

# Nuclear Radiation and the Thyroid

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## DETAILS AND RECOMMENDATIONS

### Why does the thyroid gland need special protection after a release of radioactive material?

The thyroid gland needs iodine to produce the hormones that regulate the body's energy and metabolism. The thyroid absorbs available iodine from the bloodstream. The gland cannot distinguish between stable (regular) iodine and radioactive iodine, and will absorb whatever it can. In babies and children, the thyroid gland is one of the most radiation-sensitive parts of the body. Most nuclear explosions release radioactive iodine. When thyroid cells absorb too much radioactive iodine, it can cause thyroid cancer. Babies and young children are at highest risk. The risk is much lower for people over age 40. Thyroid cancer seems to be the only cancer whose incidence rises after a radioactive iodine release. KI protects only the thyroid, but it is the organ that most needs protecting.

### What is KI?

Potassium iodide (KI) is the same form of iodine used to iodize table salt. KI floods the thyroid with iodine, thus preventing radioactive iodine from being absorbed. If taken at the proper time, KI protects the thyroid from radioactive iodine from all sources - air, food, milk, and water. KI is a non-prescription drug that can be bought over the internet and at some pharmacies. KI is made in pill and liquid forms. The two FDA-approved brands of full adult dose 130-mg KI pills are IOSAT® (Anbex, Inc.) and Thyro-Block® (Medpointe, Inc.). The FDA-approved brand of 65-mg KI pills is ThyroSafe® (Recip US). Properly packaged, KI's shelf life is at least 5 years and possibly as long as 11 years. If you accidentally take a very old pill, it may not work fully but it won't hurt you.

### What is the proof that KI works?

After the 1986 Chernobyl (formerly called "Chernobyl") nuclear accident, shifting winds blew a radioactive cloud all over Europe. As many as 3,000 people exposed to that radiation have already developed thyroid cancer. Most victims had been babies or young children living in Ukraine, Belarus, or Russia at the time of the accident. According to a UN report released in February 2002, another 8,000 to 10,000 exposed people may develop thyroid cancer within the next 10 years. Poland, immediately adjacent to Belarus and Ukraine, distributed KI to its people and does not appear to have had an increase in thyroid cancer.

### When should KI be taken?

Taken 6-12 hours before exposure to radioactive iodine, KI fills the thyroid cells and prevents the gland from absorbing radioactive iodine. KI is also protective if taken within the first few hours after exposure to radioactive iodine. People should take one dose a day, only while they are being exposed to radioactive iodine and one day afterward. KI should be used only under instruction from local health authorities. Not every radioactive release includes the radioactive iodine that can cause thyroid cancer. For example, a "dirty bomb" is not likely to contain radioactive iodine because it has a short half-life. (A "dirty bomb" is a conventional bomb mixed with

radioactive material, and designed to explode spewing out the radioactive isotopes and contaminating a wide area.) Only health authorities can determine which radioactive isotopes are released during a nuclear event, and, if radioactive iodine is released, when to take KI and how long to keep taking it.

### What are the recommended KI doses?

The U.S. Food and Drug Administration (FDA) has published general recommendations for minimum KI doses: a full 130-mg pill for adults, 65 mg for children 3 to 18 years old, 32 mg for babies 1 month to 3 years old, and 16 mg for newborns up to 1 month old. In the U.S., KI pills are now sold in both 130-mg and 65-mg doses. The pills are scored to make it easier to cut them up for children's doses. An April 2002 FDA statement says that "absolute precision in dosing is generally not critical to safety or efficacy" and "the overall benefits of KI far exceed the risks of overdosing, especially in children." According to the FDA, children over 1 month old can safely be given a full-dose 130-mg pill on each of 2 consecutive days. However, newborns should be given only a 16-mg dose. The easiest way to prepare a 16-mg dose is to dissolve a 130-mg pill in 8 oz of a clear liquid and feed the newborn 1 oz of the liquid. Another alternative is to give the newborn 16 mg of the liquid form of KI (saturated solution of potassium iodide [SSKI]), which requires a doctor's prescription. For FDA suggestions on preparing KI doses for children, see [www.fda.gov](http://www.fda.gov).

### Who should not take KI?

Millions of people have taken KI but few serious side-effects have been reported. The only people who should not take KI are those who have had a major allergic reaction to iodine. In the amounts that the FDA recommends, and for the few days that public health officials expect people to need KI, patients with thyroid disease can safely take the pills in the regularly recommended doses. During a nuclear emergency, KI's benefit far outweighs any potential risk. Adults over age 40 do not need KI at all unless they are exposed to extremely high levels of radioactive iodine.

If taken for long enough, KI can cause temporary hypothyroidism (underactive thyroid gland). "Long enough" is different for every person. Prolonged treatment can become a serious problem for very young children. Such children should be seen afterward by a health professional. Patients with Graves' hyperthyroidism or with autonomous functioning thyroid nodules should also be seen.

### Why worry so much about thyroid cancer if most people survive it?

In general, 90% of patients survive thyroid cancer. The post-Chernobyl cancers have been aggressive and have been unusual in affecting children younger than 10 years of age. Thyroid cancer survivors always remain at risk for recurrence and require lifelong medical care. Likewise, the people who were exposed to radioactive iodine from the Chernobyl accident but

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have not developed thyroid cancer remain at risk for life and must continue to be tested. The demands of regular testing and care for this large population are putting a heavy burden on both patients and health care systems.

### How should KI be incorporated into an overall emergency plan?

KI is an adjunct to evacuation, sheltering (staying in an unventilated room with the doors and windows closed), and avoiding contaminated food, milk, and water. KI should not take the place of any other protective measure.

### Won't having KI pills lull people into a false sense of security?

Not likely. Local authorities recommend that people leave the vicinity of a nuclear emergency as quickly as possible. People are being taught that KI is just a supplement to evacuation.

### Why waste time taking a pill if you're being told to evacuate?

Because nuclear releases are unpredictable but traffic jams are likely to delay speedy evacuation, people should take their KI before they evacuate, following instructions from local health officials.

### Why offer KI to people just within 10 or 20 miles of a plant?

#### Can't radiation be harmful farther away?

KI distribution should not be limited to 10 or 20 miles. No one can predict how far a radioactive iodine cloud might spread. After Chernobyl, higher than expected rates of thyroid cancer were found more than 200 miles away from the nuclear plant. Thus, no one can predict how far from a nuclear plant the U.S. should distribute KI if it is to protect every person who might be exposed to radioactive iodine. Because there is no right answer, the American Thyroid Association recommends three levels of coverage, determined by distance from the nuclear plant (see table below).

### What do U.S. government agencies recommend?

KI is endorsed for radiation protection by the U.S. Food and Drug Administration. The Department of Health and Human Services has included KI in the National Pharmaceutical Stockpile for use in health emergencies. In December 2001, the Nuclear Regulatory Commission wrote to the 34 states that either have a functioning nuclear power plant or are within 10 miles of another state's plant; the letter offered two free KI pills for each resident within the 10-mile "emergency zone" surrounding active plants, and an extra supply to be provided for transients. As of September 13, 2002, Alabama, Arizona, California, Connecticut, Delaware,

Ring	Distance from nuclear plant	Action
1	0-50 miles	Distribute KI in advance ("predistribute") to individual households, with extra stockpiles stored at emergency reception centers
2	50-200 miles	Stockpile KI in local public facilities such as schools, hospitals, clinics, post offices, and police and fire stations, for distribution upon notification by local health officials
3	>200 miles	Make KI available from the Department of Health and Human Services' National Pharmaceutical Stockpile

Florida, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Vermont and Virginia had taken up the NRC on its offer. Instead of accepting the NRC offer, Illinois chose to distribute KI pills provided by the operator of most of the state's nuclear plants. Tennessee has had its own KI program in place since 1981. Maine has discontinued its state program.

The Public Health Security and Bioterrorism Preparedness and Response Act of 2002, enacted by Congress in May 2002, creates a mechanism to extend the radius of KI distribution to communities within 20 miles of nuclear plants, and directs the President to decide which agency or agencies will oversee KI stockpiling and distribution. Distribution under the new law could begin as early as June 2003.

### Won't distribution and public education be expensive and time-consuming?

Possibly, although the potential benefit of KI far outweighs the cost. The Bioterrorism Act directs the National Academy of Sciences to study "the most effective and safe way to distribute and administer potassium iodide tablets on a mass scale." The National Academy of Sciences panel should address many of the decisions still to be made, for example: Who should be responsible for distribution? Within 50 miles of a nuclear plant, how should pills best be predistributed to families to store at home, before the time of need? Within 50 miles of a plant, should pills also be kept at local schools, clinics, post offices, and police and fire stations for distribution during an emergency? How should children be treated at school? How should stockpiles be maintained? Provision must also be made to educate the public about why KI is important, what it can and cannot do, and how and when to use it. The states that want KI are working out individual distribution and education plans, as part of their overall emergency plans. Vermont's draft plan is posted on its web site ([www.healthvermonters.info](http://www.healthvermonters.info)). It is noteworthy that the offer of KI has led some states to reassess their overall emergency response plans.

### What are other countries doing?

The World Health Organization endorses KI. France, Ireland, Sweden, and Switzerland not only stockpile KI but predistribute it to their populations.

### What does the American Thyroid Association recommend?

The American Thyroid Association (ATA) has been urging KI stockpiling since 1984. ATA members have been studying the Chernobyl nuclear accident and caring for its victims. The Association's recommendations are outlined in the public health statement [American Thyroid Association endorses potassium iodide for radiation emergencies](#). This plan is endorsed by the American Association of Clinical Endocrinologists, the Lawson Wilkins Pediatric Endocrine Society, and the Thyroid Foundation of America.

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