



# Water leak management at Metalloys

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# Background

- Water leak management is embedded in BHP Billiton's ZERO HARM strategy
- Included in Fatal Risk Control Standards of BHP Billiton
- Prevent the incident of explosions caused by water/molten material contact that often leads to loss of life.
- Lessons learned from historical incidents are often written in blood and as industry we need to do all we can to prevent this from re-occurring

# Methods used to detect water leaks

- Visual inspections
- Cooling Water Flow Meters
- Closed circuit water trending (On-line mass balance)
- Hydrogen Analysis in furnace off-gas on closed furnaces
- Furnace pressure monitoring
- Electrode resistance monitoring

# Visual Inspection

- Visually inspect all high risk areas whenever possible
- High risk areas properly defined for personnel
- These would typically be water cooled components exposed to excessive heat, or flexible pipes on the furnace roof
- Currently installing cameras to allow continuous monitoring of high risk areas rather than only when the furnace is switched out.
- Also visually inspect water circuit outlets for presence of steam which may indicate a leak on that specific circuit.

# Cooling Water Flow Meters

- Continuous flow meters installed on all circuits of the furnace
- Water flow measured in L/min
- Alarming set at 10% deviation in flow
- Furnace automatic trip on persistent flow reduction (120sec)
- Regular simulation of water leaks, as well as testing of trips and interlocks, to ensure reliability of equipment

# Flow Meter Monitoring

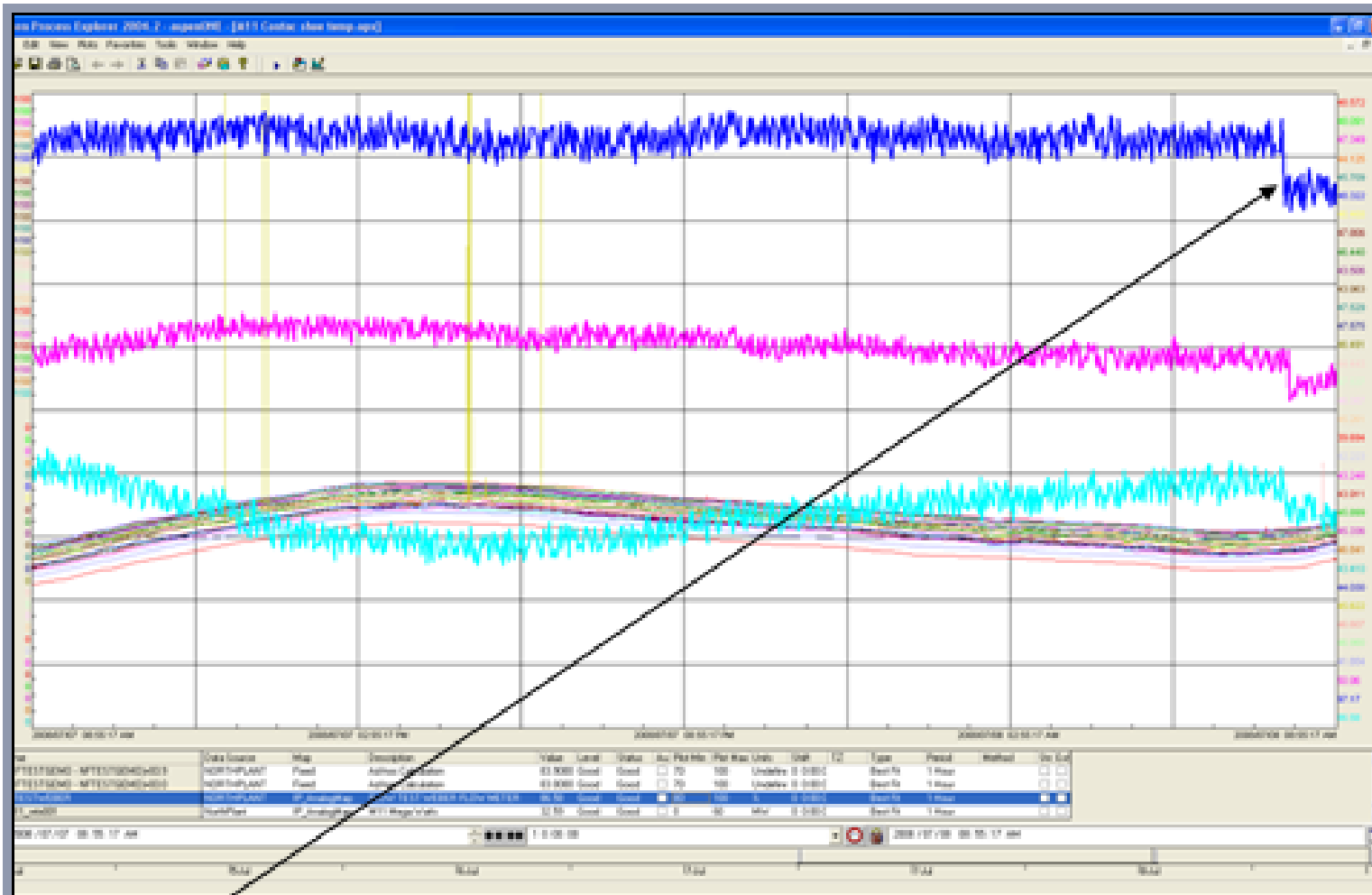
WM12 Furnace Monitoring 03

| TAGNAME    | DESCRIPTION                          | SP | PROCESS     | HI ALARM | LO ALARM |
|------------|--------------------------------------|----|-------------|----------|----------|
| WM12FTX041 | Electrode Contact Shoe No. 3-5 Flow  | 60 | 123.6 L/min | 50.0 D   | 50.0 E   |
| WM12FTX042 | Electrode Contact Shoe No. 3-6 Flow  | 60 | 120.4 L/min | 50.0 D   | 50.0 E   |
| WM12FTX043 | Electrode Contact Shoe No. 3-7 Flow  | 60 | 70.7 L/min  | 50.0 D   | 50.0 E   |
| WM12FTX044 | Electrode Contact Shoe No. 3-8 Flow  | 60 | 86.7 L/min  | 50.0 D   | 50.0 E   |
| WM12FTX045 | Electrode Contact Shoe No. 3-9 Flow  | 60 | 90.6 L/min  | 50.0 D   | 50.0 E   |
| WM12FTX046 | Electrode Contact Shoe No. 3-10 Flow | 60 | 95.0 L/min  | 50.0 D   | 50.0 E   |
| WM12FTX047 | Electrode Contact Shoe No. 3-11 Flow | 60 | 96.6 L/min  | 50.0 D   | 50.0 E   |
| WM12FTX048 | Electrode Contact Shoe No. 3-12 Flow | 60 | 93.5 L/min  | 50.0 D   | 50.0 E   |
| WM12FTX049 | SPARE                                |    | 0.0 L/min   | 50.0 D   | 50.0 D   |
| WM12FTX050 | Tapered Ring No. 1 Sleeve Flow       | 85 | 116.9 L/min | 50.0 D   | 50.0 E   |
| WM12FTX051 | Tapered Ring No. 2 Sleeve Flow       | 85 | 109.2 L/min | 50.0 D   | 50.0 E   |
| WM12FTX052 | Tapered Ring No. 3 Sleeve Flow       | 85 | 123.8 L/min | 50.0 D   | 50.0 E   |
| WM12FTX053 | Tapered Ring No. 1-1 Flow            | 85 | 120.0 L/min | 50.0 D   | 50.0 E   |
| WM12FTX054 | Tapered Ring No. 1-2 Flow            | 85 | 120.7 L/min | 50.0 D   | 50.0 E   |
| WM12FTX055 | Tapered Ring No. 2-1 Flow            | 85 | 154.3 L/min | 50.0 D   | 50.0 E   |
| WM12FTX056 | Tapered Ring No. 2-2 Flow            | 85 | 148.4 L/min | 50.0 D   | 50.0 E   |
| WM12FTX057 | Tapered Ring No. 3-1 Flow            | 85 | 123.3 L/min | 50.0 D   | 50.0 E   |
| WM12FTX058 | Tapered Ring No. 3-2 Flow            | 85 | 130.5 L/min | 50.0 D   | 50.0 E   |
| WM12FTX059 | SPARE                                |    | 0.0 L/min   | 50.0 D   | 50.0 D   |
| WM12FTX060 | SPARE                                |    | 0.0 L/min   | 50.0 D   | 50.0 D   |

# Flow Meter Monitoring – Leak simulation



# Flow Meter Monitoring – Leak simulation

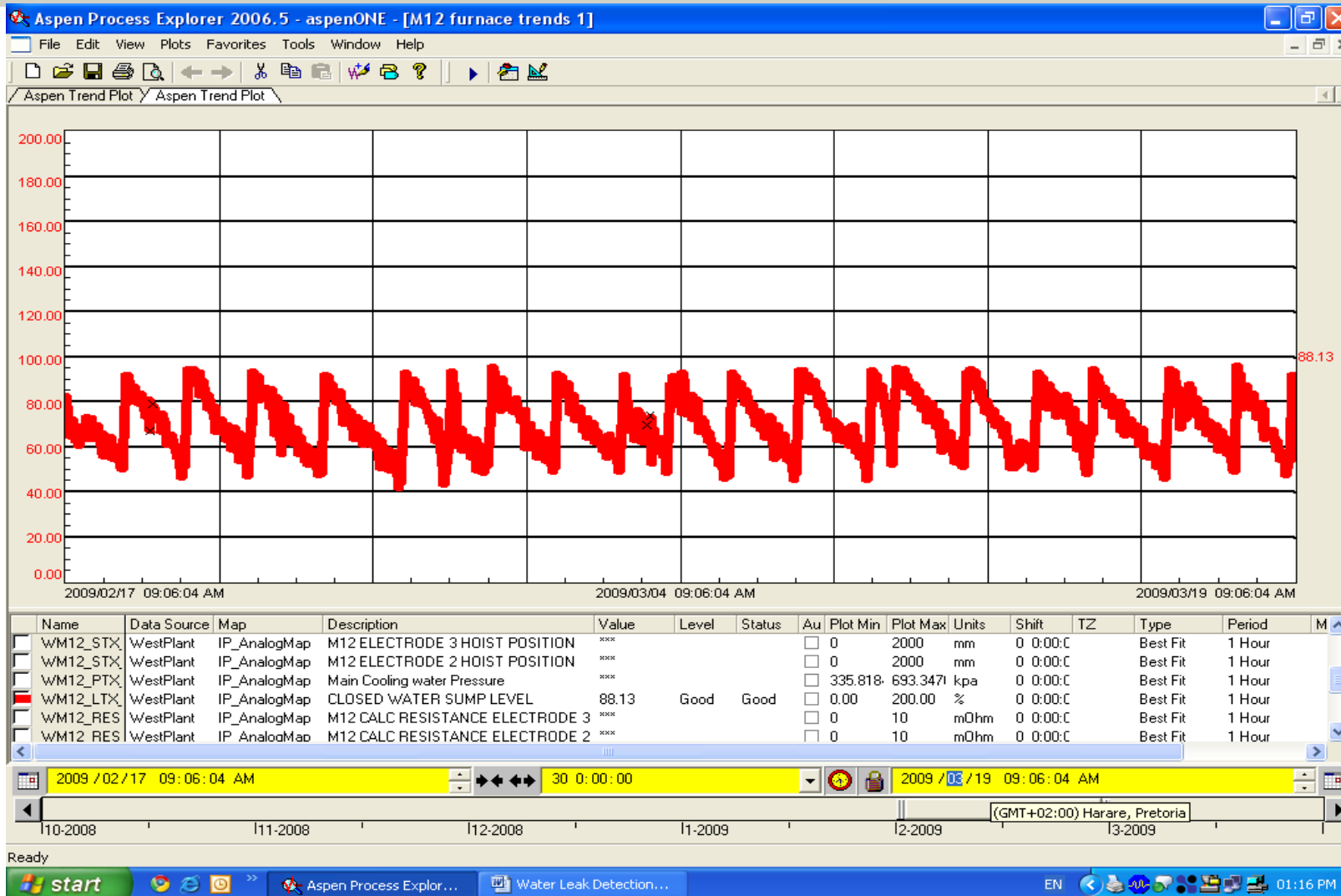


Leak simulated 20080708 +/- 2.6 liters per minute

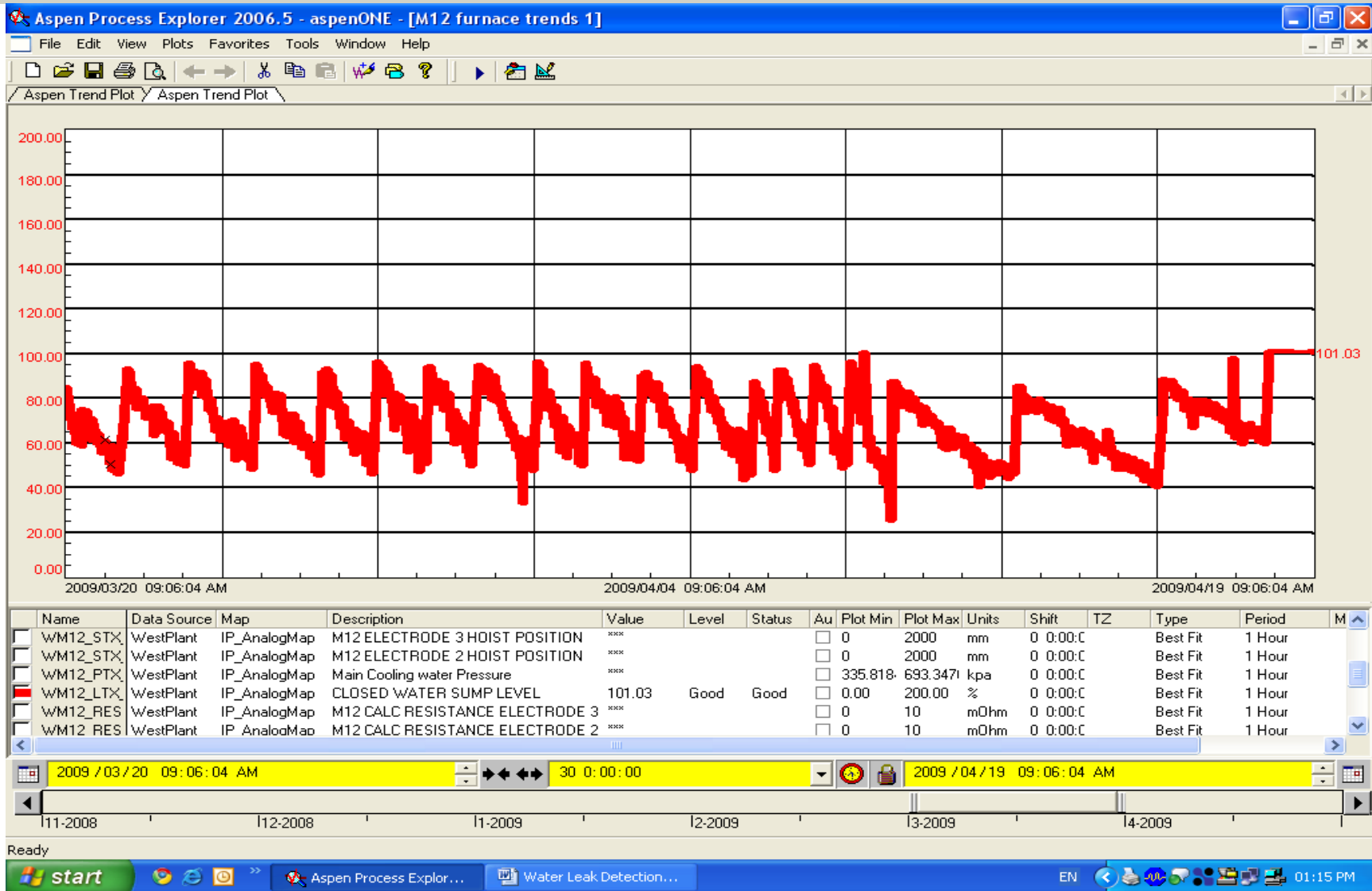
# Closed circuit water trending

- Trending water level in closed circuit water tank enables one to monitor “rate of consumption”. This is in fact continuous monitoring of mass balance for cooling water on furnace
- A sudden increase in water consumption results in change in gradient of water consumption
- This indicates the presence of a water leak on a cooling water circuit
- This normally help indicating leaks smaller than the 10% deviation picked up by flow meters.

# Closed circuit water trending



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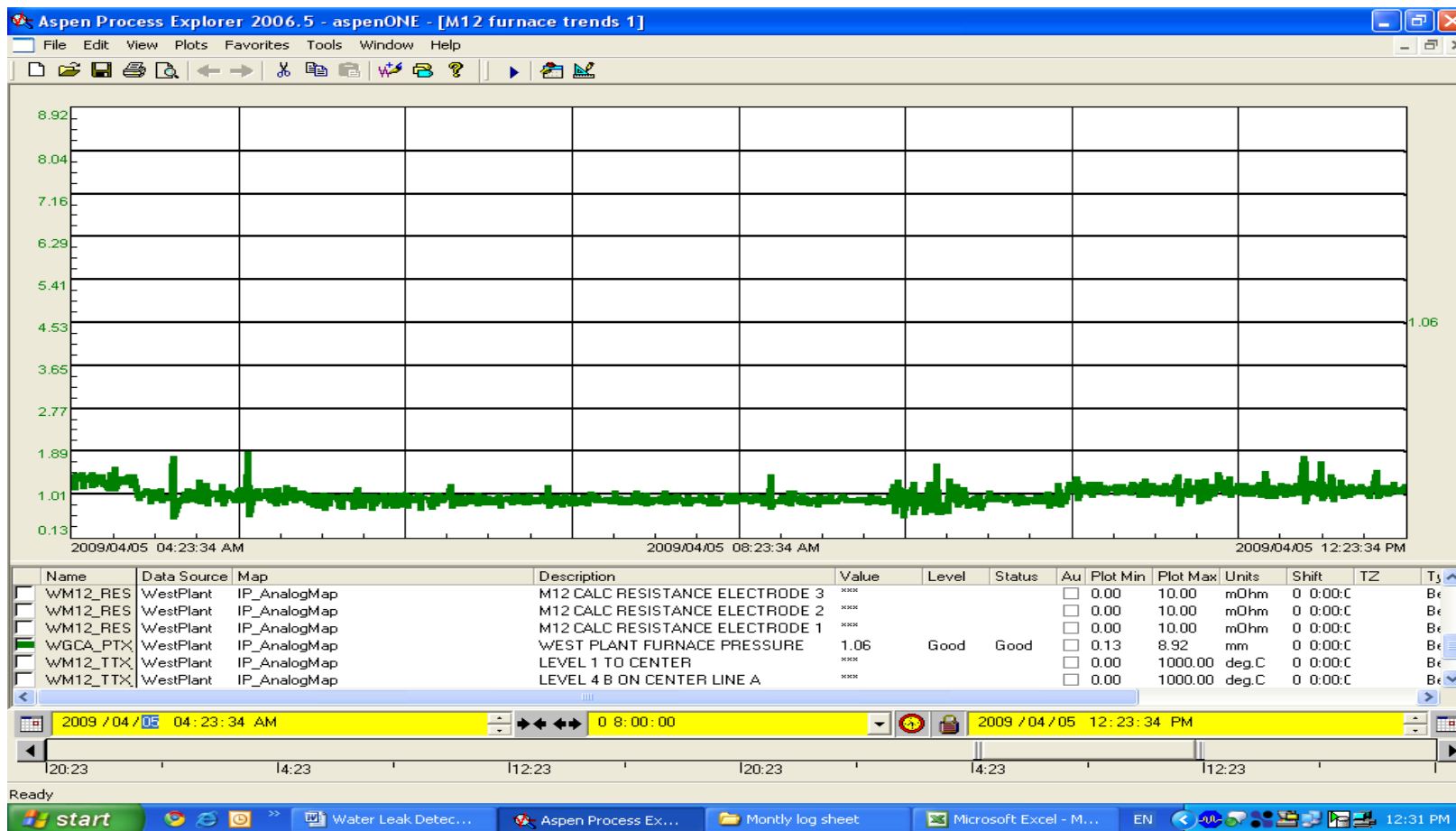


# Hydrogen Analysis in Furnace off-gas

- Continuous analysis for Hydrogen content of furnace off-gas
- Hydrogen content is dependant on moisture in raw materials, and increase from a base level should be monitored.
- Sudden increase in Hydrogen content of off-gas normally indicated water leak in furnace but mostly only water leaks in high temperature zones of the furnace are picked up here.
- Furnace trip on sudden, persistent, increase in Hydrogen

# Furnace pressure monitoring

- Unstable or erratically varying furnace pressure will indicate a water leak.

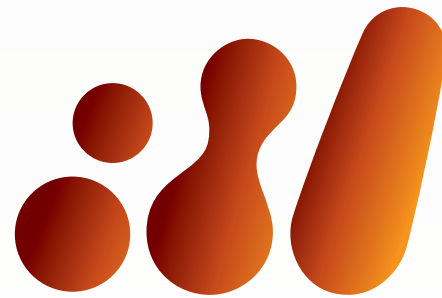


# Electrode resistance monitoring

- Increase in resistance of an electrode that cannot be controlled through normal lowering of the electrode tip position, usually indicates a water leak in the area of that electrode

# Conclusion

- Continuously trending of all of the leak detection methods is vital to identify water leaks with minimum delays.
- Most water leaks are picked up with either flow meter monitoring, or on line mass balance for water on the furnace.
- Water leak detection is more than often a result of considering more than one detection method.
- It is important to proceduralise water leak detection on furnaces, and to ensure competency of furnace operators and supervisors
- Have a defined response plan when water leak is suspected



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