

ME&S-3-Hazards of Beryllium

114

MM&S-3-Hazards of Beryllium

Date	To	From	Class	Pgs. No.	To	From	Class
1 10-10-60	ABC 1059 Hazards of Beryllium Beryllium-Hazards of	Beryllium Hazards of	skc u				
2 5-2-61	ABC 1059/1		ves				
3 4-16-62	Savini v Beryllium Corp of America	Beryllium Corp of America	ves				

UNITED STATES GOVERNMENT

Memorandum

*M.H. 3 - Hazards of
Beryllium*

TO : Woodford B. McCool
Secretariat

DATE: APR 16 1962

FROM : *Bertram H. Schur*
Assistant to the General Counsel

SUBJECT: SAVINI v. BERYLLIUM CORPORATION OF AMERICA

Attached for your signature and seal is a certificate by you to the effect that Mildred E. Nichols of the Office of the General Counsel is responsible for the custody of (1) a photostatic copy of the original of Contract No. AT-30-1-GEN-227, (2) a photostatic copy of the original of Contract No. AT-30-1-GEN-109, and (3) the original of a memorandum from M. W. Boyer, General Manager, dated August 10, 1951 entitled "Recommendations for Control of Beryllium Hazards." Certified copies of the provisions in the contracts dealing with health and safety and a certified copy of the memorandum were requested by Edward L. Wolf, a Philadelphia attorney, for possible use at a trial. After you have signed and sealed the certificate, we will forward the certified copies of the requested documents to Mr. Wolf, with copies to George P. Williams, III, the attorney representing the Beryllium Corporation.

For your convenience I have also attached the contract documents and the original of the memorandum so that you may compare them with the copies if you wish to do so.

Attachments
As above stated

X-De M-3 - Junction 9. 10/11

4-16-62

UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

CERTIFICATE

I hereby certify that Edward B. Nichols, who executed the attached certificate, is the Administrative Officer, Office of the General Counsel, United States Atomic Energy Commission, Washington 25, D. C., and in such capacity is responsible for the custody of the material referred to in said certificate.

In witness whereof I have hereunto subscribed my name and caused the seal of the U. S. Atomic Energy Commission to be affixed this 16th day of April, 1952 at Washington, D. C.

Wendell E. McCool

Wendell E. McCool
Secretary to the U. S. Atomic
Energy Commission

cc: W. B. McCool ✓

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CHD:sp

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UNITED STATES OF AMERICA

ATOMIC ENERGY COMMISSION

C E R T I F I C A T E

I, Mildred E. Nichols, do hereby certify that I am custodian of (1) a true and accurate photostatic copy of the original contract document No. AT-30-1-GEN-227 of which true and accurate copies of the provisions contained therein entitled "Title I, Construction of Plant, Article I - Scope and Term of Title I" and "Article XIX - Safety and Accident Prevention" are attached, (2) a true and accurate photostatic copy of the original contract document No. AT-30-1-GEN-109 of which true and accurate copies of the provisions contained therein entitled "Article I - Scope of this Contract" and "Article XIX - Safety and Accident Prevention" are attached, and (3) the original of a memorandum from H. H. Ruyter, then General Manager of the United States Atomic Energy Commission dated August 10, 1951, entitled "Recommendations for Control of Beryllium Hazards", of which a copy is attached; and that the said photostatic copies of the original contracts and the original of the said memorandum are on file at the Office of the United States Atomic Energy Commission, Washington 25, D. C.

Mildred E. Nichols
Administrative Officer
Office of the General Counsel
U. S. Atomic Energy Commission

Dated: _____

TITLE ICONSTRUCTION OF PLANTARTICLE I - SCOPE AND TERM OF TITLE I

Commencing November 1, 1947, the Contractor shall perform the following work and services, said work and services to be completed on or before April 30, 1948:

(a) Construct a cinder block building, approximately 2,000 square feet in area, in accordance with Contractor's Drawing No. 2262, dated November 5, 1947, entitled "Proposed Building For Vacuum Melting Of Metals", a copy of which is on file with the Atomic Energy Commission (hereinafter called the "Commission"). The contents of said document are hereby made a part of this contract with the same force and effect as if fully set forth herein. The said building shall be located adjacent to Contractor's Boiler House, on Contractor's property, and shall be positioned as shown in said Drawing No. 2262.

(b) 1. Procure the operating facilities and equipment listed in Schedule "A" entitled "Contractor-Furnished, Government-Owned Facilities and Equipment" (said schedule being attached hereto and made a part of this contract). The Contractor is authorized to procure those items listed in said Schedule "A", subject to the same monetary limitations for items procured under Title II as set forth in Article IV (c) of this contract, and provided also that, the Contractor shall not procure any alternate or additional facility or item of equipment without the prior written approval of the Commission. In the event such approval is given, any such item so procured by the Contractor shall be added to Schedule "A".

2. On or before April 1, 1948, the Government will furnish the Contractor with those operating facilities and that operating equipment listed in Schedule "B" entitled "Government-Furnished, Government-Owned Facilities and Equipment" (said schedule being attached hereto and made a part of this contract). The Contractor shall inspect, and if necessary, shall alter, repair and/or recondition each item so furnished by the Government; provided, however, that any such alteration, repair and/or reconditioning of each item costing more than \$100.00 shall require the written approval of the Commission.

(c) Install within said cinder block building, the operating facilities and equipment listed in Schedules "A" and "B" and construct therefrom a complete beryllium metal casting plant in accordance with Contractor's Drawing No. 2261-B, dated November 6, 1947 entitled "Proposed Equipment layout for Vacuum Melting of Metals", a copy of which is on file with the Commission. The contents of said document are hereby made a part of this contract with the same force and effect as if fully set forth herein. In addition thereto, the Contractor shall also perform all design, engineering and administrative work, and shall provide all necessary labor, materials, facilities, and working equipment, required to complete said installation.

(d) 1. Furnish performance and payment bonds with good and sufficient surety or sureties acceptable to the Commission. The penal sum of such bonds will be 50% of the total contract price for work performed under Title I hereof.

2. Said bonds will be dated as of the same date as the contract and will be furnished by the Contractor to the Commission at the time the contract is executed, it being understood by the parties hereto that the cost of furnishing said bonds has been computed by the Contractor and has been included in the consideration for work performed under Title I of this contract.

* * * * *

ARTICLE III - SAFETY AND ACCIDENT PREVENTION

The Contractor agrees to conform to all health and safety regulations and requirements of the Commission. The Contractor shall take all reasonable steps and precautions to protect health and minimize danger from all hazards to life and property, and shall make all reports and permit all inspections as provided in such regulations or requirements.

ARTICLE I - SCOPE OF THIS CONTRACT

The Contractor shall manufacture and deliver to the Government, F.O.B. Temple, Pennsylvania, the following:

A. 940 machined beryllium metal bricks conforming to the specifications set forth in Clinton Laboratories Drawing dated January 30, 1947, subject "Beryllium Bricks", a copy of which is in the possession of the Contractor, each brick having the following dimensions: two (2) inches plus or minus five one-thousandths (0.005) inches wide, eight (8) inches plus or minus ten one-thousandths (0.010) inches long, and two (2) inches plus or minus five one-thousandths (0.005) inches deep. All angles shall be right angles (90°) plus or minus 1/4 of a degree. Not more than 235 machined bricks shall be of beryllium metal made from Clifton Products fluorescent grade beryllium oxide and shall be of the highest purity obtainable by the present type production process. Not less than 705 machined bricks shall be of beryllium metal manufactured from beryllium basic acetate and shall conform to the chemical specifications as contained in a secret letter dated March 6, 1947 agreed to and accepted by the Contractor, a copy of which is on file in the office of the Contracting Officer. The contents of said letter are hereby made a part of this contract in the same manner as though fully set forth herein. Each brick shall be free of pits, voids, and slag inclusions and shall have a density of not less than 1.82 grams per cubic centimeter and not greater than 1.86 grams per cubic centimeter.

B. 24 unmachined beryllium metal bricks approximately two (2) inches wide by two (2) inches deep by eight (8) inches long, but capable of being machined to a finished size of two (2) inches plus or minus five one-thousandths (0.005) inches wide, two (2) inches plus or minus five one-thousandths (0.005) inches deep and eight (8) inches plus or minus ten one-thousandths (0.010) inches long, each brick weighing approximately 2.9 pounds. Of said 24 unmachined bricks, 12 shall be of beryllium metal made from Clifton Products fluorescent grade beryllium oxide and shall be of the highest purity obtainable by the present type production process. The remaining 12 unmachined bricks shall be of beryllium metal manufactured from beryllium basic acetate and shall conform to chemical specifications as set forth in the above mentioned secret letter. The Government will accept the 24 unmachined bricks if on the surface they are free of pits, voids, and inclusions serious enough to interfere with and/or prevent machining of the desired finished bricks therefrom and each brick shall have a minimum density of 1.82 grams per cubic centimeter.

ARTICLE XIII - SAFETY AND ACCIDENT PREVENTION

The Contractor shall take all steps and all precautions to protect health and to minimize danger from all hazards to life and property, and shall make all reports and permit all safety inspections of work being performed under this contract as are or may be provided for in safety regulations entitled "Atomic Energy Commission - Safety Regulations," as same may be hereafter revised, (on file in the office of the Contracting Officer), or as the Contracting Officer may direct pursuant thereto. In the event the Contractor fails to comply with said "Atomic Energy Commission - Safety Regulations" or with said directions of the Contracting Officer, the Contracting Officer, without prejudice to any other rights of the Government, may issue an order stopping all or any part of the work; thereafter, a start order for resumption of work may be issued at the discretion of the Contracting Officer. The Contractor shall make no claim for an extension of time or for compensation or damages by reason of, or in connection with, such work stoppage."

UNITED STATES ATOMIC ENERGY COMMISSION

WASHINGTON 25, D. C.

TO: Those Listed Below

DATE: August 10, 1951

FROM: M. W. Boyer, General Manager

SUBJ: RECOMMENDATIONS FOR CONTROL OF BERYLLIUM HAZARDS

SYMBOL: BHM:GAH

The following tentative recommendations for the control of beryllium hazards supersede all previous memoranda on this subject and are submitted for your information and guidance. All AEC contractors using or producing beryllium or its compounds should be informed of these recommendations. (These recommendations, unless sooner revised, will be effective until June 30, 1952).

1. The in-plant atmospheric concentration of beryllium at beryllium operations should not exceed 2 micro-grams per cubic meter as an average concentration throughout an 8-hour day.
2. Even though the daily average might be within the limits of recommendation 1, no personnel should be exposed to a concentration greater than 25 micro-grams per cubic meter for any period of time, however short.
3. In the neighborhood of an AEC plant handling beryllium compounds, the average monthly concentration at the breathing zone level should not exceed 0.01 micro-gram per cubic meter.
4. There should be an adequate medical program, supervised by a physician who is familiar with beryllium poisoning, to cover all workers exposed to beryllium and its compounds.
5. If there is any evidence that an individual has chronic beryllium poisoning, such an individual should be excluded from any further exposure to beryllium compounds.

Addressees:

Secretary to Commission
General Counsel
Director, Biology and Medicine
Director, Finance
Director, Military Application
Director, Organization and Personnel
Director, Production
Director, Public & Technical Information
Director, Reactor Development
Director, Research
Director, Construction and Supplies
Director, Raw Materials
Manager, New York Operations Office
Manager, Oak Ridge Operations Office
Manager, Hanford Operations Office
Manager, Santa Fe Operations Office
Manager, Chicago Operations Office
Manager, Idaho Operations Office
Manager, Savannah River Operations Office
Manager, Schenectady Operations Office
Manager, San Francisco Area Office

70044-3. Hazard of Beryllium

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AEC 1059/1

May 2, 1961

COPY NO. 11

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ATOMIC ENERGY COMMISSION

ADMINISTRATION OF HEALTH AND SAFETY ARTICLES
IN BERYLLIUM METAL SUPPLY CONTRACTS

Note by the Secretary

The General Manager has requested that the attached memoranda from the Directors of Military Application and Health and Safety be circulated for the information of the Commission.

W. B. McCool

Secretary

DISTRIBUTION

COPY NO.

Secretary	1
Commissioners	2 - 6,49
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Dir., of Regulation	8
Deputy Gen. Mgr.	9
Asst. Gen. Mgr.	10-11
Asst. Gen. Mgr. Mfg.	12
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ENCLOSURE I

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25, D. C.

MEMORANDUM

March 31, 1961

TO : A. R. Luedécke
General Manager

FROM : Brig. Gen. A. W. Betts, USA
Director of Military Application

SUBJECT: ADMINISTRATION OF HEALTH AND SAFETY ARTICLES IN BERYLLIUM
METAL SUPPLY CONTRACTS

SYMBOL : MAM:REP

Dr. Woodruff's memorandum of September 22, 1960, (circulated as information Staff Paper 1059) advised you of problems in meeting the AEC's environmental dust control standards in beryllium refining plants at Elmore, Ohio, and Hazleton, Pennsylvania. These two refineries are owned and operated by the Brush Beryllium Company and the Beryllium Corporation respectively.

The AEC has contracts with both Brush Company (AT(11-1)-462) and Beryllium Corporation (AT(11-1)-465) for the purchase of beryllium metal ingot. Each contract contains a health and safety article requiring the Contractor to meet the dust control standards set out in the contract. These standards were established some years ago by AEC upon recommendation of the Beryllium Medical Advisory Committee. The standards have never been completely or consistently attained in the operation of the Elmore and Hazleton plants.

When administration of the two beryllium contracts was transferred from the Chicago Operations Office to Albuquerque in January of this year, a general review of the contract provisions was undertaken. Administration of the health and safety articles in the contracts was recognized as a prime problem. Another factor which led to increased attention to these articles was the issuance by the Department of Labor of Safety and Health Standards for Federal Supply Contracts. Those standards, issued under authority of the Walsh-Healey Public Contracts Act, became effective January 28, 1961, and included the same standards for environmental conditions in beryllium processing facilities as are specified in the two AEC contracts.

As discussed by Mr. Woodruff's memorandum to you of March 6, 1961, the Beryllium Medical Advisory Committee has been reconvened for the purpose of re-evaluating the environmental control standards. Concurrent with the work of this Committee, DNA has established a task group to study contractual aspects of this matter. This group includes representatives of DNA, Health and Safety, General Counsel, Contract Policy, and Industrial Relations.

The Task Group has advised that it expects to provide me a report containing recommendations by the end of April. I am advised that the Group is giving particular attention to possible AEC responsibilities under the Walsh-Healey regulations discussed above for reporting to the Department of Labor.

Following receipt of the Task Group report, we should be able to determine the steps necessary to resolve the problem areas.

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ENCLOSURE II

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25, D. C.

MEMORANDUM

March 6, 1961

TO : A. R. Loedecke, General Manager
THRU: W. F. Finan, AGMRS

FROM : Nathan H. Woodruff, Director
Office of Health and Safety

SUBJECT: ACTION OF THE BERYLLIUM MEDICAL ADVISORY COMMITTEE

SYMBOL : HS:HP:DMR

My memorandum of September 22, 1960 (Staff Paper AEC 1059), outlined the problem posed by the toxic nature of beryllium and our intention to reconvene the Beryllium Medical Advisory Committee to consider the upward revision of present standards. This memorandum is to convey to you the results of this meeting.

The Committee consisted of:

Chairman: Dr. Donald Ross	Health Protection Branch Office of Health and Safety
Dr. James Sterner	Medical Director Eastman Kodak
Dr. Harriet Hardy	Massachusetts Institute of Technology
Dr. Harold Hodge	University of Rochester
Dr. Merrill Eisenbud	New York University
Dr. Robert Kahoe	Director, Kettering Lab- oratory University of Cincinnati
Mr. William Harris	Health and Safety Laboratory NYOO
Dr. Herbert Stockinger	USPHS, who was unable to attend this meeting

General meetings of this Advisory Committee were held concurrently with the Beryllium Workshop, sponsored by the USAF Air Material Command and the Kettering Laboratory of the University of Cincinnati, January 6 and 7. Executive sessions were held in the evenings of those days. The following conclusions were reached by the Advisory Committee and accepted by the Office of Health and Safety:

1. The environmental data from the Brush Beryllium Company and Beryllium Corporation plants rather conclusively demonstrated that large numbers of people have been exposed to concentrations of beryllium in excess of the presently accepted standards.

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2. Medical data from the two plants which have been made available to the Committee are inadequate to judge whether cases of beryllium disease have resulted from these over-exposures.

3. No revision of standards can be considered until a study of the medical records has been made by the Committee.

The Office of Health and Safety is taking the following steps to develop the data needed by the Medical Advisory Committee to complete the evaluation of present standards.

1. Obtain from the Committee a detailed description of the medical data desired. We are expecting to receive an appropriate communication from the Committee within the week.

2. Submit a request for the compilation of the required medical data through the Contract Administrator to the top management of the two companies. In order to assure that the problem and its solution is clearly understood, industrial health specialists from the Office of Health and Safety will meet with the Committee and the top management and medical staffs of the two plants. These discussions will be held at the plants in Elmore, Ohio, and Hazelton, Pennsylvania, and Committee members will have the opportunity of seeing the operations in question.

3. Ask the Committee to take the data compiled by the two medical staffs, carefully relate it to the environmental data and make a judgment on the question of changing present standards.

If it is deemed necessary to trace each of Brush's short-term employees during the past decade, the completion of the Committee's review would be quite time consuming--perhaps requiring a full year.

Meanwhile, the Division of Military Application has initiated a study to determine what actions are necessary relative to the administration of the contracts.

M.H.S. 3 4 of Beryllium

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1059

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AEC 1059

October 10, 1960

COPY NO. 45

ATOMIC ENERGY COMMISSION

TOXIC HAZARDS OF BERYLLIUM AS RELATED TO THE
REACTOR DEVELOPMENT PROGRAM

Note by the Secretary

The General Manager has requested that the attached memorandum and enclosures from the Director of Health and Safety be circulated for the information of the Commission.

W. B. McCool
Secretary

<u>DISTRIBUTION</u>	<u>COPY NO.</u>
Secretary	1
Commissioners	2 - 6
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10-01-01

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UNITED STATES GOVERNMENT

Memorandum

TO : A. R. Luedcke
General Manager
THRU: William F. Finan, AGMRS
FROM : Nathan H. Woodruff, Director
Office of Health & Safety *N.H.W.*

DATE: SEP 22 1960

SUBJECT: TOXIC HAZARDS OF BERYLLIUM AS RELATED TO THE REACTOR DEVELOPMENT PROGRAM

Your memorandum to Dr. Pittman of June 17, 1960, requesting information on the above subject was relayed to this office for a reply.

Attached as Appendix A is a general discussion of the programs of the Division of Biology and Medicine in the field of beryllium toxicity, and an indication of the communication and implementation of the results.

In summary, you can assure the Chairman that it was the Division of Biology and Medicine activities which established the standards for the environmental control of beryllium hazards and all AEC contracts involving the handling of beryllium and its compounds carry a health and safety clause which requires adherence to these standards. (appendix D shows such a contract clause).

Actually, at the beryllium refining plants at Elmore and Hazleton we find that it is impossible to maintain the air concentration below the maximum allowable concentration of $2\mu\text{ gm/M}^3$ in certain parts of the plant. There is no question but that the contractors are exerting their best effort.

It has been suggested that equipment comparable to that used for handling plutonium would be necessary to meet the present standards, and that 1) this would increase the cost of beryllium by ten times and 2) the plants would have to be shut down and rebuilt. The extra cost would be undesirable but the latter factor is unacceptable because of AEC need for the metal.

On the other hand there is good reason to believe that our present standards are unnecessarily stringent. They were

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established twelve years ago on the basis of relatively meager data and have remained unchanged to this date. Subsequent experience at Brush Beryllium Company and Beryllium Corporation of America strongly suggests that there is justification for some relaxation of our standards. At the present time we are allowing the plants to continue operating and we plan to reconvene the Beryllium Medical Advisory Committee to consider this matter and to advise us as to further action.

To the original committee which consisted of Dr. James Sterner of Eastman Kodak, Dr. Harriet Hardy of MIT, Dr. Harold Hodge of University of Rochester, Dr. Merrill Eisenbud of New York University, and Dr. Robert Kehoe of Sloan Kettering, Cincinnati, we intend to add Dr. Herbert Stockinger of USPHS (who is a member of the ACGIH Threshold Limits Committee), Mr. William Harris of NYOO, and, as chairman, Dr. John Norcross of the Office of Health and Safety, AEC Headquarters.

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APPENDIX A

We view the program of the Division of Biology and Medicine for defining the toxic hazards of beryllium as having three phases, all of which started about the same time in 1948 - 1949:

(1) The Health and Safety Laboratory, then the operating arm of the Division of Biology and Medicine, began in 1948 a period of twelve years of study of the industrial hygiene of beryllium in plants producing beryllium for the AEC. The data accumulated by this laboratory have formed the basis for setting the initial environmental standards which have since been accepted intact and retained to this day by the American Conference of Governmental Hygienists. The results of HASL's studies have been profusely reported via the Laboratory's own report series and through the professional journals catering to the control of industrial environments. All findings are readily available to the AEC operating divisions and operations offices. It is very probable that nearly all procedural details for AEC contractor control of beryllium hazards stemmed from these HASL studies.

(2) In 1948 the Division of Biology and Medicine instituted a Beryllium Medical Advisory Committee which reviewed the results of HASL's initial environmental studies and such medical data as were available from non-AEC sources (General Electric, Sylvania and others) and recommended a series of beryllium inhalation standards. Each year thereafter they met to review additional experience and to re-affirm the original standards. In 1958 the Committee was dissolved in accordance with its own recommendation that henceforth proper government and industrial agencies be encouraged to adopt maximum allowable concentrations for general publications.

The standards suggested by this group were adopted as official AEC policy and annually issued to all operations offices by means of a memorandum from the General Manager. This practice was discontinued in 1956. AEC contractors continue to recognize these standards because they have been accepted by all national professional organizations in the field of industrial health.

These same standards have been made available through the years to the New York Operations Office and the Chicago Operations

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Office and have been incorporated into the Health and Safety clauses of the beryllium production contracts.

(3) At about the same time that HASL was investigating the environmental aspects of beryllium, the Division of Biology and Medicine embarked upon a program of basic studies into the chemistry and toxicology of beryllium and pathology of beryllium disease. These research projects were activated at the University of North Carolina (1949-1954), the Trudeau-Saranac Laboratory (1950-1957), the Kettering Laboratory (1950-1958) and the University of Rochester (1947-1954). (See Appendix B). A continuing feature of this research program is the Beryllium Case Registry at Massachusetts Institute of Technology where the histories of over 650 cases of beryllium disease are maintained for the use of research workers in this field.

The results of these studies were disseminated in the same manner that all scientific data are made available, i.e. by personal visits of interested people to the laboratories, by attendance at scientific meetings, and especially by publishing the results in scientific journals. The industrial health programs of the AEC contractors using beryllium (Appendix C) are directed by professional industrial hygienists and physicians whose business it is to know the toxicology and environmental control of the materials they work with.

In summary, the Division of Biology and Medicine activities established the standards utilized by all AEC contractors in the environmental control of beryllium hazards. Analytical chemistry procedures, suggestions for engineering control, and the results of the basic research were readily available to all contractor industrial health personnel through the normal avenues of scientific thought.

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APPENDIX B

The following research contracts were or are being supported by the Division of Biology and Medicine:

1. Radioautographic Study of Distribution and Retention of Be in the Rat.
University of North Carolina (1949 - 1954)
2. Experimental and Clinical Studies Involving Beryllium and Berylliosis.
Trudeau Foundation (1950 - 1954)
3. Biological Effects of Beryllium and its Compounds
Kettering Laboratory (1950 - 1958)
4. Physico - Chemical Studies of Beryllium Complexes
University of Rochester (1949 - 1954)
5. Pathology of Acute Experimental Beryllium Poisoning
University of Rochester (1947 - 1953)
6. Studies in the Toxicology of Beryllium
University of Rochester (1947 - 1954)
7. The Analytical Chemistry of Micro-quantities of Beryllium
University of Rochester (1947 - 1952)
8. Studies on the Experimental Pathology and Biochemistry of Pulmonary Granulomatosis of Beryllium Workers
The Saranac Laboratory (1954 - 1957)
9. Biochemical Aspects of Pulmonary Granulomatosis
The Trudeau - Saranac Institute (1955 - 1957)
10. Beryllium Disease Case Registry
Massachusetts General Hospital and Massachusetts Institute of Technology (1949 - present)

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APPENDIX C

Work involving either the refining, or fabrication of beryllium or beryllium oxide is being conducted by the following AEC contractors:

1. Brush Beryllium Company, Elmore, Ohio.
2. Beryllium Corporation of America, Hazleton, Pennsylvania.
3. Nuclear Metals Incorporated, Concord, Massachusetts.
4. Atomics International, Canoga Park, California.
5. Nuclear Materials and Equipment Corp., Apollo, Pennsylvania.
6. Argonne National Laboratory, Lemont, Illinois.
7. Union Carbide Nuclear Company, Y - 12 Plant.
8. Los Alamos Scientific Laboratory, Los Alamos, New Mexico.
9. General Electric Company, Lockland, Ohio.
10. Sandia Laboratory, Albuquerque, New Mexico.
11. Lawrence Radiation Laboratory, Livermore, California.
12. Dow Chemical Company, Rocky Flats, Colorado.
13. Battelle Memorial Institute, Columbus, Ohio.
14. General Atomic Division, General Dynamics Corp.,
San Diego, California.
15. Wyman Gordon Inc., Grayton, Massachusetts.
16. Mound Laboratory, Miamisburg, Ohio

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APPENDIX D

The following article and appendix are taken from a typical AEC beryllium procurement contract (Contract # AT(11-1)-462).

ARTICLE XXIV - HEALTH PROTECTION

1. The Contractor shall take all reasonable precautions in the performance of the work under this contract to protect the health of employees and of members of the public and shall comply with all health regulations and requirements (including reporting requirements) of the Commission. In the event that the Contractor fails to comply with said regulations or requirements of the Commission, the Contracting Officer may without prejudice to any other legal or contractual rights of the Commission, issue an order stopping all or any part of the work; thereafter a start order for resumption of work may be issued at the discretion of the Contracting Officer. The Contractor shall make no claim for an extension of time or for compensation or damages by reason of or in connection with such work stoppage, but the provisions of Section 2. of Article XIV, Default, shall be applicable.
2. The Commission, at all reasonable times, shall have access to the Contractor's plant facilities and pertinent records for the purpose of determining Contractor compliance with the provisions of this Article.
3. In the event the health regulations of the Commission which are set forth in Appendix D of this contract are changed during the term of this contract and any such change causes an increase or decrease in the cost of, or the time required for, performance of this contract, an equitable adjustment shall be made in the contract price or delivery schedule or both pursuant to Article VI, Changes.
4. The Contractor agrees to insert in all subcontracts under this contract, provisions similar to Sections 1. and 2. of this Article.

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HEALTH AND SAFETY

A. In-plant Recommendations

- a. The average in-plant atmospheric beryllium concentration should not exceed 2 micrograms per cubic meter.

If the result of the daily weighted average concentration, computed on a quarterly basis, for any occupation exceeds $2 \mu\text{g}/\text{m}^3$, but is less than $5 \mu\text{g}/\text{m}^3$, the Contractor will submit plans for necessary corrections for Commission approval and provide all personnel exposed in this area with approved personal respiratory protective equipment. If the daily average concentration exceeds $5 \mu\text{g}/\text{m}^3$, the operation in question will be halted until the necessary improvements can be accomplished. A daily average concentration exceeding $2 \mu\text{g}/\text{m}^3$ will not be permitted to exist for a period exceeding 60 days except with the specific approval of the Commission. This approval will be granted only in the event that satisfactory procedures for reducing the concentration to below $2 \mu\text{g}/\text{m}^3$ have been accepted by the Commission.

- b. In the event that a single air sample shows a concentration in excess of $25 \mu\text{g}/\text{m}^3$ within the operating area, but is less than $100 \mu\text{g}/\text{m}^3$ (and this is to be confirmed within 10 days of the time at which such a sample was obtained) all exposed individuals will be provided with personal respiratory protection approved by the Commission and the Commission will be notified of steps which are being taken to eliminate the high concentration. If the concentration exceeds $100 \mu\text{g}/\text{m}^3$ in a single sample (and this is to be confirmed within the above time limit) operations will be halted and the necessary corrections made to reduce the air-borne concentrations at this single point to below $25 \mu\text{g}/\text{m}^3$. In no case will concentrations above $25 \mu\text{g}/\text{m}^3$ be permitted to exist for a period exceeding 60 days within the specific approval of the Commission. This approval will be granted only if steps have been undertaken which can be expected to provide a satisfactory reduction in air concentration.

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B. Out-Plant Recommendations

In the neighborhood of the plant handling beryllium compounds, the average concentration at the breathing zone level should not exceed 0.01 microgram per cubic meter.

In the event that the maximum average neighborhood concentration at the ground during any calendar month, as determined on a monthly basis, exceeds 0.01 micrograms per cubic meter, but does not exceed 0.05 $\mu\text{g}/\text{m}^3$, the plant will be expected to inform the AEC of specific procedures which will be undertaken to reduce the airborne concentration. In the event that the concentration exceeds 0.05 $\mu\text{g}/\text{m}^3$, operations will be immediately halted and the necessary corrections made to reduce the average concentration to below 0.01 $\mu\text{g}/\text{m}^3$. In any event, concentrations above 0.01 $\mu\text{g}/\text{m}^3$ will be permitted to exist for not more than a 60 day period unless specifically authorized by the Commission. Such authorization will be forthcoming only if steps are being taken which are expected to result in a satisfactory reduction in effluent material.

C. Medical Supervision

- a. There should be a medical program, supervised by a physician, to cover all workers exposed to beryllium and its compounds.
- b. If there is any evidence that an individual has chronic beryllium poisoning, such an individual should be excluded from any further exposure to beryllium compounds.

D. Sampling Requirements

In order to insure adequate sampling of breathing air concentrations, the following or equivalent procedures approved by the Commission should be followed:

- a. Each separate plant operation will be broken down into its primary components and the average time per day required for the accomplishment of each component and the number of times it is repeated will be determined. A minimum of 3 breathing zone samples will be taken to evaluate the exposure arising from each such job component in addition to an adequate sampling of the general air so that a complete overall exposure may be arrived at for each plant operator.

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On the basis of these samples, a daily average exposure will be computed for each operation. The average will be weighted with time by multiplying the average concentration for each job component times the amount of time spent by the operator each day in accomplishing the component. The sum of all of these products divided by the total time per day will yield the time weighted average concentration.

A minimum of 4 such evaluations will be performed each year for each operator.

- b. Representatives of the Commission will be permitted to perform similar surveys at their discretion in order that procedures being followed by the Contractor may be evaluated.
- c. Determination of the average neighborhood concentration will be made by not less than 3 permanent monitoring stations utilizing air sampling equipment capable of handling an average air volume in excess of 1 m³/min. These monitoring stations will sample continuously. Other equivalent procedures may be approved by the Commission. Meteorological data will be obtained to insure that the samples obtained by the monitoring stations can be interpreted in terms of the direction of maximum ground level concentration.

All equipment and procedures employed in the determination of these concentrations must be approved by the Commission prior to operations.

E. Approval of Construction Plans

Prior to construction, a flow diagram plus plans and specifications of hazard control procedures to be followed at each operation will be reviewed by the Commission for adequacy in meeting the very rigid standards necessary for the control of health hazards in beryllium processing. Approval, however, will be based on performance.

F. Reports

Submit such reports as the Contracting Officer may request.