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Field Evaluation of Portable Neutron Survey Instrumentation

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Purpose

- **Compare portable neutron survey instrumentation in the field**
- **Four different instruments:**
  - **Smart Neutron Radiation Detector (SNRD) with BF_3**
  - **SNRD with ^3He**
  - **Smart Wide Energy Neutron Detector (SWENDI)**
  - **RadEye NL**
- **Three different neutron sources:**
  - **Am-Be**
  - **Cf-252**
  - **Am-Li (resulted in doses too low to be useful)**

Driver

- **Travel**
  - –Tough to carry 25-40 pounds while traveling
- **Controlled Area posting**
  - –Dose limit of 100 mrem/year
  - –Some experiments are long term, must consider low doses over long periods of time for non-rad workers

SNRD

- 9 inch diameter HDPE
- BF_3 tube
- ^3He tube, 4 atm
- Sensitivity: 60 cpm per mrem/hr
- Energy range: 0.025 eV to 10 MeV
- Weight: ~20 pounds

SWENDI

- 9 inch diameter HDPE
- ^{3}He tube, 2 atm
- Sensitivity: 680 cpm per mrem/hr
- Energy range: 0.025 eV to 10 MeV (5 GeV)
- Weighs almost 40 pounds

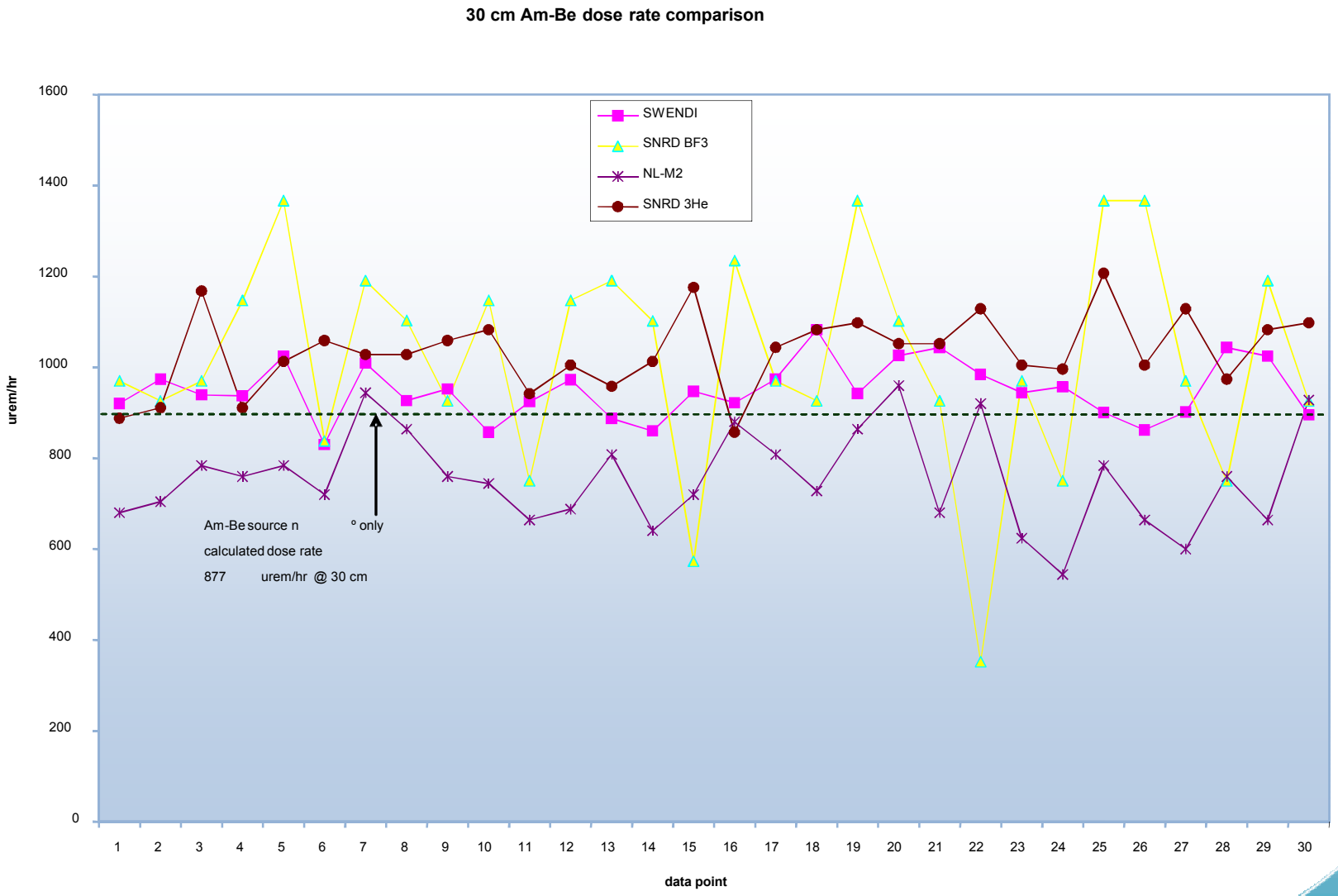
RadEye NL

- Pocket sized
- ^{3}He tube, 2.5 atm
- Sensitivity: 180 cpm per mrem/hr
- Energy range: albedo neutron dosimeter
- Weight: < 0.5 pounds

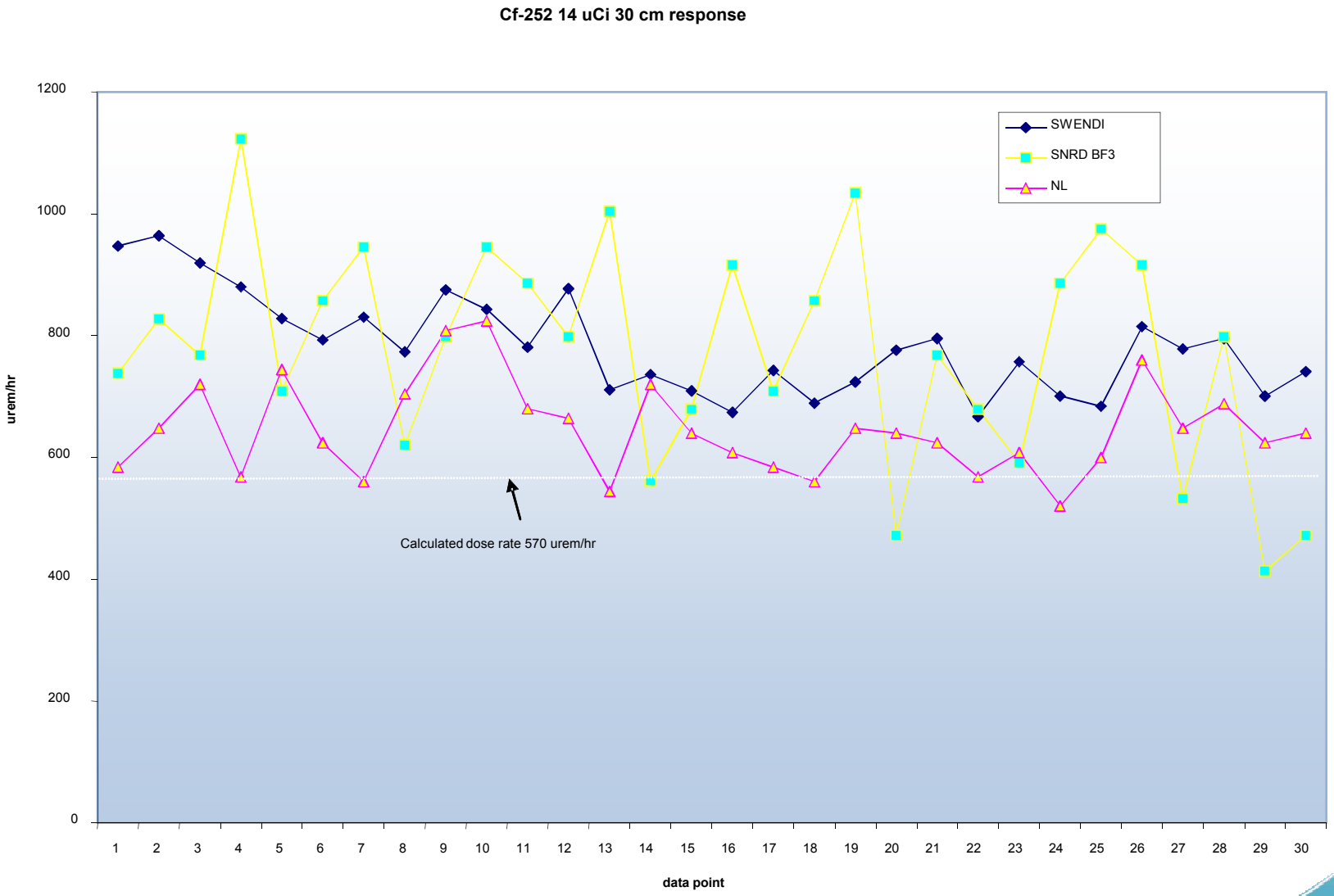
Experimental Set-up

- 30 one-minute counts for each instrument and each type of source
- Two different distances:
  - 30 cm
  - 1 meter

Results Am-Be



Results Cf-252



Results

- The NL varied from the SWENDI and SNRD by about 20% (lower) for Am-Be at 30 cm
- The NL was about 10% lower when compared to the SWENDI for Cf-252 at 1 meter
- At low doses (< 1.0 mrem/hr) the SNRD is not very precise
- At higher doses (> 5 mrem/hr) the NL corresponds well with the SWENDI (+/- 3%)

Discussion

- **The Radeye NL appears to under respond at low doses**
  - –We apply a 1.2 correction factor
  - –Only use with known, well characterized sources
  - –Very convenient for travel
  - –By-product of the chosen moderator
- **The SNRD least sensitive, least stable**
  - –Not very precise at less then 1 mrem/hr
  - –Use of a ^{3}He improves sensitivity and precision
- **The SWENDI is the most sensitive, more precise**
  - –Used for characterizing unknowns
  - –Used for low dose measurements
  - –Used to establish baselines
  - –But very heavy