Shaw The Shaw Group Inc.

Stabilization of Metals and Propellants in Soils from the Former Sunflower Army Ammunition Plan

Paul R. Lear, Ph.D and Keith Walker
Shaw Environmental & Infrastructure
Judith Meier, US ACOE

Traditional Paradigm

- Wastes contaminated with semi-volatile organics have traditionally treated via thermal treatment technologies
- Public and regulatory acceptance of thermal treatment has declined
- Alternative remedial technologies (bioremediation, soil vapor extraction, chemical oxidation, and soil washing) do not have the same level of destruction as thermal treatment technologies

Stabilization of Organics as a Remedial Alternative

- The traditional alternative remedial technologies leave residual levels of organics after treatment
- The residual levels may be unacceptable or require containment of the treated material
- Stabilization, or chemical fixation, can be acceptable since the organics are immobilized in the treated material, limiting their impact to human health and the environment

Propellant Production at SFAAP

- N-5 propellant (a mixture of nitroglycerine, nitrocellulose, diethylphthalate, 2-dinitrophenylamine, lead 2- ethylhexoate, lead salicylate, and candelilla wax) was produced at a munitions plant

Propellant Production at SFAAP

- The N-5 was rolled into sheets and extruded into solid propellant grains

Propellant Production at SFAAP

- Production plant washdown water, containing N-5 propellant paste and chips were discharged into ditches and settling ponds

Corrective Measure at SFAAP

- Building Foundation Area, Ditch and Settling Pond soils were contaminated with lead, nitroglycerine, and nitrocellulose
  - Could be reactive if concentrations of propellant are high
- Kansas DPH and Region VII agreed to a stabilized material which was not RCRA characteristically hazardous for reactivity and leached less than 0.75 mg/L lead

Stabilization Treatment Basis

- Treatability Results - Ditch Soil

Parameter	Untreated Soil		Treated Soil	
	Total (mg/kg)	TCLP (ug/L)	Total (mg/kg)	TCLP (ug/L)
Lead	1,300	8,600	1,060	<200
Nitroglycerin	65.2	2	192	<1
Nitrocellulose	2,410	55	1,670	<1

Stabilization Treatment Basis

- Treatability Results - Pond Sediment

Parameter	Untreated Soil		Treated Soil	
	Total (mg/kg)	TCLP (ug/L)	Total (mg/kg)	TCLP (ug/L)
Lead	834	9,520	874	<200
Nitroglycerin	251	5	222	<1
Nitrocellulose	3,850	94	3,470	<1

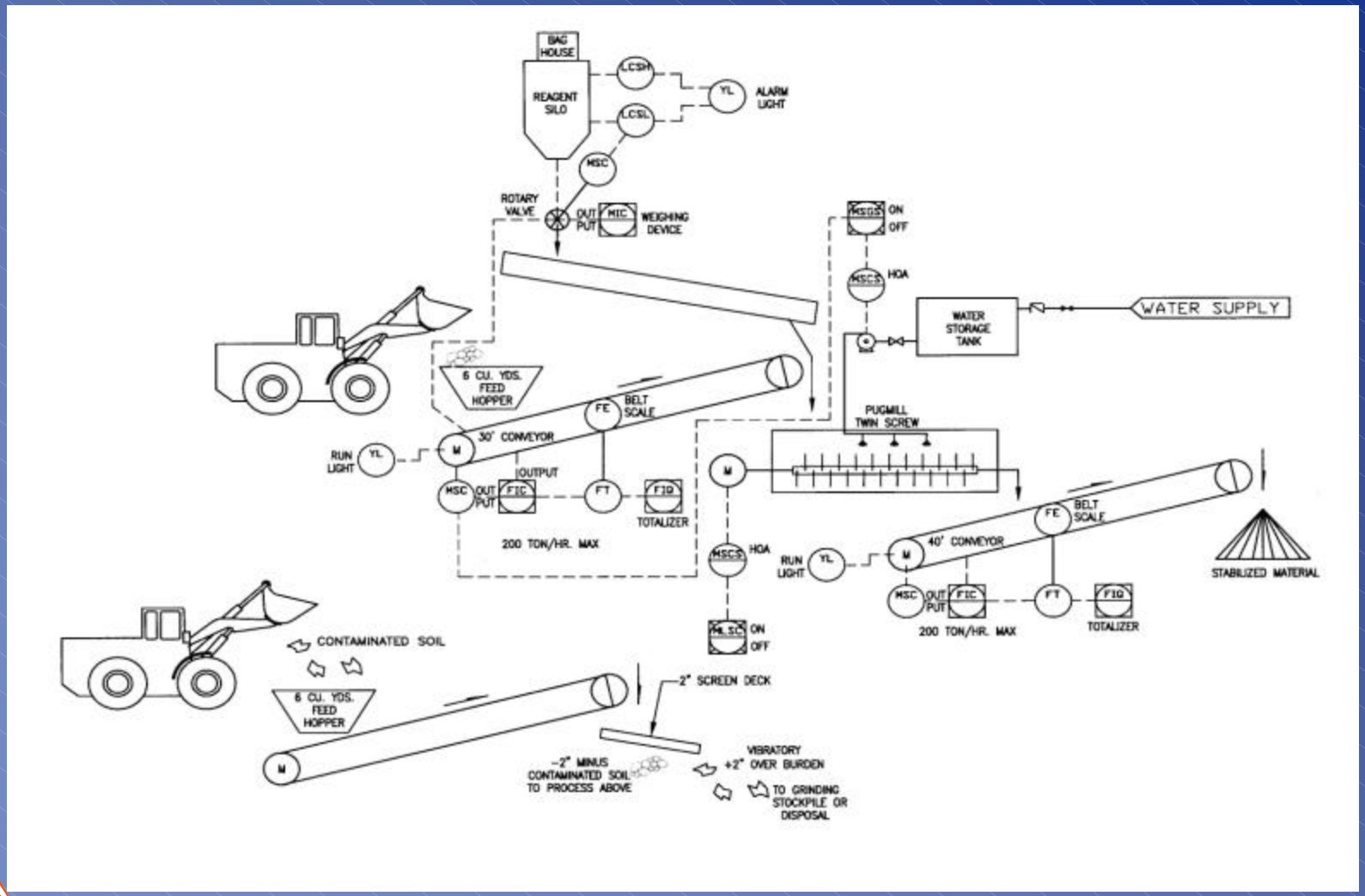
Excavation

- Production oriented in Uplands building Foundation Areas
- Surgical excavation in ditches and ponds

Excavation

- Procedures were in place to identify and mitigate risks from propellant and UXO
- Propellant was encountered though concentration not sufficient for detonation

Stabilization Treatment PFD



Screening

- Excavated material had to be screened due to:
  - Nature and extent of cohesive fines
  - Moisture content

Stabilization

- Screened material was transferred to a pugmill
- Reagent usage was controlled by PLC
- Water was added by spray bars within pugmill
- Treatment rate of 160 tons/hr average

Stockpile

- Treated material was stockpiled awaiting confirmation testing
  - Only 3 daypiles (3%) required retreatment
- Treated material hauled off-site for use as daily cover at a municipal landfill

Summary

- 46,000 tons of soil was excavated
  - 22,000 tons for Building Foundation Areas
  - 19,000 tons from drainage ditches
  - 5,000 tons from settling ponds
- Excavated soil was screened, then treated at a rate of 160 tons per hour using conventional stabilization equipment
- Treated soil was stockpiled and analyzed for LDRs and UTS prior to off-site disposal as landfill daily cover
- Coordinated project management allowed fast-track from design to execution