

## ***NCRP Releases Report No. 154, Cesium-137 in the Environment: Radioecology and Approaches to Assessment and Management<sup>1</sup>***

Cesium-137 (<sup>137</sup>Cs) is the most important long-term contributor to the environmental radiation dose received by humans and other organisms as a result of nuclear reactor operations and weapons testing. Over the past few decades, <sup>137</sup>Cs has been the most abundant residual radionuclide at many facilities in the nuclear weapons complex of the U.S. Department of Energy (DOE), at nuclear fuel reprocessing facilities, at nuclear reactor sites, at many radioactive waste disposal sites, in soils worldwide as a result of global fallout from historic nuclear weapon testing, and in the former Soviet Union and other locales in Europe as a result of the Chernobyl accident. In addition, there is concern about the use of <sup>137</sup>Cs by terrorists to create a so-called “dirty bomb.”

The primary source of <sup>137</sup>Cs in the biosphere is atmospheric nuclear weapons testing by the United States and by the former Soviet Union from the 1940s to the 1960s. Of the roughly 1 EBq (10<sup>18</sup> Bq) of <sup>137</sup>Cs released to the biosphere, ~90 % was produced by atmospheric testing. Approximately 6 % was produced by the Chernobyl accident and roughly 4 % by nuclear fuel reprocessing facilities. Of the nuclear reactor accidents, the Chernobyl accident on April 26, 1986 in the Ukraine released far more radioactivity, including <sup>137</sup>Cs, to the environment than all other nuclear accidents combined.

In addition to its relative abundance, <sup>137</sup>Cs has characteristics that enhance its importance as a major contributor to radiation dose. For example, it has a moderately long half-life (~30 y), it emits relatively high energy beta particles, its very short-lived daughter <sup>137m</sup>Ba emits a strong gamma ray, and because of its chemical properties, it is readily transported through the environment and food chains. When in solution it can be efficiently taken up by plants and assimilated by animals because of its chemical similarity to the essential nutrient, potassium. The primary deterrent to the transport of <sup>137</sup>Cs to humans and other living organisms is its very strong tendency to attach, sometimes irreversibly, to common clay minerals found in most soils and sediments.

The general intent of this Report is to provide a:

- summary of general knowledge on the properties, geographic distribution, and sources of <sup>137</sup>Cs in the environment;
- site-specific description of releases, environmental levels, transport pathways, and specific issues relative to <sup>137</sup>Cs at three major DOE facilities;
- relatively detailed treatment of the radioecology of <sup>137</sup>Cs in terrestrial and aquatic ecosystems, including biogeochemical transport mechanisms and transport modeling concepts; and
- brief summary of the more generic management issues, remediation techniques, and benefit-cost considerations of alternative strategies for lands contaminated with sufficient levels of <sup>137</sup>Cs to warrant concerns about public health and environmental quality.

NCRP Report No. 154 is available from the NCRP website, <http://NCRPpublications.org>, in both soft- and hardcopy formats. For additional information contact David A. Schauer, ScD, CHP at [schauer@NCRPonline.org](mailto:schauer@NCRPonline.org), 301.657.2652 (x20) or 301.907.8768 (fax).

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