DISTRIBUTION AND FATE OF ENERGETICS AT THE MMR KD ROCKET RANGE

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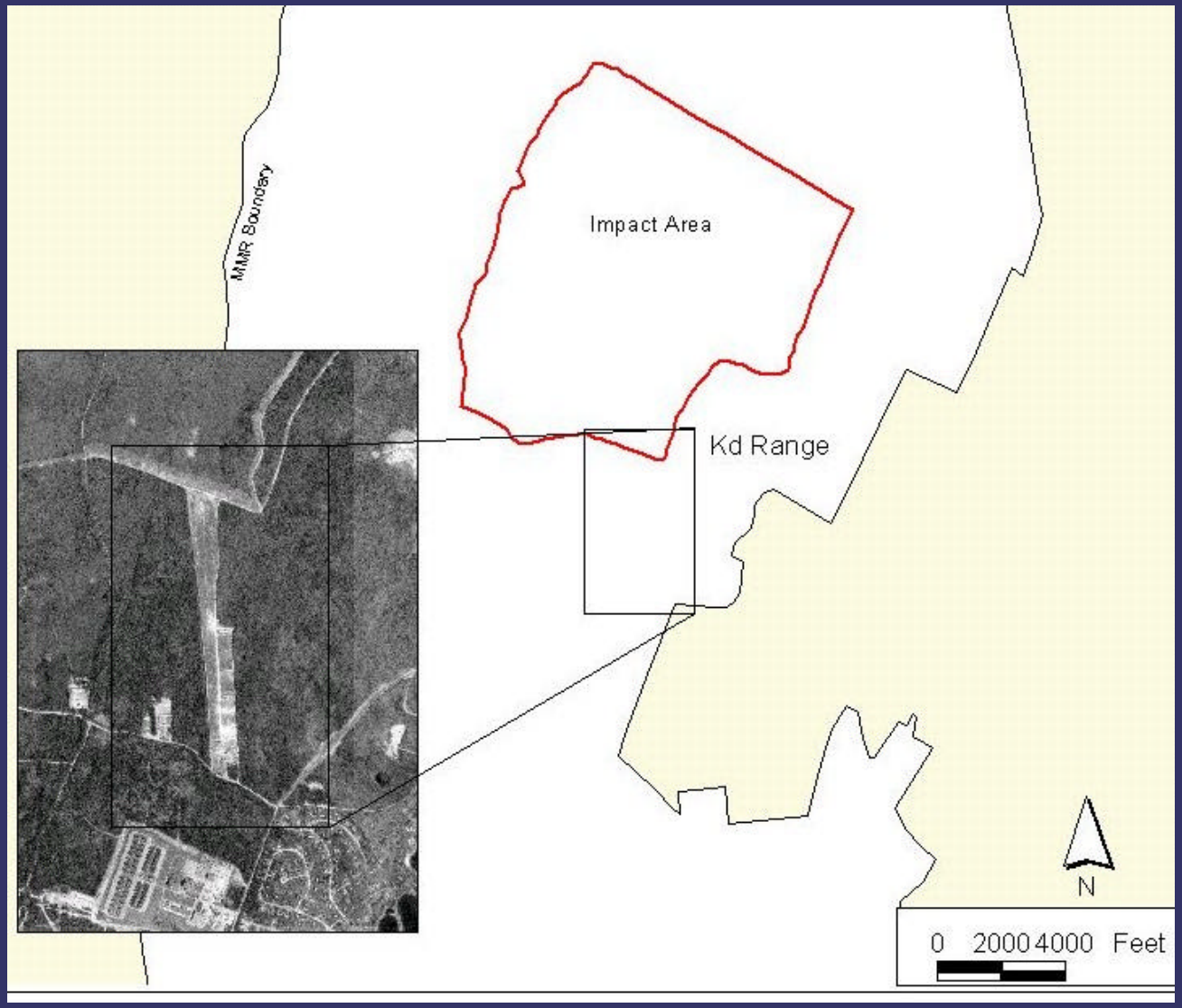
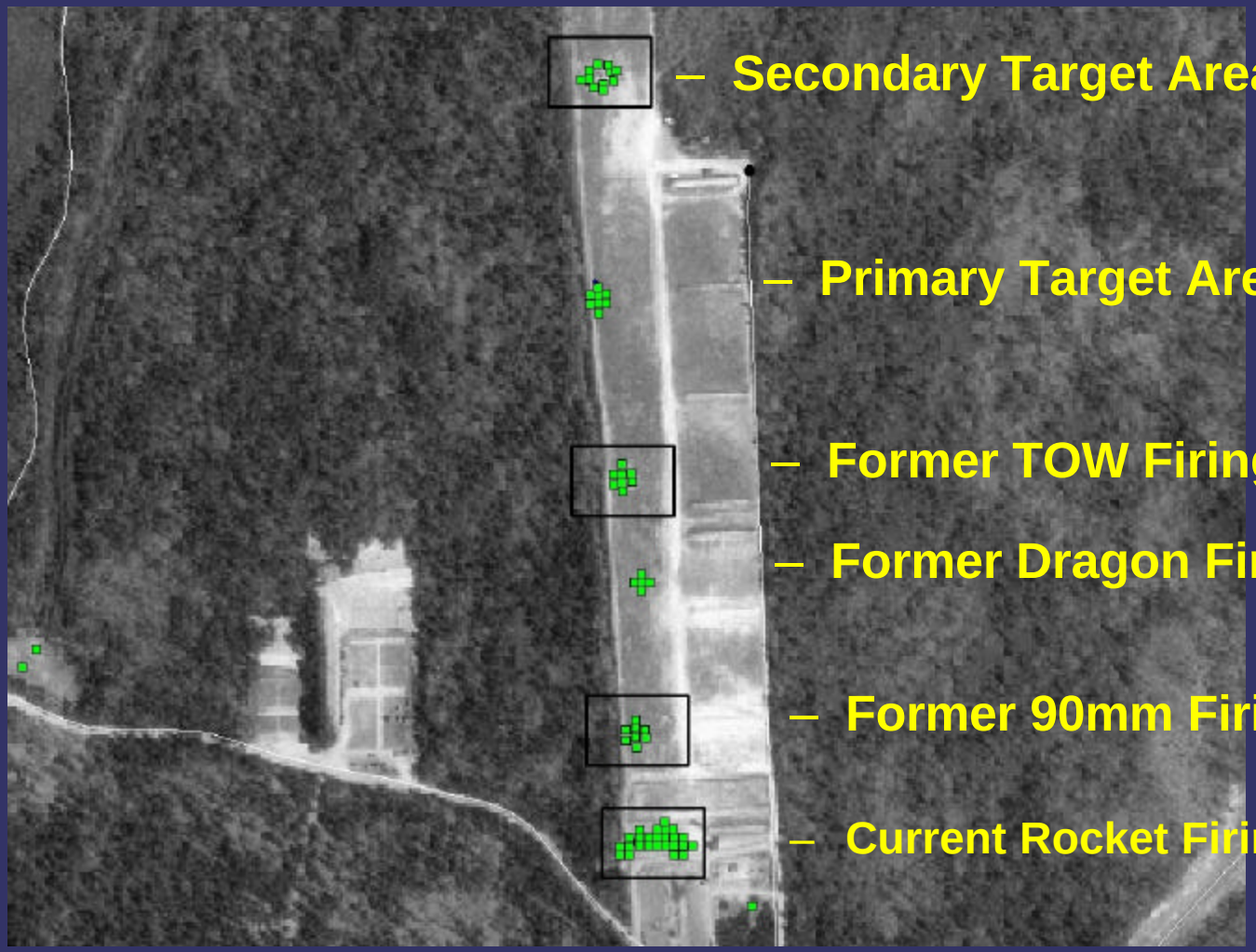
Site Location



Nitroglycerin Distribution in Surface Soil



KD Range - Site Location and Use

- Location/Description
  - Approximately 98 acres in size
  - Southeast of the Central Impact Area

- Use
  - Used as firing range from mid-1970's to 1997
  - Range consists of a 25- meter rifle range, a 600 yards known distance (KD) range, two firing points for Dragon missiles, 90 mm recoilless rifle training and one firing point for TOW missiles.
  - Historic information indicates significant anti-tank practice with rockets and grenades

Explosive and Propellant Mixtures by Ordnance Type Used at KD Range

Ordnance Type	Range Used	Explosive Filler	Warhead Explosive Quantity (g)	Propellant Filler	Propellant Quantity (g)
Grenade 40mm	KD	Comp B	RDX = 192 TNT = 128	M9	NC = 567 NG = 567
Dragon Rocket	KD	Octol	HMX = 1,114 TNT = 477	HEN-12	NC = 49.23% NG = 36.39% Triacetin = 8.16%
Recoilless Rifle 90mm	KD	Comp B	RDX = 408 TNT = 312	M82	NC = 301 NG = 66
TOW Rocket	KD	None	None.	M7 PNJ	NC = 310 NG = 201 $KCLO_4$ = 44 NC = 1,251 NG = 924 Triacetin = 207

NG - Nitroglycerin
NC – Nitro Cellulose
$KCLO_4$ – Potassium Perchlorate

Geology and Hydrogeology

- Sand from ground surface to groundwater
- Groundwater approximately 100 feet below ground surface
- Groundwater flows westerly

Investigations

- Surface Soil Sampling
  - Surface soils samples collected at 0-3 inch, 3-6 inch and 6-12 inch depth for Phase I, Phase II and Rapid Response Action (RRA) activities
  - Discrete and composite soil samples collected from grids throughout the KD range
  - Initial (Phase I and Phase II) surface soil sampling focused on locations near firing points and targets. Surface soil samples collected from 20 grids.
  - Additional sampling via additional 36 sampling grids conducted for RRA activities to delineate explosive concentrations detected in surface soil

Investigations (Continued)

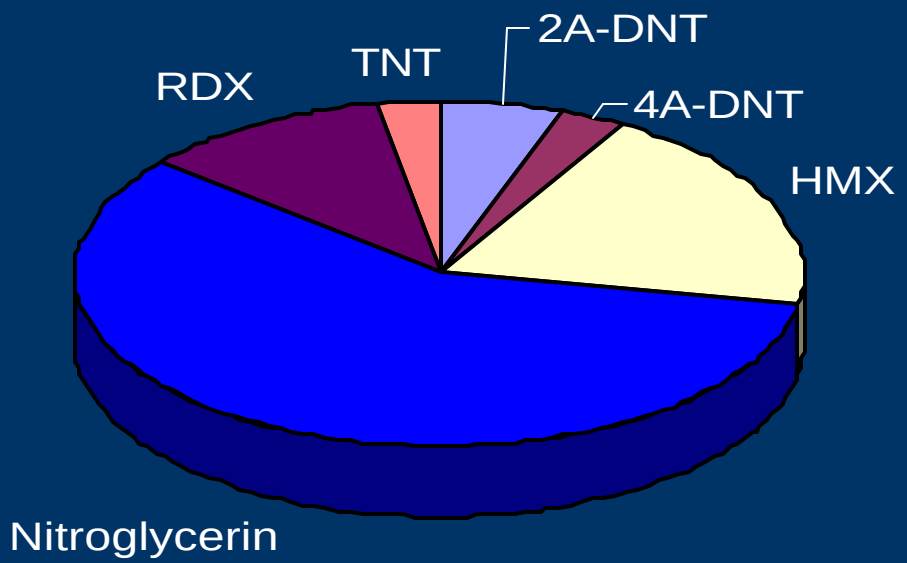
- Subsurface Soil Sampling
  - 18 subsurface soil samples collected to water table and analyzed for explosive compounds during the installation of MW-60 and MW-61
  - Only trace amounts of BEHP detected

- Groundwater Sampling
  - Trace amounts of 2,6-dinitrotoluene (2,4-DNT) and HMX detected in groundwater profile samples
  - No explosive analytes were detected in any groundwater samples at MW-14, 64, 68 and 79 located downgradient of the KD range

Surface Soil Results

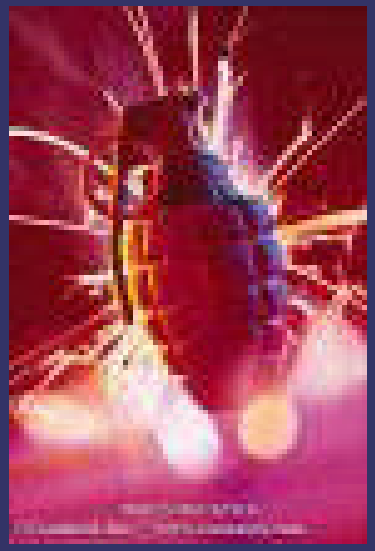
- Phase I and Phase II Sampling
  - Explosive compounds detected in 11 of the 20 grids
  - Explosive compounds identified were 2A-DNT, 4A-DNT, HMX, Nitroglycerin, RDX and TNT
  - Majority of surface soil contamination is from nitroglycerin, a propellant

Explosive Compound Distribution



RRA Assessment Activities

- Conducted to delineate explosive and propellant compounds in surface soil
- Included surface soil sampling and samples below Phase I and Phase II detection limits
- Results were used to determine limits of remediation



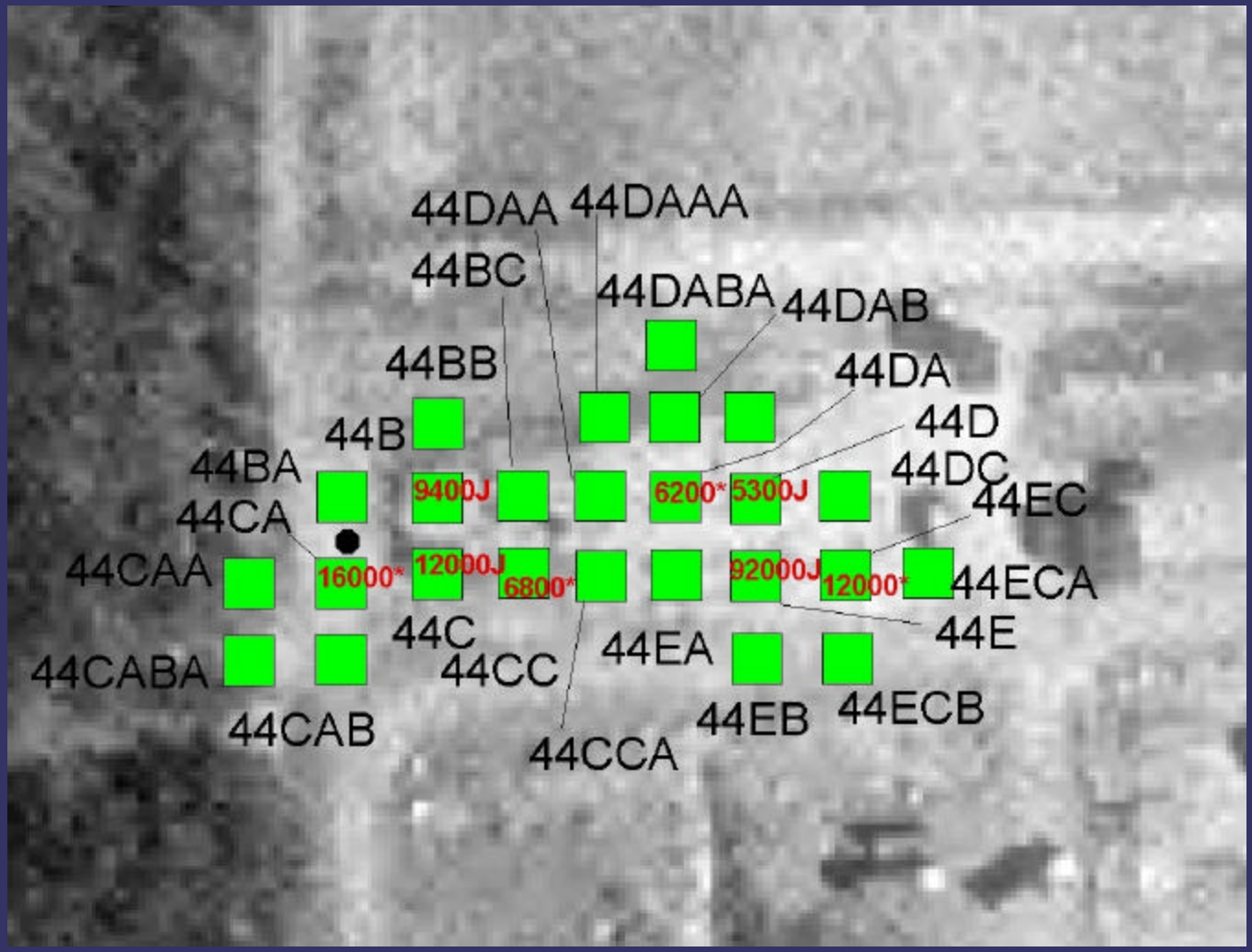
Distribution of Contaminants in Surface Soil

- Nitroglycerin
  - Predominately detected near firing points
  - Attributable to rocket propellant
  - Quantity and magnitude of detected soil concentrations appears to correlate with firing point usage
  - Concentrations decrease with depth
  - Nitroglycerin was detected at a maximum depth of 0.5-1 foot below grade

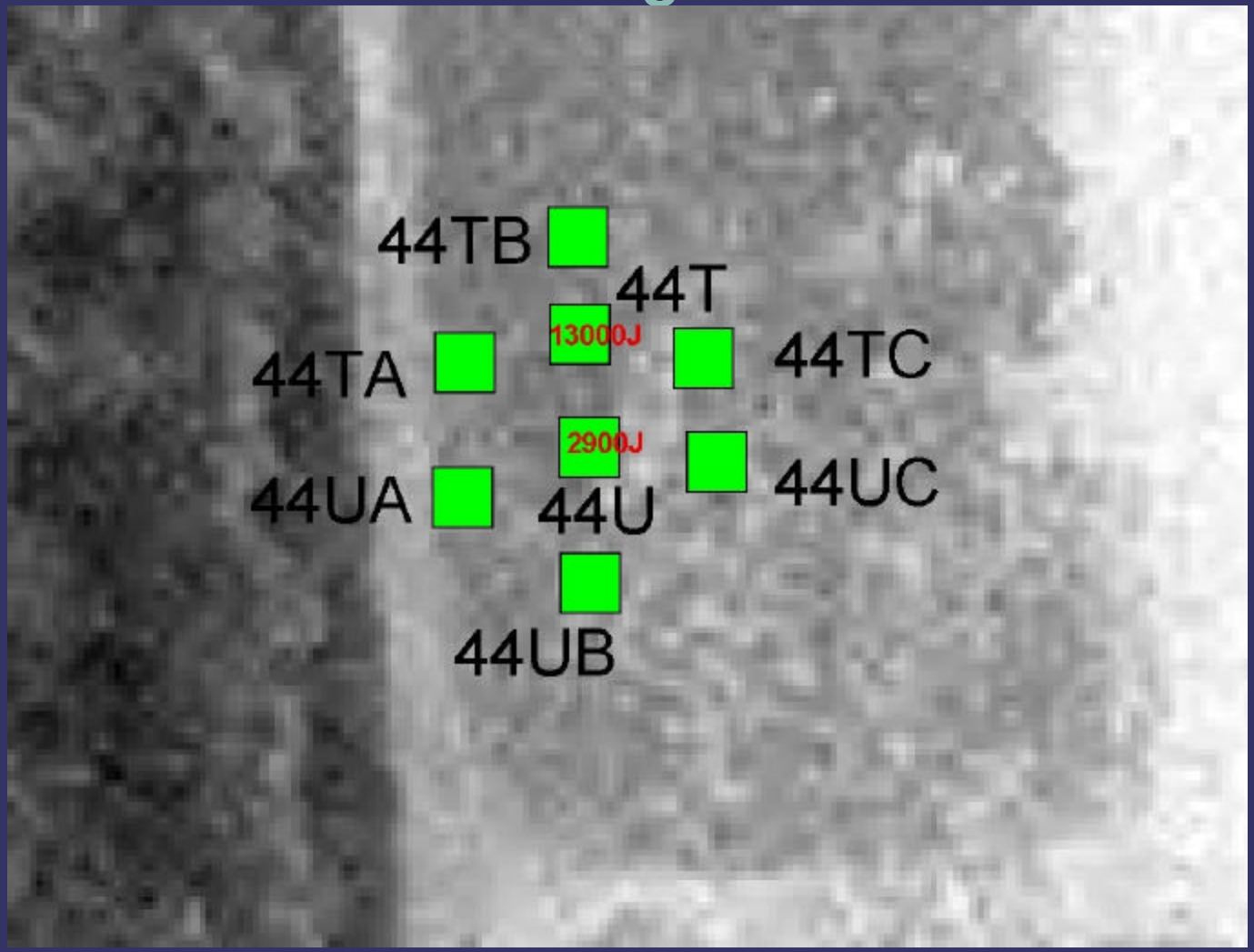
- Other Explosive Compounds
  - Detected in only two soil grids located at northern target

Nitroglycerin Distribution in Surface Soil

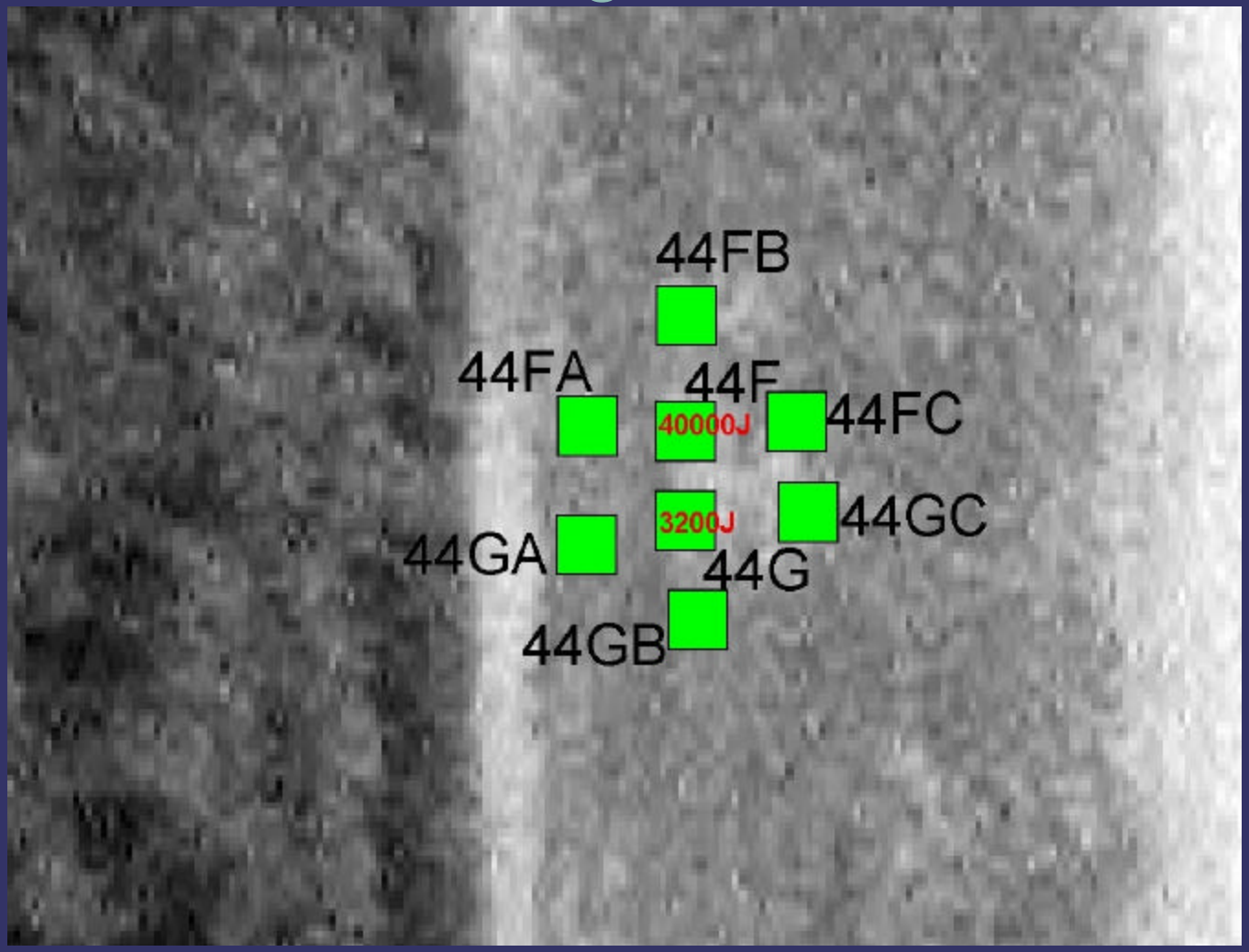
Nitroglycerin Distribution in Surface Soil - Current Rocket Firing Point



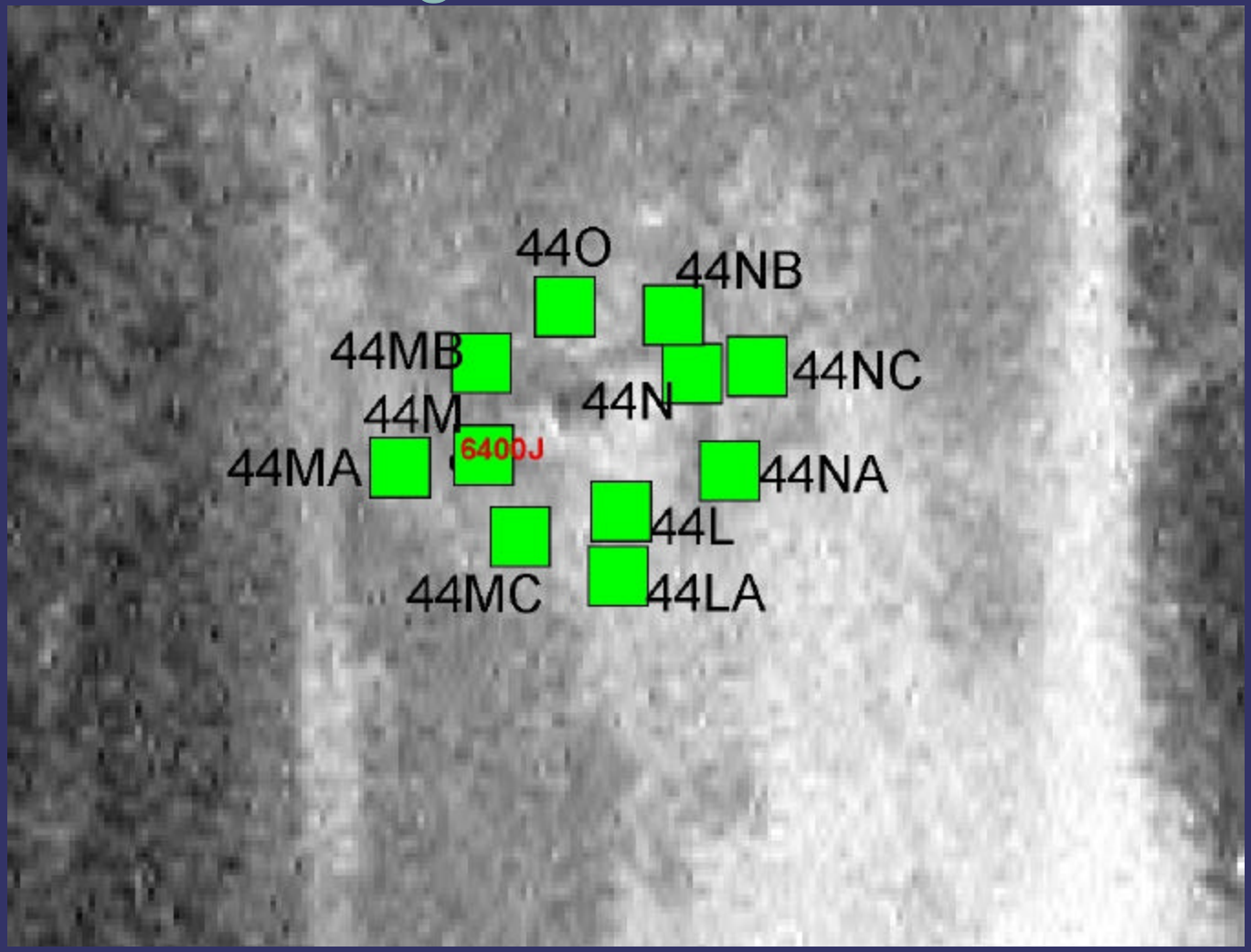
Nitroglycerin Distribution in Surface Soil - Former 90 mm Firing Point



Nitroglycerin Distribution in Surface Soil - Former TOW Firing Point



Nitroglycerin Distribution in Surface Soil - Northern Target Area



RRA Remediation Activities for Surface Soil

- EPA ordered remediation of soil due to leaching concerns
- Approximately 600 cubic yards of surface soil was excavated from the areas of concern
- Excavated soil was transported to an on-site facility for soil washing
- Post excavation soil sampling indicated successful remediation

Conclusions

- Assessment activities indicated that contamination was primarily limited to surface soil
- Nitroglycerin is the primary compound detected in surface soil samples
- No impact has been found in subsurface soil or groundwater
- Limited explosive contamination observed at primary target
- Distribution of nitroglycerin appears to correlate with firing point usage
- Nitroglycerin contaminated soil was remediated with excavation and soil washing
- Perchlorate may have been present in soil but samples were not analyzed. Groundwater samples are currently being collected for perchlorate analysis.