levels for uncontrolled release will be used.<sup>6</sup>

In addition to formal regulations for the decommissioning of licensed facilities, regulatory guidance documents were prepared by the NRC to aid licensees in preparing for and conducting decommissioning activities. In particular, NUREG/CR-1754 and NUREG/CR-1754, Addendum 1, contain detailed information regarding decommissioning alternatives, financing and methods, and time and cost estimates for decommissioning of facility

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<sup>4</sup> NUREG/CR-1754, "Technology, Safety and Costs of Decommissioning Reference Non-Fuel-Cycle Nuclear Facilities," p. 1-1, February 1981.

<sup>5</sup> 10 CFR 20.3(a)(17), "Unrestricted Area"

<sup>6</sup> NRC Regulatory Guide 8.23, op cit, p. 8.23-9.

components.<sup>7,8</sup> NUREG/CR-5849 provides additional guidance on radiological surveys.<sup>9</sup>

All regulations related to the packaging, shipping and disposal of low-level radioactive wastes apply to wastes generated during decommissioning. In 1966, the U.S. Department of Transportation (DOT) was created and given the regulatory responsibility for hazardous materials transportation. Since that time, packaging and transportation of nuclear materials have been regulated principally by the DOT. The regulations applicable to shipments of nuclear materials are published in 49 CFR, Parts 171-178, "Subchapter C - Hazardous Materials Regulations." The NRC has regulatory responsibility for safety, licensing, possession, use, transfer, and transport of byproduct, source, and special nuclear material. Regulations for their licensees regarding the transportation of radioactive material are found in 10 CFR, Part 71, "Packaging and Transportation of Radioactive Material," which compliment and incorporate by reference the DOT regulations.

In 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," the NRC also has regulatory responsibility for land disposal of radioactive waste. Included in this part are the procedures, criteria, and terms and conditions upon which the Commission issues licenses for the disposal of radioactive wastes containing byproduct, source and special nuclear material received from other persons. Low-level radioactive wastes generated at Biogen facilities are currently shipped to Barnwell, South Carolina.

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<sup>7</sup> NUREG/CR-1754, op cit.

<sup>8</sup> NUREG/CR-1754, Addendum 1, op cit.

<sup>9</sup> NUREG/CR-5849, op cit.



## 1.0 Estimate of Time Required for Planning and Preparation of the Decommissioning Plan

Planning and preparation of the decommissioning plan involves six tasks: preparation of documentation for regulatory agencies, submittal of decommissioning plan to the NRC, development of work plans, procuring of special equipment, staff training, and characterization of the radiological condition of the facilities. Using the Cost Estimating Table in NRC Regulatory Guide 3.66,<sup>1</sup> the time required to complete each of these six tasks was estimated.

### 1.1 Preparation of Documentation for Regulatory Agencies

In decommissioning facilities and sites which use low-levels of radioactivity, Biogen must abide by applicable aspects of federal regulations and guidelines, and national standards that pertain to many different topics. The regulatory documentation required for decommissioning of Biogen facilities is described in this section. The number of work days needed for the preparation of this documentation for regulatory agencies was estimated to be five days, allowing for one RSO/supervisor for two days, one health physicist for two days, and one secretary for one day.

- **License Termination and Facility Release** - Should Biogen ever decide to terminate their NRC radioactive materials license and begin facility release activities (decommissioning), 10 CFR 30.36, "Expiration and Termination of Licenses," requires, in part, that Biogen "promptly notify the NRC in writing" of their intention and to submit a completed Form NRC-314. This form is included as an attachment to NRC Regulatory Guide 3.65.<sup>2</sup>
- **Environmental Impact Statements** - In the provisions of 10 CFR 51 "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," the decommissioning of some licensee facilities may require the preparation of an environmental impact statement by the NRC. The need to prepare an environmental impact statement is determined by the NRC on a case-by-case basis.
- **Occupational Radiation Standards** - As part of 10 CFR 20, "Standards for Protection Against Radiation," sections 20.101 "Radiation Dose Standards for Individuals in Restricted Areas," and 20.103 "Exposures of Individuals to Concentrations of Radioactive Materials in Air in Restricted Areas," give the maximum permissible limits for occupational radiation exposure. From our knowledge of Biogen's inventory and operations, it is improbable that these annual occupational dose limits would be exceeded during decommissioning operations.
- **Public and Environmental Radiation Standards** - Also included as part of

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<sup>1</sup> NRC Regulatory Guide 3.66 "Standard Format and Content of Financial Assurance Mechanisms Required for Decommissioning under 10 CFR Parts 30, 40, 70, and 72," Appendix F, June 1990.

<sup>2</sup> NRC Regulatory Guide 3.65 "Standard Format and Content of Decommissioning Plans for Licensees Under 10 CFR Parts 30, 40, and 70," Appendix 1, August 1989.

10 CFR 20 are the maximum public exposure limits for external exposure, specified in section 20.105 "Permissible Levels of Radiation in Unrestricted Areas," and for internal exposure pathways, specified in section 20.106 "Radioactivity in Effluents to Unrestricted Areas." From our knowledge of Biogen's facilities, inventory and operations, it is our judgement that these public exposure limits should not be exceeded during decommissioning operations.

- **Transportation of Radioactive Wastes** - All radioactive material, contaminated laboratory equipment, or low-level radioactive waste generated during decommissioning (other than liquids discharged via sewer) must be transported according to the following regulations: 10 CFR 71, "Packaging and Transportation of Radioactive Material" and 49 CFR, Parts 171-178, "Subchapter C-Hazardous Materials Regulations."
- **Industrial Safety** - 29 CFR Parts 1910 to end, "Occupational Safety and Health Standards," contains industrial safety requirements which must be adhered to during decommissioning activities.

## 1.2 Submittal of a Decommissioning Plan to the NRC

If a licensee does not submit an application for renewal of their NRC radioactive materials license, they must terminate their use of byproduct material and begin decommissioning activities. The submittal and NRC approval of a decommissioning plan to the NRC is required before any decommissioning activities can begin. Based on the current number of Biogen radioactive material user laboratories, submittal of the decommissioning plan is estimated to require six days, allowing for one RSO/supervisor for three days, one health physicist for two days, and one secretary for one day.

## 1.3 Development of Work Plans

Work plans are prepared to guide the performance of decommissioning activities. They should include all preparatory and implementing steps of the decommissioning program including decommissioning objectives, activities and tasks, a description and an analysis of decommissioning methods and procedures and a schedule of operations. Because the work plans must be very detailed, this is a time consuming task. This task was estimated to require eight days, allowing for one RSO/supervisor for five days, one health physicist for two days, and one secretary for one day.

## 1.4 Procuring Special Equipment

Special equipment for decommissioning is normally procured separately from radiation survey equipment and equipment for the analysis of wipe tests. Although survey equipment is readily available during the operational phase of the facility, the inventory of instrumentation should be revised prior to decommissioning activities to enable the

procurement of any additional equipment needed. Examples of special equipment used in the decommissioning of a facility are: steam cleaners, wet/dry vacuums, powered floor scrubbers, oxyacetylene torches, pipe cutters, reciprocating saws, and scabblers. Biogen currently has sufficient numbers of some special equipment list. For informational purposes, the current cost of all equipment is included. This task was estimated to require one day, allowing for one RSO/supervisor for one-half day and one secretary for one-half day.

### 1.5 Staff Training

All staff involved with the decommissioning effort should receive eight hours of training in radiation safety, 10 CFR 19 "Notices, Instructions, and Reports to Workers; Inspections." Personnel who regularly work with radioactive materials are assumed to have been trained in radiological safety procedures and to be capable of operating radiation survey equipment. If offered by Biogen staff, this task was estimated to require four and one-half days, which includes one RSO/supervisor for two days, one health physicist for two days, preparing for and offering training the 8-hour radiation safety training, and one-half day of secretarial support. In the event that an outside contractor conducts the training, costs will need to be reassessed on a case-by-case basis.

### 1.6 Characterization of the Radiological Condition of the Facility

An accurate estimate of the radiological condition of the facility is important because the amount and type of radioactivity in the facility can directly affect the following: choice of method of decommissioning; projecting man-rem exposures for workers; assessing the need for decontamination as opposed to dismantling; determining shipping requirements for radioactive waste; and determining burial or disposal requirements.

Biogen has approximately sixteen laboratories and low-level waste storage areas at four Biogen facilities where radioactive materials have been used for research purposes. This task was estimated to require eight man-days, which included one RSO/supervisor for five days, one health physicist two days, and one secretary for one day.

Table 1-1 presents a summary of the number of work days needed for planning and preparation of the decommissioning plan.

In order to translate the total time estimated for planning and preparation of the decommissioning plan into labor costs, salary estimates were developed based on Regulatory Guidance presented in NUREG/CR-1754.<sup>3</sup> In Table 1-2, the annual cost for workers involved in a decommissioning effort and their overhead rate were estimated for the following general positions: RSO/supervisor, health physicist, secretary, craftsperson, and technician. These positions were given in the Cost Estimating Table found in NRC

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<sup>3</sup> NUREG/CR-1754, op cit, p. H-2.

Regulatory Guide 3.66<sup>4</sup> as examples of typical positions used during the decommissioning process. To complete decommissioning activities in a reasonable period of time, in addition to Biogen personnel, contractors may be added on an as needed basis. If Biogen personnel carry out some or all of the decommissioning activities, administrative overhead may be charged to the program.

Table 1-1: Work Days Needed for Planning and Preparation

<u>Task</u>	<u>RSO/ Supervisor</u>	<u>Health Physicist</u>	<u>Secretary</u>	<u>Total</u>
Preparation of Documentation for Regulatory Agencies <sup>a</sup>	2	2	1	5
Submittal of Decommissioning Plan to NRC <sup>b</sup>	3	2	1	6
Development of Work Plans	5	2	1	8
Procuring of Special Equipment <sup>c</sup>	0.5	0	0.5	1
Staff Training	2	2	0.5	4.5
Characterization of Radiological Condition of the Facility	5	2	1	8
Total Days	17.5	10	5	32.5

Time estimates were determined assuming that the following conditions apply:

- a) All required regulations and forms are available to the RSO/Supervisor and health physicist at the start of this task.
- b) There is no delay in the assurance of funds for decommissioning.
- c) Procurement of special equipment includes only the selection, ordering, and receiving the equipment; the time waiting for delivery is not chargeable to decommissioning.

<sup>4</sup> NRC Regulatory Guide 3.66, op cit.



Table 1-2: Unit Cost for Workers

<u>Position</u>	<u>Basic Salary (Dollars/Year)</u>	<u>Overhead Rate (%)</u>	<u>Worker Cost/Year</u>	<u>Worker Cost/Day</u>
RSO/Supervisor	\$60,000.00	21	\$72,600.00	\$279.23
Health Physicist	Consultant	N/A	N/A	\$1,200.00
Secretary	\$20,000.00	21	\$30,250.00	\$116.35
Craftsperson*	\$25,000.00	21	\$36,300.00	\$139.62
Technician*	\$25,000.00	21	\$33,880.00	\$130.31

\* These positions were not required for planning and preparation of the plan however, their salary estimates were included because their services will be required in other sections of the decommissioning cost estimate.

Multiplying the worker costs per day (as listed in Table 1-2) for each position by the total time required by each position to complete planning and preparation of the decommissioning plan (as listed in Table 1-1), the labor cost per position is obtained. Table 1-3 summarizes the labor costs for planning and preparation of the decommissioning plan.

Table 1-3: Summary of Labor Cost for Planning and Preparation of the Decommissioning Plan

<u>Position</u>	<u>Worker Cost/Day</u>	<u>Total # Man-Days</u>	<u>Total Labor Cost</u>
RSO/Supervisor	\$279.23	17.5	\$4,886.54
Health Physicist	\$1,200.00	10.0	\$12,000.00
Secretary	\$116.35	5.0	\$581.73
Total		32.5	\$17,468.27

## 2.0 Estimate of Decontamination and Dismantling Costs

### 2.1 Projecting the Size and Quantity of Radioactive Facility Components Potentially Requiring Decontamination and/or Dismantling

Dimensions of representative facility components, such as fume hoods and laboratory benches, were provided by Biogen. These dimensions were assumed to be average dimensions for each type of component to represent components in all laboratories and areas.

The numbers of components in the laboratories and areas were provided by Biogen based on current actual inventory of the equipment present in radioactive material laboratories. In order to estimate the amount of surface area which could potentially require decontamination and or dismantling, the following assumptions were made:

- **Not all facility components in laboratories and areas where radioactive materials are handled will require decontamination and/or dismantling.** Biogen requires that surface areas designated for radioactive material use are covered with bench coat such that if any material is spilled, there would be little or no surface contamination. Confirmation of this through regular radiation surveys and wipe tests has demonstrated that this procedure is an effective contamination control technique. As such, all laboratory components, with the exception of sink drains and pipes, will be assumed to be decontaminated to unrestricted release levels with no dismantling performed. In addition, those laboratory components which are deemed to be contaminated with short-lived radionuclides may be stored for decay as a means of waste management. However, these costs have not been included in this cost estimate.
- **Only a fraction of the total surface area of laboratory benches, fume hoods, or other items in a laboratory or area is actually designated for radioactive material handling.** The percentage of surface area designated for radioactive material handling is less than the total surface area in a laboratory in order to reduce the possibility of the spread of contamination. These percentages were estimated based on the Biogen's knowledge of the work performed in the laboratories. Also included is the building where low-level radioactive waste is stored and packages are received. Due to the fact that there is no repackaging of any material in this building, negligible contamination is expected. Following is a table in which these percentages are outlined.

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<u>Location Name</u>	<u>Address</u>	<u>Percentage of Surface Area Designated for Radioactive Material Handling</u>
BIO I	241 Binney Street	10%
BIO II	14 Cambridge Center	35%
BIO III	345 Vassar Street	5%
Rec/Waste	215 Bent Street (a.k.a. 190 Fifth Street)	5%

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- **Only a part of the surface area designated for radioactive material handling will potentially require decontamination due to contamination control efforts.** The percentage of surface area which potentially requires decontamination was estimated based on the Biogen's knowledge of the work performed in the laboratories and typical levels of contamination found. An estimated 10% of the total surface area designated for radioactive material handling will actually require decontamination (i.e., fume hoods, laboratory benches, sinks). In addition, due to the contamination control techniques used in laboratories and the low likelihood of wall contamination, only 5% of the wall surfaces are estimated to require decontamination. Items such as sink drains and pipes are not easily decontaminated and are therefore packaged for disposal.

#### **2.1.1 Number and Total Surface Area of Glove Boxes Potentially Requiring Decontamination**

Biogen does not possess any glove boxes for radioactive material handling.

#### **2.1.2 Number and Total Surface Area of Fume Hoods Potentially Requiring Decontamination**

The number of fume hoods and biosafety cabinets used for radioactive material handling at Biogen facilities was estimated to be eleven and their average surface area was calculated to be 5.9 m<sup>2</sup>. Based on assumptions stated in Section 2.1 of this report, a total surface area of approximately 2.88 m<sup>2</sup>, or an equivalent of 0.49 fume hoods, could potentially require decontamination (refer to Appendix 2.1 for calculations).

#### **2.1.3 Length of Ventilation Ductwork Potentially Requiring Decontamination**

Ventilation ductwork is only present from the four fume hoods, not the seven biosafety cabinets due to localized filtration. The length of ventilation ductwork from each of the four fume hoods is approximately 3.7 m. The total length of ventilation ductwork from all four of the fume hoods is 26.0 m. Lengths of ventilation ductwork are assumed to be decontaminated, however, the time involved in this procedure could increase costs enough to make dismantling, compaction, packaging, and disposal a more viable option. As such, the decision to dismantle ventilation ductwork should be made on a case-by-case basis. Based on assumptions stated in Section 2.1 of this report, a total length of approximately 2.6 m<sup>2</sup>, or an equivalent of 0.7 ducts, could potentially require decontamination. The lengths of ductwork for decontamination noted are conservative estimates (refer to Appendix 2.1 for calculations).

#### **2.1.4 Number and Total Surface Area of Laboratory Benches Potentially Requiring Decontamination**

The number of laboratory benches used for radioactive material handling at Biogen facilities was estimated as 166. An average area of 1.1 m<sup>2</sup> was determined to represent each laboratory bench in Biogen facilities. Based on assumptions stated in Section 2.1 of this report, a total surface area of 5.19 m<sup>2</sup>, or an equivalent of 4.66 laboratory benches, could potentially require decontamination (refer to Appendix 2.1 for calculations).

### **2.1.5 Number and Total Surface Area of Sinks Potentially Requiring Decontamination**

The number of sinks used for cleaning contaminated glassware and sewerage low-level radioactive liquids at Biogen facilities was estimated to be twenty-four. These assumptions were based on Biogen's knowledge of the number of sinks used for this purpose in laboratories and areas. Based on assumptions stated in Section 2.1 of this report, a total surface area of 0.88 m<sup>2</sup>, or an equivalent of 0.71 sinks, could potentially require decontamination (refer to Appendix 2.1 for calculations).

### **2.1.6 Length of Drains and Pipes Potentially Requiring Decontamination**

Based on Biogen's experience with laboratory plumbing, the length of each drain and pipe requiring decontamination was estimated to be 1 m. However, due to the difficulty in decontaminating drains and pipes, all contaminated drains and pipes are assumed to be dismantled and packaged for disposal. Therefore there was no surface area for decontamination included (refer to Appendix 2.1 for calculations).

### **2.1.7 Amount of Floor Space Potentially Requiring Decontamination**

The amount of floor space in laboratories used for radioactive material handling and waste storage at Biogen facilities will not equal the total floor space in a laboratory or area. Some of the floor space is covered by laboratory benches, fume hoods, and large equipment that can not be easily moved. Only floor space that is not covered by laboratory hardware is considered to potentially require decontamination. The amount of floor space not covered by equipment was observed to be approximately 50% of the total floor space. Based on the assumptions in Section 2.1 of this report, a total amount of floor space for all Biogen facilities of 90.2 m<sup>2</sup>, or an equivalent of 0.80 floors, could potentially require decontamination (refer to Appendix 2.1 for calculations).

### **2.1.8 Amount of Wall Surface Area Potentially Requiring Decontamination**

Due to aggressive contamination control techniques practices at Biogen facilities, it is very unlikely that contamination would occur on walls in radioactive material handling laboratories or waste storage areas. However, Biogen assumed that there would be a slight chance of some contamination occurring on walls and all wall surface area was assumed to be decontaminated to currently accepted unrestricted release levels. The total amount of wall surface area in each laboratory was estimated by multiplying the average length of each wall by the height to the ceiling (assuming a standard height of 3 meters), then multiplying by 4 (the average number of walls in each laboratory or area). It was assumed that 50% of the total wall space is covered by equipment. Of the 50% not covered with equipment, it was assumed that only 5% of the wall space could potentially require decontamination. A total area of wall space in all laboratories and areas of 5.1 m<sup>2</sup>, or an equivalent of 1.7 walls, could potentially require decontamination (refer to Appendix 2.1 for calculations).

### **2.1.9 Number and Total Surface Area of Large Refrigerators Potentially Requiring Decontamination**

The number of large refrigerators in Biogen's radioactive material laboratories is 29. This



is based on Biogen's knowledge of the number of large refrigerators in laboratories and areas. An average surface area of large refrigerators was estimated to be 5.2 m<sup>2</sup>. A total surface area for refrigerators of 5.0 m<sup>2</sup>, or an equivalent of 1.0 large refrigerator, could potentially require decontamination (refer to Appendix 2.1 for calculations).

#### 2.1.10 Number and Total Surface Area of Small Refrigerators Potentially Requiring Decontamination

The number of small refrigerators in Biogen's radioactive material laboratories is 29. This is based on Biogen's knowledge of the number of small refrigerators in laboratories and areas. An average surface area of small refrigerators was estimated to be 1.3 m<sup>2</sup>. A total surface area for refrigerators of 1.2 m<sup>2</sup>, or an equivalent of 1.0 small refrigerators, could potentially require decontamination (refer to Appendix 2.1 for calculations).

#### 2.1.11 Number and Total Surface Area of Small Laboratory Equipment Potentially Requiring Decontamination

Biogen assumed that there would be other small laboratory equipment which would require decontamination or disposal if the time involved in decontamination would not be cost effective. Due to the variety of equipment that could be present in a laboratory, an estimate of the number and total surface area was not feasible, however, allowances for their decontamination or disposal will be made.

Table 2-1 summarizes all of the information developed in Section 2.1.

Table 2-1: Estimates of the Total Surface Area and Equivalent Number of Facility Components Potentially Requiring Decontamination

Component	Total Surface Area or Length for Decontamination (m <sup>2</sup> or m)	Equivalent Number for Decontamination
Fume Hoods	2.88	0.49
Ventilation Ductwork	2.60	0.70
Laboratory Benches	5.19	4.66
Sinks	0.88	0.71
Drains and Pipes	24.00	24.00
Floor Space	90.20	0.80
Wall Space	5.10	1.70
Large Refrigerators	5.00	0.96
Small Refrigerators	1.20	0.96

## **2.2 Estimated Number of Workdays Required to Complete Decontamination**

To estimate the time necessary to complete decontamination, we assumed a certain percentage of the total time allowed for each task was distributed to each position; 10% of an RSO/supervisor's time, 70% of a technician's time, 5% of a health physicist's time and 15% of a craftsperson's time. The only exception allowed from these percentages is for monitoring for compliance, recleaning and remonitoring, if necessary. In this case, 50% of the total time allowed for each decontamination task was distributed to each position for monitoring for compliance, recleaning and remonitoring, if necessary. All estimates included equipment removal and surveying, decontamination and monitoring, recleaning of hot spots, remonitoring, and 50% ancillary time (i.e., breaks, set-up time). Suggested time allowances for the decontamination tasks were estimated based on experience conducting such decontaminations. These were used to develop probable time allowances in man-days for each of the decontamination tasks at Biogen which are discussed in the following sections.

### **2.2.1 Estimated Number of Workdays Required to Decontaminate Fume Hoods**

Decontamination of fume hoods is based on reducing residual surface contamination to currently accepted unrestricted release levels. Based on the assumption that the decontamination of one fume hood would require 0.50 days, the estimated total time involved in the decontamination of 2.88 m<sup>2</sup> or 0.49 potentially contaminated fume hoods was calculated to be 0.24 days. This allowed for 0.02 days of a RSO/supervisor's time, 0.17 days of a technician's time, 0.01 days of a health physicist's time, and 0.04 days of a craftsperson's time.

### **2.2.2 Estimated Number of Workdays Required to Decontaminate Laboratory Benches**

Decontamination of the laboratory benches is based on reducing residual surface contamination to currently accepted unrestricted release levels. Based on the assumption that the decontamination of one laboratory bench would require 0.30 days, the estimated total time involved in the decontamination of 5.19 m<sup>2</sup> or 4.66 potentially contaminated laboratory benches was calculated to be 1.40 days. This allowed for 0.14 days of a RSO/supervisor's time, 0.98 days of a technician's time, 0.07 days of a health physicist's time, and 0.21 days of a craftsperson's time.

### **2.2.3 Estimated Number of Workdays Required to Decontaminate Sinks**

Decontamination of the sinks is based on reducing residual surface contamination to currently accepted unrestricted release levels. Based on the assumption that the decontamination of one sink would require 0.20 days, the estimated total time involved in the decontamination of 0.88 m<sup>2</sup> or 0.71 potentially contaminated sinks was calculated to be 0.14 days. This allowed for 0.01 days of a RSO/supervisor's time, 0.10 days of a technician's time, 0.01 days of a health physicist's time, and 0.02 days

of a craftsperson's time.

#### **2.2.4 Estimated Number of Workdays Required to Decontaminate Floor Surface**

Decontamination of the floor surface is based on reducing residual surface contamination to currently accepted unrestricted release levels. Based on the assumption that the decontamination of one floor would require 1 day, the estimated total time involved in the decontamination of 90.2 m<sup>2</sup> or 0.80 potentially contaminated floors was calculated to be 0.80 days. This allowed for 0.08 days of a RSO/supervisor's time, 0.56 days of a technician's time, 0.04 days of a health physicist's time, and 0.12 days of a craftsperson's time.

#### **2.2.5 Estimated Number of Workdays Required to Decontaminate Wall Surface**

Decontamination of the wall surface is based on reducing residual surface contamination to currently accepted unrestricted release levels. Based on the assumption that the decontamination of one wall would require 0.50 days, the estimated total time involved in the decontamination of 5.1 m<sup>2</sup> or 1.7 potentially contaminated walls was calculated to be 0.85 days. This allowed for 0.09 days of a RSO/supervisor's time, 0.60 days of a technician's time, 0.04 days of a health physicist's time and 0.13 days of a craftsperson's time.

#### **2.2.6 Estimated Number of Workdays Required to Decontaminate Large Refrigerators**

Decontamination of the large refrigerators is based on reducing residual surface contamination to currently accepted unrestricted release levels. Based on the assumption that the decontamination of one large refrigerator would require 0.30 days, the estimated total time involved in the decontamination of 5.0 m<sup>2</sup> or 1.0 potentially contaminated refrigerator was calculated to be 0.29 days. This allowed for 0.3 days of a RSO/supervisor's time, 0.20 days of a technician's time, 0.01 days of a health physicist's time and 0.04 days of a craftsperson's time.

#### **2.2.7 Estimated Number of Workdays Required to Decontaminate Small Refrigerators**

Decontamination of the small refrigerators is based on reducing residual surface contamination to currently accepted unrestricted release levels. Based on the assumption that the decontamination of one small refrigerator would require 0.10 days, the estimated total time involved in the decontamination of 1.2 m<sup>2</sup> or 1.0 potentially contaminated refrigerator was calculated to be 0.10 days. This allowed for 0.01 days of a RSO/supervisor's time, 0.07 days of a technician's time, 0.01 days of a health physicist's time and 0.01 days of a craftsperson's time.

### **2.2.8 Estimated Number of Workdays Required to Decontaminate the Radwaste Area**

Decontamination to unrestricted release levels is assumed to be the decommissioning choice for the radwaste storage area located at 215 Bent Street. However, due to the fact that no radwaste is processed in this building, it is not expected to require much decontamination. As such, this area has been included in the decontamination estimates for laboratories and storage areas at Biogen in Section 2.2 of this report.

### **2.2.9 Estimated Number of Workdays Required to Decontaminate Ventilation Ductwork**

As stated in Section 2.1.3 of this report, ventilation ductwork will be evaluated for contamination on a case by case basis but will be assumed to be decontaminated. The estimated total time involved in the decontamination of 2.6 m<sup>2</sup> of potentially contaminated ventilation ductwork was calculated to be 0.14 days, allowing for 0.01 days of a RSO/supervisor's time, 0.10 days of a technician's time, 0.01 days of a health physicist's time, and 0.01 days of a craftsperson's time.

### **2.2.10 Estimated Number of Workdays Required to Dismantle Drains and Pipes**

As stated in Section 2.1.6 of this report, drains and pipes are assumed to be dismantled and packaged for disposal. Based on assumptions stated in Section 2.2 of this report, the estimated total time involved in the dismantling of 24.0 potentially contaminated drains and pipes was calculated to be 4.8 days, allowing for 0.24 days of a RSO/supervisor's time, 3.36 days of a technician's time, 0.24 days of a health physicist's time, and 0.48 days of a craftsperson's time.

### **2.2.11 Monitoring for Compliance, Recleaning and Remonitoring**

A final radiation survey should include laboratories, storage areas, waste accumulation areas, and other areas where radioactive contamination was detected. In addition, building corridors, rest rooms, offices, equipment rooms, etc., should be surveyed for any unknown contamination. If any contamination is found above release limits, the decontamination process for the item or area is repeated. The total time involved in monitoring for compliance, recleaning, and remonitoring, if necessary, was estimated to be 50% of the total time needed to complete all decontamination activities thus far. Therefore, this monitoring required a total of 4.37 days, allowing for 0.44 days of a RSO/supervisor's time, 3.06 days of a technician's time, 0.22 days of a health physicist's time, and 0.65 days of a craftsperson's time.

Table 2-2 summarizes the estimates developed for the number of work days required to complete decontamination and/or dismantling tasks and Table 2-3 lists the cost to complete these tasks by job category.



Table 2-2: Estimated Number of Work Days Required for Decontamination and/or Dismantling Tasks

<u>Task</u>	<u>RSO</u>	<u>Tech</u>	<u>HP</u>	<u>Craft</u>	<u>Total</u>
Decontaminate Fume Hoods, Laboratory Benches, Sinks, Floors, Walls and Refrigerators	0.38	2.67	0.19	0.57	3.81
Decontaminate Radwaste Area	N/A <sup>b</sup>	N/A	N/A	N/A	N/A
Decontaminate Ventilation Ducts and Dismantle Drains and Pipes	0.49	3.46	0.25	0.73	4.94
Monitor for Compliance, Reclean and Re-monitor, If Necessary	0.44	3.06	0.22	0.65	4.37
Total Number of Work Days per Position	1.3	9.2	0.7	2.0	13.1
Total Number of Work Years per Position <sup>a</sup>	0.007	0.046	0.003	0.010	0.066

a) Assumed 260 work days in one work year because vacation time is included in overhead costs.

b) The estimated number of work days required for decontamination the radwaste area were included in the laboratory and area estimations.

Table 2-3: Estimated Costs for Workers During Decontamination Tasks

<u>Position</u>	<u>Worker Cost/Year</u>	<u>Worker Cost/Day<sup>a</sup></u>	<u>Number of Work Days</u>	<u>Total Cost</u>
RSO/Supervisor	\$72,600.00	\$279.23	1.3	\$366.66
Technician	\$33,880.00	\$130.31	9.2	\$1,197.75
Health Physicist	N/A	\$1,200.00	0.7	\$787.86
Craftsperson	\$36,300.00	\$139.62	2.0	\$273.53
Total			13.1	\$2,625.80

### 2.3 Quantities and Costs of Special Equipment for Decontamination and/or Dismantling

Small equipment items, such as wet-dry vacuums, power floor scrubbers, and steam cleaning equipment, are commonly used for decontaminating facility components. Radiation survey equipment and equipment for the analysis of wipe samples are assumed to be readily available and not budgeted to decommissioning costs because such equipment is also used during the operation of the facility. The estimated quantity and cost of special equipment and supplies required for a decommissioning effort can be found in Table 2-4. All estimates of the cost of special equipment and supplies were based on the 1988 NUREG/CR-1754<sup>1</sup> estimates and adjusted to 1993 prices assuming an increase of 5% per year due to inflation.

Table 2-4: Cost Estimates of Special Equipment and Supplies

<u>Equipment and Supplies</u>	<u>Quantity</u>	<u>Cost of Each</u>	<u>Total Cost</u>
Steam Cleaners	2	\$2,310.00	N/A
Wet/Dry Vacuums	2	\$3,525.00	N/A
Power Floor Scrubbers	2	\$608.00	N/A
Oxyacetylene Torches	1	\$2,553.00	N/A
Pipe Cutters	2	\$100.00	N/A
Reciprocating Saws	1	\$365.00	N/A
Scabblers	1	\$400.00	N/A
Anti-contamination Clothing <sup>a</sup>	500	\$3.00	\$1,500.00
Decontamination Solution <sup>b</sup>	3	\$800.00	\$2,400.00
Total			\$3,900.00

a) Anti-contamination clothing assumed to be disposable and one suit is worn for each work day required to complete decontamination.

b) Price for decontamination solution is per 208-liter drum.

<sup>1</sup> NUREG/CR-1754, op cit, pp. H-8, H-9.



Appendix 2.1: Calculation of the Number and Total Surface Area of Components Potentially Requiring Decontamination

Section 2.1.2: Fume Hoods

Average Surface Area = 5.9 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio I = 5	X	Percentage of Surface Area for Handling = 100%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 0.18 Fume Hoods for Decon in Bio I = 1.09 m <sup>2</sup>
Average Surface Area = 5.9 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio II = 5	X	Percentage of Surface Area for Handling = 100%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 0.18 Fume Hoods for Decon in Bio II = 1.09 m <sup>2</sup>
Average Surface Area = 5.9 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio III = 1	X	Percentage of Surface Area for Handling = 100%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 0.12 Fume Hoods for Decon in Bio III = 0.69 m <sup>2</sup>

Total Surface Area of 0.49 Fume Hoods for Decontamination in all Three Areas is 2.88 m<sup>2</sup>

Section 2.1.3 Ventilation Ductwork

Average Length = 3.7 m	X	# in Radioactive Material Labs in Bio I = 3	X	Percentage of Surface Area for Handling = 100%	X	Percentage of Length for Decon = 10%	=	Total Estimated Length of 0.30 Ventilation Ducts for Decon = 1.11 m
Average Length = 3.7 m	X	# in Radioactive Material Labs in Bio II = 3	X	Percentage of Surface Area for Handling = 100%	X	Percentage of Length for Decon = 10%	=	Total Estimated Length of 0.30 Ventilation Ducts for Decon = 1.11 m
Average Length = 3.7 m	X	# in Radioactive Material Labs in Bio III = 1	X	Percentage of Surface Area for Handling = 100%	X	Percentage of Length for Decon = 10%	=	Total Estimated Length of 0.10 Ventilation Ducts for Decon = 0.37 m

Total Length of 0.7 Ducts for Decontamination in all Three Areas is 2.6 m



Appendix 2.1: Calculation of the Number and Total Surface Area of Components Potentially Requiring Decontamination  
(Continued)

Section 2.1.4: Laboratory Benches

Average Surface Area = 1.1 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio I = 45	X	Percentage of Surface Area for Handling = 10%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 0.45 Lab Benches for Decon in Bio I = 0.50 m <sup>2</sup>
Average Surface Area = 1.1 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio II = 120	X	Percentage of Surface Area for Handling = 35%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 4.20 Lab Benches for Decon in Bio II = 4.68 m <sup>2</sup>
Average Surface Area = 1.1 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio III = 1	X	Percentage of Surface Area for Handling = 5%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 0.01 Lab Benches for Decon in Bio III = 0.01 m <sup>2</sup>

Total Surface Area of 4.66 Laboratory Benches for Decontamination in all Three Areas is 5.19 m<sup>2</sup>

Section 2.1.5: Sinks

Average Surface Area = 1.3 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio I = 3	X	Percentage of Surface Area for Handling = 10%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 0.03 Sinks for Decon in Bio I = 0.04 m <sup>2</sup>
Average Surface Area = 1.3 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio II = 19	X	Percentage of Surface Area for Handling = 35%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 0.67 Sinks for Decon in Bio II = 0.83 m <sup>2</sup>
Average Surface Area = 1.3 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio III = 2	X	Percentage of Surface Area for Handling = 5%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 0.01 Sinks for Decon in Bio III = 0.01 m <sup>2</sup>

Total Surface Area of 0.71 Sinks for Decontamination in all Three Areas is 0.88 m<sup>2</sup>

Appendix 2.1: Calculation of the Number and Total Surface Area of Components Potentially Requiring Decontamination  
(Continued)

Section 2.1.6 Drains and Pipes

Average Length = 1.0 m	X	# in Radioactive Material Labs in Bio I = 3	X	Percentage of Length for Decon = 0%	=	Total Estimated Length of 3.0 Drains and Pipes for Decon = 0 m
Average Length = 1.0 m	X	# in Radioactive Material Labs in Bio II = 19	X	Percentage of Length for Decon = 0%	=	Total Estimated Length of 19.0 Drains and Pipes for Decon = 0 m
Average Length = 1.0 m	X	# in Radioactive Material Labs in Bio III = 2	X	Percentage of Length for Decon = 0%	=	Total Estimated Length of 2.0 Drains and Pipes for Decon = 0 m

Total Length of 24.0 Drains and Pipes for Dismantling in all Three Areas is 0 m

Section 2.1.7: Floors

Average Surface Area = 179.5 m <sup>2</sup>	X	# of Radioactive Material Labs in Bio I = 4	X	Percentage of Exposed Floor Area = 50%	X	Percentage of Floor Area for Decon = 10%	=	Estimated Surface Area of 0.20 Floors for Decon in Bio I = 35.9 m <sup>2</sup>
Average Surface Area = 98.1 m <sup>2</sup>	X	# of Radioactive Material Labs in Bio II = 9	X	Percentage of Exposed Floor Area = 50%	X	Percentage of Floor Area for Decon = 10%	=	Estimated Surface Area of 0.45 Floors for Decon in Bio II = 44.1 m <sup>2</sup>
Average Surface Area = 9.3 m <sup>2</sup>	X	# of Radioactive Material Labs in Bio III = 1	X	Percentage of Exposed Floor Area = 50%	X	Percentage of Floor Area for Decon = 10%	=	Estimated Surface Area of 0.05 Floors for Decon in Bio III = 0.46 m <sup>2</sup>

Appendix 2.1: Calculation of the Number and Total Surface Area of Components Potentially Requiring Decontamination  
(Continued)

Section 2.1.7: Floors (continued)

Average Surface Area = 97.5 m <sup>2</sup>	X	# of Radioactive Material Labs in Rec/Waste = 2	X	Percentage of Exposed Floor Area = 50%	X	Percentage of Floor Area for Decon = 10%	=	Estimated Surface Area of 0.10 Floors for Decon in Rec/Waste = 9.75 m <sup>2</sup>
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Total Surface Area of 0.80 Floors for Decontamination in all Four Areas is 90.2 m<sup>2</sup>

Section 2.1.8: Walls

Average Surface Area = 4.1 m <sup>2</sup>	X	Total # of Walls in Labs in Bio I = 16	X	Percentage of Exposed Wall Area = 50%	X	Percentage of Wall Area for Decon = 5%	=	Estimated Surface Area of 0.40 Walls for Decon in Bio I = 1.63 m <sup>2</sup>
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Average Surface Area = 3.0 m <sup>2</sup>	X	Total # of Walls in Labs in Bio II = 36	X	Percentage of Exposed Wall Area = 50%	X	Percentage of Wall Area for Decon = 5%	=	Estimated Surface Area of 0.90 Walls for Decon in Bio II = 2.72 m <sup>2</sup>
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Average Surface Area = 0.9 m <sup>2</sup>	X	Total # of Walls in Labs in Bio III = 8	X	Percentage of Exposed Wall Area = 50%	X	Percentage of Wall Area for Decon = 5%	=	Estimated Surface Area of 0.10 Walls for Decon in Bio III = 0.09 m <sup>2</sup>
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Average Surface Area = 3.0 m <sup>2</sup>	X	Total # of Walls in Labs in Rec/Waste = 8	X	Percentage of Exposed Wall Area = 50%	X	Percentage of Wall Area for Decon = 5%	=	Estimated Surface Area of 0.20 Walls for Decon in Rec/Waste = 0.60 m <sup>2</sup>
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Total Surface Area of 1.7 Walls for Decontamination in all Three Areas is 5.1 m<sup>2</sup>

Appendix 2.1: Calculation of the Number and Total Surface Area of Components Potentially Requiring Decontamination  
(Continued)

Section 2.1.9: Large Refrigerators and Freezers

Average Surface Area = 5.2 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio I = 1	X	Percentage of Surface Area for Handling = 10%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 0.01 Large Refrigerators for Decon in Bio I = 0.05 m <sup>2</sup>
Average Surface Area = 5.2 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio II = 27	X	Percentage of Surface Area for Handling = 35%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 0.95 Large Refrigerators for Decon in Bio II = 4.92 m <sup>2</sup>
Average Surface Area = 5.2 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio III = 1	X	Percentage of Surface Area for Handling = 5%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 0.01 Large Refrigerators for Decon in Bio III = 0.03 m <sup>2</sup>

Total Surface Area of 1.0 Large Refrigerator for Decontamination in all Three Areas is 5.0 m<sup>2</sup>

Section 2.1.10: Small Refrigerators and Freezers

Average Surface Area = 1.3 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio I = 1	X	Percentage of Surface Area for Handling = 10%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 0.01 Small Refrigerators for Decon in Bio I = 0.01 m <sup>2</sup>
Average Surface Area = 1.3 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio II = 27	X	Percentage of Surface Area for Handling = 35%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 0.95 Small Refrigerators for Decon in Bio II = 1.19 m <sup>2</sup>
Average Surface Area = 1.3 m <sup>2</sup>	X	# in Radioactive Material Labs in Bio III = 1	X	Percentage of Surface Area for Handling = 5%	X	Percentage of Surface Area for Decon = 10%	=	Estimated Surface Area of 0.01 Small Refrigerators for Decon in Bio III = 0.01 m <sup>2</sup>

Total Surface Area of 1.0 Small Refrigerator for Decontamination in all Three Areas is 1.2 m<sup>2</sup>



### 3.0 Estimate of Packaging, Shipping and Disposal Costs

#### 3.1 Decontaminating Components in Radiation Laboratories and Areas

As stated in Section 2.0 of this report, all components in radiation laboratories and areas, with the exception of sink drains and pipes, can be decontaminated. Decontamination of components in radiation laboratories and areas is based on reducing residual surface contamination to currently accepted NRC unrestricted release levels. Loose contamination can often be removed by janitorial techniques such as vacuuming, sweeping, brushing, wiping with a damp cloth or sponge, mopping with a damp mop, or scrubbing. Cleaning solutions such as non-hazardous detergents, commercial cleaning solutions, and a variety of chemicals are also used. Radioactive wastes resulting from these processes include cleaning solutions, paper products, protective clothing, plastics, rags, mops, scrub brushes and others.

All low-level radioactive liquid wastes generated during decontamination processes, provided that they are non-hazardous, readily dispersible, and will not cause effluent concentration and quantity limits to be exceeded, will be discharged via the sanitary sewer. This is currently an approved process at Biogen facilities, therefore, in the interest of waste minimization, low-level radioactive liquids will be discharged in this manner whenever possible.

Recommendations on the number of drums of solid waste generated as each component is decontaminated were provided by Biogen and were based on their experience in decontaminating components in their facilities. As mentioned above, all low-level liquid waste that is non-hazardous will be discharged via the sanitary sewer. Solid waste produced will be packed into 55-gallon ( $0.208\text{-m}^3$ ) drums to allow compaction whenever possible (although estimates are for non-compacted waste). The only exception would be the dismantled drains and pipes, which would not typically be compactable.

##### 3.1.1 Quantity of Wastes Resulting from Decontaminating Fume Hoods

A total estimated surface area of  $2.88\text{ m}^2$  for Biogen fume hoods was determined to require decontamination in Section 2.1.2 of this report. Biogen projects that decontamination of 0.49 fume hoods would produce 0.12 drums of solid waste. Drums of solid waste were then converted into an equivalent volume of  $0.03\text{ m}^3$  (refer to Appendix 3.1 for calculations).

##### 3.1.2 Quantity of Wastes Resulting from Decontaminating Laboratory Benches

A total estimated surface area of  $5.19\text{ m}^2$  for Biogen laboratory benches was determined to require decontamination in Section 2.1.4 of this report. Biogen projects that decontamination of 4.66 laboratory benches would produce 2.33 drums of solid waste. Drums of solid waste were then converted into an equivalent volume of  $0.48\text{ m}^3$  (refer to Appendix 3.1 for calculations).

##### 3.1.3 Quantity of Wastes Resulting from Decontaminating Floors

A total estimated surface area of  $90.24\text{ m}^2$  for Biogen floors was determined to require decontamination in Section 2.1.7 of this report. Biogen projects that decontamination of

0.80 floors would produce 0.80 drums of solid waste. Drums of solid waste were then converted into an equivalent volume of 0.17 m<sup>3</sup> (refer to Appendix 3.1 for calculations).

#### **3.1.4 Quantity of Wastes Resulting from Decontaminating Walls**

A total estimated surface area of 5.14 m<sup>2</sup> for Biogen walls was determined to require decontamination in Section 2.1.8 of this report. Biogen projects that decontamination of 1.70 walls would produce 1.28 drums of solid waste. Drums of solid waste were then converted into an equivalent volume of 0.27 m<sup>3</sup> (refer to Appendix 3.1 for calculations).

#### **3.1.5 Quantity of Wastes Resulting from Decontaminating Sinks**

A total estimated surface area of 0.88 m<sup>2</sup> for Biogen sinks was determined to require decontamination in Section 2.1.5 of this report. Biogen projects that decontamination of 0.71 sinks would produce 0.18 drums of solid waste. Drums of solid waste were then converted into an equivalent volume of 0.04 m<sup>3</sup> (refer to Appendix 3.1 for calculations).

#### **3.1.6 Quantity of Wastes Resulting from Decontaminating Ventilation Ducts**

A total estimated surface area of 2.60 m<sup>2</sup> for Biogen ventilation ducts was determined to require decontamination in Section 2.1.3 of this report. Biogen projects that after dismantling ventilation ducts, there would be some decontamination of the area which would produce 0.18 drums of solid waste. Drums of solid waste were then converted into an equivalent volume of 0.04 m<sup>3</sup> (refer to Appendix 3.1 for calculations).

#### **3.1.7 Quantity of Wastes Resulting from Decontaminating Large Refrigerators**

A total estimated surface area of 5.0 m<sup>2</sup> for Biogen refrigerators was determined to require decontamination in Section 2.1.9 of this report. Biogen projects that decontamination of eight refrigerators would produce 0.24 drums of solid waste. Drums of solid waste were then converted into an equivalent volume of 0.05 m<sup>3</sup> (refer to Appendix 3.1 for calculations).

#### **3.1.8 Quantity of Wastes Resulting from Decontaminating Small Refrigerators**

A total estimated surface area of 5.0 m<sup>2</sup> for Biogen refrigerators was determined to require decontamination in Section 2.1.10 of this report. Biogen projects that decontamination of eight refrigerators would produce 0.24 drums of solid waste. Drums of solid waste were then converted into an equivalent volume of 0.05 m<sup>3</sup> (refer to Appendix 3.1 for calculations). Table 3-1 summarizes all of the information developed in Section 3.1.

### **3.2 Dismantling Components in Radiation Laboratories and Areas**

As stated in Section 3.1 of this report, pipes and drains will not be decontaminated but dismantled for disposal. Wrapping components in polyethylene or facilon may help to

reduce the potential for the spread of contamination during packaging and shipment. Once components are dismantled and wrapped in polyethylene or facilon, they may require 20% more packing volume.

**Table 3-1: Estimate of the Quantity of Solid Waste Produced from the Decontamination of Components in Radiation Laboratories and Areas**

<u>Component</u>	<u>Total Surface Area for Decontamination<sup>a</sup></u>	<u>Total # of Drums of Solid Waste<sup>b</sup></u>	<u>Total Volume of Solid Waste<sup>c</sup></u>
Fume Hoods	2.88	0.12	0.03
Laboratory Benches	5.19	2.33	0.48
Floors	90.24	0.80	0.17
Walls	5.14	1.28	0.27
Sinks	0.88	0.18	0.04
Ventilation Ducts	2.60	0.18	0.04
Lg Refrigerators	5.00	0.24	0.05
Sm Refrigerators	5.00	0.24	0.05
Total	106.50	5.00	1.00

a) Surface area for decontamination is expressed in square meters.

b) Volume of each waste drum is 0.208 m<sup>3</sup>.

c) Volume of solid waste is expressed in cubic meters.

### 3.2.1 Quantity of Wastes Resulting from Dismantling Drains and Pipes

It was estimated that 24.0 drains and pipes at Biogen facilities, with a total estimated volume of 0.27 m<sup>3</sup>, require dismantling. The total estimated volume of dismantled and wrapped drains and pipes was 0.33 m<sup>3</sup>. The total estimated number of drums produced containing dismantled drains and pipes was 1.57 (refer to Appendix 3.2 for calculations).

Tables 3-2, 3-3 summarize all of the information developed in Sections 3.1 and 3.2.

### 3.3 Radioactive Waste Packaging

Primary reliance for safety in transportation of radioactive material is placed on packaging. Regulating the packaging of radioactive material is the responsibility of both the DOT and the NRC. Regulations prescribe general standards and requirements for all radioactive material packages, and for labelling, handling, and intermediate storage of those packages by carriers (49 CFR 173-180 and 10 CFR 71).



All sealed radioactive sources are assumed to be transferred to another NRC licensee prior to the start of decommissioning activities. As such, radioactivity encountered during decommissioning will be in the form of low-level radioactive contamination. All low-level radioactive waste will be shipped exclusive use, in strong-tight containers (i.e., 0.208 m<sup>3</sup> steel drums). The cost of the drums was estimated to be approximately \$40. Therefore, an estimated cost of \$476.81 would result from the purchase of 11.9 drums.

Table 3-2: Estimates of the Total Volume of Solid Waste and Dismantled Components Resulting from Decontaminating and Dismantling Radioactive Facility Components

<u>Component</u>	<u>Volume of Solid Waste in Drums from Decontamination</u>	<u>Volume of Dismantled Components in Drums</u>	<u>Total Volume of Solid Waste and Dismantled Components in Drums</u>
Fume Hoods	0.03	0.00	0.03
Laboratory Benches	0.48	0.00	0.48
Sinks	0.04	0.00	0.04
Drains	0.00	0.33	0.33
Floors	0.17	0.00	0.17
Ventilation Ducts	0.04	0.00	0.04
Walls	0.27	0.00	0.27
Refrigerators	0.10	0.00	0.10
Misc. Components	0.00	1.04	1.04
Total	1.11	1.37	2.48

\*Volumes are expressed in terms of cubic meters of solid waste or dismantled components.

Table 3-3: Total Volume of Solid Waste and Number of Steel Drums from Decontamination and Dismantling

<u>Total Volume of Solid Waste</u>	<u>Total Number of Steel Drums</u>
2.48 m <sup>3</sup>	11.9



### 3.4 Radioactive Waste Shipping

This section describes the costs of shipping of solid low-level radioactive wastes generated during decommissioning from Biogen to Barnwell, South Carolina. Information on the typical costs of shipping low-level radioactive wastes was obtained from Biogen, based on their current waste shipments, and disposal invoices. Shipping costs are included in the price of low-level radioactive waste disposal services provided by U.S. Ecology.

### 3.5 Radioactive Waste Disposal

In a conversation with a U.S. Ecology representative, the most recent cost of low-level radioactive waste disposal with their services was \$325.00/cubic foot of standard low-level radioactive waste (i.e., lab trash). The total cost of disposal of 11.9 drums, or 2.48 m<sup>3</sup> of low-level radioactive waste is \$29,055.42. Table 3-4 summarizes all costs of packaging, shipping, and disposal.

Drums of low-level radioactive waste will be primarily compactable. As such, Biogen should compact waste drums whenever possible to reduce the total volume for packaging, shipment, and disposal. In addition, use of a supercompactor facility may be considered if waste is unable to be compacted sufficiently at Biogen facilities.

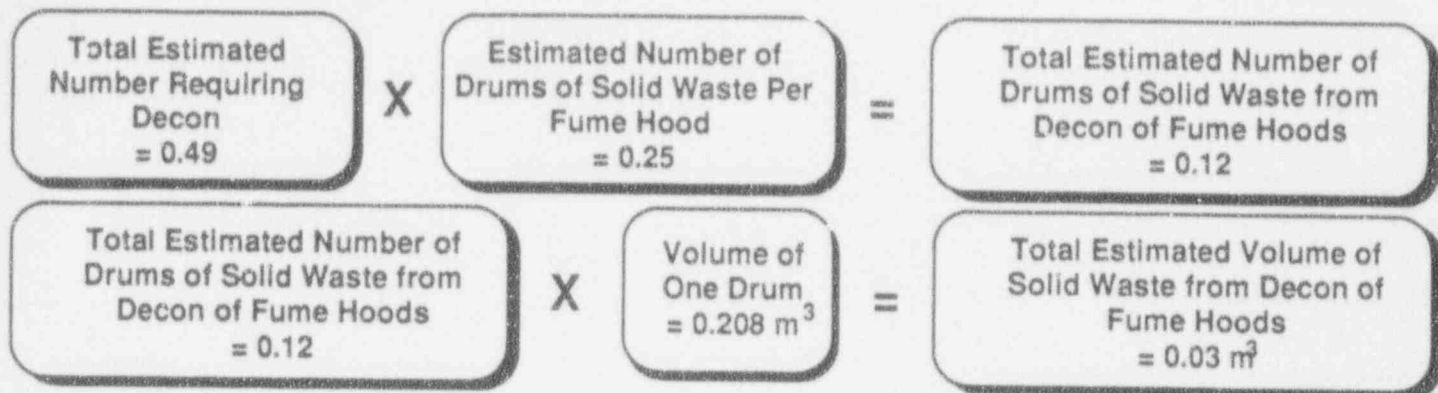
Table 3-4: Total Estimated Cost of Packaging, Shipping, and Disposal of Radioactive Waste

	<u>Cost</u>
Packaging	\$476.81
Shipping and Disposal	\$29,055.42
Total	\$29,532.23

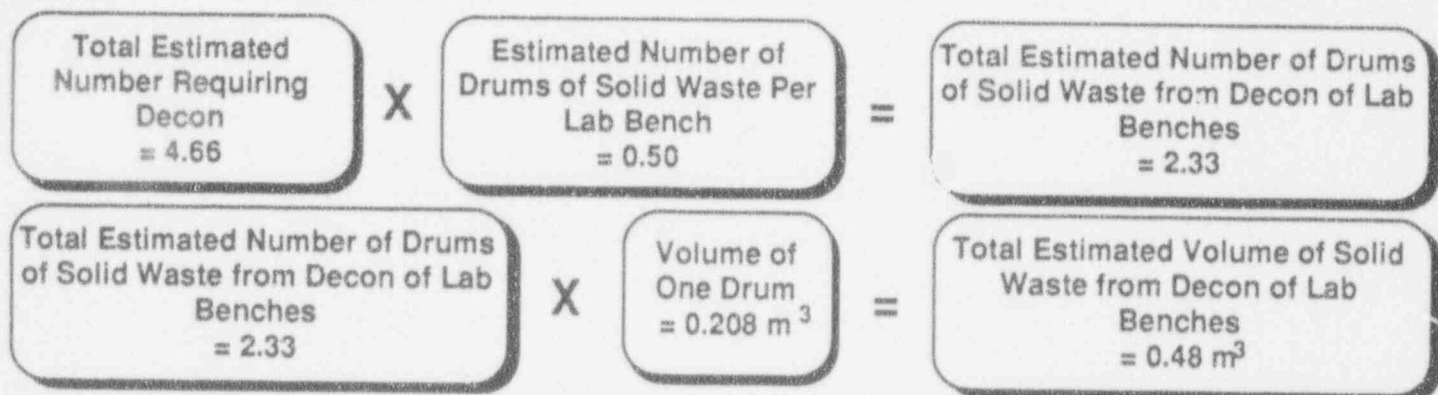


Appendix 3.1: Calculation of the Quantity of Solid Waste Resulting from Decontamination of Components

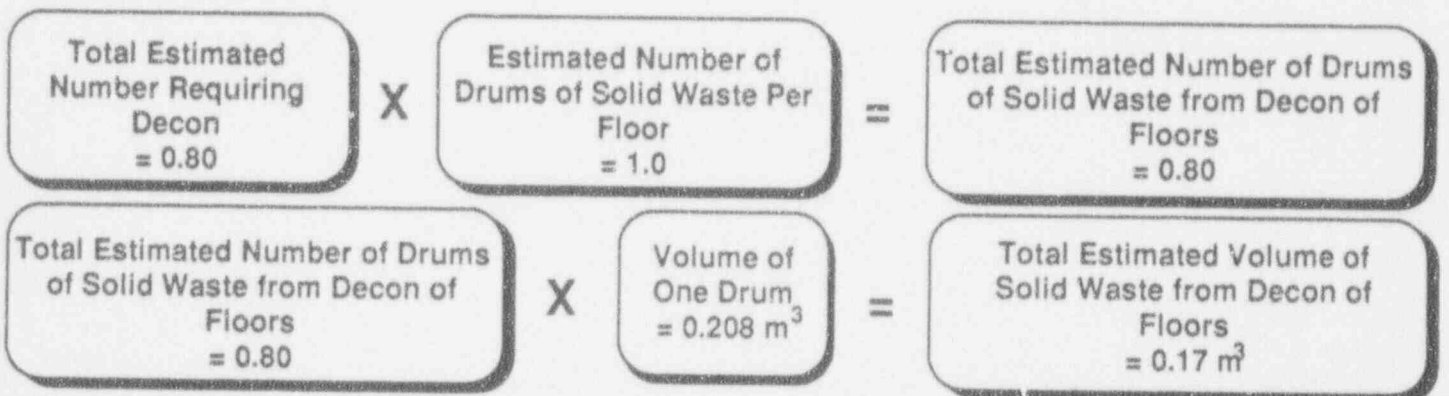
Section 3.1.3: Fume Hoods



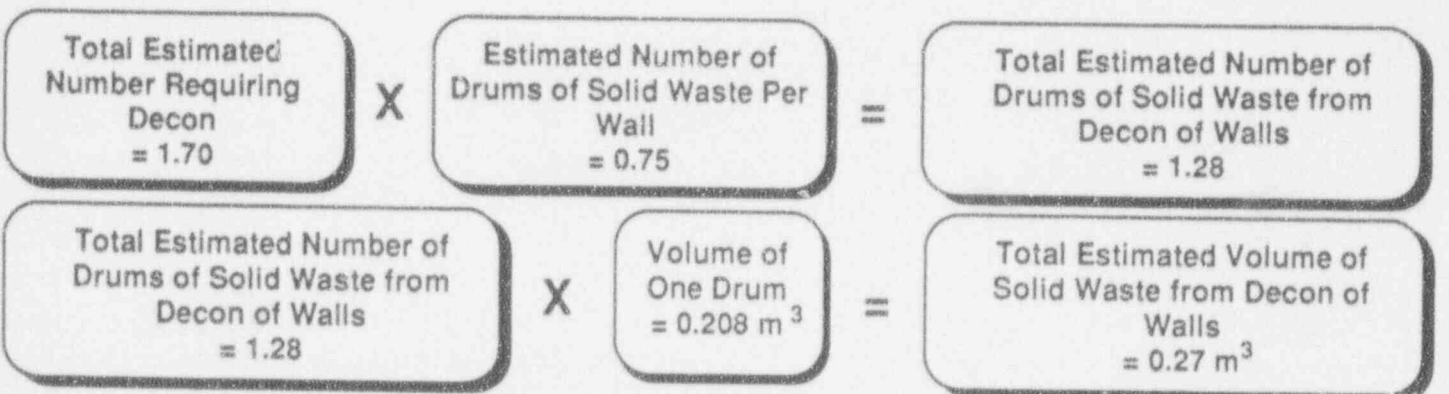
Section 3.1.4: Laboratory Benches



Section 3.1.5: Floors



Section 3.1.6: Walls



Appendix 3.1: Calculation of the Quantity of Solid Waste Resulting from Decontamination of Components (Continued)

Section 3.1.7: Sinks

Total Estimated Number Requiring Decon = 0.71	X	Estimated Number of Drums of Solid Waste Per Sink = 0.25	=	Total Estimated Number of Drums of Solid Waste from Decon of Sinks = 0.18
Total Estimated Number of Drums of Solid Waste from Decon of Sinks = 0.18	X	Volume of One Drum = 0.208 m <sup>3</sup>	=	Total Estimated Volume of Solid Waste from Decon of Sinks = 0.04 m <sup>3</sup>

Section 3.1.8: Ventilation Ducts

Total Estimated Number Requiring Decon = 0.70	X	Estimated Number of Drums of Solid Waste Per Duct = 0.25	=	Total Estimated Number of Drums of Solid Waste from Decon of Ducts = 0.18
Total Estimated Number of Drums of Solid Waste from Decon of Ducts = 0.18	X	Volume of One Drum = 0.208 m <sup>3</sup>	=	Total Estimated Volume of Solid Waste from Decon of Ducts = 0.04 m <sup>3</sup>

Section 3.1.9: Large Refrigerators

Total Estimated Number Requiring Decon = 0.96	X	Estimated Number of Drums of Solid Waste Per Large Refrigerator = 0.25	=	Total Estimated Number of Drums of Solid Waste from Decon of Large Refrigerators = 0.24
Total Estimated Number of Drums of Solid Waste from Decon of Large Refrigerators = 0.24	X	Volume of One Drum = 0.208 m <sup>3</sup>	=	Total Estimated Volume of Solid Waste from Decon of Large Refrigerators = 0.05 m <sup>3</sup>

Section 3.1.10: Small Refrigerators

Total Estimated Number Requiring Decon = 0.96	X	Estimated Number of Drums of Solid Waste Per Small Refrigerator = 0.25	=	Total Estimated Number of Drums of Solid Waste from Decon of Small Refrigerators = 0.24
Total Estimated Number of Drums of Solid Waste from Decon of Small Refrigerators = 0.24	X	Volume of One Drum = 0.208 m <sup>3</sup>	=	Total Estimated Volume of Solid Waste from Decon of Small Refrigerators = 0.05 m <sup>3</sup>



Appendix 3.2: Calculation of the Quantity of Solid Waste and Dismantled Components Resulting from Dismantling of Components

Section 3.2.1: Drains and Pipes

Total Volume for Dismantling = 0.27 m <sup>3</sup>	+	20% Packing Volume	=	Total Volume for Disposal = 0.33 m <sup>3</sup>
Total Volume for Disposal = 0.33 m <sup>3</sup>	÷	Volume of One drum = 0.208 m <sup>3</sup>	=	Total Estimated Number of Drums of Dismantled Drains and Pipes = 1.57

## 4.0 Estimate of Remediation Costs

Biogen currently has no site where there is radioactive contamination requiring remediation. However, following is a brief discussion of the steps involved in the estimation of remediation costs: radiological survey; exhume contaminated soil; package, transport and dispose of contaminated soil; and site restoration.

### 4.1 Radiological Survey

Site remediation activities begin with a radiological survey to evaluate radiological conditions. This survey provides data upon which to base decisions about remedial measures needed to protect the public and the environment.

### 4.2 Contaminated Soil Removal

Contaminated soil removal involves the removal, packaging, shipment, and burial of contaminated soil at an approved shallow-land disposal site. Removal of contaminated soil would be accomplished with standard earthmoving equipment and techniques. Contaminated vegetation should be separated from the soil and sent for incineration.

According to the NRC in NUREG/CR-1754, removal of contaminated soil can be more expensive than stabilization of the site. However, due to the low levels of radioactivity that could potentially be present in soil at the site, and the proposed intention to release the facilities and sites for unrestricted use, removal of residual soil contamination above currently accepted release limits would be the best alternative. NRC release limits used for facilities are not applicable to soil because they are stated in terms of area, whereas the soil is in terms of volume. In the current 10 CFR 20, the NRC offers volumetric effluent release limits for water which may be applied to soil at the Greenfield site. For C-14, the allowable release is approximately  $8E-4 \mu\text{Ci/ml}$ .

### 4.3 Package, Transport and Dispose of Contaminated Soil

During excavation and packaging operations, workers should wear Level D protective clothing (e.g., coveralls, gloves, boots/shoes, safety glasses, hard hat), as defined in 29 CFR 1910.120, Appendix B, "General Description and Discussion of the Levels of Protection and Protective Gear." Operations in a dusty environment may also require the use of respiratory protective equipment.

Radioactively contaminated soil should be packaged in plastic-lined 208-liter drums. Drums are then shipped to the Barnwell Nuclear Burial Site, in Barnwell, South Carolina. In the trailer, the drums are blocked and braced to prevent their movement during shipping. In addition, the doors are sealed and the drivers are instructed not to open them unless an emergency arises. If that were to occur, they are instructed in emergency procedures.

#### 4.4 Final Site Survey

A final site radiological survey will be performed prior to release of a site for unrestricted use to verify that any radioactivity remaining on the site is below limits specified for unrestricted release.<sup>1</sup> Soil samples will be obtained by a health physics technician, prepared and sent for analysis.

#### 4.5 Site Restoration

After all contaminated soil is removed and packaged for disposal, the site should be backfilled with new soil, compacted, and graded. Revegetation will be used to control wind and water erosion of the ground surface. A variety of vegetation types and species could be used, depending on the soil and climate conditions and also on the desired results.

#### 4.6 Cost of Site Remediation

It is estimated that approximately 13% of the total remediation cost would be related to the initial and final site surveys. More than 80% of the cost of site surveys would be associated with the analysis of soil samples. Most of the cost of soil removal (approximately 74%) would be related to the packaging, transportation, and disposal of the exhumed material.

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<sup>1</sup>NRC Regulatory Guide 8.23, op cit, p. 8.23-9.

5.0 Components of the Final Radiation Survey

5.1 Measurements with Survey Instruments

Measurements of all building surfaces exposed during decontamination or dismantling should be performed with appropriate hand-held survey instruments to determine residual levels of radioactive contamination. All residual levels of radioactive contamination must be below NRC unrestricted release levels before decommissioning is complete.

Radionuclides in use at Biogen facilities primarily emit one or more of the following types of radiations: beta particles and gamma rays. However, the possibility of having some alpha emitters should not be ruled out (i.e., uranium microscopy stains, etc.). The probes and detectors listed in Table 5-1 are typically used with counting rate meters to measure the total surface contamination for these radiations. It is recommended that to ensure detection of radioactive contamination by direct hand-held monitoring, the velocity of probe over a contaminated surface should not exceed 5 cm/sec.

Table 5-1: Typical Radiation Survey Instruments Commonly Used to Detect Alpha, Beta, and Gamma Radiations

<u>Radiation</u>	<u>Survey Instrument</u>
Alpha	Zinc Sulfide Scintillation Probe Air Proportional Counter (not recommended) Gas-Flow Proportional Counter "Pancake" Geiger-Mueller Probe
Beta	Anthracene or Plastic Scintillation Probe "Pancake" Geiger-Mueller Probe Ionization Chamber Gas-Flow Proportional Counter
Gamma	Sodium Iodide Scintillation Probe Energy Compensated Geiger-Mueller Probe (for exposure rate) Ionization Chamber

Portable counters of several types can be used to detect beta contamination on surfaces. The most commonly used detector of beta radiation is the "pancake" Geiger-Mueller (G-M) probe coupled with a count-rate meter. Portable G-M counters generally cannot be used to detect tritium contamination because the beta energy is too low to allow the particle to enter the detector. Wipe tests are the usual means of surveying for tritium contamination of surfaces and will be discussed in the next section. Since most beta emitters also emit gamma rays, many monitoring instruments are made to detect both radiations. The G-M probe described previously does respond to all radiations, however, it is not very efficient for detection of pure photon emitters (e.g., Iodine-125). In this case a thin sodium iodide solid scintillation probe is recommended.



## 5.2 Wipe Tests

Wipe tests are performed to determine levels of removable contamination on surfaces and equipment. In Regulatory Guide 8.23,<sup>1</sup> the NRC defines removable contamination as "radioactivity that can be transferred from a surface to a smear [wipe] test paper by rubbing with moderate pressure." They also explain, "a standardized method for smear [wipe] testing of a relatively uniform area should be used in order to allow comparison of relative levels of contamination at different times and places. A dry smear taken from an area of about 100 cm<sup>2</sup> is acceptable to indicate levels of removable contamination."

Following is an example of a standardized method for wipe testing recommended by the NRC in NUREG/CR-1754.<sup>2</sup> To conduct a wipe test for removable contamination:

- obtain small pieces of paper, such as discs of filter paper;
- rub a piece of the filter paper over the surface of the item to pick up any removable radioactivity; and
- examine wipe tests for different types of radiation by using simple counting room techniques with an appropriate instrument (refer to Table 5-2).

In that liquid scintillation counting will detect all radiations at quite good efficiencies for all radionuclides (including tritium and carbon-14), it is recommended that all final smears be evaluated by this method. Other instrumentation such as survey meters with various probes can be utilized for decontamination efforts in the field.

## 5.3 Termination Survey Report

According to the NRC in NUREG/CR-1754,<sup>3</sup> the results of the final radiation survey are to be communicated to the NRC in a report entitled the "Termination Survey Report." Its purpose is to establish that the contamination remaining on the premises is within the limits specified in the NRC guidelines. The termination survey report shall:

- identify the premises;
- show the reasonable effort has been made to eliminate residual contamination;
- describe the scope of the final radiation survey and the general procedures followed; and
- state the findings of the final radiation survey.

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<sup>1</sup> NRC Regulatory 8.23, op cit, p. 8.23-3.

<sup>2</sup> NUREG/CR-1754, op cit, pp. C-16-C-17.

<sup>3</sup> NUREG/CR-1754, op cit, pp. 4-14, 4-15.

Table 5-2: Sample Counters for Assay of Wipes for Removable Contamination

<u>Counter Type</u>	<u>Radiation Detected</u>
Geiger-Mueller	Alpha Beta Gamma
Gas-Flow Proportional Counter	Alpha Beta Gamma
Nal(Tl) Scintillation Detector Well or Standard Crystal	Gamma X-Ray
ZnS Scintillation Detector	Alpha
Liquid Scintillation Counter	Alpha Beta Gamma X-Ray
Semi-Conductor Detector	Gamma X-Ray

The NRC will review each of the sections found in the report to determine if the site has been successfully decommissioned. They could make one of two general decisions regarding the decommissioning effort. The NRC could decide to terminate the facility license thereby concluding that the facilities have been successfully decommissioned. Alternatively, they could decide to visit the facilities to make observations as to their general condition and confirm the final radiation survey conclusions by surveying. The NRC will not terminate the radioactive material license until they are satisfied that all levels of residual radioactive contamination are below currently accepted contamination release levels. The NRC provides such release levels in NRC Regulatory Guide 8.23.4 This information is included as an Attachment to this Section of the report.

#### 5.4 Cost of the Final Radiation Survey

The cost of the final radiation survey is based primarily on employee time involved in conducting the survey and use of in-house counting equipment. An accurate estimate of the radiological condition of the laboratories and areas where radioactive materials had been used must be conducted to demonstrate that residual radioactivity is below currently accepted contamination release levels.

<sup>4</sup> NRC Regulatory Guide 8.23, op cit, p. 8.23-9.

The final radiation survey team should consist of a supervisor, health physics technician and secretary. We assumed that the team would require approximately the same amount of time for the final radiation survey as calculated for the amount of time to monitor for compliance, reclean and remonitor facilities in Section 2.2.11 of this report. A summary of the costs developed in this section is found in Table 5-3.

Table 5-3: Cost of the Final Radiation Survey

<u>Final Survey</u>	<u>Man-Days</u>	<u>Cost</u>
RSO/Supervisor	0.4	\$122.22
Health Physicist	0.2	\$262.62
Technician	3.1	\$399.25
Craftsperson	0.7	\$91.18
Total	4.4	\$875.27

## 6.0 Summary and Conclusions of Decommissioning Cost Estimate

This report presents all of the information necessary to complete the Decommissioning Cost Estimate for Biogen facilities. Following the Introduction, there were six sections, each containing interrelated information needed to determine the final decommissioning cost estimate.

Section 1 of this report, "Estimates of the Time Required for Planning and Preparation of the Decommissioning Plan," involved estimating annual salaries for a list of positions commonly required during a decommissioning effort. These salaries were used in later sections to develop further manpower estimates. Then, projections of the amount of time it would take for an RSO/supervisor, health physicist, and secretary to complete the following tasks were developed: preparation of documentation for regulatory agencies; submittal of a decommissioning plan to the NRC; development of work plans; procurement of special equipment; staff training; and characterization of the radiological condition of the facility.

In Section 2 of this report, "Estimates of Decontamination and Dismantling Costs," the numbers and sizes of laboratories, areas, and facility components that could require decontamination or dismantling were estimated. Then, the quantity and cost of special equipment and supplies that would be required for decommissioning were estimated. Finally, using the salary estimates developed in Section 1, projections of the time and costs for an RSO/supervisor, technician, health physicist, and craftsperson to complete the following tasks were estimated: decontaminate or dismantle laboratory fume hoods, benches, sinks, refrigerators, radwaste area, sink drains and pipes, ventilation systems; and monitoring for compliance, recleaning, and remonitoring.

The estimates of decontaminated and dismantled components developed in Section 2 were directly related to the estimates of packaging, shipping, and disposal provided in Section 3. In this section, the number and volume of radioactive waste containers needed for packaging, shipping, and disposal of all radioactive facility and area components which were decontaminated or dismantled were provided. These quantities were then used to determine the cost of packaging, shipping, and disposal of solid radioactive waste and dismantled components from Biogen facilities to the Barnwell Nuclear Burial Site, a low-level radioactive waste disposal facility located in Barnwell, South Carolina.

Although Biogen does not have a site which requires remediation, alternatives for a site containing soil contamination were identified in Section 4 of this report, "Estimate Remediation Costs." Contaminated soil removal was assumed to be the best method to use. After all contaminated soil is removed from the site, a final radiation survey should be conducted demonstrating that residual levels of radioactive contamination are below currently accepted NRC release limits. Site restoration or backfilling and revegetation completes site remediation activities.

The importance of a final radiation survey, conducted once decontamination and decommissioning of a facility is complete, is discussed in Section 5 of this report, "Prepare Final Survey Estimates." The purpose of this survey is to demonstrate that residual levels of radioactive contamination at Biogen facilities are below currently



accepted NRC release limits. This survey should consist of conducting hand-held meter surveys and taking wipe samples for analysis of residual levels of radioactive contamination.

Based on our analysis of the various Biogen facilities, we estimated that the cost of decommissioning all facilities would be approximately \$54,401.56. This cost included all steps in the decommissioning process as described in Section 1-5 of this report. The NRC recommends the addition of a contingency factor of 25% to account for any unexpected costs associated with decommissioning. The total cost of decommissioning all facilities including the contingency is \$68,001.95. A summary of all decommissioning costs is presented in Table 6-1.

Table 6-1: Summary of Decommissioning Cost Estimate

<u>Section #</u>	<u>Description</u>	<u>Cost Estimate</u>
1	Estimates of Time Required for Planning and Preparation of the Decommissioning Plan	\$17,468.27
2	Estimates of Decontamination and Dismantling Costs	\$2,625.80
	Equipment Rental and Purchase	\$3,900.00
3	Estimates of Packaging, Shipping, and Disposal Costs	\$29,532.23
4	Estimate Remediation Costs	\$0.00
5	Prepare Final Survey Estimates	\$875.27
Subtotal		\$54,401.56
	Additional 25% Contingency	\$13,600.39
Total		\$68,001.95

## Section 7: References

NUREG/CR-1754 "Technology, Safety and Costs of Decommissioning Reference Non-Fuel-Cycle Nuclear Facilities," Pacific Northwest Laboratory for the U.S. Nuclear Regulatory Commission, February 1981.

NUREG/CR-1754, Addendum 1, "Technology, Safety and Costs of Decommissioning Reference Non-Fuel-Cycle Nuclear Facilities, Compendium of Current Information," Pacific Northwest Laboratory for the U.S. Nuclear Regulatory Commission, October 1989.

NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination," Oak Ridge Associated Universities, June 1992.

U.S. Nuclear Regulatory Commission Regulatory Guide 3.65 "Standard Format and Content of Decommissioning Plans for Licensees Under 10 CFR Parts 30, 40, and 70," U.S. Nuclear Regulatory Commission, August 1989.

U.S. Nuclear Regulatory Commission Regulatory Guide 3.66 "Standard Format and Content of Financial Assurance Mechanisms Required for Decommissioning Under 10 CFR Parts 30, 40, 70, and 72," U.S. Nuclear Regulatory Commission, June 1990.

U.S. Nuclear Regulatory Commission Regulatory Guide 8.23 "Radiation Safety Surveys at Medical Institutions," U.S. Nuclear Regulatory Commission, January, 1981.

617 252 9200

TELEPHONE CONVERSATION LOG

DATE: August 31, 1993

PERSON CALLED:

Susan Lee 9236

ORGANIZATION:

Biogen Inc.

TELEPHONE NUMBER:

617 804 8900

LICENSE NUMBER:

20-19808-01

DOCKET NUMBER:

30-19268

MAIL CONTROL NUMBER:

113030

PERSON CALLING:

David B. Everhart (215) 337-6936  
USNRC Region. I FAX Numbers  
475 Allendale Road (215) 337-5269 or  
King of Prussia, PA 19406 (215) 337-5234

SUBJECT:

DECOMMISSIONING / FINANCIAL ASSURANCE

SUMMARY:

REQUESTED 30 DAY EXTENSION TO REVIEW  
R/A WITH BIOGEN + BANK LAWYERS TO "FIX"  
DEFICIENCIES

12/7

will send within 1 week

12/7 NEEN UNTIL 1/15/94

WHERE IS LETTER OF CREDIT?

ACTION REQUIRED/TAKEN:

SIGNATURE:

DATE:

AUG 09 1993

License No.: 20-19808-01  
Docket No.: 030-19268  
Control No.: 113030

Biogen Research Corporation  
ATTN: Frederic A. Eustis, III  
Vice President-General Counsel  
14 Cambridge Center  
Cambridge, Massachusetts 02142

Dear Mr. Eustis:

Subject: Financial Assurance

This is in reference to your letters dated July 27, 1990 and July 30, 1990 with attached Decommissioning Funding Plan, Letter of Credit and Trust Agreement to provide financial assurance for License No. 20-19808-01. We have reviewed your submittals and request that you modify your submissions to address the specific matters listed below:

1. You itemized the cost estimate for decommissioning Biogen facilities by major decommissioning activity and provided supporting documentation; however, you did not sufficiently support the decommissioning cost estimates. In particular, the estimates of the total person-hours required to decontaminate the facility and the cost to dispose of radioactive waste appear low compared to estimates found in NUREG/CR-1754 (enclosed) for a reference facility with similar components. In addition, it does not appear that you included the costs of decontaminating wall space in the decommissioning cost estimates.

Please substantiate your estimates of work days required to decontaminate the facility, as well as the estimated cost of radioactive waste disposal or revise these estimates and the total decommissioning cost estimate. Submit additional detail explaining the estimates of required labor hours and waste disposal costs including the estimated costs for decontaminating wall spaces.

Note that your estimate that 10 radioactive waste disposal drums will hold 75 m<sup>3</sup> implies a capacity of 7.5 m<sup>3</sup> per drum. A standard 55-gallon drum will hold 0.208 m<sup>3</sup> or about 7.5 ft<sup>3</sup> of material.

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2. Item 1 of the cost estimating tables in your Decommissioning Funding Plan estimates that it will require 14.5 person-days for planning and preparation of your facility for decommissioning and six days for a final radiation survey. Appendix B to NUREG/CR-1754 Addendum 1, estimates that it would require more than 60 person-days to conduct planning and preparation of any of six reference laboratories for decommissioning, and from 13 to 36 days to conduct a final radiation survey. Either modify your estimates or provide additional details to support your estimate of the number of person-days required for planning and preparation for decommissioning of this facility and for conducting a final radiation survey.
3. Regulatory Guide 3.66 recommends that a contingency factor be included in the decommissioning cost estimate to ensure that you are prepared for unexpected circumstances that could raise decommissioning costs. NUREG/CR-1754 uses a contingency factor of 25 percent in its cost estimates for each of six reference laboratories. Please incorporate a contingency factor into the decommissioning cost estimates. If you use a contingency factor other than 25%, please substantiate why that factor is appropriate. Also, confirm that you have not included credit for any salvage value that may be realized with the sale of potential assets after decommissioning in the cost estimate.
4. You changed certain provisions found in the recommended wording in Regulatory Guide 3.66 regarding the Standby Letter of Credit which relate to the notification requirements found at the end of Paragraph 3 on page 4-33 of the Regulatory Guide. The recommended wording addresses notification requirements in the case of the financial institution's insolvency as follows:

"The bank shall give immediate notice to the applicant and the ["NRC"] of any notice received or action filed alleging (1) the insolvency or bankruptcy of the financial institution or (2) any violations of regulatory requirements that could result in suspension or revocation of the bank's charter or license to do business. The financial institution also shall give immediate notice if the bank, for any reason, becomes unable to fulfill its obligation under the letter of credit."

This language ensures that both the NRC and the licensee are given adequate warning of events that may jeopardize the financial assurance. Your Stand-by Letter of Credit, however, does not require "immediate notice," but rather states that the issuer "will endeavor to give prompt notice..." This language is insufficient to ensure adequate

protection for the NRC. In addition, the letter of credit omitted the last sentence of the above paragraph requiring notice if the issuer "becomes unable to fulfill its obligation under the letter of credit." Please revise the Letter of Credit to match the recommended wording in page 4-33 of Regulatory Guide 3.66.

5. Your Trust Agreement includes several statements limiting the trustee's liability resulting from acts caused by its gross negligence or willful misconduct (e.g., Section 4, Section 10, Section 12 and Section 19 of the submitted Trust Agreement). These statements excessively limit the trustee's liability for various trust management activities, and threatens the effectiveness of the agreement for financial assurance purposes. These statements should be deleted, and the recommended wording regarding trustee liability found in Section 6, page 4-20 of Regulatory Guide 3.66, should be added instead. The recommended wording states that the trustee must manage the trust "solely in the interest of the beneficiary and with the care, skill, prudence, and diligence under the circumstances then prevailing which persons of prudence, acting in a like capacity and familiar with such matters, would use in the conduct of an enterprise of a like character and with like aims."
6. The submitted Trust Agreement allows withdrawals of up to \$10,000 without written NRC approval. This exceeds the 10 percent level recommended by the NRC which provides the NRC greater opportunity to monitor Biogens' decommissioning spending by requiring written NRC approval for withdrawals larger than the specified amount. Please revise the Trust Agreement to limit withdrawals to no more than 10 percent of the outstanding balance without written NRC approval.
7. Section 15 of the submitted Trust Agreement requires only 30 days notice of the trustee's resignation or replacement. Regulatory Guide 3.66, in Section 13, page 4-22, recommends 90 days notice. The 30 days afforded by the submittal may not allow the NRC nor the licensee adequate time to secure an alternate trustee or transfer the trust funds to a replacement. Please modify the agreement to provide 90 days notification of trustee resignation or replacement.
8. Section 22 of the submitted Trust Agreement adds the following condition:

"This Agreement shall become effective when the Trustee shall have received an incumbency certificate as to the names and specimen signatures of the officers of the Grantor authorized to sign this Agreement and any certificates, notices, directions, instructions and other communication hereunder.

As soon as possible, the Grantor shall provide to the Trustee a ratification of the Grantor's Board of Directors ratifying the execution, delivery and performance by the Grantor of this Agreement."

Biogen does not provide any indication of whether or not this condition has been met. The NRC must be able to determine if the condition has been satisfied to ensure that the standby trust agreement is effective. Please submit evidence of the effective date of the agreement.

9. Although you submitted a copy of your corporate by-laws, they do not specify that the Vice President, General Counsel is authorized to enter into a trust agreement for the licensee. Evidence of authority to represent the company is necessary, as recommended by Regulatory Guide 3.66, to ensure the validity and enforceability of the financial assurance mechanism. Please submit evidence that the Vice President, General Counsel is authorized to sign the agreement.
10. Schedule A of your submittal does not include the address of the licensee, the address of the licensed activity, nor the cost estimate applicable to the agreement as recommended in Regulatory Guide 3.66, page 4-26. The addresses assist the trustee in determining if funds should be distributed for a specific facility. In addition, the submitted Schedule B is incomplete because it does not include the deposit of \$100 referenced in Section 4 of the standby trust agreement. Please submit a completed Schedule A and a revised Schedule B.
11. Your submission includes a "specimen certificate of events", which refers to an attached "specimen certificate of resolution" which we are unable to locate. Without the specimen, the NRC cannot be sure that the trustee will release decommissioning funds only upon receiving appropriate instructions. Please submit a "specimen certificate of resolution", which should contain blank spaces for dates and signatures when decommissioning activities commence, as recommended on page 4-25 of Regulatory Guide 3.66.
12. Your submission does not appear to include a letter of acknowledgement with the Trust Agreement, as recommended by Regulatory Guide 3.66 on page 4-27. The acknowledgement is needed to verify the execution of the Trust Agreement and to certify the trustee's signature and authority to enter into the agreement. Please submit a letter of acknowledgement.

We will continue our review upon receipt of this information. Please reply in duplicate to my attention at the Region I office and refer to Mail Control No. 113030. If you have any questions regarding this letter please call David Everhart of my staff at (215) 337-6936. Since your license requires financial assurance, we request that you respond within 30 calendar days of the date of this letter.

Sincerely,

Original Signed By:  
John D. Kinneman

John D. Kinneman, Chief  
Research & Development and  
Decommissioning Section  
Division of Radiation Safety  
and Safeguards

Enclosures:

1. Regulatory Guide 3.66
2. NUREG/CR 1754
3. NUREG/CR 1754, Addendum 1

bcc:

J. Kinneman, RI

DRSS:RI  
Everhart/mfb

8/5/93

DRS:HQ  
Evkoski

8/8/93

DRSS:RI  
Kinneman

8/8/93



M516  
K-2



January 14, 1993

Via Airborne

Mr. John D. Kinneman  
Chief, Research & Development and  
Decommissioning Section  
Division of Radiation Safety and Safeguards  
Mail Control No. 113030  
United States Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406-1415

Re: Biogen, Inc. - Decommissioning Funding Plan: License No. 20-19808-01

Dear Mr. Kinneman:

I received your letter dated August 9, 1993 containing comments and requests for additional information with respect to Biogen's Decommissioning Funding Plan to provide financial assurance for License No. 20-19808-01. In response to your comments, I enclose the following:

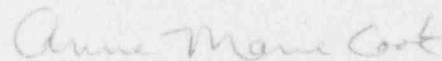
1. Revised Cost Estimate. In response to paragraphs 1, 2 and 3 of your letter, I enclose a revised Decommissioning Cost Estimate.
2. Revised Standby Letter of Credit. In response to paragraph 4 of your letter, I enclose a copy of an amendment to the Standby Letter of Credit presently in place. The amendment makes the changes you requested and increases the amount of the Letter of Credit from \$25,000 to \$75,000.
3. Amendment No. 1 to Trust Agreement. In response to the comments contained in paragraphs 5, 6, 7, 8, 10, 11, and 12 of your letter, I enclose an Amendment No. 1 to Trust Agreement which amends the trust agreement in the manner you requested. Please note, however, that I have not revised Schedule B of the Trust Agreement to include the deposit of \$100 referenced in Section 4. As I indicated by telephone to Mr. David Everhart of your office, the "Fund", as defined in the text of Section 10, includes the deposit. Schedule B, as defined in the Trust Agreement, refers only to the Letter of Credit.

113030

In paragraph 9 of your letter, you requested evidence of the authority of the Vice President-General Counsel to enter into the Trust Agreement on behalf of Biogen. Under the By-Laws of Biogen, Vice Presidents have such power and duties as may from time to time be determined by the Board of Directors or the Chairman of the Board. The Chairman of the Board of Biogen is also the President and is responsible for day-to-day operations of the Company. The By-Laws do not require that the Vice-Presidents' powers be specified in writing. Since the Chairman gave the Vice President-General Counsel the authority to sign the Trust Agreement but did not reduce that authority to writing, the written authorization of the Vice President-General Counsel to act is the enabling provision of the By-laws.

If you have any further questions or need any additional information with respect to any of the foregoing, please do not hesitate to call me at (617) 252-9821 or with respect to technical matters, Susan Lee at (617) 252-9236.

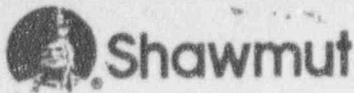
Sincerely,



Anne Marie Cook  
Assistant General Counsel

cc. Susan Lee

cook.environment.nrcresp.ltr



Shawmut Bank, N.A.  
 P.O. Box 2176, Boston, MA 02211-2176, Tel. 617-292-2000

International Department  
 Telex: W.U.I 6817133  
 Cable: SHAWMUT  
 S.W.I.F.T. ADDRESS: NASH US 33

APPLICANT'S COPY

STANDBY LETTER OF CREDIT AMENDMENT  
 S040785W 010

JANUARY 10, 1994  
 PAGE 01

ADVISED BY MAIL DIRECT:

U.S. NUCLEAR REGULATORY COMMISSION  
 WASHINGTON, D.C. 20555  
 REF: LICENSE # 20-19808-01, 02-19808-02

GENTLEMEN:

THE ABOVE MENTIONED LETTER OF CREDIT, ISSUED BY ORDER AND FOR  
 ACCOUNT OF BIOGEN, INC. IS AMENDED AS FOLLOWS:

CREDIT AMOUNT INCREASED BY: FIFTY THOUSAND AND NO/100 DOLLARS  
 UNITED STATES CURRENCY (USD 50,000.00)  
 TO A NEW AVAILABLE AMOUNT OF: SEVENTY-FIVE THOUSAND AND NO/100  
 DOLLARS UNITED STATES CURRENCY (USD 75,000.00)

DELETE:

"WE WILL ENDEAVOR TO GIVE PROMPT NOTICE TO THE APPLICANT AND THE  
 DEPARTMENT OF A NOTICE RECEIVED OR ACTION FILED ALLEGING THE  
 INSOLVENCY OR BANKRUPTCY OF THE BANK OR ALLEGING ANY VIOLATIONS  
 OF REGULATORY REQUIREMENTS WHICH SHALL RESULT IN SUSPENSION OR  
 REVOCATION OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS."

INSERT AND SUBSTITUTE:

"THE BANK SHALL GIVE IMMEDIATE NOTICE TO THE APPLICANT AND THE  
 NRC OF ANY NOTICE RECEIVED OR ACTION FILED ALLEGING (1) THE  
 INSOLVENCY OR BANKRUPTCY OF THE FINANCIAL INSTITUTION OR (2) ANY  
 VIOLATIONS OF REGULATORY REQUIREMENTS THAT COULD RESULT IN  
 SUSPENSION OR REVOCATION OF THE BANK'S CHARTER OR LICENSE TO DO  
 BUSINESS. THE FINANCIAL INSTITUTION ALSO SHALL GIVE IMMEDIATE  
 NOTICE IF THE BANK, FOR ANY REASON, BECOMES UNABLE TO FULFILL  
 ITS OBLIGATION UNDER THE LETTER OF CREDIT."

THIS AMENDMENT IS TO BE CONSIDERED AS PART OF THE ABOVE MENTIONED  
 LETTER OF CREDIT.

\*\*\* ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED \*\*\*

VERY TRULY YOURS,

AUTHORIZED SIGNATURE

This credit is subject to the 'Uniform Customs and Practice for Documentary Credits' (1993 Revision), International Chamber of Commerce, Publication No. 400

NOT NEGOTIABLE  
COPY

## AMENDMENT NO.1 TO TRUST AGREEMENT

THIS AMENDMENT NO. 1 TO TRUST AGREEMENT is entered into as of this 11th day of January, 1994 by and between Biogen, Inc., a Massachusetts corporation (the "Grantor") and the Shawmut Bank, N.A., a national banking association (the "Trustee")

WHEREAS, the U.S. Nuclear Regulatory Commission (the "NRC") has requested that Grantor modify a certain Trust Agreement between Grantor and Trustee dated July 20, 1990 (the "Trust Agreement") to conform to the applicable decommissioning regulatory guide; and

WHEREAS, the Grantor and the Trustee desire to amend the Trust Agreement as set forth herein as requested by the NRC.

NOW THEREFORE, the Grantor and the Trustee agree as follows:

1. Amendment to Trust Agreement.

The Trust Agreement is hereby amended as follows:

- (a) Section 4. The last sentence of Section 4 of the Trust Agreement is deleted in its entirety.
- (b) Section 7. The second sentence of Section 7 of the Trust Agreement is replaced in its entirety with the following:

"The Grantor's certificate presented pursuant to this Section shall not request a withdrawal from the Fund which exceeds 10% of the outstanding balance of the Fund, unless NRC approval is attached."
- (c) Section 10. The last sentence of Section 10 of the Trust Agreement is deleted in its entirety.
- (d) Section 12. The last sentence of Section 12 of the Trust Agreement is deleted in its entirety.
- (e) Section 15. Section 15 of the Trust Agreement is amended by changing the number 30 to the number 90 in the two places in which the number appears in the Section.
- (f) Section 19. Section 19 of the Trust Agreement is replaced in its entirety with the following:

"In investing, reinvesting, exchanging, selling, and managing the Fund, the Trustee shall discharge its duties with respect to the Fund solely in the interest of the beneficiary and with the care, skill, prudence, and diligence under the circumstances



then prevailing which persons of prudence, acting in a like capacity and familiar with such matters, would use in the conduct of an enterprise of a like character and with like aims; except that:

- (i) Securities or other obligations of the Grantor, or any other owner or operator of the facilities, or any of their affiliates as defined in the Investment Company Act of 1940, as amended (15 U.S.C. 80a-2(a)), shall not be acquired or held, unless they are securities or other obligations of the Federal or a State government;
- (ii) The Trustee is authorized to invest the Fund in time or demand deposits of the Trustee, to the extent insured by an agency of the Federal Government, and in obligations of the Federal Government such as GNMA, FNMA, and FHLM bonds and certificates or State and Municipal bonds rated BBB or higher by Standard and Poors or Baa or higher by Moody's Investment Services; and
- (iii) For a reasonable time, not to exceed 60 days, the Trustee is authorized to hold uninvested cash, awaiting investment or distribution, without liability for the payment of interest thereon.

The Trustee shall not incur personal liability of any nature in connection with any act in the administration of this trust or in carrying out any directions of Grantor, the NRC or any state agency issued in accordance with this Agreement other than those liabilities arising out of Trustee's failure to use the standard of care set forth above. The Trustee shall be indemnified by the Grantor from and against any personal liability to which the Trustee may be subjected by reason of any act or conduct in its official capacity, including all expenses reasonably incurred in its defense in the event the Grantor fails to provide such defense, other than those liabilities arising out of Trustee's failure to use the standard of care set forth in this Section."

- (g) Schedule A Schedule A to the Trust Agreement is replaced in its entirety with a revised Schedule A in the form attached as Exhibit A hereto.
- (h) Schedule B. Schedule B to the Trust Agreement is replaced in its entirety with a revised Schedule B in the form attached as Exhibit B. hereto.
- (i) Specimen Certificate of Events The Specimen Certificate of Events attached to the Trust Agreement is amended by attaching thereto specimen resolutions in the form attached as Exhibit C hereto.

## 2. Effective Date of Trust Agreement.

The parties acknowledge that the Trust Agreement became effective on July 20, 1990 and remains in full force and effect on the date hereof.

IN WITNESS WHEREOF, the parties have executed this Agreement as of this 11th day of January 1994.

GRANTOR:

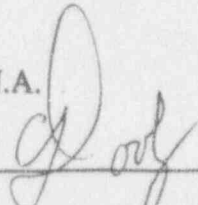
BIOGEN, INC

By: 

Title: Vice President - General Counsel

TRUSTEE:

SHAWMUT N.A.

By: 

Title: ASSISTANT VICE PRESIDENT

ACKNOWLEDGEMENT

Commonwealth of Massachusetts

County of: Middlesex

On this 11<sup>th</sup> day of January 1994, before me, a notary public in and for the county and State aforesaid, personally appeared Michael J. Atencio, and he did depose that he is the Vice President General Counsel of Biogen, Inc., which executed the above instrument, that he knows the seal of said company; that the seal affixed to such instrument is such corporate seal; that it was so affixed by order of such company; and that he signed his name thereto by like order.

Barbara A. Murphy  
[Signature of notary public]

My Commission Expires 4-25-97  
[Date]

ACKNOWLEDGEMENT

Commonwealth of Massachusetts

County of: SUFFOLK

On this 13<sup>th</sup> day of January, 1994, before me, a notary public in and for the county and State aforesaid, personally appeared CHARLES E. DOOLEY and he did depose that he is the ASSISTANT VICE PRESIDENT, of Shawmut, N.A., which executed the above instrument, that he knows the seal of said entity; that the seal affixed to such instrument is such corporate seal; that it was so affixed by order of such entity; and that he signed his name thereto by like order.

James H. Byrne  
[Signature of notary public]

My Commission Expires 01-24-97  
[Date]



SCHEDULE ANRC Licenses of Biogen, Inc.

<u>Location</u>	<u>License Number</u>	<u>Estimated Percentage of Total Cost</u>
14 Cambridge Center	20-19808-01 20-19808-02	87%
215 Bent Street	20-19808-01	1%
241 Binney Street	20-19808-01	10%
345 Vassar Street	20-19808-01	2%

STANDBY LETTER OF CREDIT AMENDMENT  
S040785W 010JANUARY 10, 1994  
PAGE 01

ADVISED BY MAIL DIRECT:

U.S. NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555  
REF: LICENSE # 20-19808-01, 02-19808-02

GENTLEMEN:

THE ABOVE MENTIONED LETTER OF CREDIT, ISSUED BY ORDER AND FOR  
ACCOUNT OF BJOGEN, INC. IS AMENDED AS FOLLOWS:CREDIT AMOUNT INCREASED BY: FIFTY THOUSAND AND NO/100 DOLLARS  
UNITED STATES CURRENCY (USD 50,000.00)  
TO A NEW AVAILABLE AMOUNT OF: SEVENTY-FIVE THOUSAND AND NO/100  
DOLLARS UNITED STATES CURRENCY (USD 75,000.00)

DELETE:

"WE WILL ENDEAVOR TO GIVE PROMPT NOTICE TO THE APPLICANT AND THE  
DEPARTMENT OF A NOTICE RECEIVED OR ACTION FILED ALLEGING THE  
INSOLVENCY OR BANKRUPTCY OF THE BANK OR ALLEGING ANY VIOLATIONS  
OF REGULATORY REQUIREMENTS WHICH SHALL RESULT IN SUSPENSION OR  
REVOCAION OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS."

INSERT AND SUBSTITUTE:

"THE BANK SHALL GIVE IMMEDIATE NOTICE TO THE APPLICANT AND THE  
NRC OF ANY NOTICE RECEIVED OR ACTION FILED ALLEGING (1) THE  
INSOLVENCY OR BANKRUPTCY OF THE FINANCIAL INSTITUTION OR (2) ANY  
VIOLATIONS OF REGULATORY REQUIREMENTS THAT COULD RESULT IN  
SUSPENSION OR REVOCAION OF THE BANK'S CHARTER OR LICENSE TO DO  
BUSINESS. THE FINANCIAL INSTITUTION ALSO SHALL GIVE IMMEDIATE  
NOTICE IF THE BANK, FOR ANY REASON, BECOMES UNABLE TO FULFILL  
ITS OBLIGATION UNDER THE LETTER OF CREDIT."THIS AMENDMENT IS TO BE CONSIDERED AS PART OF THE ABOVE MENTIONED  
LETTER OF CREDIT.

\*\*\* ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED \*\*\*

VERY TRULY YOURS,

AUTHORIZED SIGNATURE



Shawmut Bank, N.A.

P.O. Box 2176, Boston, MA 02211-2176, Tel. 617-292-2000

EXHIBIT B

International Department  
Telex: W.U.I 6817133  
Cable: SHAWMUT  
S.W.I.F.T. ADDRESS: NASH US 33

ADVISING BANK'S COPY

IRREVOCABLE STANDBY LETTER OF CREDIT

JULY 26, 1990

S040785W

PAGE 01

U.S. NUCLEAR REGULATORY COMMISSION  
WASHINGTON, DC 20555  
REF: LICENSE # 20-19808-01, 02-19808-02

DEAR SIR OR MADAM:

WE HEREBY, ESTABLISH OUR IRREVOCABLE STANDBY LETTER OF CREDIT IN YOUR FAVOR, AT THE REQUEST AND FOR THE ACCOUNT OF BIOGEN, INC., 14 CAMBRIDGE CTR., CAMBRIDGE, MA 02142, UP TO THE AGGREGATE AMOUNT OF TWENTY FIVE THOUSAND AND 00/100 U.S. DOLLARS \*\*\*\*\*\$25,000.00 AVAILABLE UPON PRESENTATION BY YOU OR YOUR DESIGNEE OF

(1) YOUR SIGHT DRAFT, BEARING REFERENCE TO THIS LETTER OF CREDIT NUMBER S040785W

AND

(2) YOUR SIGNED STATEMENT READING AS FOLLOWS:

"I CERTIFY THAT THE AMOUNT OF THE DRAFT IS PAYABLE PURSUANT TO REGULATIONS ISSUED UNDER AUTHORITY OF THE U.S. NUCLEAR REGULATORY COMMISSION (NRC), AN AGENCY OF THE U.S. GOVERNMENT, PURSUANT TO THE ATOMIC ENERGY ACT OF 1954, AS AMENDED AND THE ENERGY REORGANIZATION ACT OF 1974."

THIS LETTER OF CREDIT IS ISSUED IN ACCORDANCE WITH REGULATIONS ISSUED UNDER THE AUTHORITY OF THE U.S. NUCLEAR REGULATORY COMMISSION (NRC), AN AGENCY OF THE U.S. GOVERNMENT, PURSUANT TO THE ATOMIC ENERGY ACT OF 1954, AS AMENDED, AND THE ENERGY REORGANIZATION ACT OF 1974. THE NRC HAS PROMULGATED REGULATIONS IN TITLE 10, CHAPTER 1 OF THE CODE OF FEDERAL REGULATIONS, PART 30, WHICH REQUIRE THAT A HOLDER OF, OR AN APPLICANT FOR, A LICENSE ISSUED UNDER 10 CFR PART 30, PROVIDE ASSURANCE THAT FUNDS WILL BE AVAILABLE WHEN NEEDED FOR DECOMMISSIONING.

THIS LETTER OF CREDIT IS EFFECTIVE AS OF JULY 26, 1990 AND SHALL EXPIRE ON JULY 26, 1991, BUT SUCH EXPIRATION DATE SHALL BE AUTOMATICALLY EXTENDED FOR A PERIOD OF ONE YEAR ON JULY 26, 1991 AND ON EACH SUCCESSIVE EXPIRATION DATE, UNLESS, AT LEAST 90 DAYS BEFORE THE CURRENT EXPIRATION DATE, WE NOTIFY BOTH YOU AND BIOGEN, INC. BY RETURN RECEIPT THAT WE HAVE DECIDED NOT TO EXTEND THIS LETTER OF CREDIT BEYOND THE CURRENT EXPIRATION DATE. IN THE EVENT YOU ARE SO NOTIFIED, ANY UNUSED PORTION OF THE CREDIT SHALL BE AVAILABLE UPON PRESENTATION OF YOUR SIGHT DRAFT WITHIN 90 DAYS AFTER THE DATE OF RECEIPT OF NOTIFICATION BY BOTH YOU AND BIOGEN, INC. AS SHOWN ON THE LATER OF THE SIGNED RETURN RECEIPTS AND READING AS FOLLOWS:

INSTRUCTIONS TO THE ADVISING BANK

Please complete and forward to beneficiary the attached original advice without adding your confirmation

CONTINUED

NOT NEGOTIABLE

72/11 (4/87)



**Shawmut Bank, N.A.**

P.O. Box 2176, Boston, MA 02211-2176, Tel. 617-292-2000

EXHIBIT B

International Department  
Telex: W.U.I. 6817133  
Cable: SHAWMUT  
S.W.I.F.T. ADDRESS: NASH US 33

ADVISING BANK'S COPY

IRREVOCABLE STANDBY LETTER OF CREDIT

JULY 26, 1990

S040785W

PAGE 02

U.S. NUCLEAR REGULATORY COMMISSION  
WASHINGTON, DC 20555  
REF: LICENSE # 20-19808-01, 02-19808-02

"WE CERTIFY THAT THE LICENSEE HAS FAILED TO REPLACE THIS LETTER OF CREDIT WITH OTHER COLLATERAL ACCEPTABLE TO THE DEPARTMENT WITHIN 30 DAYS OF THE BANK'S NOTICE TO TERMINATE THE LETTER OF CREDIT."

WHENEVER THIS LETTER OF CREDIT IS DRAWN ON, UNDER AND IN COMPLIANCE WITH THE TERMS OF THIS CREDIT, WE SHALL DULY HONOR SUCH DRAFT UPON PRESENTATION TO US, AND WE SHALL DEPOSIT THE AMOUNT OF THE DRAFT DIRECTLY INTO THE STANDBY TRUST OF BIOGEN, INC. IN ACCORDANCE WITH YOUR INSTRUCTIONS.

WE WILL ENDEAVOR TO GIVE PROMPT NOTICE TO THE LICENSEE AND THE DEPARTMENT OF A NOTICE RECEIVED OR ACTION FILED ALLEGING THE INSOLVENCY OR BANKRUPTCY OF THE BANK OR ALLEGING ANY VIOLATIONS OF REGULATORY REQUIREMENTS WHICH SHALL RESULT IN SUSPENSION OR REVOCATION OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS.

DRAFTS DRAWN HEREUNDER MUST BE MARKED "DRAWN UNDER SHAWMUT BANK, N.A., CREDIT NO. S040785W DATED JULY 26, 1990".

D.C. PENNYBAKER ASSISTANT VICE PRESIDENT JULY 26, 1990

THIS CREDIT IS SUBJECT TO THE UNIFORM CUSTOMS AND PRACTICE FOR DOCUMENTARY CREDITS (1983 REVISION) INTERNATIONAL CHAMBER OF COMMERCE, PUBLICATION NO 400.

NOT NEGOTIABLE COPY

INSTRUCTIONS TO THE ADVISING BANK

Please complete and forward to beneficiary the attached original advice without adding your confirmation

72/11 (4/87)



SPECIMEN CERTIFICATE OF RESOLUTION

I, \_\_\_\_\_, do hereby certify that I am Secretary of Biogen, Inc., a Massachusetts corporation, and that the resolution listed below was duly adopted at a meeting of this Corporation's Board of Directors on \_\_\_\_\_, 19 \_\_\_\_.

IN WITNESS WHEREOF, I have hereunto signed my name and affixed the seal of this Corporation this \_\_\_\_ day of \_\_\_\_\_, 19 \_\_\_\_.

\_\_\_\_\_  
Secretary

RESOLVED, that this Board of Directors hereby authorizes the President, or such other employee of the Company as he may designate, to commence decommissioning activities at [insert name of facility] in accordance with the terms and conditions described to this Board of Directors at this meeting and with such other terms and conditions as the President shall approve with and upon the advice of counsel.

\*\*\*\*\*  
\*\*\* ACTIVITY REPORT \*\*\*  
\*\*\*\*\*

TRANSMISSION OK

TX/RX NO. 9890

CONNECTION TEL 62529617

CONNECTION ID

START TIME 01/13 08:37

USAGE TIME 08'21

PAGES 11

RESULT OK

030-19268

FOURTEEN CAMBRIDGE CENTER, CAMBRIDGE, MA 02142 • 617-252-9200 • FAX 617-252-9617

BIOGEN

January 27, 1992

*Portion of  
Renewal for  
Financial Assurance*

U.S. Nuclear Regulatory Commission, Region I  
Nuclear Materials Safety Section B  
475 Allendale Road  
King of Prussia, PA 19406

To Whom it may Concern:

This is to request renewal of License number 20-19806-01, which is due to expire February 29, 1992. Enclosed (in duplicate) are:

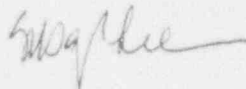
- NRC Form 313 Application for Material License.
- A description of Biogen's current radiation safety program.

Also enclosed is:

- A check in the amount of \$1100, the application fee.

If there are any questions about the program or this application, you may contact me directly at the above address or by phone at (617) 252-9236. Thank you for your attention to this matter.

Very truly yours,



Susan B. Lee, RSO, Manager  
Environmental Health and Safety

*COMBINED WITH 113030  
TAKEN FROM 116065*

OFFICIAL RECORD COPY

ML 10

JAN 28 1992

Due to the expansion of Bio III, and increasing labor costs since the decommissioning funding plan was initially prepared, the site specific cost estimate for decommissioning has been updated. The format and instructions provided in NUREG/CR-1754 Addendum 1, October 1989 were used to develop the spreadsheet to make the cost estimate. The grand total of decommissioning cost at this time is **\$24,450**. Attached is a single page summary of the calculation.

Biogen maintains a letter of credit in the amount of \$25,000 issued by Shawmut Bank, N.A. to provide financial assurance of its ability to pay for decommissioning under 10 CFR 30. Please refer to Mr. Frederic A. Eustis, III's letter of 26 July 1990, and its attachments for additional information regarding this financial assurance. This information continues to be consistent with Biogen's Radiation protection program.



BIO I,II,III: 1/92

1. PLANNING & PREP

TABLE 1

TASK	SUPV.	DAYS TECH/FOREN	CHP	CLERICAL	TOTAL DA	\$ COST
1. PREP DOCUMENTS	1		1	0.5	2.5	1572
2. SUBMIT PLAN	2		0.5	1	3.5	1343
3. DEVEL WORK PLAN	1				1	309
4. PROCURE EQT.	ALL ON HAND					
5. STAFF TRN'G	1		1		2	1509
6. SURVEY FACILITIE	6	1	0.5	0	7.5	2595
7. OTHER						
1. PLANNING & PREP.	11	1	3	1.5	16.5	7328
2. DECONTAM/DISMA LABOR EST(TABLE 3)	1	12	0.5	3	16.5	3201
5. FINAL SURVEY LABOR EST(TABLE 9)			6	1	7	7326
GRAND TOTAL LABOR						17855

NUMBER DIMENSIONS

GLOVE BOX	0	
FUME HOODS	9	
HOT CELLS	0	
LAB BENCH (M)		45
SINK/DRAIN	8	
FLOOR SPACE(SQ.M)		12
VENT DUCT (M)	3	30
WALL SPACE		
OTHER		

JOB	TABLE 2 LABOR ESTIMATE	
	\$/YR X 21% OH	\$/DAY
TECH/FOREN	28000	33880
CHP		N/A
CLERICAL	25000	30250
CRAFTSMAN		N/A
SUPV/RSO	61000	73810
		141
		1200
		126
		200
		308

3. PACKING, SHIPPING, DISP OF LLRW

	NO.	\$/UNIT	\$ EST.
DRUMS	17	35	595
STORE FOR DECAY	15 DRUMS		5000
DISPOSAL	1 DRUM	1000	1000
			6595

4. RESTORATION	N/A
5. FINAL SURVEY	SEE ABOVE
6. SITE STABILIZATIC	N/A

TOTAL SUPPLIES	6595
TOTAL LABOR	17855
	24450

LIST OF INSTRUCTIONS

BIOGEN RESEARCH CORPORATION

In reviewing the comments the reviewer will note that there will be some overlap between ICF and OGC comments. The following comments should be included in the basis for the deficiency letter:

1. ICF comments 1 through 13, plus last paragraph.
2. All OGC comments.

All other comments and discussions are for reviewer information.

February 6, 1991

Note to: Louis Bykoski, NMSS/LLWM

From: Mike Finkelstein, OGC/R&FC

Re: Review of ICF Comments in 5th Package dated 1/7/91

For each of the submittals listed below, the regional reviewers must verify that the document is a signed copy of the original and duly notarized.

Unless otherwise stated, the ICF comments and recommendations are correct and should be implemented.

Biogen Research Corporation (DFP, Letter of Credit)

All ICF recommendations should be implemented because the analysis is correct. No further comments are submitted on Biogen's submittal.



## ICF INCORPORATED

December 21, 1990

To: Dr. Lou Bykoski, NMSS/NRC

From: David Mitamura, Greg Currey, Michael Berg, and John Collier,  
ICF Incorporated

Subject: Review of Decommissioning Funding Plan with Letter of Credit  
Submitted by Biogen, Inc.

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Biogen, Inc. in Cambridge, Massachusetts submitted a decommissioning funding plan (DFP) using a letter of credit in the amount of \$25,000. The submission assures estimated decommissioning costs of \$23,076 for license 20-19808-01 issued under 10 CFR Part 30. The submission also refers to license 20-19808-02 issued under 10 CFR Part 30, but states that this second license does not require financial assurance. Upon review of the submission, ICF recommends that NRC Region I require the licensee to modify the submission in the following ways:

- (1) Submit additional detail explaining the estimates of required labor hours and waste disposal costs;
- (2) Submit additional detail to support estimated number of person-days required for planning and preparation;
- (3) Incorporate a contingency factor into the total decommissioning cost estimate and clarify that no credit was taken for salvage value;
- (4) Submit a signed letter of credit;
- (5) Amend the letter of credit to revise the language addressing notification requirements;
- (6) Delete statements in the standby trust agreement limiting the trustee's liability to gross negligence or willful misconduct;
- (7) Revise the standby trust agreement to limit withdrawals to no more than 10 percent of the outstanding balance without written NRC approval;
- (8) Revise the standby trust agreement's notification provisions regarding trustee resignation or replacement;
- (9) Submit evidence of the effective date of the standby trust agreement.



- (10) Submit evidence that the party signing the standby trust agreement for the licensee is authorized to represent the company;
- (11) Complete Schedule A and revise Schedule B of the standby trust agreement;
- (12) Submit a specimen certificate of resolution; and
- (13) Submit a letter of acknowledgement with the standby trust agreement.

Each recommendation is discussed in detail below.

(1) **Submit Additional Detail Explaining the Estimates of Required Labor Hours and Waste Disposal Costs**

Although the licensee itemized its cost estimate by major decommissioning activity and provided supporting documentation, it did not sufficiently support its decommissioning cost estimates. In particular, the licensee's estimates of the total person-hours required to decontaminate its facility and the cost to dispose of radioactive waste appear low compared to estimates in NUREG/CR-1754<sup>1</sup> for a reference facility with similar facility components.<sup>2</sup> In addition, the licensee does not include the costs of decontaminating wall space in its decommissioning cost estimates.

ICF recommends that the licensee substantiate its estimates of work days required to decontaminate its facility, as well as its estimated cost of radioactive waste disposal. Alternatively, the licensee may choose to revise these estimates and subsequently its total decommissioning cost estimate, and explain the new assumptions used.

(2) **Submit Additional Detail to Support Estimated Number of Person-Days Required for Planning and Preparation**

The licensee estimates that it will require 14.5 person-days for planning and preparation of its facility for decommissioning and six days for a final radiation survey. NUREG/CR-1754, however, estimates that it would require more than 60 person-days to conduct planning and preparation of any of six reference laboratories for decommissioning, and from 13 to 36 days to conduct a final radiation survey (see Addendum 1, Appendix B). ICF recommends

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<sup>1</sup> NUREG/CR-1754, Addendum 1, Technology, Safety and Costs of Decommissioning Reference Non-Fuel-Cycle Nuclear Facilities: Compendium of Current Information, Pacific Northwest Laboratory, October 1989.

<sup>2</sup> One factor contributing to the underestimation of disposal costs is the assumption that 10 radioactive waste disposal drums will hold 75 m<sup>3</sup> (cubic meters) of waste, implying a capacity of 7.5 m<sup>3</sup> per drum. The standard 55-gallon drum holds 0.208 m<sup>3</sup> of waste. Accordingly, the licensee should clarify or revise its estimates for the number of drums needed.

that the licensee provide additional detail to support its estimate of the number of person-days required for planning and preparation of its facility for decommissioning and for conducting a final radiation survey.

(3) Incorporate a Contingency Factor into the Total Decommissioning Cost Estimate and Clarify that No Credit Was Taken for Salvage Value

The licensee apparently has not made any allowance in its cost estimate for contingencies. The draft *Regulatory Guide* "Standard Format and Content of Financial Assurance Mechanisms Required for Decommissioning Under 10 CFR Parts 30, 40, 70, and 72," January 1990, recommends that a contingency factor be included in the decommissioning cost estimate. Incorporating a contingency factor in the cost estimate will help to ensure that the licensee is prepared for unexpected circumstances that could raise decommissioning costs. NUREG/CR-1754 uses a contingency factor of 25 percent in its cost estimates for each of six reference laboratories. ICF recommends that the licensee incorporate a contingency factor of 25 percent into its decommissioning cost estimates. The licensee may choose to use a lower contingency factor if it can show why a lower factor is appropriate. Furthermore, the licensee should clarify that it has not included in its cost estimate credit for any salvage value that may be realized with the sale of potential assets after decommissioning (see page 1-13 of the draft *Regulatory Guide*).

(4) Submit a Signed Letter of Credit

The letter of credit does not have an authorized bank officer signature. In addition the words "Not Negotiable Copy" are stamped across the letter. Each of these factors would preclude NRC from drawing on the submitted letter of credit. The "Not Negotiable Copy" stamp implies that NRC does not have the original letter of credit, as required to draw on the credit under the terms of the letter. The absence of a signature implies that the mechanism has not yet been executed. ICF recommends that NRC require the licensee to submit the original letter of credit signed by an authorized representative of the bank.

(5) Amend the Letter of Credit to Revise the Notification Requirements

The licensee changed or omitted certain provisions recommended in the draft *Regulatory Guide* relating to the notification requirements from the end of Paragraph 3. The recommended wording addresses notification requirements in the case of the financial institution's insolvency as follows:

The bank shall give immediate notice to the applicant and the [insert "NRC" or name of State agency] of any notice received or action filed alleging (1) the insolvency or bankruptcy of the financial institution or (2) any violations of regulatory requirements that could result in suspension or revocation of the bank's charter or license to do business. The financial institution also shall give immediate notice if the bank, for any reason, becomes unable to fulfill its obligation under the letter of credit.

This language ensures that both NRC and the licensee are given adequate warning of events that may jeopardize the financial assurance. The submission, however, does not require "immediate notice," but rather states that the issuer "will endeavor to give prompt notice. . ." This language is insufficient to ensure adequate protection for NRC. In addition, the letter of credit omitted the last sentence of the above paragraph requiring notice if the issuer "becomes unable to fulfill its obligation under the letter of credit." ICF recommends that NRC require the licensee to modify the letter of credit to more closely match the wording recommended in the draft *Regulatory Guide*.

(6) Delete Statements in the Standby Trust Agreement Limiting the Trustee's Liability to Gross Negligence or Willful Misconduct

The submitted standby trust agreement includes several statements limiting the trustee's liability to that resulting from acts caused by its gross negligence or willful misconduct (e.g., Section 4, Section 10, Section 12, Section 19). These statements excessively limit the trustee's liability for various trust management activities, and threatens the effectiveness of the agreement for financial assurance purposes. ICF recommends that NRC require these statements to be deleted, and that the standards for trustee liability recommended in the draft *Regulatory Guide*, Section 6, page 4-20) be added instead. The recommended language states that the trustee must manage the trust "solely in the interest of the beneficiary and with the care, skill, prudence, and diligence under the circumstances then prevailing which persons of prudence, acting in a like capacity and familiar with such matters, would use in the conduct of an enterprise of a like character and with like aims."

(7) Revise the Trust Agreement to Limit Withdrawals to No More Than 10 Percent of the Outstanding Balance Without Written NRC Approval

As submitted, the standby trust agreement allows withdrawal from the \$25,000 trust fund up to \$10,000 without written NRC approval. This \$10,000 withdrawal limit exceeds the 10 percent level specified in NRC guidance.<sup>3</sup> ICF recommends that Section 5 of the submitted standby trust agreement be revised to add this provision. This provision provides NRC greater opportunity to monitor the licensee's decommissioning spending by requiring written NRC approval for withdrawals larger than the specified amount.

(8) Revise the Standby Trust Agreement's Notification Provisions Regarding Trustee Resignation or Replacement

Section 15 of the submitted standby trust agreement requires only 30 days notice of the trustee's resignation or replacement. The draft *Regulatory Guide*, in Section 13 of the recommended wording (page 4-22), however, requires

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<sup>3</sup> "Response to Question Related to the Trust Fund Mechanism," from Timothy Johnson, NMSS/NRC to Karen Davis, St. Louis University, August 7, 1990. Although this guidance applies to a stand-alone trust fund, we assume NRC would give the same response to the same question regarding a standby trust fund.

90 days notice. The 30 days afforded by the submittal may not allow NRC or the licensee adequate time to secure an alternate trustee or transfer the trust funds to the replacement. ICF recommends that NRC require the licensee to modify the agreement to provide 90 days notification of trustee resignation or replacement.

(9) **Submit Evidence of the Effective Date of the Standby Trust Agreement**

Section 22 of the submitted standby trust agreement adds the following condition: "This Agreement shall become effective when the Trustee shall have received an incumbency certificate as to the names and specimen signatures of the officers of the Grantor authorized to sign this Agreement and any certificates, notices, directions, instructions and other communication hereunder. As soon as possible, the Grantor shall provide to Trustee a ratification of the Grantor's Board of Directors ratifying the execution, delivery and performance by the Grantor of this Agreement." The submission, however, does not provide any indication of whether this condition has been met. NRC must be able to determine if the condition has been satisfied to ensure that the standby trust agreement is effective. Therefore, ICF recommends that NRC require the licensee to submit evidence of the effective date of the agreement.

(10) **Submit Evidence that the Party Signing the Standby Trust Agreement for the Licensee is Authorized to Represent the Company**

Although the licensee submitted a copy of its corporate by-laws, they do not specify that the vice president, general counsel is authorized to enter into a standby trust agreement for the licensee. Evidence of authority to represent the company is necessary, as recommended by the draft *Regulatory Guide*, to ensure the validity and enforceability of the mechanism. ICF recommends that NRC require the licensee to submit evidence that the vice president, general counsel is authorized to sign the agreement.

(11) **Complete Schedule A and Revise Schedule B of the Standby Trust Agreement**

The submitted Schedule A does not include the address of the licensee, the address of the licensed activity, or the cost estimate applicable to the agreement, as recommended in the draft *Regulatory Guide*, page 4-26. The addresses assist the trustee in determining if funds should be distributed for a specific facility. In addition, the submitted Schedule B is incomplete because it does not include the deposit of \$100 referenced in Section 4 of the standby trust agreement. ICF recommends that the licensee submit a completed Schedule A and a revised Schedule B.

(12) **Submit a Specimen Certificate of Resolution**

The submission lacks a specimen certificate of resolution, which should contain blank spaces for dates and signatures until decommissioning activities are commenced, as recommended on page 4-25 of the draft *Regulatory Guide*. The submission includes a specimen certificate of events, which refers to an attached specimen certificate of resolution. Without the specimen, NRC cannot be sure that the trustee will release decommissioning funds only upon



receiving appropriate instructions. ICF recommends that NRC require the licensee to submit the specimen certificate.

(13) Submit a Letter of Acknowledgement with the Standby Trust Agreement

The submission does not include a letter of acknowledgement with the standby trust agreement, as recommended by the draft *Regulatory Guide* on page 4-27. The acknowledgement is needed to verify the execution of the standby trust agreement and to certify the trustee's signature and authority to enter into the agreement. Therefore, ICF recommends that NRC require the licensee to submit a letter of acknowledgement.

Other Issues

The licensee made a few other modifications to the standard wording of the letter of credit and numerous other modifications to the standard wording of the standby trust agreement provided in the draft *Regulatory Guide*. These modifications do not decrease the protection provided by the mechanisms. The following modifications are the most noteworthy:

- (1) Section 1 of the standby trust agreement defines the terms "applicable law," "decommissioning," "grantor," "investment grade," "investment securities," and "trustee". These definitions do not appear to jeopardize the prudent management of the trust fund, to limit activities for which funds may be expended, or to constrain NRC's control over decommissioning procedures.
- (2) Section 8 of the standby trust agreement omits language recommended by the draft *Regulatory Guide* that would allow the trustee to invest in any non-excluded investment so long as the trustee acts

"solely in the interest of the beneficiary and with the care, skill, prudence, and diligence under the circumstances then prevailing which persons of prudence, acting in a like capacity and familiar with such matters, would use in the conduct of an enterprise of a like character and with like aims."

This provision has been replaced by language that "the Trustee may rely upon [the instructions of the licensee] unless it is evident that the directed investment does not satisfy the conditions of this Section 8." The rest of Section 8 limits the trustee's investment and reinvestment options to "investment securities," which are defined in Section 1 as "FDIC insured interest bearing money market fund of [Shawmut Bank] used for its corporate trust customers." These provisions are more protective of the assets in the trust than allowed by the recommended wording.

- (3) Section 9 of the standby trust agreement omits language recommended in the draft *Regulatory Guide*, page 4-20, authorizing the trustee to purchase shares in any investment company registered under the Investment Company Act of 1940. This provision would add flexibility to the trustee's investment options. The agreement does allow other acceptable investments, however.
- (4) Section 11, which addresses taxes and expenses of the trust, states that "the Trustee is authorized to make such withdrawals from the fund for such purposes. To the extent the investments in the Fund are not sufficient for any such purposes the Grantor shall be obligated to pay such costs and expenses directly to the Trustee." This statement allows the trustee to make payments for proper charges incurred. Without this statement, the trustee would still be authorized to pay these expenses from the fund based on other language in this section.
- (5) The specimen certificate of events includes a signature blank for the licensee's clerk, rather than the licensee's secretary as recommended in the draft *Regulatory Guide*. The licensee submitted by-laws, however, demonstrating the authority of the clerk to sign the specimen.

Finally, NRC should ensure that documents submitted by the licensee are originally signed duplicates, as recommended in the draft *Regulatory Guide*. In addition, NRC should ensure that it possesses the original letter of credit, and that it does not contain a stamp marked "Not Negotiable Copy." Unless the documents are official and have been properly signed, NRC cannot be certain that the financial assurance mechanism is enforceable. Because ICF does not possess the original submission, we cannot verify compliance with these requirements.

attachments

REVIEW OF DECOMMISSIONING FUNDING PLAN (DFP)

Name of company or institution: Biogen

Number of licenses and applicable regulations: 2 10 CFR Part 30 \*  
\_\_\_\_\_ 10 CFR Part 40  
\_\_\_\_\_ 10 CFR Part 70  
\_\_\_\_\_ 10 CFR Part 72

Isotopes handled and possession limits (specify units):  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Total cost estimate for licenses listed above: \$ 23,076.00

General comments on DFP:

Licensee states that guidance on cost and time for decommissioning were obtained from NUREG/CR-1754, Addendum 1 in developing cost estimate.

\* Only one of these licenses requires financial assurance.

CHECKLIST FOR REVIEWING DECOMMISSIONING FUNDING PLANS (DFF's)

QUESTIONS

COMMENTS

<p>(1) Does the licensee provide supporting documentation for its cost estimates?</p> <p><input checked="" type="checkbox"/> Yes    <input type="checkbox"/> No</p>	
<p>(2) Does the licensee use the Appendix F "Cost Estimating Tables?"</p> <p><input checked="" type="checkbox"/> Yes    <input type="checkbox"/> No</p>	
<p>(3) Does the cost estimate include the following major cost elements?</p>	
<p>(i) Planning and Preparation?</p> <p><input checked="" type="checkbox"/> Yes    <input type="checkbox"/> No</p>	
<p>(ii) Decontamination and/or Dismantling of Radioactive Facility Components?</p> <p><input checked="" type="checkbox"/> Yes    <input type="checkbox"/> No</p>	
<p>(iii) Packaging, Shipping, and Disposal of Radioactive Wastes?</p> <p><input checked="" type="checkbox"/> Yes    <input type="checkbox"/> No</p>	
<p>(iv) Restoration of Contaminated Areas on Facility Grounds?</p> <p><input type="checkbox"/> Yes    <input type="checkbox"/> No    <input checked="" type="checkbox"/> NA</p>	<p>Licensee states that this activity is not applicable.</p>
<p>(v) Final Radiation Survey?</p> <p><input checked="" type="checkbox"/> Yes    <input type="checkbox"/> No</p>	
<p>(vi) Site Stabilization, Long-Term Surveillance?</p> <p><input type="checkbox"/> Yes    <input type="checkbox"/> No    <input checked="" type="checkbox"/> NA</p>	<p>Licensee states that this activity is not applicable.</p>



CHECKLIST FOR REVIEWING I/P's (continued)

QUESTIONS

COMMENTS

<p>(4) Is the total cost estimate reasonable for the type(s) and size(s) of facility licensed?</p> <p> <input type="checkbox"/> Yes     <input checked="" type="checkbox"/> No  <input type="checkbox"/> Not Sure         </p>	<p>See below.</p>
<p>(5) Are the cost estimates for individual facility activities and/or components reasonable?</p> <p> <input type="checkbox"/> Yes     <input checked="" type="checkbox"/> No  <input type="checkbox"/> Not Sure         </p>	<p>Substantiate work days required to decontaminate and dispose of lab components.</p> <p>Walls are not included in components given and floor dimensions are only for contaminated area. No information on total lab size given.</p> <p>75m<sup>3</sup> of waste will not fit in 10-55gal drums (208m<sup>3</sup> each). 361 drums of waste will increase estimate by \$200,000.</p> <p>Substantiate work days required for planning, preparation and final radiation survey.</p>

CHECKLIST FOR REVIEWING DFP's (continued)

QUESTIONS

COMMENTS

<p>(6) Do the computations seem correct?</p> <p><input checked="" type="checkbox"/> Yes      <input type="checkbox"/> No</p>	
<p>(7) Does the licensee take credit for the potential salvage value of recovered materials or decontaminated equipment?</p> <p><input type="checkbox"/> Yes      <input checked="" type="checkbox"/> No</p>	<p><i>Licensee does not mention salvage value.</i></p>
<p>(8) Does the licensee include a contingency factor in the cost estimate?</p> <p><input type="checkbox"/> Yes      <input checked="" type="checkbox"/> No</p>	<p><i>Licensee does not mention a contingency factor.</i></p>
<p>(9) Does the licensee provide a description of the methods that will be used to adjust the decommissioning cost estimate periodically over the life of the facility?</p> <p><input checked="" type="checkbox"/> Yes      <input type="checkbox"/> No</p>	<p><i>Estimates will be revised when license is amended or renewed, and at termination. Revised estimates will reflect changes in inflation, lab space, materials used, disposal options + costs and decommissioning techniques.</i></p>

APPENDIX A  
CHECKLIST FOR DECOMMISSIONING FINANCIAL ASSURANCE

NAME OF LICENSEE OR APPLICANT

Biogen, Inc.

MAILING ADDRESS

14 Cambridge Center

Cambridge, MA 02142

A. Licensee Part (check one of the following):

- Part 30 Licensee or Applicant       Part 70 Licensee or Applicant
- Part 40 Licensee or Applicant       Part 72 Licensee or Applicant

B. Check appropriate item in each category (if applicable)

1. July 27, 1990 Date of Financial Assurance Submission Issue Date: July 26, 1990  
Effective: July 26, 1990  
Expires: July 26, 1991
2.  Public Entity  
 Private Entity
3.  Certification of Financial Assurance  
 Decommissioning Funding Plan
4. (a)  Prepayment Option (See Appendix B)
  - Trust Fund
  - Escrow Account
  - Certificate of Deposit
  - Government Fund
  - Deposit of Government Securities
- (b)  Surety/Insurance/Other Guarantee (See Appendix C)
  - Surety bond
  - Letter of Credit \$25,000 Fee has not been determined.
  - Line of Credit
  - Parent Company Guarantee/Financial Test
- (c)  External Sinking Fund, Sinking Account and Surety/Insurance (See Appendix D)
  - Trust Fund
  - Escrow Account
  - Certificate of Deposit
  - Government Fund
  - Deposit of Government Securities
  - Surety Bond
  - Letter of Credit
  - Line of Credit
- (d)  Statement of Intent (public entities only)

\*May not be used in combination with any other instrument.

APPENDIX C

CHECKLIST FOR SUBMISSION OF SURETY/INSURANCE/PARENT COMPANY GUARANTEE

A. Check Appropriate Form of Surety/Insurance/Guarantee

- Surety Bond
- Letter of Credit *Similar wording, but some many passages are significantly different. Many paragraphs have been added.*
- Line of Credit
- Parent Company Guarantee/Financial Test\*
- Insurance

B. Check Documents Submitted for Surety/Insurance/Guarantee

1. Surety Bond
  - Surety Bond
  - Standby Trust Agreement
  - Acknowledgement
2. Letter of Credit
  - Letter of Credit
  - Standby Trust Agreement
  - Acknowledgement

*Related Documents*  
*specimen certificate of events - not signed, incomplete*  
*Certificate of Resolution - not included*  
*Schedule A - incomplete*  
*Schedule B - incomplete*  
*Schedule C - Trustee's fees have not yet been agreed upon.*
- No, but see Section 505 Trust* → 3. Line of Credit
  - Verification
  - Standby Trust Agreement
  - Acknowledgement
4. Parent Company Guarantee
  - Letter from Chief Executive Officer of Applicant or Licensee
  - Letter from Chief Financial Officer of Parent Company
  - Financial Test: Alternative [I or II]
  - Auditor's Special Report and Attached Schedule
  - Corporate Guarantee
  - Standby Trust Agreement
  - Acknowledgement
5. Insurance
  - Certificate of Insurance
  - Standby Trust Agreement
  - Acknowledgement

May not be used in combination with any other instrument.



EXHIBIT 3-5

CHECKLIST OF CRITERIA FOR REVIEW OF TRUST AGREEMENTS<sup>a</sup>

- ✓ • Copy of corporate by-laws or other evidence <sup>Standby Trust</sup> indicating that parties signing the financial instrument (for the applicant) are authorized to represent the organization in the transaction.  
Includes by-laws and articles <sup>(of organization)</sup>.  
No evidence that party signing the ~~letter of credit~~ is authorized.  
Evidence that the financial instrument is an originally signed duplicate (e.g., an executed copy of the instrument).  
~~No signature, "Non-Negotiable Copy" stamp.~~  
*Payin willowick*
- ✓ • Evidence that the financial institution has authority to act as a trustee. ~~Shawmut Bank's bylaws~~ <sup>Yes (see Direction of Trust Trust)</sup>
- ✓ • ~~Does not provide evidence that Shawmut Bank is regulated by a Federal Agency.~~  
Purpose of trust ("whereas" clauses).  
~~missing "Whereas, the grantor has elected to use a letter of credit to provide~~  
1. Description missing: "Whereas, when payment is made under a letter of credit, this standby trust shall be used for the receipt of such payment." Others are o.k.  
Grantor or grantors (introductory paragraph).  
→
- Date: July 20, 1990
  1. Names Biogen, Inc., a Massachusetts Corporation
  2. Addresses
- ✓ • Trustee or trustees.
  1. Names and addresses Shawmut Bank, N.A. (no address)
  2. Bank or corporate trustee (introductory paragraph)
- ✓ • Identification of facilities and cost estimates (Section 2).<sup>b</sup>  
→ Refers to Schedule A for cost estimates, which Schedule A does not provide

<sup>a</sup> Adapted from 17A Am Jur Legal Forms 2d (Rev) §251.94.

<sup>b</sup> References are to recommended wording for trust agreements provided in Section 4.

EXHIBIT 3-5 (continued)

- ✓ • Words of transfer, conveyance, and delivery in trust (Section 3).
- ✓ • Payments constituting the trust fund (Section 4).  
Initial \$100, letter of credit Section 4 refers to  
Schedule B which does not specify an amount. Check  
wording.
- ✓ • Duration of trust.  
? until terminated
- Description of trust property.
  - ✓ 1. Property described in attached schedule (Schedule B) N/A ok
  - ✓ 2. Cash \$100
  - ✓ 3. Stock and other securities N/A
- ✓ • Additions to trust. Check wording in Section 4.
- Distribution of trust principal (Section 5).  
Check wording
  - ✓ 1. Disbursement to licensee upon proper certification
  - ✓ 2. Payment for activities at NRC's direction in writing
  - ✓ 3. Refund to grantor at NRC's specification in writing after completion of decommissioning activities
  - ✓ 4. Withdrawal provisions must not exceed 10 percent. (5%)  
Nominal  
ant is  
> 10%  
(5%)
- Trust management (Sections 6-8).  
missing some wording, others altered
  1. Discretionary powers
  2. Fiduciary duty
  3. Commingling and investment
  4. Sale or exchange of trust property
  5. Scope of investments
  - ✓ 6. Express powers of trustee
  7. Borrowing money and encumbering trust assets
- (Optional provisions)

EXHIBIT 3-5 (continued)

- 8. Insurance
- 9. Operation of business
- 10. Compromise of claims

- Taxes and expenses (Section 9). *language added*
- Annual valuation (Section 10). *language altered + some added.*
- Advice of counsel (Section 11). *verbatim*
- Authority, compensation, and tenure of trustees (Sections 12-14).
  - ✓ 1. Trustee compensation - *added phrase*
  - ✓ 2. Successor trustee *used 30, not 90, days*
  - ✓ 3. Instructions to trustee *missing some language*
- Amendment of agreement (Section 15). *verbatim*
- Irrevocability and termination (Section 16). *verbatim*
- Immunity and indemnification (Section 17). *added language, typo.*
- Law to govern construction and operation of trust (Section 18). *verbatim*
- Interpretation and severability (Section 19). *verbatim*
- Added sections: "Acceptance of Trust", "Ownership of Funds;  
Date (signature block). Beneficial Interests") "Conditions."  
*No date, but stated in introductory TP*
- ✓ • Signatures (signature block).
- ✓ • Acknowledgements, seals or attestations, if necessary or desired  
(witness by notary public). *witnesses, but no seals,  
Witnesses not identified as Notaries Public.*
- ✓ • Acceptance of trust by trustee or trustees (acknowledgment).  
: ~~No~~ Acknowledgement in Section 5 (added) of the trust,  
"Acceptance of Trust." *3-21 40 acknowledgement*

EXHIBIT 3-7

CHECKLIST OF CRITERIA FOR REVIEW OF LETTERS OF CREDIT

- Copy of corporate by-laws or other evidence indicating that parties signing the financial instrument (for the applicant) are authorized to represent the organization in the transaction.  
~~bylaws, articles of organization. No evidence that signatories are authorized. N/A~~
- ✓ Evidence that the financial instrument is an originally signed duplicate (e.g., an executed copy of the instrument).  
No signatures, "Not Negotiable Copy" stamp.
- ✓ Evidence that the financial institution is regulated by Federal or State agency (e.g., member of FDIC, Federal Reserve System, etc.).  
~~Yes~~ Yes      Shawmut Bank, N.A.
- ✓ The instrument must be entitled a letter of credit.  
"Irrevocable Standby Letter of Credit"
- ✓ The letter should be limited in amount.  
\$25,000
- ✓ The letter of credit must contain a specified expiration date or be written for a definite term.  
Expires July 26, 1991, automatically extended each year
- ✓ The issuer's obligation to pay the beneficiary should arise only upon presentation of a draft or other documents specified in the letter of credit.  
~~automatically extended each year~~
- ✓ The bank must not be called upon to determine a question of fact or law at issue between the licensee and the Commission or State regulatory agency.  
~~Implied~~ Implied
- The licensee should have an unqualified obligation to reimburse the issuer for payments made under the letter of credit.
- ✓ Letter of credit is payable to a Standby trust  
Yes.



DATE *9/10/90*  
TIME *5:00*  A.M.  P.M.

TELEPHONE OR VERBAL CONVERSATION RECORD

INCOMING CALL  OUTGOING CALL  VISIT

PERSON CALLING <i>Decher</i>	OFFICE/ADDRESS	PHONE NUMBER	EXTENSION
PERSON CALLED <i>Chuck Dooly</i>	OFFICE/ADDRESS	<i>(617) 292-</i>	<i>3106</i>

CONVERSATION

SUBJECT *His request for us to return 2 letters of credit from Biogen and New England.*

SUMMARY *agreements*

*He said that there is no way for the NRC to deposit the funds in the Trust and therefore he wants the irrevocable letters of credit back. I told him to write a letter stating what he wants and why he wants it.*

REFERRED TO:

ACTION REQUESTED

*File*

ADVISE ME OF ACTION TAKEN.

INITIALS

DATE

ACTION TAKEN

INITIALS

DATE

DATE 9/10/90

TELEPHONE OR VERBAL CONVERSATION RECORD

TIME 3:00  A.M.  P.M.

INCOMING CALL

OUTGOING CALL

VISIT

PERSON CALLING

Chuck Dooley

OFFICE/ADDRESS

Shawmut Bank  
~~Shawmut Bank~~

PHONE NUMBER

EXTENSION

(617) 292-3106

PERSON CALLED

Reber

OFFICE/ADDRESS

Federal St.  
Boston MA

PHONE NUMBER

EXTENSION

CONVERSATION - C2211

SUBJECT

SUMMARY

Letters of credit for Biogere and  
New England Agri- for \$25,000  
were sent and shouldn't have been  
sent <sup>mediated</sup> 8/3/90

Should have had Trust agreements  
sent between Bank and these

He wants letters of credit back

Letters of credit + trust in same  
package

REFERRED TO:

ACTION REQUESTED

File

ADVISE ME OF ACTION TAKEN.

INITIALS

DATE

ACTION TAKEN

INITIALS

DATE

BIOGEN

30 July 1990

U.S. Nuclear Regulatory Commission  
Region 1  
Division of Radiation Safety & Safeguards  
Nuclear Material Safety, Section B  
475 Allendale Rd.  
King of Prussia, PA 19406

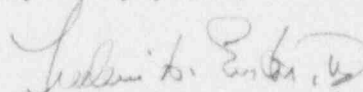
Re: Biogen Inc. License # 20-19808-01 and 20-19808-02  
Financial Assurance

Dear Sir:

As additional support for the Shawmut's Bank capacity to act as trustee, I enclose a certificate from the bank.

If you have any questions about our application, please call or write.

Very truly yours,



Frederic A. Eustis, III  
Vice President - General Counsel

FAE/mh  
Enclosure

90 AUG -6 NO 26

RECEIVED REGION 1

AUG 06 1990

113030

OFFICIAL RECORD COPY **ML 10**

I further certify that the Officer-in-Charge of the Trust Division, acting pursuant to Section 9.2 of the By-Laws and the aforementioned votes of the Board of Directors, has delegated to the individuals named below, acting singly, full power and authority in the name and on behalf of the Showmut Bank, National Association, as trustee, administrator, registrar of stocks and bonds, or in any other fiduciary capacity administered in its Trust Division, under seal of the association or otherwise, by manual signature over the general designations of "Authorized Officer", "Authorized Official", "Authorized Signature" or such other title set forth opposite his name:

To authenticate bonds, and to execute and deliver contracts, checks and drafts; foreclosure and other deeds of real estate, and discharges, releases, extensions, and assignments of mortgages; certificates of stock, registered bonds and proxies by which stock held or owned by the association as fiduciary or agent shall be represented at corporate meetings; declarations of trust to be executed by the association as trustee, and, generally, all other instruments or documents relating to property or rights of all kinds held or owned by the association, as trustee or agent.

I further certify that the following is a specimen of each such person's signature, and that said Articles of Association, By-Laws, Votes and Delegations of Signing Authority are all in full force and effect.

Name	Office	Signature
Hax Goldsmith	Vice President	<i>Hax Goldsmith</i>
Robert J. Dunn	Vice President	<i>Robert J. Dunn</i>
Clark M. Whitcomb	Vice President	<i>Clark M. Whitcomb</i>
John J. Flynn	Assistant Vice President	<i>John J. Flynn</i>
Paul G. Grenier	Assistant Vice President	<i>Paul G. Grenier</i>
Charles E. Dooley	Assistant Vice President	<i>Charles E. Dooley</i>
Natalie S. Forrest	Assistant Vice President	<i>Natalie S. Forrest</i>
Barbara A. Glovino	Assistant Vice President	<i>Barbara A. Glovino</i>
Lee E. MacDonald	Assistant Vice President	<i>Lee E. MacDonald</i>
Valerie Larkins Senew	Assistant Vice President	<i>Valerie Larkins Senew</i>
Samuel McMurtrie, Jr.	Corporate Trust Officer	<i>Samuel McMurtrie, Jr.</i>
Arthur Biakeslee	Authorized Officer	<i>Arthur Biakeslee</i>
Bonette Bouchard	Authorized Officer	<i>Bonette Bouchard</i>
Stephanie S. Burnett	Authorized Officer	<i>Stephanie S. Burnett</i>
Bryan R. Calder	Authorized Officer	<i>Bryan R. Calder</i>
Alan B. Coffey	Authorized Officer	<i>Alan B. Coffey</i>
Laura Crowley	Authorized Officer	<i>Laura Crowley</i>
Anthony L. Esfeno	Authorized Officer	<i>Anthony L. Esfeno</i>

Maureen Ekblom	Authorized Officer
Mark A. Forgetta	Authorized Officer
Joseph Fortuna	Authorized Officer
Peter H. Fowles	Authorized Officer
Stephen G. Fritch	Authorized Officer
Gilman N. Gauvin	Authorized Officer
Lynnette Hamilton	Authorized Officer
Elizabeth C. Hammer	Authorized Officer
Peter D. Holland	Authorized Officer
Michael N. Hopkins	Authorized Officer
Vito Iacovazzi	Authorized Officer
Janet F. Malkasian	Authorized Officer
Frank McDonald, Jr.	Authorized Officer
William Monroe	Authorized Officer
Diane C. Murphy	Authorized Officer
Rochwell J. Spalding	Authorized Officer
Phyllis Thompson	Authorized Officer
David Torres	Authorized Officer
Andrea F. Turlo	Authorized Officer
Phillip R. Welsher	Authorized Officer
Kathleen D. Woods	Authorized Officer

*Maureen Ekblom*  
*Mark A. Forgetta*  
*Joseph Fortuna*  
*Peter H. Fowles*  
*Stephen G. Fritch*  
*Gilman N. Gauvin*  
*Lynnette Hamilton*  
*Elizabeth C. Hammer*  
*Peter D. Holland*  
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*Janet F. Malkasian*  
*Frank McDonald, Jr.*  
*William Monroe*  
*Diane C. Murphy*  
*Rochwell J. Spalding*  
*Phyllis Thompson*  
*David Torres*  
*Andrea F. Turlo*  
*Phillip R. Welsher*  
*Kathleen D. Woods*

IN WITNESS WHEREOF, I have hereunto set my hand and the seal of Showmut Bank, National Association.

(Seal)

Date: July 27, 1990

*Al Hoppel*  
 Assistant Secretary



I, Arnold I. Kappel, Assistant Secretary of Shawmut Bank, National Association (the "Bank"), hereby certify that the following is a true and complete copy of Article First of the Articles of Association of the Bank:

"FIRST. The title of this Association shall be 'Shawmut Bank, National Association'; the Association in conjunction with its said legal name may also use, as a trade name, 'Shawmut Bank, N.A.' and its former name, 'Shawmut Bank of Boston, N.A.'"

I further certify that the following is a true and complete copy of Section 9.2 of the By-laws of the Bank:

"Section 9.2. Trust Division Signing Authority. The Chairman of the Board, each Vice Chairman of the Board, the President or the Officer-in-Charge of the Trust Division shall have full power and authority, in the name and on the behalf of the association as trustee, administrator, executor, registrar of stocks and bonds, or in any other fiduciary capacity administered in the Trust Division, under seal of the association or otherwise, to authenticate bonds, and to execute and deliver contracts, checks, and drafts; foreclosure and other deeds of real estate, and discharges, releases, extensions, and assignments of mortgages; certificates of stock, registered bonds, and proxies by which stock held or owned by the association as herein stated shall be represented at corporate meetings; declarations of trust to be executed by the association as trustee; and, generally, all other instruments or documents relating to property or rights of all kinds held or owned by the association as herein stated; all subject to such limitations as the Board of Directors may impose. The Board of Directors may from time to time, subject to such limitations as it may impose, authorize other officers or designated individuals to act as aforesaid in the name and on behalf of the association, or authorize the Chairman of the Board, each Vice Chairman of the Board, the President or Officer-in-Charge of the Trust Division to so delegate such authority. Signing authority hereunder delegated may, in the case of checks and in other instances specifically authorized by the Board of Directors, be exercised either by manual or facsimile signature and either such signature may be over the title of the signing officer or over the general designations of 'Authorized Officer', 'Authorized Official' or 'Authorized Signature'."

I further certify that the following is a true and complete copy of a Vote of the Board of Directors, adopted at a meeting duly called on July 18, 1968; as amended by votes on May 18, 1972 and July 27, 1988:

"Voted: That, as permitted by Section 9.2 of the By-laws, the Chairman of the Board, the Vice Chairman of the Board, the President, the officer-in-charge of the Investment Services and Private Banking

Division, any Executive Vice President, and any Senior Vice President respectively, acting singly, are hereby authorized to delegate to officers or employees of the Bank or, in a particular transaction, to such other person or persons, whether or not such person or persons are officers or employees of the Bank, selected by him on such conditions as he may determine, authority to sign and deliver in the name and on behalf of the Bank, under its corporate seal wherever appropriate, any instruments and documents required in the ordinary operation of the Investment Services and Private Banking Division, including the authentication of bonds, for which the Bank acts as Trustee. Such delegation shall be in writing and signed by the delegating officer and countersigned by the Cashier, or in his absence, by an Assistant Cashier. The Secretary shall keep the records of such delegations and shall report on the same to the Board of Directors when requested. All delegations heretofore executed under the prior existing and existing By-laws are hereby ratified and affirmed and shall continue in effect until amended or revoked.

I further certify that the following is a true and complete copy of Vote of the Board of Directors, adopted at a meeting duly called and held on November 10, 1988:

"Further Voted: That, to the extent votes and documents adopted or executed prior to November 10, 1988 remain in effect and with respect to each action thereunder after said date each document previously executed by the Officer-in-Charge of the Trust Division, the Officer-in-Charge of the Financial Management Division or the Officer-in-Charge of the Investment Services and Private Banking Division shall continue in force and effect as a document executed by the Officer-in-Charge of the Investment Services Division and each reference to the Officer-in-Charge of the Trust Division, the Officer-in-Charge of the Financial Management Division or the Officer-in-Charge of the Investment Services and Private Banking Division in any such previously adopted vote of the Board of Directors of this Bank or any committee of the Board or in documents heretofore executed by or on behalf of the Bank or by the Officer-in-Charge of the Trust Division, the Officer-in-Charge of the Financial Management Division or the Officer-in-Charge of the Investment Services and Private Banking Division shall be deemed to be a reference to the Officer-in-Charge of the Investment Services Division; and the words "Trust Department" or "Trust Division" or "Financial Management Division" or "Investment Services and Private Banking Division" or words of similar import in any such votes or documents shall be deemed to be a reference to and include the Investment Services Division of this Bank wherever the facts and context so permit."

030-19268

BIOGEN

Log	Aug-3-7
Remitter	
Check No.	076405 / Refunded
Amount	2500 500
Fee Category	3m / per IN 90-38
Type of Fee	ind
Date Check Rec'o.	8/2/90
Date Completed	8/6/90 12/6/90
By:	leg JK

July 27, 1990

Mr. John Kinneman, Chief  
 Nuclear Materials Safety Section B  
 Division of Radiation Safety and Safeguards  
 U.S. Nuclear Regulatory Commission Region I  
 475 Allendale Road  
 King of Prussia, Pennsylvania 19406

Dear Mr. Kinneman:

In order to ensure that adequate funding is available to cover all costs associated with decommissioning facilities covered by licenses 20-19808-01 and 20-19808-02, enclosed please find Biogen's decommissioning funding plan (DFP). The DFP includes:

- a site specific cost estimate for decommissioning,
- a description of the method(s) of assuring funds for decommissioning.

For license 20-19808-01:

Although guidance for estimating time and cost of decommissioning components of research laboratories using radionuclides were taken from NUREG/CR-1754 Addendum 1, October 1989, current cost estimates are based on actual labor costs for staff and consultants, actual per drum charges for radioactive waste disposal, and actual time required to do the cleaning necessary to bring surface contamination to the level acceptable for unrestricted use. These cost estimates will be revised at the time of amendment or renewal, and at the time when Biogen wishes to terminate activities under the license. The revision of cost estimate will reflect changes in inflation, increase or decrease in laboratory space and/or use of radionuclides, changes in disposal options and costs, and changes in techniques used for decommissioning.

The format of the site specific cost estimate is that published in Appendix F of the Draft Regulatory Guide Task DG-3002, January 1990. The grand total of cost estimate at this time is \$23,076.

90  
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 11:00  
 RECEIVED

113030

JUL 27 1990

OFFICIAL RECORD COPY ML 10

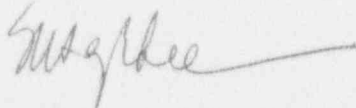
For license 20-19808-02:

Only a sealed source of Cs-137, 2800 curies, is covered by this license and no financial assurance is required.

Also enclosed is Biogen's check for \$500 covering the license ammendment fee.

Please examine the enclosed documents and contact me immediately if you require additional information or documentation.

Very truly yours,



Susan B. Lee, RSO, Manager  
Environmental Health and Safety

cc: Eustis

Biogen, Inc.

Decommissioning Funding Plan  
July 27, 1990

Cost Estimating Tables

1. Planning and Preparation

Table 1  
Work Days and Cost (\$)

<u>Task</u>	<u>Supervisor</u>	<u>C.H.P.</u>	<u>Clerical</u>	<u>Total</u>	<u>Total(\$)</u>
Preparation of Documentation for Regulatory Agencies	1	1	.5	2.5	\$ 1563
Submittal of Decommissioning Plan to NRC when required by 10CFR 30.36(c)(2)	2	.5	1	3.5	1321
Development of Work Plans	1			1	302
Procuring Special Equipment		N/A	all equipment on hand		0
Staff Training	1	1		2	1502
Characterization of the Radiological Condition of the Facility	5	.5		5.5	2110
<b>Totals</b>	<b>8</b>	<b>5.5</b>	<b>1.5</b>	<b>14.5</b>	<b>6798</b>

Table 2  
Unit Cost for Workers

<u>Position</u>	<u>Base Salary</u>	<u>Overhead Rate</u>	<u>\$/yr</u>	<u>\$/day</u>
RSO/Supervisor	\$ 50,000	21%	\$60,000	\$ 302
Technician	25,000	21	30,250	151
Craftsman	25,000	21	30,250	151
C.H.P. (consultant)				1200
Clerical	20,000	21	24,200	121



2. Decontamination and/or Dismantling of Radioactive Facility Components (All components to be decontaminated to unrestricted use except as noted by \*. These will be stored for decay or shipped to a LLRW site.)

<u>Item</u>	<u>No.</u>	<u>Dimensions</u>	<u>* Notation</u>
Glove Box	0		
Fume Hood	10	5 and 6 ft hoods	
Fume Hood	1	5 ft hood	*
Lab Benches	125	linear feet	
Sinks	7	12 ft <sup>2</sup>	
Cup sinks & drains	4	10 ft drain pipes	*
Drains	7	10 ft drain pipes	*
Contaminated floor space			
	100	ft <sup>2</sup>	*
Ventilation Ductwork	120	linear feet	*
Freezers & Fridges	40	units	
Rad Waste compactor	1	unit	

**Table 3**  
Work Days and Cost

- Decon/Dismantle Major components and/or Processing and Storage tanks: N/A
- Decon/Dismantle Laboratories, Fume Hoods, Glove Boxes, Lab Benches, etc.:
 

<u>Supv.</u>	<u>Tech.</u>	<u>Crafts.</u>	<u>CHP</u>	<u>Total</u>	<u>Total(\$)</u>
2	10	3	1	16	\$ 3767
- Decon/Dismantle Waste Areas: included in 2. above.
- Decon/Dismantle Service Facilities: included in 2. above.
- Decon/Dismantle Waste Treatment Facilities and Storage Areas on the site (including exhume and package contaminated soil and tailings, if any): N/A
- Monitor for compliance, and reclean and remonitor, if necessary: included in 2. above.
- Other (e.g. contractor fees): included in 2. above as "crafts workers".

**Table 4**  
Equipment and Supplies

<u>Item</u>	<u>Quantity</u>	<u>Cost(\$)</u>	<u>Total Cost (\$)</u>
Rad waste drums	10	31	\$ 310

Note: All other monitoring and cleaning to unrestricted use equipment, instruments, supplies, and analytic capabilities are already available on site.



BIOGEN

26 July 1990

U.S. Nuclear Regulatory Commission  
Region 1  
Division of Radiation Safety & Safeguards  
Nuclear Material Safety, Section B  
475 Allendale Rd.  
King of Prussia, PA 19406

Re: Biogen Inc. License # 20-19808-01 and 20-19808-02  
Financial Assurance

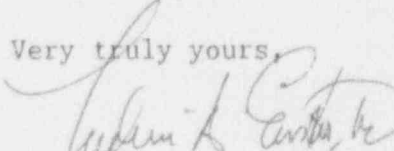
Gentlemen:

Pursuant to 53 FR2 4018 Biogen, Inc. hereby submits the following documents to provide financial assurance of its ability to pay for decommissioning under 10 CFR 30:

1. Letter of credit in the amount of \$25,000 issued by Shawmut Bank, N.A.;
2. Certified copy of Biogen's Articles of Association and Bylaws;
3. Evidence that Shawmut bank is regulated by a Federal agency;
4. Letter from Ms. Susan Lee regarding estimated cost of decommissioning as part of a decommissioning funding plan together with a check for license amendment.
5. Standby Trust Agreement between Shawmut Bank, N.A. and Biogen, Inc.

If you have any questions regarding the foregoing, please give me a call or write.

Very truly yours,

  
Frederic A. Eustis, III  
Vice President - General Counsel

FAE/mh  
Enclosures (6)  
cc: J. Catterall  
S. Lee  
D. Woonton - Shawmut

APPENDIX A  
CHECKLIST FOR DECOMMISSIONING FINANCIAL ASSURANCE

NAME OF LICENSEE OR APPLICANT

Biogen, Inc. [20-19808-01, 20-19808-02]

MAILING ADDRESS

14 Cambridge Center

Cambridge, MA 02142

A. Licensee Part (check one of the following):

- Part 30 Licensee or Applicant      \_\_\_\_\_ Part 70 Licensee or Applicant  
\_\_\_\_\_ Part 40 Licensee or Applicant      \_\_\_\_\_ Part 72 Licensee or Applicant

B. Check appropriate item in each category (if applicable)

1. July 1990 Date of Financial Assurance Submission
2. \_\_\_\_\_ Public Entity  
 Private Entity
3. \_\_\_\_\_ Certification of Financial Assurance  
 Decommissioning Funding Plan
4. (a) \_\_\_\_\_ Prepayment Option (See Appendix B)  
      \_\_\_\_\_ Trust Fund  
      \_\_\_\_\_ Escrow Account  
      \_\_\_\_\_ Certificate of Deposit  
      \_\_\_\_\_ Government Fund  
      \_\_\_\_\_ Deposit of Government Securities  
      (b)  Surety/Insurance/Other Guarantee (See Appendix C)  
          \_\_\_\_\_ Surety bond  
           Letter of Credit  
          \_\_\_\_\_ Line of Credit  
          \_\_\_\_\_ Parent Company Guarantee/Financial Test\*  
      (c) \_\_\_\_\_ External Sinking Fund, Sinking Account and Surety/  
          Insurance (See Appendix D)  
          \_\_\_\_\_ Trust Fund  
          \_\_\_\_\_ Escrow Account  
          \_\_\_\_\_ Certificate of Deposit  
          \_\_\_\_\_ Government Fund  
          \_\_\_\_\_ Deposit of Government Securities  
          \_\_\_\_\_ Surety Bond  
          \_\_\_\_\_ Letter of Credit  
          \_\_\_\_\_ Line of Credit  
      (d) \_\_\_\_\_ Statement of Intent (public entities only)

\*May not be used in combination with any other instrument.





Shawmut Bank A.

PO Box 2176, Boston, MA 02211-2176, Tel. 617-292-2000

International Department  
Telex: W.U.16817133  
Cable: SHAWMUT  
S.W.I.F.T. ADDRESS: NASH US 33

IRREVOCABLE STANDBY LETTER OF CREDIT

JULY 26, 1990

S040785W

PAGE 01

U.S. NUCLEAR REGULATORY COMMISSION  
WASHINGTON, DC 20555  
REF: LICENSE # 20-19808-01, 02-19808-02

DEAR SIR OR MADAM:

WE HEREBY, ESTABLISH OUR IRREVOCABLE STANDBY LETTER OF CREDIT IN YOUR FAVOR, AT THE REQUEST AND FOR THE ACCOUNT OF BIOGEN, INC., 14 CAMBRIDGE CTR., CAMBRIDGE, MA 02142, UP TO THE AGGREGATE AMOUNT OF TWENTY FIVE THOUSAND AND 00/100 U.S. DOLLARS \*\*\*\*\*\$25,000.00 AVAILABLE UPON PRESENTATION BY YOU OR YOUR DESIGNEE OF

(1) YOUR SIGHT DRAFT, BEARING REFERENCE TO THIS LETTER OF CREDIT NUMBER S040785W

AND

(2) YOUR SIGNED STATEMENT READING AS FOLLOWS:

"I CERTIFY THAT THE AMOUNT OF THE DRAFT IS PAYABLE PURSUANT TO REGULATIONS ISSUED UNDER AUTHORITY OF THE U.S. NUCLEAR REGULATORY COMMISSION (NRC), AN AGENCY OF THE U.S. GOVERNMENT, PURSUANT TO THE ATOMIC ENERGY ACT OF 1954, AS AMENDED AND THE ENERGY REORGANIZATION ACT OF 1974."

THIS LETTER OF CREDIT IS ISSUED IN ACCORDANCE WITH REGULATIONS ISSUED UNDER THE AUTHORITY OF THE U.S. NUCLEAR REGULATORY COMMISSION (NRC), AN AGENCY OF THE U.S. GOVERNMENT, PURSUANT TO THE ATOMIC ENERGY ACT OF 1954, AS AMENDED, AND THE ENERGY REORGANIZATION ACT OF 1974. THE NRC HAS PROMULGATED REGULATIONS IN TITLE 10, CHAPTER 1 OF THE CODE OF FEDERAL REGULATIONS, PART 30, WHICH REQUIRE THAT A HOLDER OF, OR AN APPLICANT FOR, A LICENSE ISSUED UNDER 10 CFR PART 30, PROVIDE ASSURANCE THAT FUNDS WILL BE AVAILABLE WHEN NEEDED FOR DECOMMISSIONING.

THIS LETTER OF CREDIT IS EFFECTIVE AS OF JULY 26, 1990 AND SHALL EXPIRE ON JULY 26, 1991, BUT SUCH EXPIRATION DATE SHALL BE AUTOMATICALLY EXTENDED FOR A PERIOD OF ONE YEAR ON JULY 26, 1991 AND ON EACH SUCCESSIVE EXPIRATION DATE, UNLESS, AT LEAST 90 DAYS BEFORE THE CURRENT EXPIRATION DATE, WE NOTIFY BOTH YOU AND BIOGEN, INC. BY RETURN RECEIPT THAT WE HAVE DECIDED NOT TO EXTEND THIS LETTER OF CREDIT BEYOND THE CURRENT EXPIRATION DATE. IN THE EVENT YOU ARE SO NOTIFIED, ANY UNUSED PORTION OF THE CREDIT SHALL BE AVAILABLE UPON PRESENTATION OF YOUR SIGHT DRAFT WITHIN 90 DAYS AFTER THE DATE OF RECEIPT OF NOTIFICATION BY BOTH YOU AND BIOGEN, INC. AS SHOWN ON THE LATER OF THE SIGNED RETURN RECEIPTS AND READING AS FOLLOWS:

CONTINUED



Shawmut Bank, N.A.

PO Box 2176, Boston, MA 02211-2176, Tel. 617 292-2000

International Department  
Telex: WUI 6817133  
Cable: SHAWMUT  
S.W.I.F.T. ADDRESS: NASH US 33

ORIGINAL

IRREVOCABLE STANDBY LETTER OF CREDIT

JULY 26, 1990

5040785W

PAGE 02

U.S. NUCLEAR REGULATORY COMMISSION  
WASHINGTON, DC 20555  
REF: LICENSE # 20-19808-01, 02-19808-02

"WE CERTIFY THAT THE LICENSEE HAS FAILED TO REPLACE THIS LETTER OF CREDIT WITH OTHER COLLATERAL ACCEPTABLE TO THE DEPARTMENT WITHIN 30 DAYS OF THE BANK'S NOTICE TO TERMINATE THE LETTER OF CREDIT."

WHENEVER THIS LETTER OF CREDIT IS DRAWN ON, UNDER, AND IN COMPLIANCE WITH THE TERMS OF THIS CREDIT, WE SHALL DULY HONOR SUCH DRAFT UPON PRESENTATION TO US, AND WE SHALL DEPOSIT THE AMOUNT OF THE DRAFT DIRECTLY INTO THE STANDBY TRUST OF BIOGEN, INC. IN ACCORDANCE WITH YOUR INSTRUCTIONS.

WE WILL ENDEAVOR TO GIVE PROMPT NOTICE TO THE LICENSEE AND THE DEPARTMENT OF A NOTICE RECEIVED OR ACTION FILED ALLEGING THE INSOLVENCY OR BANKRUPTCY OF THE BANK OR ALLEGING ANY VIOLATIONS OF REGULATORY REQUIREMENTS WHICH SHALL RESULT IN SUSPENSION OR REVOCATION OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS.

DRAFTS DRAWN HEREUNDER MUST BE MARKED "DRAWN UNDER SHAWMUT BANK, N.A., CREDIT NO. 5040785W DATED JULY 26, 1990".

D.C. PENNYBAKER ASSISTANT VICE PRESIDENT JULY 26, 1990

THIS CREDIT IS SUBJECT TO THE UNIFORM CUSTOMS AND PRACTICE FOR DOCUMENTARY CREDITS (1983 REVISION) INTERNATIONAL CHAMBER OF COMMERCE, PUBLICATION NO 400.

**Shawmut Bank, N.A.**

P.O. Box 2176, Boston, MA 02211-2176, Tel. 617-292-2000

International Department  
Telex: W.U.16817133  
Cable: SHAWMUT  
S.W.I.F.T. ADDRESS: NASH US 33

IRREVOCABLE STANDBY LETTER OF CREDIT

JULY 26, 1990

S040785W

PAGE 01

U.S. NUCLEAR REGULATORY COMMISSION  
WASHINGTON, DC 20555  
REF: LICENSE # 20-19808-01, 02-19808-02

DEAR SIR OR MADAM:

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(1) YOUR SIGHT DRAFT, BEARING REFERENCE TO THIS LETTER OF CREDIT NUMBER S040785W

AND

(2) YOUR SIGNED STATEMENT READING AS FOLLOWS:

"I CERTIFY THAT THE AMOUNT OF THE DRAFT IS PAYABLE PURSUANT TO REGULATIONS ISSUED UNDER AUTHORITY OF THE U.S. NUCLEAR REGULATORY COMMISSION (NRC), AN AGENCY OF THE U.S. GOVERNMENT, PURSUANT TO THE ATOMIC ENERGY ACT OF 1954, AS AMENDED AND THE ENERGY REORGANIZATION ACT OF 1974."

THIS LETTER OF CREDIT IS ISSUED IN ACCORDANCE WITH REGULATIONS ISSUED UNDER THE AUTHORITY OF THE U.S. NUCLEAR REGULATORY COMMISSION (NRC), AN AGENCY OF THE U.S. GOVERNMENT, PURSUANT TO THE ATOMIC ENERGY ACT OF 1954, AS AMENDED, AND THE ENERGY REORGANIZATION ACT OF 1974. THE NRC HAS PROMULGATED REGULATIONS IN TITLE 10, CHAPTER 1 OF THE CODE OF FEDERAL REGULATIONS, PART 30, WHICH REQUIRE THAT A HOLDER OF, OR AN APPLICANT FOR, A LICENSE ISSUED UNDER 10 CFR PART 30, PROVIDE ASSURANCE THAT FUNDS WILL BE AVAILABLE WHEN NEEDED FOR DECOMMISSIONING.

THIS LETTER OF CREDIT IS EFFECTIVE AS OF JULY 26, 1990 AND SHALL EXPIRE ON JULY 26, 1991, BUT SUCH EXPIRATION DATE SHALL BE AUTOMATICALLY EXTENDED FOR A PERIOD OF ONE YEAR ON JULY 26, 1991 AND ON EACH SUCCESSIVE EXPIRATION DATE, UNLESS, AT LEAST 90 DAYS BEFORE THE CURRENT EXPIRATION DATE, WE NOTIFY BOTH YOU AND BIOGEN, INC. BY RETURN RECEIPT THAT WE HAVE DECIDED NOT TO EXTEND THIS LETTER OF CREDIT BEYOND THE CURRENT EXPIRATION DATE. IN THE EVENT YOU ARE SO NOTIFIED, ANY UNUSED PORTION OF THE CREDIT SHALL BE AVAILABLE UPON PRESENTATION OF YOUR SIGHT DRAFT WITHIN 90 DAYS AFTER THE DATE OF RECEIPT OF NOTIFICATION BY BOTH YOU AND BIOGEN, INC. AS SHOWN ON THE LATER OF THE SIGNED RETURN RECEIPTS AND READING AS FOLLOWS:

INSTRUCTIONS TO THE ADVISING BANK

Please complete and forward to beneficiary the attached original advice without adding our confirmation

CONTINUED

**Shawmut Bank, N.A.**

P.O. Box 2476, Boston, MA 02241-2476, Tel: 617-292-2000

International Department  
Telex: WUI 6817133  
Cable: SHAWMUT  
S.W.I.F.T. ADDRESS: NAC1115 33

IRREVOCABLE STANDBY LETTER OF CREDIT

JULY 26, 1990

S040785W

PAGE 02

U.S. NUCLEAR REGULATORY COMMISSION  
WASHINGTON, DC 20555  
REF: LICENSE # 20-19808-01, 02-19808-02

"WE CERTIFY THAT THE LICENSEE HAS FAILED TO REPLACE THIS LETTER OF CREDIT WITH OTHER COLLATERAL ACCEPTABLE TO THE DEPARTMENT WITHIN 30 DAYS OF THE BANK'S NOTICE TO TERMINATE THE LETTER OF CREDIT."

WHENEVER THIS LETTER OF CREDIT IS DRAWN ON, UNDER AND IN COMPLIANCE WITH THE TERMS OF THIS CREDIT, WE SHALL DULY HONOR SUCH DRAFT UPON PRESENTATION TO US, AND WE SHALL DEPOSIT THE AMOUNT OF THE DRAFT DIRECTLY INTO THE STANDBY TRUST OF BIDGEN, INC. IN ACCORDANCE WITH YOUR INSTRUCTIONS.

WE WILL ENDEAVOR TO GIVE PROMPT NOTICE TO THE LICENSEE AND THE DEPARTMENT OF A NOTICE RECEIVED OR ACTION FILED ALLEGING THE INSOLVENCY OR BANKRUPTCY OF THE BANK OR ALLEGING ANY VIOLATIONS OF REGULATORY REQUIREMENTS WHICH SHALL RESULT IN SUSPENSION OR REVOCATION OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS.

DRAFTS DRAWN HEREUNDER MUST BE MARKED "DRAWN UNDER SHAWMUT BANK, N.A., CREDIT NO. S040785W DATED JULY 26, 1990".

D.C. PENNYBAKER ASSISTANT VICE PRESIDENT JULY 26, 1990

THIS CREDIT IS SUBJECT TO THE UNIFORM CUSTOMS AND PRACTICE FOR DOCUMENTARY CREDITS (1983 REVISION) INTERNATIONAL CHAMBER OF COMMERCE, PUBLICATION NO 400.

NOT NEGOTIABLE  
COPY

72/11 (4/87)

INSTRUCTIONS TO THE ADVISING BANK

Please complete and forward to beneficiary the attached original advice without adding your confirmation.



CLERK'S CERTIFICATE

I, Frederic A. Eustis, III, Clerk of Biogen, Inc., a Massachusetts corporation, do hereby certify that attached hereto is a correct and complete copy of the Articles of Association and the By-laws of Biogen, Inc. and such Articles and By-laws are in full force and effect.

WITNESS my hand and the seal of Biogen, Inc. this 26 th day of July 1990.



---

Frederic A. Eustis, III  
Clerk  
Biogen, Inc.

PROVISIONS OF ARTICLES OF ORGANIZATION  
OF  
BIOGEN, INC.

1. NAME

The name by which the Corporation shall be known is:  
BIOGEN, INC.

2. CORPORATE PURPOSES

The purposes for which the Corporation is formed are as follows:

To engage in or cause to be carried out research, development, manufacturing and marketing in the field of biotechnology and generally in the biological, chemical, pharmaceutical, agricultural, energy, nutritional, mining and other related fields and to engage in related commercial activities;

To develop and acquire, manage, exploit, license and alienate patents, processes or formulas, trademarks and copyrights, including all related rights;

To purchase or otherwise acquire, invest in, own, mortgage, pledge, sell, assign and transfer or otherwise dispose of, trade and deal in and with personal property of every kind, class and description (including, without limitation, goods, wares and merchandise of every kind, class and description), to manufacture goods, wares and merchandise of every kind, class and description, both on its own account and for others;

To borrow or lend money, and to make and issue notes, bonds, debentures, obligations, and evidences of indebtedness of all kinds, whether or not secured by mortgage, pledge, or otherwise, without limit as to amount, and to secure the same by mortgage, pledge, or otherwise, and generally to make and perform agreements and contracts of every kind and description;

To purchase, receive, take by grant, lease, or otherwise acquire, own, hold, improve, employ, use, mortgage, pledge, assign, transfer or otherwise dispose of and otherwise deal in and with, real property, or any interest therein, wherever situated;

To subscribe for, take, acquire, hold, sell, exchange and deal in shares, bonds, obligations and securities of any corporation, government, authority or company and to make such other investments as the Corporation may see fit;

To establish, participate in, promote, subsidize and assist companies, syndicates, or partnerships of all kinds and to finance and refinance the same;

To guarantee to the fullest extent permitted by law the payment of principal, premium (if any), interest, or dividends with respect to bonds, debentures, bills of exchange, notes and other evidences of indebtedness, stocks and other securities, and to guarantee the performance of any contract or obligation, entered into by any corporation, partnership, association, trust or any other entity or natural person whether established or domiciled within or outside the Corporation's jurisdiction of incorporation;

To operate branches in various foreign countries and generally to engage in or carry on foreign operations; and

Generally to engage in or carry on any business permitted by the laws of the Commonwealth of Massachusetts to a corporation organized under the Massachusetts Business Corporation Law or any successor statute.

3. CAPITALIZATION

The total number of shares and the par value, if any, of each class of stock which the Corporation is authorized to issue is as follows:

Class of Stock	Without Par Value	With Par Value	
	Number of Shares	Number of Shares	Par Value
Preferred .....	0	20,000,000	\$.01
Common .....	0	55,000,000	\$.01

4. DESCRIPTION OF CLASSES OF STOCK

Any and all shares of stock issued, and for which the full consideration has been paid or delivered, shall be deemed fully paid stock; and the holder of such shares shall not be liable for any further call or assessment of any other payment thereon.

(a) Each holder of Common Stock shall at every meeting of stockholders be entitled to one vote in person or by proxy for each share of Common Stock held by him. The holders of the Common Stock shall be entitled to such dividends as may from time to time be declared by the Board of Directors out of any funds legally available for the declaration of dividends, subject to any provision of these Articles of Organization, as amended from time to time, and subject to the relative rights and preferences of any shares of Preferred Stock authorized and issued hereunder. No share of Common Stock shall entitle its holder to have any preemptive right in or preemptive right to subscribe to any additional shares of Common Stock or any shares of any other class of stock which may at any time be authorized or issued, or any bonds, debentures or other securities convertible into shares of stock of any class of the Corporation, or options or warrants carrying rights to purchase such shares or securities.

(b) The Board of Directors is authorized, subject to limitations prescribed by law and the provisions of this Article 4, to provide for the issuance of the shares of Preferred Stock, with or without series, and, by filing a certificate pursuant to the applicable law of the Commonwealth of Massachusetts (the "Certificate of Designation"), to establish from time to time the number of shares to be included in each such series and to fix the designation, preferences, voting powers, qualifications and special or relative rights or privileges of the shares of each such series. In the event that at any time the Board of Directors shall have established and designated one or more series of Preferred Stock consisting of a number of shares less than all of the authorized number of shares of Preferred Stock, the remaining authorized shares of Preferred Stock shall be deemed to be shares of an undesignated series of Preferred Stock until designated by the Board of Directors as being a part of a series previously established or a new series then being established by the Board of Directors. Notwithstanding the fixing of the number of shares constituting a particular series, the Board of Directors may at any time thereafter authorize the issuance of additional shares of the same series except as set forth in the Certificate of Designation.

The authority of the Board of Directors with respect to each series of Preferred Stock shall include, but not be limited to, determination of the following:

(i) the number of shares constituting that series and the distinctive designation of that series, and whether additional shares of that series may be issued;

(ii) whether any dividends shall be paid on shares of that series, and, if so, the dividend rate on the shares of that series; whether dividends shall be cumulative and, if so, from which date or dates, and the relative rights of priority, if any, of payment of dividends on shares of that series;

(iii) whether shares of that series shall have voting rights in addition to the voting rights provided by law and, if so, the terms of such voting rights;

(iv) whether shares of that series shall be convertible into shares of Common Stock or another security and, if so, the terms and conditions of such conversion, including provisions for adjustment of the conversion rate in such events as the Board of Directors shall determine;

(v) whether or not the shares of that series shall be redeemable and, if so, the terms and conditions of such redemption, including the date or dates upon or after which they shall be redeemable and the amount per share payable in case of redemption, which amount may vary under different conditions and at different redemption dates; and whether that series shall have a sinking fund for the redemption or purchase of shares of that series and, if so, the terms and amount of such sinking fund;

(vi) whether, in the event of purchase or redemption of the shares of that series, any shares of that series shall be restored to the status of authorized but unissued shares or shall have such other status as shall be set forth in the Certificate of Designation;

(vii) the rights of the shares of that series in the event of the sale, conveyance, exchange or transfer of all or substantially all of the property and assets of the Corporation, or the merger or consolidation of the Corporation into or with any other corporation, or the merger of any other corporation into it, or the voluntary or involuntary liquidation, dissolution or winding up of the Corporation, and the relative rights of priority, if any, of shares of that series to payment in any such event;

(viii) whether the shares of that series shall carry any preemptive right in or preemptive right to subscribe for any additional shares of Preferred Stock or any shares of any other class of stock which may at any time be authorized or issued, or any bonds, debentures or other securities convertible into shares of stock of any class of the Corporation, or options or warrants carrying rights to purchase such shares or securities; and

(ix) any other designation, preferences, voting powers, qualifications, and special or relative rights or privileges of the shares of that series.

## 5. RESTRICTIONS

The restrictions, if any, imposed by the Articles of Organization upon the transfer of shares of stock of any class are as follows:

NONE

### 6A. CERTAIN BUSINESS COMBINATIONS

#### (a) Vote Required for Certain Business Combinations

(1) *Higher Vote for Certain Business Combinations.* In addition to any affirmative vote required by law or these Articles of Organization, and except as otherwise expressly provided in paragraph (b) of this Article 6A:

(i) any merger or consolidation of the Corporation or any Subsidiary (as hereinafter defined) with (a) any Interested Stockholder (as hereinafter defined) or (b) any other corporation (whether or not itself an Interested Stockholder) which is, or after such merger or consolidation would be, an Affiliate (as hereinafter defined) of an Interested Stockholder; or

(ii) any sale, lease, license, exchange, mortgage, pledge, transfer or other disposition (in one transaction or a series of transactions) to or with any Interested Stockholder or any Affiliate of any Interested Stockholder of any assets of the Corporation or any Subsidiary having an aggregate Fair Market Value (as hereinafter defined) equal to or greater than 10% of the combined assets of the Corporation and its Subsidiaries; or

(iii) the issuance or transfer by the Corporation or any Subsidiary (in one transaction or a series of transactions) of any securities of the Corporation or any Subsidiary to any Interested Stockholder or any Affiliate of any Interested Stockholder in exchange for cash, securities or other property (or a combination thereof) having an aggregate Fair Market Value equal to or greater than 10% of the combined assets of the Corporation and its Subsidiaries, except pursuant to an employee benefit plan of the Corporation or any Subsidiary thereof; or

(iv) any reclassification of securities of the Corporation (including any reverse stock split), or recapitalization of the Corporation, or any merger or consolidation of the Corporation with any of its Subsidiaries or any other transaction (whether or not with or into or otherwise involving an Interested Stockholder) which has the effect, directly or indirectly, of increasing the proportionate share of the outstanding shares of any class of equity or convertible securities of the Corporation or any Subsidiary which are directly or indirectly owned by any Interested Stockholder or any Affiliate of any Interested Stockholder; or

(v) the adoption of any plan or proposal for the liquidation or dissolution of the Corporation proposed by or on behalf of an Interested Stockholder or any Affiliate of any Interested Stockholder.

shall require the affirmative vote of the holders of at least eighty percent (80%) of the voting power of the then outstanding shares of capital stock of the Corporation entitled to vote in the election of directors (the "Voting Stock"), voting together as a single class (it being understood that for purposes of this Article 6A, each share of the Voting Stock shall have the number of votes granted to it pursuant to Article 4 of these Articles of Organization). Such affirmative vote shall be required notwithstanding the fact that no vote may be required, or that a lesser percentage may be specified, by law or by any other provisions of these Articles of Organization or any Certificate of Designation (as defined in Article 4 of these Articles of Organization), or in any agreement with any national securities exchange or otherwise.

(2) *Definition of "Business Combination".* The term "Business Combination" as used in this Article 6A shall mean any transaction which is referred to in any one or more of clauses (i) through (v) of subparagraph (1) of this paragraph (a).

(b) *When Higher Vote Is Not Required.* The provisions of paragraph (a) of this Article 6A shall not be applicable to any particular Business Combination, and such Business Combination shall require only such affirmative vote as is required by law and any other provisions of these Articles of Organization, if, in the case of any Business Combination that does not involve any cash or other consideration being received by the stockholders of the Corporation solely in their capacity as stockholders of the Corporation, the condition specified in the following subparagraph (b)(1) is met, or, in the case of any other Business Combination, all of the conditions specified in either of the following subparagraphs (b)(1) or (b)(2) are met:

(1) *Approval by Disinterested Directors.* The Business Combination shall have been approved by a majority of the members of the Board of Directors (the "Board") who are Disinterested Directors (as hereinafter defined), it being understood that this condition shall not be capable of satisfaction unless there is at least one Disinterested Director.



(2) *Price and Procedural Requirements.* All of the following conditions shall have been met:

(i) The aggregate amount of the cash and the Fair Market Value as of the date of the consummation of the Business Combination of consideration other than cash to be received per share by the holders of Common Stock of the Corporation in such Business Combination shall be at least equal to the higher of the following:

(A) (if applicable) the highest per share price (including any brokerage commissions, transfer taxes and soliciting dealers' fees) paid by the Interested Stockholder or any of its Affiliates for any shares of Common Stock of the Corporation acquired by it (1) within the two-year period immediately prior to the first public announcement of the proposal of the Business Combination (the "Announcement Date") or (2) in the transaction in which it became an Interested Stockholder, whichever is higher; or

(B) the Fair Market Value per share of Common Stock of the Corporation on the Announcement Date or on the date on which the Interested Stockholder became an Interested Stockholder (the "Determination Date"), whichever is higher.

(ii) The aggregate amount of the cash and the Fair Market Value as of the date of the consummation of the Business Combination of consideration other than cash to be received per share by holders of shares of any class of outstanding Voting Stock other than Common Stock shall be at least equal to the highest of the following (it being intended that the requirements of this subparagraph (b)(2)(ii) shall be required to be met with respect to every class of outstanding Voting Stock, whether or not the Interested Stockholder has previously acquired any shares of a particular class of Voting Stock);

(A) (if applicable) the highest per share price (including any brokerage commissions, transfer taxes and soliciting dealers' fees) paid by the Interested Stockholder or any of its Affiliates for any shares of such class of Voting Stock acquired or beneficially owned by it that were acquired (1) within the two-year period immediately prior to the Announcement Date or (2) in the transaction in which it became an Interested Stockholder, whichever is higher; or

(B) (if applicable) the highest preferential amount per share to which the holders of shares of such class of Voting Stock are entitled in the event of any voluntary liquidation, dissolution or winding up of the Corporation; or

(C) the Fair Market Value per share of such class of Voting Stock on the Announcement Date or on the Determination Date, whichever is higher.

(iii) The price determined in accordance with subparagraphs (i) and (ii) of this subparagraph (b)(2) shall be subject to appropriate adjustment in the event of any stock dividend, stock split, combination of shares or similar event.

(iv) The holders of all outstanding shares of Voting Stock not beneficially owned by the Interested Stockholder immediately prior to the consummation of any Business Combination shall be entitled to receive in such Business Combination cash or other consideration for their shares meeting all of the terms and conditions of this paragraph (2) (provided, however, that the failure of any stockholders who are exercising their statutory rights to dissent from such Business Combination and receive payment of the fair value of their shares to exchange their shares in such Business Combination shall not be deemed to have prevented the condition set forth in this subparagraph (2)(iv) from being satisfied).

(v) The consideration to be received by holders of any particular class of outstanding Voting Stock (including Common Stock) shall be in cash or in the same form as the Interested Stockholder has previously paid for shares of such class of Voting Stock. If the Interested Stockholder has paid for shares of any class of Voting Stock with varying forms of consideration, the form of consideration to be received per share by holders of such class of Voting Stock shall be either cash or the form used to acquire the largest number of shares of such class of Voting Stock previously acquired by the Interested Stockholder.

(vi) After such Interested Stockholder has become an Interested Stockholder and prior to the consummation of such Business Combination: (A) except as approved by a majority of the Disinterested Directors, there shall have been no failure to declare and pay at the regular date therefor any full quarterly dividends (whether or not cumulative) on any outstanding Preferred Stock of the Corporation; (B) there shall have been (I) no reduction in the annual rate of dividends paid on the Common Stock of the Corporation (except as necessary to reflect any subdivision of the Common Stock), except as approved by a majority of the Disinterested Directors, and (II) an increase in such annual rate of dividends as necessary to reflect any reclassification (including any reverse stock split), recapitalization, reorganization or any similar transaction which has the effect of reducing the num-

ber of outstanding shares of the Common Stock, unless the failure so to increase such annual rate is approved by a majority of the Disinterested Directors; and (C) neither such Interested Stockholder nor any of its Affiliates shall have become the beneficial owner of any additional shares of Voting Stock except as part of the transaction which results in such Interested Stockholder becoming an Interested Stockholder.

(vii) After such Interested Stockholder has become an Interested Stockholder, such Interested Stockholder shall not have received the benefit, directly or indirectly (except proportionately as a stockholder), of any loans, advances, guarantees, pledges or other financial assistance or any tax credits or other tax advantages provided by the Corporation, whether in anticipation of or in connection with such Business Combination or otherwise.

(viii) A proxy or information statement describing the proposed Business Combination and complying with the requirements of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), and the rules and regulations thereunder (or any subsequent provisions replacing the Exchange Act or such rules or regulations) shall be mailed to stockholders of the Corporation at least thirty (30) days prior to the consummation of such Business Combination (whether or not such proxy or information statement is required to be mailed pursuant to the Exchange Act or subsequent provisions). Such proxy or information statement shall contain, if a majority of the Disinterested Directors so requests, an opinion of a reputable investment banking firm which shall be selected by a majority of the Disinterested Directors, furnished with all information such investment banking firm reasonably requests and paid a reasonable fee for its services by the Corporation upon the Corporation's receipt of such opinion, as to the fairness (or lack of fairness) of the terms of the proposed Business Combination from the point of view of the holders of shares of Voting Stock (other than the Interested Stockholder).

(c) **Certain Definitions.** For the purposes of this Article 6A:

(1) A "person" shall include any individual, group acting in concert, corporation, partnership, association, joint venture, pool, joint stock company, trust, unincorporated organization or similar company, syndicate, or any group formed for the purpose of acquiring, holding or disposing of securities.

(2) "Interested Stockholder" shall mean any person (other than the Corporation or any Subsidiary) who or which:

(i) is the beneficial owner, directly or indirectly, of more than fifteen percent (15%) of the voting power of the then outstanding Voting Stock; or

(ii) is an Affiliate of the Corporation and at any time within the two-year period immediately prior to the date in question was the beneficial owner, directly or indirectly, of more than fifteen percent (15%) of the voting power of the then outstanding Voting Stock; or

(iii) is an assignee of or has otherwise succeeded to any shares of Voting Stock which were at any time within the two-year period immediately prior to the date in question beneficially owned by any Interested Stockholder, if such assignment or succession shall have occurred in the course of a transaction or series of transactions not involving a public offering within the meaning of the Securities Act of 1933.

(3) A person shall be a "beneficial owner" of any shares of Voting Stock:

(i) which such person or any of its Affiliates or Associates (as hereinafter defined) beneficially owns, directly or indirectly within the meaning of Rule 13d-3 of the Exchange Act, as in effect on March 31, 1988; or

(ii) which such person or any of its Affiliates or Associates has (A) the right to acquire (whether such right is exercisable immediately or only after the passage of time), pursuant to an agreement, arrangement or understanding or upon the exercise of conversion rights, exchange rights, warrants or options, or otherwise; provided, however, that a person shall not be deemed the beneficial owner of securities tendered pursuant to a tender or exchange offer made by or on behalf of such person or any of such person's Affiliates or Associates until such tendered securities are accepted for purchase; or (B) the right to vote pursuant to any agreement, arrangement, understanding or otherwise; provided, however, that a person shall not be deemed the beneficial owner of any security if the agreement, arrangement or understanding to vote such security (I) arises solely from a revocable proxy or consent solicitation made pursuant to, and in accordance with, the Exchange Act and (II) is not also then reportable on Schedule 13D under the Exchange Act (or a comparable or successor report); or

(iii) which are beneficially owned, directly or indirectly within the meaning of Rule 13d-3 under the Exchange Act, as in effect on March 31, 1988, by any other person with which such person or any of its Affiliates or Associates has any agreement, arrangement or understanding for the purpose of acquiring, holding, voting (except to the extent permitted by the proviso of subparagraph (c)(3)(ii)(B) above) or disposing of any shares of Voting Stock;

provided, however, that in the case of any employee stock ownership or similar plan of the Corporation or of any Subsidiary in which the beneficiaries thereof possess the right to vote any shares of Voting Stock held by such plan, no such plan nor any trustee with respect thereto (nor any Affiliate of such trustee), solely by reason of such capacity of such trustee, shall be deemed, for any purposes hereof, to beneficially own any shares of Voting Stock held under any such plan.

(4) For the purposes of determining whether a person is an Interested Stockholder pursuant to subparagraph (c)(2), the number of shares of Voting Stock deemed to be outstanding shall include shares deemed owned through application of subparagraph (c)(3), but shall not include any other shares of Voting Stock which may be issuable pursuant to any agreement, arrangement or understanding, or upon exercise of conversion rights, warrants or options, or otherwise.

(5) "Affiliate" and "Associate" shall have the meanings ascribed to such terms in Rule 12b-2 of the General Rules and Regulations under the Exchange Act, as in effect on March 31, 1988.

(6) "Subsidiary" means any corporation of which a majority of any class of equity security is owned, directly or indirectly, by the Corporation; provided, however, that for the purposes of the definition of Interested Stockholder set forth in subparagraph (c)(2), the term "Subsidiary" shall mean only a corporation of which a majority of each class of equity security is owned, directly or indirectly, by the Corporation.

(7) "Disinterested Director" means any Director of the Corporation who is not an Affiliate or Associate of the Interested Stockholder and was a member of the Board prior to the time that the Interested Stockholder became an Interested Stockholder, and any Director who is thereafter chosen to fill any vacancy on the Board or who is elected and who, in either event, is not an Affiliate or Associate of the Interested Stockholder and in connection with his or her initial assumption of office is recommended for appointment or election by a majority of Disinterested Directors then serving on the Board.

(8) "Fair Market Value" means: (i) in the case of stock, the highest closing sale price during the 30-day period immediately preceding and including the date in question of a share of such stock on the Composite Tape for New York Stock Exchange-Listed Stocks, or, if such stock is not quoted on the Composite Tape, on the New York Stock Exchange, or, if such stock is not listed on such Exchange, on the principal United States securities exchange registered under the Exchange Act on which such stock is listed, or, if such stock is not listed on any such exchange, the highest closing bid quotation with respect to a share of such stock during the 30-day period preceding and including the date in question on the National Association of Securities Dealers, Inc. Automated Quotations System or any system then in use, or, if no such quotations are available, the fair market value on the date in question of a share of such stock as determined in good faith by a majority of the Disinterested Directors; and (ii) in the case of property other than cash or stock, the fair market value of such property on the date in question as determined in good faith by a majority of the Disinterested Directors.

(9) In the event of any Business Combination in which the Corporation survives, the phrase "consideration other than cash to be received" as used in subparagraphs (b)(2)(i) and (ii) of this Article 6A shall include the shares of Common Stock of the Corporation and/or the shares of any other class of outstanding Voting Stock retained by the holders of such shares.

(10) For the purposes of determining the "Announcement Date", in the event that the first public announcement of the proposal of the Business Combination is made after the close on such date of any securities exchange registered under the Exchange Act on which any shares of the Voting Stock of the Corporation are traded, or of the National Association of Securities Dealers, Inc. Automated Quotations System or any other system on which any shares of the Voting Stock of the Corporation are listed, then the Announcement Date shall be deemed to be the next day on which such exchange or quotations system is open.

(d) **Powers of the Board of Directors.** A majority of the Board shall have the power and duty to determine for the purposes of this Article 6A, on the basis of information known to them after reasonable inquiry, whether a person is an Interested Stockholder, which determination shall be conclusive. Once the Board has made a determination, pursuant to the preceding sentence, that a person is an Interested Stockholder, then a majority of Disinterested Directors shall have the power and duty to determine for the purposes of this Article 6A, on the basis of information known to them after reasonable inquiry, (i) the number of shares of Voting Stock beneficially owned by any person, (ii) whether a person is an Affiliate or Associate of another, (iii) whether the assets which may be the subject of any Business Combination have, or the consideration which may be received for the issuance or transfer of securities by the Corporation or any Subsidiary in any Business Combination has, an aggregate Fair Market Value equal to or greater than 10% of the combined assets of the Corporation and its



Subsidiaries and (iv) whether all of the applicable conditions set forth in subsection (b)(2) shall have been met with respect to any Business Combination, any of which determinations by a majority of the Disinterested Directors shall be conclusive. A majority of the Disinterested Directors shall have the further power to interpret all of the terms and provisions of this Article 6A, which interpretation shall be conclusive.

(e) **No Effect on Fiduciary Obligations of Interested Stockholders.** Nothing contained in this Article 6A shall be construed to relieve any Interested Stockholder of any fiduciary obligation imposed by law.

(f) **Amendment, Repeal, etc.** Notwithstanding any other provisions of these Articles of Organization or the By-Laws of the Corporation (and notwithstanding the fact that a lesser percentage or no vote may be specified by law, these Articles of Organization or the By-Laws of the Corporation), and in addition to any affirmative vote of the holders of Preferred Stock or any other class of capital stock of the Corporation or any series of the foregoing then outstanding which is required by law or by or pursuant to these Articles of Organization, the affirmative vote of the holders of eighty percent (80%) or more of the voting power of the outstanding Voting Stock, voting together as a single class, shall be required to amend or repeal, or adopt any provisions inconsistent with, this Article 6A.

## 6B. CERTAIN TRANSACTIONS APPROVED BY THE BOARD OF DIRECTORS

Except as provided in Article 6A of, or as otherwise provided in, these Articles of Organization, the Corporation may authorize, by a vote of a majority of the shares of each class of stock outstanding and entitled to vote thereon, (a) the sale, lease or exchange of all or substantially all of its property and assets, including its goodwill, upon such terms and conditions as it deems expedient, and (b) the merger or consolidation of the Corporation with or into any other corporation, provided, however, that such sale, lease, exchange, merger or consolidation shall have been approved by a majority of the members of the Board of Directors.

## 6C. BOARD OF DIRECTORS

(a) **Mandate and Number.** The business and affairs of the Corporation shall be managed under the direction of the Board of Directors, the number of which, subject to any right of the holders of any series of Preferred Stock then outstanding to elect additional directors under specified circumstances, shall be fixed from time to time by the Board of Directors pursuant to the By-Laws of the Corporation.

(b) **Term.** Subject to the rights of the holders of any series of Preferred Stock then outstanding, the directors shall be divided into three classes, as nearly equal in number as possible, with the term of office of the first class to expire at the 1989 Annual Meeting of Stockholders or any special meeting in lieu thereof, the term of office of the second class to expire at the 1990 Annual Meeting of Stockholders or any special meeting in lieu thereof and the term of office of the third class to expire at the 1991 Annual Meeting of Stockholders or any special meeting in lieu thereof. At each Annual Meeting of Stockholders or special meeting in lieu thereof following such initial classification and election, directors elected to succeed those directors whose terms expire shall be elected for a term of office to expire at the third succeeding Annual Meeting of Stockholders or special meeting in lieu thereof after their election and until their successors are duly elected and qualified.

(c) **Newly Created Directorships and Vacancies.** Subject to the rights of the holders of any series of Preferred Stock then outstanding, newly created directorships resulting from any increase in the authorized number of directors or any vacancies in the Board of Directors resulting from death, resignation, retirement, disqualification, removal from office or other cause may be filled only by a majority vote of the directors then in office even though less than a quorum, or by a sole remaining director. In the event of any vacancy resulting other than from an increase in the authorized number of directors, the director elected as provided in the foregoing sentence shall serve for the remainder of the full term of the class in which the vacancy occurred rather than until the next Annual Meeting of Stockholders. In the event of any increase or decrease in the authorized number of directors, (i) each director then serving as such shall nevertheless continue as director of the class of which he is a member until the expiration of his current term or his prior death, retirement or resignation and (ii) the newly created or eliminated directorships resulting from such increase or decrease shall be apportioned by the Board of Directors among the three classes of directors so as to ensure that no one class has more than one director more than any other class. To the extent possible, consistent with the foregoing rule, any newly created directorships shall be added to those classes whose terms of office are to expire at the latest dates following such allocation and any newly eliminated directorships shall be subtracted from those classes whose terms of office are to expire at the earliest dates following such allocation, unless otherwise provided for from time to time by resolution adopted by a majority of the directors then in office, although less than a quorum. In the event of a vacancy in the Board of Directors, the remaining directors, except as otherwise provided by law, may exercise the powers of the full Board of Directors until the vacancy is filled.



(d) *Removal.* Subject to the rights of the holders of any series of Preferred Stock then outstanding, any director, or the entire Board of Directors, may be removed from office at any time (i) only for cause and (ii) only by the affirmative vote of the holders of at least 80% of the voting power of all of the then outstanding shares of the Corporation entitled to vote generally in the election of directors, voting together as a single class, or by the affirmative vote of three-fourths of the directors then serving. A director may be removed for cause only after a reasonable notice and opportunity to be heard before the body proposing to remove him.

(e) *Amendment, Repeal, etc.* Notwithstanding anything contained in these Articles of Organization to the contrary, the affirmative vote of the holders of at least 80% of the total voting power of all of the outstanding shares of the Corporation entitled to vote generally in the election of directors, voting together as a single class, shall be required to alter, amend or repeal this Article entitled "Board of Directors" or adopt any provision in these Articles of Organization or the By-Laws inconsistent with this Article entitled "Board of Directors".

#### 6D. INDEMNIFICATION

(a) *Right to Indemnification.* Each person who was or is made a party or is threatened to be made a party to or is otherwise involved in any action, suit or proceeding, whether civil, criminal, administrative or investigative (hereinafter a "proceeding"), by reason of the fact that he or she is or was a director or an officer of the Corporation or is or was serving at the request of the Corporation as a director or officer of another corporation, including, without limitation, any corporation or other entity of which a majority of any class of equity security is owned, directly or indirectly, by the Corporation (a "Subsidiary") or any Affiliate of the Corporation as such term is defined in Rule 12b-2 of the General Rules and Regulations under the Securities Exchange Act of 1934, as amended, or of a partnership, joint venture, trust or other enterprise, including service with respect to an employee benefit plan (hereinafter an "indemnitee"), whether the basis of such proceeding is alleged action in an official capacity as a director or officer, or in any other capacity while serving as a director or officer, shall be indemnified and held harmless by the Corporation to the fullest extent authorized by the Massachusetts Business Corporation Law, as the same exists or may hereafter be amended (but, in the case of any such amendment, only to the extent that such amendment permits the Corporation to provide broader indemnification rights than such law permitted the Corporation to provide prior to such amendment), against all expense, liability and loss (including, without limitation, attorneys' fees, judgments, fines, ERISA excise taxes or penalties, costs of investigation and preparation of defense and amounts paid or to be paid in settlement) reasonably incurred or suffered by such indemnitee in connection therewith; provided, however, that, except as provided in Section (c) hereof with respect to proceedings to enforce rights of indemnification, the Corporation shall indemnify any such indemnitee in connection with a proceeding (or part thereof) initiated by such indemnitee only if such proceeding (or part thereof) was authorized by the Board of Directors of the Corporation.

(b) *Advance of Expenses.* The right to indemnification conferred in Section (a) of this Article 6D shall include the right to be paid by the Corporation the expenses incurred in defending any such proceeding in advance of its final disposition (hereinafter an "advancement of expenses"), provided, however, that an advancement of expenses incurred by an indemnitee in his or her capacity as a director or officer shall be made only upon delivery to the Corporation of an undertaking (hereinafter an "undertaking"), by or on behalf of such indemnitee, to repay all amounts so advanced if it shall ultimately be determined by final judicial decision from which there is no further right to appeal (hereinafter a "final adjudication") that such indemnitee is not entitled to be indemnified for such expenses under this Section or otherwise. The rights to indemnification and to the advancement of expenses conferred in Sections (a) and (b) of this Article shall be contract rights and such rights shall continue as to an indemnitee who has ceased to be a director or officer and shall inure to the benefit of the indemnitee's heirs, executors and administrators.

(c) *Right of Indemnitee to Bring Suit.* If a claim under Section (a) or (b) of this Article is not paid in full by the Corporation within sixty days after a written claim has been received by the Corporation, except in the case of a claim for an advancement of expenses, in which case the applicable period shall be twenty days, the indemnitee may at any time thereafter bring suit against the Corporation to recover the unpaid amount of the claim. If successful in whole or in part in any such suit, or in a suit brought by the Corporation to recover an advancement of expenses pursuant to the terms of an undertaking, the indemnitee shall be entitled to be paid also the expense of prosecuting or defending such suit. In (i) any suit brought by the indemnitee to enforce a right to indemnification hereunder (but not in a suit brought by the indemnitee to enforce a right to an advancement of expenses) it shall be a defense that, and (ii) in any suit by the Corporation to recover an advancement of expenses pursuant to the terms of an undertaking the Corporation shall be entitled to recover such expenses upon a final adjudication that, the indemnitee has not met any applicable standard for indemnification set forth in the Massachusetts Business Corporation Law. Neither the failure of the Corporation (including its Board of

Directors, independent legal counsel, or its stockholders) to have made a determination prior to the commencement of such suit that indemnification of the indemnitee is proper in the circumstances because the indemnitee has met the applicable standard of conduct set forth in the Massachusetts Business Corporation Law, nor an actual determination by the Corporation (including its Board of Directors, independent legal counsel, or its stockholder) that the indemnitee has not met such applicable standard of conduct, shall create a presumption that the indemnitee has not met the applicable standard of conduct or, in the case of such a suit brought by the indemnitee, be a defense to such suit. In any suit brought by the indemnitee to enforce a right to indemnification or to an advancement of expenses hereunder, or by the Corporation to recover an advancement of expenses pursuant to the terms of an undertaking, the burden of proving that the indemnitee is not entitled to be indemnified, or to such advancement of expenses, under this Article or otherwise shall be on the Corporation.

(d) *Rights Not Exclusive.* The rights to indemnification and to the advancement of expenses conferred in this Article shall not be exclusive of any other right which any person may have or hereafter acquire under any statute, these Articles of Organization, the Corporation's By-Laws, or any agreement, vote of stockholders or disinterested directors or otherwise.

(e) *Insurance.* The Corporation may purchase and maintain insurance, at its expense, to protect itself and any director, officer, employee or agent of the Corporation or another corporation, partnership, joint venture, trust or other enterprise, including, without limitation, any Subsidiary or Affiliate or any employee benefit plan, against any expense, liability or loss, whether or not the Corporation would have the power to indemnify such person against such expense, liability or loss under the Massachusetts Business Corporation Law. The Corporation's obligation to provide indemnification under this Article shall be offset to the extent of any payment received by the indemnitee from any other source of indemnification or pursuant to any otherwise applicable insurance coverage under a policy maintained by the Corporation or any other person.

(f) *Employees and Agents.* The Corporation may, to the extent authorized from time to time by the Board of Directors, grant rights to indemnification and to the advancement of expenses to any employee or agent of the Corporation or any Subsidiary or Affiliate to the fullest extent of the provisions of this Article with respect to the indemnification of and advancement of expenses to directors and officers of the Corporation.

(g) *Agreements.* The Corporation may, to the extent authorized from time to time by the Board of Directors, enter into agreements with any director, officer, employee or agent of the Corporation or any Subsidiary or Affiliate to the fullest extent of the provisions of this Article with respect to the indemnification of and advancement of expenses to such person.

(h) *Amendment.* Without the consent of a person entitled to the indemnification and other rights provided in this Article (unless otherwise required by the Massachusetts Business Corporation Law), no amendment modifying or terminating such rights shall adversely affect such person's rights under this Article with respect to the period prior to such amendment.

(i) *Savings Clause.* If this Article or any portion hereof shall be invalidated on any ground by any court of competent jurisdiction, then the Corporation shall nevertheless indemnify each indemnitee as to any liabilities and expenses with respect to any proceeding to the fullest extent permitted by any applicable portion of this Article that shall not have been invalidated and to the fullest extent permitted by applicable law.

## 6E. LIMITATION OF LIABILITY OF DIRECTORS

No director of the Corporation shall be personally liable to the Corporation or its stockholders for monetary damages for breach of fiduciary duty as a director notwithstanding any provision of law imposing such liability; provided, however, that this Article shall not eliminate or limit any liability of a director (i) for any breach of the director's duty of loyalty to the Corporation or its stockholders, (ii) for acts or omissions not in good faith or which involve intentional misconduct or a knowing violation of law, (iii) under Sections 61 or 62 of the Massachusetts Business Corporation Law, or (iv) with respect to any transaction from which the director derived an improper personal benefit.

The provisions of this Article shall not eliminate or limit the liability of a director of this Corporation for any act or omission occurring prior to the date on which this Article became effective. No amendment or repeal of this Article shall adversely affect the rights and protection afforded to a director of this Corporation under this Article for acts or omissions occurring while this Article is in effect.

If the Massachusetts Business Corporation Law is subsequently amended to further eliminate or limit the personal liability of directors or to authorize corporate action to further eliminate or limit such liability, then

the liability of the directors of this Corporation shall, without any further action of the Board of Directors or the stockholders of this Corporation, be eliminated or limited to the fullest extent permitted by the Massachusetts Business Corporation Law as so amended.

#### 6F. INTERCOMPANY DEALINGS

The Corporation may enter into contracts or transact business with one or more of its directors, officers or stockholders or with any corporation, organization or other concern in which one or more of its directors, officers or stockholders are directors, officers, stockholders or are otherwise interested and may enter into other contracts or transactions in which one or more of its directors, officers or stockholders are in any way interested. In the absence of fraud, no such contract or transaction shall be invalidated or in any way affected by the fact that such one or more of the directors, officers or stockholders of the Corporation have or may have any interest which is or might be adverse to the interest of the Corporation even though the vote or action of directors, officers or stockholders having such adverse interest may have been necessary to obligate the Corporation under such contract or transaction.

At any meeting of the Board of Directors of the Corporation (or of any duly authorized committee thereof) at which any such contract or transaction shall be authorized or ratified, any such director or directors may vote or act thereat with like force and effect as if he had not such interest, provided in such case that the nature of such interest (though not necessarily the extent or details thereof) shall be disclosed or shall have been known to the directors. A general notice that a director or officer is interested in any corporation or other concern of any kind referred to above shall be a sufficient disclosure as to the interest of such director or officer with respect to all contracts and transactions with such corporation or other concern. No director shall be disqualified from holding office as a director or an officer of the Corporation by reason of any such adverse interest, unless the Board of Directors shall determine that such adverse interest is detrimental to the Corporation. In the absence of fraud, no director, officer or stockholder having such adverse interest shall be liable on account of such adverse interest to the Corporation or to any stockholder or creditor thereof or to any other person for any loss incurred by it under or by reason of such contract or transaction, nor shall any such director, officer or stockholder be accountable on such ground for any gains or profits realized thereon.

#### 6G. MAKING, AMENDING AND REPEALING BY-LAWS

The directors of the Corporation shall have power to make, alter, amend and repeal the By-Laws of the Corporation in whole or in part except with respect to any provision thereof which by law or these Articles of Organization or such By-Laws requires action by the stockholders, who shall also have power to make, alter, amend and repeal the By-Laws of the Corporation. Any By-Laws made by the directors under the powers conferred hereby may be altered, amended, or repealed by the directors or the stockholders. Notwithstanding the foregoing and anything contained in these Articles of Organization to the contrary, Articles II and VII and Sections 2 and 3 of Article I of the By-Laws, and this Article 6G, shall not be altered, amended or repealed, and no provision inconsistent therewith or herewith shall be adopted, without the affirmative vote of the holders of at least eighty percent (80%) of the voting power of all shares of the Corporation entitled to vote generally in the election of directors, voting together as a single class.

#### 6H. PLACE OF MEETINGS OF STOCKHOLDERS

Meetings of stockholders of the Corporation may be held anywhere in the United States to the extent permitted by the By-Laws.

#### 6I. PARTNERSHIP IN ANY BUSINESS ENTERPRISE

The Corporation may be a partner in any business enterprise which the Corporation would have the power to conduct by itself.



BIOGEN, INC.

BY-LAWS

ARTICLE I

STOCKHOLDERS

1. *Place of Meetings.* All meetings of the stockholders shall be held either at the principal office of the Corporation or at such other place within the United States as is determined by the Board of Directors or the Chairman of the Board of Directors and stated in the notice of the meeting.

2. *Annual Meetings.* The annual meeting of the stockholders entitled to vote shall be held at ten o'clock in the forenoon (or at such other time as is determined by the Board of Directors or the Chairman of the Board of Directors and stated in the notice) on a date to be determined by the Board of Directors within six months after the end of each fiscal year, on any day that is not a Saturday, Sunday or legal holiday, and if a Saturday, Sunday or legal holiday, then on the next succeeding day that is not a Saturday, Sunday or legal holiday, at such location as is determined by the Board of Directors or the Chairman of the Board and stated in the notice. The purposes for which an annual meeting is to be held, in addition to those prescribed by law, by the Articles of Organization and by these By-Laws, may be specified by the Board of Directors or the Chairman of the Board. If no annual meeting is held on the date fixed, or by adjournment therefrom, a special meeting of the stockholders may be held in lieu thereof, and any action taken at such special meeting shall have the same force and effect as if taken at the annual meeting.

3. *Special Meetings.* Subject to the rights of the holders of any class or series of preferred stock of the Corporation, special meetings of the stockholders entitled to vote may be called by the Board of Directors or the Chairman of the Board of Directors, and shall be called by the Clerk, or in the case of the death, absence, incapacity or refusal of the Clerk, by any other officer, upon written application of one or more stockholders who are entitled to vote and who hold at least forty percent (40%) in interest of the capital stock entitled to vote at the meeting.

4. *Notice of Meetings.* Notice of all meetings of stockholders, stating the place, date and hour thereof, and the purposes for which the meeting is called, shall be given to each stockholder entitled to vote thereat by the Clerk or other person calling the meeting. Notice must be given in writing and such writing shall be sufficient if given personally or by postage-prepaid mailing, or by any other means permitted by law. Notice must be given at least seven (7) days before the meeting, to each stockholder entitled to vote thereat and to each stockholder who, by law, the Articles of Organization or these By-Laws, is entitled to such notice, such notice addressed to his usual place of business or residence as it appears upon the books of the Corporation. Notice shall be deemed given when it is received, if hand delivered, or when dispatched, if delivered through the mails or by courier, telegraph, telex, telecopy or cable. No notice of a meeting of the stockholders need be given to any stockholder if such stockholder, by a writing (including, without limitation, by telegraph, telex, telecopy or cable) filed with the records of the meeting (and whether executed before or after such meeting) waives such notice, or if such stockholder attends the meeting without protesting prior thereto or at its commencement the lack of notice to him. Every stockholder who is present at a meeting (whether in person or by proxy) shall be deemed to have waived notice thereof.

5. *Quorum.* At any meeting of stockholders, the holders of a majority in interest of all stock issued, outstanding and entitled to vote at a meeting shall constitute a quorum, except that, if two or more classes of stock are outstanding and entitled to vote as separate classes, then in the case of each such class, a quorum shall consist of the holders of a majority in interest of the stock of that class issued, outstanding and entitled to vote.

6. *Adjournments.* Any meeting of the stockholders may be adjourned to any other time and to any other place by the stockholders present or represented at the meeting, although less than a quorum, or by any officer entitled to preside or to act as clerk of such meeting if no stockholder is present in person or by proxy. It shall not be necessary to notify any stockholder of any adjournment. Any business which could have been transacted at any meeting of the stockholders as originally called may be transacted at any adjournment thereof.

7. *Votes and Proxies.* At all meetings of the stockholders, each stockholder shall have one vote for each share of stock having voting power registered in such stockholder's name, and a proportionate vote for any fractional shares, unless otherwise provided or required by the Massachusetts Business Corporation Law, the Articles of Organization or these By-Laws. Scrip shall not carry any right to vote unless otherwise provided therein, but if scrip provides for the right to vote, such voting shall be on the same basis as fractional shares. Stockholders



may vote either in person or by written proxy. No proxy which is dated more than six months before the meeting at which it is to be used shall be accepted, and no proxy shall be valid after the final adjournment of such meeting. Proxies need not be sealed or attested. Notwithstanding the foregoing, a proxy coupled with an interest sufficient in law to support an irrevocable power, including, without limitation, an interest in the stock or in the Corporation generally, may be made irrevocable if it so provides, need not specify the meeting to which it relates, and shall be valid and enforceable until the interest terminates, or for such shorter period as may be specified in the proxy. A proxy with respect to stock held in the name of two or more persons shall be valid if executed by one of them unless at or prior to exercise of the proxy the Corporation receives a specific written notice to the contrary from any one of them. A proxy purporting to be executed by or on behalf of a stockholder shall be deemed valid unless challenged at or prior to its exercise.

8. *Conduct of Business.* The Chairman of the Board of Directors or his designee, or, if there is no Chairman of the Board or such designee, then a person appointed by a majority of the Board of Directors, shall preside at any meeting of stockholders. The chairman of any meeting of stockholders shall determine the order of business and the procedures at the meeting, including such regulation of the manner of voting and the conduct of discussion as seem to him in order.

9. *Action at a Meeting.* When a quorum is present, the holders of a majority of the stock present or represented and entitled to vote and voting on a matter (or if there are two or more classes of stock entitled to vote as separate classes, then in the case of each such class, the holders of a majority of the stock of that class present or represented and entitled to vote and voting on a matter), except where a larger vote is required by law, the Articles of Organization or these By-Laws, shall decide any matter to be voted on by the stockholders. Any election by stockholders shall be determined by a plurality of the votes cast by the stockholders entitled to vote at the election. No ballot shall be required for such election unless requested by a stockholder present or represented at the meeting and entitled to vote in the election. The Corporation shall not directly or indirectly vote any share of its stock. Nothing in this section shall be construed to limit the right of the Corporation to vote any shares of stock held directly or indirectly by it in a fiduciary capacity.

## ARTICLE II

### BOARD OF DIRECTORS

1. *Powers.* The Board of Directors may exercise all the powers of the Corporation except such as are required by law or by the Articles of Organization or these By-Laws to be otherwise exercised, and the business and affairs of the Corporation shall be managed under the direction of the Board of Directors. Without limiting the generality of the foregoing, the Board of Directors shall have power, unless otherwise provided by law, to purchase and to lease, pledge, mortgage and sell such property (including the stock of the Corporation) and to make such contracts and agreements as they deem advantageous, to fix the price to be paid for or in connection with any property or rights purchased, sold, or otherwise dealt with by the Corporation, to borrow money, issue bonds, notes and other obligations of the Corporation, and to secure payment thereof by the mortgage or pledge of all or any part of the property of the Corporation. The Board of Directors may determine the compensation of directors. The Board of Directors or such officer or committee as the Board of Directors shall designate, may determine the compensation and duties, in addition to those prescribed by these By-Laws, of all officers, agents and employees of the Corporation.

2. *Number.* The Corporation shall have a Board of Directors, which shall consist of not less than three and not more than fifteen directors, which number, subject to the rights of the holders of any preferred stock of the Corporation to elect Directors, shall be determined from time to time by the Board of Directors, except that, in the absence of any such determination, such number shall be nine (9). Such number may be enlarged or reduced by a vote of a majority of the directors then in office. Subject to the rights of the holders of any series of Preferred Stock then outstanding, if the Board of Directors is divided into one or more classes, at each annual meeting of stockholders or special meeting in lieu thereof following the initial classification of the Board of Directors, directors elected to succeed those directors whose terms then expire shall be elected for a term of office to expire at the third succeeding annual meeting of stockholders or special meeting in lieu thereof after their election and until their successors are duly elected and qualified. No director need be a stockholder.

3. *Tenure.* Except as otherwise provided by law, by the Articles of Organization, or by these By-Laws, each director, including the Chairman of the Board, shall hold office until the next annual meeting of stockholders and until his successor is elected and qualified or until he sooner dies, resigns, is removed or becomes disqualified. Any director may resign by giving written notice of his resignation to the Chairman of the Board, the President, the Clerk or the Secretary, if any, or to the Board of Directors at a meeting of the Board, and such resignation shall become effective at the time specified therein.

4. *Removal.* Subject to the rights of the holders of any series of Preferred Stock then outstanding, any director, or the entire Board of Directors, may be removed from office at any time (i) only for cause and (ii) only by the affirmative vote of the holders of at least 80% of the voting power of all of the shares of the Corporation entitled to vote generally in the election of directors, voting together as a single class, or by the affirmative vote of three-fourths of the directors then serving. A director may be removed for cause only after a reasonable notice and opportunity to be heard before the body proposing to remove him.

5. *Vacancies.* Subject to the Articles of Organization, any vacancy in the office of director may be filled by a majority vote of the directors then in office even though less than a quorum, or by a sole remaining director. Subject to the Articles of Organization, newly created directorships resulting from an increase in the authorized number of directors may be filled by a majority vote of the Board of Directors then in office even though less than quorum, or by a sole remaining director.

6. *Meetings.* Meetings of the directors need not be held in the state of incorporation.

(a) *Regular Meetings.* Regular meetings of the Board of Directors may be held without call or notice at such places and at such times as may be fixed by the Board of Directors from time to time, provided that any director who is absent when such determination is made shall be given notice of the determination. A regular meeting of the Board of Directors may be held without call or notice at the same place as the annual meeting of stockholders, or the special meeting held in lieu thereof, immediately following such meeting of stockholders.

(b) *Special Meetings.* Special meetings of the Board of Directors may be called by the Chairman of the Board, the President, the Treasurer, the Clerk, or one or more directors. Notice of the time and place of all special meetings shall be given by the Clerk or the Secretary or the officer or directors calling the meeting. Notice must be given orally, by telephone, or by telegraph, telex, telecopy or cable or in writing, and such notice shall be sufficient if given in time to enable the director to attend, or in any case if sent by mail, by courier or telegraph, telex, telecopy or cable at least three days before the meeting, addressed to a director's usual or last known place of business or residence. No notice of any meeting of the Board of Directors need be given to any director if such director, by a writing (including, without limitation, by telegraph, telex, telecopy or cable) filed with the records of the meeting (and whether executed before or after such meeting), waives such notice, or if such director attends the meeting without protesting prior thereto or at its commencement the lack of notice to him. A notice or waiver of notice need not specify the purpose of any special meeting.

7. *Quorum of Directors.* At any meeting of the Board of Directors, a majority of the number of directors then constituting a full Board of Directors then serving shall constitute a quorum, but a lesser number may adjourn any meeting from time to time without further notice. In the event of a vacancy in the Board of Directors, the remaining directors, except as otherwise provided by law, may exercise the powers of the full Board of Directors until the vacancy is filled.

8. *Action at a Meeting.* Unless otherwise provided by law, the Articles of Organization or these By-Laws, action on any matter brought before any meeting at which there is a quorum may be taken by vote of a majority of the directors then present at the meeting, unless a different vote is required by law, the Articles of Organization or these By-Laws.

9. *Action Without a Meeting.* Unless otherwise provided by law, the Articles of Organization or these By-Laws, any action required or permitted to be taken at any meeting of the directors may be taken without a meeting if all the directors then in office consent to the action in writing and the written consents are filed with the records of the meetings of directors. Such consents shall be treated for all purposes as a vote at a meeting.

10. *Committees of Directors.* The Board of Directors may, by vote of a majority of the number of directors then constituting a full Board, elect from its membership an Executive Committee (to be chaired by the Chairman of the Board) and such other committees as it may determine, comprised of such number of its members as it may from time to time determine (but in any event not less than two), and delegate to any such committee or committees some or all of its powers, except those which by law, the Articles of Organization or these By-Laws it is prohibited from delegating. Except as the directors may otherwise determine, any such committee may make rules for the conduct of its business, but, unless otherwise provided by the directors or in such rules, its business shall be conducted as nearly as may be in the manner as is provided by these By-Laws for the directors.

11. *Telephone Conference Meetings.* The Board of Directors or any committee thereof may participate in a meeting of such Board of Directors or committee thereof by means of a conference telephone (or similar communications equipment) call by means of which all persons participating in the meeting can hear each other at the same time, and participation by such means shall constitute presence in person at a meeting.

## ARTICLE III

### OFFICERS

1. *Enumeration.* The officers of the Corporation shall be the Chairman of the Board of Directors, the President, the Treasurer, the Clerk and such other officers as the Board of Directors or the Chairman of the Board may determine, including, but not limited to, one or more Vice-Presidents, one or more Assistant Treasurers, one or more Assistant Clerks, and a Secretary.

2. *Election.* The Chairman of the Board, the President, the Treasurer and the Clerk shall be elected annually by the directors at their first meeting following the annual meeting of the stockholders or special meeting in lieu thereof. The Board of Directors or the Chairman of the Board may, from time to time, elect or appoint such other officers as it or he may determine, including, but not limited to, one or more Vice-Presidents, one or more Assistant Treasurers, one or more Assistant Clerks, and a Secretary.

3. *Qualification.* No officer need be a stockholder. The Chairman of the Board, and any Vice Chairman appointed to act in the absence of the Chairman, shall be elected by and from the Board of Directors, but no other officer need be a director. Two or more offices may be held by any one person. If required by vote of the Board of Directors, an officer shall give bond to the Corporation for the faithful performance of his duties, in such form and amount and with such sureties as the Board of Directors may determine. The premiums for such bonds shall be paid by the Corporation.

4. *Tenure.* Each officer elected or appointed by the Board of Directors shall hold office until the first meeting of the Board of Directors following the next annual meeting of the stockholders or special meeting in lieu thereof and until his successor is elected or appointed and qualified, or until he dies, resigns, is removed or becomes disqualified, unless a shorter term is specified in the vote electing or appointing said officer. Each officer appointed by the Chairman of the Board shall hold office until his successor is elected or appointed and qualified, or until he dies, resigns, is removed or becomes disqualified, unless a shorter term is specified by any agreement or other instrument appointing said officer. Any officer may resign by giving written notice of his resignation to the Chairman of the Board, the President, the Clerk or the Secretary, if any, or to the Board of Directors at a meeting of the Board, and such resignation shall become effective at the time specified therein.

5. *Removal.* Any officer elected or appointed by the Board of Directors may be removed from office with or without cause by vote of a majority of the directors then in office. Any officer appointed by the Chairman of the Board may be removed from office with or without cause by the Chairman of the Board. An officer may be removed for cause only after a reasonable notice and opportunity to be heard before the body or person proposing to remove him.

6. *Chairman of the Board.* The Chairman of the Board shall preside at all meetings of the Board of Directors and stockholders at which he is present and shall have such authority and perform such duties as may be prescribed by these By-Laws or from time to time determined by the Board of Directors.

7. *President.* The President shall, subject to the control and direction of the Board of Directors, have and perform such powers and duties as may be prescribed by these By-Laws or from time to time be determined by the Board of Directors or the Chairman of the Board.

8. *Vice Presidents.* The Vice Presidents, if any, in the order of their election, or in such other order as the Board of Directors or the Chairman of the Board may determine, shall have and perform the powers and duties of the President (or such of the powers and duties as the Board of Directors or the Chairman of the Board may determine) whenever the President is absent or unable to act. The Vice Presidents, if any, shall also have such other powers and duties as may from time to time be determined by the Board of Directors or the Chairman of the Board.

9. *Treasurer and Assistant Treasurers.* The Treasurer shall, subject to the control and direction of the Board of Directors, have and perform such powers and duties as may be prescribed in these By-Laws or be determined from time to time by the Board of Directors or the Chairman of the Board. All property of the Corporation in the custody of the Treasurer shall be subject at all times to the inspection and control of the Board of Directors. Unless otherwise voted by the Board of Directors, each Assistant Treasurer, if any, shall have and perform the powers and duties of the Treasurer whenever the Treasurer is absent or unable to act, and may at any time exercise such of the powers of the Treasurer, and such other powers and duties, as may from time to time be determined by the Board of Directors or the Chairman of the Board.

10. *Clerk and Assistant Clerks.* The Clerk shall be a resident of Massachusetts unless the Corporation has a resident agent appointed for the purpose of service of process. He shall have and perform the powers and



duties prescribed in these By-Laws and such other powers and duties as may from time to time be determined by the Board of Directors. He shall attend all meetings of the stockholders and shall record upon the record book of the Corporation all votes of the stockholders and minutes of the proceedings at such meetings. He shall have custody of the record books of the Corporation. Assistant Clerks, if any, shall have such powers as the Board of Directors or the Chairman of the Board may from time to time designate. In the absence of the Clerk from any meeting of stockholders, an Assistant Clerk, if one be elected, otherwise a Temporary Clerk designated by the person presiding at the meeting, shall perform the duties of the Clerk.

11. *Secretary and Assistant Secretaries.* The Board of Directors or the Chairman of the Board may appoint a Secretary and, in his absence, an Assistant Secretary, but if no Secretary or Assistant Secretary is elected, the Clerk (or, in the absence of the Clerk, any Assistant Clerk) shall act as the Secretary. The Secretary or, in his absence, any Assistant Secretary, shall attend all meetings of the directors and shall record all votes of the Board of Directors and minutes of the proceedings at such meetings. The Secretary or, in his absence, any Assistant Secretary (or the Clerk), shall notify the directors of their meetings, and shall have and perform such other powers and duties as may from time to time be determined by the Board of Directors or the Chairman of the Board. If a Secretary or an Assistant Secretary is elected but is absent from any such meeting, the Clerk (or any Assistant Clerk) may perform the duties of the Secretary; otherwise, a Temporary Secretary may be appointed by the meeting.

#### ARTICLE IV

#### SCIENTIFIC BOARD

1. *Powers.* The Scientific Board shall provide advice to the Corporation and the Board of Directors with respect to the general policy of the Corporation regarding scientific and technological matters relating to the Corporation's scientific activities.

2. *Number.* The Corporation shall have a Scientific Board, which shall consist of not less than three members, which number shall be determined from time to time by the Scientific Board, with the consent of the Board of Directors. No member of the Scientific Board need be a stockholder.

3. *Tenure.* Each member of the Scientific Board shall be appointed by the Scientific Board and shall hold office until his successor is elected or appointed and qualified, or until he dies, resigns, is removed or becomes disqualified, unless a shorter term is specified in the vote electing or appointing said member. Any member of the Scientific Board may resign by giving written notice of his resignation to the Chairman of the Board, the President, the Clerk or the Secretary, if any, or the Board of Directors, and such resignation shall become effective at the time specified therein.

4. *Removal.* Any member of the Scientific Board, or the entire Scientific Board, may be removed from office at any time with or without cause and only by the affirmative vote of a majority of the Scientific Board and the affirmative vote of a majority of the Board of Directors. A member of the Scientific Board may be removed for cause only after a reasonable notice and opportunity to be heard before the body proposing to remove him.

5. *Vacancies.* The Scientific Board shall have the power to fill vacancies on the Scientific Board, unless at any time there shall be less than three members currently serving, in which case the Board of Directors shall appoint such member or members to the Scientific Board as may be necessary to increase the membership of the Scientific Board to three members.

6. *Meetings.* The Scientific Board shall appoint from its membership a chairman and a secretary. In the absence of either the chairman or the secretary from the meeting, the Scientific Board shall appoint another of its members to assume the duties of chairman or secretary, as the case may be, at such meeting. A majority of the Scientific Board shall constitute a quorum for the conduct of any business and the action of a majority of the Scientific Board members present at a meeting at which a quorum is present shall constitute the action of the Scientific Board. In addition to having one vote on any matter, the chairman, or person acting as chairman, of the Scientific Board shall have a casting vote in the event of a tie vote on such matter. The secretary of the Scientific Board shall keep the minutes of each meeting of the Scientific Board. The Scientific Board may adopt such by-laws and other rules and regulations as it may deem appropriate with respect to notice and the holding of its meetings. The Board of Directors may nominate, with the consent of the Scientific Board, such persons as the Board of Directors may deem appropriate who are not members of the Scientific Board to attend any meeting of the Scientific Board.

7. *Compensation.* The Board of Directors shall determine the compensation of the members of the Scientific Board.



ARTICLE V  
CAPITAL STOCK

1. *Certificates of Stock.* Each stockholder shall be entitled to a certificate or certificates representing in the aggregate the shares of the capital stock of the Corporation owned by him, except that the Board of Directors may provide by resolution that some or all of any or all classes and series of shares of the Corporation shall be uncertificated shares, to the extent permitted by law. All certificates for shares of stock of the Corporation shall state the number and class of shares evidenced thereby (and designate the series, if any), shall be signed by the Chairman of the Board, the President or a Vice President and either the Treasurer or an Assistant Treasurer, may (but need not) bear the seal of the Corporation and shall contain such further statements as shall be required by law. The Board of Directors may determine the form of certificates of stock except insofar as prescribed by law or by these By-Laws, and may provide for the use of facsimile signatures thereon to the extent permitted by law. In case any officer who has signed or whose facsimile signature has been placed on such certificate shall have ceased to be such officer before such certificate is issued, it may be issued by the Corporation with the same effect as if he were such officer at the time of its issue. Every certificate for shares which are subject to any restrictions on transfer pursuant to the Articles of Organization, these By-Laws or any agreement to which the Corporation is a party, shall have the restrictions noted conspicuously on the certificate and shall also set forth upon the face or back thereof either the full text of the restrictions or a statement of the existence of such restrictions and a statement that the Corporation will furnish a copy thereof to the holder of such certificate upon written request and without charge. Every stock certificate issued while the Corporation is authorized to issue more than one class or series of stock, shall set forth on the face or back thereof either the full text of the preferences, voting powers, qualifications and special and relative rights of the shares of each class and series, if any, authorized to be issued as set forth in the Articles of Organization, or a statement of the existence of such preferences, powers, qualifications and rights, and a statement that the Corporation will furnish a copy thereof to the holder of such certificate upon written request and without charge.

2. *Transfers of Stock.* The transfer of all shares of stock of the Corporation, so as to affect the rights of the Corporation, shall be effected only by transfer recorded on the books of the Corporation, in person or by duly authorized attorney, and upon the surrender of the certificate properly endorsed or assigned. The transfer of all shares of stock of the Corporation shall be subject to the restrictions, if any, imposed by the Articles of Organization, these By-Laws or any agreement to which the Corporation is a party.

3. *Holders of Record.* The person registered on the books of the Corporation as the owner of the shares shall have the exclusive right to receive dividends thereon and to vote thereon as such owner, shall be held liable for such calls and assessments as may lawfully be made thereon, and except only as may be required by law, may in all respects be treated by the Corporation as the exclusive owner thereof. It shall be the duty of each stockholder to notify the Corporation of his post office address. The Corporation shall not be bound to recognize any equitable or other claim to or interest in shares of stock of the Corporation on the part of any other person except as may be otherwise expressly provided by law.

4. *Lost or Destroyed Certificates.* The directors of the Corporation may, subject to Massachusetts General Laws, Chapter 156B, Section 29, as amended from time to time, or any successor statute, determine the conditions upon which a new certificate of stock may be issued in place of any certificate alleged to have been lost, destroyed or mutilated.

5. *Record Date.* The Board of Directors may fix in advance a date not more than sixty days preceding the date of any meeting of stockholders or the date for the payment of any dividend or the making of any distribution to stockholders or the last day on which the consent or dissent of stockholders may be effectively expressed for any purpose, as the record date for determining the stockholders having the right to notice of and to vote at such meeting and any adjournment thereof, or the right to receive such dividend or distribution, or the right to give such consent or dissent. In such case, only stockholders of record on such record date shall have such right, notwithstanding any transfer of stock on the books of the Corporation after the record date. Without fixing such record date the Board of Directors may, for any such purposes, close the transfer books for all or any part of such sixty-day period. If no record date is fixed and the transfer books are not closed, the record date for determining stockholders having the right to notice of or to vote at a meeting of stockholders shall be at the close of business on the day next preceding the day on which notice is given, and the record date for determining stockholders for any other purpose shall be at the close of business on the day on which the Board of Directors acts with respect thereto.

6. *Issue of Stock.* Subject to the Articles of Organization, the whole or any part of any unissued balance of the authorized capital stock of the Corporation or the whole or any part of any capital stock of the Corporation held in its treasury may be issued or disposed of by vote of the Board of Directors in such manner, for such consideration and on such terms as the Board of Directors may determine.

## ARTICLE VI

### MISCELLANEOUS PROVISIONS

1. *Fiscal Year.* Except as otherwise determined by the Board of Directors from time to time, the fiscal year of the Corporation shall end on December 31 of each year.
2. *Seal.* The Board of Directors shall have the power to adopt and alter the seal of the Corporation.
3. *Execution of Instruments.* All deeds, leases, transfers, contracts, bonds, notes, checks, drafts and other obligations authorized to be executed by an officer of the Corporation in its behalf shall be signed by such person or persons as may be authorized from time to time by vote of the Board of Directors.
4. *Voting of Securities.* Except as the Board of Directors may otherwise designate, the President or Treasurer may waive notice of and act on behalf of the Corporation, or appoint any person or persons to act as proxy or attorney in fact for the Corporation (with or without discretionary power and/or power of substitution) at any meeting of stockholders of any other corporation or organization any of the securities of which may be held by the Corporation.
5. *Dividends.* Unless otherwise required by the Massachusetts Business Corporation Law or the Articles of Organization, the Board of Directors may declare and pay dividends upon the shares of capital stock of the Corporation, which dividends may be paid either in cash, securities of the Corporation or other property.
6. *Corporate Records.* The original, or attested copies, of the Articles of Organization, By-Laws and records of all meetings of the incorporators and stockholders, and the stock and transfer records, which shall contain the names of all stockholders and the record address and the amount of stock held by each, shall be kept at the principal office of the Corporation, or at an office of its transfer agent, Clerk or resident agent, and shall be open at all reasonable times to the inspection of any stockholder for any proper purpose, but not to secure a list of stockholders or other information for the purpose of selling said list or information or copies thereof or of using the same for a purpose other than in the interest of the applicant, as a stockholder, relative to the affairs of the Corporation.
7. *Contributions.* The Board of Directors shall have authority to make donations from the funds of the Corporation, in such amounts as the Board of Directors may determine to be reasonable and irrespective of corporate benefit, for the public welfare or for community fund, hospital, charitable, religious, educational, scientific, civic or similar purposes, and in time of war or other natural emergency in aid thereof.
8. *Evidence of Authority.* A certificate by the Clerk, an Assistant Clerk, the Secretary or an Assistant Secretary, or a Temporary Clerk or Temporary Secretary, as to any action taken by the stockholders, Board of Directors, any committee of the Board of Directors or any officer or representative of the Corporation shall, as to all persons who rely thereon in good faith, be conclusive evidence of such action.
9. *Ratification.* Any action taken on behalf of the Corporation by the directors or any officer or representative of the Corporation which requires authorization by the stockholders or the directors of the Corporation shall be deemed to have been authorized if subsequently ratified by the stockholders entitled to vote or by the directors, as the case may be, at a meeting held in accordance with these By-Laws.
10. *Reliance upon Books, Records and Reports.* Each director or officer of the Corporation shall be entitled to rely on information, opinions, reports or records, including financial statements, books of account and other financial records, in each case presented by or prepared by or under the supervision of (1) one or more officers or employees of the Corporation whom the director or officer reasonably believes to be reliable and competent in the matters presented, or (2) counsel, public accountants or other persons as to matters which the director or officer reasonably believes to be within such person's professional or expert competence, or (3) in the case of a director, a duly constituted committee of the Board of Directors upon which he does not serve, as to matters within its delegated authority, which committee the director reasonably believes to merit confidence, but he shall not be considered to be acting in good faith if he has knowledge concerning the matter in question that would cause such reliance to be unwarranted. The fact that a director or officer so performed his duties shall be a complete defense to any claim asserted against him, except as expressly provided by statute, by reason of his being or having been a director or officer of the Corporation.
11. *Articles of Organization.* All references in the By-Laws to the Articles of Organization shall be deemed to refer to the Articles of Organization of the Corporation, as amended and in effect from time to time.
12. *Control Share Acquisition.* Until such time as this section shall be repealed or these By-Laws shall be amended to provide otherwise, the provisions of Chapter 110D of the Massachusetts General Laws shall not apply to "control share acquisitions" of the Corporation within the meaning of said Chapter 110D.

13. *Interpretation.* The Board of Directors shall have the power to interpret all of the terms and provisions of these By-Laws and the Articles of Organization, which interpretation shall be conclusive.

14. *Gender.* Whenever the masculine gender is used in these By-Laws, it shall include the feminine and the neuter wherever appropriate.

ARTICLE VII  
AMENDMENTS

These By-Laws may be altered, amended or repealed, in whole or in part, by vote of a majority of the Board of Directors, except with respect to any provision thereof which by law, the Articles of Organization, or these By-Laws requires action by the stockholders, in which case these By-Laws may be amended in whole or in part by the stockholders at any annual or special meeting by vote of the holders of a majority in interest of the issued and outstanding and entitled to vote, except as otherwise provided in the Articles of Organization. The nature or substance of the proposed alterations, amendment or repeal shall be stated in the notice of the meeting.

A true copy.

ATTEST:

\_\_\_\_\_  
Clerk

TRUST AGREEMENT

This TRUST AGREEMENT, entered into as of July 20, 1990 by and between BIOGEN, INC., a Massachusetts corporation (the Grantor) and the SHAWMUT BANK, N.A., a national banking association (the Trustee).

WHEREAS, the U.S. Nuclear Regulatory Commission (NRC), an agency of the U.S. Government, pursuant to the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974, has promulgated regulations in Title 10, Chapter I of the Code of Federal Regulations, Part 30. These regulations, applicable to the Grantor, require that a holder of, or an applicant for, a Part 30 license provide assurance that funds will be available when needed for required decommissioning activities.

WHEREAS, the Grantor has elected to use a letter of credit to the account of the NRC to provide all of such financial assurance for the facilities identified in Schedule A hereto (collectively, the Facility); and

WHEREAS, the Grantor, acting through its duly authorized officers, has selected the Trustee to be the trustee under this Agreement, and the Trustee is willing to act as trustee,



NOW, THEREFORE, in consideration of the premises, of the acceptance by Trustee of the trusts created and of other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the Grantor and the Trustee agree as follows:

Section 1. Definitions. As used in this Agreement:

Applicable Law shall mean all applicable laws, statutes, treaties, rules, codes, ordinances, regulations, permits, certificates, orders, interpretations, licenses and permits of any Federal, state, county, municipal, foreign, international, regional or other governmental authority, agency, board, body, instrumentality or court, and judgments, decrees, injunctions, writs, orders or like action of any court, arbitrator or other judicial or quasi judicial tribunal (including those pertaining to health, safety, the environment or otherwise).

Decommissioning shall mean the decommissioning and, whether or not occurring simultaneously therewith, retirement from service of the Facility, and the related possession, maintenance, removal and disposal of material, radioactive or otherwise, used in or produced by or relating to the Facility, including, without limitation, as appropriate, (i) placement and maintenance in a state of protective storage, (ii) in-place entombment and maintenance, (iii) dismantlement, (iv) property and permanent removal, decontamination, disposition of debris fixtures, (v) razing, (vi) removal and disposition of debris

related to the Facility, (vii) restoration, and release by all Federal, state, county, municipal, foreign, international, regional and other governmental authorities, agencies, boards, bodies, instrumentalities or courts having jurisdiction, of the Facility or the real estate unrelated thereto for unrestricted use, (viii) any other actions related to decommissioning and retirement from service required by the NRC and (ix) all activities undertaken incident to the implementation thereof.

Grantor shall mean the NRC licensee who enters into this Agreement and any successors or assigns of the Grantor.

Investment Grade shall mean a rating by Standard & Poor's Corporation of A or better (or Standard & Poor's current equivalent thereof) and, if Moody's Investors Services, Inc., also rates the security or the security is not rated by Standard & Poor's, a rating by Moody's of A2 or better (or Moody's current equivalent thereof).

Investment Securities shall mean FDIC insured interest bearing money market fund of the Trustee used for its corporate trust customers.

Trustee shall mean the trustee who enters into this Agreement and any successor Trustee.

Section 2. Costs of Decommissioning. This Agreement pertains to the cost of decommissioning the materials and activities identified in License Number 20-19808-01 and 20-19808-02 issued pursuant to 10 CFR Part 30 as shown in Schedule A. The Grantor has full responsibility for

Decommissioning and has agreed to pay, be solely responsible for, indemnify and hold harmless the Trustee and any successor, assignee or transferee of the Trustee from and against all costs related to decommissioning and all claims relating or allocable to, or incurred in connection with Decommissioning, and to enter into this Agreement to establish the Fund (as defined below), to hold moneys paid from time to time by Grantor to pay such costs of Decommissioning.

Section 3. Establishment of Fund. The Grantor hereby establishes with the Trustee the trust fund (the Fund) for the benefit of the NRC. The Grantor and the Trustee intend that no third party have access to the Fund except as provided herein.

Section 4. Payments Constituting the Fund. Payments made to the Trustee by the Grantor for the Fund shall include (i) all property, cash and investments thereof, (ii) all dividends, interest, cash, instruments and other property from time to time received, receivable or otherwise distributed or distributable in respect of or in exchange for any or all such investments, (iii) all rights and privileges with respect to such investments and (iv) all proceeds of any of the foregoing and any property of any character whatsoever into which any of the foregoing may be converted. The Fund is established initially by the deposit of \$100 by the Grantor. Such investments, together with the proceeds of the letter of credit described in Schedule B hereto, and any other investments or property subsequently transferred to the Trustee in and

hereunder shall be referred to as the Fund, together with all earnings and profits thereon, less any payments or distributions made by the Trustee pursuant to this Agreement. The Fund shall be held by the Trustee, IN TRUST, as herein provided. The Trustee shall not be responsible nor shall it undertake any responsibility for the amount of, or adequacy of the Fund, nor any duty to collect from the Grantor, any payments necessary to discharge any liabilities of the Grantor established by the NRC nor have any implied duties with respect to any of the foregoing. The Trustee shall have no liability hereunder other than acts caused by its gross negligence or willful misconduct.

Section 5. Acceptance of Trust. The Trustee accepts the trusts created hereby and declares that it will hold all estate, right, title and interest in and to the Fund upon the trusts set forth herein, but only on the terms of this Agreement, and agrees to receive and disburse all moneys and investments constituting any part of the Fund in accordance with this Agreement. No implied duties or obligations shall be read into this Agreement against the Trustee.

Section 6. Ownership of Funds; Beneficial Interests. The Fund is being created by Grantor, and the beneficial interest in the Fund shall be in the NRC.

Title to any and all investments or property held in the Fund shall be held by the Trustee in its name as owner of record. At all times, the Trustee shall be entitled to



exercise in its discretion any and all voting, consensual and other rights and powers accruing to the owner of the investments or any part thereof. Without limiting the generality of the foregoing, the Trustee shall have the right, in its name, to settle, compromise, prosecute or defend any action, claim or proceeding with respect to any of the investments and to sell, assign, endorse, pledge, transfer and make any agreement respecting, or otherwise deal with, the same; provided, however, that nothing herein contained shall be construed as requiring or obligating the Trustee to make any inquiry as to the nature or sufficiency of any payment received by it or as to the authenticity of any certificate or notice received by it, to present or file any claim or notice, or except as required by Section 7, to take any action with respect to any of the investments.

Section 7. Payment for Required Activities Specified in the Plan. The Trustee shall make payments from the Fund to the Grantor on any day on which the Trustee is open for business upon presentation to the Trustee of the following:

- a. A certificate duly executed by the Clerk of the Grantor attesting to the occurrence of the events, and in the form set forth in the attached Specimen Certificate, and
- b. A certificate attesting to the following conditions:

- (1) that decommissioning is proceeding pursuant to an NRC-approved plan;
- (2) that the funds withdrawn will be expended for activities undertaken pursuant to that Plan, and
- (3) that the NRC has been given 30 days' prior notice of the Grantor's intent to withdraw funds from the Fund.

The Grantor's certificate presented pursuant to this Section shall not request a withdrawal from the Fund which exceeds 5% of the outstanding balance of the Fund or \$10,000, whichever is greater, unless NRC approval is attached. The Trustee may accept and rely upon the Grantor's certificate as proof that these conditions are satisfied, and the Trustee shall be fully protected and held harmless in relying upon any such certificate.

In the event of the Grantor's default or inability to direct decommissioning activities as determined by NRC, the Trustee shall make payments from the Fund as the NRC shall direct, in writing, to provide for the payment of the costs of required activities covered by the Agreement. The Trustee shall reimburse the Grantor or other persons as specified by the NRC, or State agency, from the Fund for expenditures for required activities in such amounts as the NRC, or State agency, shall direct in writing. In addition, the Trustee shall refund to the Grantor such amounts as the NRC specifies

in writing. Upon refund, such funds shall no longer constitute part of the Fund as defined herein. The Trustee may rely upon any such written notice or direction received by it from the NRC and shall be fully protected and held harmless in relying upon any such notice or direction.

Section 8. Trust Management. The Trustee shall invest and reinvest the principal and income of the Fund and keep the fund invested as a single fund, without distinction between principal and income, in accordance with general investment policies and guidelines which the Grantor may communicate in writing to the Trustee from time to time, subject, however, to the provisions of this Section.

Any amounts held by the Trustee in the Fund shall be invested and reinvested by it from time to time, but only in Investment Securities. The Grantor or an investment advisor appointed by it shall direct such investments and reinvestments by written direction which shall certify that the directed investment or reinvestment qualifies as an Investment Security and is within any applicable limitation mandated by the NRC. The Trustee may rely upon such direction and certification unless it is evident that the directed investment does not satisfy the conditions of this Section 8.

Section 9. Commingling. The Trustee is expressly authorized in its discretion to transfer from time to time any or all of the assets of the Fund to any common, commingled, or collective trust fund created by the Trustee in which the Fund

is eligible to participate, subject to all of the provisions thereof, to be commingled with the assets of other trusts participating therein.

Section 10. Express Powers of Trustee. Without in any way limiting the powers and discretion conferred upon the Trustee by the other provisions of this Agreement or by law, the Trustee is expressly authorized and empowered:

- (a) To sell, exchange, convey, transfer, or otherwise dispose of any property held by it, by public or private sale, as necessary for prudent management of the Fund;
- (b) To make, execute, acknowledge, and deliver any and all documents of transfer and conveyance and any and all other instruments that may be necessary or appropriate to carry out the powers herein granted;
- (c) To register any securities held in the Fund in its own name, or in the name of a nominee, and to hold any security in bearer form or in book entry, or to combine certificates representing such securities with certificates of the same issue held by the Trustee in other fiduciary capacities, to reinvest interest payments and funds from matured and redeemed instruments, to file proper forms concerning securities held in the Fund in a timely fashion with appropriate



government agencies, or to deposit or arrange for the deposit of such securities in a qualified central depository even though, when so deposited, such securities may be merged and held in bulk in the name of the nominee or such depository with other securities deposited therein by another person, or to deposit or arrange for the deposit of any securities issued by the U.S. Government, or any agency or instrumentality thereof, with a Federal Reserve bank, but the books and records of the Trustee shall at all times show that all such securities are part of the Fund;

- (d) To deposit any cash in the Fund in interest-bearing accounts maintained or savings certificates issued by the Trustee, in its separate corporate capacity, or in any other banking institution affiliated with the Trustee, to the extent insured by an agency of the Federal government; and
- (e) To compromise or otherwise adjust all claims in favor of or against the Fund.

The Trustee shall be fully protected and held harmless from its actions under this Section other than losses or liabilities arising from its own gross negligence or willful misconduct.

Section 11. Taxes and Expenses. The Grantor shall, with the cooperation of Trustee, prepare any tax returns and other reports for or with respect to the Fund as may be required from time to time by Applicable Law.

All taxes of any kind that may be assessed or levied against or in respect of the Fund and all brokerage commissions incurred by the Fund shall be paid from the Fund. All other expenses incurred by the Trustee in connection with the administration of this Trust, including fees for legal services rendered to the Trustee, the compensation of the Trustee to the extent not paid directly by the Grantor, and all other proper charges and disbursements of the Trustee shall be paid from the Fund, and the Trustee is authorized to make such withdrawals from the Fund for such purposes. To the extent the investments in the Fund are not sufficient for any such purposes the Grantor shall be obligated to pay such costs and expenses directly to the Trustee.

Section 12. Annual Valuation. After proceeds of the letter of credit have been deposited in the Fund, the Trustee shall annually, at least 30 days before the anniversary date of such deposit, furnish to the Grantor and to the NRC at its address as provided by Grantor, a statement stating the value of the Trust. Any securities in the Fund shall be valued at market value as of no more than 60 days before the anniversary date of the establishment of the Fund. The failure of the Grantor to object in writing to the Trustee within 90 days

after the statement has been furnished to the Grantor and the NRC, or State agency, shall constitute a conclusively binding assent by the Grantor, barring the Grantor from asserting any claim or liability against the Trustee with respect to the matters disclosed in the statement. Notwithstanding the foregoing the Trustee shall not have any liability from any claims or losses resulting hereunder other than such liabilities resulting from its own gross negligence or willful misconduct.

Section 13. Advice of Counsel. The Trustee may from time to time consult with counsel with respect to any question arising as to the construction of this Agreement or any action to be taken hereunder. The Trustee shall be fully protected, to the extent permitted by law, in acting on the advice of counsel.

Section 14. Trustee Compensation. In addition to payments and reimbursements to which the Trustee is entitled under Section 11, the Trustee shall be entitled to reasonable compensation for its services as agreed upon in writing with the Grantor. (See Schedule C)

Section 15. Successor Trustee. Upon 30 days notice to the NRC, the Trustee may resign; upon 30 days notice to NRC and the Trustee, the Grantor may replace the Trustee; but such resignation or replacement shall not be effective until the Grantor has appointed a successor Trustee and this successor accepts the appointment. The successor Trustee shall have the

same powers and duties as those conferred upon the Trustee hereunder. Upon the successor Trustee's acceptance of the appointment, the Trustee shall assign, transfer, and pay over to the successor Trustee the funds and properties then constituting the Fund. If for any reason the Grantor cannot or does not act in the event of the resignation of the Trustee, the Trustee may apply to a court of competent jurisdiction for the appointment of a successor Trustee or for instructions. The successor Trustee shall specify the date on which it assumes administration of the trust in a writing sent to the Grantor, the NRC or State agency, and the present Trustee by certified mail 10 days before such change becomes effective. Any expenses incurred by the Trustee as a result of any of the acts contemplated by this Section shall be paid as provided in Section 11.

Section 16. Instructions to the Trustee. All orders, requests, and instructions by the Grantor to the Trustee shall be in writing, signed by such persons as are signatories to this agreement or such other designees as the Grantor may designate in writing. The Trustee shall be fully protected in acting without inquiry in accordance with the Grantor's orders, requests, and instructions. If the NRC or State agency issues orders, requests, or instructions to the Trustee these shall be in writing, signed by the NRC, or State agency, or their designees, and the Trustee shall act and shall be fully protected and held harmless in acting in accordance with such



orders, requests, and instructions. The Trustee shall have the right to assume, in the absence of written notice to the contrary, that no event constituting a change or a termination of NRC, or State agency, hereunder has occurred. The Trustee shall have no duty to act in the absence of such orders, requests, and the instruction from the Grantor and/or the NRC, or State agency, except as provided for herein.

Section 17. Amendment of Agreement. This Agreement may be amended by an instrument in writing executed by the Grantor, the Trustee and the NRC, or State agency, or by the Trustee and the NRC or State agency, if the Grantor ceases to exist.

Section 18. Irrevocability and Termination. Subject to the right of the parties to amend this Agreement as provided in Section 17, this trust shall be irrevocable and shall continue until terminated at the written agreement of the Grantor, the Trustee, and the NRC or State agency, or by the Trustee and the NRC or State agency, if the Grantor ceases to exist. Upon termination of the trust, all remaining trust property, less final trust administration expenses, shall be delivered to the Grantor or its successor.

Section 19. Immunity and Indemnification. The Trustee shall not incur personal liability of any nature in connection with any reasonable act or omission, made in good faith, in the administration of this trust, or in carrying out any directions by the Grantor, the NRC, or State agency, issued

in accordance with this Agreement other than those liabilities resulting from its own gross negligence or willful misconduct. The Trustee shall be indemnified and saved harmless by the Grantor or from the Fund, or both, from and against any personal liability to which the Trustee may be subjected by reason of any act or conduct in its official capacity, including all expenses reasonably incurred in its defense in the event the Grantor fails to provide such defense.

Section 20. This Agreement shall be administered, construed, and enforced according to the laws of the Commonwealth of Massachusetts.

Section 21. Interpretation and Severability. As used in this Agreement, words in the singular include the plural and words in the plural include the singular. The descriptive headings for each section of this Agreement shall not affect the interpretation or the legal efficacy of this Agreement. If any part of this Agreement is invalid, it shall not affect the remaining provisions which will remain valid and enforceable.

Section 22. Conditions. This Agreement shall become effective when the Trustee shall have received an incumbency certificate as to the names and specimen signatures of the officers of the Grantor authorized to sign this Agreement and any certificates, notices, directions, instructions and other communication hereunder.

As soon as possible, the Grantor shall provide to Trustee a ratification of the Grantor's Board of Directors ratifying the execution, delivery and performance by the Grantor of this Agreement.

IN WITNESS WHEREOF the parties have caused this Agreement to be executed by the respective officers duly authorized and the incorporate seals to be hereunto affixed and attested as of the date first written above.

ATTEST:

*Shirley G. Lundy*  
Product Manager

BIOGEN, INC.

By: *Ludwig B. Esterl, Jr.*  
Title: VP - General Counsel

ATTEST:

*S. McMurtrie, Jr.*  
S. McMurtrie, Jr.  
Corporate Trust Officer

SHAWMUT BANK, N.A.

By: *Clark M. Whitcomb*  
Title: CLARK M. WHITCOMB, VICE PRESIDENT

SPECIMAN CERTIFICATE OF EVENTS

Shawmut Bank, N.A.  
1 Federal Street  
Boston, MA 02211

Attn: Trust Department

Gentlemen:

In accordance with the terms of the Standby Trust Agreement with you dated as of July 20, 1990, I, \_\_\_\_\_, Clerk of Biogen, Inc., hereby certify that the following events have occurred:

1. Biogen, Inc. is required to commence the decommissioning of its facilities located at [insert location of facility] (hereinafter called the decommissioning).
2. The plans and procedures for the commencement and conduct of the decommissioning have been approved by the United States Nuclear Regulatory Commission, or its successor, on \_\_\_\_\_ (copy of approval attached).
3. The Board of Directors of Biogen, Inc. has adopted the attached resolution authorizing the commencing of the decommissioning.

\_\_\_\_\_  
Clerk of Biogen, Inc.

\_\_\_\_\_  
Date



Schedule A

NRC LICENSES OF BIOGEN, INC.

20-19808-01  
20-19808-02

Schedule B

LETTER OF CREDIT



Shawmut Bank N.A.

P.O. Box 2176, Boston, MA 02211-2176, Tel. 617-292-2000

International Department  
Telex: WU16817133  
Cable: SHAWMUT  
S.W.I.F.T. ADDRESS: NASH US 33

IRREVOCABLE STANDBY LETTER OF CREDIT

JULY 26, 1990

S040785W

PAGE 01

U.S. NUCLEAR REGULATORY COMMISSION  
WASHINGTON, DC 20555  
REF: LICENSE # 20-19808-01, 02-19808-02

DEAR SIR OR MADAM:

WE HEREBY, ESTABLISH OUR IRREVOCABLE STANDBY LETTER OF CREDIT IN YOUR FAVOR, AT THE REQUEST AND FOR THE ACCOUNT OF BIOGEN, INC., 14 CAMBRIDGE CTR., CAMBRIDGE, MA 02142, UP TO THE AGGREGATE AMOUNT OF TWENTY FIVE THOUSAND AND 00/100 U.S. DOLLARS \*\*\*\*\*\$25,000.00 AVAILABLE UPON PRESENTATION BY YOU OR YOUR DESIGNEE OF

(1) YOUR SIGHT DRAFT, BEARING REFERENCE TO THIS LETTER OF CREDIT NUMBER S040785W

AND

(2) YOUR SIGNED STATEMENT READING AS FOLLOWS:

"I CERTIFY THAT THE AMOUNT OF THE DRAFT IS PAYABLE PURSUANT TO REGULATIONS ISSUED UNDER AUTHORITY OF THE U.S. NUCLEAR REGULATORY COMMISSION (NRC), AN AGENCY OF THE U.S. GOVERNMENT, PURSUANT TO THE ATOMIC ENERGY ACT OF 1954, AS AMENDED AND THE ENERGY REORGANIZATION ACT OF 1974."

THIS LETTER OF CREDIT IS ISSUED IN ACCORDANCE WITH REGULATIONS ISSUED UNDER THE AUTHORITY OF THE U.S. NUCLEAR REGULATORY COMMISSION (NRC), AN AGENCY OF THE U.S. GOVERNMENT, PURSUANT TO THE ATOMIC ENERGY ACT OF 1954, AS AMENDED, AND THE ENERGY REORGANIZATION ACT OF 1974. THE NRC HAS PROMULGATED REGULATIONS IN TITLE 10, CHAPTER 1 OF THE CODE OF FEDERAL REGULATIONS, PART 30, WHICH REQUIRE THAT A HOLDER OF, OR AN APPLICANT FOR, A LICENSE ISSUED UNDER 10 CFR PART 30, PROVIDE ASSURANCE THAT FUNDS WILL BE AVAILABLE WHEN NEEDED FOR DECOMMISSIONING.

THIS LETTER OF CREDIT IS EFFECTIVE AS OF JULY 26, 1990 AND SHALL EXPIRE ON JULY 26, 1991, BUT SUCH EXPIRATION DATE SHALL BE AUTOMATICALLY EXTENDED FOR A PERIOD OF ONE YEAR ON JULY 26, 1991 AND ON EACH SUCCESSIVE EXPIRATION DATE, UNLESS, AT LEAST 90 DAYS BEFORE THE CURRENT EXPIRATION DATE, WE NOTIFY BOTH YOU AND BIOGEN, INC. BY RETURN RECEIPT THAT WE HAVE DECIDED NOT TO EXTEND THIS LETTER OF CREDIT BEYOND THE CURRENT EXPIRATION DATE. IN THE EVENT YOU ARE SO NOTIFIED, ANY UNUSED PORTION OF THE CREDIT SHALL BE AVAILABLE UPON PRESENTATION OF YOUR SIGHT DRAFT WITHIN 90 DAYS AFTER THE DATE OF RECEIPT OF NOTIFICATION BY BOTH YOU AND BIOGEN, INC. AS SHOWN ON THE LATER OF THE SIGNED RETURN RECEIPTS AND READING AS FOLLOWS:

INSTRUCTIONS TO THE ADVISING BANK

Please complete and forward to beneficiary the attached original advice without adding your confirmation

CONTINUED

**Shawmut Bank N.A.**

P.O. Box 2176, Boston, MA 02211-2176, Tel. 617-292-2000

International Department  
Telex: W.U.I. 6817133  
Cable: SHAWMUT  
S.W.I.F.T. ADDRESS: NASH US 33

IRREVOCABLE STANDBY LETTER OF CREDIT

JULY 26, 1990

S040785W

PAGE 02

U.S. NUCLEAR REGULATORY COMMISSION  
WASHINGTON, DC 20555  
REF: LICENSE # 20-19808-01, 02-19808-02

"WE CERTIFY THAT THE LICENSEE HAS FAILED TO REPLACE THIS LETTER OF CREDIT WITH OTHER COLLATERAL ACCEPTABLE TO THE DEPARTMENT WITHIN 30 DAYS OF THE BANK'S NOTICE TO TERMINATE THE LETTER OF CREDIT."

WHENEVER THIS LETTER OF CREDIT IS DRAWN ON, UNDER, AND IN COMPLIANCE WITH THE TERMS OF THIS CREDIT, WE SHALL DULY HONOR SUCH DRAFT UPON PRESENTATION TO US, AND WE SHALL DEPOSIT THE AMOUNT OF THE DRAFT DIRECTLY INTO THE STANDBY TRUST OF BIOGEN, INC. IN ACCORDANCE WITH YOUR INSTRUCTIONS.

WE WILL ENDEAVOR TO GIVE PROMPT NOTICE TO THE LICENSEE AND THE DEPARTMENT OF A NOTICE RECEIVED OR ACTION FILED ALLEGING THE INSOLVENCY OR BANKRUPTCY OF THE BANK OR ALLEGING ANY VIOLATIONS OF REGULATORY REQUIREMENTS WHICH SHALL RESULT IN SUSPENSION OR REVOCATION OF THE BANK'S CHARTER OR LICENSE TO DO BUSINESS.

DRAFTS DRAWN HEREUNDER MUST BE MARKED "DRAWN UNDER SHAWMUT BANK, N.A., CREDIT NO. S040785W DATED JULY 26, 1990".

D.C. PENNYBAKER ASSISTANT VICE PRESIDENT JULY 26, 1990

THIS CREDIT IS SUBJECT TO THE UNIFORM CUSTOMS AND PRACTICE FOR DOCUMENTARY CREDITS (1983 REVISION) INTERNATIONAL CHAMBER OF COMMERCE, PUBLICATION NO 400.

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## INSTRUCTIONS TO THE ADVISING BANK

Please complete and forward to beneficiary the attached original advice without adding your confirmation.



Schedule C

FEES

To be agreed



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

DEC 12 1990

BIOGEN  
ATTN: Susan B. Lee, RSO  
Fourteen Cambridge Center  
Cambridge, MA 02142

REFUND OF APPLICATION FEE

1. BACKGROUND:

Check Received August 2, 1990  
Application Dated July 27, 1990  
Check Number 016408  
Check Amount \$500

2. REFUND:

Amount \$500

This refund is now being processed and will be sent as soon as possible.

3. REASON FOR REFUND:

Fee for application dated July 27, 1990, for License No. 20-19808-01, is being refunded in accordance with Information Notice 90-38, Supplement #1.

NOTE: ENCLOSED IS A COPY OF THE MAY 23, 1990 FEDERAL REGISTER NOTICE CONTAINING THE COMMISSION'S REVISED FEE REGULATIONS WHICH WENT INTO EFFECT JULY 2, 1990. IF YOU HAVE ANY QUESTIONS CONCERNING THE FEES TO BE SUBMITTED WITH FUTURE APPLICATIONS, PLEASE CONTACT US AT 301-492-4650.

*M.M.*  
Maurice Messier *89 12/12/90*  
License Fee and Debt Collection Branch  
Division of Accounting and Finance  
Office of the Controller

Enclosure: May 23, 1990  
Federal Register notice

