The Use of Less Toxic Chemical Retardants when Suppressing Wildfires

https://laist.com/2018/08/06/california_has_had_a_monster_wildfire_every_year_for_the_past_7_years.php

https://www.accuweather.com/en/business/the-2019-california-wildfires-caused-less-damage-than-the-last-two-devastating-seasons/643455

Background:

- Increased by 53.4%
- Longevity by 18.7%
- About 3,400 deaths yearly

- Airborne tactics used
- PHOS-CHEK 259-Fx
- Efficient wildfire retardant

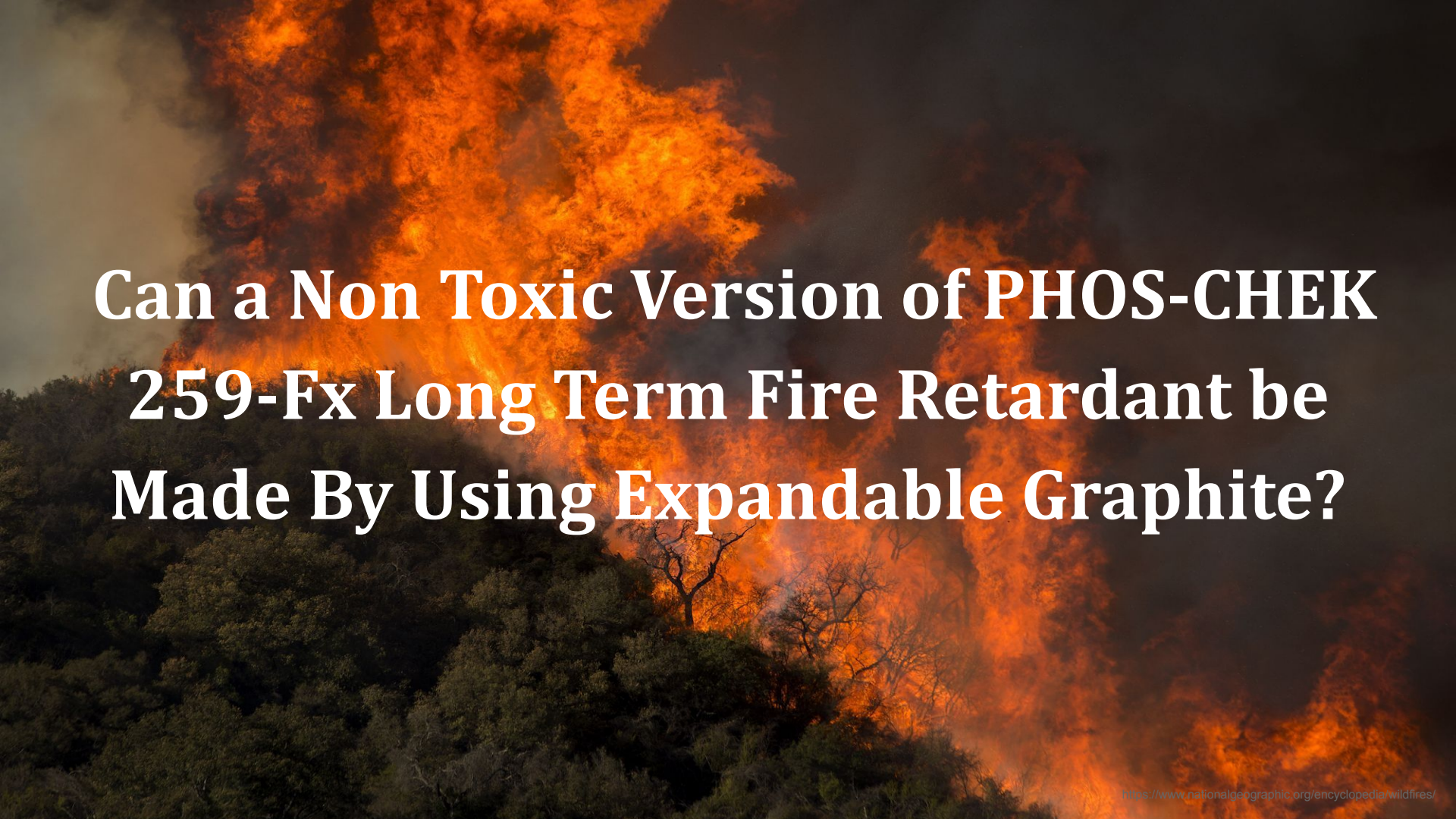
- Encourages eutrophication
  - (Abundant nutrients)
  - Overgrowth of plant life
  - Death of aquatic life

- Nitrate and phosphorus enlarged 2 to 9-fold
- Many dead trout found
- More than 700 adult salmon found dead

- USFA tried to prevent
- Can’t be dropped within 300 feet
- However,
  - Accidental drops
  - Wind
  - Rainwater runoff

https://www.kxro.com/1000-jobs-now-open-for-the-us-forest-service-in-the-pacific-northwest/

- Gary Fortner
  - House completely covered
  - 1 of 5
  - Took weeks to clean

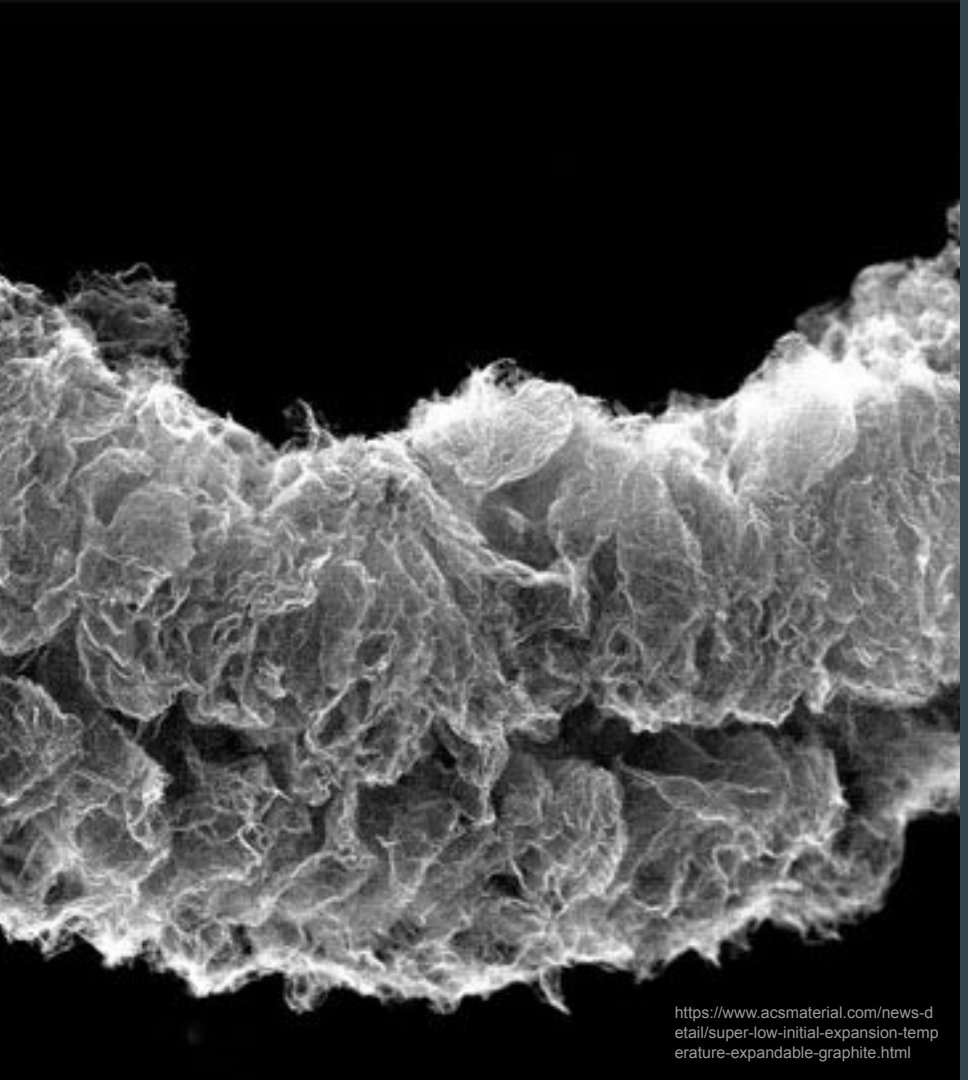


Can a Non Toxic Version of PHOS-CHEK 259-Fx Long Term Fire Retardant be Made By Using Expandable Graphite?

https://www.nationalgeographic.org/encyclopedia/wildfires/

- Expandable Graphite (EG)
  - (reversible inclusion)
  - Unique format
  - Intercalated by other chemicals
  - EG expands creating insulating foam layer

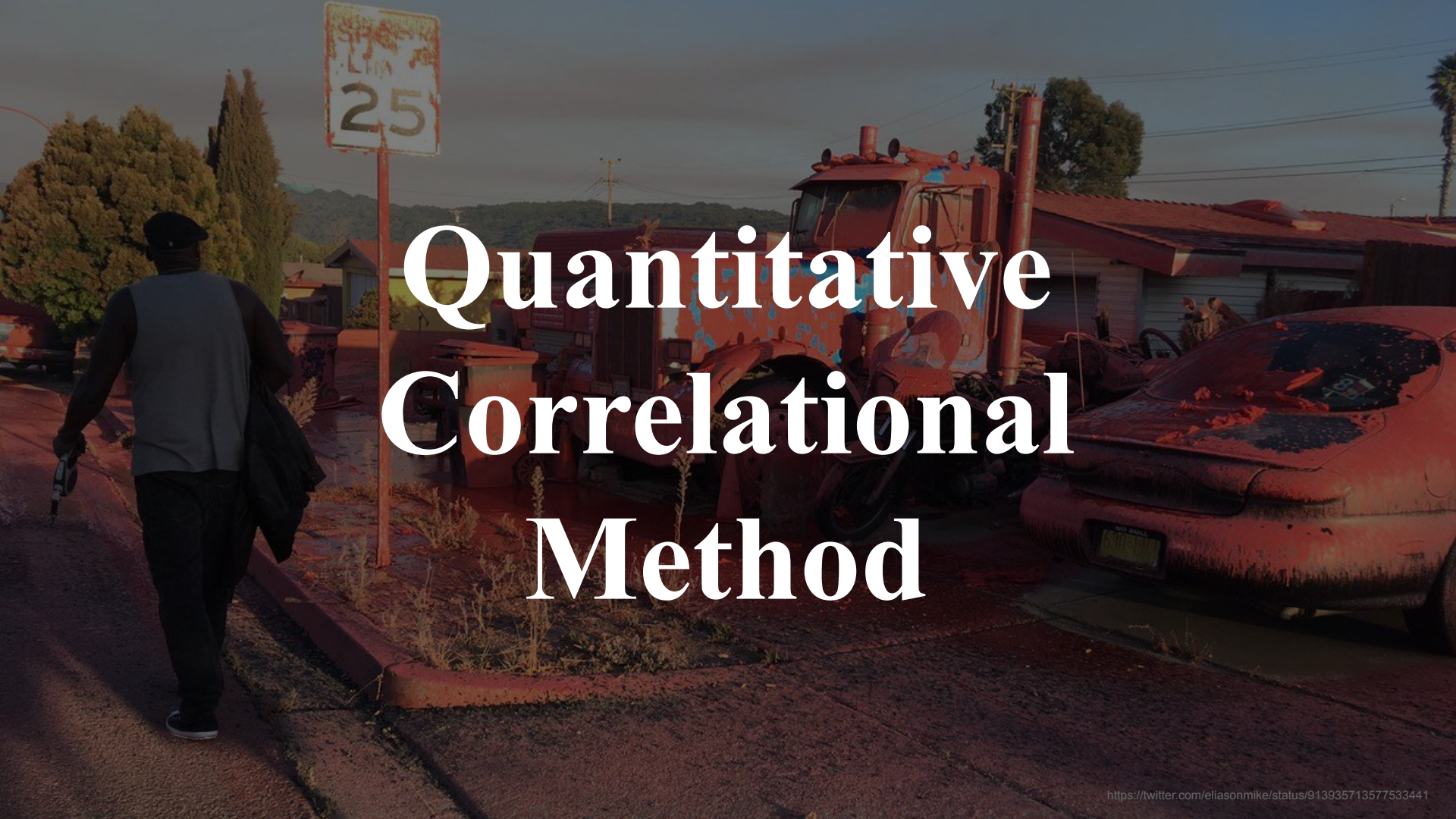
https://www.researchgate.net/figure/Expandable-graphite-on-heating-the-graphite-expands-150-to-200-times-and-acts-as-a-very_fig1_248814601


https://www.acsmaterial.com/news-detail/super-low-initial-expansion-temperature-expandable-graphite.html

- How EG works:
  - Intumescent coat shields underlying polyurea (PU)
  - Lowers temperature of PU slower
  - Char prevents diffusion of oxygen

- Benefits of EG
  - Performance does not degrade
  - Controlled pH
  - Reduces smoke
  - Non-toxic

https://www.graphite-shop.com/en/product-23.html



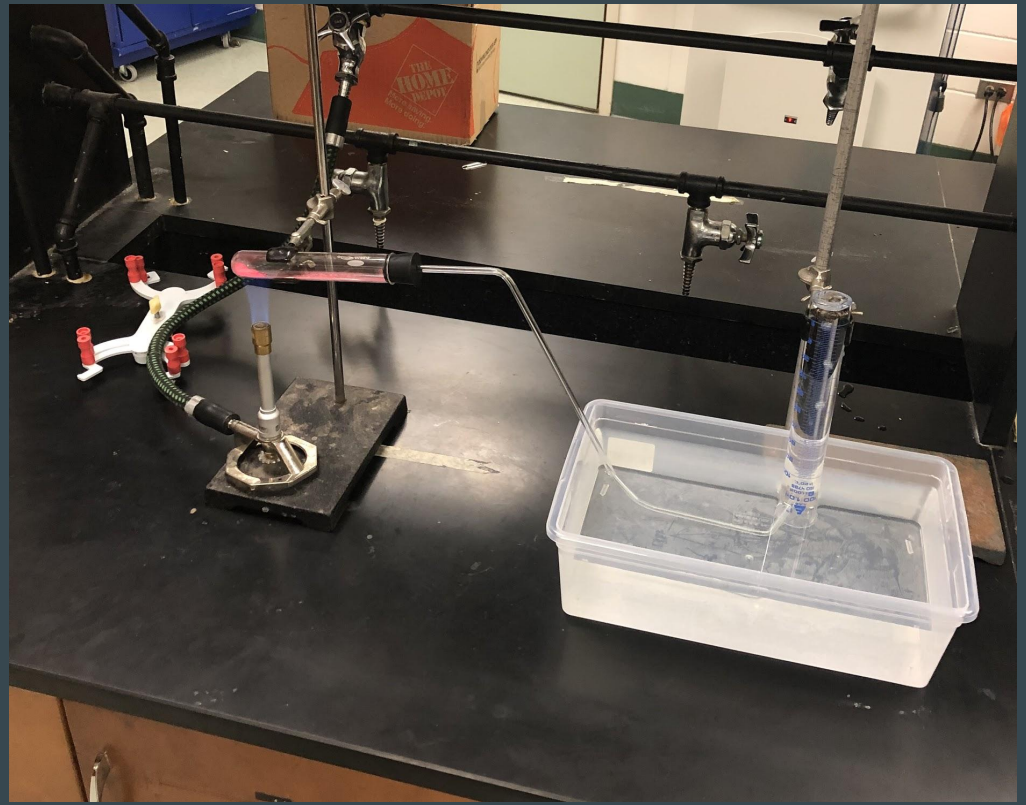
Quantitative Correlational Method

https://twitter.com/eliasonmike/status/913935713577533441

- Testing and comparing gas production and retardancy
  - Gas collection by water displacement
  - Time it took for each product to put out a flame

- Making the EG
  - Mix 9 to 1 ratio
  - Add 25 grams graphite
  - Set for 24 hours
  - Filter till no longer acidic
  - Dry overnight
  - Microwave powder

- Lower oxygen production results in smaller flame
- EG produced nearly ½ as much gas as PHOS-CHEK



- Infrared thermometer used to make sure both products were dropped on a flame of equal temperature (120 degrees Fahrenheit)
- PHOS-CHEK put out all flames immediately
- EG would have put out the flames if it weren’t for the onset temperature and mesh size chosen

Limitations:

- No current research-backed tests exist to compare retardancy of 2 powder products
- It is impossible to test these products on a wildfire

Conclusion:

- If EG is better, it could be used as a non-toxic version of PHOS-CHEK
- Such would revolutionize the fire fighting industry
- A ripple chain effect can devastate entire ecosystems just from the death of fish in a single waterway

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