

# C H E R N O B Y L

## How much radiation was released?

### A NUKEWATCH FACT SHEET

The Chernobyl disaster's explosions and 40-day-long fire<sup>1</sup> that began in Ukraine in the former USSR April 26, 1986, spread radioactive materials to every country in the northern hemisphere—but how much? Vastly different estimates of total dispersed radiation have come from a variety of institutions, commissions, agencies and committees and are based on limited information about the amount of melted fuel and graphite left in the reactor's wreckage in Ukraine.

- The disaster “released a globe-girdling cloud of radiation that the U.S. Lawrence Livermore National laboratory estimates to have exceeded 4.5 billion curies.<sup>2</sup> Other estimates range as high as 9 billion curies.”<sup>3</sup>
- “A staggering amount of radioactivity was released during the meltdown, according to Joe Mangano in his 2012 book *Mad Science*, “Never before in history had this amount of radiation entered into the environment at one time.”<sup>4</sup>
- In 2006, “The Other Chernobyl Report” (TORCH) concluded that the sum total of radioactivity released was  $12 \times 10^{18}$  Becquerels, or about 324.3 million curies.\* TORCH estimates that about 30 percent of the reactor's 190 tons of fuel was distributed over the reactor building and surrounding areas, about 1-2 percent was ejected into the atmosphere, and the reactor's total inventory of radioactive noble gases (xenon and krypton) was released.<sup>5</sup>
- In 2006, the Institute for Environmental and Energy Research in Maryland reported that, excluding noble gases, this largest single nonmilitary radiation release was estimated at 100 to 200 million curies.<sup>6</sup>
- In 2005, the Chernobyl Forum, comprising more than 100 scientists, eight UN agencies and the governments of Russia, Belarus and Ukraine, found the total amount of radioactivity released over 10 days reached 14 exa-becquerels ( $14 \times 10^{18}$  Becquerels)—or 378.3 million curies.<sup>7</sup>
- In 1996, Vladimir Chernousenko, a fellow of the Institute of Theoretical Physics of the Ukrainian Academy of Sciences and chief scientific supervisor of the “clean up” team inside the 10-kilometer zone around the Chernobyl reactor, wrote that independent experts have estimated that 80 percent of the reactor's radioactivity escaped—about 6.4 billion curies.<sup>8</sup>
- *Time* magazine reported in 1989 that perhaps “one billion or more” curies were released rather than the 50 to 80 million curies estimated by Russian authorities.<sup>9</sup>
- The Russian government and the International Atomic Energy Agency (IAEA) claimed in a 1986 report that 50 million curies of radioactive debris, plus another 50 million curies of rare and inert gasses were discharged. MIT nuclear engineer Alexander Sich concluded in his 500-page doctoral dissertation, that between 200 million and 250 million curies of

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<sup>1</sup> French Nuclear Energy Agency, “The release, dispersion and deposition of radionuclides,” AEN/NEA, in *Chernobyl: Assessment of Radiological and Health*, 2002 (<http://www.oecd-nea.org/rp/chernobyl/c02.html>)

<sup>2</sup> Colin Norman, “Hazy Picture of Chernobyl Emerging,” *Science*, Vol. 232, June 13, 1986, pp. 1331-1333

<sup>3</sup> Gar Smith, *Nuclear Roulette: The Truth About the Most Dangerous Energy Source on Earth*, Chelsea Green, 2012, p. 58-59

<sup>4</sup> Joe Mangano, *Mad Science: The Nuclear Power Experiment*, OR Books, 2012, p. 224. ¶ In addition, the Woods Hole Oceanographic Institution reports that the still-leaking triple meltdowns at Fukushima, Japan caused “the largest accidental release of radiation to the ocean in history.” (<http://www.whoi.edu/main/topic/fukushima-radiation>)

<sup>5</sup> Ian Fairlie & David Sumner, “The Other Chernobyl Report,” April 2006, pp. 7, 19, & 21 (re. UNSCEAR, 2000 Report to the General Assembly, Anx. J.)

<sup>6</sup> Cathie Sullivan, “Chernobyl: Two Decades Later,” *Science for Democratic Action*, IEER, April 2006, p. 7

<sup>7</sup> Rob Edwards, “Major UN report counts human cost of Chernobyl,” *New Scientist*, Sept. 5, 2005

<sup>8</sup> V. Chernousenko “The Truth About Chernobyl,” *Critical Mass: Voices for a Nuclear-Free Future*, Ruggiero & Sahulka, Eds., Open Media, 1996, p. 127

<sup>9</sup> Michael Lemonick, “The Chernobyl Cover-Up,” *Time*, Nov. 13, 1989, p. 73

radioactive material were released “in the first 10 days.” Sich said the complete core meltdown spewed “far worse contamination than previously reported.”<sup>10</sup>

- In May 1986, Joseph Hendrie, a former Chair of the U.S. Nuclear Regulatory Commission, said, “They have dumped the full inventory of volatile fission products from a large power reactor into the environment. You can’t do any worse than that.”<sup>11</sup> Likewise, the Union of Concerned Scientists’ Kennedy Maize concluded in 1987 that “the core vaporized”—a reference to 190 tons of fuel and all nine billion curies of radioactive material.<sup>12</sup>

- Geneticist Valery Soyfer, a molecular biologist in the former Soviet Union, analyzed the USSR’s 1986 report to the IAEA, which even *Time* later condemned as a cover-up. Soyfer wrote that if only 100 million curies were vented, then world “back-ground radiation doubled at once.”<sup>13</sup> In November 1987, nineteen months after Chernobyl, the U.S. National Council on Radiation Protection (NCRP) doubled its estimate of the average “background” radiation to which people in the U.S. are exposed—from 170 millirem (mR) to 360 mR per-year.<sup>14</sup> In 2009, the NCRP again nearly doubled its estimated average annual dose, from 360 mR per-year, to 620 mR.<sup>15</sup>

The NCRP said the additional exposures were “coming from exposure to medical tests such as body scans.” These “medicinal” scans are not safe. Some CT scans deliver the radiation equivalent of 400 chest X-rays.<sup>16</sup>

According to Prof. David Spiegelhalter of Cambridge University, “Because more than 70 million CT scans are carried out each year, the U.S. National Cancer Institute has estimated that 29,000 Americans will get cancer as a result of the CT scans they received in 2007 alone.”<sup>17</sup>

In addition, “Estimated Risks of Radiation-Induced Fatal Cancer from Pediatric CT,” published in 2001 in *American Journal of Roentgenology*, concluded: “In the U.S., of approximately 600,000 abdominal and head CT examinations annually performed in children under the age of 15 years, a rough estimate is that 500 of these individuals might ultimately die from cancer attributable to the CT radiation.”

- The U.S. government’s Argonne National Laboratory in Chicago estimated in 1986 that 30 percent of Chernobyl’s total radioactivity—three billion of an estimated nine billion curies—was released.<sup>18</sup>

**\* One curie is a very large amount of ionizing radiation: 37 billion atomic disintegrations per-second. There are 37 billion Becquerels in every curie.**

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<sup>10</sup> Alexander Sich, “Chernobyl Thesis,” Letter, *Science*, Vol. 266, Dec. 9, 1994, p. 1627; Associated Press, “Chernobyl damage reportedly worse than believed,” *Milwaukee Journal*, Jan. 31, 1994

<sup>11</sup> “Soviets battle meltdown,” *Minneapolis Star-Tribune*, May 9, 1986, pp. 1A & 8A

<sup>12</sup> Kennedy Maize, “The Anatomy of an Accident,” *Not Man Apart*, Friends of the Earth, March 1987, p. 9

<sup>13</sup> Valery Soyfer, “Bad News From Chernobyl Gets Worse,” *Los Angeles Times*, & *St. Louis Post Dispatch*, April 24, 1987

<sup>14</sup> Warren Leary, “Radiation Estimate in U.S. Almost Doubled in Report,” *New York Times*, Nov. 20, 1987

<sup>15</sup> Patricia Doddona, “NRC weighs new study of cancer risks near nuclear plants,” *The Day*, Feb. 25, 2011; NCRP, “Ionizing Radiation Exposure of the Population of the U.S.,” Report No. 160, 2009

<sup>16</sup> Walt Bogdanich & Rebecca Ruiz, “FDA to Increase Medical Radiation Oversight,” *New York Times*, Feb. 10, 2010

<sup>17</sup> D. Spiegelhalter, “Japan nuclear threat: Tsunami is the bigger tragedy,” BBC News, March 21, 2011 <[bbc.com/news/world-asia-pacific-12785274](http://bbc.com/news/world-asia-pacific-12785274)>

<sup>18</sup> Casey Bukro, “Fallout from ‘60s A-tests worse than Chernobyl,” *Chicago Tribune*, June 22, 1986