Minutes of Meeting

VGB-Technical Committee:	**Generation and Technology**
VGB-Working Panel:	**PGMON**
	Power Generation Maintenance Optimisation Network
	34th Meeting on 19./20. 4. 2076 in Copenhagen

Agenda

Welcome (Anders Rasmussen)

Technology

TOP 1: P 91 experiences
Reuven Nacht, IEC

TOP 2: Flow accelerated corrosion
Pierre Cerckel, Electrabel

TOP 3: Automatically assessing of the availability of a plant
Claude Degrave, RDF

TOP 4 Reliability management of a safety related protection system (feed heater anti-flooding)
Paul Thame, E.ON UK

Plant ageing and maintenance expenditure

TOP 5: Two shifting strategies and costs
Alan Joslin, RWE Npower

Maintenance Quality

TOP 6: Failure Mode Effect & Criticla Analysis for coal yard of Maasvlakte Power Plant
Henk Wels, NRG

TOP 7: Tooling Management in the Maintenance Competence Center
Pierre Cerckel, Electrabel

TOP 8: Basic Reliability Analysis
Henk Wels, NRG

TOP 9: LTSA Experiences
Reuven Nacht, IEC

Miscellaneous

TOP 10: Topics suggested for next meeting

TOP 11: Place and date of next venue

TOP 1: P 91 experiences
Reuven Nacht, IEC

IEC have encountered severe difficulties during the construction of its two new coal firing boilers and the construction of our six new HRSG and steam lines, with assuring of the required quality of the material P/T 91 (Strength and Creep Life).
This material (ferietic martensitic steel) contains 9% Cr, and small amounts of Vanadium, Molibolenum and Nitrogen.
It was developed in the mid eighties and became very promising and popular in boilers headers and steam lines construction as it allows much higher steam parameters and still thinner walls in headers and steam line, while promising long life with good creep and corrosion resistance.
IEC encountered some difficulties, first with cracking of stainless steel welded to P-91 (which required changing finishing SH and RH during the construction of new coal firing boilers, thus postponing 550 MW units start up by some 6 month). Later steam lines and headers of six new HRSG were found with low providing hardness the material to be deficient, with low strength and low creep life. Some were repaired, some replaced but some remain in the units.
Special monitoring program, Long Term Repair Agreement (LTRA) was agreed with the OEM.
Root cause analysis made by IEC with the support of expert metallurgists proved that for the first mishap, welds must have been done under especially clean conditions. As for the HRSG parts, Heat Treatments of the P-91 during fabrication, during shop welds, and during field welds must be performed precisely as specified. Any small deviation from that may cause severe degradation of the material strength (considerably) and creep resistance which be effected by order of 1:10! i. e.- Creep life will be only 10 % of the healthy material!
Heat treatments, such as Normalising, Tempering and PWHT must be scrutinized very carefully.
Hardness measurements must be carried out extensively, and ASME code is about to be changed to include demands for 195-250 VH (Vickers hardness) values, and specific directions for heat treatment values of temperatures rate of change and times.
Other recommendations on how to avoid getting into similar troubles are discussed in the presentation.

The presentation can be found in the closed user group.

TOP 2: Flow accelerated corrosion
Pierre Cerckel, Electrabel

The presentation can be found in the closed user group.

TOP 3: Automatically assessing of the availability of a plant
Claude Degrave, RDF

Recently, the Engineering Department of the EDF group has committed itself into an international program of combined-cycles plants building. The contracts issued for these types of plants often were of the B.O.O.T type : Build, Own, Operate and Transfer. They contained some performance targets for the future plant, and particularly availability targets.

During the call for tenders phase of the building of a new plant, the EDF engineering Department had to be able to forecast its availability. The forecasting should moreover have to be

performed in quite a short time (less than 2 months) to facilitate the choice between several design options.

In order to bring a satisfying issue to this problem, the EDF Research & Development branch proposed to develop a simple method for computing the availability of complex plants, based on the pre-processing of all the possible plant configurations and systems, using up-to-date probabilistic tools such as KB3/IFAST. It involves plant process studies, data mining, user questioning, dependancy analyses.

This method is applied since 2001 to the combined cycle plants and the nuclear power plants, and may be applied shortly in the future to hydro plants. It could be extend to the re-engineering of some current installations.

The presentation can be found in the closed user group.

TOP 4 Reliability management of a safety related protection system (feed heater anti-flooding)
Paul Thame, E.ON UK

Critical safety protection systems are designed to reduce risk to a tolerable level. Consider, for example, the feed heater anti-flooding protection system. This reduces the risk of catastrophic water ingress into a steam turbine through a bled steam line by operating isolation valves automatically when a float switch detects high water level in a heater. The protection system must be reliable enough to ensure that the risk of catastrophic turbine water ingress meets a target safety level. This is achieved by suitable selection of components and system design.

The protection level that the system provides is classified by a SIL rating (Safety Integrity Level) in accordance with EN 61511. SIL ratings range from 1 to 4 where SIL 4 offers the highest level of protection. SIL 1 and SIL 2 are the most common in fossil fired power station protection systems and the anti-flooding system is likely to fall in this range.

Having designed a protection system to achieve a given SIL rating, it will only achieve it in practice if it is properly tested and maintained, otherwise its reliability will fall with time. In Section 16 of Part 1, EN 61511 states a number of requirements to ensure that protection systems retain their effectiveness. These include:

- Inspection and functional testing at appropriate intervals
- Suitably qualified maintenance personnel
- Prioritisation of defect maintenance
- Collection and analysis of demand rate and failure rate data
- Written system management policy and record keeping.

Furthermore, the adequacy of the system should be re-assessed if the system is modified or there are changes to the risk that it protects against. Modifications should be properly controlled and authorised following an impact assessment, records must be kept and drawings updated.

The presentation can be found in the closed user group.

TOP 5: Two shifting strategies and costs
Alan Joslin, RWE Npower

The EU Large Combustion Plant Directive comes into force in January 2008. Operators may choose to opt their plant out of the higher levels of emissions constraints, but with limits on the hours of operation from 2008, and closure by 2015. This is further complicated where units share a common chimney, because the hours limit is based on the time any units using the chimney are in operation, not actual unit operating time.

With a maximum operating time before closure, operators will want to optimise operations to maximise earnings. Ideally units will run very flexibly to operate only during the most lucrative times. However, doing so increases risks of failure. Forced outages are particularly costly for units sharing a common chimney, because if the other units remain on load, the failed unit cannot make up the lost operating time at a later date.

To arrive at an operating strategy that takes these factors into account, two-shifting strategy has to be re-examined. This presentation reviews the factors that need to be taken into account to arrive at an optimum two-shift strategy, including fuel costs, maintenance costs, and evaluation of risks. It also proposes ways that the issue of sharing a common chimney can be taken into account.

The presentation can be found in the closed user group.

TOP 6: Failure Mode Effect & Criticla Analysis for coal yard of Maasvlakte Power Plant
Henk Wels, NRG

The presentation can be found in the closed user group.

TOP 7: Tooling Management in the Maintenance Competence Center
Pierre Cerckel, Electrabel

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TOP 8: Basic Reliability Analysis
Henk Wels, NRG

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TOP 9: LTSA Experiences
Reuven Nacht, IEC

IEC is currently introducing eight new CCGT (three 9FA by GE and five V94.3A2 by Siemens) with total capacity of about 3000 MW. Before deciding on this type of units of “F” technology there was a strong resistance to the introduction of new technology (not yet proven in operation) in to IEC fleet. The deciding element in favour was the vision of competition, where the higher

efficiency of the “F” technology CCGT (56%) as compare to the mere 49 % of the “E” technology. The lack of experience and confidence lead the contracting of Long Term Service Agreements with the suppliers of the gas turbines which include performance and availability guarantees. Demand by the union that labor will be in house, left only GE and Siemens in the bid.
The LTSA contracts cover mainly planned maintenance, new spare parts, repair of the spares and the support of unplanned maintenance and agreed price (after OPC warrantees end). The LTSA provide extended guarantees of Availability, Efficiency and Capacity, with bonuses and penalties. New upgrades by the OEM are provided on Win Win situation. The LTSA`s assure on site OEM field engineers, provision of experts, as necessary, and on line monitoring from the OEM centers. The experience gained so far at IEC proved very successful especially when unplanned maintenance was repaired immediately. It is important to include in such contracts the number of operations and not limit by time (alone), because of possible delays in unit start up. Upgrades should be part of the contract. Owner must develop in house monitoring and know how also to get the full attention of the OEMs.
Advantages and disadvantages of LTSA contracts and IEC experience and recommendations and cost evaluations are presented. As long as new parts are by OEM and the specifications to repair used parts are difficult to control, LTSA contracts are the right direction.

The presentation can be found in the closed user group.

TOP 11: Topics suggested for next meeting

- Maintenance Organisation
- Long Term Service Agreements
- Asset management
- Sampling maintenance
- Strategic Parts Pooling
- Fire safety, insurance
- Engineering risk management
- Risk High Speed Line
- Experience with NON-OEMs at revisions
- Responsibility of contractors, subcontractors
- Specification of hot gas path
- E-Learning
- Return of experience (maintenance)
- Insurance
- Maintenance Strategies
- CMS

TOP 12: Place and date of next venue

The next meeting will be on 11.126. October 2007 in Birmingham.

Essen, July 2007