

## **Minutes of Meeting**

VGB-Technical Committee: **Generation and Technology**

VGB-Working Panel: **PGMON**

**Power Generation Maintenance Optimisation Network**

**38<sup>th</sup> Meeting on 26./27. 3. 2009 in Arnhem**

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## Agenda

### Welcome (Paul Thame)

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- TOP 2: GENSIP update and inspection sampling of steam pipes  
Paul Thame, EON UK
- TOP 3: Monitoring Technology on large electrical machines  
Marius Cloutier, Vibrosystem
- TOP 4: R0 Cracking in 7FA and 9FA engines: Some thoughts about rotating stall  
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- TOP 5: Monitoring and Targetting of Air Ingress  
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- TOP 6: Reliability of city heating  
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**TOP 1: New maintenance strategy for the Vattenfall power stations  
Henning Lundstrom, Vattenfall**

As a part of a general business project “Operational Excellent” Vattenfall has worked out a new maintenance strategy for the thermal power stations in Denmark.

The maintenance strategy is a comprehensive paper setting objectives for:

Maintenance priority	Renewal of equipment
Budget/accounting	Investments
Planning (overhaul)	Spare part strategy
Performance management	Benchmarking
Purchase	Renewal of equipment
IT tools	Documentation
Resources: competences - organization – cooperation - education – networking.	

The maintenance strategy includes a number of guidelines related to these topics.

The maintenance strategy is based on the company MISSIONS and VISIONS as well as the objectives and values from the Vattenfall STRATEGIC AMBITIONS.

The main objectives of the strategy are to secure high values of the availability and the reliability and at the same time use best practice methods for the maintenance to obtain a high profit.

All though the staffs of the power stations are very experienced in maintenance a new tool to prioritize the maintenance jobs were needed.

The well known method of **Reliability Centered Maintenance (RCM)** fulfill the requirements, then

*RCM is a maintenance strategy, which in an efficient way ensures the highest possible reliability of the power plants and at the same time ensures the security for both personal and equipment as well as for the environment.*

All maintenance works have been divided in 4 types.

The 4 types of maintenance work are predefined in the Plant Maintenance Module (PM) in the SAP system used.

The implementation of the RCM method operates with the criticality for each piece of equipment, defined as the consequences in case the equipment fails.

The criticalities are deducted from impact to personal security, loss of production capacity, loss of profit, probability of failure and environmental consequences.

Supplementary information from a **Failure Analysis Form** with data of

- Function
- Functional Failure
- Failure mode
- Failure effect
- Failure frequency - MBTF
- Failure cause? Random or age. Are a PF interval (warning time before failure) available?
- STTF – Safe Time To Failure

Will finally together with a decision tree lead you to the optimal type of maintenance, which also are the basis for choosing the right number of spare parts.

The RCM evaluation process is performed by the staff from the power stations and the Engineering Department. The evaluation process is at first hand based at the existing statistics or operational experiences without any use of fancy statistical methods.

When the power stations have gained more experiences with the use of the maintenance strategy, the collected operational data can improve the statistics.

Education for both management staff as well as for the skilled workers in the shops and the engineers has been established together with the maintenance strategy.

The presentation can be found in the closed user group.

**TOP 2: GENSIP update and inspection sampling of steam pipes**  
**Paul Thame, EON UK**

Most coal fired power generating units in the UK are now about 40 years old. To ensure that they continue to operate safely, the power producers have clubbed together in a programme called GENSIP, the Generators' Safety and Integrity Programme, that will produce a series of Good Practice Guides for ageing coal plant. The guides will be developed with the support of a research and development programme and they will target specific hazards with improved risk control measures. These measures will include inspection and testing practices, the application of new technologies and the adapting of existing risk control measures to account for ageing.

UK Health and Safety law demands that the safety risk to people is reduced as low as reasonably practicable (ALARP). This is explained in the document "Reducing Risks, Protecting People" ([downloadable from http://www.hse.gov.uk/risk/theory/r2p2.htm](http://www.hse.gov.uk/risk/theory/r2p2.htm)) and the ALARP Suite (<http://www.hse.gov.uk/risk/theory/alarp.htm>).

The biggest safety risk with ageing coal plant has been identified as steam release. Failure of steam pipes or other vessels can result in large volumes of scalding steam being released into the boiler house. One of the most important control measures against the risk of steam release is NDT. With the huge amount of pipework in a boiler, it is not reasonably practicable to inspect all of it every inspection. This means that a sampling strategy is required. This is guided by the level of risk, knowledge of damage mechanisms and locations, capabilities of the NDT technique and the results of previous inspections and defects. With the need to reduce the risk ALARP, an analytical approach to sampling strategy is being investigated that should ensure the best risk control.

The presentation can be found in the closed user group.

**TOP 3: Monitoring Technology on large electrical machines**  
**Marius Cloutier, Vibrosystem**

VibroSystM is a leading developer and manufacturer of unique solutions based on innovative sensor technologies and advanced diagnostics for large rotating machinery such as turbogenerators, hydrogenerators and large electric motors.

Since 1986, VibroSystM has been broadening its product line by pursuing the development of capacitive measuring technology and other innovative products for vibration, proximity and displacement applications in various industrial fields.

The presentation can be found in the closed user group.

**TOP 4      R0 Cracking in 7FA and 9FA engines: Some thoughts about rotating stall**  
**Yves De Mulder, Laborelec**

During start-up and shutdown, a subharmonic component is visible in the shaft vibration on the compressor bearing. This is measured during every start-up. The measured rotating stall has a variable level.

A blade can support a certain force without crack initiation. This threshold depends on the erosion depth. In normal condition, the force acting on the blades is below this threshold, this for all blades. With the higher rotating stall, the force acting on blades is higher, and for two particular blades, the force was above the threshold, which lead to crack initiation.

Some questions remain open: why is the rotating stall higher during some starts, why are some units always quiet while other ones can have relatively often higher rotating stall, where does rotating stall occur, is it possible to avoid this by changing the IGV controls or other settings ?

The presentation can be found in the closed user group.

**TOP 5:      Monitoring and Targetting of Air Ingress**  
**Andrew Lythgoe, RWENpower**

An advanced ID:FD test that considers all entry and exit points from the boiler 'envelope' has been developed at npower to allow measurement and subsequent targetting of boiler air ingress. Costs of ingress are allocated to areas of boiler to assist boiler engineers with development of scheme papers / budgets. This methodology is used pre and post outage and as a result can be used as a contractor performance measure.

More recently a combination of helium, ultrasonic, thermal camera and "Leak Mate" testing has been used to identify areas of ingress on condensers at several power plants (load limiting in one case). This work can be done both by central engineering as required, or by the stations on an ad-hoc basis.

The presentation can be found in the closed user group.

**TOP 6:      Reliability of city heating**  
**Henk Wels, NRG**

On behalf of Essent-Warmte a reliability analysis was set up to assess the expected value for energy not served, calculate the dominance of components, the necessary amount of redundancy, etc. In setting up the model it was made sure that the model builder had a working knowledge of the system to be modeled and Essent-Warmte specialists had a working knowledge of reliability parameters & tools. This was carried out by an introductory workshop on RAM and a workshop resulting in a Failure Mode Effect Analysis FMECA. The city heating system for Eindhoven's Grasrijk neighborhood was taken as a pilot application. The model was built in Excel both analytically and using @RISK for Monte Carlo simulation. In this way speed of calculation, the extensive features of Monte Carlo and quality (both models should produce the same average values) were assured. The model showed that practical optimum sectionalizing to limit the consequences of piping failures was feasible. Also it showed the dominance of boiler and gas motor components with regard to forced outages and the optimum time for maintenance in the

boiler house. The amount of redundancy to reach specified reliability targets is easily calculated with the model.

The presentation can be found in the closed user group.

**TOP 7: CEZ, Czech Power Company  
Miroslav Krpec, CEZ**

Miroslav Krpec presented the CEZ.

The presentation can be found in the closed user group.

**TOP 8: Operation Time Extension  
Claude Degrave, EDF**

At the beginning of the life of a nuclear Power Station in France you get the permission for construction and operation for 10 years. Then you have to renew it with all the circumstance as reassess and improvement. After 30 years you have to do an extended program for that.

This has been done for the 900 MW class. EDF decided to operate the 1300MW class up to 60 years (as in USA and Switzerland). The extended studies were also done for the first class.

The Authorities demanded a higher safety level. EDF is looking for more Power Output for the second class. Most of the important components are screened. Maybe they have to be repaired, modified or changed. There will be also strong regulations for release (also zinc). The I & C equipment has to be refitted.

Maybe EDF has to spend 400 Mio € from 2015 to 2035 for each unit.

**TOP 9: Small conference on reliability & maintenance optimisation of power plants**

It was decided to initiate a small conference beginning of 2010. The main topics should be related to reliability and maintenance optimisation. The conference will be prepared by Henk Wels and Yves De Mulder with the support of VGB.

**TOP 10: Place and date of next venue**

The next meeting will be held on 7./8. October 2009 in Lippendorf.

Essen, Mai 2009