

# COMPARATIVE TEST ON SOIL SAMPLING AT A CLOSED FUEL STATION

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## Aim for this comparison was to

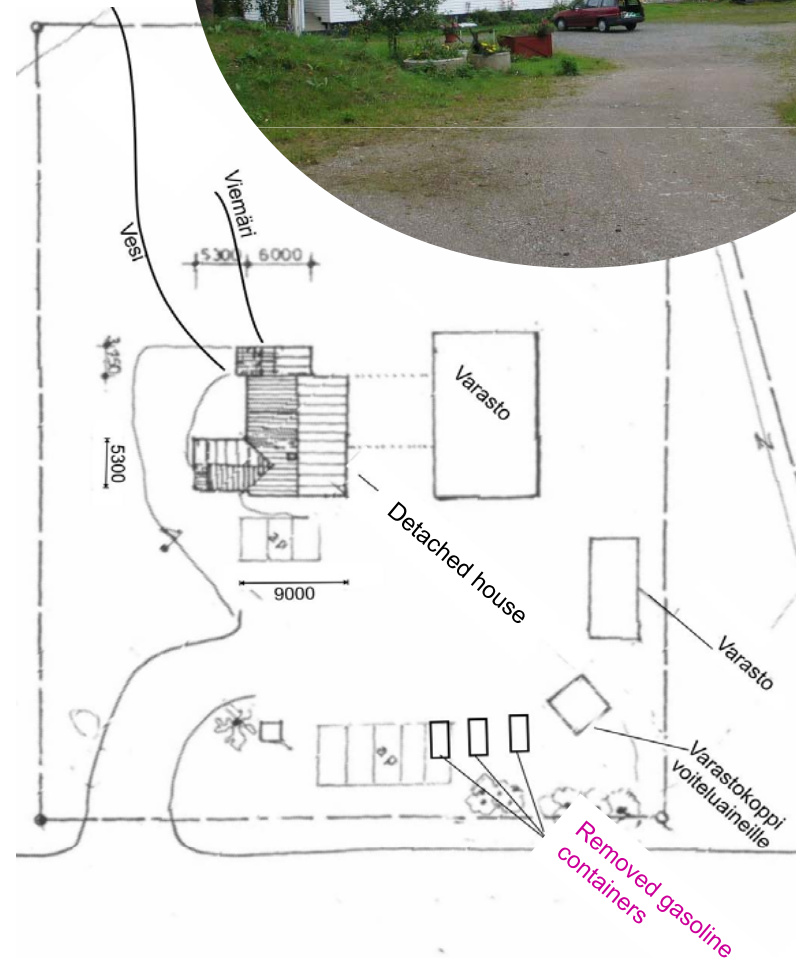
- Compare sampling procedures of contaminated soil between participated sampling teams
- Evaluate if the sampling design and procedure affected the conclusion on the need for remediation
- Demonstrate the use of quality procedures in sampling

## Setup of the comparison

- Expert planning group with different background
- In autumn 2008 during two weeks
- Participants: nine sampling teams from different organizations (participation fee: 1000 euro)
- Funded partly by Ministry of the Environment (40 %)
- One reference team, SOILI

## The site

- Gasoline station (before 1990)
- Area = 0.5 ha
- Contaminants detected by SOILI
  - Hydrocarbons (C10-C21, C22-C40)
  - Volatile organic carbons (C5-C10, BTEX)



## Organization of field work

- Not an authentic situation
  - Time limit 4,5 h.
  - Detailed plan was required in advance based on history due to practical and financial reasons.
  - Amounts of samples to the lab limited (max 15).
- Deviations due to other reasons than sampling planning and procedures minimized:
  - Same drilling equipment.
  - All samples transported and stored by the organizers.
  - VOC samples fixed with methanol on site.
  - Samples analyzed at same laboratory.
- Sampling practices were also documented by the organizer.



## Slide 4

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T2

Esitys tallennetaan muotoon PowerPoint-esitys (\*.pptx). Tällöin kaikki esityksessä käytetyt ominaisuudet toimivat ongelmitta.

[Voit poistaa tämän kommentin klikkaamalla hiiren oikeaa korvaa "Poista kommentti"](#)

Tekijä, 20/05/2011



## Observations from field work

- Experienced personnel most important factor for valid sampling!
  - Certification of sampling personnel
- Big differences in homogenization procedures and storage of samples
- Use of field instruments
  - Calibration?
  - Interpretation?



## Quality of homogenization was determined by split samples

- One sample was divided into 2 subsamples and both were analyzed in the laboratory.
- Sampling teams with good homogenization practices had less than 10 % difference in concentrations between the subsamples
- The difference between hydrocarbon concentrations (C10-C21) in subsamples was up to 30 %.

- Careful mixing during field work increases the representability.

Split sampling design  
quality assurance tool



## Heterogeneity of the site was determined by repeated sampling

- Two sampling holes were drilled less than 0,5 m from each other.
- Mean difference in hydrocarbon concentrations (C10-C21) was 80 % (range 2% - 177%).
  - This is natural heterogeneity of the site which affect **uncertainties of field investigation!**

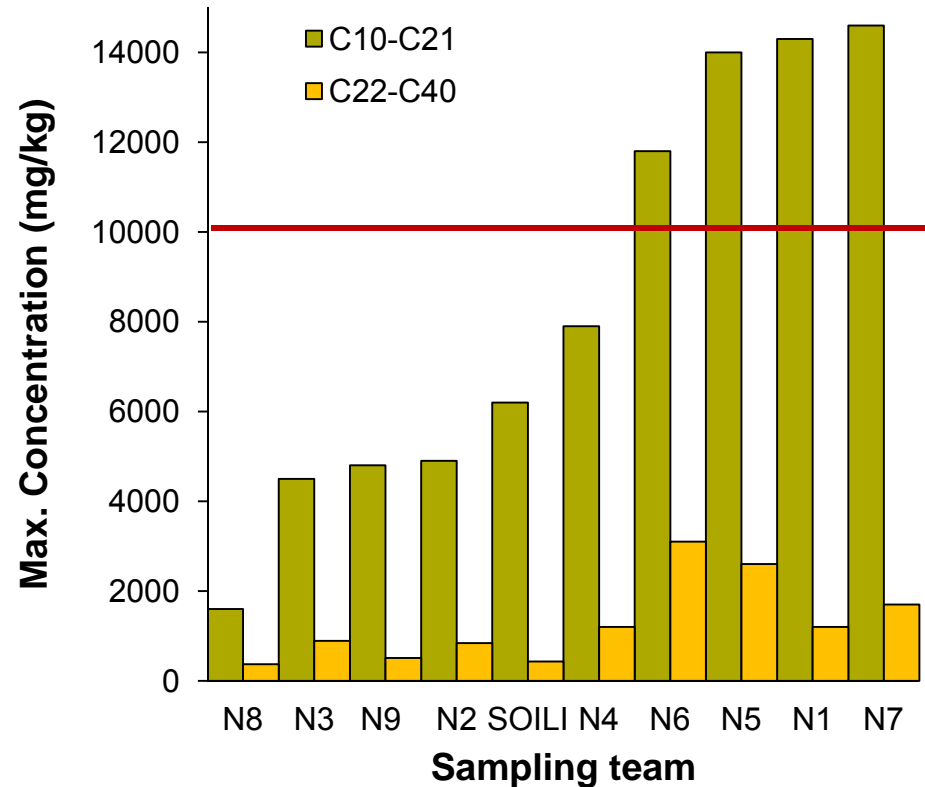
- Large heterogeneity on site → more samples are needed to reduce uncertainty of field investigation.
- Estimation of uncertainties should be estimated for every site specific investigation!





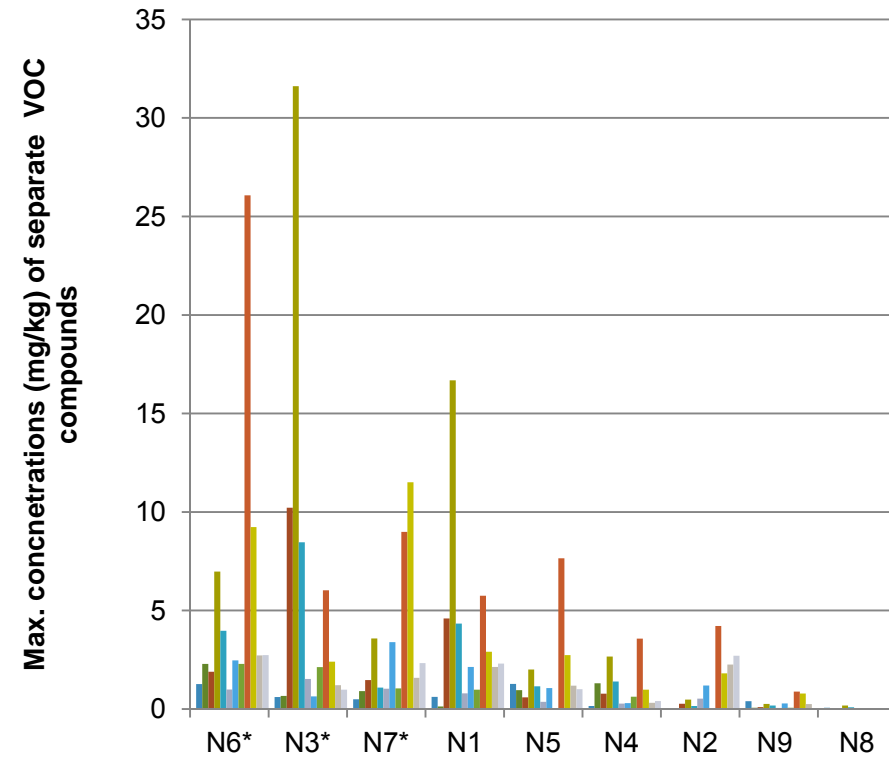
## Maximum concentrations of PHCs found by different groups

- Maximum conc. found varied between 1 600 – 15 000 mg/kg
- Only four groups detected hazardous waste concentrations ( — )
  - Affects costs!
- Max conc. did NOT correspond to amount of samples investigated or use of field instruments.



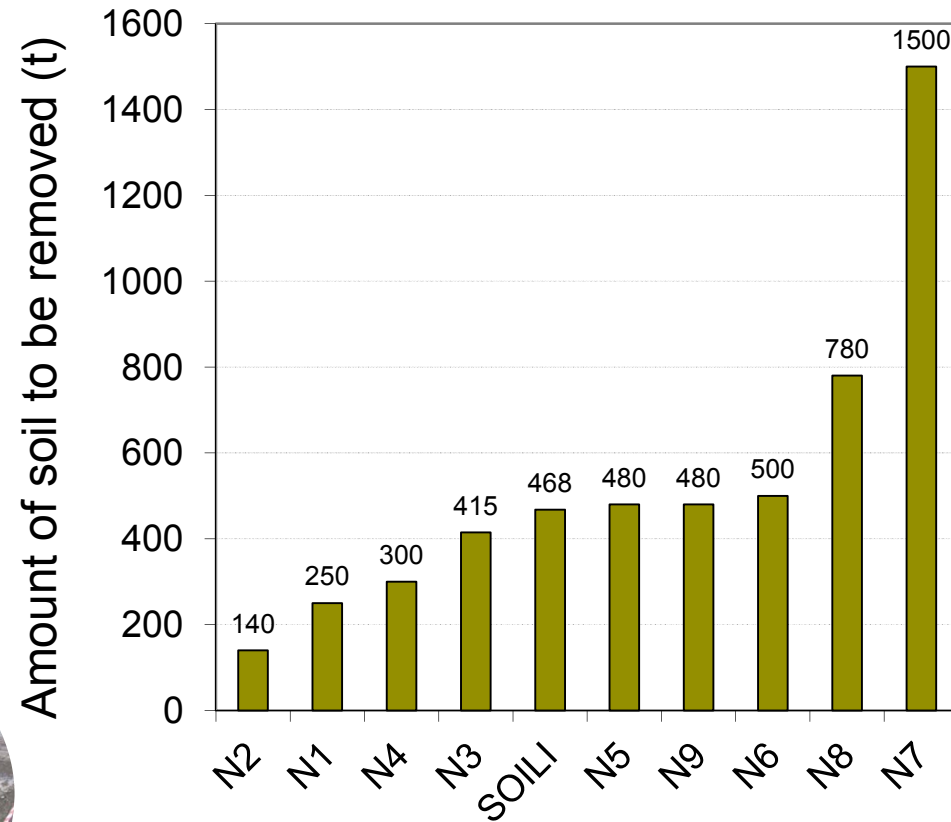
## Determination of volatile organic compounds (VOC) on the site

- \* Samples kept in cold by sampling team.
- Higher awareness of how to handle VOC compounds is needed (mixing, storing, fixing).



## Estimation of soil to be remediated

- All teams agreed, that the site had to be restored.
- The estimated amount of soil to be remediated varied 10 times (range 140 -1 500 t soil).
- Most estimations were close to executed.



## Conclusions

- Difficult to estimate performances of separate teams, because the matrix was very heterogeneous. The results of the SOILI team were not necessarily better than the others.

### BUT

- Comparison tests = good means to increase the awareness of quality issues in this field
- The results were presented at an open seminar with more than 60 participants → interesting discussions!
- Sufficient education and training of the sampling personnel is required. Guidelines are in preparation.
- Demo: use of quality assurance tools (representability, uncertainties) increases the transparency of sampling procedures (e.g. split sampling taken into use!)

## Acknowledgement to group of experts:

- Proficiency test providers
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- Problem holders:
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  - S. Nikunen, SOILI – programme (Finnish Petroleum Federation)
- Legislators
  - O. Pyy, SYKE
- Soil researchers
  - K. Jørgensen & K. Björklöf, SYKE



Thank you for your attention!!



# Need for restoration of contaminated soil is determined on site

- Level of contamination and the remediation need to be assessed **site specifically** by estimation of the hazard and damage of the contaminant on human health and on the environment.
- Threshold value PHC = 300 mg/kg (C10-C21) and 600 mg/kg (C21-C40)
- **Quality of sampling procedures difficult to measure** and performance of the sampling team may affect the outcome of the assessment?

