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Resources and Forensics Signatures to Help Determine the Origin of Sealed Radiological Sources

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In the event of a terrorist obtaining and possibly detonating a device with radiological material, analysis of the material and source capsule could provide law enforcement with valuable clues to the origin of the material; this information could then provide further leads on where the source or material was obtained.

Argonne and Idaho National Laboratories have for the past 11 years been working on understanding signatures that could be used to identify specific source manufacturers. These signatures include source materials of construction, dimensions, weld details, elemental composition, and isotopic abundances of the radioactive material. These signatures have been collected in a library that now contains more up-to-date information on radioactive source signatures than any other database/library in the world. Collection of material for our database has included open source information from vendor catalogs and web pages, discussions with source manufacturers (protected thru non-disclosure agreements), and government registries such as the United States Nuclear Regulatory Commission's Sealed Source and Device Registry. Based on the information collected, profiles of source manufacturers and distributors haven been developed. Details of our database will be described.

Although the shape and dimensions of sources may help identify the manufacturer, additional information would be helpful to better pinpoint the manufacturer or supplier of a particular source. The analysis of parent daughter decay pairs can provide the "time since purification"or time since the "end of irradiation". This apparent age of the source can provide an estimated date when the source material/capsule was manufactured and can be used to exclude many manufacturers based on company manufacturing histories logged in the database.

This "age dating"technique requires analysis of both radioactive and stable isotopes. For the analysis of stable isotopes mass spectrometry measurements are essential, however the parent daughter decay pairs used in age dating often have the same atomic mass and require chemical separations to eliminate isobaric interferences in the mass spectrometric measurement. For example the parent Cs-137 interferes with the determination of the radioactive decay daughter Ba-137; similarly Co-60 interferes with the determination of the daughter Ni-60. Separation procedures and age dating analysis have been completed for cesium-137 (Cs/Ba), strontium-90 (Sr/Zr), and cobalt-60 (Co/Ni) sources. Some representative data will be provided.

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