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MEMORANDUM FOR: Bernard Singer, Chief
Radioisotopes Licensing Branch
Office of Nuclear Material Safety
and Safeguards

FROM: Robert E. Alexander, Chief
Occupational Health Standards Branch
Office of Standards Development

SUBJECT: "GUIDELINES FOR BIOASSAY REQUIREMENTS FOR TRITIUM"

Enclosed are three copies of the interim guideline, "Guidelines for Bioassay Requirements for Tritium," which incorporates suggestions and changes agreed upon at our meetings. In accordance with our agreement, when the Health Physics Society Standards Committee completes its standard and it becomes approved as an ANSI standard, we can then consider to what degree we wish to incorporate the ANSI standard into a formal Regulatory Guide. In the meantime, while our Task No. OH 713-4 to develop a formal Regulatory Guide is in HOLD, we hope the enclosed interim guidelines will be helpful in your licensing programs.

Robert E. Alexander, Chief
Occupational Health Standards Branch
Office of Standards Development

Enclosure

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DATE ➤	10/26/77	10/27/77				

GUIDELINES FOR BIOASSAY REQUIREMENTS FOR TRITIUM

Nuclear Regulatory Commission

Division of Fuel Cycle and Material Safety

October 19, 1977

AB/REA

BIOASSAY REQUIREMENTS FOR TRITIUM

I. Conditions Requiring Bioassay

A. Routine Bioassay is required when quantities processed by an individual at any one time, or total amount processed per month, exceed those for the respective forms of tritium as shown in the attached Table 1.

B. Above 0.1 of, but less than, the levels in Table 1, routine bioassay is required unless a written justification is submitted for not performing bioassays.

C. Except as stated in I.D. below, bioassay is not required for process quantities less than 0.1 of those in Table 1.

D. Special bioassay measurements should be performed to verify the effectiveness of respiratory protection devices and other protective clothing. If an individual wearing a respiratory protective device or protective clothing is subjected to a concentration of tritium in air (in any form) such that his or her intake with no protection would have exceeded that which would result from exposure for 40 hours per week for 13 weeks at uniform concentrations of tritium in air as specified in Appendix B, Table I, Column I, 10 CFR 20,* bioassays should be

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*Multiplying the concentration given in Appendix B, 5×10^{-6} μCi/ml, by 5.3×10^{8} ml gives the corresponding quarterly intake of tritium by inhalation. This is assumed equal to the uptake of tritium (as HTO) by absorption through the skin unless the form of tritium in the air can be demonstrated to have lower uptakes. The total uptake, including skin absorption, would be assumed to be about 6.3 mCi, which delivers a dose commitment of about 1.25 rems to standard man.

performed to determine the resulting actual tritium intake. These special bioassay procedures should also be conducted, for personnel wearing respirators, if for any reason the average tritium concentration in air and the duration of exposure are unknown.

II. Who Should Participate

All workers involved in the processing of tritium, under conditions specified in I above, or sufficiently close that intake is possible, should participate.

III. What Types of Bioassays Should be Performed

A. Baseline (including Pre-employment, or Pre-operational Urinalysis, not more than one month prior to beginning work with tritium requiring bioassay under Section I above).

B. Routine Urinalysis

C. Post-operational. Within one month of last possible exposure to tritium.

D. Diagnostic. Within one week of any sample exceeding levels given as action points in Section V below. See V.A.2.(d).

IV. How Often

A. Initial Routine Samples

Within 48 hours following entry of an individual into an area where operations require bioassay according to Section I.A and

B above, and then every two weeks or more frequently thereafter as long as the individual is working with ^{3}H.

B. After 3 Months

The sampling frequency selected in accordance with Section IV.A above may be changed to quarterly if, after 3 months, the following 3 conditions are met:

(1) The average urinary tritium concentration from specimens obtained during the 3-month period does not exceed 3 μCi/l,

(2) Where measurements of the concentration of tritium in air are required as a condition of the license, the quarterly average concentration (μCi/ml) to which workers are exposed, multiplied by the factor 6.3×10^{8} ml, does not exceed 0.8 mCi, and

(3) The working conditions during the 3-month period, with respect to the potential for tritium exposure, are representative of working conditions during the period in which a quarterly urinalysis frequency is employed, and there is no reasonable expectation that the criteria given in (1) and (2) above will be exceeded.

V. Action Points and Corresponding Actions

A. Bi-Weekly or More Frequent Sampling

1. If urinary excretion rates exceed 5 μCi/liter, but are less

than 50 μCi/liter, the following course of action should be taken:

(a) a survey of the operations involved, including air and area monitoring, should be carried out to determine the cause(s) of exposure and evaluate potential for further larger exposures.

(b) Implement any reasonable corrective actions indicated in the survey that may lower the potential for further exposures.

(c) A repeat urine sample should be taken within one week of the previous sample and should be evaluated within a week after collection.

(d) Any evidence from (a) and (b) indicating that further work in the area might result in an employee receiving a dose commitment in excess of the limits established in §20.101 should serve as cause to remove the employee from work in this operation until the source of exposure is discovered and corrected.

2. If urinary excretion rates exceed 50 μCi/liter, the following course of action should be taken:

(a) Carry out all steps as in 1.(a) to (d) above.

(b) If the projected dose commitment exceeds 5 rems, report the incident to the NRC in accordance with §20.403 of 10 CFR Part 20.

(c) Refer the case to appropriate medical/health physics consultation for recommendations regarding therapeutic procedures that may be carried out to accelerate removal of tritium from the body and reduce the dose as low as reasonably achievable.

(d) Carry out repeated sampling (urine collections of at least 100 ml each) at approximately one-week intervals, at least until samples show an excretion rate less than 5 μCi/liter. If there is a possibility of long-term organic compartments of tritium that require evaluation, continue sampling as long as necessary to ensure that appreciable exposures to these other compartments do not go undetected.

B. Quarterly Sampling

Carry out actions at levels as indicated under A. above, and if the excretion rate continues to exceed 5 μCi/liter, also reinstitute biweekly (or more frequent) sampling for at least the next 6-month period, even when urinary excretion falls below 5 μCi/liter.

TYPES OF OPERATION	HTO FORM (& forms other than those on right-hand cols.)	HT or T_2 GAS IN SEALED PROCESS VESSELS	NUCLEOTIDE PRECURSORS	HTO MIXED WITH MORE THAN 10K_g OF INERT H_2O OR OTHER SUBSTANCES
PROCESSES IN OPEN ROOM OR BENCH, WITH POSSIBLE ESCAPE OF TRITIUM FROM PROCESS VESSELS	0.1 Ci	100 Ci	0.01 Ci	0.01 Ci/K_g
PROCESSES WITH POSSIBLE ESCAPE OF TRITIUM, CARRIED OUT WITHIN A FUME HOOD OF ADEQUATE DESIGN, FACE VELOCITY, AND PERFORMANCE RELIABILITY	1 Ci	1000 Ci	0.1 Ci	0.1 Ci/K_g
PROCESSES CARRIED OUT WITHIN GLOVEBOXES, ORDINARILY CLOSED, BUT WITH POSSIBLE RELEASE OF TRITIUM FROM PROCESS AND OCCASIONAL EXPOSURE TO CONTAMINATED BOX AND BOX LEAKAGE	10 Ci	10,000 Ci	1 Ci	1 Ci/K_g

Table 1

ACTIVITY LEVELS OR CONCENTRATIONS ABOVE WHICH BIOASSAY SHALL BE REQUIRED

Quantities present ($<10K_g$) may be considered either the amount processed by an individual at any one time (when accidental intake is more likely), or the amount of activity entered into process (throughput) during any one month (when routine handling of repeated batches is the more likely source of exposure). Concentrations in the right-hand column may be used when activity in process is always diluted in more than $10K_g$ of other reagents, as in nuclear reactor coolant systems.