**ADAMS Template: SECY-067**

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| DOCUMENT DATE: | 05/20/1969 |
| TITLE: | PRM-30-44 by Westinghouse Electric to Amend Part 30 to Exempt from Licensing Requirements Microwave Receiver Protector Tubes with Less than 150 Millicuries of Tritium |
| CASE REFERENCE: | PRM on 10 CFR Part 30 |
| KEY WORD: | RULEMAKING COMMENTS |
| Document Sensitivity | Non-sensitive – SUNSI Review Complete |

DOCKET NUMBER
PETITION RULE PRM-30-44

JUN 2 1970

PRM-30-44

Mr. Karl R. Schendel
License Administrator
Westinghouse Electric Corporation
Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Dear Mr. Schendel:

In response to your petition for rule making, enclosed is a copy of a notice of rule making amending the Commission's regulations in 10 CFR Part 30 to exempt from licensing requirements the possession and use of microwave receiver protector tubes containing not more than 150 millicuries of tritium.

The notice of rule making is being filed with the Office of the Federal Register. The amendment will become effective upon publication in the Federal Register.

Sincerely,

ORIGINAL SIGNED BY
LESTER R. ROGERS

Lester Rogers, Director
Division of Radiation Protection
Standards

Distribution:
Docket File (RPS)
Secretariat w/cy for
Public Document Room
Attn: Stan Robinson
Product Standards Br., RPS
Program Assistance Br., RPS

Enclosure:
Notice of Rule Making

DOCKETED
USAEC
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Office of the Secretary
Public Proceedings
Branch

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| MEFitzPatrick:mfs | |
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Microwave Protector tubes



DEC 2 2 1969

PRM 30-44



Mr. Karl R. Schendel
License Administrator
Westinghouse Electric Corporation
Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Dear Mr. Schendel:

In response to your petition for rule making, PRM 30-44, enclosed is a copy of a notice of proposed rule making to amend the Commission's regulations in 10 CFR Part 30. The proposed amendment would amend § 30.15(a)(8)(i) to exempt from licensing requirements the possession and use of microwave receiver protector tubes containing not more than 150 millicuries of tritium.

The notice is being transmitted to the Office of the Federal Register and will allow 30 days for public comment after publication in the Federal Register.

Sincerely,

ORIGINAL SIGNED BY
LESTER R. ROGERS

Lester Rogers, Director
Division of Radiation Protection
Standards

Distribution:
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Secretariat w/copy for
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Attn: Stan Robinson
Product Standards Branch, RPS
Program Assistance Branch RPS

Enclosure:
Notice of Proposed Rule Making

| RPS:PAB | RPS:DIR |
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| MBFitzPatrick:mfs | |
| GLHutton | LRogers |
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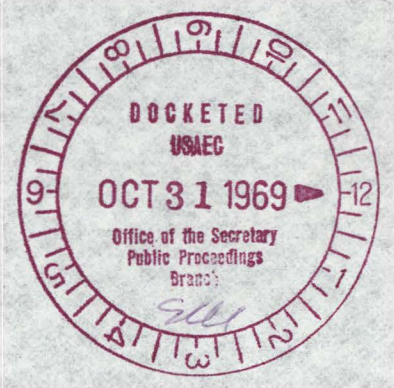
cc: Stan Robinson, SECY

DOCKET NUMBER
PETITION RULE PRM 30-44

OCT 30 1969




Westinghouse Electric Corporation
Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Karl H. Schandel, License Administrator

Gentlemen:

As our review has progressed on your petition for rule making (PRM 30-44) to exempt from licensing requirements special purpose electron tubes, we have determined that additional information is required concerning the quantity of tritium activity per tube as set out in your petition.

You have stated in your petition that your radar receiver protector tubes contain various quantities of tritium up to a limit of 150 millicuries. What is the lowest practical amount of tritium required for your present design of microwave receiver protector tube to function as intended? What would you consider to be the lowest practical quantity of tritium that should be provided in an exemption as the limit, taking into account possible changes in design and foreseeable future requirements? Do you consider 150 millicuries sufficient for the limit on the quantity of tritium that may be contained in any foreseeable microwave receiver protector tube?

We would appreciate receiving any additional information you might have that bears on the safety of the 150-millicurie limit on the quantity of tritium in the tubes described in your petition for rule making.

Sincerely yours,

ORIGINAL SIGNED BY
LESTER ROGERS

Lester Rogers, Director
Division of Radiation Protection
Standards

cc: Pub. Document Room
Stan Robinson, Secy.

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UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

DOCKET NUMBER
PETITION RULE PRM-30-44

JUN 20 1969



Mr. Karl R. Schendel
License Administrator
Westinghouse Electric Corporation
Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Dear Mr. Schendel:

Thank you for your letter of May 20, 1969, in which you request that the Commission amend its regulation "Rules of General Applicability to Licensing of Byproduct Material," 10 CFR Part 30, so as to exempt from licensing requirements electron tubes, designed for use as radar receiver protectors, containing not more than 150 millicuries of tritium. This request is considered a petition for rule making as provided for by 10 CFR Part 2.802 of the Commission's regulations.

The petition has been docketed to recognize your request for amendment of 10 CFR Part 30 and has been assigned Docket No. PRM-30-44. Further correspondence pertaining to this petition should reference this docket number. As staff review progresses on your petition, it may be necessary to request additional information.

In connection with your petition you submitted "Proprietary Information in Support of Petition for Rule Making," consisting of a letter dated May 20, 1969, and a drawing 106 D1. We have determined that disclosure of the information set out in "proprietary Information in Support of Petition for Rule Making" is not required in the public interest nor by 10 CFR Part 9, and would adversely affect Westinghouse Electric Corporation. Accordingly, the "Proprietary Information in Support of

Petition for Rule Making" is hereby withheld from public disclosure as provided in section 2.790 of 10 CFR Part 2. Such withholding from public inspection, however, shall not affect the right, if any, of persons properly and directly concerned to inspect the document.

Sincerely,

Forrest Western

Forrest Western, Director
Division of Radiation Protection
Standards


ATOMIC ENERGY COMMISSION

[DOCKET NO. PRM-30-44]

WESTINGHOUSE ELECTRIC CORPORATION

Notice of Filing of Petition for Rule Making

Notice is hereby given that Westinghouse Electric Corporation, Gateway Center, Pittsburgh, Pennsylvania, by letter dated May 20, 1969, has filed with the Atomic Energy Commission a petition for rule making to amend the Commission's regulations pertaining to the licensing of byproduct material.

The petitioner requests that the Commission amend its regulations "Rules of General Applicability to Licensing of Byproduct Material," 10 CFR Part 30 so as to exempt from licensing requirements electron tubes, designed for use as radar receiver protectors, containing not more than 150 millicuries of tritium.

A copy of the petition for rule making is available for public inspection in the Commission's Public Document Room at 1717 H Street NW., Washington, D. C.

Dated at Germantown, Maryland this 23rd day of June 1969.

For the Atomic Energy Commission

W. B. McCool
Secretary

Westinghouse

U. S. ATOMIC ENERGY COMMISSION

PETITION FOR RULE MAKING

5/20/69

DOCKET NUMBER
PETITION RULE PRM-30-44

Westinghouse Electric Corporation

Gateway Center
Box 2278
Pittsburgh Pennsylvania 15230

May 20, 1969

Acknowledged by card 5/22/69
SM


U. S. Atomic Energy Commission
Office of the Secretary
Washington, D. C. 20545

Attention: Mr. W. B. McCool, Secretary

Gentlemen:

Subject: Petition for Rule Making

The Westinghouse Electric Corporation respectfully petitions for the amendment of Part 30 of Title 10 of the Code of Federal Regulations to include special purpose electron tubes containing not more than 150 millicuries of tritium among the items exempted from regulatory requirements in paragraph 10 CFR 30.15(a). Specifically, we petition that paragraph 10 CFR 30.15(a) be amended to add an item, "Electron tubes (special purpose) containing no more than 150 millicuries of tritium."

The special purpose electron tubes which are the subject of this petition are designated as "TR-type" and are employed primarily as receiver protectors in military radars used in aircraft. They protect the sensitive receiver from the high power transmitter pulse when the transmitter is keyed. The incorporation of tritium in the tubes results in significant improvements as follows:

a. Elimination of the ignitor ("primer," "keepalive") discharge which has been used in TR electron tubes for over 25 years.

b. Elimination of the 1000 volt power supply normally used to sustain the dc ignitor discharge discussed in a.

c. Elimination of the mechanical shutter mechanism and its associated power supply. The shutter is normally used to protect the sensitive receiver from interference from nearby radars when all power is off and the aircraft is parked.

d. Elimination of the wideband noise which is normally generated by the dc ignitor discharge. This noise tends to mask very weak target responses at the receiver.

e. Improvement of reliability since connections or wires to the gas stages of the tube are not needed.

f. Improvement in life since the dissociation rate of the constituent heavy gases in the ignitor stage is greatly decreased.

The improvement in the tube through the use of tritium is of direct benefit to the defense posture of the United States, since it increases the MTBF (mean-time-between-failures) for operational airborne radars by increasing life and reliability of a critical component well known for its relatively short life.

The exemption of this tube from regulatory requirements is desirable due to the geographical mobility inherent in military aircraft. If specific licensing were required, the resulting restraints on aircraft movement would make the use of the tube impractical and the defense establishment would be deprived of its benefits.

The Westinghouse Electric Corporation has established that the unregulated distribution and use in military hardware (specifically radars) of electron tubes, TR-type, containing not more than 150 millicuries of tritium will be unlikely to have any adverse effect on the health and safety of the public. This includes the general public as well as military and trained civilian personnel, though only the latter groups will normally come in contact with the tube. The tube is typically located in the microwave section of a radar, and the radar is normally embedded in the nose of an aircraft except for brief maintenance periods when either trained civilian or military personnel are in attendance.

Attachment A describes the construction of the subject tube. Attachment B contains information on the application of the tube and Attachment C contains an analysis and computations relative to the nominal exposure to an individual which might result from credible accident situations.

Correspondence on this subject should be sent to me at the above address. However, we are prepared to visit with the AEC, and bring along a dummy tube to help clarify any points that may arise. My telephone number is (412) 255-3907.

Very truly yours,

Karl R. Schendel

Karl R. Schendel
License Administrator

KRS:sw

Attachments: A, B and C

21 copies transmitted

ATTACHMENT A

The essential details of the physical construction of the Westinghouse electron tube, TR-type, are shown in Westinghouse drawing 106D1, which has been transmitted separately.

The tritium is sorbed on a pair of metallic tabs which are spot-welded in a central location within the ignitor stage. Normal tube operating temperatures are from -55°C to +90°C (-67°F to +194°F).

The ignitor stage filler gas is a mixture of gases commonly used in microwave receiver protector tubes. These gases include argon, krypton, ammonia, and water vapor at a total pressure of all constituents (other than tritium) of no more than 50 torr at 20°C. The tritium equilibrium pressure is negligible at 20°C since it is locked in its host material.

The tubes will be designed for a nominal 8 years life so that essentially zero leakage will be mandatory.

The tritium tabs are centrally located within the ignitor stage as shown in the drawing 106D1. This stage is a hermetically sealed unit and all materials within the envelope are inorganic. The materials within the vacuum envelope are tin, kovar, nickel, braze alloys, and glass. This stage, after installation in the final tube assembly, is enclosed by a heavy-gauge steel can. Identically constructed units have been successfully tested under 50 g shock forces, 11 milliseconds, 3 drops; 2 g vibrational forces, 5 to 500 hertz and temperature cycled from -55°C to +90°C at 30 minute cycling times. We have accidentally dropped such

ATTACHMENT A (continued)

tubes from heights up to 6 feet without rupturing the ignitor stage envelope. All materials are highly temperature resistant. The lowest melting point of any material present is 460°F, which is the melting point of the tin used to attach the glass windows of the ignitor stage.

The tubes contain no rare or precious materials in quantities which would be economically recoverable. Consequently, there is no likelihood that they would be the objects of any salvage operation.

ATTACHMENT B

During operation of the subject tube as a radar receiver protector, it must be continuously connected integrally with the receiver which it is to protect. The radar receiver is normally not accessible to individuals nor can individuals remain in close proximity to the subject tube. When the tube is operational in the aircraft, the only physical contact that is possible must be made during maintenance and repairs of the radar, and this is almost always performed by military technicians or trained civilian personnel. Electron tubes of the type shown in drawing 106D1 are normally not used in civilian marine or weather radar.

The design life of the tube is approximately 2/3 of the half-life of tritium. The activity within the tube will be approximately 63% of the original amount at the time they are discarded.

ATTACHMENT C

Foreseeable handling operations which the subject tube will undergo as an exempt item are:

1. Transportation to customer
2. Storage
3. Installation into the product
4. Storage as product
5. Operation by user
6. Maintenance periods
7. Removal from product
8. Transportation to disposal area
9. Disposal

The presence of the tritiated tabs in a sealed tube would not produce a radiation exposure to an individual handling the tube in the course of these operations because the soft beta radiations from the tritium would be stopped by the tube walls. Furthermore, none of the above operations normally involves conditions which would violate the integrity of the tube seal. Therefore, the tubes may be handled under normal conditions with absolute safety.

The evaluation of the maximum exposure to an individual as a result of an accident will be made for the following credible accident conditions:

Case I. Rupture of tube window during maintenance or storage of tubes at normal room temperatures.

Case II. Accident, such as a fire, resulting in the melting of the tube seal.

ATTACHMENT C (continued)

The evaluation of exposure rates is subject to the following assumptions:

a. Each tube contains a total of 150 millicuries of tritium adsorbed onto the surface of tabs welded within the ignitor stage of the tube.

b. The accident occurs inside a military storage depot with dimensions of approximately 50' x 50' x 15' and an available volume of 35,000 cu.ft. The ventilation system supplies only one air change per hour.

c. At room temperature, tritium is desorbed from the tabs at a rate of 20 microcuries per 8-hour period per curie of tritium present.

d. Dispersion of any released tritium gas due to buoyancy, thermal convection, drafts, etc., is essentially instantaneous.

e. All the tritium in the tube is assumed to escape as a gas.

f. All available tritium atoms displace a hydrogen atom in the water vapor in the air or combine with oxygen to form tritiated water vapor. This action is assumed to take place essentially instantaneously and no resulting tritiated water vapor is assumed to condense out from the room air.

ATTACHMENT C (continued)

g. The exposed individual leaves the exposure area after a normal work shift (assumed to be 10 hours), the work week being 6 working days/week for 50 weeks/year.

h. Exposures are averaged over a period of one year.

Case I. A credible accident condition would be rupture of a single tube window during handling. The tube would be left in a work area for a prolonged period of time at room temperature before disposal. The rate of release of tritium from titanium-tritium foils has been measured by J.A.B. Gibson of the United Kingdom Atomic Energy Authority. Gibson's results are reported in the United Kingdom Atomic Energy Authority Memorandum AERE-M1169 (1963) entitled, "The Possible Radiological Hazards from Tritium Sources Absorbed on Titanium." At normal room temperatures, the rate of evolution from 15 curie sources was less than 20 microcuries per 8 hours per curie of absorbed tritium. Gibson found experimentally that tritium sources of 3 curies activity typically released 3 microcuries per 8 hours per curie of absorbed tritium. The highest measured release rate found by Gibson has been assumed, although the rate of release decreases with source activity. Based on the stated assumptions, the concentration of tritium at normal room temperatures assumed constant over 8 hours is:

$$\frac{20 \text{ microcurie released/8 hr-curie} \times 0.15 \text{ curie/tube} \times 8 \text{ hr}}{35{,}000 \text{ cu.ft./hr} \times 8 \text{ hr} \times 2.834 \times 10^4 \text{ cm}^3\text{/cu.ft.}} =$$

$3.8 \times 10^{-10} \frac{\text{microcurie}}{\text{cm}^3}$ per tube.

ATTACHMENT C (continued)

With the assumption that the exposure time to an individual is 10 hours daily for a 6-day work week, 50 weeks per year, the activity concentration per tube with ruptured window at normal room temperature is, averaged over one year;

$$\frac{10 \text{ hours/work day}}{24 \text{ hours/day}} \times \frac{(6\text{x}50) \text{ work days/year}}{365 \text{ days/year}} \times 3.8 \times 10^{-10} \frac{\text{microcurie}}{\text{cm}^3}$$

$$\text{per tube} = 1.3 \times 10^{-10} \frac{\text{microcurie}}{\text{cm}^3} \text{ per tube.}$$

It is unlikely that even as many as five tubes with cracked windows will be located in the same storage area at the same time, for a prolonged period.

The allowable concentration of tritium in air given in Column I, Table II of Appendix B of 10 CFR 20 is $2 \times 10^{-7}$ microcurie/$cm^3$, therefore under conditions of a ruptured window, there is little likelihood that permissible concentrations will be exceeded. Consequently, unregulated use of the tubes will not have any adverse affect on the health and safety of the public.

Case II. Any accident involving temperatures exceeding the melting temperature of the tube seal (450°F, the temperature at which the vacuum envelope loses its integrity) also leads to increased tritium desorption rates. In the case where a single radar or aircraft which uses one of the subject tubes is concerned, there is no danger to the health and safety of individuals when the release of the full 150 millicurie occurs in an open air space. However, the case of a fire at a storage depot, where spare parts are kept in quantities is a credible accident case that is of interest. The maximum credible exposure to an individual as the

ATTACHMENT C (continued)

result of a storage depot accident is evaluated using the assumptions a, b, d, e, f and g previously listed and in addition the assumptions which follow:

j. Ten (10) tubes are present in the storage area.

k. 100% of the available tritium is desorbed as the result of thermal effects and escapes as a gas.

l. An individual is exposed to the entire inventory of tritium in one hour.

m. Following the exposure, the activity level returns to background.

The amount of tritium released is 150 millicuries/tube x 10 tubes = 1.5 curies, into a volume of 35,000 cu.ft. x 2.834 x $10^4$ $cm^3$/cu.ft. Assuming an exposure time of one hour the activity concentration averaged over a one year period is

$$\frac{1.5 \times 10^6 \text{ microcurie} \times 1 \text{ hour exposure}}{3.5 \times 10^4 \text{ cu.ft.} \times 2.834 \times 10^4 \text{ cm}^3/\text{cu.ft.} \times 8760 \text{ hrs/yr}} =$$

$1.7 \times 10^{-7}$ microcurie/$cm^3$.

Should the exposure take place over a longer period of time, the concentration of the nuclide will be lowered as a result of air changes caused by forced convection in the vicinity of the fire and greater dilution of the nuclide by diffusion will occur. The calculation above does not take into account this greater dilution of tritium in air during a conflagration due to the forced convection of air.

ATTACHMENT C (continued)

The calculated tritium concentration, $1.7 \times 10^{-7}$ microcurie/$cm^3$, for a fire accident involving 10 tubes destroyed in an open fire, is approximately 10 percent below the allowed concentration of $2 \times 10^{-7}$ microcuries/$cm^3$ allowed in Column I, Table II of Appendix B of 10 CFR 20.

We offer the following discussion of the above results and of the assumptions on which this result is based:

Assumption a. The total activity of 150 millicuries is consistent with the quantity for which the exemption is requested.

Assumption b. The cubic content is assumed to be conservative for a storage depot, either in the field or in a manufacturing facility of the type used to fabricate the subject tubes. Any accident in open spaces (out-of-doors) or in a larger space, would result in an even lower concentration.

Assumptions d, e, f, k, m. These assumptions are conservative. In a conflagration severe enough to melt the seals of a collection of tubes, appreciable forced convection of air will rapidly disperse released tritium.

The assumption that tritium displaces ordinary hydrogen in water vapor or combines with atmospheric oxygen during the time of actual conflagration may not be justified. An individual exposed to tritium gas rather than tritiated water vapor would have an allowable exposure level to tritium

ATTACHMENT C (continued)

gas two orders of magnitude greater than the exposure level to tritiated water vapor (from Appendix B, Table II, Column I of 10 CFR 20).

The construction of the subject tube is such that none of the tritium that is desorbed from the radioactive tabs will combine with any other material in the tube, so that all of the desorbed tritium can be considered released to the air. The assumption that no condensation occurs is conservative, since condensation would reduce the tritium concentration in air. The allowable concentration in liquids, as listed in Appendix B, Table II, Column 2, is four orders of magnitude greater than the allowable concentration in air.

Assumption c. Gibson measured a room temperature release rate of 20 microcurie/8 hour/curie of adsorbed material only for a freshly prepared 15 curie tritiated titanium foil. Sources having lower activity showed release rates per curie of adsorbed tritium of only 3 microcuries/8 hours /adsorbed curie. The release rate computed for accident Case I is larger than will actually be encountered in an accident of the type under discussion.

Assumption j. A major proportion of tubes are individually installed into a radar set as isolated tubes. Spare tubes would be typically produced in limited quantity and it is unlikely that more than ten would be stored in any single depot location.

ATTACHMENT C (continued)

Assumption 1. In the event of a conflagration sufficiently severe to melt the seals of a collection of tubes it is unlikely that an individual will receive more than an hour of actual exposure as forced convection of air in a conflagration will rapidly dilute the concentration of tritium in the air. In the case of a fire, persons are likely to absent themselves from the immediate vicinity of the fire.

It is credible that in a conflagration, highly temporary and localized activity concentrations of tritiated water vapor could possibly be encountered which could exceed the annually-averaged limit of $2 \times 10^{-7}$ microcuries/$cm^3$. However, this would depend upon the coincidence of the following circumstances; a fire in a tube storage area located at the tubes, personnel in the area at the time the tube seals melt, restricted ventilation at the storage area and appreciable conversion of released tritium gas into tritiated water. While such a combination of circumstances is conceivable, it should be weighed with the fact that an open fire conflagration of sufficient intensity to destroy the subject tubes in appreciable numbers would simultaneously produce conditions involving lack of containment, strong air convection and dispersion and remoteness of personnel that would make it likely that no individual would receive an appreciable radiation exposure. Therefore, under the Case II accident condition, the unregulated use of the tube is unlikely to have any adverse effect on the health and safety of individuals.

ATTACHMENT C (continued)

With respect to the disposal of the tubes, the sealed ignitor stage containing the tritiated tabs is ruggedly constructed. Nevertheless, it is credible that during disposal operations an individual tube window could be mechanically ruptured. In the event that window rupture occurs, the mechanical strength and geometry of the ignitor stage and surrounding stages is such as to prevent mechanical handling of the tritiated tabs or removal of the tabs. It is impossible for an individual to touch the tabs with his fingers even if all five tube windows are purposefully ruptured. The tube has no likelihood of being mechanically deformed in a way which will allow mechanical removal of the tritiated tabs from the tube or direct handling of the tritiated tabs. The tritium beta radiation, with a mean energy below 6 KeV, is not sufficiently energetic to penetrate even a thin layer of restraining material and the confined tube geometry would permit only a very little direct beta radiation through a ruptured window. Bremsstrahlung from these weak betas would be negligible. For these reasons, the tritium source contained within the subject tube should not under any circumstances constitute a hazard due to external surface activity.

The dissipation of adsorbed tritium through a ruptured window while the tube slowly rusts away on some junk heap is a variation of the Case I accident. However, the resulting concentration (assumed to occur out-of-doors) and the likelihood of a person remaining in the vicinity of the tube are both greatly reduced.