EIS001822

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EIS Program Manager
U.S. Department of Energy
OCRWN
Yucca Mt.
Site Characterization Office

RECE...

FEB 2 8 2000

Dear Ms. Dixon,

1... My wife, Lynda McDowell, and I are concerned about the funneling of East Coast nuclear reactor waste through our neighborhood. We are both research scientists in the Department of Chemistry at Washington University. The cyclotron that was used to produce fissionable material as part of the Manhattan Project is still part of our department, but now houses a Machine shop and Mass Spectrometer Laboratory. Lynda is a physical chemist and I am a biologist
2... (psychologist, pharmacologist, molecular, cell, and structural biologist). A recent article in the journal Science (see summary below from Chemical & Engineering News) shows that our
3 government is ignoring work performed by their own nuclear chemists: There are simply no known safe storage options for nuclear waste. The containment ponds in which the spent fuel rods are currently stored continues to be the only rational storage option. In this state the material can be constantly monitored for safety and manipulated if need be to maintain containment.

4 The driving force to consolidate this toxic material must be to prevent its use by terrorists. Unfortunately there are fanatics willing to suffer lethal radiation doses for the opportunity to poison millions. One could mount an argument for regional containment ponds (East, Midwest,
1 cont. and West) to address this concern. I would suggest that if trains are to be used for transport, we need a national initiative for building a new rail system that avoids major population centers. This system could be designed for eventual use for high-speed trains after the national security issues have been mitigated. This is not, of course, a very original idea, since concerns about effective national defense led President Eisenhower to implement construction of the interstate highway system.

Sincerely yours,

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NEWS OF THE WEEK

January 17, 2000
Volume 78, Number 3
CENEAR 78 3 p. 13
ISSN 0009-2347

RECEIVED
FEB 28 2000

Heavyweight PuO2 loses stability title

Mitch Jacoby

Disproving conventional wisdom, researchers have shown that PuO2 is not the most stable binary plutonium oxide. A nonstoichiometric compound, PuO2+x, which forms slowly as PuO2 reacts with moist air, turns out to be the thermodynamically favored oxide [Science, 287, 285 (2000)]. The study explains several puzzling observations in plutonium chemistry and has implications for civilian and military applications.

The investigation was conducted by a group of staff scientists at <http://www.lanl.govLos Alamos National Laboratory (LANL) , Los Alamos, N.M., including John M. Haschke (now a private consultant in Waco, Texas), Thomas H. Allen, and Luis A. Morales.

"It's careful and thorough work," remarks Norman M. Edelstein, a heavy-element researcher at Lawrence Berkeley National Laboratory, Berkeley, Calif. Edelstein adds that these latest findings represent "an important contribution" for a number of reasons.

2 cont. To begin with, the LANL research answers decades-old questions about fundamental plutonium properties like color and oxidation state. Haschke points out that PuO2 is dark yellow. The green color that has been observed previously is due to the higher oxide, he says--not impurities, as some have suggested.

And contrary to the commonly held view that the oxidation state of plutonium in the stable oxide is exclusively Pu(IV), the present work shows that PuO2 can be oxidized as high as PuO2.27, suggesting that more than 25% of plutonium atoms are in the Pu(VI) state.

The study also provides another mechanistic explanation for the hydrogen production that's been observed during plutonium hydrolysis and oxidation. Gas evolution in sealed storage containers leads to pressure buildup--a serious concern for long-term storage.

"The new results have great consequences for underground disposal of nuclear wastes," writes Charles Madic of the Centre CEA de Saclay (part of the French Atomic Energy Commission), Gif-sur-Yvette, France, in a commentary in the same issue of Science.

A key factor in favor of burying plutonium waste is the highly insoluble nature of Pu(IV) compounds. But now the safety of those practices needs to be reconsidered, Madic comments, in light of the fact that Pu(VI) species are far more soluble and hence more mobile in geological environments. Madic adds that these latest findings also call for "new evaluations of industrial operations involving PuO2."

2 cont. Haschke explains that water molecules split into hydrogen and oxygen atoms as water vapor adsorbs on solid PuO_2. Oxygen (from water) converts the dioxide into a higher oxide:

$PuO_2 + xH_2O \; PuO_{2+x} + 2xH$

In an oxygen-free environment, he says, hydrogen atoms form H_2 that can desorb from the oxide surface.

"But if oxygen is present, hydrogen and oxygen react to form water because it's the thermodynamically favored process," Haschke asserts. That reaction serves to replenish the supply of surface water molecules. The newly formed H_2O may then desorb from the surface or dissociate. If it dissociates, then the oxidation process continues and dioxide is converted to higher and higher oxides. Haschke says the group now plans to address environmental plutonium-migration issues.