FMC Waste Contamination Profile

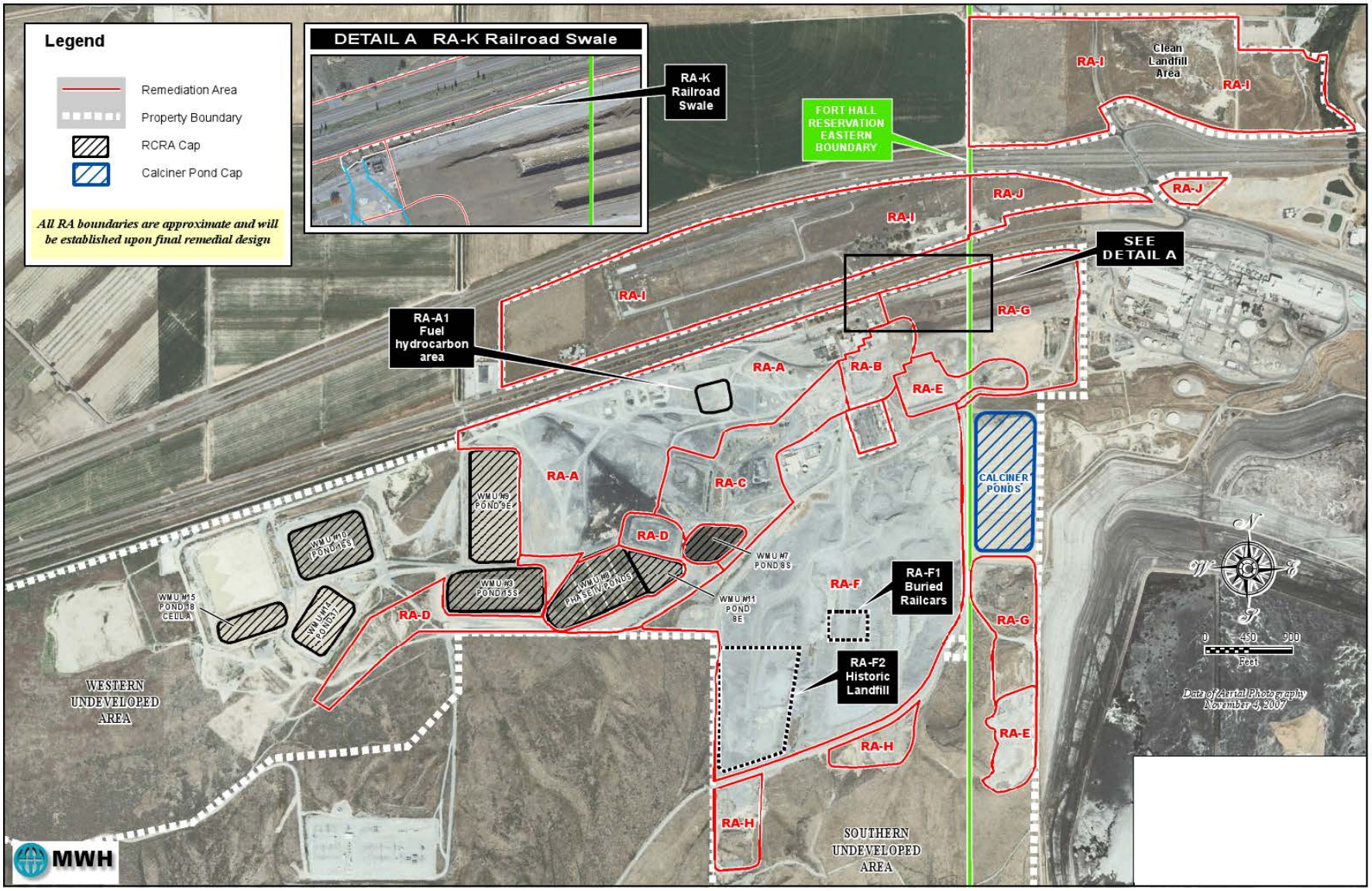
Easter Michaud Flats Superfund Site

Pocatello, Idaho

EPA Region 10

Locations of Waste at the Former FMC Plant Site

Wastes contain metals, radionuclide, and/or elemental phosphorus (P4)



Waste Descriptions

Wastes, process feed materials, and by-products on the FMC Site containing metals and radionuclides include

- ore (process feed)
- slag
- precipitator solids
- phossy solids
- calciner pond solids
- calcined ore
- ferrophos (by-product)

Elemental phosphorus (P4) is found throughout site in fill, former ponds, and in one case has leached into native soil

Metals found in wastes include

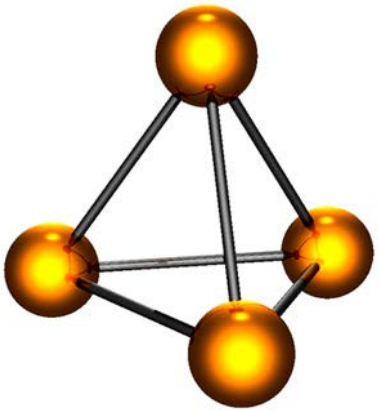
- Antimony
- Arsenic
- Cadmium
- Lead
- Nickel
- Thallium
- Vanadium

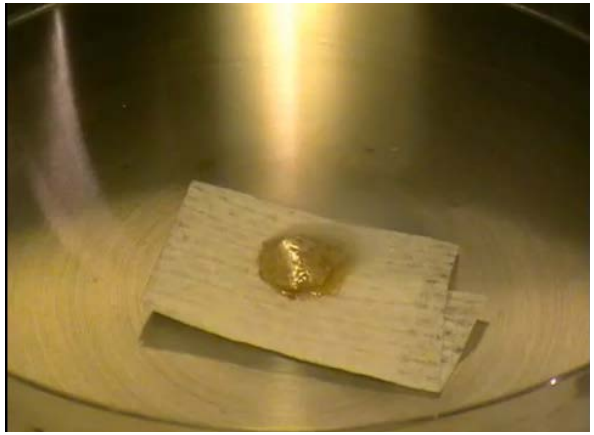
Radionuclides found in wastes include

- Lead-210
- Polonium-210
- Potassium-40
- Radium-226
- Uranium-238

Waste Descriptions (cont'd)

- Elemental Phosphorus (P4)
- http://www.youtube.com/watch?v=U6_-EUcswSc
  - Pyrophoric – spontaneously ignitable in air; oxidizes with exposure to atmospheric oxygen at normal temperatures
  - Reacts quickly with oxygen to produce phosphorus pentoxide (P_2O_5) smoke
  - Slowly reacts with water to produce phosphine (PH_3)
  - Used in matches and in weaponry (smoke shielding, incendiary weaponry)
  - Health and Safety Concerns
    - P4 is highly toxic by ingestion, inhalation, and skin absorption; may be fatal; corrosive to body tissues; skin burns very possible.
    - P_2O_5 smoke reacts with water in air to make phosphoric acid aerosol





3 General Waste Types at the FMC Site

1. Wastes managed in ponds and surface impoundments
2. Wastes and products leached into native soil or disposed on-site
3. Wastes used as fill materials to contour the site

Contaminants of Concern	Ore	Slag	Precipitator Solids	Phossy Solids	Calciner Pond Solids	Calcined Ore	Ferrophos	Coke[1]	Soil	95th UCL Background Concentrations
Antimony (mg/kg)	-	-	146	194	-	-	-	-	-	0.28
Arsenic (mg/kg)	14.6	-	44.6	180	14.3	-	-	-	-	10.4
Cadmium (mg/kg)	125	-	5,240	2,010	538	-	-	-	-	0.72
Hydrocarbons (mg/kg)	-	-	-	-	-	-	-	3.75 - 31.1	-	-
Fluoride (mg/kg)	-	-	-	-	1,300	-	-	-	-	302
Lead (mg/kg)	-	-	1,073	-	-	-	-	-	-	23.9
Lead-210 (pCi/g)	36.3	13	1,140	409	34.1	21.9	-	-	-	2.02
Nickel (mg/kg)	-	-	-	-	-	-	1,150	-	-	18.7
Phosphine (mg/kg)	-	-	-	-	-	-	-	-	0 – 1.0[2]	0
Polonium-210 (pCi/g)	-	-	657	72.3	458	-	-	-	-	1.17
Potassium-40 (pCi/g)	-	-	152	27.4	70.4	-	-	-	-	15.0
Radium-226 (pCi/g)	29.6	25.1	11.3	-	17.4	26.7	-	-	-	0.953
Thallium (mg/kg)	-	-	-	-	340	-	-	-	-	0.13
Uranium-238 (pCi/g)	27.5	29.3	6.39	-	17.9	24.2	-	-	-	0.88
Vanadium (mg/kg)	-	-	-	-	-	-	6,330	-	-	19.6

[1]Coke contains polycyclic aromatic hydrocarbons, six of which were found to be in concentrations that pose risk. There is no “background” concentration for hydrocarbons.
[2]Phosphine may be present in soils where elemental phosphorus is known to be present .

1. Wastes Managed in Ponds and Surface Impoundments

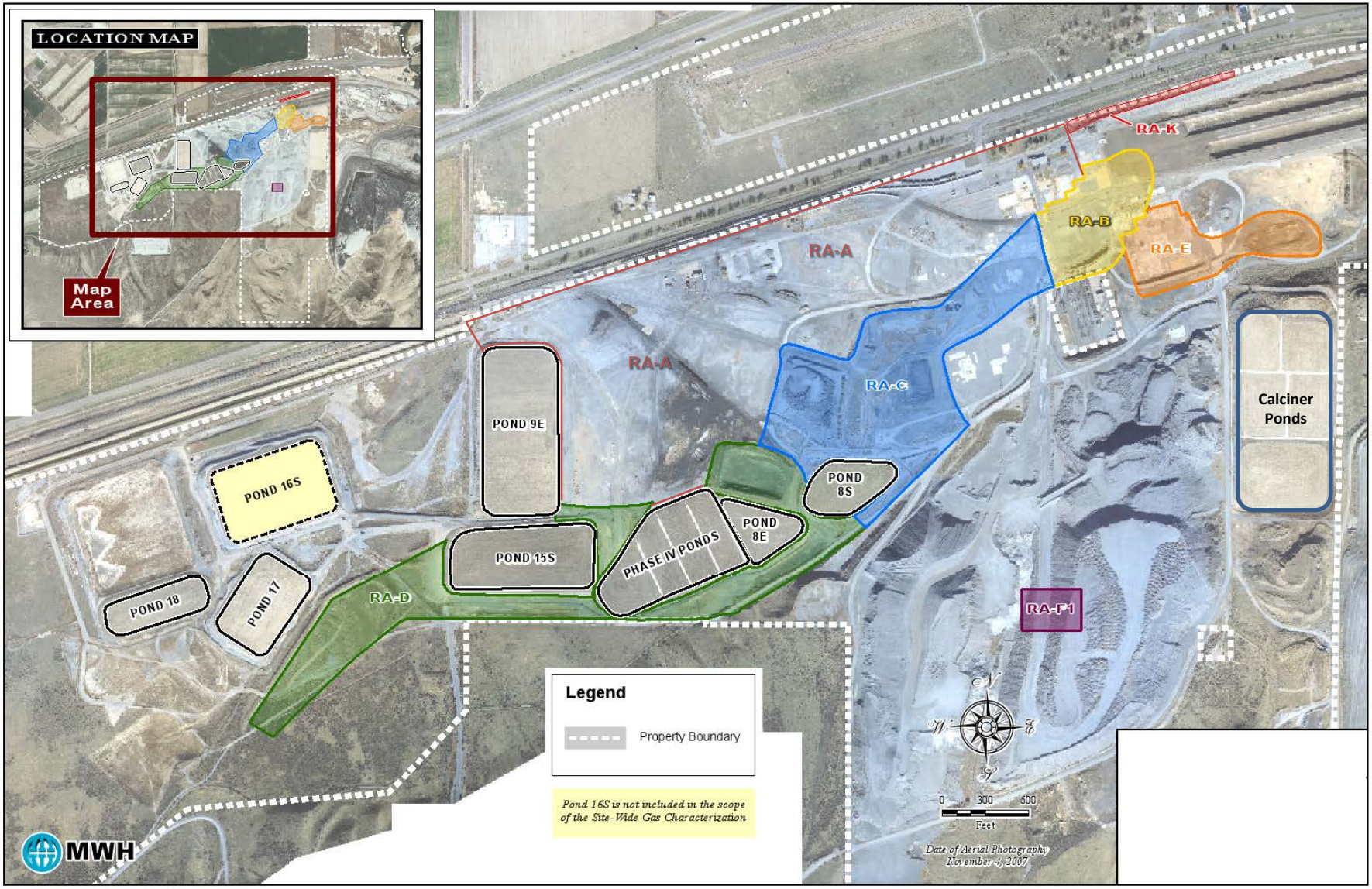
Process wastes were managed in 2 types of ponds

- Metals and radionuclide wastes
  - Calciner Ponds

- Metals, radionuclide, and P4 wastes
  - P4 present up to nearly 100%
  - Pond 8S
  - Pond 8E
  - Phase IV Ponds
  - Pond 9E
  - Pond 15S
  - Pond 16S
  - Pond 17
  - Pond 18

(map on next slide)

Wastes and Pond Locations Within the FMC Site



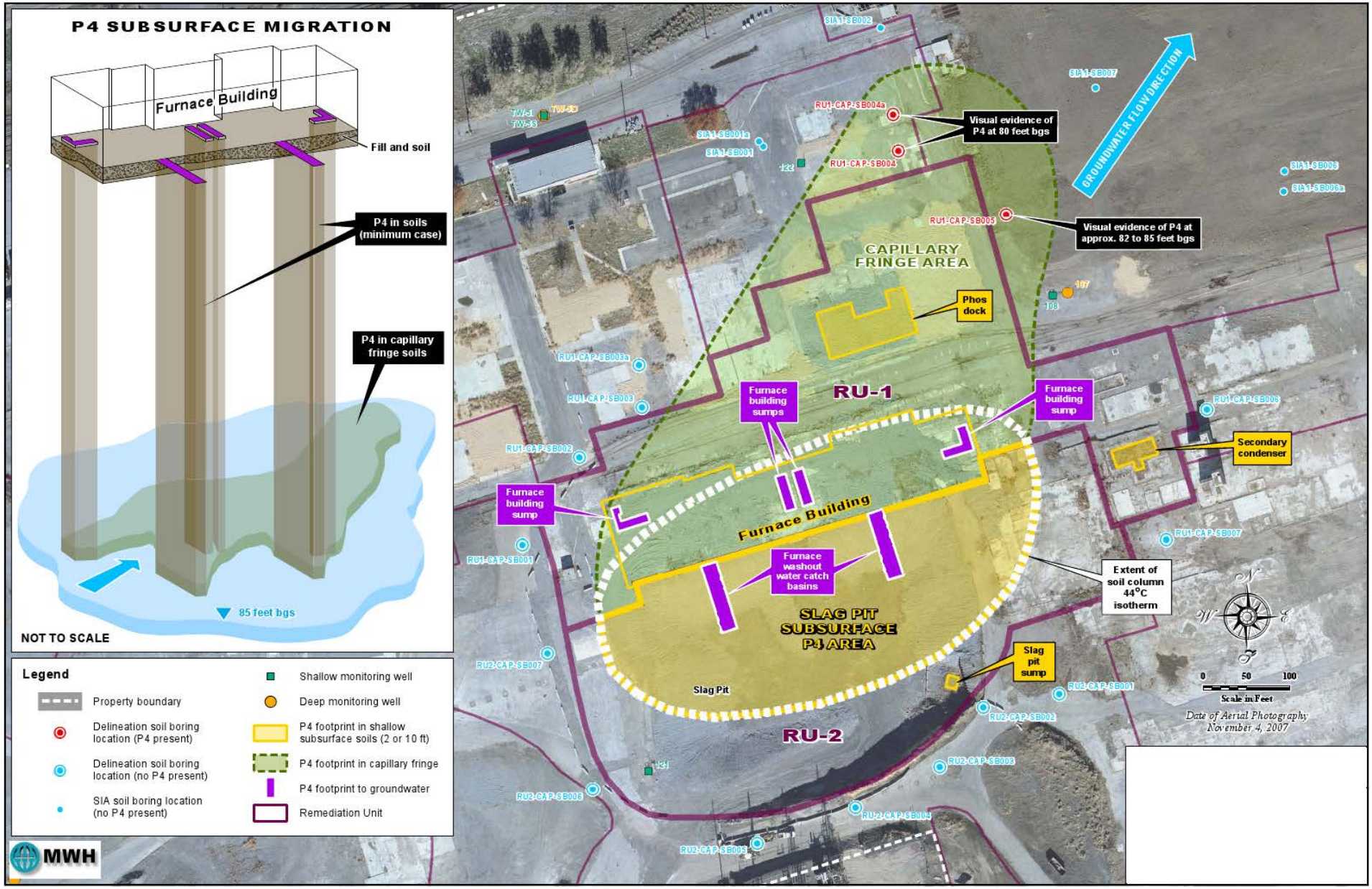
2. Wastes and Products Leached Into Native Soil or Disposed On-Site

Process products (P4) were leached or disposed on-site

- Furnace Building and Slag Pit Leaks (see picture on next slide)
  - Liquid P4 spills and leaks over process history
  - Thermal gradient in soil to groundwater created by 50 years of furnace building use at ~2300°F
  - P4 liquid product leaked beneath the facility
  - P4 extends groundwater 85-90 ft below ground surface under furnace building and approximately 700 feet downgradient in groundwater
  - As thermal gradient returned to ambient temperatures P4 solidified
  - Estimated 52,400 tons of P4 beneath furnace building
  - P4 may be present up to 100% in certain areas

- Buried Railcars in Slag Pile
  - 21 railcars filled with P4 sludge buried in the slag pile in 1964
  - Railcars estimated 10-25% full, with 75-95% P4 material in each railcar
  - Estimated 2,000 tons of P4 remaining in railcars

P4 Conceptual Site Model



3. Wastes used as fill materials to contour the site

Waste materials were used on-site as fill for contouring

- Metals and radionuclide waste used for fill
  - primarily slag
  - ~20 – 30 pCi/g
- Metals, radionuclide, and P4 wastes used for fill
  - P4 typically a few ppm to ~10% of fill material
  - precipitator solids
  - phossy solids
  - ferrophos

Determining the Vertical and Lateral Extent of Contamination

– Bulk of data was collected under
  - Remedial Investigation (1996)
  - Supplemental Remedial Investigation (2009)

– Due to Health and Safety issues associated with P4 and sample collection, investigation strategy focused on waste characterization and delineation, and placement of waste
  - Fill vertical and lateral extent determined (estimated volume of P4 in each area)
  - Ponds – depths, volumes, and wastes are known from post closure plans
  - Leaching from other sources

Feasibility Study

The Feasibility Study determined site risks could be managed by capping or treatment

– Preferred Alternative (Alternative 3) ~$47.2 Million

- After grading, evapotranspiration caps placed over areas that may contain P4
- After grading, gamma caps placed over areas containing only metals and radionuclides
- Windblown fugitive dust containing metals and radionuclides will be scraped or tilled, north of the facility
- Underground piping in certain areas containing residual P4 would be cleaned and disposed offsite

– Clean Closure (Alternative 8) ~$3.5 Billion

- Excavation and treatment of all contaminated soils on the FMC OU
- All P4 contaminated material would be excavated and treated onsite before offsite disposal
- P4 treated through caustic hydrolysis, metals treated through metals stabilization
- All materials transported to offsite landfill, where FMC OU would be clean closed

Implementability

- Preferred Alternative (Alternative 3)
  - Relatively easy to implement
  - All capping and excavation technologies are proven and have succeeded in reducing risk at other sites
  - Low risk to the community and workers
  - Low risk of not being successful at reducing site risks
  - Time to implement 3-5 years

- Clean Closure (Alternative 8)
  - Difficult to implement
  - No proven full scale technology for volume of P4 which requires treatment
  - Technical risks exist specifically in regards to excavating and transporting large volumes of P4
  - Short term risks are high to workers that may be excavating, transporting, and treating large volumes of P4
  - Significant cost difference between Alternative 3 and Alternative 8
  - Time to implement 30-50 years

Conclusion

EPA Region 10 has chosen Alternative 3 as the Preferred Alternative to manage waste in place at the FMC OU based on balancing the 9 criteria

Any remaining wastes onsite could be treated in the future if proven technology develops

5-year reviews provide a sound opportunity to re-evaluate technology and effectiveness of remedy