



Sustaining reliable shipment of radioactive materials

**IMO Class 7 RAM
is good for YOUR health!**

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Sustaining reliable shipment of – IMO Class 7 RAM

- Why is the shipment of Class 7 – RAM so vital to
 - public health?
 - the global food chain?
- Risk Management: Safety by Design
 - Source, Flask, Container: Design & Regulation
- The Problem
 - Barriers to acceptance of Class 7 RAM
 - Perceived risk and legislation
- The Solution
 - Education and Training
 - Harmonisation of Local Legislation

How WE ALL benefit from REVISS sustainable shipment of RAMs?



Using gamma radiation from Cobalt-60:

- 45% of all single-use medical consumables are made sterile
- Herbs and Spices, pasteurised to avoid food borne illness
- Cancer causing fumigants, for the eradication of pests in transit, are gradually replaced
- Mosquitoes are made sterile to break breeding cycles and eradicate Malaria

Gloves, Gown, masks, surgical blades, syringes



Pasteurising high risk food ingredients



Replacing cancer causing fumigants

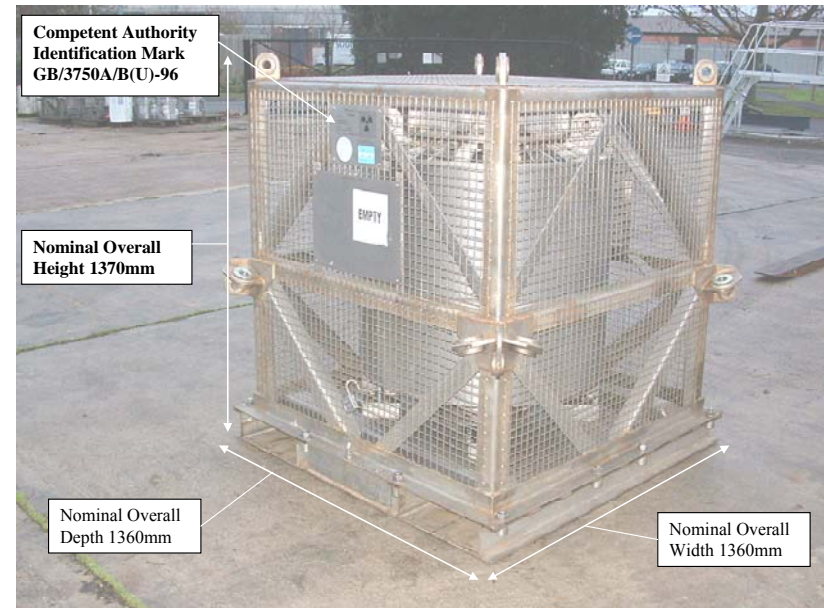
Eradication of Malaria



What are the perceived shipping risks?

- Contamination of personnel and environment by accidental damage and breach of packaging
- Non-classified workers' exposure to radiation dose dockside and vessel
- Damage of non-RAM product in close proximity to RAM packages on-board

Transport Package Design 3750A





Containment

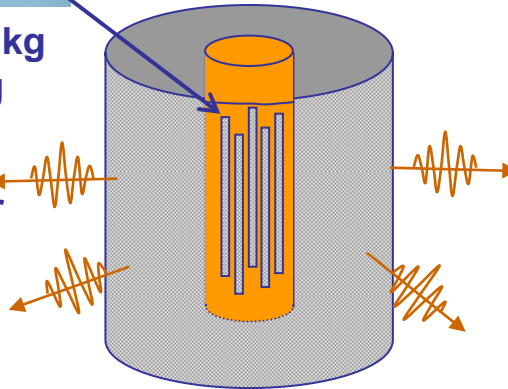
Safety by Design: Source, Flask, Container



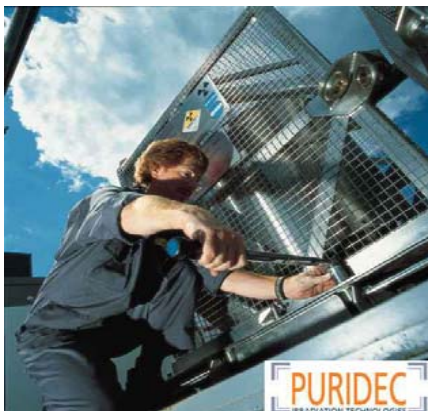
Special Form Sources
– Double encapsulated
Qualify at **HIGHEST LEVEL** to ISO2919
resistance to bend,
puncture, vibration, fire

Shipped Sources ~ 6.5 kg
Of which : Co-60 ~ 3 kg

Transport Index
 $TI_{(1m)} = 0.02 \text{ mSv/Hr}$



Shielding: Lead or DU
Flask ~ 4,000 kg



- Type-B(U) flasks cost £100k – 200k
- designed to International Atomic Energy Agency transport regulations
- Design approved by the national competent authority: Department for Transport
- Must withstand transport accident scenarios under extreme environmental conditions
- Tested for resilience to high-speed impact and fire
- **Much greater containment than typically achieved for hazardous chemicals, liquids or gases**

REVISS containers in gauge, CSC plated with proprietary tie-down fixings

Risk Management

Safety by Design: Transport Flask

- Up to 17 **consecutive** prototype drop tests from 1 – 9 m on to hardened concrete target and steel post to prove design integrity for license
 - witnessed by the regulating authority
 - **MUST** maintain physical product containment
 - **MUST** maintain radiation and thermal shielding throughout repeated drops onto most vulnerable components
- Computer simulation used to model impact damage
 - 350 different simulations



Computer modelling



Ultra high speed camera
to capture impact





Perceived Risk - Fear of radiation from handling B(U) Radioactive Packages

- UK average annual dose absorbed by the public is 2.5 milli-Sieverts
 - from atmospheric emissions when we fly, through geological emissions from the natural environment or when we undergo medical x-rays
- REVISS classified workers handling B(U) flasks every day register a total measured dose of 2 mSv per year
 - **LESS than the national average**



Handling B(U) Radioactive Packages in Ports and on Ships has **NO IMPACT on Port workers' annual radiation dose uptake**



Perceived Risk – damage to non-RAM product close to B(U) Radioactive Packages

- Transport Index ~ 2 i.e. 0.02 mSv/hr
 - 1 month **constantly** at 1 m from package delivers 13.5 mSv i.e. 13.5 mGy (γ dose)
- Same magnitude as medical treatment:
 - CT scan = $8 - 10 \text{ mGy}$
- Compare with radiation processing:
 - 3 thousand times less than the dose to stop onions from sprouting ($30,000 \text{ mGy}$)
 - 25 million times less than dose to sterilise medical products ($25,000,000 \text{ mGy}$)



Carrying B(U) Radioactive Packages for prolonged periods of time, in close proximity to inanimate packages essentially **NO IMPACT on adjacent packages**

Sustaining reliable shipment of Co-60 – IMO Class 7 RAM



- Vital to Public Health Worldwide
- Package containment much greater than achieved for dangerous liquid, powder or gaseous chemicals
- **NO IMPACT** on Port workers' annual radiation dose uptake
- **NO IMPACT** on adjacent packages in transit
- *"In 40 years of shipping commercial quantities of Co-60, there have been no radiological incidents"*
 - *Eliana Amaral, Director of the Division of Radiation Transport and Waste Safety in the IAEA:*



Logistical barriers...

Why do carriers reject radioactive class 7 cargos

- Perceived Risk
 - Lack of training and education
- Lack of Harmonisation of Local Legislation makes attainment of Transit and Transhipment Permits unpredictable:

INDIA RAILWAYS TONE MATERIAL, TEST AND PACKING			
CLASS 7 - RADIOACTIVE			
1 X Type A (1) Package			
Net Weight	100	kg	0.00
Radioactive Content	100	kg	0.00
Activity	100	Bq	0.00
Activity Concentration	100	Bq/g	0.00
Surface Contamination	100	Bq/cm ²	0.00
Transport Index	100		0.00
Radioactive Content	100	kg	0.00
Activity	100	Bq	0.00
Activity Concentration	100	Bq/g	0.00
Surface Contamination	100	Bq/cm ²	0.00
Transport Index	100		0.00

- **ONLY 100 - 200 ISO containers of Co-60 per year** ← Low imperative to train staff
- Co-60 sources shipped alongside non-dangerous goods
 - Large number of ports to be transited
 - Transhipment Hubs
 - Port Terminal Specific



What is the result?

- Some regions essentially without sea-freight access for Co-60
- Threat to Healthcare and Public Welfare
 - Sterile single use medical supplies in short supply
 - Use of toxic chemical fumigants prolonged
 - Malaria left un-checked



A Call to Action for Regulatory Bodies

- to simplify and work to achieve harmonisation of regulations controlling the passage of radioactive material through ports
- to encourage/recommend an element of class 7 training be included in the standard Dangerous Goods Training required by those in the transport chain
- to provide access to educational material to enlighten carriers and port workers to the humanitarian benefits of radioactive materials
- to debate the merits of defining a new UN category to help identify low volume class 7 RAM for healthcare and humanitarian applications



Thank you

REVISS is a member of :

The International Irradiation Association (iiA);

The Panel on Gamma and Electron Irradiation;

International Source Suppliers / Producers Association (ISSPA);

The Customs-Trade Partnership Against Terrorism (C-TPAT);

Gamma Industry processing Alliance (GIPA)

An Approved European Economic Operator

