Filter Debris Analysis

Report Key

Machine Status.
Normal
Marginal
Critical

Customer Information. Background information on the machine, lube, and filter. Vital information for accurate analysis of data.

Observations. Detailed comments on the overall results of the analysis.

XRF Data Table. Results of analysis are presented showing % of each element on patch and the corresponding mass. Limits are statistically derived trend and level parameters that signal various stages of failure progression. Rate is the mass divided by filter hours.

XRF Data. Graphical depiction of the elemental mass of the analytes.

MetalSCAN Data. Table of ferrous debris counts in 2 size ranges. Limits are statistically derived.

Micropatch. Visual of debris patch analyzed by XRF. Thickness is estimate of debris thickness in ug/cm^2.

INSIGHT SERVICES
Tel: 261-251-2510, Fax: 216-251-2515

Machine Condition: **MARGINAL**
#1 Gas Turbine

FILTER DEBRIS ANALYSIS

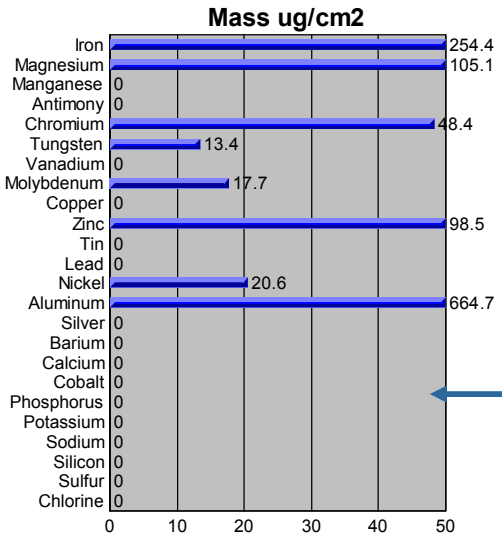
GASTOPS

Lube Type:	MOBIL JET OIL II	**Received:**	3/5/2009 12:00:00AM	**ATTN:**	**Jack Boilerman**
Machine MFG:	OEM	**Report:**	2/7/2009 12:00:00AM		Great Lakes Generation
Machine MOD:	Aero-Deriv GT	**Sample No:**	19 - 1 - 1000 - 1		1643 Fastcatte Rd
MachineType:	Aero/Aircraft Turbine	**Analyst:**	MM		McMacken, IN 60543
Filter MFG:	OEM Unknown	**Filter Loc:**	Lower Filter		
Filtration:	10 mic	**Flow:**	Canister		
Installed:	Feb 5 2008	**Removed:**	Feb 7 2008	**Days On Filter:**	2

Observations / Recommendations:
The current analysis detected an abnormal wear progression. Please Inspect and repair immediately. Several elements are significantly over their recommended limits. In addition, the ferrous counts on the Metalscan exceed their limits. The primary elements detected are aluminum and iron. It is likely that the wear debris may be due to failure causing damage to the aluminum housing.

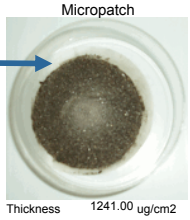
1 EDXRF Elements

	Limit	Rate	%	Mass
Iron		127.2	20.5	254.4
Magnesium		52.6	8.5	105.1
Manganese				
Antimony				
Chromium	4.0	24.2	3.9	48.4
Tungsten	17.7	6.7	1.1	13.4
Vanadium	76.6			
Molybdenum		8.9	1.4	17.7
Copper				
Zinc	52.9	49.3	7.9	98.5
Tin	647.3			
Lead				
Nickel		10.3	1.7	20.6
Aluminum	58.9	332.4	53.6	664.7
Silver	28.5			
Barium				
Calcium				
Cobalt				
Phosphorus				
Potassium				
Sodium	4.0			
Silicon				
Sulfur	14.7			
Chlorine				



2 MetalSCAN Debris

Micropatch



Thickness 1241.00 ug/cm2

Size Range	125-250 um SML	>250 um LRG	Total
Ferrous Count	300	50	350
Ferrous Count Limit	270	30	300

Great Lakes Generation assumes sole responsibility for the application of and reliance upon results and recommendations reported by Insight Services, whose obligation is limited to good faith performance.

Page 1 of 1 Insight Services - 20338 Progress Drive - Cleveland, OH 44149 Lab No.399023

1 **EDXRF:** Energy dispersive x-ray spectroscopy involves analyzing captured particles removed from the filter for their constituent chemical elements while eliminating any interference from the oil. While similar to ICP spectroscopy, the XRF excites the atoms with a blast of x-rays. Each element produces x-rays at a unique set of energies, allowing one to non-destructively measure the elemental composition of a sample. The emitted light in the form of x-rays matches the mass of the chemical element.

2 **MetalSCAN Debris:** MetalSCAN is a full-flow, on-line oil debris monitoring system which detects virtually 100 per cent of ferromagnetic wear metal particles. As used in FDA, the solvent with all the wear debris washed from the filter passes through the MetalSCAN sensor and all particles are sized by their metallurgy.