PAUL GUINN
RSS

TII INDUSTRIES, INC.
P. O. BOX 433, RD 165 KILOMETER 1.06
TOA ALTA, PUERTO RICO 00758
(809) 870-2700, (809) 726-4362 TELEX 385-9479

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November 27, 1984

Mr. Paul Guinn
U.S. Regulatory Commission
101 Marietta Street N.W.
Atlanta, Georgia

Dear Mr. Quinn:

Enclosed is the answer to questions submitted by Mr. Phillip Chambless on his recent visist to our premisses. I hope these will be satisfactory to you.

If there are any doubts please let us know.

Very truly yours,

Greg Cortes

TII Industries

GC/ac

Enclosure

Official Copy

REPLY TO ATTN: OF PAUL GUINN

1. H_3 BIOASSAY PROGRAM

   a. How samples are collected?

   b. Who analize the samples?

   c. How does he do it?

   d. Does he have NBS traceable standards for use in his counting system?

2. Provide total annual release quantity and annual concentration?

3. Address the potential for accumulation of H_3 outside your plant by stating that your consultant will take some water & vegetation samples near the site of the plant & analyzing for H_3.

4. Describe immediate surrounding area including distances from stacks to nearest residences, schools, etc.

5. Describe actions you use to keep employee exposures ALARA.

6. Describe functions & location of the sample lines from the two tritium monitors.

   Statement about alarm levels, program for changing desiccant.

7. Resubmit QA testing program used on surge arresters?

8. Address your waste handling program for (1) pumps (2) oil (3) reject tubes.

9. State that authorized users are physically present during manifold operation.

10. Functions of your consultant.

    Calibrations?
    Survegs?
    Bioassays?

11. Is any equipment removed from the restricted area, if so how is it monitored for the presence of radioactivity?

12. Vistors allowed to enter restricted area?

13. What is the frequency for performing wipe test on floors, equipment?

14. Address training of new employees including possible radiation safety orientation from Gomez.

1. H_3 Bioassy Program

   A. How samples are collected?

      Every month and on a specified date, every person having access to the controlled area is given a specimen bottle and a urine sample collected.

   B. Samples are analized by our Consultant Santiago Gomez.

   C. See 1C.

   D. See 1D.

2. Section 14b we show a release of .285 ci/station every time we process 200 tubes. (Copy Attached)

   Then: $\frac{200}{285} = \frac{2,240.00}{X}$ (tubes processed yearly) or 2,240,000

   X = 3192 ci = Yearly release.

   At the bottom of the page we show the caculation for the average concentration per week. This is a constant and it is the same for the annual concentration.

3. In order to check the potential for accumulation of H3 on the outside of our plant, in the past Mr. Santiago Gomez has taken some water samples from the surrounding areas.. No activity was found. This time he will try analizing samples of the vegetation in the surroundings.

4. There are residences at about 100 ft. from stacks towards the northwest part of the plant. (See attached drawing: BP 1000-1).

5. In order to maintain employee exposure as low as possible, we have established an exposure level of one uci/lt. This was done based on the information gathered thru the years of operation which showed the maximum exposures to be no greater than two uci/lt when urine specimen were checked.

   Whenever an employee shows any activity beyond the one uci/lt limit established, such person is immediately removed for the controlled area until his body activity drops below the one uci/lt level. This usually takes from one to two weeks.

$\frac{200 \text{ tubes}}{285 \text{ mCi}} = \frac{2,240.00 \text{ tubes}}{x \text{ mCi}}$

$x = 3192 \text{ mCi}$

Yearly

?

not

3192 Curies

maybe both 285Ci & 2,240,00 divided by 1000

6. We presently have two Johnston Tritium Monitors.

Monitor #1 - Johnston Model Triton 955 is connected via copper tubing to both stacks. It switches from one stack to the other every minute. This monitor is set 5 uci/m 3.

Monitor # 2 - Johnston Model Triton 955B. Monitors the controlled area. The sample line is located in the center of the room at 5 feet from the floor. This monitor is set to 5 uci/m 3.

Both monitors are calibrated every month and the desicant changed before calibration. In some occasions it has been necessary to change the desicant twice a month due to extreme high humidity. Filters are changed in a weekly bassis or sooner if needed.

7. The manufacturing operation sequence to produce these devices consists of first hydrogen brazing sub-assemblies, then leak-checking by pressurizing to 70 psig, immersing in "Freon" and checking for bubbles. Following this, 200 leak-checked devices are placed on a high vacuum manifold and evacuated to a maximum pressure of 5 X 10 - 5 mm of Mercury prior to baking. They are then vacuum baked, at 500°C and the pressure of the devices and the entire manifold system again monitored. The pressure at this point will be no greater than 10 -5 mm of Mercury prior to any attempt of backfilling with radioactive gas mixture, thus insuring leak-tight integrity before gas enters into the device. The devices are backfilled with the Hydrogen -3 gas mixture at at pressure much lower then atmospheric and cold welded with a specially designed tool. The gas mixture contained in the machine's manifold is then evacuated through a high vacuum pump and exhausted into a stack outside the building's roof. The machine's manifold is then backfilled with Argon to atmospheric pressure, prior to reloading.

The machine's gas handling manifold system consists of a completely closed loop. The manifold and tubes are kept below atmospheric pressure at all times whenever Hydrogen -3 is employed. In the event of a system leak, the atmosphere is drawn into the system, thereby preculding any out flow of tritium into the work area.

The inspection and acceptance criteria for manufactured devices will be thus:

Inspection Step	Acceptance Criteria
1. Leak-check brazed assemblies	No bubbles appearing when pressurized to 70 psig and immersed in Freon
2. Evacuation under "hard" vacuum	Able to be evacuated to a maximum pressure of 5 X 10⁻5mm of Mercury
3. Evacuation under "hard" vacuum	Able to be evacuated to a maximum of 10 -5 of Mercury

4.	Hi-Pot Test - Result is dependent on gas content in devices and is done immediately following pinch-off operation	Tube discahrge at an impressed potential of 425 ± 75 volts D.C.
5,	Hi Pot Test after aging	Tube discharge at impressed potential of 425 ± 75 volts D.C.

Devices not meeting the Hi-Pot Test requirements will be rejected and entered in the Daily Production Log.

8. Any radioactive waste generated is packaged inside the controlled area. Prior to any packages leaving the controlled area, wipe samples are taken on exterior surfaces to insure compliance with applicable DOT and NRC regulations. The only waste originated is whenever we have a defective pump. Pump and oil will be sent to a burial site in the U.S.A. This is done thru Teledyne Isotopes which provides drums, paper work and instructions.

   Rejected tubes fall into two categories:

   Leak or open tubes and tubes reading out of limits. 75 to 80% of rejects are leaky or open tubes which contain no gas. All other tubes are sent out for burial every time we have a waste shippment.

9. There is at least one authorized user present during the manifold operation.

10. Function of our consultant.

    A) Surveys and bioassays. During his visits he holds short meetings with the employees to discuss safety and good house keeping in the controlled area. He is also available any time an employee has a question or doubt about his work.

11. All equipment is serviced inside the controlled area.

12. No visitors are allowed in the controlled area. There are glass windows from where all the operation can be observed.

13. Wipe test on floors and equipment will be done in a quarterly bassis.

14. We have always had three or more authorized users in our premises. Whenever one of them leaves the job another person is sent out for training in the U.S.

URINE ANALYSIS PROCEDURES AND CALCULATIONS

By Santiago Gomez Figueroa,

1. Take one cc.of urine sample in a LSC 20 cc. vial
2. Add 9 cc. of AQUASOL (Liquid Scintillation Solution) and shake it.
3. Count samples in a Liquid Scintillation Counter using the appropriate setting for H-3
4. Using the Over-all Efficiency of the Counter (see attached),calculate the number of dpm/cc of each sample by the expression:

$$dpm/cc = \frac{cpm/cc}{Eff.}$$

5. Calculate the number of uCi/liter of each sample by:

$$uCi/liter = \frac{dpm/cc}{2.22 \times 10^{3}}$$

6. Calculate the Body Burden in uCi,assuming a total volume of 40 liters of liquids in the standard man:

$$uCi(B.B.) = (dpm/cc) \times 1.82 \times 10^{-2}$$

7. Calculate the % MPBB taking 10^{3} uCi as the Maximum Permissible Body Burden (MPBB) for H-3:

$$\% \text{ MPBB} = uCi(B.B.) \times 10^{-1}$$

CALCULATIONS OF EFFICIENCY IN LS COUNTING TECHNIQUES

By Santiago Gomez Figueroa

A. Procedures for Internal Standarization and Quenching Effect consideration.

1. Count a sample prepared in the regular way and record as R_1

2. Add 10 of a H-3 calibrated Standard Solution, count the sample and record as R_2

3. Calculate net 10 of the H-3 calibrated Standard Solution and counted in the Liquid Scintillation Counter by:

$$R_3(\text{net } 10\ ) = R_2 - R_1$$

4. Take R_o as the 10 of the H-3 calibrated Standard Solution in dpm

5. Get Efficiency (Eff.) by:

$$\text{Eff.} = \frac{R_3}{R_o}$$

$$\% \text{ Eff.} = (R_3/R_o) \times 100$$

B. Procedures for rountine Efficiency check out:

1. Correct for decay the Standard in dpm and record as A_o(dpm)

2. Count the Standard in the LSC and record as R(cpm)

3. Calculate %Eff. by the expression:

$$\% \text{ Eff.} = \frac{R(\text{cpm})}{A_o(\text{dpm})} \times 100$$

Standards Used:
1. Tritium Standard - NES - 004 (See enclosed copy)
2. Beckman - Unquenched Standards Set (Sept.1983) No.566321 - Control No.9401 (See enclosed copy)
3. Beckman Quenched Standards- Set 1058 (5-1-1967)

CERTIFICATE OF RADIOACTIVITY CALIBRATION

Tritium Standard
NES-004

Lot Number: 552-220
Half-Life: 12.35±0.01 years

The activity of Hydrogen-3 was found to be
3.12×10^6 dpm/ml on April 25, 1972

DESCRIPTION OF THE STANDARD

Chemical Composition	Toluene-^{3}H
Volume	Aproximately 10 milliliters
Physical Form	10cc. Combivial

METHOD OF CALIBRATION

The standard was calibrated by liquid scintillation counting using the National Bureau of Standards tritated toluene standard #4947 as an internal standard.

IMPURITIES

Less than 1% according to the producer of the isotope

ERRORS

Random Errors(3 times the standard deviation)

a. Precision of the NENC measurement ±2.8%

Systematic Errors

a. Accuracy of the NBS standard ±1.0%

Overall Error

2.8 + 1.0 = ±3.8%

NEN New England Nuclear
575 Albany Street, Boston, Mass. 02118
CUSTOMER SERVICE: (617) 482-9595

) Backfilling Electron Devices

Tritium will be incorporated into our devices using pressurized gas cylinders from a commercial source. After filling the devices, the remaining gas in the tube manifold system will be exhausted to a plenum chamber on the roof with a blower system of 10,000 CFM. The maximum amount of gas that will be exhausted is as follows:

$$\frac{\text{Bottle}}{\frac{2300 \times 1140}{22}} = \frac{\text{Manifold}}{\frac{850 \times 40}{X}}$$

$$x = \frac{850 \times 40 \times 22}{2300 \times 1140} = .285 \text{ Ci/Station}$$

$$10{,}000 \text{ CFM} = 2.8 \times 10^{8} \text{ Cm}^3/\text{min}$$

The maximum anticipated instantaneous discharge for six stations would be:

$$6 \times .285 = 1.71 \text{ Ci}$$

$$\frac{17.1 \times 10^{5} \text{ uCi}}{2.8 \times 10^{8} \text{ Cm}^3} = 6.11 \times 10^{-3} \text{ uCi/cm}^3$$

The above figure surpasses the maximum allowable concentration denoted in Appendix B, Table II of 10 CFR Part 20 on an instantaneous basis.

However, if we take the weekly discharge of 2.85×10^{5} uCi each multiplied by 240, we arrive at a total of 6.84×10^{7} uCi total for the week. This activity will be diluted by the plenum chamber moving 10,000 CFM of air. Thus 10,000 x 60 min. x 168 hrs. x 28,320 $= 2.85 \times 10^{12} \text{Cm}^3$ air/wk.

Then $$\frac{6.84 \times 10^{7} \text{ u Ci}}{2.85 \times 10^{12} \text{ cm}^3} = 2.4 \times 10^{-5} \text{ uCi/cm}^3$$

The above figure is approximately 60% of the average maximum allowable concentration of 3H that can be discharged according to 10CFR part 20.

6 stations x 5 days/week x 8 times/day = 240

6.84×10^{7} µCi x 50wks = 3.42×10^{9} µCi

3.42×10^{3} Ci

3420 Curies yearly

BECKMAN

566321
LIQUID SCINTILLATION STANDARDS SET

Distributed by:
Beckman Instruments, Inc. Scientific Instruments Division
Irvine, California 92713

PRODUCT DESCRIPTION

The 566321 Liquid Scintillation Standards Set consists of precisely calibrated, sealed, unquenched samples of carbon-14 (^{14}C), tritium (^{3}H), labeled toluene in scintillation solution, and an unquenched scintillation blank. The scintillation solutions used contain 4 grams of PPO (2,5-diphenyloxazole) and 0.05 gram of POPOP (p-bis[2-(5-phenyloxazolyl)] benzene) per liter of toluene, which has been purified by distillation from sodium under high-purity nitrogen. Both the PPO and POPOP are scintillation-grade fluors. All standards are furnished in 20-milliliter, low-potassium glass ampoules and sealed under nitrogen, with special precautions taken to exclude oxygen and moisture, which cause quenching. The radioactive standards are prepared by dispensing 15 milliliters of a ^{14}C or ^{3}H master solution into a 20-milliliter ampoule and flame-sealing it immediately. After leak-testing, an aluminum cap is attached to the ampoule and a titanium dioxide-based paint is applied to the top of the ampoule. The blank standard is prepared in a similar way.

ACTIVITY CALIBRATION AND ERROR ANALYSIS

The ^{14}C and ^{3}H standards have been assayed for activity by comparison with the National Bureau of Standards (NBS) carbon-14 solution standard, Standard Reference Material (SRM) No. 4925, benzoic acid in toluene, and tritium solution standard SRM No. 4947, tritiated toluene in toluene. The method of calibration was liquid scintillation sample channels ratio (SCR) quench correction using secondary standards prepared from the NBS standards. The estimated activities for the activity standards and the reference dates for all standards are as follows:

^{3}H 104600 dpm 1 Sept 83 Ref. Date

^{14}C 27000 dpm 1 Sept 83 Ref. Date

Blank 1 May 83 Ref. Date

The ^{3}H is from Production Lot No. H362 ;

the ^{14}C is from Production Lot No. C355 ;

and the Blank is from Production Lot No. B188 .

The overall uncertainties associated with the activity values are estimated to be less than ± 3.0 % for the ^{3}H and ± 3.0 % for the ^{14}C. These estimates are determined in accordance with error analysis procedures recommended by the International Commission on Radiation Units and Measurements (ICRU Report 12). The limits are calculated by arithmetically summing the uncertainty due to random errors at the 99% confidence level with the assessable systematic errors. Random errors arise from production and assay procedures such as dispensing, weighing and counting. Systematic errors consist of uncertainty in the activity of the NBS-based secondary standards, overall uncertainty of the NBS SRM NO. 4947 as a function of time (assuming a half-life of 12.26 years and a half-life uncertainty of 0.5%), uncertainties in the standard weights used for calibrating the balances used in gravimetric determinations, losses of activity by evaporation and uncertainties in corrections applied for the effects of radioactive impurities.

(over)

RECOMMENDATIONS FOR USE

Unquenched standards can be used to: (1) measure day-to-day ^{3}H and ^{14}C counting efficiencies for comparison with original factory specifications and for verifying stable system performance; (2) measure E^2/B ratios for low level activity counting; (3) measure ^{3}H and ^{14}C "spillover" in dual-label counting channels. The instrument operator manual should be consulted for specific instructions on use of these standards with a given liquid scintillation system.

LIMITATIONS ON USE

Unquenched standards should not be used to construct quench correction curves for calibration of quenched samples.

PRECAUTIONS ON STORAGE AND USE

The 566321 Standards are prepared taking great care to exclude moisture, oxygen, and organic impurities which might affect their long-term stability. The fluors which they contain, however, are susceptible to photochemical degradation, and excessive exposure to sunlight or fluorescent lighting may result in their deterioration. File samples of the manufacturer are stored in the dark at room temperature and, when in use, exposed only to incandescent lighting. This treatment has resulted in long-term stability—at least 3 years—and is recommended for standards in active use.

PRECAUTIONS AND THE SAFE USE OF EXEMPT QUANTITY RADIOACTIVE MATERIALS

1. The accompanying radioactive material is exempt from the licensing requirements of the U.S. Nuclear Regulatory Commission or of any agreement state.
2. Radioactive material – not for human use – introduction into foods, beverages, cosmetics, drugs, or medicinals, or into products manufactured for commercial distribution is prohibited – exempt quantities should not be combined.
3. Radioactive material should be stored in a designated area in its original shipping container or labeled inner package.
4. Do not eat, drink, smoke, apply cosmetics, store, or prepare food in any area where radioactive materials are used.
5. Avoid direct contact with all radioactive materials by use of protective articles, such as disposable gloves and lab coats.
6. Use necessary precautions to prevent contamination of the laboratory and equipment, e.g., absorbent material on work surfaces, disposable lab ware.
7. Do not pipette by mouth.
8. Handle all sealed radioactive sources with care so as not to disturb the physical integrity of the capsule or ampoule.
9. Radioactive organic liquids should be disposed of in the same manner as their non-radioactive chemical equivalents, through normal laboratory methods. Water-soluble radioactive materials may be disposed of through the sanitary sewer when flushed with copious amounts of water.
10. Radioactive solids and sealed sources should be disposed of in normal laboratory waste.
11. These precautions are not necessarily adequate for other uses of radioactive material.

Beckman Instruments, Inc. Fullerton, CA 92634
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