IAS Resolves Bacterial and Biological Contamination in Steam Turbine Lube Oil Reservoir and Related Systems

The Situation

An evaluation of the current charge of turbine oil revealed the following issues:

- RPVOT result is below 25% of new lube value
- RULER result shows low antioxidants; phenols are depleted and amines are below 50%
- Insoluble contamination is elevated
- Rust Prevention test failed
- ISO Particle Cleanliness is above the maximum recommended cleanliness of 18/16/13
- Water content is elevated; showing 1.1% water
- Elemental analysis reveals Calcium, which is not typical in turbine oils of this type
- Bacteria test revealed moderate to significant bacteria growth

Foreign Contaminants Found in Reservoir

The Solution

The bacteria and water is the cause of short service life on the system filters and bacteria has most likely spread throughout the entire lubrication system. The biological growth must be removed from the lubrication system prior to the installation of new turbine oil.

IAS will provide a turnkey service to make the system suitable for a new charge of turbine oil.

Bacteria, Water and Sludge Found in Reservoir

Project Objectives

- To complete a 100% safe project
- To decontaminate the entire lube oil and hydraulic oil system of biological growth
- To manually decontaminate the oil reservoir and drain all system low point
- To achieve the target ISO Cleanliness Code for new turbine oil

Benefits

⇒ Zero safety and environmental incident
⇒ Reliable start-up for extended operation
⇒ Extend equipment life
⇒ Ensure fluid and system cleanliness
⇒ Minimize future maintenance and repair costs
⇒ Achieving 100% customer satisfaction

IAS WORKS SAFELY

IAS worked 347.25 man-hours without any safety incidents, near misses or accidents. IAS continues to be the leader in safety training and project safety awareness.

Industrial Action Services, Inc.
12713 U.S. Hwy 69 South
Huntington, Texas 75949
800-536-9511

SYNCHRONIZING RELIABILITY WITH PRODUCTION

IAS
INDUSTRIAL ACTION SERVICES, INC.

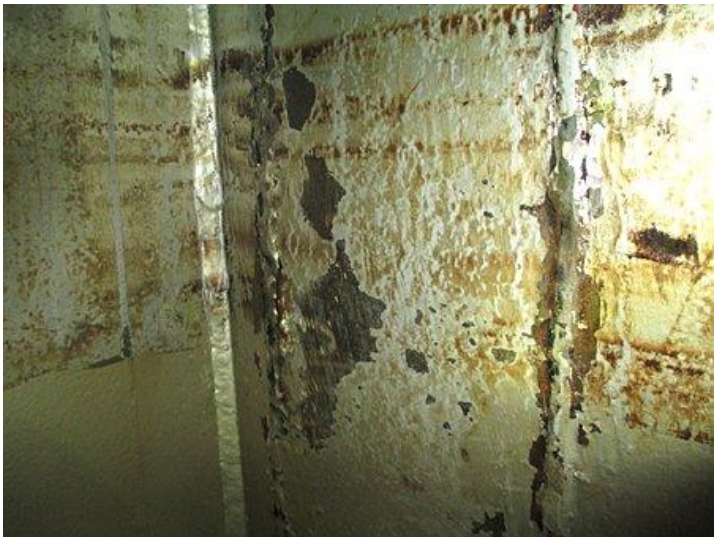
PROJECT SCOPE

- Mobilization, safety training, LOTO and equipment set up
- Disposal company will pump out oil, IAS to assist
- Decontaminate reservoir
- Drain low points into customer-supplied drums: 2 pedestals and 2 generator bearing housings on turbine deck, filter housings and conditioning skid
- Filter in 2,500 gallons of Mobil purge oil and biocide
- Energize reservoir heater and engage system pumps while IAS does kidney loop on reservoir for 72 hours
- Pump out oil for disposal; IAS to assist company contractor
- Decontaminate Reservoir – final wipe down
- IAS to filter in new Mobil DTE 732
- Engage system pumps, Kidney loop reservoir for final particle count

LUBE OIL RESERVOIR DECONTAMINATION

Reservoir sludge removal before cleaning

Reservoir Floor After Cleaning

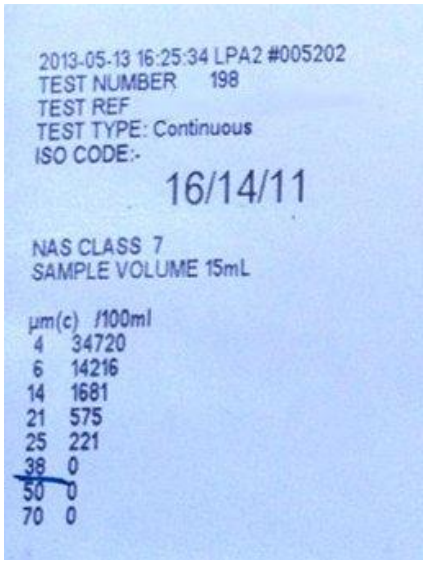


Reservoir walls before cleaning

Reservoir walls after cleaning

Fluid Purification

The final fill of Mobil DTE 732 was purified from the delivery truck into the reservoir with IAS's Fluid Purification Unit's Micro Filtration Process. Once the oil was in the reservoir, the customer engaged the system pumps and circulated the oil throughout the lube oil system while IAS performed a side stream filtration. The following results were achieved in this process and confirmed with the MP Filtri Dual Laser Particle Counter.



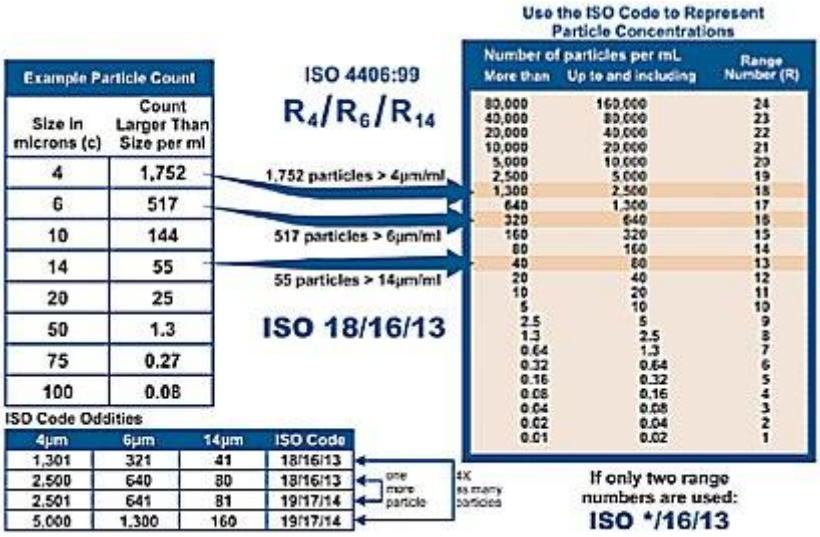
2013-05-13 16:25:34 LPA2 #005202
TEST NUMBER 198
TEST REF
TEST TYPE: Continuous
ISO CODE:-

16/14/11

NAS CLASS 7
SAMPLE VOLUME 15mL

µm(c)	/100ml
4	34720
6	14216
14	1681
21	575
25	221
38	0
50	0
70	0

Final Particle Count



Use the ISO Code to Represent Particle Concentrations

Example Particle Count	
Size in microns (c)	Count Larger Than Size per ml
4	1,752
6	517
10	144
14	55
20	25
50	1.3
75	0.27
100	0.08

ISO 4406:99
$R_4/R_6/R_{14}$

1,752 particles > 4µm/ml
517 particles > 6µm/ml
55 particles > 14µm/ml

ISO 18/16/13

Number of particles per mL More than	Up to and including	Range Number (R)
80,000	160,000	24
40,000	80,000	23
20,000	40,000	22
10,000	20,000	21
5,000	10,000	20
2,500	5,000	19
1,300	2,500	18
640	1,300	17
320	640	16
160	320	15
80	160	14
40	80	13
20	40	12
10	20	11
5	10	10
2.5	5	9
1.3	2.5	8
0.64	1.3	7
0.32	0.64	6
0.16	0.32	5
0.08	0.16	4
0.04	0.08	3
0.02	0.04	2
0.01	0.02	1

ISO Code Oddities

4µm	6µm	14µm	ISO Code
1,301	321	41	18/16/13
2,500	640	80	18/16/13
2,501	641	81	19/17/14
5,000	1,300	160	19/17/14

one more particle
4X as many particles

If only two range numbers are used:
ISO */16/13

Conclusion

Customer's personnel were informed during the entire project by IAS Project Manager via meetings and Work Order Service Receipts. The reservoir was completely reinstated, the two bearing housings cleaned by IAS were deemed satisfactory and the new turbine oil surpassed the customer's cleanliness specification.

Recommendation

IAS recommends performing a High Velocity Chemical Cleaning during the next planned outage to remove the rust in the lube oil system and reservoir. This process will remove rust, scale, corrosion, varnish and other organic and/or inorganic contamination. This service is always followed by a High Velocity Oil Flush.