PUTTING OUT THE FIRE

(Environmental, Safety and Health Concerns, and Remedial Alternatives for Tire Fires)

Kerrie L. Greenfelder, PE, BCEE

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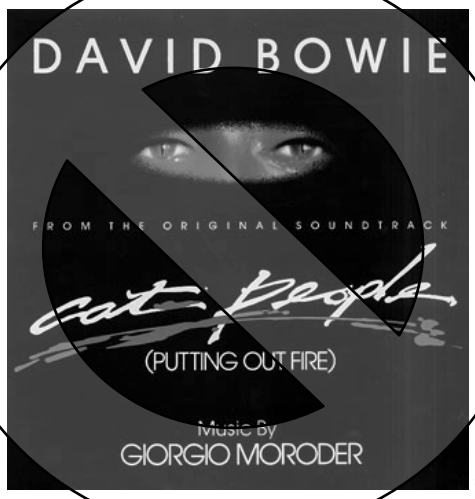
CDM Smith

Today's Talk – What it isn't…



[Image courtesy of the world wide web]

Today's Talk

- The Problem with Tire Disposal and Recycling
- The Fire
- Other Fires
- Characterization
- Remediation – Part I
- Corrective Action Plan
- Remediation – Part II
- The Site Today and Tomorrow

Tire Disposal and Recycling

- According to USEPA: At the end of 2003, the US generated approximately 290 million scrap tires
- Where do all these tires go?
- 80% are reused:
  - Fuel
  - Recycled products
  - Exported
  - Etc.

Wagon Mound, NM "River of Tires"

[Image courtesy of the world wide web]

Tire Disposal and Recycling

- According to the USEPA:
  - 38 states ban whole tires from landfills
  - 35 states allow shredded tires to be placed in landfills
  - 11 states ban all tires from landfills
  - 17 states allow processed tires to be placed into monofills
  - **8 states** have no restrictions on placing scrap tires in landfills
- Illegal Dumping – it happens…

Southwest Tire Processors (STP)

- Former tire recycling site – shredding and chipping facility in Socorro
- Approximately 7 acres in size
- Allowed to store 10,000 tires (max), no more than 20 ft wide x 50 ft long x 8 ft high
- Adjacent to a State Highway, a railroad spur, and a mountain range

Site Operations

- Site granted a 10-year operating permit
- The 7 acre site was divided into discrete areas:
  - Whole tires
  - Rough shred tires
  - Chips
  - Rubber crumbs
- Shredded 25 tons/day
- In 2000 the site contained **<u>500,000</u> tire equivalents**


[Image courtesy of the world wide web]

Southwest Tire Processors Before the Fire

The Fire – June 2000

- A transformer on a power pole near the site **exploded**
- Stored combustible material ignited and triggered a **tire fire**
- Responders:
  - Fire Departments
  - Rescue Units
  - Local Agencies
  - State Agencies
  - Federal Agencies
- USEPA directed crews to move soil to site to smother fire
- Seven (7) days later, the fire was declared extinguished by USEPA

[Image courtesy of the world wide web]

Other Fires – 1983 Rhinehart, Virginia

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  high and nearly 50 miles long
- Air pollution emissions deposited in three states
- Burned for nine months
- Pollutants were lead and arsenic
- Superfund site

[Image courtesy of the world wide web]

Other Fires – 1999 Westley, California

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- pyrolitic oil
- 30 days to extinguish

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Other Fires – 1990 Hagersville, Ontario, Canada

- 12-14 million tires
- Temperatures up to 20,000F
- Evacuation of all residents within 14-km
- Plume could be seen in Cleveland, OH
- Over 300,000L of water and foam were eventually dropped by water-bomber
- 17 days to extinguish

[Images courtesy of the world wide web]

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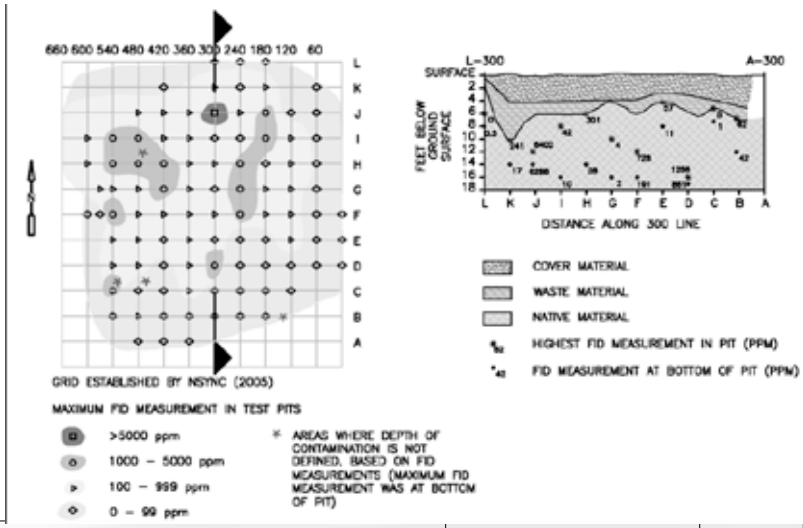
Tire Composition	Compound Name(s)	Mass %
Rubber	Styrene butadiene	47
Dry Pigments	Carbon black	46
Softeners	Aromatic oil	2
Plasticizers	2,2-dibenzamidodiphenyl disulfide; dithiobisbenzanilide	<0.1*
Activators	Zinc oxide Stearic acid	1 1
Accelerators	P-phenylenediamine derivatives Sulfur containing compounds	3.0 to 3.3
Protectants	Wax	0.23
Flame Retardants	Red phosphorous, metal hydroxides, halogens	<0.1
Structural Materials	Steel Belts, rayon, nylon, and polyester	Generally<5.0 of the final mass

Contaminants Reported from Multiple Tire Fires

Metals	VOCs	PAH	Other
• Cadmium* • Chromium* • Cobalt • Copper • Lead* • Zinc	• Benzene • Ethylbenzene* • Styrenes* • Toluene* • Xylene*	• Anthracene* • Benzo(a)pyrene* • Benzo(k)-fluoranthene* • Fluoranthene* • Naphthalene* • Phenanthrene* • Pyrene*	• Dioxins* • Furans*

* Detected at STP in 2005 site assessment

2005 Site Investigation



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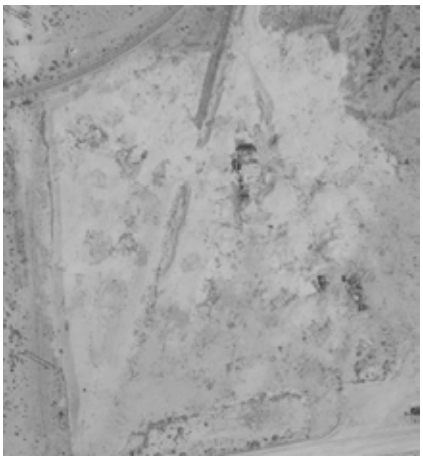
2010 Site Investigation



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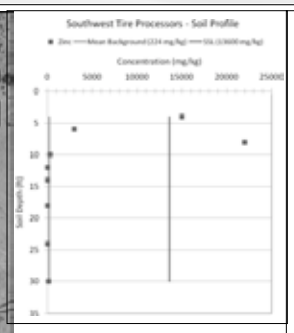
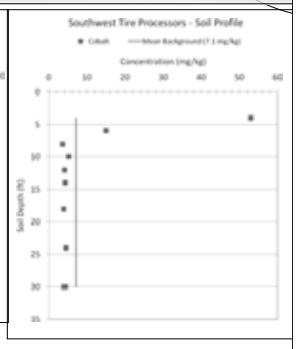
Site Characterization Results - Metals





Zinc and Cobalt were the only metals above background concentrations

Organic Compounds

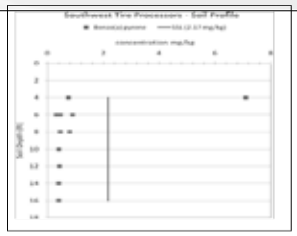


Figure 8: Concentration of Benzo(a)pyrene in Soil Profile.

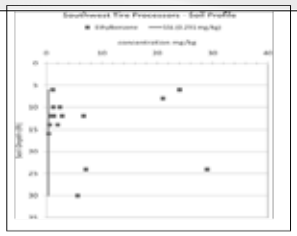


Figure 9: Concentration of Ethylbenzene in Soil Profile.

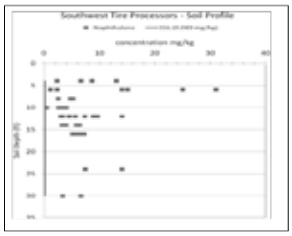


Figure 10: Concentration of Naphthalene in Soil Profile.

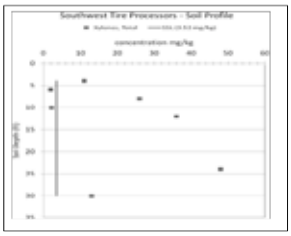
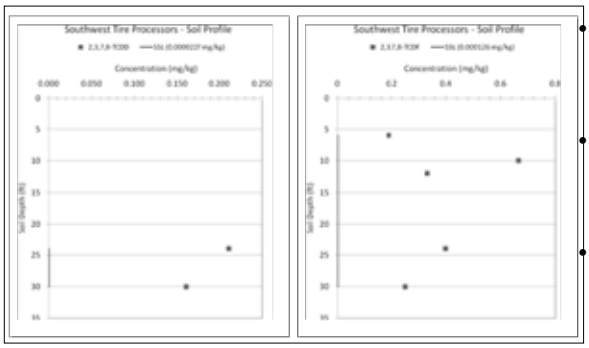


Figure 11: Concentration of Total Xylenes in Soil Profile.

Four organic compounds were detected at concentrations exceeding the Soil Screening Level (SSL) in 3 or more samples:

- Benzo(a)pyrene
- Naphthalene
- Ethylbenzene
- Total Xylenes

Dioxins and Furans



- Twelve different dioxin and furan compounds were detected
- SSLs have been established only 2,3,7,8-TCDD and 2,3,7,8-TCDF
- All detected dioxins and furans are within the extent of contamination defined by the presence of naphthalene

Site Characterization

- Results of the assessments:
  - Fire impacted soils are concentrated on the central portion of the site
  - Highest contaminant levels are present at 6-16 feet below surface
  - Soil contaminants of concern:
    - Metals: Zinc and Cobalt
    - Organic Compounds and Dioxins/Furans: Naphthalene
- No contaminants detected in groundwater

Conceptual Corrective Action Plan

- Results of the 2010 assessment:
  - "Hot Spots" (or **Fumaroles**) continued to smolder under the soil cover…

[Image courtesy of the world wide web]

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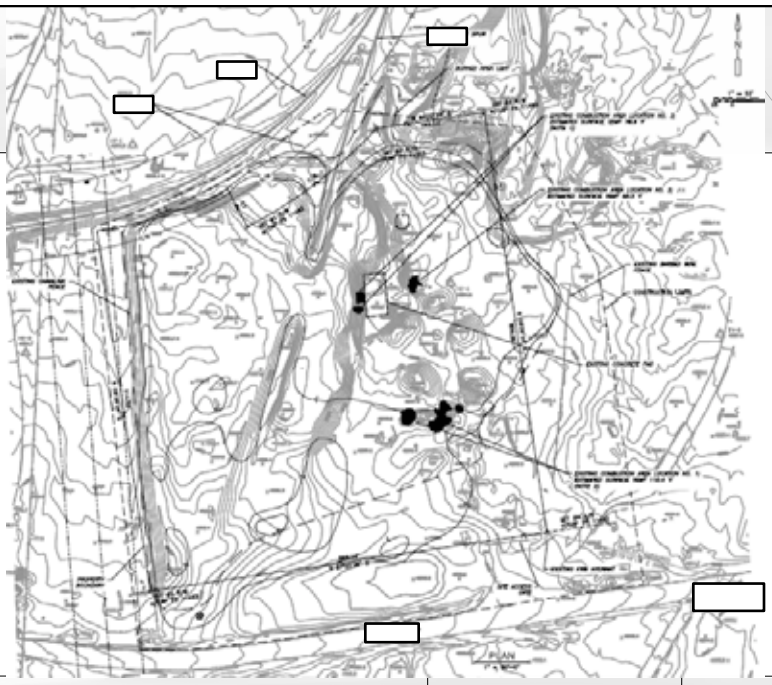

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Corrective Action Plan

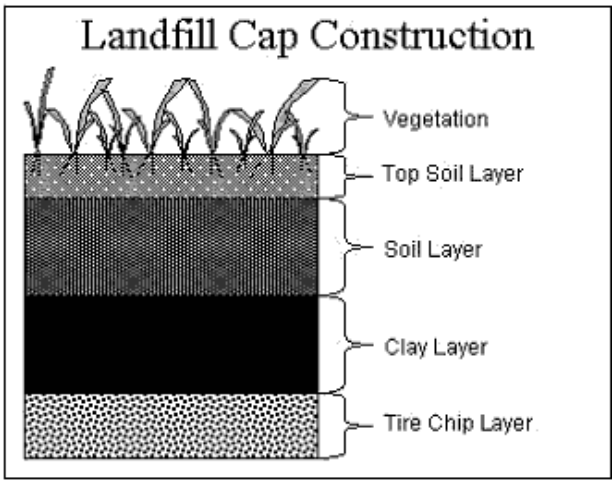
Extinguish the Areas of Combustion:

1. Let fire burn itself out
2. Quench it (i.e., add water or foam)
3. Uncover "hot spots" to allow faster burn
4. Add more dirt (i.e., cover it)
5. Add accelerants to speed up burn
6. Excavate and "dunk" smoldering materials
7. ???

Corrective Action Plan

- Once extinguished, then what do you do with site?
- ?? Construct a landfill cover or "cap":
  - Multi-layer system, comprised of soil
  - Minimizes exposure to wind and water erosion on surface of waste area
  - Prevent infiltration of water into waste area (and potentially carry contaminants to groundwater)
  - Support vegetation growth

Corrective Action Plan – Landfill Cover



[Image courtesy of the USEPA]

Corrective Action Plan – Landfill Cover

- Effectiveness – HIGH: Well developed technology, especially in dry climates
- Implementibility – HIGH: Closure regulations specify native materials, all available locally; exposure to waste debris minimal
- Timeframe – SHORT: Design and construction simple
- Cost – LOW: Dirt work; local transportation
- Recommended Alternative – YES! Cap it!

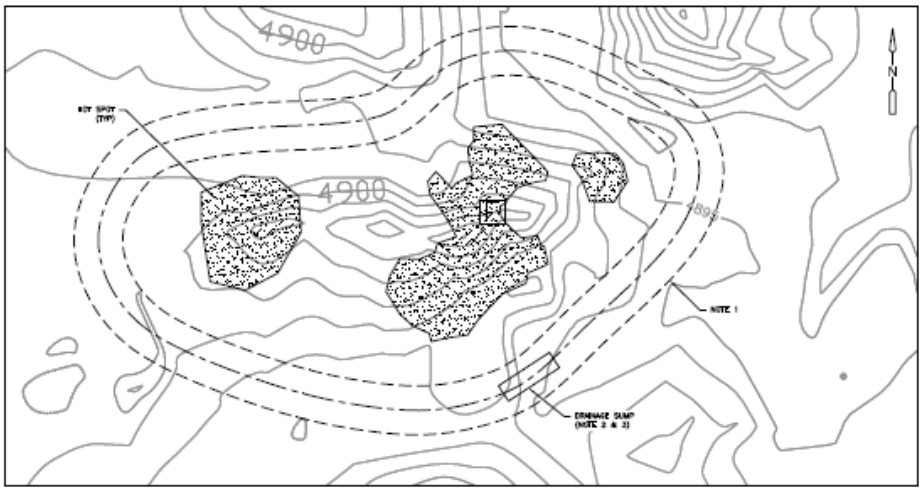
Remediation (Part II) – September 2011

- Design landfill cover:
  1. Determine method for quenching of "hot spots"
  2. Geotechnical testing to select cover materials
  3. Cover design
  4. Obtain regulatory approval
  5. Construction sequencing

Remediation (Part II) – September 2011

- Construction:
  - Remove recycling equipment and site debris
  - Quench "hot spots" (with assistance from local fire department)
    - Chase "burning face" back
    - Extinguish with foam/water mixture
    - "Stir fry" it…

Remediation (Part II) – September 2011



COMBUSTION AREA NO. 1

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Remediation (Part II) – September 2011

- Construction:
  - Level site (from "Mars" terrain to nice mound)
  - Move soil to build cap
  - Move more soil to build cap
  - More soil moving…
  - Plant vegetation
  - Secure the site

Remediation (Part II) – September 2011

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Construction Completion

Construction Completion

The Site Today

The Site – in the Future

- What comes next?
- Periodic maintenance
- Move a little more dirt…
- More vegetation growth
- Future Use:
  - Construct high-rise apartment buildings on top of it?
  - Construct tennis courts on top of it?

Closing / Questions?

THANK YOU!

CDM Smith
Kerrie Greenfelder, PE, BCEE
GreenfelderKL@cdmsmith.com
505/243-3200