RADIUM-226 SOURCE REMEDIATION

Lowerline and Coolidge Streets
New Orleans, LA

A presentation for the City of New Orleans

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January 18, 2019

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- 1. History and Site Description
- 2. Description of Phase 1 Activities
- 3. Discoveries During Phase 1
- 4. Results of Gamma Walkover Survey
- 5. Results of Laboratory Analysis of Soil Samples
- 6. Dose Estimate and Air Sample Results
- 7. Assumptions and Concerns
- 8. Proposed Phase 2 Activities

RADIUM-226 SOURCE REMEDIATION

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1. HISTORY AND SITE DESCRIPTION

- Located in "Gert Town" portion of NOLA near the intersection of Lowerline and Coolidge streets.
- Area is primarily residential with supporting service businesses.
- "Gert Town" has a history of light industry and residential occupants. Former Superfund site (Hayward Chemical) is 3 blocks south.
- Xavier University is 3 blocks north.
- Radium-226 "Source" discovered during DOE radiation sweep in 2013.
- Initial investigation found no immediate threat to public.
- Followup in-situ investigation by DOE/LDEQ indicated a point or highly localized Ra-226 "source" between 1 and 10 mCi.
- Dose rate at contact with pavement surface 1.2-1.5 mR/hr.
- DOE triage report provided description and location of "source".

HISTORY AND SITE DESCRIPTION

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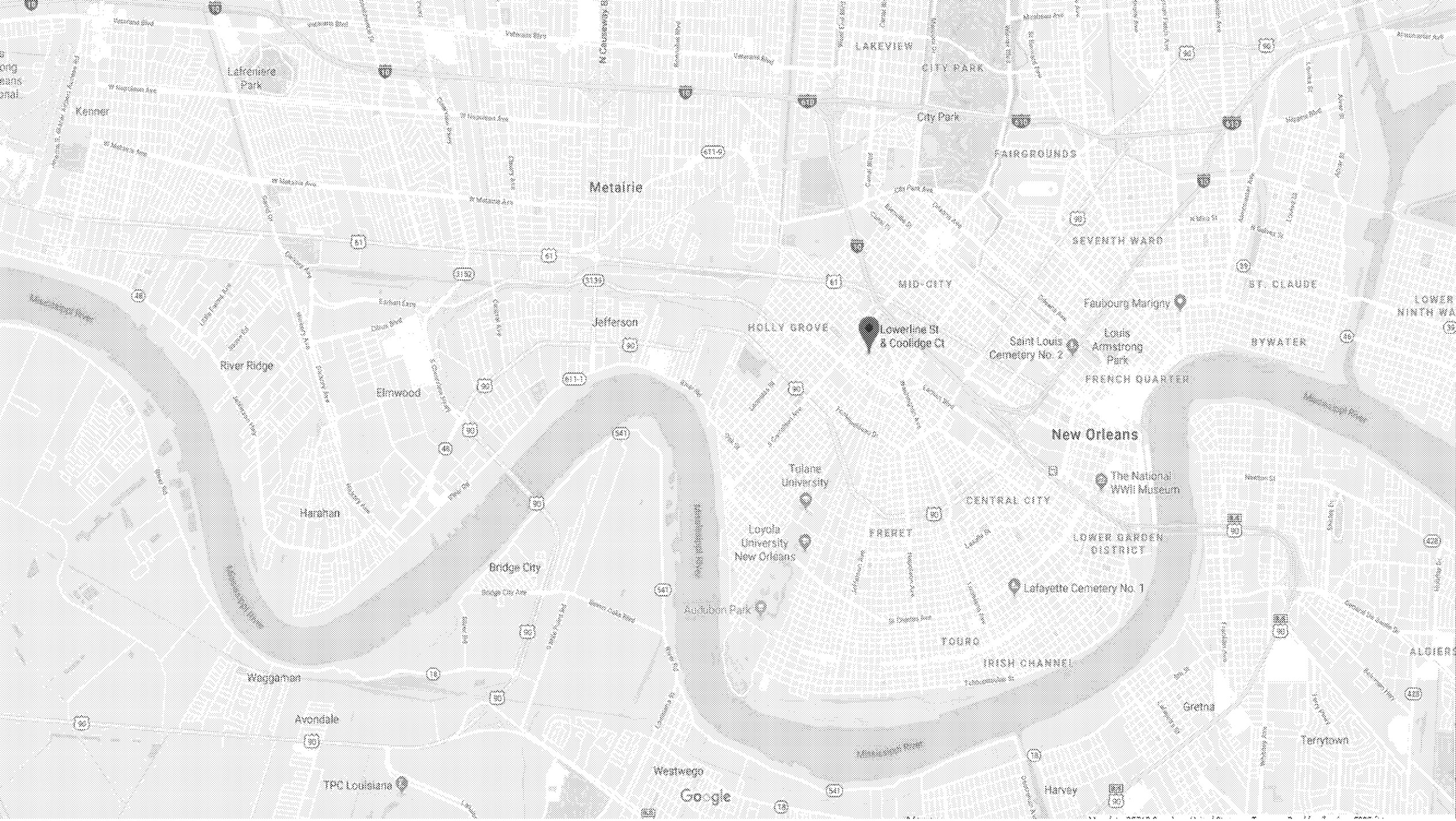
Lafreniere Park
Kenner
Metairie
LAKEVIEW
CITY PARK
City Park
FAIRGROUNDS
SEVENTH WARD
MID-CITY
ST. CLAUDE
Faubourg Marigny
Jefferson
HOLLY GROVE
Lowerline St & Coolidge Ct
Saint Louis Cemetery No. 2
Louis Armstrong Park
BYWATER
FRENCH QUARTER
River Ridge
Elmwood
New Orleans
Tulane University
The National WWII Museum
CENTRAL CITY
Harahan
Loyola University New Orleans
FRERET
LOWER GARDEN DISTRICT
Bridge City
Lafayette Cemetery No. 1
Audubon Park
TOURO
IRISH CHANNEL
Wagganman
Avondale
Gretna
Terrytown
Westwego
TPC Louisiana
Harvey
Google

United States Postal Service
Pep Boys Auto Parts & Service
McDonald's
Magnolia Discount
Chinese Kitchen
Raising Canes Chicken Fingers
Daughters of Charity Health Center - Carrollton
Shell
Da Hair Connect
& Hibachi
O'Reilly Auto Parts
Norwood Thompson Playground
NTB-National Tire & Battery
University of Louisiana
Hall's Motorsports New Orleans
WWUE-TV Fox8
S Carrollton Ave
Lowerline St
Washington Ave
Broadway St
Earhart Blvd
Carrollton Ave
Bienville St
Dante St
Eleanor St
Dublin St
Drexel Dr
Cleveland St
Ivy St
Cherokee St
Ferdinand St
Fig St
Oak St
Maple St
Willow St
Cedar St
Birch St
Colapissa St
Bruxelles St
Burthe St
Cambronne St
Jeanette St
Audubon Pl
Audubon St
Audubon Park
Bienville St
Freeman St
Calliope St
Soniat St
Joseph St
Philip St
Olivier St
Nashville Ave
Leake Ave
Jefferson Davis Pkwy
Sweet Home Rd
Google

Fern St
Olive St
Lowerline St
Edinburgh St
Pine St
Palm St
Lowerline St
& Coolidge Ct
Olive St
Lowerline St
Coolidge Ct
Pine St
Edinburgh St
St Joseph Baptist Church
Edinburgh St
Lowerline St
Olive St
Bible Way Missionary
Holiness Church
Olive St
Pine St
Lowerline St
Google

2. DESCRIPTION OF PHASE 1 ACTIVITIES

- Mobilization
  - Work plan developed per LDEQ requirements and ARS Radioactive Materials License for Decontamination and Decommissioning.
  - Exemption provided by LDEQ for temporary relocation of waste materials to Port Allen for characterization and final packaging.
  - Utility clearance and safety briefings performed.
  - Street barricaded and work zone established.
  - Instrumentation and air monitor operational checks performed.
  - Drums prepared to receive material (lined, absorbent added, wrapped)
  - Dose rates collected at designated spot to confirm position.
  - Safety, work package, and RWP briefing performed with work crew.

DESCRIPTION OF PHASE 1 ACTIVITIES

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- Remediation
  - Concrete saw used to cut asphalt approximately 3'x3' around the location.
  - Air sampling in and around the work area conducted.
  - Mini-Excavator used to removed asphalt and set aside. Surveyed and released as clean.
  - Subsurface material removed in lifts, surveyed, and placed into prepared drums.
  - Excavation to a depth of approximately 24—30 inches.
  - Material screened visually and with dose rate meter for "source".
  - Magnitude and extend found exceeded scope – excavation halted.
  - Samples collected of 3 drums of material and excavation at completion.
  - Excavator bucket successfully decontaminated and released.
  - Equipment and material surveyed and released.
  - Drums closed, labeled, and shipped by DOT hazmat carrier to Port Allen.
  - Demobilization

DESCRIPTION OF PHASE 1 ACTIVITIES

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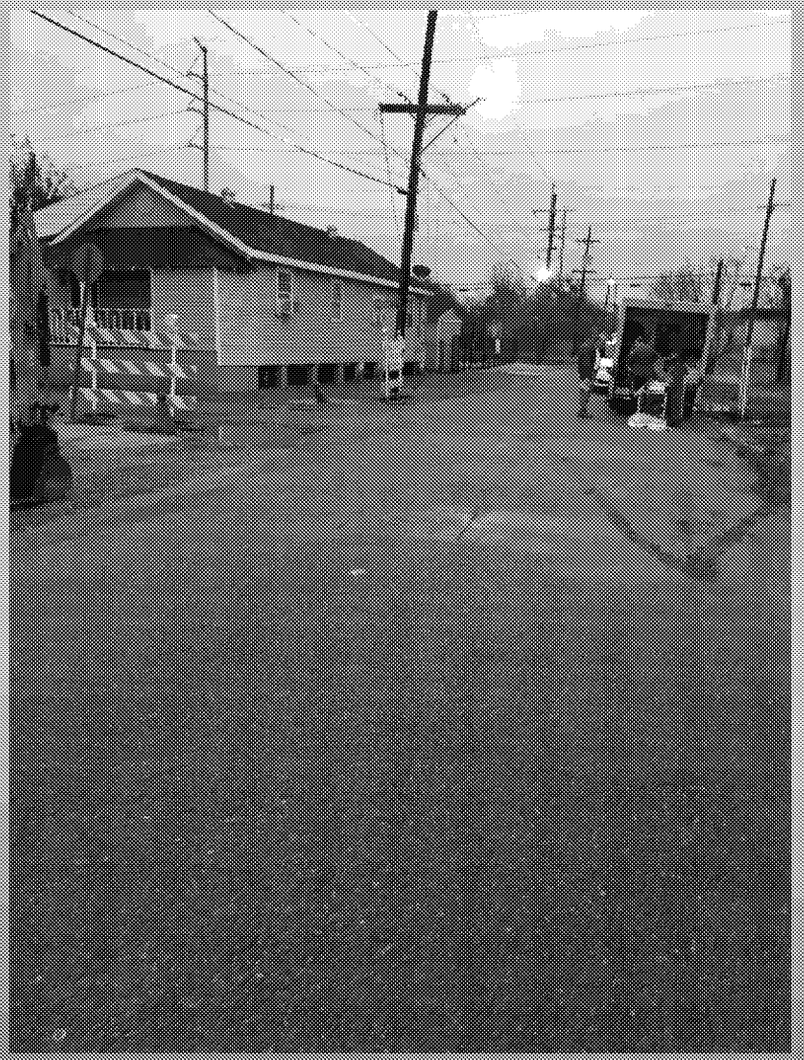

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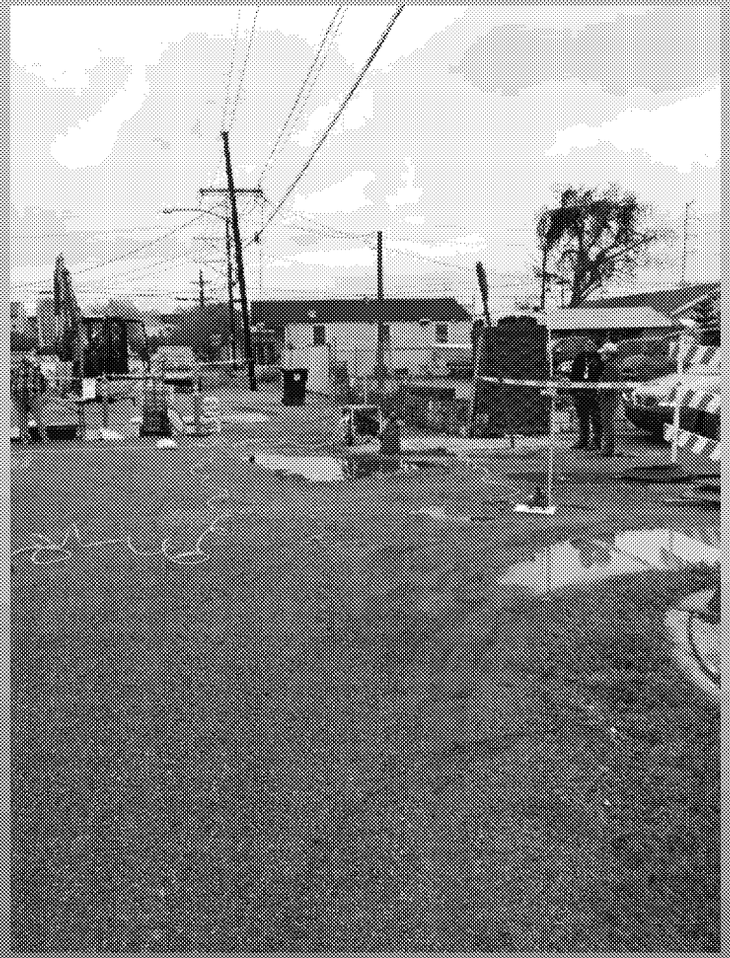

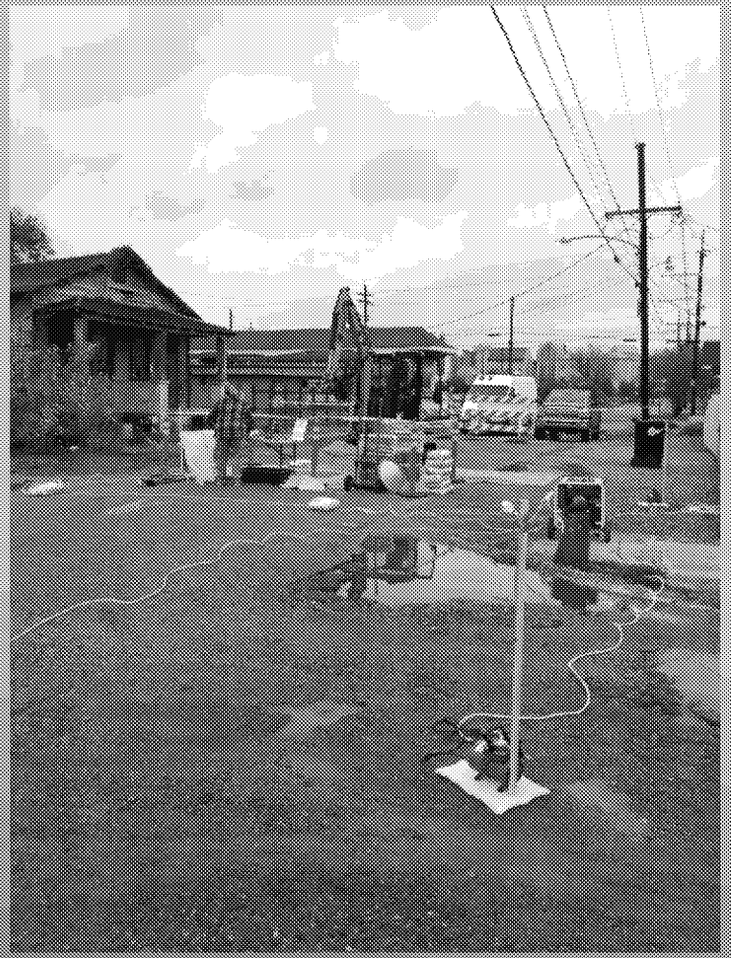

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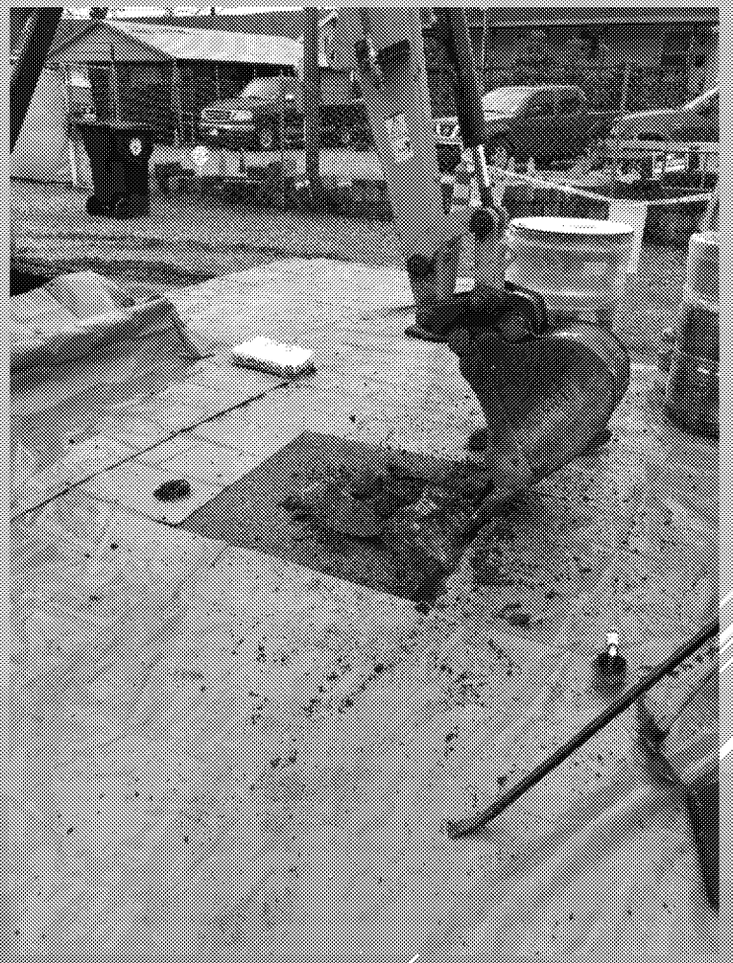

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3. DISCOVERIES DURING PHASE 1

- Contamination appears to be below 2nd layer of asphalt. It is intermingled with and below a layer of crushed oyster shell roadbase.
- No "source" or obvious source capsule was discovered during excavation.
- Localized rate incrementally increased from 1.5 mR/hr to 10,000 mR/hr during excavation.
- General Area dose rates exceeded posting requirements and required the radiological area to be broadened.
- Significantly elevated alpha contamination levels were discovered in the excavation.
- Removable contamination in excess of release limits was detected on the bucket and surrounding plastic.
- Contamination appears bound to the soil. Decontamination was achieved after removal of soil from equipment and excavator.

DISCOVERIES DURING PHASE 1

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- 10,000 mR/hr "source material" identified, bagged, contained, wrapped in 2 layers of lead blankets, and placed into the center of a sand filled 55-gallon drum for transport to Port Allen.
- Contact dose rate 53 mR/hr.
- Other contaminated soil drums range from background to 38 mR/hr.
- Significant contamination remained after excavating 24-30" (>2.5MCPM, 5 mR/hr).
- There was an unknown metallic cable/debris discovered in the bottom of the excavation.
- Several other areas of elevated dose rate were discovered around the original location.
- After consultation with NOLA and LDEQ, the excavation placed in a safe configuration (decontaminated, equipment released, waste removed, backfilled, and cold patch applied).

DISCOVERIES DURING PHASE 1

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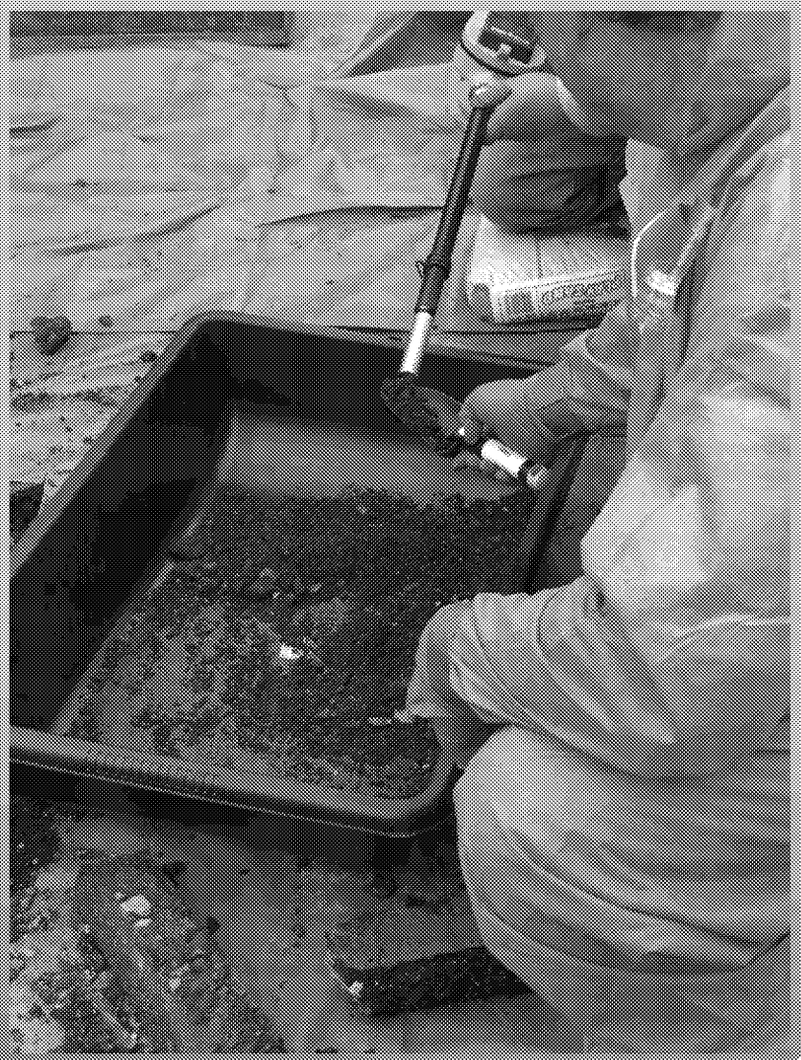

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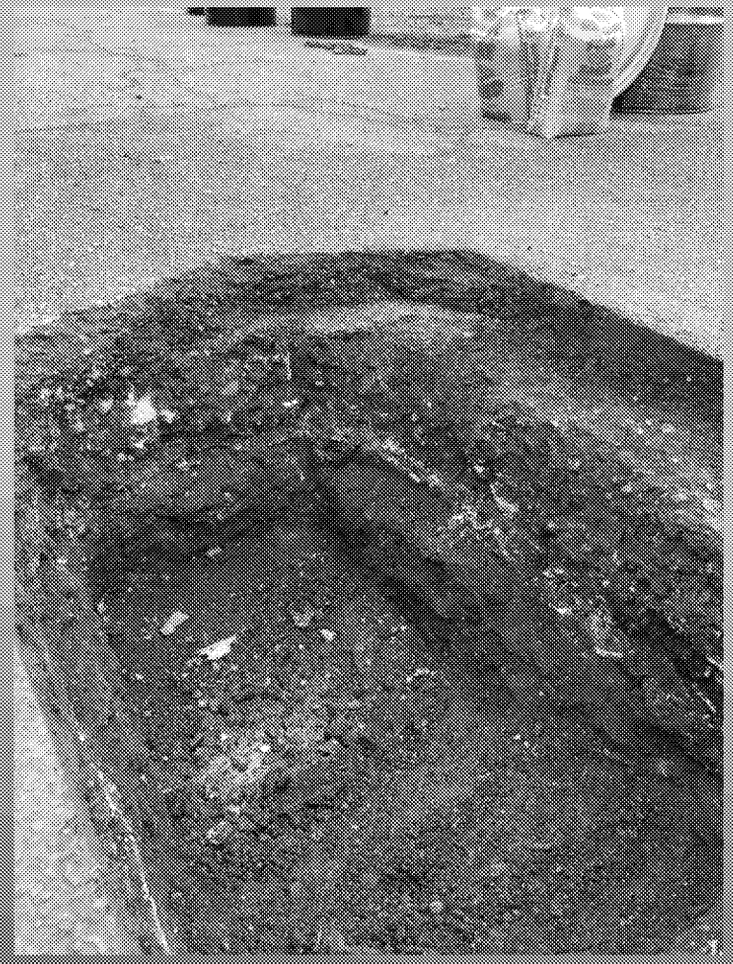

DISCOVERIES DURING PHASE 1

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DISCOVERIES DURING

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4. RESULTS OF GAMMA WALKOVER SURVEY

RESULTS OF GAMMA WALKOVER SURVEY

- Gamma Walkover Survey was performed on December 3, 2018.
- Lowerline Street from Edinburgh to Olive and portions of Coolidge was surveyed.
- Survey parameters and methodology:
  - 2x2 inch sodium iodide with lead collimator/shield – very sensitive to gamma adiation emitted by Ra-226.
  - Positioned 4 inches off the ground.
  - Transitioned linearly at 1-1.5 feet per second.
  - Radiation levels are recorded each second along with position.
  - Positional information collected using Trimble GPS.
  - Accuracy within 24".
- Survey revealed multiple areas of elevated dose rate along Lowerline Street.

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RESULTS OF GAMMA WALKOVER SURVEY

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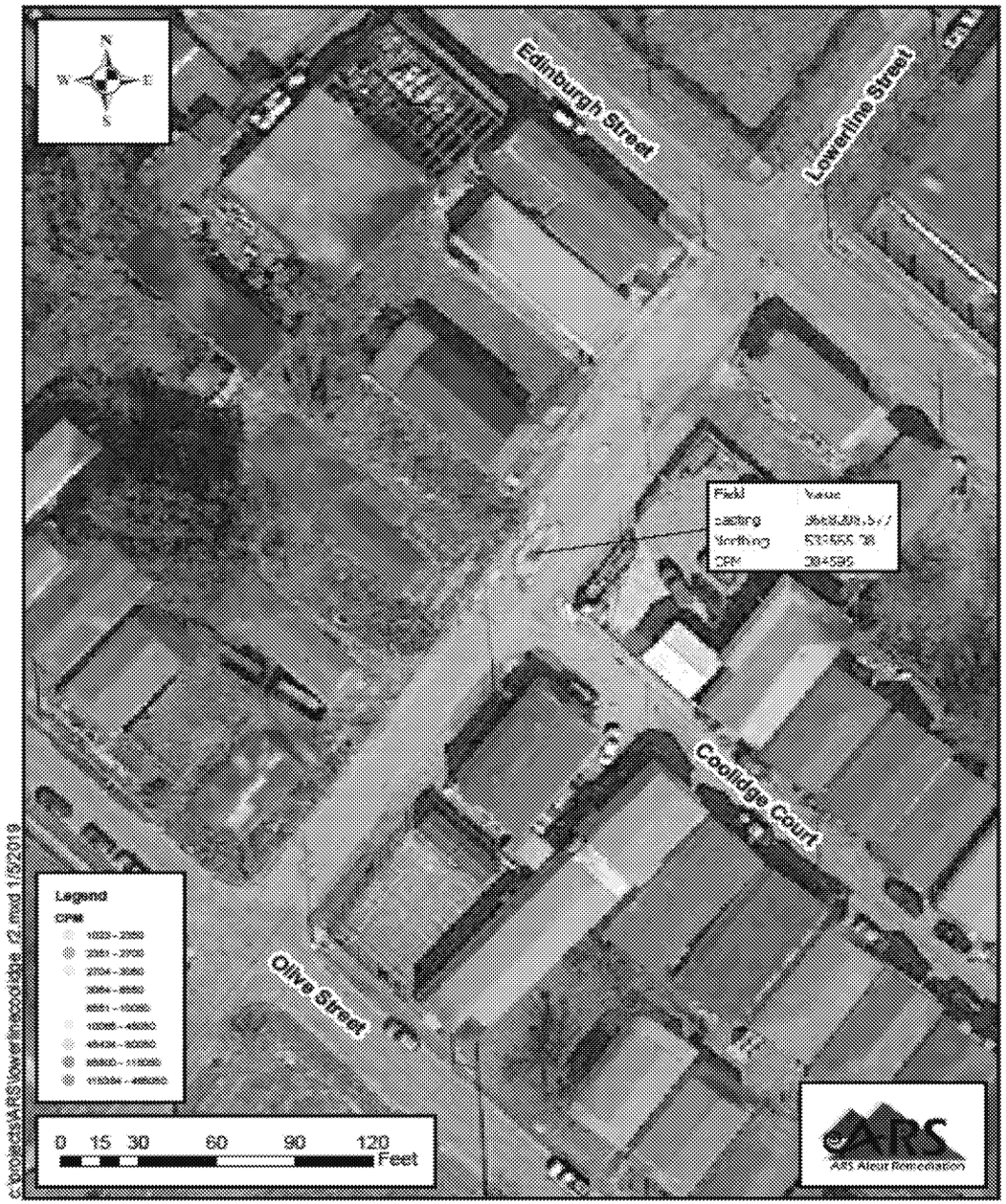

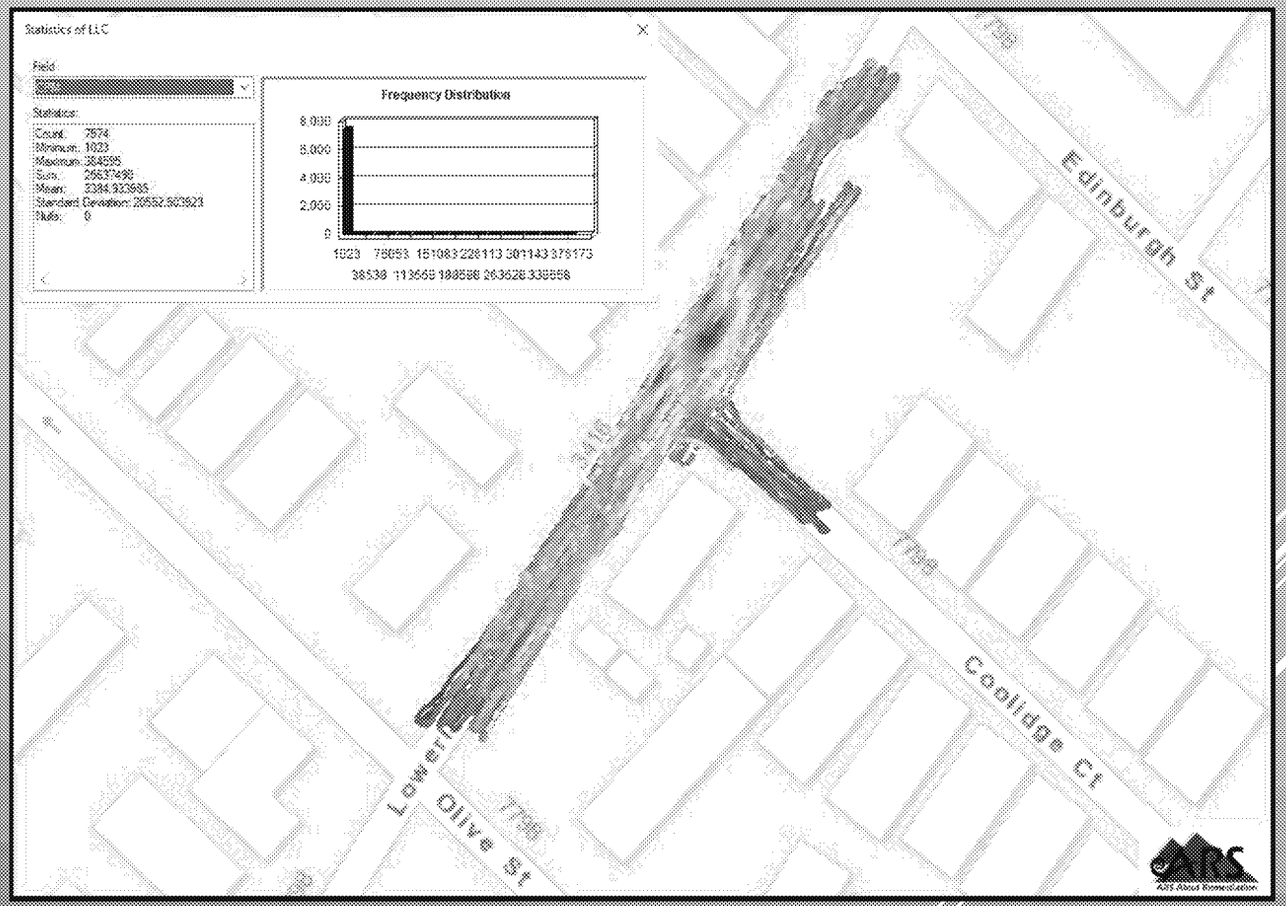

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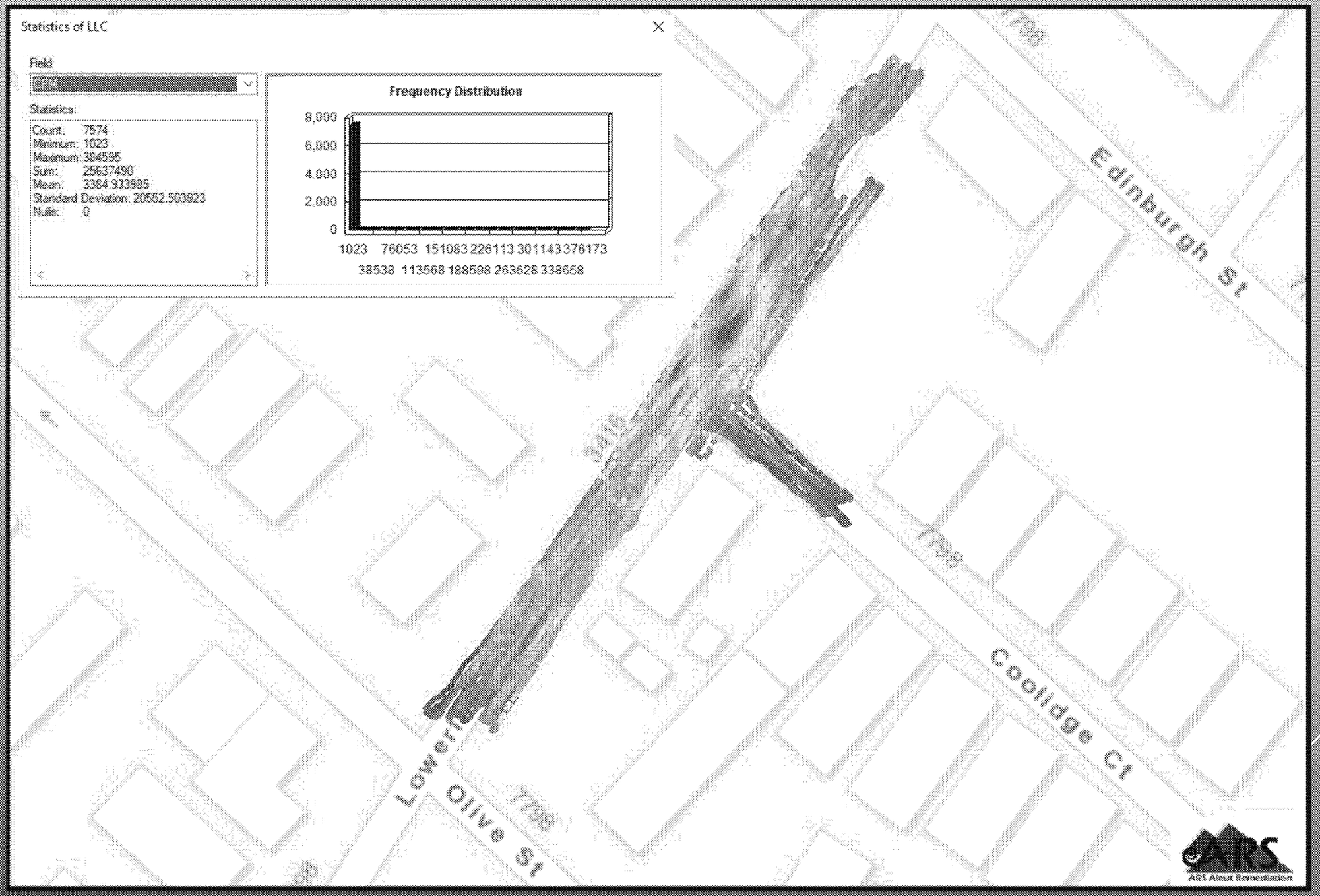
Statistics of LLC

Field

[redacted]

Statistics:

Count: 7574
Minimum: 1023
Maximum: 394595
Sum: 25637490
Mean: 3384.933985
Standard Deviation: 20552.503923
Nulls: 0



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5. RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLES

- Soil samples collected from drums of soil to bound contaminated soil (first drum removed below asphalt and last drum).
- Soil collected from excavation prior to backfill.
- Source material was not sampled.
- Results found elevated Ra-226 and daughter products in the lower soils and excavation.
- Out of equilibrium Pb-210 results indicate significant Rn-222 concentrations and migration of Ra-226 daughters due to radon diffusion.
- Results found greater than 40 times the requested 5 pCi/g cleanup remains in the excavation.
- Results consistent with pre-closure survey of the excavation.

RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLES

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Location	Ra-226 (pCi/g)	Pb-210 (pCi/g)	Total NORM (pCi/g)
Drum 1	1.04	16.3	53.4
Drum 2	190	664	2932
Drum 3	24,758	14,564	163,500
Excavation	215	762	3344

RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLES

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6. DOSE ESTIMATE AND AIR SAMPLE RESULTS

DOSE ESTIMATE AND AIR SAMPLE RESULTS

- Dose estimates were performed for the Maximally Exposed Individual (MEI) and excavator operator based on measured dose rates and air sample results.
- Dosimeters for RadWorkers are being processed.
- Dose estimates for workers indicated dose was less than project specific ALARA goals and regulatory limits.
- Air samples from breathing zone, general area, and work zone perimeter were analyzed for gross alpha and beta.
- Air sample results for perimeter air samples were less than regulatory limits.

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Location	Concentration (uCi/mL)	Percent Ra-226 DAC	Percent App B Effluent Limit
Breathing Zone	1.93E-13	0.064	NA
General Area	1.44E-13	0.048	16.0
Perimeter NE	2.69E-14	0.009	2.99
Perimeter SE	-4.67E-14	-0.016	-5.19
Perimeter S	1.86E-14	0.006	2.07

DOSE ESTIMATE AND AIR SAMPLE RESULTS

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7. ASSUMPTIONS AND CONCERNS

ASSUMPTIONS AND CONCERNS

- Working hypothesis

  In the late 40's or 50's, a radium source, such as a plumb-bob type radiography source, it's box, and actuator, was lost in the vicinity of Lowerline and Coolidge. During the placement of the oyster shell roadbase, the source container was destroyed and the source material displaced over a large area with 10x20 foot primary hot spots Over the course of grading the roadway, contamination was spread to adjacent areas, contaminating approximately 1000 square feet of surface area.

- Assumptions
  - Additional source material of similar or greater strength will be discovered south of the original location.
  - Adjacent locations are smaller and less contaminated based on GWS.
  - Contamination has migrated to at least 30 inches in depth.
  - In order to attain the 2x background cleanup criteria, significant soil will require removal (approx. 20x40, 20x10, and 5x5 feet).
  - Asphalt is uncontaminated and will meet release criteria (IFB).
  - Contamination has not migrated past the roadbase into adjacent soils.

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- Concerns
  - Source material of greater strength than anticipated is encountered.
  - Contamination is found at depths greater than 3 feet.
  - Groundwater is present in the excavation.
  - Migration of contamination beyond the roadbase into soils along the road.
  - Decontamination of equipment (e.g. excavator)
  - Coordination of logistics, JIT delivery of materials and equipment, loading and shipping waste materials.
  - Control/security of the work site, equipment, and contaminated materials.
  - Coordination of road closure with city and the residents
  - Potential for utilities crossing Lowerline in the excavation.

ASSUMPTIONS AND CONCERNS

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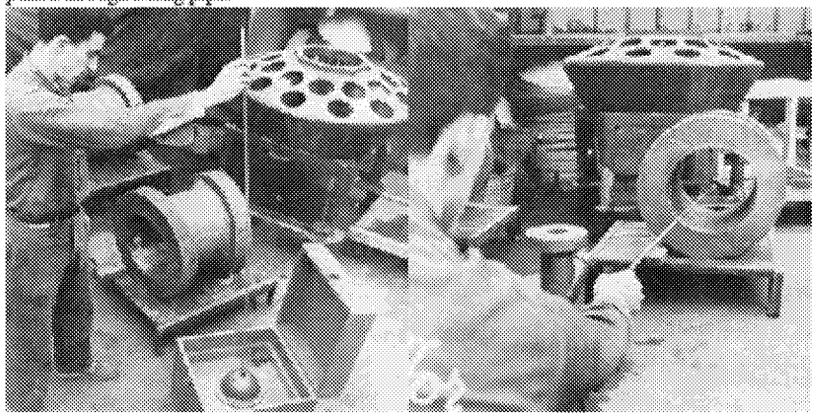
Radium Industrial Radiography Source (ca. 1940s)

This is an example of an industrial radiography source of the type used in the 1930s and 1940s. Sometimes referred to as a plumbbob, it would have contained approximately 0.1 Ci of Ra-226. Although expensive, radium was used because no other radionuclides were then available of sufficient strength. After World War II, Ir-192 and Co-60 quickly became the radionuclides of choice and the use of radium was abandoned.

When used, the radiography source would be placed on one side of the weld or metal casting being "x-rayed," while a sheet of photographic film was placed on the other side. Exposure times were quite long, e.g., one hour to as much as four days. The source was either handled with a long pole ("fishpole") or tied to a cord. The latter method, for example, would allow it to be pulled through a long pipe.



The above B & W photos are from NUREG/BR-0024 *Working Safely in Gamma Radiography*. In the picture on the left, the source is being removed from its shield ("pig"). The photo on the right shows the source being held at the end of a fishpole. The long exposure time and an unsteady hand often resulted in a blurry x-ray image.

The radium (usually radium sulphate) was packed into a cylindrical silver container, which was then placed inside a larger outer capsule. There were two general types of radium capsules: the aluminum type shown at the top of the page, and a steel type. The latter, manipulated at the end of a magnetic handling rod, had two parts: an hexagonal base with a flat bottom (ca. 1" diameter and 1" long) and a short conical cap.

References:

NUREG/BR-0024 *Working Safely in Gamma Radiography*.

Morrison, A. *Radiography with Cobalt-60*. Nucleonics December 1949. Pages 19-32.

Radioactive Sources **Museum Directory**

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8. PROPOSED PHASE 2 ACTIVITIES

- Revise existing work plan and gain LDEQ approval.
- Mobilization of personnel and heavy equipment.
- Install physical controls (barricades and temporary fencing).
- Establish and implement radiological safety controls and monitoring.
- Saw cutting and excavation using excavator.
- Packaging, characterization, shipping, and disposal of soil/roadbase/source material (~100 cubic yards of soil and road base).
- Confirmatory sampling.
- Decontamination of equipment.
- Backfilling and patching the roadway.
- Post remediation survey
- Demobilization

PROPOSED PHASE 2 ACTIVITIES

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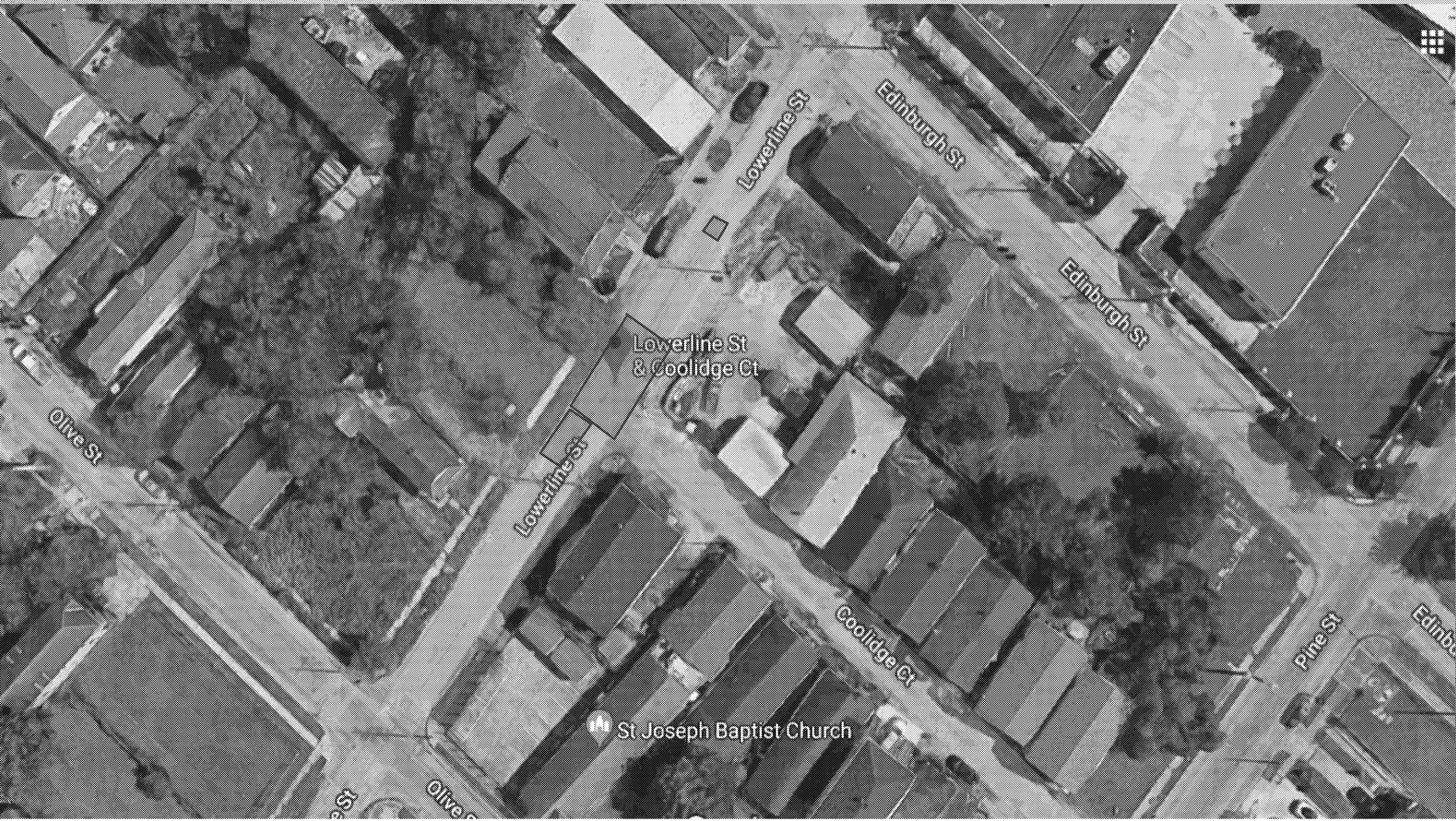
Lakeline St
Edinburgh St
Edinburgh St
Lowerline St
& Coolidge Ct
Olive St
Lowerline St
Coolidge Ct
Pine St
St Joseph Baptist Church
Olive St
Google


Lowerline St
Edinburgh St
Lowerline St
& Coolidge Ct
Edinburgh St
Olive St
Lowerline St
Coolidge Ct
Pine St
St Joseph Baptist Church

February 2019

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
27	28	29	30	31	1	2
3	4 Mobilization	5 Mobilization	6 Mobilization	7 Mobilization and Training	8 Site Prep	9
10	11 Site Prep Saw Cut	12 Excavation Backfill First Excavation	13 Excavation	14 Excavation Ship First Load	15 Excavation and Load	16 Finish Excavation if not complete Ship Last Load Survey Out Equipment Backfill excavations
17	18 Demob Equipment and Fencing Down Cold Patch Asphalt	19 Final Walkover Survey	20	21	22	23
24	25	26	27	28	1	2

Cost

PROPOSED PHASE 2 ACTIVITIES

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