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September 18, 2012

R.W. Borchardt
Executive Director for Operations
Rulemakings and Adjudications Staff
Office of the Secretary
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

Dear R.W. Borchardt

This letter is in response to your letter dated July 5, 2012.

The intent of our request is to amend the NRC regulations to allow the commercial distribution of tritium markers.

Enclosed are the answers to your questions about missing information in our petition.

1. **Supporting documentation and other pertinent information necessary to support the action the petitioner requested**

Enclosed are two documents to support our petition for regulation:

A. Dose calculations for use of tritium markers under normal use and accident conditions.

B. Presidential Memorandum on Scientific Integrity March 9, 2009

2. **Specific cases that the petitioner is aware of in which the current rule is deficient or needs to be strengthened**

The statement in 10 CFR 32.22(b) that an NRC application can be denied " if the end uses of a product can not be reasonably foreseen" is a subjective statement, for which there is no specific criteria in the regulations. It is unfair to deny applications based upon subjective statements where the criteria are not codified in the regulations.

The same is true regarding the designation of "frivolous use," in the NRC policy statement on consumer products (both the current version and the new draft version) and referenced is NUREG 1556 Vol. 3, Revision 1, which do not clearly define terms used, or detailed criteria used to make determinations.

As long as the product meets the other criteria in 10 CFR 32.22, especially the radiation dose limits, there is no basis to deny an application.

President Obama's memorandum on Scientific Integrity states "Science and the scientific process must inform and guide decisions of my Administration on a wide range of issues, including improvement of public health..." Subjective decisions not based on defined criteria are not scientific.

What the NRC seems to be addressing here is the potential misuse of a product. One potential misuse could be a tritium marker being used as a toy.

The potential misuse of many products in our society, besides those containing radioactive material can not be ultimately foreseen. Bug spray, drain cleaner, or other household chemicals can be accidently ingested, yet the product is not banned outright. The user is required to read the instructions and use the product in the manner the manufacturer intended, and is further instructed to "keep out of reach of children."

The applicant should be permitted to submit an application to prove their product meets the criteria of the regulations.

3. **Dose calculations that the petitioner stated were an enclosure to her request**

For some reason the NRC did not receive the dose calculations we previously submitted. They are enclosed with this reply.

4. **Clarification on the regulations the petitioner wants amended.**

We apologize for the confusion over our references to the existing regulations.

You are correct, one section we wish to amend is 10 CFR 30.15, where we wish to add a category under section 2 (reserved) for tritium markers, with a maximum activity level up to 25mCi of H-3.

We request that 10 CFR 30.19, "Self-luminous products containing tritium, krypton-85, or promethium-147", section (c) be amended to include an additional sentence which reads "Tritium markers used to label equipment are not considered to be toys or adornments, and shall not be sold as such."

We request that 10 CFR 32.22 "Self-luminous products containing tritium, krypton-85, or promethium-147: Requirements for license to manufacture, process, produce, or initially transfer." include an additional sentence under section (b) to read "An applicant can not be denied a device registration or distribution license if they have adequately demonstrated that the criteria in 32.23 2(i) to (xvi) has been met."

If you have any questions please call me at 323-766-2555 or email me at motti@campco.com

Sincerely,

Motti Slodowitz
President/CEO

CampCo

4625 W. Jefferson Blvd. Los Angeles, CA 90016
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Sincerely,

Motti Slodowitz
President/CEO

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release March 9, 2009

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

SUBJECT: Scientific Integrity

Science and the scientific process must inform and guide decisions of my Administration on a wide range of issues, including improvement of public health, protection of the environment, increased efficiency in the use of energy and other resources, mitigation of the threat of climate change, and protection of national security.

The public must be able to trust the science and scientific process informing public policy decisions. Political officials should not suppress or alter scientific or technological findings and conclusions. If scientific and technological information is developed and used by the Federal Government, it should ordinarily be made available to the public. To the extent permitted by law, there should be transparency in the preparation, identification, and use of scientific and technological information in policymaking. The selection of scientists and technology professionals for positions in the executive branch should be based on their scientific and technological knowledge, credentials, experience, and integrity.

By this memorandum, I assign to the Director of the Office of Science and Technology Policy (Director) the responsibility for ensuring the highest level of integrity in all aspects of the executive branch's involvement with scientific and technological processes. The Director shall confer, as appropriate, with the heads of executive departments and agencies, including the Office of Management and Budget and offices and agencies within the Executive Office of the President (collectively, the "agencies"), and recommend a plan to achieve that goal throughout the executive branch.

Specifically, I direct the following:

1. Within 120 days from the date of this memorandum, the Director shall develop recommendations for Presidential action designed to guarantee scientific integrity

throughout the executive branch, based on the following principles:
(a) The selection and retention of candidates for science and technology positions in the executive branch should be based on the candidate's knowledge, credentials, experience, and integrity;
(b) Each agency should have appropriate rules and procedures to ensure the integrity of the scientific process within the agency;
(c) When scientific or technological information is considered in policy decisions, the information should be subject to well-established scientific processes, including peer review where appropriate, and each agency should appropriately and accurately reflect that information in complying with and applying relevant statutory standards;
(d) Except for information that is properly restricted from disclosure under procedures established in accordance with statute, regulation, Executive Order, or Presidential Memorandum, each agency should make available to the public the scientific or technological findings or conclusions considered or relied on in policy decisions;
(e) Each agency should have in place procedures to identify and address instances in which the scientific process or the integrity of scientific and technological information may be compromised; and
(f) Each agency should adopt such additional procedures, including any appropriate whistleblower protections, as are necessary to ensure the integrity of scientific and technological information and processes on which the agency relies in its decisionmaking or otherwise uses or prepares.
2. Each agency shall make available any and all information deemed by the Director to be necessary to inform the Director in making recommendations to the President as requested by this memorandum. Each agency shall coordinate with the Director in the development of any interim procedures deemed necessary to ensure the integrity of scientific decisionmaking pending the Director's recommendations called for by this memorandum.
3. (a) Executive departments and agencies shall carry out the provisions of this memorandum to the extent permitted by law and consistent with their statutory and regulatory authorities and their enforcement mechanisms.
(b) Nothing in this memorandum shall be construed to impair or otherwise affect:
(i) authority granted by law to an executive department, agency, or the head thereof; or
(ii) functions of the Director of the Office of Management and Budget relating to

budgetary, administrative, or legislative proposals.

(c) This memorandum is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity, by any party against the United States, its departments, agencies, or entities, its officers, employees, or agents, or any other person.

4. The Director is hereby authorized and directed to publish this memorandum in the Federal Register.

BARACK OBAMA

International Radiation Safety Consulting, Inc.

Dose Calculations for Tritium-Activated Markers

Doses to Various Critical Groups from Tritium-Activated Markers
Based on NUREG-1717 Methodology

Prepared by:
K. Paul Steinmeyer, Radiation Safety Associates, Inc.
11/28/2011

A. Introduction

This document contains dose calculations to support a petition for regulation for a new exemption category for tritium-activated devices intended to make locating flashlights, equipment cases, zipper pulls and the like easier in the dark. These devices will hereinafter be referred to as "markers" or "tritium markers." NUREG-1717[1] addresses numerous iterations of isotopes and quantities contained in license-exempt devices. The markers that are the subject of this report are Gaseous Tritium Light Sources (GTLS). Each device consists of a gaseous tritium source (Registration number NY-1271-S-101-S) inside a polycarbonate cylinder. A stainless steel knurled cap is permanently affixed to each end of the polycarbonate cylinder. The dimensions of these devices are: 1.8 cm long by 0.8 cm diameter by 0.2 cm thick. See Figure 1. The robust construction protects the marker from physical damage.

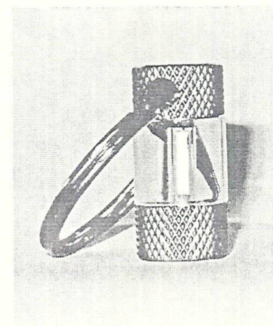

Figure 1. Gaseous tritium light source (marker).

B. Radioactive Material Contained

Isotope: Hydrogen-3 (tritium), one (1) sealed source per device

Activity: 25 mCi (925 MBq) per device

Half-life: 12.28 years

C. Quantities to be Possessed, Transported and Distributed

- The maximum number of markers distributed per year is estimated to be 100,000 (2,500 Ci).
- The maximum number of markers contained in the distributor's warehouse is estimated to be 6,000 (150 Ci).
- In normal handling and storage, the quantities of exempt units that are likely to accumulate in one location during marketing and distribution of the product is 6,000 (150 Ci).
- The maximum number of markers contained in one transport vehicle is estimated to be 2,200 (55 Ci).
- The maximum number of markers assumed to be contained in one residence at one time is estimated to be 5 (0.125 Ci).

D. External Dose Potential

1. Particle Radiation

[1] U.S. Nuclear Regulatory Commission. "Systematic Radiological Assessment of Exemptions for Source and Byproduct Materials." NUREG-1717. Washington, D.C., June 2001. Section 2.14 Self-Luminous Products.

Tritium (H-3) decays to stable Helium-3 (He-3) by emitting a beta particle. No direct photon radiation occurs during this transformation. The E_{max} energy of this beta particle is 0.0186 MeV (18.6 keV) and the E_{av} energy is 0.005685 MeV (5.69 keV)[2]. The yield of this transformation is 1.0.

Inspection of the Beta Particle Range-Energy Curve from the Health Physics and Radiological Health Handbook[3] shows that a ^3H beta particle, even at the maximum particle energy (with a yield approaching zero) will not penetrate a density-thickness of 7 mg/cm^2 (the nominal density-thickness of the upper layer of the epidermis (the *stratum corneum* or dead skin cell layer). Therefore, as an external hazard, there would be *no* shallow dose (SDE), *no* eye dose (LDE) and *no* deep dose (DDE) delivered to any person from the ^3H particle emissions.

2. Photon Radiation

Bremsstrahlung photon emissions from an intact device will be negligible. This is confirmed in NUREG-1717[4] on page A.4-10, Table A.4.2 footnote b, which states that for ^3H the "Dose due to *bremsstrahlung* is assumed to be zero (0), because the energies of the *bremsstrahlung* photons are very low and pathways of internal exposure also are assumed to occur."

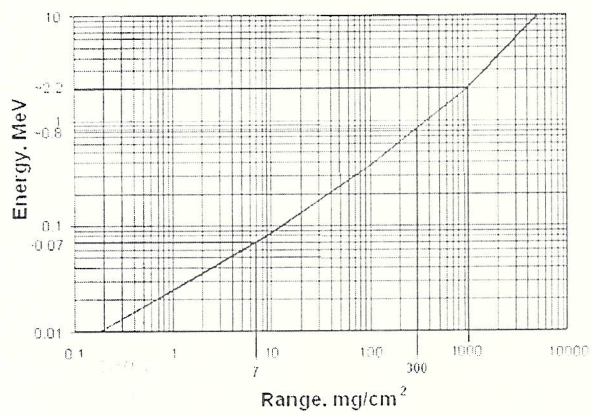

Figure 2. Beta particle range-energy curve showing threshold energies for shallow (7 mg/cm^2), lens or eye (300 mg/cm^2) and deep (1000 mg/cm^2) dose equivalents.

3. Summary of External Dose Potential

External radiation dose delivered by tritium gas leaking from a GTLS marker is considered to be zero.

E. Internal Dose Potential

1. Analog to Tritium Markers

[2] Kocher, David C. "Radioactive Decay Data Tables." U.S. Department of Energy, DOE/TIC-11026.

[3] After Schleien, Bernard "The Health Physics and Radiological Health Handbook," Revised Edition, copyright 1992, p. 184.

[4] U.S. Nuclear Regulatory Commission. "Systematic Radiological Assessment of Exemptions for Source and Byproduct Materials." NUREG-1717. Washington, D.C., June 2001.

A careful review of NUREG-1717 revealed that self-luminous handgun sights represent a GTLS that is representative of the proposed tritium markers in a number of ways.

- Each set of handgun sights contains 50 mCi of ^{3}H compared to 25 mCi per individual marker;
- Each handgun source is contained in a Pyrex (glass) tube about 0.5 cm in length, 0.1 cm in outside diameter, and 0.02 cm in wall thickness compared to 0.8 cm diameter, 1.8 cm long, 2 mm wall thickness;
- An annual distribution of 100,000 gun sight units (5,000 Ci) is assumed compared to 100,000 marker units per year (2,500 Ci);
- Relatively brief contact or close proximity times for both handgun sights (used by non-law enforcement personnel) and tritium markers for most segments of the population;
- Relatively long contact or close proximity times for both handgun sights (used by law enforcement personnel) and tritium markers for certain segments of the population; and
- The useful lifetime of the handgun sights is estimated to be 10 years.

Because of these similarities, the dose assessments of the tritium markers will parallel those of the hand gun sights as described in NUREG 1717 *Systematic Radiological Assessment of Exemptions for Source and Byproduct Materials*. This marker assessment addresses the following:

- Distribution and transport
- Routine use
- Disposal
- Accidents
- Misuse

Doses to installers[5] were not considered because these tritium markers will be distributed directly to end users with no need for installation.

2. Distribution and Transport (NUREG 1717 section 2.14.5.1)

The potential radiation doses from distribution and transport of the tritium-activated markers are adapted from the estimates in NUREG 1717[6], which uses the generic methodology of Appendix A.3[7]. In applying this methodology, it is assumed that local parcel-delivery drivers in large trucks pick up the tritium-activated markers from suppliers and take them to a local terminal, where they are shipped by semi-truck to other local terminals for delivery to retail distributors. Furthermore, it is assumed that each shipment passes through an average of four regional terminals before reaching its final destination. It is also assumed that the radiation dose to workers at both local terminals and regional terminals are the same as those estimated for workers in a large warehouse and the leakage rate from the tritium-activated markers is 10 ppb/h, or 100 times less than the value of 1 ppm/h used in the development of the generic methodology in Appendix A.3.

Most of the tritium-activated markers (25 mCi/unit) are assumed to be shipped in lots of 6000 or less to retail distributors (the gun sight model uses shipments of 1,000 units per shipment at 50 mCi/unit, total

[5] See NUREG 1717, section 2.14.5.2 Gun Sight Installers.
[6] NUREG 1717 section 2.14.5.1 Distribution and Transport
[7] NUREG 1717.

of 50 Ci, so doses will be increased by a factor of *15050* or 3). The gun sight dose model includes two additional transport steps that will not be required for tritium-activated markers:

(1) delivery to gunsmiths for installation, and;
(2) pickup and delivery of the modified hand guns to gun buyers.

Elimination of these steps is conservative in that it decreases the probability of a transport accident, and fewer transportation workers handle the items, thus reducing collective dose, but no dose reduction is made in this evaluation. Based on these assumptions and generic methodology in Appendix A.3, the individual EDE could be 0.3 mrem for a local parcel-delivery driver who is assumed to pick up 6000 tritium-activated markers from the same supplier each week (50 wk/yr). Individual doses to other truck drivers, terminal workers, and members of the public along truck routes would be less. The total collective EDE from distribution of a total of 100,000 tritium-activated markers could be 0.003 person-rem.

3. Routine Use (NUREG 1717 section 2.14.5.3)

Because a tritium-activated marker may be used in a variety of ways by end users, the following two scenarios have been chosen to indicate potential doses from routine use. (These scenarios are derived from those in NUREG 1717 section 2.14.5.3.)

Scenario I. A sales representative (analogous to a police officer in NUREG 1717) spends 6 h/day (1500 h/yr) in a car. One tritium-activated marker is attached to his brief case and one to his computer case (exposure to two markers—total of 50 mCi) and both are in the car. He also spends 12 h/day (4380 h/yr) at home (exposure to one marker—one of the marked items is left at the office). The vehicle is assumed to have a volume of 6.2 m^3 and a ventilation rate of 5 volume changes per hour, and the residence is assumed to have a volume of 450 m^3 and a ventilation rate of 1 volume change per hour (see Appendix A.1). The breathing rates are assumed to be 0.9 and 1.2 m^3/h while at home and at work, respectively.

The equilibrium concentrations of ^3H in the vehicle and in the home are approximately 30 pCi/m^3 and 1 pCi/m^3, respectively. For the sales representative, the annual EDE is estimated to be 0.006 mrem in the first year. For an assumed average of three other family members, the initial annual EDEs are estimated to be less than 0.001 mrem, assuming the other family members are exposed at home over the same 12-hour period as the sales representative.

Scenario II. An individual has a tritium-activated marker on five personal items in his home (total of 125 mCi). The equilibrium concentration is 1 pCi/m^3, under the above assumptions, and the annual EDE is approximately 0.001 mrem for the individual and three other family members, assuming they each spend 12 h/day at home.

Collective Dose. To estimate the collective EDE from the routine use of the 100,000 tritium-activated handgun sights used for 10 years, it was assumed that 20% of the sights were purchased by private gun owners and 80% were purchased for police officers (or other law enforcement agents). The collective EDE would total about 4 person-rem, essentially all attributable to police officers, for 1 year's distribution of 100,000 handgun sights initially containing 50 mCi of ^3H each. When applied to tritium markers, this collective dose calculation is extremely conservative. It is unlikely that individuals would be in direct proximity to one or more tritium markers for as long as a police officer is to his handgun. However, to simplify the calculation while still maintaining a significant degree of conservatism, we will

only factor the collective dose down by a factor of 25 mCi50 mCi or 0.5. No adjustment is made for contact time. The conservatively derived collective dose is therefore estimated to be 2 person-rem, based on NUREG 1717 paragraph 2.14.5.3.

4. Disposal (NUREG 1717 paragraph 2.14.5.4)

The dose estimates due to disposal in NUREG 1717 are based on tritium-activated handgun sights, each containing 50 mCi of ^3H. Since tritium markers contain only half that activity the doses and activities stated in the NUREG have been cut in half for purposes of this report.

To estimate the potential radiation doses due to the disposal of tritium-activated markers containing ^3H, the generic disposal methodology of Appendix A.2 has been used. It is assumed in applying this methodology that most of the GTLSs remain intact during waste collection and landfill disposal. Thus, a reduction by a factor of 10 is applied to the following dose-to-source ratios for inhalation and ingestion in Appendix A.2:

(1) Waste collectors at both landfills and incinerators;
(2) Workers at landfills;
(3) Off-site members of the public exposed to airborne releases during landfill operation and releases to groundwater following disposal in landfills; and
(4) Future on-site residents. The total activity of ^3H remaining from 1 year's distribution of 100,000 tritium-activated markers after 10 years of use is approximately 1,500 Ci.

For disposal at landfills, the annual individual EDE would be less than 0.0005 mrem to waste collectors. The annual individual doses to workers at landfills, off-site members of the public, and future on-site residents would be less. The total collective EDE was found to be about 0.15 person-rem, due almost entirely to exposures to offsite members of the public from groundwater releases.

For disposal by incineration, the annual EDE would be 0.002 mrem to waste collectors. The annual individual dose to workers at incinerators and off-site members of the public are less. The total collective EDE is about 0.2 person-rem, due mainly to exposures to off-site members of the public from airborne releases during incinerator operations.

The above dose estimates are for exposure to multiple exempt units during waste collection and disposal. For a tritium-activated marker containing 25 mCi of ^3H initially, the assumed activity is about 15 mCi at time of disposal, and the individual EDE to a waste collector would be less than 0.0005 mrem.

5. Accidents (NUREG 1717 paragraph 2.14.5.5)

In the case of accidents, the following scenarios have been considered:

1. A catastrophic release from crushing of a single tritium marker (based on the NUREG-1717 example in section 2.14.5.5) of the crushing of a tritiated rifle scope[8] in a repair shop,
2. An accident involving the crushing of a single tritium marker (based on the NUREG-1717 example in section 2.14.5.5) of the crushing of a single rifle scope in a home, and

[8] Rifle sights contain significantly more activity—300 mCi—than handgun sights.

3. A shipping accident in a storeroom or cargo-handling area involving the crushing of a shipment of 1000 tritium markers (based on the NUREG-1717 example in section 2.14.5.5) of crushing of a shipment of 1000 tritiated handgun sights .

The ^{3}H contained in the tritium-activated markers is assumed to be 99% HT (gas) and 1% HTO (tritiated water), the same as in the NUREG scenario. Based on these assumptions and the generic accident methodology in Appendix A.1, the potential radiation doses from the crushing of the below-listed items containing ^{3}H can be summarized as follows:

1. From the NUREG 1717 Appendix A methodology, and using the data in Tables A.1.2 and A.1.9, it can be shown that a gunsmith at a repair shop involved in the crushing of a single rifle scope containing 300 mCi of ^{3}H could receive an EDE of 20 mrem at a small shop or 10 mrem at a large shop. Since a tritium marker contains 25 mCi of ^{3}H, the potential dose in this scenario would be a fraction of *25300* (0.083) times 20 mrem (10 mrem) or **2 mrem at a small shop (1 mrem at a large shop)**.

2. From the NUREG 1717 Appendix A methodology, and using the data in Tables A.1.2 and A.1.9, it can be shown that a person at home involved in the crushing of a single rifle scope containing 300 mCi of ^{3}H could receive an EDE 0.8 mrem. Since a tritium marker contains 25 mCi of ^{3}H, the potential dose in this scenario would be a fraction of *25300* (0.083) times 0.8 mrem or **0.07 mrem**.

3. From the NUREG 1717 Appendix A methodology, and using the data in Tables A.1.2 and A.1.9, it can be shown that a worker in a storeroom or cargo-handling area involved in the crushing of 1,000 handgun sights containing a total of 50 Ci of ^{3}H could receive an EDE of 50 mrem. Since 1,000 tritium markers contain 25 Ci of ^{3}H, the potential dose in this scenario would be a fraction of *2550* (0.5) times 50 mrem or **25 mrem**.

6. Misuse (NUREG 1717 paragraph 2.14.5.5)

In the case of misuse, the NUREG 1717 analysis, section 2.14.5.5, considers the exposure to a 5-year-old child who plays with a self-luminous sight from a handgun as a "glow-in-the-dark" toy at night while going to sleep during one year. It is assumed that (1) the handgun sight is a 10-year-old sight containing 30 mCi of ^{3}H, (2) the child handles the sight 10 min/day, (3) the child absorbs 2% of the ^{3}H released from the sight through a skin area of 3 cm^2 while handling the sight, and (4) the child sleeps in a closed bedroom with the sight for 12 h/day. It is further assumed that (1) the bedroom has an enclosed volume of 27 m^3 and a ventilation rate of 1 air change per hour (see Appendix A.1), (2) the child's breathing rate is 0.24 m^3/h while sleeping (ICRP 66), (3) the dose conversion factors for inhalation and ingestion[9] are about twice those for an adult (ICRP 67; ICRP 71), and (4) the total surface area of the child's skin is approximately 0.8 m^2 (ICRP 23).

In making the dose estimates for these tritium markers, all of the assumptions stated above will be used.

[9] The dose conversion factors for EDE due to ingestion of ^{3}H or absorption of ^{3}H through the skin are the same numerically.

Based on these assumptions, the potential radiation doses to the 5-year-old child can be summarized as follows:

1. The dose equivalent to the skin of the 5-year-old child due to absorption of ^3H from the gun sight could be 0.8 mrem when averaged over 3 cm^2 of skin area in contact with the sight. Since a 10-year-old tritium marker contains roughly 15 mCi ^3H, the potential dose in this scenario would be a fraction of *1530* or (0.5) times 0.8 mrem or **0.4 mrem**.

2. The EDE would be less than 0.001 mrem due to absorption of ^3H through the skin in contact with the sight, and 0.002 mrem due to airborne releases of ^3H from the sight. Since a 10-year-old tritium marker contains 14.2 mCi of ^3H, the potential dose in this scenario would be a fraction of *1530* or (0.5) times 0.001 mrem or **0.0005 mrem through skin contact** and 0.5 times 0.002 or **0.001 mrem due to airborne releases**.

Table 1. Summary of Potential Radiation Doses From Self-Luminous Markers Containing ^3H (From NUREG717 Table 2.14.3)

Exposure Pathway	Individual Annual Effective Dose Equivalent (mrem)	Collective Effective Dose Equivalent (person-rem)
Distribution and transport	0.1	0.003
Gun sight installers	0.3	0.007
Routine use	0.03	4
Disposal		
Landfills	<0.001	0.3
Incinerators	0.004	0.4
Accidents and misuse		
Toy for a child	0.002	--
Crushing of gun sights	50	--

7. Safety Criteria (NUREG 1717 paragraph 2.14.5.6)

Table 2.14.4 compares the results of the current dose assessment for self-luminous gun sights with the safety criteria for self-luminous products set forth in 10 CFR 32.23 (see Section 2.14.1). First, the limiting 10 CFR 32.23 values for dose to the whole body are compared with the current assessment's maximum estimates of the annual individual EDE due to ^3H releases from the self-luminous gun sights. Second, the limiting 10 CFR 32.23 values for dose to skin are compared with the current assessment's maximum estimates of the annual dose equivalent to skin of individuals exposed by ^3H absorption through the skin in contact with the sights. The individual doses to the whole body (EDE) and the dose equivalents to skin do not exceed the dose limits set forth in 10 CFR 32.23 (see Table 2.14.6).

Table 2. Comparison of Estimated Maximum Individual Doses From Self-Luminous Markers Containing ^3H and Limiting Organ Doses From 10 CFR 32.23 *(From NUREG 1717 Table 2.14.4)*

Exposure Conditions	Maximum Individual Dose (mrem/yr or mrem)	Regulatory Limit For Organ Dose (mrem/yr or rem)
	EFFECTIVE DOSE EQUIVALENT	

Routine use and disposal of a single exempt unit	0.03 mrem/yr	1 mrem/yr
Accidents involving a single exempt unit	20 mrem	0.5 rem 15 rem
Normal handling and storage of multiple exempt units	0.3 mrem/yr	10 mrem/yr
Accidents involving multiple exempt units	50 mrem	0.5 rem 15 rem
DOSE EQUIVALENT TO SKIN		
Normal handling and storage of multiple units	30 mrem/yr	150 mrem/yr

8. Conclusion

The data and calculations above address gaseous tritium light sources (GTLS) in the form of marker lights, containing activities of 25 mCi per device. The report directly utilizes the doses calculated in NUREG 1717 for self-luminous handgun sights because they and the tritium markers are analogous in so many ways (see section E.1. above).

Each tritium marker contains a registered and evaluated gaseous tritium source (Registration number NY-1271-S-101-S), so an Agreement State regulatory agency is satisfied that these devices meet certain design requirements and are able to be distributed to licensees for numerous applications and in various configurations.

The dose calculations for handgun sights shown in NUREG 1717 are conservative in all respects when compared to tritium markers. This is due primarily to only 25 mCi of ^{3}H being used in each tritium marker, compared to 50 mCi per handgun sight set. In some instances this report adjusts the estimated dose for this difference, and in some instances no adjustment is made. Not adjusting the doses based on activity is conservative.

An annual distribution of 100,000 gun sight units (5,000 Ci) is assumed compared to 100,000 marker units per year (2,500 Ci). Collective dose has been estimated by making a 25 mCi50 mCi reduction in the NUREG 1717 calculation, but not making any adjustment for projected use times or contact times. These times are projected to be much shorter for the tritium markers than for handgun sights.

Using the handgun analogies, and making dose adjustments based only on the difference in activities, and considering the maximum credible number of the devices from this manufacturer presumed to be present in the manufacturer's or a distributor's warehouse at any one time, in a transport vehicle and in an end user's facility, projected doses to the average member of the critical group are well below the limits stated in 10 CFR 32.23 and 32.24.

November 28, 2011

K. Paul Steinmeyer, RRPT

NRC FORM 253 (9-96) — U.S. NUCLEAR REGULATORY COMMISSION

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