Item # 4
FOIA-2003-0374

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

MAR 29 1994

MEMORANDUM FOR: Those on Attached List

FROM: Carl J. Paperiello, Director
Division of Industrial and
Medical Nuclear Safety, NMSS

SUBJECT: REVISION 1, SUPPLEMENT TO POLICY AND GUIDANCE DIRECTIVE FC 84-20: "IMPACT OF REVISION OF 10 CFR PART 51 ON MATERIALS LICENSE ACTIONS"

This supplement replaces the supplement to FC 84-20 dated February 19, 1992, and provides guidance on materials license actions that qualify for categorical exclusion under 10 CFR 51.22(c)(14)(i) through (xv), and also guidance for determining when field studies and other materials license actions are eligible for categorical exclusion in accordance with 10 CFR 51.22(c)(14)(xvi).

BACKGROUND:

Licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review include those actions listed in § 51.22(c)(14)(xvi), which states:

> (14) Issuance, amendment, or renewal of materials licenses issued pursuant to 10 CFR parts 30, 31, 32, 33, 34, 35, 36, 39, 40 or part 70 authorizing the following types of activities:
>
> . . .
>
> (xvi) Any use of source, byproduct, or special nuclear material not listed above which involves quantities and forms of source, byproduct, or special nuclear material similar to those listed in paragraphs (c)(14)(i) through (xv) of this section (Category 14)

If a particular materials license action does not fall under a categorical exclusion in §§ 51.22(c)(14)(i) through (xv), it may still be eligible for exclusion under § 51.22(c)(14)(xvi). However, as stated in the March 1, 1984 memorandum, from the Deputy Director, Office of Nuclear Material Safety and Safeguards (NMSS), (See Attachment to PG&D FC 84-20), the Commission has directed the staff, in a Staff Requirement Memorandum, dated February 28, 1984, to prepare:

> "a written memorandum explaining why the action qualifies for the categorical exclusion (emphasis in original) selected. The written memorandum shall include a discussion of the factors listed in the

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MEMORANDUM FOR: Those on Attached List

C. H. Hehl, Director
Division of Radiation Safety and Safeguards, RI

J. Philip Stohr, Director, Director
Division of Radiation Safety and Safeguards, RII

William L. Axelson, Director
Division of Radiation Safety and Safeguards, RIII

Dwight D. Chamberlain, Acting Director
Division of Radiation Safety and Safeguards, RIV

Ross A. Scarano, Director
Division of Radiation Safety and Safeguards, RV

John E. Glenn, Chief
Medical, Academic, and Commercial
Use Safety Branch
Division of Industrial and
Medical Nuclear Safety, NMSS

Frederick C. Combs, Chief
Operations Branch
Division of Industrial and
Medical Nuclear Safety, NMSS

Robert L. Baer, Chief
Source Containment and Devices Branch
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Charles J. Haughney, Chief
Storage & Transport Systems Branch
Division of Industrial and
Medical Nuclear Safety, NMSS

selected subsections[1] and shall become part of the permanent docket or record relating to that action."

This written memorandum should be signed by the Director, Division of Industrial and Medical Nuclear Safety (IMNS), NMSS, or his delegate, and should be included in the license file.

As noted in Policy and Guidance Directive (PG&D) FC 84-20, the NRC may prepare an EA or statement in any case as it deems appropriate, regardless (emphasis added) of whether it is covered by a categorical exclusion. The preparation of all EAs or statements for materials license actions needs to be coordinated with NMSS.

GUIDANCE:

Guidance on the use of categorical exclusions is provided below in three sections for convenience: (I) Exclusions under § 51.22(c)(14)(i) through (xv), (II) Exclusions under § 51.22(c)(14)(xvi), and (III) Exclusions based on license actions found to be within the safety envelope of previous license actions that qualified under I and II.

I. License Actions That Qualify for Categorical Exclusion Under §§ 51.22(c)(14)(i) through (xv)

Since these license actions do not need an EA, coordination with NMSS with regard to an EA normally is not needed. However, in the case of novel or unusual license applications in this category, the regions should consult with NMSS, at an early stage of the review, on the possible need for an EA.

(A) License actions that clearly qualify for categorical exclusion under §§ 51.22(c)(14)(i) through (xv) - Such license actions, except for license termination actions (see Section I.(B)(i) below), do not need an EA or documentation in the license file with regard to the issue of an EA. Nor do such license actions need to be coordinated with NMSS with regard to whether an EA is needed.

(B) License actions that qualify for categorical exclusion under §§ 51.22(c)(14)(i) through (xv) based on additional technical and/or license-based justifications - Such license actions do not need an EA. Nor do such license actions necessarily need to be coordinated with NMSS with regard to whether an EA is needed. Unless otherwise stated below, the licensing staff needs to place, in the license file, written justification to support the determination that an EA is not needed. Examples of license actions which will need either documentation or justification are discussed below.

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[1] The "selected subsections" are §§ 51.22(c)(9), (c)(11, or (c)(14)(xvi). For materials licensees, the only exclusion that applies is § 51.22(c)(14)(xvi).

(i) All license termination actions - Documentation is required regardless of whether a license termination action clearly qualifies for a categorical exclusion under §§ 51.22(c)(14)(i) through (xv).

(a) For routine license termination actions that clearly qualify for categorical exclusion under §§ 51.22(c)(14)(i) through (xv), the close out survey and the submitted form NRC-314 which certifies the proper disposition of the licensee's radioactive materials, are sufficient documentation. Additional documentation for more complex license termination actions will be determined by the regions on a case-by-case basis. Only complex license termination actions, such as a license action that requires the submittal of a decommissioning plan (e.g., 10 CFR 30.36(c)(2)(i)), will require documentation of the justification to support why an EA is not needed. In many cases, such license actions need to be coordinated with the Division of Low-Level Waste and Decommissioning (LLWM) of NMSS (see Section (c) below). LLWM is responsible for providing the justification for any license termination action the regions has coordinated with LLWM.

(b) For license actions that qualify for categorical exclusion under §§ 51.22(c)(14)(i) through (xv) based on additional technical and/or license-based justification, the licensing staff will need to place in the license file, justification to support a determination that an EA is not needed. License termination actions for this group of licenses, if the justification has already been provided for the license, can follow section (a) above. Otherwise, the necessary justification needs to be placed in the license file.

(c) LLWM will coordinate with IMNS for the determination on whether an EA is needed (see Enclosure C), on those actions which have been referred to them. Unless otherwise noted, the regions can use LLWM's responses to them concerning decommissioning activities as the region's justification to support a determination that an EA is not needed.

(ii) The performance of field studies in which licensed material originating onsite is deliberately released directly into the environment for the purposes of the study - If a research and development or academic institution application proposes to release to the environment radioactive materials that originated onsite (i.e., within the controlled property of the licensee), an EA is normally not needed and is covered under categorical exclusion § 51.22(c)(14)(v) provided[2]:

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[2] Even if a particular license action will meet these criteria, the Region can request NMSS to make a determination on whether a Sholly-type notice should be issued (see footnote 3 below).

(a) All releases, originating onsite, to the environment (e.g., air and liquid effluents, direct radiation from deposition of radioactive materials from the release (e.g., groundshine), etc.) comply with ALARA and Part 20 requirements.

(b) To assist in demonstrating compliance with the requirements of 10 CFR Part 20, the licensee should set ALARA goals for air effluents at a modest fraction of the values in Appendix B, Table 2, Columns 1 and 2, to §§ 20.1001-20.2401. Experience indicates that values of about 10 millirems per year from all of the licensee's radioactive air effluents should be practicable for almost all materials facility licensees (see Regulatory Guide 8.37). Therefore, as a first step toward demonstrating compliance with ALARA for radioactive air effluents, the licensee demonstrates that the nearest member of the general public receives no more than 10 millirems per year from all of the licensee's radioactive air effluents (i.e., licensee demonstrates it meets the Environmental Protection Agency's air emission standard).

(c) All releases onsite comply with all applicable decommissioning requirements (e.g., decommissioning recordkeeping requirements pursuant to 10 CFR 30.35(g), etc.) and current decommissioning policies.

Documentation that supports the licensee's application as meeting the above criteria is sufficient to support why an EA is not needed. For license actions that cannot meet the above criteria, the regions should coordinate with IMNS to determine whether an EA is needed. For example, an EA would be required for discrete sources released to the environment, that originated onsite, and which may not be recovered at the conclusion of the study or decommissioning.

II. License Actions That Qualify For Categorical Exclusion Under § 51.22(c)(14)(xvi)

All license actions that qualify for categorical exclusion under § 51.22(c)(14)(xvi) will require a Technical Assistance Request (TAR) to IMNS. The Director, IMNS, or his delegate, will respond to the TAR with a memorandum to the region that originated the TAR. In addition, the Director, IMNS, or his delegate, may choose to publish a notice in the FEDERAL REGISTER, similar to that required by 10 CFR 50.91(a)[3], on the availability, to the public, of the IMNS memorandum. Upon completion of all IMNS actions, the IMNS memorandum is to be included in the official license file.

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[3] These FR notices are commonly referred to as Sholly Notices, which declare to the public that no significant hazards, based on staff analysis, will result following the approval of such license actions.

(A) Field Studies - Supplemental information to the Final Rule (49 CFR, 9352, March 12, 1984,) page 9377, for "use of radioactive materials for research and development and for educational purposes" concerning categorical exclusion § 51.22(c)(14)(v) states:

> "This categorical exclusion does not encompass (a) processing or manufacturing, (b) performance of field studies in which licensed material is deliberately released directly into the environment for purposes of the study, or (c) use of radioactive tracers in field flood studies involving secondary and tertiary oil and gas recovery."

Thus, field studies in which licensed material is deliberately released directly into the environment,[4] for purpose of the study, or use of radioactive tracers in field flood studies involving secondary and tertiary oil and gas recovery, cannot, by themselves, qualify for categorical exclusion under § 51.22(c)(14)(v). However, if such studies qualify for categorical exclusion under § 51.22(c)(14)(xvi), an EA will not be needed. Enclosure A gives an example of a field study which did not require an EA.

To expedite the processing of the TAR, the Regions should perform an initial technical assessment, to be enclosed with the TAR, to justify why the field study qualifies for categorical exclusion under § 51.22(c)(14))(xvi). Enclosure B provides the type of information that should be submitted to assist the Director, IMNS, or his delegate, in developing the necessary documentation, to be placed in the licensee's file, as directed by the Commission under categorical exclusion § 51.22(c)(14)(xvi).

(B) Others - Paragraph 51.22(c)(14)(xvi) of 10 CFR Part 51 can also be used for license actions, other than field studies, as justification for not performing an EA. A TAR to IMNS will be needed. The Regions should perform either an initial technical assessment or provide the license-based rationale (i.e., based on the licensing, inspection, and other information) on why the particular license action qualifies for categorical exclusion under § 51.22(c)(14)(xvi). Enclosures C and D give examples of the type of information that should be submitted to the Director, IMNS, or his delegate, in developing the necessary documentation, to be placed in the licensee's file, as directed by the Commission for not performing an EA under categorical exclusion § 51.22(c)(14)(xvi).

III. License Actions That Have Been Found To Be Within The Safety Envelope Of Previous License Actions That Qualified Under Categorical Exclusion §§ 51.22(c)(14)(i) through (xvi)

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[4] The staff interprets these releases to be those that originated offsite.

If a previous technical and/or license-based analysis had been performed which bounded the environmental radiological hazards to the public for the specific generic issue and the Region believes its specific license action is within the safety envelope of the previous generic analysis, the Region can cite the previous generic analysis, document its rationale for making this assessment, and file copies of the previous analysis and its rationale in the license file. No coordination with NMSS is necessary. If the previous analysis referenced categorical exclusion § 51.22(c)(14)(xvi), the documentation shall include the original memorandum from the Director, IMNS, or his delegate.

Carl J. Paperiello, Director
Division of Industrial and
Medical Nuclear Safety, NMSS

Enclosures:
A. Memo fm C. Paperiello to R. Bellamy dtd 12/8/93
B. Note fm D. Howe to File dtd 11/23/93
C. Memo fm C. Paperiello to W. Axelson dtd 11/16/93
D. Memo fm C. Paperiello to C. Hehl dtd 10/20/93

Multiple Addressees 6 MAR 09 1994

If a previous technical and/or license-based analysis had been performed which bounded the environmental radiological hazards to the public for the specific generic issue and the Region believes its specific license action is within the safety envelope of the previous generic analysis, the Region can cite the previous generic analysis, document its rationale for making this assessment, and file copies of the previous analysis and its rationale in the license file. No coordination with NMSS is necessary. If the previous analysis referenced categorical exclusion § 51.22(c)(14)(xvi), the documentation shall include the original memorandum from the Director, IMNS, or his delegate.

/s/

Carl J. Paperiello, Director
Division of Industrial and
Medical Nuclear Safety, NMSS

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DEC 08 1993

MEMORANDUM FOR: Ronald R. Bellamy, Chief
Nuclear Materials Safety Branch, RI

FROM: Carl J. Paperiello, Director
Division of Industrial and
Medical Nuclear Safety, NMSS

SUBJECT: DEPARTMENT OF THE INTERIOR, BUREAU OF MINES REQUEST TO AMEND LICENSE NO. 37-01712-11 TO USE XENON-133 IN A VENTILATION TRACER STUDY AT THE EXPERIMENTAL MINE, BRUCETON RESEARCH CENTER, PITTSBURGH, PENNSYLVANIA, AND NEED FOR AN ENVIRONMENTAL ASSESSMENT

This refers to your Technical Assistance Request dated August 7, 1992 (Enclosure 1), requesting guidance on whether the Department of the Interior, Bureau of Mines, License No. 37-01712-11, amendment request to use xenon-133 in a ventilation tracer study at the Experimental Mine, Bruceton Research Center, Pittsburgh, Pennsylvania, requires the NRC to perform an environmental assessment (EA) pursuant to 10 CFR Part 51. Based on a technical analysis and pursuant to 10 CFR 51.22(c)(14)(v) and (xvi), an EA will not be required.

During the technical review, certain radiation safety concerns associated with the use of xenon-133 gas in a mine and by a licensee authorized to use only sealed sources, foils, and sealed gas were identified and summarized in Enclosure 2. Once the radiation safety issues and other issues identified by the region are resolved with the licensee, the region can amend the license to authorize the requested study.

The staff determined three categorical exclusion paragraphs for licensing and regulatory actions are applicable to the Bureau of Mines' proposed amendment request to use xenon-133 gas. The "research and development" paragraph is applicable because the license is a research and development license and the amendment is for a research study. The "medical and veterinary" paragraph is applicable in combination with the "catch all" paragraph because the form and quantity of xenon-133 use is similar to that in the medical use of xenon-133.

1. 10 CFR 51.22(c)(14)(v), "Use of radioactive materials for research and development and for educational purposes".

   The proposed study is a research and development study that involves releasing xenon-133 gas into the fresh air stream within the mine, measuring concentrations of xenon-133 at points in the mine downstream from the injection point, and releasing xenon-133 directly into the environment (i.e., in air or water leaving the mine). The purpose of

Enclosure A

the study is to develop a xenon-133 detector and determine whether xenon-133 can be used as a tracer in an underground coal mine to characterize air flow patterns for later use in characterizing underground coal fires.

The March 12, 1984, statement of consideration for the final rule amending 10 CFR Part 51 to implement section 102(2) of the National Environmental Policy Act of 1969 (49 FR 9352) provided additional guidance on this categorical exclusion. The following statements addressing research and development situations with direct releases into the environment are in the statement of consideration. "This categorical exclusion does not encompass . . . (b) performance of field studies in which licensed material is deliberately released into the environment for the purposes of the study . . . ."

While it initially appears the proposed study should have an environmental assessment because it is a field study (it is performed outside a laboratory in an unrestricted area that is inseparable from the environment) with all releases going directly into the environment, additional consideration must be given to the isotope used and the effect of the planned releases on the environment. The short half-life of xenon (5.24 days), the quantities released, and the chemical inertness of xenon ensure that it will have a negligible effect on the environment.

The most probable route of exposure to humans, other animals, and plants is direct contact with the radioactive xenon-133 gas. The probability and consequences of any effects will diminish with time, as the xenon-133 decays. The most significant hazard to humans is the external radiation hazard from the beta particles and x-rays associated with being submersed in the xenon-133 gas cloud. In this study, the probability of direct or prolonged contact of xenon-133 with the general public, other animals and plants is insignificant because of scheduling the study for a weekend, restricting entrance to the mine, releasing multiple small quantities of xenon-133 (12 to 48 millicuries per release) instead of one large release (300 millicuries), and environmental dispersion and dilution factors.

Internal hazards are not as significant because the metabolically inactive xenon-133 is rapidly removed from humans and other animals by exhaling. In medical studies xenon-133 is generally washed out of the lungs in one or two breaths regardless of whether the xenon-133 is administered as a inhaled gas or injected in saline suspension. (Xenon-133 in the 10 to 30 millicurie levels are physiologically inactive and gas entering the circulatory system is returned to the lungs and exhaled after a single pass through the peripheral circulation.) This gives a very low probability of internal exposure.

Xenon-133 is not expected to either enter underground potable water supplies or remain in plants or animals because of its short radioactive half-life and its chemically inert properties. The short half-life precludes it from reaching underground potable water supplies before it decays away. It is unlikely xenon-133 will enter the plant or animal food chain, because the experiment will be performed in the winter and the xenon will have decayed away before the normal plant growing season.

Therefore, this study meets the criteria of a categorical exclusion for research and development under this paragraph.

2. 10 CFR 51.22(c)(14)(xvi) "any use of source, byproduct, or special nuclear material not listed above, which involves quantities and forms of source, byproduct, or special nuclear material similar to those listed in paragraphs (c)(14)(i) through (xv) of this section (Category 14)."

10 CFR 51.22(c)(14)(iv), "Medical and veterinary".

The description of activities in the statements of consideration for this exclusion includes among other things "laboratory use of unsealed sources for performance of diagnostic tests or for tracer studies for research purposes. . . . releases to air and water . . . are of small quantities, or if of larger quantities, are short lived. Effluent releases . . . are estimated at less than 10 percent of the applicable limits."

The licensee proposed to release up to a maximum of 300 millicuries (the total available on site) of xenon-133 in either 20 releases of 12 millicuries each or 5 releases of 48 millicuries. The releases will be made over a one to two day period with waiting periods between the releases. The waiting periods are to either insure the xenon-133 detector is reading background or position the detector at a new location. The xenon-133 is ultimately exhausted outside the mine. The total effluent releases, if averaged over a year, are significantly less than 10 percent of the 10 CFR Part 20 releases permitted to the unrestricted area. Further, xenon-133 is a short-lived radioisotope with a half-life of 5.24 days.

In medical institutions, xenon-133 is used in patient diagnostic lung perfusion and brain imaging tests. During the perfusion test, patients are rebreathing xenon-133 gas administered in dosages between 6 and 30 millicuries per test. Some brain imaging studies use xenon-133 gas; others use xenon-133 suspended in saline. A number of patients can be scheduled for the xenon-133 perfusion or brain imaging tests in any day. The xenon-133 in the medical institution may be either exhausted to the outside or released into a xenon-133 trap where it is held until it decays.

DEC 08 1993

Ronald R. Bellamy 4

Therefore, the Bureau of Mines' proposed activity meets both the categorical exclusion criteria of 10 CFR 51.22(c)(14)(v) "use of radioactive materials for research and development" and the criteria of 10 CFR 51.22(c)(14)(xvi) because the quantities and form of the xenon-133 gas are similar to the quantities and form of xenon-133 used in the medical activities categorical exclusion (i.e., 10 CFR 51.22(14)(iv)), and does not need an environmental assessment.

If you have any questions, please feel free to contact Dr. Donna-Beth Howe of my staff at (301) 504-2636.

/s/

Carl J. Paperiello, Director
Division of Industrial and
Medical Nuclear Safety, NMSS

Enclosures:
1. TAR fm R. Bellamy
   dtd 8/7/92
2. Summary of Radiation Safety Concerns

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Occupational Concerns

There are a number of reasons why the licensee needs to place special emphasis on providing specific radiation safety and emergency procedure instruction to individuals participating in the study, restricting access to the mine area during the study, insuring adequate surveys are performed before returning the mine to unrestricted use, and informing Bruceton Research Center personnel of the study. These reasons include the following: the fact that the study involves radioactive materials and situations outside the normal radiological experiences of either the Pittsburgh Research Center or the University of Kentucky, Department of Mining Engineering personnel; the unique situation of people being able to enter and exit the mine only through the radioactive material effluent release "stack;" and the fact that normally the Experimental Mine and each worker in the mine is an unrestricted area and non-radiation worker, respectively.

All personnel involved with the experiment should be provided with instructions and written procedures on both the handling of xenon-133 in normal or emergency situations and adequate area or removable contamination survey procedures, as well as, the normal proper receipt, transportation, and disposal procedures. These instructions should include:

1. identification of the responsible individual for specific radiation protection decisions;

2. procedures to handle spill situations inside and outside the mine;

3. procedures to handle situations increasing the xenon-133 air concentration, or causing xenon-133 movement into areas outside the predicted study area (i.e., the surface buildings or other portions of the mine);

4. personnel evacuation procedures in the event of a spill, failure of the mine ventilation system, and other adverse situations;

5. guidance on the performance of area and removable contamination surveys and determination of when the mine is releasable to unrestricted use;

6. a policy on minimum weather condition requirements needed prior to starting the xenon-133 releases (i.e., conditions to insure the dispersion of the xenon outside the mine).

The licensee should be encouraged to use non-radioactive methods to determine probable areas of xenon-133 concentration in the mine due to dead spaces prior to releasing the xenon-133. This information can be used in assuring the surveys performed prior to releasing the mine to unrestricted use are adequate.

11/23/93

NOTE TO: Files

FROM: Donna-Beth Howe, Ph.D.
Medical and Academic Section

SUBJECT: STAFF TECHNICAL REVIEW OF DEPARTMENT OF INTERIOR, BUREAU OF MINES, REQUEST TO RELEASE XENON-133 FOR VENTILATION STUDIES IN THE BUREAU OF MINES EXPERIMENTAL RESEARCH MINE AT BRUCETON RESEARCH CENTER PITTSBURGH PENNSYLVANIA

Background

By letter dated July 17, 1992, the Department of the Interior, Bureau of Mines, Pittsburgh Research Center (the licensee) requested an amendment to Byproduct Material License 37-01712-11 to perform a xenon-133 gas mine ventilation study at the Pittsburgh Research Center Experimental Mine, located at the Bruceton Research Center, Pittsburgh, Pennsylvania.

The license currently authorizes the use of byproduct material in the form of sealed sources, foils, and gas in sealed tubes for reference standards, analytical instruments, gauges, and research and development of instruments and gauges. It does not authorize the use of unsealed gases and prohibits the release of byproduct material in field studies. The proposed amendment would authorize the licensee to possess and store xenon-133 gas at the Pittsburgh Research Center (part of the Bruceton Research Center). It would also authorize the University of Kentucky, Department of Mining Engineering personnel in coordination with the licensee's personnel to use xenon-133 gas for a ventilation study in the licensee's Experimental Mine.

The xenon-133 gas study is part of a research project entitled, "Assessment of the extent of fires in abandoned mine lands using non-invasive tracer techniques." The purpose of the study is to evaluate the potential effectiveness of xenon-133 gas as a tracer to determine the ventilation characteristics of underground mines for application to underground coal mine fires. In the United States alone, there are 100 underground coal mine fires. They are a serious health, safety, and environmental hazard because of toxic fumes emissions and air quality deterioration.

The three basic methods of fighting underground mine fires, i.e., excavation, making fire barriers, and surface sealing, are usually unsuccessful, because it is difficult to locate and treat all combustion areas. Underground fire is easily spread by the migration of hot gases to discontinuous and discrete fire zones; initial information and monitoring techniques are usually inadequate; and fires presumed to be extinguished can reignite within 3 to 5 years if all the burning material was not removed or cooled.

Enclosure B

Information gained from xenon-133 gas movement measurements made at the Experimental Mine, with its well-characterized tunnels and air ventilation system, is expected to be used later in coordination with xenon-133 releases at mines with underground fires to map inaccessible air pathways supplying oxygen to the underground fire. If the tracer can be used to identify the source of incoming air, then human intervention to control the flow of oxygen feeding the fire may reduce the extent of the combustion, decrease the probability of reignition, and increase the effectiveness of current and future fire fighting techniques.

The University of Kentucky researchers have experience using xenon-133 gas in laboratory situations, but they do not have experience with releasing radioactive materials in field or mine situations. They have performed tests with small scale ventilation ducts and computer models. Certain parameters such as mine void, roughness of the walls, and location of the detector, that may have significant effects on the performance and detection of the tracer in an actual mine fire, cannot be replicated in the laboratory.

Xenon, a noble gas, is chemically inert, heavier than air, and may temporarily adhere to some plastics, rubber, and dust particles or get dispersed in water. Xenon-133 has a 5.24 day half-life and decays by beta emission to stable cesium-133. The primary radiation products are a beta particle with a maximum energy of 346 kiloelectron volts (99 percent per disintegration) and cesium X-rays with an energy of 81 kiloelectron volts (36 percent per disintegration).

In this review, the term "xenon release point" will be used to refer to the initial point where the xenon-133 is released within the mine into the mine airstream, and the terms "xenon exhaust point" or "mine exhaust point" will be used to designate the final point at which xenon-133 is released from the mine into the environment. These terms should reduce the inherent confusion found when the word "release" is used in a radiological hazards review. Another point of confusion may exist because the mine layout differs significantly from most areas where radioactive gasses are used. In most cases, the area has at least one door for people to enter or exit the area, a vent to bring fresh air in, and a stack to exhaust volatilized radioactive effluents. In the Experimental Mine, the twin side-by-side entrance tunnels serve not only as the doorway into and out of the mine, but also the only stack to exhaust the radioactive effluents. Therefore, people entering the mine during the experiment, in effect, are walking into the effluent release stack.

Mine Description

The Experimental Mine is part of three interconnected coal mines located under the Bruceton Research Center. The Bruceton Research Center is a 0.96 square kilometer (238 acre) facility,

in the Pittsburgh suburbs, where approximately 1600 people work for three different federal agencies. The Bureau of Mines Pittsburgh Research Center owns approximately 0.72 square kilometers (178 acres) and has approximately 700 employees and contractors; the Department of Energy owns approximately 0.24 square kilometers (60 acres) and has approximately 800 employees and contractors; and the Mine Safety and Health Administration occupies one building and has approximately 100 employees.

The Experimental Mine is connected to the Safety Research Coal Mine by two tunnels and two 7.6-centimeter (3-inch) holes. The two tunnels between the coal mines can be closed off by closing the explosion-proof doors in the permanent bulkheads. The tunnels connected by the two 7.6-centimeter (3-inch) holes can be isolated from the xenon-133 gas study area by closing the doors in other bulkheads. The Safety Research Coal Mine is, in turn, connected by a 5 centimeter (2-inch) hole to the third coal mine.

Both the Experimental Mine and the Safety Research Coal Mine are active research mines. For radiological purposes, these mines are considered unrestricted areas both before and after the study and the Bureau of Mines workers in the mine at these times are not radiological occupational workers. The Experimental Mine provides a dedicated mine for the testing of coal and gas explosions and for underground fire research in a full-scale multiple-entry mine.

The Experimental Mine elevation ranges from 308 to 312 meters (1009 to 1022 feet) and the overburden ranges from 1 or 2 meters to 30 meters (few feet to 100 feet). One office building (building 143), a series of 9 side-by-side maintenance trailers (building 145), and six other smaller structures (buildings 2, 7, 12, 25, 102, and 105) are located directly over the portion of the Experimental Mine where the xenon-133 study will be performed. Another office building (building 140) is 23 meters (75 feet) above the tunnels adjacent to the xenon study area. For the most part, the workers in these structures are not radiological workers.

The normal Experimental Mine ventilation system forces outside air into the mine through a 12-meter (40-foot) shaft from the surface approximately 46 meters (150 feet) from the Experimental Mine's side-by-side walk-in entrances. The air is then pushed through the "east air course" (which includes the xenon-133 gas study area). The xenon release point is approximately 165 meters (540 feet) from the mine entrance, and the first detector measurement location is approximately 107 meters (350 feet) from the xenon release point. From the last experimental measurement point in the east air course, the air passes through approximately 1.5 kilometers (4,800 feet) of additional tunnels before it is exhausted out of the same two side-by-side walk-in mine entrances described above. These final tunnels are actually

3 interconnecting parallel 0.4 kilometer (0.25 mile) long tunnels. The air may pass through either 2 or 3 of these tunnels.

The average dimensions of the tunnels are 2 meters (6.5 feet) high and 3 meters (10 feet) wide. The calculated volume of the tunnel between the release point and the first detector location ranges from approximately 784,000 to 1,577,000 liters (27,700 to 55,700 cubic feet) depending on whether the air flows into connecting or parallel tunnels. The calculated volume of the tunnel between the first detection point and the last detection point is 1,104,000 liters (39,000 cubic feet). The total volume of all the tunnels the xenon is expected to flow through is about 12,000,000 liters (412,000 cubic feet).

The air flow at the release point is expected to be 1,400,000 liters per minute (50,000 cubic feet per minute). One air exchange in the part of the mine exposed to xenon should occur every 8.3 minutes. The length of a xenon-133 slug is about 390 meters (1,200 feet).

Study Description

The study is expected to extend over one weekend in the next 12 months. It is not expected to be repeated. Pressurized xenon-133 gas will be released into the fresh air stream at the xenon release point which is within the mine at the beginning of an area referred to as the "coal reserve for standard samples" ("coal reserve"). The detector will be positioned close to the floor downstream from the xenon release point and be constantly sampling the air during the measurement part of the study. Since the University of Kentucky has only one analytical xenon-133 gas detector, multiple xenon-133 gas releases are necessary to collect data at each of the five detection points and to collect data for multiple measurements at each detection point. The detector was built specifically for the xenon mine study and its performance will be an integral part of the study.

The xenon-133 analytical detector has a 8.1-liter counting chamber with a 15 milliliter per minute pump. The instrument can detect concentrations of xenon-133 as low as 3.7 becquerels per liter (0.1 nanocurie per liter).

Three 3,700 megabecquerel (100 millicurie) xenon-133 vials will be used during the study. At the Mine, the 3,700 megabecquerels (100 millicuries) of xenon-133 will be injected into an evacuated 28.3 liter (1 cubic foot) pressure cylinder. Nitrogen gas will be added to the gas cylinder until the xenon concentration is 22.6 megabecquerels per liter (0.61 millicurie per liter) (i.e., the cylinder is pressurized to approximately 585 kilopascals (85 pounds per square inch) and contains

164 liters of gas). If all 11,100 megabecquerels (300 millicuries) are used in the study, the pressurized tank filling procedure will be repeated two more times.

In the first trial, 444 megabecquerels (12 millicuries) will be released to confirm that the xenon-133 goes into the air stream and the detector can measure it. If the xenon-133 is detected, three other 444 megabecquerel (12 millicurie) releases will be made. A total of 4 xenon-133 releases and detector measurements will be made for each detector location. There will be a total of 5 detection points.

If the xenon-133 is not detected, the first measurement will be repeated with a 1,776 megabecquerel (48 millicurie) release. If the xenon-133 is then detected, the experiment will continue with 4 more 1,776 megabecquerel (48 millicurie) releases (one for each new detector location). If the xenon-133 is still not detected, the experiment will be terminated.

The xenon release point, approximately 165 meters from the coal mine entrance, will remain stationary. The xenon-133 gas will be released through a tube terminating 183 centimeters (6 feet) downstream from the cylinder and the researchers. For the first measurement, the detector will be approximately 107 meters away and a total of 444 megabecquerels (12 millicuries) of xenon-133 will be released over a 2-minute period. The mine air flow will be adjusted so that at the xenon release point it is 1,400,000 liters per minute (50,000 cubic feet per minute). If the xenon is evenly distributed throughout the 2-minute slug of air, the xenon-133 concentration in the slug would be 159 becquerels per liter (4.3 nanocuries per liter) and the slug will be about 390 meters long.

The calculated volume of the tunnel between the xenon release point and the first detector location ranges from approximately 784,000 liters (27,700 cubic feet) to 1,577,000 liters (55,700 cubic feet) depending on whether the air flows into the connecting or parallel tunnels in the "coal reserve." The calculated volume of the tunnel between the first detection point and the last detection point is 1,104,000 liters (39,000 cubic feet). The total volume of all the tunnels from the xenon release point to the mine exhaust point (the mine's main entrance) is about 12,000,000 liters (412,000 cubic feet). With an air flow of 1,400,000 liters per minute, one air exchange should occur every 8.3 minutes during the study in the part of the mine exposed to xenon.

If the air flow is 1,400,000 liters per minute, the front of the slug should move from the xenon release point to the first detector point in either 30 or 60 seconds and to the fifth detector location in either 75 or 135 seconds. The straightest air path to this point includes four 4-meter (12-foot) dead-end side corridors, 2 right-angle turns preceding short dead-end

tunnels, and a 250 foot dead-end tunnel. These side corridors and tunnels are expected to create eddy currents and dead spaces that will affect the shape of the xenon slug and the

concentration of xenon-133 in the slug. Some xenon-133 may settle out in dead air spaces. Once the xenon slug passes the fifth data collection point, there are approximately 1.5 kilometers (4,800 feet) of tunnels before the xenon exhaust point is reached.

The Environment

The regional geology of the Bruceton Research Center consists of sedimentary rocks of the Pennsylvania and Permian periods. The Monogahela Group, a cyclic sequence of shale, limestone, sandstone, and coal, tops the hills at the site. The Pittsburgh Coal within this group has been extensively mined out in the area. The Conemaugh Group, a cyclic sequence of sandstone, shale and limestone, underlies the Monogahela Group. The stream beds and river valleys are lined with quaternary alluvium. Two clay veins run over the xenon study area. (A clay vein is a geological crack in the coal formation that filled with clay and earth during the geological development of the area.)

Two surface streams, McElheny Run and Lick Run, are located at the boundaries of the Bruceton Research Center. McElheny Run flows into Lick Run which in turn converges with Peters Creek which empties into the Monogahela River about 5.5 miles down stream. The Experimental Mine is described as a dry mine with little or no water seepage.

Most drinking water comes from surface water drawn from the Monogahela River either at Elrama (about 9.7 kilometers (6 miles) upstream from Peters Creek) or Becks Run (about 23.3 kilometers (14.5 miles) downstream of Peters Creek). Thirteen houses within a 6.4 kilomenter (4 mile) radius and two others within a 1.6 kilometer (1 mile) radius of the Bruceton Research Center receive their drinking water from ground wells.

The closest wetland is located along Lick Run near the Wallace Road - Cochran Mill intersection. This wet land has a 0.16 kilometer (0.1 mile) frontage on Lick Run and is classified as R30WZ (i.e., riverine upper perennial open water intermittently exposed/permanent). According to the Pennsylvania Game Commission, there are no endangered or threatened animals in the vicinity of the Bruceton Research Center. The mine is actively used for experiments and there are no known animals living in the Experimental Mine.

The nearest communities consist of two separate housing developments about 1.6 kilometers (1 mile) northeast and southeast of the Center, respectively. Each development has

approximately 1,000 residents. The closest residences are approximately 0.2 kilometers (0.13 miles) from the property line. (Only two houses within the 1.6 kilometer (1 mile) radius have drinking water wells.

Pathways to the Environment

The natural dynamics of sun, wind, and rain are factors in determining the xenon-133 movement in the environment. Xenon, a noble gas, is chemically inert, heavier than air, essentially insoluble in water, and temporarily adheres to some plastics and rubber.

In general, xenon-133 gas presents a submersion hazard, rather than an inhalation or absorption hazard. Xenon-133 gas is generally washed out of the lungs in one or two breaths regardless of whether the xenon-133 is administered as a gas or in saline suspension. (As demonstrated in diagnostic studies on humans using 10 to 30 millicuries of xenon-133, xenon-133 is physiologically inactive and gas entering the circulatory system is returned to the lungs and exhaled after a single pass through the peripheral circulation.)

Xenon-133 has a radioactive half life of 5.24 days and decays by beta emission to stable cesium-133. The primary radiation products are a beta particle with a maximum energy of 346 kiloelectron volts and cesium X-rays with an energy of 81 kiloelectron volts).

Within the Mine. The xenon-133 gas is expected to be pushed as a rather large slug through the mine. The Experimental Mine has a number of auxiliary tunnels and rooms with dead ends between the xenon-133 release point and the mine entrance (i.e., the xenon exhaust point). Each one of these areas is expected to set up eddy currents that can either spread out the slug or pull xenon-133 out of the main air stream into the dead air spaces. Xenon-133 is not expected to permeate the rock or coal formations, but may move through actively venting cracks or boreholes. The existing bore holes from the surface to the mine tunnels are capped and not expected to affect the air flow. Although the air stream is expected to take the path of least resistance through the mine, it should also move air into all available spaces. Xenon-133 remaining in the main air stream is expected to exit the mine in the first air exchange (approximately 8.3 minutes). Xenon-133 moved into the side tunnels and dead air spaces will take longer to flush out and may decay first.

The worst case mine situation would be if the ventilation system failed after the second of two 1,776 megabecquerel (48 millicurie) releases. Since the complete air exchange in the Experimental Mine (i.e., approximately every 9 minutes) is approximately equal to the time needed to set up and measure each release, it would be difficult to have more than two xenon-133

air slugs in the mine once the ventilation system failed. In this case, the researchers exiting the mine through the mine entrance (the mine exhaust tunnel) would have to walk through one or two of the xenon slugs.

The maximum instantaneous air concentration of xenon-133 in an existing slug (0.159 or 0.636 becquerels per millliliter (4.3 or 17.6 picocuries per millliliter)) is generally less than the Title 10 Code of Federal Regulations Part 20 limits for occupational exposure to xenon-133 air concentrations when averaged over a year. The Part 20 limits are 0.37 and 3.7 becquerels per millliliter (10 and 100 picocuries per millliliter), before and after January 1, 1994 respectively. If the ventilation system failed during the production of a slug, the xenon-133 concentration in the partially formed slug could be much higher than the concentration in the existing slug.

The researchers will not be exposed to any slug for a prolonged period of time. Assuming each person in the mine moves through the existing slug for a total of 15 minutes while exiting the mine (a conservative estimate of the time spent in the slugs), the total dose per person would be 10 microsieverts (1 millirem) whole body or 1 microsievert (0.1 millirem) deep dose equivalent. For the partially formed slug, the xenon-133 concentration would have increase by a factor of 5,000 or 50,000 to either 3 or 30 kilobecquerels (80 or 800 nanocuries per milliliter) for the same individual to receive 50 millisieverts (5 rem) whole body dose or deep dose equivalent, respectively, in fifteen minutes. Further, the mine could be closed until the xenon decayed or the ventilation system was able to clear the mine to preclude other xenon exposures. The doses could be reduced further if the researchers exited the mine upstream from the xenon release point before entering the last 46 to 90 meters (150 to 300 feet) of the exhaust tunnel. This dose could be reduced to zero by exiting the Experimental Mine through the Research Safety Mine but this should not be necessary.

Outside the Mine. Xenon-133 is not expected to either enter underground potable water supplies or remain in plants or animals because of its short radioactive half-life and its chemically inert properties. The short half-life precludes it from reaching underground potable water supplies before it decays away. This also precludes it from migrating through the rock and coal to the work places located above the mine before it decays. It could be forced through open active ventilating cracks to these structures, but the path of least resistance is to remain in the much larger tunnels. Further, since the experiment will be performed in the winter, the xenon-133 will have decayed away before the normal plant growing season.

Although xenon may become mechanically suspended in water, it does not chemically react with the water molecules and is expected to outgas quickly. Xenon temporarily suspended in rain, snow, or fog may initially become part of the surface water, but would outgas in a short period of time. Xenon in contact with

plant or animal life is metabolically inert and not expected to be taken up and retained in either plants or animals. Animals ingesting xenon suspended in water are expected to exhale the xenon.

If the experiments work, all of the xenon-133 released (i.e., from 240 millicuries to the entire 300 millicuries on site) is expected to be lost to the environment. It should be lost in increments of 444 or 1776 megabecquerels (12 or 48 millicuries). In extremely stagnant outdoor air conditions, the xenon being heavier than air would be expected to flow down hill. Instead of dispersing, under these conditions it may collect in low lying areas or depressions. This situation can be avoided by ensuring the studies are not performed on foggy or still days. Under normal weather conditions of natural air turbulence, the xenon should rapidly dispersed once it leaves the mine.

Environmental Effects and Conclusions

Pathway to Humans. Several factors, such as scheduling the xenon-133 releases on a weekend, restricting access to the mine during the releases, and the distance from the mine entrance to the boundary of the Pittsburgh Research Center, make it unlikely that the xenon-133 will come in direct contact with the general public.

The most significant hazard to humans is the external radiation hazard from the beta particles and x-rays associated with being submersed in the xenon-133 gas cloud, i.e., the most probable route of exposure is direct contact with the radioactive xenon-133 gas.

Internal hazards are not as significant because, if inhaled the metabolically inactive xenon-133 is rapidly removed by exhaling. In medical studies xenon-133 is generally washed out of the lungs in one or two breaths regardless of whether the xenon-133 is administered as a inhaled gas or injected in saline suspension. (As demonstrated in diagnostic studies on humans using 10 to 30 millicuries of xenon-133, xenon-133 is physiologically inactive and gas entering the circulatory system is returned to the lungs and exhaled after a single pass through the peripheral circulation.) This gives a very low probability of internal exposure. The possible ingestion route involves swallowing xenon-133 gas either temporarily trapped in particles or mechanically suspended in water. In this situation, like the injected xenon, the xenon is also expected to be exhaled rapidly. As discussed before, xenon-133 will not get into potable ground water, or the plant or animal food chain.

Effects On Plant and Animal Species. Because no known plants or animals live in the Experimental Mine, plants and animals exposed to the xenon-133 have to live at the Bruceton Research Center or in the surrounding area. Since the xenon-133 air stream is

expected to be dispersed and diffused once it leaves the mine, few plants or animals are expected to come into prolonged contact with the xenon-133 beta particles or x-rays. Further, the probability and consequences of effects will diminish with time, as the xenon-133 decays.

Effects on Endangered or Threatened Species. There are no known endangered or threatened species either living or having home ranges in the vicinity of the Experimental Mine or Bruceton Research Center.

Agencies and Persons Contacted

In performing this review, the staff contacted the Bureau of Mines, Pittsburgh Research Center and the University of Kentucky, Department of Mining Engineering.

References

Kim, Ann G., and Chaiken, Robert F., "Abandoned Mined Land Fire Survey and Evaluation," Proceedings of the 12th annual NAAMLP Conference: Returning Mined Land to Beneficial use, Breckenridge, Colorado, September 16-20, 1990.

Diamond, W. P., Irani, M. C., Aul, G.N., and Thimons E.D., Chapter 6 "Instruments, Techniques, and Equipment", Methane Control Research: Summary of Results, 1964-80, Bureau of Mines Bulletin 689, 1988.

Donna-Beth Howe, Ph.D.
November 23, 1993

NOV 1 6 1993

MEMORANDUM FOR: William L. Axelson, Director
Division of Radiation Safety & Safeguards, RIII

FROM: Carl J. Paperiello, Director
Division of Industrial and
Medical Nuclear Safety, NMSS

SUBJECT: DEPARTMENT OF ARMY PROPOSAL TO STORE FOR DECAY DISCARDED PROMETHIUM-147 WEAPON SIGHTS (LICENSE NO. 12-00722-07) RESPONSE TO REGION III QUESTION ON NEED FOR AN ENVIRONMENTAL ASSESSMENT

This refers to a telephone conversation with John Madera, of your staff, concerning whether the Department of Army's request, to amend the license for the Fort Bragg, North Carolina, site to store for decay, weapon sights containing promethium-147 (Enclosure 1), will require the NRC to perform an environmental assessment (EA) pursuant to 10 CFR Part 51. The Army's request has been reviewed by the Division of Low-Level Waste Management and Decommissioning (LLWM). LLWM's analysis (Enclosure 2) was forwarded to you in an earlier memorandum (Enclosure 3). Based on the technical analysis provided by LLWM and pursuant to 10 CFR 51.22(c)(14)(xvi), an EA will not be required. Unless there are other issues involved, Region III can amend the Army's license to authorize its request to store the sights for decay or it can decommission the Fort Bragg site (the Ammunition Supply Point (ASP) Yard) for unrestricted use. Should the Army choose to decommission the ASP yard, where the sights are buried, the Army will still be responsible for all non-radioactive hazards at the yard, such as unexploded munitions.

10 CFR 51.22(c)(14)(xvi) excludes an applicant/licensee from an environmental review on licensing and regulatory actions for "any use of source, byproduct, or special nuclear material not listed above, which involves quantities and forms of source, byproduct, or special nuclear material similar to those listed in paragraphs (c)(14)(i) through (xv) of this section (Category 14)." The staff has found the Army's proposed amendment request to be similar to the following categorical exclusion paragraphs discussed below:

1. <u>10 CFR 51.22(c)(14)(i), "Distribution of radioactive material and devices or products containing radioactive material to general licensees and to persons exempt from licensing."</u>

   Already discussed in the LLWM's technical analysis (Enclosure 2), 10 CFR §§ 30.14, 30.15, and 30.19 authorize a member of the general public to receive and possess devices containing Pm-147 (up to 2 mCi) in sealed sources, and products containing Pm-147 (up to concentrations of 200 pCi per gram) without further regulatory control. Once these devices and products (e.g., timepieces, lock illuminators, self luminous products, etc.) have served their useful life, the devices and products are normally disposed of as trash, by either incineration or burial

Enclosure C

in a landfill. The disposal of hundreds of timepieces annually to a large municipal landfill, in addition to disposal of other used devices and products under 10 CFR §§ 30.14, 30.15, and 30.19, is similar to the Army's proposed activity to decay in storage the gunsights, containing Pm-147 microspheres, at the Ft. Bragg ASP yard, resulting in a very unlikely hypothetical annual maximum dose of .0036 millirem to an intruder into the fenced off area.

2. 10 CFR 51.22(c)(14)(xiii), "Manufacturing or processing of source, byproduct, or special nuclear materials for distribution to other licensees, except processing of source material for extraction of rare earth and other metals."

All NRC licensees that manufacture or process sealed sources or devices containing Pm-147 are required under 10 CFR 30.35(g) to maintain records that the Commission considers important to decommissioning such as: (1) § 30.35(g)(3)(ii) which states, "All areas outside of restricted areas that require documentation under § 30.35(g)(1)."; or (2) § 30.35(g)(3)(iv) which states, "All areas outside of restricted areas which contain material such that, if the license expired, the licensee would be required to either decontaminate the area to unrestricted release levels or apply for approval for disposal under 10 CFR 20.302 or 20.2002." These and other decommissioning requirements (e.g., submittal of a decommissioning plan) are intended to provide the staff sufficient information to identify all potential health and safety problems before the Commission authorizes the termination of a materials license. Therefore, routine licensing actions, such as the decommissioning of the site used by a manufacturer of sealed sources or devices, are normally categorically excluded from an EA pursuant to 10 CFR 51.22(c)(14)(xiii)

The Army's activity is similar to that of a manufacturer or processor of sealed sources or devices containing Pm-147 in that both are required to maintain records for decommissioning, all areas, outside of restricted areas that have been contaminated with soil containing Pm-147 exceeding NRC limits for release of area for unrestricted use. These contaminated areas could have occurred from incidents such as inadvertent leaks from restricted areas (addressed under § 30.35(g)(3)(ii)) or spills during transport of Pm-147 over unrestricted areas (addressed under § 30.35(g)(3)(iv)).

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Mr. William L. Axelson - 3 -

Although the Army's proposed activity is not covered under a specific categorical exclusion paragraph in 10 CFR 51.22(c)(14)(i)-(xv), pursuant to 10 CFR 51.22(c)(14)(xvi), the Army's proposed activity is similar to the activities of either 10 CFR 51.22(c)(14)(i) or 10 CFR 51.22(c)(14)(xiii), and therefore qualifies for categorical exclusion.

If you have any questions, please feel free to contact Susan Greene of my staff at (301) 504-2686 or Joseph Wang at (301) 504-2611.

/S/

Carl J. Paperiello, Director
Division of Industrial and
Medical Nuclear Safety, NMSS

Enclosures:
1. Ltr fm D. Skogman to NRC dtd 10/28/92
2. Memo fm J. Austin to J. Glenn dtd 9/8/93
3. Memo fm J. Glenn to J. Madera dtd 9/17/93

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SEP 08 1993

MEMORANDUM FOR: John E. Glenn, Chief
Medical, Academic, and Commercial
Use Safety Branch
Division of Industrial and
Medical Nuclear Safety, NMSS

FROM: John H. Austin, Chief
Decommissioning and Regulatory
Issues Branch
Division of Low-Level Waste Management
and Decommissioning, NMSS

SUBJECT: TECHNICAL ASSISTANCE REQUEST - DEPARTMENT OF ARMY PROPOSAL TO STORE FOR DECAY DISCARDED PROMETHIUM-147 WEAPON SIGHTS (LICENSE NO. 12-00722-07)

In February 1993, you forwarded a Technical Assistance Request (TAR) to the Division of Low-Level Waste Management and Decommissioning (LLWM) regarding the U.S. Army's request to store for decay discarded Promethium-147 (Pm-147) weapon sights at its Fort Bragg, North Carolina site. You asked us to review documents submitted by the licensee, and provide an environmental assessment based on our findings, including any concerns about Nuclear Regulatory Commission policy that may have been raised by the situation.

LLWM originally stated in 1991 that this would be treated as a 10 CFR §20.302 disposal request. However, review of information from the licensee has led us to propose that the site could be released for unrestricted use (from a radiological standpoint) in accordance with appropriate decommissioning criteria.

Appendix A to this memo presents some background history of the site, and a description of the source term. Appendix B presents a radiological impacts analysis prepared by LLWM.

Since Region III will continue to hold an active license for the U. S. Army, possibly still including the Fort Bragg site, we suggest that the Region determine the proper licensing action for this decommissioning. If an Environmental Assessment is needed, the Region should use the site history and radiological impacts analysis provided herein to prepare the Environmental Assessment.

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We request that Region III keep us on concurrence and distribution for correspondence pertaining to the release of this site to ensure that our data base on these types of releases, which we maintain for the agency, remains current.

If you have any questions, please contact me at 504-2560 or Bill Lahs at 504-2569.

Michael F. Weber for

John H. Austin, Chief
Decommissioning and Regulatory
Issues Branch
Division of Low-Level Waste Management
and Decommissioning, NMSS

Enclosures: As stated

APPENDIX A: HISTORY OF SITE AND SOURCE TERM DESCRIPTION

I. Site Background and History

From 1987 to 1989, between 3,000 and 4,000 expended rocket tubes with radioactive sights were discarded in two locations at Fort Bragg. The tubes were equipped with weapon sights that originally contained 3 mCi of Pm-147 encapsulated in ceramic microspheres[1]. The Pm-147 is licensed by the Nuclear Regulatory Commission under license BML 12-00722-7.

In one location -- the Ammunition Supply Point (ASP) Yard -- the sights were randomly dumped over an area measuring roughly 100 yards by 300 yards. The Army graded the area to consolidate the material. Attempts by the Army to recover the weapon sights in the ASP were discontinued following the discovery of live ammunition mixed with the sights in the debris. The graded earth was subsequently pushed into a single large pile within the ASP[2]. The Army reports that the pile currently measures 35 ft. by 50 ft. by 10 ft (17,500 cubic feet). The ASP is now bounded by a security fence to prevent unauthorized entry due to its use as an ammunition facility[3].

In the second location -- the Directorate of Personnel and Community Environmental Hygiene Agency (DPCA) Recycling Yard -- the weapon sights were discarded in two trenches. In 1990 the rocket tubes were crushed, pushed into a trench and buried in the DCPA yard. The Army stated that tubes placed in the DCPA yard were completely recovered[4].

II. Source Term Description

According to the licensee, all the weapon sights were manufactured in 1977 or earlier[5]. The licensee also indicated[6] that 1,000 intact sights and 500 damaged sights were recovered; we therefore used a conservative number of

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[1] Environmental Site Assessment for Radiation at Ammunition Supply Point and Directorate of Personnel and Community Activities Recycling Yard, Fort Bragg Military Reservation, North Carolina, Barbara A. Lisle, Department of the Interior, U.S. Geological Survey, 1992, pp.12,17.

[2] Letter, David P. Skogman, Chief, Systems, Chemical and Radiation Division, Department of the Army, Rock Island, Illinois to John Madera, USNRC, Glen Ellyn Illinois, September 6, 1991, p. 1.

[3] Letter, Russell D. Hartwig, Acting Chief, Systems, Chemical and Radiation Division, Department of the Army, Rock Island, Illinois to John Madera, USNRC, Glen Ellyn Illinois, July 7, 1993, p. 1.

[4] ibid.

[5] Letter, Russell Hartwig to USNRC, July 7, 1993, op cit, p. 1.

[6] Skogman letter, op cit., p. 2.

3,000 sights remaining in the pile in the ASP. Using the Pm-147 half-life of 2.6 years, it can be calculated that the current total activity in the disposal area is no more than 150 mCi. The calculated average concentration of Pm-147 in the affected soil is about 200 pCi/g. Pm-147 is effectively a pure beta emitter (0.23 MeV max.) which decays to Sm-147, an alpha emitter with a half-life of 1 E+11 years. As a result, the total activity of Sm-147 will not exceed about 230 pCi [9 Ci x ($2.6/1 \times 10^{11}$) = 230 pCi][7].

[7] If this material were dispersed over 17,500 ft^2, the resulting concentration would be insignificant.

APPENDIX B: RADIOLOGICAL IMPACTS ANALYSIS

Because of both (1) the physical and chemical characteristics of the sights containing the Pm-147 (ceramic microspheres), and (2) the magnitude and half-life of the total radioactivity at the site, the potential pathways for radiological exposure to members of the general public are limited. The leach rate of Pm-147 from the ceramic microspheres has been shown to be very small[1]. Thus, when coupled with the small inventory of Pm-147 and its 2.6 year half-life, exposures through water dependent pathways are not considered credible.

For the same reasons, together with the unavailability of the land for near-term agricultural use (due to the unexploded ordnance in the Ammunition Supply Point yard), exposures through the plant/meat/milk pathways are also not considered credible. The limited inventory and areal extent of the Pm-147 contamination preclude any significant direct exposure from the beta activity, and these factors and the microspheric physical form preclude resuspension-inhalation from being considered a credible pathway. As a result, the only pathway considered credible for this radiological impact analysis is secondary ingestion; that is, direct ingestion of soil containing the sights.

Quantitative data for secondary ingestion rates range from 10 mg to 500 mg per day[2]. Using 200 pCi/g as the average concentration of Pm-147 over the contaminated area, an individual could theoretically ingest 3.65 E-2 μCi annually. 10 CFR Part 20 Appendix B to §§20.1001-20.2402 provides annual limits on intake (ALIs) by a reference man for given radionuclides. The value for Pm-147 is 5 E+3 μCi (stochastic). Since this value would result in a committed effective dose equivalent of 5 rems, the hypothetical dose from ingestion of 3.65 E-2 μCi annually can be calculated to be 3.6 E-2 mrem.

In the Order Establishing Criteria and Schedule for Decommissioning the Bloomsburg Site (57 FR 6136, February 20, 1992), the Nuclear Regulatory Commission staff provided maximum soil concentration values for release of property whose soil shows evidence of radioactive contamination. Although Pm-147 was not among the radionuclides for which soil concentrations were provided, the Order did include a value for strontium-90 of 5 pCi/g. The decay of Sr-90 and its daughter Yttrium-90 involve beta emissions with maximum energies of 0.55 and 2.27 MeV, respectively. The energy of these betas can be compared with the 0.23 MeV maximum energy of the beta emission from Pm-147. This energy difference, along with other considerations, results in the ALI for Sr-90 being 40 μCi (stochastic). Without considering the limited extent of the theoretical exposure pathways for Pm-147 discussed above, a comparable soil release criterion for Pm-147, based on the ratio of ALIs, would be about 625 pCi/g.

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[1] Properties and Uses of a Unique Ceramic Carrier for Radioisotopes, T.N. Lahr and J.P. Ryan, 3M Nuclear Products, St. Paul, MN, April 2, 1963, p. 4.

[2] NUREG/CR-5512, Vol. 1, Final Report, p. 6.14.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
799 ROOSEVELT ROAD
GLEN ELLYN, ILLINOIS 60137

NOV 18 1992

MEMORANDUM FOR: John E. Glenn, Chief, Medical, Academic, and Commercial Use Safety Branch, NMSS

THRU: John A. Grobe, Chief, Nuclear Materials Safety Branch, Region III

FROM: George M. McCann, Chief, Materials Licensing Section, Region III

SUBJECT: REQUEST FOR GUIDANCE AND TECHNICAL ASSISTANCE REGARDING A REQUEST BY THE DEPARTMENT OF THE ARMY TO STORE FOR DECAY DISCARDED PROMETHIUM-147 WEAPON SIGHTS (LICENSE NO. 12-00722-07)

Enclosed for your review is the licensee's environmental assessment of the Fort Bragg Military Reservation in North Carolina. This submission, we believe, will answer your concerns described in your memorandum to John A. Grobe, Chief, Nuclear Materials and Safeguards Branch, Region III, dated November 15, 1991, and communicated to the licensee in the RIII letter dated December 13, 1991 (enclosed).

The Army's Fort Bragg situation and request, previously described in the RIII memorandum dated March 28, 1991, does not represent a significant environmental or health and safety problem but it did raise various NRC policy questions. Therefore, we would appreciate your guidance and technical assistance with the review of the enclosed environmental assessment in order to closeout this licensing action.

If you have any questions or require clarification on any of the information stated above, you may contact John R. Madera of my staff at FTS 388-5746.

George M. McCann, Chief
Materials Licensing Section

Enclosures:
1. Letter and environmental assessment dated October 28, 1992
2. Memorandum dated November 15, 1991

Encl. 1

OCT 20 1993

MEMORANDUM FOR: Charles W. Hehl, Director
Division of Radiation Safety & Safeguards, RI

FROM: Carl J. Paperiello, Director
Division of Industrial and Medical
Nuclear Safety, NMSS

SUBJECT: SENECA ARMY DEPOT - TECHNICAL ASSISTANCE REQUEST ON REQUEST FOR AUTHORIZATION TO DECONTAMINATE EQUIPMENT (CONTROL NUMBER 116420)

This is in response to a memorandum from Dr. Ronald Bellamy, of your staff, to Dr. John Glenn, dated June 11, 1993 (Enclosure 1), on whether the NRC should require the Department of the Army, Seneca Army Depot, to submit additional information, as part of its license renewal application, for the NRC to perform an environmental assessment (EA) pursuant to 10 CFR Part 51. In its license renewal application dated November 2, 1992, Seneca Army Depot requested authorization to receive, store, and decontaminate machinery and equipment contaminated with depleted uranium. Based on the information provided by Seneca in the license renewal application and its response, dated September 2, 1993, to Region I's request for additional information (Enclosure 2), an EA will not be required if Seneca limits the interim storage period of other Agencies' (i.e., the Department of Energy's (DOE's) and the U.S. Air Force's) contaminated machinery and equipment at Seneca to less than 180 days.

10 CFR 51.22(c)(14)(xvi) excludes an applicant/licensee from an environmental review on licensing and regulatory actions if "any use of source, byproduct, or special nuclear material not listed above which involves quantities and forms of source, byproduct, or special nuclear material similar to those listed in paragraphs (c)(14)(i) through (xv) of this section (Category 14)." Seneca's new proposed activity (i.e., decontamination of contaminated machinery and equipment), as described in its license renewal application, consists of three different uses of licensed material. These are: (1) receipt and possession of licensed material; (2) use, processing, and packaging of licensed material; and (3) shipping and disposal of licensed material. Each "use" has been evaluated by the staff against the appropriate categorical exclusion paragraph and found to be similar to the following categorical exclusion paragraphs discussed below:

1. "Receipt and possession of licensed material" is similar to 10 CFR 51.22(c)(14)(x), "Possession of radioactive material incident to performing services such as installation, maintenance, leak tests and calibration."

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Since Seneca plans to decontaminate the DOE's and the Air Force's machinery and equipment contaminated with depleted uranium as well as that of the Army's, a licensing action which authorizes Seneca to conduct this specific activity is similar to that of a service licensee because Seneca will be receiving, possessing, and performing "maintenance" of the DOE's and the Air Force's contaminated machinery and equipment.

2. "Use, processing, and packaging of licensed material" is similar to 10 CFR 51.22(c)(xiii), "Manufacturing or processing of source, byproduct, or special nuclear materials for distribution to other licensees, except processing of source material for extraction of rare earth and other metals."

   After receipt of the DOE's and the Air Force's contaminated machinery and equipment, unlike most service licensees, Seneca's maintenance activity could result in the generation of up to 10,000 kilograms of depleted uranium contamination. The contamination generated from Seneca's maintenance operation (i.e., decontamination) is depleted uranium. Seneca's proposed activity is similar to that of a manufacturer of depleted uranium penetrators or shielding because these manufacturers generate a large amount of depleted uranium-contaminated waste in the processing of source (i.e., depleted uranium) materials. Both Seneca and the source material manufacturer will also package the depleted uranium contaminated waste for disposal at a licensed land burial facility.

3. "Shipping and disposal of the licensed material" is similar to 10 CFR 51.22(c)(14)(xii), "acceptance of packaged radioactive wastes from others for transfer to licensed land burial facilities provided the interim storage period for any package does not exceed 180 days and the total possession limit for all packages held in interim storage at the same time does not exceed 50 curies."

   Unlike a source material manufacturer, Seneca will also ship not only its own waste, but also packaged radioactive wastes originating from another specific licensee (i.e., the DOE or the Air Force), to licensed land burial facilities. This proposed activity is similar to that of a waste broker because the waste broker is authorized to transfer other licensees' wastes to licensed land burial facilities.

   However, Seneca needs to be consistent with all restrictions (i.e., interim storage does not exceed 180 days and the total possession limit for all packages held in interim storage at the same time does not exceed 50 curies) placed on waste brokers under this categorical

exclusion. Seneca has already committed to limit the contaminated machinery and equipment (including the Army's) to less than 10,000 kilograms of depleted uranium, or a total activity of 3.36 curies (Enclosure 2). Therefore, Seneca needs to commit to an interim storage period, for the DOE's and the Air Force's contaminated depleted uranium, of less than 180 days in order to qualify under this categorical exclusion. The need for this commitment is consistent with the staff's earlier response to ALARON's request to amend its waste broker license to store, repair, and maintain licensed material in contaminated equipment (Enclosure 3). Unlike waste brokers, Seneca is not commercially receiving, storing, and shipping radioactive wastes to licensed land burial facilities.

Although Seneca's proposed activity is not covered under a specific categorical exclusion paragraph in 10 CFR 51.22(c)(14)(i)-(xv), pursuant to 10 CFR 51.22(c)(14)(xvi), Seneca's proposed activity is similar to the activities of 10 CFR 51.22(c)(14), paragraphs (x), (xii), and (xiii) when taken together, and therefore qualifies for a categorical exclusion.

The contact person on my staff for this TAR is Joseph Wang who can be reached at (301) 504-2611.

Carl J. Paperiello, Director
Division of Industrial and
Medical Nuclear Safety, NMSS

Enclosures:
1. Memo fm R. Bellamy to J. Glenn dtd 6/11/93
2. Ltr fm R. Johnson to J. Kinneman dtd 9/2/93
3. Memo fm J. Glenn to R. Bellamy dtd 7/30/93

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

JUN 11 1993

License No. SUC-1275
Docket No. 040-08526
Control No. 116420

MEMORANDUM FOR: John E. Glenn, Chief
Medical, Academic and Commercial Use Safety Branch
Office of Nuclear Material Safety
and Safeguards

FROM: Ronald R. Bellamy, Chief
Nuclear Materials Safety Branch
Division of Radiation Safety
and Safeguards

SUBJECT: SENECA ARMY DEPOT - REQUEST FOR AUTHORIZATION TO DECONTAMINATE EQUIPMENT - Technical Assistance Request

Background:

In their renewal application for the above referenced license, the Department of the Army, Seneca Army Depot requests authorization to receive, store, and decontaminate machinery and equipment contaminated with depleted uranium. The machinery and equipment would be received primarily from other Army licensees, but might be received from Army contractors. Some of the equipment would be also contaminated with hazardous materials, such as beryllium, which might result in the production of mixed waste.

Problem:

The categorical exclusions in 10 CFR 51.22 do not seem to cover this activity. Since most of this equipment was contaminated as a result of the uranium munitions program 51.22(c)(14)(xv) might apply, but it seems such an activity was likely not considered in adopting that exclusion. If no categorical exclusion applies, an Environmental Assessment (EA) would need to be prepared before the license can be amended to authorize this activity.

If Seneca wishes to decontaminate equipment from other than Army licensees, an EA will be required.

Prior to issuing the license, we will assure that contaminated equipment will not be stored indefinitely and that the Army has adequate plans for handling the mixed waste generated.

We would appreciate a prompt response to this Technical Assistance Request.

Ronald R. Bellamy

Ronald R. Bellamy, Chief
Division of Radiation Safety
and Safeguards, RI