



On-line Asset Integrity Monitoring

Introduction & Overview

With today's aging infrastructure, plant equipment and structures are deteriorating in service. The result is a significant increase in cost for traditional inspection and maintenance. Acoustic Emission (AE) is a non-destructive testing (NDT) technique used to perform global inspections of large structures or equipment. AE not only lends itself as an excellent periodic, global inspection technique, but by its very nature it is also an effective tool for continuous monitoring of plant equipment to enhance process safety.

Materials and structures emit energy in the form of stress waves (acoustic emissions) as a result of sudden microstructure movement or change. These stress waves spread through the structure and are detected on the surface of the structure by piezoelectric sensors. These sensors convert the stress waves to electrical signals that can be processed and analyzed by specially designed instruments.

AE On-line Asset Monitoring provides plant personnel the ability to detect anomalies at an early stage, the development of a defect and warning of its presence. With the advanced warning of a developing problem, the owner/operator has additional time to plan and implement a remediation plan. This is made possible by correlating the AE detect activity with other process variables.



Application Solutions

Typical periodic integrity monitoring is conducted under a controlled stimulus of the structure. The periodic test, from installation through completion, is performed in a relatively short time period. Once the periodic test is complete, analysis of the data may indicate the presence of defects or indicate a need for continued monitoring of the structure for additional defect growth or the development of new defects.

Continuous On-line Asset Integrity Monitoring is conducted over an extended period of time and does not require forced load or temperature changes, although they are beneficial. Apart from avoiding the need to interrupt the process, a major benefit of On-line Asset Integrity Monitoring is determining any association between defect growth and operating conditions. By utilizing different types of sensors such as thermocouples, strain gauges and others, the acoustic emission data can be correlated to process variables and provide insight as to what process function is driving the defect. It can also assist with optimizing the operating conditions that minimize equipment damage.

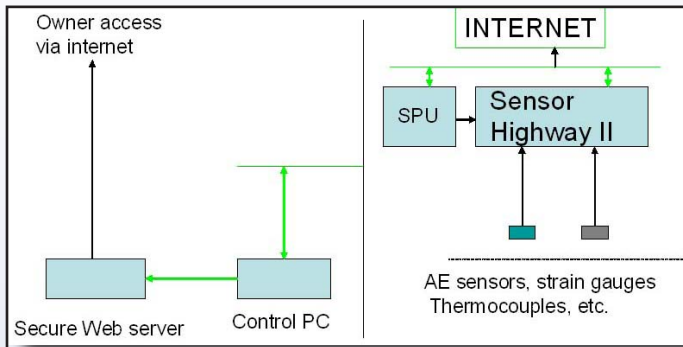
Until recently, On-line Integrity Asset Monitoring was confined to a few specialized applications such as high energy piping in refineries and power plants. Costs were high due to the need for AE personnel, while data analysis was difficult and time-consuming. The continued advancement of computer and software, high-speed modems and high speed internet connections have made remote monitoring a reality. The AE specialist can now operate the on-line system and evaluate on-line data remotely and report results by website or e-mail.

This technology is another option that allows management to continue to operate plant equipment while providing valuable information regarding safety and efficiency.

System Schematic

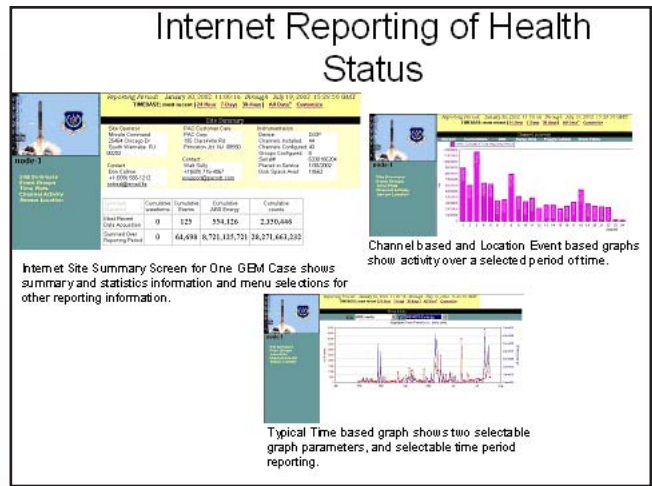
Shown below is a diagram of a typical system configuration. First there is the front end sensing device(s). These may be AE sensors, but may also be thermocouples, accelerometers, strain gauges or others. They are connected to the system via hard wire connections or wireless communications.

Next is the local signal processing unit (SPU). It provides the necessary data and storage functions. It also has local alarm capabilities should a pre-programmed data type occur. This is intended to alert the operator that a significant event is occurring or has just occurred.



System Schematic

The SPU also provides an interface between it and the internet. This allows the unit to be operated from a remote location. Thru the internet connection, the SPU can transfer data, screen displays and alarms to a remote location. It can also be operated thru the internet so the remote location can alter operating conditions and various data parameters. At the remote location, a second computer is connected to the SPU via the internet. This system is used for remote storage and further analysis of data to ensure any developing problem is detected at its earliest possible stage.



Typical Report Summarizing Activity

Shown above is a typical report provided to the plant operator on a periodic basis. The reporting period basis may be a daily, weekly or monthly report depending on the operator's needs. It summarizes the activity that has occurred since the previous report in a complete, concise format. Additional information may be provided should a condition develop that would warrant it.

The on-line system can also provide valuable information relating to the process within the vessel. In many cases the on-line system can detect variations in the "noises" relating to the process which can provide valuable feedback to the operation personnel. In addition operation personnel can use the on-line system to determine if and where process problems or variations are occurring along with a process monitor and a mechanical integrity monitor.

Features & Benefits

Enhanced Process Safety

The use of an on-line process monitor provides feedback which helps ensure the process is operating as designed and there is no degradation of the structure as a result of the internal activities.

Prevent Catastrophic Failure

Defects can be detected at an early stage allowing early warning, owner/operators have more time to determine what and when actions should be taken.

Reduce Maintenance Cost

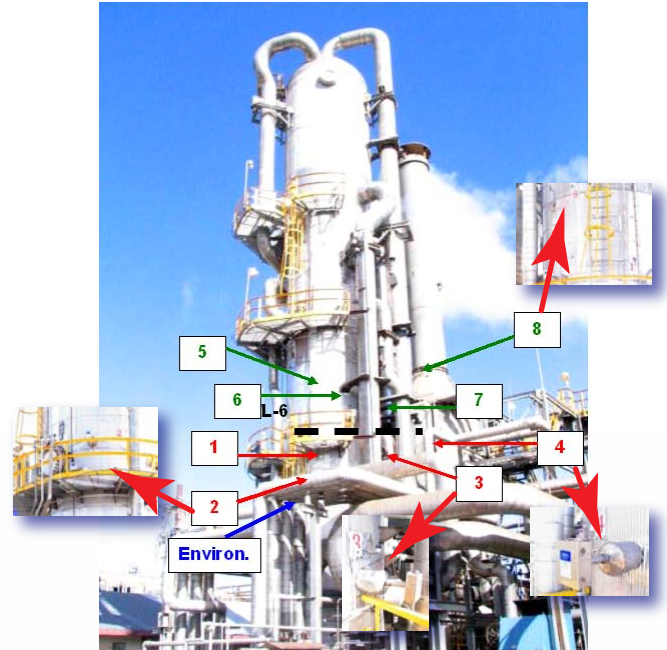
The on-line system provides an early warning of the presence of defects. With this information the owner operator can plan any necessary corrective actions over a longer and more convenient time period.

Less Costly Repairs

By having information regarding a defect, the owner/operate can institute repairs at an earlier stage in the defect life cycle thereby addressing the repair at an earlier stage for an easier, faster, less complicated and less expensive repair.

Reduced Number of Inspections

The on-line system continuously provides the operator a current status of the equipment's integrity. With this available on demand, the operator has less of a need to enter and inspect the vessel



AE Monitoring of Vessel Sensor Locations: Sensors 1 to 8 Monitor Vessel, Sensor 2 Monitors Pressure and Sensor 3 Monitors Temperature

Prevent Business Interruptions

The on-line system alerts the operator to the presence of a problem before it causes an unexpected outage. Unscheduled business interruptions can be minimized or eliminated altogether.

Improved Risk Management

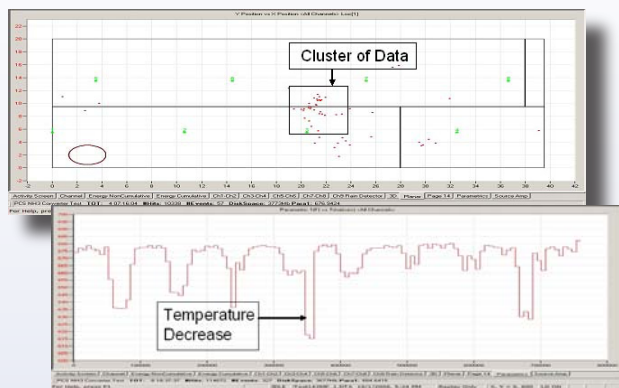
On-line monitoring provides current up-to-date information regarding the mechanical integrity of the asset. With this information more accurate Risk Modeling can be performed.

Improved Emergency Response

Should a situation arise that requires an emergency response, the on-line system can help direct the respondents to the most critical areas.

Potential For Reduced Insurance Costs

With an early warning system that prevents an impending failure, some insurance companies have reduced or held consistent insurance premiums.



AE Activity Related to Temperature of Vessel

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