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Book reviews

J.M. Kenton, D.H. Ian, M.G. Patrick, Nuclear Forensic Analysis, Taylor & Francis/CRC Press, Boca Raton, FL, 2005, US$ 149.95, 507 pp., ISBN 0-8493-1513-1.

Major terrorist attacks in the United States on the World Trade Center, first by detonation of a urea nitrate bomb and later by airplanes, has caused much concern for potential followup events, especially for nuclear based explosions. The breakup of the Soviet Republic and the large amount of nuclear material that was exposed as a result to thievery raised much worldwide concern.

> "To counter these new threats, innovative disposal protocols for dismantlement operations, and better nuclear safeguards in general, have been developed to prevent the diversion of materials from existing inventories."

The goal then is to keep such rogue material out of the hands of terrorists and if it is recovered from them to determine its composition and origin. The book's authors state their goal as follows:

> "The primary technical objective of nuclear forensic analysis is to determine the attributes of questioned radioactive specimens. Reduced to simple terms, the salient forensic questions for a nuclear sample are: What is it? What was its origin? How did it get there? Who was involved? Such analyses can be the most multidisciplinary of scientific endeavors."

The authors go on to describe the purpose of the book which is as follows: "The effective attribution of suspect items, through measurements of both source and route signature species, is the domain of nuclear forensic analysis and the focus of this book."

Chapter 2 reviews the fundamentals: physical basis of nuclear forensic science. The authors start with Dalton who developed the concept of the atom. Later contributions by Mendeleev, Roentgen, Chadwick, and Curie are briefly touched on. Radioactive decay is discussed both theoretically and mathematically. Also treated are nuclear structure, isomers, nuclear reactions, natural radioactivity, and fission, barrier penetration, and energy production.

Chapter 3, entitled "Engineering issues," discusses how a forensic analysis interprets physical signatures which are defined by differences in nuclear, mechanical, and chemical engineering techniques to identify the source of a given material. This chapter is an excellent discussion of the various types of nuclear reactors: boiling water, pressurized water, liquid metal fast breeder, high temperature gas cooled, and hypothetical molten salt breeder reactor. The last section of the chapter discusses the recovery and purification of heavy elements from reactor products.

Selected subsequent chapters are entitled:

- Chemistry and nuclear forensic science;
- Principles of nuclear explosive devices;
- Chronometry—this is a discussion of how the concentration of nuclides that are linked by decay can be used to determine the time elapsed since the last chemical purification;
- Techniques for small signatures;
- Collateral forensic indicators, i.e., stable isotopes;
- Sample matrices and collection;
- Radioactive procedures (such as dissolution, redox, and separation).

Skipping to the last part of the book, I found several chapters dealing with "real life" cases. They are:

- Forensic investigation of a highly enriched uranium sample interdicted in Bulgaria;
- Counterforensic investigation of US enrichment plants;
- Nuclear smuggling hoax—D-38 counterweight;
- Nuclear smuggling hoax—Sc metal;
- Fatal "cold fusion" explosion;
- Questioned sample from the US Drug Enforcement Agency.

This is a book that raises real concern for the possible impact of terrorist activities but its content will markedly assist in protection.

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