FORM NRC-2
(7-77)
10 CFR 40

Approved by GAO
R0203

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR SOURCE MATERIAL LICENSE

Pursuant to the regulations in Title 10, Code of Federal Regulations, Chapter 1, Part 40, application is hereby made for a license to receive, possess, use, transfer, deliver or import into the United States, source material for the activity or activities described.

1. (Check one)
- ☐ (a) New license
- ☐ (b) Amendment to License No. _____
- ☒ (c) Renewal of License No. STB-1129
- ☐ (d) Previous License No. _____

2. NAME OF APPLICANT
Minnesota Mining & Mfg. Company
Attention: Robert G. Wissink

3. PRINCIPAL BUSINESS ADDRESS
3M Center
St. Paul, MN 55144

4. STATE THE ADDRESS(ES) AT WHICH SOURCE MATERIAL WILL BE POSSESSED OR USED
1425 Parkway Drive
Menomonie, Wisconsin 54751

3M Center
St. Paul, MN 55144

3M Chemolite Plant, Hwy 61 and Chemolite Blvd., Cottage Grove, MN

5. NAME OF PERSON TO BE CONTACTED CONCERNING THIS APPLICATION
Duane C. Hall

6. TELEPHONE NO. OF INDIVIDUAL NAMED IN ITEM 5
612/733-7316

7. DESCRIBE PURPOSE FOR WHICH SOURCE MATERIAL WILL BE USED
Thorium nitrate, $Th(NO_3)_4.4H_2O$, is converted into $Th(OH)x(NO_3)y$ and combined with other nonradioactive metal salts at 3M's Chemolite facilities. This material is then formed into micrograin ceramic materials at the 3M Menomonie Plant. The source material is converted into ThO_2 in the process.

8. STATE THE TYPE OR TYPES, CHEMICAL FORM OR FORMS, AND QUANTITIES OF SOURCE MATERIAL YOU PROPOSE TO RECEIVE, POSSESS, USE, OR TRANSFER UNDER THE LICENSE

(a) TYPE	(b) CHEMICAL FORM	(c) PHYSICAL FORM (*Including % U or Th.*)	(d) MAXIMUM AMOUNT AT ANY ONE TIME (*kilograms*)
NATURAL URANIUM			
URANIUM DEPLETED IN THE U-235 ISOTOPE			
THORIUM (ISOTOPE) Natural	Any, primarily $Th(NO_3)_4.4H_2O$, $Th(OH)x(NO_3)y$ & ThO_2	Any	1136 kg-3M Center 2273 kg - Menomonie 2273 kg-Cottage Grove

(e) MAXIMUM TOTAL QUANTITY OF SOURCE MATERIAL YOU WILL HAVE ON HAND AT ANY TIME (*kilograms*)
5682 kg of Natural Thorium at all 3 locations at any one time.

9. DESCRIBE THE CHEMICAL, PHYSICAL, METALLURGICAL, OR NUCLEAR PROCESS OR PROCESSES IN WHICH THE SOURCE MATERIAL WILL BE USED, INDICATING THE MAXIMUM AMOUNT OF SOURCE MATERIAL INVOLVED IN EACH PROCESS AT ANY ONE TIME, AND PROVIDING A THOROUGH EVALUATION OF THE POTENTIAL RADIATION HAZARDS ASSOCIATED WITH EACH STEP OF THOSE PROCESSES.

See Attachment A

10. LIST THE NAMES AND ATTACH A RESUME OF THE TECHNICAL QUALIFICATIONS INCLUDING TRAINING AND EXPERIENCE OF APPLICANT'S SUPERVISORY PERSONNEL AND THE PERSON RESPONSIBLE FOR THE RADIATION SAFETY PROGRAM (OR OF APPLICANT IF AN INDIVIDUAL).

See Attachment A, B & C

11. DESCRIBE THE EQUIPMENT AND FACILITIES WHICH WILL BE USED TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE OR PROPERTY AND RELATE THE USE OF THE EQUIPMENT AND FACILITIES TO THE OPERATIONS LISTED IN ITEM 9. INCLUDE: (a) RADIATION DETECTION AND RELATED INSTRUMENTS (including film badges, dosimeters, counters, air sampling, and other survey equipment as appropriate. The description of radiation detection instruments should include the instrument characteristics such as type of radiation detected, window thickness, and the range(s) of each instrument).

See Attachment A

(b) METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED IN (a) ABOVE, INCLUDING AIR SAMPLING EQUIPMENT. (For film badges, specify method of calibrating and processing, or name supplier).

See Attachment A

11(c). VENTILATION EQUIPMENT WHICH WILL BE USED IN OPERATIONS WHICH PRODUCE DUST, FUMES, MISTS, OR GASES, INCLUDING PLAN VIEW SHOWING TYPE AND LOCATION OF HOOD AND FILTERS, MINIMUM VELOCITIES MAINTAINED AT HOOD OPENINGS AND PROCEDURES FOR TESTING SUCH EQUIPMENT

See Attachment A

12. DESCRIBE PROPOSED PROCEDURES TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE AND PROPERTY AND RELATE THESE PROCEDURES TO THE OPERATIONS LISTED IN ITEM 9; INCLUDE: (a) SAFETY FEATURES AND PROCEDURES TO AVOID NONNUCLEAR ACCIDENTS, SUCH AS FIRE, EXPLOSION, ETC., IN SOURCE MATERIAL STORAGE AND PROCESSING AREAS

See Attachment A

(b) EMERGENCY PROCEDURES IN THE EVENT OF ACCIDENTS WHICH MIGHT INVOLVE SOURCE MATERIAL

See Attachment A

(c) DETAILED DESCRIPTION OF RADIATION SURVEY PROGRAM AND PROCEDURES

See Attachment A & B

13. WASTE PRODUCTS: *If none will be generated, state "None" opposite (a), below. If waste products will be generated, check here* [X] *and explain on a supplemental sheet:*

(a) Quantity and type of radioactive waste that will be generated.

(b) Detailed procedures for waste disposal. See Attachment A

14. IF PRODUCTS FOR DISTRIBUTION TO THE GENERAL PUBLIC UNDER AN EXEMPTION CONTAINED IN 10 CFR 40 ARE TO BE MANUFACTURED, USE A SUPPLEMENTAL SHEET TO FURNISH A DETAILED DESCRIPTION OF THE PRODUCT, INCLUDING:

(a) PERCENT SOURCE MATERIAL IN THE PRODUCT AND ITS LOCATION IN THE PRODUCT.

(b) PHYSICAL DESCRIPTION OF THE PRODUCT INCLUDING CHARACTERISTICS, IF ANY, THAT WILL PREVENT INHALATION OR INGESTION OF SOURCE MATERIAL THAT MIGHT BE SEPARATED FROM THE PRODUCT.

(c) BETA AND BETA PLUS GAMMA RADIATION LEVELS (*Specify instrument used, date of calibration and calibration technique used*) AT THE SURFACE OF THE PRODUCT AND AT 12 INCHES.

(d) METHOD OF ASSURING THAT SOURCE MATERIAL CANNOT BE DISASSOCIATED FROM THE MANUFACTURED PRODUCT.

CERTIFICATE

(*This item must be completed by applicant*)

15. *The applicant, and any official executing this certificate on behalf of the applicant named in Item 2, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 40, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.*

BY: Robert G. Wissink
(*Signature*)

Dated July 14, 1982

Robert G. Wissink
(*Print or type name*)

Manager, Health Physics Services
(*Title of certifying official authorized to act on behalf of the applicant*)

WARNING: 18 U.S.C. Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

Form NRC-2 (7-77)

RENEWAL APPLICATION (JULY, 1982)
U. S. NRC LICENSE STB-1129
ATTACHMENT A

ITEM 9-PROCESS DESCRIPTION

The process consists of converting thorium nitrate, $Th(NO_3)_4 \cdot 4H_2O$, which is 42% thorium by weight into thorium hydroxynitrate, $Th(OH)_x(NO_3)_y$. This material is prepared at the 3M Chemolite Plant in closed chemical reactor vessels. The maximum amount of thorium nitrate in any one batch is 1000 kilograms. The thorium nitrate consists of solid crystals which are not readily dispersible in air. Air samples which have been taken during the charging operation have shown airborne concentrations to be less than 10% of the maximum permissible level of 6×10^{-11} microcuries per cubic centimeter. Because of the low airborne concentrations, air sampling is not conducted during the charging operation. As a precaution when charging the thorium nitrate to the chemical reactor, the operators wear a 3M Brand 9900 Dust Respirator, rubber gloves and coveralls to minimize internal radiation exposures. The chemical reactors are located in areas away from those generally occupied by personnel. The individuals involved in the process are film badged.

Following the chemical conversion of thorium nitrate to the thorium hydroxynitrate, the material is combined with nonradioactive metal salts, concentrated, stored in plastic containers, frozen and shipped to the 3M Menomonie, Wisconsin Plant or 3M Center, Building 219, in DOT approved containers. Because the concentrate is stored and transported in plastic containers in the frozen state, dispersal of the material is extremely unlikely and it has been concluded that the storage and shipment in this manner presents little hazard. At either of the plants, the frozen concentrate is stored in freezers, away from generally occupied areas to minimize external exposures. As needed, the concentrate is thawed and processed into micrograin ceramic material and subsequently heat treated to convert it into thorium oxide (ThO_2). The finished product is 60% thorium. The use is classified. It is anticipated that about 4500 kilograms of thorium nitrate will be used each year.

ITEM 10-RADIATION SAFETY PROGRAM PERSONNEL

As outlined in Attachment B, Section I of the 3M Health Physics Manual, corporate responsibility for all radiation safety programs in 3M has been delegated by 3M upper management to the 3M Medical Department, Health Physics Services. The organization chart for Health Physics Services and resumes for the Health Physicists within Health Physics Services are shown in Attachment C.

The individual responsible for all matters related to health and safety for the production of micrograin ceramic material as described in Item

9 is Mr. Albert J. Melberg, Manager, Ceramic Fibers Products Project. Mr. Melberg has a BBA from Hamline University and has been with 3M Company for 32 years. He has been involved with thorium since 1971 as a Marketing Director and as Manager of the Ceramic Fibers Products Project. Mr. Melberg was provided Health Physics training on two separate occasions with each session lasting two hours. This training was provided by M. W. Hinz of Health Physics Services. The sessions included formal lecturing and discussion of application of the lecture material to the use of source material by the Ceramic Fibers Products Project. The content of the training sessions is outlined below:

1. Radiological and Chemical Properties of Thorium.
2. External and Internal Exposure Hazards, Including Exposure Limits and Biological Effects of Radiation.
3. Basics of Safety and Handling Procedures.
4. Explanation of Safety and Handling Procedures to Protect Employees from Hazards of Thorium.
   a) Protective Clothing.
   b) Contamination Control Program.
   c) Waste Disposal Program.
   d) Inventory.
   e) Personnel Monitoring Program.
   f) Emergency Procedures.
5. Applicable Parts of 10 CFR 19, 20 and 40 and NRC STB-1129 License Conditions.

ITEM 11(a)-RADIATION DETECTION EQUIPMENT

Personnel Monitoring

Film badges are provided to all personnel involved with thorium at 3M Center, the 3M Chemolite Plant and the 3M Menomonie Plant through a purchase agreement with R. S. Landauer, Jr. and Company. The film badges are changed on a monthly basis.

Radiation Detection Equipment

Instrumentation for monitoring radiation levels and performing contamination assessment are listed below.

Number of Instruments	Model Number	Radiation Detected	Range (mR/hr)	Window Thickness (mg/cm^2)	Use
3M Chemolite					
1	Eberline Model RO-2		0-5,000	7 & 400	Surveying
1	Eberline HP-210 Probe with MS-3 Scaler		-	1.4-2.0	Assaying
1	Eberline PRM-6 with AC-3 Probe		0-500,000 cpm	1.5	Monitoring
3M Menomonie					
1	Eberline Model RO-2		0-5,000	7 & 400	Surveying
1	Eberline HP-210 Probe with MS-3 Scaler		-	1.4-2.0	Assaying
1	Eberline PAC-4S		$1\text{-}2 \times 10^6$ cpm	1.5	Monitoring
3M Center - Health Physics Services					
1	Eberline Model RO-1		0-500,000	1.7	Surveying
2	Eberline Model RO-3		0-5,000	3.5	Surveying
1	Eberline PAC-4S		$1\text{-}2 \times 10^6$ cpm	1.5	Monitoring
1	Eberline PRM-6 with AC-3 Probe		0-500,000 cpm	1.5	Monitoring
1	Eberline HP-210 Probe with MS-3 Scaler		-	1.4-2.0	Assaying
2	Eberline AC-23 Probe with RM-19 Ratemeter		0-500,000 cpm	1.5	Monitoring
1	Eberline E-530 with HP-190 and HP-270 Probes			2 & 30	Monitoring
1	Nuclear Chicago 2650 with end and side window probes.		1-100	2 & 30	Monitoring
1	Victoreen Model 570 Condenser R-Meter		(several chambers)		Surveying

Air Sampling Equipment

Three Eberline Model RAS-1 air samplers (one at 3M Center and two at 3M Menomonie) and one Hi-Q Filter Products Company Model CF50-V air sampler at 3M Center are available to monitor the presence of airborne materials when thorium is being processed at Menomonie or Building 219. Particulate samples are collected on air filters which are then decayed to eliminate natural occurring radioactive materials and counted in the Eberline HP-210 probe with MS-3 scaler units.

ITEM 11(b)-RADIATION SURVEY INSTRUMENT CALIBRATIONS

Dose Rate Measuring Instruments

The portable radiation survey instruments (EIC RO-1, RO-2, RO-3, and E-530 with side window probe and the Nuclear Chicago 2650 with side window probe) are calibrated semi-annually by placing them in a known radiation field from a Cesium-137 source and observing the meter response. The sources are possessed and used under U.S. NRC License 22-00057-06 at 3M Static Control Systems Division facilities in New Brighton, Minnesota. The calibration facility contains a 3M Model 4F6S source and a 3M Model 4D6L source containing 50 millicuries and 10 curies of Cesium-137, respectively. The facility is calibrated using a Victoreen Condenser R-Meter which is calibrated by Victoreen against an NBS calibrated Cesium-137 standard. For instrument calibrations the survey instrument is placed at a known distance from the source where the radiation field is known. A two point calibration is performed on each scale with the two points separated by at least 50% and a survey instrument is considered properly calibrated when the instrument readings are within plus or minus 10% of the known value at each point. The instruments are calibrated by a member of Health Physics Services.

Portable Alpha Survey Meters

The Eberline PAC-4S and PRM-6 meters with AC-3 probes are calibrated semi-annually by a member of Health Physics Services. They are calibrated with Eberline Model S94-1 certified Plutonium-239 Alpha Calibration Standards which contain four sources having a total activity of approximately two microcuries. The sources are accurate to plus or minus 2% of the stated value and are traceable to primary standards maintained by the National Bureau of Standards.

HP-210 Probe with MS-3 Scaler

This system is used for evaluating smear tests and air sample filters. The instruments are calibrated with an Eberline Model DNS-4 certified Thorium-230 alpha calibration standard. A calibration including a plateau check with the Thorium-230 calibration standard is conducted quarterly under the supervision of a member of 3M Health Physics Services. Each time the counter is used for assay work, a Cesium-137 check source is used to determine that it is working properly.

ITEM 11(c)-AIRBORNE CONTAMINATION CONTROL

The thorium nitrate crystals which are used in charging the chemical reactors are not readily dispersible in air. Air samples which have been taken during the charging operation have shown airborne concentrations to be less than 10% of the maximum permissible level of 6×10^{-11} microcuries per cc. Because of the low airborne concentrations, air sampling is not conducted during the charging

operation. As a precaution, when charging the thorium nitrate to the chemical reactor, the operators wear a 3M Brand 9900 Dust Respirator, rubber gloves and coveralls to minimize internal radiation exposures. Smear testing is conducted around the reactor after the material has been charged.

The thorium-containing concentrate is frozen after it is removed from the chemical reactor and remains frozen while being shipped to 3M Menomonie or 3M Center, Building 219. Until used it is maintained in the frozen state in freezers. Because the concentrate is sealed in plastic containers and frozen, dispersal of the material is extremely unlikely and it is concluded that the storage and shipment in this manner present little hazard. At either 3M Menomonie or 3M Center, Building 219, the thorium containing concentrate is thawed and formed into micrograin ceramic materials and heat treated. An Eberline Model RAS-1 air sampler is operated continuously to monitor for the presence of airborne materials when thorium is being processed at Menomonie. Air samples to date have shown the average airborne concentration of thorium to be less than 10% of the maximum permissible concentration level of 6×10^{-11} microcuries per cc.

ITEM 12(a)-SAFETY FEATURES AND PROCEDURES

Thorium nitrate is initially received at 3M's Chemolite Plant in metal drums and is stored away from flammable materials. When used, the thorium nitrate is emptied directly from the metal shipping containers into chemical reactors for processing into thorium hydroxynitrate and finally into concentrate form. No flammable materials are used in the processing of thorium. The equipment and buildings in which the thorium is processed are constructed to qualify the process area as a Class I Group D area when processing flammable materials for other 3M products manufactured there. Thus, all equipment is designed to process flammable materials without experiencing fires or explosions.

Once the material has been formed into the thorium-containing concentrate, it is frozen and stored in freezers away from flammable materials. It is packaged in dry ice when it is shipped from 3M Chemolite to the Menomonie Plant or 3M Center Building 219 in DOT approved containers and is stored in freezers until it is needed for final processing into micrograin ceramic material.

Flammable materials are not used when processing the concentrate into ceramic material and the final product is stored away from flammable materials. All radioactive waste is stored in metal DOT approved shipping containers away from flammable materials.

All 3M plants have emergency teams trained to provide first aid and fire coverage. Surveys are conducted on a routine basis to check on the adequacy of fire fighting equipment and first aid supplies. An agreement exists between 3M and the St. Paul Fire Department and the East County Line Fire Department to respond to calls at 3M Center, between 3M and the Grove Estates Fire Department to respond to calls at Chemolite, and between 3M and the Menomonie Fire Department to respond to calls at the Menomonie Plant.

ITEM 12(b)-EMERGENCY PROCEDURES

Should an emergency situation arise which involves release of thorium containing material to the work area, to the environment, or to the sanitary sewer system in any of the facilities where thorium is processed, immediate action is taken to secure the source of release and to isolate areas which may have become contaminated. Access to any contaminated area is restricted and decontamination of personnel is begun immediately using conventional cleaning techniques including removal of contaminated clothing if necessary. 3M Health Physics Services is notified immediately and a Health Physicist is dispatched to the affected area to evaluate personnel exposures and releases and to determine if notification of the NRC and other authorities is required. The Health Physicist assists in clean up operations and determining when areas are cleaned to unrestricted area limits at which time the affected areas can be re-entered by laboratory or production

personnel to commence normal operations.

ITEM 12(c) - RADIATION SURVEY PROGRAM

General Program

The general Radiation Safety Program is outlined in Section I of the 3M Health Physics Manual enclosed as Attachment B.

3M Chemolite Program - 3M Chemolite

1. External Exposure

In order to minimize external exposures, containers of thorium nitrate and frozen thorium-containing concentrate are stored in areas away from those normally occupied by personnel. Film badges are worn by all personnel involved with thorium production. Exposures to personnel since film badging was begun in 1974 have been well below 25% of the limit specified in 10 CFR Part 20.

2. Contamination Control

Contamination control is based on adherence to strict containment procedures and a surface contamination testing program. When thorium nitrate is charged to a chemical reactor, the operator wears rubber gloves and a lab coat or coveralls and a 3M Model 9900 Dust Respirator. In addition, the area around the chemical reactor is covered with paper or plastic to catch any material which may have spilled during the operation. After the material is charged, the paper or plastic is disposed of as radiaoctive waste and wipe testing is conducted to determine whether or not any contamination has resulted. If contamination in excess of the limits specified below is found the area affected is thoroughly decontaminated.

During the remainder of the thorium process, an area contamination survey using an Eberline PAC-4S or PRM-6 with AC-3 alpha scintillation probe alpha scintillation survey meter is performed at specified areas at least once each shift and when a spill has occurred. Wipe testing is performed at specified times during the process when material is charged to or drained from process vessels and when a spill has occurred. Contamination limits permit (1) total maximum levels of 3000 dpm alpha/100 square centimeters provided the average does not exceed 1000 dpm alpha/100 square centimeters and (2) removable levels up to 200 dpm alpha/100 square centimeters. When levels in excess of these limits are found, cleaning is performed until the limits are complied with. All cleaning materials are disposed of as radioactive waste. Solid radioactive waste is collected in DOT approved waste containers. When filled, these containers are

stored in locations away from generally occupied areas until shipped off site to a licensed waste disposal facility.

3. Sanitary Sewer System Releases

Effluent containing small amounts of thorium is released to the sanitary sewer system in accordance with the provisions of 10 CFR 20.303 whenever chemical reactors are cleaned. Every effort is made to remove as much activity as possible prior to cleaning. The chemical reactors are filled with water and other cleaning solutions to dissolve any residual activity and a sample of the effluent is assayed to determine the concentration before release. In addition, the amount of thorium being released to the sewer system is calculated based on a material balance (the amount of starting material minus the amount of product). A record is kept of the quantity and concentrations of thorium discharged. The inside of the chemical reactor is wipe tested and areas showing removable contamination greater than 200 dpm alpha/ 100 square centimeters are subject to recleaning.

3M Menomonie Plant

1. External Exposure

The process area in the 3M Menomonie Plant is isolated from the remainder of the building to restrict occupancy to only those individuals who are directly involved in the micrograin ceramic material production operation. The containers of frozen thorium-containing concentrate received from 3M Chemolite are stored in areas away from those normally occupied by personnel as are containers of radioactive waste. This serves to minimize external exposure to all personnel. Film badges are worn by all personnel involved with the thorium production process.

2. Contamination Control

The thorium production area is established as a controlled area. Access is limited to only those personnel directly involved with the thorium production. There are a limited number of access points to the area and physical barriers and instructional signs exist at these access points to inform personnel they are entering a controlled area.

All personnel working in the area wear protective clothing such as smocks or coveralls and shoe covers. Upon exiting the controlled area, the protective clothing and shoe covers are removed.

The production area is vacuumed with a vacuum cleaner containing a HEPA filter once a shift and the area is also wet mopped once a shift. When thorium is being processed, wipe testing is conducted

on floors, stationary equipment and other surfaces at least once every two weeks. The removable surface contamination limit in the controlled area is 1000 disintegrations per minute alpha per 100 square centimeters. The fixed surface contamination limit is 25,000 disintegrations per minute alpha per 100 square centimeters provided the average does not exceed 5,000 disintegrations per minute alpha per 100 square centimeters.

Uncontrolled areas immediately outside the controlled area are wipe tested at least once weekly. The limits which apply there are as follows. The fixed contamination limit is 3,000 disintegrations per minute alpha per 100 square centimeters with the average being 1000 disintegrations per minute alpha per 100 square centimeters. The removable contamination limit is 200 disintegrations per minute alpha per 100 square centimeters. Fixed surface contamination is assessed every two weeks using an Eberline PAC-4S alpha scintillation survey meter or an Eberline PRM-6 with AC-3 probe alpha scintillation survey meter. Any areas showing contamination in excess of the limits specified above are cleaned until the limits are complied with.

All equipment being removed from the controlled area is surveyed for fixed and removable contamination and must comply with the uncontrolled area limits specified above.

3. Air Sampling

Air sampling is conducted at two locations within the production area where it is possible for thorium to become airborne. Continuous air samples are collected at these locations to measure the maximum airborne concentration an individual can be exposed to. Using the measured airborne concentrations, employee internal exposure assessments can be made. Air sample filters are changed every two weeks and decayed at least two days before counting to allow the decay of the natural occurring radon and thoron daughters. Gelman Type A or E glass fiber filters are used as the collecting medium. Air sample filters are counted on the Eberline HP-210 probe and MS-3 scaler.

The sensitivity of assay is 4×10^{-13} microcuries per cubic centimeter. Air samples have shown the average airborne concentration of thorium to be less than 10% of the maximum permissible level of 6×10^{-11} microcuries per cc.

3M Center Building 219

1. General

Presently only final product storage and shipment, temporary storage of raw material and frozen concentrate, quality control

and specific problem solving operations are conducted in Building 219. Thus, thorium is handled only on an infrequent basis there. The radiation survey program outlined below is thus conducted only when thorium is being used in Building 219.

2. External Exposure

Film badges are worn by all personnel who work with thorium.

3. Contamination Control

Whenever thorium is being used in Building 219, wipe tests are conducted on floor, stationary equipment and other surfaces at least once a month when it is in use or at the end of use should the period of use be less than one month. The removable contamination limit is 200 disintegrations per minute alpha per 100 square centimeters. The fixed contamination limits are 3,000 disintegrations per minute alpha per 100 square centimeters maximum with the average being 1000 disintegrations per minute alpha per 100 square centimeters.

4. New Project Review

Should any new research or product development of materials containing thorium be performed in Building 219, radiation safety procedures will be established by Health Physics Services.

Radiation Safety Responsibilities

The individual having overall responsibility for ensuring that the established radiation safety program in the Ceramic Fibers Product facilities implemented is Mr. A. J. Melberg (See Item 10 above). It is his responsibility to ensure that records of surveys, material inventories, personnel exposures, receipt, use and disposal of materials are maintained. Records of surveys, air sampling results, sewer sampling results, instrument surveys, receipts and transfer or thorium, etc. are maintained in the facility to which the records apply. The master thorium inventory record is maintained at the 3M Menomonie Plant. Personnel exposure records are maintained by Health Physics Services.

Health Physics Services conducts quarterly audits when thorium is being processed to determine that its use is in compliance with the regulations, license conditions and 3M policy. These audits include but are not limited to:

1. Reviewing inventory records.
2. Conducting radiation surveys with portable survey instruments.
3. Reviewing personnel exposure records and monitoring needs.
4. Reviewing survey records for wipe tests, surveys of incoming

packages and waste disposal.

5. Inspecting facilities for adequate posting and labeling.

If deficiencies are found they are discussed at the time of the audit and corrective actions are decided upon. Following an audit, a formal written report is sent to the person in the facility having radiation safety responsibilities and to Mr. A. J. Melberg. A quarterly summary audit report is also sent to Mr. Melberg.

Thorium Inventory Control

Thorium nitrate is ordered by the 3M Chemolite facility. Prior to ordering new material, the inventory records are checked to ensure that the possession limit of 2273 kilograms will not be exceeded upon its receipt. A purchase requisition is then forwarded to Health Physics Services who makes an additional check to ensure that possession limits will not be exceeded and then the requisition is forwarded to 3M Purchasing where the purchase order is written.

When the material is received at the 3M Chemolite facility, an additional check is made to ensure that the possession limit is not exceeded. If not, it is accepted. If the possession limit is exceeded part of the material may be forwarded to 3M Menomonie or 3M Center Building 219 assuming their possession limits will not be exceeded. If possession limits will be exceeded at any of the facilities the excess material will be returned to the supplier.

If the quantity and form of received material are greater than the limits specified in 10 CFR 20.205, the packages are monitored and a record is kept of the results. If monitoring results show external contamination is greater than 0.01 microcuries/100 square centimeters, or radiation levels exceed those in 10 CFR 20.205(c)(2), 3M Health Physics Services is notified. They will in turn notify the appropriate regulatory agencies and transportation firms.

The master inventory records are maintained at the 3M Menomonie Plant. Building 219 and the 3M Chemolite facility forward receiving and shipping reports to this facility so that up to date accurate records may be maintained for all locations where thorium is being used. On a semi-annual basis, a physical inventory is performed at each site to determine the amount of thorium physically present. The running inventory is then corrected to reflect the actual physical inventory amounts. Explanation of differences between the running and physical are determined and are placed in the inventory record file.

Personnel Training Program

3M Chemolite

All personnel at the 3M Chemolite facility are instructed in the

hazards of natural thorium in relationship to their respective production activities. This training is provided by the Plant Safety Engineer using a videotape in which a member of Health Physics Services outlines the Radiation Safety Program and the Plant Safety Engineer outlines the specific responsibilities of the employees. All personnel view the videotape prior to commencing work activities.

Each person is informed that the production operations are being performed under a radioactive material license granted by the U.S. NRC. Personnel are further instructed that a manual detailing the Radiation Safety Program at Chemolite is maintained by the Plant Safety Engineer. It contains copies of Section I of the 3M Health Physics Manual, detailed additional radiation safety procedures written by Health Physics Services, 10 CFR Parts 19 and 20, and a copy of the U.S. NRC License and amendments. This manual is available for personnel to review at any time. At each training session each person is requested to sign a training acknowledgment form which is placed in the training file maintained by the 3M Chemolite Plant. Health Physics Services is advised of those personnel who have been trained by the Plant Safety Engineer.

3M Menomonie Plant

All personnel who work with thorium at the 3M Menomonie Plant are instructed in the hazards of natural thorium in relationship to their respective production activities. This training is provided by the Menomonie Plant Thorium Production Superintendent using an audio tape recorded by Health Physics Services outlining the Radiation Safety Program and the specific responsibility of the employees. All new employees listen to the tape when they commence working in the Ceramic Fibers Product production facilities.

Each person is informed that the production operations are performed under a radioactive material license granted by the NRC. Personnel are further instructed that a manual detailing the Radiation Safety Program at Menomonie is maintained by the Thorium Production Superintendent. It contains copies of Section I of the 3M Health Physics Manual, detailed additional radiation safety procedures written by Health Physics Services, 10 CFR Parts 19 and 20 and a copy of the U.S. NRC license and amendments. It is available for personnel to review at any time.

Upon completion of initial training each person is requested to sign a training acknowledgment form which is placed in their personnel file. Health Physics Services is advised of those individuals having completed their training.

For women employees, a training session discussing U.S. NRC Regulatory Guide 8.13 entitled "Prenatal Radiation Exposure" is also provided. This training is recorded on a videotape by a member of 3M Health

Physics Services and is shown to the employee by the Menomonie Plant Thorium Production Superintendent. Upon completion of this training, all women are requested to sign a training acknowledgment form which is also included in their personnel file. Each woman also receives a copy of Regulatory Guide 8.13.

Should additional training be requested or should quarterly audits indicate that additional training is required, Health Physics Services will arrange to provide the additional training through the Menomonie Plant Thorium Production Superintendent.

ITEM 13 - RADIOACTIVE WASTE DISPOSAL

Solid Waste

Solid radioactive waste consists of filters, scrap ceramic material, gloves, contaminated cleaning materials, etc. The solid waste is collected in DOT approved waste containers and is packaged and labeled in accordance with appropriate regulations before transfer to a licensed radioactive waste disposal facility. Small amounts of liquid are either solidified, dried or absorbed on approved absorbent material in accordance with the requirements of the waste disposal facility to which the waste is being shipped and processed as waste in DOT approved containers.

Equipment which has been used for thorium work is decontaminated before it can be used in an unrestricted area. If the equipment cannot be decontaminated to acceptable levels (see Contamination Control above) equipment is stored in a secure location and used only for thorium work or is processed as radioactive waste.

Sewer Discharges

All reasonable steps are taken to prevent discharging of thorium to the sanitary sewer system. However, certain steps do require that small amounts of thorium be discharged. These discharges are made in accordance with the provisions of 10 CFR 20.303. To minimize discharges, washings from small vessels are collected in containers where the water is allowed to evaporate and the solid sediment is treated as solid radioactive waste.

All waste shipments are coordinated and audited by Health Physics Services personnel to ensure that the material is packaged correctly and is shipped in accordance with requirements of the U.S. NRC and DOT regulations.

ATTACHMENT B

SECTION I

3M HEALTH PHYSICS MANUAL

Minnesota Mining & Manufacturing Company
Health Physics Manual

SECTION I

GENERAL RADIATION SAFETY
POLICIES & ADMINISTRATIVE RESPONSIBILITIES

SECTION I

TABLE OF CONTENTS

INTRODUCTION

The use of radioactive materials and other ionizing radiation sources used by 3M Company can be divided into four general categories; sealed sources used in manufacturing and production areas, sealed sources for sterilization of products, sources used in research for product development and improvement, and radioactive material converted into useful products. Each of these four areas requires special procedures to assure that good practice minimizes personnel exposure to ionizing radiation and that exposures are within the radiological health standards of various regulatory agencies.

Section I of the 3M Health Physics Manual covers general radiological health policies and outlines administrative responsibilities which apply to all users of ionizing radiation sources. This section is intended for use with one or more subsequent sections.

Section II covers those policies and procedures which specifically apply to the users of sealed radioactive sources, x-ray gauges for coating weight measurements and electron beam equipment for curing.

Section III contains those policies and procedures which apply to research and development activities where limited amounts of radioisotopes are used for tracer studies and for product development. This section is intended primarily for laboratories at the 3M Center where relatively small quantities of unsealed isotopes are used, but also covers custom made equipment development activities necessitating sealed source handling. Activities covered by this section are those which are typically permitted under a U.S. Nuclear Regulatory Commission Type B broad scope byproduct material license.

Section IV of the manual is for the 3M Static Control Systems Dept. whose work is permitted under a Type A broad scope byproduct material license. The scope of activities under the Static Control Systems Department necessitates special radiological health considerations and these are covered in this section.

Section V of the manual is for the Medical Products Division which operates a gamma sterilization facility at Brookings, South Dakota. Special design considerations of the facility and the amount of radioactivity being used in it necessitates special consideration even though the material is in sealed source form.

I. Medical Department, Health Physics Services

The possession of radioactive materials requires licensing by the U.S. Nuclear Regulatory Commission or one of the states with which the NRC has reached regulatory agreements. Those states which have not reached agreements with the NRC require the registration of radioactive materials. The possession of all other ionizing radiation sources such as x-ray machines, requires registration in most states. These licensing and registration requirements have been established to assure that users of ionizing radiation sources have adequate health and safety programs.

Health Physics Services is a section of the 3M Medical Department and serves as a central coordinating group for 3M's licensing and registration activities. Its responsibilities were established by the 3M Management Committee in 1959. Functions include:

A. Establishing and supervising external radiation monitoring programs.

B. Studying radiation source handling procedures and recommending improvements.

C. Conducting training sessions for persons unfamiliar with radiation safeguards and procedures.

D. Establishing controls to prevent exposure to persons outside radiation controlled areas.

E. Establishing and maintaining a central recordkeeping system.

F. Establishing waste disposal procedures.

G. Establishing procedures for prevention and control of emergencies.

H. Establishing controls to minimize radiation exposures to employees and the public.

I. Establishing controls to minimize the release of radioactive material to the environment.

J. Participating in the planning of laboratory and production facilities where radiation sources are to be used.

K. Inspecting and auditing activities involving ionizing radiation sources to assure compliance with the regulations of such agencies as the Nuclear Regulatory Commission, Department of Transportation, Occupational Safety and Health Administration, and state health departments.

L. Handling licensing and registration activities with the Nuclear Regulatory Commission and state agencies.

B. Special Byproduct Material

Special Byproduct Material licenses are issued for the distribution of certain products containing radioactive material. These are called general licenses or exempt distribution licenses. Such licenses are issued to the 3M department or division which distributes the material. The application for such a license is prepared by that department with Health Physics Services performing the health and safety evaluations. The completed application is reviewed, approved and forwarded to the NRC or an Agreement State by Health Physics Services.

C. Source Material and Special Nuclear Material

Source Material and Special Nuclear Material licenses are pursuant to a different set of regulations than those for Byproduct Material Licenses. Applications have a significantly different format and the health and safety program is often such that special procedures are necessary. These licenses are issued in the name of the department or division using the material. However, the application for the license is a cooperative effort between that department or division and Health Physics Services. As with the other licenses, Health Physics Services submits the completed application to the NRC.

D. Registrations

Registrations are submitted by Health Physics Services to the appropriate state agency. These registrations apply to both radioactive materials as well as machine type ionizing radiation sources. In the case of radioactive material in non-Agreement States the registration is a matter of informing a state agency that the material is in 3M possession since the NRC health and safety regulations apply. With x-ray and other machine type ionizing radiation sources the health and safety regulations of the state are applicable and the use of the registered source must be in compliance with them.

III. Health Physics Audits

Title 10, Parts 19 and 20, Code of Federal Regulations contain the standards for protection against radiation with which the use of radioactive material must be in compliance. Agreement States have similar regulations and non-agreement states have regulations for the use of ionizing radiation producing machines. Health Physics Services conducts periodic audits to determine that the use of ionizing radiation sources is in compliance with these regulations, the conditions on the licenses, statements in the license applications, and 3M policies. These audits and surveys include such things as:

1. Reviewing inventory records.
2. Conducting radiation surveys with portable survey instruments.
3. Reviewing personnel exposure records and monitoring needs.
4. Reviewing source leak test procedures.
5. Inspecting the facility for adequate posting and labeling, storage facilities, and disposal methods.

Upon completion of an audit where radioactive material is used, deficiencies are noted and methods of correcting them are recommended. The user of the material is then expected to correct the deficiency. Failure to correct it can jeopardize the license and the ability of other users to work under it; therefore, the privilege of using radioactive material is contingent upon compliance with all appropriate regulations.

Similar audits are conducted for ionizing radiation producing machines. During these audits a determination is made regarding whether the equipment meets the applicable 3M and state standards. Standards can vary from state to state, but installations meeting the 3M radiation exposure criteria will meet the occupational exposure criteria of all states.

IV. Radiation Safety Officer and User Training

It is important that all ionizing radiation source users are knowledgeable about the radiation safety aspects of the source they are using and about the regulations which apply to its use. At any one 3M facility several users may be involved; however, one of these is to be designated the Radiation Safety Officer (RSO). His specific responsibilities are outlined in subsequent sections of this manual. When there is only one user in a facility he shall be the Radia- Safety Officer. Although manufacturing plants are not considered a facility an RSO will be appointed whenever radioactive material in thickness and level gauges is used in the plant.

Users and/or RSO's will be provided with the training they need by a Health Physicist. As a minimum, this training will include a discussion of: (a) external and internal health hazards, (b) handling techniques, (c) emergency procedures, (d) permissible quantities of radiation exposure, (e) surveys, (f) posting and labeling, (g) personnel monitoring, (h) waste disposal, (i) reports and records, and (j) the 3M health physics program. The training will be specific for the type and quantity of radioactive material to be used. If at a later date other types of radioactive material are to be used, additional training will be provided.

Those RSO's in manufacturing plants using thickness gauges with beta sources will be shown how to open the source housing so that shutter solenoids, fail safe springs, and other components needing repair can be serviced. Should removal of the source be necessary it will be done only by a manufacturer's representative or a 3M Health Physicist. As part of the training program an RSO may be shown how to do it, but source handling will be limited to the health physicist. Source removal should only be necessary when a replacement is necessary after a one half-life period of service.

V. Source Inventory

The 3M Company is accountable for all sources of radioactive material in its possession and records must be kept of receipts, removals, transfers, and waste. Health Physics Services keeps a company-wide inventory of all sealed sources and their location. Thickness and level gauges are listed by gauge model number, source model number, manufacturer, location, isotope, and quantity. X-ray equipment and other ionizing radiation sources are similarly inventoried. Records on unsealed sources are inventoried by the respective user and/or RSO. A quarterly inventory report is to be submitted to Health Physics Services for all unsealed sources. In addition to the reports, Health Physics Services audits user and/or RSO records on a periodic basis.

VI. Personnel Monitoring

The purpose of licensing and health and safety regulations is to minimize exposure to radiation and prevent exposures from exceeding the applicable limits. To accomplish this, a personnel monitoring program for both external and internal radiation exists. External radiation monitoring consists of a routine film badge, TLD, pocket chamber, or self-reading dosimeter program. The program is administered by Health Physics Services and is available for use at any 3M facility.

Even though the program is available, not all users of radiation sources are provided with film badges or other monitoring devices. When radiation surveys or evaluations show that personnel exposure levels are likely to be less than 25% of the occupational limits such monitoring is not required. This would typically be the situation with individuals whose work takes them near beta gauges and level gauges. 3M policy requires that the use of these types of radiation sources must meet public exposure criteria which is only 10% of the occupational limits.

For personnel working with radioactive materials in an unsealed form and of such quantity that a significant inhalation or ingestion exposure could occur, there is an internal radiation monitoring program. On a routine basis this consists of urine analysis for gross beta-gamma or specific nuclide activity. Supplemental techniques such as fecal analysis and whole body counting are employed when the situation warrants.

Another acceptable way to measure internal exposures is to take air samples in the area occupied by the worker. The concentration of radioactivity in the air can be compared to a table of Maximum Permissible Concentrations which are based on internal dose values. Frequently this is the best technique and it is used on a regular basis.

Permanent records are kept on personnel who have been included in an external or internal radiation exposure monitoring program. Those employees working under NRC or Agreement State licensed activities are provided with a record of their exposures upon termination of work with 3M or transfer to non-radiation work. So that these records are complete, new or transferred employees who will be working with ionizing radiation sources and who have had radiation exposures prior to joining 3M are expected to obtain a record of this exposure from their former employer. Personnel monitoring records are kept by Health Physics Services.

VII. Losses, Thefts, Accidents

As soon as a loss, theft, or accident involving a radiation source is known it is to be immediately reported to Health Physics Services. An investigation as to the circumstances surrounding the incident will be conducted, especially to determine if there is a hazard to employees and/or the public. Health Physics Services reports such incidents to the NRC or respective state agency when it is required by regulation and when it is in the best interests of all concerned.

Incidents which must be reported are as follows:

A. Immediate Notification

1. Radiation exposure to the whole body in excess of 25 rems, to the skin of the whole body in excess of 150 rems, and to the extremities in excess of 375 rems.
2. The release of radioactive material which will, when averaged over 24 hours, exceed 5000 times the limits of Title 10, Part 20 Code of Federal Regulations, Appendix B, Table II.
3. A loss of one working week or more of any affected facility.
4. Damage to property in excess of $200,000.

B. 24-Hour Notification

1. Radiation exposure to the whole body in excess of 5 rems, to the skin of the whole body in excess of 30 rems, and to the extremities in excess of 75 rems.
2. The release of radioactive material which will, when averaged over 24 hours, exceed 500 times the limits of Title 10, Part 20 Code of Federal Regulations, Appendix B, Table II.
3. A loss of one working day or more of any affected facility.
4. Damage to property in excess of $2,000.

VIII. Facility Responsibilities (Radiation Safety Officer)

Each facility using ionizing radiation sources is charged with the responsibility of having a radiation safety program and a Radiation Safety Officer. Both are to be approved by the facility manager(s). The RSO is to be trained by a Health Physicist or someone approved by Health Physics Services when such training is necessary. The responsibilities of an RSO will vary depending upon the type of radiation sources being used in the facility. These are listed in more detail in subsequent sections of this manual.

IX. User Responsibilities

In many situations the use of radiation sources will require written procedures in addition to those in the applicable sections of the Health Physics Manual. Each user is expected to adhere to these procedures as well as those in the Manual. Any deviation from them is to be reported to the user's supervisor and/or RSO. When changes to procedures are necessary they should be discussed with the RSO and Health Physics Services before they are implemented.

X. Waste and Contaminated Materials

Although regulations permit the disposal of limited quantities of radioactive waste by burial in the ground, release to the atmosphere and release to sanitary sewer systems, such methods should not be used whenever other alternatives are feasible. On a regular basis waste pick-ups are scheduled in the St. Paul area by an NRC licensed waste disposal organization. This organization transports solid and liquid wastes to government licensed burial sites. Solid and liquid wastes should be packaged by 3M for transfer to the waste disposal organization.

Whenever radioisotope work may create significant airborne activity such work should be performed in hoods or glove boxes having special air cleaning systems such as absolute filters. Such systems will remove most of the particulate radioactivity which can then be discarded as solid waste material. Hoods and glove boxes designed to prevent release of material to the working environment as well as to the public environment require certain minimum specifications and often special monitoring systems. These monitoring systems usually consist of a means for exhaust stack sampling and are designed for continuous or intermittent sampling, depending on the need. A program establishing sampling frequency and analytical techniques must be prepared in conjunction with the monitoring system. Accordingly, Health Physics Services must be consulted when such systems are contemplated and designed.

Equipment which has been used for radioisotope work must be decontaminated before it can be used in a non-radiation area. The degree of decontamination necessary will depend upon the nature of the equipment, how it is to be used and the nature of the isotopes involved. These decisions will be made on an individual basis by Health Physics Services and will follow appropriate regulatory guidelines.

For the most part inexpensive glassware should be discarded as solid radioactive waste to avoid discharging radioactive material into the sanitary sewer systems as part of cleaning procedures. Laboratory equipment which cannot be discarded should be cleaned using procedures which will minimize the amount of radioactive material reaching the sanitary sewer.

Whenever it appears that significant amounts of radioactive material may be discharged into a sewer system a monitoring program is to be established. Such a program will consist of suitable sampling equipment and procedures for handling, analyzing, and recording sample results.

XI. Exposure Standards

Radiation exposure standards are based on the concept that an individual working with ionizing radiation sources can safely receive a whole body dose of 5 rem/calendar year from age 18 throughout his working lifetime. Included with this is the concept of dose bank which means that whenever a person receives less than 5 rem in any calendar year, the unused part can be incurred at the rate of 12 rem/year in succeeding years until such time that his total dose reaches 5 (Age-18). All 3M personnel engaged in activities covered by a Type A license are under the dose bank concept of exposure. An example of how this works is as follows.

If an employee is 30 years old, he is permitted to have an occupational exposure of 5 (30-18) which equals 60 rem. Should his accumulated exposure at age 30 be only 20 rem, he has a dose bank of 40 rem. His future allowable whole body exposure then becomes 3 rem/calendar quarter (12 rem/year) until such time he reaches the maximum of 5 (Age-18). However, a 3M administrative limit of 2 rem/calendar quarter has been established and an investigation is conducted whenever a user exceeds this value. Employees without a dose bank are restricted to 1.25 rem/calendar quarter (5 rem/year) until such time that a dose bank exists which will permit the additional exposure.

Personnel working under a Type B license are restricted by 3M to whole body exposures of 1.25 rem/calendar quarter (5 rem/year) and those working under a sealed source type license are restricted to 0.125 rem/calendar quarter (0.5 rem/year). Whole body exposures at the Medical Products sterilizer in Brookings, S.D. are limited to 1.25 rem/calendar quarter for those personnel who enter the sterilization room and 0.125 rem/calendar quarter for those personnel who are not required to enter the room.

For all licenses the regulations permit a dose to hands and forearms, feet and ankles of 18.75 rem/calendar quarter and for the skin of the whole body, 7.5 rem/calendar quarter. As with whole body exposures 3M administrative levels have been established and they are shown in the table below. These levels have been established in accordance with regulatory requirements to maintain exposures as low as reasonably achievable. An investigation will be conducted whenever personnel exceed the administrative levels.

The following table summarizes the quarterly dose limits.

Part of Body	Dose Limits (rem/calendar quarter)							
	NRC Limits		3M Limits					
			Type A		Type B	Sealed Source	Medical Products Sterilizer	
	With Dose Bank	Without Dose Bank	With Dose Bank	Without Dose Bank			Personnel Who Enter Sterilizer Room	Personnel Who Do Not Enter Sterilizer Room
Whole Body Dose	3.0	1.25	2.0	1.25	1.25	0.125	1.25	0.125
Skin of Whole Body Dose	7.5	7.5	5.0	5.0	5.0	0.5	5.0	0.5
Hands, Forearms, Feet and Ankles Dose	18.75	18.75	12.5	12.5	12.5	1.25	12.5	1.25

Although ionizing radiation source handling procedures strive to keep the radiation dose to the user as low as practicable, it is of special interest to minimize radiation exposure to certain types of users. Accordingly, Health Physics Services should be advised whenever users are less than 18 years of age or whenever a female learns she is pregnant. Normally no adjustment in job activities will be necessary, but the situation wil be reviewed to be certain minimal potential hazards exist and that exposures for these individuals are within the appropriate regulatory guidelines.

XII. Radiation Monitoring Equipment

Portable radiation detection instruments are in the possession of Health Physics Services for the purpose of assessing hazards from external radiation sources. These instruments include several "Cutie-Pie" type survey meters, two types of G-M counters, and a special alpha monitoring instrument. Similar instruments are in the possession of Central Research Laboratories, the Static Control Systems Department, and Riker Laboratories. Survey instruments are periodically calibrated in accordance with the procedures in NRC Regulatory Guide 8.21 to the extent of those procedures are appropriate for the instrument use.

Special laboratory analytical instruments are also directly or indirectly a part of the radiological health program of 3M. The analytical instruments include several liquid scintillation counters, internal proportional counters, G-M counters, count rate meters, multichannel gamma analyziers, and automated sample handling equipment.

XIII. Caution Signs

The use of warning signs having the radiation symbol along with such wording as "Caution - Radiation Area" is established by regulations. Each sign has a specific meaning and the conditions under which it is to be posted are specified. It is inappropriate and in Minnesota, illegal, to use these signs for any reason other than their stated purpose. Health Physics Services should be consulted whenever there is uncertainty as to their conditions of use.

Each of these signs has a yellow background with a purple or magenta three bladded propeller. Wording on the sign may be one of the following:

Caution - Radiation Area

Caution - Radioactive Material(s)

Caution - High Radiation Area

Caution - Airborne Radioactivity Area

Caution - This Equipment Produces X-Rays When Energized

Caution - This Equipment Produces Ionizing Radiation When Energized

This is an example of a typical label:

XIV. Inspections by Regulatory Agencies

The 3M Company is regularly inspected by a representative of the NRC and occasionally by a state agency. For example, Type A licenses are inspected semi-annually, Type B licenses biennially, and the Medical Products Sterilizer license every three years. Sealed source licenses are inspected on an unspecified schedule. The inspections include a review of records and a physical inspection of 3M's licensed facilities. Most inspections are unannounced, but do occur during normal working hours.

Health Physics Services is usually the first to be contacted when inspections are conducted in the St. Paul area. The scope of the inspection is outlined by the inspector after which the RSO's and users are notified. The inspection may last several days or several hours depending upon the type of license involved and the inspector's scope of activities. Should the inspector first contact a user or RSO in the St. Paul area that person should immediately notify Health Physics Services.

The RSO is usually the first person contacted in facilities outside the St. Paul area. Since these facilities generally only have sealed radioactive sources or ionizing radiation producing machines the inspections last only a few hours and consist mainly of reviewing records. Questions which cannot be answered by the RSO should be referred to Health Physics Services.

Upon completion of an inspection, 3M is verbally informed of the findings. A formal written notice of the NRC or state representative's findings is provided either at the completion of the inspection or mailed within 30 days following the visit. When noncompliance items are listed, the notice should be forwarded to Health Physics Services before any commitment is made to bring activities into compliance. Often the interpretation of being in compliance or in noncompliance involves the use of technical language with special meanings. Health Physics Services will correspond with the regulatory agency explaining 3M's position in the matter.

DEFINITIONS

Agreement State

A state which has reached an agreement with the U.S. Nuclear Regulatory Commission to assume responsibility for the licensing of byproduct radioactive material. The Agreement States are: Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Idaho, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, North Dakota, Oregon, South Carolina, Tennessee, Texas, and Washington.

Byproduct Material

Radioactive material which has been made radioactive or formed in the process of producing or utilizing special nuclear material in nuclear reactors. Byproduct material does not include source material, special nuclear material, accelerator produced radioactive material or radium.

Code of Federal Regulations - Title 10

Part 19 - "Notices, Instructions, and Reports to Workers; Inspections".
Part 20 - "Standards for Protection Against Radiation".
Part 21 - "Reporting of Defects and Noncompliance".
Part 30 - "Rules of General Applicability to Licensing of Byproduct Material".
Part 31 - "General Domestic Licenses for Byproduct Material".
Part 32 - "Specific Licenses to Manufacture or Transfer Certain Items Containing Byproduct Material".
Part 33 - "Specific Domestic Licenses of Broad Scope for Byproduct Material".
Part 34 - "Licenses for Radiography and Radiation Safety Requirements for Radiographic Operations".
Part 35 - "Human Uses of Byproduct Material".
Part 40 - "Domestic Licensing of Source Material".
Part 70 - "Domestic Licensing of Special Nuclear Material".
Part 71 - "Packaging of Radioactive Material for Transport and Transportation of Radioactive Material Under Certain Conditions".
Part 110 - "Export and Import of Nuclear Facilities and Materials".
Part 170 - "Fees for Facilities and Materials Licenses and Other Regulatory Services ...".

Detector Housing

The container or fixture in which the ionization detector is mounted in a thickness or level gauge.

Dosimeter

A device worn on the body for purposes of measuring the amount of radiation to which a person is exposed. Commonly this is a film badge, pocket ionization chamber or thermoluminescent device.

Exempt Distribution License

A license granted to a manufacturer or distributor which permits the distribution of small quantities of radioactive material to persons who are exempt from licensing requirements. Examples are radioactive self-luminous dials on wrist watches, clocks and compasses.

Facility

The place where ionizing radiation sources are used. When an entire building is used for ionizing radiation source work it is considered the facility. When a group of adjoining or nearby laboratories in a building are involved in ionizing radiation source work they are considered the facility. A single laboratory using ionizing radiation sources is a facility when adjacent laboratories do not use such sources. A manufacturing plant where thickness and level gauges are used is not considered a facility.

General License

A license granted to a manufacturer or distributor which permits the distribution of radioactive material to persons who must comply with certain sections of the Code of Federal Regulations. Examples are thickness gauges, level gauges, and static elimination devices which contain appreciable quantities of radioactive material but which are not directly accessible to the user.

Radiation Safety Officer (RSO)

The person directly responsible for the radiation safety program in a facility or manufacturing plant.

Sealed Source

Radioactive material which is encased in a capsule or otherwise sealed to prevent leakage or escape.

Source Assembly

A radioactive source and the shielding block attached thereto which has been designed for installation in the source housing of a thickness gauge. In some cases the shutter mechanism may also be part of the assembly.

Source Housing

The outer container or fixture in which the radioactive source, source assembly, and shutter mechanism is located in thickness and level gauges.

Source Material

Uranium or thorium, or any combination thereof in any physical or chemical form.

Special Nuclear Material

Plutonium and uranium enriched in the isotopes 233 or 235.

Type A Broad Scope License

A license authorizing receipt, acquisition, ownership, possession, use, transfer, and import of any chemical or physical form of the byproduct material specified in the license. The quantities specified are in the multicurie range.

Type B Broad Scope License

A license authorizing the receipt, acquisition, ownership, possession, use, transfer, and import of limited quantities of byproduct material in any chemical or physical form.

Unsealed Source

Radioactive material other than that in a sealed source.

User

Any individual who uses or handles ionizing radiation sources or is directly associated with the use and handling of such sources.

ATTACHMENT C

HEALTH PHYSICS SERVICES ORGANIZATION CHART

AND

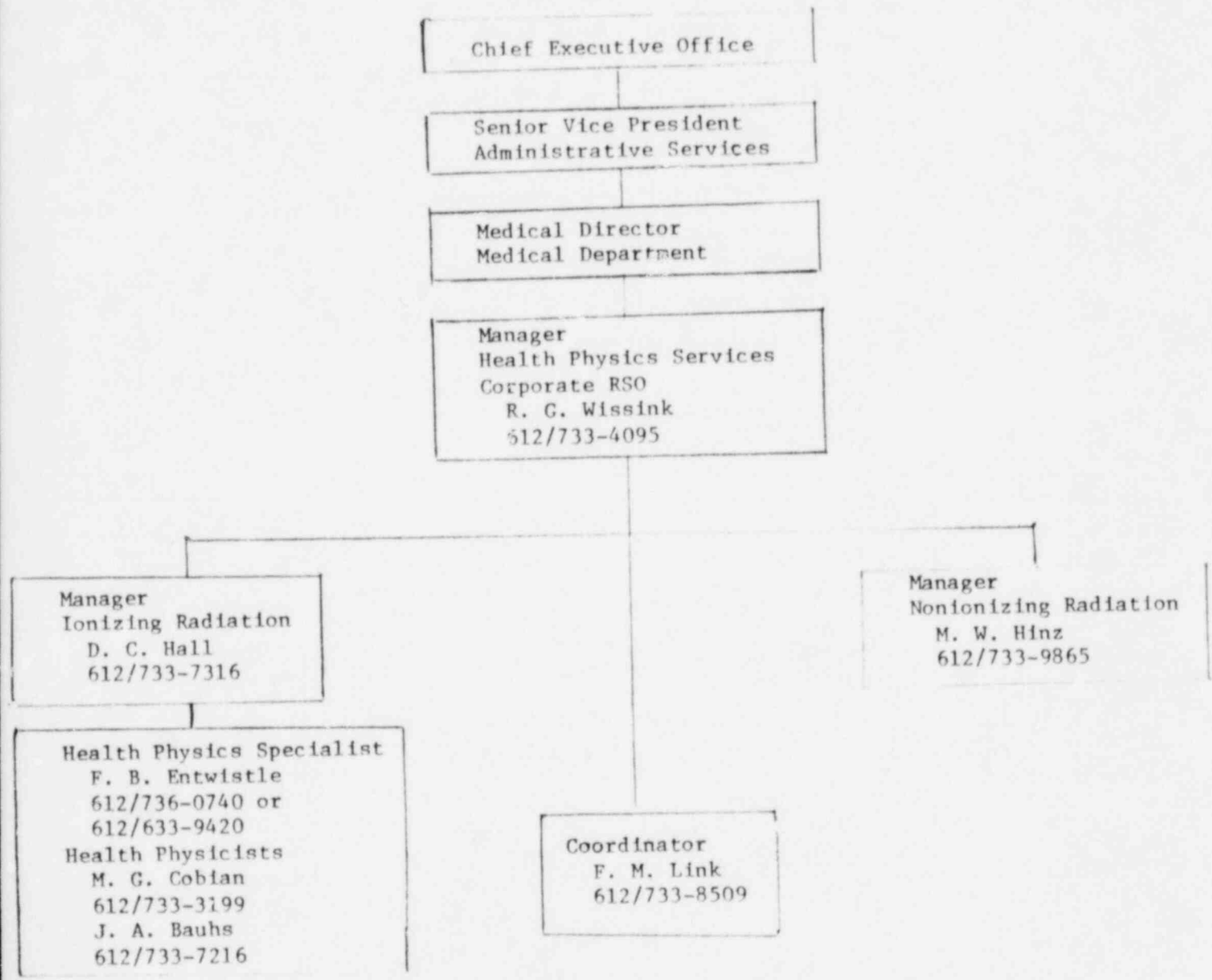
RESUMES

ATTACHMENT

CORPORATE RESPONSIBILITY

MEDICAL DEPARTMENT, HEALTH PHYSICS SERVICES, ORGANIZATION CHART

3M COMPANY, 3M CENTER, ST. PAUL, MINNESOTA 55144



RESUME

Name: Robert G. Wissink

Title: Manager, Health Physics Services

Educational Background:

Mankato State College, Mankato, Minnesota
B. S. Degree, 1957
Majors: Physics, Mathematics

University of Rochester, Rochester, New York
M. S. Degree, 1958
Major: Radiation Biology

Certified Health Physicist by American Board of Health Physics
Certified Safety Professional by the Board of Certified Safety Professionals

Employment History:

Minnesota Mining & Manufacturing Company
September, 1964 - Present
Responsibilities include planning, directing, and managing a corporate radiological health program for 3M and its subsidiaries, serving as Chairman of the 3M Isotope Committee, acting as Accountability Representative for Special Nuclear Materials, and acting as 3M liaison with federal and state regulatory agencies.

Rural Cooperative Power Association, Elk River, Minnesota
June, 1959 - September, 1964
Manager, Radiological Physics Department
Responsibilities included supervision of waste disposal, personnel monitoring, decontamination, radiochemistry, radiation monitoring, instrument calibration and environmental surveys for the AEC owned Elk River Reactor Facility.

Wisconsin State College, Whitewater, Wisconsin
September, 1958 - June, 1959
Instructor of Physics. Responsibilities included teaching courses in General Physics, Mechanics, and Atomic Physics. An Atomic Physics Laboratory program was established and conducted in connection with the Atomic Physics course.

September, 1957 - September, 1958
AEC Fellowship Student in Radiological Physics at the University of Rochester, and the Health Physics Division, Brookhaven National Laboratory.

Professional Activities:

Health Physics Society
Membership Committee 1967-70
Placement Committee 1970-73
Annual Meeting Place Committee 1973-76
Local Arrangements Committee, 23rd Annual Meeting (Chairperson) 1977-78
Board of Directors 1978-1981

North Central Chapter - Health Physics Society
Secretary 1970-71
President 1972-73

American Industrial Hygiene Association
Non-Ionizing Radiation Committee 1970-74
Ionizing Radiation Committee 1975-1979

American National Standards Institute
N43-3.2 Industrial Radiation Gauging Devices Committee 1975-Present

University of Minnesota
Guest Lecturer, School of Public Health 1964-Present

State of Minnesota
Minnesota Health Department Advisory Committee on Radiation Safety 1969-76

Governor's Task Force on Low Level Radioactive Waste Management 1981-

RESUME

Name: DUANE C. HALL

Title: Manager, Ionizing Radiation, Health Physics Services

Educational Background:

University of Wisconsin
River Falls, Wisconsin - B. S. Degree, 1962
Majors: Physics, Mathematics

Vanderbilt University
Nashville, Tennessee - M. S. Degree, 1965
Major: Physics
Certified Health Physicist by American Board of Health Physics

Employment History:

Minnesota Mining & Manufacturing Company
June, 1969 - present

Responsibilities include providing health physics assistance to individuals and groups within 3M Company to assure adequate safeguards are employed in work with radioactive materials and ionizing radiation, serving as a member of the 3M Company Isotope Committee and participating in the pre-evaluation of health and safety requirements for new projects and changes in established programs.

Niagara Mohawk Power Corporation, Buffalo, New York
September, 1968 - June, 1969 - Environmental Engineer

Nuclear Engineering Section
Special Projects Engineering Department
Responsibilities included assisting in selection of sites for nuclear and conventional fueled electric generating stations, establishment of programs for determination of necessary site, meteorological, limnological and geological information, establishment of environmental survey programs, and air and water pollution studies.

Rural Cooperative Power Association, Elk River, Minnesota
September, 1964 - September, 1968

Manager, Radiological Physics Department
Responsibilities included supervision of waste disposal, personnel monitoring, decontamination, radiochemistry, radiation monitoring, instrument calibration and environmental surveys for the AEC-owned Elk River Reactor Facility.

September, 1962 - September, 1964

AEC Health Physics Fellowship Student at Vanderbilt University and the Health Physics Division, Oak Ridge National Laboratory.

Professional Activities:

Health Physics Society
Plenary Member since 1964
Admissions Committee, 1969-72
Nominating Committee, 1973-76 (Chairperson 1974-76)
Affiliates Committee, 1977 to 1980
Local Arrangements Committee, 23rd Annual Meeting 1977-78

North Central Chapter - Health Physics Society
Member since 1970
Council Member, 1972-75
President Elect and Program Chairperson 1975-76
President, 1976-77

Upper Midwest Section - American Industrial Hygiene Association
Member since 1970

Publications: "Elk River Reactor Operating Experience: by R. J. Campbell, D. Hall, and D. Kettner; appearing in Nuclear Safety, December 1966, Volume 7, #4. "Internal Conversion Coefficients in the Decay of Cobalt-57" by D. C. Hall and R. G. Albridge, appearing in Nuclear Physics, A91, (1967), 493-504.

Papers: Co-author of paper entitled "Advantages of Air Operated Vacuum Pumps in Sampling Systems" presented by J. K. Sugg at the AIHA Annual Meeting in Minneapolis, MN, on June 5, 1975.

Author of paper entitled "Low Energy Beta Monitor" presented at the NCC-HPS April 14, 1972 meeting in Ames, IA.

RESUME

Name: Michael W. Hinz

Title: Manager, Nonionizing Radiation

Educational Background:

Worthington Community College, Worthington, Minnesota
A. A. Degree, 1969
Major: Physics

University of Minnesota, Minneapolis, Minnesota
B. Physics Degree, 1971
Major: Physics

University of Minnesota, Minneapolis, Minnesota
M. S. Degree, 1972
Major: Environmental Health

Certified Health Physicist by American Board of Health Physics

Employment History:

Minnesota Mining & Manufacturing Company
December, 1972 - Present

Responsibilities include providing health physics assistance to individuals and groups within 3M to assure adequate safeguards are employed in work with nonionizing radiation in laboratory and production areas. They also include participating in the pre-evaluation of health and safety requirements for new projects and changes in established programs.

June, 1971 - December, 1972

U. S. Public Health Service Fellowship Student in Environmental Health at the University of Minnesota, and the Health Physics Group, Lawrence Livermore Laboratory.

Mayo Clinic, Rochester, Minnesota
Summers of 1967, 1968, 1969, and 1970
Laboratory Technician in Biophysics

Responsible for radioisotope shipment logging and disposition, isotope assay, instrument calibration, radioisotope generator elution, radioisotope dilution work for patient injection, waste disposal, construction and calibration of a shadow shield whole body counter and environmental air sampling.

Michael W. Hinz (Resume continued)

Professional Activities:

Health Physics Society
Plenary member since 1973
Admissions Committee 1976-79
Local Arrangements Committee, 23rd Annual Meeting 1977-78
Program Committee 1980-1982

North Central Chapter - Health Physics Society
Member since 1973
Secretary 1976
Councilman 1976-1979
President-Elect 1980-1981
President 1981-1982

Upper Midwest Section - American Industrial Hygiene Association
Member since 1973

RESUME

Name: Michael G. Cobian

Title: Health Physicist

Educational Background:

University of Wisconsin - R.F.
River Falls, Wisconsin
B. S. Degree, 1973
Majors: Physics and Mathematics

University of Minnesota
Minneapolis, Minnesota
Major: Public Health
(Attended August, 1973 - July, 1974)

Employment History:

Minnesota Mining and Manufacturing Company
August, 1974 - Present

Responsibilities include providing health physics assistance to individuals and groups within 3M Company to assure adequate safeguards are employed in work with radioactive materials and ionizing radiation. They also include participating in the pre-evaluation of health and safety requirements for new projects and changes in established programs.

M. G. Cobian (Resume Continued)

Professional Activities:

Health Physics Society
Plenary Member 1977-Present

North Central Chapter - Health Physics Society
Member 1974-Present
Chapter Council 1978 - 1981

American Industrial Hygiene Association - Upper Midwest Local Section
Member 1976 - Present

RESUME

Name: Frederick B. Entwistle

Title: Health Physics Specialist

Educational Background:

University of California, San Diego; LaJolla, California
B. A. Degree, 1972
Major: Biology

The University of Michigan, Ann Arbor, Michigan
M. S. Degree, 1974
Major: Environmental Health Sciences
Certified Health Physicist by American Board of Health Physics

Employment History:

Minnesota Mining & Manufacturing Company
October, 1976 - Present
Responsibilities include providing health physics assistance to individuals and groups within 3M Company to assure adequate safeguards are employed in work with ionizing radiation in manufacturing areas. They also include participating in the pre-evaluation of health and safety requirements for new projects and changes in established programs.

Minnesota Department of Health
February, 1976 - October, 1976
Radiation Technician
Responsibilities included the inspection of x-ray machines and other sources of radiation regulated by the State of Minnesota for compliance with state and federal standards. They also included evaluation of shielding plans for x-ray installations and updating of the state radiological emergency plan.

The University of Michigan
May, 1974 - May, 1975
Research assistant and teaching assistant in the School of Health.
Responsible for lectures and laboratory exercises in radiation physics and dosimetry and for the design and operation of an environmental monitoring program.

September, 1972 - May, 1974
HEW Health Physics Traineeship student at the University of Michigan and the Chalk River National Laboratory, Atomic Energy of Canada, Limited.

F. B. Entwistle (Resume continued)

Professional Activities:

Health Physics Society	
Member	1973-Present

North Central Chapter - Health Physics Society	
Member	1976-Present
Secretary-Treasurer	1981-83

RESUME

Name: John A. Bauhs

Title: Health Physicist

Educational Background:

University of Wisconsin-Stevens Point
Stevens Point, Wisconsin - B.S. Degree, 1977
Majors: Physics, Mathematics

University of Wisconsin - Madison
Madison, Wisconsin - M.S. Degree, 1980
Major: Radiological Sciences

Employment History:

Minnesota Mining & Manufacturing Company
May, 1980 - Present

Responsibilities include providing health physics assistance to individuals and groups within 3M Company to assure adequate safeguards are employed in work with radioactive materials and ionizing radiation. They also include participating in the pre-evaluation of health and safety requirements for new projects and changes in established programs.

UW - Madison, Medical Physics Department
September, 1977 - May, 1979 and September, 1979 May, 1980

Research Assistant at the University's Gas Target Neutron Source. Responsibilities included TLD and ionization chamber dosimetry, also the design and construction of detectors and electronic equipment. Special projects included an analysis of the atmospheric dispersion of tritium stack releases.

Teaching assistant for graduate level Health Physics and Radiotherapy Physics courses. Responsibilities included the design and teaching of labs and correcting papers.

UW - Madison, Synchrotron Radiation Center
June, 1979 - September, 1979

Research Assistant

Responsibilities included an analysis of the potential radiation hazard of the Aladdin 1 GeV electron storage ring and the submission of a comprehensive report on the radiation hazard including proposed shielding.

John A. Bauhs (Resume Continued)

Professional Activities:	Health Physics Society Member since 1978
Publications:	Bauhs, J. A. and P. M. DeLuca, Aladdin Radiation Safety Report. Wisconsin Medical Physics Report No. WMP-118 (April, 1980). DeLuca, P. M., J. A. Bauhs, D. W. Pearson, "Calculated and Measured HTO Atmospheric Dispersion Rates Within Meters of a Release Site:, Health Physics Journal. Vol 41, P 191 (July 1981).