

Clean Dirt,



No Doubt!
www.ner.ab.ca

Enhanced bioremediability of residual organic compounds in post-TDU clean dirt?

Darryl R. Nelson, Ty Watchell, & Nick Platts.

Nelson Environmental Remediation Ltd.

Spruce Grove, Alberta.

Clean Dirt,



No Doubt!

Global Customers.

Onsite Service.

Guaranteed Results.



NER: mobile *ex-situ* thermal desorption operations for organics-impacted soils.

PHCs, & a wide range of organic chemicals (e.g., solvents, herbicides).



Global Customers. Onsite Service. Guaranteed Results.



What of the (below-Tier) residual OCs?
(Site ecology. Future Tier levels.)



Hot (~500 °C or ~900 °F).

Dry (*cf.*, water's high dielectric constant).

Anoxic (i.e., extremely low O₂).

Freshly-exposed mineral grain surfaces (i.e., both mechanically & thermally).

Clay minerals (common soil phyllosilicates; very high surface areas per gram).



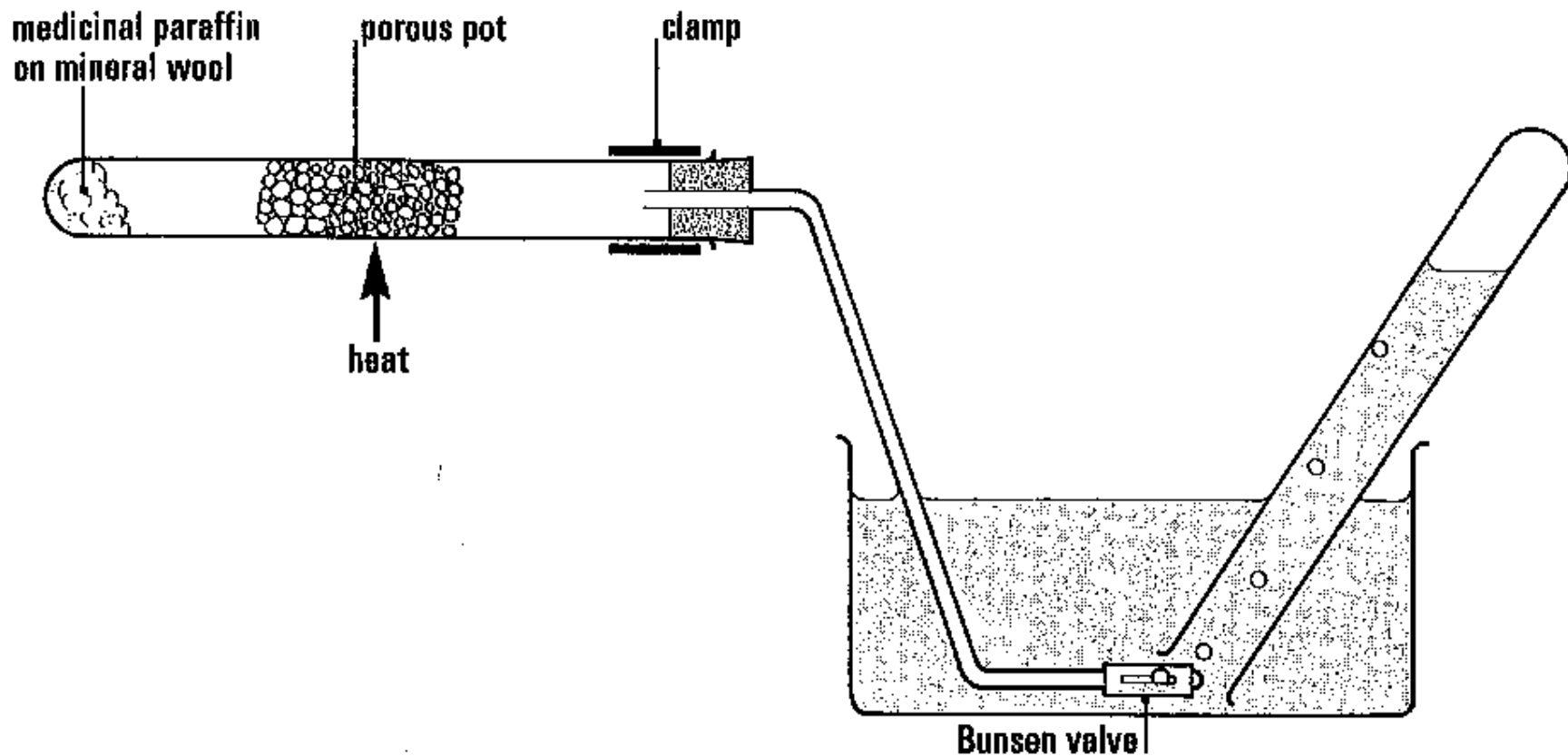
Chemically-reasonable expectation of essentially **uncontrolled heterogeneous catalytic cracking reactions** (*cf.*, 1940s).



Global Customers.

Onsite Service.

Guaranteed Results.



Classic catalytic cracking experiment.

Clean Dirt,



No Doubt!

Global Customers.

Onsite Service.

Guaranteed Results.



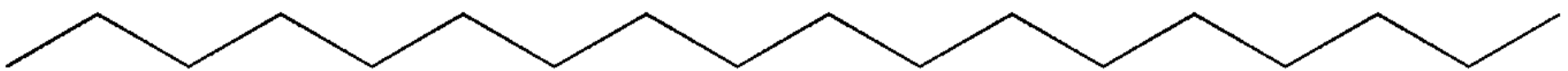
PHC F3 (>C₁₆ - C₃₄ range), e.g., n-Octadecane, C₁₈H₃₈



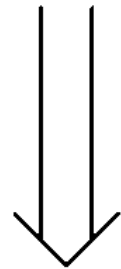
Clay mineral (hot-dry-anoxic-activated inorganic surface).



e.g., n-Octadecane ($C_{18}H_{38}$)

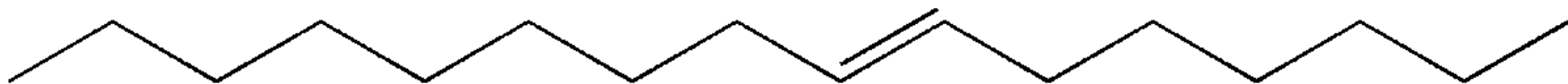
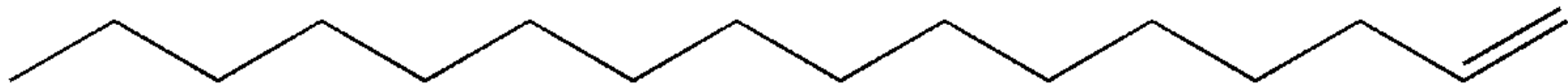


Hot, dry, anoxic,
& freshly-exposed
clay mineral surfaces.



Inorganic heterogeneous
cracking catalysis.

n-Hexadecane ($C_{16}H_{34}$) + ethene (C_2H_4).



Clean Dirt,

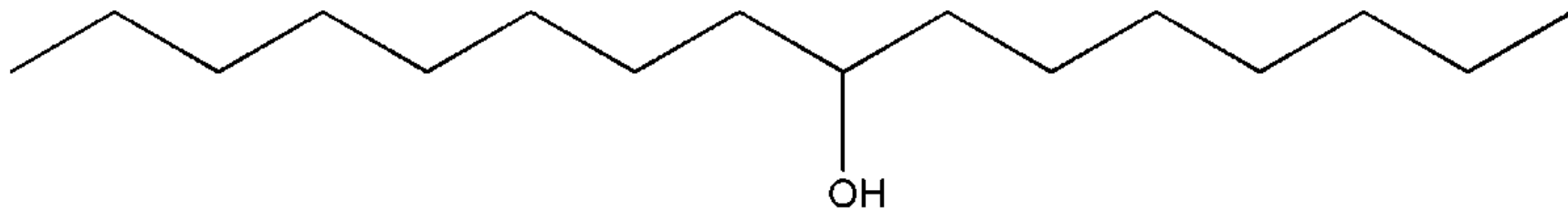
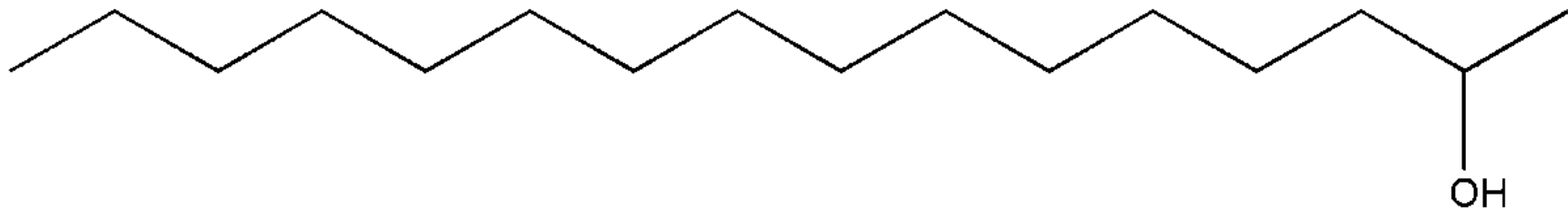


No Doubt!

Global Customers.

Onsite Service.

Guaranteed Results.





Essentially uncontrolled **thermal & catalytic cracking reactions.**

Hydrolytic addition during quenching.

Aerial oxidation in the fresh clean dirt pile.

A wide product distribution.

Functionalized residuals, including: branchings, alkenyl functions (*t* & *i*), oxy-functionalities (-OH, -COOH).

Molecular '*handles*' for enzymatic action.

A beneficent 'gift' for the client at demobilization.



Global Customers.

Onsite Service.

Guaranteed Results.



What of others methods?

If your PHC method has hot-dry-anoxic conditions & a class of catalytically-active inorganic(s) either entrained/exposed, your suite of residual organic compounds (ROCs) will contain site-new chemical species (via thermal/catalytic cracking, hydrogenation/dehydrogenation, hydrolytic addition, partial oxidation, etc) with molecular '*handles*' for microbial activity.

If your PHC method is wetted all the way through, IO catalytic activities will generally be quenched (*cf.*, electrode surfaces).



Global Customers. Onsite Service. Guaranteed Results.



NER is pleased to be here at RemTech 2010.

Thank you for your attention.

Questions.

Darryl R. Nelson, Ty Watchell, & Nick Platts.

Nelson Environmental Remediation Ltd.

www.ner.ab.ca

780-960-3660 (Corp.)

"Clean Dirt, No Doubt!"



Global Customers.

Onsite Service.

Guaranteed Results.



NER's "TDU" process for soil remediation:

- dig up the dirty dirt.
- heat it up to "desorb" volatile organic compounds "VOCs" (e.g., diesel).
- re-hydrate the clean dirt.
- oxidise the VOCs as efficiently as possible through to CO₂ and H₂O.
- send samples of the clean dirt to a chemical laboratory for analysis.
- once cleared, put the clean dirt back where it came from ("backfill").
- "chase the plume" to track the dirty dirt through the subsurface to make sure we get it all.
- landscape/seed/replant the cleaned site, as per the landowner's instructions.



Global Customers.

Onsite Service.

Guaranteed Results.