

Nuclear Radiation and the Thyroid

WHAT IS THE THYROID GLAND?

The thyroid gland is a butterfly-shaped endocrine gland that is normally located in the lower front of the neck. The thyroid's job is to make thyroid hormones, which are secreted into the blood and then carried to every tissue in the body. Thyroid hormones help the body use energy, stay warm and keep the brain, heart, muscles, and other organs working as they should.

WHY DOES THE THYROID GLAND NEED SPECIAL PROTECTION AFTER A RELEASE OF RADIOACTIVE MATERIAL?

The thyroid gland needs iodine to produce hormones that regulate the body's energy and metabolism. The thyroid absorbs available iodine from the bloodstream. The thyroid 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 accidents release radioactive iodine into the atmosphere, which can be absorbed into the body. When thyroid cells absorb too much radioactive iodine, it can cause thyroid cancer to develop several years after the exposure. Babies and young children are at highest risk. The risk is much lower for people over 40. Thyroid cancer seems to be the only cancer whose incidence rises after a radioactive iodine release. Potassium iodide protects only the thyroid, but it is the organ at greatest risk from radioactive iodine.

WHAT IS POTASSIUM IODIDE (KI)?

Potassium iodide (KI) is the same form of iodine used to iodize table salt. Taking KI fills the thyroid with iodine, thus preventing radioactive iodine from being absorbed. If taken soon enough, KI protects the thyroid from radioactive iodine from all sources – milk, other foods, air, and water. KI is a non-prescription drug that can be purchased over the internet and at some pharmacies. KI is available in pill and liquid forms. KI products approved by the Food and Drug Administration (FDA) are Iosat Tablets (130 mg), ThyroSafe Tablets (65 mg), and ThyroShield Solution (65 mg/ml). Properly packaged, Potassium iodide tablet's shelf life is at least 5 years and possibly as long as 11 years. If you take a very old pill, it may not work fully but it will not hurt you.

WHAT IS THE PROOF THAT KI WORKS?

After the 1986 Chernobyl nuclear accident, shifting winds blew a radioactive cloud over Europe. As many as 3,000 people exposed to that radiation developed thyroid cancer over the next 10 years. Most victims had been babies or young children living in Ukraine, Belarus, or Russia at the time of the accident. The region of excess risk extended up to a 200 mi radius from Chernobyl. Poland, immediately adjacent to Belarus and Ukraine, distributed KI to >95% of their children within 3 days of the accident and did not appear to have an increase in thyroid cancer during the first 3 years of clinical follow up.

WHO SHOULD TAKE KI?

Since children are at the highest risk to exposure to radioactive iodine, KI should be available to all of them. Because of the risk to the fetus, pregnant women should also take KI in the event of a nuclear accident. Adults are at a lower risk but still may benefit from KI. In addition to KI, priority should be given 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.

WHEN SHOULD KI BE TAKEN?

KI fills the thyroid cells with iodine and prevents the gland from absorbing radioactive iodine for approximately 24 hours. People should take one dose a day while they are being exposed to radioactive iodine until the risk no longer exists. KI should be used only under instruction from local health authorities. Not every radioactive release includes the radioactive iodine that can cause thyroid cancer.

Health authorities can determine which radioactive isotopes are released during a nuclear event. If radioactive iodine is released, then health authorities will advise on when and how long to take KI.

WHAT ARE THE RECOMMENDED KI DOSES?

The FDA recommends the following doses:

| AGE | DOSE |
|--------------------|--------|
| 0 – 1 months | 15 mg |
| 1 months – 3 years | 32 mg |
| 3 – 12 years | 65 mg |
| >12 years | 130 mg |

A 15-mg dose can be given to a newborn 0-1 month dissolving a 130-mg pill in 8 oz of a clear liquid and feeding the newborn 1 oz of the liquid.

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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; it is safe to take KI even if you have a shellfish or contrast dye allergy. During a nuclear emergency, KI's benefit far outweighs any potential risk. Adults over 40 years old do not need KI at all unless they are exposed to extremely high levels of radioactive iodine.

Patients with thyroid disease can safely take the pills in the FDA recommended doses. KI should be used for 10-14 days or as directed by public officials (until risk of exposure has passed or other measures are implemented). If KI is taken for a prolonged amount of time, it can lead to temporary hypothyroidism (underactive thyroid gland) or hyperthyroidism (an overactive gland) in some people.

Prolonged treatment can cause thyroid dysfunction 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 by their health care provider.

IS THERE REASON TO BE CONCERNED ABOUT THYROID CANCER?

In general, 90% of patients survive thyroid cancer. The post-Chernobyl cancers have some aggressive features and have been unusual in affecting children younger than 10 years. Thyroid cancer survivors always remain at risk for recurrence and require lifelong medical care. Likewise, the children who were exposed to radioactive iodine from the Chernobyl accident, but have not developed thyroid cancer, remain at risk for life and must continue to be tested though the question of surveillance is still unsettled.

HOW SHOULD KI BE INCORPORATED INTO AN OVERALL EMERGENCY PLAN?

KI is an adjunct to other critical responses. These are evacuation or, if not recommended or not possible, 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 these and any other protective measures.

WILL TAKING 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 should be taught that KI is part of the response to a nuclear accident in addition to evacuation.

WHY WASTE TIME TO TAKE A PILL IF YOU ARE BEING TOLD TO EVACUATE?

Nuclear releases are unpredictable and traffic jams are likely to delay speedy evacuation. People should take their KI before they evacuate, following instructions from local health officials.

WHY NOT PRE-DISTRIBUTE KI TO PEOPLE 10 TO 50 MILES AWAY FROM A NUCLEAR PLANT?

The Department of Health and Human Services (HHS) has recommended distribution of KI to individuals residing within 10 miles of a nuclear plant.

The American Thyroid Association (ATA) agrees with the predistribution of KI to people living within 10 miles of a nuclear plant and recommends stockpiling of KI for those living within 50 miles of a nuclear plant. In areas beyond 10 miles and particularly beyond 50 miles of the nuclear facility, the most likely route of exposure will be through the ingestion pathway.

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, it is difficult to predict how far from a nuclear plant the U.S. should distribute KI in an effort to protect every person who might be exposed to radioactive iodine. Because of this uncertainty, the American Thyroid Association recommends these levels of coverage, determined by distance from the nuclear plant:

DISTANCE ____ ACTION

- 0 – 10 mi Distribute KI in advance ("Pre-distribute") to individual households, with extra stockpiles stored at emergency reception centers
- 10 – 50 mi 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

WHAT ARE OTHER COUNTRIES DOING?

The World Health Organization endorses KI distribution. Many countries, including Belgium, Finland, France, Ireland, Japan, Sweden, and Switzerland, stockpile KI and pre-distribute it in the areas adjacent to nuclear power plants.



FURTHER INFORMATION

Further details on this and other thyroid-related topics are available in the patient thyroid information section on the American Thyroid Association® website at www.thyroid.org.

For information on thyroid patient support organizations, please visit the [Patient Support Links](#) section on the ATA website at www.thyroid.org

