DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
8945 LATTY AVENUE
BERKELEY, MISSOURI 63134

REPLY TO
ATTENTION OF:

February 10, 2003

Formerly Utilized Sites Remedial Action Program

Subject: Revision 0 - Iowa Army Ammunition Plant Site Reconnaissance Survey for Buildings L-37-1, L-37-2, L-37-3 dated February 2003

Mr. Don Flater
Iowa Department of Public Health
401 SW 7th Street, Suite D
Des Moines, Iowa 50309-0075

Dear Mr. Flater:

Enclosed are two copies of the final Iowa Army Ammunition Plant Site Reconnaissance Survey for Buildings L-37-1, L-37-2, L-37-3, Rev. 0 for your files. In addition, a copy of our response to your comments has been included. Copies of these documents are also being provided directly to both Mr. Randy Rohrman of U. S. Environmental Protection Agency, Region VII and to Mr. Rodger Allison of the Iowa Army Ammunition Plant.

If you have any questions regarding this matter, please contact Mr. Brian Harcek at (314) 260-3933.

Sincerely,

Sharon Cotner

Sharon Cotner
FUSRAP Program Manager

Enclosures

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ST. LOUIS DISTRICT, CORPS OF ENGINEERS
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February 10, 2003

Formerly Utilized Sites Remedial Action Program

Subject: Revision 0 - Iowa Army Ammunition Plant Site Reconnaissance Survey for Buildings L-37-1, L-37-2, L-37-3 dated February 2003

Mr. Rodger Allison
Iowa Army Ammunition Plant
17571 State Highway 79
Middletown, Iowa 52638-5000

Dear Mr. Allison:

Enclosed are two copies of the final Iowa Army Ammunition Plant Site Reconnaissance Survey for Buildings L-37-1, L-37-2, L-37-3, Rev. 0 for your files. In addition, a copy of our response to your comments has been included. Copies of these documents are also being provided directly to both Mr. Randy Rohrman of U. S. Environmental Protection Agency, Region VII and to Mr. Don Flater of the Iowa Department of Public Health.

If you have any questions regarding this matter, please contact Mr. Brian Harcek at (314) 260-3933.

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Subject: Revision 0 - Iowa Army Ammunition Plant Site Reconnaissance Survey for Buildings L-37-1, L -37-2, L -37-3 dated February 2003

Mr. Randy Rohrman
U.S. Environmental Protection Agency
Region VII
901 North 5th Street
Kansas City, Kansas 66101

Dear Mr. Rohrman:

Enclosed are three copies of the final Iowa Army Ammunition Plant Site Reconnaissance Survey for Buildings L-37-1, L-37-2, L-37-3, Rev. 0 for your files. In addition, a copy of our response to your comments has been included. Copies of these documents are also being provided directly to both Mr. Don Flater of Iowa Department of Public Health and to Mr. Rodger Allison of the Iowa Army Ammunition Plant.

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Sharon Cotner
FUSRAP Program Manager

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FINAL

IOWA ARMY AMMUNITION PLANT SITE RECONNAISSANCE SURVEY FOR BUILDINGS L-37-1, L-37-2, L-37-3

ST. LOUIS, MISSOURI

FEBRUARY 2003

prepared by
U.S. Army Corps of Engineers, St. Louis District Office

with assistance from
Science Applications International Corporation
under Contract No. ECAS F44650-99-D0007, ECAS358

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF ACROYMNS AND ABBREVIATIONS

AEC	Atomic Energy Commission
AHA	activity hazard analyses
ANSI	American National Standards Institute
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Ci/g	curies per gram
cm	Centimeters
Co	Cobalt
cpm	counts per minute
Cs	Cesium
DQO	data quality objective
DU	depleted uranium
EPA	Environmental Protection Agency
FUSRAP	Formerly Utilized Sites Remedial Action Program
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSA	Historical Site Assessment
HSWP	health and safety work permits
IAAAP	Iowa Army Ammunition Plant
LAP	load, assemble, and pack
LiF	Lithium fluoride
LLC	Limited Liability Company
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDA	minimum detectable activity
MDC	minimum detectable concentration
mrem	Millirem
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
PPE	personal protective equipment
Pu	Plutonium

LIST OF ACROYMNS AND ABBREVIATIONS (Cont'd)

QA/QC	Quality Assurance/Quality Control
RMSA	Radioactive Material Storage Areas
RPM	Radiation Protection Manager
SAIC	Science Applications International Corporation
SSHO	Site Safety and Health Officer
TLD	thermo-luminescent dosimeters
U	Uranium
USACE	United States Army Corps of Engineers

1.0 INTRODUCTION

Science Applications International Corporation (SAIC) has prepared this Site Reconnaissance Survey Plan for the St. Louis District United States Army Corps of Engineers (USACE) to define the initial radiological investigation survey activities (hereafter referred to as the site reconnaissance survey) at the Iowa Army Ammunition Plant (IAAAP) in Burlington, Iowa (Figure 1). Based on available information, as follows, buildings within the scope of this plan have a low probability of radiological contamination:

- The buildings were only used to facilitate receipt and shipment of sealed radioactive material.
- The buildings were routinely surveyed for radiological contamination with no known spills or areas of elevated activity.
- The buildings are no longer used to receive or ship licensed radioactive material or for any other purpose with regard to licensed radioactive material.

The objective of this site reconnaissance survey plan is to collect sufficient radiological data in order to substantiate the known information discussed above. The data collected will be used to determine if the designation of the Yard L warehouse buildings (Figure 2) L-37-1, L-37-2, and L-37-3 (hereafter referred to as the warehouse buildings) as radiologically non-impacted or impacted and assist in determination of proper classification if determined to be impacted, using the guidance contained in NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) (EPA, 2000).

This plan is being prepared to define the activities required to complete a limited site reconnaissance survey of the warehouse buildings with the intent of maximizing the use of all data collected for future evaluations of buildings or building surfaces determined to be impacted. This survey plan does not meet the requirements for a radiological final status survey. Buildings or building surfaces determined to be impacted after evaluation of site reconnaissance survey data will require more comprehensive surveys to evaluate the nature and extent of AEC contamination. The Site Reconnaissance Survey Plan will:

1. Establish the radiological criteria to be used during the survey,
2. Discuss reference standards to be followed during survey design,
3. Develop applicable data quality objectives
4. Include an assessment of existing American Ordnance interior radiological sampling data, and
5. Address issues and concerns brought up in the project kick-off meeting

This site reconnaissance survey will assist the USACE in substantiating the conclusions of past Historical Site Assessments (HSA). It will also provide input to future site evaluations (if any area or structure is determined to be impacted) to determine radiation dose posed from radiological contamination by locating areas and media impacted by the spread of contamination and determining the magnitude of the contamination present on warehouse building surfaces. Other objectives of this survey include:

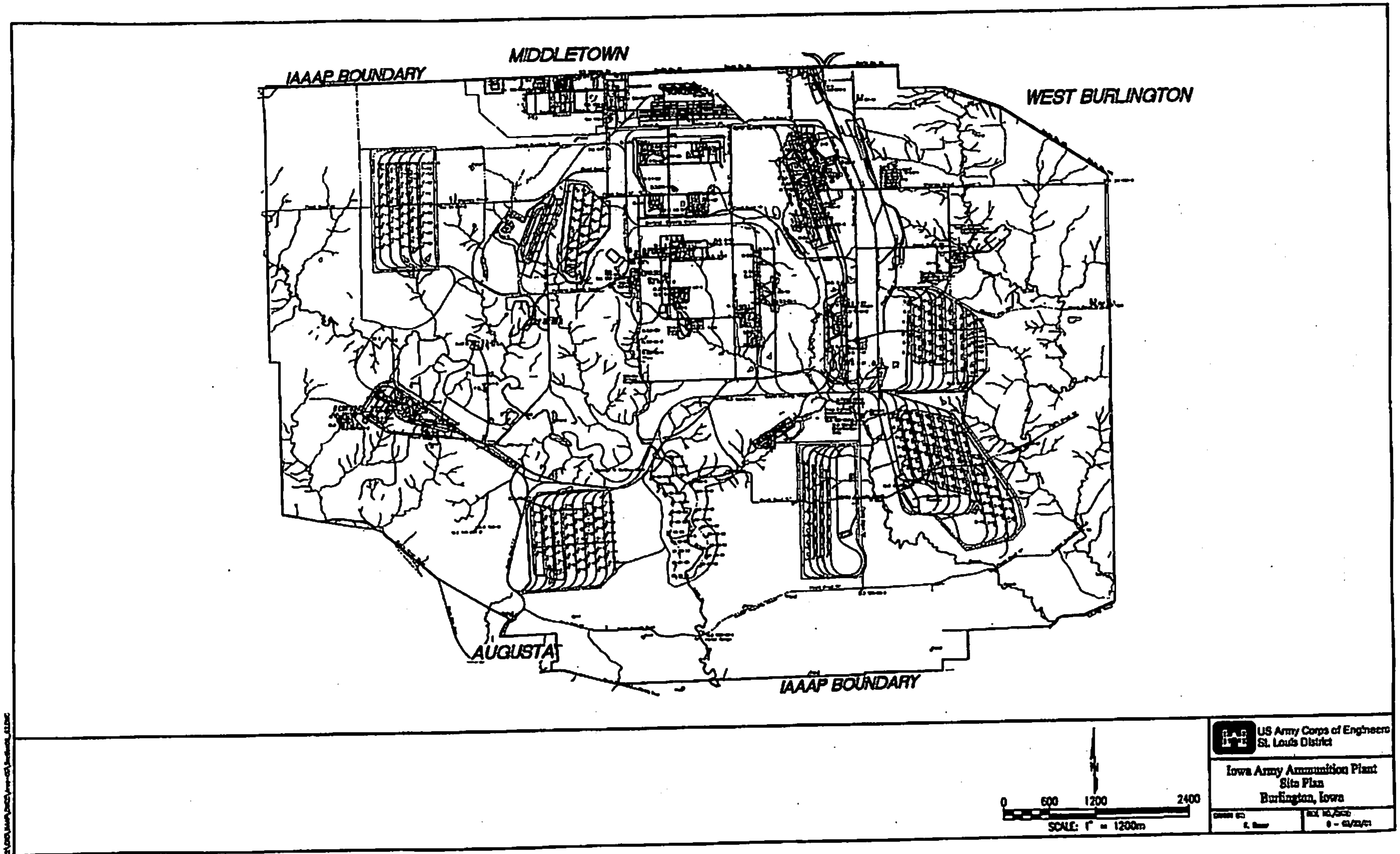

Figure 1. Site Plan of IAAAP

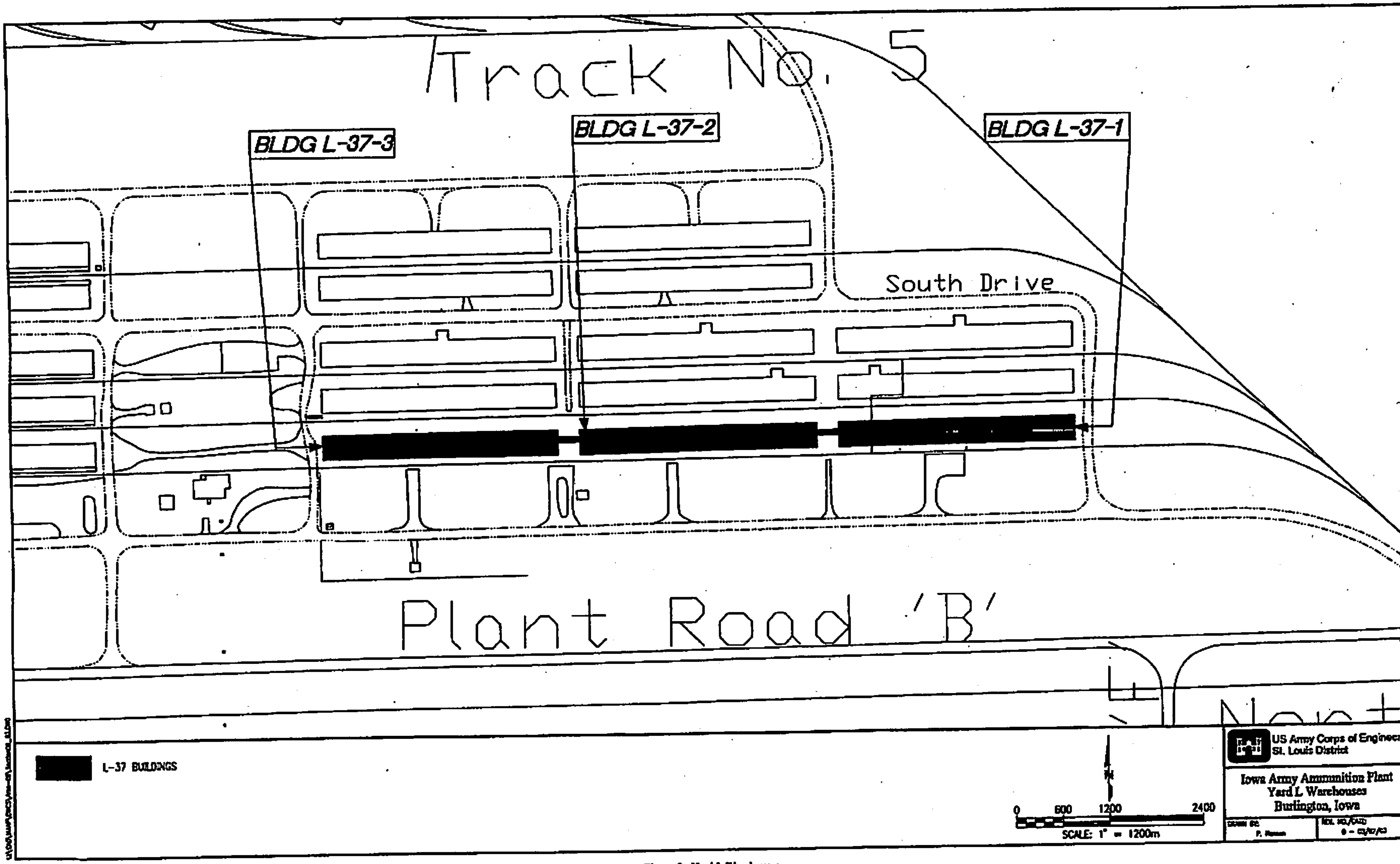

Figure 2. Yard L Warehouses

1. Providing data to complete a preliminary dose assessment if the area is determined to be impacted. If required, the preliminary dose assessment will occur after the radionuclide ratios of the potential contaminants of concern have been identified and/or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Preliminary Assessment/HSA process completed;
2. To assist in the determination as to whether the warehouse buildings are radiologically impacted and assist in determination of proper MARSSIM classification if determined to be impacted. Please reference letter dated 16 January 2003 to stakeholders from St. Louis FUSRAP;
3. Providing input for the design of future characterization surveys if necessary;
4. If necessary, identify areas that may be appropriate for obtaining reference area measurements that are to estimate the background radioactive material concentrations on building surfaces or within building materials (i.e., gross alpha/beta) at the site.

This site reconnaissance survey plan only addresses the warehouses listed above and only covers the actual building interior and exterior structures. This plan does not include soils or land areas. The actions outlined by this plan should not be construed to set a precedent for other locations within the IAAAP. The Yard L warehouses represent a unique situation which is most effectively handled by the use of a Site Reconnaissance Survey to classify the subject warehouses as "impacted" or "non-impacted" under FUSRAP.

2.0 SITE DESCRIPTION / HISTORY

IAAAP is a government facility, owned by the United States Army and operated by a private contractor, American Ordnance, LLC. It is located in the southeastern part of Iowa, near the town of Middletown, approximately 10 miles west of the Mississippi River. The IAAAP is a secured facility covering 19,011 acres in a rural setting. Approximately 7,751 acres are leased for agricultural use, 7,500 acres are forested land, and the remaining area is used for administrative and industrial purposes. Figure 1 is a map of IAAAP.

According to the *Remedial Investigation/Risk Assessment, Iowa Army Ammunition Plant, Middletown Iowa* (USACE, 1996), IAAAP was initially developed in 1941, and has undergone modernization and expansion since that time. Production of ammunition and explosives for World War II began at the facility in September 1941 and ended in August 1945. Production was resumed in 1949 and has continued to the present.

IAAAP is currently operated to load, assemble, and pack (LAP) ammunition items, including projectiles, mortar rounds, warheads, demolition charges, anti-tank mines, anti-personnel mines, and the components of these munitions, including primers, detonators, fuses, and boosters. The LAP operations use explosive material and lead-based initiating compounds. Only a few of the existing production lines are in operation.

IAAAP historical information indicates that Yard L was used by the AEC. A map prepared as part of an environmental agency evaluation of AEC activities, dated 1972, indicated that a portion of Yard L (i.e. 3 warehouses) was used by AEC to provide Line 1 storage space for classified component part storage starting in 1960. This portion of Yard L has double security fencing. Insufficient evidence has been gathered to date to properly classify the Yard L warehouses in accordance with MARSSIM. A limited number of radiological removable surveys have been reported from the 3 warehouses. All radiological results reported to date indicate no increase in removable radioactivity within the range of background.

3.0 ORGANIZATION AND RESPONSIBILITIES

SAIC, under contract to the USACE, has developed this site reconnaissance survey plan. SAIC is responsible for the overall coordination and implementation of the site reconnaissance survey as detailed in this plan. The contractor will perform scans and fixed point measurements at selected locations, under direct USACE supervision. The roles and responsibilities of key personnel for the site reconnaissance survey are listed in Table 1.

Table 1. Roles and Responsibilities

Role	Person	Phone	Responsibility
SAIC Project Manager	Jim Moos	(314) 581-6081	Assures all activities are performed in accordance with this plan and that all project quality, compliance, and health and safety requirements are followed.
SAIC Survey Supervisor	Rodney Alderson	(314) 581-6082	Assures survey measurements and sampling are conducted in accordance with this plan.
IAAAP Project Manager	Leon Baxter	(319) 753-7101	Provides oversight, direction and coordination for activities in this plan that impact or affect IAAAP.
IAAAP Safety	Robert Haines	(319) 753-7859	Provides safety and occupational oversight for the hazards presented by the IAAAP.
USACE Health Physicist* (*Primary point of contact regarding this Plan.)	Brian Harcek	(314) 260-3933	Provides the overall responsibility, technical oversight, direction, and coordination for the implementation of this plan.

4.0 SURVEY DESIGN

Radiological monitoring will be conducted to determine the presence, if any, of radiological contamination. The design of this survey will follow MARSSIM and the CERCLA protocols as they relate to a site reconnaissance survey plan. Radiological monitoring will include scanning for total beta surface activity and fixed point measurements for total alpha and beta surface activity using portable radiological survey equipment, and collection of smears for measurement of removable alpha and beta activity.

Specific Data Quality Objectives (DQOs) established for this survey include:

- Quality Assurance/Quality Control (QA/QC) of fixed point and removable activity measurements will be conducted at a frequency of at least 1 in 20.
- Radiological field instruments used for site reconnaissance surveys will be quality control checked at the beginning of each survey day to determine acceptance and usability of data collected. The established acceptance criteria will be instrument background within ±3 standard deviations of the mean site background and source checks within ±20% of the known value.

- To validate scan, total, and removable minimum detectable concentration (MDC)/minimum detectable activity (MDA) values, the actual radiological instruments used will have site specific background and efficiency values ±20% of the values used in modeling. If instrument background and efficiency values fall outside this range, new site specific MDC/MDAs will be calculated.
- Target MDA of 50% of the screening level for all survey instrumentation.

4.1 PROCESS KNOWLEDGE

It is understood that there is a low probability of radiological contamination at the warehouse buildings; however, the design of the site reconnaissance survey for the collection of radiological data will take into consideration:

1. The known limited operational history of buildings L-37-1, L-37-2, and L-37-3 as documented in Section 2.0.
2. The potential contaminants of concern for this survey are Co-60, Cs-137, Pu-239, and depleted uranium (DU). DU is signified by the reduction of the U-235 isotope below its natural abundance of 0.7%. The abundance of U-235 in DU is typically on the order of 0.2 to 0.3%. The specific activity of DU is 3.637×10^{-7} curies per gram (Ci/g) with an activity abundance of 92.18%, 1.49%, and 6.36% for U-238, U-235, and U-234, respectively.
3. As necessary, background radioactivity present in building materials will be determined through reference measurements of similar materials at a non-impacted area of the site.
4. The type of radiation (β-γ, or α) scanned for will have an associated surface efficiency selected for the purpose of calculating an instrument scan speed. Surface efficiency is based on the radionuclide being detected (type of radiation and energy) and the material type (concrete, steel, etc.) being scanned.
5. The selected instrument's scanning MDC for the establishment of an appropriate screening level. The selected screening level will be used for the purpose of supporting the designation of the warehouse(s) as either non-impacted or impacted.

4.2 INSTRUMENT SELECTION

Survey instruments used for radiological measurements will be:

1. Selected based on the survey instrument's detection capability for the contaminants of concern;
2. Calibrated in accordance with American National Standards Institute (ANSI) N323A, *Radiation Protection Instrumentation Test and Calibration – Portable Survey Instruments* (ANSI, 1997) for the spectrum of radiation energies expected at IAAAP; and
3. Operated and maintained by qualified personnel, in accordance with SAIC's Health Physics Program procedures (e.g., physical inspection, background checks, response/operational checks, etc.).

Based on the data quality objectives listed in section 4.0, the following instrumentation has been selected for use during this site reconnaissance survey:

- Ludlum Model 2360 ratemeter/scaler coupled with a Ludlum Model 43-89 (ZnS plastic scintillator) hand held probe or equivalent for scanning and fixed point measurements.

- Ludlum Model 2929 scaler coupled with a Ludlum Model 43-10-1 smear counter or equivalent to count smears for removable activity.

Radiological field instrumentation used for this site reconnaissance survey will be calibrated in accordance with ANSI N323A, *Radiation Protection Instrumentation Test and Calibration – Portable Survey Instruments* (ANSI, 1997) within the past 12 months (or more frequently if recommended by the manufacturer). Daily QC checks will be conducted on each instrument and operated in accordance with USACE approved SAIC Health Physics Procedures. Only data obtained using instruments that satisfy these performance requirements will be accepted for use during this survey.

4.3 STATIC AND SCAN MINIMUM DETECTABLE CONCENTRATIONS (MDCS)

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) (EPA, 2000) provide methodology for calculation of minimum detectable concentrations (MDCs). The following details the approach for calculating site specific MDCs for use in the site reconnaissance survey process at IAAAP.

The steps utilized for calculating MDCs follow the approach detailed in NUREG-1507. The steps include:

- Calculating the minimum detectable count rate (MDCR) by selecting a given level of performance, scan speed, and background level of the detector; and

- Selecting a surveyor efficiency, if applicable.

For determining the MDCs, the average beta background value for the Ludlum 43-89 was assumed to be 160 counts per minute (cpm). The observable background counts (b') is defined as the number of background counts observed within the observation interval (i). The observation interval was selected as the time that 25% of the probe is over a 4"×4" (100 cm^2) area of interest. The equation used for calculating b' is as follows:

$$b' = (\text{background count rate}) \times (\text{observation interval}) \times (1\ \text{min}/60\ \text{sec}) = \text{counts/interval}$$

The minimum detectable number of net source counts in the interval is given by s_i. Therefore, for an ideal observer, the number of source counts required for a specified level of performance can be arrived at by multiplying the square root of the number of background counts by the detectability value associated with the desired performance (d') as shown below:

$$s_i = d' \sqrt{b_i}$$

The MDCR is defined as the increase above background recognizable during a survey in a given period of time. The variable, *d'*, is defined as the index of sensitivity and is dependent on the selected decision errors for Type I (alpha) and Type II (beta) errors. A true positive error (1–β) of 95% and a false positive error (alpha) of 60% were selected to be consistent with NUREG-1507. The value of 1.38 was obtained from Table 6.1 in NUREG-1507 (Table 6.5 in MARSSIM).

$$MDCR = s_i \times (60/i) = cpm$$

Finally, the scan MDCs for structure surfaces may be calculated:

$$\text{Scan MDC} = \frac{MDCR}{\sqrt{p}\,\varepsilon_i\,\varepsilon_s \frac{probe\ area}{100\ cm^2}}$$

where:

$MDCR$ = minimum detectable count rate (cpm)
ε_i = instrument efficiency (cd^{-1})
ε_s = surface efficiency (unitless)
p = surveyor efficiency (unitless, typically assumed to be 0.5)

Counter Detection Limit (L_D) – 95% confidence level is calculated for each instrument by using the following equation:

$$L_D = 3 + 3.29\sqrt{(R_B)(T_S)(1+\frac{T_S}{T_B})}$$

where:

L_D = *a priori* detection limit [minimum significant activity level]
R_B = background count rate (cpm)
T_B = background count time (minutes)
T_S = sample count time (minutes)

The detection limit, L_D, is the *a priori* (before the fact) activity level that an instrument can be expected to detect 95% of the time. It is the smallest amount of activity that can be detected at a 95% confidence level. It should be used to calculate the minimum detection capability of an instrument.

The fixed point measurement MDA is calculated as follows:

$$\text{MDA (dpm/100 cm}^2) = \frac{L_D}{[DA][\varepsilon_i][\varepsilon_s][T]} x \frac{100\,cm^2}{100\,cm^2}$$

where:

DA = detector area (cm^2)
ε_i = instrument efficiency (cd^{-1})
ε_s = surface efficiency (unitless)
T = count time (minutes)

For the smear counting a Ludlum 2929/43-10-1 or equivalent will be used. MDA for the smear counter will be calculated as follows.

$$\text{Smear MDA } (dpm/100cm^2) = \frac{L_D}{(T)\,(\varepsilon_i)}$$

where:

T = smear count time (minutes)
ε_i = instrument efficiency (cd^{-1})

The calculations of MDCs for selected instrumentation proposed for IAAAP are presented in Appendix A.

4.4 SCREENING LEVELS

The established screening levels for total gross alpha and beta activity have been selected from Table 1, Screening Levels for Clearance, ANSI/HPS N13.12-1999. The screening levels for gross alpha and beta removable activity have been set at 10% of the limit for total alpha and beta activity, respectively. Table 2 lists the screening levels used for this site reconnaissance survey:

Table 2. Selected Screening Levels

	Total Contamination dpm/100cm^2	Removable Contamination dpm/100cm^2	Investigation Level for Scanning
Gross alpha	600	60	N/A
Gross beta	6,000	600	4,800

5.0 SURVEY IMPLEMENTATION

The survey will be implemented as outlined by this plan by a qualified survey team. The survey team will consist of a team leader and two technicians. The survey team will be qualified in accordance with the St. Louis Health Physics Manual and have a minimum of 15 years combined radiological survey experience. USACE Health Physicist will provide technical oversight of the survey. The survey will be conducted in accordance with the applicable St. Louis Health Physics Procedures and the St. Louis Sampling and Analysis Guide.

Uranium has associated alpha, gamma and beta radiations, which can be used to identify the presence of residual contamination and estimate the concentrations potentially present at the

IAAAP. Beta scans are being used because alpha radiation is a less reliable indicator of true surface activity levels due to greater attenuation.

A Ludlum Model 2360 coupled with a Ludlum 43-89 (ZnS plastic scintillator) (or equivalent) will be used for performance of the beta scans. Scan speed with these detectors will be approximately 1-2 in/sec. Distance from the detector probe to the surface being scanned will be approximately 1/4 inch.

Instrument response will be continuously monitored during scanning through use of the audible instrument signal. Scanning results will be recorded in counts per minute (cpm), which along with the appropriate instrument geometry and calibration information will be used to convert the data to dpm/100cm^2 for comparison to criteria. If the investigation level (80% of the screening level) is reached during scanning, the surveyor shall pause to allow the instrument response to stabilize. A biased fixed point measurement and smear should be performed where elevated activity was noted (and confirmed) during the scan survey.

Screening beta scans will generally be performed over accessible areas. Accessible is defined for the purposes of this plan, as areas where safety considerations or other restrictions do not prevent access for normal scanning activities (i.e., in overhead areas and/or under equipment). The beta scan surveys will be biased to areas with the highest potential for contamination based on the professional judgment of the survey supervisor. Areas likely to be considered for this site reconnaissance survey may include but are not limited to:

- entrances and exits;
- ventilation;
- sumps and floor drains;
- high traffic areas; and
- shipping and receiving loading and offloading areas.

Total alpha-beta surface activity (fixed-point) measurements will be conducted as necessary over the floor, walls and equipment horizontal surfaces within the warehouses. Fixed-point gross beta activity measurements will be made with 30 second static counts using a (43-89) ZnS plastic scintillator. The results of the survey for alpha and beta, both, will be recorded in cpm and converted to dpm upon completion of the survey.

Removable activity is measured by smearing an area of approximately 100 cm^2 with a dry filter paper; alpha and beta activity on the smear sample is then measured. Removable alpha and beta surface activity samples (smears) will be collected at a minimum of seventy-five fixed-point (total alpha-beta) surface activity measurements in each warehouse. The smear will be collected, counted for radioactivity, and documented prior to conclusion of the survey.

Activity shall be calculated using the following equations:

$$ncpm = gcpm - bcpm$$

where:

ncpm = net counts per minute
gcpm = gross counts per minute
bcpm = instrument background counts per minute

$$\text{dpm}/100\ \text{cm}^2 = \frac{\text{ncpm}}{\varepsilon_i \times \varepsilon_s \times \text{DA}} \times \frac{100\ \text{cm}^2}{100\ \text{cm}^2}$$

where:

DA = detector area
ε_i = instrument efficiency (cd^{-1})
ε_s = surface efficiency (unitless)
Ludlum 43-89 detector area = 125 cm^2

The objective of this survey is to determine if radioactive contamination exists within the warehouses. A minimum of seventy-five fixed point and removable measurements will be performed in each of the three warehouses. The measurements will be distributed across the various types of media present in the warehouses. The measurements will include those areas of highest probability of contamination as determined by the survey team, as well as random locations. The amount of measurements for a given media type will be dependent on the variability of the measurements and probability of contamination.

5.1 SURFACE EFFICIENCY

The effects of self-absorption may produce considerable error in the reported surface activity levels. A surface efficiency (ε_s) of 0.5 (unitless) for beta and 0.25 for alpha will be used based on recommendations found in NUREG-1507, Section 5.3.2.

5.2 FIELD LOGBOOK ENTRIES

The survey supervisor (or designee) will maintain logbooks to document project information and a daily written record of all survey activities. Logbooks will be maintained in accordance with the *Sampling and Analysis Guide for the St. Louis Sites* (USACE, 2000b) and SAIC *Field Technical Procedure-1215, Use of Field Logbooks* (SAIC, 1999a). Logbook entries may include, but are not limited to:

- Project personnel;
- Personnel contacts;
- Training activities;
- Daily tailgate meetings;
- Daily scanning and smear activities;
- Weather conditions; and
- Nonconformances, issues and concerns.

6.0 SAFETY AND HEALTH

6.1 SITE SAFETY AND HEALTH

Site safety and health requirements for site tasks are based on potential physical, radiological, and chemical hazards. The survey team will follow the general site safety and health requirements documented in SAIC's *Site Safety and Health Plan for the St. Louis* (USACE, 2000a) *FUSRAP Sites, St. Louis Health Physics Manual* (SAIC, 1998), and *St. Louis Environmental Compliance and Health and Safety (EC&HS) Procedures Manual* (SAIC, 1999b). These documents/procedures are written to comply with the Nuclear Regulatory Commission (NRC), Occupational Safety and Health Administration (OSHA), and USACE regulations and have been approved for use by the St. Louis District USACE. The survey team will also follow any additional IAAAP safety requirements.

The survey supervisor is the designated onsite Site Safety and Health Officer/Radiation Protection Manager (SSHO/RPM) for the site reconnaissance survey and maintains the responsibility for compliance with these requirements. Specific health and safety requirements will be documented on task specific activity hazard analyses (AHAs) and health and safety work permits (HSWPs) for all survey and sampling activities detailed in this plan. The task-specific AHAs will be submitted to the St. Louis District USACE for approval prior to the start of field activities.

6.2 SAFETY AND HEALTH TRAINING

All survey team personnel are required to meet the training requirements stated in the *Site Safety and Health Plan for the St. Louis FUSRAP Sites* (USACE, 2000a) to include HAZWOPER (40 hour and current 8 hour refresher), medical surveillance, health and safety orientation and radiation awareness training.

Prior to conducting work on site, members of the survey team will be required to attend the IAAAP safety briefing conducted by the IAAAP Safety Officer. At a minimum, this training will cover site access requirements, installation rules and regulations, and emergency response procedures for the facility. All survey team personnel will follow the emergency response procedures in effect for the IAAAP.

6.3 TASK SPECIFIC PPE

The minimum level of protection that will be used for non-intrusive survey activities at this site is Level D Protective Equipment (safety boots, hard hat, safety glasses). Additional personal protective equipment (PPE) such as Tyvek® coveralls, boot covers, or cotton/leather gloves may be required based on conditions encountered during the survey or new information regarding on-site contaminants not yet known. The designated on-site SSHO/RPM has the responsibility for determining if an upgrade in health and safety work permit (HSWP)/PPE requirements is required once the survey team has mobilized to the site.

6.4 PERSONNEL MONITORING REQUIREMENTS

Due to the low probability of contamination at the Yard L warehouses, survey team members are not likely to incur greater than 10% of a regulatory dose limit (i.e., 500 mrem) from external sources of radiation and therefore dosimetry is not required.

It is not likely that any personnel will receive an intake of radioactive material that results in an internal exposure exceeding the monitoring threshold of 500 millirem (mrem) (0.1 ALI) during survey activities; however, routine surveillance monitoring of the work environment may be conducted by obtaining breathing zone air samples if required by the applicable HSWP. All air filters collected will be analyzed and evaluated to verify that airborne radioactive material is not present or generated in the work area at levels that would result in exposures exceeding the monitoring threshold. If airborne radioactive material is determined to be present at levels exceeding the monitoring threshold, survey activities will be stopped and the SSHO/RPM will be notified to determine appropriate changes to protective requirements and personnel monitoring.

7.0 SAMPLE AND WASTE DISPOSITION

There will be a limited amount of waste generated as a result of this survey. The waste generated will consist of PPE (e.g. surgeon gloves, booties) and swipes. All efforts will be made to survey the PPE for unrestricted release for "clean" trash disposal. All radioactive waste generated during the Site Reconnaissance Survey is the responsibility of the USACE and will be bagged and labeled and stored in an existing Radioactive Material Storage Area (RMSA) located at Firing Site 12 (FS-12) at IAAAP. All attempts will be made to minimize the amount of radioactive waste generated during the survey.

8.0 DOCUMENTATION OF FINDINGS

Upon completion of the Site Reconnaissance Survey, the St. Louis District will issue a report detailing the results of the survey. If no radiological contamination is discovered above the plan specified guidelines, the warehouses will be classified as non-impacted and FUSRAP will take no further action. If the survey results indicate that the criteria set forth in the plan are exceeded, the warehouses will be classified as impacted and required to have a Final Status Survey Plan developed and implemented in the future. This report, will at a minimum, contain the following information:

- Radiological survey forms showing scan locations, locations of elevated scan levels (if any), fixed point measurement locations, and smear sample locations;
- Tables of gross alpha and beta activities for each measurement/sample collected from IAAAP to include the result in dpm/100 cm^2; and
- Evaluation of how collected data compares to the screening level.

9.0 REFERENCES

American National Standards Institute (ANSI), 1997. *Radiation Protection Instrumentation Test And Calibration – Portable Survey Instruments*, N323A, New York.

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

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APPENDIX A

SCAN AND STATIC MDCs FOR SITE RECONNAISSANCE SURVEY INSTRUMENTS USED AT IAAAP

Ludlum 43-89 (ZnS plastic scintillator)

Surface: Steel structural beams
Background (R_B) = 160 cpm β, 1 cpm α
Probe dimensions: 3.0" x 6.5"
Probe active area: 125 cm^2
Scan Speed = 2 inches/sec
Fixed point measurement time (T_S) = 30 seconds
Background count time (T_B) = 10 minutes
ε_i = 0.27 β, 0.16 α
ε_s = 0.5 β, 0.25 α (NUREG-1507, Section 5.3.2)
p = 0.50
d' = 1.38

Scan Measurement – beta (β)

i = 5.0 inches/2 in sec^{-1} = 2.5 seconds
b_i = (160 cpm) (1 min/ 60 sec) (2.5 sec) = 6.67 counts/observation interval

$s_i = 1.38\sqrt{6.67} = $ 3.6 net source counts

MDCR = 3.6 (60/2.5) = 86 cpm

$$\text{Scan MDC} = \frac{86 \text{ cpm}}{\sqrt{0.50}(0.27)(0.5)(1.25)} = 721 \text{ dpm}/100 \text{ cm}^2$$

Fixed Point Measurement – beta/gamma (β)

$$L_D = 3 + 3.29\sqrt{(160)(0.5)\left(1+\frac{0.5}{10}\right)} = 33 \text{ counts}$$

$$\text{MDA} = \frac{33}{[125][0.27][0.5][0.5]} \times \frac{100\text{cm}^2}{100\text{cm}^2} = 391 \text{ dpm}/100\text{cm}^2$$

Fixed Point Measurement – alpha (α)

$$L_D = 3 + 3.29\sqrt{(1)(0.5)\left(1+\frac{0.5}{10}\right)} = 5 \text{ counts}$$

$$MDA = \frac{5}{[125][0.16][0.25][0.5]} x \frac{100cm^2}{100cm^2} = 200\ dpm/100cm^2$$

Ludlum 43-10-1 (bench smear counter) MDA– beta (β)

$R_B = 60$ cpm
$T_B = 10$ min.
$T_S = 0.5$ min.
$\varepsilon_i = 0.4\ \beta$

$$L_D = 3 + 3.29\sqrt{(60)(0.5)\left(1+\frac{0.5}{10}\right)} = 21 \text{ counts}$$

$$\text{Smear MDA} = \frac{21}{(0.5)(0.4)} = 105\ dpm/100cm^2$$

Ludlum 43-10-1 (bench smear counter) MDA– alpha (α)

$R_B = 0.4$ cpm
$T_B = 10$ min.
$T_S = 0.5$ min.
$\varepsilon_i = 0.34\ \alpha$

$$L_D = 3 + 3.29\sqrt{(0.4)(0.5)\left(1+\frac{0.5}{10}\right)} = 5 \text{ counts}$$

$$\text{Smear MDA} = \frac{5}{(0.5)(0.34)} = 29\ dpm/100cm^2$$

APPENDIX B

PROPOSED SCHEDULE FOR THIS PLAN

PROPOSED SCHEDULE FOR THIS PLAN

12/09/2002	Award (Notice to proceed)
12/19/2002	Kick-off Conference Call with all parties
01/10/2003	Draft plan issued for review
01/24/2003	Comments on Draft Plan due to St.Louis
02/06/2003	Conference call to resolve comments
02/10/2003	Final Plan issued
02/11/2003	Commence field work
02/14/2003	Field work completed
02/21/2003	Draft Report issued for review
03/14/2003	Comments on Report due to St.Louis
03/18/2003	Conference call to resolve comments (afternoon)
03/25/2003	Final Report issued