

# [ NEWS :

## Chemistry management and nuclear revival

### GIVING PLANT OPERATORS GREATER CONTROL OVER WATER/STEAM CHEMISTRY

#### Chemistry Expert System provides detailed advice

**Many new power plants do not have a dedicated chemistry expert on site. In order to help alleviate this situation, Laborelec is developing a Chemistry Expert System. It enables plant operators to correctly handle water/steam chemistry problems. The tool, which automatically generates alarm messages and suggests actions, is currently being tested.**

The Chemistry Expert System uses a whole range of measurements at different points throughout the water/steam circuit. It uses chemistry parameters related to water purity and treatment, such as sodium and silica concentrations, cation conductivity, pH, and oxygen concentration. The system is being developed by Laborelec based on its own chemistry specifications, as well as on data that are generated by the automatic plant information control system.

#### [ System provides warnings and suggests actions

"The Chemistry Expert System automatically informs operators when a specific parameter exceeds the preset limits," explains Mélissa Duyckaerts. "It also suggests corrective actions and asks related parameters to be closely monitored. Depending on the type of problem, the system demands a reaction immediately, within 24 hours or within a maximum of one week."

When operators receive an alarm message, they first have to validate the data before taking actions. They can carry out additional measurements if required. The operational mode of the power plant is taken into account. During start-up, for instance, measurements are not reliable. Therefore, no action is recommended even if the value does not comply with specifications. Once the measurement is validated, the system calculates known correlations between parameters to help detect possible causes.

#### [ A two-year project

The system is designed to be used on all types of power plants. It particularly addresses plants that have no chemists on site. "We are currently testing the system with off-line data from the Langerlo coal-fired power plant," adds Duyckaerts. "This involves a manual introduction of data from the plant control system. In the next stage, the system will also be tested on-line at the Castelnou combined cycle power plant." The Chemistry Expert System is expected to be fully operational in 2010.

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### ANSWERING THE NEED FOR CHEMICAL EXPERTISE

Power plant operators have fewer chemical experts at their disposal. Yet nowadays, new and upcoming legislation requires ever stricter follow-up of chemical substances. Moreover, chemistry plays an important role in the current revival of nuclear energy. Laborelec is expanding and applying its chemical expertise in every domain worldwide. Our chemistry competence centre is active throughout Europe and our specialized services and specific research programmes bring us all over the world, especially to the Middle East. Read more about it in this edition of Laborelec News.

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#### [ In short

- The Chemistry Expert System enables plant operators to handle chemistry issues themselves
- The system highlights problems and suggests appropriate actions in order to validate and solve issues
- It helps improve unit availability and reduce maintenance costs by identifying chemistry excursions early

#### [ Early warning yields benefits

In addition to monitoring, the Chemistry Expert System also has a preventive function. Operators are warned beforehand if the evolution of a certain value is bound to activate an alarm. This early identification of chemistry excursions enables operators to react more quickly to avoid degradations or efficiency drops.



*The Chemistry Expert System helps plant operators identify and handle chemistry problems.*

## SOFTWARE TOOL IMPROVES MANAGEMENT OF CHEMISTRY PARAMETERS

To help chemists monitor the key parameters of power plants, Laborelec is helping plants with the implementation of a Laboratory Information Management System (LIMS) developed by Siemens. LIMS keeps track of all data generated by manual and on-line measurements, and compares them with required chemistry specifications. The tool is currently being deployed across GDF SUEZ power plants.

LIMS covers all chemistry data related to process water, waste water, biofuels, and chemical treatment products. It combines on-line data generated by the plant information (PI) system with those coming from manual measurements by chemists. The measured data are automatically compared with chemistry specifications defined in the system. When the result exceeds specifications, the system demands validation by an expert.

### [ Reliability and traceability

"Measurements that are within the defined specifications are automatically registered by the system," explains Mélissa Duyckaerts. "However, any data that do not meet specifications have to be validated. The chemist can choose to carry out additional analyses before validating. A comment can be added to justify why a measurement is validated or not." This mechanism increases overall data reliability and provides a clear audit trail of problems encountered and actions taken.

### [ A time-saving tool for chemists

"People in charge of chemistry typically cover several power plants in a zone. They cannot be physically present at every plant every day," observes Duyckaerts. "LIMS enables them to remotely request daily reports, for instance with all measurements that did not comply with specifications. This gives them an instant overview of the status of each plant in their zone." In addition, the scheduler plans all manual and PI measurements that need to be carried out and transmits this schedule to the chemist in the form of a daily work list. The first LIMS systems are expected to go live in the spring of 2009.

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### [ Laborelec helps plants configure the system

For LIMS to be used efficiently, it requires a number of configurations. These include:

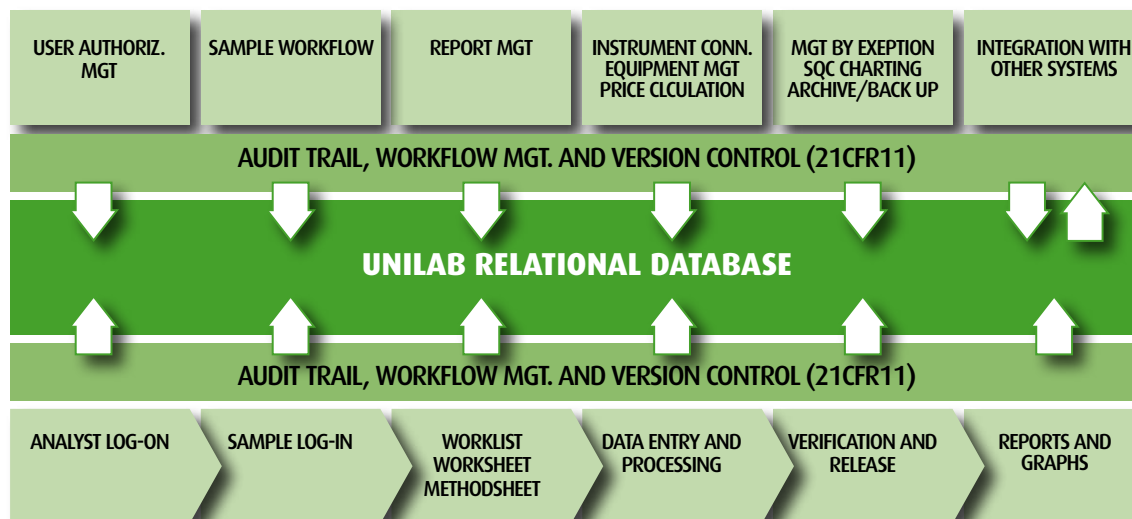
- The measurement points, for which Laborelec has developed a harmonized codification
- The parameters, which can be found in the dictionary developed by Laborelec
- The measurement methods, also to be found in the dictionary
- The scheduler

Laborelec helps power plants optimally configure the system and harmonize work processes.

### [ In short

- Laborelec is helping GDF SUEZ power plants implement the LIMS system to register chemistry parameters
- LIMS produces a daily work list for chemists
- The system improves the reliability and traceability of measurements that exceed specifications
- It is based on harmonized tools and work processes

## CONFIGURATION LEVEL



## OPERATIONAL LEVEL

Laborelec assists power plants in optimally configuring the Laboratory Information Management System (LIMS).

## PARTICIPATING IN EPR RESEARCH

### Water chemistry for the secondary and cooling circuits

**Together with AREVA NP, the GDF SUEZ Group is involved in the design of a European Pressurized Reactor (EPR). Laborelec's experts are currently investigating the optimal water chemistry conditions for the secondary and cooling water circuits of such a plant. Their results are likely to have a major impact on the design of the EPR.**

In the past, nuclear power plants were built to last for 40 years. With the construction of an EPR power plant - a third generation type of nuclear reactor with improved efficiency - the GDF SUEZ Group aims for a lifecycle of at least 60 years. During the design phase, various partners are investigating the optimal conditions necessary to guarantee such a long lifespan. Among them are Laborelec experts who are investigating water chemistry.

#### [ Cooling circuit: evaluating treatment techniques

"To ensure a proper functioning of the cooling water circuit, two treatments are necessary," states Coralie Goffin. "One is necessary to avoid scale deposits. The other is required to keep control over the development of micro-organisms such as legionella and macro-organisms such as mussels." These two treatments are site-specific and may have a large impact on the EPR design.

"We started our research by a literature review of the anti-scaling and biocide treatment techniques that are currently available," explains Goffin. "Next, we studied the best practices in Belgium as well as those from abroad and complemented it with our own experiences. Based on this investigation, we worked out specific recommendations for each EPR location under consideration. Our advice takes into account ecological, economic, and legislative considerations to maximize the sustainability over the next 60 years."

#### [ Secondary circuit: water treatment and permanent monitoring

Laborelec is also investigating the water treatment as well as the permanent monitoring that is necessary for the follow-up of the secondary water chemistry. "What is the optimal conditioning treatment? What effect will this conditioning have on the applied materials as well as the environment? How should the demineralized water be produced? These are all questions we are looking to answer," states Goffin.

In the field of permanent quality monitoring, Laborelec is investigating which techniques are used worldwide to verify the quality of the water, the condition of the materials, and the occurrence of leaks. In addition, our experts are establishing which parameters should be monitored, at which locations samples need to be taken, and which actions need to be undertaken for accurate measurements. Based on the research of its experts, Laborelec will offer the GDF SUEZ Group advice which will then be used to design a site-specific optimal EPR unit.

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#### [ In short

- Together with AREVA NP, the GDF SUEZ Group is involved in the design of a third generation nuclear power plant, the European Pressurized Reactor
- Laborelec's water chemistry experts advise on:
  - Anti-scaling and biocide treatment techniques for the cooling water circuit
  - Water conditioning and permanent monitoring techniques for the secondary circuit

***"OUR ADVICE TAKES INTO ACCOUNT THE ENVIRONMENTAL IMPACT, THE COST-EFFECTIVENESS, AND CURRENT AND ANTICIPATED LEGISLATION."***



*The advice of Laborelec's water chemistry experts will be used for a sustainable design of the secondary and cooling water circuits of the European Pressurized Reactor.*

## RESEARCH IN NUCLEAR POWER TECHNOLOGY

### Close collaboration with the French CEA

**At the request of the GDF SUEZ Group, Laborelec is planning research in the field of nuclear power technology. Our experts will collaborate closely with the field experts of the French Commissariat à l'Énergie Atomique (CEA), a renowned research centre for nuclear power.**

In order to cope with the ever-growing demand for energy, GDF SUEZ wants to use all possible sources, including nuclear power. The Group wants to significantly expand its knowledge in nuclear power technology and has asked Laborelec to define a set of research projects.

#### [ CEA adds specialized expertise and equipment

A nuclear environment poses harsh conditions for conducting tests: high temperatures, high pressures, and radioactivity. Specialized equipment and expertise are crucial to perform research under such conditions.

"When GDF SUEZ gave us this research assignment, we immediately contacted our colleagues at the CEA," explains Coralie Goffin. "This organization has an impressive track record in nuclear research. Moreover, it can back up this expertise with dedicated laboratories and technical means. This combination offers optimal conditions to perform the tests we envision."

#### [ Detailed definition of the research projects

In 2008, Laborelec experts met with CEA field experts on several occasions. During these meetings, they selected two research domains. "Steam generator fouling is one of the areas we would like to investigate. Limiting this type of contamination should greatly enhance a power plant's useful life," points out Goffin. This project will be done in collaboration with EdF. "Another interesting research domain is the optimization of the primary water treatment. The goal here is to limit the dosimetry and hence the impact on the equipment's materials."

"We have determined the necessary tasks for the next three years for each of the selected research domains," Goffin continues, "including the deliverables, the objectives, and the budget. The steering committee of the collaboration between GDF SUEZ and CEA will determine the tasks we can start with."

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#### [ In short

- Laborelec will collaborate with the French nuclear research experts of the CEA, performing research in the field of nuclear power generation
- Research domains, deliverables, objectives, and budget have all been defined

**"LABORELEC AND THE FRENCH NUCLEAR RESEARCH EXPERT CEA HAVE JOINED FORCES IN NUCLEAR POWER TECHNOLOGY RESEARCH."**

