FINAL PROJECT REPORT
Southeast USA Chemical Plant

High Velocity Oil Flush, System Decontamination and Fluid Purification
Steam Turbine Generator, IR Compressor and Expander
7/15/2010 – 7/27/2010

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1.0 EXECUTIVE SUMMARY

IAS is providing this Final Project Report as a way to demonstrate the complete success of the project recently performed for a SE USA Chemical Plant by outlining the primary objectives and project scope; the methodology used to succeed; and the key benefits provided to our customer.

2.0 INTRODUCTION

IAS was requested by the customer to perform a turn-key, High Velocity Oil Flush, System Decontamination and Fluid Purification on their Section 36 Compressor K-3604. IAS offered their proven process to restore the system to optimal performance and cleanliness levels. Provided here are details on the project, customer and site.

Company Name:		Asset Location:	**Sec. 36**
Account Number:	**7456250**	Primary Asset ID:	**K-3604**
Site Location:		Alternate Asset ID:	**NA**
Primary Contact:		Asset Description:	**Turbine Compressor**
Primary Contact Title:	**Mechanical Maintenance Planner**	Reservoir Capacity:	**1200 USG**
Street Address:		Estimated Fluid Volume:	**1100 USG**
City:		Fluid Manufacturer:	**Mobil**
State:		Fluid Type:	**DTE Light**
Zip Code:		Fluid Grade:	**ISO 32**
Primary Contact Phone:		Service Number:	**770165**
Primary Contact Email:		Date of Service:	**7/15/2010 – 7/27/2010**

3.0 PRIMARY OBJECTIVES

- IAS was to restore the systems back to, or surpassing the industry standards, OEM specifications and customer's requirements.
- This was to be verified when the final oil ISO 4406 Code was brought to 16/14/11, as per the proposal.
- This was to be verified with onsite particle counts and mesh screens, witnessed and approved by the customer's representative.

4.0 PROJECT DETAILS

4.1 PROJECT SCOPE

- IAS provided their own tools, equipment and manpower required for every aspect of the project.
- IAS performed all necessary connections and disconnections into the systems.
- IAS safely administered all of their cleaning on all systems.
- IAS provided real time onsite verification through particle counts and screens with independent third party analysis.

4.2 PROJECT SAFETY

- **IAS was committed to upholding the highest standards of safety. We successfully worked 1,277 man hours without any reportable incidents or safety concerns.**

5.0 METHODOLOGY

5.1 HIGH VELOCITY FLUSH

IAS chose to use a proven method for their High Velocity Flush by flushing the system in stages. The first stage was to clean the cooler, isolated from the system. The second stage IAS performed the flush on the main system with the compressor and expander. The third stage was a flush on the system reservoir. The temperature and velocity of the fluid flushing through the system enables a large amount of turbulence which allows a far more thorough system cleaning.

5.2 FLUID PURIFICATION AND SYSTEM DECONTAMINATION

IAS refilled the entire system with new oil and ran it through the system in line with specialized purification systems. The new oil was purified by means of multi-stage filtration, vacuum distillation and sub-micron decontamination. This allowed any remnant contamination and debris in the system to be fully removed, and the new fluid to remain at peak levels much longer than would it otherwise be capable of doing.

6.0 KEY BENEFITS

- Extended life of the systems
- Ensure fluid and system cleanliness
- Minimization of future maintenance and repair costs
- Reliable equipment start-up

7.0 TIMELINE

7/15/2010	IAS mobilized to the job site.
7/19/2010	IAS Technicians attended a mandatory permitting and safety meeting.
7/19/2010	IAS Technicians began jumper hook up. IAS also had to change scope by isolating the cooler from the main system due to system design.
7/20/2010	IAS began the cooler flush.
7/22/2010	IAS finished the flush on the cooler and began the flush on the main system.
7/23/2010	IAS finished flush on the compressor.
7/24/2010	IAS finished flush on expanders and the main system.
7/24/2010	IAS then began reservoir cleaning.
7/25/2010	IAS completed the reservoir cleaning, thus finishing the flush.
7/26/2010	IAS Project Manager met with customer representatives for post job meeting.
7/26/2010	IAS demobilized from the job site.

8.0 EQUIPMENT SET UP

8.1 HIGH VELOCITY FLUSH

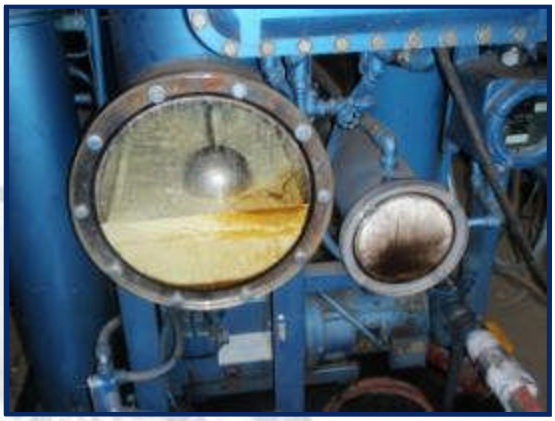
High Velocity Flushing Equipment being staged

Flushing Equipment in line with system and hold tote

IAS sets up their High Velocity Flushing equipment in a closed circuit with the system being flushed allowing for temperature control, velocity control and filter monitoring.

8.2 FLUID PURIFICATION AND SYSTEM DECONTAMINATION

Fluid Purification Equipment being staged



Fluid Purification Equipment in line with system

IAS is capable of removing varnish, water and further particulate from the fluid and system.

9.0 Project Results

9.1 High Velocity Flush

INDUSTRIAL ACTION SERVICES INCORPORATED
SPEED • PRECISION • RELIABILITY

HIGH VELOCITY FLUSHING REPORT

Overall Condition: **NORMAL**

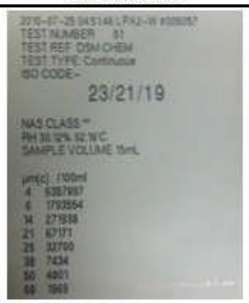
Company Name:	Southeast USA Chemical Plant	Asset Location:	
Account Number:	7456250	Primary Asset ID:	K-3604
Site Location:		Alternate Asset ID:	N/A
Primary Contact:		Asset Description:	Turbine Compressor
Primary Contact Title:	Mechanical Maintenance Planner	Reservoir Capacity:	1200 USG
Street Address:		Estimated Fluid Volume:	1100 USG
City:		Fluid Manufacturer:	Mobil
State:		Fluid Type:	DTE Light
Zip Code:		Fluid Grade:	ISO 32
Primary Contact Phone:		Service Number:	770165
Primary Contact Fax:		Date of Service:	7/15/2010 - 7/27/2010

FLUSHING PROJECT PARAMETERS

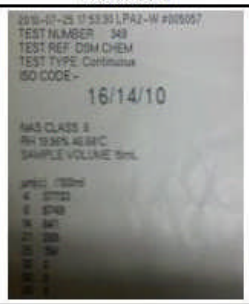
PRIMARY LINE SIZE (STD IN)	0.5 1 1.5 2 2.5 3 4 6 8 10 12 14 16	2
FLOW RATE (USGPM)	40 80 120 160 200 240 280 320 360 400 440 480 520	416
FLUID VELOCITY (FPS)	4 8 12 16 20 24 28 32 36 40 44 48 52	40.8
VISCOSITY @ TEMP (SUS)	4 8 12 16 20 24 28 32 36 40 44 48 52	45.3
REYNOLDS NUMBER (Re) /TURBULENT FLOW @≥ 4,000/	10000 15000 20000 25000 30000 35000 40000 45000 50000 ### 60000 65000 70000	67,249
FLUID TEMPERATURE (°F)	15 30 45 60 75 90 105 120 135 150 165 180 195	145
FLUSH DURATION (HOURS)	12 24 36 48 60 72 84 96 108 120 132 144 156	135
VOLUME CIRCULATED (USG)	.25MM .5MM .75MM 1MM 1.25MM 1.5MM 1.75MM 2MM 2.25MM 2.5MM 2.75MM 3MM 3.25MM	3.36 MM

FINAL FLUID ANALYSIS	FLUSH START		AFTER FLUSH	
Appearance	Dark		Amber	
System Appearance	Contaminated		Clean	
Large Solids Present	Yes		No	
Small Solids Present	Yes		No	
Water Content	Moderate		None	
Laser Particle Count	23 / 21 / 19		16 / 14 / 10	
Particle Size Range	Counts / mL	Code	Counts / mL	Code
≥ 4 Microns	6357897.000	23	37733.000	16
≥ 6 Microns	1793554.000	21	6749.000	14
≥ 14 Microns	271938.000	19	641.000	10
≥ 21 Microns	67171.000	17	255.000	9
≥ 25 Microns	32700.000	16	154.000	8
≥ 38 Microns	7434.000	13	0.000	0
≥ 50 Microns	4801.000	13	0.000	0

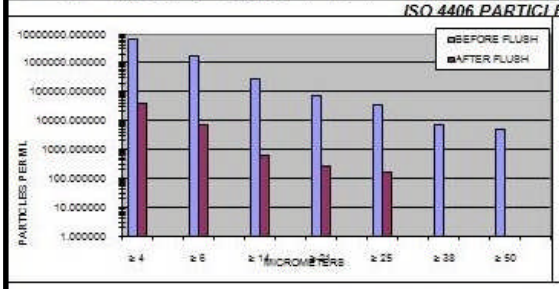
START COUNT

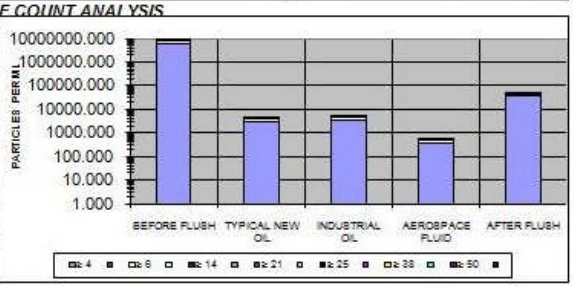


END COUNT



ISO 4406 PARTICLE COUNT ANALYSIS

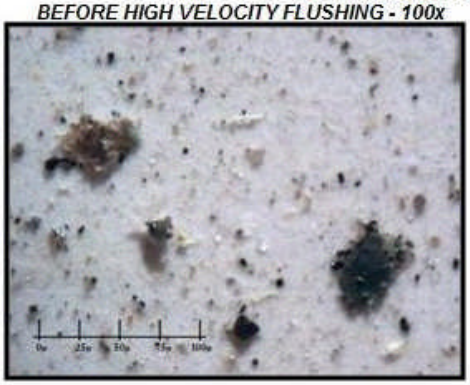




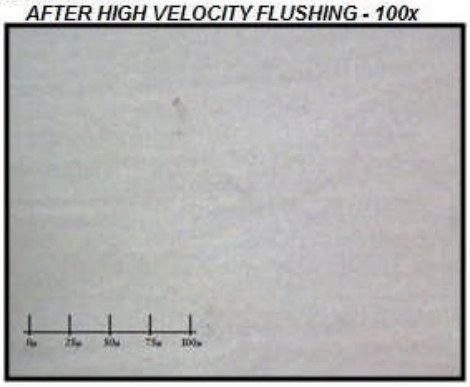
PHOTOGRAPHIC ANALYSIS

FLUID ANALYSIS - DIGITAL MICROPHOTOGRAPH

BEFORE HIGH VELOCITY FLUSHING - 100x



AFTER HIGH VELOCITY FLUSHING - 100x



MACROFERROGRAM ANALYSIS - WARRANTY SCREENING RESULTS

INITIAL SCREEN RUN

SCREEN SIZE:	**3 inches**
LOCATION:	**Down stream- Most Return Line Point**
SCREEN MATERIAL:	**316L STAINLESS STEEL**
MESH:	**100**
MICRON RATING:	**149**
FLOW RATE (USGPM):	**416 USGPM**
TOTAL FLOW (USG):	**49920 USG**
SCREEN RATING (1-5):	**4**
PASS / FAIL:	**FAIL**
CUSTOMER WITNESS:	**YES**

FINAL SCREEN RUN

SCREEN SIZE:	**3 inches**
LOCATION:	**Down streem- Most Retun Line Point**
SCREEN MATERIAL:	**316L STAINLESS STEEL**
MESH:	**100**
MICRON RATING:	**149**
FLOW RATE (USGPM):	**416 USGPM**
TOTAL FLOW (USG):	**99840 USG**
SCREEN RATING (1-5):	**1**
PASS / FAIL:	**PASS**
CUSTOMER WITNESS:	**YES**

Roger Connolly

IAS Project Manager

IAS Critical Projects Coordinator

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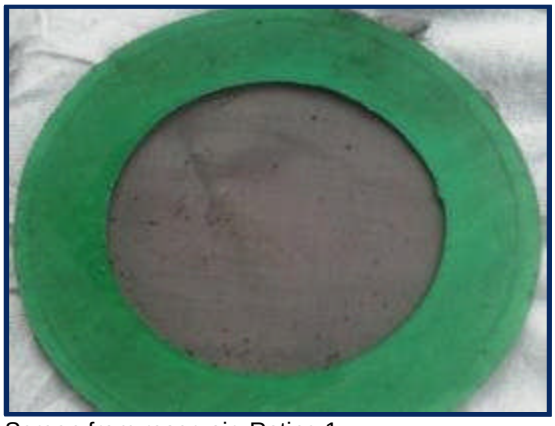
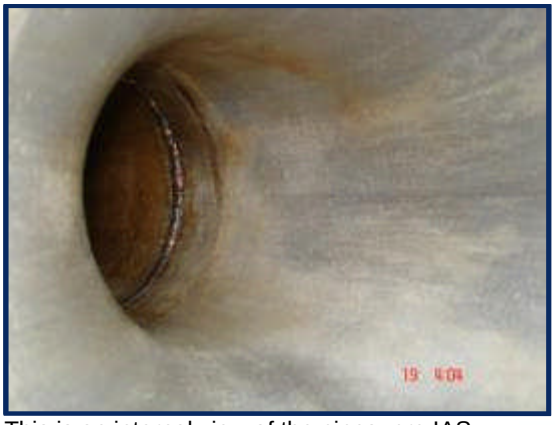
9.2 FLUID PURIFICATION AND SYSTEM DECONTAMINATION


Screen from reservoir, Rating 4


Screen from reservoir, Rating 1


This is an internal view of the pipes, pre IAS.


This is an internal view of the pipes, post IAS.


This is an internal view of the reservoir, pre IAS.


This is an internal view of the reservoir, post IAS.

10.0 RECOMMENDATIONS FOR CONTINUED RELIABILITY

With the amount of first-hand knowledge gained through past projects with exact and similar equipment IAS offers these expert fluid recommendations for the Chemical Plant in regards to their Steam Turbine Generator K-3604, or like systems, that a fluid level should be maintained in accordance with an ISO 4406-99 Code of 16/14/11 and a water content level less than 300ppm to ensure peak system performance. IAS is committed to providing our customers with all assistance and services to ensure their systems are kept at their optimum performance levels to guarantee smooth operations and minimize future downtime and maintenance costs.

11.0 CONCLUSION

This project was concluded to the specification of our customer. All solid inorganic contamination has been successfully removed from the Turbine and Compressor system K-3604 to the satisfaction of our customer. All final inspections- on mesh screens, particle counts and visual- by the customer's representative and met with their approval and confirmed that their systems were cleaned beyond industry standards and OEM specifications.

Respectfully submitted by:

Kevin B. Sapp
President and CEO, IAS