

Managing the bomb's supply side

Unmaking the Bomb A Fissile Material Approach to Nuclear Disarmament and Nonproliferation

Harold A. Feiveson, Alexander Glaser,
Zia Mian, and Frank N. von Hippel
MIT Press, 2014. \$30.00 (296 pp.).
ISBN 978-0-262-02774-8

Reviewed by Matthew Bunn

Plutonium and highly enriched uranium (HEU) are the essential ingredients of nuclear weapons. They do not exist in appreciable quantities in nature and are quite difficult to produce. But with such materials in hand, most states—and potentially even some particularly sophisticated terrorist groups—would be able to make at least a crude nuclear explosive. Hence controlling those materials and the means to make them is a critical element of regulating the path to the bomb.

Unmaking the Bomb: A Fissile Material Approach to Nuclear Disarmament and Nonproliferation is a brilliant survey of how weapons-usable materials are controlled and produced. In clear, concise prose, Harold Feiveson, Alexander Glaser, Zia Mian, and Frank von Hippel take us from the dawn of the nuclear age to the present. (Truth in advertising: von Hippel is a friend and former boss of mine, and the other authors are colleagues.) They describe the technologies that can be used to produce plutonium and HEU; the history of production around the world; the global stockpiles of those materials and how to reduce them; the ways in which civil nuclear energy systems could increase states' ability to produce materials for weapons; and options for ending further production and civilian use of those materials, including for purposes such as scientific research and medical isotope production.

Unmaking the Bomb paints a deeply disturbing picture. Our species has produced enough separated plutonium and HEU for well more than 100 000 nuclear

weapons. Those materials, which exist in hundreds of buildings and bunkers in more than 20 countries—with widely varying security measures in place—create grave security dangers and potentially impose obstacles to disarmament. Fortunately, as the book makes clear, few technical barriers exist to reducing stocks of HEU. Indeed, until 2013 nearly 1 in 10 light bulbs in the US was being powered by material from dismantled Russian nuclear bombs. For 20 years the US had been buying low-enriched uranium produced from 500 tons of HEU—enough to fuel more than 20 000 nuclear weapons.

Plutonium presents a trickier problem. The fuel-production costs, including those to handle and secure the toxic, weapons-usable material, exceed the fuel's value. (Indeed, the cost of the US program to turn excess weapons plutonium into fuel has ballooned to more than \$30 billion.) The authors of *Unmaking the Bomb* explore several alternatives for plutonium disposal, particularly options for preparing it for storage in geologic repositories or deep boreholes.

Today nearly all nuclear power reactors use low-enriched uranium fuel that cannot support an explosive chain reaction. And although those reactors produce plutonium in their spent fuel, the amount is 1% by weight, and it would require a complex chemical process known as reprocessing to get the plutonium into a form that could be used in a bomb or recycled as fuel. The authors make a persuasive case that economics, safety, security, and nonproliferation arguments all tilt against such reprocessing for civilian power.

Unmaking the Bomb covers three topics surprisingly briefly. First, for a book whose subtitle includes the word “disarmament,” it only briefly addresses key aspects of that goal, from how nuclear weapons would be dismantled to how the whole process would be verified. It does, however, briefly discuss “nuclear archaeology” techniques that might be useful in determining whether countries' declarations of how much plutonium and HEU they have match up with the physical evidence from their production facilities. Second, the book devotes only a few pages to the global nuclear inspection regime imple-

mented by the International Atomic Energy Agency and how it might be strengthened.

Third, and most surprising, *Unmaking the Bomb* includes only a few sentences on keeping plutonium and HEU secure and out of the hands of terrorist groups—despite a global series of nuclear security summits that started in 2010. The final chapter recommends policy initiatives in four areas, but effective security of stockpiles is not one of them.

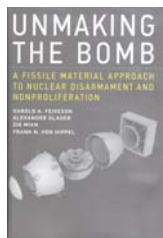
Fundamentally, managing the dangers posed by plutonium and HEU is one of the greatest challenges our species will face for decades—perhaps centuries—to come. *Unmaking the Bomb* is essential reading for understanding that challenge and the steps that would be needed for the world community to rise to it.

An Observer's Guide to Clouds and Weather A Northeastern Primer on Prediction

Toby Carlson, Paul Knight, and
Celia Wyckoff
American Meteorological Society,
2014. \$30.00 paper (224 pp.).
ISBN 978-1-935704-58-4

With meteorological practice currently focusing on mathematical modeling and quantitative analysis, it is refreshing to read a solid academic return to the more artful, look-out-the-window aspects of the field. *An Observer's Guide to Clouds and Weather: A Northeastern Primer on Prediction* is a handy book that will serve the atmospheric science community well as both an introduction for undergraduate students and a refresher of the fundamentals for long-time practitioners.

As stated in the preface, the authors “wish to make the reader's experience much more intimate with the atmosphere than simply viewing computer-generated output.” The authors are Toby Carlson, an emeritus professor in the Pennsylvania State University's department of meteorology; Paul Knight, a senior lecturer in the department and the climatologist for the Commonwealth of Pennsylvania; and Celia



Matthew Bunn is a professor of practice at Harvard University's John F. Kennedy School of Government in Cambridge, Massachusetts, and leads Harvard's Project on Managing the Atom.