

# Aptech Updates

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Aptech Engineering Services, Inc.

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## CLAIMS AND LITIGATION CONSULTING ACTIVITIES

The Legal Business Area at APTECH has been busy with its usual dizzying array of cause investigations. Here are some of the highlights:

**Appliances** We are investigating fires or explosions in two different residential gas-fired **range/ovens**, two commercial-size **warm air furnaces**, an electric **heating mat** for pets, a **copy machine**, a **commercial range/oven**, a **clothes dryer** and a **washing machine**. We looked into the mechanics and failure modes of a **press-type coffee maker**. A client asked us to investigate a pinch-point injury on a **pizza dough-rolling machine**. Just in time for summer, we evaluated a **propane grill** fire for manufacturing defects vs. operator error.

**Structures** A fire in an apartment complex was caused when electrical utility workers momentarily "**dropped**" the **neutral leg** at the power pole. This overloaded a cable in one of the apartment units and ignited the roof. In another apartment-related investigation, the fire origin was traced to some **electrical wiring** in a wall. The wiring location was improper, and apparently a workman drilled a hole through the wall and unknowingly damaged the wiring. In another case, a home caught fire several hours after installers of an air conditioner used a **gas torch** to solder the refrigerant tubing. Combustibles in the ceiling apparently had begun smoldering after being contacted by the torch flame.

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### Power Generation News

[Method to Prevent Slagging and Fouling for Coal-Fired Boilers, Allow Increased Use of Low Sulfur Coals, Reduces SO<sub>2</sub> and Eliminates SO<sub>3</sub> Emissions](#)

#### Background/Problem

Many coal-fired power plants are switching to, or blending with low sulfur PRB coals to reduce sulfur emissions. Many of these plants are severely limited in how much PRB coal can be used because of the Flue Exit Gas Temperature (FEGT) now being far above the lower temperature necessary to promote slagging. This causes increased slagging and fouling in the upper

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### Petrochemical Service News

[APTECH Attends its 12th NPRA Conference](#)

The APTECH petro group exhibited once again at the annual NPRA Reliability and Maintenance conference and exhibition. The conference was held in the Ernest Morial Convention Center, New Orleans from 24-27th May. This premier event of the petroleum refining and petrochemical



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### Nuclear Power Service News

[Pressurizer Heater Sleeve Repair Evaluations](#)

The Pressurizer is a critical component in pressurized water reactors (PWR) that maintains proper reactor coolant system pressure and water level through internal heating controls. The Pressurizer bottom head has several penetrations to accommodate heater rod assemblies through welded sleeves. These Alloy 600 heater sleeves have suffered primary water stress corrosion cracking (PWSCC) near the attachment weld between the sleeve and the inner head surface. In response, APTECH has completed a comprehensive evaluation of the degraded weld

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 Claims and Litigation Consulting Activities

Finally, we assisted the insurance investigators on a fire in the **LaSalle Bank building** in downtown Chicago. Twenty floors of this historic building were heavily damaged by fire and water. The leading cause is thought to be an electrical malfunction.

**Boilers and Machinery** A rash of **boiler explosions** have been keeping us busy. They are more properly termed “furnace explosions” that is, the delayed ignition of gas in the firebox rather than a sudden release of steam. In another matter, we have been investigating the dramatic meltdown of an **electric generator** in a power plant on the East Coast. The evidence suggests that a repair contractor made errors in the re-stacking of the stator. We have also investigated the mechanical breakdowns of two different **diesel engines**. In one case, the engines in a fleet of earthmovers prematurely wore out due to contaminated diesel fuel. In the other case, improper maintenance and operation caused engine failures in several Mississippi long boats.

**Agricultural** We are investigating a fire in a **cotton-harvesting machine**. Most cotton picker fires occur in the collection basket on top of the machine, after the pneumatically airborne lint is ignited by a spark from a rock or an old horseshoe. In our case, the fire was in the diesel engine. It was preceded by unusual maintenance activity. Also in the area of agriculture, we investigated a fire in a gas-fired conveyor machine that **dehydrates citrus peel**. The dried peel is used as a cooking spice. One of the gas burners ignited fragments of the dried product that had fallen down into the vitiated air plenum. This fire spread upward into the conveyors and eventually involved the entire plant. Fortunately, the machine itself was stainless steel and survived the fire pretty much intact.



**Pipeline** We were retained to investigate the cause of a disastrous fire in a fractured **gasoline pipeline**. The accident resulted in multiple injuries and fatalities. A backhoe operator hit the pipe during trenching operations for a new water pipe.

**Floods** We recently have investigated several “spurious activations” of fire protection **sprinklers** in commercial buildings (see separate article in this issue). The incidents involved only one sprinkler in the system; after it had been newly installed. In one instance, a sprinkler caused one million dollars worth of damage to computer servers in just a few minutes. Two other floods we investigated involved the failures of **compression fittings** in under-the-sink plastic tubing. In another major flood, a **high-rise** in San Francisco was soaked from top to bottom when the building's water system malfunctioned. The water was released up in the machine room penthouse, and then cascaded down the elevators, walls and

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waterwalls, superheaters, and reheaters. The result is decreased reliability, lower efficiency, higher maintenance costs, and less power generated. This technology may apply to fireboxes in many other units that were sized too small to even consider the use of low Sulfur coals.

Added to this problem is the need to reduce Sulfur emissions. Sulfur emission credits continue to increase in price, driving owners to install expensive scrubbers that require high maintenance and energy costs. These costs will no doubt result in consumer rate increases. This will be even more costly to utilities that have units with limited or no ability to burn PRB coals. It is expected the cost of scrubbers will increase as the demand increases because of the inability of suppliers to serve the entire industry.

#### Solution

APTECH received Patent No. 6,883,443 on April 26, 2005 that will accomplish the following:

- Allow more low Sulfur PRB coal to be used reducing emissions nationwide
- Lower SO<sub>2</sub> emissions by up to 80% and SO<sub>3</sub> emissions by up to 100%
- Prevent or greatly reduce slagging and fouling
- Reduce capital, operating, and maintenance costs for generating power
- Increase the reliability and efficiency of operating units
- Reduce cost burden to consumers

#### Brief Description of the Technology

Flue gas is extracted from the exhaust gas duct downstream of the precipitator providing gas practically free of flyash and at the lowest possible temperature. This low temperature gas is then ducted to and injected through special registers and ports to mix with the main flue gas flow from the coal combustion. The location is selected to provide enough residence time to cool down the flyash particles below the ash sintering temperature. Ash slagging and fouling of the waterwall, superheater, and reheater are greatly reduced or eliminated.

The technology is enhanced with the use of water vapor injection to achieve further drops in temperature. By adding a Ca- and/or Mg-based slurry to the spray, about 75-80% of the SO<sub>2</sub> and up to 100% of the SO<sub>3</sub> will be taken out of emissions. This is possible because of the long residence time in the furnace and the possibility to mix the solvent with the main gas flow properly. This can be achieved with a Calcium-to-Sulfur ratio of about 1.5, which is substantially lower than conventional applications.

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[APTECH Implements another RBI Project in Australia](#)

Huntsman Chemical in Botany Bay, Sydney Australia, began the implementation of APTECH's RDMIP program in March 2005. After five days of RBI training, the facility, which manufactures surfactants and other speciality chemicals, began the prioritization and planning of their 2005 turnaround using RDMIP. This is the second Huntsman facility in Australia to license APTECH's RDMIP program.



APTECH's Steve Anderson (2nd from left) with Huntsman staff.

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stairwells. Finally, a pharmaceutical **environmental chamber** was flooded when an installer forgot to close a valve for the night.

We are always amazed at the amount of damage that a release of water in a building can do. Sometimes it can approach the damage from a fire. However, at least there is a better chance of salvaging some of the contents after a flood, as opposed to a fire. As the old saying goes, "Things can be dried out, but not unburned."

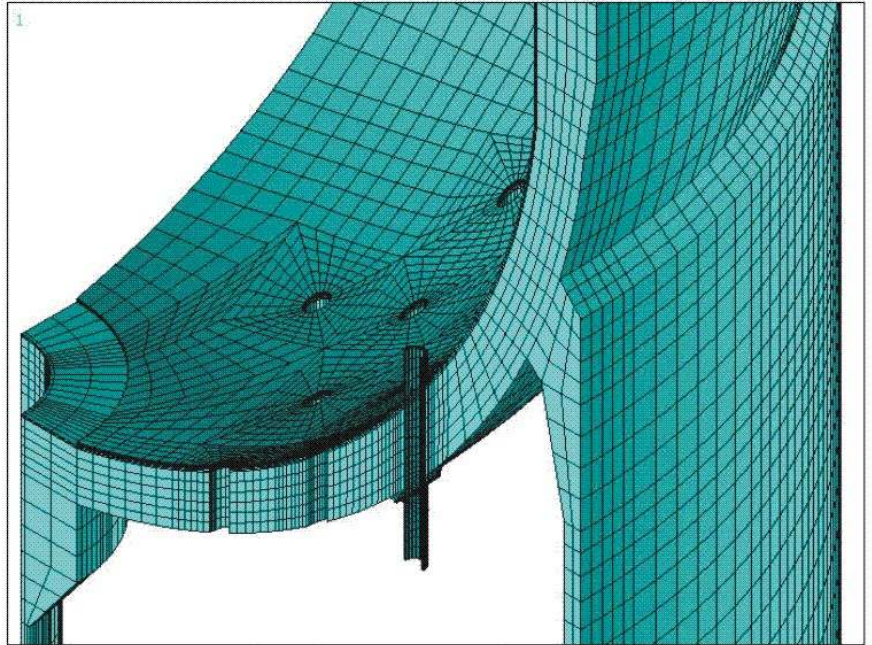


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and performed design calculations for the repair detail that was implemented at a recent plant outage for a major nuclear utility.

The repair technique commonly used for such Alloy 600 penetrations is known as the half-nozzle repair method. The repair constitutes removal of the lower portion of the original sleeve by cutting at approximately the mid-wall location. A new, more resistant, Alloy 690 sleeve of the same dimensions is attached to the pressurizer bottom head. The resistance of Alloy 690 to PWSCC is superior to that of Alloy 600. The new attachment weld is a J-groove weld at the outside surface of the pressurizer bottom head. The J-groove is machined on a weld pad, which is deposited on the exterior of the head as part of the weld repair procedures. Hence, the pressure boundary is moved from the original interior J-groove weld to the outside J-groove/weld pad connection between the pressurizer bottom head and the Alloy 690 sleeve. When installed, a vertical gap is maintained between the original sleeve stub, which is not removed and remains in service, and the new sleeve in order to prevent interference during service conditions.

APTECH's evaluation included fracture mechanics calculations for critical flaw size and flaw growth for potential cracks that may remain in service at the completion of the



Pressure Heater Sleeve Model

repair. These detailed calculations were performed in accordance with ASME Section XI flaw evaluation procedures, considering all the critical design loadings and weld residual stresses associated with the original J-groove attachment weld. Three dimensional finite element stress analysis methods were employed to define the local stresses at the sleeve-to-head attachment locations. Flaw acceptance criteria from IWB-3600 of ASME Section XI, as well as an extension of such criteria to elastic plastic fracture mechanics conditions were employed to permit the repair geometry to be acceptable for continued service of 40 years commencing from the date of repair.

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industries represents 90% of the US refining industry, 52 petrochemical facilities as well as 15 overseas countries. Geoff Egan, Steve Anderson, and Stephen Harper attended the exhibition.

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