1. Every nuclear power reactor dumps radioactive water, scatters radioactive particles, and disperses radioactive gases as part of its **routine**, everyday operation. **It doesn't take an accident**. Federal regulations permit these radioactive releases.

2. Radioactivity is measured in curies. An average operating nuclear power reactor will have about **16 billion** curies in its reactor core. This is the equivalent long-lived radioactivity of at least 1,000 Hiroshima bombs. In contrast, a large medical center, with as many as 1,000 approved laboratory areas in which radioactive materials are used, may have a combined inventory of only about **two** curies.

3. Many of a reactor's byproducts give off radioactive particles and rays for enormously long periods --- described in terms of "half-lives." For example, iodine-129 has a half-life of about 16 million years; technetium-99 = 211,000 years; and plutonium-239 = 24,000 years. Xenon-135, a noble gas, decays into cesium-135, an isotope with a 2.3 million-year half-life. Radioactive materials give off hazardous radioactivity for **at least ten half-lives.**

4. A reactor's fuel rods, pipes, tanks and valves can leak. **Mechanical failure and human error** can also cause leaks. As a nuclear plant ages, so does its equipment --- and leaks generally increase.

5. Liquid releases:

a. Some contaminated water is intentionally removed from the reactor's cooling system to reduce the amount of radioactive and corrosive chemicals that damage valves and pipes. This water is filtered and then either recycled back into the cooling system or released into the environment.

b. A typical 1000-megawatt pressurized water reactor (with a cooling tower) takes in about 20,000 gallons of river, lake or ocean water per minute for cooling; circulates it through a 50-mile maze of pipes; returns about 5,000 gallons per minute to the same body of water; and releases the remainder to the atmosphere as vapor. A similar reactor without a cooling tower can take in as much as one-half million gallons per minute. **The discharge water is contaminated with radioactive isotopes in amounts that are not precisely tracked and are potentially biologically damaging.**

c. Government regulations allow radioactive water containing "permissible" levels of contaminants to be released to the environment. **Permissible does not mean safe.** Detectors at reactors are set to allow radioactive water to be released, **unfiltered,** if below the "permissible" legal levels.

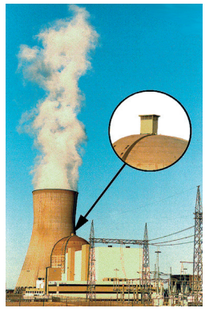
6. Gaseous releases:

Some radioactive gases, stripped from the reactor cooling water, are retained in decay tanks for days before being released into the atmosphere through filtered **roof top vents.** Some gases leak into the power plant buildings' interiors and are released during periodic "purges" or "ventings." These airborne gases contaminate not only the air, but also fall out upon soil and water.

7. Radioactive releases from a nuclear power reactor's routine operation often are **not fully detected or reported.** Accidental releases also cannot be completely verified or documented.

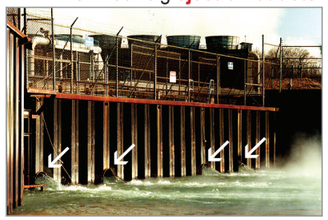
PLANNED RELEASES from Nuclear Plants into Air, Water, and Soil

IT DOES NOT TAKE AN ACCIDENT



The **vent** on top of the Reactor Building at the Callaway 1000-megawatt pressurized water reactor.

Water discharge area at the Palisades nuclear power plant on Lake Michigan. Note the flow from four big **ejection outlets.**



8. Economically feasible filtering technologies **do not exist** for some major reactor byproducts, such as radioactive hydrogen (tritium) and noble gases, such as krypton (that becomes rubidium, and then strontium) and xenon (that becomes cesium). Some liquids and gases are retained temporarily in tanks so that the shorter-lived radioactive materials can break down before the batch is released to the environment.

9. The Nuclear Regulatory Commission relies upon self-reporting and computer modeling by each reactor's operator in an attempt to track radioactive releases and their projected dispersion. A significant portion of the environmental monitoring data is extrapolated --- **it's virtual, not real.**

10. Any exposure to radiation increases the risk of damage to tissues, cells, DNA and other vital molecules, potentially causing genetic mutations, cancers, leukemias, birth defects, and reproductive, cardiovascular, endocrine, and immune system disorders.

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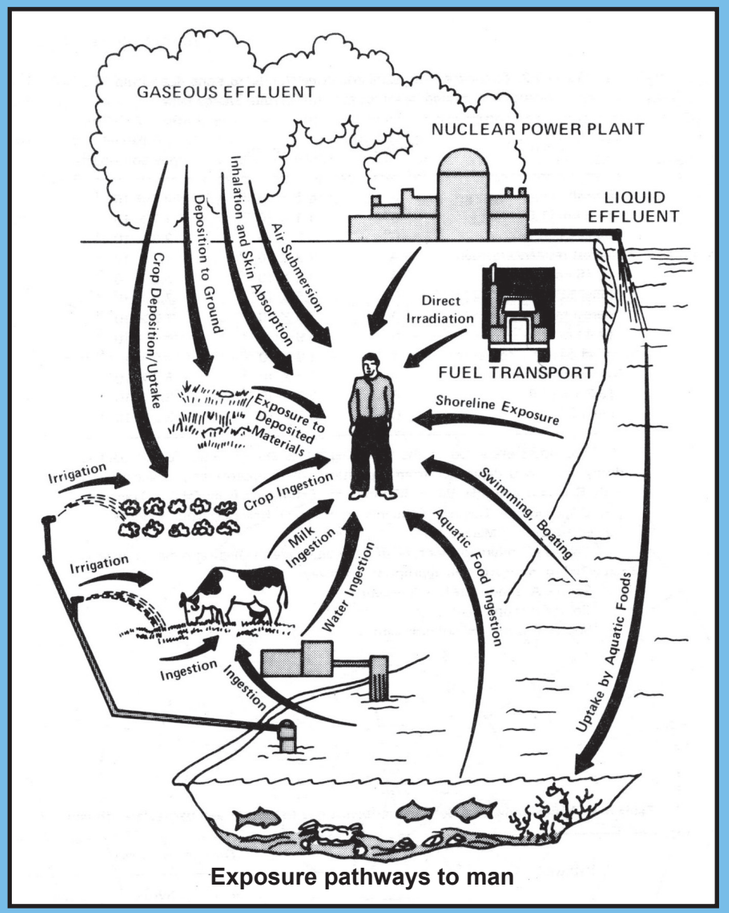
December 2012 UPDATED: October 2015.

ROUTINE RADIOACTIVE RELEASES FROM U.S. NUCLEAR POWER PLANTS



Exposure pathways to man

↑A DIAGRAM PUBLISHED IN 1977 BY THE U.S. NUCLEAR REGULATORY COMMISSION

1. **Arkansas One 1 & 2 (AR)**
Dardanelle Reservoir, Arkansas River
2. **Beaver Valley 1 & 2 (PA)**
Ohio River
3. **Braidwood 1 & 2 (IL)**
Braidwood Lake, Kankakee River
4. **Browns Ferry 1, 2 & 3 (AL)**
Tennessee River
5. **Brunswick 1 & 2 (NC)**
Cape Fear River, Atlantic Ocean
6. **Byron 1 & 2 (IL)**
Rock River
7. **Callaway (MO)**
Missouri River
8. **Calvert Cliffs 1 & 2 (MD)**
Chesapeake Bay
9. **Catawba 1 & 2 (SC)**
Lake Wylie, Catawba River
10. **Clinton (IL)**
Clinton Lake, Salt Creek
11. **Columbia (WA)**
Columbia River
12. **Comanche Peak 1 & 2 (TX)**
Squaw Creek Reservoir, Brazos River
13. **Donald C. Cook 1 & 2 (MI)**
Lake Michigan
14. **Cooper (NE)**
Missouri River
15. **Davis-Besse (OH)**
Lake Erie
16. **Diablo Canyon 1 & 2 (CA)**
Pacific Ocean
17. **Dresden 2 & 3 (IL)**
Kankakee River
18. **Duane Arnold (IA)**
Cedar River
19. **Joseph M. Farley 1 & 2 (AL)**
Chatahoochee River
20. **Fermi 2 (MI)**
Lake Erie
21. **James A. FitzPatrick (NY)**
Lake Ontario
22. **Fort Calhoun (NE)**
Missouri River
23. **R. E. Ginna (NY)**
Lake Ontario
24. **Grand Gulf (MS)**
Mississippi River
25. **Edwin I. Hatch 1 & 2 (GA)**
Altamaha River
26. **Hope Creek (NJ)**
Delaware River
27. **Indian Point 2 & 3 (NY)**
Hudson River
28. **LaSalle 1 & 2 (IL)**
LaSalle Lake, Illinois River
29. **Limerick 1 & 2 (PA)**
Schuylkill River
30. **McGuire 1 & 2 (NC)**
Lake Norman, Catawba River
31. **Millstone 2 & 3 (CT)**
Niantic Bay of Long Island Sound
32. **Monticello (MN)**
Mississippi River
33. **Nine Mile Point 1 & 2 (NY)**
Lake Ontario
34. **North Anna 1 & 2 (VA)**
Lake Anna, North Anna River, Pamunkey River, York River, Chesapeake Bay

35. **Oconee 1, 2 & 3 (SC)**
Lake Keowee, Savannah River
36. **Oyster Creek (NJ)**
Barnegat Bay of Atlantic Ocean
37. **Palisades (MI)**
Lake Michigan
38. **Palo Verde 1, 2 & 3 (AZ)**
Groundwater plus Phoenix sewage water from 35 miles away provide the cooling water. Waste water is evaporated; saturated sludges are shipped to a radioactive waste dump.
39. **Peach Bottom 2 & 3 (PA)**
Conowingo Pond, Susquehanna River, Chesapeake Bay
40. **Perry (OH)**
Lake Erie
41. **Pilgrim (MA)**
Cape Cod Bay of Atlantic Ocean
42. **Point Beach 1 & 2 (WI)**
Lake Michigan
43. **Prairie Island 1 & 2 (MN)**
Mississippi River
44. **Quad Cities 1 & 2 (IL)**
Mississippi River
45. **River Bend (LA)**
Mississippi River
46. **H. B. Robinson 2 (SC)**
Lake Robinson, Black Creek
47. **Saint Lucie 1 & 2 (FL)**
Atlantic Ocean
48. **Salem 1 & 2 (NJ)**
Delaware River
49. **Seabrook (NH)**
Atlantic Ocean
50. **Sequoyah 1 & 2 (TN)**
Chickamauga Lake, Tennessee River
51. **Shearon Harris (NC)**
Harris Lake, Buckhorn Creek, Cape Fear River
52. **South Texas Project 1 & 2 (TX)**
Colorado River, Gulf of Mexico
53. **V. C. Summer (SC)**
Monticello Reservoir, Broad River
54. **Surry 1 & 2 (VA)**
James River, Chesapeake Bay
55. **Susquehanna 1 & 2 (PA)**
Susquehanna River, Chesapeake Bay
56. **Three Mile Island (PA)**
Susquehanna River, Chesapeake Bay
57. **Turkey Point 3 & 4 (FL)**
Biscayne Bay of Atlantic Ocean
58. **Vogtle 1 & 2 (GA)**
Savannah River
59. **Waterford 3 (LA)**
Mississippi River
60. **Watts Bar 1 & 2* (TN)**
Watts Bar Lake, Tennessee River
*Unit #2 is expected to begin operating in 2016.
61. **Wolf Creek (KS)**
Coffey County Lake, Neosho River

REACTORS ARE CLOSING
For an update, go to: http://www.beyondnuclear.org/reactors-are-closing/

REACTORS ROUTINELY RELEASE RADIOACTIVE WASTES INTO THE WATER AND INTO THE AIR !!