COR

**Department of Energy**
Carlsbad Field Office
P. O. Box 3090
Carlsbad, New Mexico 88221

January 8, 2009

Mr. Jonathan Edwards
U.S. Environmental Protection Agency
Office of Air and Radiation
401 M Street, S.W.
Washington D.C. 20460

Subject: Notification of Intent to Begin Low Background Radiation Experiment

Dear Mr. Edwards:

The purpose of this correspondence is to provide the Environmental Protection Agency (EPA) notice that the Department of Energy (DOE) has begun preparatory activities to support additional basic research in the unique underground environment of the Waste Isolation Pilot Plant (WIPP) for the Low Background Radiation Experiment (LBRE). The LBRE will start no sooner than March 15, 2009. A project description is included in Attachment 2.

The LBRE research will be conducted by several collaborators, led by New Mexico State University (NMSU), and will be performed in the north experimental area in the E300 drift between N1100 and N1400 and consist of two unrelated phases, as described in the attachment.

NMSU researchers will assemble and calibrate an *in vivo* radiobioassay system within the Carlsbad Environmental Monitoring and Research Center (CEMRC) facilities in Carlsbad. The system will then be re-assembled in the WIPP underground, where support services and clothes changing facilities will be provided. Once the system is assembled and operating, researchers will measure background radiation, and perform calibrations and measurements using ultra-low radiation phantoms containing known ultra pure radioactive sources.

A second element of LBRE will conduct biological testing on ultra-radiosensitive bacterial cultures. Research to identify biological changes in culture growth curves resulting from absence of background exposure will test low dose response of the colonies.

In accordance with the conditions set forth in a March 11, 2003 letter from F. Marcinowski (EPA) to I. Triay (DOE), enclosed is the Unreviewed Safety Question (USQ)/ Project Description for the LBRE. The USQ determination (Attachment 1) shows that there will be:

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- no changes in underground ventilation
- no additional hazardous substances or new hazards introduced into the underground
- no change in the facility footprint
- no modification to the waste disposal processes or any impact to the waste disposal operations
- provisions to remove LBRE equipment from the underground upon completion of the activity

The USQ process also reviewed the hazards associated with this experiment and concluded that there is no significant risk associated with the LBRE. WIPP safety reviews have been conducted and it has been determined by the DOE that the project will not interfere with waste handling or disposal operations.

The DOE has determined that the WIPP facilities and infrastructure can provide support for this project without interfering with the primary mission of the WIPP. LBRE status will be included in the Annual Change Report.

If you have any questions, please contact Mr. Roger Nelson of my staff at (575) 234-7213.

Sincerely,

David C. Moody

David C. Moody
Manager

Enclosures

cc: w/enclosures
T. Peake, EPA *ED
C. Byrum, EPA ED
R. Lee, EPA ED
V. Daub, CBFO ED
R. Nelson, CBFO ED
R. Patterson, CBFO ED
WIPP Operating Record
CBFO M&RC

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**Title: Project Description for the Low Background Radiation Experiment (LBRE)**

**Scope:** The scope of this USQ evaluation addresses the affect of the staging of LBRE equipment and supplies in the underground including the transport of nitrogen gas cylinders to the experimental area, the storage of the two liquid nitrogen tanks; and the installation of three modules (whole body counter cell, the dressing room, and counting room).

**Description:** The LRBE will be located in the north experimental area in the E300 drift between N1100 and N1400 (see Figure 1 in the attached project description). This area is not located near the disposal panel.

The project description for the LBRE outlines the requirements, materials required, hazards, and mitigation of such, expectations and plan of action associated with the establishment of the LBRE in the WIPP underground. The LBRE measure low radiation exposures of personnel using the ultra-low background radiation that exists in the WIPP underground. These measurements will establish a method to evaluate whether a radiation worker has been exposed to radiation and determine whether the Linear No Threshold (LNT) or the Hormesis model is correct for the assessment of radiation risk.

**Safety Basis Documentation Reviewed:**

DOE/WIPP 07-3372, Rev. 0, WIPP DSA, Chapter 3, Table 3.3-5 Event; 05C-CH/RH-UG, UID 630, Section 3.4.2.15.1; Chapter 11.4.3
DOE/WIPP 07-3373, Rev. 0, WIPP TSRs, LCO 3.6.1, 3.6.2, 3.6.3
DOE/WIPP 95-2065, Rev. 10, CH DSA, w/approved page changes, Table A-14, UG3-10
DOE/WIPP 95-2125, Rev. 10, CH TSRs, w/approved page changes, Section 5.6.9
DOE/WIPP 06-3174 Rev. 0, RH DSA, w/approved page changes
DOE/WIPP 06-3178 Rev. 0, RH TSRs, w/approved page changes, Section 5.6.9

**Other References:**

WP 02-AR3001, Revision 7, Unreviewed Safety Question Determination Project Description for the Low Background Radiation Experiment (Attached)

1. Does the proposed activity or PISA increase the probability of occurrence of an accident previously evaluated in the existing safety basis?

   [X ] No [ ] Yes/Maybe

   **Basis:** The proposed LBRE does not increase the probability of occurrence of an accident previously evaluated in the existing safety basis because representative accidents were identified in the Hazard Analysis as listed above in the safety basis documentation. The events of concern are explosions and puncture impacts to waste containers in the waste path or at the waste face. There will be no change to the events as described.

2. Does the proposed activity or PISA increase the consequences of an accident previously evaluated in the existing safety basis?

   [X ] No [ ] Yes/Maybe

**Basis:** The proposed LBRE does not increase the consequences of an accident previously evaluated as because unmitigated consequences were indentified as moderate to the public in all events. Compressed gas cylinders controls are provided in Section 5.6.9 of the CH DSA, Rev. 10 and the RH DSA, Rev. 0 along with the WIPP TSR, Rev. 0 LCO 3.6.1, 3.6.2, and 3.6.3. The proposed LBRE activities will be conducted in the north end of the mine away from the waste disposal path and storage panel.

3. Does the proposed activity or PISA increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the existing safety basis?

   [X ] No [ ] Yes/Maybe

**Basis**: The proposed LBRE does not affect any equipment important to safety or waste handling activities identified or described in the safety basis. Section 4, "Equipment/Materials" of the attached project description does not identify, support the use of or impact equipment important to safety. Therefore there is no increase in the occurrence of a malfunction of equipment important to safety.

4. Does the proposed activity or PISA increase the consequences of a malfunction of equipment important to safety previously evaluated in the existing safety basis?

   [ X] No [ ] Yes/Maybe

**Basis:** Since there is no increase in the material-at-risk, the LBRE will be located in the north end of the experimental area, and compressed gas cylinder control will comply with the TSR requirements, there is no increase in the consequences of a malfunction of equipment important to safety.

5. Does the proposed activity or PISA create the possibility of an accident of a different type than any previously evaluated in the existing safety basis?

   [X ] No [ ] Yes/Maybe

**Basis:** The proposed LBRE does not introduce new hazards not identified in the accidents described in section 2.0 above. The accidents of concern are explosions and punctures, which were previously evaluated in the existing safety basis. The proposed LBRE does not introduce new accident initiators or hazards. Therefore, there is no increase in the possibility of an accident of a different type than previously evaluated in the existing safety basis.

6. Does the proposed activity or PISA create the possibility of a malfunction of equipment important to safety of a different type than any previously evaluated in the existing safety basis?

   [X ] No [ ] Yes/Maybe

**Basis**: The proposed LBRE does not relocate, modify, or affect any equipment identified in the existing safety basis as important to safety. Therefore, the possibility of a malfunction of equipment important to safety is not possible.

7. Does the proposed activity or PISA reduce a margin of safety?

   [X ] No [ ] Yes/Maybe

**Basis**: The proposed LBRE will comply with all existing TSR controls, their bases, key attributes of the applicable safety management programs. The proposed LBRE does not degrade the preventive and mitigative features of any safety SSCs or the performance of equipment important to safety. Therefore there is no reduction in the margin of safety from the proposed LBRE.

**Conclusion:**

[ X ]All questions above were answered "No"; therefore, no USQ exists.

[ ] One or more of the above questions was answered "Yes"; therefore, DOE approval is required prior to performing the proposed activity.

Safety basis change required? [x] No [ ] Yes, change number

| **USQ Evaluator #1** | | **USQ Evaluator #2 (Independent Reviewer)** | |
|---|---|---|---|
| Patty Hollen | | James McCormick | |
| (Print Name) | | (Print Name) | |
| **SIGNATURE AVAILABLE ON FILE** | | **SIGNATURE AVAILABLE ON FILE** | |
| Signature | Date | Signature | Date |

**NRB REVIEW (If Required)**

Meeting No.: NA Date:

NRB Chairman Concurrence: NA Date:

Signature

**OTHER REVIEW (If Required)**

Print and Sign: NA Date:

# Project Description

# for the

# Low Background Radiation

# Experiment (LBRE)

LBRE Project Description

Contents:


1. Introduction
2. Location
3. Configuration
4. Equipments/materials
5. Hazards
6. Training
7. WIPP Procedures Applicable to the experiment.
8. Site specifications
9. Installation and setup
10. Completion and removal

# Project Description for the Low Background Radiation Experiment (LBRE)

## 1. Introduction

This document outlines the requirements, materials required, hazards and mitigation of such, expectations and plan of action associated with the establishment of the Low Background Radiation Experiment in the WIPP underground. The main target of this project is to measure very low radiation exposures of people utilizing the ultra-low background radiation that exists in the WIPP underground. These measurements will also help the DOE to establish a method to evaluate whether a radiation worker was exposed to radiation during his work. Another achievement in this project will be to determine whether the Linear No Threshold (LNT) model or the Hormesis model, is correct for the assessment of radiation risk.

## 2. Location

The LRBE is proposed to be located near the EXO experiment in the WIPP underground in the North Experiment Area (NExA). NExA is located in the E-300 drift between the N-1100 drift and the N-1400 drift as shown in figure 1 below.

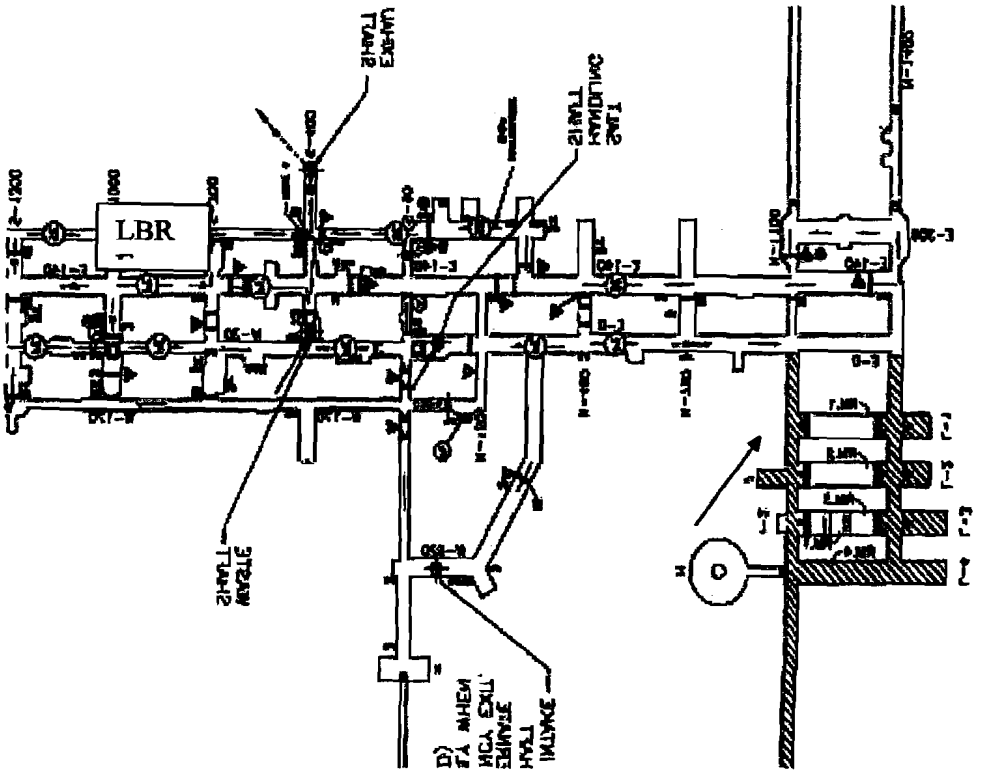


**Figure 1.** Underground Location

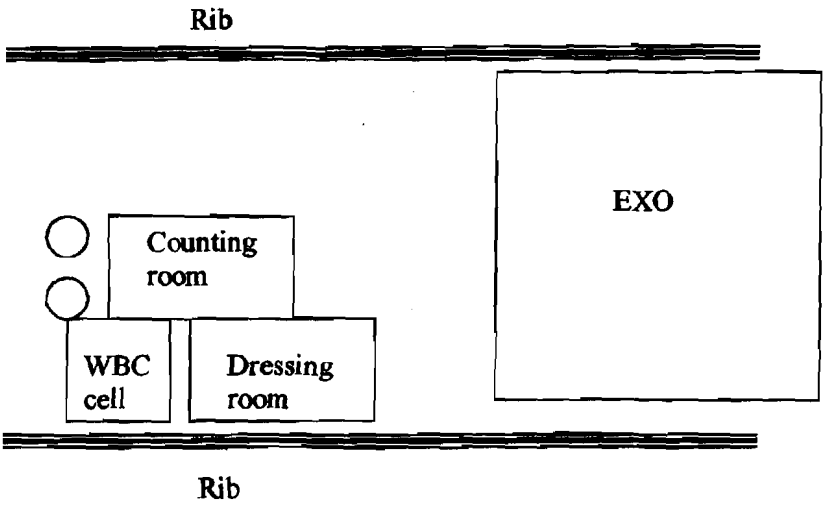


**Figure 2.** Experimental Arrangement and Location within the Room

### 3. Configuration

The experimental area will occupy three modules. The first module is the whole body counter cell. This cell is a shielded cell made from pre-world war II steel and has been used as shielding while counting background radiation. Inside the cell, a specially designed counting chair and positioning mechanism is secured, and a set of two or three High Purity Germanium (HPGe) detectors will be suspended from the ceiling of the cell and aimed to the chest of the individual. These detectors are mounted in two cryostats which will be filled with liquid nitrogen. Fresh ventilation air will be provided to the cell, and an oxygen level detector will monitor the level of oxygen inside. Alternatively, the cell will house a carbon dioxide incubator that can

be used for cell culture applications. These incubator(s) will not be present when an individual is being counted.

The second module is the dressing room. This module will have a space for the individuals to change their clothes to scrubs, and it will open directly to the first module.

The third module is the counting room. This room will hold all the electronics and the computers needed for the experiment.

Outside the modules, there will be two liquid nitrogen tanks to provide the coolant liquid for the detectors in the shielded cell. The first module is a 5 feet wide by 7.5 feet deep by 7 feet high. Figure 3 contains a picture of the first module. The other modules are 8 x 10 x 7 feet.

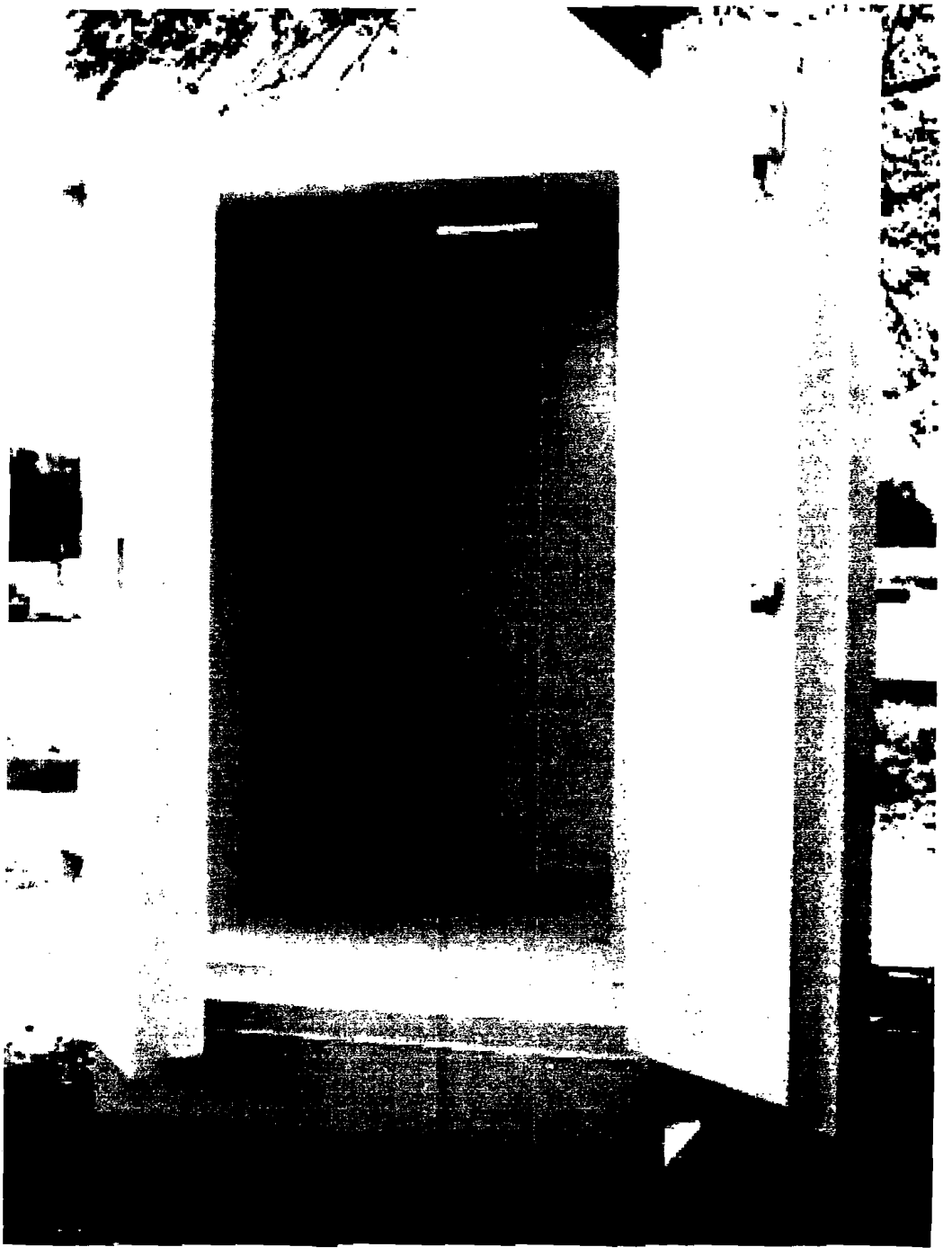

Figure 3. The shield cell (module 1)

**4. Equipment/Materials**

a. 3 HPGe detectors

b. Environmental Oxygen monitor

c. Electronics rack

d. LN2 Dewars, 250 liter capacity (2 required)

e. Biological incubator.

f. $CO_2$ Dewar, 50 liter capacity.

g. Regular computer

h. Calibration sources

i. Torso phantom

**5. Hazards**

**Cryogenics**:

LN2 will be present in the facility. Liquid nitrogen consumption during operations is estimated at a maximum of 20 liters per day. Solid-state detectors constructed from HPGe are employed to detect internally deposited radioactive materials in human subjects. For these detectors to correctly operate, they must be maintained at $LN_2$ temperatures. To achieve this requirement, each detector has a tank or cryostat which holds a limited quantity of $LN_2$ .

***$LN_2$, is at a temperature of -196 °C and can cause frostbite or eye injury if not handled properly. In addition, nitrogen gas can displace the oxygen in an enclosed area and poses a suffocation risk in poorly ventilated areas. The following safety precautions shall be followed when working with $LN_2$:***

- Safety glasses, face shield, and an apron shall be worn at all times while filling cryostats with liquid nitrogen.
- Insulated or leather gloves shall be worn when touching surfaces or handling objects cooled by $LN_2$.
- $LN_2$ shall be used only in well-ventilated areas.
- A backup person shall be present at all times during the process of filling the cryostats.

**Radiation:**

Small amounts of radioactive sources will be used at the facility. These sources are used for calibration and they are very limited in activity. The largest source will be the mix gamma source (Co-60, Eu-152, Am-241) with an activity less then 50 μCi. All radiological sources will be stored and utilized per approved WIPP procedures.

**6. Required Training**

GET-208 (16 hours) is required for site access.

SAF-501 (40 hours) Mine Safety, Inexperienced Miner Training,

SAF640 Cryogens, Refrigerants, and Process Gasses Safe Use and Handling

SAF-619 Compressed Gas Cylinder Safety

RAD-101 (16 hours), Radiation Safety Training,

**7. WIPP Procedures Applicable to LBRE**

(Additional procedures may apply)

| | |
|---|---|
| WP 02-AR3001 | Unreviewed Safety Question Determination |
| WP 02-EC.12 | Site Users Guide for Organizations, Personnel, or Companies that perform Work on U.S. Department of Energy Property or Rights-of-Way on or around the Waste Isolation Pilot Plant. |
| WP 02-RC3108 | Request for Disposal |
| WP 04-AD3011 | Equipment Tagout/Lockout |
| WP 04-AD3013 | Underground Access Control |
| WP 10-2 | Maintenance Operations Instruction |
| WP 10-WC3011 | Maintenance Process |
| WP 12-FP3003 | Combustible Loading Controls Program |
| WP 12-HP3002 | Radioactive Material Control |
| WP 12-IH.02-12 | Cryogens, Refrigerants, and Process Gasses |
| WP 12-IH1020 | Abnormal Condition Involving Cryogenics/Process Gas |
| WP 12-IS.01 | WIPP Industrial Safety Manual |

**8. Alcove specifications**

| | |
|---|---|
| Temperature - | $80\pm10^{0}$F |
| Relative Humidity - | 15-60 percent |
| Electrical Requirements - | 10 kW in a single 110v feed to the modules |
| Telephone - | 1 party line wired telephone connection |
| Dust/fumes- | Dust abatement plastic curtains (Brattice Material) |

**9. Installation and setup**

CEMRC (Carlsbad Environmental Monitoring and Research Center) will provide all the measurement parts including the detectors, the electronics, the incubators and the computers. All the other components including modules 2 and 3 and the liquid nitrogen will be supplied by WIPP. All the installation for the detectors, electricity and the $LN_2$ will be scheduled and coordinated by the WIPP Technical Support Team.

**10. Completion and removal**

The WIPP is a RCRA-regulated facility and is responsible for any accidental spillage, removal, and cleanup of hazardous material. All materials received by the WIPP warehouse will be in compliance with and processed per approved WIPP procedures. All experimenters are responsible to notify the WIPP technical support engineer and the WIPP warehouse of any expected shipments.

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| CORSPDNCE ID |
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| CBFO:OOM:RN |
| CORSPDNCE/UFC # 09-0001:UFC4700 |
| CONCURRENCE |
| RTG. SYMBOL R. Nelson |
| Initials/Sig RN |
| Date 1/6/09 |
| RTG. SYMBOL R. Patterson |
| Initials/Sig RLP |
| Date 1/6/09 |
| RTG. SYMBOL D. Daub |
| Initials/Sig |
| Date 1/9/09 |
| RTG. SYMBOL D. Moody |
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In accordance with the conditions set forth in a March 11, 2003 letter from F. Marcinowski (EPA) to I. Triay (DOE), attached is the Unreviewed Safety Question (USQ)/ Project Description for the LBRE. The USQ determination (Attachment 1) shows that there will be:

- no changes in underground ventilation,
- no additional hazardous substances or new hazards introduced into the underground,

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## Cooper, Andrea

**From:** Cooper, Andrea

**Sent:** Thursday, January 08, 2009 4:51 PM

**To:** 'edwards.jonathan@epa.gov'

**Cc:** Peake, Tom; 'Byrum'; 'lee.raymond@epa.gov'; Daub, Vernon - DOE; Nelson, Roger - DOE; Patterson, Russ - DOE; Moody, Dave C. - DOE; Roush, Parrish

**Subject:** Notification of Intent to Begin Low Background Radiation Experiment (Please see attachment)

**Attachments:** 09-0001.pdf

**Hardcopy to follow by mail. Thank you.**

*Andrea Cooper*
*Lead Secretary*
*DOE Carlsbad Field Office*
*575-234-7333 (office)*
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