



Smith & Wesson[®] Watches

A Division of CampCo Inc.

United States Nuclear Regulatory Commission
Anthony Kirkwood MS:T8F5
Washington DC 20555-0001

March 15, 2004

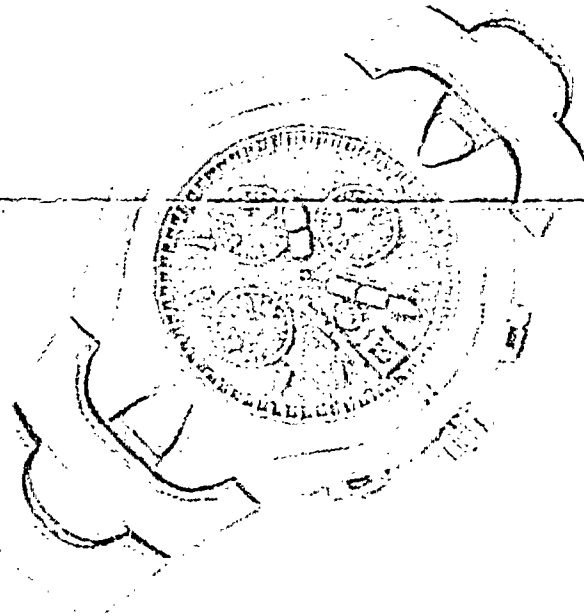
Dear Mr. Kirkwood,

Thank you very much for all of the help you have given me in processing this license request.

Following you will find the information you requested to be double checked on the amount of tritium contained in our watches.

Please contact me with further instructions.

Sincerely,
Paula J. Petry
CampCo/Smith & Wesson Watches



4625 W. Jefferson Blvd Los Angeles, CA 90016

Tel: 323.766.2555 Fax: 323.766.2424

www.swwatches.com

MAR 23 2004

Date = 2/7/04
 To = Camp co / Paula (Fax = 303 266-2424)
 From = Blaine

ACTIVITY OF TRITIUM LAMPS FOR WATCHES

		<u>Activity</u>
1.	Part No. 263020G0060A 0.63 x 2.00mm (for second hand)	0.00190 Ci
2.	Part No. 263041G0060A 0.63 x 4.10mm (for hour hand)	0.00314 Ci
3.	Part No. 263066G0060A 0.63 x 6.60mm (for minute hand)	0.00462 Ci
4.	Part No. 251024G0100A 0.95 x 2.40mm (for index on dial)	0.00828 Ci

Total number of activity for watch hands = $0.00190 + 0.00314 + 0.00462$
 = 0.00966 Ci / 0.35742 GBq.

Total number of activity for watch dials = 0.00828×12
 = 0.09936 Ci / 3.67632 GBq.

Total number of activity for the whole watch is $0.10902 \text{ Ci} / 4.03374 \text{ GBq}$.

** 1 Ci = 37 GBq.

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T-907 P.002/303 F-1

TimeZone - TimeZone Classics - 107 : LUMINOUS WATCH HANDS

Page:

Promethium

<http://www.shel.ac.uk/chemistry/web-elements/Pm/key.html>

<http://www.dne.bnl.gov/CoN/nuc/PI/Pm147.shtml>

Promethium is a man-made element (in nuclear reactors), although its spectrum can be seen in the light of certain stars. Promethium was discovered in the 1940s, and was available in gram size quantities by the 1960s. Promethium-147 was first used to illuminate LCD watch displays in the 1970s. The half-life of Pm-147 is only 2.6 years, with decay by pure beta emission to Samarium-147, maximum beta energy of 0.224 MeV. Samarium-147 is basically stable, being an alpha emitter with a half life of 100 billion (10 to 11th power) years. The beta emitted is sufficiently energetic that when it strikes high-Z material (metals) it gives off some low energy X-rays (bremsstrahlung). A mixture of Promethium Oxide Pm-2 O-3 and scintillator Zinc Sulfide (Copper activated) ZnS(Cu) can be used. The X-rays are shielded by using leaded glass or leaded acrylic resin as a crystal. Because of the short half-life of Pm-147, this material is not suitable for fine watches. Also, sapphire crystals cannot be leaded. Manufacturers do it because it is so cheap. See:

http://www.patents.ibm.com/details?patent_number=4285055

Tritium

<http://128.165.46.15/tritium.html>

<http://www.hfbr.bnl.gov/hfbrweb/hdb1079a.html>

Watches containing tritium paint have been available to the general public (the possession, use, and transport of such timepieces without a license) in the U. S. since 1961. Tritium (Hydrogen, H-3) is a pure beta emitter decaying to Helium He-3 (stable) with a half life of 12.33 years. The 18.6 keV (max) beta can be stopped by a piece of paper and is biologically not very hazardous. Tritium is made in a high neutron flux reactor, by bombarding Lithium-6 (naturally occurring) with neutrons. The last U. S. high neutron flux reactor at Savannah River was shut down in 1988. Medical isotopes that must be produced by neutron activation are made in Canada at Chalk River or in Europe. It will not be until the first half of the next decade before there will be a domestic source of high flux neutrons.

Modern watches with tritium hands will often have a very small label T or T 25 or T<25 on the watch face below the numeral 6 position. 25 refers to 25 mCi (milliCurie). One Curie (Ci) represents the amount of radioactive material that has the same number of disintegrations per second as one gram of Radium. This is now defined as 3.7×10^{10} disintegrations per second. The S. I. unit for activity is the Becquerel (Bq), defined as one disintegration per second.

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Gaseous Tritium Light Source

The tritium gas filled, phosphor (scintillator) coated, borosilicate glass capsule used in Luminox watches (<http://www.luminox.com>) was patented by Texas Instruments. The patent was applied for in 1978 and granted in 1981. See the patent in the IBM U. S. patent database at

http://www.patents.ibm.com/details?patent_number=4273398

The name Traser was registered for this device in 1978:

<http://www1.uspto.gov/tmdb/index.html>

<http://www.timezone.com/messageView.aspx?forumId=tzclassic&msgId=tzclassic001211>

77.

MAR 23 2004

Texas Instruments did not mass produce the Traser. This fell to mb-microtec. In 1983, mb-microtec ag (Niederwangen, Switzerland), through their U. S. distributor mb-microtec inc (North Tonawanda, NY), registered a 1000 mCi radioactive sealed source, to be used as a UV light source for US Navy research at Port Hueneme, California, with the Nuclear Regulatory Commission. See (requires Acrobat Reader):

<http://www.hsrdo.ornl.gov/nrc/ssdr/04460101.pdf>

Mb-microtec registered various radioactive sealed sources with up to 50,000 mCi for various (licensed) uses with the NRC in 1984. See:

<http://www.hsrdo.ornl.gov/nrc/ssdr/04460102.pdf>

In 1993, mb-microtec filed a petition with the NRC to allow gaseous tritium light sources (GTLs) with 25 mCi or less in watches to be regulated in the same manner as 25 mCi tritium paint watches. This was approved March of 1998. See

<http://www.nrc.gov/NRC/COMMISSION/SECYS/secy1997-028/1997-028scy.html>

<http://www.nrc.gov/NRC/COMMISSION/SECYS/1998-060scy.html>

The Richard Barry Marketing Group (RBMG) of River Vale, New Jersey, has marketed watches with GTLS markers, initially under the microtec label, since 1989. The watches are now sold under the name Luminox (<http://www.luminox.com>). These watches were positioned at the \$200 price point. In 1999, Luminox will be offering Swiss-made, sapphire crystal, stainless steel watches, and later, titanium watches.

* In 1996, mb-microtec registered radioactive sealed sources for watches containing up to 100 mCi with the Nuclear Regulatory Commission. See (requires Acrobat Reader):

<http://www.hsrdo.ornl.gov/nrc/ssdr/04460103.pdf>

* Note that in the NRC text there is reference to GTLS watches containing up to 200 mCi. These 200 mCi sources were used for permanent illumination of LCD watches. Other uses of GTLS are found in compasses, thermostats, and gun sights. Improvements in design have allowed excellent luminosity in watches with 25 mCi. Presumably this is what prompted the consumer version of analog GTLS watches.

Radiation Dose

A wearer of a radium-dialed watch will receive a gonadal dose of not more than 4 mrad/yr. This is to be compared to the natural radiation dose of 100-300 mrad/yr. A NY-LA flight will give a dose of about 1 mrad. The wearer of a metal-backed Tritium dialed watch receives a much lower dose: about 0.03 mrad/yr. The dose from GTLS watches should be significantly lower than 0.03 mrad/yr because the Tritium is sealed in glass capsules. The rad has dimensions of energy absorbed per unit mass, and is equal to 100 ergs/gram. The S. I unit is the Gray (Gy) and is equal to 1 Joule/kilogram. 1 rad = 1 cGy (centiGray).

See Medical Effects of Ionizing Radiation, 2nd ed., Fred Mettler and Arthur Upton, W. B. Saunders, Philadelphia, 1995, chpt. 2, Sources of Radiation Exposure, p. 42.

Tritium is a pure beta emitter, with a beta range of 6 mm in air, 0.0052 mm in water. Thus, the beta particles cannot even penetrate the dead layer of the skin, which is 0.07 mm thick. The danger from Tritium comes from ingestion or absorption of Tritium through the skin. The beta particles from a Tritium decay within the body can in fact damage cells.

Totally plastic watches (i. e. with plastic backs = Swatch) containing Tritium paint can allow some Tritium to diffuse through the back of the watch and thence through the wearers skin. The concentration of Tritium in the urine for these wearers is ten times higher than that of persons wearing Tritium watches with metal backs.

<http://www.tlmezone.com/messageView.aspx?forumId=tzclassic&msgId=tzclassic001211>

7 /

MAR 23 2004