Office of Health, Safety and Security
Operating Experience Level 3

OE-3: 2012-01 January 2012

Control of Sealed Radioactive Sources

PURPOSE

This Operating Experience Level 3 (OE-3) document provides information on a safety concern related to use of a sealed radioactive source where hazard controls were not evaluated.

BACKGROUND

Leaking sealed radioactive sources at the Department of Energy (DOE) National Laboratories have resulted in contamination of personnel, facilities, and personal property. Recent events occurred at Brookhaven National Laboratory (BNL) and Pacific Northwest National Laboratory (PNNL). Details of these events are listed below.

At BNL, a contamination event was caused by a Cesium-137 (265 micro-Curie) source used to test area radiation monitors. The source was used and transported onsite without evaluating the potential hazards associated with using the source.

At PNNL, a contamination event was caused by a Plutonium-238 (3.9 milli-Curie) source. When subsequently subjected to very cold temperatures in an experimental apparatus, the source leaked.

Discussions with radiation protection managers indicate that it is a common practice to use sealed radioactive sources without historic information on the design specifications of the source (i.e., unknown pedigree). Such sources are typically used for response checking radiation monitoring equipment; i.e., verifying the operability of the equipment, but not for calibration purposes. Information on the source design specifications is needed in order to develop and implement appropriate hazard controls for the use and transportation of the source.

DISCUSSION

The incident at BNL resulted from failure of a "sealed" source of Cesium-137 of unknown pedigree. The failure to follow Department of Transportation and DOE requirements for vehicular movement of sealed radioactive sources may have also contributed to the spread of radioactive contamination.

The PNNL event resulted from the sealed radioactive source not maintaining its integrity under the environmental conditions encountered. In both situations the design specifications for the sources and their use were undefined and appropriate hazards controls were not identified and implemented.

CONCLUSION

Loss of control of radioactive material can result in unplanned personnel exposures and spread of radioactive contamination both on and off DOE sites.

REFERENCES

Title 10, Code of Federal Regulations, part 835, *Occupational Radiation Protection* (10 CFR 835), specifies requirements for use of sealed radioactive sources. Depending on the activity of the source (see 10 CFR 835,

appendix E), controls include inventory and periodic leak testing of the sources at intervals not greater than 6 months.

The 10 CFR 835 broadly defines sealed radioactive sources as a "radioactive source manufactured, obtained, or retained for the purpose of utilizing the emitted radiation."

Per this definition, there are many applications where the use of radioactive material for the purpose of response checking radiation monitors would be considered use of a sealed radioactive source under 10 CFR 835.

10 CFR 835 also defines an accountable sealed radioactive source as a “sealed radioactive source having a half-life equal to or greater than 30 days and an isotopic activity equal to or greater than the corresponding value provided in appendix E of 10 CFR 835.”

Because accountable sealed radioactive sources are considered potentially more hazardous than sealed radioactive sources with an isotopic activity less than the 10 CFR 835 criteria, they require the additional controls specified in 10 CFR 835, such as periodic inventory and leak testing.

However, 10 CFR 835.1201, "Sealed radioactive source control," also requires that all sealed radioactive sources be used, handled, and stored in a manner commensurate with the hazards associated with operations involving the sources. This requirement applies to both accountable and nonaccountable sealed radioactive sources.

DOE's Implementation Guide for 10 CFR 835, DOE G 441.1-1C, *Radiation Protection Programs Guide for Use with Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection*, endorses several nongovernmental national consensus standards for radiation protection including:

- ANSI/HPS N43.6-1997, *Sealed Radioactive Sources Classification* (updated 2007)

This standard provides a manufacturer of sealed radioactive sources with a set of tests to evaluate the safety of its products under specified conditions, and also to assist a user of such sources to select types that suit an application, especially where protection against radioactive contamination is concerned.

Tests include:

- temperature
- pressure
- impact
- vibration
- puncture

While the requirements and guidance are typically sufficient for sources manufactured and designed to be used as sealed radioactive sources and used in accordance with the manufacturer's directions, additional precautions frequently are needed for use of sealed radioactive sources of unknown pedigree.

RECOMMENDATIONS

DOE sites that use accountable sealed radioactive sources with unknown pedigree should evaluate their use and the need to upgrade associated radiological controls.

The evaluation should consider:

- Current source activity;
- Chemical and physical form;
- Estimated age and end-of-life expectations;
- Use, including anticipated challenges to the source integrity during transportation; and
- Potential hazards associated with failure of the source.

Replacement of the sealed radioactive source with one meeting specified manufacturing criteria and performance tests is also an option for most applications and may ultimately be the safest and most cost-effective approach.

Additional radiological controls for accountable sealed sources with unknown pedigrees could include such actions as: restrictions on use, more frequent leak testing, and/or more frequent radiological monitoring associated with use of the source (e.g., survey source and package prior to, and after, use) and additional personnel protective equipment,

Sites should also evaluate their use of all sealed radioactive sources, including manufacturer certified sources, sources with unknown pedigrees and nonaccountable sources, to ensure that they are used in accordance with the manufacturers' directions (if any) and that they are used, handled, and stored in a manner commensurate with the hazards associated with operations involving the sources.

ADDITIONAL SOURCES OF INFORMATION

Questions regarding this OE-3 report can be directed to Dr. Bill McArthur by telephone at (301) 903-6061 or via e-mail at **bill.mcarthur@hq.doe.gov**.

This OE-3 document requires no followup report or written response.

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