

# Environmental analyses and services at LTU

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## Air pollution, exhaust gas measurements, chemical analysis

Measurements of air pollutants and exhaust emissions;

-Aldehydes

-Volatile organic compounds, hydrocarbons

-Particles

-In exhaust gas: THC, CO, NOX, NO<sub>2</sub>, NO, NH<sub>3</sub>, N<sub>2</sub>O, CO and CO<sub>2</sub>

### **Type of service:**

Analysis, measurement

### **Equipment:**

In house:

TSI's Scanning Mobility Particle Sizer (SMPS)

VOC Air Analyzer - GC-FID

Bischoff HPLC with UV-detector

Waters HPLC - UV

Varian GC - FID

Gas chromatograph PE Autosystem (GC/FID)

Finnigan GC-MS, Iontrap

Chrompack GC-FID

Varian GC - FID/ECD

Perkin-Elmer System 2000 FT-IR spectrometer

Perkin-Elmer 1700 X NIR FT-Raman spectrometer.

Renishaw System 2000 Raman spectrometer

Chemagnetics CMX-360 NMR spectrometer

Gas Analyzer Bruel Kjaer Type 1301

Potentiometric titrations:

Bomb calorimeter

Viscosimeter

PE Flame atomic absorption spectrometer

PE Atomic absorption spectrometer (AAS)

Netzsch STA 409C for thermal analysis – DTA/TGA/DSC STA/QMS

By cooperation:

Equipment for measurements of THC, CO, CO<sub>2</sub>, NOX, NO<sub>2</sub>, NO

### **Location:**

See comments

### **Time:**

Continuous

### **Cost:**

Ask for a quotation

### **Comments:**

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## Biochemical Methane Potential, BMP

Assay of the biodegradability of materials under anaerobic conditions. Usually performed under 21+ days. Used to investigate biogas formation potential and anaerobic treatability of various materials. Sometimes called an anaerobic BOD.

Normally performed in triplicate at our lab.

### **Type of service:**

Analysis, measurement

### **Equipment:**

Standard laboratory equipment, gas tight vessels, pressure transducers, datalogger, gas chromatograph with FID and TCD detectors.

Publications:

### **Location:**

Internal

### **Time:**

Continuous

### **Cost:**

Offer on request

### **Comments:**

Capacity sometimes used to the limit.

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## Borehole system design

Design of borehole systems for heating and cooling applications. The outcome of the analysis is the required number of boreholes, borehole depth and spacing.

**Type of service:**

Other service

**Equipment:**

Design simulation tool

**Location:**

Internal

**Time:**

See comments

**Cost:**

About 25 h of work

**Comments:**

We carry out these designs frequently. Usually we are able to complete this kind of projects within 5-6 weeks.

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## Chemical equilibrium calculations

For the speciation of metals in environmental water phases, we offer chemical equilibrium calculations. The quantity of each component in the system is required, either as total concentration (sum over all phases) or as activity of a free component (e.g. pH as proton activity).

**Type of service:**

Other service

**Equipment:**

Software: PHREEQC-2

Databases: Minteq, Wateq, LLNL, PHREEQC

**Location:**

Internal

**Time:**

Continuous

**Cost:**

Offer on request

**Comments:**

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## Environmental impact assessment

Environmental impact assessments for roads, railroads and spatial planning

**Type of service:**

Other service

**Equipment:**

-

**Location:**

Internal

**Time:**

Seasonal

**Cost:**

**Comments:**

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## Equipment for PIV- measurements

Particle image velocimetry (PIV) is used to measure flow velocity fields inside transparent media like air and water. We have suitable pulsed lasers, CCD-cameras and software for measurements both in 2D and 2.5D

**Type of service:**

Analysis, measurement

**Equipment:**

Contact Per Gren

**Location:**

Internal

**Time:**

Seasonal

**Cost:**

To be negotiated

**Comments:**

Our pulsed laser are not movable outside our lab. so if these laser are in use then the experimental set-up must be moved to our lab. The rest of the equipment can more easily be moved around.

**Contact persons:**

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## High speed photography.

An image converter high speed camera (Ultramac) which records images from 2 000 up to 20 000 000 frames/second with illumination equipment and a various amount of lenses for different imaging situations is available at our lab.

**Type of service:**

Analysis, measurement

**Equipment:**

For more information contact Per Gren.

**Location:**

Internal

**Time:**

Seasonal

**Cost:**

To be negotiated

**Comments:**

The camera can quite easily be moved inside our building but outside is more difficult.

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## Internal flow and deformation fields in opaque objects

Using X-ray illumination, CCD-cameras and a tomographic technique flow fields or deformation fields inside non-transparent objects can be measured

**Type of service:**

Analysis, measurement

**Equipment:**

Equipment for X-ray radiography and tomography for studies of internal internal deformation and flow fields in opaque objects. For more information contact Mikael Sjö Dahl.

**Location:**

Internal

**Time:**

Seasonal

**Cost:**

To be negotiated

**Comments:**

X-ray radiation may be harmful to living organisms so this equipment must be used with special care and insight.

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## Landfill gas emission/deponigasmätning

Measurement and analysis of LFG emissions from landfill sites / mätning och analys av deponigasemissioner från avfallsupplag

CH<sub>4</sub>, CO<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, CO, H<sub>2</sub>

**Type of service:**

Analysis, measurement

**Equipment:**

Static chamber and GC / statiska kammare och GC

**Location:**

See comments

**Time:**

Continuous

**Cost:**

See comments

**Comments:**

LFG emissions are measured at the field and analysis is usually performed at the laboratory. Price depends on the number of samples to be taken and analysed.

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## Leaching tests

We offer all kinds of national, Nordic, and European standard leaching tests such as

- (a) shaking tests
- (b) column tests
- (c) diffusion tests
- (d) availability tests
- (e) sequential leaching tests

On request, we are glad to adapt leaching test protocols for special purposes.

### **Type of service:**

Analysis, measurement

### **Equipment:**

### **Location:**

Internal

### **Time:**

Continuous

### **Cost:**

Offer on request

### **Comments:**

### **Contact persons:**

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## Metal content in soil - XRF

Metal analysis in soil/metallanalys i jord

**Type of service:**

Analysis, measurement

**Equipment:**

Portable XRF

**Location:**

See comments

**Time:**

Continuous

**Cost:**

Varies depending on the number of sample

**Comments:**

Can be done in the laboratory or as field measurements

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## Methane oxidation

Assessment of methane oxidation capacity in soil

**Type of service:**

Analysis, measurement

**Equipment:**

Test performed in bottles at the lab, Analysis with GC

**Location:**

Internal

**Time:**

Continuous

**Cost:**

5000 kr/sample

**Comments:**

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## Pulsed lasers

Two pulsed lasers are available at our lab., a double pulsed Ruby laser and an injection seeded, Twin cavity, Q-switched Nd:YAG laser. They are used in holographic and speckle interferometry, speckle photography, PIV and other techniques to record fast events in solids and transparent media

### **Type of service:**

Analysis, measurement

### **Equipment:**

These lasers can not be moved around and will only be used in our lab. so experimental set-ups must be moved there.

For further information contact Per Gren.

### **Location:**

Internal

### **Time:**

See comments

### **Cost:**

To be negotiated

### **Comments:**

The lasers can give single pulses, double pulses or pulse trains with time separations from the microsecond range to the milliseconds with each pulse a few 10th nanoseconds (which "freezes" most mechanical events. Auxiliary equipment as oscilloscopes, delay units, CCD-cameras etc are also available.

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## Scanning Vibrometer PSV-300

This is a new instrument (2003) for an optical fast, accurate, non-contact vibration field measurements. Applications are within modal analysis, sound field measurements, finding sources of noise, structural damage and to optimize design of products.

**Type of service:**

Analysis, measurement

**Equipment:**

see [www.polytech.com](http://www.polytech.com)

**Location:**

Internal

**Time:**

Seasonal

**Cost:**

To be negotiated

**Comments:**

The equipment consist of an scanning optical head, an electronic controller and management system with computer and monitor on a a separate movable duty cabinet. So the instrument can be moved quite easy inside our building.

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## Sound and Vibration measurements

Measurement and analysis in the sound and vibration area;

- Building acoustics
- Industrial noise and vibration
- Engine noise and emission
- Audio and music
- Sound quality

### **Type of service:**

Analysis, measurement

### **Equipment:**

- B&K Pulse FFT and real time analyser
- I-deas analysis software
- Head acoustics sound quality system
- Cue-Sim 6-axis motion simulator
- 600 kW engine test system
- Anecoic acoustics chamber
- Reverberation room
- Building acoustics lab

### **Location:**

See comments

### **Time:**

Continuous

### **Cost:**

quote

### **Comments:**

Address;

Luleå university of technology

Sound&Vibration dep.

971 87 Luleå

Located at F-house;

[http://www.luth.se/depts/arb/index\\_files/karta.jpg](http://www.luth.se/depts/arb/index_files/karta.jpg)

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## test

test

**Type of service:**

Analysis, measurement

**Equipment:**

test

**Location:**

Internal

**Time:**

Continuous

**Cost:**

test

**Comments:**

test

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## Thermal response test (TED measurements)

This type of measurements are used before the design of larger borehole systems. Measurements are made in-situ and the analysis gives the thermal properties of the ground and thermal resistance of the borehole.

**Type of service:**

Analysis, measurement

**Equipment:**

Mobile response test equipment.

**Location:**

Internal

**Time:**

See comments

**Cost:**

approx. 30000:-

**Comments:**

Now and then - all over Sweden

**Contact persons:**

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## Total Organic Carbon, TOC

Assessment of a materials organic carbon content. Also inorganic carbon, IC, is quantified.

**Type of service:**

Analysis, measurement

**Equipment:**

Shimatsu TOC analyser

**Location:**

Internal

**Time:**

Continuous

**Cost:**

Offer on request

**Comments:**

Capacity sometimes in full use

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## Toxicity assessment

Toxicity assessment using luminescent bacteria (*Vibrio fischeri*) according to ISO 11348-3

**Type of service:**

Analysis, measurement

**Equipment:**

luminescent bacteria

**Location:**

Internal

**Time:**

Continuous

**Cost:**

Varies depending on the number of sample

**Comments:**

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## TV holography and Shearography

The equipment is also called Electronic holography and DSPI (digital speckle pattern interferometry). The equipment is used for sinusoidal optical modal analysis, Non-destructive testing and deformation field measurements. The optics can be changed from out-of-plane into in-plane sensitivity as well as for shearography.

**Type of service:**

Analysis, measurement

**Equipment:**

See <http://www.pcholo.com/>

Ask Mikael Sjö Dahl for more information

**Location:**

Internal

**Time:**

Seasonal

**Cost:**

To be negotiated

**Comments:**

This equipment can not be moved outside our lab.

**Contact persons:**

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