EPA-SAB-RAC Review of MARSAME

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Implementation

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Overview of Survey Design and Implementation

- Survey Design (Chapter 4)
  - Statistical Decision Making
  - Classification of M&E
  - Survey Design Optimization
  - Documenting Survey Design
- Implementation (Chapter 5)
  - Health & Safety
  - Handling M&E

Overview of Survey Design and Implementation (Cont'd)

- Implementation of Survey Design (Cont'd)
  - Segregating the M&E
  - Setting Measurement Quality Objectives
  - Determining Measurement Uncertainty
  - Determining Measurement Detectability
  - Determining Measurement Quantifiability
  - Selecting a Measurement Technique & Instrumentation Combination
  - Quality Control

Survey Design
(Chapter 4)

Statistical Decision Making (Section 4.2)

- Null & Alternative Hypothesis
  - Only one can be true
- Discrimination Limit
  - LBGR For Scenario A
  - UBGR For Scenario B
- Scenario A = Assumes M&E $\geq$ Action Level
- Scenario B = Assumes M&E $\leq$ Action Level
- Limit Type I (α) and Type II (β) Decision Errors
- Develop Operational Decision Rule

Classification of M&E (Section 4.3)

- Class 1
  - Highest potential for rad > Action Level (AL)
  - Highest potential for “hotspots”
- Class 2
  - Low potential for rad > AL
  - Little or no potential for “hotspots”
- Class 3
  - Low or no potential for rad > background
  - Insufficient evidence for non-impacted

Survey Design Optimization (Section 4.4)

- Measure 100% If Practical OR Graded Approach
- Scan-Only Surveys
  - Moving measurement of % of item
  - Individual results may or may not be recorded
- In Situ Surveys
  - Static measurement of % of item
  - Limited # measurements, long count times
- MARSSIM-Type Surveys
- Optimize Survey Design To Be Most Resource-Efficient and meet DQOs

Survey Design Optimization (Section 4.4)

- Recommended % surveyed based on classification
  - Class 1 Scan-Only or In Situ Surveys – 100%
  - Class 2 Scan-Only or In Situ Surveys –

$$\% \, Scan = \frac{(10 - \frac{\Delta}{\sigma})}{10} \times 100\%$$

  - Class 3 Scan-Only or In Situ Surveys – ≤ 10%

Documenting Survey Design (Section 4.5)

- Routine Surveys and SOPs
- Case Specific Applications

Implementation
(Chapter 5)

Health & Safety (Section 5.2)

- Physical hazards, chemical hazards and potential for injury while performing the survey
- Job Safety Analysis prior to start of work

Handling M&E (Section 5.3)

- Prepare M&E for Survey
  - Disassembly
  - Segregation
  - Physical rearrangement of M&E
- Provide Access
- Transport of the M&E may be necessary to facilitate survey

Segregating M&E (Section 5.4)

- Purpose
  - Decrease measurement uncertainty
  - Ease of handling
  - Different disposition options
- Based on physical and radiological attributes, not just radionuclide concentrations or radiation levels

Setting Measurement Quality Objectives (MQOs) (Section 5.5)

- Determine the required measurement method uncertainty at the UBGR
- Determine the required measurement method uncertainty at concentrations above the UBGR

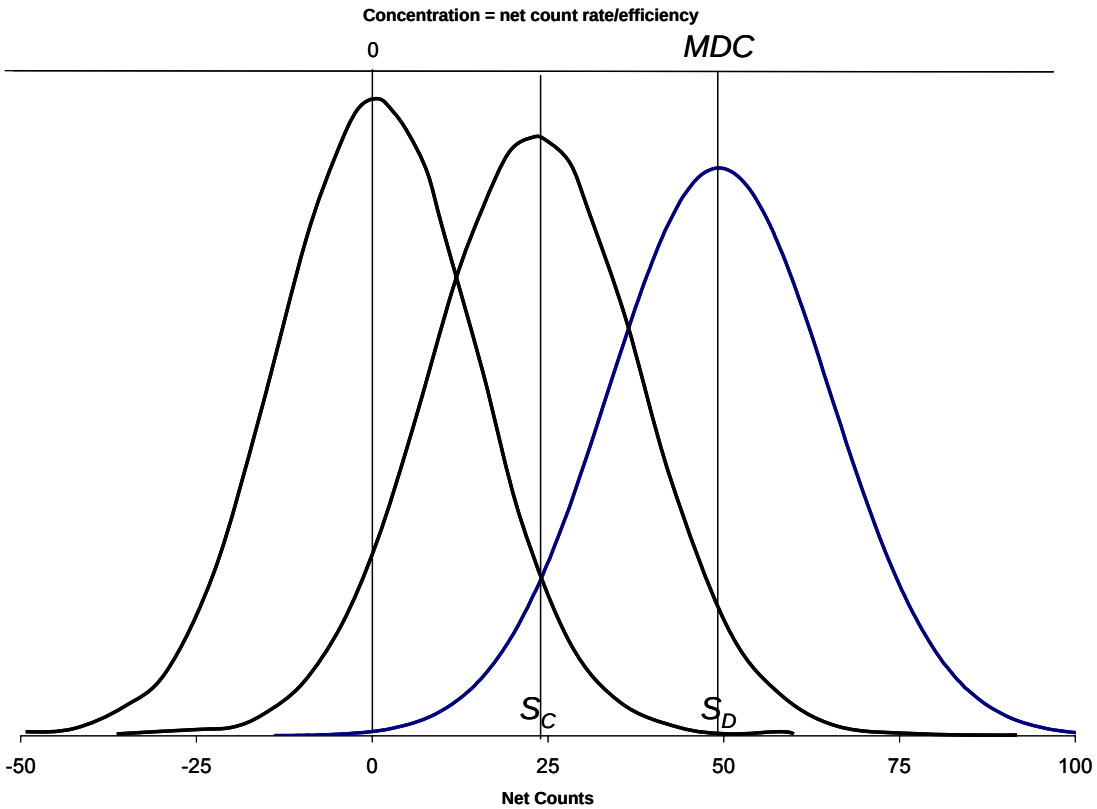
Determining Measurement Uncertainty (Section 5.6)

- Use ISO GUM terminology and procedures
- Consider additional sources of uncertainty
  - Possible to calculate manually
  - Software is available to assist

Determining Measurement Detectability (Section 5.7)

- Calculate the Critical Value (S_C)
- Calculate the Minimum Detectable Value (S_D)
- Calculate the MDC
  - The concentration at which the probability of detection is $1 - \beta$ when the detection criterion is such that the probability of false detection in a sample with zero concentration is at most α.

Determining Measurement Detectability (Section 5.7)

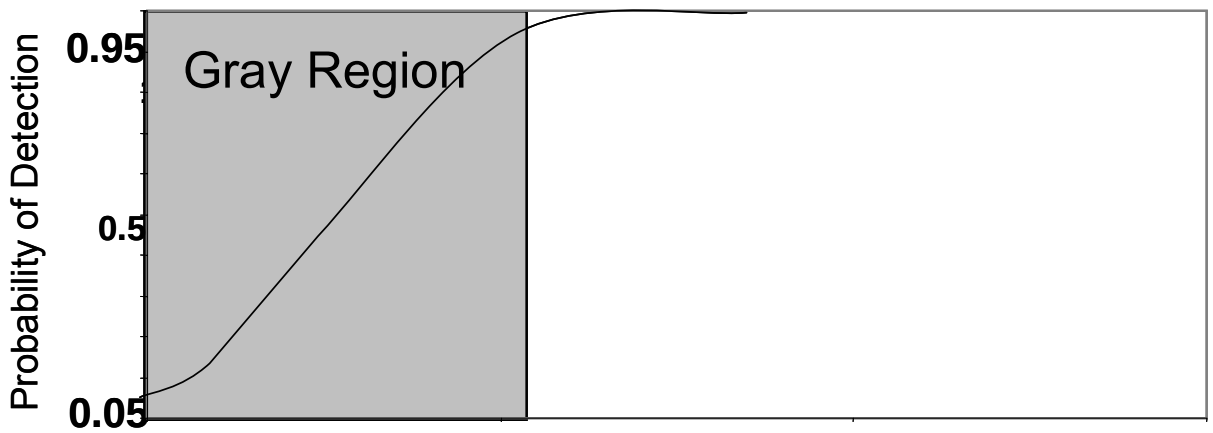


Relationship Between the Critical Value, the Minimum Detectable Net Counts and the MDC (upper x-axis in units of concentration, lower x-axis in units of net counts)

Determining Measurement Quantifiability (Section 5.8)

- Calculate the MQC
  - The concentration at which the measurement process gives results with a specified relative standard deviation.
  - By convention, 10% is specified.

Determining Measurement Detectability (Section 5.8)



Net Count:	0	S_C	S_D or LLD	N/A
Concentration:	0	N/A	MDC	MQC
Multiple of the uncertainty:	0	1.5-2.5	3-5	10

Selecting a Measurement Technique & Instrumentation Combination (Section 5.9)

- Measurement Techniques
- Instrumentation
- Measurement Method
  - Considered a combination of a measurement technique and an instrument

Quality Control (Section 5.10)

- Measurement Performance Indicators
- Instrument Performance Indicators

Questions

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DEPARTMENT OF ENERGY UNITED STATES OF AMERICA
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