ISS TEPC Measurement Results
Jun 07 – Sep 08

Space Radiation Analysis Group
Johnson Space Center
ISS TEPC Summary

• Right cylinder of A150 plastic – 5 cm x 5 cm
  – Gas is pure propane, simulating 2 µm of tissue
  – the projected area is 30 cm² and sensitive volume of the detector is 103 cm³ for isotropic exposure.

• Current measurement location is JPM
  – New modules recently mapped Node 2, Columbus, and JPM

• Measures lineal energy (y) in the range 0.4 – 1000 keV/µm
  – y spectra recorded 1 per minute and dose rate/dose equivalent rate calculated every ~4 seconds

• Data sent to the ground every minute and has an alarm threshold of 0.05 mGy/min

• Currently used to officially track Expedition exposures = MRE

• ISS TEPC launched on STS-117 to replace failed unit.
  – Operational since 6/2007
ISS TEPC
Current Location - JPM 1A5
ISS Configuration
ISS TEPC Long Term Dose Rate

[Graph showing long-term dose rate with various labels for different stations and dates from 6/16/07 to 9/16/08.]

- LAB S4
- SM P327
- NOD2PD
- SM P410
- COL
- SM P327
- LAB S4
- SM Stdb CQ
ISS TEPC Daily Measurements

![Graph showing dose and dose equivalent rates over time](Image)

- **Absorbed Dose Rate**
- **Dose Equivalent Rate**
Real Time ISS TEPC Data

Date

Dose/Dose Eq

Dose - microGy/day
Dose Equivalent - microSv/day

Shuttle Docked

- 0
- 200
- 400
- 600
- 800

Dose/Dose Eq
ISS TEPC MRE

ISS Expedition 17 Crew Mission Reference Exposure

Mission Reference Exposure (mrad)

Date (2008)

Administrative Limit

Preflight Projection Range

MRE: 3770 mrad as of September 6, 2008

RS EVA 20

RS EVA 20A

Instrument Values
Columbus Module

- The NASA ISS TEPC has completed a measurement campaign in the Columbus Module.

- We moved the detector on March 3, at ~10:43 GMT to the Columbus EPM Rack COL1A3. The measurement period ended on 4/14/08.
  - We have 42 days of monitoring data available.

- We also have overlapping measurement data from the Shuttle-based TEPC during the STS-123 mission (3/11/08- 3/26/08). Docking of the Shuttle to ISS occurred on 3/12 and Kibo was installed.

- The average altitude of ISS during the period was 346 km.
TEPC Location in Columbus

TEPC Location:
EPM Rack
# Columbus Results

## March 4 - 10

<table>
<thead>
<tr>
<th></th>
<th>GCR</th>
<th>Trapped</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dose (µGy)</strong></td>
<td>922.506</td>
<td>790.482</td>
<td>1712.988</td>
</tr>
<tr>
<td><strong>Dose Eq (µSv)</strong></td>
<td>2768.831</td>
<td>1413.807</td>
<td>4182.638</td>
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<tr>
<td><strong>Particles Count</strong></td>
<td>16883289</td>
<td>12613729</td>
<td>29497018</td>
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<tr>
<td><strong>Time (minutes)</strong></td>
<td>8816</td>
<td>626</td>
<td>9442</td>
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<tr>
<td><strong>µGy/day</strong></td>
<td>140.691</td>
<td>120.556</td>
<td>261.248</td>
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<tr>
<td><strong>µSv/day</strong></td>
<td>422.275</td>
<td>215.62</td>
<td>637.894</td>
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</table>

## March 18 – 24

<table>
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<tr>
<th></th>
<th>GCR</th>
<th>Trapped</th>
<th>Total</th>
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<tbody>
<tr>
<td><strong>Dose (µGy)</strong></td>
<td>872.357</td>
<td>592.419</td>
<td>1464.776</td>
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<tr>
<td><strong>Dose Eq (µSv)</strong></td>
<td>2571.033</td>
<td>1067.608</td>
<td>3638.642</td>
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<tr>
<td><strong>Particles Count</strong></td>
<td>16168033</td>
<td>9620668</td>
<td>25788701</td>
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<tr>
<td><strong>Time (minutes)</strong></td>
<td>8232</td>
<td>502</td>
<td>8734</td>
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<tr>
<td><strong>µGy/day</strong></td>
<td>143.828</td>
<td>97.674</td>
<td>241.502</td>
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<tr>
<td><strong>µSv/day</strong></td>
<td>423.894</td>
<td>176.02</td>
<td>599.913</td>
</tr>
</tbody>
</table>
ISS TEPC and CR-39: 8/07 - 3/08

Integral LET Spectrum (Dose Equivalent, ICRP 60)

ISS - Expedition 15

Dose Equiv. (> LET_{inf.}) (Sv/d)

LET_{inf.} (keV/μm water)
## Radiation Area Monitors (RAM) Data (Exposure Time = 231.1 d)

<table>
<thead>
<tr>
<th>Dosimeter/Location</th>
<th>Dosimeter Type</th>
<th>Measured Dose (mGy)</th>
<th>(^1\text{Dose Low-LET (&lt;10 keV/}\mu\text{m water)} Q=1) (mGy)</th>
<th>(^1\text{Dose CR-39 High-LET (&gt;10 keV/}\mu\text{m water)} Q&gt;11) (mGy)</th>
<th>(^1,2\text{Total Dose (mGy)})</th>
<th>(^1,2\text{Dose Equivalent (mSv)})</th>
<th>(^1,2\text{Quality Factor})</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEPC</td>
<td>TLD-100</td>
<td>44.32 ± 0.36</td>
<td>39.68</td>
<td>47.60 ± 0.59</td>
<td>130.17 ± 5.42</td>
<td>2.73 ± 0.11</td>
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<tr>
<td></td>
<td>TLD-300</td>
<td>47.25 ± 0.97</td>
<td>40.24</td>
<td>48.16 ± 1.08</td>
<td>130.73 ± 5.50</td>
<td>2.71 ± 0.11</td>
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<tr>
<td></td>
<td>OSLD-Luxel 300s</td>
<td>45.99 ± 0.67</td>
<td>41.59</td>
<td>49.51 ± 0.82</td>
<td>132.08 ± 5.45</td>
<td>2.67 ± 0.11</td>
<td></td>
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<tr>
<td></td>
<td>OSLD-Luxel 3s</td>
<td>49.59 ± 1.02</td>
<td>43.29</td>
<td>51.21 ± 1.12</td>
<td>133.78 ± 5.51</td>
<td>2.61 ± 0.11</td>
<td></td>
</tr>
</tbody>
</table>

Comments:  
1. Quantities may not be measured/calculated for all of the dosimeter locations
2. Quantities calculated by combining the CR-39 dose results with the TLDs/OSLDs dose results, as recommended by NCRP 142 (2002), Equation (6.1).
Conclusions

- **Dose & Dose Eq Range**
  - 0.18-0.55 mGy day\(^{-1}\)
  - 0.50-1.1 mSv day\(^{-1}\)

- **Q factor range**
  - 2.04 – 2.68

- **GCR/Trapped ratio**
  - 70% Dose Eq is GCR

- **ISS TEPC operating well for over 1 year**