

UT Southwestern Radiation Safety Office

Bioassay Requirements for I-125 and I-131

Based on 10CFR20 and the Texas Regulations for Control of Radiation

I. Conditions under which bioassays are necessary

Periodic bioassays are necessary when an individual handles in open form unsealed quantities shown in the table below. The quantities shown apply to both the quantity handled at any one time or total amount of activity handled by an employee over any three month period.

Activity levels above which bioassay for I-125 and I-131 are necessary

Types of Operation	Volatile or Dispersible*	Bound to Nonvolatile Agent*
Processes in open room or bench , with possible escape of iodine from process vessels.	1 mCi	10 mCi
Processes with possible escape of iodine carried out within a fume hood of adequate design, face velocity, and performance reliability.	10 mCi	100 mCi
Processes carried out within glove boxes , ordinarily closed, but with possible release of iodine from process and occasional exposure to contaminated box and box leakage.	100 mCi	1000 mCi

* Quantities may be considered the cumulative amount in process handled by a worker during a three month period. Quantities in the right hand column may be used when it can be shown that activity in process is always chemically bound and processed in such a manner that I-125 or I-131 will remain in nonvolatile form and diluted to concentrations less than 0.1 mCi/mg of nonvolatile agent. In those laboratories working only with I-125 in radioimmunoassay (RIA) kits, the quantities of I-125 are very small and in less volatile forms; thus, bioassay requirements may be judged from the right hand column.

II. Persons to receive bioassays

All workers handling quantities of radioactive iodine shown in the table above or working sufficiently close to the process so that intake is possible (e.g., within a few meters and in the same room as the worker handling the material) should be bioassayed.

III. Types of bioassay that should be performed

1. Baseline (preemployment or preoperational) - prior to beginning work with radioactive iodine. This is to assure the worker is not already contaminated internally.
2. Routine - on a quarterly basis as long as working conditions have remained constant with regard to amount of Iodine handled.
3. Emergency - as soon as possible after any incident that might cause thyroid uptakes to be excessive.
4. Postoperational - a bioassay should be performed within two weeks of the last possible exposure to I-125 or I-131 when operations are being discontinued or when the worker is terminating activities with potential exposure to these radionuclides.
5. Diagnostic - follow-up bioassay should be performed within two weeks of any measurements exceeding levels given as action points in section IV, in order to confirm the initial results and, in the case of a single intake, to allow an estimate of the effective half-life of radioiodine in the thyroid.

IV. Action points and corresponding actions

ADMINISTRATIVE LIMITS		ACTION
I-125	I-131	
0.75 uCi	0.63 uCi	Internal Dose Calculation, Investigation (See Appendix A)
2.5 uCi	2.0 uCi	Same as above plus provide medical consultation (See Appendix B - Section 1)
60 uCi	50 uCi	Same as Above and a report notifying the Texas Department of Health - Bureau of Radiation Control (See Appendix B - Section 2)

Appendix A

Whenever the thyroid burden exceeds 0.75 uCi of I-125 or 0.63 uCi of I-131, the following actions shall be taken.

1. The internal dose (mrem) as effective dose equivalent and committed dose equivalent will be calculated. The effective dose equivalent will then be added to the external effective dose equivalent obtained with dosimeters to determine the TOTAL effective dose equivalent.

Whole Body Dose:

$$\text{I-125 Effective Dose Equivalent} = (\#n\text{Ci}) \times (0.024 \text{ mrem/nCi}) = \# \text{ mrem}$$

$$\text{I-131 Effective Dose Equivalent} = (\#n\text{Ci}) \times (0.033 \text{ mrem/nCi}) = \# \text{ mrem}$$

Organ or Tissue Dose:

$$\text{I-125 Committed Dose Equivalent} = (\#n\text{Ci}) \times (0.814 \text{ mrem/nCi}) = \# \text{ mrem}$$

$$\text{I-131 Committed Dose Equivalent} = (\#n\text{Ci}) \times (1.073 \text{ mrem/nCi}) = \# \text{ mrem}$$

2. An investigation of the operations involved, including ventilation surveys, shall be carried out to determine the cause of exposure and to evaluate the potential for further exposures.
3. If the investigation indicates that further work in the area might result in exposure of a worker to concentrations that are excessive, the Radiation Safety Office will restrict the worker from further exposure until the source of exposure is discovered and corrected.
4. Corrective actions that will eliminate or lower the potential for further exposures should be implemented.
5. A repeat bioassay should be taken within one week of the previous measurement in order to confirm the effectiveness of the corrective action taken or to verify internal radioiodines present.

Appendix B

SECTION I

*Whenever the thyroid burden at the time of measurement exceeds **2.5 uCi of I-125**, or **2.0 uCi of I-131**, the following actions should be taken:*

1. Calculate the internal dose using the methods described in Appendix A.
2. Carry out an investigation as described in Appendix A.
3. As soon as possible, refer the case to appropriate medical consultation for recommendations regarding therapeutic procedures that may be carried out to accelerate removal of radioactive iodine from the body. This should be done within two-three hours after exposure when the time of exposure is known so that any prescribed thyroid blocking agent would be effective.
4. Carry out repeated measurements at approximately one week intervals at least until the thyroid burden is less than 0.75 uCi of I-125 or 0.63 uCi of I-131.

SECTION 2

*If the thyroid burden at any time exceeds **60 uCi of I-125** or **50 uci of I-131**, the following actions should be taken:*

1. Carry out all steps described in the above sections.
2. Notify the Texas Department of Health - Bureau of Radiation Control within 30 days and follow the procedures outlined in 25 TAC §289.202(yy) [TRCR 21.1203].

REFERENCES and CALCULATIONS

Texas Department of Health - Bureau of Radiation Control. Texas Regulations for Control of Radiation 25 TAC §289.202 [TRCR Part 21]. Austin, TX; 1993.

International Commission on Radiological Protection. Limits for Intakes of Radionuclides by Workers. Oxford: Pergamon Press; ICRP Publication 30, Supplement to Part I; 1979.

Annual Limits on Intake, ALI, based on nonstochastic limit for inhalation

$$\frac{\text{Nonstochastic limit (50 rem)}}{\text{Committed dose equivalent per intake of unit activity (rem/uCi)}} = x \text{ uCi}$$

ALI for I-125 \equiv 2E06 Bq = 60 uCi

ALI for I-131 \equiv 2E06 Bq = 50 uCi

Calculations for Internal Dose:

For Effective Dose Equivalent:

Weighted Committed Dose Equivalent for inhalation of I-125 \equiv = 0.024 mrem/nCi

Weighted Committed Dose Equivalent for inhalation of I-131 \equiv = 0.033 mrem/nCi

For Committed Dose Equivalent to the thyroid:

Committed dose equivalent for inhalation of I-125 \equiv 0.814 mrem/nCi

Committed dose equivalent for inhalation of I-131 \equiv 1.073 mrem/nCi