TITLE: **Considerations for Storing Very Hazardous Materials**

IDENTIFIER: Y-1997-OR-LMERX10-0901
DATE: 9/24/97

LESSONS LEARNED STATEMENT: The following must be carefully considered when storing very hazardous materials:

>- possible decomposition products
>- adequacy of packaging
>- labeling of primary and secondary containers

DISCUSSION: On 6/17/97 a Radiation Control Technician discovered radioactive contamination in the fume hood of a laboratory designated as a radioactive material storage area. The source of the contamination was carbon-14 (C14) tagged methylmercury iodide. This compound was contained inside a small glass vial with a plastic lid (the manufacturer's container) and was properly identified and labeled with a yellow and magenta radiation symbol. The glass vial was enclosed in a plastic liquid scintillation vial and labeled with a black marker as C14. This was housed in a sealed glass desiccator along with other items. The outside of the desiccator was clean, but contamination was discovered on plastic items inside the desiccator. At the time of the discovery, the laboratory was being cleaned out in preparation for a new use.

The original user of the methylmercury iodide had disposed of much of this chemical approximately 8 years ago. This particular item apparently had been overlooked because it was not clearly identified as radioactive material needing disposal.

There was no personnel exposure to radioactive materials in this incident. To ensure there was no concern for organic mercury exposure, two individuals (one involved in the disposal process and one who regularly worked in the lab) were checked for blood mercury levels. The results were less than the detectable level of 5 ug/L of mercury (in blood).

ANALYSIS: A library search for additional information on the chemical properties of the compound produced few results. One researcher reported that methylmercury chloride rapidly breaks down to inorganic mercury (Medeiros, 1981). More significantly, it was learned that compounds tagged with radioisotopes decompose faster than their untagged counterparts (because the radiation energy is absorbed by the compound itself and/or its immediate surroundings). The absorbed energy excites the molecules, which can break up, or react with other molecules, and produce "impurities". The rate of decomposition depends on the specific activity of the radioisotopes and on the fraction of the energy absorbed. (Tritiated compounds, for example, with high activity of low energy beta emissions, have a greater rate of decomposition.) This concept, familiar to radiochemists, may not be well-known to many scientists working with isotopically-tagged compounds.

According to a representative of the chemical manufacturer, the decomposition rate of tagged methylmercury iodide is fairly rapid, approximately 1% per month, unless it is stored in liquid nitrogen.

The manufacturer's packaging (with the plastic lid) was inadequate to hold the methylmercury iodide decomposition products. These products likely include C14-tagged methane which is volatile and C14-tagged methyl iodide which is known to absorb through the skin and is believed to bind to plastic. The manufacturer now ships methylmercury iodide in borosilicate glass ampules sealed under nitrogen.

RESOLUTION/RECOMMENDED ACTIONS: Before any very hazardous material is stored for future use, individuals must consider the shelf life, possible decomposition products, and the adequacy of the packaging. They must also ensure that the primary container and any secondary container are labeled appropriately.

Chemicals which, upon storage for long periods, can be degraded by thermal instability, atmospheric oxidation, photolysis, or hydrolysis, should be given special attention. Very toxic chemicals should be clearly indicated. A separate inventory of very hazardous materials (along with expiration dates if applicable) is recommended. Chemicals which are no longer needed should be transferred to laboratories that require them or should be properly disposed of.

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REFERENCES: Medeiros, D. M. (1981), Bulletin of Environmental Contamination and Toxicology, Vol. 27, No. 4, pages 467-469.
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FOLLOW-UP ACTION: Information in this report is accurate to the best of our knowledge. As means of measuring the effectiveness of this report please notify Claretta J. Sullivan at (423) 241-3134, e-mail at sv2@ornl.gov of any action taken as a result of this report or of any technical inaccuracies you find. Your feedback is important and appreciated.