EURADOS INTERCOMPARISONS FOR PERSONAL DOSEMETERS (2008-2010): RESULTS & CONCLUSIONS

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1) Introduction to EURADOS & the intercomparison programme
2) Intercomparison methods
3) IC 2008 - whole body dosemeters
4) IC 2009 - extremity dosemeters
5) IC 2010 - whole body dosemeters
6) Conclusions

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1) Introduction to EURADOS

European Radiation Dosimetry Group

“The objective of EURADOS is to advance the scientific understanding and the technical development of the dosimetry of ionising radiation in the fields of radiation protection, radiobiology, radiation therapy and medical diagnosis by the stimulation of collaboration between European laboratories, specially those of the European Communities.”

www.eurados.org

eurados.IC2012@babcock.co.uk

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1) Introduction to the intercomparison programme

✓ Personal Dosemeter Intercomparisons - aims

✓ Check the operations of individual monitoring services (IMS)
✓ Enable anonymous comparison of participants’ results
✓ QA - demonstrate compliance with appropriate QM Systems

✓ Participation is recommended in international literature & standards

✓ RP-160: Technical recommendations for monitoring individuals occupationally exposed to external radiation, EC (2009)
✓ ISO 17025: General requirements for the competence of testing and calibration laboratories, EN ISO/IEC 17025:2005
1) Introduction to the intercomparison programme

✔ EURADOS-WG2 (2007): A programme of sustainable intercomparisons

✔ Schedule: whole body every 2 years + extremity or neutron in between

✔ Conform, as far as possible, with ISO 14146:2000 – trumpet curves

✔ Accredited laboratories to provide the irradiations

✔ Issue “Certificate of Participation” – but no “pass/fail” assessment of results

✔ Participant price – 1250 Euros
2) Intercomparison Methods

- EURADOS Council formally appoint Organising Group (OG) and co-ordinator
- Preparation – proposal with draft irradiation plan & budget
- EURADOS Council approval & announcement
- Applications, invoices, dosemeters sent to co-ordinator
- Intercomparison procedures….
- "Certificates of Participation” issued at participants meeting

\[ R = \frac{H_{p,\text{participant}}}{H_{p,\text{reference}}} \]
2) Intercomparison Methods - procedures

i) Dosemeters arrive

ii) Re-label all dosemeters

iii) Dosemeters $\rightarrow$ irradiation lab

iv) Return dosemeters to IMS
2) EURADOS AM 2011 Prague - Participants meeting
3) IC 2008 for whole body dosimeters

- OG: T. Grimbergen, M. Figel, A.M. Romero, H. Stadtmann, A. Mc Whan

### Quality, \( H_p(10), H_p(0.07) \) (mSv), Number of dosemeters

<table>
<thead>
<tr>
<th>Quality</th>
<th>( H_p(10) )</th>
<th>( H_p(0.07) )</th>
<th>Number of dosemeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-60</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>N-60 45°</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>N-150 45°</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>N-60 + S-Cs</td>
<td>(3 + 1)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>S-Cs + N-60</td>
<td>(3 + 1)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>S-Cs</td>
<td>0.5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>S-Cs</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>S-Cs</td>
<td>10</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>S-Co</td>
<td>150</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

#### Participants
- 52 IMS / 62 systems from 24 countries (only 48 with both \( H_p(10) \) and \( H_p(0.07) \))

#### Type
- Film (10)
- TLD (46)
- Others (6)

#### Irradiations
- GAEC (Greek Atomic Energy Commission)

**Results out of range:**
- \( H_p(10) = 7\% \)
- \( H_p(0.07) = 12\% \)
3) IC 2008 for whole body dosemeters

- 63% of the systems were TLDs using LiF:Mg,Ti as the detector
- Greater variation observed for Hp(0.07) compared to Hp(10) results
- 74% of the systems met the trumpet curve criteria (maximum 2 “outliers”)
- 60% of the systems had no values out of range

Radiation quality →

diamond = median
box = 50% of range
bar = 90% of range
dots = max and min
4) IC 2009 for extremity dosemeters

- **OG:** T. Grimbergen, M. Figel, A.M. Romero, H. Stadtmann, A. Mc Whan

<table>
<thead>
<tr>
<th>Radiation</th>
<th>Quality</th>
<th>$H_{2}(0.07)$ (mSv)</th>
<th>Number of dosemeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta</td>
<td>$^{85}$Kr, 0°</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>$^{90}$Sr/$^{90}$Y; 0°</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>$^{90}$Sr/$^{90}$Y; 60°</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Photons</td>
<td>N-20; 0°</td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>W-80; 0°</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>W-80; 0°</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>W-80; 60°</td>
<td>400</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>W-80; 60°</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>N-150; 0°</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>S-Cs; 0°</td>
<td>30</td>
<td>2</td>
</tr>
</tbody>
</table>

- Participants: 44 IMS / 59 systems from 18 countries (only 37 for mixed fields - beta & photon)
- Type: Ring (46), Fingertip (4), Wrist/Ankle (9)
- Irradiations: Seibersdorf (Austria), IRSN (France)

Number of results out of range:
- Photons = 10%, Beta = 35%
4) IC 2009 for extremity dosemeters

- 48% of the systems used LiF:Mg,Cu,P as detector element
- Poorer results for beta irradiations: Kr-80, due to low energy, and for Sr-90 at 60° due to the irradiation angle. Strong dependence on energy & angle.
- For the photon irradiation, linear & angular responses are satisfactory
- 54% of the systems met the “trumpet curves criteria” (maximum of 2 outliers)
- 45% of the systems had all values inside the range
5) IC 2010 for whole body dosemeters

OG: A. Mc Whan, E. Fantuzzi, M. Figel, T. Grimbergen A.M. Romero, H. Stadtmann

<table>
<thead>
<tr>
<th>Quality</th>
<th>$H_{p}(10)$, $H_{p}(0,07)$ (mSv)</th>
<th>Number of dosemeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-40 30º</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>N-40 + S-Cs</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>W-110 45º X</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>W-110 45º Y</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>W-250 + S-Cs</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>S-Cs</td>
<td>0.5</td>
<td>2</td>
</tr>
<tr>
<td>S-Cs</td>
<td>2.5</td>
<td>4</td>
</tr>
<tr>
<td>S-Cs</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>S-Co</td>
<td>250</td>
<td>2</td>
</tr>
</tbody>
</table>

Participants: 70 IMS / 85 systems from 30 countries (only 66 with both $H_{p}(10)$ and $H_{p}(0,07)$)

Type:
- Film – 13
- TLD – 59
- OSL – 8
- Other - 5

Irradiations: BEV - Austria

Number of results out of range:
- $H_{p}(10) = 5\%$
- $H_{p}(0,07) = 9\%$
5) IC 2010 for whole body dosemeters

- 63% of TLD systems used LiF: Mg, Ti as a detector.
- Greater spread of results for Hp (0.07) than for Hp (10)
- Marked problems for some systems for N40/30°
- 86% of systems met the criteria for trumpet curves (maximum 2 "outliers")
- 74% without any value out of range

diamond = median
box = 50% of range
bar = 90% of range
dots = max and min
6) Conclusions

1) The high levels of interest and participation confirm the need for the IMS participation in dosimetry intercomparisons.

2) The results show that European IMS have, in general a very high standard, although improvement is needed in some aspects, eg extremity dosimetry.

3) Between 2008 and 2010 there was an observed improvement in the performance of film dosemeter systems.

4) EURADOS is currently running 2 intercomparisons:
   - whole body photon (IC2012)
   - neutron-gamma mixed fields (IC2012n)

Application deadline 29 June!
THANK YOU FOR YOUR ATTENTION 😊