

Potassium Iodide (KI)

What is potassium iodide?

Potassium iodide, also called KI, is a salt of stable (not radioactive) iodine that is used to protect against inhaled or ingested radioactive iodine in an emergency situation.

Stable iodine is an important chemical needed by the body to make thyroid hormones. Most of the stable iodine in our bodies comes from the food we eat. KI is also available in a medicine form, either pill or liquid.

Where does radioactive iodine come from?

Radioactive iodine is one of about 200 different radioactive atoms

(radionuclides) that can be produced when uranium atoms fission or split apart upon being struck by a neutron. For example, radioactive iodine is contained in the fuel of a nuclear power plant. Radioactive iodine is also made for medical purposes under controlled conditions using an accelerator.

Is radioactive iodine hazardous?

Radioactive iodine is hazardous if ingested in significant amounts. Radioactive iodine undergoes radioactive transformation, releasing both beta and gamma radiation. If we are close to radioactive iodine or if we take radioactive iodine into our bodies, our bodies will be exposed to its beta and gamma emissions. If radioiodine is absorbed from the bloodstream and stored in the thyroid gland, the thyroid gland and the rest of the body will receive higher radiation doses than they would if the radioiodine simply passed through the body. This absorption and storage can be prevented by the appropriate use of KI.



Photo courtesy of [Oak Ridge Associated Universities](#)

KI Thyroid Blocking Agent

Are there any beneficial uses of radioactive iodine?

Radioactive iodine has been used for the past half century for diagnostic and therapeutic purposes in medicine. In small amounts, it is used to determine whether or not the thyroid gland is functioning normally. When tagged to certain pharmaceuticals, it can be used to create images of certain organs of the body. When administered in larger doses, it can lower the activity of an overactive thyroid gland and cause it to function normally. In even higher doses, it has been proven to be a very effective cure for thyroid cancer.

What are the effects of radioiodine in the thyroid gland?

Radioiodine in the thyroid gland can lead to increased radiation dose to the thyroid gland and to the rest of the body. Radiation to the thyroid gland of children increases their risk of developing thyroid cancer later in life.

How does KI protect against radioactive iodine?

The thyroid gland needs iodine to carry out its hormone-production function. The gland is constantly removing iodine from the bloodstream. When iodine enters the bloodstream, the thyroid gland does not discriminate between radioactive and stable iodine. Therefore, if stable iodine (in the form of KI) is taken shortly before or shortly after radioactive iodine enters the body, the thyroid gland will absorb the iodine that it needs, including from the stable KI. Consequently, less radioactive iodine will be absorbed and much of the radioactive iodine will be eliminated from the body in a week or two.

How much KI is given?

If pills are given to block the thyroid from the uptake of radioiodine, the dose for an adult is 130 milligrams per day. If liquid is given, the dose for an adult is 2 milliliters per day. Doses for children and infants vary, so they are not listed here. They can be found at the [Radiation Emergency Medical Management](#) (REMM) Web site.

Are there any hazardous side effects associated with taking KI?

There are some known side effects of KI—for example, it can be a skin and respiratory irritant. According to the Mayo Clinic, other possible side effects include hives; joint pain; swelling of the arms, face, legs, lips, tongue, and/or throat; swelling of the lymph glands; burning of the mouth or throat; confusion; headache (severe); increased watering of the mouth; irregular heartbeat; metallic taste; numbness, tingling, pain, or weakness in the hands or feet; soreness of the teeth and gums; symptoms of a head cold; unusual tiredness; weakness or heaviness of the legs; diarrhea; nausea or vomiting; and stomach pain (Mayo Clinic 2010). An individual experiencing any severe side effects should contact a physician for medical consultation. Although many side effects are possible, there is no known lethal dose or concentration of KI.

While there have been minimal side effects observed in large populations administered KI (such as after the Chernobyl accident), KI is a pharmaceutical that should be taken only on the advice of health care advisers. A small number of people have an allergic reaction to iodine, which can cause hazardous side effects in them. Since there is a possibility of side effects, national scientific organizations and the U.S. Food and Drug Administration (FDA) have established recommendations for thyroid doses following an accident involving radioactive iodine at which administering KI should be considered. The current FDA recommendation for state health officials is to consider administering KI to the population if the thyroid has the potential to exceed a dose of 50 *mGy** to pregnant women and children and 100 mGy in other adults. If the potential exposure to the thyroid gland is below these dose levels, the FDA considers the radiation risk from effects of radioiodine in the thyroid gland not great enough to warrant the use of KI (Food and Drug Administration 2001).

Is there an alternative to taking KI pills?

The primary protective action in state emergency-response plans is evacuation and sheltering. Administration of KI is a supplemental action when it is warranted. If state health officials advise evacuation and/or sheltering in place, this should be done immediately. The absolute best protection is to avoid exposure to any unjustified radiation. This includes radiation from radioiodine and the many other radionuclides that could be released from a nuclear incident.

Is KI a “magic bullet” to be used in the event of a nuclear power plant accident or a dirty bomb?

KI has been erroneously represented as a “magic bullet” of radiation protection. KI, if taken properly, only protects against internal radiation from radioiodine taken into the body. It will NOT protect against any external radiation or internal intakes of other radionuclides.

A “dirty bomb” is a conventional explosive device incorporating radioactive material. It is designed to produce contamination with the radioactive material and instill fear and panic. It is unlikely that radioiodine would be used in a dirty bomb due to its short *half-life* and low radiotoxicity compared to other radioactive materials that are more likely to be used. KI would have no protective value from a dirty bomb that did not incorporate radioactive iodine.

Are we now better prepared to deal with nuclear power plant emergencies?

We learned a lot from the accidents at Three Mile Island and Chernobyl. This information has been incorporated into our emergency plans, which are now designed to get people out of harm’s way in a timely fashion and assure that they receive no or minimal radiation exposure. One of the lessons learned from Chernobyl, for example, is that administration of KI is an appropriate protective action when the situation warrants.

In the event of any nuclear emergency, the best procedure to follow is to tune in to the emergency radio and television channels and follow the advice given by public health agencies that are in charge of our safety in an emergency.

*Words in italics are defined in the Glossary on page 3.

Glossary

Gy or Gray

An International System of Units (SI) unit of radiation absorbed dose in terms of energy deposited per unit mass of material, e.g., tissue. The gray is the unit of absorbed dose and has replaced the rad. The average individual in the United States receives about 3 mGy from natural sources of radiation. 1 gray = 1 joule/kilogram and also equals 100 rad; 10 mGy = 1 rad.

Half-Life

Also called physical or radiological half-life, the time in which one-half of the activity of a particular radioactive substance is lost due to radioactive decay. Measured half-lives vary from millionths of a second to billions of years.

References

Food and Drug Administration. U.S. Department of Health & Human Services. Potassium iodide as a thyroid blocking agent in radiation emergencies. December 2001. Available at: <http://www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/ucm080542.pdf>. Accessed 10 February 2011.

Mayo Clinic. Iodine and potassium iodide (strong iodide) (oral route): Side effects. November 2010. Available at: <http://www.mayoclinic.com/health/drug-information/DR600175/DSECTION=side-effects>. Accessed 10 February 2011.

Resources for More Information

Centers for Disease Control and Prevention. Emergency preparedness and response: Potassium iodide (KI). October 2006. Available at: <http://www.bt.cdc.gov/radiation/ki.asp>. Accessed 10 February 2011.

Food and Drug Administration. U.S. Department of Health & Human Services. Frequently asked questions on potassium iodide (KI). February 2010. Available at: <http://www.fda.gov/Drugs/EmergencyPreparedness/BioterrorismandDrugPreparedness/UCM072265>. Accessed 10 February 2011.

Radiation Emergency Medical Management. U.S. Department of Health & Human Services. Guidance on diagnosis & treatment for health care providers: Potassium iodide (KI). August 2010. Available at: <http://www.remm.nlm.gov/potassiumiodide.htm>. Accessed 10 February 2011.

ThyroShield. Information on a U.S. Food and Drug Administration-approved liquid for blocking the thyroid. Available at: <http://www.thyroshield.com/>. Accessed 10 February 2011.

The Health Physics Society is a nonprofit scientific professional organization whose mission is excellence in the science and practice of radiation safety. Formed in 1956, the Society has approximately 5,500 scientists, physicians, engineers, lawyers, and other professionals. Activities include encouraging research in radiation science, developing standards, and disseminating radiation safety information. The Society may be contacted at 1313 Dolley Madison Blvd., Suite 402, McLean, VA 22101; phone: 703-790-1745; fax: 703-790-2672; email: HPS@BurkInc.com.