

Final Site Release Surveys: Application of NUREG/CR-5849

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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

PURPOSE/OBJECTIVES

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

KEY ELEMENTS/CONCEPTS STATISTICAL BASIS

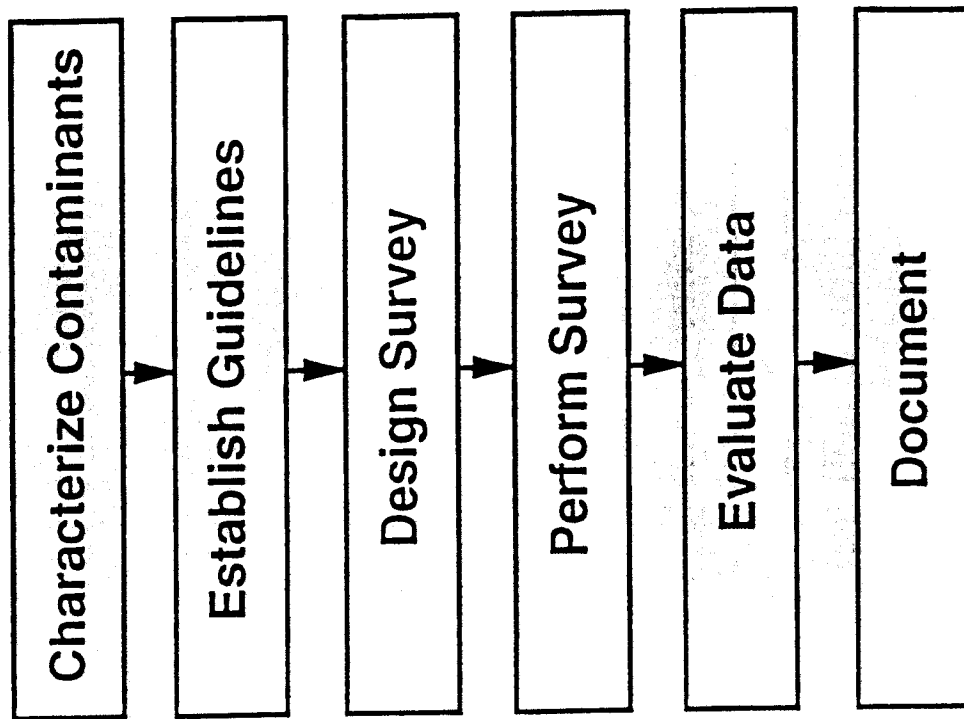
- Overall 95% confidence level that guidelines are met
- Systematic, complete coverage of affected areas; random coverage of unaffected areas
- Minimum number of data points to enable statistically valid evaluation
- Detection/measurement sensitivities to be documented

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**

PRINCIPLE COMPONENTS OF SURVEYS FOR LICENSE TERMINATION



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

KEY ELEMENTS/CONCEPTS

GUIDELINES AND CONDITIONS

(cont'd.)

- Surface activity (dpm/100 cm²)
 - Average (over 1 m²) levels at or below guideline value
 - Maximum levels <3 times guideline value
 - Removable activity <20% of guideline value

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

* To be changed
to higher

KEY ELEMENTS/CONCEPTS

GUIDELINES AND CONDITIONS

(cont'd.)

■ Exposure rates ($\mu\text{R/h}$)

- Do not exceed background at 1 m from surface by greater than guideline value
- Average over approximately 10 m² for indoor areas
- Average over 100 m² 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.)

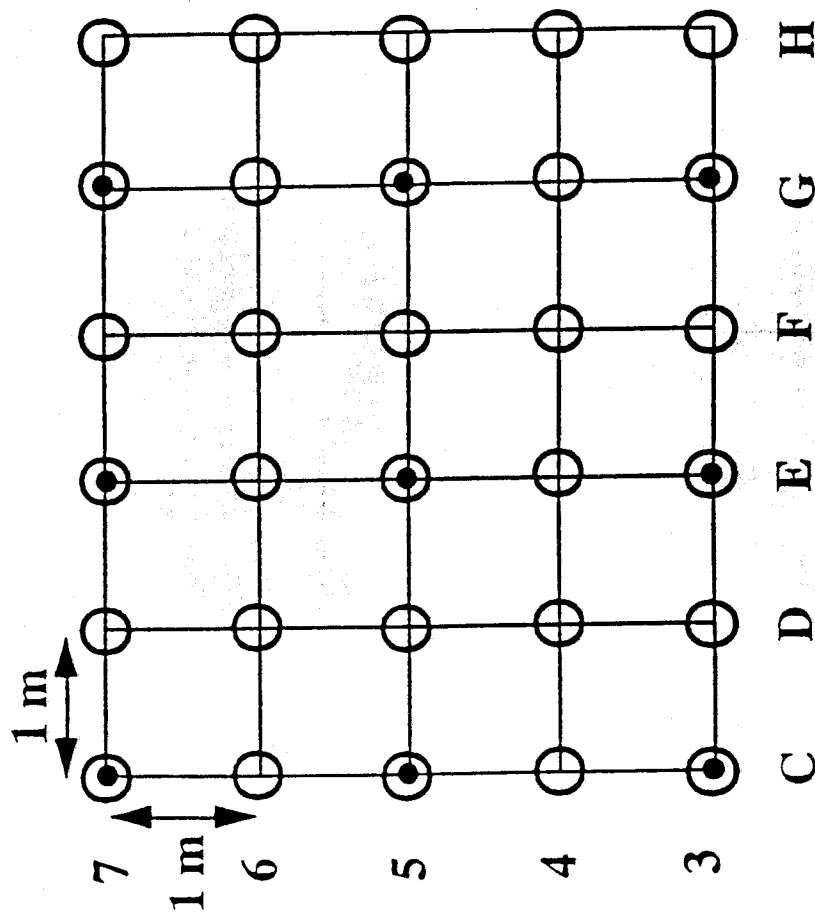
■ Measurement/sampling locations

- 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

Standard

Measurement/Sampling Pattern

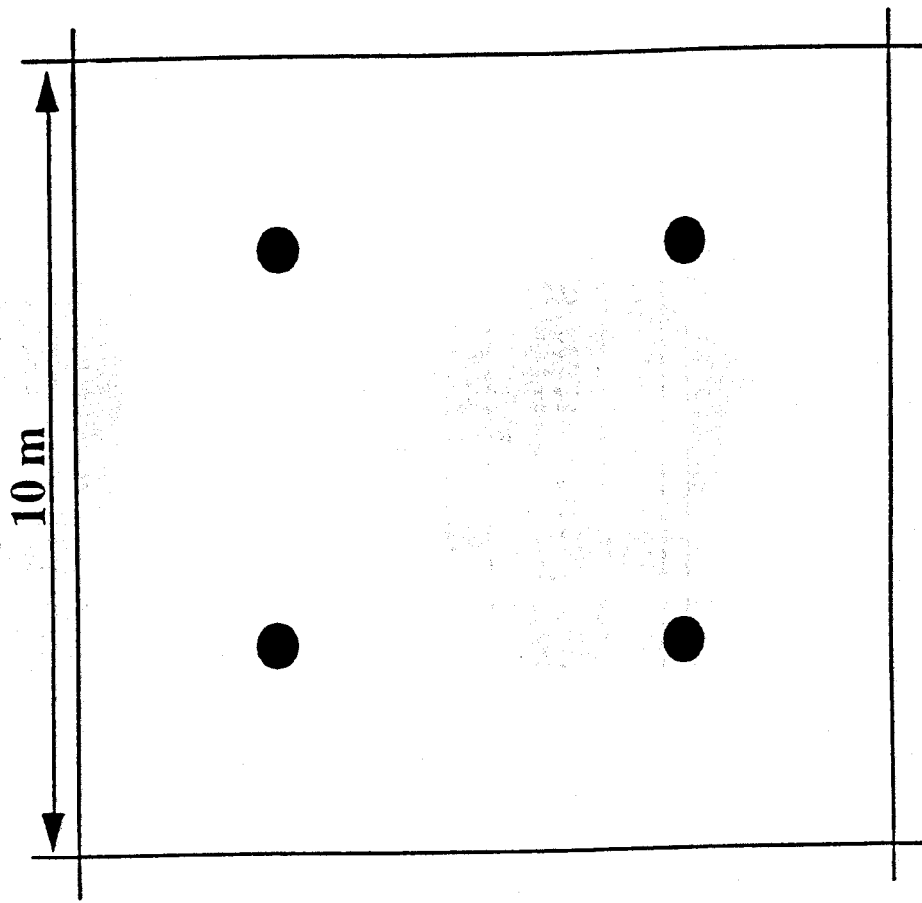
Systematic Grid Survey of Structure Surfaces



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

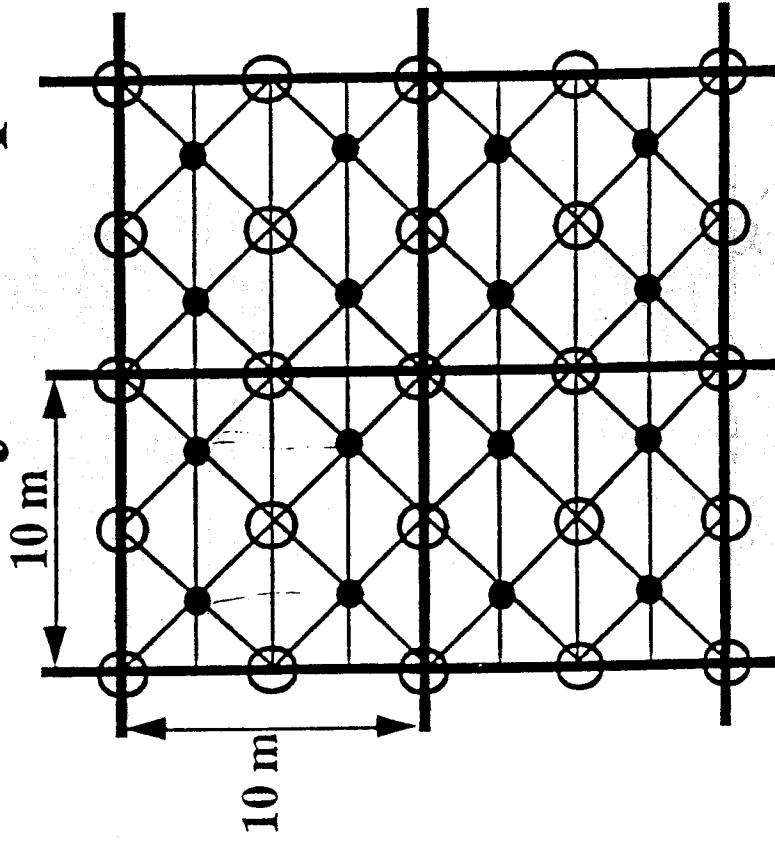
Standard Sampling Pattern

Systematic Sampling of Soil



● Locations of systematic soil sampling

Soil Sampling Pattern to Identify Hot Spots



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

KEY ELEMENTS/CONCEPTS DATA EVALUATION

■ Uncertainties and detection sensitivities provided

$$\begin{array}{rcl} 250 \pm 100 & (75)^a \\ -100 \pm 200 & (250)^a \\ 0 \pm 10 & (12)^a \end{array}$$

^aIndicates detection/measurement sensitivity

KEY ELEMENTS/CONCEPTS DATA EVALUATION

(cont'd.)

- Compare survey data with all applicable guidelines for evaluated areas

$X_{\max}$ < Maximum guideline

$\bar{X}$ < Average guideline

μ_{α} $\bar{X} + t_{1-\alpha, df} \frac{S_X}{\sqrt{n}}$

μ_{α} < Average guideline; if not, remediate or obtain additional samples

Perform for each survey unit

PURPOSE OF CONFIRMATION

- **Conduct independent third party overview**
- **Evaluate adequacy of documentation**
- **Evaluate procedures**
- **Validate accuracy of field measurement and analytical techniques**

CONFIRMATORY ACTIVITIES

- Document review
- Confirmatory sample analysis
- Independent confirmatory surveys

ISSUES FROM PROGRAM EXPERIENCE

(cont'd.)

■ Survey

- Selection of inadequate/inappropriate instrumentation
- Lack of information on survey methodology
- No surface scans conducted
- Inadequate sample analyses