



IAS VARNISH AND CONTAMINATION REMOVAL PROCESS TECHNOLOGY DESIGNED TO INSURE A RELIABLE START UP AFTER MAINTENANCE OR COMMISSIONING PROJECTS

The IAS process specifically addresses the existing off-specification nature of system internals, system fluid and significant gels, varnish and other similar fluid degradation caused contamination. Based on vast amounts of experience with various systems under an assortment of service conditions, coupled with reports and interviews with customer and industry reliability professionals, the following issues are expected to be encountered in many fluid systems and the root cause problems will be corrected with during the IAS decontamination process.

The IAS process ensures the complete removal of system contamination such as: varnish, gels, suspended solid contamination, moisture contamination and other forms of fluid degradation which results in filter plugging, oil mist eliminator coating and failures, mechanical failures associated with contamination build-up within the system, lack of lubrication and fluid transfer properties, additive precipitation, etc. Moreover, IAS further makes sure that the existing fluid is purified back to within the physical, chemical and cleanliness specification(s) for the equipment and the fluid, which includes all OEM guidelines, plant guidelines, industry standards, etc.

Additionally, the IAS process delivers the same decontamination results on all "asset-associated" / auxiliary equipment such a filter housings, accessible oil mist elimination systems, oil coolers, etc. to ensure the asset's entire reliability is assured. Another important benefit is that the existing fluid will be purified, scrubbed free of contamination through proprietary purification processes, up to and including, the IAS Tri-Blend D.O.A. Electro-Physical Separation Process, Electro-Magnetic Charged Particle Agglomeration, Hi-Speed Electrostatic Precipitation, Sub-Micron and Nano mechanical filtration, Fractional Vacuum Distillation to remove moisture and gaseous contamination and rendered fit for continued use...which includes a guarantee backed by on-site real-time and off-site independent laboratory analysis fit for continued use. This avoids the cost of replacement fluid and negates the costs associated with fluid disposal.

The IAS process delivers the following benefits:

- **Ensured system cleanliness**
- **Ensured fluid cleanliness**
- **Extended equipment life**
- **Reliable equipment start-up / extended operation**

The IAS process is the most reliable, economical and safe way to remove unwanted contamination from fluids which are degraded or degrading and simultaneously eradicates system contamination which has fouled the fluid system and can and /or will cause mechanical shortcomings.

WHY CHOOSE IAS?

Don't Wait Until Catastrophe Strikes?

***Prevent The Chain Reaction Of Wear!
Eliminate Sludge & Varnish Build-up!***

IAS can save your plant millions in forced outages. Whether triggered by new equipment installation, sudden failure, or gradual contamination build-up, IAS provides the turnkey services necessary to manage, monitor and advance all phases of your plant's equipment reliability objectives.

Ensure A Reliable Start-Up...Flush And Decontaminate Your Equipment After:

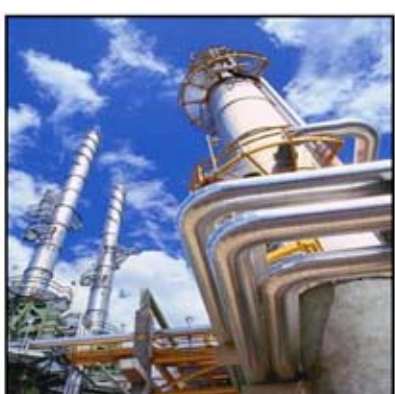
- New Installations
- Sudden Failures
- Gradual Contamination Build-Up
- Scheduled Outages & Plant Turnarounds

In today's world of sophisticated equipment and OEM warranties, rely on IAS to ensure that your equipment and its fluid systems are operating within specification.

- Turn-Key Service – Minimal Support Required
- Fast, On-Time Completion
- Exceed OEM / Industry Requirements
- Real-Time Analysis And Reporting Included
- 24/7 Management By Trained & Certified Technicians
- Extensive Personnel & Equipment Resources

The IAS process utilizes the latest technologies and equipment to complete your project on time and on budget.

- Auxiliary "Jumper" Hoses & Piping Provided
- Pipe-Fitting Included – Turn-Key
- High-Velocity Flow – Reynolds Numbers >25,000
- Full-Flow Sub-Micron Filtration
- Minimal Project Footprint
- Procedure-Based Operations
- Chemical Cleaning Capabilities
- Real-Time, Laser Particle Counting
- Engineered Process Units
- Supplemental Vacuum Dehydration
- Confined-Space Reservoir Decontamination
- Self-Powered Options – No Electrical Support Required
- Emergency Response – 24/7





LABORATORY FLUID ANALYSIS REPORT 1/7/2009 **Normal**

Company Name: **Texas Refining Corporation** Asset Location: **F21 Unit (FCCU)**
 Account Number: **1902** Primary Asset ID: **C-201 A**
 Site Location: **Pinebliss Refinery** Alternate Asset ID: **Laboration & Associated Sub-System**
 Primary Contact: **John Anderson** Asset Description: **STD Centrifugal Wet Gas Compressor**
 Primary Contact Title: **Maintenance Manager** Reservoir Capacity: **2,875 USG**
 Street Address: **13708 Blue Main Street** Reported Fluid Volume: **2,308 USG**
 City: **Pinebliss** Fluid Manufacturer: **ExxonMobil**
 State: **TX** Fluid Type: **DTE Light**
 Zip Code: **77271** Fluid Grade: **ISO 32**
 Primary Contact Phone: **(713) 355-5800** Purchase Order Number: **36422821**
 Primary Contact Fax: **(713) 355-5261** Service Number: **497967**
 Primary Contact Email: **john.anderson@TRC.com** Invoice Number: **547273**
 Start Date of Service(s): **1/2/2009** Account Representative: **Dan MacGregor**
 End Date of Service(s): **1/1/2009**

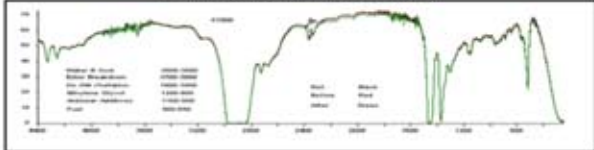
<<< Analysis Summary >>>

On 01-12-2009, condition monitoring technicians responded to a reported catastrophic failure on the FCC Vint Gas Compressor. On-site inspection and fluid analysis indicated that the system had been significantly contaminated with metal debris as a result of the incident. Technicians also identified severe levels of varnish & moisture distributed throughout the system internals as well as the fluid. Systems taken into consideration during the analysis included inlet or supply, return, seal or supply, trip on & control oil. IAS was asked to monitor to the site on an emergency basis and perform a comprehensive turn-key system decontamination & fluid purification. IAS inventoried the existing system fluid and performed a purification process which included water removal, mechanical filtration and desolved varnish removal. After installing 50 jumpers, IAS then performed a high-velocity flush on the entire system and its associated sub-systems. The process was monitored and managed by technicians 27 / 7 until completion. IAS performed real-time ISO particle counting and API screening. The fluid was returned to specification and the system has been thoroughly decontaminated. The asset should be considered fit for re-commissioning.

Emission Spectroscopy

Reference	Fe	Co	Si	W	Pb	Cr	Mn	Al	Ti	Ag	Ca	Mg	Zn	P	Na	Mo	Sr	Se	K	V
Before	20	12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
After	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

FTIR Infrared Chemical Fingerprint - Overlay

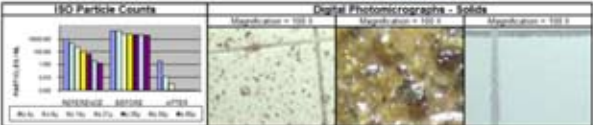


Reference Sample Before Sample After Sample

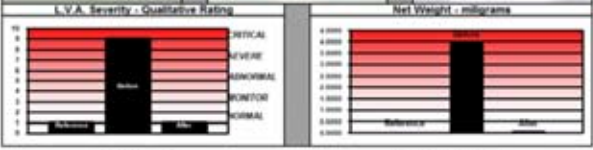


Fluid Analysis Test Item	Method	New Fluid Reference	Fluid Before Service	Fluid After Service
Kerosene (ASTM D156) @ 30°C	1-405	5.5	5.7	5.5
Kerosene (ASTM D156) @ 60°C	1-405	5.5	5.7	5.5
Viscosity Index	9-170	99	97	99
Total Acid Number (TAN)	1-251	0.07	0.07	0.07
Cloud Point	1-102	5	5	5
Neutralization	1-102	4	4	5
20/40 Visc	9-160	7	6	7
Water by Fall Filter (ppm)	1-118	98	200	97
Flash Point (°F)	1-10	424	401	405
Water-Powder Gumpager (API)	4-10	2	2	2
Filtrate Solids (mg/l)	3-120	0.0	0.0	0
SLN Sediment Volume	1-18	Negative	Negative	Negative
RP 017 (Water)	3-120	99	97	99
Demulsibility (ASTM D156)	9-160	40.0.0.0	21.0.0.0	40.0.0.0
Special Test 1	161	161	161	161
Special Test 2	161	161	161	161
Moisture Separator (CEN)	1-10	405	405	405
Leak Paths (Leak)	10-145.0	261.94.0	261.94.0	261.94.0

Particle Size Range	Counts /ml	ISO Code	Counts /ml	ISO Code	Counts /ml	ISO Code
0 - 4 Microns	824.90	20	8264.02	24	2.90	9
4 - 6 Microns	182.22	6	1822.68	24	0.63	4
6 - 10 Microns	101.82	6	4497.53	23	0.49	1
10 - 15 Microns	64.07	4	470.07	23	0.00	0
15 - 20 Microns	27.50	2	276.00	22	0.00	0
20 - 30 Microns	4.88	2	262.44	22	0.00	0
30 - 50 Microns	1.07	0	207.60	22	0.00	0



Latent Varnish Accumulation (L.V.A.) Severity



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 STYLE Certified Lubrication Specialist (CLS)
 Laboratory Analysis Independently Verified By: M&T Laboratories, Houston, TX
 78 East Redwood Circle • Spring, Texas 77381 • (281) 538-9111 Phone • (281) 538-9547 Fax • www.M&TOnline.com

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 78 East Redwood Circle • Spring, Texas 77381 • (281) 538-9111 Phone • (281) 538-9547 Fax • www.M&TOnline.com

ISO 23 / 22 / 21
LVA: 9

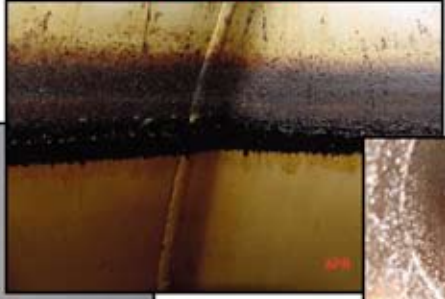
ISO 12 / 9 / 6
LVA: 1



BEFORE AFTER



CONTAMINATED RESERVOIR



CONTAMINATED SYSTEM PIPING



CLEAN RESERVOIR



CLEAN SYSTEM PIPING



EXAMPLES

Sludge, Additive Precipitation, Varnish



Figure A – EXTREME CONDITION OF PIPING IN SOME MACHINES



Figure B – TYPICAL CONTAMINATION FOUND IN SIMILAR SYSTEM SAMPLES

FURTHER EXAMPLES - SPECIFICALLY FOR VARNISH AND SLUDGE

Sludge, Additive Precipitation, Varnish Results on Critical Equipment



Figure D – VARNISHED VALVE INTERNALS THAT FAILED



Figure E – VARNISHED VALVE BODY

FURTHER EXAMPLES

Sludge, Additive Precipitation, Varnish Results on Critical Equipment



Figure F - TURBINE PIPING INTERNALS SAMPLE - PREVIOUS PROJECT

TYPICAL PROJECT RESULTS



305 Nebraska St.
South Houston, TX 77587
713-944-8381

Report Date: 03/26/2010
Sample Date: 03/25/2010

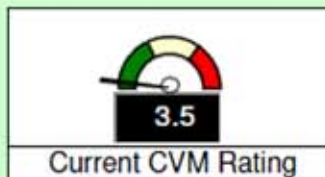
CVM

Sample Number: 10032068
Equipment: B4 Mitsubishi STG
Status: **NORMAL**

Chromatic Varnish Meter

IAS
34 E Amberglow Circle

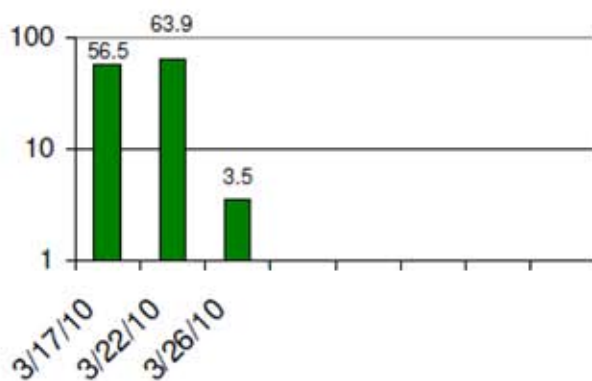
The Woodlands TX 77381-6108



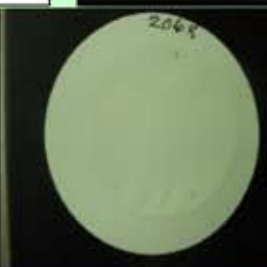
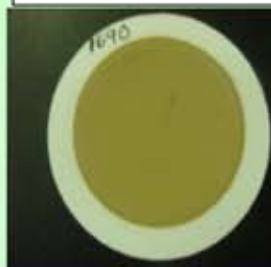
Point ID	Equipment Type	Fluid In Use
0015	Unknown	Mobil Turbine Oil 32

The varnish number is NORMAL. The CVM has detected an acceptably low level of soft contaminants due to oil degradation. Recommended sampling interval for this component is quarterly. Please refer to the routine report for additional data and recommendations.

CVM History



Result	Description
3.5	Varnish Number
74	Filter Weight (mg/l)



VARNISHING POTENTIAL ANALYSIS

Lube Type:	UNKNOWN UNKNOWN	Received:	01/30/2009
Machine MFG:	UNKNOWN	Report:	1/30/2009 8:20:00PM
Machine MOD:		Sample No:	1035-3-15
Machine Type:	Industrial Turbine		

Observations/Recommendations

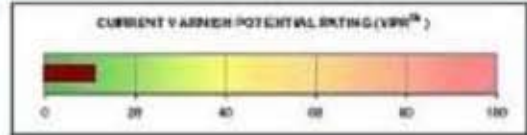
The current test results indicate a low level of degradation by-products associated with varnishing. Please continue routine sampling to monitor the trend in the level.

	01/29/2009	01/23/2009	01/22/2009	01/17/2009
 <p>UC VALUE</p>				
 <p>COLOR VALUE</p>				
				
SAMPLE DATE	01/29/2009	01/23/2009	01/22/2009	01/17/2009
LAB ID	489764	489105	489104	489103
ULTRACENTRIFUGE TEST				
UC VALUE				
MEMBRANE PATCH COLORIMETRY				
COLOR VALUE	10	18	20	34
PHYSICAL PROPERTIES				
ACID NUMBER				
KARL FISHER WATER				
RULER TEST				
RULER %				
AMINE				
PHENOLIC				



OSASM QUANTITATIVE SPECTROPHOTOMETRIC ANALYSIS

VARNISH REMOVAL PROJECT, PROJECT CONDUCTED ON GE FRAME 7FA WHILE ON-LINE. SPECIFIC CUSTOMER INFORMATION WITHHELD PENDING APPROVAL FOR PUBLIC DISSEMINATION.



UNIT ID	COMPONENT ID	COMPONENT REF NO	OIL TYPE
T-9	TURBINE	139	TEXACO GT ISO 32 / SHELL #BX
SAMPLE NUMBER	ANALYST	SAMPLE DATE	REPORT DATE
	JOHN ZUFELT	020608	2-12-08

INTERPRETATION OF CURRENT DATA

TEST RESULTS ARE SATISFACTORY (Based on the information available). The VARNISH POTENTIAL RATING is in the NORMAL range. OSA indicates LOW levels of the specific contaminants known to produce / promote varnish deposits. RESAMPLE in three months. Filter Project Dec. 07.

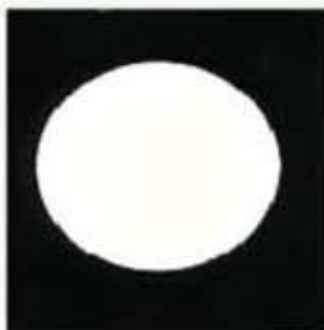


BEGINNING PATCH – PRIOR

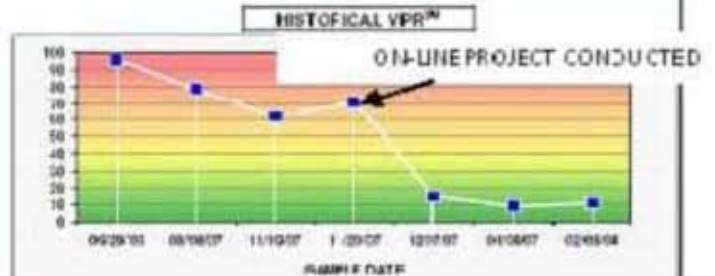
The OSA Varnish Potential Rating describes the user's concern's propensity to produce harmful deposits. Ratings and sample severity are assigned based on the level of varnish-producing contaminants present in the lubricant sample.

ENDING PATCH – AFTER

QView



RESULT	DESCRIPTION
11	VARNISH POTENTIAL RATING (VPR™)
32	FILTER WEIGHT (mg/L)



*****NOTE*****

A fluid drain-down and change-out alone WILL NOT correct the system problems associated with this type of condition which include but may not be limited to:

- **A REDUCTION IN FLUID PROPERTIES, SUCH AS ACID NUMBER, RESISTIVITY, ETC. WHICH CAN COMPROMISE THE SAFETY OF THE SYSTEM AND ULTIMATELY THE PLANT.**
- **EXTREME LOSS OF FLUID TRANSFER AND LUBRICATION CAPABILITY DUE TO SYSTEM CONTAMINATION BUILD-UP WHICH RESULTS IN LARGE AMOUNTS OF WASTED MONEY ON UNNECESSARY ENERGY CONSUMPTION AND PREMATURE WEAR.**
- **DEGRADATION AND DEPLETION OF VALUABLE ANTI-OXIDATION ADDITIVES WHICH WORK TO PREVENT PREMATURE FLUID BREAK-DOWN AND SYSTEM COMPLICATIONS.**

A FLUID CHANGE-OUT ALONE, WITHOUT ADDRESSING THE DETERIORATED RELIABILITY OF THE OVERALL SYSTEM DUE TO BUILD-UP OF FLUID DETERIORATION AND SLUDGE AND GEL PRECIPITATION BY-PRODUCTS, WILL ALMOST IMMEDIATELY RESULT IN THE NEW FLUID DISSOLVING THE LEFT-OVER MATERIAL IN THE SYSTEM PIPING & VESSELS...RESULTING IN FLUID RE-CONTAMINATION, RAPID RE-DETERIORATION, SUSTAINED LOSS OF RELIABILITY AND A 100% FAILURE IN CORRECTING THE ROOT CAUSE OF THE PROBLEM.

SOLUTION:

The IAS process specifically addresses BOTH the off-specification system internals and the system fluid.

The IAS process delivers the following benefits:

- **Ensured system cleanliness - SYSTEM BUILD-UP IS REMOVED**
- **Ensured fluid cleanliness - FLUID IS REVITALIZED**
- **Extended fluid life - RESULTING FROM THE NEWLY CLEANED SYSTEM AND FLUID**
- **Safe operating conditions - SAFE OPERATIONAL LEVELS OF FLUID ARE RETURNED**
- **Reduced cost of operation - LUBRICATION & HYDRUALIC TRANSFER IS OPTIMIZED**
- **High Levels of Reliability and Plant Production Capacity - LIKE NEW CONDITION**

The success of this project is always unconditionally guaranteed 100% by IAS.

IF INDEPENDENT LABORATORY ANALYSIS DOES NOT PROVE THE SUSCESS OF THE PROJECT...THERE IS NO CHARGE, NO INVOICE, NO COST.