# Capitalizing on an environmental enterprise

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## ABSTRACT

*Tools are available today to manage an enterprise environmentally. Key elements include a distributed Process Control System (DCS), an Environmental Information Management System (EIMS), a global historian, and artificial intelligence, linked together to provide key decision making information. Such information can be used by the process control operator and plant and corporate operations management. Information technology is the key to successfully implementing an enterprise that will yield higher profits and higher efficiency and eliminate NOVs (Notices of Violation).*


How do you currently manage environmental data? How do you manage your process to ensure environmental compliance? How do you keep up with ever-changing rules and regulations while maintaining the lowest possible production costs? Are more cost-effective solutions available in this high tech world than there were five years ago?

The environmental network seamlessly integrates advanced tools to ensure security of environmental data, as well as capitalize on it. This network includes the process control network, where the distributed control system (DCS), operator workstations, host computer, process optimization, and emissions prediction modeling systems reside. The plant network is where engineering workstations, plant MIS and Environmental Information Management System (EIMS) systems, and other plant operational systems are found. The corporate network includes the corporate MIS and EIMS systems, planning, purchasing, human resources, and other systems.

Tools for process optimization use real time information from many of the systems residing at all three network levels. For example, process optimization systems use operational costs, such as fuel, labor, power, along with process sensor information, to continually optimize process operating costs. Process optimization systems also send operational data back to the plant and corporate MIS and EIMS systems. **Figure 1** shows the flow of this information to the three networks.

## ENVIRONMENTAL MEASUREMENTS

The EPA has rules and regulations, set forth in the Clean Air Act, that require pollutants to be measured and reported properly. In the past, Continuous Emissions Monitoring Systems (CEMS) have been used for the measurement and reporting function to satisfy these regulations. A typical CEMS involves collecting a gas sample from the stack, transporting the sample to a sample conditioning system to remove interferences such as water vapor, and analyzing the sample-specific pollutants. The analyzers send a signal to a stand-alone data acquisition and reporting system. This system is also used to perform specific routines to calculate missing data when the CEMS analyzer is not operational or does not meet QA/QC specifications. In most cases, the CEMS data acquisition and reporting system is not part of the DCS process or the computer that houses the process historian.

## EMBEDDED CEMS

**Figure 2** illustrates an embedded CEMS that eliminates many of the disadvantages of typical extractive CEMS.

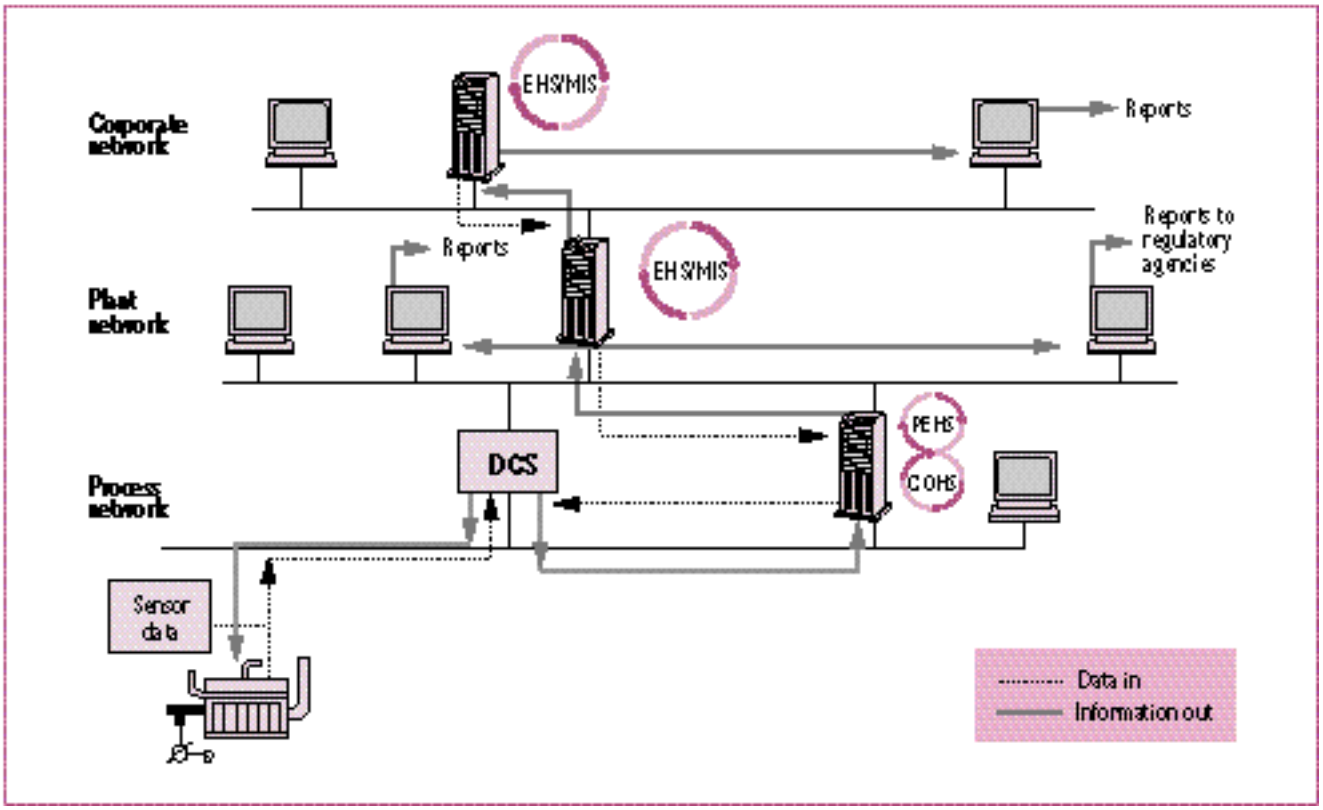
All daily and weekly averages will be done at the controller level to ensure data security. Daily and weekly averages will be passed to the process historian to formulate the monthly and quarterly averages as well as the long-term data storage. Data substitution to satisfy regulations will be an added function, where needed, when data has been lost. This would happen, in the case of sensor failure, if redundant sensors were not installed.

Listed below are some of the realized advantages of the embedded CEMS:

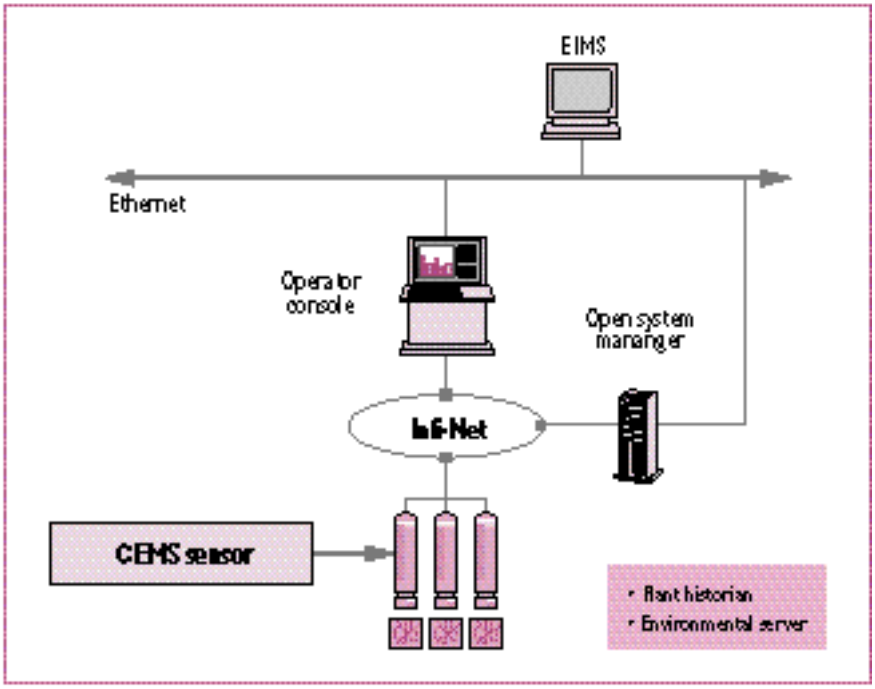
- Capital costs are reduced by eliminating the stand-alone data acquisition/reporting computer.
- Maintenance costs are reduced by integrating CEMS maintenance with the plant DCS control system maintenance.
- The reliability and software support of the CEMS data acquisition and reporting system is now part of the process control and reporting system, which is very reliable.
- The CEMS sensor input can now easily be part of process control and optimization.

## PREDICTIVE EMISSIONS MODELING SYSTEMS (PEMS)

**Figure 3** illustrates two different methods of implementing PEMS on a DCS. In the first example, the PEMS will reside in the environmental server where the process historian is housed. While this is a perfectly good solution, it does not provide the highest level of security for envi-



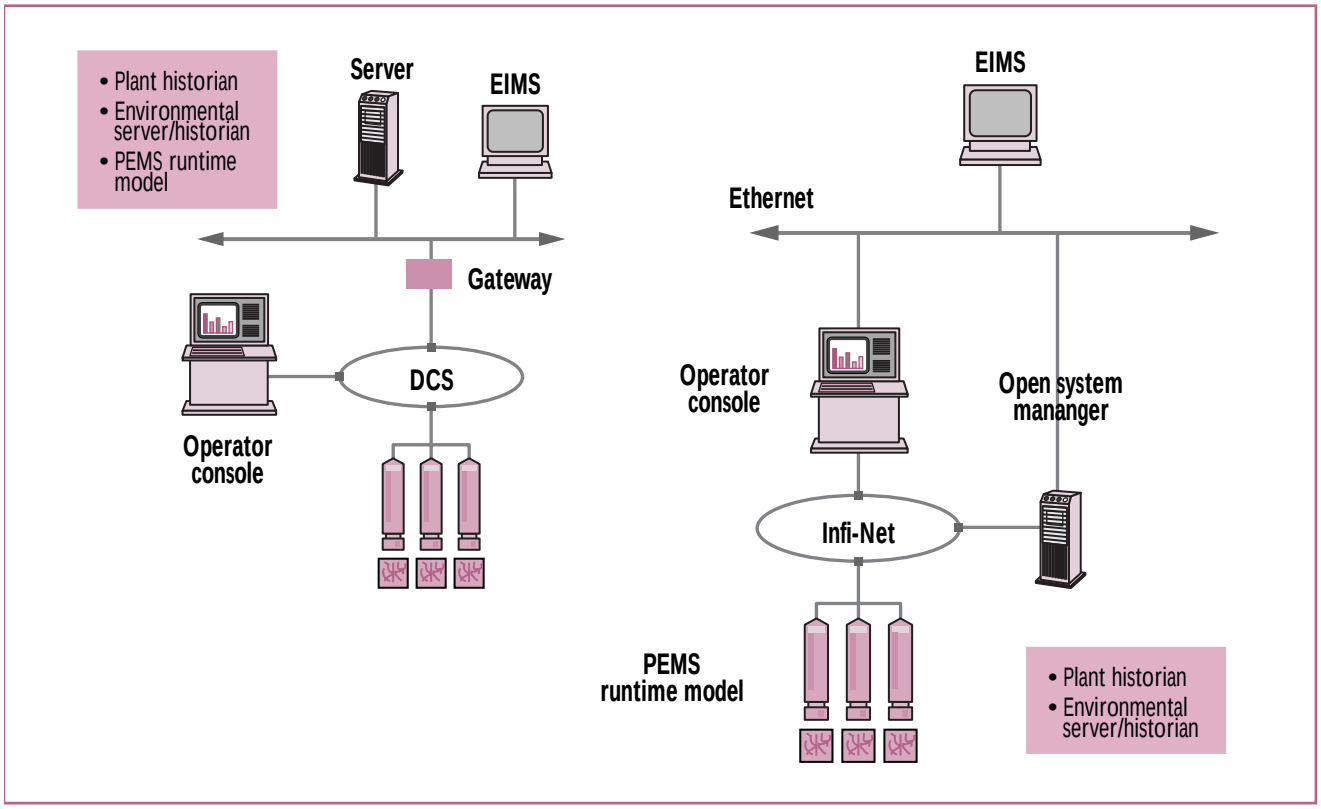

*1. EH&S enterprise data flow*




*2. Embedded CEMS architecture*

ronmental data. If the server went down for an hour or two, the only option would be to substitute data per the regulations. If a process was being operated close to the permit limits for maximum efficiency, most likely it would be out of compliance when the data substitution was made. The substituted data is more conservative than actual data. In the second example, the PEMS runtime model resides in the controller of the process control system, which will allow for instant redundancy. By having redundancy at the prediction level, a user should never have to rely on substituted data, as there will always be predicted data that is valid. In both cases, the data predicted will be averaged where the PEMS model resides, for short-term averages, and the historian will do all long-term averages. The historian will pass the information to the Environmental Information Management System (EIMS) for reporting to the agencies. The embedded PEMS architecture provides the following advantages:

- Lower initial cost
- Instant redundancy
- Highest degree of data security
- Integrated closed loop control on permit limits.




*3. Two methods of implementing predictive emissions modeling systems on a distributed process control system*

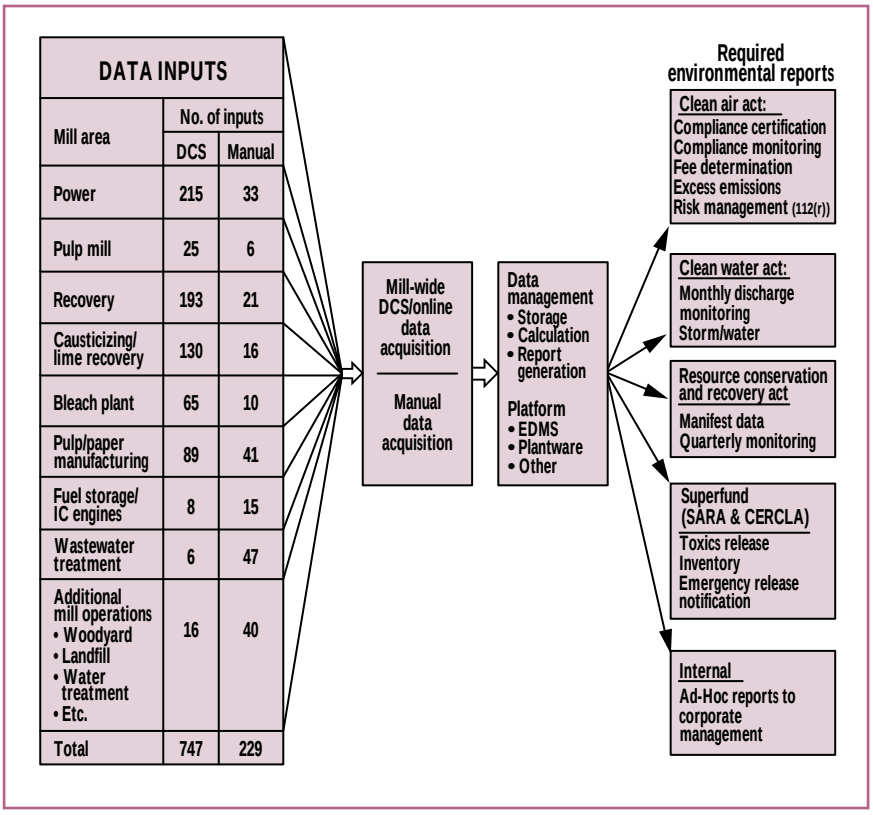
The embedded architecture is the best solution, whether the emissions numbers are coming from direct measurement or from a predicted method.

## COMPLIANCE OPTIMIZATION MODELING SYSTEMS (COMS)

Compliance Optimization Modeling Systems or COMS use compliance data such as CEMS data along with process, cost, and accounting data to reduce operating costs.

A predictive model is always built into the COMS so that the model can send new setpoints to the process control system and ensure that there are no exceedances. The predictive model must be used so that reactive time of the system is fast enough to control parameters such as carbon monoxide that require quick responses.

The COMS would utilize the same reporting structure that the PEMS used. The same architecture is used; however, the COMS needs to communicate to the Local Area Net-




*4. Environmental information management system flow diagram*

work (LAN) or the Wide Area Network (WAN) for cost accounting data. The COMS can analyze the production schedule, the compliance requirements, and fuel costs (from purchasing) to determine the most economical way to operate the process unit to meet production.

## PULP AND PAPER ENVIRONMENTAL INFORMATION

Pulp and paper mills have a very big task collecting all of the environmental information needed to file the regulated reports with the EPA and state agencies. **Figure 4** illustrates an integrated pulp and paper mill's environmental data. According to the information presented in Fig. 4, there were 747 inputs needed to generate reports for the Clean Air Act, Clean Water Act, Resource Conservation & Recovery Act, Superfund and internal ad-hoc measured by the process control system. This information, being housed by the process control system, is secure, accurate, and, most of the time, redundant. The transfer of that data in the proper format will allow the process historian to average the data in an efficient manner and move it to the Environmental Information Managment System (EI-MS). The data transfer will provide the following advantages:

- Significant reduction in man-hours collecting data for the air report, water report, etc.
- Secure and accurate data
- Data trail for future references.

**KEYWORDS**
*Artificial intelligence, control systems, distributed control, environments, information systems, management, pollution control, process control.*

## NETWORKS

Real network computing paybacks will occur in the end user organizations, not in the central IS budgets. This cost-benefit analysis must have business functional value items assigned to leverage investments, rather than merely show "quick and dirty" bottom-line savings. For example, if an environmental manager requires data from the process control system to file environmental reports, the investment payback will come in the form of decreased man-hours and time to deliver very accurate data. The tangible values associated with installing an IT platform are:

- Reduced computing/storage costs
- Cut maintenance/operational costs
- Cheaper S/W licenses and distribution
- Lower communication costs
- Shared expensive resources.

In most cases the user will also realize intangible values to the installed LAN/WAN networks. Generally the following intangible values are realized:

- Enhanced customer service
- Improved quality
- Adaptability and responsiveness
- Reduced time to everything
- End user empowerment.

## SUMMARY

The integration of tools can significantly reduce a company's environmental compliance costs. By planning the seamless integration of sensors, DCS, environmental monitoring (measured or predicted), historical archiving, EIMS, and networks to costing data, significant reductions in mill operations and environmental data management can be realized. **TJ**

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