OVERVIEW OF NRC MANUAL, NUREG/CR-549, ON SURVEYS FOR LICENSE TERMINATION

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ORISE

ABSTRACT

The Nuclear Regulatory Commission (NRC) has developed Draft NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination; the Manual describes a process of designing, conducting, evaluating and documenting radiological surveys in a manner which will provide a high degree of assurance that NRC guidelines and conditions for residual radioactive material in facilities have been satisfied, before they are released from licensing restrictions. The importance of quality assurance in the radiological survey process is emphasized throughout the Manual. Statistical approaches to survey design and data interpretation, recommended by the Environmental Protection Agency for evaluation of hazardous material cleanup at Superfund (CERCLA) sites, are incorporated. Although this Manual is written primarily to assist the licensee in conducting radiological surveys for decommissioning purposes, its principles and methodologies will be useful for conducting radiological surveys for decommissioning purposes, its principles and methodologies will be useful for conducting other types of radiological surveys, performed by licensees, NRC inspectors, and their contractors.

The Manual is currently undergoing extensive review and testing in decommissioning projects under actual field conditions. Following the completion of these evaluations, the Manual will be finalized.

This presentation briefly summaries the key elements in the decommissioning survey process, with emphasis on the recommended statistical aspects of survey design and methodologies for interpreting and evaluating data, relative to NRC guidelines and conditions.

OVERHEADS

Overview of NRC Manual, NUREG/CR-5849, on Surveys for License Termination

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BACKGROUND/HISTORY

- Developed for NRC/NRR
- Replaces NUREG/CR-2082 (1981)
- Complements NRC initiatives in decommissioning, e.g. updating residual activity guidelines (NUREG/CR-5512)
- Consistent with approaches of other organizations (DOE and EPA)
- Draft to be finalized after field experience

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PURPOSE/OBJECTIVES

- To present a methodology for final radiological surveys. Other procedures and methodologies may be acceptable
- To better define appropriate documentation requirements

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KEY ELEMENTS/CONCEPTS

STATISTICAL BASIS

- Overall 95% confidence level that guidelines are met
- Systematic, complete coverage of affected areas; random coverage of unaffected areas
- Minimum number of data points to enable statistically valid evaluation
- Detection/measurement sensitivities to be documented

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KEY ELEMENTS/CONCEPTS

STATISTICAL BASIS

(cont'd.)

- Uncertainties reported with data
- EPA methodology for comparison of results with guidelines
- Standard procedures for determining additional data needs

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KEY ELEMENTS/CONCEPTS

GUIDELINES AND CONDITIONS

- General
  - Survey objective is an overall 95% confidence level of meeting guidelines
  - Appropriate guideline selection is critical
  - Draft manual does not identify specific guideline values; NRC currently developing guidelines
  - Guidelines will be levels above background
  - *Average* level refers to weighted average

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KEY ELEMENTS/CONCEPTS

GUIDELINES AND CONDITIONS

(cont'd.)

- Surface activity (dpm/100 cm^2)
  - Average (over 1 m^2) levels at or below guideline value
  - Maximum levels <3 times guideline value
  - Removable activity <20% of guideline value

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KEY ELEMENTS/CONCEPTS

GUIDELINES AND CONDITIONS

(cont'd.)

- Soil activity (pCi/g)
  - Average (over 100 m^2) levels at or below guideline value
  - Maximum levels <3 times guideline value and $<(100/A)^{1/2}$, where A is the area of the elevated location

KEY ELEMENTS/CONCEPTS

GUIDELINES AND CONDITIONS

(cont'd.)

- Exposure rates (μR/h)
  - Do not exceed background at 1 m from surface by greater than guideline value
  - Average over approximately 10 m^2 for indoor areas
  - Average over 100 m^2 for outdoor areas
  - Maximum <2 times guideline value

KEY ELEMENTS/CONCEPTS

SURVEY DESIGN

- Classification of areas by contamination potential
  - Affected

    Potential or known radioactive contamination
    Location of spills and unusual occurrences with release potential
    Burial/disposal areas
  - Unaffected

    All areas not classified as affected

KEY ELEMENTS/CONCEPTS

SURVEY DESIGN

(cont'd.)

- Reference Grid Systems
  - Structures
    Affected areas: 1 m x 1 m
    Unaffected areas: not required
  - Grounds
    Affected areas: 10 m x 10 m
    Unaffected areas: not required
    Hot spot evaluation: 5 m triangular grid

KEY ELEMENTS/CONCEPTS

SURVEY DESIGN

(cont'd.)

- Survey units
  - Contiguous areas with common history or characteristics
  - Maximum survey unit size

    Affected area:
    Structures 100 m^2
    Grounds 10,000 m^2

    Unaffected areas: not limited

KEY ELEMENTS/CONCEPTS

SURVEY DESIGN

(cont'd.)

- Scanning to evaluate general conditions and identify *hot spots*
  - 100% coverage of affected areas
  - 10% of unaffected areas
  - Scan for all radiations that might be detectable
  - Optimize selection of instrument/technique; sensitivity of <25% of guideline value is performance target

KEY ELEMENTS/CONCEPTS

SURVEY DESIGN

(cont'd.)

- Measurement/sampling locations
  - Systematic, thorough coverage of affected areas
  - Surface activity measurement frequency depends on scanning sensitivity

    <25% of guideline, interval is 2 m
    >25% of guideline, interval is 1 m
  - Random coverage of unaffected areas
  - Minimum of 30 data points per survey unit

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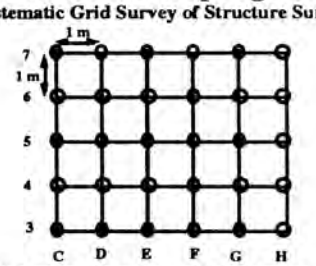
Standard Measurement/Sampling Pattern

Systematic Grid Survey of Structure Surfaces



● If scanning technique can detect <25% of guideline level
O If scanning technique cannot detect <25% of guideline level

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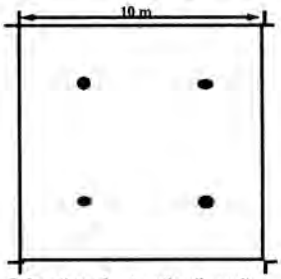
Standard Sampling Pattern

Systematic Sampling of Soil



● Locations of systematic soil sampling

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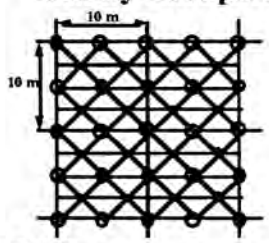
Soil Sampling Pattern to Identify Hot Spots



● Systematic sampling locations
O Additional sampling locations to provide close-spaced triangular grid patterns

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KEY ELEMENTS/CONCEPTS

DATA EVALUATION

- Uncertainties and detection sensitivities provided

  250 ± 100 (75)[a]
  -100 ± 200 (250)[a]
  0 ± 10 (12)[a]

[a]Indicates detection/measurement sensitivity

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KEY ELEMENTS/CONCEPTS

DATA EVALUATION

(cont'd.)

- Compare survey data with all applicable guidelines for evaluated areas

  X_{max} < Maximum guideline

  $\overline{X}$ < Average guideline

  μ_α $\quad \overline{X} + t_{1-\alpha, df} \frac{s_X}{\sqrt{n}}$

  μ_α < Average guideline; if not, remediate or obtain additional samples

  Perform for each survey unit

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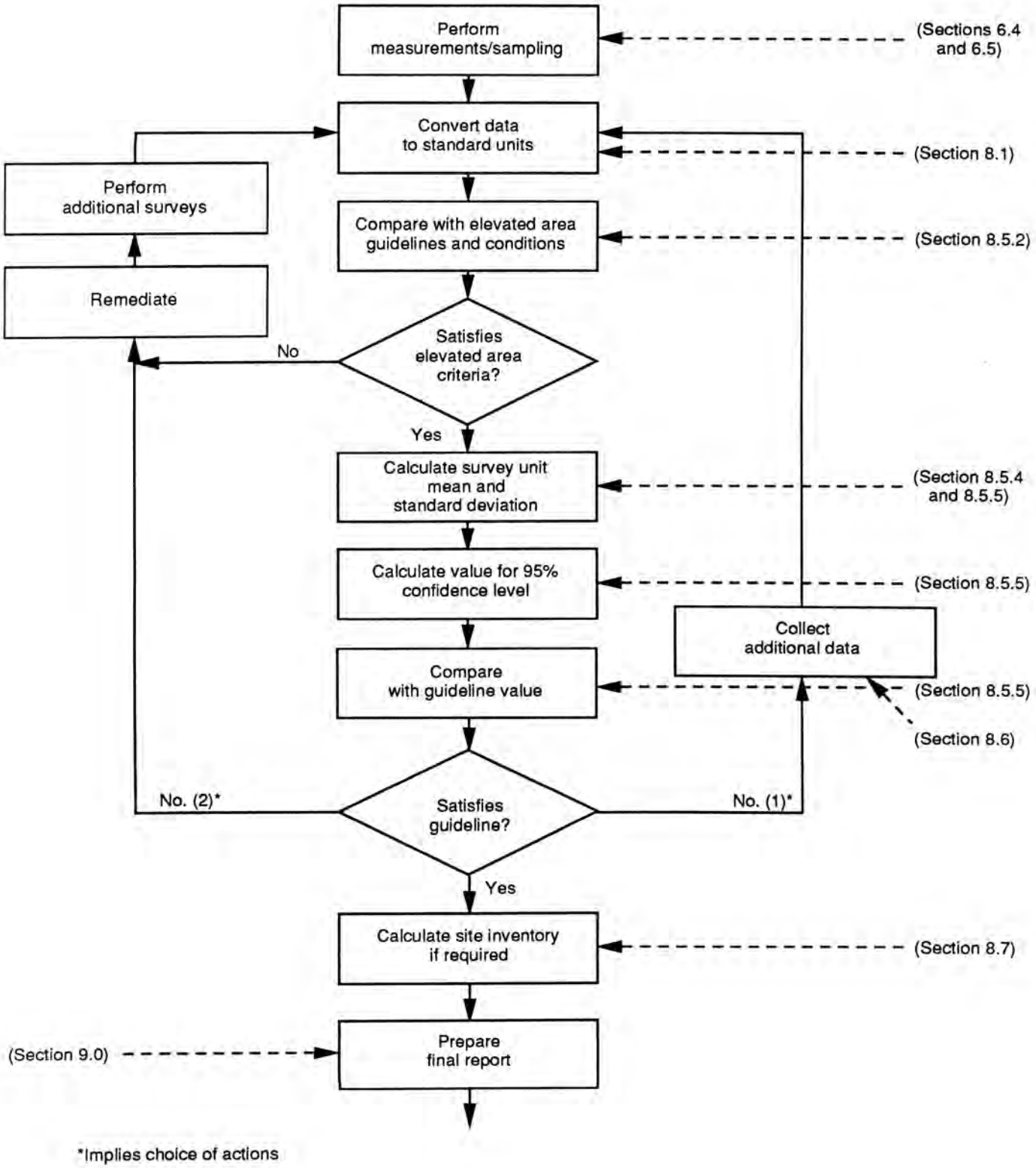

FIGURE 8-1: Flow Diagram for Interpreting and Comparing Survey Data with Guideline Value