

Is Your Radiation Instrument Telling You What You Think It Is?

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**Technical Presentation
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Interpretation of Radiation Measurements

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Outline for this Presentation

- Steps for defensible measurements
- Interpretation may be more about attitudes and risk perceptions, than about technology
- Two axioms on interpreting measurements
- A few anecdotes about interpretations
- Interpretation as a response to fears
- Caution leads to “precautionary principle”
- Dealing with uncertainty
- Many factors can cause measurements to be misleading

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Steps for Defensible Measurements

- 1. Deciding what to measure ?
 - Exposure or contamination ?
- 2. Choosing the proper instrument
- 3. Verifying instrument performance
- 4. Using the instrument properly
 - According to calibration ?
- If you have been careful with above steps,
 - There are still countless pitfalls
 - You now have measurements to interpret

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Two Axioms on Measurements

- 1) “Measurement results have no meaning until interpreted for a particular purpose”



They are just numbers

- 2) “Measurements only have a meaning in terms of how they are interpreted”

The meaning is whatever people believe

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Psychology of Radiation Measurements

- Interpretation may have as much to do with attitudes and perceptions as it does with technology
- Same measurements may have different meanings for others
- Examples:
 - Technician at nuclear plant, “We got a hot one here!”
 - Industrial worker saw GM meter go off scale
 - Granite counter tops
 - Firemen observing twice background
 - Screaming GM meter



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Common Aspect of Scenarios

- If its measurable, it must be bad!
- Interpretation of measurements is often a matter of responding to fears
- One person’s answer for defending conservative decision, “Why take chances?”
- Common mindset
Measurement = “Deadly Radiation”
- Risks of NOT taking action
 - Fears, criticism, responsibilities
 - Making a mistake

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Interpretation of Radiation Measurements

Questions for Interpretation ?

- What do the numbers mean ?
- Are the measurements defensible ?
- What decision do you want to make ?
- How much resources are you willing to commit on the basis of these measurements ?
- What is the risk of making a mistake ?
 - What if you act or do not act ?
 - How will you be held accountable ?
 - Possible litigation ?
 - Upset workers ? Union ? Management ?

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Making Good Decisions

- How to avoid decisions that may not be warranted by the data, false positives
 - Be skeptical, ask lots of questions before decisions
- Repeat measurements for confirmation, with other people and other instruments ideally
- Typical when finding actionable levels
 - Most want to take immediate action
- No one wants to be criticized
 - For not taking action



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Dealing with Uncertainty

- Most people do not want to deal with uncertainty, they want absolute values
- They typically do not ask questions to evaluate the data or to determine if the data are defensible
- Tendency is to assume all data are of high quality and suitable for making decisions
 - When the number is written down, it becomes reliable



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Defending Results

- Ask lots of questions
- How do you know if the data are any good ?
- Right instrument, working properly, used properly, calibration, energy dependence, geometry ?
- Report results with estimates of all sources of uncertainty,
 - Be careful of significant figures
- Always repeat for confirmation,
 - Before reporting or making expensive decisions

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Summary

- Common assumptions
 - If its measurable - it must be bad
 - Written data are always good
 - Must take immediate action
- Common to make decisions (cry wolf)
 - Without verifying the measurement
- Stay calm
- As minimum – repeat at least once
 - For confirmation, with other instruments and people, if possible



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Summary

- What do the numbers mean ?
- Measurements only have meaning in terms of interpretation
- Data interpretation may be driven by fears
 - Of radiation
 - Of consequences, health risks, liabilities
 - Of making a mistake
- Is your interpretation defensible ?
- What are you willing to commit ?

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Interpretation of Radiation Measurements

Questions ?



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