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Coal Ash Is More Radioactive than Nuclear Waste

By burning away all the pesky carbon and other impurities, coal power plants produce heaps of radiation

By Mara Hvistendahl | December 13, 2007 | 99

CONCENTRATED RADIATION: By burning coal into ash, power plants concentrate the trace amounts of radioactive elements within the black rock.*Image: ©ISTOCKPHOTO.COM*

The popular conception of nuclear power is straight out of *The Simpsons*: Springfield abounds with signs of radioactivity, from the strange glow surrounding Mr. Burn's nuclear power plant workers to Homer's low sperm count. Then there's the local superhero, Radioactive Man, who fires beams of "nuclear heat" from his eyes. Nuclear power, many people think, is inseparable from a volatile, invariably lime-green, mutant-making radioactivity.

Coal, meanwhile, is believed responsible for a host of more quotidian problems, such as mining accidents, acid rain and greenhouse gas emissions. But it isn't supposed to spawn three-eyed fish like Blinky.

Over the past few decades, however, a series of studies has called these stereotypes into question. Among the surprising conclusions: the waste produced by coal plants is actually more radioactive than that generated by their nuclear counterparts. In fact, the fly ash emitted by a power plant—a by-product from burning coal for electricity—carries into the surrounding environment 100 times more radiation than a nuclear power plant producing the same amount of energy. * [*See Editor's Note at end of page 2*]

At issue is coal's content of uranium and thorium, both radioactive elements. They occur in such trace amounts in natural, or "whole," coal that they aren't a problem. But when coal is burned into fly ash, uranium and thorium are concentrated at up to 10 times their original levels.

Fly ash uranium sometimes leaches into the soil and water surrounding a coal plant, affecting cropland and, in turn, food. People living within a "stack shadow"—the area within a half- to one-mile (0.8- to 1.6-kilometer) radius of a coal plant's smokestacks—might then ingest small amounts of radiation. Fly ash is also disposed of in landfills and abandoned mines and quarries, posing a potential risk to people living around those areas.

In a 1978 paper for *Science,* J. P. McBride at Oak Ridge National Laboratory (ORNL) and his colleagues looked at the uranium and thorium content of fly ash from coal-fired power plants in Tennessee and Alabama. To answer the question of just how harmful leaching could be, the scientists estimated radiation exposure around the coal plants and compared it with exposure levels around boiling-water reactor and pressurized-water nuclear power plants.

The result: estimated radiation doses ingested by people living near the coal plants were equal to or higher than doses for people living around the nuclear facilities. At one extreme, the scientists estimated fly ash radiation in individuals' bones at around 18 millirems (thousandths of a rem, a unit for measuring doses of ionizing radiation) a year. Doses for the two nuclear plants, by contrast, ranged from between three and six millirems for the same period. And when all food was grown in the area, radiation doses were 50 to 200 percent higher around the coal plants.

McBride and his co-authors estimated that individuals living near coal-fired installations are exposed to a maximum of 1.9 millirems of fly ash radiation yearly. To put these numbers in perspective, the average person encounters 360 millirems of annual "background radiation" from natural and man-made sources, including substances in Earth's crust, cosmic rays, residue from nuclear tests and smoke detectors.

Dana Christensen, associate lab director for energy and engineering at ORNL, says that health risks from radiation in coal by-products are low. "Other risks like being hit by lightning," he adds, "are three or four times greater than radiation-induced health effects from coal plants." And McBride and his co-authors emphasize that other products of coal power, like emissions of acid rain–producing sulfur dioxide and smog-forming nitrous oxide, pose greater health risks than radiation.