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September 19, 2002

Mr. James A. Mills, P.E.
U.S. Army Corps of Engineers, St. Louis District
Contracting Officer's Representative
CEMVS-ED-C
1222 Spruce Street
St. Louis, MO 63103

1526.20020919.001

RE: Contract No. DACW43-00-D-0515, Task Order 0004
Transmittal of Revision C of the Methodology for Release of Railroad Ties from the
St. Louis FUSRAP Sites

Dear Mr. Mills:

Please find enclosed a copy of Revision C of the *Methodology for Release of Railroad Ties from the St. Louis FUSRAP Sites* for your review. This paper is being submitted as requested by the USACE St. Louis District Health Physicist. All comments received have been incorporated into this version. A copy of the response to comments is attached.

We appreciate the opportunity to serve the United States Army Corps of Engineers on this project. If you have any questions please call me at (314) 770-3027 or Steve Passig at (314) 770-3026.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Randy C. Hansen
Task Manager

cak

encl.

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Contractor: SAIC	Contract Number DACW43-00-D-0515	Document Date: August 2002
Revision 0	TECHNICAL WORK RECORD 01-010 METHODOLOGY FOR RELEASE OF RAILROAD TIES FROM THE ST. LOUIS FUSRAP SITES	
	Comments from D. McKinley Dated August 19, 2002	

Comment Number	Page/Section/ Paragraph	Comment	Response
1	General	Instead of focusing only on railroad ties, should this Technical Work Record (TWR) be expanded to apply to any porous media encountered at the St. Louis FUSRAP Sites (SLS)? In fact, it was my understanding that this TWR would apply to any porous media, not just railroad ties. If this TWR would apply to any porous media, suggest the TWR be revised to reflect this larger application.	This TWR was not intended to apply to all porous media. It can be expanded to include any type of wood encountered. Another paper is currently in development that will address other types of consolidated material. The information from this paper will be used for wood types of consolidated materials in the other paper.
2	General	Suggest acronyms and abbreviations be defined the first time they are used (e.g., dpm/cm ² , RAM, pCi/g, etc.).	Agree.
3	Title Page	Since this TWR is being sent out for regulator review, suggest "Revision 0" be revised to read "Revision B" in keeping with the nomenclature currently in use.	Agree.
4	P1, §1.0, ¶1	<p>First sentence. This sentence refers to the document as a paper, when the title page identifies it as a TWR. Also, the sentence appears to imply that only those ties released are to be surveyed. In fact, Figure 1 appears to indicate that every impacted tie is to be surveyed. Therefore, suggest the first sentence be rewritten as follows: "The purpose of this Technical Work Record (TWR-01-010) is to provide...(SLS) in order to allow for the release without radiological restrictions of those ties that meet the criteria established herein."</p> <p>Second sentence. The sentence appears to imply that all ties surveyed are to meet the appropriate criteria. In fact, only those ties actually released without restriction must meet the criteria. Therefore, suggest the sentence be rewritten as follows: "Railroad ties released without use restrictions...Release."</p> <p>Third sentence. Plural subject/singular verb - "meets" should be "meet".</p>	<p>Agree that the paper should be referred to as a TWR consistently throughout.</p> <p>Agree that the 1st sentence was unclear. Changed to read, "The purpose of this technical work record (TWR) is to provide decision logic necessary to determine if railroad ties encountered during remedial activities at the St. Louis FUSRAP Sites (SLS) are impacted by radionuclides and appropriate survey methodologies to allow for the unrestricted release of those RR ties that meet the criteria established herein."</p> <p>Second sentence: Agree. Wording changed to read: "Impacted railroad ties shall be surveyed to determine if they meet the appropriate surficial</p>

		<p>Penultimate sentence. This sentence appears to imply that only those ties released are to be surveyed. Suggest the sentence be rewritten as follows: "The railroad ties determined to be impacted will require surveying...Ties."</p> <p>Last sentence. This sentence appears to imply that only those results for ties that are ultimately released are to be documented. However, Section 6.0 appears to imply that results for every tie surveyed are to be documented. Please clarify this discrepancy. I believe all survey results should be documented, regardless of whether the tie is released or not, as implied by Section 6.0.</p>	<p>release criteria specified in the Nuclear Regulatory Guide 1.86 (RG 1.86), "Termination of Operating Licenses for Nuclear Reactors" and the volumetric release criteria specified in American National Standard ANSI/HPS N13.12 – 1999, "Surface and Volume Radioactivity Standards for Unrestricted release."</p> <p>Third sentence: Agree</p> <p>Penultimate sentence: Agree. Sentence changed to read, "The railroad ties determined to be impacted require surveying with handheld instrumentation (for total contamination levels), survey for removable contamination levels, and volumetric testing (when applicable) as in Figure 1, <i>Survey Protocol for Release of Railroad Ties</i>."</p> <p>Last sentence: Agree. Sentence changed to read, "The surveyor shall document the results of all surficial and volumetric testing results."</p>
5	Figure 1	<p>Suggest the figure be footnoted and/or a discussion added to the text to present the criteria and decision logic to be utilized in the field to determine whether or not a tie is potentially impacted by MED/AEC contamination as opposed to other potential sources (e.g., at SLDS, potential CT contamination is a concern). Alternatively, suggest the text in the first box be rewritten as follows: "Determine if railroad tie is potentially impacted".</p>	<p>Agree that first box is too restrictive. The first box has been changed to read, "Is the RR tie located in an area for which USACE has determined remediation to be appropriate?"</p> <p>No – RR tie not impacted. No survey required for unrestricted release.</p> <p>Yes – Points to next box, "Remove gross debris from RR tie"</p>
6	P 3, ¶1	<p>First sentence. Please capitalize "Release".</p> <p>Last sentence. Suggest "this paper" be replaced with "this TWR".</p>	<p>Agree. Release has been capitalized.</p> <p>Agree. Text changed as suggested.</p>
7	P3, §3.0, ¶1	<p>Last sentence. It is unclear whether the approach presented for calculating MDCs is generic for any survey process at the SLS that is also to be applied to railroad ties or whether the approach presented for calculating MDCs is specific to the survey process for railroad ties. Please revise the text to clarify.</p>	<p>Agree. Added text to clarify that the MDCs are specific to RR ties.</p>

8	P3, §3.0, ¶2	A verb tense and/or form different from that used in the rest of the TWR is used here. Suggest the verb tense and/or form be revised to be consistent with the rest of the TWR.	Agree. Sentence rewritten.
9	P5, §5.0, ¶2	<p>This paragraph (as well as the preceding paragraph) appears to indicate that both multiple representative measurement sampling and single measurement sampling may be appropriate. However, Figure 1 only mentions the single measurement technique. Please clarify this apparent discrepancy.</p> <p>First sentence. This sentence uses the phrase "single measurement techniques", implying more than one technique can be used. Suggest these various techniques be identified in the text or the document in which these techniques are identified be referenced.</p> <p>This paragraph appears to imply that only in those instances where volumetric activity concentrations are homogeneously distributed throughout the material (I assume "material" refers to "railroad tie") are single measurement techniques to be used. It is unclear what "process knowledge" could be used to support the determination that volumetric activity concentrations are homogeneously distributed throughout a railroad tie. My own personal experience at operational wood treating sites has shown that obtaining the relatively homogeneous distribution of creosote (or even pentachlorophenol) in a railroad tie requires the use of extreme heat and pressure. Therefore, I find it difficult to justify an assumption that volumetric radiological activity concentrations are homogeneously distributed throughout a railroad tie. Thus, I believe that one sample per railroad tie, as stated in Figure 1, is not representative of the potential volumetric contamination of a tie.</p>	<p>Agree. Text changed in several areas to clarify the discrepancy.</p> <p>Text changed to clarify.</p> <p>Defer to your experience. Removed entire sentence.</p> <p>Note that the whole point here is that if a RR tie is determined to be potentially impacted then it will be scanned over an appropriate percentage of its surface based on the potential for contamination. It is unlikely that any tie that is not contaminated on its surface will be contaminated volumetrically. Therefore, there is no reason to collect a volumetric sample unless the tie surface is contaminated near (>80%) the surficial release criteria. The only reason for taking any volumetric sample is because the RR tie is porous and has some potential to be volumetrically contaminated (in my opinion a very small potential). Taking a volumetric sample at the location of highest activity noted during the scan makes the most sense to determine if the RR tie is impacted volumetrically.</p> <p>Agree that taking one sample is not representative of the potential contamination of a tie. It is conservative and represents the probable worst case volumetric contamination. That is the whole point. Minimize the cost to determine if the tie is</p>

			<p>impacted. If the area with the highest surficial contamination has volumetric contamination less than the volumetric criteria, then the tie does not require further volumetric sampling and can be determined to be non-impacted volumetrically. At that point the only question that remains is: Can the tie be released based on surficial survey results? If so, then the tie should be released.</p>
10	P6, §6.0	<p>Suggest the document(s) on which this information is to be recorded (e.g., field logbook) be identified in the text. Also, suggest the location where the records are to be maintained also be identified. Alternatively, suggest that the records are to be maintained in accordance with the Sampling and Analysis Guide.</p>	<p>Disagree. Whoever is responsible for the survey should document the survey in accordance with their RPP survey procedures just like they would if they surveyed a tool for unrestricted release. Records will be maintained with site RPP records.</p>

**SAIC
TECHNICAL WORK RECORD 01-010
METHODOLOGY FOR RELEASE OF RAILROAD TIES
FROM THE
ST. LOUIS FUSRAP SITES**

**REVISION C
ST. LOUIS, MISSOURI**

**PREPARED FOR
U.S. ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT**

CONTRACT No. DACW43-00-D-0515

SEPTEMBER 2002

1.0 INTRODUCTION

The purpose of this technical work record (TWR) is to provide decision logic necessary to determine if railroad (RR) ties encountered during remedial activities at the St. Louis FUSRAP Sites are impacted by radionuclides and appropriate survey methodologies to allow for the unrestricted release of those RR ties that meet the criteria established herein.

The United States Army Corps of Engineers (USACE) conducted a cost analysis and has determined that in most cases it would be more cost effective to simply dispose of impacted RR ties than to survey them for release. The disposition of RR ties (i.e., survey versus direct disposal) will be determined on a case by case basis by the USACE. Impacted RR ties not slated for direct disposal (hereafter referred to as impacted RR ties) shall be surveyed to determine if they meet the appropriate surficial release criteria specified in the Nuclear Regulatory Guide 1.86 (RG 1.86), "*Termination of Operating Licenses for Nuclear Reactors*" and the volumetric release criteria specified in American National Standard Institute (ANSI), ANSI/HPS N13.12 – 1999, "*Surface and Volume Radioactivity Standards for Unrestricted Release* (ANSI 1999; NRC 1974). Impacted RR ties with survey results that do not exceed the criteria above may be released for unrestricted use.

RG 1.86 and ANSI 13.12 guidance meet the intent of the *Record of Decision (ROD)* for the *St. Louis Downtown Site* and the *Engineering Evaluation/Cost Analysis for the Hazelwood Interim Storage and St. Louis Airport Sites* attainment of applicable or relevant and appropriate requirements (ARARs). The RR ties determined to be impacted require surveying with handheld instrumentation (for total contamination levels), survey for removable contamination levels, and volumetric testing (when applicable) as in Figure 1, Survey Protocol for Release of Railroad Ties. The surveyor shall document the results of all surficial and volumetric testing.

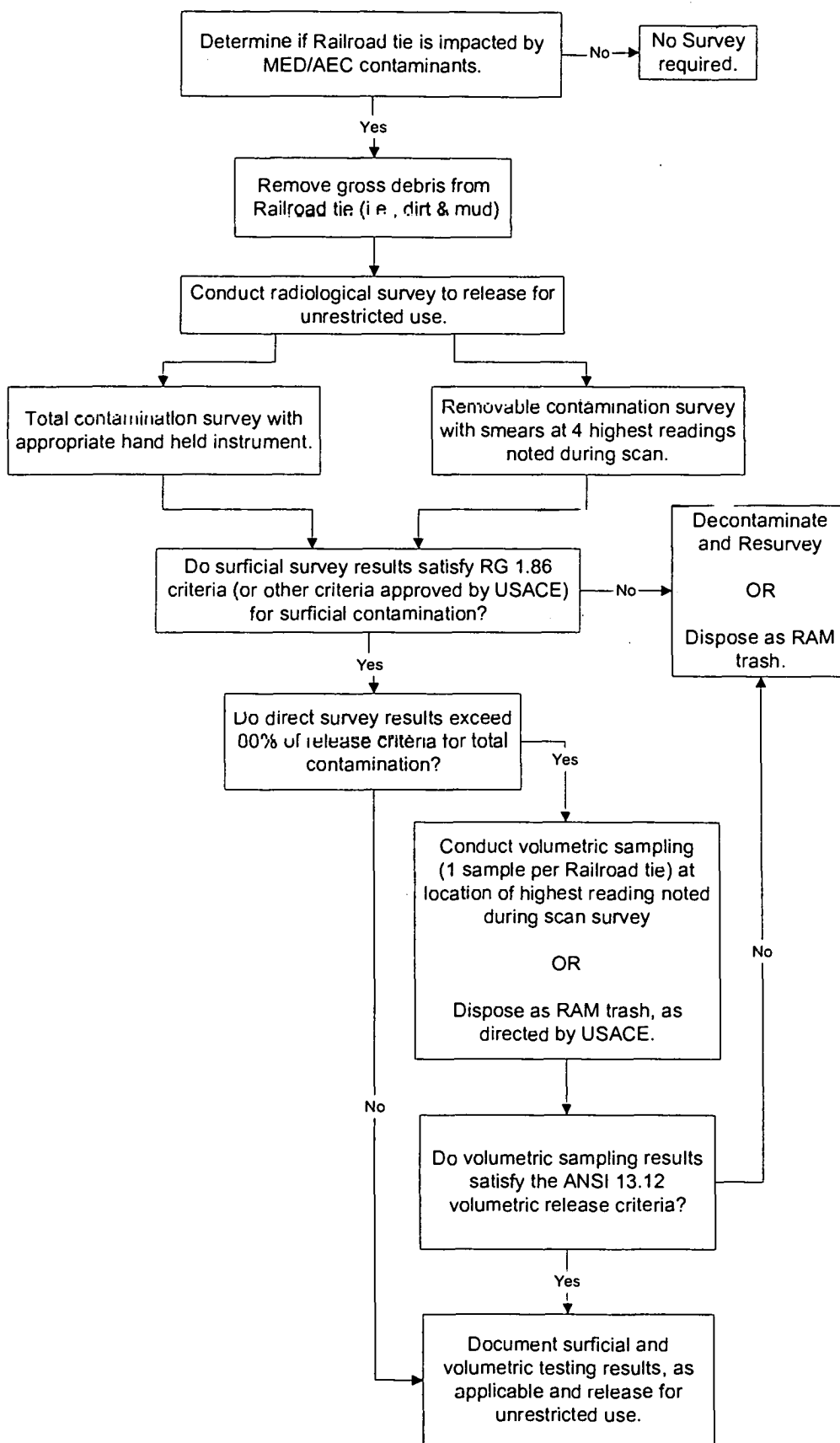
2.0 RELEASE CRITERIA

RG 1.86 provides criteria (Table 1), which are protective of the public health and the environment, and have historically been used as the basis for surficial limits (disintegrations per minute per 100 square centimeter or dpm/100 cm²) for unrestricted release of equipment and material from nuclear facilities. RG 1.86 contains no risk or dose based support for the surficial limits presented; however, the limits are conservative as compared to more recent guidance such as ANSI 13.12 and NUREG-1640, "*Radiological Assessments for Clearance of Equipment and Materials From Nuclear Facilities*" (NRC, 1998), which were derived based on a primary dose criterion of 1 millirem/year (mrem/yr) to a member of the modeled critical group of receptors.

Table 1 – RG 1.86 Surficial Release Criteria

	Total Contamination (dpm/100 cm²)	Removable Contamination (dpm/100 cm²)
Gross Alpha	100	20
Gross Beta	5,000	1,000

Figure 1. Survey Protocol for Release of Railroad Ties



ANSI/HPS N13.12 – 1999, *Surface and Volume Radioactivity Standards for Unrestricted Release* (ANSI, 1999) provides criteria in picocurie per gram (pCi/g), which are protective of the public health and the environment, for unrestricted release of items and materials. The release criterion listed in ANSI 1999 for unrestricted release are divided into four groups based on similarity of exposure and potential dose. For the St. Louis FUSRAP Sites projects, natural uranium, uranium 238 (U-238), radium 226 (Ra-226), thorium 230 (Th-230) and associated decay chains are the primary contaminants. The two groups of ANSI 1999 criteria applicable to the St. Louis FUSRAP Sites are provided in Table 2 below. RG 1.86 does not address materials that may be volumetrically contaminated, therefore, ANSI 13.12 criteria will be used to test the railroad ties for volumetric contamination if required by the methodology provided in this TWR.

Table 2 – ANSI 13.12 Volumetric Release Criteria

Radionuclide Groups	Volume Screening (pCi/g)
Radium, and thorium: Ra-226, Ra-228, Th-228, Th-230, Th-232, and associated decay chains, and others	3
Uranium: U-234, U-235, U-238, natural uranium, and others	30

3.0 MINIMUM DETECTABLE CONCENTRATIONS

NUREG 1507, *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions* (NRC, 1998), and NUREG 1575, *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) (DoD, 2000) provide methodology for calculation of minimum detectable concentrations (MDCs). The MDC is the minimum concentration of the contaminant that can be measured with certainty. The MDC is mainly dependent on background count rate and the efficiency of the detector to detect the contaminant on the surface being surveyed. Scan MDC is also very dependent on the speed at which the surveyor moves the detector probe along the surface being surveyed. It is necessary to determine the MDC for an instrument to demonstrate that the instrument selected for the survey is sensitive enough to detect the contaminant at or below the release criterion. The following details the approach for calculating site specific MDCs for uranium, radium, and thorium for use in the RR tie survey process at the St. Louis FUSRAP Sites.

The steps utilized for calculating MDCs follow the approach detailed in NUREG 1507 (NRC, 1998). The steps include:

1. Calculate the minimum detectable count rate (MDCR) by selecting a given level of performance, scan speed, and background level of the detector; and
2. Select a surveyor efficiency, if applicable.

Using the methodology outlined in NUREG-1507, the following lists the calculated MDCs for instrumentation anticipated for these surveys.

Ludlum 43-89 Alpha-Beta Scintillation Instrument (or equivalent)

Alpha Scan measurements

Background = 2.0 cpm (treated wood)
Probe dimensions: 3.0" x 6.5"
Probe active area: 125 cm²
Probe speed = 0.5 inch/second
 $\epsilon_i = 0.13$
 $\epsilon_s = 0.54$ (treated wood)
 $p = 0.50$
 $d' = 1.38$
cpm = counts per minute
MDC = 78 dpm/100 cm²

Beta Scan measurements

Background = 275 cpm
Probe dimensions: 3.0" x 6.5"
Probe active area: 125 cm²
Probe speed = 2 inches/second
 $\epsilon_i = 0.25$
 $\epsilon_s = 0.50$ (treated wood)
 $p = 0.50$
 $d' = 1.38$
cpm = counts per minute
MDC = 1025 dpm/100 cm²

Alpha Fixed measurements

Background = 2.0 cpm (treated wood)
Probe active area: 125 cm²
 $T_b = 1$ minute
 $T_s = 2$ minutes
 $\epsilon_i = 0.13$
 $\epsilon_s = 0.54$ (treated wood)
cpm = counts per minute
MDC = 80 dpm/100 cm²

Beta Fixed measurements

Background = 275 cpm
Probe active area: 125 cm²
 $T_b = 1$ minute
 $T_s = 0.5$ minute
 $\epsilon_i = 0.25$
 $\epsilon_s = 0.50$ (treated wood)
cpm = counts per minute
MDC = 639 dpm/100 cm²

Ludlum 43-10-1 / 2929 Bench Scaler Combination (or equivalent)

Alpha measurements

Background = 0.1 cpm
 $\epsilon_i = 0.30$
 $t_s = 1$ minute
 $t_b = 1$ minute
cpm = counts per minute
MDA = 14 dpm

Beta measurements

Background = 50 cpm
 $\epsilon_i = 0.40$
 $t_s = 1$ minute
 $t_b = 1$ minute
cpm = counts per minute
MDA = 89 dpm

4.0 IMPLEMENTATION

Measurement of the quantity of radioactive material on or in impacted RR ties shall be performed to verify compliance with the surficial and/or volumetric release criteria described in Section 2.0. Radiological measurements performed for the purpose of unrestricted release shall include direct field surveys of the item (surficial contamination), measurement of removable contamination (surficial contamination), and laboratory analysis of representative samples of the item (volumetric contamination), as described in Figure 1, Survey Protocol for Release of Railroad Ties and the guidance below.

The first step in the evaluation process (as outlined in Figure 1) for RR ties should be to define if they are impacted or not impacted. Historical samples, process knowledge, contamination levels of the soil in the general area of the RR ties, and the history of the actual RR ties should be used to determine if the ties are impacted. The RR ties should be evaluated independently of the area classification where the ties are located.

If it is determined that the RR ties are impacted, a graded approach similar to MARSSIM should be used to determine scan survey requirements as follows.

- RR ties that have, or had prior to decontamination efforts, a potential for radioactive contamination or known contamination in excess of the release limits will require a 100% scan coverage.
- RR ties that have, or had prior to decontamination efforts, a potential for radioactive contamination or known contamination above background but less than the release criteria will require at least a 10% scan survey. The scan survey shall concentrate on areas of highest expected contamination. For example, the survey supervisor shall evaluate the RR tie and direct the scan to the areas of highest potential.
- RR ties that are designated as impacted but with no expectation of residual contamination, or to contain residual contamination at a fraction above background shall be scanned on a biased judgment made by the survey supervisor.

5.0 CONCENTRATION AVERAGING

Averaging is inherent to the radiological measurement process for determining both surface activity and volumetric activity concentrations. When measuring activity levels on or in items for unrestricted release, a determination of the average radionuclide concentrations should be performed such that:

1. Multiple surface measurements (direct scans or fixed point measurements in areas where elevated activity is found) are averaged over a surface area not to exceed 1 square meter (m^2). For items with a surface area less than $1 m^2$, an average over the entire surface shall be derived for each item.
2. Multiple volumetric samples are not necessary for release of the RR ties; therefore, averaging is not applicable to volumetric sampling activities. Volumetric samples are only required if surface scans exceed 80% of the release

criteria for total surficial contamination and will only be collected at one location (e.g., the location of highest activity noted during the scan survey).

3. No single measurement made to calculate an average surface activity shall exceed 3 times the surface release criteria.

In lieu of multiple representative measurement sampling, single measurements may be used to determine conformance with the volumetric release criteria, if appropriate. Process knowledge may be used to support the determination that the volumetric activity concentrations are homogeneously distributed throughout the material.

6.0 RECORDS

The following records shall be maintained:

1. Description of item(s) surveyed. The description should be sufficiently complete to permit a knowledgeable person to identify the item(s) and to associate the description with the survey results for the item(s).
2. Surficial and volumetric survey results, date, and identity of the person who performed the survey.
3. Archived procedures or records that specify pertinent details of calibration, operating instructions, personnel training, derivation of efficiencies and conversion factors, and other technical details of the unrestricted release method.

7.0 REFERENCES

American National Standard Institute (ANSI) 1999. *Surface and Volume Radioactivity Standards for Unrestricted Release*, ANSI/HPS N13.12, Health Physics Society, August.

Nuclear Regulatory Commission (NRC) 1974. *Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors*, June.

NRC 1998. *Radiological Assessments for Clearance of Equipment and Materials from Nuclear Facilities*, December.

NRC 1998. *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*, NUREG-1507, June.

DoD 2000. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, NUREG-1575, EPA 402-R-97-016, Revision 1, August.

FUSRAP Document Management System

Year ID

00 3370

Further Info?

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Operating Unit

St. Louis Sites

Site

Area

MARKS Number

FN:1110-1-8100g

Primary Document Type

Site Management

Secondary Document Type

Reference Documents

Subject or Title

Revision C of the Methodology for Release of Railroad Ties from the St. Louis FUSRAP Sites (with SAIC transmittal letter and Response to USACE Comments)

Author/Originator

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Company

SAIC

Date

9/19/2002

Recipient(s)

James Mills

Company (-ies)

CEMVS-ED-C

Version

Final

Original's Location

Central Files

Document Format

Paper

Confidential File?

☐

Comments

SAIC number

Bechtel ID

Include in which AR(s)?

- ☐ North County
- ☐ Madison
- ☐ Downtown
- ☐ Iowa

ETL

Filed in Volume

