An Introduction to TROJAN DryOut Systems

TROJAN DRY-OUT SYSTEMS

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Who does Trojan Manufacture ?

- Trojan Dry Out Systems is for transformers **on line** removing following contaminants :

  - Dissolved moisture
  - Dissolved Gases
  - Particulate
  - Acidity

- Benefits: transformer safer to operate
  increase the life expectancy of the transformer.
  Save money on longer transformer life

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Trojan's Customers

- Customers include:

NIE (UIK)	TNB (Malaysia)	PAWA (Aust)
EDF (France)	PGCIL (India)	Barrick Gold (PNG)
Air Liquide	Transpower (NZ)	Ameren (USA)
Rio Tinto	Pacific Aluminium	ABB
Duke Energy	Hydro One (Canada)	GE
TVA (USA)	Ergon Energy (Aust)	PG&E (USA)
PacifiCorp	Powercor (Aust)	LCRA (USA)

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The role of insulation in a transformer

- **The cellulose insulation is the weakest link in a transformer.**
- **The life of the insulation determines the life of the transformer**
- **The higher the water content - the faster paper degrades** (looses mechanical strength)
- **Over 98% of the moisture in a transformer is contained in the insulation**

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Features of all Trojan Online Systems

- **Well proven safety features – excellent record**
- Automatic shutdown & isolation during Faults
- Remote Communication
- Water removal from oil and paper
- Acidity removal from oil (option)
- Most important is to reduce the water in the paper.
  98% of the moisture is in the paper

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Trojan Solutions offered

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Adsorbent
TDOS System

The TDOS is our most popular System

- Analysis, Vacuum Degassing & Water Removal Cycles
- Large capacity filters remove water to ≤ 2ppm
- Water removal filters automatically Re-Dried daily.
  Automatic filter regeneration (patented) 24-months filter life
- Possible to Acid scavenger optional module
- No effect on oil DGA during Analysis & Water Removal cycles
- Automated – PLC controlled - Minimal operator involvement required

TDOS Installations
USA – Australia - Malaysia

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TDOS Analysis 17 Days – Oil Saturation value is Most Important

Bottom Oil Temperature varies between 15C and 45C

Relative saturation varies by over a 25% - peaking at 68%. Recommended < 10%

Water in Oil ppm varies between 25ppm to 52ppm

Traditional oil sample can not identify real condition. (Needs to know the temperature of Tx during sampling)

Relative Saturation (RS) is the actual amount of water measured in the oil in relation to the solubility leve
temperature. If the water level goes above the saturation point, the water forms emulsion and begins to c

Pre Dry-Out Analysis - Water in cellulose 4.3%

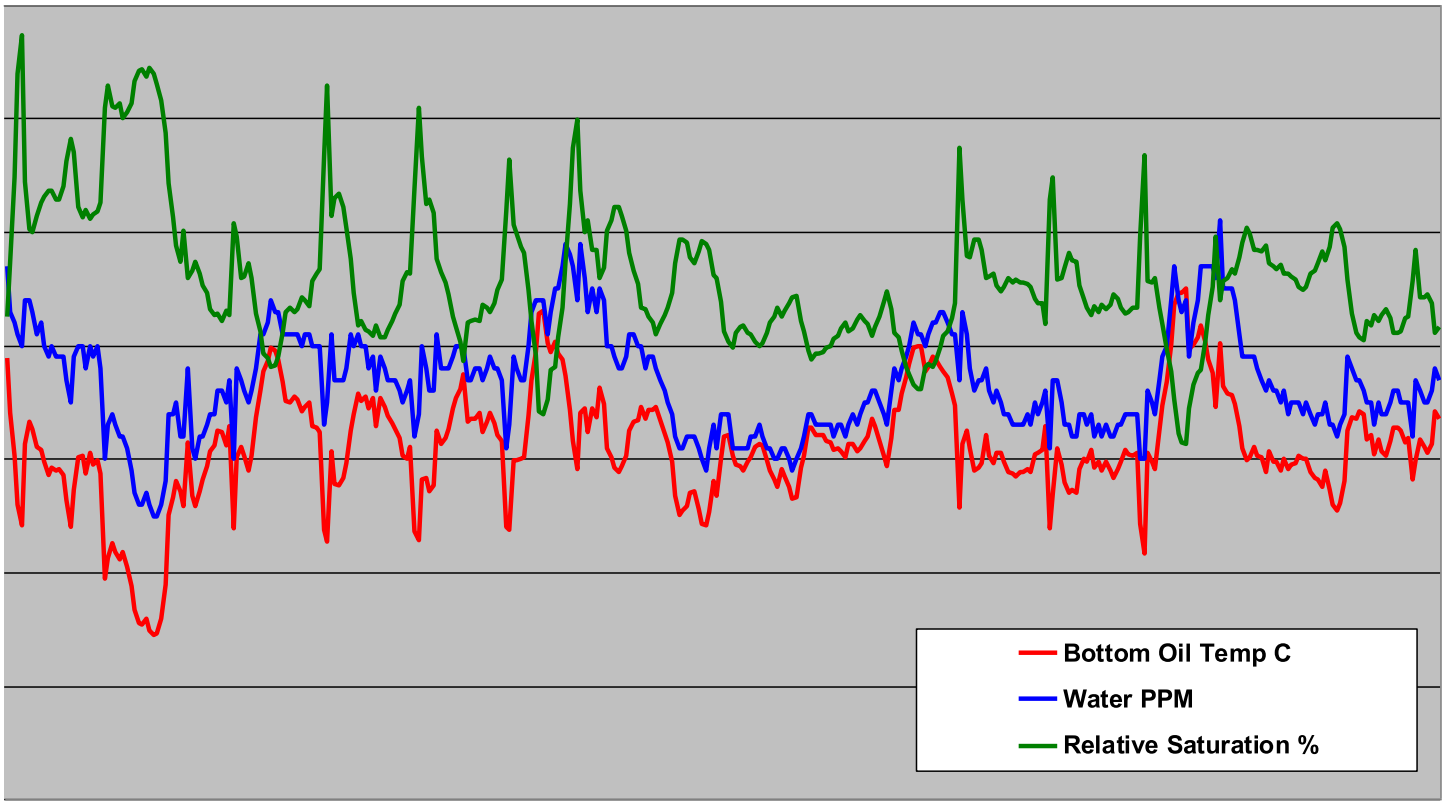


Table 1 – Water in Oil Solubility as a Functio

Oil Temperature	Water Content i
0°C	22
10°C	36
20°C	55
30°C	83
40°C	121
50°C	173
60°C	242
70°C	331
80°C	446
90°C	592
100°C	772

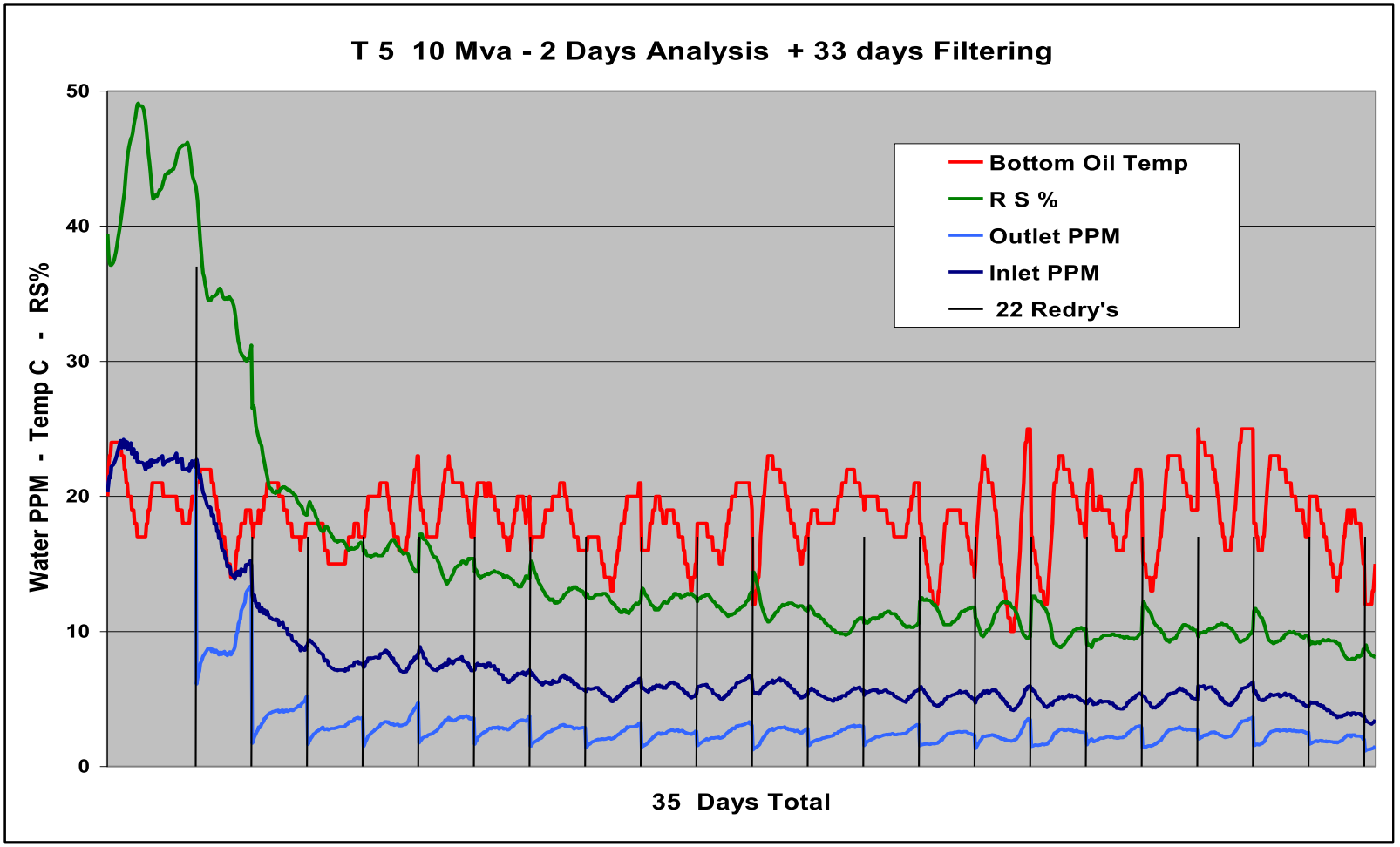
The max amount of water the oil
dissolved. More T = more water i

TDOS Analysis – Filtering & Auto Filter Re-Dry

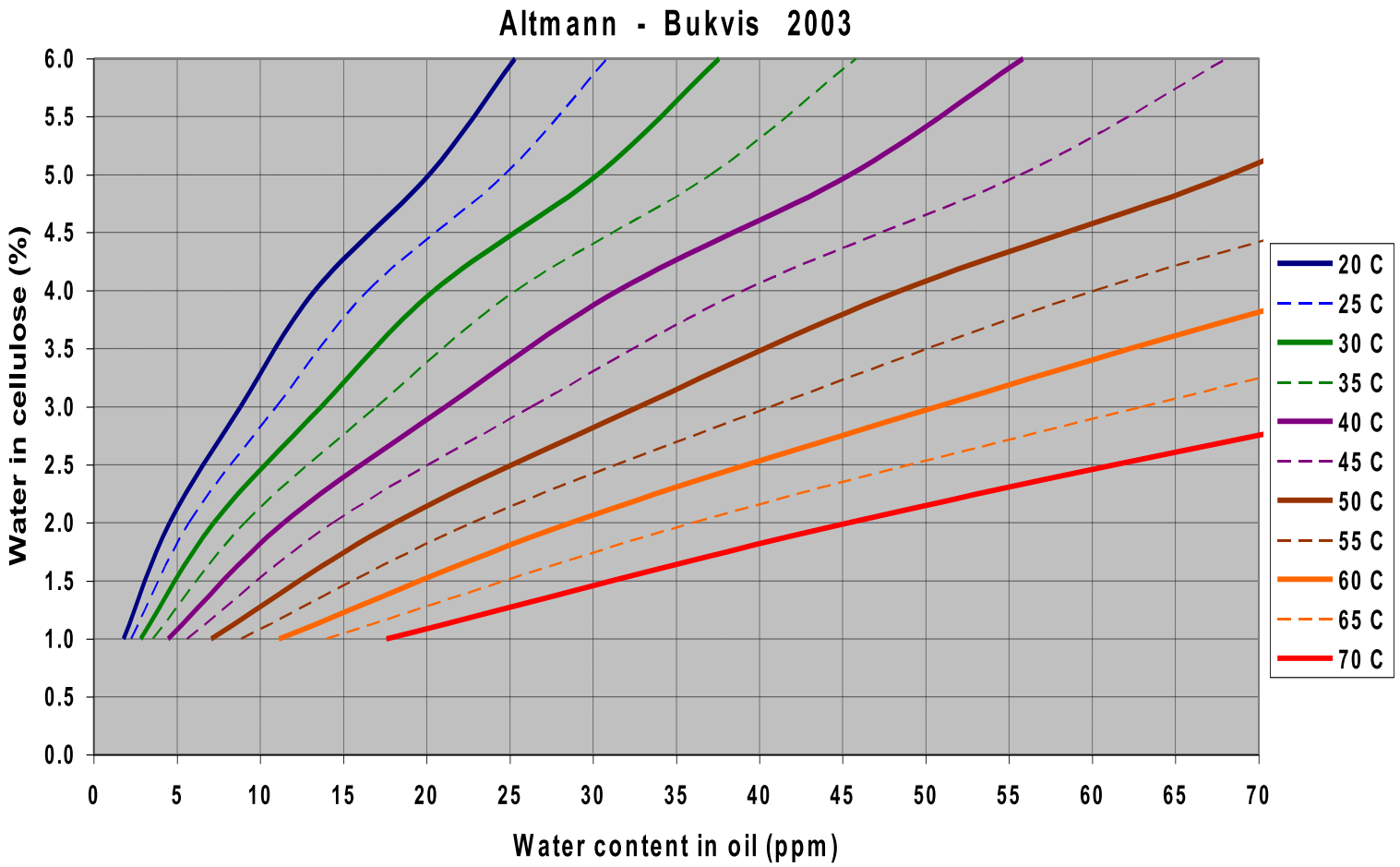
10 Mva Tx - Analysis for 2 days and Water Removal for 33 days

4.2 litres of water removed from Transformer

Vertical lines = Water Removal Filters automatically Dried Out



PPM Equilibrium curves (98% of moisture is in the cellulose)



On 80 °C cellulose self life is 40 years if water content is 1 %
10 years if water content is 3 %

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Recent Installation – AL, USA

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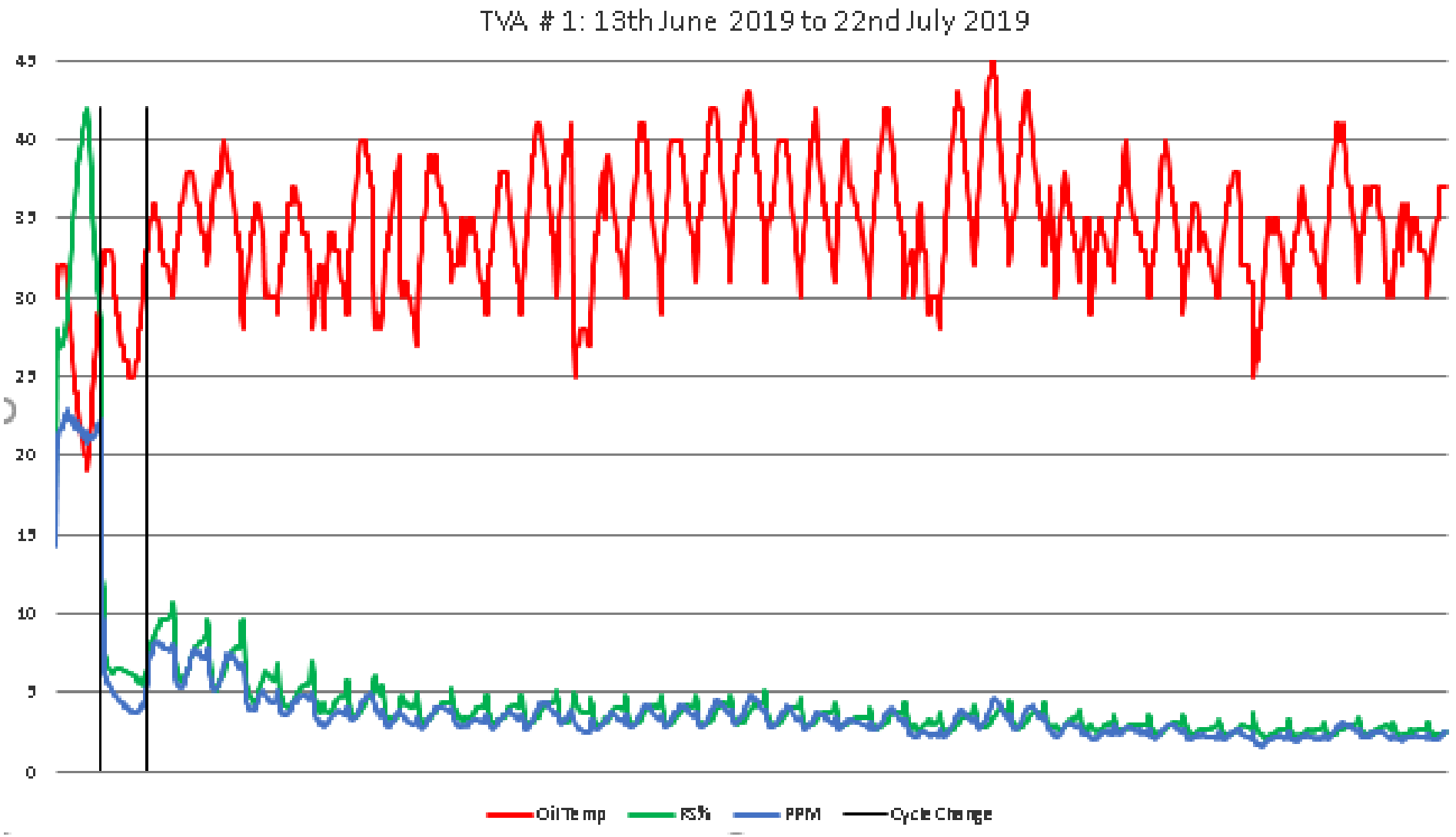
Recent Installation – AL, USA



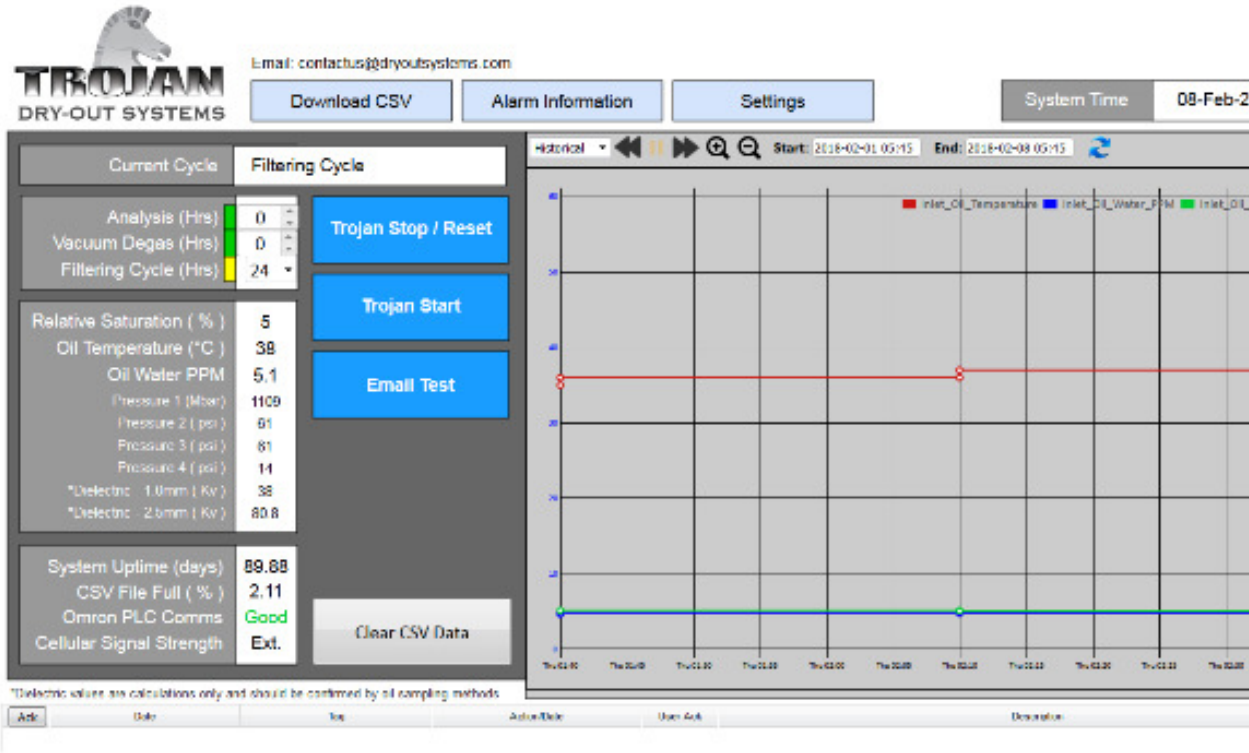
Water over 20 ppm

Water less 5 ppm

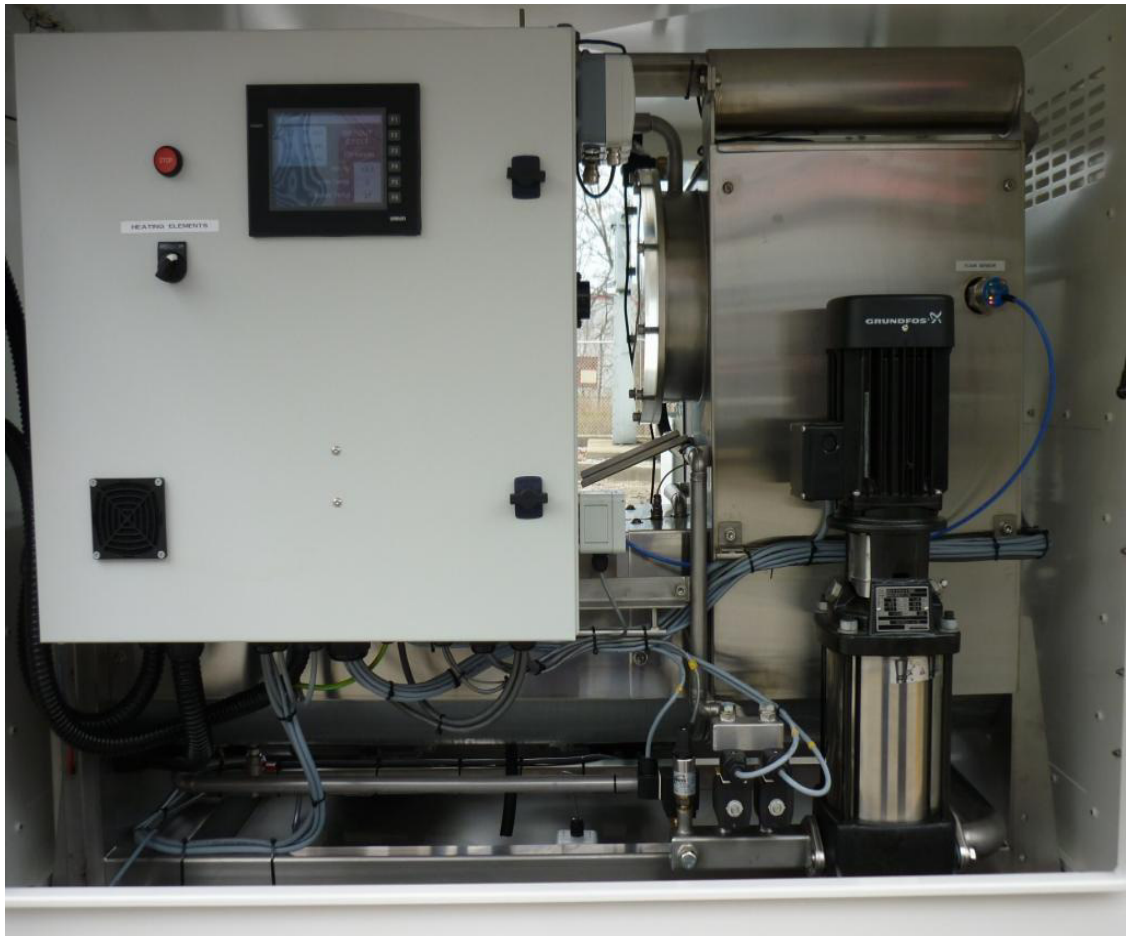
Web based Remote Communications

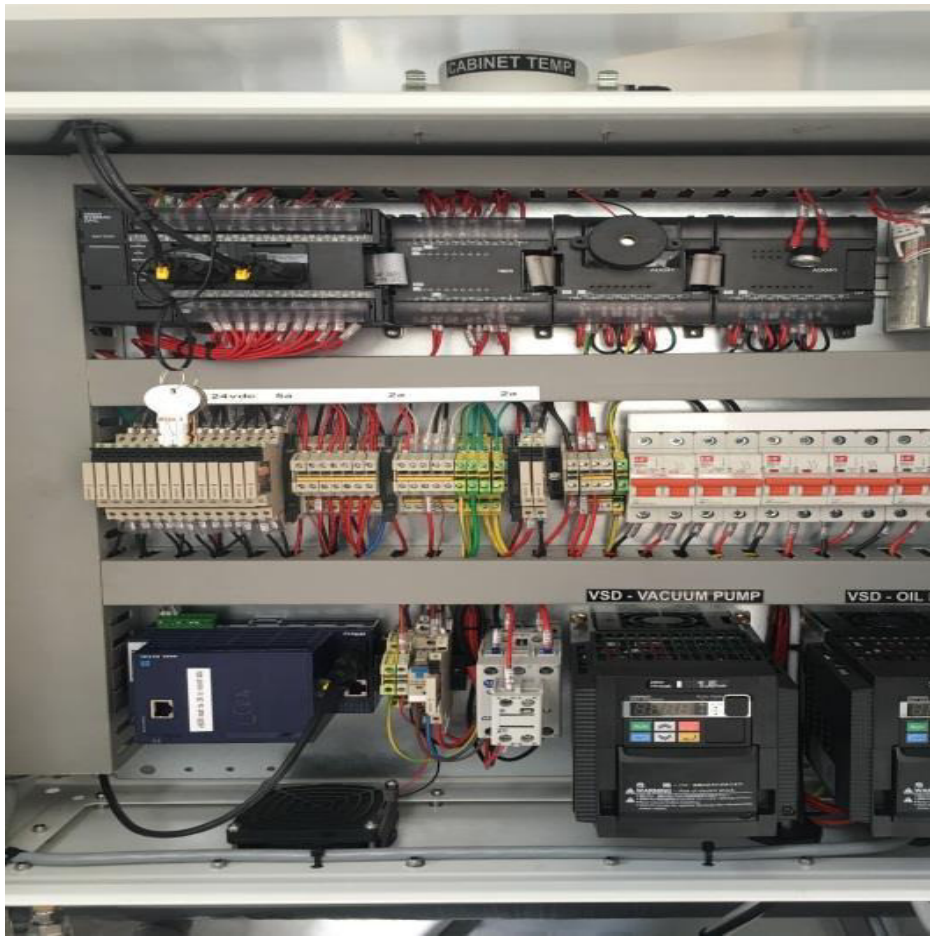
Connect via browser on smartphone; tablet; laptop; PC, to:

- Check on operating status and real time oil values
- Restart / Stop / Change Treatment Cycles
- Download the operating data
- Monitor real time



Trojan Dry Out Systems Ltd
High Quality - Reliable





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Portable – Compact - Low Cost Operation

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Examples of Use

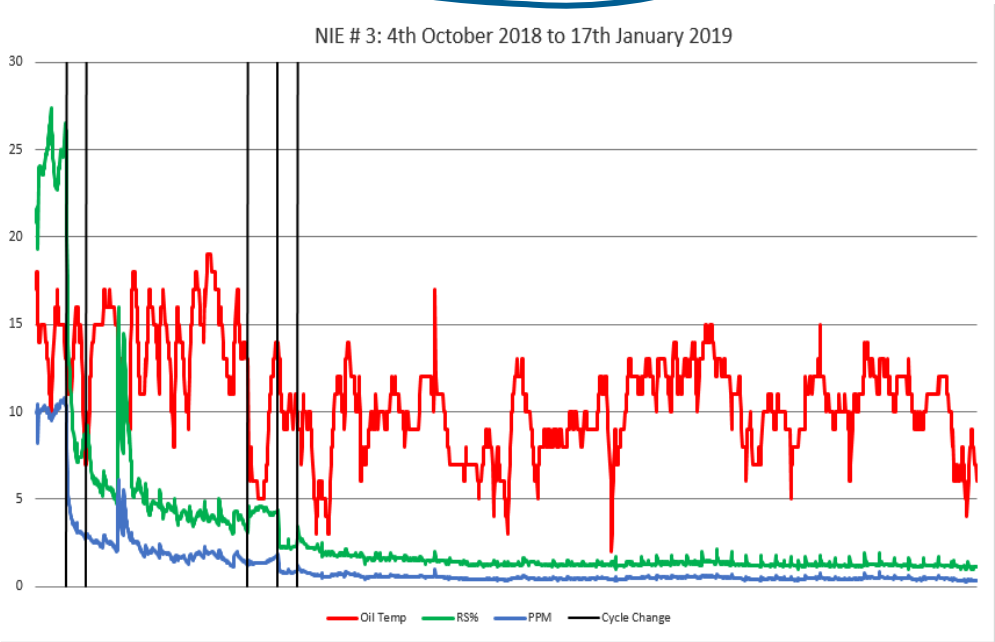
Tank Farms

Generation - confined space

Case Study # 7:
Systems: TDOS 1000 HV
Location: UK

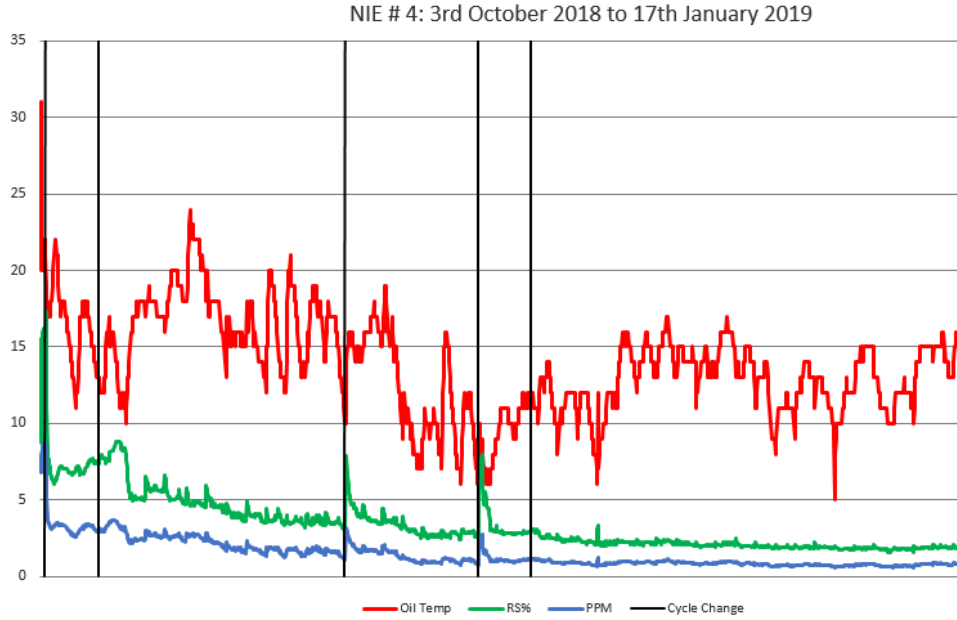
Started at 27% RS / 10 PPM

Now at 1.1% RS / 0.34 PPM



Started at 22% RS / 9 PPM

Now at 1.6% RS / 0.55 PPM



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