



Sellafield Ltd

**Skin dose assessments for
contaminated individuals
using VARSKIN**

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**A Nuclear Management Partners company
operated under contract to the NDA**

Skin dose assessments for contaminated individuals, using VARSKIN

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- Relevant legislation
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Sellafield employee monitoring for contamination using frisk probe.

Sellafield Root Causes of Personal Contamination

- Accidents
- Plant failures
- Personal protective equipment failures
- Inadequate risk perception
- Inadequate instructions
- Cross contamination at undressing barriers
- Failure to follow procedures

We can address these factors, but with an ageing site such as Sellafield the potential remains for something to go wrong resulting in personal contamination.

Relevant Legislation

- IRR99
 - Regulation 7
Prior Risk Assessment
 - Regulation 8
Restriction of Exposure
 - Regulation 11
Dose Limitation

 - Regulation 23
Dosimetry for Accidents
Dose assessment by Approved
Dosimetry Service required if dose
likely to be greater than three-tenths
of the relevant dose limit.



VARSKIN

Varskin 4.0 [Minimize] [Maximize] [Close]

File Help

Source Geometry

Point Sphere
 Disk Slab
 Cylinder

Special Options

Include Photon Dose
 Perform Volume Averaging

Radionuclide Library

Activity Units: Bq

Select
Add
Remove

Use Distributed Source

Selected Radionuclides

Cs-137: 1.78E+05 Bq
Ba-137m: 1.78E+05 Bq
Ru-106: 7.84E+04 Bq
Rh-106: 7.84E+04 Bq
Sr-90: 6.20E+04 Bq
Y-90: 6.20E+04 Bq

Edit Remove Clear

Disk Source Irradiation Geometry

Skin Thickness or Skin Density Thickness: 7 mg/cm²
Air Gap Thickness: 0 mm
Cover Thickness: 0.077 mm
Cover Density: 1 mg/cm²

Multiple Cover Calculator

Source Area: 4 cm²
Source Diameter: 2.26 cm

Calculate Doses

Methodology for Assessing Skin Dose

1. Obtain Information from Contaminated Individual:

What?

- What were they doing when they got contaminated?
- What activity was measured from the contamination?
- What clothing were they wearing?
- What surface area of skin/clothing was contaminated?

Where?

- Where on their person/clothing were they contaminated?
- Where were they working?

When?

- When was the contamination discovered?
- When were they last monitored before that?

Establish:

- Duration of Exposure
- Isotopes
- Activity
- Intervening Clothing
- Source Geometry

Use pessimistic assumptions where information not known:

e.g. Sellafield worst-case isotopic mix for skin dose: 40% ^{90}Sr , 40% ^{90}Y , 20% ^{137}Cs

2. Run Calculation

3. Interpret Results

4. Take Further Action if Necessary

Welfare of the Contaminated Individual

- The individual themselves is the best source of information about the contamination incident. **But,**
 - They are likely to be stressed, suddenly the centre of attention.
 - Maybe they did something wrong and are worried about repercussions.
 - They might have concerns concerned about their dose.
 - They might have had to endure lengthy decontamination processes.
- Take time to talk to the individual, understand what their concerns are and explain why the information that they give is important to assess if there is any risk to their health.
- Give them the opportunity to ask questions.



The dose assessment is more than just a calculation; try and see it from the individual's point of view.

Example

- **Event:**

During a routine survey of a workshop contamination was discovered on a chair. An individual had been working in the workshop for 3 hrs prior to the contamination being discovered.

- **Activity:** 12.1kBq

- **Isotopes:** Building fingerprint 28% $^{90}\text{Sr}/^{90}\text{Y}$, 72% ^{137}Cs .

- **Clothing worn:** Coveralls

- **Exposure Time:** Assume 3 hrs.

- **Geometry:** Assume point source.

Results:

- VARSKIN calculation indicates 5.66 mSv equivalent dose to the skin, under pessimistic assumptions.

- No further action required.



Summary

- Prior risk assessment and hierarchy of control measures should prevent personal contamination. But things can go wrong...
- Methodology required at Sellafield for the assessment of significant skin doses in the event of an accident.
- VARSKIN 3 trialled, and proposed as a suitable technique for Sellafield. VARSKIN 4 now installed and available for use by dosimetry dept.
- VARSKIN is straightforward to use, minimal training required, fast to calculate a result.
- Relies on having adequate information to run a calculation.
- The contaminated individual is the best source of information about the incident - **remember their health and welfare.**

