Implementation and Evaluation of a Radiological Field Investigation for Real Property Interests Associated with the FUSRAP Maywood Site - 15611

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ABSTRACT

Public streets, easements, and rights-of-way, collectively referred to as Real Property Interests (RPI), pose challenging and complex problems for the FUSRAP Maywood Project Team. RPIs are components of a multi-faceted objective to evaluate all remaining sources of contamination for which the Government is responsible under the Maywood Record of Decision. USACE designed and implemented a MARSSIM-based radiological investigation within sixteen potentially impacted RPIs. These RPIs were not completely addressed on their own or in conjunction with nearby property investigations or remediations. However, these RPIs were investigated based on the potential for or known impact of FMSS contamination as determined through both a historic data review of the transport mechanism (downstream waste deposition) and process knowledge obtained during Final Status Survey of proximal properties. The primary objectives of this investigation were to confirm the presence or absence of FUSRAP contamination within a given RPI, provide sufficient data to release an RPI if contamination was not encountered, and provide sufficient data for either design of an appropriate remedial solution or implementation of Land Use Controls when contamination was encountered. Of additional value, knowledge gained during the RPI investigations will allow the team to share useful radiological data with local officials and utility service providers. This information will support better, more informed decisions by all parties involved in situations such as emergency subsurface utility repairs, roadway improvement planning, or even natural disaster response. Finally, certain unexpected outcomes learned during the final data analysis may lead to refinement of the conceptual site model. Logistical lessons learned and challenges encountered during the Maywood investigation may also be helpful to stakeholders, planners, and managers of similar projects wishing to identify their own potential liability within public streets, easements, rights-of-way, and other types of RPIs.

INTRODUCTION

Investigation Purpose

The purpose of this investigation is to document and evaluate the status of Real Property Interests (RPIs) subject to Formerly Utilized Sites Remedial Action Program (FUSRAP) Maywood Superfund Site (FMSS) activities. RPIs are areas such as streets or rights-of-way (ROW) that were not specifically addressed on their own or in conjunction with nearby property investigations but are potentially impacted by the FMSS contamination. A number of these RPIs are areas within roadways or easements to which U.S. Army Corps of Engineers (USACE) either does not or will not have access, thus resulting in a potential for contaminated soil to remain in place. Another trigger for an area to be included as an RPI is proximity to the Lodi Brook Culvert (LBC). Efforts to investigate these areas will be undertaken to assist the USACE and U.S. Environmental Protection Agency (EPA) in future FMSS document preparation as the Site moves towards completion.

The USACE developed a RPI Work Plan to support radiological closure of properties at the FMSS. USACE will document all data, recommendations, and conclusions associated with an RPI in a final report. For those RPIs recommended for unrestricted release, the report will provide sufficient information for USACE, EPA, and NJDEP to evaluate the RPI's release status. The surveys described have been designed in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual

(MARSSIM) Final Status Survey (FSS) requirements [1]. The surveys are designed to determine the extent, if any, of residual FUSRAP contamination in soils within the RPI areas.

The specific objectives of the surveys are to:

- Identify the presence or absence of radioactive contamination {as defined in the Site Record of Decision (ROD) [2]} in surface or subsurface soils.
- If no contamination is present, collect sufficient supporting data to demonstrate no further assessment or action (based on MARSSIM methodology) is warranted due to property not being impacted.
- If contamination is present, delineate the extent of contamination to allow for the design of appropriate measures such as Land Use Controls (LUC) or remediation.

Background

The FMSS is located approximately 20 kilometers (12 miles) north-northwest of New York City and 21 kilometers (13 miles) northeast of Newark, NJ. Properties are located in a highly developed area of northeastern NJ in the Boroughs of Maywood and Lodi and the Township of Rochelle Park.
The FMSS consists of 88 formally designated properties. The U.S EPA and U.S. Department of Energy (DOE) agreed to divide the 88 properties into two phases of efforts. Residential properties were identified as Phase 1 properties. Commercial and Government-owned properties were identified as Phase 2 properties. Later, undesignated properties (those not included in the National Priorities List designation) were identified by USACE as Phase 3 properties. The majority of these properties were surveyed by the Government but not designated as FMSS vicinity properties based on data and action levels in use at the time of the investigations.

The Government addressed the Phase I properties with Removal Actions and other remedial measures between 1984 and 1999 under an Action Memorandum [3]. The Phase 2 properties are addressed in the 2003 Soils and Buildings ROD for the Site. The Phase 3 properties are being addressed in a separate technical memorandum. The EPA conducted a Five-Year Review (FYR) in 2009 and identified several Phase I and Phase II properties that required additional actions such as Land Use Controls (LUCs) or further investigation [4]. Areas identified as RPIs span over Phase 1, 2, and 3 properties and are currently being addressed.

A full characterization of roads, streets, easements, rights of way (ROW), etc. herein referred to as Real Property Interests (RPI), has not been done throughout the FMSS area. In the 1980's, aerial and mobile drive-by scans of the FMSS area, all streets in Lodi, and five additional streets in Maywood were conducted. One RPI, the I-80 West Right of Way, was partially addressed in the Engineering Evaluation/Cost Analysis for a Removal Action in Support of Roadway Improvement Projects at the FUSRAP Maywood Superfund Site [5]. Other RPIs are known or suspected to be contaminated based on contamination assessment of adjacent properties or proximity to the LBC. RPIs would meet the definition of inaccessible material as defined in the 2003 Soils and Buildings ROD.

The Westerly Brook is a perennial stream that originates north of the FMSS. With the construction of NJ Route 17 in the 1930s, the brook's historic southerly flow was diverted through the northwest corner of the Maywood Interim Storage Site, turning west under Route 17 and through the Township of Rochelle Park. Most of the brook now flows through a storm drain culvert. Westerly Brook is not a significant source of contaminant migration. Properties in Rochelle Park (along Grove Avenue and Park Way) were contaminated from dusts, fill borrow, and limited run-off from the former FMSS waste pits. Contamination was shallow and primarily away from the roads. Accordingly, USACE has not identified any RPI areas of concern in Rochelle Park. Figure 1 shows the general Maywod Site.

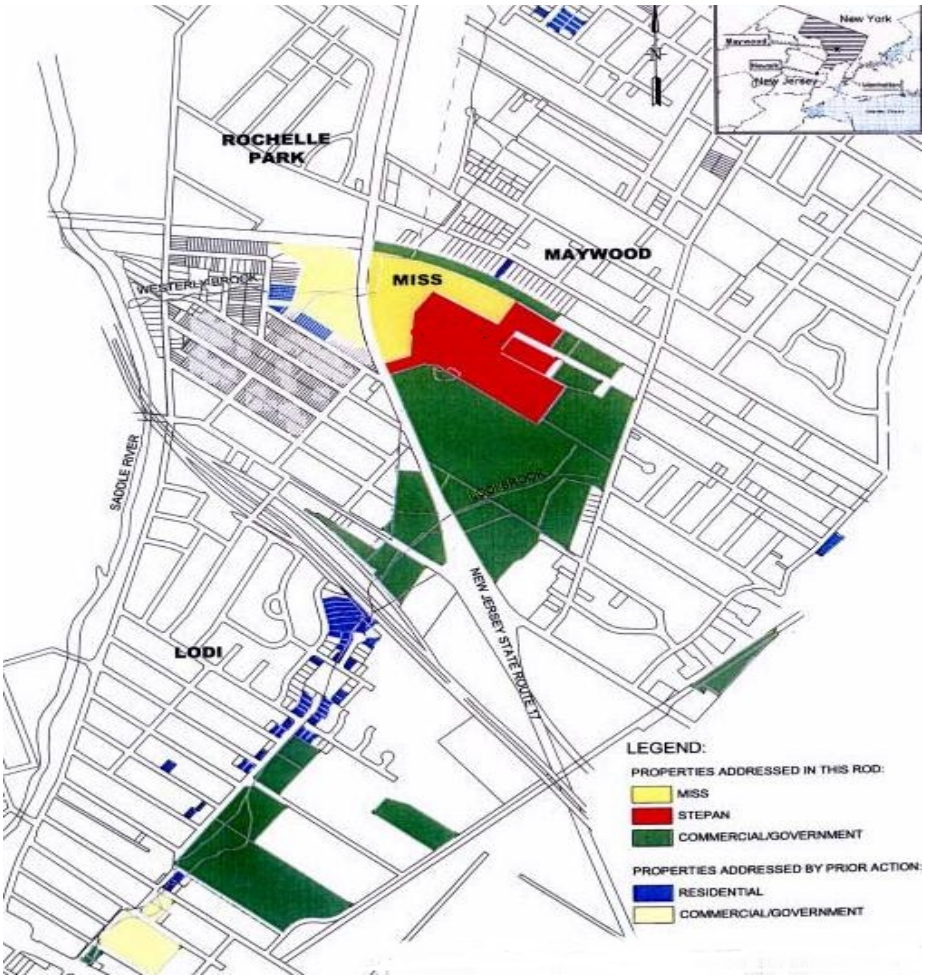

Fig.1. FUSRAP Maywood Superfund Site

The Lodi Brook is a perennial stream originating on the FMSS. Most of the original stream channel was diverted to an underground storm drain culvert in the 1960's to accommodate rapid development in the Site area. The former channel pathways essentially match the distribution of contaminated materials in the Borough of Lodi. Much of the LBC's path is therefore considered an RPI area of concern.

Conceptual Site Model

From about 1916 through 1955, the Maywood Chemical Works (MCW) processed radioactive thorium ore. The residues (or tailings) from the process operation were a clay-like dirt that contained significant quantities of low-level radioactive materials. Other MCW processing operations generated additional waste products, such as lanthanum, lithium compounds, detergents, alkaloids, essential oils and products from tea and cocoa leave processing. MCW pumped process wastes to diked areas west of the plant.

In 1932, New Jersey Route 17 was built through the disposal areas. Portions of the former disposal area west of Route 17 were sold and are now private properties in Rochelle Park. Process wastes migrated (via streams and mechanical means) onto adjacent properties in Rochelle Park and Maywood. Some waste materials were excavated and used as fill dirt and mulch for nearby properties. Waste materials were also transported via Lodi Brook (much of which was later replaced by a storm water drainage system) and to a lesser extent Westerly Brook. Properties impacted by contaminants of concern are being remediated.

However, RPIs for the most part have not been remediated under FUSRAP. The majority of the RPIs are roads and storm water culverts adjacent to properties previously remediated.

DESCRIPTION

This investigation is comprised of the following primary elements:

- Historical data review (review of documentation and records of both the RPI and adjacent properties)
- Survey (Data collection)
- Reporting

The major activities for this investigation are presented in Table 1 below.

Table I. Investigation Tasks

Activity	Tasks
Evaluate contamination potential	Review all previously collected radiological data
	Identify radionuclides of concern and appropriate Derived Concentration Guideline Levels (DCGLs)
	Identify boundaries of survey units and FSS classes
Establish reference system	Determine frequency and locations of measurements
	Prepare Site maps and sampling plans
Determine background levels	Identify appropriate background concentrations in soil at the Maywood Site using the Maywood Background Study Report [6].
	Confirm background gamma levels at the Maywood Site for selected instruments
Perform measurements	Perform surface gamma scanning
	Perform down hole gamma logging
	Collect soil samples
Analyze samples	Analyze samples at the onsite Maywood laboratory
Interpret Data	Validate data and identify important parameters
	Calculate sample statistics
	Perform statistical evaluation and hypothesis testing
Prepare Reports	Compile data tables
	Develop site maps and graphs
	Document and prepare final report

Scope

Site-specific soil cleanup criteria per the Soils ROD must be met before RPIs can be considered not impacted or warranting no further investigation. This sampling effort is consistent with the processes developed in the Maywood Master Final Status Survey Plan [7] and with MARSSIM methodology. All work associated with this plan will be completed in accordance with existing FMSS Plans and Standard Operating Procedures (SOP)to include the FMSS Site Safety and Health Plan [8].

Design

A scoping survey of each RPI will be designed to meet FSS Data Quality Objectives (DQO). This will provide data of sufficient quantity and quality to identify areas requiring remediation, identify and classify survey units based on contamination potential, and to use as FSS data where appropriate. Once complete, the scoping results will either serve as a characterization survey (if contamination above ROD criteria is found) or provide sufficient data for FSS data evaluation and release of the area (if no contamination above ROD criteria is found).

Surveys consist of the following:

- Gamma Walkover Scans - surveys were performed to cover 100% of accessible areas in each surveyed RPI. Scan surveys were performed using a 5cm x 5cm (2x2 inch) Sodium Iodide (NaI) detector (or equivalent) coupled with a ratemeter/scaler that is configured to output directly to a Global Positioning System (GPS) unit.
- Sampling location identification (random start, triangular grid, and bias) - RPI areal extent was established based on a review of historical data (adjacent property investigations, PRAR, etc.), physical features, MARSSIM methodology, and comparison to the site conceptual model. A random start point triangular grid with 15.24 meter (50 foot) spacing was established across each RPI. A biased soil sample was collected at the location where the highest gamma walkover datum point is observed.
- Soil sampling (Surface and subsurface) - sampling was performed at the identified sample locations. Continuous soil core geoprobes (or similar technology) were utilized to sample subsurface soils. Soil cores were drilled to the point below ground surface that coincides with the deepest location where contamination had been identified on adjacent properties or where there is the potential for contamination, based on historical data and assumptions. A minimum of three samples were obtained at each subsurface sampling location: in the first 15 centimeters (six inches) of soil (or soil beneath any road base), at the depth where the maximum gross gamma measurement is observed, and at the deepest elevation of excavation on adjacent remediated properties or 0.348 meters (1 foot) beyond the apparent fill depth based on whichever is encountered first, i.e., the highest elevation.
- Down hole Gamma Logging - to the extent possible, down hole gamma logging was performed using a sodium-iodide gamma detector. Readings were obtained every 15 centimeters (six inches) below ground surface.
- Core gamma scanning – Soil cores were scanned with a Geiger-Mueller (GM) detector and compared to down hole gamma logging results. If there was inconsistency between the measured depth of elevated GM beta-gamma counts in the soil boring core and the corresponding recorded depth of elevated gamma counts in the borehole gamma profile, it indicated potential soil compression or loss of material in the soil boring tubes.
- Laboratory Analysis (Gamma spectrometry) – All samples were hand delivered to and analyzed for radionuclide concentration at the USACE FUSRAP Maywood Laboratory (UFML). The lab utilized its internal laboratory procedures and analyze the soils samples by gamma spectrometry method Ga-01-R-HASL 300.
- Documentation - Project data was recorded and controlled per logbook SOP [9]. Photographs of sampled areas may have been taken to support logbook entries. Once surveys are complete, a report will be generated documenting the findings and recommendations for each RPI, ultimately to demonstrate compliance with cleanup criteria or comply with the requirements of LUC.

Criteria

The FUSRAP Maywood Site soil cleanup criteria for residential soils is an average concentration of 5 pCi/g of Ra-226 and Th-232 combined and an average concentration of 100 pCi/g total uranium, above background, regardless of depth.

The FUSRAP Maywood Site soil cleanup criteria for commercial surface soils (to a depth of 15 cm) is an average concentration of 5 pCi/g of Ra-226 and Th-232 combined and an average concentration of 100 pCi/g of total uranium, above background. The soil cleanup criteria for commercial subsurface soils (i.e., below 15cm) is an average concentration of 15 pCi/g of Ra-226 and Th-232 combined and an average concentration of 100 pCi/g of total uranium, above background. The commercial criteria also cites the more restrictive residential criteria as an As Low As is Reasonably Achievable goal.

This investigation will use the residential limits to initially evaluate the RPIs. The final status of RPIs will be determined based on criteria established in future decision documents.

DISCUSSION

While sixteen RPIs (See Figure 2) were identified and investigated, 2 example RPIs which illustrate the flexibility of the combined investigation approach and the overall investigation lessons learned were chosen to discuss herein. Figure 3 illustrates a typical RPI sample location grid.

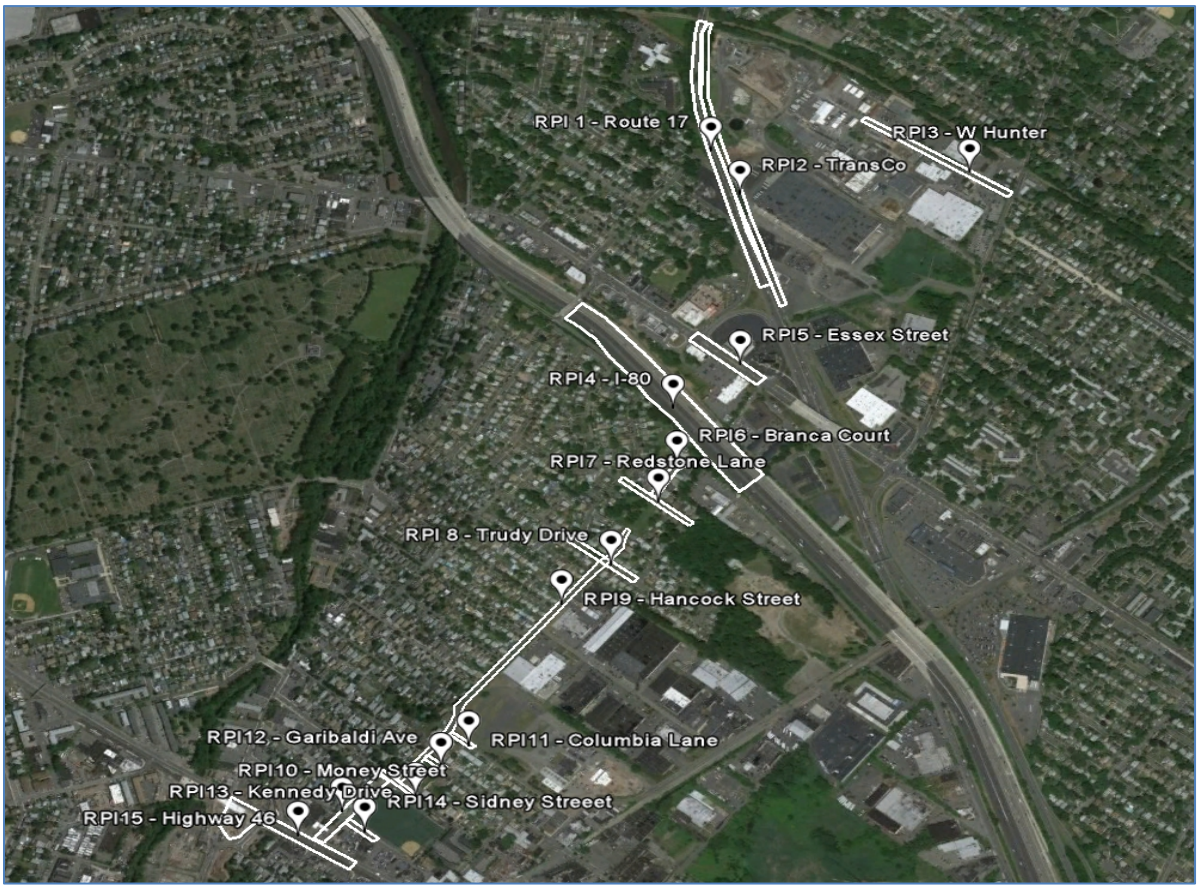

Fig. 2. RPIs

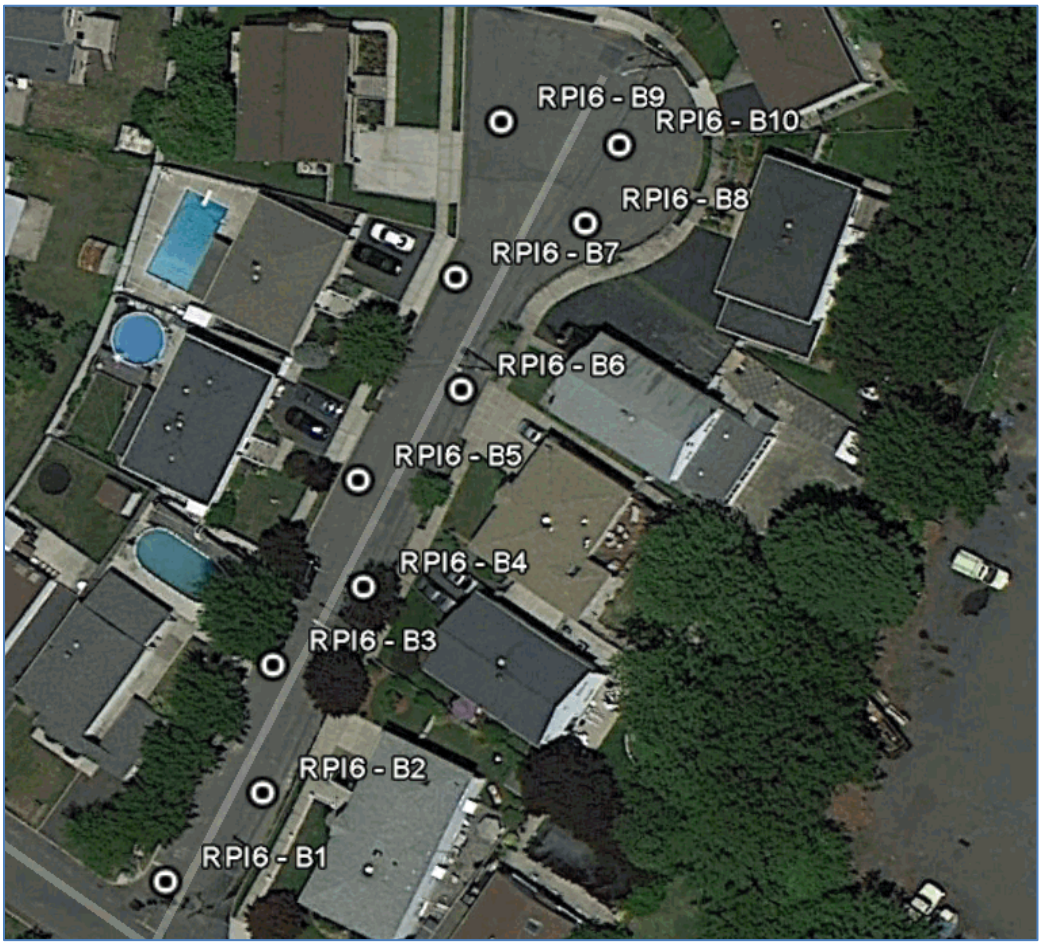

Fig. 3. Example RPI Triangular Grid

RPI Example 1

Example 1 represents an RPI with the high probability of being contaminated above criteria. Over 25 properties on either side of the street were investigated and/or remediated due to contamination associated with the LBC. Each property investigation, characterization, post remedial action and/or verification report was reviewed for data or information to define the potential vertical and horizontal extent of potential contamination impacts to the RPI. Investigation boundaries were established based on the potential for contamination to exist in the RPI. The RPI extends approximately 670 meters (2,200 feet) south from Redstone Park to Kennedy Street. A triangular grid of 50 borings was placed on the roadway and surveyed. Borings extended to a depth of 3.66 meters (12 feet) based on depth of remediations on adjacent properties.

Fig. 4. RPI Example 1 Planned Sample Locations

RPI Example 1 Findings

Data from the RPI demonstrates that a significant portion of the RPI is uncontaminated. The non contaminated areas will be broken into MARSSIM Survey Units and documented in Final Status Survey Reports in accordance with MARSSIM. These areas will be released without further regard to radioactivity. The remaining portions of the RPI will be considered for either remedial actions or LUC. A map of the contaminated portions of RPIs will be provided to the community leaders for consideration of worker protection and waste disposal when working on contaminated portions of the RPI. These considerations are outside the scope of this paper and are not discussed herein. Figure 5 presents the RPI survey results.

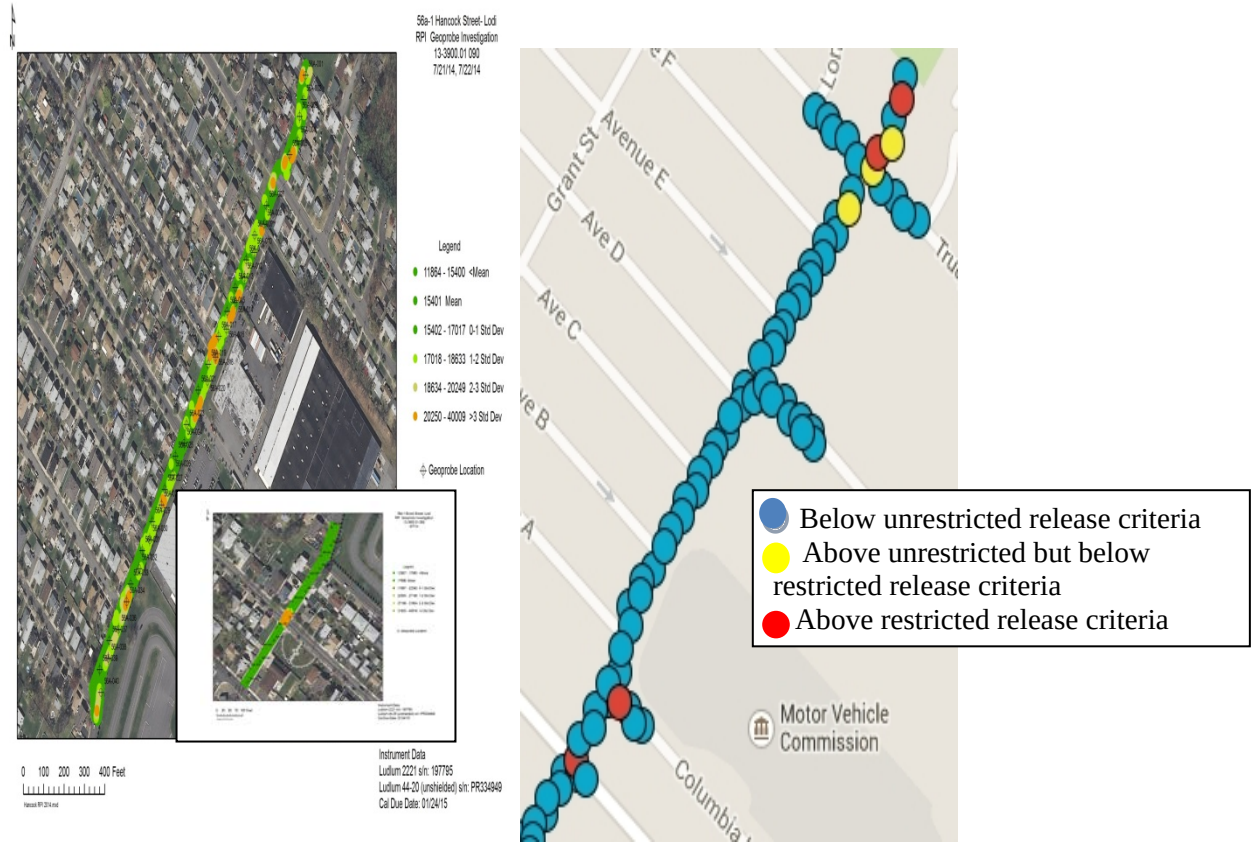

Fig. 5. RPI Example 1 Findings

RPI Example 2

Example 2 represents an RPI with a moderate probability of being contaminated above criteria. Two properties on either side of the street were investigated and/or remediated due to contamination associated with the LBC. Each property investigation, characterization, post remedial action and/or verification report was reviewed for data or information to define the potential vertical and horizontal extent of potential contamination impacts to the RPI. Investigation boundaries were established based on the potential for contamination to exist in the RPI. The RPI extends approximately 76.2 meters (250 feet) east from Brook Street. A triangular grid of 5 borings was placed on the roadway and surveyed. Borings extended to a depth of 2.44 meters (8 feet). In addition, 2 biased samples were placed in the area where the LBC crosses Columbia Lane, as determined in the field. Figure 6 presents the planned sampling locations.

RPI Example 2 Findings

Data from the RPI demonstrates that the RPI is contaminated near and along the LBC. The RPI will be considered for either remedial actions or LUC. The remaining non contaminated areas of the RPI will not be subject to the remedial actions, however, given the distance between sample points the contaminated area will be conservatively overestimated as being between the corner of the RPI and the clean point on the other side of the LBC. This results in a significant portion of the RPI identified as contaminated. A map of the contaminated portions of RPI will be provided to the community leaders for consideration of worker protection and waste disposal when working on contaminated portions of the RPI. These

considerations are outside the scope of this paper and are not discussed herein. Figure 7 presents the RPI survey results.

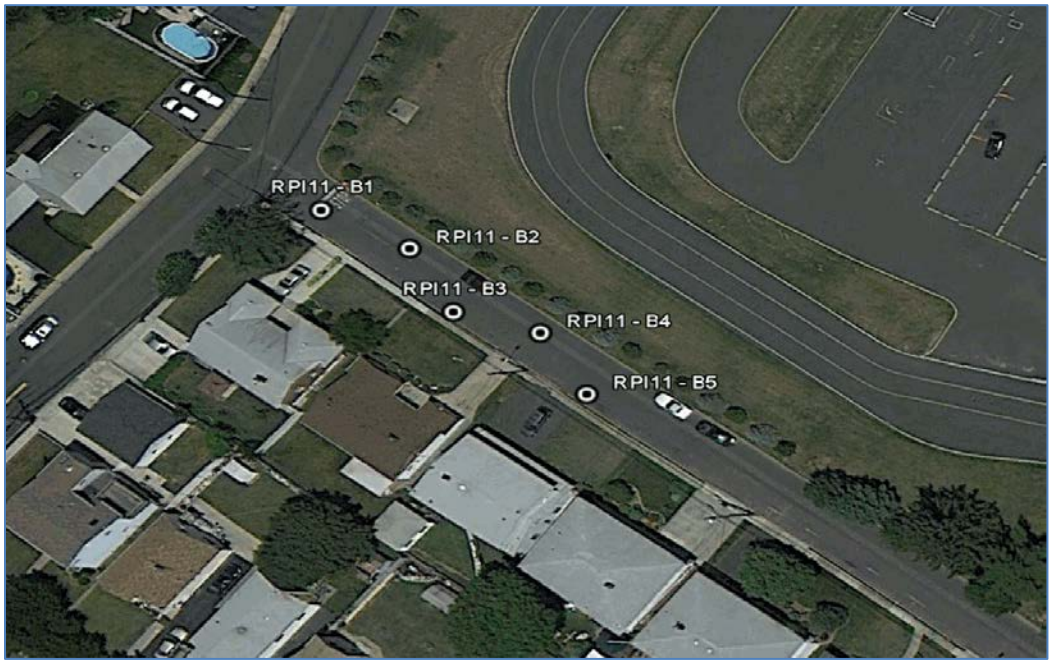

Fig. 6. RPI Example 2 Planned Sample Locations

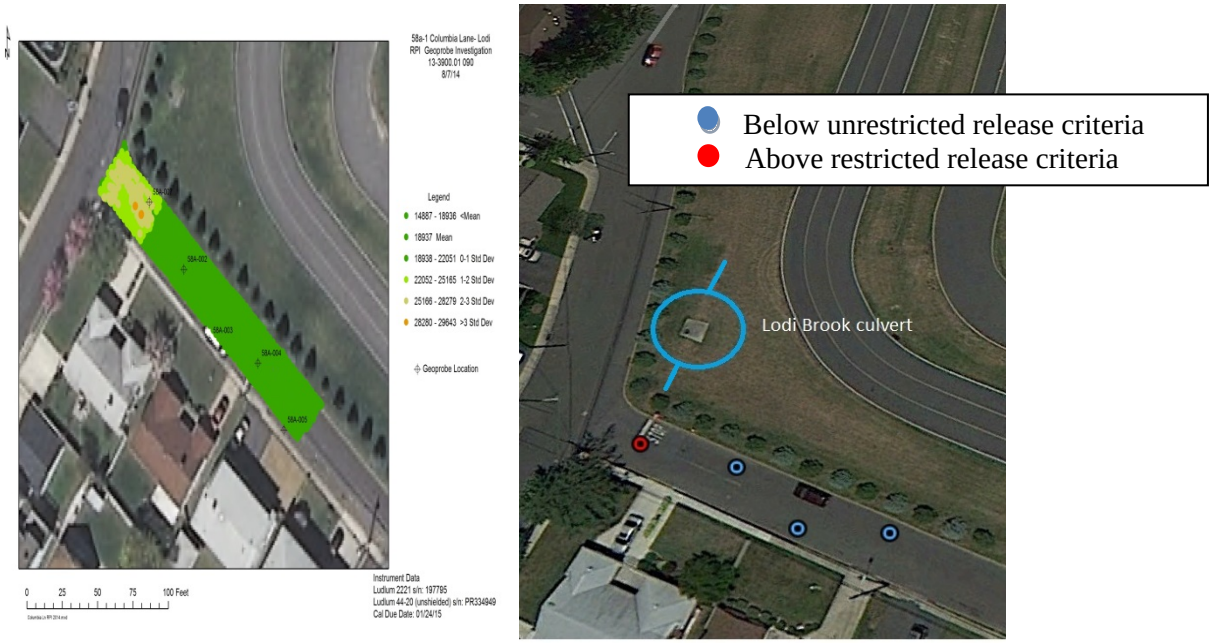

Fig. 7. RPI Example 2 Findings

Lessons Learned

Lessons learned from the investigation effort are presented and should be considered by those planning to investigate RPIs on other sites.

The historical data review portion of the investigation was a significant effort. Simply locating reports, data, and information generated over the project's 30 plus years timeframe was a challenge. The format (microfiche, hard copy, computer program, etc.) of information must be considered as well. Once gathered, the reading of each data source and consolidation of data and information into a format that allows investigation planning and reporting of historical data takes time. Finally, how to include historical data in the final reports may be challenging based on original format, amount of geospatial information provided, type of information, etc. versus the final report format.

Use of historical data to address RPI's when possible saved effort and resources. Four of the sixteen RPIs did not require field investigations. Two of these were due to the fact that historical data provided the basis that they were contaminated above the criteria. Historical data included data such as aerial photos, construction as built drawings, and sample data. One was due to it being an Interstate that could not be closed for a reasonable investigation and historical data suggests contamination extends under it, and the other was a street which had extensive sidewall sampling from adjacent property remediations which demonstrated that contamination did not extend under the street. The RPIs known to be contaminated were not investigated further and remedial designs and or LUCs are being established to address them. The RPI which had sufficient data to conclude it was not impacted will be documented accordingly.

Loss of data due to safety concerns must be considered. Due to safety concerns several planned data collection locations had to be abandoned. In all but one such case this was limited to one location and thus did not negatively impact the statistical strength of the sample population. The one RPI that a significant number of sample locations could not be sampled was a major highway which could not be shut down. USACE sampled all off road locations in the RPI, but the actual highway will be considered for LUC based on the contamination potential and areal extent as determined from the conceptual site model for the RPI and professional judgment.

Non project controlled issues such as rights of entry (to sample), traffic control, public outreach, noise ordnances, and utility clearance, complicate any investigations on RPIs and the time to address these must be considered. Sufficient time was allocated by the Maywood team to address these and other ancillary issues accordingly.

Problems will arise and the project team should be prepared to address them to minimize impact to schedule. Utility drawings and field mark outs by city utility staff and NJ One Call proved to be unreliable in a couple of instances. Water lines were penetrated by sampling equipment at two locations. City maintenance crews were on hand and repaired the water lines in a timely manner. A review of the incidents, safety procedures, and survey designs determined that all procedures were followed by the field crews. Impact to over all investigation schedule were mitigated by quick investigations into the root cause of issues and field modifications (slight increase in safety standoff distance from mark out).

Identification of stakeholders and use of data is critical to determine reporting formats. At FMSS the primary stakeholders are the EPA, NJDEP, Local government and city maintenance crews. Two types of data output or reporting are required. The first is to address the Site's NPL listing and future delisting issues. The second is to provide information in a easily useable format for city utility crews to enable them to quickly know if radiological protection and waste procedures should be applied during emergency repairs to utilities (e.g. broken water mains). The reporting format for CERCLA purposes is

specified in guidance documents and fairly standard across the FUSRAP. The USACE project team chose to present data in a street map view for city maintenance crews.

USACE is in the report writing phase of the process and expects additional lessons learned to develop during the writing and subsequent regulator reviews of reports.

CONCLUSIONS

The investigation of RPIs at FMSS required significant resources. Historical research, conceptual model refinement, planning documents, sample collection, data reporting, and final reports each pose challenges. Lessons learned and challenges encountered during the Maywood investigation may also be helpful to stakeholders, planners, and managers of similar projects wishing to identify their own potential liability within public streets, easements, rights-of-way, and other types of RPIs.

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