



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460



FEB 4 2004

OFFICE OF  
AIR AND RADIATION

R. Paul Detwiler, Acting Director  
Carlsbad Field Office  
U.S. Department of Energy  
P.O. Box 3090  
Carlsbad, NM 88221-3090



Dear Mr. Detwiler:

I am writing in response to Dr. Inés Triay's September 3, 2003, letter that provided the Environmental Protection Agency (EPA) additional information to assist the Agency's review of Phase I of the Enriched Xenon Observatory Experiment (EXO). We have completed our final review and hereby approve Phase I of EXO.

The EXO experiment proposed by the Department of Energy (DOE) will be located underground in the Core Storage Alcove of the Waste Isolation Pilot Plant (WIPP). Its purpose is to investigate neutrino-less double-beta decay, an extremely rare nuclear process that will allow measurement of the mass of neutrinos. Phase I is expected to last from one to five years and aims to demonstrate the detector technology. The detector consists of a time projection chamber containing up to 200 kilograms of enriched xenon, with significant amounts of copper, lead, water, and liquid nitrogen used for various shielding, containment, recovery, and re-purification components. Phase II, which will be covered in a subsequent approval request, would represent a scaled-up version of the same detector, containing up to ten tons of enriched xenon.

The EPA completed a preliminary review of the EXO experiment and notified DOE of the results in a letter from Frank Marcinowski dated March 6, 2003. In our preliminary review we determined that the documentation addressed all the items in our experimental review checklist except for one item: "Are accidents reasonably considered or are they discounted out-of-hand?" The accident analysis initially provided by DOE in November, 2002 did not adequately consider the potential impacts, both short-term and long-term, on the WIPP facility from accidents related to the EXO experiment. Specifically, the documentation in Attachment 6 of the project description in your original submission, which involves unreviewed safety

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questions (USQ), noted that the EXO experiment “is not described in the SAR [Safety Analysis Report]” and claimed that “there are no potential impacts to SAR accidents,” but provided no information to support such a claim. The Agency believes that the increased number, complexity, and physical extent of potential future experiments at the WIPP warrants a more in-depth exploration of the potential effects of accidents on the operations and performance of the WIPP than has been previously analyzed. Specifically, we requested that the Department of Energy expand the SAR, or provide a substantially equivalent analysis to examine the potential effects of such accidents.

Dr. Triay’s September, 2003 letter provided such an expanded analysis in the form of an updated Unreviewed Safety Question and modified Safety Analysis Report. We have completed our review of this additional material and found that it adequately addresses the concerns noted in our March 6, 2003, letter. With the additional information, we find that the EXO experiment, Phase I, now satisfies all elements of the EPA WIPP Experiment Review Checklist. Therefore, the Agency approves the emplacement and implementation of Phase I of the EXO experiment located in the former Core Storage Alcove. Please keep us informed of your progress and submit for our review and approval any modifications or changes to the proposed plan for this experiment. This approval does not extend to Phase II of the EXO experiment; as discussed above, DOE must separately request approval to expand the experiment.

Once again, our consideration or approval of emplacement of any experiments is based solely on technical grounds in accordance with 40 C.F.R. Part 194. Please be advised that any consideration or approval does not in any way constitute a determination that DOE has actual statutory authority under the WIPP Land Withdrawal Act to conduct such activities, nor is this letter intended to indicate in any manner the Agency’s opinion on this question.

If you have any questions about this guidance, please contact Tom Peake at (202) 343-9765.

Sincerely,  
  
Frank Marcinowski, Director  
Radiation Protection Division

Enclosure

cc: Lynne Smith, DOE/HQ  
Roger Nelson, DOE/CBFO  
Russ Patterson, DOE/CBFO  
Matthew Silva, EEG  
Steve Zappe, NMED

## EPA EXO PHASE ONE EXPERIMENT CHECKLIST

### EPA WIPP Experiment Review Checklist

EPA has several primary interests and concerns related to placing individual experiments in the WIPP underground:

First, can the introduction of this experiment effect in anyway the long-term integrity and viability of the primary design purpose of the WIPP, the disposal system?

Secondly, is there anything about the experiment that degrades or jeopardizes the approved design repository baseline from the EPA certification?

Finally, does this experiment's potential interaction with other experiments create additional potential hazards to the short-term operational phase or the long-term performance of the disposal system? In other words, are there any potential synergistic effects from the separate experiments in case unforeseen circumstances occur?

Our review will be looking for clear evidence that these issues have been adequately considered and clearly documented.

#### **Plan and Description:**

- ✓ Does the experimental description provide sufficient detail to allow the EPA to understand the scope and size of this experiment?
- ✓ Does the description adequately describe the experimental design and setup?
- ✓ Is the description complete enough to understand exactly how the experiment will be performed?

#### **Location:**

- ✓ Is the location of the experiment adequately described so that the EPA can see that its location will not have a negative impact on waste disposal operations?

#### **Configuration and Organization:**

- ✓ Does the configuration clearly define the actual experimental setup in such a way that the EPA can analyze synergistic impacts of this experiment?

#### **Hazard Analysis:**

- ✓ Is there an hazard analysis for the particular experiment?
- ✓ Does the hazard analysis consider the short-term impact of the experiment on:
  - ✓ Waste disposal operations?
  - ✓ Waste movement in the underground?
  - ✓ The approve certification design and operational process?
  - ✓ Are all reasonable failures considered?

## EPA EXO PHASE ONE EXPERIMENT CHECKLIST

- ✓ Are accidents reasonably considered or are they discounted out-of-hand?
- ✓ Does the hazard analysis consider the potential long-term impact of the experiment:
  - ✓ Is the review complete enough to consider all reasonable feature, events, and process that could be a result of this experiment?
  - ✓ Are all reasonable failures considered?
  - ✓ Are accidents reasonably considered?
  - ✓ Does the hazard analysis reasonably address performance assessment type of issues with appropriate calculations?
- ✓ Does the hazard analysis examine potential synergistic effects with other experiments?
- ✓ Stated in the EA, "... engineered safety features and controls would be implemented to prevent the occurrence of these accidents." For this experiment does the documentation show that this has been reasonably done?
- ✓ The EA states that for some liquids (e.g. scintillation liquid) chemical reactions with salt are unknown but would be investigated before their introduction into the underground. Does this documentation clearly describe that this has been done, if needed, for this experiment?
- ✓ Does this document clearly explain a plan of how salt roof, floor, and wall maintenance will be done in and around this experiment?
- ✓ Does the document adequately describe the additional shoring and bracing, if needed, added to protect this experiment from roof fall, etc?
- ✓ Does the documentation adequately describe the secondary containment systems, if necessary, used to prevent uncontrolled releases of liquids?

### **Installation and Implementation:**

- ✓ Is the installation discussion sufficiently clear and detailed to allow the EPA to understand how experimental equipment and personal will be placed underground so that their introduction will not interfere with waste disposal operations?
- ✓ Is it clear that the installation plan has reasonably considered possible accidents and their impact on ongoing waste disposal operation?
- ✓ Is it clear that waste disposal is the primary operation when compared to this experiment?

## EPA EXO PHASE ONE EXPERIMENT CHECKLIST

### **Completion:**

- ✓ Is the plan reasonably complete enough to show that equipment removal and area clean-up has been considered?

### **Removal:**

- ✓ Is there a commitment to remove the experiment from the underground before the closure of the facility?
  - ✓ If not, is there an analysis to evaluate the experiments expected impact on the disposal systems long-term performance?
  - ✓ Is a performance assessments needed to evaluate this experiments possible impact on long-term repository performance?

### **Summary:**

- ✓ Can the EPA agree that the experiment is well planned, implemented, and that it is controlled?
- ✓ Can the introduction of this experiment effect in anyway the long-term integrity and viability of the primary design purpose of the WIPP, the disposal system?
- ✓ Is there anything about the experiment that degrades or jeopardizes the approved design repository baseline from the EPA certification?
- ✓ Does this experiment's potential interaction with other experiments create additional potential hazards to
  - ✓ the short-term operational phase or
  - ✓ the long-term performance of the disposal system?