
SELF-MONITORING, REPORTING AND COMPLIANCE MONITORING IN FINLAND

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SUMMARY

Licence writing, self-monitoring, periodic reporting made by operators and inspectors must fit seamlessly to each others. In the system, all "players" must have overall understanding of what the environmental requirements are, how objectives can be reached, what actions must be taken to protect the environment and what are the consequences if a "player" breaks these "rules".

Although the self-monitoring and reporting system removes some duties (like monitoring of emissions) from authorities to the operators, it however requires that authorities must be well educated and they have to possess necessary powers to set and enforce necessary environmental requirements.

Either environmental authorities or other authorities must have the means to supervise the fact that self-monitoring done by operators is working properly. It is also essential that environmental information (like applications, permit, monitoring program and reports made by operator) are publicly available.

The basis for inspection and the enforcement are built up gradually. For most common pollutants there are national programs that are made together with all interest groups. In the preparation of the permit, authorities have close contacts with the applicant. This helps inspectors to get know the mills and to identify processes and practices that affect emissions. They are ready to carry out the inspection/enforcement work. Inspectors can help those persons who write the permit to make it clear and detailed enough. Because of possible future conflicts, it is important that permit holders and inspectors understand the requirements of the permit in the same way.

The population of Finland is about 5 millions and we have about 2,000 establishments that must have an environment permit on air or water protection. In waste management the number of establishment is about 6,000. The permit has the monitoring program that describes the monitoring of water discharges and air emission in detail. The program also has requirements for reporting. The reporting consists of the periodical reporting and reports about disturbances. Because applications, permits and reports are publicly available and because the public is interested in how installations are regulated and inspected, missuses are, to a large extent prevented.

The authorities receive and inspect the reports and make necessary site inspections. Inspection reports are written and fed into a nationwide computer system together with permits and information from periodical reports. The knowledge and experience from inspection work are taken into consideration when new legislation is drafted.

At least one laboratory has been prosecuted because it made fault laboratory analyses, one pulp mill was found guilty because it tried to hide its too large water discharges and some inspectors have every now and then been prosecuted because they have not carried out their inspection work properly. Although there are only separate cases, this demonstrates that it is possible to get caught.

In the future compliance questions will become more complex. In an integrated approach (air and water protection and waste management), regulators must be able to find a right balance between different areas of environmental protection and questions dealing with international competitiveness of installations also are becoming real issues.

1 ENVIRONMENTAL OBJECTIVES AND LICENCE WRITING

Good legislation and good permits are a solid foundation for a self-monitoring.

The central administration in Finland has an obligation to draft necessary legislation and general requirements for environmental protection.

Overall goals of environmental protection derived from legislation are set by the Council of State. The Council of State can make decisions on environmental quality, emissions into air, water, quality of raw materials and fuels and on waste management. In different areas (air, waste, water) the forms may differ (air emission limit values from large combustion plan or waste management plan).

The Council of State decisions on these matters are done together with industry, energy producers and in some cases also with non-governmental environmental organizations, although the Ministry of Environment usually finalizes the drafts for the Council of State. As part of this approach to decision-making, different parties are not bound to consensus or common position papers. However, in this process, they develop a somewhat common understanding what is possible and at what costs. They may not always agree on the level of environmental protection that is needed. In a small country, almost all who have largest powers to influence decisions are known to each others and on one hand this is an advantage but on the other hand over the years problems can develop. Nevertheless, needed new regulations seems to result mostly on time.

In matters that fall under the jurisdiction of the Water Court, representatives do not take part in the preparatory work for these decisions, because the Courts are independent from administration. However persons from regional environmental centres and from the Finnish Confederation of local authorities take part in the workgroups and committees that prepare papers.

Water Courts, which focus only on water protection, and regional and local authorities are in practice bound by those decisions if they are given as orders but if the decision made by Council of State are guidelines then license writing bodies can go to more stringent requirements if local circumstances so require. There are however a limited number of decisions by the Council of State, so in many cases courts, regional and local authorities have a large independent decision making power.

In their decisions, Water Courts give the regional environmental authorities rights to decide up on compliance monitoring programs for individual establishments. For other environmental permits, regional and local authorities have according to laws rights also to decide up on compliance monitoring plans. Monitoring plans are nowadays separate, but in the near future they will be integrated.

An operator makes application for an environmental permit, and he or she also supplies all necessary technical and environmental impact studies that are needed for licence writing. Concerning an air permit there should also be a proposal for an air emission monitoring program. The preparation of the license includes different kind of hearings and statements through which the opinions of the public and other authorities are received. If the establishment is new and a large one then there is also Environment Impact Assessment that has similar procedures as licencing procedure and actually duplicates some procedures.

The Water Court or the licence writing authority must be able to identify from a licence application:

- what is the state of environment (air quality is in the statement of the municipality);
- most important sources of emissions and what kind emissions there are into air, water and wastes;
- processes and process conditions that have large influence on emissions;
- how large are the emissions and what might be impacts into environment;
- what processes or control equipments are used to control emissions, and if the environmental situation requires what possibilities are to further control emissions and what the control costs might be;
- what is Best Available Technology (BAT) technique and what are the estimated emissions compared to emissions of BAT techniques (so far only air, but in 1999 integrated approach);
- in air permit application also a proposal for air emission monitoring; and
- how wastes are minimized, recovered or recycled and costs for further actions.

All permit applications are made available to public. In water protection there are some special procedures to get public opinion and in other areas of environmental protection persons can give their opinions. Business and trade secrets are confidential but the confidentiality is in practise rather limited compared to other Member States in the European Union.

The permit must contain environmental requirements that insure that environmental objectives can be reached. The requirements must be expressed in such a way that authorities, operators and the public understand them in a same way. It is also equally important that limit values are set in such a way that operator has technical and economical possibilities to carry out the needed monitoring.

2 MONITORING PROGRAM AND SELF-MONITORING

Usually the operator proposes a compliance monitoring program during the licensing procedure. In this way operators know how these requirements can be implemented already in the planning stage. Secondly, the coverage of monitoring can be enlarged: quite a lot of measurements can be continuous instead of periodical measurements and the periodic measurements can be made more often. If an operator has a system for environmental management consistent with the European Union's EMAS regulation, where she or he is committed to further control the emissions, then self-monitoring also produces information directed to that purpose. Operators at large installation usually have a better understanding about the emissions than those measuring laboratories that mainly make routine measurements and only seldom have possibilities to measure in very demanding places.

2.1 Scope of monitoring required

The self-monitoring is not restricted only to the monitoring of the emissions. The monitoring of process values gives valuable information that can be used to identify such process conditions that are typical to low/high emissions.

The monitoring program should be so detailed and well written that it must define clearly what and how the monitoring is carried out. It must produce data and information that can be used to assess if the emissions are lower than set limit values.

Although we have had different licensing procedures for water and air protection, the monitoring programs have more or less same elements:

- a short overview of the installation;
- identification of pollutants and their main sources;
- naming the pollutants that must be measured continuously or periodically;
- description of measuring systems; places where samples are taken or in case of in situ measurements the locations of measuring equipments, what analyzing equipments are used, how data is collected and the emissions are calculated from the measured data;
- overall view of the quality control program of the emission measurements; this should include among other things the parallel measurements done by the laboratory that has accredited measuring methods;
 - quality requirements of parallel measurements may come into licences of the installations that have continuous measurements in the near future; and
- identification of process values to be measured and used to conform that conditions are proper for emission measurements or in some case to back up continuous measurements or to collect data in order to better understand processes in order to further control emissions.

2.2 Insuring quality data

The comparability of data produced by the self-monitoring is a valid question. In life one cannot be 100 per cent sure always, but certain things increase the overall confidence to self-monitoring:

- open access to monitoring program and periodic reports;
- a well working national accreditation system; and
- clear requirements how good measurements must be.

The Last item is especially demanding: all quality systems of emission measurements seem to be valid only in one country because they rely so much not only on national practices but also on national structures. With globalization of production we must be able set measuring requirements in a more harmonized way.

The Ministry of the Environment of Finland has financed a series of studies by the State Research Institute concerning estimation of uncertainty of continuous measurements. The latest report is "Determination of Uncertainty of Automated Measuring Systems (AMS) Under Field Conditions Using a Second Method as Reference". And it can be downloaded from <http://www.vtt.fi/ket/ket3/pdf/puustinen.pdf>.

Our intention is to use it on a test basis when setting requirements for continuous measuring for air emissions during late 1998 and 1999. The idea of quality assurance of continuous measurements based on the estimation of uncertainty has been presented in national technical meetings. A Report to show how to do it was published on the Internet only in June 1998, so final reflections from authorities and the industries side have not been received.

3 REPORTING AND ENVIRONMENTAL INFORMATION SYSTEM COVERING LICENCED INSTALLATIONS

The reporting requirements of the operator (including self-monitoring) are written either into a permit itself or into the monitoring program which is annexed to the permit. Setting reporting requirements should be closely linked to permitting. Usually there are many kinds of reporting. Reports on:

- the stoppages of control devices and accidents;
- the exceeding of the limit values;
- emissions (on monthly or yearly bases); and
- the results of the monitoring of process conditions and actions taken.

The depth of reporting depends on installation and reporting mentioned in the last bullet comes into question only with some complex process industry.

It is important that reporting requirements are clearly written not leaving any large space for interpretation. It is most difficult to tell when stoppages of control device or other non-normal emissions are so large that they have to be reported immediately to authorities. Usually it takes a little time to develop a well functioning system. When it is ready it has to be assessed periodically to compare results of reporting with information needed to protect the environment and with the resources allocated.

Reports mentioned in first, second and fourth bulleted items above are sent either to regional or to local (smaller installations) authorities. Reports mentioned in third bullet cover also production, raw materials (not all), fuels used, running times of boilers and some information on costs of environmental investments. Emissions into air and water and wastes are covered.

The reporting format is nationally coordinated, because the main part of that information is fed by regional environmental centres into nationwide data system covering information on all installations that must have some kinds of environmental licences. The system called VAHTI covers states environmental administration: regional centres, the Finnish Environmental Institute and the Ministry of the Environment. Some municipalities and cooperative partners are connected via special procedures (a copy of an emission database in a separated computer placed outside of a firewall) on trial bases (in 1998) to a part of the system.

In VAHTI all installations that have environmental permits are considered as customers. To a customer the following data is attached:

- all environmental licences
- inspection reports
- periodic data (production, raw materials, fuels and emissions, yearly running hours of boilers)

VAHTI utilizes closed Intranet networks. Periodic data is stored in SQL-server, the interface to feed in data is (so far) programmed with Visual Basic (By MS), but common reports from the database are made using IIS/ASP-technology. It is also possible to make SQL-queries into a database if more detailed information is needed. New licences and inspection reports are stored in a network server of regional environmental centres. Because of its nature VAHTI serves among other things also as a basic data bank for emission inventories in Finland.

The Finnish Environmental Institute and the Finnish Statistic make nationwide reports on emissions and wastes, regional environmental centres make regional reports and municipalities local reports. Local reports also cover environmental quality data.

If we have fresh ideas and enough resources, we will develop VAHTI to an integrated tool from where the authorities who prepare environmental licences, can get an environmental situation of an area. The situation could cover information on all installations with their permits and emissions and the environmental quality data (available) of the area of concern.

4 COMPLIANCE MONITORING

Authorities who prepare or decide on a permit also decide on monitoring programs to carry out compliance monitoring. In a small country this is workable solution.

Compliance monitoring is based on the monitoring program that the authorities have defined, on reports made by operator and on necessary site visits.

Reports concerning stoppage of control devices, non-normal emissions or exceedances are assessed immediately and site visits done if deemed necessary. Depending upon the problems (air, water or waste), authorities have different procedures to enforce regulations. On air protection they can use either administrative or court procedures, but on water protection they have to ask the Water Court to take necessary actions.

In small installations, a yearly report usually gives enough information to assess if the installation is in compliance with its limit values.

Large and complex process industry installations have to make normal periodic reports every three to four months. There are some limit values that are yearly averages and through periodic reports, authorities can follow how the situation is developing during the year and can in good time require further actions if necessary. Notes written that require installations to supply additional information or a decision to require further actions by the Water Court or operator are also in the VAHTI information system.

Regional and local authorities try make site visits every year to installations even where there does not seem to anything wrong according to reports. Authorities must make a report of every site visit and deposit it in the VAHTI information system.

In Appendix 1, there is a simplified description of how the requirements of an existing power plant (such as a permit, emission limit values, a monitoring program, reporting) are drafted and how the compliance monitoring is carried out. The Appendix tells more about the process of how emissions limit values and monitoring requirements are set. The emission limit values and their background and details of the monitoring program are discussed only to illustrate the level of environmental requirements of existing power plants and how the quality control of the emission measurements has been developed in Finland.

By doing this I want to underline the importance of good preparation of the permit and the monitoring program. The Finnish legislation does not legally allow the inspectors go above the permit by setting additional requirements. On a voluntary basis, it is possible for the inspectors to give their advise if operators want to further develop their environmental protection. And, due to procedures (in air protections and waste management) this can be integrated easily into the ordinary permitting system because changes in operation can easily trigger a new permitting process.

The authorities adopt the monitoring program. They can use an independent laboratory to audit the monitoring program if, like in the case presented in the Appendix, continuous measurements are used. If only periodical methods are used to measure "ordinary" pollutants, then the audit is not used. The operator pays the costs of the audit. The audit can be very detailed and require knowledge that only a few laboratories have. There are some laboratories in Finland that have accredited emission measuring methods.

We have, according to European Union regulation, short term emission limit values for dust, but still yearly emission limit values for SO₂ and NO_x for power plants. In order to be able to follow how average emission of those two pollutants are developing during the year, the authorities may, like in the case in the Appendix, require two interim reports. The authorities can require additional control measures during the year and it is not necessary to wait for the yearly report if it seems that emissions will be larger than the limit values. After yearly reports have arrived, the authorities check with municipal authorities about how air quality has developed in corresponding places and make the assessments of the environmental protection situation. According to these assessments, the authorities make site visit(s).

5 SOME VIEWS ABOUT THE FUTURE

5.1 Changing focus of inspections

Increasing use of EMAS-systems will promote an operator's own activity to develop environmental protection systems at least in large installations. This will shift the authorities' responsibilities from actual ground work (like checking analyzers or measuring emissions) to activities that check and confirm monitoring systems run by operators.

5.2 International trends and changing economics put more pressure on environmental control

Generally speaking "all easy and not so costly(?) environmental control measures" have been done. This means that for installations, investment decisions to control air emissions, water discharges and further minimize or recycle waste increasingly compete with each other. Also the international competitiveness of installations operating in Finland must be increasingly assessed against the long term environmental goals set by politicians. That is why we have to increase the performance of the environmental administration.

5.3 Finding ways to make environmental controls more efficient and effective

Ways to improve the performance could be: more effective legislation, better education, more effective system to collect, assess and distribute data and information.

We, however, must remember that if the public does not approve and support the goals and means of environmental protection then administration cannot properly monitor the compliance of installations. Ultimately, it is the public demand that maintains and motivates continued environmental vigilance.

5.4 Harmonization of Performance Measurement

With globalization of production we must be able set measuring requirements in a more harmonized way.

APPENDIX 1 THE REGULATION OF AN EXISTING POWER PLANT, CASE EMISSIONS TO AIR

Background

Acid deposition has been an environmental problem in Finland a long time. The origin of acidifying substances is both domestic and neighbouring countries. On the European scale acidifying substances (sulphur, nitrogen oxides and ammonium) has been regulated by UN/ECE conventions and protocols.

The results of model calculation showed that foreign and domestic emissions should be decreased in order to lower the acid deposition under the critical levels. The Sulphur Committee, comprised of authorities (also permitting and inspecting authorities from regional environmental centers and municipalities), industry, power producers and NGOs, was set up to study needs and possibilities to decrease sulphur emissions. Need were identified and cost curves were established for major sulphur compounds emitting sectors. The committee made recommendations on what actions (like emission limit values, bilateral agreement with neighbours and actions on UN/ECE-level) should be made to reduce sulphur deposition. By domestic actions, we could reduce sulphur emission by 80 per cent (compared to year 1980). A similar committee has investigated possibilities to reduce NO_x-emissions. The proposal was made to reduce NO_x-emission by 15 per cent. The need was much more, but due to increasing uncertainties in UN/ECE negotiations, it was not possible to agree on a unanimously proposal for large reductions.

The example power plant has three boiler (315 MW_{th}, 315 MW_{th} and 315 MW_{th}) and it produces both power and heat. The regional authority gave the present permit in 1994. Before giving the permit the authority made site inspections on:

- 11 June 1991;
- 7 November 1991;
- 24 November 1992; and
- 10 December 1993.

The emission limit values are

Sulphur dioxide	230 mg/MJ (yearly bases, but covers also disturbances)
Nitrogen oxides	200 mg/MJ (yearly bases, but covers also disturbances)

The operator has to make a study on how to further control nitrogen oxides emission to levels 180 mg/MJ, 125 mg/MJ and 70 mg/MJ. (For new boilers the emission limit value is 50 mg/MJ.)

The earlier permit included emission monitoring requirements (continuous monitoring of sulphur dioxide and nitrogen oxides), but the 1994 permit added the following requirements:

- CO or TOC (unburned carbon) must be measured continuously after 1 January 1995
- NO₂ part of the total nitrogen oxides must be studied
- the heavy metal balances must be measured in 1995

- the operator must submit to the authorities a new emission monitoring plan before 31 December 1997.

The operator must submit, in addition to yearly reports, two separate ½ year reports. Requirements for the reports concerning disturbances and the exceedances of emission values were set out.

The operator started to draft the monitoring program and in the negotiations between the authority and the operator it was agreed that the operator would order an audit from an independent laboratory that has accredited measuring systems.

The audit report came into the authority May 1997 and contain some suggestions to further develop the quality control of the continuous measurement. The operator submitted the monitoring program to the authority 31 December 1997.

The main points of the monitoring program are:

- Operation
 - How efficient burning is, the condition of control equipment, operational disturbances
- Fuels
 - Main fuel is coal; coal used is measured as daily average and momentary coal use is calculated from steam generated.
 - Samples are taken periodically and from weekly samples caloric value, moisture, sulphur content, ash content and content of volatiles are analysed.
 - From yearly samples (every import country separately) heavy metals are analysed.
- Average production levels
 - Calculated from the amount of high pressure steam.
- Efficient of burning
 - Boilers are equipped with computerized systems (boiler II most modern).
 - Continuous measurement of CO-concentration.
 - LOI from ashes.
- Operation and condition of control equipments
 - ESP => voltages and currents
 - FGD => SO₂-concentration and temperature before and after the FGD
- Deviations from normal conditions
 - Those deviations (and actions to bring conditions into normal) which have effect on emissions are recorded and analysed.
- Continuous measurements of emissions
 - Velocity of flue gases and temperature

- ==> SO₂, NO_x and TSP emissions
- SO₂, NO_x and TSP concentrations
- To calculate emissions comparable (mg/MJ) to emissions limit values the results of measurements are divided by fuels used.
- All relevant data and emissions are recorded into process computer of the plant and there are detailed requirements how long 1 minute averages, 10 minutes averages, 1 hour averages, daily averages, monthly averages and yearly averages are stored.
- Operation of measuring equipments are recorded (calibrations, services ...).
- Measuring systems are calibrated by parallel measurements at least once a year using equipments.
- Reporting
 - Yearly report + two separate report (January to April and January to August).
 - On monthly basis productions, fuels used, emissions and an assessment on how good measurements have been, highest hourly emissions.
 - Immediate reports concerning disturbances that have effect to emissions.

