

TROUBLE SHOOTING STEAM TURBINE PHOSPHATE ESTER EHC SYSTEMS

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INTRODUCTION

This talk will focus on trouble shooting EHC fluid problems. Generally this means that the fluid is out of specification.

While fluid overheating can be a factor, the root cause is usually some aspect of the filtration and/or purification equipment.

GE TURBINES

GE large turbine systems have either 400 or 800 US gallon reservoirs with a TAFEFU (transfer and fullers earth filtration unit). This usually has two Hilliard media housings with either one or two cartridges. Usually with fullers earth or Selexsorb.

Each cartridge is about 6" (15 cm) OD and 18" (46 cm) long. This is the '718' size.

GE PURIFICATION



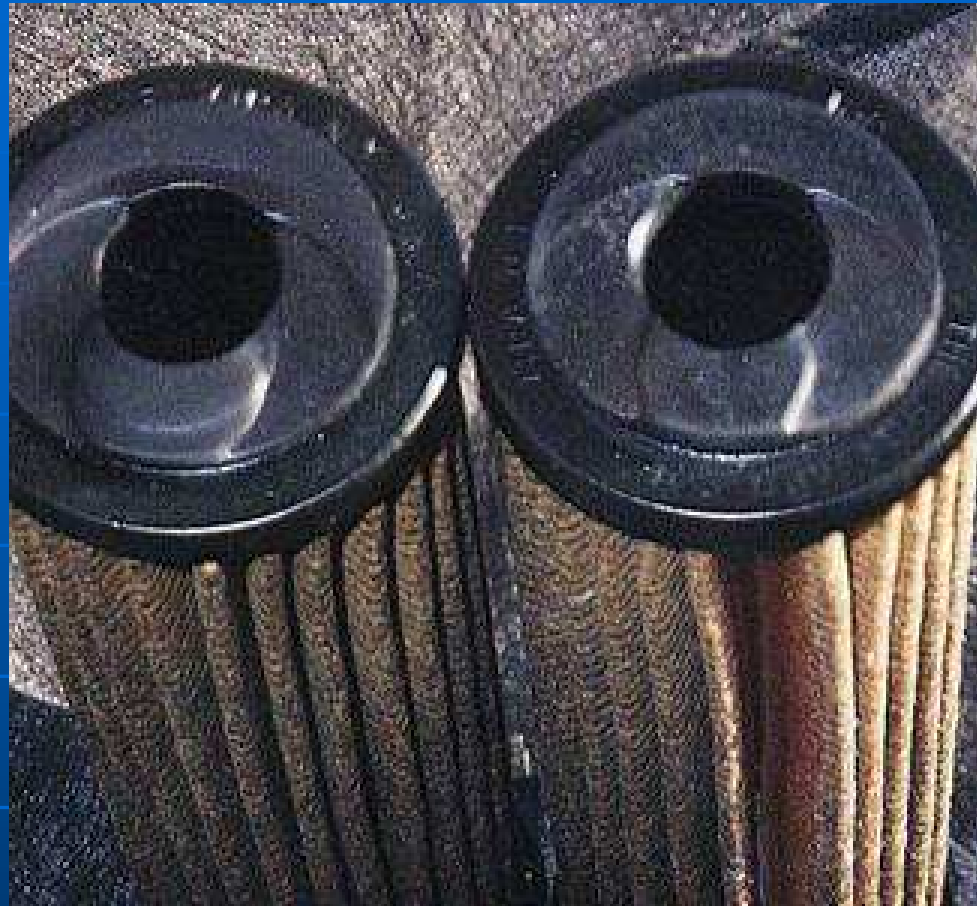
**One Cartridge High
'1' Gpm**



**VENT
VALVES**

**Two Cartridges High
'2' Gpm**

Note: Vent Housings After Installation



Post Media Filter Elements Showing Seal Patterns
From Misalignment - Use A 20" One

GEK-46355F (1990) page 49

Change all fullers earth filter elements together every **three** months **or** sooner **or** whenever one of the following is present:

The Δp reaches **30 psi** (207 kPa),

The chlorine content is **>100 ppm**,

The water content is **>0.20%**,

The acid number reaches **0.20 mgKOH/g**.



**GE Reservoir Internals - Examine For Level,
Foam And/Or Plunging Streams**

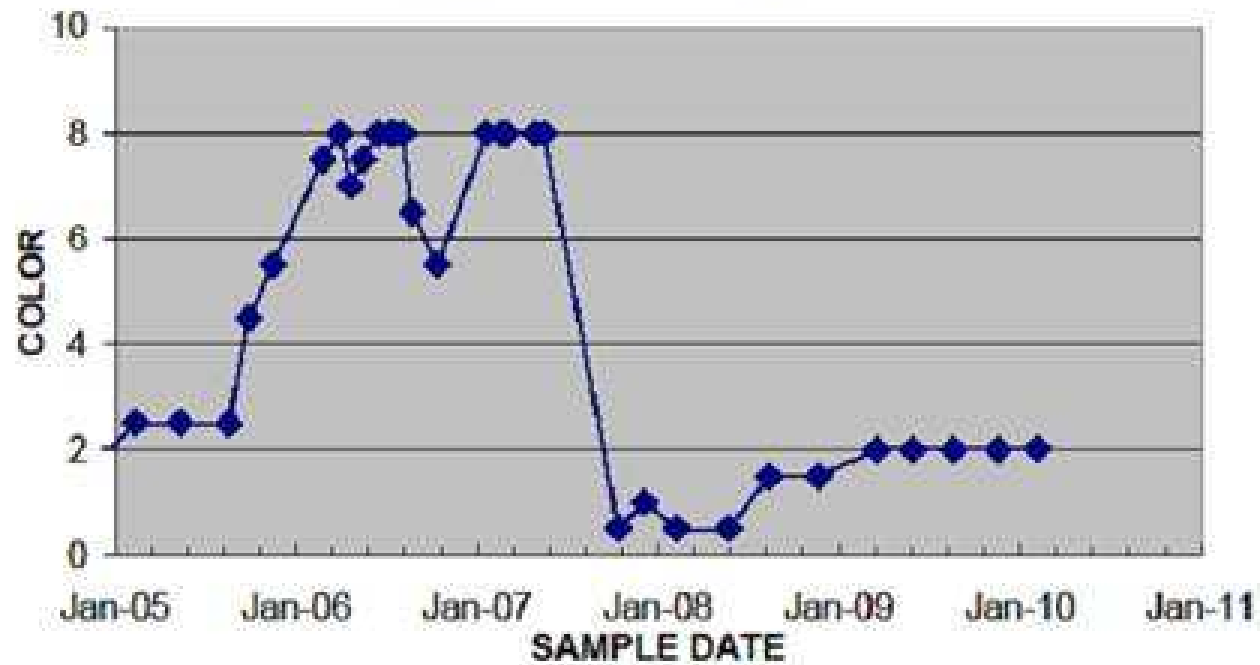


GE Newer Vertical HPU



TR-20 Condition System Suction

FLUID COLOR - CLEANED CONDITIONER SUCTION STRAINER



**Do Not Assume - Verify And Correct
Root Cause**



TR20 Conditioner Gauges

WESTINGHOUSE (SIEMENS)

The reservoir is smaller at 300 US gallons. The normal operating level is three quarters full. There are two 100% pumps mounted under the reservoir. These are now variable displacement piston types.

The purification system has two Nugent housings in series through which 1 gpm of fluid is 'now' continuously circulated. It used to be 'as required'.

The first housing takes a media cartridge followed by a 5 micron nominal 'cellulose' filter element.



Nugent Housings - Use The Right Pressure Gauges And Know The Correct Values

PURIFICATION MEDIA CHANGES

According to O&MM 120 the purification media is supposed to be changed when the pressure drop is **>30 psi** or when the purification media is no longer effective in maintaining operational limits. The limits include the chlorine content (<100 ppm), water content (<0.10%), acid number (<0.25 mg KOH/g), resistivity (>5.0 Gohm.cm) and particulate contamination (<SAE Class 2 or - ISO 14/12).

The maximum acidity was lowered to 0.2 mgKOH/g and the maximum pressure drop to **15 psi** in O&MM 120 Rev 1.



**Westinghouse Unit Showing New Pump Hoses -
What To Use & When To Change?**

FILTERS



**Showing Location Of The 10 Micron Metal
'Cuno' Pump Discharge Filters**



**Not Really Better - Plugged 3 Micron
Fiberglass Pump Discharge Elements**



**Reservoir Return Piping
Westinghouse - Good Return Pipe Depth But
Possibly A Low Level At One Time**

ABB (ALSTOM)

Most users with the larger ABB steam turbines had fluid **darkening**, rising acid numbers, foaming and deposits but apparently not significant operational problems.

The systems can contain up to 17,000 litres (4,500 gallons). The reservoirs also have a vapor extraction fan that is not common on phosphate ester control systems.

MEDIA



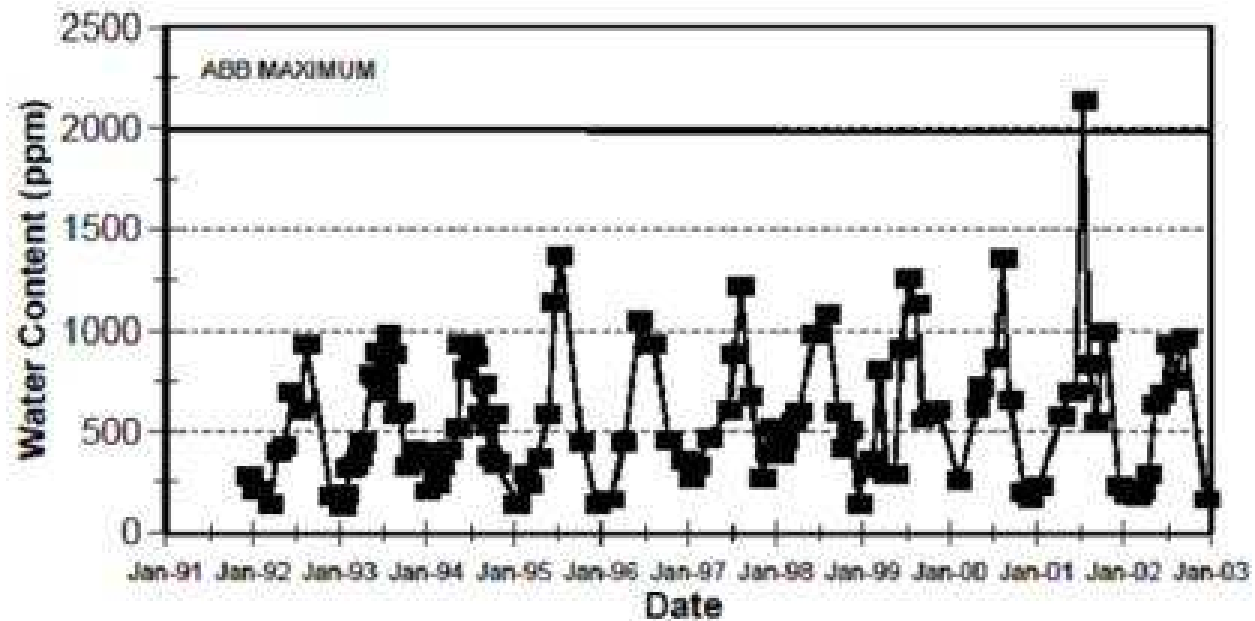
FILTER

Taller Housing Takes Bulk Media. The Shorter Filter Has 7 Filter Elements - Note No Pressure Gauge On Filter Housing



**ABB Reservoir Top -
Showing a PRV and the Vapor Extraction Fan**

UNIT 1 - WATER

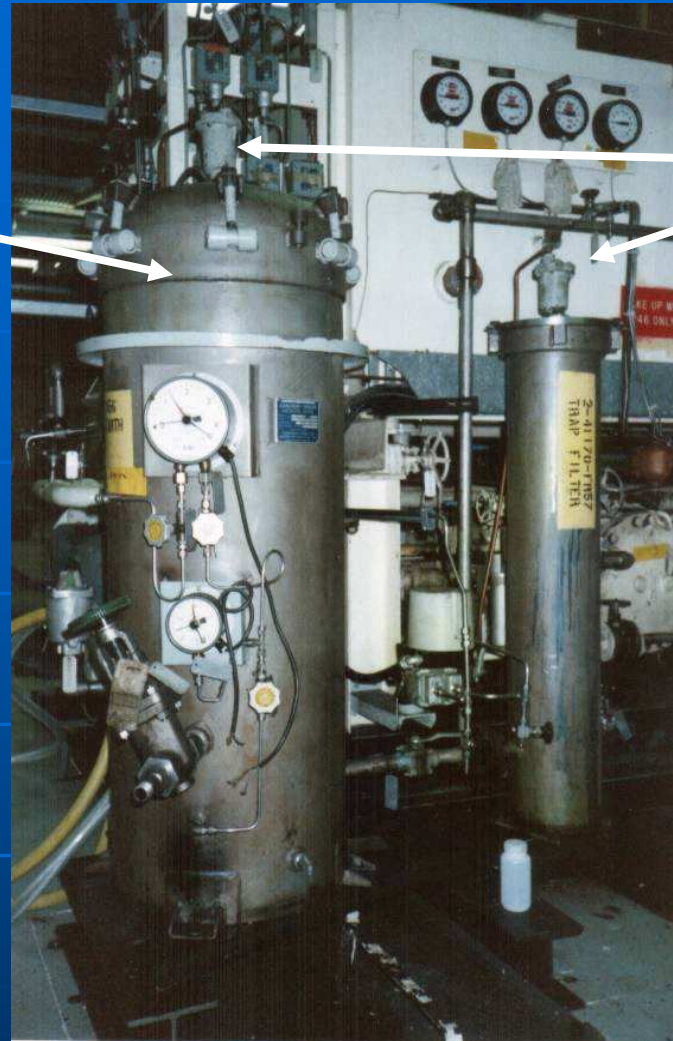


Normal Seasonal Variations
Need Regular Samples



**Material Compatibility - No Buna N but Viton,
EPR, Nylon or PTFE**

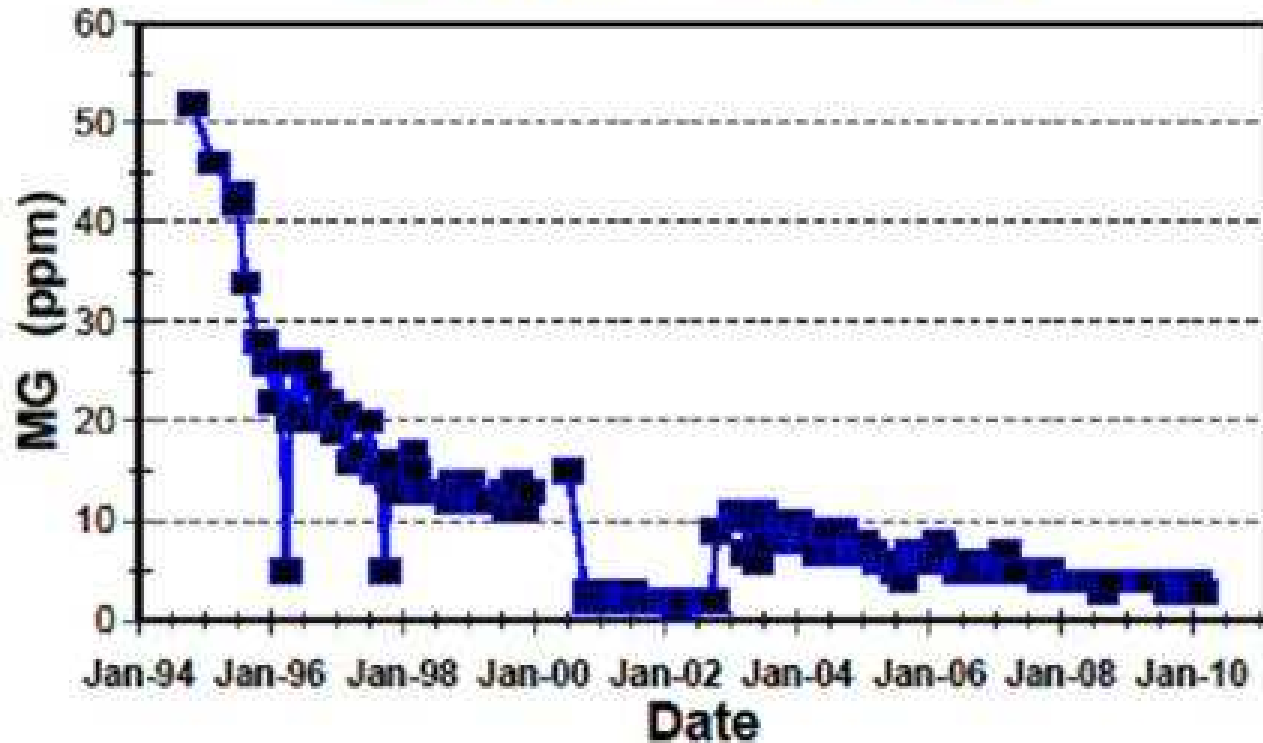
MEDIA



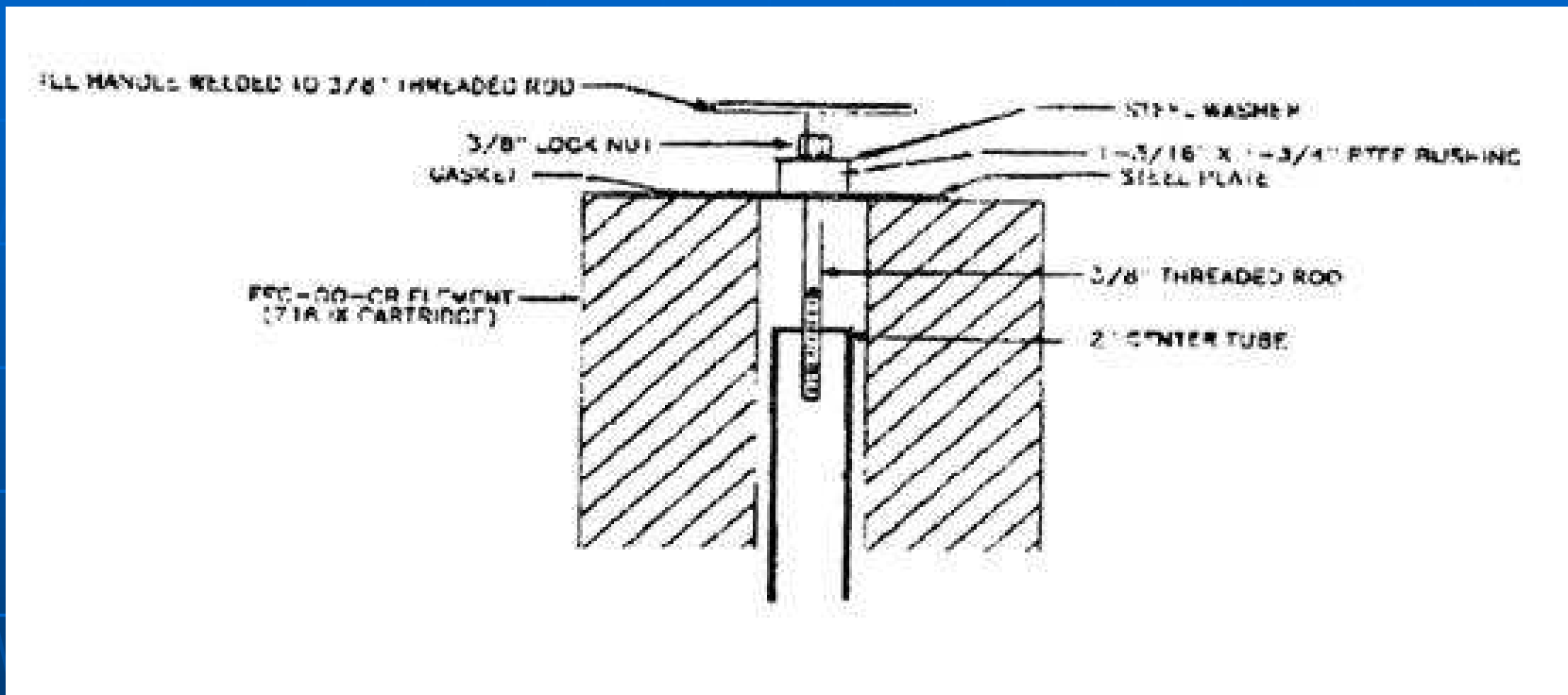
AIR RELEASE
VALVES

**NEIP Fullers Earth Housing (8 Cartridges) On
The Left And Trap Filter On The Right**

MAGNESIUM CONTENT ONE ADVANTAGE OF ION EXCHANGE



Using IX Cartridges Instead Of Fullers Earth



HILCO Housing Hold Down 'T' Handle



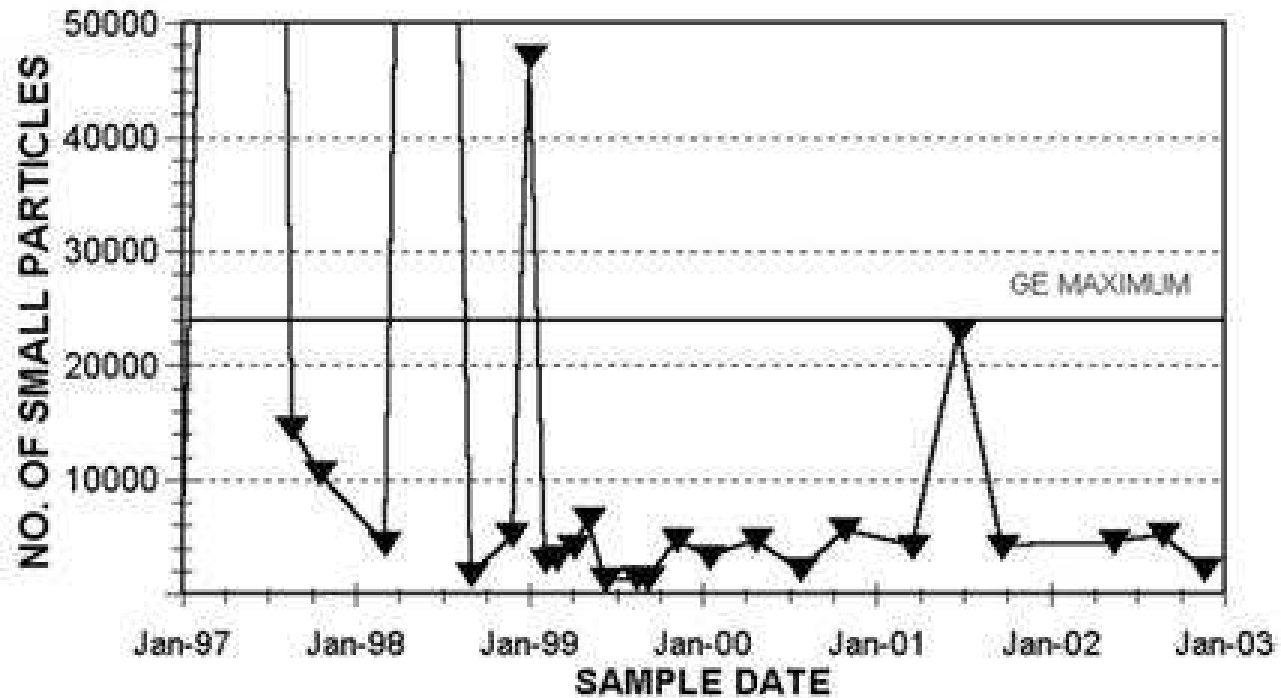
**New Fluid Filtration - Do Operators Really Know
What The Red Pin Means?**

ROOT CAUSES

Fluid maintenance problems can usually be traced back to one or more of the following;

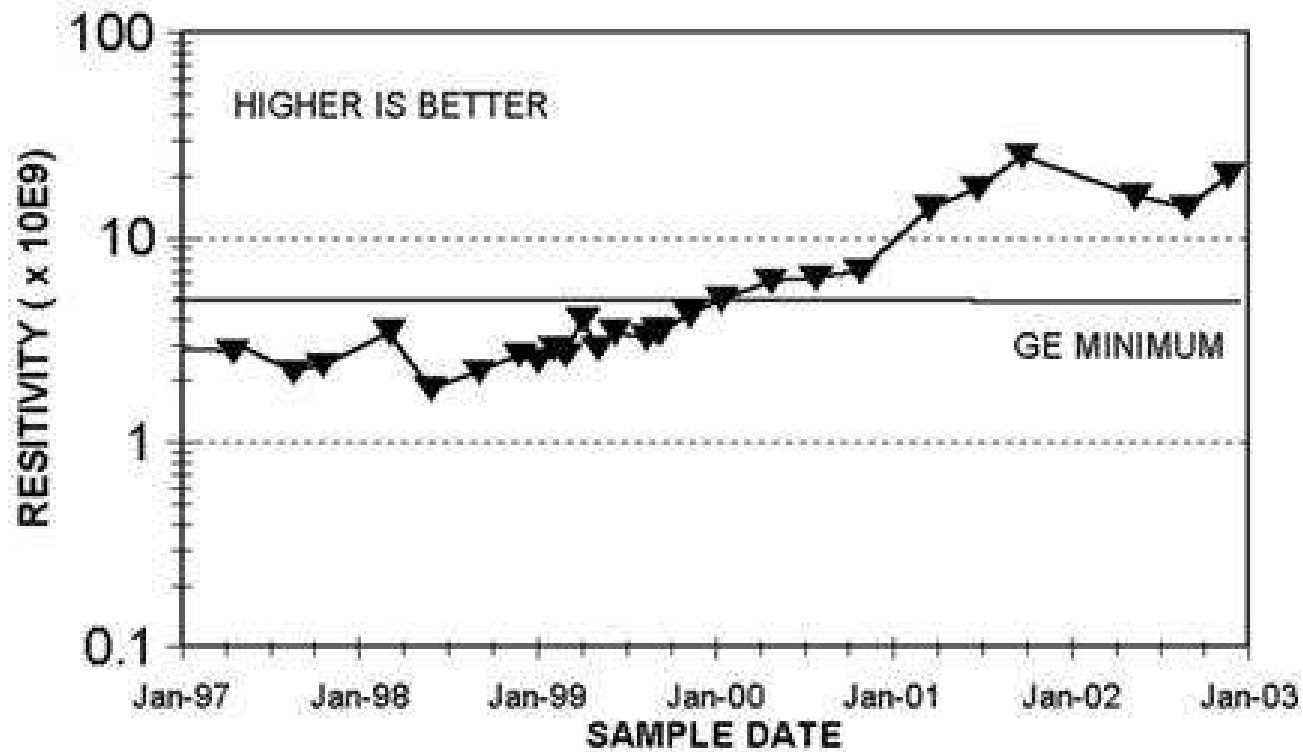
1. Purification media left in too long.
2. Fluid is being overstressed.
3. Defective valves, settings or procedures.
4. Purification flowrate is wrong.
5. Media stored wrong, too wet or too dry.
6. Purification housings are air bound.
7. The wrong purification media.
8. The wrong fluid is being used.

UNIT 5



Particle Counts - Know Who Took The Sample And How

UNIT 5



Resistivity - Slowly Getting Better

TAKING ACTION - ONE STATION

- 1.** Dried fuller earth cartridges.
- 2.** Used a better 20" trap filter.
- 3.** Added reservoir dry air purge.
- 4.** Did FE changes every three months.
- 5.** 'Caked' new FE then changed trap filter.
- 6.** Reduced TAFEFU flowrate to 1 gpm.
- 7.** Added a TAFEFU flow gauge.
- 8.** Installed proper housing pressure gauges.
- 9.** Raised fluid temperature.
- 10.** Returned to true '718' FE cartridges.
- 11.** Improved sampling procedures.
- 12.** Used clean sample bottles (free).

PREVENTING FLUID PROBLEMS

1. Change the purification media **long** before the fluid gets out of specification.
2. Have **current** documentation.
3. Have working and proper housing pressure **gauges**.
4. Verify compliance and status with walk-downs, stores withdrawals, operator logs and good fluid **samples**.
5. Examine **used** parts and get overhaul reports for valves, pumps and servovalves.

SUMMARY

In **most** cases the reason that the fluid has gone out of specification is that the fluid maintenance has changed.

It can be activity related re when, what or how it was done but also improper , substitution, `incompatibility, component degradation, sampling, testing, and/or other.

To determine what has to be done, it is first necessary to determine what has or has not been done to cause the problem.

ACTIONS

On a mature unit or one that historically not had fluid issues, determine what has changed. Base decisions on facts not what the computer says or what was thought.

On a new unit or one that has had problems for years, do not assume it was designed correctly or installed properly. Try to bench mark with a sister unit.

TRAINING

Few EHC system engineers are being given any real training on the details of their systems and more importantly on what is normal for the fluid.

While the manuals and files might be somewhere who has time to look? Plus you are now supposed to be able to take care of it because you are in that seat.

But a lot of help is available.

SELF TRAINING

Try to walk the system and to visit the package every week looking for leaks, take pressure readings, look at the drum storage and maintenance activities. Take digital photos.

Try to witness filter changes and sampling. Ensure that the right fluid tests are being done and done when required.

During outage look inside reservoirs

Stay in touch with sister stations as well as with your fluid and filter suppliers.

CONCLUSIONS

1. With simple but effective improvements it is usually possible to restore the fluid to specification without costly add-on equipment or outages.
2. Changes should be based on fact. Verify actual practices and check claims by others.

CONCLUSIONS

3. Effective fluid maintenance requires a champion to coordinate efforts and to keep the efforts going but resolution requires the active support of a number of different work groups.

4. The cause of the fluid 'problems' can be for more than one reason.

Thank You