

SAFETY HANDLING SHEET

INSTRUCTIONS FOR THE HANDLING OF ZINC SELENIDE OPTICAL ELEMENTS COATED WITH RADIOACTIVE THORIUM COMPOUNDS

1. INTRODUCTION

High efficiency infra red anti-reflection coatings on ZnSe may contain very small radio-activities from the naturally occurring isotopes of thorium.

In coated elements, the thorium layer is sandwiched between outer thin film layers to produce a "CLOSED RADIOACTIVE SOURCE". The outermost layer is a non-radioactive material chosen for its good mechanical properties which protects the underlying layers.

(CLOSED SOURCE means an object free from patent defect which is a radioactive material solely because it consists of one or more radionuclides firmly incorporated on or in, or sealed within, solid inert non-radioactive material so as to prevent in normal use the dispersion of any radioactive material.)

2. INSTRUCTIONS FOR NORMAL HANDLING OF THESE COATINGS

During normal handling or cleaning THERE IS NO RADIATION HAZARD TO THE OPERATOR as the closed elements contain so very little radioactive material, i.e. approximately 4.6 Becquerels per cm² of coated surface.

The only precautions to be observed are those which should be used for the handling and cleaning of any delicate optical component, i.e. the wearing of vinyl gloves such as Kimberley-Clark "Kinguard".

3. INSTRUCTIONS FOR THE HANDLING OF SCRATCHED COATINGS

The handling of scratched coatings should present very little hazard to personnel, however the following should be noted. When the surface of the optical element becomes scratched, it is possible for a small amount of the thorium coating to be removed. This liberated thorium coating may present a minor hazard if inhaled or ingested, the magnitude of the hazard being directly proportional to the quantity of thorium released. A small scratch 0.1mm wide and 1cm long would allow the release of about 8×10^{-6} g of thorium. This is equivalent to an activity of 0.05Bq. This figure should be compared to the permitted dosage limit which is between 10kBq and 100kBq per year dependent upon the exact proportion of the thorium isotopes. This low level is encouraging but at all times it is necessary to apply the principle of dosage being as low as reasonably achievable regarding the potential for the ingestion of radioisotopes.

The International Commission on Radiological Protection and the British Ionising Radiations regulations 1985 require not only to stay within dose limits but also to keep radiation doses to individuals to the minimum which can be practically achieved. Thus is it advised that simple precautions are taken when handling scratched elements aimed at minimising skin contamination and preventing material inhalation and ingestion. Accordingly we advise the use of vinyl gloves, together with a protective mask or filter respirator such as a 3M 9920. Operators should wash their hands thoroughly after contact with damaged elements. The use of elaborate protective clothing and radiation monitoring is considered excessive.

To remove loose material from scratched surfaces it is recommended that a clean, soft, cotton cloth dampened with acetone to be used. Gently wipe away any loose delaminated material from the scratch and its adjacent area. The cloth should be sufficiently wet to allow the loose material to be lifted and retained in the cloth. Used cloths, gloves and masks should be disposed of in a plastic bag, which should be sealed for disposal.

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4. INSTRUCTIONS FOR HANDLING BROKEN COATED ZINC SELENIDE ELEMENTS

Dealing with broken or smashed optical elements presents similar hazards plus the additional danger of skin cuts and punctures produced by the broken substrate material as this is an additional potential route for the ingress of thorium. It must be emphasised that for physiological reasons ingress of thorium through skin wounds is more hazardous than the intake of the same amount of material by the oral route. Any wounds or skin lesions must be cleaned and dressed before any individual continues in the clear up operation.

If a component is accidentally smashed, several smaller CLOSED SOURCES are produced from the one large element; only a small proportion of the contained thorium will be exposed or released. Cleaning up should be performed by an operator wearing a disposable mask and gloves, together with a disposable paper coat to prevent any smaller fragments of the element becoming trapped in everyday clothing. Smaller fragments should be gently swept up using a plastic brush and dustpan avoiding the production of airborne dust. Place the broken fragments, dustpan & brush, dust respirator & mask, gloves and paper coat into a cardboard box, which should then be placed into a plastic bag and sealed for disposal.

5. GENERAL INFORMATION

- i) Thorium is potentially harmful if inhaled or ingested, therefore all eating, drinking and smoking should be prohibited in relevant working areas. After handling coated optical elements hands should be thoroughly washed immediately.
- ii) Natural thorium contains three isotopes, thorium 232,230 and 228. The radiations emitted include gamma rays and alpha particles. Alpha particles have the greater radiobiological significance.
- iii) A becquerel (Bq) is equivalent to 1 nuclear disintegration per second.
 $1 \text{ Bq} = 27 \times 10^{-12} \text{ Ci} = 27\text{pCi}$ $37000 \text{ Bq} = 1\mu\text{Ci}$
- iv) Disposal in the UK of contaminated protective clothing and broken optical elements may be effected under one of the following orders:
 - a) The Radioactive Substances (Prepared Uranium & Thorium Compounds) Exemption Order 1962. Statutory Instrument No. 2711
 - b) The Radioactive Substances (Substances of Low Activity) Exemption Order 1986. Statutory Instrument No. 1002
- v) In the event of an incident involving the release of radioactive material, the use of a contamination monitor to examine both personnel and the working environment is considered advantageous, though perhaps not essential in view of the very small activities present. If your company employs a Radiation Protection Advisor they will be able to advise you on suitable types of instruments.

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Supercedes earlier issues. Minor layout changes only.

The above information is believed to be correct but does not purport to be all inclusive and must be used only as a guide.

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