

# Regulatory control of 'kit markers' containing gaseous tritium light sources (GTLS)

The Radiation Board is aware that some so-called 'kit markers' containing gaseous tritium light sources (GTLS) (氚氣自發光源) are being sold on the internet. These kit markers are usually in the form of an outer polycarbonate casing enclosing one or more GTLS, which itself contains the radioactive substance tritium (H-3). They are also known by other names, such as glow rings, self-illuminated markers, self-powered markers or spot markers, etc., and depending on the GTLS, the kit markers can be of different colours and brightness. Information of these **kit markers** or **glow rings** could be found by searching on the internet.

In many cases, they are intended for use by military personnel to mark vital equipment and the controls and switches on them in hazardous situations such as in combat or in ammunition depots or fuel storage areas, or when they need to undertake covert operation in the dark.

In fact, GTLS have been used in various types of GTL devices (氚氣自發光源裝置) by different types of professionals. These devices include such specialized items as weapon and gun sights (槍械瞄準儀), special-purpose torches for map reading in the dark or under water, and signs and dials and switches on trains and aircrafts.

However, these GTLS and kit markers have gradually found their way into more mundane items such as compasses, fishing floats, and even some 'novelty and frivolous' items such as common torches and key rings.

As GTLS contains the radioactive substance tritium, the placing of these kit markers into the market, for whatever purposes, has to be regulated. Having weighed the benefits against the potential harm, it is the view of the Board that while use of kit markers for dedicated purposes by professionals might be justified; unrestricted sale of common kit markers to the public is unjustified.

The following 'Questions and Answers' provide specific information on kit markers using GTLS, and give the rationale for the local regulatory control of these devices.

## Q & A on Kit Markers using Gaseous Tritium Light Source (GTLS)

### 1. What are GTLS and GTLS Kit Markers (氚氣自發光源工具標誌)?

Gaseous tritium light sources are sealed glass vessels that give off light in various colours. Usually it is green light because the human eye is most sensitive to its wavelength. To fabricate a GTLS, the glass vessel is coated on the inner wall with luminous matter known as phosphor (磷光體) (different phosphors are used for different colours), and then it is filled with the radioactive tritium gas and sealed airtight. The beta particles ( $\beta$  粒子) emitted by the tritium during its decay will come into contact with the coating. The phosphor will absorb the energy of the beta particles and convert it into visible light.

Kit markers with gaseous tritium light sources (GTLS) are usually in the form of an outer polycarbonate casing enclosing one or more GTLS. They can be considered as one type of GTL devices (氚氣自發光源裝置).

### 2. What are the intended purposes of these GTLS kit markers?

GTLS kit markers are supposedly for marking vital equipment and devices used by military and emergency response personnel, professional mountaineers and divers, pilots, and other professionals such as disciplined or civilian forces who need to perform search and rescue operations and might need to quickly and readily locate safety-related or even safety-critical equipment in dark environments. And these kit markers are always marketed as such.

### 3. What is the usual activity of tritium contained in these kit markers?

The activity of tritium in these markers usually ranges from about 1 GBq (吉貝可) to a few GBq, but could be up to tens of GBq, depending on the luminosity required by the specific group of users for their specific working environments (e.g. military forces).

#### 4. What is the policy of the Radiation Board on the marketing of these GTLS kit markers?

The Board maintains, as a fundamental principle for the use of radioactive substances, that the use of these GTLS kit markers, whether they each contain more or less than 1 GBq of tritium gas, has to be justified as a practice (判斷其作為一個實踐的正當性) and source.

While use of GTLS kit markers by military and emergency response personnel and certain groups of specialists may be justified, the risk-benefit equation will change when it comes to unrestricted use of these kit markers by the general public. It is the view of the Board that kit markers for general use (home, casual outing, or the like) do not meet the criterion of justification.

#### 5. What about the regulatory and exemption policy on the marketing of GTLS kit markers in other countries?

In the USA, while the US Nuclear Regulatory Commission (美國核安全管理委員會) (NRC) licences the use of GTLS in timepieces and gun sights and compasses in the US, it does not seem that it would licence the use of GTLS in common kit markers, or in other frivolous applications.

[Reference: NUREG 1556, Vol. 8, Section 5; 10 CFR Part 32].

In Japan, the Japanese Government (Ministry of Education, Science and Technology) (日本文部科學省) recalled about 5500 cell phone straps with GTLS indicated that such frivolous use of GTLS could happen, and that they are forbidden there.

[Reference: The Yomiuri Shimbun, December 8, 2008].

In the United Kingdom, while they may impose little restrictions on sale of these GTLS kit markers to members of the public, the UK supplier Tracer had posed such a note on its web site [www.traser.co.uk](http://www.traser.co.uk), which stated that 'glow rings (commercial name for GTLS kit markers) can only be delivered to the UK due to international regulatory differences regarding the use of GTLS'.

[Reference: EC Radiation Protection 146, Section 4.1.1, 2007].

This indicated that sale of GTLS kit marker as an ordinary consumer item **has not been at all that common even among European countries.**

(Remark: The website no longer exists, indicating that perhaps the company does not exist any more, or that it no longer maintains the website, or that it does not run the business of selling GTLS kit markers any more!)

That a few member states in the European Union (notably the UK and the Netherlands) allow the sale of GTLS kit markers of limited tritium gas activity does not mean that this is the case for the majority of member states. This inconsistency merely reflects the differences of different member states in the judgement, the legislation, the effectiveness of control and hence the regulation of consumer products with small quantities of radioactive substances.

[Ref. 2: EC Radiation Protection 146, Section 6.2, 2007]

## **6. What considerations have been taken by the Board in not granting licences for the unrestricted sale of GTLS kit markers to the public?**

It all boils down to the principle of justification. The benefit of introducing the GTLS kit markers to the public, which constitutes a new exposure situation (一個新的照射狀況), must be weighed against the risk associated with it.

In indoor or home environment, traditional lighting devices, including the common torches, are usually available. As to casual outdoor activities, there are also many non-radioactive alternative gears for illumination, including the increasingly common, and brighter, LED devices. In these circumstances, even though the risks of using the GTLS kit markers are small, the relative benefits offered by GTLS kit markers are so minimal that they are hardly adequate to outweigh the various risks involved, radiological or otherwise.

Radiological risks mainly come from the potential exposure due to breakage (accidental or due to vandalism), loss (unintentional or deliberate), and the subsequent uncontrolled disposal. They may be small for a limited number of GTLS used by professionals, but definitely will increase with their proliferation into the possession of the general public.

Non-radiological risks comprise possible non-acceptance or opposition, which is

rather likely, of the use of these GTLS in seemingly mundane consumer items by the general public, and the amenability of regulatory control of these GTLS kit markers should the public or their representatives demand it.

There is a significant potential that these GTLS kit markers, if widely available, be proliferated into some frivolous uses, as we have seen these kit markers used in key chains, in mobile phone straps, etc. If these kit markers are to be marketed without restrictions, their likely inexpensive cost, coupled with the likely non-specialists and young people as the majority of users, the chances that these kit markers would be roughly handled, carelessly or maliciously, should not be underestimated. Their inadvertent and careless disposal would also be much more likely than that for the usually much more expensive timepieces.

It is anticipated that unrestricted distribution of these GTLS kit markers to the public would mean a low probability for the return of these kit markers to the supplier when they are disused. Any radioactive contamination (放射性污染) due to their breakage (accidental or intentional) would more than likely be gone unnoticed by the user, let alone other members of the public and the regulatory authority. The decontamination of contaminated surfaces that would be needed to meet the clearance level (解控水平) for public use will also be an important issue from the view point of possible public anxieties.