SAFE WORK PRACTICES FOR RADIOIODINE (I-125 & I-131)

PURPOSE:
The main purpose of this document is to provide safe work practices for radioactive iodine users. It will outline the required procedures, best practices and precautions that need to be taken when working with radioiodine, specifically radioisotopes of I-125 and I-131. In addition to the safe practices and to provide background for the practices; the regulatory requirements, health risks and monitoring services available are also included.

REGULATORY REQUIREMENTS:
Radioiodine is a health risk since it can easily concentrate in the thyroid if the appropriate containment procedures are not used. In CNSC regulatory document RD-58, the thyroid monitoring requirements are focused on volatile (unbound) radioiodines due to the high risk of this form of radioiodine to concentrate in the thyroid. Currently, the University of Ottawa’s Nuclear Substance and Radiation Devices license 07152-1-23.0 does not differentiate between bound or unbound iodine and requires thyroid monitoring of individuals if they use a single 24 hour period more than 2 MBq (0.054 mCi) of iodine-125 or iodine-131 on the open room, more than 200 MBq (5.41 mCi) in a fume hood or more than 20 GBq (541 mCi) in a glove box. Thyroid monitoring is also required if individuals are involved in a spill of greater than 2 MBq or if an individual has external (skin) contamination.

Reporting:
If thyroid monitoring detects more than 10 kBq of iodine-125 or iodine-131 in the thyroid, the licensee shall immediately make a preliminary report to CNSC and have bioassay performed within 24 hours by a person licensed by CNSC to provide internal dosimetry.

HEALTH RISKS:
Radioactive iodine has an affinity for the thyroid gland and can quickly concentrate in the gland which can have serious health issues such as thyroid cancer. Volatile, powdered and gaseous radioiodines can easily be inhaled and extra care and vigilance must be taken. Note, the health risk is low for work with radioimmunoassay (RIA) kits since they contain small quantities of I-125 in a non-volatile form and thyroid monitoring is not required.

THYROID MONITORING SERVICES:
External
There are currently, two external thyroid monitoring service providers, Health Canada and the Ottawa Hospital. These service providers are described in greater detail in the under their respective headings.

Health Canada:

TOH:

2 University of Ottawa’s Nuclear Substances and Radiation Devices License # 07152-1-23.0.
In-House
ORM is currently, updating and re-instating its thyroid monitoring program. Information concerning the program will be disseminated once the program is approved.

SAFE WORK PRACTICES FOR I-125 and I-131:
Regulated requirements

- For samples of I-125 and I-131 with activities greater than 2 MBq and less than 200 MBq, all work must be performed in the fumehood.
- For samples of I-125 and I-131 with activities greater than 200 MBq and less than 20,000 MBq, all work must be performed in a glovebox.
- Contact ORM or the Radiation Specialist immediately,
  - if you have exceeded the limits above,
  - if you have been involved in a spill of greater than 2 MBq of I-125 or I-131, or
  - if you have I-125 or I-131 contamination on your skin.

The Radiation Specialist will organize a means to have your thyroid screened for the applicable iodine. Monitoring will be done the day following the handling or incident and 5 days after. Note, if you have a concerned and feel you have been exposed to either I-125 or I-131, a thyroid screening can be done.

- If you have been involved in a spill greater than 2 MBq you will also need to complete the Radioactive Accident/Incident Report (see Radiation Safety Web site for form: https://orm.uottawa.ca/programs/radiation)

Best Practices

- Wear a dosimeter
- Ensure the radioiodine is properly shielded (check by using a survey meter). I-125 is easily shielded with 0.16 to 0.32 cm of lead
- Use a NaI scintillation probe (efficiency is approximately 13%) or liquid scintillation counter to detect I-125. Note, G-M pancake or G-M cylindrical probes are very inefficient for detecting low-energy I-125 gamma rays (~0.5%)
- If using a fumehood, keep the sash as low as possible and ensure air flow is away from you
- Wear appropriate PPE. Note, some radioiodine compounds may penetrate gloves and skin therefore the use of tools and wearing two pairs of gloves is recommended. (Outer layer of gloves should be changed whenever they are suspected to be contaminated.)
- Store waste in ventilated enclosure such as a fumehood
- For spills involving unreacted radioiodine a solution of sodium thiosulphate can be used to make the radioiodine chemically stable. (Antioxidants such as sodium thiosulphate help reduce both the decomposition and volatilization of NaI I-125 solutions)

Precautions
Radiioiodines in powdered form are easily inhaled and they should be treated as volatile radioiodines.

Volatilization is a very significant concern with I-125 especially when it is in the disassociated (free) form.

Volatility may increase as a result of acidifying.

Store at room temperature since frozen solutions enhance radioiodine volatility.

Open stock bottle slowly and carefully since opening a bottle, especially a new (fresh) bottle may cause radioiodine to be released.

Maintaining radioiodine solutions in dilute concentrations minimizes radiolytic decomposition.

References
Perkin Elmer, Iodine-125 Handling Precautions, 2004
Perkin Elmer, Technical Data Sheet – Radionuclides Na125I, Product number NEZ033A
University of Michigan, Occupational Safety & Environmental Health, Iodine – 125, (downloaded from web, March 2, 2018)