ROTHBAND

X-Ray Aprons

The Why, what's, when's and how's of radiation safety

UN-COMPROMISING RADIATION PROTECTION SOLUTIONS

Who are we?

Radiographers
BiR , CORIPS, SOR - members
Radiation protection Supervisor

Manufacturer of Radiation protection
Based in Lancashire, UK
Family Run Business
Pioneers in Radiation Protection

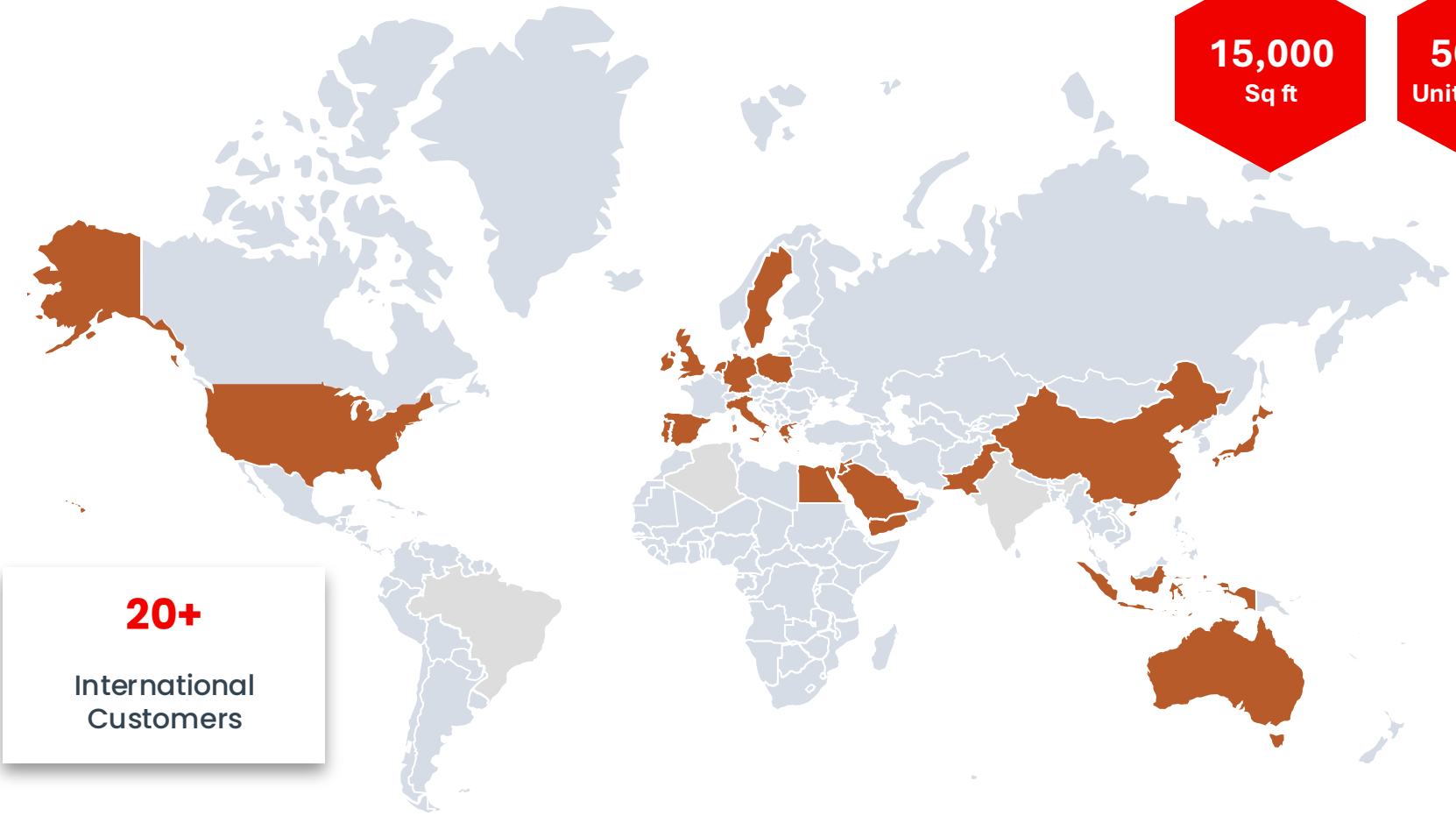
Global Reach

ROTHBAND

15,000
Sq ft

5000 PA
Units capacity

2X
CAD Cutting Machines



No 1

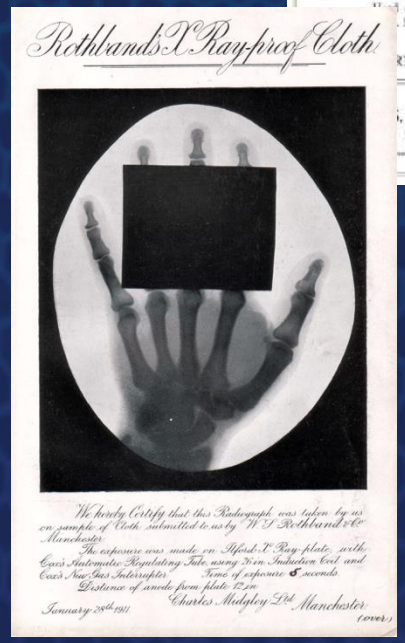
UK Market

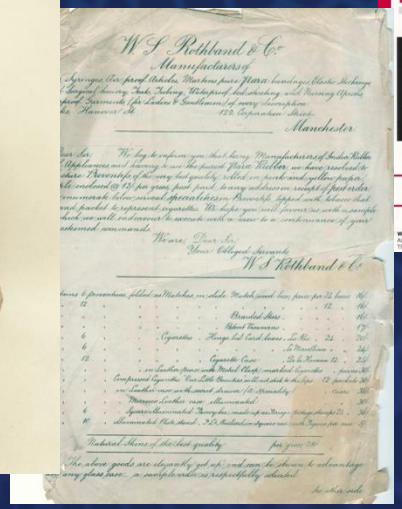
20+

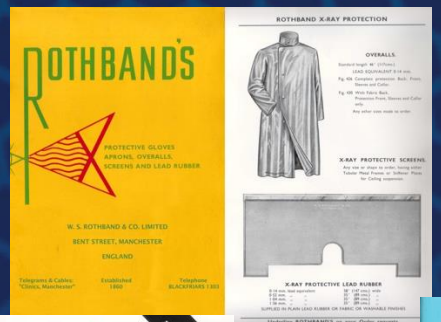
International Customers

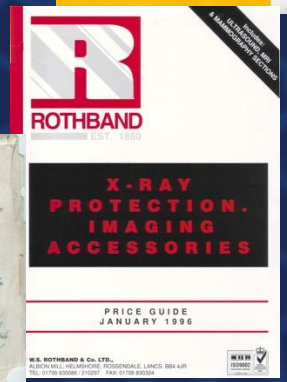
UN-COMPROMISING RADIATION PROTECTION SOLUTIONS

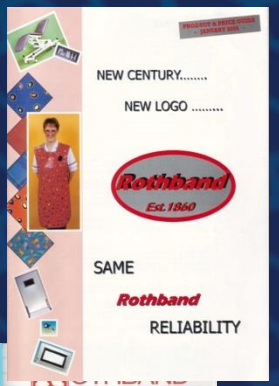
COMPANY HISTORY











EDGE
BILAYER
LEAD FREE

COMPANY ESTABLISHED

FIRST RUBBER X-RAY CLOTH A WORLD FIRST

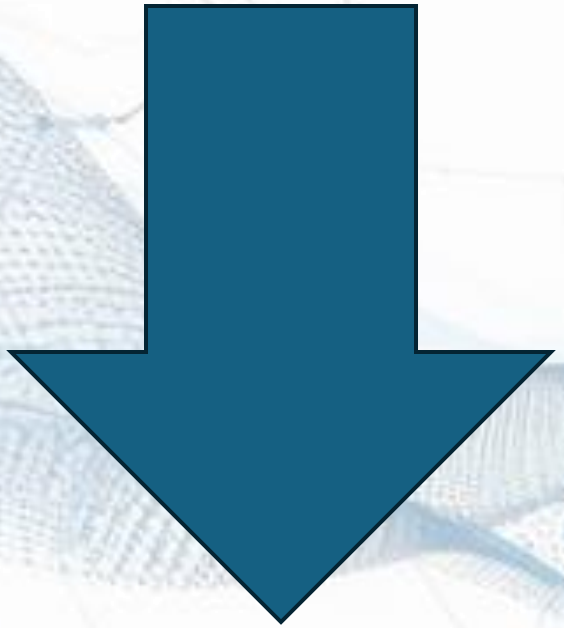
EDGE BILAYER LAUNCHED PASSING THE NEW IEC 61331-1 BBG* TEST STANDARDS AT THE LIGHTEST WEIGHT

COLLABORATION WITH SURGEONS TO PRODUCE THE INNOVATIVE MAMMO SHIELD

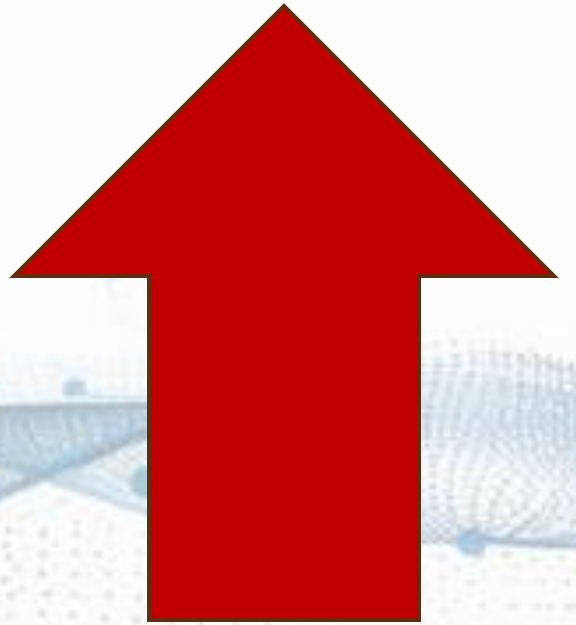
1860 | 1911 | 1920-1970 | 2000 | 2015 | 2018 | 2023 | 2024 | 2025

UN-COMPROMISING RADIATION PROTECTION SOLUTIONS

Why is radiation protection still important?



Equipment Dose Reduction



Increase in procedures

(6 FOLD INCREASE OVER 12 YEARS SINCE 2008 – 2020 STUDY*)

Increase in procedure times

Complex cases – FEVARS etc

*https://www.iaea.org/newscenter/news/radiation-protection-of-patients-in-the-new-era-of-medical-imaging

RADIATION DOSE IS ACCUMALITIVE

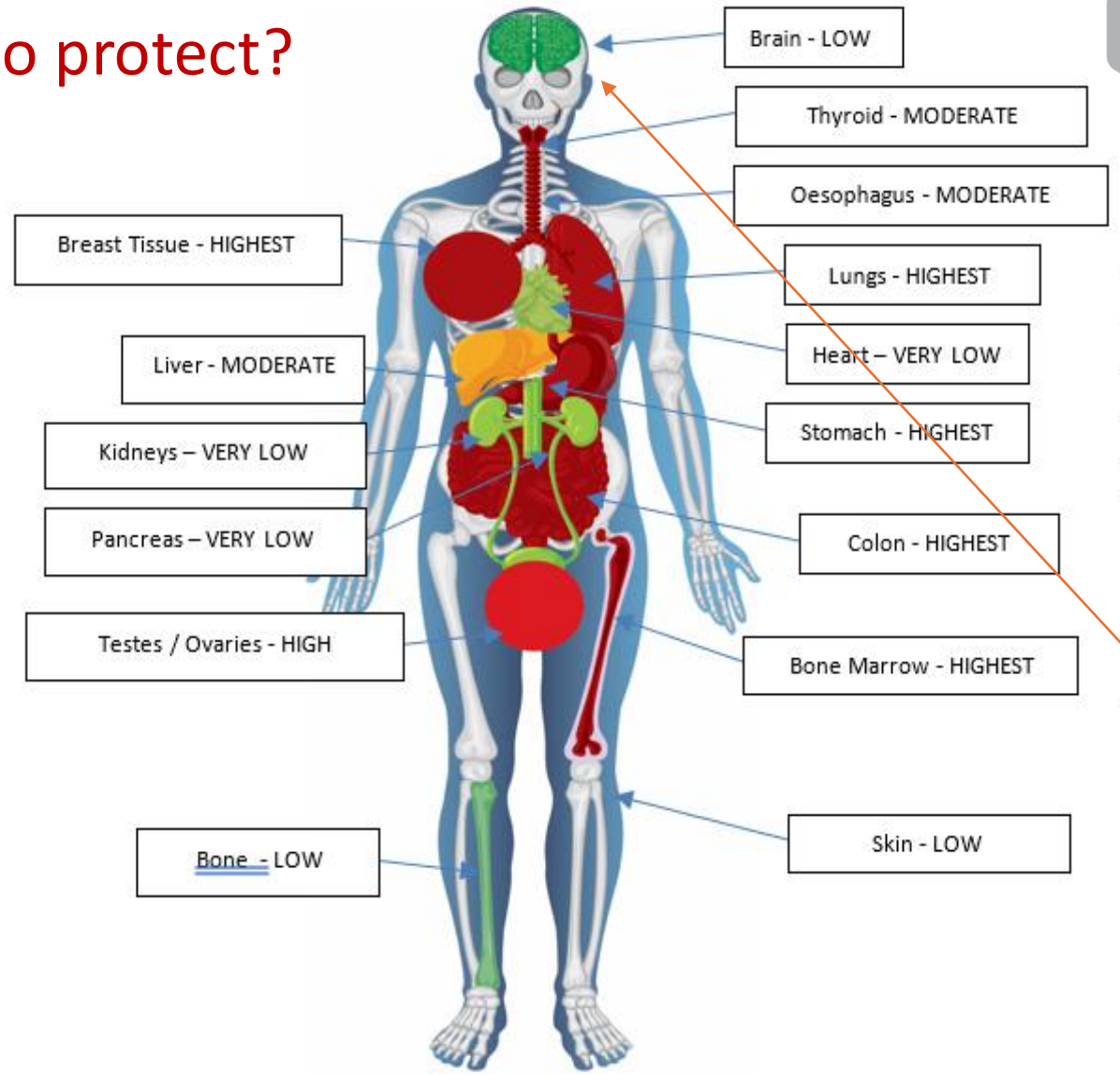
What are we trying to protect?

Risk analysis

How Much Radiation Can we have?

Public: 1 mSv PA
Healthcare worker (un-Classified): 6 mSv PA
Classified Worker: 20 mSv PA

Source: HSE.co.uk



VERY LOW RISK
LOW RISK
MODERATE RISK
HIGH RISK
HIGHEST RISK

Relative to very low risk: low risk 1.25x greater risk; moderate risk 5x greater risk; high risk 10x greater risk; highest risk 15x greater risk.

Data from Ref 1

IRR17, - Major change is the reduction in the dose limit for exposure to the lens of the eye – the Directive introduces a reduction of equivalent dose from 150 mSv to 20 mSv in a year.

Source: www.britishcardiovascularsociety.org

How do we protect?

European Regulations

PPE REGULATIONS (EU) 2016/425

PROTECTIVE MATERIALS
IEC 61331-1:2014 BBG*

GARMENT DESIGNS
IEC 61331-3:2014

How do we protect?

Common radiation protection materials

Heavier Atomic Weight Elements

		K-EDGE (KEV)
74 W	TUNGSTEN	69.52
82 Pb	LEAD	88.00
83 Bi	BISMUTH	90.52

Lighter Atomic Weight Elements

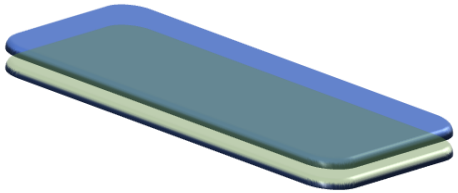
		K-EDGE (KEV)
50 Sn	TIN	29.20
51 Sb	ANTIMONY	30.49
56 Ba	BARIUM	37.44

How do we protect?

Common radiation protection materials

LEAD

LEAD FREE ADMIX



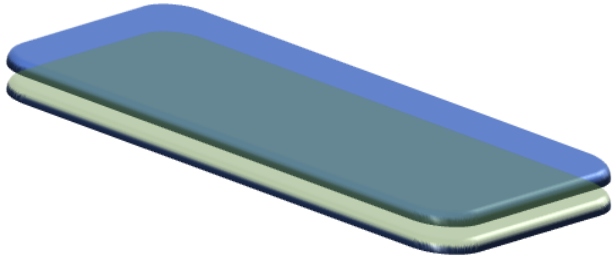
BILAYERS

HEAVIER → LIGHTER

What are the advantages of Bilayer over Admix?

Common radiation protection materials

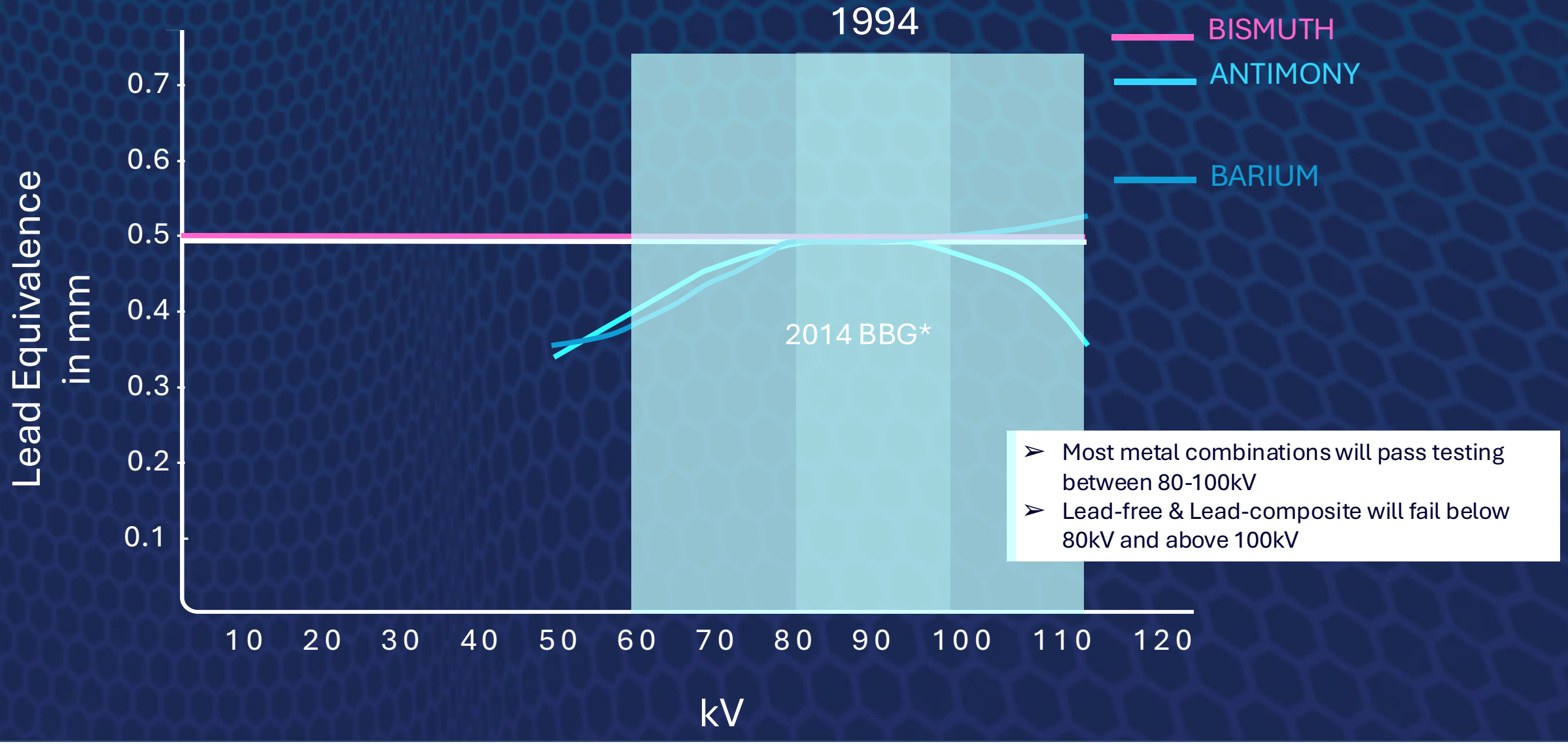
VS



LEAD FREE ADMIX

BILAYERS

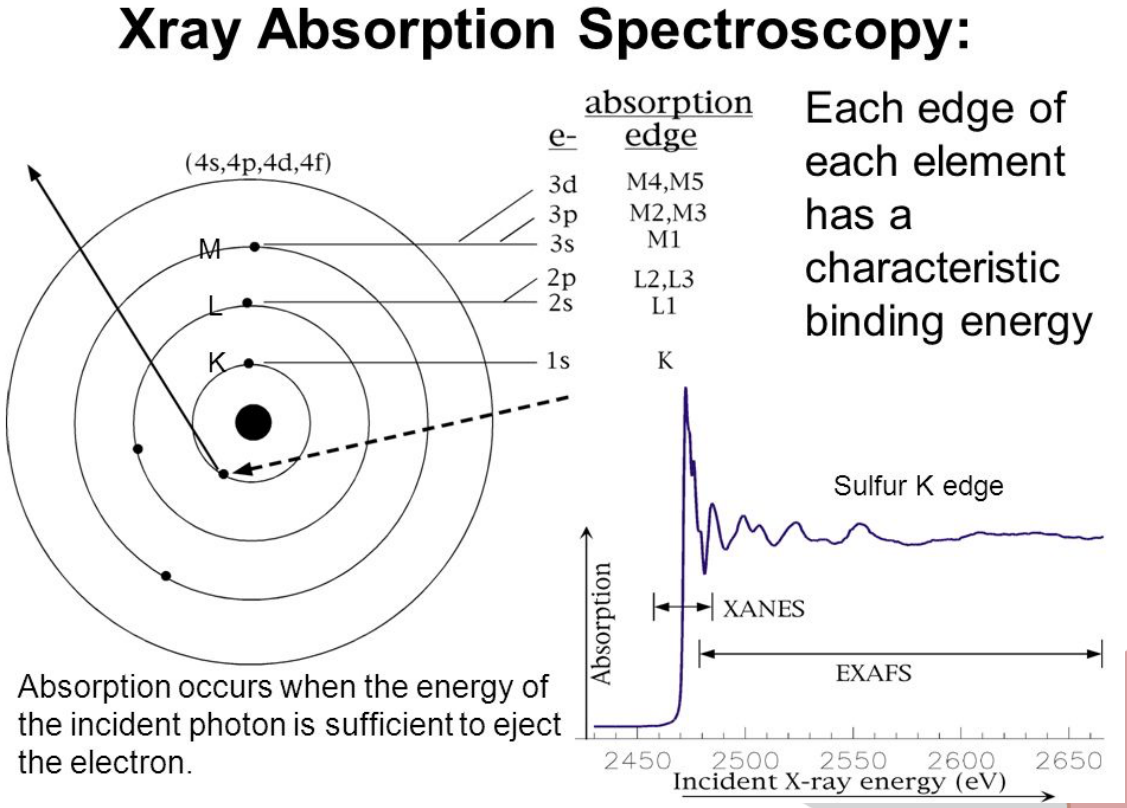
IEC 61331-2014 BBG*



- Most metal combinations will pass testing between 80-100kV
- Lead-free & Lead-composite will fail below 80kV and above 100kV

K-edges & fluorescence

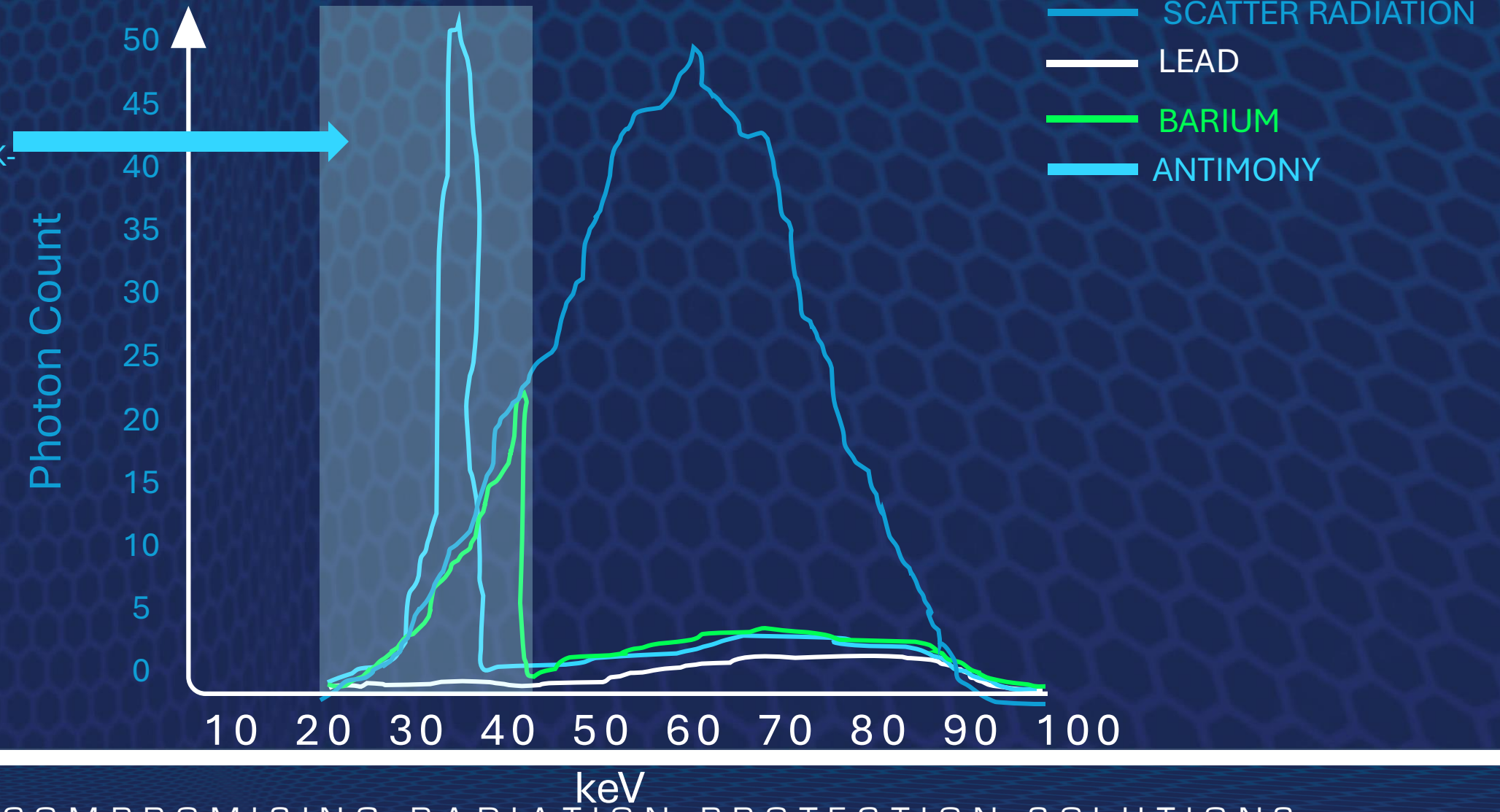
- A K-edge describes a sudden increase in the attenuation coefficient of photons occurring at a particular level of keV just above the binding energy of the ‘K’ shell electron
- All elements have a number of ‘K’ edges at certain levels of keV
- At the K-edge the attenuation coefficient decreases as electrons are displaced



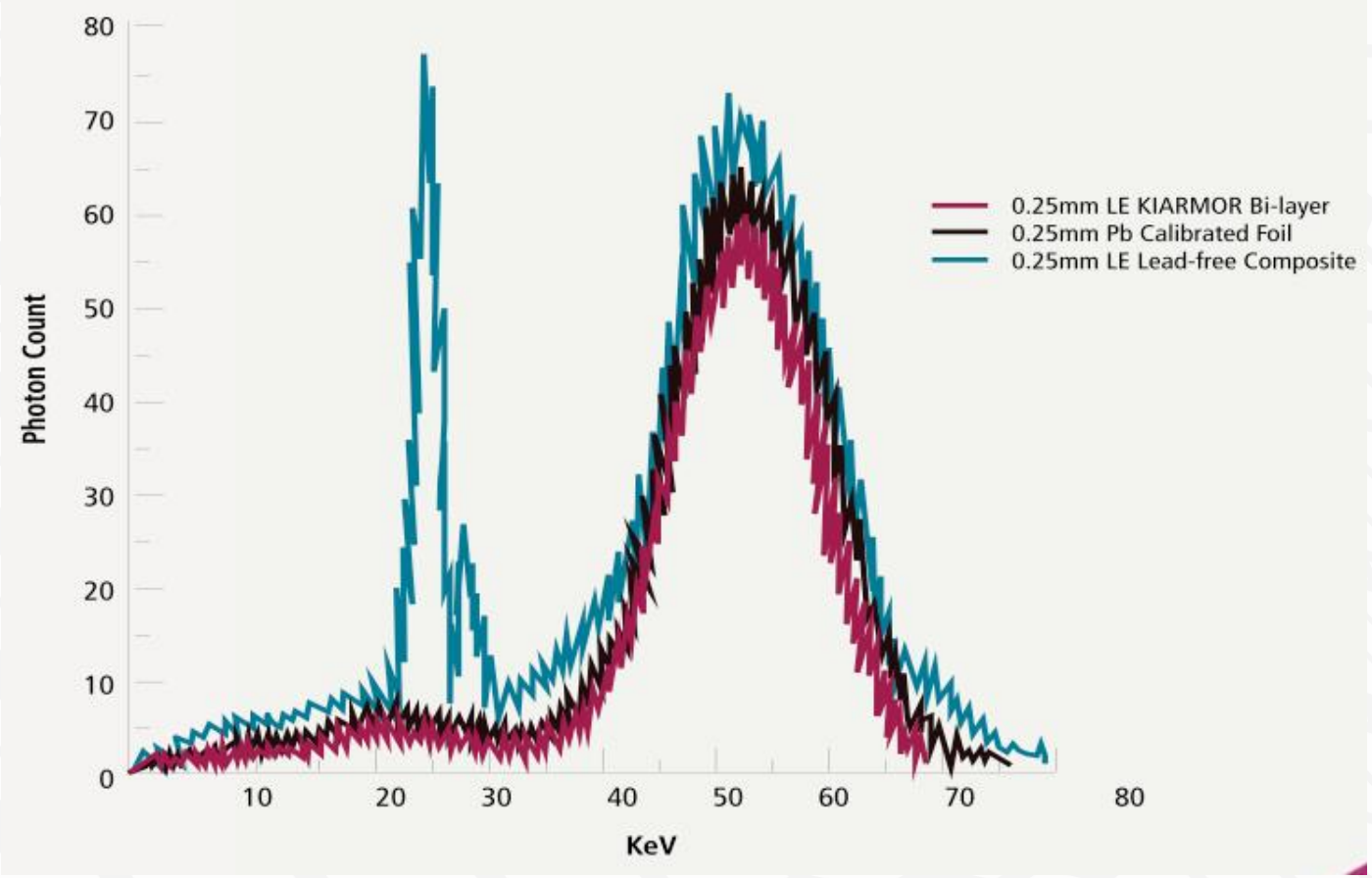
Main Beam Transmission keV Spectrum at 100kV

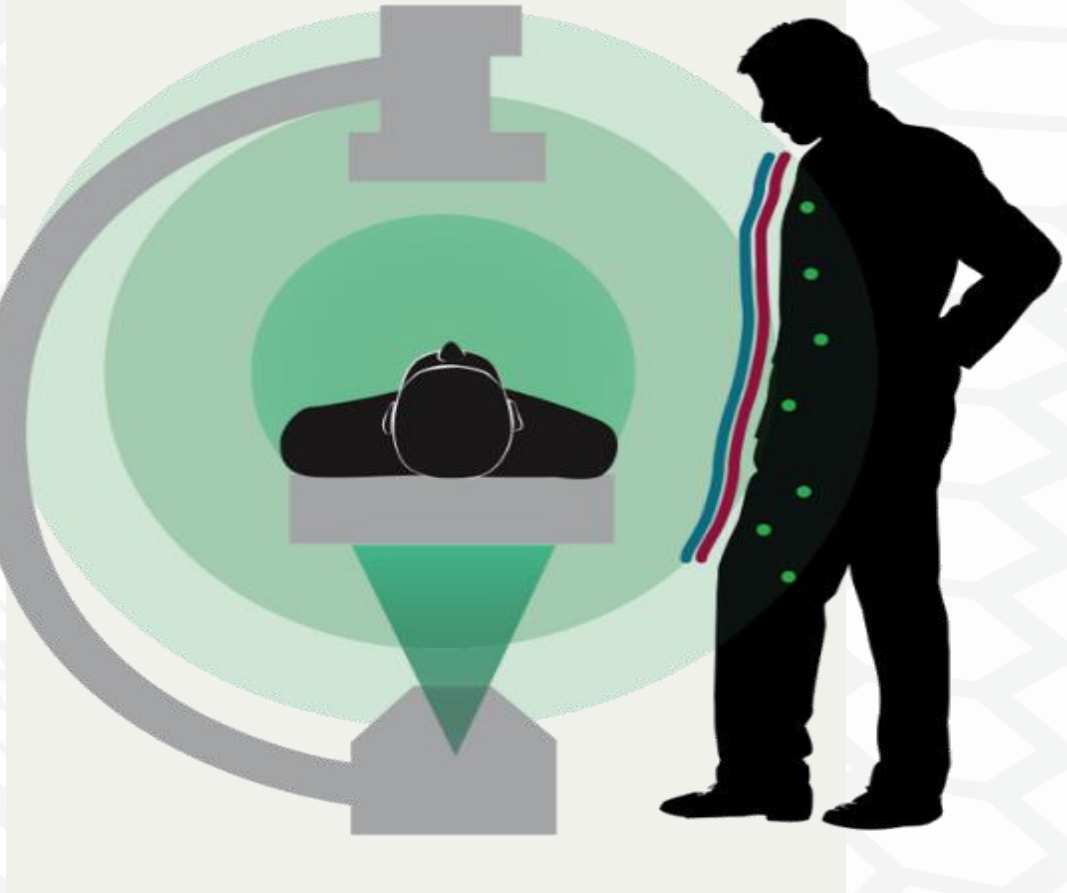
Comparison of the Attenuating Properties of Lead, Antimony & Barium at 0.25 LE.

Fluorescence produced at the K-edge appears in the area of concern for absorbed dose.



What are the advantages of Bilayer over Admix?





European Regulations

PPE REGULATIONS (EU) 2016/425

PROTECTIVE MATERIALS
IEC 61331-1:2014 BBG*

GARMENT DESIGNS
IEC 61331-3:2014

Garment Design

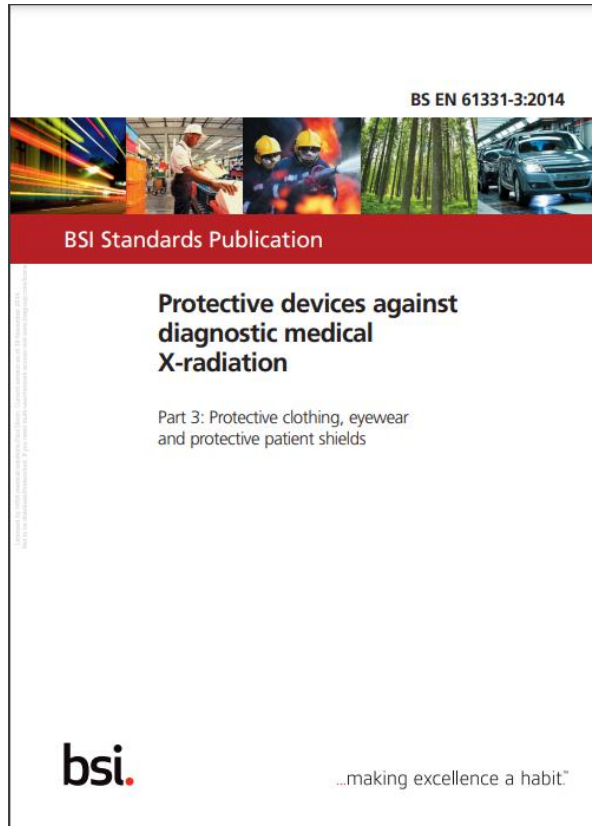
Responsibilities of the manufacturer

PROTECTIVE APRONS shall consist of one or more layers of protective material and shall be designed to cover **the front part of the body from the throat down to at least the knees**, the entire breastbone and the shoulders.

The width of the material on each shoulder **shall be not less than 8 cm** for persons having the minimum chest girth of 76 cm (according to EN 340:2003) and shall be graded as chest girth increases.

PROTECTIVE APRONS and THYROID COLLARS are used for protection against SCATTERED RADIATION and are tested in the 50 kV to 110 kV TUBE VOLTAGE RANGE. However such devices and materials are **useful in SCATTERED RADIATION from primary x-ray beams with TUBE VOLTAGES 60 kV to 120 kV because the scattered spectra of these better match those of primary beams having TUBE VOLTAGES 10 kV less.**

Where heavy-duty, or heavy-duty closed PROTECTIVE APRONS or THYROID COLLARS are worn for RADIOLOGICAL examinations or in procedures **where there is exposure to higher energy radiation, greater than 125 kV, for example in "in-room CT assist" procedures, such PROTECTIVE APRONS should also meet or exceed the LEAD EQUIVALENT values for radiation quality 150 kV, and be marked or labelled accordingly.**



Standards Specifications of Aprons:

Open Designs – e.g. front only or tabards
Closed Designs – Closed at the sides

Light Duty – 0.25 Pb LE
Heavy Duty – 0.35 Pb LE at the front - 0.25 Pb LE at the back

Garment Design

Types of Lead Apron – Open Design

Benefits:

Easy to put on.
Easy to remove whilst sterile
Well Ventilated

Disadvantages:

Perceived – one size fits all
Easy to wear badly

Garment Design

Types of Lead Apron – Closed Design

Benefits:

Easy to put on.
Better side coverage of the axilla and
breast tissue

Disadvantages:

Not easy to remove whilst sterile
Less well ventilated
A more precise fit

Garment Design

Types of Lead Apron – Two Piece Aprons (includes both open & closed designs)

Benefits:

Weight spread between hips and shoulders
Ventilation between the overlap

Disadvantages:

Not easy to remove whilst sterile
A more precise fit

Selecting the right apron for the environment

- What exposures are being used?
  - High KV? Apron that protects up to 150KV?
- Where are you standing?
  - RPA's often advise 0.35 Pb for operators and 0.25 Pb for others in the room
- Are you standing or sitting?
  - SITCO?
- Where is the x-ray tube in relation to your position during the surgery?
  - Head on?
  - Side on?
  - Which side?
- Do you need the apron for the duration of the surgery?
- Do you have MSK considerations?

How to wear a lead apron properly

Tabard Aprons

COVERAGE OF STERNUM

DOWN TO THE KNEE

SUFFICIENT OVERLAP

OVERLAP WITHIN 10 CM

NO GAPPING

How to wear a lead apron properly

Closed Designs

ENSURE THE INNER FLAP IS PROPERLY POSITIONED

MAKE SURE THE LOWER PANELS ARE PROPERLY ALINGED

ROTHBAND

INNOVATION MISSION

ROTHBAND

Better Axilla Protection

UN-COMPROMISING RADIATION PROTECTION SOLUTIONS

Mission:

To Provide Better Axilla Protection to Healthcare Professionals in Orthopedic Environments

Two self-reported US studies of female orthopaedic surgeons have shown a 1.9 fold increase in all-cause cancer incidence and a 2.9-3.9 fold increased incidence of breast cancer.

This increase was not seen in plastic surgeons or urologists, and remained when the cohort was matched against a control population [8-10].

British Orthpaedic Association - 2023

DEFINING THE ISSUE

The Unique Challenges of Orthopedic Surgery

- Wearing the correct sized lead apron is the best way to ensure the breast tissue is adequately covered.
- Some hospital departments have a transient workforce consisting of trainees and visitors.
- Healthcare professionals come in all shapes and sizes, making it challenging for employers to provide adequate radiation protection coverage to a variable population of staff.
- Orthopaedic Surgery has its own unique challenges when it comes to effective x-ray protection.

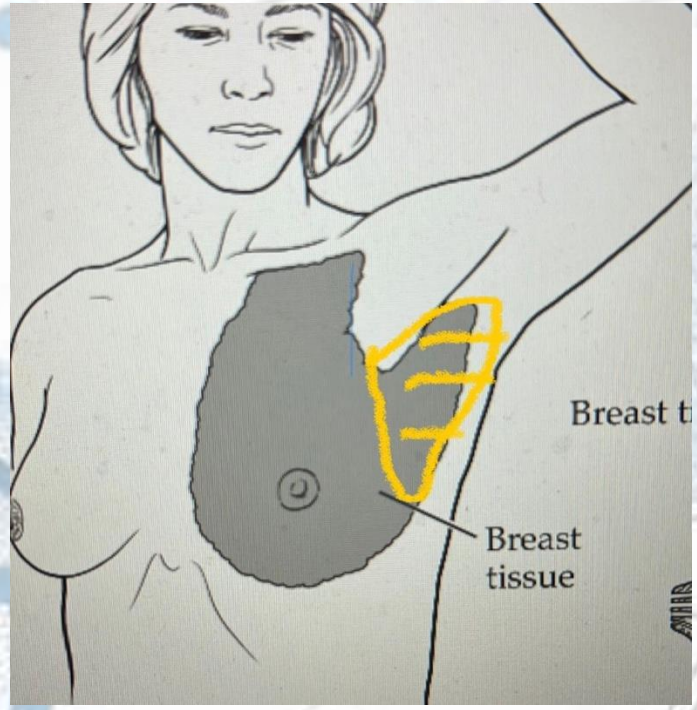
DEFINING THE ISSUE

The area of concern

Tabard gown

Standard vest

High axilla vest



Images: British Orthpaedic Association - 2023

DEFINING THE ISSUE

The unique Challenges of Orthopedic Surgery

Orthopedic Surgeons tend to have more dynamic Interaction with their patients during x-ray screening.

This can result in compromising the effectiveness of the available protection.

Design objectives

- Provide sufficient coverage of the axilla
- Avoid a sleeve configuration that would add extra weight to the upper arm
- Dynamic movement to ensure coverage

Product Objectives

RETROFIT

TO EXISTING PPE

ACCESSIBLE QA

FOR REGULAR CHECKS

ONE SIZE FITS ALL

SIMPLE TO ORDER

AFFORDABLE

PROCUREMENT

Final Product

THANK YOU