Norwegian permitting, monitoring and reporting.

Requirements and practices
Norsk Energi

- Industry association established in 1916
- 80 experts with BSc, MSc and PhD
- Consultancy, engineering services, analysis and training
- Independent from equipment suppliers and manufactures
- 90% of turnover from private industry
- 10% international projects unded by Norwegian government and IFIs
The effective, environmentally friendly and safe utilisation of energy

Is reducing CO₂ emissions important for you too?

NORSK ENERGI

www.energi.no
Permits

Two kind of emission permits for industrial installations:

1. IPPC/IE-permit
   All major components (listed in Annex 1 of the Directive) emitted to air, water and soil, except GHG-gases. Also regulates waste, noise, energy/resources and management systems.

2. ETS-permit
   GHG-gases (mainly CO$_2$, N$_2$O, CH$_4$ and some PFCs)
IPPC/IE-permit

Industrial Emission Directive introduced in 2010
Replaces 7 directives including the IPPC Directive
Strengthened use of BREF’s (BAT) recommendations
Updated minimum binding ELVs for LCPs
Increased transparency – NGOs recognized as stakeholders
Tightened requirements for operators and for the competent authority
Permitting procedure

Simplified steps of IPPC/IE-permitting procedure:
1. The installation prepares and submits application (normally with external expertise)
2. EPA reviews application to check if required information is complete and at a sufficient standard
3. Hearing. Application sent to all relevant neighbors, authorities and NGOs.
4. EPA ask applicant to comment all inputs from hearing
5. EPA reviews input from hearing and comments from applicant and issue a preliminary permit to be commented by applicant Negotiations may take place
6. EPA issues final permit (with a new hearing period)
General Principles

Installations shall be operated in accordance with following principles:

- All preventive measures are taken against pollution
- Best available techniques (BAT) is applied
- No significant pollution is caused
- The generation of waste and utilisation of waste is in accordance with the Directive 2008/98/EC on Waste
- Energy is used efficiently – energy management system
- The necessary measures are taken to prevent accidents and limit their consequences
- The necessary measures are taken upon definitive cessation of activities.
General Principles (2)

- Full-scale permitting
  - Combustion plants (≥ 50 MW);
  - Waste incineration or co-incineration plants;
  - Certain installations and activities using organic solvents;
  - Installations producing titanium dioxide.

- Other installations have to go through a simplified process but must comply with certain regulations (e.g., national standard for small-scale combustion plants).

- In cases where a polluting industrial activity is an obvious or a possible contributor to an exceedance or a possible exceedance of an ambient air quality limit, the Permitting Authority may require an improvement plan as a condition in the pollution permit.
Structure of Application

1. About installation
2. Location
3. Production
4. Emission to water
5. Emission to air
6. Waste
7. Noise
8. Precautions and risk assessment
9. Internal control and emission control systems
10. Signature
11. Attachments

The applicant shall suggest ELVs and monitoring program based on IED, BAT evaluations, background levels, recommended pollution levels and dispersion models.
Control and Monitoring of Air Emissions

Emission limit values and other conditions shall be based on:

- Achievable emission levels based on the use of BAT
- Assessment of local conditions
- Emission limit values and other conditions laid down for other activities in the same type of industry/geographic area/type of pollutants

Emission limit values are set as concentration limit values (mg/Nm$^3$) and pollution load (kg/h)

If the effluents are not in compliance with BAT, temporary emission limits should be given for a period of up to 4 years

The frequency of the measurements and the need of on-line monitoring for various installations are determined by the environmental authorities with input from the BREF documents and by risk analysis (e.g. likelihood of exceeding ELVs). The installations report all emissions once a year through an electronic reporting system.
Example RHI Normag

Production of MgO – magnesia, at Herøya Norway
Expanded plant to also produce fused MgO in 2012
New permit required – Norsk Energi coordinated the application process

Process flow diagram fused magnesia plant
### Monitoring program – RHI Normag

Monitoring program magnesia kiln fired with **bio oil, heavy oil or carbon monoxide gas**:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>ELV – concentration*</th>
<th>ELV – accumulated</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust/PM</td>
<td>10 mg/Nm³</td>
<td>5,7 tons/y</td>
<td>Continuously</td>
</tr>
<tr>
<td>NOₓ as NO₂</td>
<td>200 mg/Nm³</td>
<td>114 tons/y</td>
<td>Continuously</td>
</tr>
<tr>
<td>CO</td>
<td>100 mg/Nm³</td>
<td>57 tons/y</td>
<td>Continuously</td>
</tr>
</tbody>
</table>

* Averaged over 24h

Typical example of reduced number of parameters to be monitored when commercial fuels are used

Also ELVs and monitoring requirements may be changed with a change in fuel
Monitoring program – RHI Normag

Monitoring program magnesia kiln fired with waste oil:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>ELV – concentration</th>
<th>ELV – accumulated</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust/PM</td>
<td>10 mg/Nm³*</td>
<td>5,7 tons/y</td>
<td>Continuously</td>
</tr>
<tr>
<td>NOₓ as NO₂</td>
<td>200 mg/Nm³*</td>
<td>114 tons/y</td>
<td>Continuously</td>
</tr>
<tr>
<td>SO₂</td>
<td>50 mg/Nm³*</td>
<td>28 tons/y</td>
<td>Continuously</td>
</tr>
<tr>
<td>TOC</td>
<td>10 mg/Nm³*</td>
<td>-</td>
<td>Continuously</td>
</tr>
<tr>
<td>HCl</td>
<td>10 mg/Nm³*</td>
<td>5,7 tons/y</td>
<td>6 months</td>
</tr>
<tr>
<td>HF</td>
<td>1 mg/Nm³*</td>
<td>0,57 tons/y</td>
<td>6 months</td>
</tr>
<tr>
<td>CO</td>
<td>100 mg/Nm³*</td>
<td>57 tons/y</td>
<td>Continuously</td>
</tr>
<tr>
<td>Mercury</td>
<td>0,3 mg/Nm³**</td>
<td>-</td>
<td>6 months</td>
</tr>
<tr>
<td>Kadmium/tallium</td>
<td>0,05 mg/Nm³**</td>
<td>-</td>
<td>6 months</td>
</tr>
<tr>
<td>Heavy metals***</td>
<td>0,5 mg/Nm³**</td>
<td>-</td>
<td>6 months</td>
</tr>
<tr>
<td>Dioxins and furans</td>
<td>0,1 mg/Nm³**</td>
<td>-</td>
<td>6 months</td>
</tr>
</tbody>
</table>

* Averaged over 24h  ** Averaged 6-8 hours  *** Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V
BAT evaluations

The installation suggests ELVs and a monitoring program based on acceptable simulations, BREF documents and how similar installations perform.

This requires a thorough review of relevant BREF documents:

* Cement, Lime and Magnesium Oxide Manufacturing Industries*
* Waste Incineration*
* Large Volume Inorganic Chemicals*
Emission to air

The installation must submit calculations/simulations of how emissions to air dispersed – ex. dispersion of NOx and PM – determination of necessary stack height and flue gas velocity out of stack.

Air consultant: Norsk Energi
Monitoring program – risks analysis

The monitoring plan (sampling plan) is developed by the installation, but must be approved by the EPA.

Monitoring program is often determined in close communication with EPA, and with assistance from external consultant.

Drawing from Reference Document on the General Principles of Monitoring

Table from Reference Document on the General Principles of Monitoring
## Determination of monitoring prog.

EPA has the final word when settling the permit requirements and monitoring program.

<table>
<thead>
<tr>
<th>Level of ELV</th>
<th>Cont. monitoring vs. regular samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel</td>
<td>Fuel</td>
</tr>
<tr>
<td>BAT described in BREFs</td>
<td>Size of installation (size of emission)</td>
</tr>
<tr>
<td>Simulations submitted with application</td>
<td>Variations in emissions</td>
</tr>
<tr>
<td>Vulnerability in neighboring areas</td>
<td>Vulnerability in neighboring areas</td>
</tr>
<tr>
<td>Background concentration</td>
<td>Cost of equipment</td>
</tr>
<tr>
<td>Requirements at similar installations</td>
<td>Requirements at similar installations</td>
</tr>
</tbody>
</table>

These are all inputs to an overall decision by EPA.
Monitoring program – 3rd party verification

Continuous measurement equipment shall be verified by third party annually (AST – annual surveillance test)

Continuous measurement equipment shall be calibrated by third party on a regular basis (3/5 year).

All other measurements (annual, every 6 months, etc.) shall be performed by third party

Third parties shall be accredited.
Monitoring example Norcem Brevik

Cement plant in Brevik Norway

Fuel consumption 2009:
- Fossil fuel: 69243 tons
- Alternative fuel: 132322 tons (waste fractions)

Produces approx 1 Mton clinker and 1,2 Mton cement

BREFs:
- Cement. Lime and Magnesium Oxide Manufacturing Industries
- Waste Incineration
Monitoring program – Norcem

Monitoring program cement kiln fired with various fossil fuels, bio fuels and waste fractions:

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<thead>
<tr>
<th>Parameter</th>
<th>ELV – concentration*</th>
<th>ELV – accumulated</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust/PM</td>
<td>30 mg/Nm³</td>
<td>50 tons/y</td>
<td>Continuously</td>
</tr>
<tr>
<td>HCl</td>
<td>10 mg/Nm³</td>
<td>25 tons/y</td>
<td>Continuously</td>
</tr>
<tr>
<td>HF</td>
<td>1 mg/Nm³</td>
<td>0,25 tons/y</td>
<td>6 months</td>
</tr>
<tr>
<td>NOₓ as NO₂</td>
<td>800 mg/Nm³</td>
<td>2200 tons/y</td>
<td>Continuously</td>
</tr>
<tr>
<td>SO₂</td>
<td>-</td>
<td>300 tons/y</td>
<td>Continuously</td>
</tr>
<tr>
<td>TOC</td>
<td>30 mg/Nm³</td>
<td>-</td>
<td>Continuously</td>
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<td>0,05 mg/Nm³</td>
<td>-</td>
<td>6 months</td>
</tr>
<tr>
<td>Mercury</td>
<td>0,05 mg/Nm³</td>
<td>30 kg/y</td>
<td>6 months</td>
</tr>
<tr>
<td>Heavy metals**</td>
<td>0,5 mg/Nm³</td>
<td>-</td>
<td>6 months</td>
</tr>
<tr>
<td>Dioxins and furans</td>
<td>0,5 ng/Nm³</td>
<td>-</td>
<td>6 months</td>
</tr>
</tbody>
</table>

* Averaged over 24h
** Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V
Monitoring example Hoff Energy Central

- Light fuel oil
- 110MW boiler capacity
- Produces district heating to citizens in Oslo
- BREF: Large combustion plant
## Monitoring program – Hoff

### Emission limits:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>ELV [mg/Nm³]</th>
<th>ELV [kg/h]</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOₓ as NO₂</td>
<td>200</td>
<td>24.8</td>
</tr>
<tr>
<td>SO₂</td>
<td>100</td>
<td>12.4</td>
</tr>
<tr>
<td>Dust/PM</td>
<td>10</td>
<td>1.2</td>
</tr>
<tr>
<td>CO</td>
<td>50</td>
<td>6.2</td>
</tr>
</tbody>
</table>

### Monitoring requirements:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mon. frequency</th>
<th>Averaging</th>
<th>Number of tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOₓ as NO₂</td>
<td>Continuously</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>SO₂</td>
<td>Calculated*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dust/PM</td>
<td>Annually</td>
<td>1h</td>
<td>2**</td>
</tr>
<tr>
<td>CO</td>
<td>Annually</td>
<td>1h</td>
<td>Continuously***</td>
</tr>
<tr>
<td>Soot-number</td>
<td>Annually</td>
<td>NA****</td>
<td>2</td>
</tr>
</tbody>
</table>

* Calculated based on sulfur level in oil and fuel consumption (factors)
** 2 tests a 1 hour captured on filter, analyzed in accredited laboratory
*** Direct reading field instrument
**** Soot pump
Reporting requirements

Norwegian Pollution Release and Transfer Registry – user perspective
The Norwegian PRTR

Releases to air and water as well as transfers of waste from one compartment to another.

Total emissions to air in Norway

Statistics Norway and the Climate and Pollution Agency calculate the total annual national emissions to air of 20 emission components. + Read more

Pollutants

<table>
<thead>
<tr>
<th>Carbon dioxide fossil (CO2 (F))</th>
<th>Sulphur dioxide (SO2)</th>
<th>Copper (Cu)</th>
<th>SuspendedParticles (PM10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane (CH4)</td>
<td>Arsenic (As)</td>
<td>Mercury (Hg)</td>
<td>Particulate matter (PM2.5)</td>
</tr>
<tr>
<td>Dioxins (Dioxin)</td>
<td>Cadmium (Cd)</td>
<td>Lead (Pb)</td>
<td>Total Suspended Particles (TSP)</td>
</tr>
</tbody>
</table>
| Nitrogen oxides (NOx)           | Chromium (Cr)         | Nitrous oxide (N2O) | [...]

Trends of selected pollutants (see complete list)

- Carbon dioxide fossil (CO2 (F))
- Methane (CH4)
- Nitrogen oxides (NOx)
- Sulphur dioxide (SO2)
The Norwegian PRTR

Releases to air and water as well as transfers of waste from different sectors, both aggregated and at facility level.

Hafslund Fjernvarme, Hoff Varmesentral Skøyen

Permit and control reports (Norwegian only): Valid permit, Control report 2011
Authority: Klima- og forurensningsdirektoratet
Carbon units: Control report 2012
Emission Trading Scheme Authority: Klima- og forurensningsdirektoratet

Releases of Carbon dioxide (CO2) (in 1000 tonn per year)

Hafslund Fjernvarme, Hoff Varmesentral Skøyen

[Graph showing releases of Carbon dioxide (CO2) over years 2003 to 2011]

Category

- Carbon dioxide (CO2)
- Carbon dioxide fossil (CO2 (F))
- Carbon monoxide (CO)
- Nitrogen oxides (NOx)
- Particulate matter (INSTOV)
- Sulphur dioxide (SO2)
The Norwegian PRTR
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Releases of Nitrogen oxides (NOx) (in tonn per year)

View
- To air
- To water
- Not reported

Category
- Carbon dioxide (CO2)
- Carbon dioxide fossil (CO2(f))
- Carbon monoxide (CO)
- Nitrogen oxides (NOx)
- Particulate matter (INSTOV)
- Sulphur dioxide (SO2)
The Norwegian PRTR

Releases to air and water as well as transfers of waste from different sectors, both aggregated and at facility level.

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on map

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Carbon units and emissions in CO2-equivalents (in tonn per year) *

[Graph showing emissions over time]
The Norwegian PRTR

Releases to air and water as well as transfers of waste from different sectors, both aggregated and at facility level

Hafslund Fjernvarme, Hoff Varmesentral Skøyen

on map

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Carbon units and emissions in CO2-equivalents (in tonn per year) *

View

- Emissions
- Carbon units

Export to...
- Excel
- Word
- CSV
Fulfillment of monitoring requirements

Permit

Tillatelse til virksomhet etter forurensningsloven
for Hoff varmeentral, Viken fjørvarme AS

Table:

<table>
<thead>
<tr>
<th>Bedriftsnavn</th>
<th>Bebyggelsesområde</th>
<th>Halvområde 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoff varmeentral</td>
<td>Kommune</td>
<td>Oslo</td>
</tr>
<tr>
<td>Postadresse: Postboks 4380</td>
<td>Postnr.</td>
<td>0027 Oslo</td>
</tr>
<tr>
<td>Adresser: Braggs gate 46</td>
<td>Bydel</td>
<td>Grubbegaten</td>
</tr>
<tr>
<td>Postnummer: 40-3</td>
<td>Postnummer</td>
<td>0027</td>
</tr>
<tr>
<td>Byskatte nr. til 2008: 101 02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFT nr. til 2008: 0088, 0087, 0086</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SFT nr. til 2008: 0088, 0087, 0086

Inspection report

Inspeksjonsrapport

Hoff varmeentral AS

Dato for inspeksjonen: 24. mars 2011

Rapportnummer: 2011.022 KLIF

Kontaktperson ved kontrollen:

Viktor Bergseth

Resultat fra inspeksjonen:


Norsk Energi

NORDEN-BRUK,
Thank you for your attention
From concentration to annual emissions

\[
E = Q \times C/100 \times (MW/EW) \times T
\]

Where:

- **E** = Annual load of the chemical species emitted (kg/yr)
- **Q** = Fuel mass flow rate (kg/h)
- **C** = Concentration of the elemental pollutant in fuel (wt%)
- **MW** = Molecular weight of the chemical species emitted (kg/kg-mole)
- **EW** = Elemental weight of the pollutant in fuel (kg/kg-mole)
- **T** = Operating hours (h/yr)

The emissions during operating hours may vary a lot, then more samples and/or good modeling of emissions are needed.