



MISTRAS

**TRIPLE 5
INDUSTRIES**

Early Tube Leak Detection: See What You Can't Hear

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Power Generation**

**One Source for
Asset Protection Solutions**

Acoustic Monitoring



Early steam leak detection in power boilers, recovery boilers, feedwater heaters and Heat Recovery Steam Generators (HRSGs)

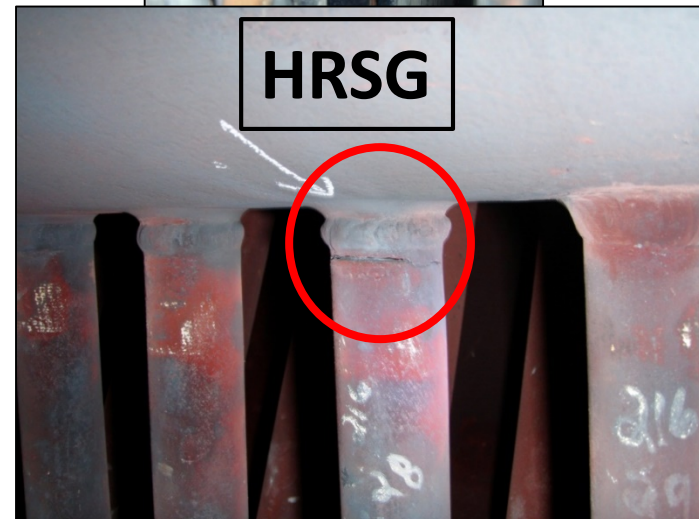
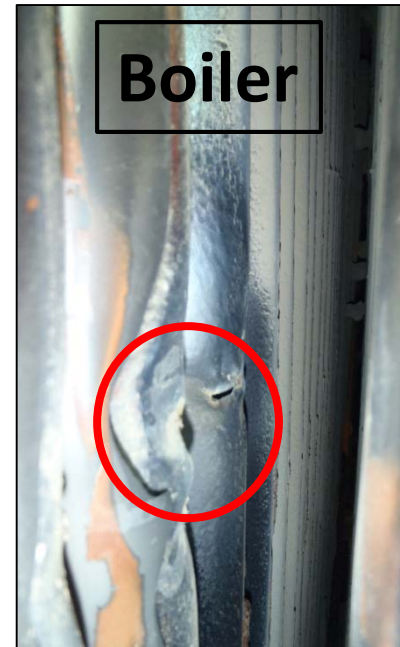
Agenda

- Benefits of Acoustic Monitoring
- How Acoustic Monitoring works & Associated Hardware
- Sensor Locations on the Boiler
- Leak Trends and Spectrum Analysis



Acoustic Monitoring Detects

- Boiler tube leaks
- Feedwater heater tube leaks and operational anomalies
- HRSG tube leaks
- Stuck sootblowers
- Sootblower effectiveness
- Boiler pluggage and slagging
- Leaking valves and external issues
- Damaging vibration

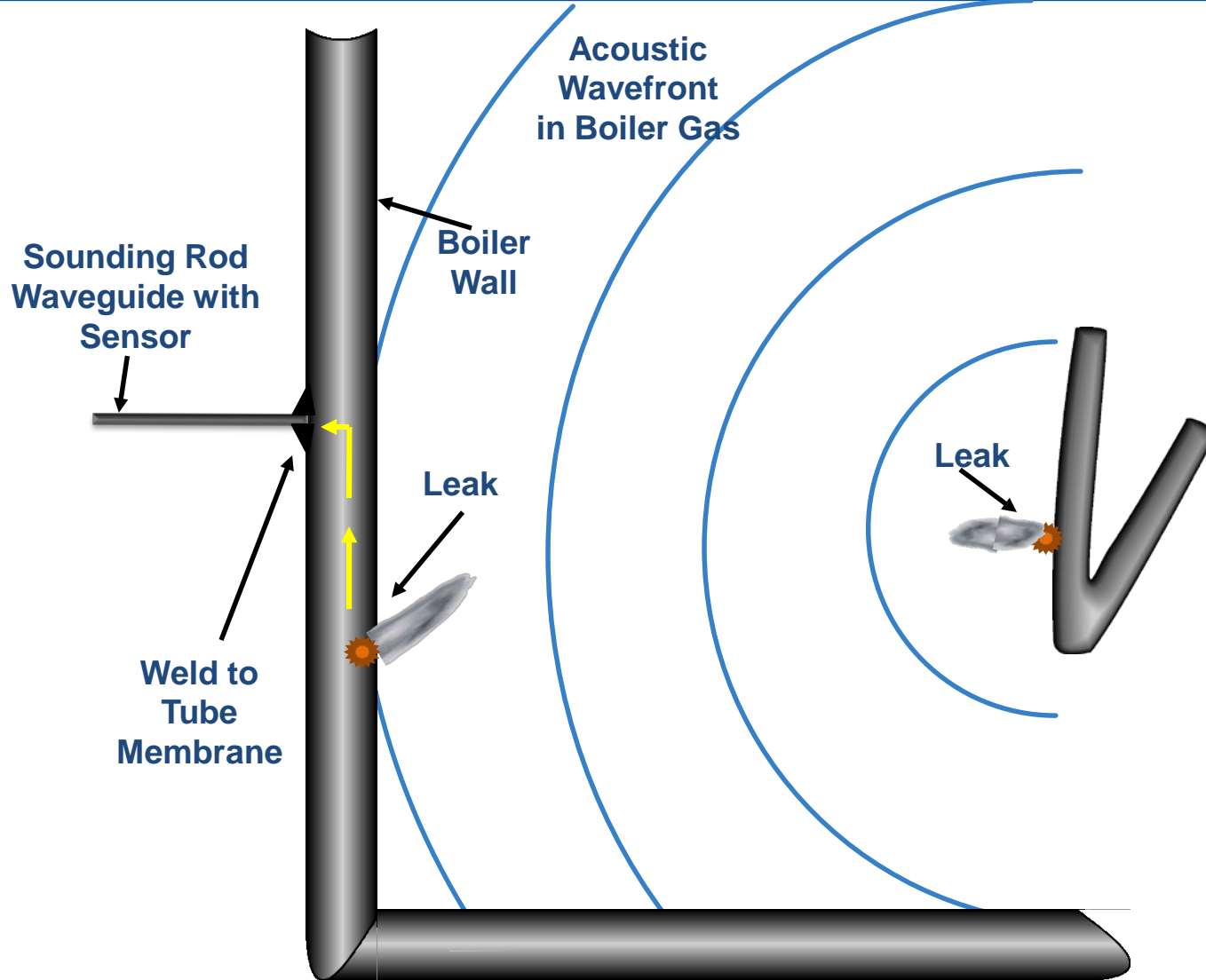


Acoustic Monitoring is used to:

- Detect leaks earlier than traditional methods
- Reduce secondary damage
- Locate area of leak(s) before unit comes offline
- Trend the severity and progression of the leak with real time data
- Schedule a maintenance vs. a forced outage
- Pre plan jobs with correct assets
- Manage market exposure and risk
- Avoid shadow loss of generation/production
- Provides additional safety measures for high risk areas

HOW ACOUSTIC MONITORING WORKS & ASSOCIATED HARDWARE

Boiler Leak Detection



Boiler Sounding Rod Installation



- Non invasive rods weld to boiler wall
- Sensor mounted on end
- Covered with sensor/rod box for protection

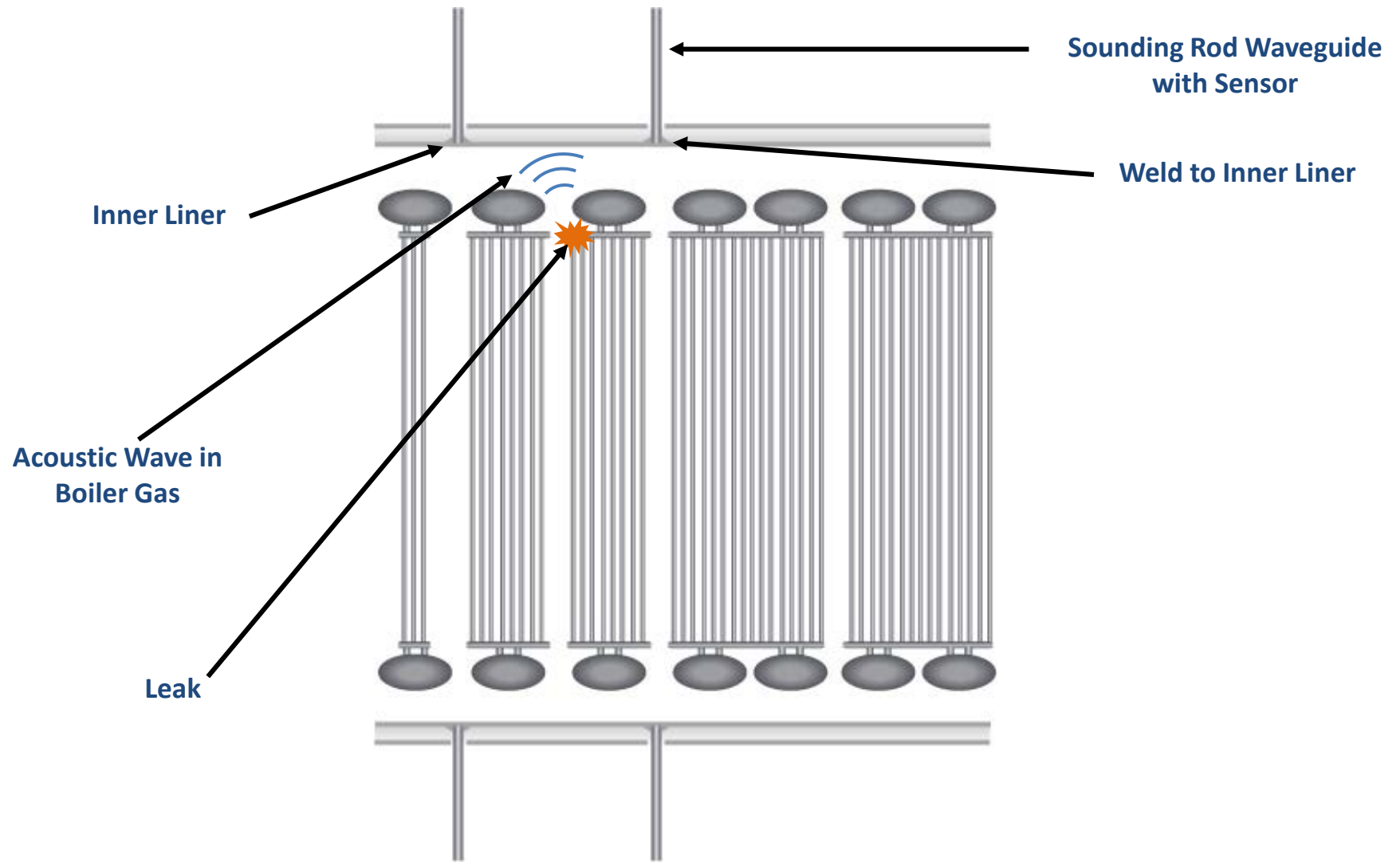
Feedwater Heater Sounding Rod Installation

- Non invasive rod welds to the shell at the tube sheet below the water level
- Sensor mounted on end
- Covered with sensor box for protection





HRSRG Leak Detection



HRSG Sounding Rod Installation

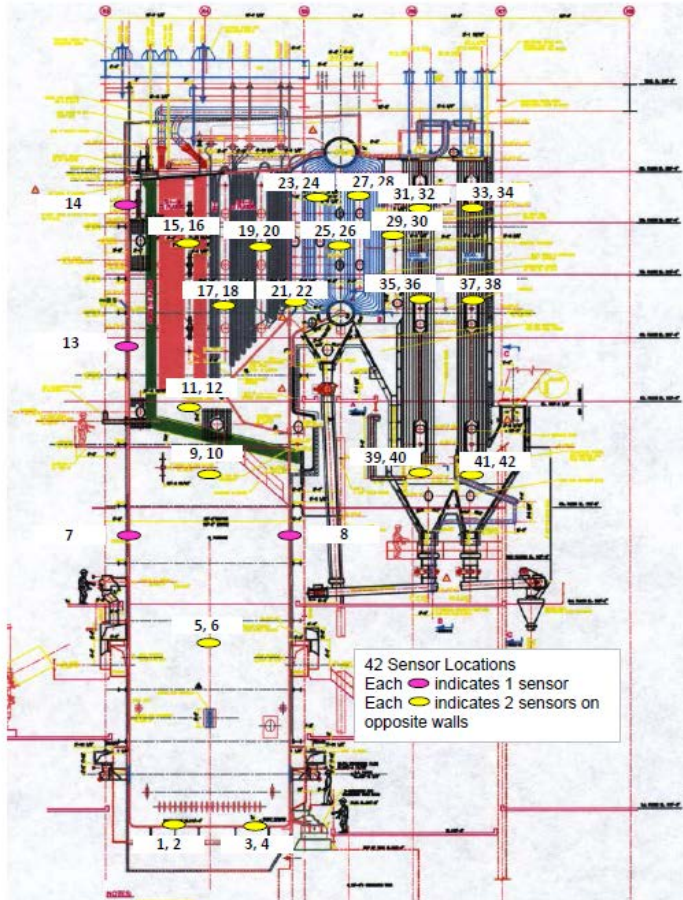


- Non invasive rods weld to inner liner
- Sensor mounted on end
- Covered with sensor box for protection
- Length determined based on access



SENSOR LOCATIONS ON THE BOILER

Sensor Locations on the Boiler



- Each  indicates 2 sensors on opposite walls
- Each  indicates 3 sensors on the same wall
- Each  indicates 2 sensors on the same wall

- Sensor locations chosen based on tube configuration and plant areas of concern
- Leak noise follows the gas flow of the unit

Boiler Software Map

ACOUSTIC MONITORING SYSTEM - [SENSOR MAP]
AMS DISPLAYS

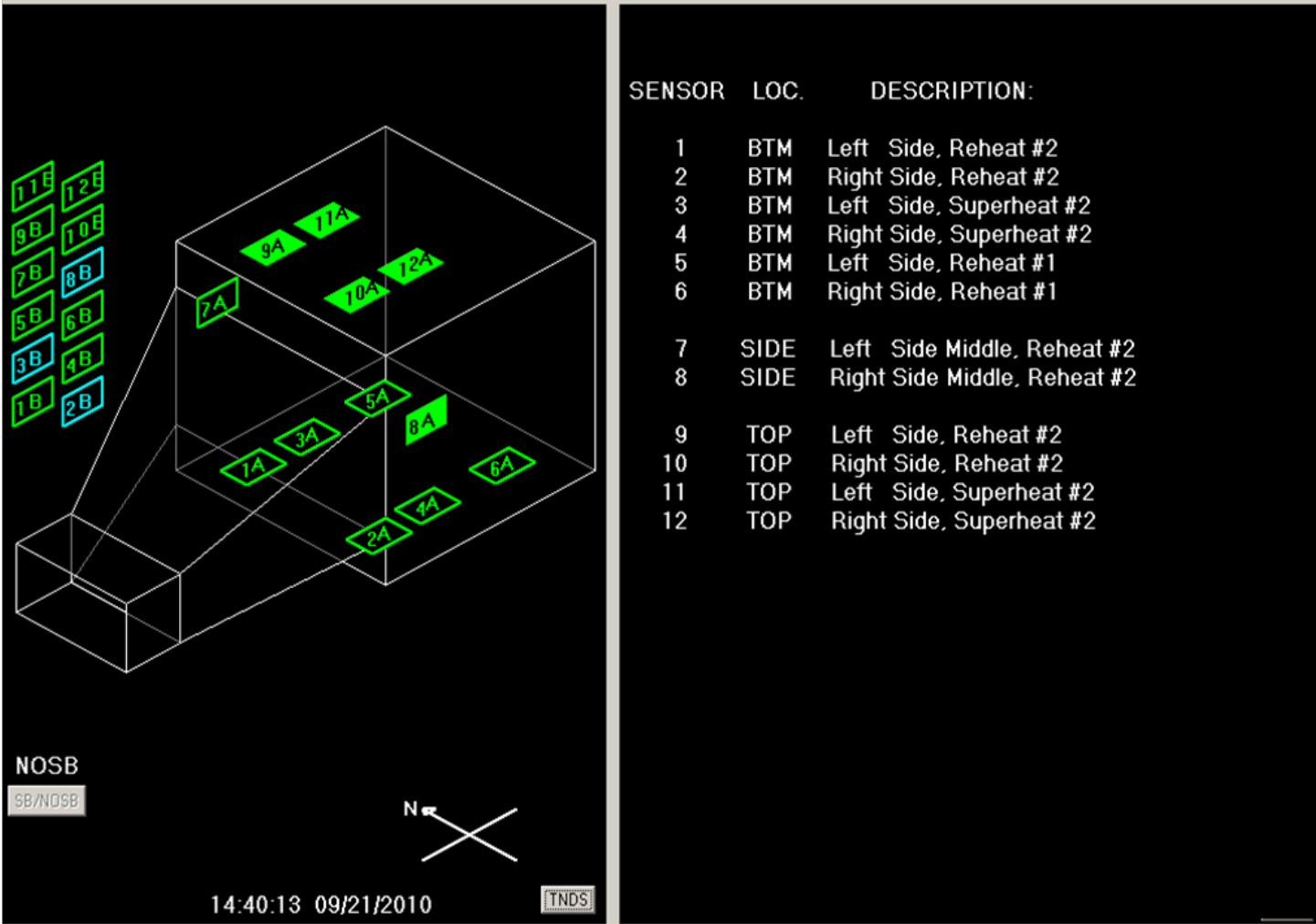
The image shows a 3D perspective view of a boiler system with various sensors numbered 1 through 32. Sensors 1-28 are distributed across the boiler's structure. Sensors 31 and 32 are highlighted with yellow circles and arrows pointing to them from the legend table. A north arrow is visible at the bottom of the 3D view.

Sensor:	EL	Description:
1/2	2.5	South / North Lower Slope
3/4	3.5	Front Lower South / North Furnace
5/6	3.5	Rear Lower South / North Furnace
7/8	5.5	Front Upper South / North Furnace
9/10	5.5	Rear Upper South / North Furnace
11/12	6	South / North Furnace Nose Arch
13/14	7	Front South / North SH Div. Panels
15/16	7.5	Lower South / North SH/RH Pend. Platen
17	8	Upper South SH/RH Pend. PL.
18	8	Upper North SH/RH Pend. PL.
19	8	South SH Pend. Spaced Ass'y.
20	8	North SH Pend. Spaced Ass'y.
21	7.5	South Upper Backpass
22	7.5	North Upper Backpass
23	7	South Horiz. RH/Lower Backpass
24	7	North Horiz. RH/Lower Backpass
25	7	South Eco. /Lower Backpass
26	7	North Eco. /Lower Backpass
27	9	South Penthouse
28	9	North Penthouse
31		Deck FW Heater #1
32		Deck FW Heater #2

SB
SB/NOSB
13:33:30 03/13/2008
TND

BAR TND SPEC MAP JRN STAT -9

HRSB Software Map



3D wireframe map of a reheat system with sensor locations labeled 1A through 12B. A legend on the left lists sensor IDs in colored boxes. A table on the right provides details for sensors 1 through 12.

SENSOR	LOC.	DESCRIPTION:
1	BTM	Left Side, Reheat #2
2	BTM	Right Side, Reheat #2
3	BTM	Left Side, Superheat #2
4	BTM	Right Side, Superheat #2
5	BTM	Left Side, Reheat #1
6	BTM	Right Side, Reheat #1
7	SIDE	Left Side Middle, Reheat #2
8	SIDE	Right Side Middle, Reheat #2
9	TOP	Left Side, Reheat #2
10	TOP	Right Side, Reheat #2
11	TOP	Left Side, Superheat #2
12	TOP	Right Side, Superheat #2

NOSB
SB/NOSB

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TNDS

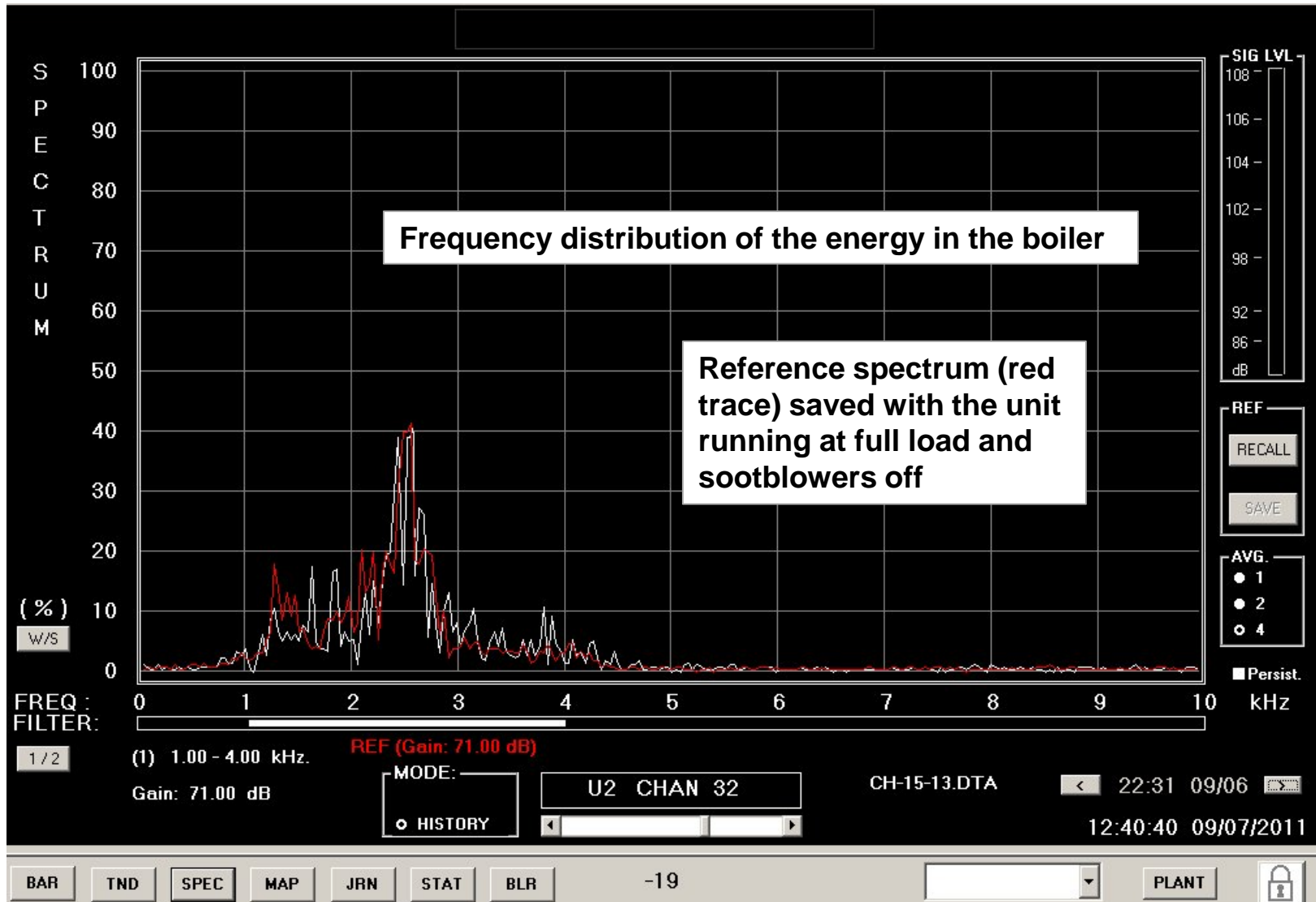
BAR TND SPEC MAP JRN STAT -6 PLANT

SIGNAL TREND

Normal Baseline Trend

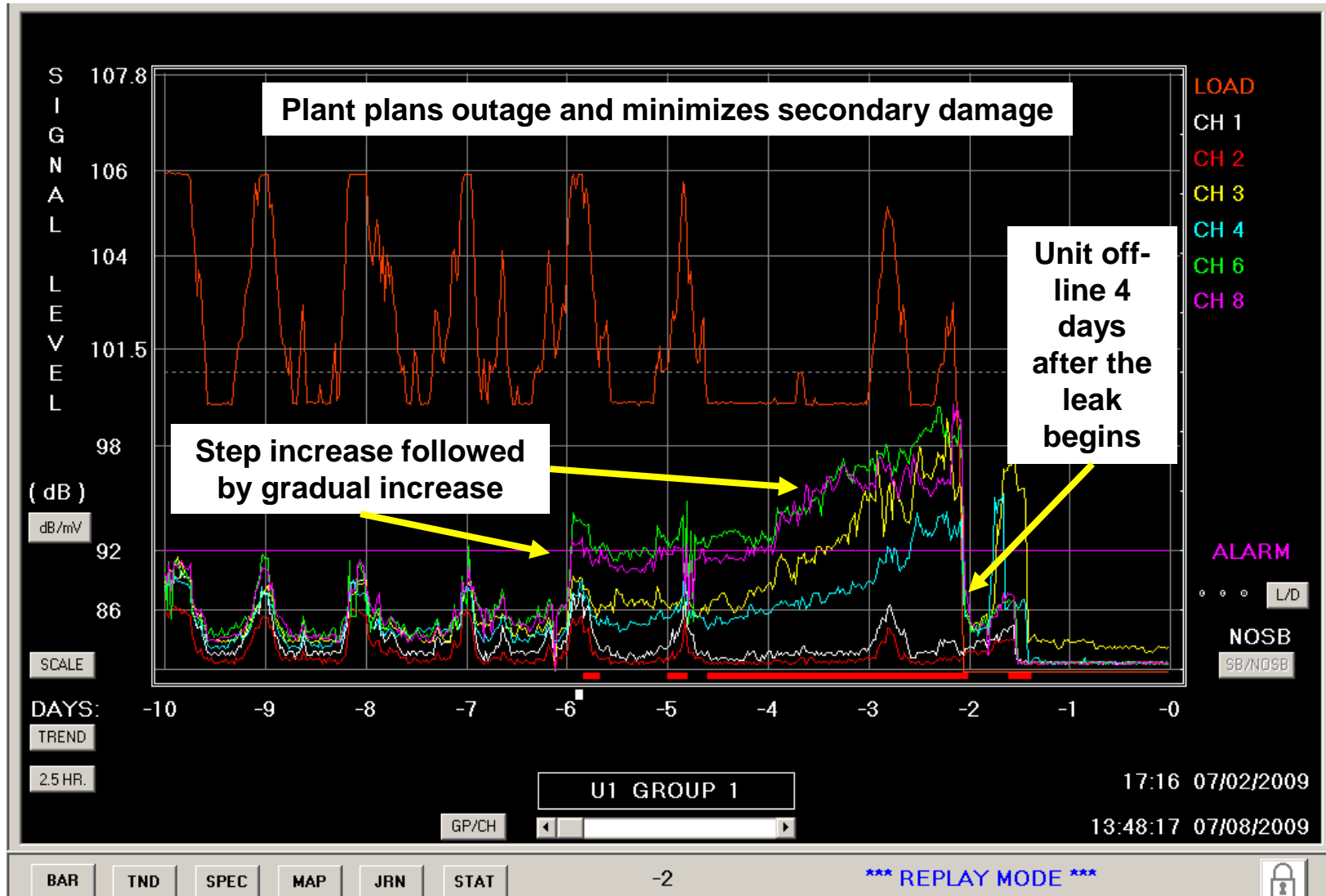


Normal Spectrum

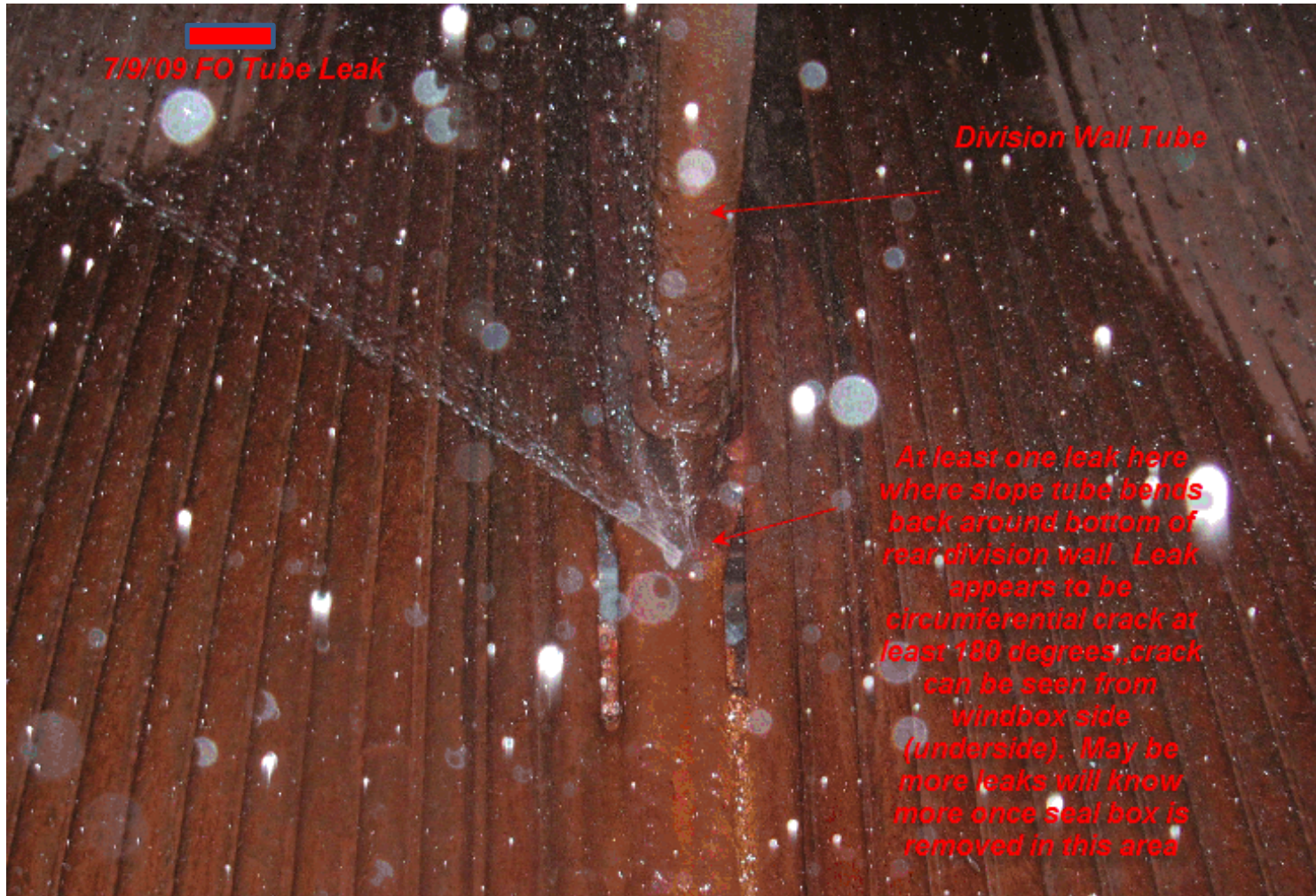


LEAK TRENDS & SPECTRUM ANALYSIS

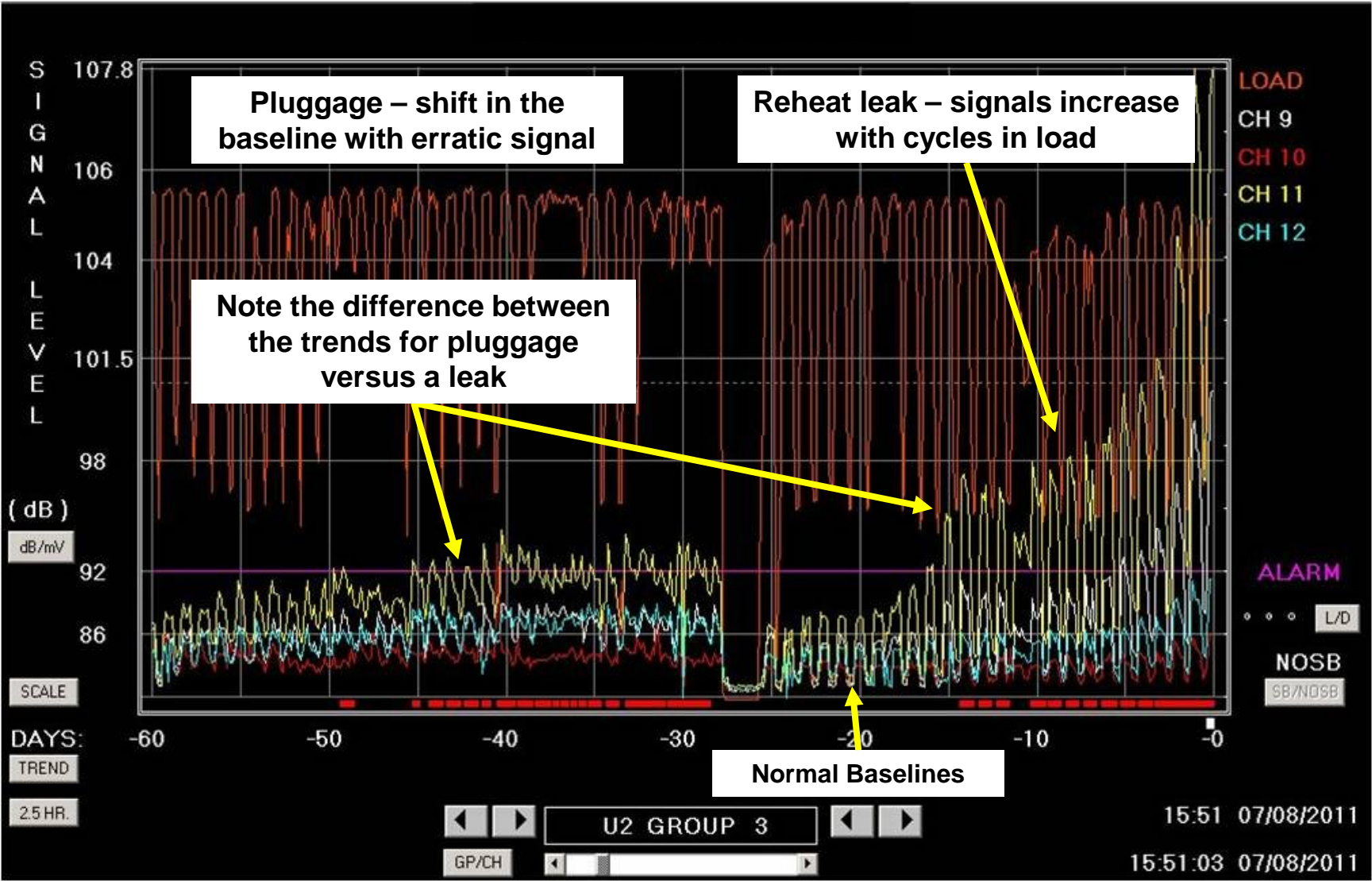
Waterwall Leak



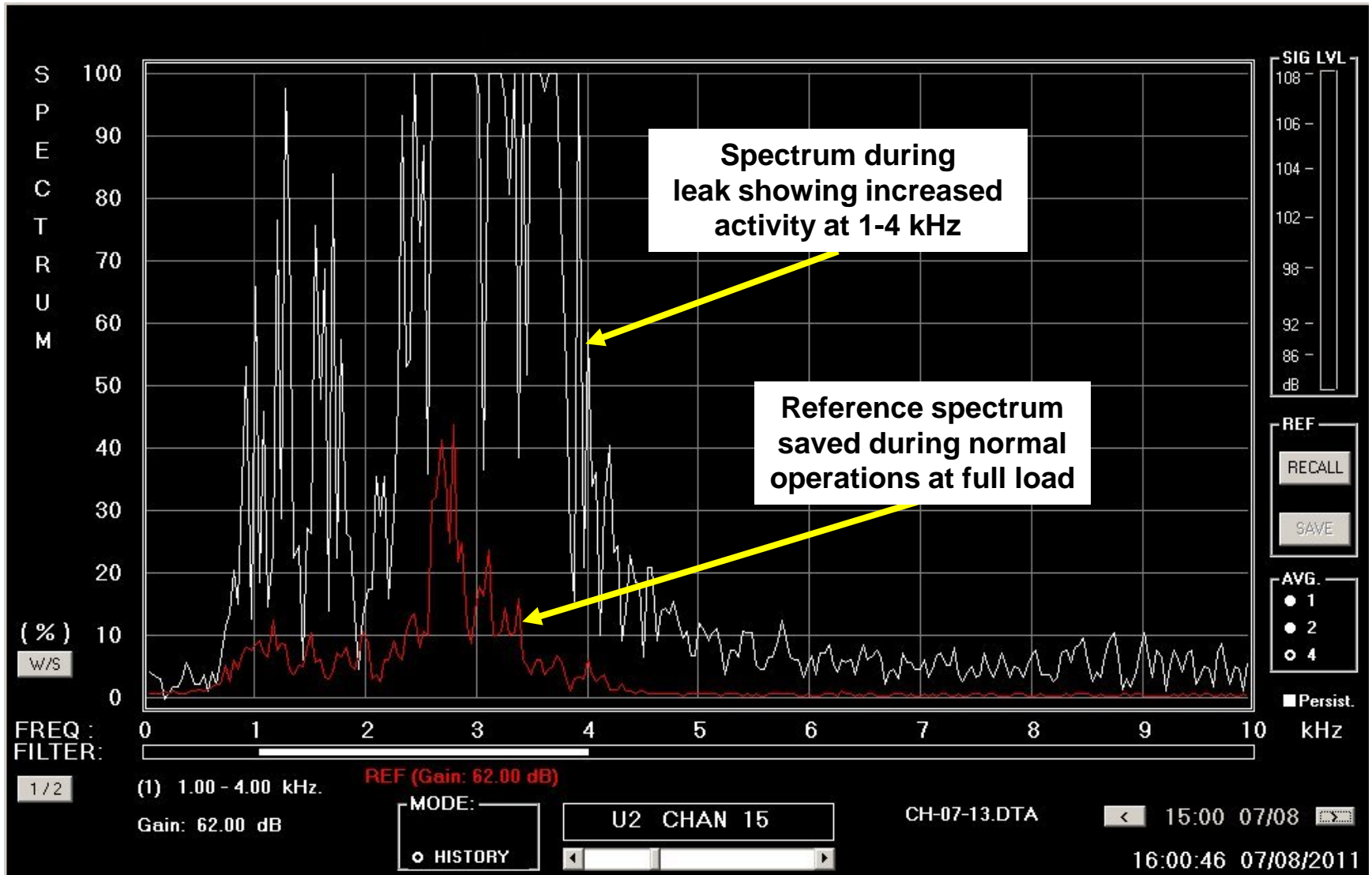
Waterwall Leak



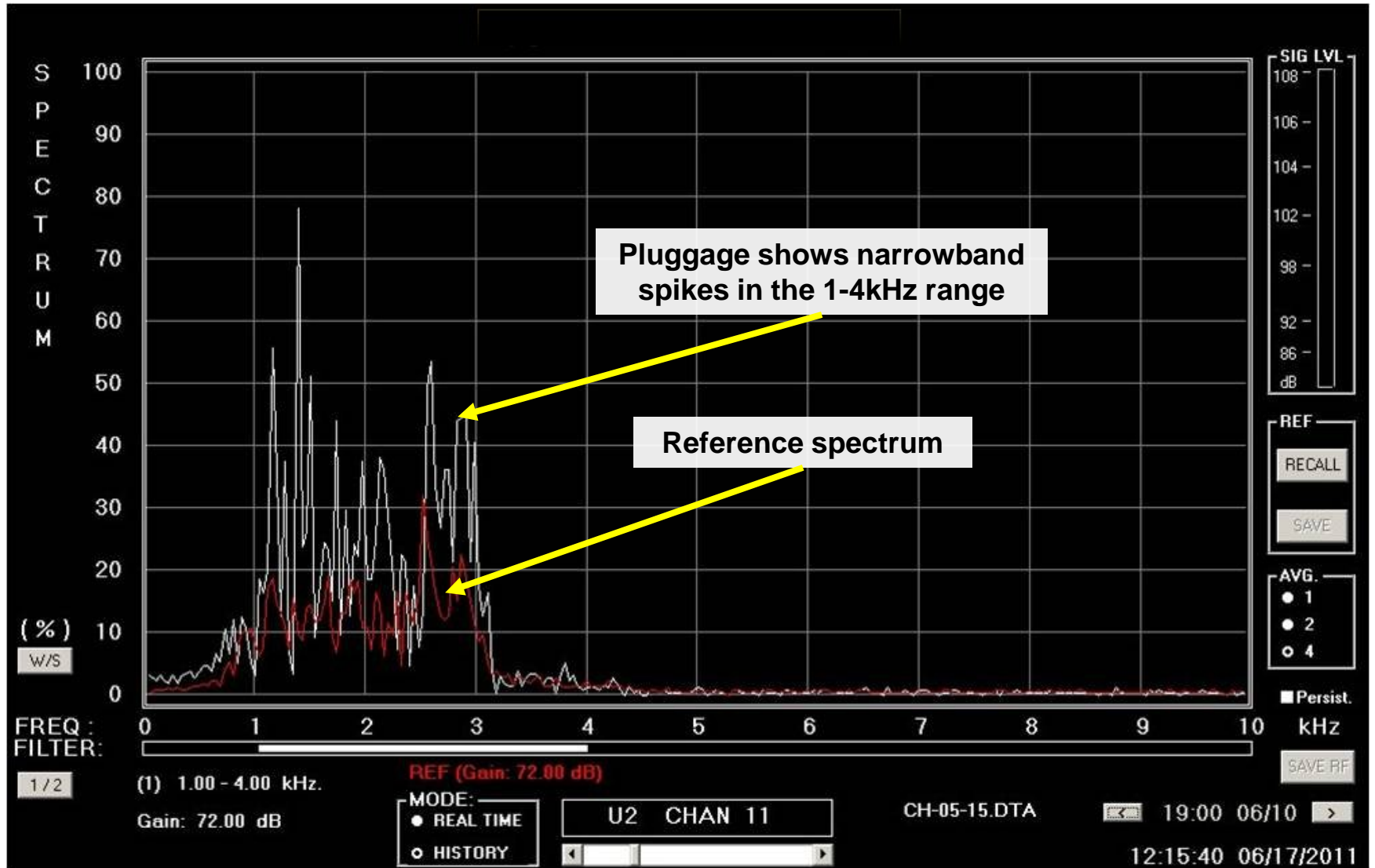
Pluggage & Reheat Leak



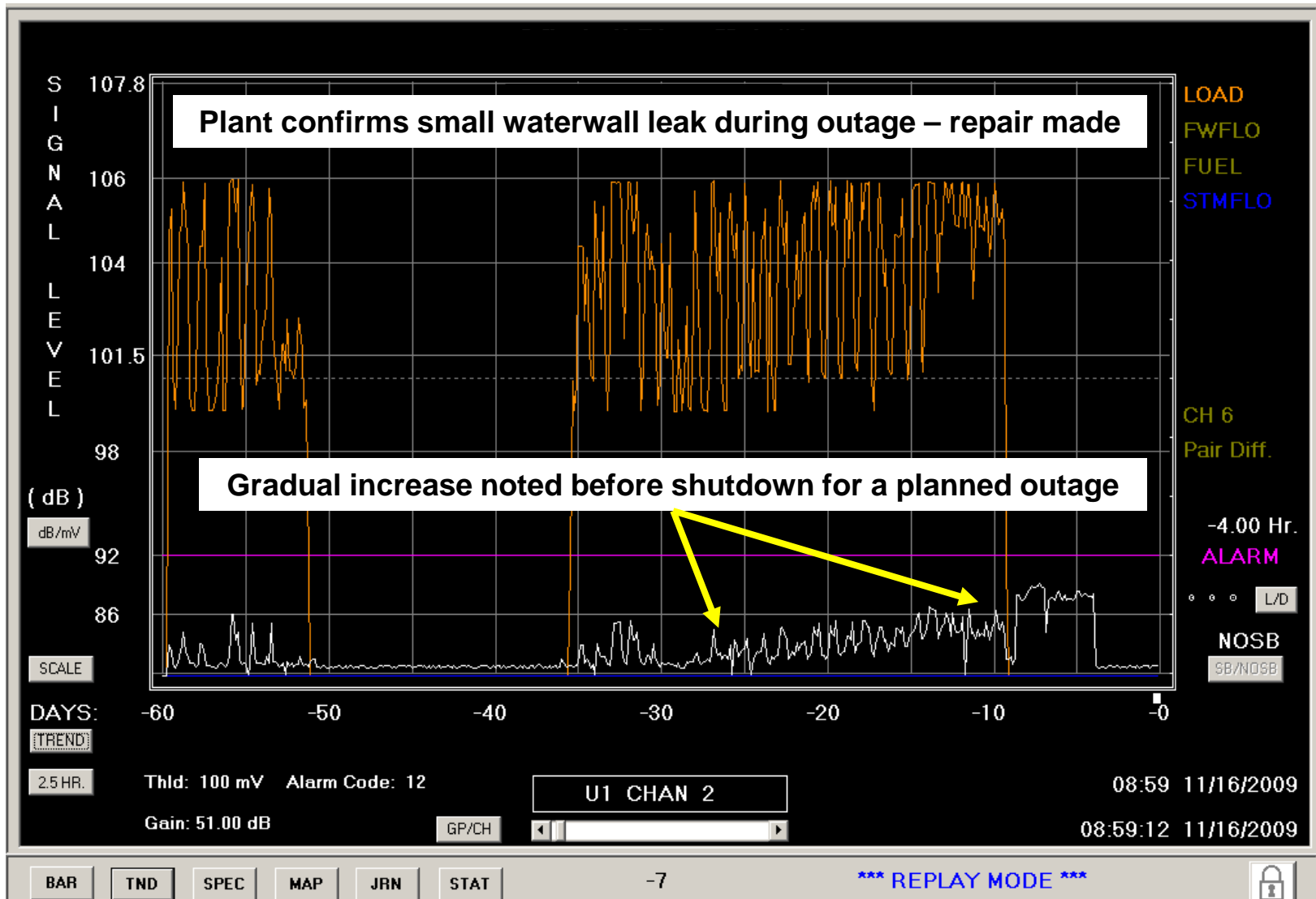
Reheat Leak Spectrum



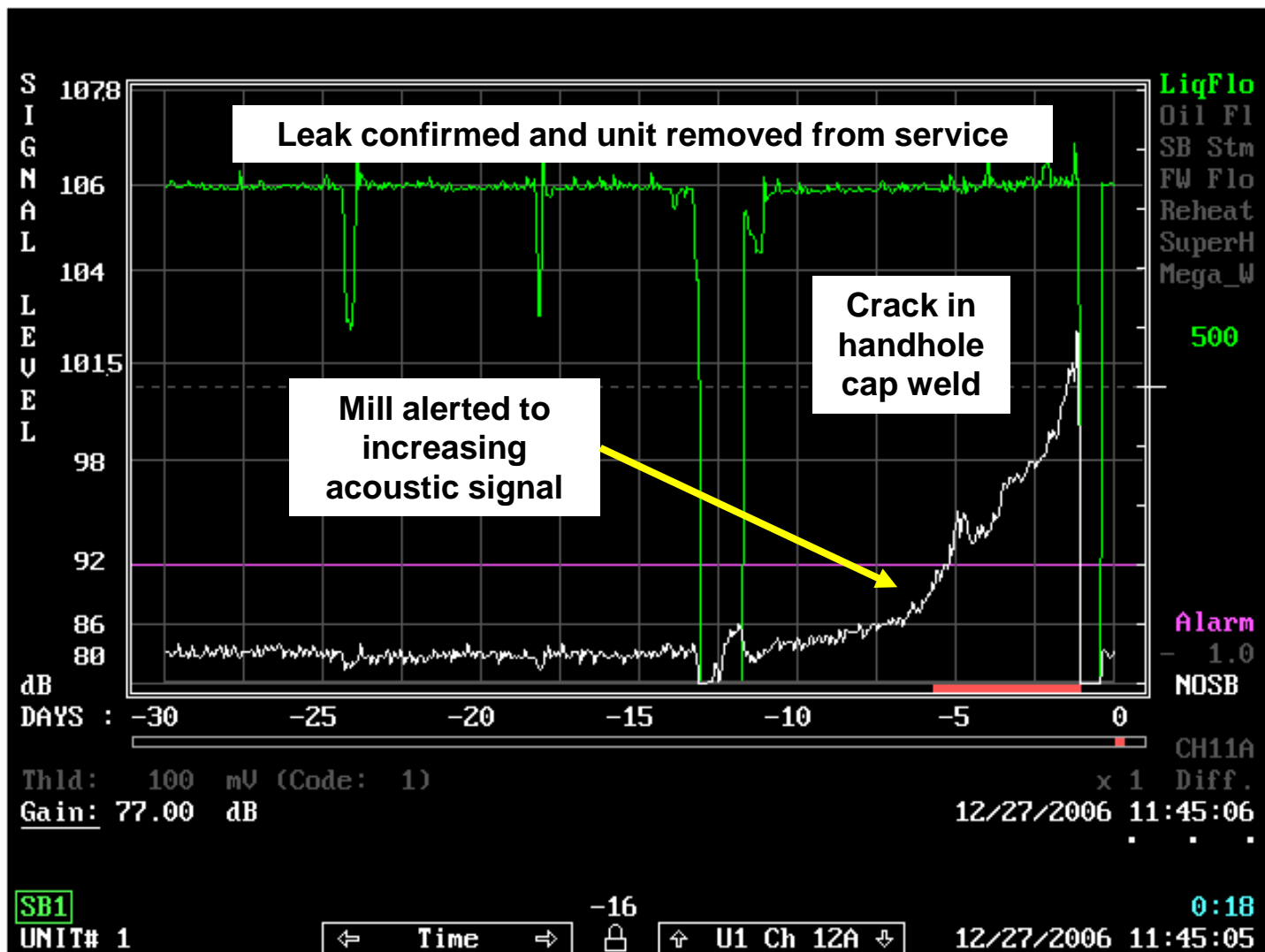
Pluggage Spectrum



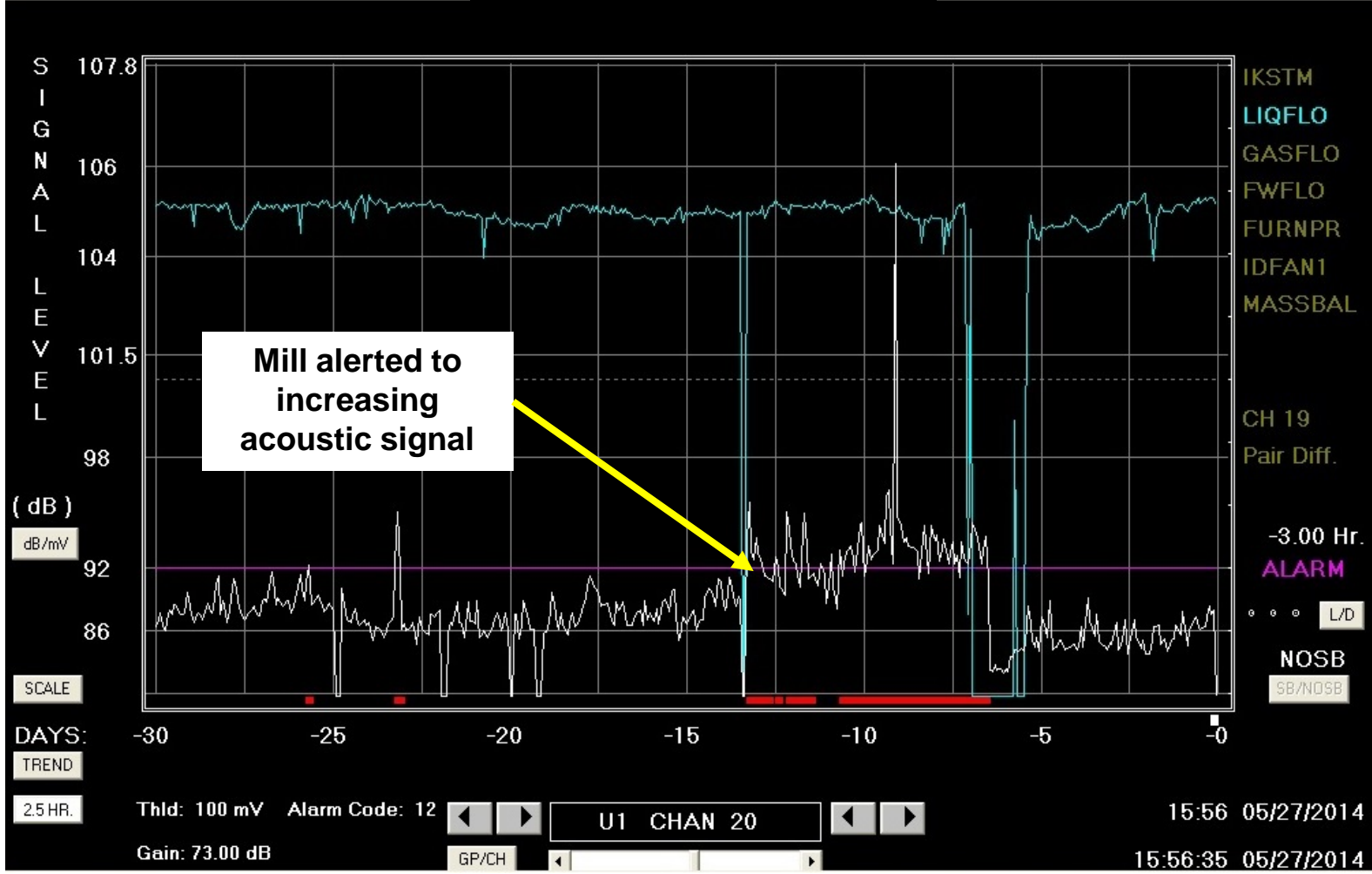
Pinhole Waterwall Leak



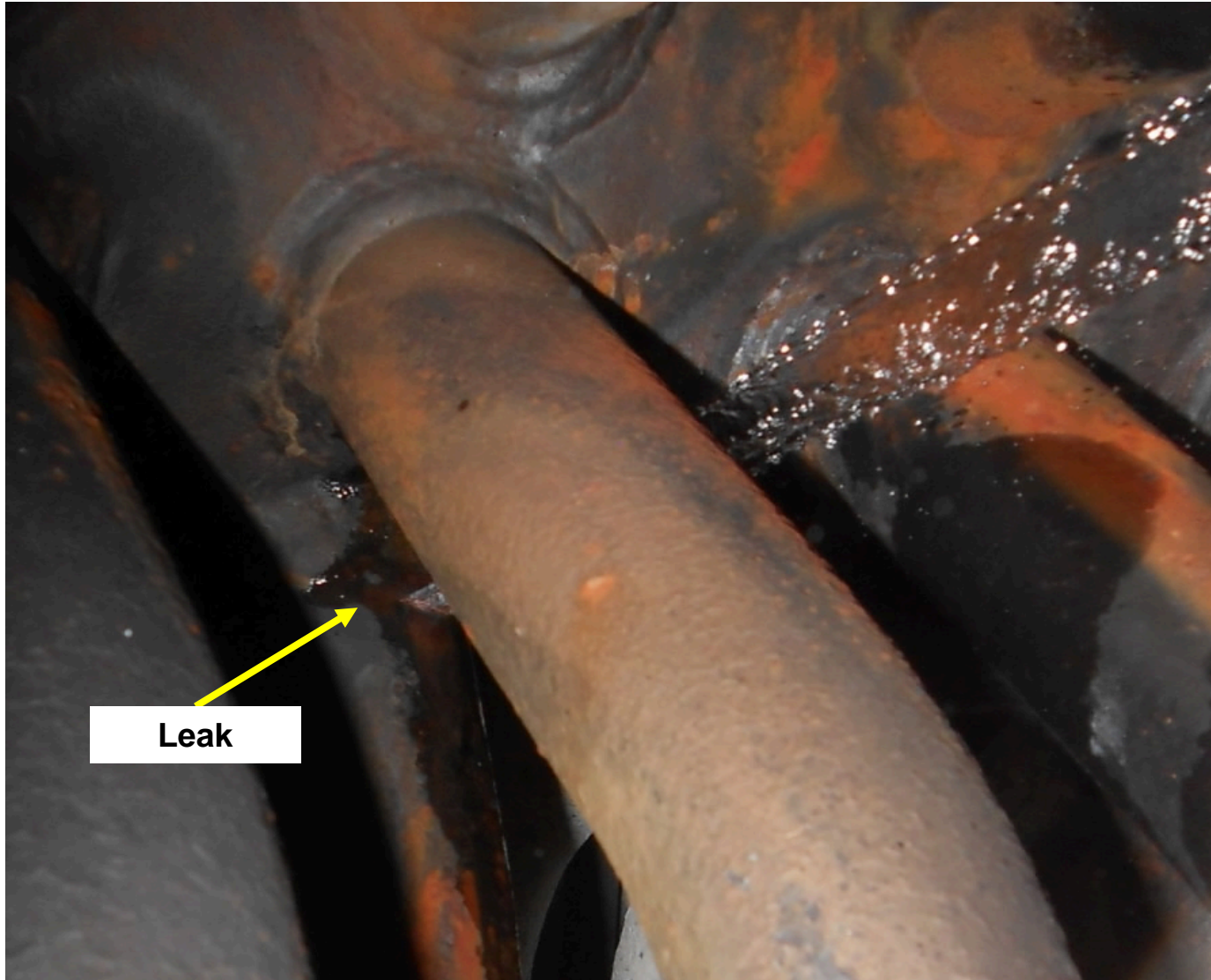
Recovery Boiler Economizer Header Leak



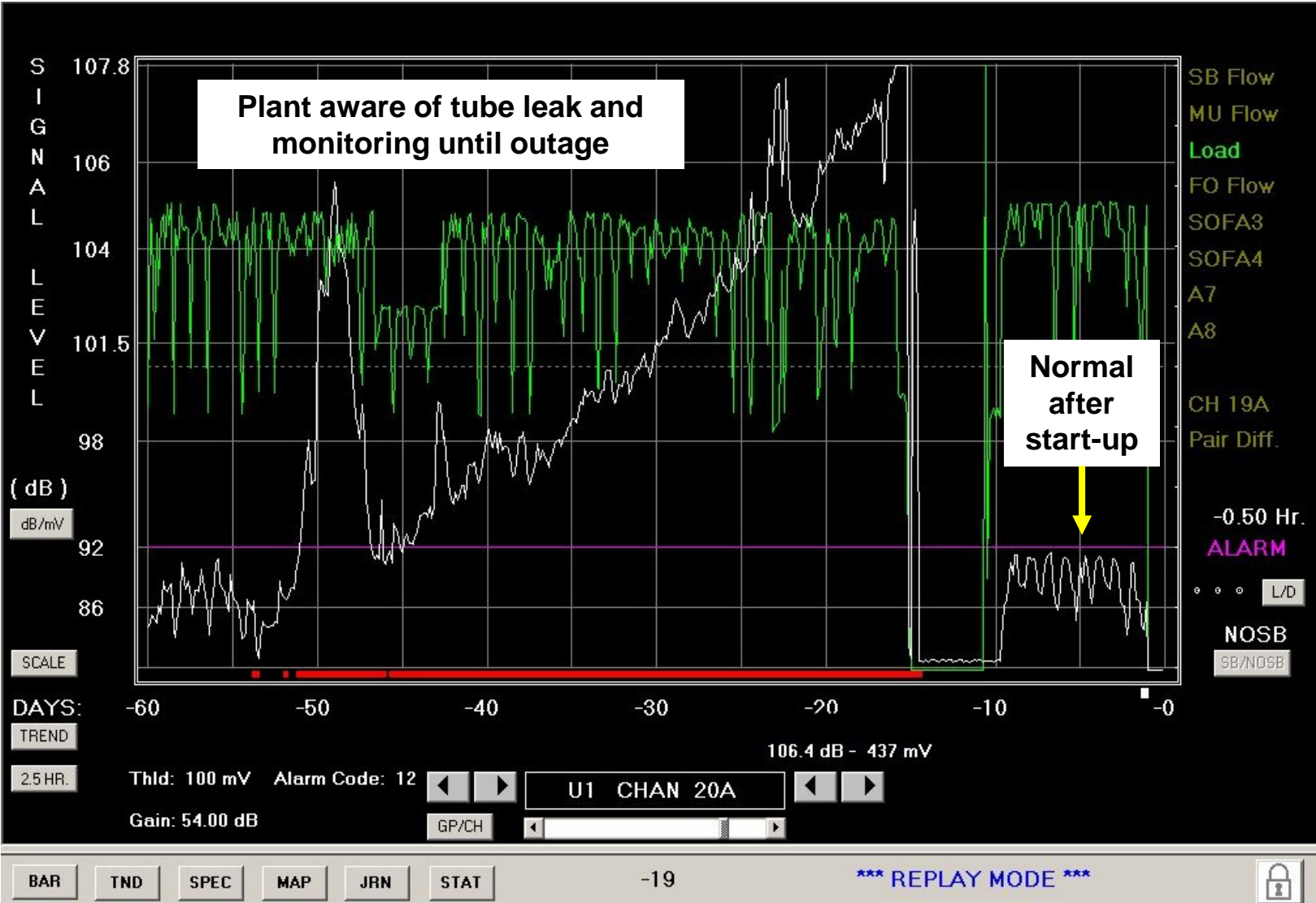
Recovery Boiler Economizer Leak



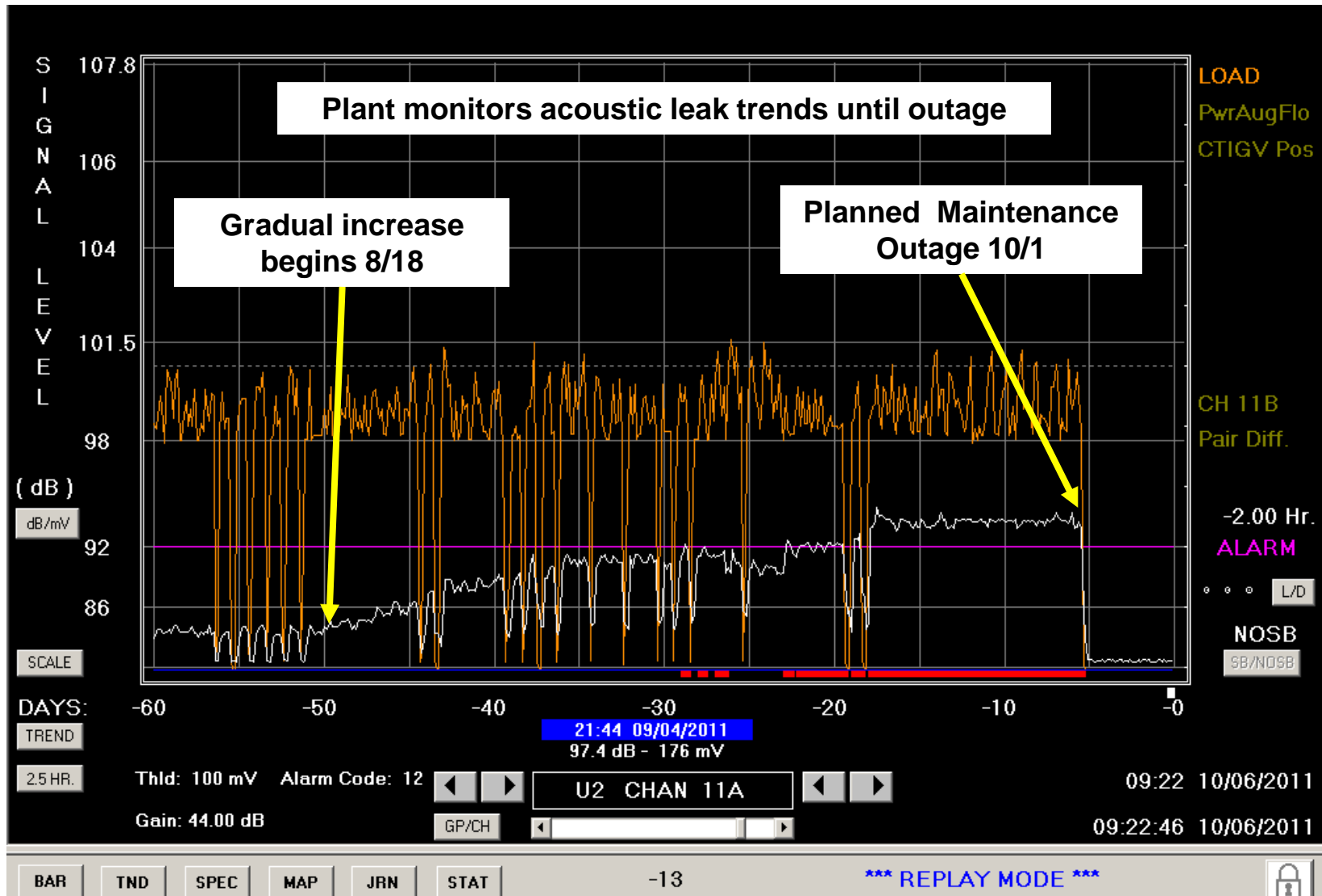
Recovery Boiler Economizer Leak



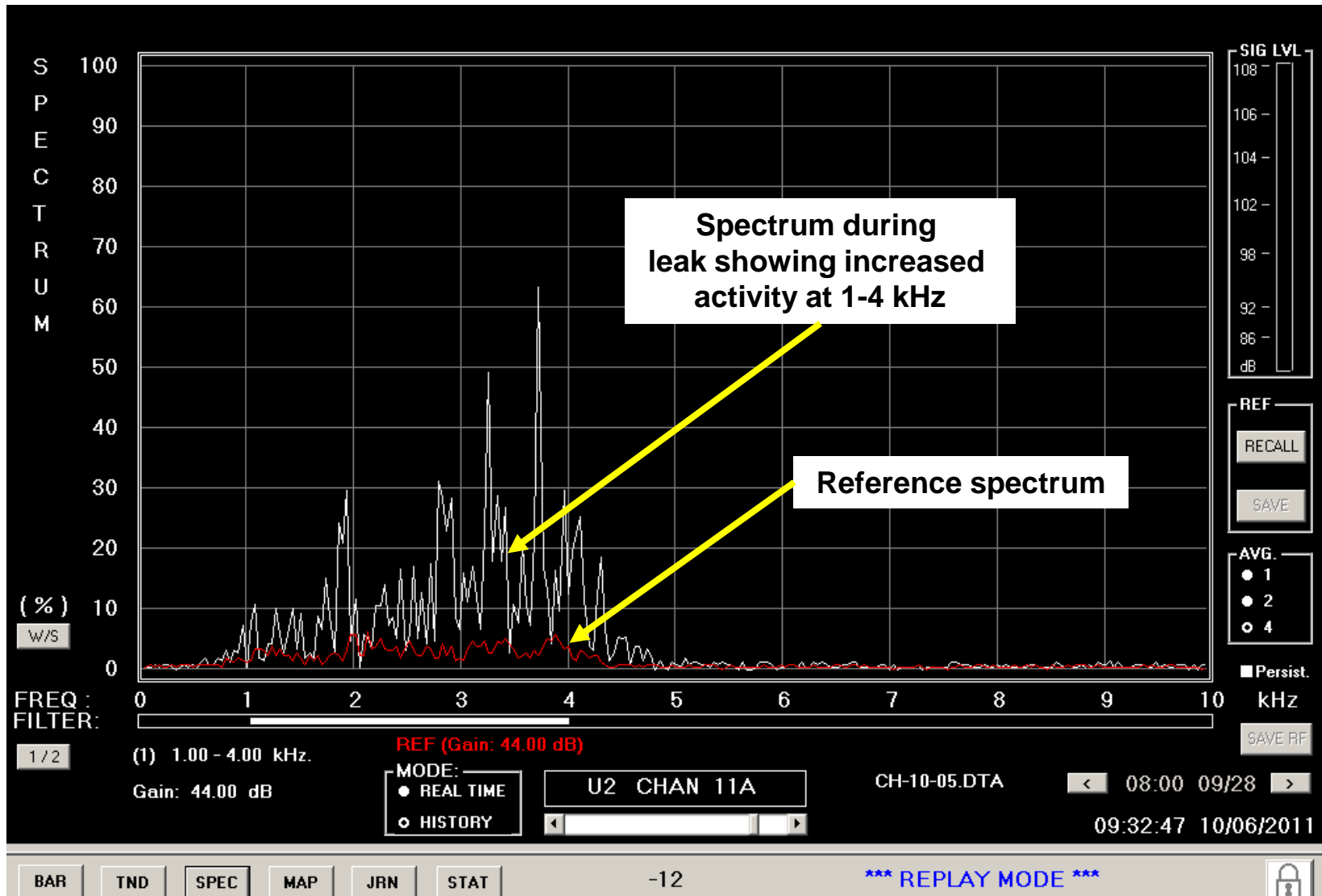
Heat Exchanger Leak



HRSRG Superheat Leak



HRSO Superheat Leak Spectrum



HRSG Superheat Leak

No other plant indications
of a leak





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Thank you!

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**One Source for
Asset Protection Solutions**