

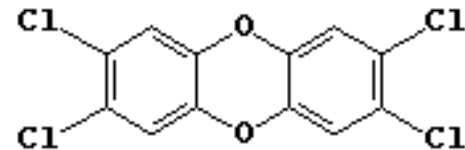
Danang

Et termisk fyrtårnsprojekt

5 år senere

Brug af Agent Orange i Danang

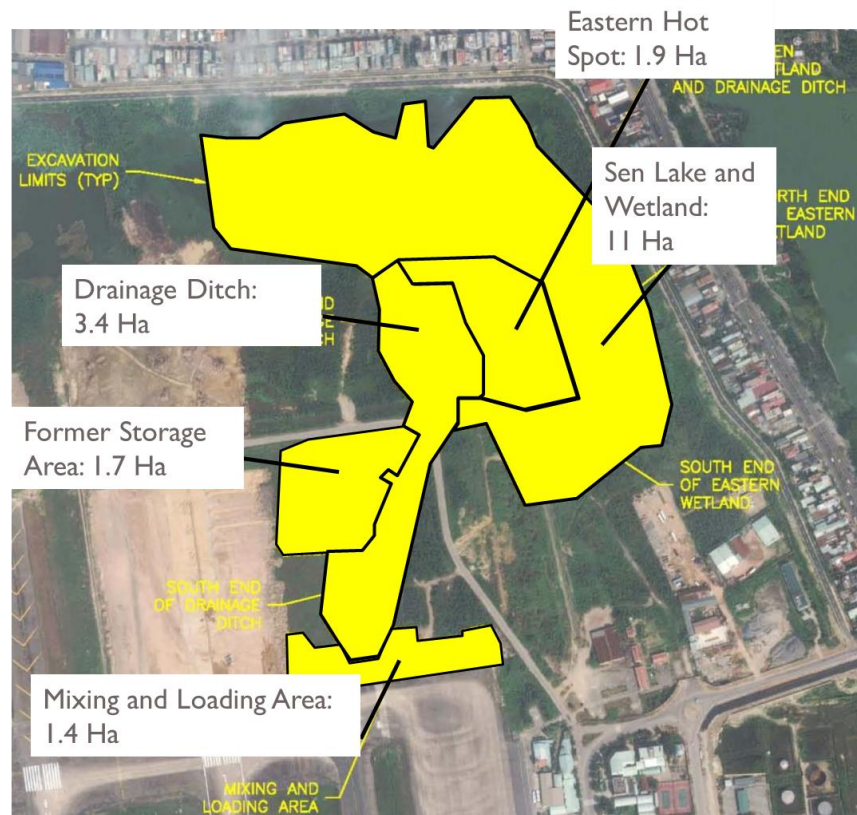
- Operation Ranch Hand – herbicider til afløvning
- Agent Orange indeholdt dioxinen 2,3,7,8-TCDD
- Over 100,000 tønder brugt i Danang



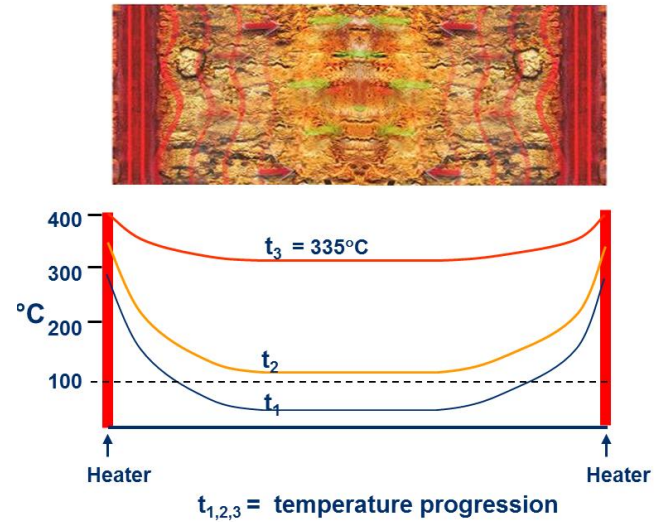
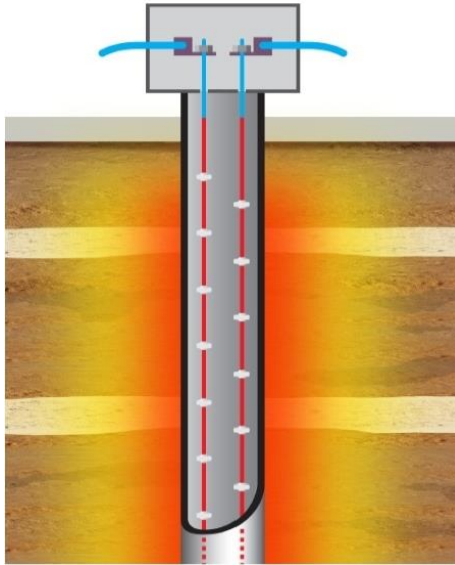
2,3,7,8-tetrachlorodibenzo-p-dioxin

Afværgeområder

- Forureningsundersøgelser – 151 prøver
- Opgravningsområder
- ~20 Ha total areal
- 15 cm til > 3 m dybde
- 80.000 – 90.000 m³



Valg af teknologi



Hvorfor IPTD?

- Effektivitet

Eneste kendte alternativ, der kan fjerne dioxin til de vietnamesiske standarder (1,000 ppt)/(150 ppt)

- Miljømæssig påvirkning

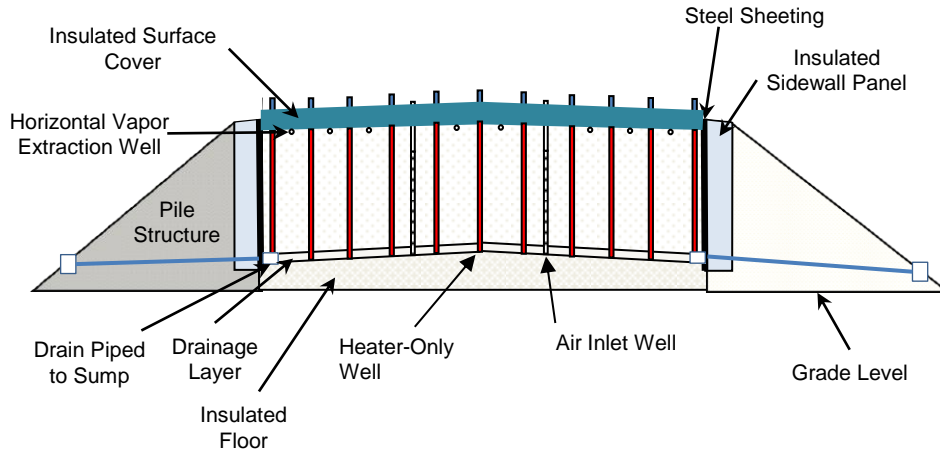
IPTD lavest potentielle påvirkning

- Økonomi

IPTD sammenlignelig med de øvrige alternativer når længerevarende monitoring og administration blev indregnet

Design

Design



- 105 m x 70 m x 6 m pile
- Volumen = 43.750 m³
- 1,254 heater boringer
- Horisontal ekstraktion

- Luftindtag
- 56 temperatur-moniteringsboringer
- Behandling af luft og væske ved køling, fase separation, filtrering og adsorption



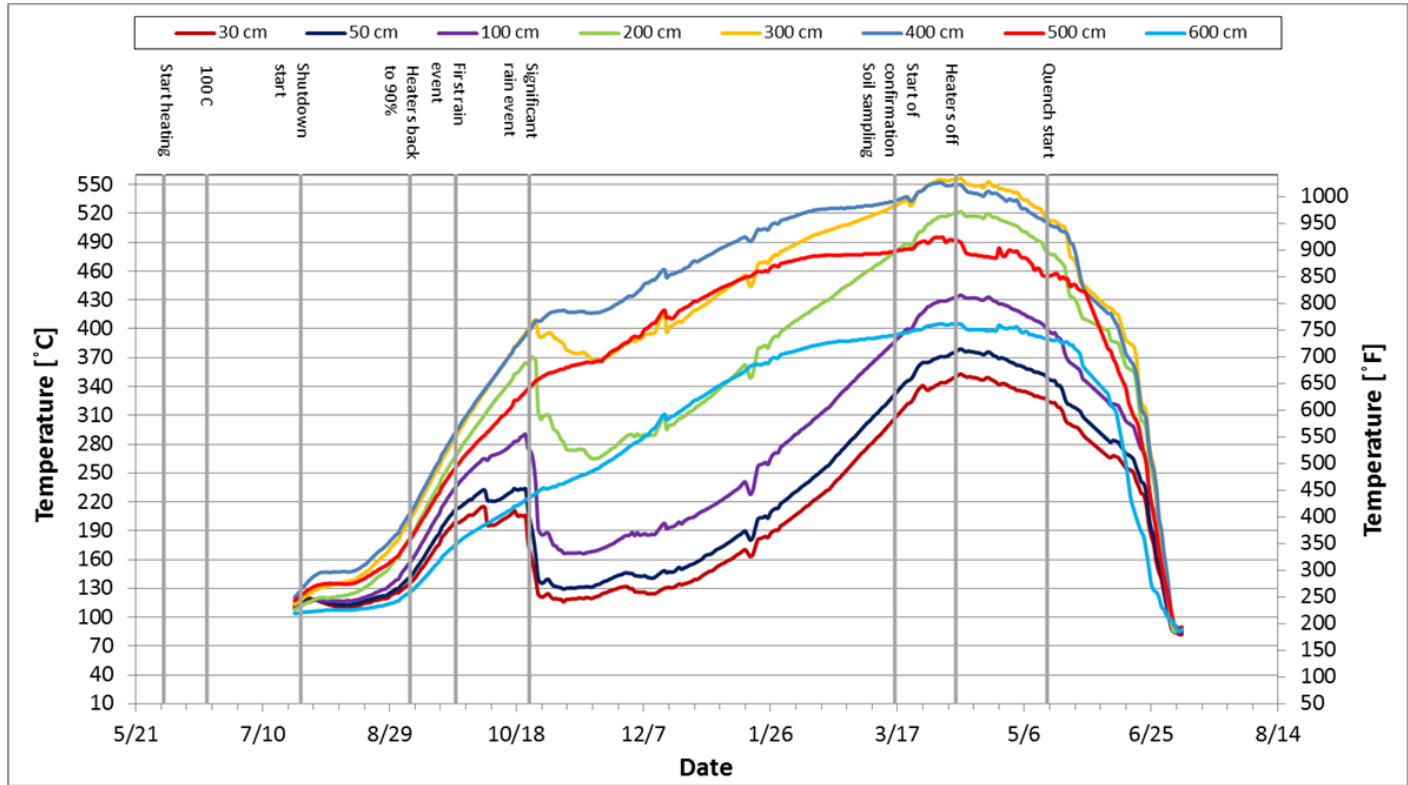
Drift fase 1

Fase 1: Oktober 2014 vedvarende regn



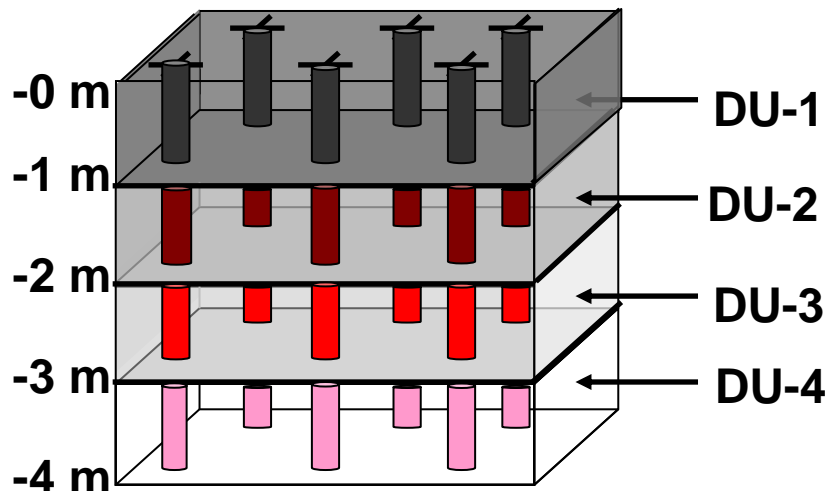
Drift fase 1

Temperaturgennemsnit
(dybdeopdelt)

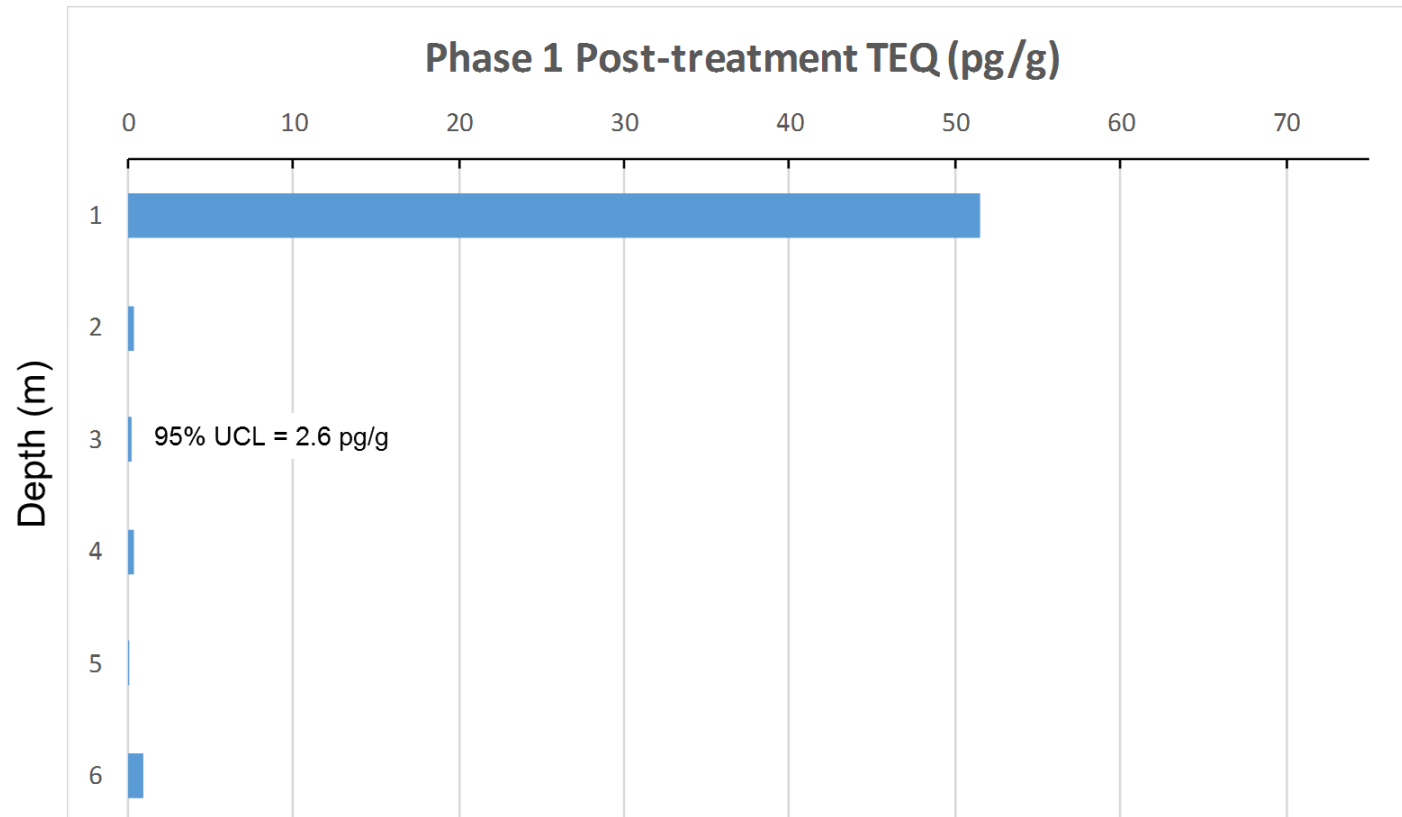


Prøvetagning

- Verificere koncentration < 150 ppt
- Pile opdelt i 1m decision units
- Tre dobbeltanalyser i et enkelt lag



Fase 1 Dokumentationsanalyser (maj 2015)



Nedkøling og tømning

- Fase 1 pile kølet maj-juli 2015
- Behandlet jord fjernet september-oktober 2015



Temporary storage area for Phase 1 treated material

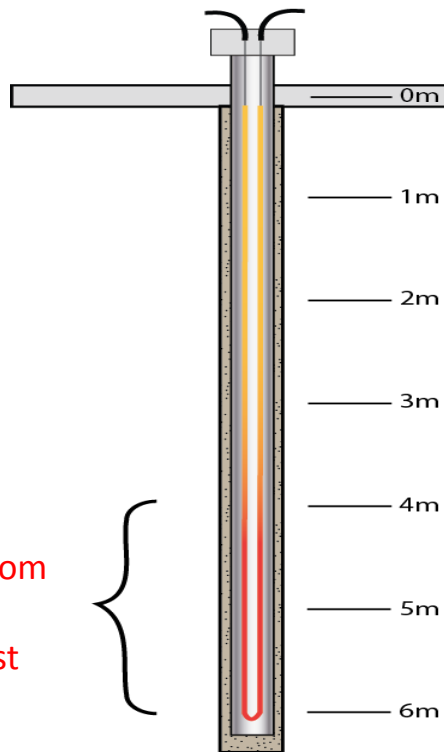
Removal of Phase 1 treated soil/sediment

Modificeringer af design

Fase 2

Modificeret heater layout

Phase 1 Design

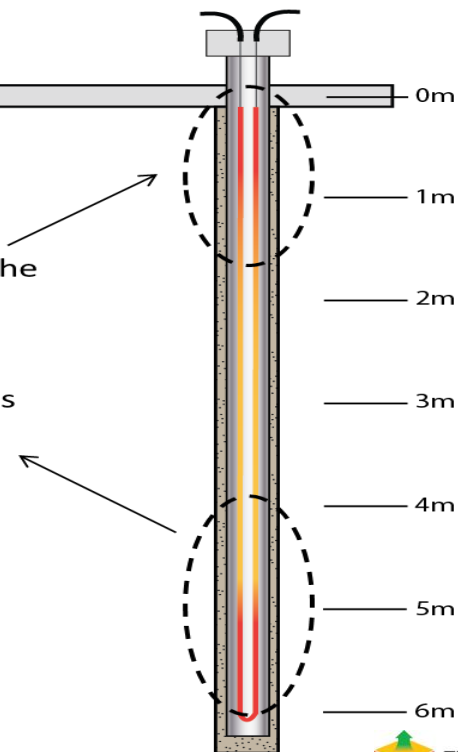


Bottom
2m
boost

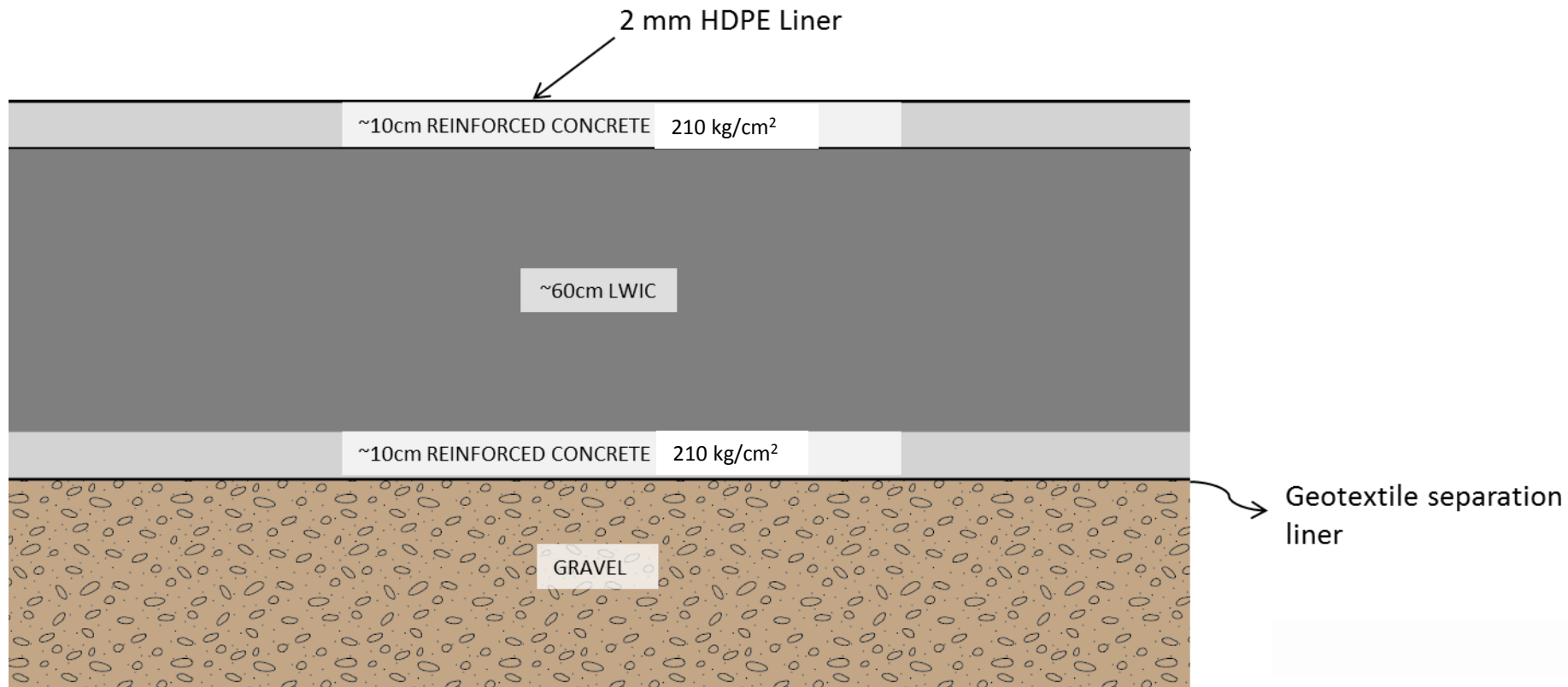
Temps were typically
100°-200° higher at
this depth during
operation

Phase 2 Design

The top 1.7 m and the
bottom 2 m will be
boosted. This will
distribute needed
energy to the depths
that were most
difficult to heat.

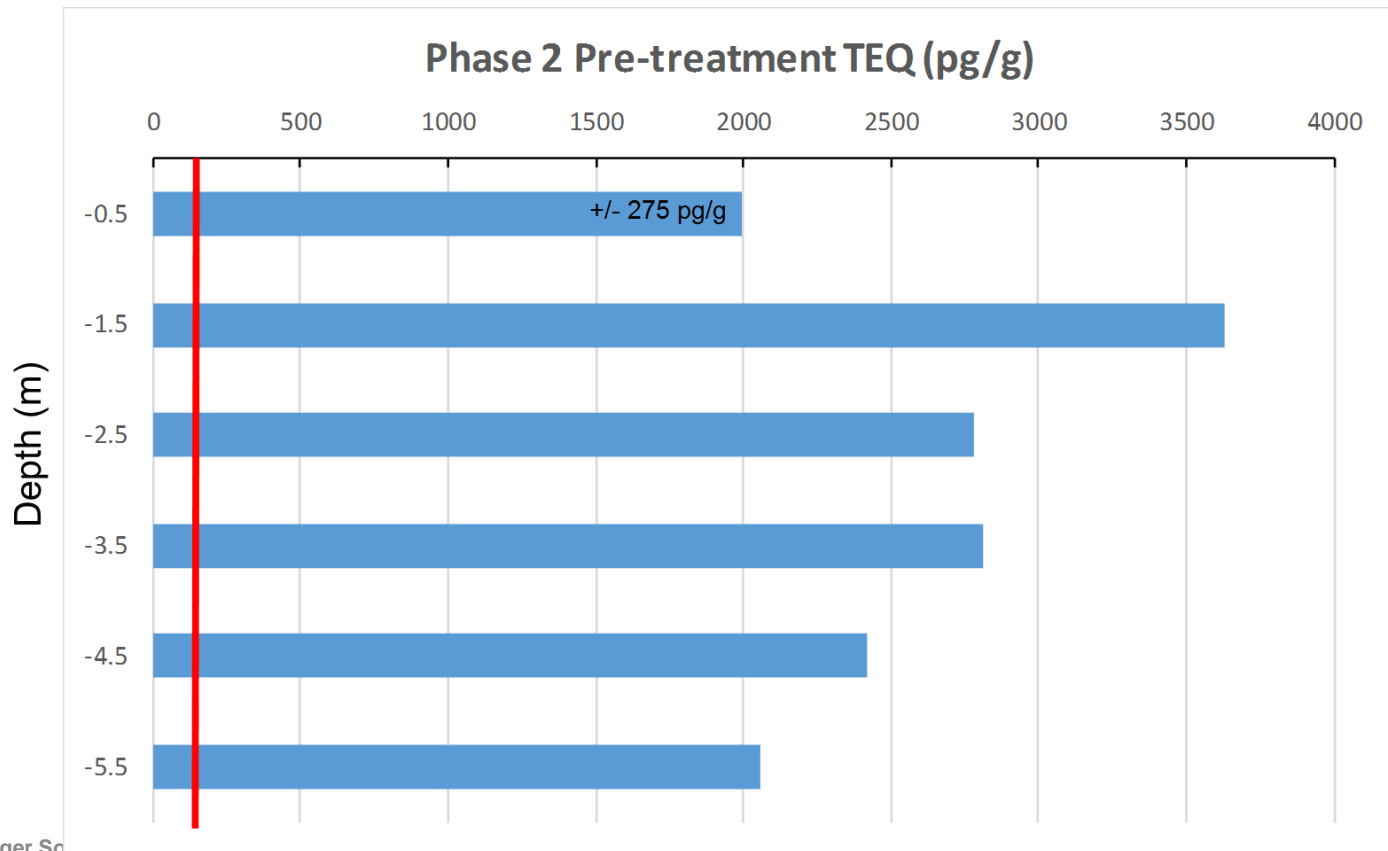


Modificeret vapor cover

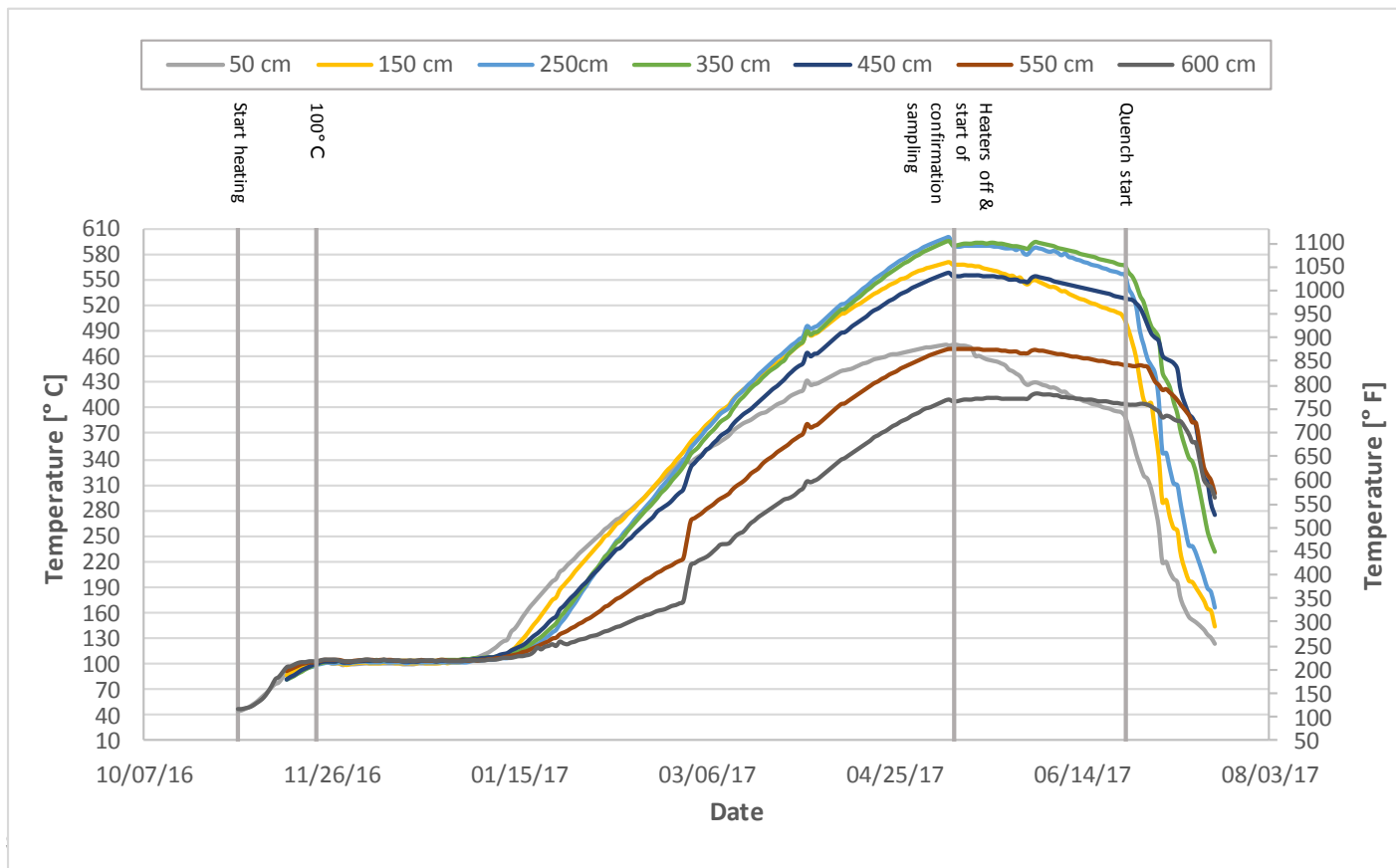


Drift fase 2

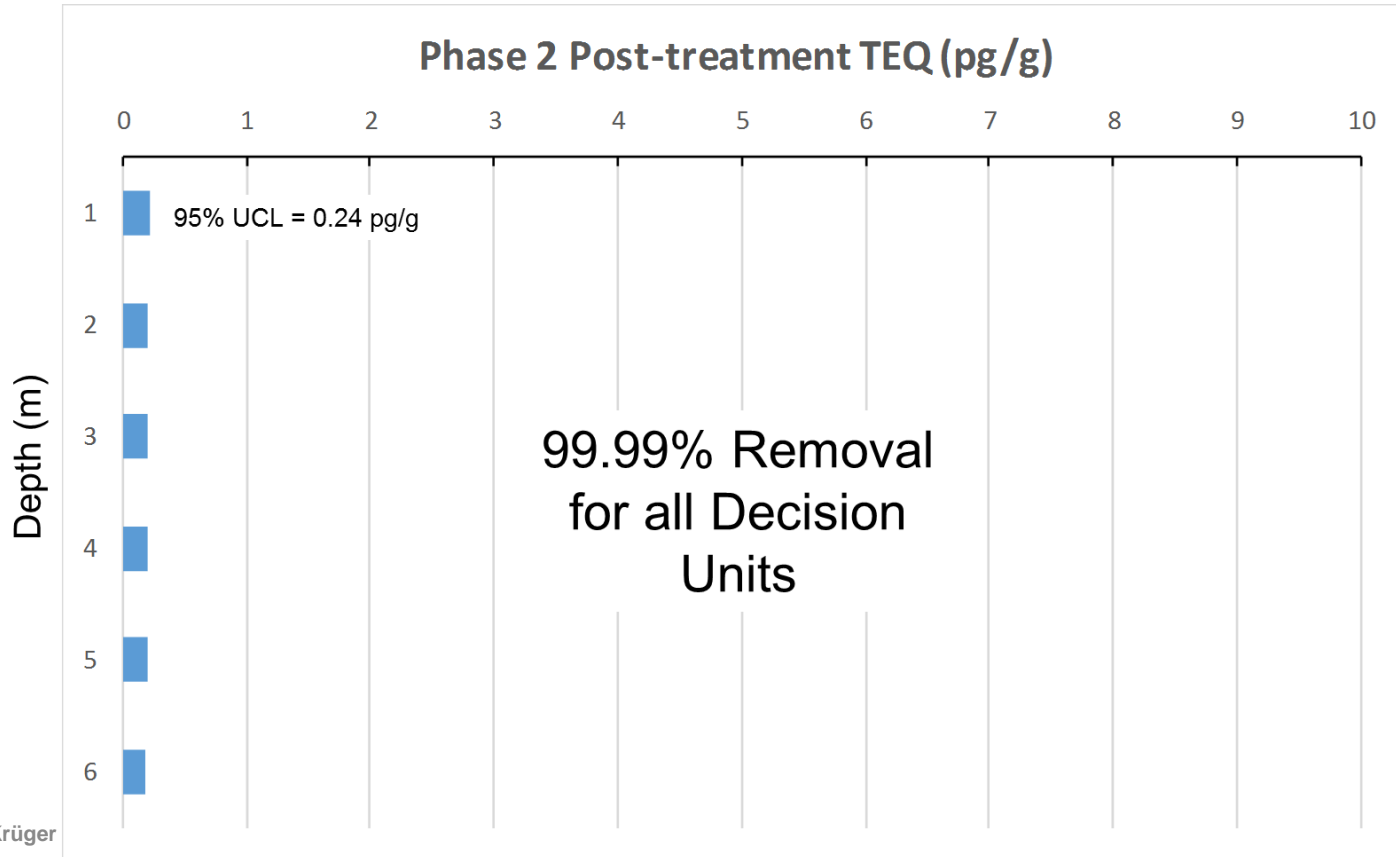
Fase 2 – Initial koncentrationer



Fase 2 – Gennemsnitstemperatur



Fase 2 – Dokumentationsanalyser (maj 2017)



Konklusioner

- IPTD nåede alle oprensningskrav med mere end > 99,99% fjernelse
- Robust design er nødvendigt – især ved høj temperatur sites
- På mindre end 9 år er undersøgelser, design og oprensning gennemført
- Danang Lufthavn leveres tilbage i 2018

Project team



USAID
FROM THE AMERICAN PEOPLE



SOCIALIST REPUBLIC OF VIETNAM
MINISTRY OF NATIONAL DEFENCE



TERRATHERM
Think Thermal



TETRA TECH



listen. think. deliver.

KRÜGER  **VEOLIA**

 **VEOLIA**
WATER

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