RECEIVED
SEP 26 1983

030-20266

FORM NRC-313 I (3-80) 10 CFR 30

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
INDUSTRIAL

1. APPLICATION FOR: *(Check and/or complete as appropriate)*

TZ&Z (23111)

X	a. NEW LICENSE
	b. AMENDMENT TO: LICENSE NUMBER
	c. RENEWAL OF: LICENSE NUMBER

See attached instructions for details.

Completed applications are filed in duplicate with the Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety, and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555 or applications may be filed in person at the Commission's office at 1717 H Street, NW, Washington, D. C. or 7915 Eastern Avenue, Silver Spring, Maryland.

2. **APPLICANT'S NAME** *(Institution, firm, person, etc.)*

Silver King Mines, Inc.

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
605-662-7203

3. **NAME AND TITLE OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION**

Gary W. Cummings, Resident Manager

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
605-662-7203-202

4. **APPLICANT'S MAILING ADDRESS** *(Include Zip Code)*
(Address to which NRC correspondence, notices, bulletins, etc., should be sent.)

P. O. Box 49
TVA Mill - East of the Railroad Tracks
Edgemont, South Dakota, 57735

5. **STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED** *(Include Zip Code)*

At the address listed in Item #4.

(IF MORE SPACE IS NEEDED FOR ANY ITEM, USE ADDITIONAL PROPERLY KEYED PAGES.)

6. **INDIVIDUAL(S) WHO WILL USE OR DIRECTLY SUPERVISE THE USE OF LICENSED MATERIAL**
(See Items 16 and 17 for required training and experience of each individual named below)

	FULL NAME
a.	Please see attached Sheet No. 1
b.	
c.	

RECEIVED BY LFMB
Date 9/28/83
Log Sept TV
By Brown
Orig. To
Action Comp

Applicant 30-32
Check No. #1170-3L
Amount/Fee Application
Type of Fee
Date Check Rec'd 9/28/83
Received By Brown

7. **RADIATION PROTECTION OFFICER**

George Thomas Wilson

Attach a resume of person's training and experience as outlined in Items 16 and 17 and describe his responsibilities under Item 15.

8. **LICENSED MATERIAL**

LINE NO.	A ELEMENT AND MASS NUMBER	B CHEMICAL AND/OR PHYSICAL FORM	C NAME OF MANUFACTURER AND MODEL NUMBER *(If Sealed Source)*	D MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTIVITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME
(1)	Am241:Be	Sealed Source	As per Troxler drawing # A-102451	2 Sources, No single source to exceed 40 mCi
(2)	Cs137	Sealed Source	As per Troxler drawing # A-102112	2 Sources, No single source to exceed 9 mCi
(3)	Ra226	Sealed Source Special Form Material	Iso. Prod. Labs. Model HGE-226-1 Type 193	No single source to exceed 1.05 mCi
(4)	Please see attached Sheet	No. 2.		

	E DESCRIBE USE OF LICENSED MATERIAL
(1)	For use in a Troxler Model 3411B Surface Moisture Density Guage to measure properties of construction materials.
(2)	For use in a Troxler Model 3411B Surface Moisture Density Guage to measure properties of construction materials.
(3)	For use in portable radiation survey instrument calibration (please see Item 10b).
(4)	See sttached Sheet No. 2.

FORM NRC-3

60097

9. STORAGE OF SEALED SOURCES

LINE NO.	CONTAINER AND/OR DEVICE IN WHICH EACH SEALED SOURCE WILL BE STORED OR USED. A.	NAME OF MANUFACTURER B.	MODEL NUMBER C.
(1)	Surface Moisture Desnsity Guage	Troxler Electronics	Model 3411B
(2)	Surface Moisture Density Guage	Troxler Electronics	Model 3411B
(3)	D.O.T. 7A Type A/Shipping/Storage Container	Iso. Prod. Labs.	N/A
(4)	Sources listed in Item 8, Line No.'s 4, 5 and 6 are low activity electro-deposited Alpha sources.		

10. RADIATION DETECTION INSTRUMENTS

LINE NO.	TYPE OF INSTRUMENT A	MANUFACTURER'S NAME B	MODEL NUMBER C	NUMBER AVAILABLE D	RADIATION DETECTED (alpha, beta, gamma, neutron) E	SENSITIVITY RANGE (milliroentgens/hour or count/minute) F
(1)	Gamma Scintillometer	Ludlum	Model 19	4	Gamma	0-250 mR/hr
(2)	Geiger-Muller	Ludlum	Model 3-99 Model 44-9	2	Alpha, Beta, Gamma	0-50,000 cpm
(3)	Geiger-Muller	Ludlum	Model 177 Model 44-9	1	Alpha, Beta, Gamma	0-50,000 cpm
(4)	Alpha-Scintillometer	Ludlum	Model 3-99 Model 43-5	3	Alpha	0-50,000 cpm

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

☒ a. CALIBRATED BY SERVICE COMPANY

NAME, ADDRESS, AND FREQUENCY

Please see attached Sheet No. 3

☒ b. CALIBRATED BY APPLICANT

Attach a separate sheet describing method, frequency and standards used for calibrating instruments.

Please see attached Sheet No. 3

12. PERSONNEL MONITORING DEVICES

TYPE (Check and/or complete as appropriate.) A	SUPPLIER (Service Company) B	EXCHANGE FREQUENCY C
☐ (1) FILM BADGE	Tennessee Valley Authority Western Area Radiological Laboratory Muscle Shoals, Alabama, 35660	☒ MONTHLY
☒ (2) THERMOLUMINESCENCE DOSIMETER (TLD)		☐ QUARTERLY
☐ (3) OTHER (Specify): _____		☐ OTHER (Specify):

13. FACILITIES AND EQUIPMENT (Check were appropriate and attach annotated sketch(es) and description(s).

☐ a. LABORATORY FACILITIES, PLANT FACILITIES, FUME HOODS (Include filtration, if any), ETC.

☒ b. STORAGE FACILITIES, CONTAINERS, SPECIAL SHIELDING (fixed and/or temporary), ETC. (Please see attached Sheet No. 7)

☐ c. REMOTE HANDLING TOOLS OR EQUIPMENT, ETC.

☐ d. RESPIRATORY PROTECTIVE EQUIPMENT, ETC.

14. WASTE DISPOSAL

a. NAME OF COMMERCIAL WASTE DISPOSAL SERVICE EMPLOYED

NONE

b. IF COMMERCIAL WASTE DISPOSAL SERVICE IS NOT EMPLOYED, SUBMIT A DETAILED DESCRIPTION OF METHODS WHICH WILL BE USED FOR DISPOSING OF RADIOACTIVE WASTES AND ESTIMATES OF THE TYPE AND AMOUNT OF ACTIVITY INVOLVED. IF THE APPLICATION IS FOR SEALED SOURCES AND DEVICES AND THEY WILL BE RETURNED TO THE MANUFACTURER, SO STATE.

Licensed material will be returned to the manufacturer for disposition or sold to another user licensed to possess such material. The material identified in Item 8, Line No.'s 1 and 2, will be sold to another licensed user as an instrument only.

INFORMATION REQUIRED FOR ITEMS 15, 16 AND 17

Describe in detail the information required for Items 15, 16 and 17. Begin each item on a separate page and key to the application as follows:

15. RADIATION PROTECTION PROGRAM. Describe the radiation protection program as appropriate for the material to be used including the duties and responsibilities of the Radiation Protection Officer, control measures, bioassay procedures *(if needed)*, day-to-day general safety instruction to be followed, etc. If the application is for sealed source's also submit leak testing procedures, or if leak testing will be performed using a leak test kit, specify manufacturer and model number of the leak test kit.

16. FORMAL TRAINING IN RADIATION SAFETY. Attach a resume for each individual named in Items 6 and 7. Describe individual's formal training in the following areas where applicable. Include the name of person or institution providing the training, duration of training, when training was received, etc.

    a. Principles and practices of radiation protection.

    b. Radioactivity measurement standardization and monitoring techniques and instruments.

    c. Mathematics and calculations basic to the use and measurement of radioactivity.

    d. Biological effects of radiation.

17. EXPERIENCE. Attach a resume for each individual named in Items 6 and 7. Describe individual's work experience with radiation, including where experience was obtained. Work experience or on-the-job training should be commensurate with the proposed use. Include list of radioisotopes and maximum activity of each used.

18. CERTIFICATE

(This item must be completed by applicant)

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 30, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.

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.

a. LICENSE FEE REQUIRED *(See Section 170.31, 10 CFR 170)* 10 CFR 170.31.3.L $110.00	b. CERTIFYING OFFICIAL *(Signature)* Gary W. Cummings c. NAME *(Type or print)* Gary W. Cummings
(1) LICENSE FEE CATEGORY: Application New License	d. TITLE Resident Manager
(2) LICENSE FEE ENCLOSED: $110.00	e. DATE 9-20-83

FORM NRC-313 I (3-80)

Attached Sheet No. 1 Item No. 6
Byproduct Material License Application
For: Silver King Mines, Inc.
P. O. Box 49
Edgemont, South Dakota, 57735
Telephone: 605-662-7203

INDIVIDUALS WHO WILL USE OR DIRECTLY SUPERVISE THE USE OF LICENSED MATERIAL

A. ONLY THE LICENSED MATERIAL SPECIFIED IN ITEM 8, LINE NO.'S 1 AND 2

a. Keith Edwin Andersen, Chief Engineer

b. John William Koller, Field Supervisor

c. James Allen Miller, Surveyor

d. Additional personnel who as a minimum have completed the manufacturer's (TROXLER ELECTRONICS) training or equivalent, been instructed in Silver King Mines, Inc. operating and emergency procedures relating to nuclear density gauges, demonstrated their knowledge in the safe use of the equipment, and are authorized in writing by the Radiation Safety Officer will be allowed to operate the equipment.

B. INDIVIDUALS WHO WILL USE OR SUPERVISE THE USE OF ANY LICENSED MATERIAL SPECIFIED IN ITEM 8

a. George Thomas Wilson, Radiation Safety Officer

b. Robert Dwight Sedlacek, Radiation Safety Technician

c. Robert George Harding, Radiation Safety Technician

d. Paula Jean Bonner, Environmental Technician

60097

Attached Sheet No. 2 Item No. 8
Byproduct Material License Application
For: Silver King Mines, Inc.
P. O. Box 49
Edgemont, South Dakota, 57735
Telephone: 605-662-7203

8. LICENSED MATERIAL - Continued

Line No.	Element and Mass Number	Chemical and/or Physical Form	Name of Manufacture and Model Number	Maximum Number of Millicuries and/or Sealed Sources and Maximum Activity Per Source Which Will Be Possessed At Any One Time
	A	B	C	D
(4)	Am-241	Electro-Deposition to a mirror finish Platinum Foil	Not Applicable	No single source to exceed 0.105×10^{-3} mCi
(5)	Ra-226	Electro-Deposition to a mirror finish Platinum Foil	N/A	No single source to exceed 0.105×10^{-3} mCi
(6)	Pc-210	Electro-Deposition to a mirror finish Platinum Foil	N/A	No single source to exceed 0.105×10^{-3} mCi

DESCRIBE USE OF LICENSED MATERIAL

E

(4) To be used as an energy marker for an alpha spectroscopy system.

(5) To be used as an energy marker for an alpha spectroscopy system.

(6) To be used as an energy marker for an alpha spectroscopy system.

Attached Sheet No. 3 Item No. 11

Byproduct Material License Application

For: Silver King Mines, Inc.
P. O. Box 49
Edgemont, South Dakota, 57735
Telephone: 605-662-7203

CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

11a. At the present time the instruments are calibrated by the manufacturer:

Ludlum Measurements, Inc.
501 Oak Street
Sweetwater, Texas 79556

Radiation detection instruments are calibrated semi-annually or at the manufacturer's recommended interval, whichever is shorter. Quality assurance records and charts are maintained for each instrument. Instruments are recalibrated when they vary by more than 20% from the expected check value.

On issuance of the byproduct material license and acquisition of the proper sources, the instruments will be calibrated by the applicant following procedure described in Item 11b.

11b. Radiation detection instruments are calibrated semi-annually or at the manufacturer's recommended interval which ever is shorter, or when QA records and charts indicate the need.

Only persons qualified to use the source, familiar with calibration procedures and authorized by the RSO will calibrate detection equipment.

Attached Sheet No. 4
Byproduct Material License Application
For: Silver King Mines, Inc.
P. O. Box 49
Edgemont, South Dakota, 57735
Telephone: 605-662-7203

Item No. 11 (continued)

GAMMA SCINTILLATOR CALIBRATION PROCEDURES

1. Calculate the present activity of the calibration source using the formula:

$$A = A_o e^{-\lambda t}$$

2. Calculate the exposure rate at one meter, using the present activity calculated in Step No. 1 and the formula: $\Gamma = 0.156\ nE(10^5\ \mu a)$.

Γ = mR/hr at 1 meter per mCi

n = gamma quanta per disintegration

E = energy of gamma quanta in MeV

μa = energy absorption coefficient for gamma in air (STP) in cm-3

3. Select exposure rates that correspond to approximately 1/3 and 2/3 full scale readings for each range on the instrument being calibrated. Using the inverse square law, $mR/hr = n\Gamma/S^2$ calculate the calibration distances necessary to provide the selected exposure rates.

4. Measure and mark the appropriate distances calculated in Step 3. Calibration distances are measured from the active center of the calibration source to the active center of the detector.

5. Using the volt meter in the electronic calibrator, determine the voltage plateau set the high voltage slightly above the plateau center by adjusting the high voltage potentiometer. Using the pulser, adjust the range potientiometers so the meter indicates the pulser input value for each range. Make initial adjustment of each range by this method.

6. Place the appropriate warning signs limiting access to the calibration area. Bring the instruments to be calibrated and the calibration equipment to the calibration area.

Obtain the source in its container from the storage cabinet. Remove the source from the container with forceps and attach it to the source holder.

7. Place the source center at the position marked in Step 4. Place the detector center in the first position marked in Step 4. Set the range switch to the appropriate range and check the instrument reading. If necessary, adjust it with the appropriate potientiometer to bring the instrument to the correct value. Continue calibration at the various locations though the instrument ranges making adjustments as necessary. Record the data on the calibration sheet.
8. When the necessary calibration data has been taken and adjustments made, return the source to its container and the container to the storage area. Secure and lock the storage area.
9. Complete the calibration form, verifying all scales are with in ±10% of the true rate or determine the appropriate correction factor and attach a calibration certificate with correction factors to the instrument. The person calibrating the instrument must date and sign the certificate and indicate when calibration is next due.

Note: Never leave the source unattended except when properly secured in the storage area.

G-M Calibration Procedures

1. Using the electronic pulser set the high voltage control to the G-M detector operating voltage (normally 900V).
2. With the pulse generator, calibrate the meter scale at 1/3 and 2/3 full scale by adjusting the range calibration potentiometer, so the instrument reading matches the pulser input. Do this for each meter range.

3. Determining the calibration distances for the source calibration. (See Steps 1, 2, 3 and 4 in Gamma Scintillator Calibration Procedures.)

4. Take the instruments and necessary equipment to the calibration area and post the appropriate warning signs. Remove the calibration source and container from the secure area and bring it to the calibration area. Using the forceps remove the source from its container and attach it to the source holder.

5. Expose the instrument to the known radiation field established in Step 3. Check instrument/detector response and make calibration adjustments as necessary.

6. Return the source and container to the storage area, and secure the area.

Alpha Scintillometer Calibration

1. Determine the detector operating voltage. Expose the detector to an alpha calibration source, using the volt meter in the electronic calibrator establish an operating voltage plateau curve (applied voltage vs. count rate).

2. Set the operating voltage at the flattest portion of the curve developed in Step 1.

3. Using the pulser set the meter scale, for each range, to correspond to the pulser input. Use values 1/3 and 2/3 full scale for each range.

4. Calculate the activity of the calibration source ($A = A_o e^{-\lambda t}$) and exposing the detector to the source and adjust the calibration controls to the desired reading.

5. Determine the system efficiency by counting a source of known activity (traceable to NBS). Efficiency is counts per minute read on the meter divided by the 4π Activity of the Source (DPM).

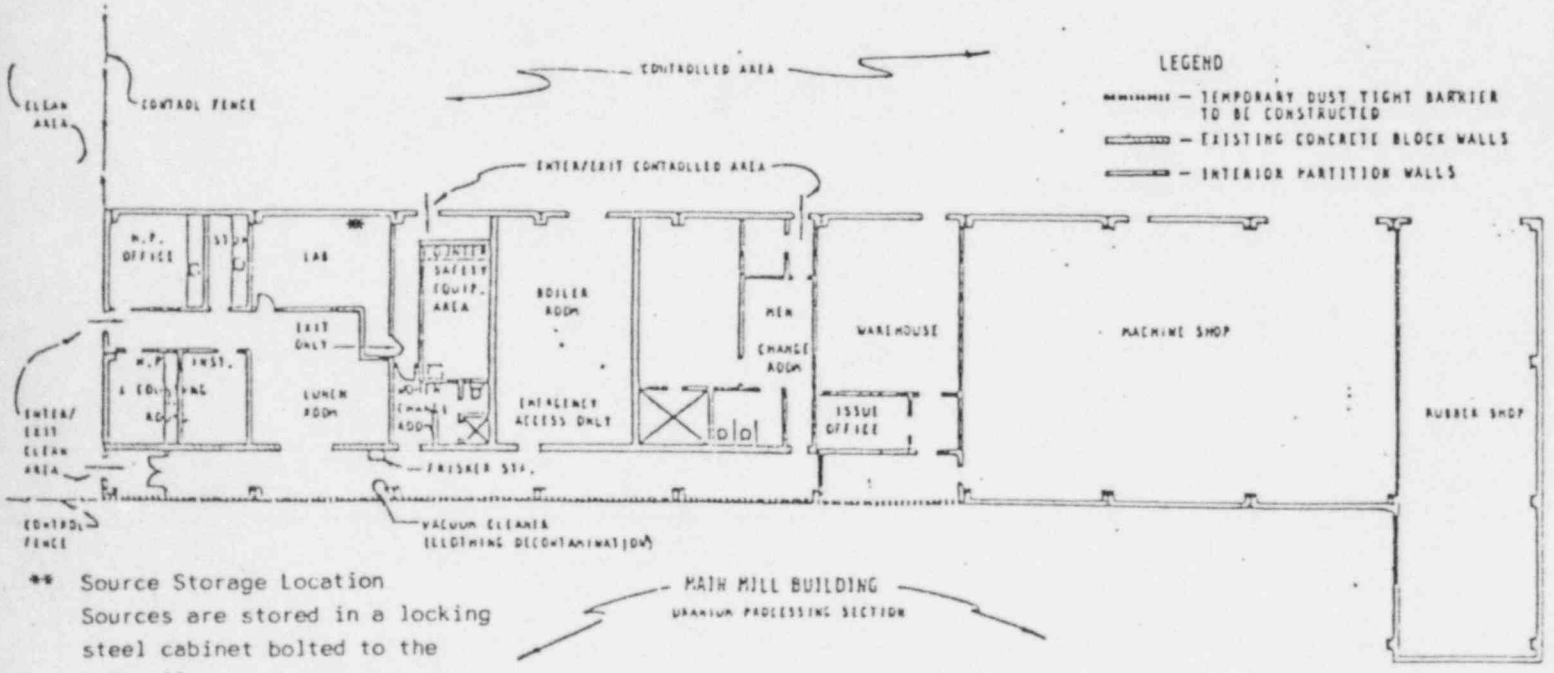
Attached Sheet No. 7 Item No. 13
Byproduct Material License Application
For: Silver King Mines, Inc.
P. O. Box 49
Edgemont, South Dakota, 57735
Telephone: 605-662-7203

13 b. Storage Facilities, Containers, Special Shielding

The storage facility is an upright steel storage cabinet with locking doors. The cabinet is located in the laboratory area as indicated in Figure 1 and is firmly bolted to the laboratory wall. The Resident Manager and RSO have the cabinet keys and control access to the sources. Both doors leading into the laboratory lock as do the three exterior building doors leading to the area.

The sources are stored in the shipping/storage containers identified in Item No. 9.

Special shielding is not used. The shipping and storage containers identified in Item 9 should provide adequate shielding. Of the rooms adjacent to the source storage area, the laboratory has the highest occupancy at approximately 24 man-hours per week. The remaining adjacent rooms are rarely occupied, approximately 10 man-hours per week.



** Source Storage Location
Sources are stored in a locking steel cabinet bolted to the Lab wall.

Fig. 1 NORTH SECTION of the MAIN MILL BUILDING
CONTAMINATION CONTROL FACILITY

Attached Sheet No. 8 Item No. 15
Byproduct Material License Application
For: Silver King Mines, Inc.
P. O. Box 49
Edgemont, South Dakota, 57735
Telephone: 605-662-7203

RADIATION PROTECTION PROGRAM, as related to the Licensed Material

I. RADIATION PROTECTION OFFICER RESPONSIBILITIES ARE TO:

A) Coordinate the safe use of licensed material.

B) Assure compliance with the requirements of Title 10 CFR Parts 19, 20, applicable state regulations, and all applicable US DOT regulations.

C) Assure byproduct materials possessed under the license are in conformity to materials listed on the license.

D) Assure that use of devices is only by persons named as users under the license or persons who have completed acceptable training.

E) Assure all users wear personnel monitoring while using gauges, or sealed sources.

F) Assure sources are properly secured against unauthorized removal at all times.

G) Serve as point of contact and give assistance in case of emergency to insure that all proper authorities are notified promptly in case of accidents.

H) Assure that terms and conditions of the license are met such as:

1) Periodic leak tests are performed.
2) All required records are kept and reviewed periodically for compliance with regulations: these include source certificates, leak test reports, personnel exposure reports, and records of transfer of radioactive materials.

II. RADIATION PROTECTION PROGRAM

A. Handling Procedures

1. No one shall operate, attempt to operate, or transport an instrument or sealed source unless they have been authorized by the RSO to do so.

2. Each source shall be kept in a "safe" or stored position when not in use.

3. Each employee shall wear a film badge or other dose measurement device when using or transporting the instrument or sealed source.

4. Never expose yourself to the bare source without sufficient reason for justification of the additional dose.

5. Keep all unauthorized persons out of the operating area. Unauthorized persons should be no closer than 5 meters (15 feet). The general public must not be unnecessarily exposed to radiation.

6. At all times the gauge's and sources shall be secured against unauthorized removal. If stolen, they could be abandoned under conditions which could be hazardous.

7. Insure that the gauge has had leak tests performed at the intervals required by the Radioactive Materials License.

8. If there are any doubts about use of the instrument, ASK. The Radiation Safety Officer either knows the answer or will obtain one.

B. SECURITY

Locks shall be maintained on the equipment to prevent accidental exposure of the sealed source when not under the direct supervision of authorized personnel. In addition, storage containers shall be physically secured to prevent tampering or removal by unauthorized personnel.

C. PERSONNEL MONITORING

If personnel monitoring is required, no person shall use equipment unless he is in possession of the appropriate form of dosimetry. Equipment or sources specified in Item 8, Line No.'s 1, 2 and 3, require the use of dosimeters.

D. RECORDS AND REPORTS

1. A biannual physical inventory to account for all sealed sources received and possessed under the license shall be performed. The inventory record shall be maintained for inspection, and filed in a fireproof cabinet.

2. All sealed sources shall be leak tested at the interval required by the license. When transferred, in the absence of a leak test certificate, the source shall not be put into use until so tested.

3. Reports from the dosimetry service shall be maintained on file for inspection.

4. When an employee terminates employment, a record of the total received dose shall be made available to the individual on request.

E. INCIDENTS

1. Immediate telephone notification shall be made to the following in the event of loss of a sealed source, whether accidental or due to theft.

A. Company Radiological Safety Officer

B. U. S. NRC Region IV Office

C. State Department of Water and Natural Resources, Radiological Protection Division

D. Local Authorities
Fire, police, or state highway patrol, if necessary.

E. Troxler Electronic Laboratories, or Isotope Products Laboratories, if necessary.

Within 30 days after the loss, a written report must be filed with NRC giving detailed description of the source, circumstances of the loss, statement of disposition, possible radition exposures or hazard, actions taken to recover the source, and procedures which will be implemented to prevent a recurrence of the loss or theft.

2. Any exposure of operators which exceeds the limits given in 10 CFR part 20 shall be reported to the NRC detailing circumstances of the exposure, possible injury, and measures taken to prevent a recurrence.

F. EMERGENCY PROCEDURES

1. INVOLVING SURFACE MOISTURE DENSITY GAUGES

A. In the event of physical damage to a gauge, an exclusion area with a radius of fifteen (15) feet around the gauge shall be maintained until the extent of source damage (if any) is determined. If a vehicle is involved, it must be stopped and remain stopped until the extent of contamination hazard (if any) is determined. If visual examination of the instrument and source indicates damage to the source, including fracture of the weld, the appropriate authorities and Troxler Electronic Laboratories, Inc. should be notified. The instrument may be removed from the site by using a shovel or other long handled instrument and placed in a suitable container such as a metal drum.

B. In the event of source leakage or separation (real or suspected) of a source from its normal containment, the 15 feet exclusion area shall be maintained until the arrival of the appropriate authorities.

60097

C. If the rod containing the source becomes separated from the gauge, the rod will be picked up using pliers or tongs and inserted into top of the instrument, thus providing shielding. The rod shall then be secured in place using tape to prevent accidental unshielding of the source.

2. INVOLVING OTHER SEALED SOURCES

A. In the event of physical damage to a sealed source an exclusion area of 15 feet radius will be established around the source and will be maintained until the extent of damage to the source can be determined. If visual examination of the source indicates damage, including fracture of the welds, the appropriate authorities and the manufacturer will be notified.

B. In the event of source leakage or separation (real or suspected) the 15 feet exclusion area shall be maintained until the arrival of the appropriate authorities.

G. TRANSPORT BY PRIVATE MOTOR VEHICLE

1. The surface moisture density gauge, in its container, may be transported by motor vehicle under the "YELLOW II" label without placarding the vehicle as required by 49 C R 177.823.

The device shall be locked and its container placed in a portion of the vehicle which can be locked. When not in transit the equipment shall be stored in a secured area.

Since the container has a Transport Index of 0.1 or greater it may not be stored less than 30 centimeters from passengers per 40 CFR 174.586. It also shall not be stored for more than 8 hours at less than 1 meter from undeveloped film.

2. Other sources will be transported in accordance with applicable D.O.T. regulations.

H. LEAK TESTS

Tests for leakage shall be performed utilizing the Troxler Model 3880 Leak Test Kit or the equivalent.

Attached Sheet No. 12 Item No. 16
Byproduct Material License Application
For: Silver King Mines, Inc.
P. O. Box 49
Edgemont, South Dakota, 57735
Telephone: 605-662-7203

FORMAL TRAINING IN RADIATION SAFETY

1. Keith Edwin Andersen, Chief Engineer

12/3/80 Training course for the use of Nuclear Testing Equipment, presented by TROXLER ELECTRONIC LABORATORIES, INC. covering the following material:

A. Radiologic Safety

1. Principals and Practices of Radiation Protection

2. Leak Testing Procedures

3. Mathematics and Calculations Basic to the Use and Measurement of Radioactivity

4. Biological Effects of Radiation

5. Radioactive Measurement Standardization and Monitoring Techniques and Instruments

6. Accident and Incident Procedures

7. Procedures for Nuclear Gauge Storage and Transportation

8. General Safety Precautions

B. Gauge Operation

1. Instrument Theory

2. Operating Procedures

3. Maintenance

4. Field Application

5. Gauge Calibration

60097

2. John William Koller, Field Supervisor

Training:

12/3/80 Training course for use of Nuclear Testing Equipment, presented by TROXLER ELECTRONIC LABORATORIES, INC.

A. Radiologic Safety

1. Principals and Practices of Radiation Protection
2. Leak Testing Procedures
3. Mathematics and Calculations Basic to the Use and Measurement of Radioactivity
4. Biological Effects of Radiation
5. Radioactive Measurement Standardization and Monitoring Techniques and Instruments
6. Accident and Incident Procedures
7. Procedures for Nuclear Gauge Storage and Transportation
8. General Safety Precautions

B. Gauge Operation

1. Instrument Theory
2. Operating Procedures
3. Maintenance
4. Field Application
5. Gauge Calibration

3. James Allen Miller, Surveyor

Training:

12/3/80 Training course for use of Nuclear Testing Equipment, presented by TROXLER ELECTRONIC LABORATORIES, INC.

A. Radiologic Safety

1. Principals and Practices of Radiation Protection
2. Leak Testing Procedures
3. Mathematics and Calculations Basic to the Use and Measurement of Radioactivity
4. Biological Effects of Radiation
5. Radioactive Measurement Standardization and Monitoring Techniques and Instruments
6. Accident and Incident Procedures
7. Procedures for Nuclear Gauge Storage and Transportation
8. General Safety Precautions

B. Gauge Operation

1. Instrument Theory
2. Operating Procedures
3. Maintenance
4. Field Application
5. Gauge Calibration

4. Robert Dwight Sedlacek, Radiation Safety Technician

Training:

June 1983: URANIUM MINE RADIATION SAFETY COURSE

Presented by: Canadian Institute for Radiation Safety, a 40 hour course. Please see attached course outline (Appendix A).

Nov. 15-17, 1982: Radiation Monitoring and Control Reteted to Uranium Mining and Milling, am 18 hour course presented by the United States Department of Labor, Mine Safety and Health Administration. Please see attached course outline (Appendix B).

October 1982: Radiation Protection and Environmental Surveillance for Uranium Resource Organizations, a 40 hour course presented by Eberline Corporation. Please see attached course outline (Appendix C).

60097

5. Robert George Harding, Radiation Safety Technician

Training:

June 1983: URANIUM MINE RADIATION SAFETY COURSE

Presented by: Canadian Institute for Radiation Safety, a 40 hour course.

Please see attached outline (Appendix A).

March 1983: Introduction to Health Physics, a 40 hour course presented by Eberline.

Please see attached outline (Appendix D).

November 1982: Radition Monitoring and Control Related to Uranium Mining and Milling, an 18 hour course. Presented by the United States Department of Labor, Mine Safety and Health Administration. Please see attached outline (Appendix C).

6. Paula Jean Bonner, Environmental Technician

Training:

June 1983: URANIUM MINE RADIATION SAFETY COURSE

Presented by: The Canadian Institute for Radiation Safety, a 40 hours course. Please see attached outline for details (Appendix A).

November 1982: Radiation Monitoring and Control Related to Uranium Mining and Milling, an 18 hour course. Presented by: the United States Department of Labor, Mine Safety and Health Administration. Please see attached course outline (Appendix B).

October 1982: Radiation Protection and Environmental Surveillance for Uranium Resource Organizations, a 40 hour course presented by Eberline Corporation. Please see attached course outline (Appendix C).

7. George Thomas Wilson, Radiation Safety Officer

Training:

Nov. 4-5, 1982: Applied Health Physics
Presented by: Oak Ridge Associated Universities. A copy of the course outline is attached (Appendix E).

Dec. 3, 1980: Training course for use of Nuclear Testing Equipment presented by TROXLER ELECTRONIC LABORATORIES, INC.

A. Radiologic Safety

1. Principals and Practices of Radiation Protection
2. Leak Testing Procedures
3. Mathematics and Calculations Basic to the Use and Measurement of Radioactivity
4. Biological Effects of Radiation
5. Radioactive Measurement Standardization and Monitoring techniques and Instruments
6. Accident and Incident Procedures
7. Procedures for Nuclear Gauge Storage and Transportation
8. General Safety Precautions

B. Gauge Operation

1. Instrument Theory
2. Operating Procedures
3. Maintenance
4. Field Application
5. Gauge Calibration

1980: "Radiation Monitoring and Control Related To Uranium Mining and Milling", an 18 hour course presented by the United States Department of Labor, Mine Safety and Health Administration. A course outline is attached (Appendix B).

Attached Sheet No. 20 Item No. 17
Byproduct Material License Application
For: Silver King Mines, Inc.
P. O. Box 49
Edgemont, South Dakota, 57735
Telephone: 605-662-7203

EXPERIENCE

1. Keith Edwin Andersen

1976 to the Present: Silver King Mines, Inc., Edgemont, South Dakota, Chief Engineer

Mr. Andersen has held the position of Chief Engineer since 1978, and has been in charge of the Engineer Department at the Edgemont Uranium Mill, owned by TVA. His experience is in construction engineering, surveying and uranium exploration field work.

2. John William Koller

1978 to the Present: Silver King Mines, Inc., Edgemont, South Dakota, Field Supervisor

Mr. Koller has worked in the Engineering Department at the Edgemont Uranium Mill, owned by Tennessee Valley Authority, for five years. Primarily experienced in surveying and exploration field work.

3. James Allen Miller

1978 to the Present: Silver King Mines, Inc., Edgemont, South Dakota, Surveyor

Mr. Miller has worked in the Engineering Department at the Edgemont Uranium Mill, owned by TVA, for five years. His experience is primarily in surveying and exploration field work.

4. Robert Dwight Sedlacek, Radiation Safety Technician

1976 to the Present: Silver King Mines, Inc., employed at the Edgemont Uranium Mill.

Since 1978 Mr. Sedlacek has worked in the Mill Laboratory. His primary responsibilities are:

Environmental Sampling (radiologic and non-radiologic)
Collection of in plant area, air and water samples
Fluorometric analyses for Uranium in area air samples and ore samples.

60097

Mr. Sedlacek is also experienced in the use of all the radiation detection equipment available on site, and regular uses exempt quantities of byproduct material in the form of calibration check sources.

From 1976 to 1978, Mr. Sedlacek worked as a laborer on a Uranium Exploration drill rig.

5. Robert George Harding, Radiation Safety Technician

1977 to the Present: Silver King Mines, Inc., employed at the Edgemont Uranium Mill.

Radiation Safety Technician, November 1983 to present. Mr. Harding assists with the environmental radiation monitoring, conducts routine inplant area air sampling for airborne contaminants and conducts gamma radiation surveys. Runs laboratory analysis of in plant samples and other sampling duties as required.

Mr. Harding is familiar with all the radiation detection equipment available on site, and has the day to day responsibility for the instrument quality assurance program. Mr. Harding regularly uses exempt quantities of C3-137, Th-230, Tc99 in the form of calibration check sources.

Draftsman, 1978 to 1982.

Laboratory Technician, 1977 to 1978
Mr. Harding collected in plant area air samples and analyzed them fluorometrically for Natural Uranium. He was also responsible for the environmental sampling program being conducted at that time.

1974 to 1977 - Non-Radiologic work.

1973 - 1974 - Susquehanna Western, Inc., Edgemont, South Dakota, Laboratory Technician

Primary responsibilities involved mill process sampling and assay on the total milling operation. Primary processing was for uranium and vanadium.

6. Paula Jean Bonner

1979 to the Present: Silver King Mines, Inc., Edgemont, South Dakota

Environmental Technician: 1981 to present.

Primary responsibilities are in conducting environmental radiation surveys, personnel monitoring, in plant sampling and record keeping duties. Ms. Bonner is familiar with the radiation detection equipment available on site. She regularly works with exempt quantities of Cs-137, Th-230, Tc-99 in the form of calibration check sources.

Surveyor: 1979 to 1981

Ms. Bonner worked in the Engineering Department primarily in surveying and exploration field work.

7. George Thomas Wilson

1979 to Date: Silver King Mines, Inc., Edgemont, South Dakota

May 1981 to the Present: Project Engineer, Radiation Safety Officer

Mr. Wilson's responsibilities include:

Supervision of Environmental Monitoring and Radiological Monitoring Programs established by TVA. Develop and establish a radiation safety program, and health and safety programs for the Mill Decommissioning Project. Evaluation of environmental, and radiological aspects of mine, mill and other plant facility design and construction plans and programs. Perform and supervise radiation surveys and health physics monitoring. His primary experience dealing with byproduct material, other than with exempt quantity sources, was obtained during training at Oak Ridge Associated University.

Project Engineer: May 1980 - May 1981

Mr. Wilson's primary responsibilities were in preliminary planning and conceptual design of the tailings disposal area, proposed new mill site and tailings impoundment area. Assisted the Environmental Engineer on environmental radiologic surveys.

10/4/82
GTW

APPENDIX E

Applied Health Physics Course

READING LIST

Topic	
ATOMIC AND NUCLEAR STRUCTURE: 10/4	ANL 7291 - pp. 21-30; Chart of the Nuclides - pp. 2-5
MODES OF RADIOACTIVE DECAY: 10/4	NCRP#58 - pp. 1-7; Knoll - pp. 3-25; Kocher - pp. 3-8
CHARGED PARTICLE INTERACTIONS: 10/5	ANL 7291 - pp. 50-61; NCRP#58 - pp. 10-12; Knoll - pp. 39-62
RATES OF RADIOACTIVE DECAY: 10/5	ANL 7291 - pp. 35-38; NCRP#58 - pp. 8-10
G-M COUNTERS: 10/5	Knoll - Chapters 3 and 7; NCRP#58 - pp. 30-31; ANL 7291 - pp. 207-214; NCRP#57 - several sections
IONIZATION CHAMBERS: 10/5	Knoll - Chap. 5; NCRP#58 - pp. 21-24, 258-265, 279; ANL 7291 - pp. 210-211
PROPORTIONAL COUNTERS: 10/6	Knoll - Chap. 6; NCRP#58 - pp. 24-29; ANL 7291 - pp. 211-213
COUNTING STATISTICS: 10/6	Knoll - Chap. 4; NCRP#58 - Chap. 7; ANL 7291 - pp. 256-264
PHOTON INTERACTIONS: 10/7	Knoll - pp. 62-71; NCRP#58 - pp. 12-15, 34, 124-128; ANL 7291 - pp. 62-76
QUANTITIES AND UNITS: 10/7 10/8	Knoll - pp. 74-78; ANL 7291 - pp. 98-108; NCRP#39 - pp. 80-84
RADIATION BIOLOGY: 10/8	NCRP#39 - pp. 6-9, 33-54; ANL 7291 - pp. 133-147 IAEA#152 - pp. 44-46
RADIATION PROTECTION GUIDES:	NCRP#39 - all; NCRP#48 - all; ANL 7291 - pp. 162-171 (somewhat out of date)
G-M SURVEY INSTRUMENTS:	ANL 7291 - pp. 285-287; NCRP#65 - pp. 48-49; NCRP#57 - pp. 95, 96, 102, 116, 117; IAEA#152 - p. 94
PROPORTIONAL SURVEY INSTRUMENTS:	ANL 7291 - pp. 287-289; NCRP#57 - pp. 115, 125-126

May 14, 1982, JRF:kh/lw

60097

SCINTILLATION DETECTORS:	Knoll - Chapters 8 and 9; ANL 7291 - pp. 219-224; NCRP#58 - pp. 31-38 and several other sections
GAMMA-RAY SPECTROSCOPY:	Knoll - Chapters 10 and 18; NCRP#58 - pp. 34, 38-41, 128-168
SCINTILLATION SURVEY INSTRUMENTS:	ANL 7291 - pp. 292-294; NCRP#57 - pp. 96, 102, 115, 116; NCRP#50 - pp. 75-78
BREMSSTRAHLUNG, CHARACTERISTIC X-RAYS, AND X-RAY TUBES:	ANL 7291 - pp. 58, 59, 65, 66; Knoll - pp. 19-25; NCRP#49 - pp. 24, 25, 33
ASSAY OF RADIONUCLIDES:	NCRP#58 - Several Sections; Knoll - pp. 732-739
PERSONNEL MONITORING AND POCKET DOSIMETERS:	NCRP#57 - pp. 62-84, 96-99, 136-141; ANL 7291 - pp. 315, 332-336; IAEA#152 - pp. 92-93
INTERNAL DOSIMETRY:	ANL 7291 - pp. 176-202 (Somewhat Out of Date) IAEA#152 - pp. 24-28, 48-63
IONIZATION SURVEY INSTRUMENTS:	NCRP#57 - pp. 94-95, 101, 116; ANL 7291 - pp. 277-285; NCRP#50 - pp. 66-75; IAEA#152 - p. 94
THERMOLUMINESCENT DOSIMETRY:	Knoll - pp. 755-759; ANL 7291 - pp. 228-229, 336-338; NCRP#50 - pp. 78-84; NCRP#57 - pp. 97-98
FILM DOSIMETRY:	Knoll - pp. 750-755; ANL 7291 - pp. 315-328; NCRP#57 - p. 97
EXTERNAL BETA DOSE DETERMINATION:	ANL 7291 - pp. 298-299; NCRP#57 - pp. 100-104; Knoll - pp. 168-169; IAEA#152 pp. 28-29
X NATURAL BACKGROUND RADIATION:	NCRP#45 - all; ANL 7291 - pp. 150-159; NCRP#50 - pp. 5-49; NCRP#58 - pp. 217-223
SURVEY INSTRUMENT CALIBRATION:	NCRP#57 - several sections; ANL 7291 - pp. 283-285; NCRP#50 - pp. 77-78
CONTAMINATION SURVEYS:	NCRP#57 - pp. 18-20, 114-117; NCRP#65 - pp. 44-50; ANL 7291 - pp. 402-404
X AIR SAMPLING:	ANL 7291 - pp. 348-372; NCRP#50 - p. 123; NCRP#57 - pp. 20-22, 118-122

May 14, 1982, JRF:kh/lw

FACILITY DESIGN:	NCRP#39 - pp. 19-23; ANL 7291 - pp. 412-423; NCRP#48 - several sections; IAEA#152 - pp. 91, 111
STACK SAMPLING:	ANL 7291 - pp. 372-373
BIOASSAY:	NCRP#57 - pp. 69-74; NCRP#65 - pp. 51-55
WHOLE-BODY COUNTING:	NCRP#57 - pp. 74-76, 129-132; ANL 7291 - pp. 155-156; NCRP#65 - pp. 55-58
RADIATION SHIELDING:	ANL 7291 - pp. 115-125; NCRP#49 - all; IAEA#152 - pp. 113-118
TRANSIENT AND SECULAR EQUILIBRIUM:	ANL 7291 - pp. 40-42; NCRP#58 - pp. 9-10; Kocher - p. 20
LIQUID SCINTILLATION COUNTING:	Knoll - pp. 244, 247, 350-352; NCRP#58 pp. 41-46
RADIATION EMERGENCIES AND ACCIDENTS:	IAEA#152 - all; NCRP#65 - all
TRANSPORTATION REGULATIONS:	10 CFR20.205; 10 CFR 71; 49 CFR 172, 173
X-RAY SHIELDING:	NCRP#49 - all
RESPIRATORY PROTECTION:	IAEA#152 - pp. 41-42, 91,101-111; NCRP#57 - pp. 6-8; ANL 7291 pp. 78-79, 421
SEMICONDUCTOR DETECTORS (Charged Particles):	Knoll - Chap. 11; NCRP#58 - pp. 48-53, 102-107, 193-194, 228-229; NCRP#57 - pp. 127-129; ANL 7291 - pp. 214-219
SEMICONDUCTOR DETECTORS (Photons):	Knoll - Chapters 12 and 13; NCRP#58 - pp. 48-53, 159-167, 194-195, 243-245, 258
LICENSING REGULATIONS:	10 CFR
PROTECTIVE CLOTHING:	IAEA#152 - pp. 91, 110
ATMOSPHERIC DISPERSION OF RADIONUCLIDES:	IAEA#152 - pp. 3-20
RADIONUCLIDE PATHWAYS TO MAN:	NCRP#50 - pp. 54-58
ENVIRONMENTAL MONITORING: INTRODUCTION:	NCRP#50 - all

May 14, 1982, JRF:kh/lw

ENVIRONMENTAL SAMPLE PREPARATION AND COUNTING:	NCRP#50 - several sections
RADON MONITORING:	NCRP#57 - pp. 120-121; NCRP#45 - pp. 78-86; NCRP#50 - pp. 18-21, 102-103, 113, 187-188
WASTE DISPOSAL:	10 CFR20.301ff.; NCRP#48 - pp. 33-35
NEUTRON SOURCES:	Knoll - pp. 26-37; NCRP#38 - pp. 19-20, 25-27, 100-102; ANL 7291 - pp. 76-79
NEUTRON INTERACTIONS:	Knoll - pp. 71-73, 518-523; NCRP#38 - pp. 10-13; ANL 7291 - pp. 79-86; Chart of The Nuclides - pp. 9-11
NEUTRON DETECTION:	Knoll - Chapters 14 and 15; NCRP#38 - pp. 21-24
NEUTRON SURVEY INSTRUMENTS:	NCRP#57 - pp. 104-107; ANL 7291 - pp. 289-292, 294-298
NEUTRON ACTIVATION:	NCRP#57 - pp. 107-110; ANL 7291 - pp. 86-88
NEUTRON SHIELDING:	NCRP#38 - pp. 28, 106-123; ANL 7291 - pp. 83-86, 125-128
FISSION AND CRITICALITY:	ANL 7291 - pp. 381-385, 405-406; Chart of the Nuclides - pp. 6, 12; NCRP#57 - pp. 58, 140
COINCIDENCE COUNTING AND ANTI-COINCIDENCE COUNTING:	Knoll - several sections (see index); NCRP#58 - several sectons (see index)
NUCLEAR REACTORS:	ANL 7291- pp. 380-406; NCRP#38 - p. 38
NEUTRON PERSONNEL MONITORING:	NCRP#57 - pp. 110-114; NCRP#38 - pp. 124-131; ANL 7291 - pp. 328-332

May 14, 1982, JRF:kh/lw

APPENDIX A

URANIUM MINE RADIATION SAFETY COURSE

COURSE OUTLINE

In its role of enforcing regulations pertaining to the health and safety of mine workers, the Atomic Energy Control Board, in conjunction with provincial governments, federal agencies and other interested authorities and institutions has initiated and is sponsoring this second Uranium Mine Radiation Safety Course.

This course deals specifically with dust and radiation in the uranium mining environment and identifies the characteristics, sources and methods of control of these potential hazards as they relate to inspection duties in uranium mines.

Lectures, demonstrations, discussions, and visits will be led by experts in their field. Practical sessions in the laboratory and mines will provide training in instrument calibration and sampling.

Enrollment priority will be given to those involved in mines inspection duties. It is hoped that a cross section of Mine Inspectors, Mine Management Union Representatives and related federal and provincial departments will attend.

LECTURE TOPICS

Radiation Fundamentals - I
Radiation Fundamentals - II
Epidemiological Studies of Radiation Induced Cancer
Regulatory Exposure and Dose Limits
Biological Effects of Dust
Measurement of Dust
Sources and Control of Dust in Mining and Milling Operations
Uranium Mine and Mill Tailings Management
Personal Hygiene in Uranium Mills
Regulatory Processes in Uranium Mining and Milling in Canada
Radiation Exposure Record Keeping in Mines and Mills
Personal Alpha Dosimetry in Uranium Mining Industry
Practical Aspects of Controlling Radon Daughters in Underground and Open Pit Mines
Radiation Hazards in Mines and Mills and Gamma Dose Measurement
Radon and Thoron Daughter Measurements
Ventilation Systems and Maintenance
Training Requirements
Description, Operation, and Maintenance of Instruments
Mine Visits
Practical Use of Gravimetric Samplers and Konimeters
Kusnetz Method of Personal Dosimetry and Working Level Meters

APPENDIX B

Radiation Monitoring Outline
November 15-17, 1982

Nov. 15	1-4 p.m.	- Radiation Units, concepts, and theory (essential in understanding sampling and control strategies).
Nov. 16	8-12 noon	- Epidemiological aspects of uranium miner lung cancers - Underground radiation regulations - MDA - Instant Working Level Meter radon-daughter sampling - Kusnetz radon-daughter sampling - Gamma measurements
	1-4 p.m.	- Kusnetz equipment calibration - Tsivoglou and Rolle radon-daughter sampling - Thoron-daughter sampling
Nov. 17	8-12 noon	- Radon daughter and gamma exposure recordkeeping - Radon daughter control principles and practices
	1-4 p.m.	- Perform Kusnetz radon-daughter sampling and MDA-IWLM radon-daughter sampling in USBM radon chamber - Perform pump calibration - Closing remarks

Robert
Robert
a
Paula
MSA COURSE

Radiation Monitoring Class
Tentative Agenda
November 15-17, 1982

November 15

1:00 - 1:20 p.m.	Introduction and Registration	W.E. Cooper
1:20 - 1:45 p.m.	Prequiz	W.E. Cooper
1:45 - 2:00 p.m.	Film "A" is for Atom"	
2:00 - 2:15 p.m.	Break	
2:15 - 4:00 p.m.	Radiation Theory, Concepts, and Units	W.E. Cooper

November 16

8:00 - 8:45 a.m.	Underground Radiation Requlations	W.E. Cooper
8:45 - 9:00 a.m.	Gamma Measurements	W.E. Cooper
9:00 - 9:15 a.m.	Break	
9:15 - 10:00 a.m.	Epidemiological Agents of Uranium Miner Lung Cancers	W.E. Cooper
10:00 - 10:45 a.m.	MDA - IWLM Radon-Daughter Sampling	W.E. Cooper
10:45 - 11:30 a.m.	Kusnetz Radon-Daughter Sampling	W.E. Cooper
11:30 - 12:45 p.m.	Lunch	
12:45 - 2:00 p.m.	Kusnetz Equipment Calibration	J.F. Stewart
2:00 - 2:15 p.m.	Break	
2:15 - 2:45 p.m.	Quiz I	J.F. Stewart
2:45 - 3:15 p.m.	Tsivoglou and Rolle Radon-Daughter Sampling	J.F. Stewart
3:15 - 4:00 p.m.	Thoron-Daughter Sampling	J.F. Stewart

November 17

8:00 - 9:00 a.m.	Radon-Daughter and Gamma Exposure Recordkeeping	D.D. Rapp
9:00 - 9:30 a.m.	Film "Protection Against Radioactivity"	
9:30 - 9:45 a.m.	Break	
9:45 - 11:00 a.m.	Radon-Daughter Control	D.D. Rapp
11:00 - 11:30 a.m.	Quiz II	D.D. Rapp
11:30 - 11:45 a.m.	Closing Remarks	R.T. Beckman
11:45 - 1:00 p.m.	Lunch	
1:00 - 4:00 p.m.	Lab Session: Pump calibration Kusnetz radon-daughter sampling MDA-IWLM radon-daughter sampling	

APPENDIX D

Introduction To Health Physics

This introductory course presents the fundamentals of health physics. The course consists of 37 hours of classroom instruction including a session featuring hands-on experience with typical radiation protection instrumentation. Evening reading and homework assignments are considered to provide maximum benefit to the student. A tour of Eberline's radiochemistry laboratory is planned to observe analysis of environmental and bioassay samples. For additional information please contact the Course Coordinator.

Registration

The limited number of students per class requires that acceptance be based upon order of registration. Registration is confirmed upon receipt of tuition. Closing date for registration is two weeks prior to the first day of class.

Tuition

The tuition for the course is $700 which includes all class materials and textbooks. Please submit your tuition and registration form to the Course Coordinator in Albuquerque, New Mexico.

Cancellation

Full refund of tuition will be allowed to applicants provided notification of cancellation is received by Eberline in Albuquerque by the registration closing date. No refund will be provided to applicants cancelling after this date.

Eberline retains the option to cancel this class if an acceptable number of applications for enrollment are not received. If the class is cancelled, all applicants will be notified and their tuitions refunded.

Class Location and Hours

The course will be conducted in Albuquerque, N.M. Registration will be at 9:00 a.m., on Monday and class will follow until 5:00 p.m. Class hours are 8:00 - 5:00 for the following four days, with one hour for lunch.

REGISTRATION FORM

Introduction To Health Physics

Desired class date: *(Check one)*
- [X] March 7-11, 1983
- [ ] Sept. 12-16, 1983

Name Robert Harding

Title Radiation Safety Tech

Organization Silver King Mines, Inc.

City Edgemont

State South Dakota Zip 57735

Business Phone 605-662-7203

Residence Phone 605-662-7191

Return to: **Course Coordinator**
Eberline Services Division
3807 Academy Parkway South, N.E.
Albuquerque, New Mexico 87109
(505) 345-9931

Experience One year in lab
Three months Radiation Surveys

Education (academic plus significant short courses)
High School, 1 year college,
MSHA - Radiation Monitoring

Nature of present duties ...
Air Sampling, Lab work, Gamma
Surveys as needed

Position / Responsibility
Radiation Safety Tech.

(Please return registration form with tuition prior to desired class date. Thank you.)

Class Schedule

Monday 9 a.m. Registration & introduction

10-12 a.m. Terminology
Atomic structure

1-5 p.m. Radioactive & decay mechanisms
Alpha, beta & gamma emission
Ionization
Attenuation

Tuesday 8-9 a.m. Homework review

9-12 a.m. Dosimetry
Internal & external dose
Bioassay

1-5 p.m. Biological effects of radiation
Basic interactions
Acute & chronic dose
Dosimetry interactions

Wednesday 8-9 a.m. Homework review

9-12 a.m. Instrumentation theory
Gas-filled particle counters
Scintillation detectors
Semiconductors
Ion chambers
Thermoluminescent dosimeters

1-5 p.m. Instrumentation applications laboratory
Monitoring methods
Counting statistics
Data reduction

Thursday 8-9 a.m. Homework review

9-3 p.m. Laboratory operations
Gamma spectrometry
Alpha spectrometry
Radiochemical techniques
Analytical procedures
Quality control
Lab safety procedures

3-5 p.m. Laboratory tour

Friday 8-9 a.m. Homework review

9-12 a.m. Radiation protection regulations
10 CFR 20 requirements
Personnel protection
Transportation

1-5 p.m. Environmental impact pathways
Atmospheric diffusion
Bioaccumulation
Dose calculation

Radiation Protection And Environmental Surveillance For Uranium Resource Organizations

APPENDIX C

This course consists of 34 hours of classroom instruction devoted to situations commonly encountered at uranium production facilities. Problems specific to *in situ* leach operations will be discussed.

Training includes procedures and methods for proper occupational protection and monitoring of environmental impact. Topics include physical and chemical properties of uranium and its daughters, radiation detection instrumentation, sampling and analysis, environmental and occupational dose calculations.

Typical instrumentation used in the detection of uranium and its decay products with special emphasis on radon will be demonstrated.

Registration

The limited number of students per class requires that acceptance be based upon order of registration. Registration is confirmed upon receipt of tuition. Closing date for registration is two weeks prior to the first day of class.

Tuition

The tuition for the course is $700 which includes all class materials and textbooks. Please submit your tuition and registration form to the Course Coordinator in Albuquerque, New Mexico.

Cancellation

Full refund of tuition will be allowed to applicants provided notification of cancellation is received by Eberline in Albuquerque by the registration closing date. No refund will be provided to applicants cancelling after this date.

Eberline retains the option to cancel this class if an acceptable number of applications for enrollment are not received. If the class is cancelled, all applicants will be notified and their tuitions refunded.

Class Location and Hours

The course will be conducted in Albuquerque, N.M. Class hours are indicated by the Class Schedule. An optional three hour presentation on health physics basics, terminology and principles will be offered free of charge. This presentation will begin at 9:00 a.m. on Monday.

L4009

REGISTRATION FORM

Radiation Protection And Environmental Surveillance For Uranium Resource Organizations

Robert & Phillip Eberline

Desired class date: *(Check one)*
- ☐ April 25–29, 1983
- ☐ July 11–15, 1983
- ☐ Oct. 24–28, 1983

Name _____

Title _____

Organization _____

City _____

State _____ Zip _____

Business Phone _____

Residence Phone _____

Return to: **Course Coordinator**
Eberline Services Division
3807 Academy Parkway South, N.E.
Albuquerque, New Mexico 87109
(505) 345-9931

Experience _____

Education (academic plus significant short courses) _____

Type of Uranium Resources Work (present) _____

Position / Responsibility _____

(Please return registration form with tuition prior to desired class date. Thank you.)

Class Schedule

Monday 9-12 a.m.	Basic health physics (optional) Terminology Radioactive decay Dosimetry
1-1:30 p.m.	Registration & Introduction
1:30-5 p.m.	Uranium & daughters Physical & chemical properties Radiological impact Milling and other processing
Tuesday 8-10 a.m.	Environmental sampling Preoperation monitoring Gamma survey Operation monitoring
10 a.m.-5 p.m.	Instrumentation fundamentals Principles of detection Selecting the correct instrument Monitoring methods
Wednesday 8-3 p.m.	Instrumentation laboratory Field Instruments Radon detection Radon progeny detection
3-5 p.m.	Laboratory analysis Radiochemical techniques Analytical procedures Quality control
Thursday 8-12 a.m.	Occupational rad protection I State & federal regulations Personnel protection Transportation
1-5 p.m.	Occupational rad protection II Decontamination Internal dosimetry Bioassay Respiratory protection
Friday 8-12 a.m.	Environmental impact analysis Source term estimator Atmospheric diffusion Dose calculation