Potassium Iodide (KI) Guidelines

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Emergency Management Branch,
Ministry of Health and Long-Term Care

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1. Purpose

The purpose of this document is to provide guidance to health providers and local organizations on matters related to Iodine Thyroid Blocking (ITB) with stable iodine, for those communities located within the Primary Zone of the four major nuclear installations in Ontario and the Fermi 2 nuclear installation in Michigan, USA. The information in this document only applies to incidents involving a nuclear facility and does not apply to any other radiological incidents.

Internal exposure of the thyroid to radioiodine is one of the risks of a nuclear facility accident involving a release of radioiodine to the environment. The thyroid is exposed when radioiodine is either inhaled or ingested. Irradiation occurs when radioiodine enters the body and accumulates in the thyroid gland. ITB to protect the thyroid gland is an important consideration and is an Annex of the Ministry of Health and Long-Term Care's (MOHLTC) *Radiation Health Response Plan (RHRP)*.

The dose criteria and specific instructions for the utilization of stable iodine used in this policy are largely based on Health Canada's 2003 recommendations in the *Canadian Guidelines for Intervention During a Nuclear Emergency*.

1.1 Stable Iodine and Iodine Thyroid Blocking

Stable Iodine and Radioiodine

Stable iodine is an essential nutrient that is needed in very small quantities for the thyroid gland to function properly. Iodine is incorporated by the thyroid gland to produce thyroid hormones, which are essential for metabolism in all age groups. The thyroid gland does not differentiate between non-radioactive and radioactive iodine and can absorb both. Uptake of radioiodine may increase the risk of thyroid cancer, particularly in children. The younger the age at exposure, the higher the risk is for developing thyroid cancer in later life.[1]

Effects from Thyroid Exposure to Radioiodine

The selective and rapid concentration and storage of radioiodine in the thyroid gland can result in internal radiation exposure of the thyroid, which may lead to an increased risk of thyroid cancer and benign nodules and, at high doses (several Gy), hypothyroidism (thyroid hormone levels that are too low). These risks can be reduced or prevented through timely administration of ITB to the at-risk population.

[1] WHO, 2011.

Iodine Thyroid Blocking (ITB)

ITB is the method used to prevent or reduce the thyroid gland's ability to absorb inhaled or ingested radioiodine[2]. This is accomplished through the ingestion of a stable iodine compound either before or shortly after exposure to radioiodine. The preferred stable iodine compound is potassium iodide (KI). In Canada, KI is considered a Natural Health Product and not a drug.[3]

When taken at the appropriate dosage and within the correct time interval related to exposure to radioiodine, KI fills up the thyroid with stable iodine. This prevents the thyroid from absorbing radioiodine. As a result, the radioiodine will have no place to accumulate and is excreted naturally.

The World Health Organization, the U.S. Food and Drug Administration, Health Canada and numerous other governments and agencies have concluded that short-term administration of KI at recommended dosage levels is considered to be a low-risk protective measure for populations with normal thyroid function. Most importantly, it can provide protective benefits for those who are vulnerable to thyroid disease such as pregnant and nursing women, newborns and children.

Use with Other Protective Measures

ITB is one of several measures available to protect the health of the public from exposure to radiation resulting from the release of radioiodine from a nuclear installation. Evacuation before emissions have started is the most effective protective measure in the event of a nuclear emergency because it protects the whole body from all radionuclides through all exposure pathways.

ITB for the exposed population will always be implemented in conjunction with other protective measures such as evacuation (if emissions have started or are imminent), and sheltering for the public or together with restrictions on entering affected areas for emergency workers. Depending on the nature of the event, precautionary ingestion control measures involving local food, milk, and water may also be a consideration. The use of KI is intended to supplement, not to replace, other protective measures.

Limits of Iodine Thyroid Blocking

The use of KI for ITB is only effective in protecting the thyroid against inhaled or ingested radioiodine and does not provide any protection against the other radionuclides that may be released in an accident at a nuclear installation or any other non-facility radiological event. KI does not provide protection against external irradiation of the thyroid.

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[2] Radioactive isotopes of iodine that could be released during a nuclear emergency include I^{131}, I^{132}, I^{133}, and Te^{132}.

[3] There are two brands of KI listed on Health Canada's Licensed Natural Health Product Database: Radblock and Iosat.

For the purposes of these guidelines, ITB would be implemented to protect against internal exposure to radioiodine through inhalation only and not ingestion through the food chain. The risk of internal exposure to radioiodine via ingestion through the food chain would be addressed/managed by Ontario promptly implementing precautionary ingestion control measures involving local food, milk, and water in the event of a nuclear emergency so that ITB for this purpose would not be required.

2. Planning Considerations

When developing a local KI distribution strategy, consideration should be given to the following scenarios and the scenario-specific preferences for precautionary and protective measures.

Delayed Emission

In the event of a delayed emission release,[4] which can provide anywhere from two to seven days of lead time, other precautionary and protective measures such as sheltering, evacuation, and protective ingestion control measures for food, water, and milk may take precedence over ITB. For example, if an evacuation can be completed before the emission is released, then KI distribution and ITB would not be required.

Imminent or Ongoing Emission

In the event of a severe accident, where the emissions released are either imminent or ongoing, immediate implementation of protective measures would be required in the Primary Zone including an order to take KI for ITB, in conjunction with evacuation and/or sheltering, and food, water, and milk controls as appropriate.

Persons Unable to Evacuate

Planning considerations need to include those who may be unable to evacuate in a timely manner and are at risk to be exposed to radioiodine. This may include patients and staff in nursing homes, long-term care homes, hospitals, essential services personnel, and prisons/detention centres. In such a situation, direction would be given to shelter, and if appropriate, consume an age-appropriate KI dose every 24 hours for the duration of the exposure until it is possible to evacuate. The maximum feasible amount of time that sheltering would be implemented is two days. Municipalities need to consider this factor when calculating the required quantity of KI for the Primary Zone to ensure sufficient KI stock is available.

[4] A delayed emission release refers to the containment systems at nuclear facilities. See the *RHRP* section 4.16 for more information.

3. Roles and Responsibilities for Administering KI

Section 5.11 of the *Provincial Nuclear Emergency Response Plan, Master Plan 2009 (PNERP)* outlines the responsibilities related to KI:

- Pursuant to nuclear installation responsibilities to assist offsite authorities under the Regulation of Class I Facilities (Nuclear Safety and Control Act), nuclear installations (except Fermi 2) shall procure, in advance, adequate quantities of KI pills, for the Primary Zone population for use during a nuclear emergency.
- Designated municipalities[5] shall detail in their plans the means by which they will facilitate the availability of KI pills for Primary Zone institutions and for emergency centres (Emergency Worker, Reception and Evacuee Centres).
- Designated municipalities for the Pickering, Darlington, and Bruce Power nuclear facilities shall detail in their plans the means by which they will facilitate the availability of KI pills for any member of the Primary Zone population who may wish to possess a supply.
- The MOHLTC will ensure that KI is available for the Town of Amherstburg, should there be an event at the Fermi 2 facility in Michigan.
- Other operational responsibilities regarding ITB (stocking, distribution, and administration) are prescribed in the *Radiation Health Response Plan (RHRP)*, as prepared by the MOHLTC.
- The decision to administer KI will be taken by the Chief Medical Officer of Health for Ontario (CMOH).[6]

Decision to Administer

If conditions require the need for ITB as a precautionary measure to protect public health, the decision to instruct the public to consume KI is made by the CMOH in coordination with the Provincial Emergency Operations Centre (PEOC) and the local MOH. This communication will be coordinated with local MOHs, PEOC, and community EOCs to ensure consistency in messaging. The communication of the CMOH decision to administer KI will also include information about when, how, and by whom KI should be taken, and incident-specific information such as: a rationale for the recommendation, risks and benefits of taking KI, where to obtain KI, dosage recommendations, and any other pertinent information deemed necessary at the time.

3.1 Planning and Response Phase Functions Related to KI

There are specific functions related to KI that should occur during the planning and response phases. The organizations responsible for these functions vary with each community, with Public Health Units and/or local Emergency Management Offices most often taking them on. Each community should designate who is responsible for these functions. Below is a general description of those functions:

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[5] Those municipalities identified in Annex A of the *PNERP*: Kincardine, Durham, Toronto, Laurentian Hills/Deep River, and Amherstburg. From this point forward, "municipality" or "municipal" refers to these designated municipalities.

[6] This decision would be made in collaboration with the impacted region's Medical Officer of Health (MOH) and the PEOC.

Planning Phase:

During the planning phase, the main functions centre on facilitation of the availability of KI to the general public and on pre-distribution to selected institutions within the Primary Zone. This includes determining the number of tablets required, and replacing expired stock. The organizations providing those functions should also act as a conduit for information on proper storage of the stock and general information on KI. Keeping records of which institutions have stock and the level of community pre-distribution is another important role, as the MOHLTC will request this information on an annual basis. If deemed required, the medical directive for the dispensing of KI should be written by the local MOH during this phase as well.

Response Phase:

Once the decision has been made by the CMOH to administer KI in response to a nuclear emergency[7], the local MOH will sign off on the previously written medical directive (if applicable) for dispensing KI at reception and evacuee centres, or by an alternate method of dispensing agreed upon with the local level and the MOHLTC. This includes providing information with the KI and having staff available to respond to questions. Public information will be provided by the MOHLTC through a fact sheet and include the rationale for administering KI, as well as any additional incident-specific information.

In order to provide a general picture of KI coverage rates during an emergency response, information needs to be collected on the number of people who have received KI wherever it has been distributed; this information is to be provided to the MOHLTC. Any reported adverse reactions to KI must also be reported to the MOHLTC. The mechanism for reporting will be determined at the time of the response.

3.1.1 Administration in Schools and Daycares:

Upon the direction of the CMOH, KI will be distributed to children at schools and daycares in the Primary Zone by those facilities' staff members. This authority is derived from the Ontario Ministry of Education Policy/Program Memorandum No. 81 (1984), which considers this action to be "providing temporary assistance in cases of emergency."[8]

To avoid confusion, schools in the Primary Zone should annually send a letter to parents/guardians requesting consent to distribute KI to their children if required in an emergency, and to record this consent and contraindications any children may have.

[7] This decision will be disseminated through many channels including from the PEOC to Municipal Emergency Operations Centres and from the CMOH to local MOHs.
[8] See description here.

4. Procurement, Stocking, and Distribution

4.1 Procurement

As noted in section 3, nuclear installations (except Fermi 2) are responsible for procuring adequate quantities of KI for the Primary Zone population. The MOHLTC ensures KI availability for Amherstburg in case of an emergency at Fermi 2. In both cases, the procurement is done in consultation with the municipality to ensure adequate numbers for the Primary Zone population.

4.2 KI Inventory

The designated municipality will calculate the required quantity of KI stock to cover the Primary Zone, and provide this information to the appropriate nuclear installation (or the MOHLTC for Amherstburg). Considerations to inform calculation should include the number of residents, businesses, and institutions within the Primary Zone for all target populations (see section 2 for additional planning considerations). This data should be updated whenever the KI inventory expires and is replaced.
The following information is to be provided with the tablets[9]:

- What the tablets are for
- When to take the tablets
- How to ingest the tablets
- Who should take the tablets and the priority populations
- How to give fractional doses for children, infants, and neonates
- Maximum number of dosages for certain groups
- Contraindications (medical conditions which indicate that stable iodine should not be taken)
- Adverse effects
- Under what conditions one should consult a physician
- Expiry date

4.2.1 Record Keeping & Reporting

The municipality should maintain records of pre-distributed KI inventories stored in institutions. Regular reviews should be carried out with the assistance of the nuclear installation (or the MOHLTC for Amherstburg) to ensure stocks are adequate in quantity and quality.

On an annual basis, the MOHLTC will contact each municipality to gather information on KI, including the amounts, expiry dates, number dispensed from pharmacies, general uptake, and the types of locations to which it has been pre-distributed.

4.3 Distribution Strategy

The effectiveness of ITB depends on the time KI is taken relative to exposure. Once the CMOH provides the direction to take KI, it must be made available to the public in

[9] This will be contained in the information that accompanies the pills and the MOHLTC KI Fact Sheet.

order to maximize effectiveness. Therefore, the distribution strategy should strive for availability of KI in as many locations as possible. Within the Primary Zone, pre-distribution of KI to key public institutions may be a supportive tactic for ensuring prompt availability.

Municipalities are responsible to include in their plans the process by which they will facilitate the availability of KI tablets for the general public and institutions in the Primary Zone, and also for Emergency Worker Centres and Evacuee and Reception Centres. Part of this planning should consider any regulations around dispensing of natural products such as KI, and as appropriate, any standards of practice from relevant professional regulatory colleges.

The following subsections are meant to provide guidance for pre-distribution of KI to ensure access to those most vulnerable, and allow for quick distribution in the event of an emergency. These suggestions are not exhaustive, as municipalities should store at locations deemed strategically necessary, and tailor their plans to the specific characteristics of the location and population around local nuclear installations.

4.3.1 Pre-distribution to the Public

Municipalities need to ensure that KI tablets are made available to all residents, businesses, and institutions in the Primary Zone who may wish to possess a supply as part of their preparation for a nuclear emergency. Clear instructions should be issued with the tablets, and the public should be made aware on a regular basis of their importance and how to obtain them.

Residents of the Primary Zone should be encouraged to have a supply of KI for their family at home. KI needs to be ingested shortly before or after exposure to help protect against the negative health effects of radioiodine. Having an at-home supply can facilitate timely administration, for that reason any public education and awareness campaigns should emphasize these facts.

4.3.2 Public Education

Public education for people in the Primary Zone is an important aspect of a local KI program. Members of the public should be provided with basic information on the benefits and risks associated with using KI and the importance of having an at-home supply. They should be made aware that KI only protects the thyroid from internal exposure to radioiodine and that it only be taken at the direction of the Province. Methods for promoting these messages can include newspaper ads, letters to physicians and residents, distribution through pharmacies, press releases, social media, information brochures, special KI pick-up days, or joint education materials with the nuclear power plant. This information will assist individuals in making informed decisions on KI use.

4.3.3 Locations of Stocks

KI tablets should be pre-distributed by the municipality to the following types of institutions within the Primary Zone in quantities sufficient for people who live or work in this zone for the indicated number of days (in parentheses):

- Schools (one day)
- Daycares (one day)
- Nursing homes and Long-Term Care Homes (three days)
- Hospitals (three days)
- Prisons and Detention Centres (three days)
- Police and Fire Departments, Emergency Medical Services (three days)

It is the responsibility of the institution to properly maintain these stocks by ensuring:

1. Tablets are stored according to product information and kept in an accessible location.
2. The appropriate environment is maintained.
3. There are processes to ensure staff members have knowledge of the stock.

During a nuclear emergency, reception and evacuee centres must have stocks of KI tablets to distribute to persons passing through or staying at the centre who do not have their own supply. Municipal authorities are expected to make prior arrangements for this purpose.

Emergency Worker Centres must also have stocks of KI tablets for the use of emergency workers during an emergency. As mentioned in section 3, it is the responsibility of the municipal authorities to detail in their plans the means by which they will facilitate this.

5. Intervention Threshold

The International Atomic Energy Agency (IAEA) recommends that ITB should be implemented if the projected equivalent dose to the thyroid exceeds 50 millisieverts (mSv) in the first seven days.[10] Therefore, the intervention threshold for administration of KI in Ontario is also set at 50 mSv thyroid dose in the first seven days for all target populations. ITB will always be accompanied by sheltering or evacuation.

Despite the recommended intervention threshold for KI administration, time criticality to ensure KI effectiveness may require the commencement of ITB based on projected preliminary modeling, provided by the PEOC's Scientific Section, and not on actual surveillance data.

5.1 Target Populations

KI administration is considered to be a practical and effective protective measure for the general public in an emergency. The risks and benefits of taking KI should be considered on an age-specific basis.

Newborns and children are especially vulnerable to radioiodine. There are three reasons for this sensitivity. First, the small size of their thyroids means they receive a higher radiation dose per unit intake of radioiodine. Second, they have a higher yearly thyroid cancer risk per unit dose than an adult. Third, they have a longer time span for cancer to occur.[11]

Based on data from Chernobyl, the risk of thyroid cancer from exposure to radioiodine appears to be inversely related to age. This data suggests that individuals over 40 years of age are unlikely to require ITB. It is also important to note that elderly people are at a lower risk of developing radiation-induced thyroid cancer, and also may be at higher risk of experiencing adverse effects from KI ingestion.

For those with a history of thyroid dysfunction (such as Graves' disease, goitre, and autoimmune thyroiditis), additional consideration should be given as this is an influential factor in increasing the risk of KI adverse effects.

Priority Populations – The following populations are at highest risk for negative health effects to the thyroid from radioiodine, and therefore will benefit the most from ITB. They must be targeted for priority ITB in the event of a nuclear emergency:

- Newborns (< 1 month)
- Infants (1 month – 3 years)
- Children (3 – 12 years)
- Adolescents (12 – 18 years)

[10] IAEA Safety Standards Series No. GSG-2, Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency, 2011.
[11] WHO, 2011.

- Pregnant women or women who are breastfeeding
- All workers responding within the Primary Zone or within the zone where public evacuation, sheltering or KI is considered

During ITB, consideration should also be given to assessing for any possible contraindications.

For the adult population, evidence suggests that the benefit of KI decreases with age (>40). Individuals should consider their own risks and benefits for their need for ITB. Unless they have a contraindicated condition, no person in the Primary Zone or otherwise affected by the emergency should ever be denied KI if they request it.

5.2 Dosage

The recommended quantity required for ITB in an average adult person (18 years and up) is 100 mg of elemental iodine per day which equals 130 mg of KI. To achieve this, dosage tablets of either 65 mg or 130 mg of KI can be used according to the table below.

Recommended single dosage of stable iodine according to age group[12]:

Age Group	Recommended Quantity of Elemental Iodine (mg) [1]	Corresponding Dose Potassium Iodide (KI) (mg)	# of 130 mg tablets	# of 65 mg tablets
Adults (18 yrs +) Incl. pregnant or lactating women[4]	100	130	1	2
Adolescents (12-18 yrs) [2]	50	65	1/2	1
Children (3–12 yrs)	50	65	1/2	1
Infants (1 month–3 yrs)	25	32	Use KI Liquid Solution[3]	1/2
Newborns (< 1 month)[4]	12.5	16	Use KI Liquid Solution[3]	Use KI Liquid Solution[3]

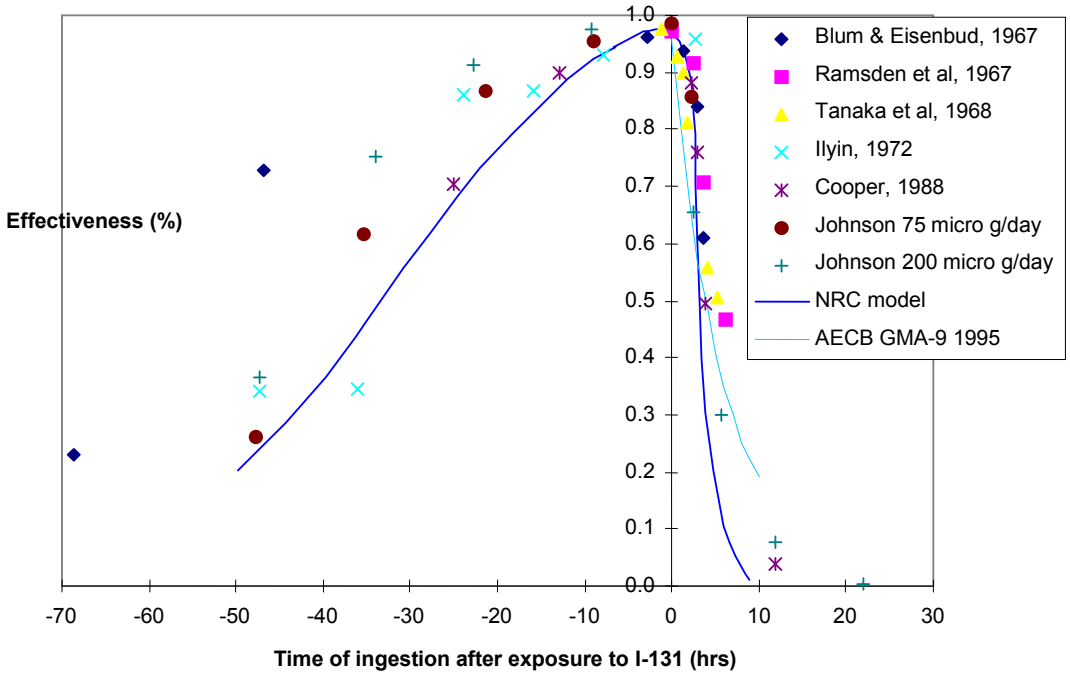
1 A 65 mg tablet of potassium iodide contains 50 mg of iodine.
2 Adolescents approaching adult size (over 150 lbs/70kg) should receive the full adult dose (130 mg).
3 See "Preparation of a KI Liquid Solution".
4 Pregnant or lactating women and newborns should take only one single dose of KI.

[12] Adapted from: Canadian Guidelines for Intervention During a Nuclear Emergency, Health Canada. November 2003. AND U.S. Department of Health and Human Services; Food and Drug Administration; and Center for Drug Evaluation and Research's *Potassium Iodide as a Thyroid Blocking Agent in Radiation Emergencies,* December 2001.

5.2.1 Timing of KI Administration

Ideally, ITB should commence before exposure to radioiodine. The optimum time is two to six hours earlier. However, if that is not possible, it should commence as soon after first exposure as possible, ideally within three hours. After four hours, effectiveness is reduced by half, while no benefit is gained after a delay of 24 hours. A single dose of KI protects the thyroid gland for 24 hours. The MOHLTC may recommend taking a dose of KI every 24 hours if the dose to the thyroid is still high and evacuation is not feasible. Individuals intolerant of KI at protective doses, and neonates, pregnant and lactating women (in whom repeat administration of KI raises safety issues, see section 5.5) must be given priority with regard to other protective measures.

Figure 1: Effectiveness of KI (%) as a function of time (hours) of ingestion after exposure[13]



5.3 Use of KI for Persons over 40

For adults over 40, the scientific evidence suggests that ITB is not recommended or required unless doses to the thyroid are expected to exceed levels that would threaten thyroid function, which is about 5 Gy. Doses at such a high level are unlikely to occur far away from an accident site. Also, the risk of radiation-induced thyroid cancer in persons over 40 is extremely low and decreases with age, while the risk of

[13] International Safety Research, 2008.

side effects from taking KI increases with age as the incidence of thyroid diseases is higher.[14]

Despite the aforementioned evidence, persons over 40 in the Primary Zone or otherwise affected by the emergency should not be denied KI if they request it, unless they have a contraindicated condition. In practice, the target populations mentioned in section 5.1 must always receive KI first.

Persons over 40 should receive information about the risks of KI for their age group and then decide for themselves whether to take it or not.

5.4 Administration of a KI Liquid Solution to Children, Infants, and Others Incapable of Swallowing a KI Tablet

It is important that KI is administered to infants and children since they are at highest risk from the effects of exposure to radioiodine. The dose to the thyroid from radioiodine in a given situation will be higher in this group because of the smaller size of the gland.

Persons unable to swallow a KI tablet, and children receiving a fractional dose, may require a KI liquid solution. For instructions on preparing a KI liquid solution, please see Appendix 1.

5.5 Risks & Other Concerns of KI

The risk of side effects from taking a dose of KI for ITB is extremely low for all age groups,[15] and the overall benefit of ITB outweighs the risk of side effects. Nevertheless, the possibility of such effects, though rare, requires that ITB be: reserved only for situations where it is absolutely necessary; only be taken when directed by the Province; and be taken for a short time frame, i.e., one or two doses. There is an increased risk of side effects for people with thyroid disorders such as auto-immune thyroiditis, Graves' disease, and nodular goitre. Such disorders are more commonly seen in adults and the elderly and are rare in children. Rare side effects in other parts of the body, such as gastrointestinal effects or hypersensitivity reaction, may occur but are generally mild.[16]

Thyroidal side effects may result from KI administration, especially in people with iodine deficiency. Thyroidal side effects of stable iodine include iodine-induced thyrotoxicosis, which is more common in older people and in iodine-deficient areas. In addition, iodide goitre and hypothyroidism are potential side effects more common in iodine-sufficient areas.[17]

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[14] WHO, 1999.
[15] During the Chernobyl accident, the incidence of severe side effects from a single dose of stable iodine was less than 1 in 10 million in children and less than 1 in a million in adults. WHO, 1999.
[16] WHO, 1999.
[17] U.S. HHS, 2001.

People who are sensitive to iodine, have an existing or previous thyroid disorder, or any other concerns, should consult their doctor prior to taking KI.

5.5.1 Clinical Conditions that Contraindicate Administration of KI

People with these conditions should not take KI, and need to be protected by other precautionary and protective measures on a case-by-case basis and under medical advice. These conditions include[18]:

- Hypersensitivity to iodine. This is a very rare disorder that should not be confused with the more common hypersensitivity to contrast agents which contain iodine used in certain radiological examinations.
- Dermatitis herpetiformis, a chronic skin condition associated with an increased risk of iodine hypersensitivity.
- Hypocomplementaemic vasculitis, an uncommon inflammation of the vascular walls, which can occur in certain immunological disorders and is associated with an increased risk of iodine hypersensitivity.
- Myotonia congenital, an extremely rare congenital defect involving muscle stiffness.

5.5.2 Pregnant Women

Pregnant women must be among the first to be protected by taking KI during an emergency. A woman's thyroid gland is metabolically more active during pregnancy, and the amount of radioiodine taken up is increased in comparison to other adults. The fetal thyroid gland can be exposed to radioiodine through the placenta, but can also be protected with KI taken by the mother.

Pregnant women should take only one single dose of KI due to the risk of blocking the fetal thyroid function with excess stable iodine.[19]

Once the nuclear emergency is over, pregnant women should inform their doctor that they have taken KI so this can be added to their medical records, and the thyroid function of the newborn baby can be evaluated.[20]

5.5.3 Breastfeeding Women

When instructed by provincial authorities, breastfeeding women should take the recommended adult dosage for their own protection and potentially to reduce the radioiodine content of the breast milk, but not as a means to deliver KI to infants. The amount of KI provided through breast milk is not enough to protect the thyroid of an infant exposed to radioiodine. Therefore, in addition to the KI taken by the breastfeeding woman, the baby should also be given KI at the recommended dosage. Unless otherwise instructed, breastfeeding women should take only one single dose of

[18] WHO, 2011.
[19] WHO, 2011.
[20] WHO, 2011.

KI because the stable iodine component of breast milk may also pose a risk of hypothyroidism in nursing neonates. If repeat dosing of the mother is necessary, due to continuing severe irradiation, the nursing neonate should be monitored as recommended below.[21]

5.5.4 Newborn Babies (< 1 month)

The World Health Organization recommends that newborn babies should take only one single dose of KI. Taking more than one dose increases their risk for developing hypothyroidism. If not treated, hypothyroidism can cause brain damage.[22] A consultation with a pediatrician within the first week after administration of KI is advisable. Neonates who have taken KI must be monitored by their healthcare provider for the potential development of hypothyroidism by measurement of thyroid stimulating hormones (TSH) and free thyroxine (FT4). Thyroid hormone therapy should be instituted in cases in which hypothyroidism develops.[23]

[21] U.S. HHS, 2001.
[22] CDC, 2012.
[23] U.S. HHS, 2001 & WHO 2011.

6. Acronyms and Abbreviations

CMOH - Chief Medical Officer of Health - Ontario
CNSC – Canadian Nuclear Safety Commission
EMB – Emergency Management Branch
EMCPA – Emergency Management and Civil Protection Act
EMS - Emergency Medical Services
EOC – Emergency Operations Centre
EWC – Emergency Worker Centre
FT4 - free thyroxine
Gy – Gray
HC – Health Canada
IAEA – International Atomic Energy Agency
ITB – Iodine Thyroid Blocking
kg - kilogram
KI – Potassium Iodide
lbs - pounds
MDU – Monitoring and Decontamination Unit
MEMC – Ministry Emergency Management Coordinator
MEOC – Ministry Emergency Operations Centre
MOH – Medical Officer of Health
MOHLTC – Ministry of Health and Long-Term Care
mg - milligram
mGy - milliGray
mSv – milliSievert
NESS - National Emergency Stockpile System
NRU – National Research Universal (part of Chalk River Laboratories)
OPG – Ontario Power Generation
PAL – Protective Action Level
PEOC – Provincial Emergency Operations Centre
PHAC- Public Health Agency of Canada
PHU - Public Health Unit
PNERP – Provincial Nuclear Emergency Response Plan
RDD - Radiation Dispersal Device
RHRP – Radiation Health Response Plan
RN – Radiological / Nuclear
Sv – Sievert
TSH - thyroid stimulating hormones
WHO – World Health Organization

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Appendix 1: Preparation of a Potassium Iodide (KI) Liquid Solution

Persons unable to swallow a KI tablet, and children under three years, will require a KI liquid solution. Instructions for preparing the KI liquid solution using **two 65 mg tablets** are given below.

To Make the KI Solution, You Will Need:

- **Two 65 mg KI tablets**
- Teaspoon
- Small bowl
- Four teaspoons of water
- Four teaspoons of a drink, for example: milk, chocolate milk, orange juice, pop, infant formula, raspberry syrup, or water

Directions for Making the KI Solution:

Step 1. Soften the KI tablets:

- Put two **65 mg** KI tablets into a small bowl. Add four teaspoons of water. Soak the tablets for one minute.

Step 2. Crush the Softened KI tablets:

- Use the back of the teaspoon to crush the tablets in the water. At the end of this step, there should not be any large pieces of KI. This makes the KI and water mixture.

Step 3. Add a drink to the KI and water mixture:

- Choose a drink from the list above. Mix four teaspoons of the desired drink with KI and water mixture made in Step 2. Adding the desired drink makes the final KI solution.

Step 4. Give the right amount of the final KI solution, using the chart below.

How Much of the Final KI Solution to Give Each Day

The chart below tells you how many teaspoons of the final KI solution to give each day. The amount is based on the person's age. Give KI **once** a day until a risk of significant exposure to radioiodines no longer exists, with the exception of infants < 1 month of age who should only receive one dose.

Age	Once Daily Dose of KI Solution*
19 years and older	8 teaspoons (40 ml)
13 to 18 years (over 150 lbs/70 kg)	8 teaspoons (40 ml)
13 to 18 years (under 150 lbs/70kg)	4 **teaspoons (20 ml)**
4 to 12 years	4 **teaspoons (20 ml)**
Over 1 month through 3 years	2 **teaspoons (10 ml)**
An infant from birth through 1 month*	1 **teaspoon (5 ml)**

***This is the amount to give for *one* dose. Infants < 1 month should receive only one single dose.**

Storage of Prepared KI Mixture

- KI mixtures keep for up to seven days in the refrigerator. Discard unused portions.

Adapted from: United States Food & Drug Administration, *Potassium Iodide ("KI") Preparation and Dosing Instructions for Use During a Nuclear Emergency To Make KI Solution (Liquid Form), using two 65 mg KI Tablets*, August 22, 2012. Available online at: www.fda.gov/kiprepare.

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