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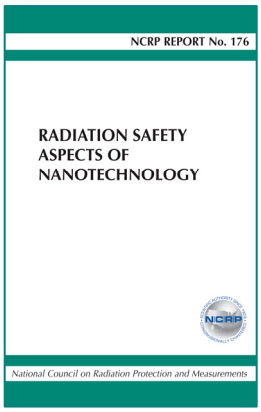
NCRP Report No. 176, *Radiation Safety Aspects of Nanotechnology*



National Council on Radiation Protection and Measurements (NCRP) Report No. 176, *Radiation Safety Aspects of Nanotechnology*, is intended primarily for operational health physicists, radiation safety officers, and internal dosimetrists who are responsible for establishing and implementing radiation safety programs involving nanotechnology. Nanotechnology is the understanding, engineering, control and use of matter at the nanoscale (*i.e.*, dimensions between ~1 and 100 nm) where unique material phenomena enable novel applications. The Report also provides useful information for workers, managers, and regulators who are either working directly with or have other responsibilities related to work with radioactive nanomaterials or the use of radiation in nanotechnology.

Specifically, this Report provides information and guidance on the following topics:

- definition of nanotechnology and nanomaterials;
- types and sources of nanomaterials, including naturally occurring, incidentally produced, and engineered nanomaterials;
- types, sources, and applications of radioactive nanomaterials and the use of radiation in nanotechnology;
- nonradiological hazards of radioactive nanomaterials;
- elements of a standard radiation safety program, including internal dosimetry, that might require modification when handling radioactive nanomaterials, especially situations where the nanomaterials may be dispersible as nanoparticles (NP); and
- appendices on radiolabeled nanomaterials, biokinetic models, and behavior of airborne NP.

The potential radiological hazards of radioactive nanomaterials should be considered within the context of the overall hazards posed by the materials. Because of the uniqueness of some of the nonradiological hazards associated with nanomaterials and the remaining uncertainties about those hazards, the radiation safety program should be coordinated with other occupational health disciplines (*e.g.*, industrial hygiene, occupational safety) so that all the potential hazards are adequately addressed.

In addition to standard radiation safety training requirements, training in nanotechnology settings should address any unique characteristics and safety considerations related to radioactive nanomaterials. The majority of the elements of a standard radiation safety program for handling radioactive materials are directly applicable to the handling of radioactive nanomaterials or are applicable with minor modifications in situations where potential exists for dispersion of radioactive nanoparticles (RNP). The program element that could potentially require the most modification is internal dosimetry. It is believed the current models for performing internal dose calculations will generally be suitable; however, the possible differences in the biokinetic behavior of RNP may require the adjustment of uptake, transfer, and elimination parameters when performing internal dose assessments. Exposure situations involving NP should be assessed by obtaining and using material-specific information whenever possible. New research should be undertaken to address these biokinetic and dosimetric data needs. Greater experience in using radioactive nanomaterials may lead to revised NCRP guidance on the radiation safety aspects of nanotechnology, particularly in the area of internal dosimetry, in the future.

The Report can be ordered from NCRP in both PDF and hardcopy formats by calling (301) 657-2652 x15 or by email, NCRPpubs@NCRPonline.org. For additional information contact Dr. Kathryn D. Held, Executive Director, at kathy.held@NCRPonline.org, 301-657-2652 (x20) or 301-907-8768 (fax).

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