

Wiltech's CFC Elimination Plan

WILTECH

Component Cleaning & Refurbishment Facility

KSC, FL.

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Foreword

- *It Is Our Objective to Employ a Strategy That Lends Itself to Minimizing Both Toxicity Concerns and Facility and Productivity Costs While Satisfying the Cleaning and Verification Issues Associated With the Broad Range of Contaminants We Encounter on Hardware at KSC/CCAS.*

OVERVIEW

- *We Will Maximize Our Use of Aqueous Processes in Both Cleaning and Verification.*
- *A Revision to OP-52, Incorporating All of Our Aqueous Cleaning and Verification Procedures, Has Been Submitted for Review and Approval.*
- *CRCA Has Formulated a Plan to Test an Economical Dual Solvent Strategy for Our Alternative Solvent Solution.*

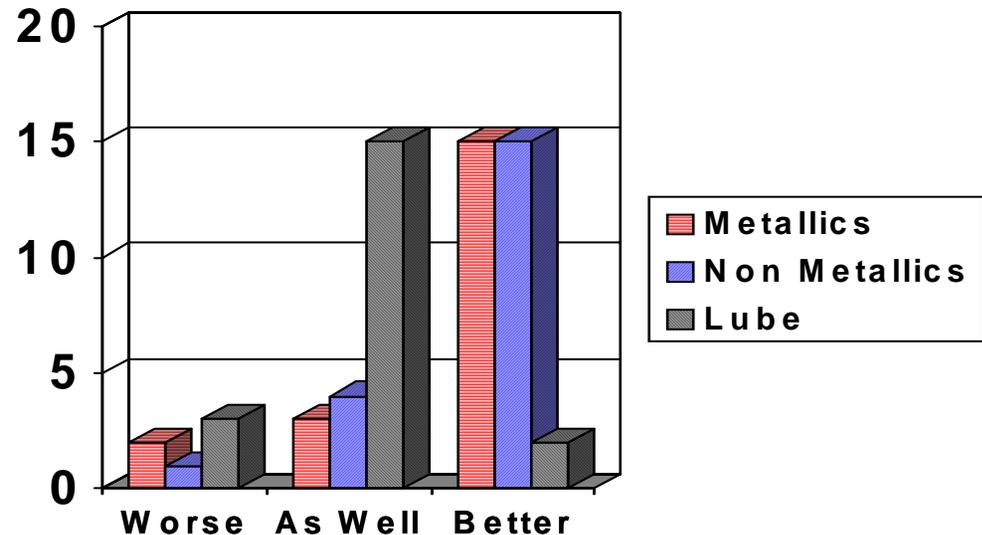
Aqueous Cleaning & Verification

- *Aqueous Verification Methodologies Have a Two Year Experience Base on a Variety of GSE Components and Sampling Equipment.*
- *OP-52 Was Revised and Now Includes Aqueous Cleaning and Verification Procedures and Was Submitted to the Program for Review and Approval.*
- *50% Of the Current Workload Is Verified Using Aqueous Methods.*
- *90% Of the Total Workload Is Degreased Aqueously.*
- *An Additional Estimated 20% Solvent Savings Would Be Realized If the Proposed Expanded Use of Aqueous Methods Are Approved.*
- *Aqueous Cleaning Is Effective, Environmentally Friendly and Economical (i.e.. Cost of Materials, Equipment, Facilities and Labor).*

Vigorous Manual Agitation Particulate Sampling Method

- Objective - Develop an aqueous method that sees as well as CFC-113 dip method.
- After a suitable aqueous method was developed using Zonyl and water, 20 assorted work orders composed of more than 900 individual items were tested.
- Each work order was split, half was sampled aqueously and the other sampled with CFC-113.
- The aqueous sample result was compared to the CFC-113 result.
- The analysis judged the particulate release characteristic for metallics, non-metallics and lube.

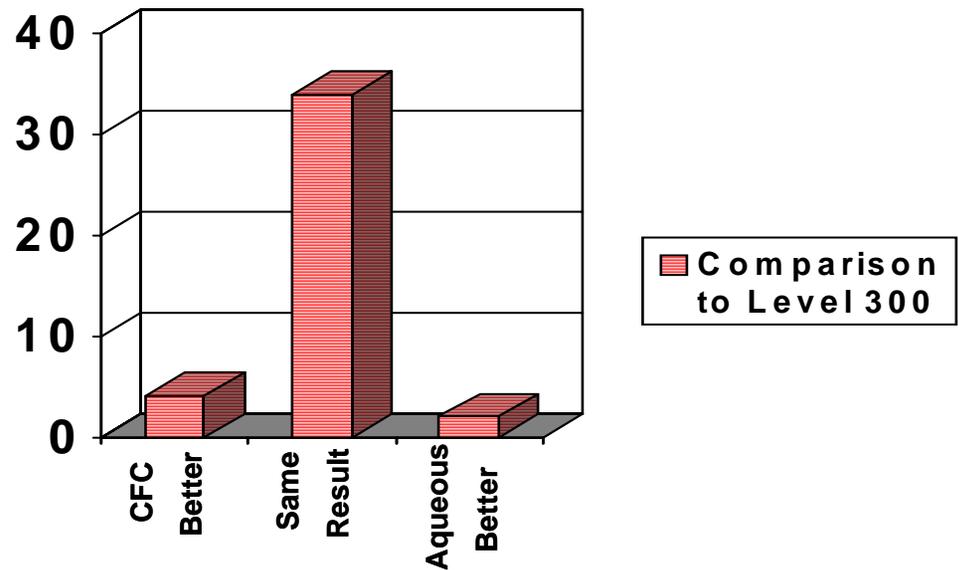
**Aqueous Method's Vision
Compared to CFC Method**



Low Pressure Impingement Sampling Method

- Objective - Develop an aqueous method that sees as well as CFC-113 flush method.
- After a suitable aqueous method was developed using DM water, 40 assorted work orders were tested.
- Each work order was sampled aqueously and read to Level 300 and then backed-up with CFC-113.
- The graph represents the results of the comparison. Aqueous and CFC results that agree (both pass or both fail the Level 300 requirement) are placed in the "Same Result" category. Aqueous results that pass Level 300 but the CFC backup indicates failure are placed in the "CFC Better" category. Aqueous results that fail Level 300 but the CFC backup indicates acceptance are placed in the "Aqueous Better" category.

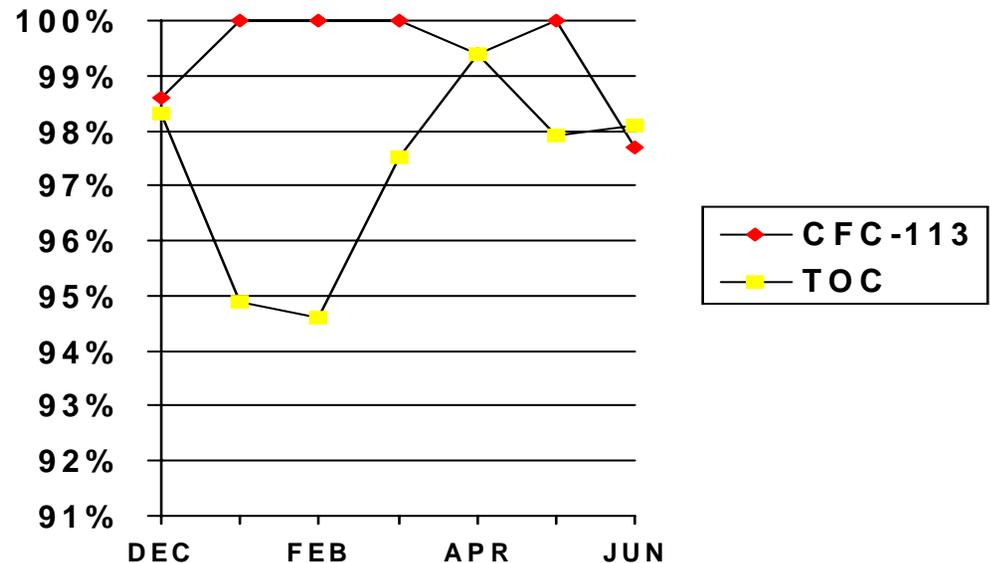
Aqueous vs CFC Method



TOC Quality Check

- Objective - Statistically compare the acceptance rates of TOC Vs Solvent NVR results.
- The report was generated July 30, 1996 and looked at six months worth of data, over 2,000 data points.
- The analysis judged the TOC method as effective, if not a little more sensitive than the solvent method.

NVR ACCEPTANCE RATES



Aqueous Filter Cleaning and Verification

- *New Aqueous Filter Cleaning & Validation Methods Exceed Performance Expectations.*
- *25% - 35% Solvent Savings Can Be Realized If This Method Is Approved by the Program.*
- *Has Been Implemented on GSE Filters With Only Minor Difficulties.*
- *New Method Employs Nylon and Aclar Bags in Lieu of Canisters in the Process.*
- *Full Disclosure of the New Aqueous Filter Cleaning Method Can Be Found in Wiltech Engineering Report RD1997-1.*

Solvents

- *Current CFC-113 Bulk Supplies Will Be Exhausted in the Summer of 1999.*
- *Only AK-225, Vertrel MCA and HFE-7100 Are Being Added to SE-S-0073 As CFC-113 Alternatives on a Compatibility Level.*
- *Wiltech Is Proposing a Dual Solvent Strategy Using Vertrel MCA and HFE-7100 to Eliminate CFC-113 Usage.*
- *AK-225 Is Not Being Considered for Use in Our CFC Elimination Plan at This Time Because of Time and Cost Constraints Imposed by Facility Mods, Strong Toxicity Concerns and Currently Mandated Phase Out of AK-225. Impacts to Production Would Be Severe.*

Dual Solvent Strategy

- *Vertrel MCA Will Be Used Outside of the Clean Room Where Facility Costs and Exposure Concerns Can Be Minimized.*
- *NVR Verification Can Be Performed With Vertrel MCA Outside the Clean Room Relieving Medium to Heavy Hydrocarbon Contamination Concerns.*
- *HFE-7100 Will Be Used for the Verification Fluid in the Clean Room for Both Particulate and NVR (Light Hydrocarbon Contamination).*
- *Aqueous Cleaning and Verification Techniques Will Continue to Be Employed Whenever Possible.*
- *Items Being Certified to an “A” Level NVR Will Be Tested As Follows:*
 - *Items Solvent Degreased and Solvent Verified Will Be NVR Tested Twice, Once With Vertrel MCA in Preclean and Again With HFE-7100 in the Clean Room.*
 - *Items Aqueously Degreased and Solvent Verified Will Be NVR Tested Once With HFE-7100 in the Clean Room.*
 - *Suitable Items May Be Completely Processed Aqueously and Tested for NVR Using the TOC Method.*

Solvent Properties

<i>PROPERTY</i>	<i>CFC-113</i>	<i>AK-225 *</i>	<i>VERTREL MCA</i>	<i>HFE-7100</i>
Boiling Point - °C	48	54	39	60
Surface Tension - Dynes/cm	17.3	16.2	15.2	13.6
Vapor Pressure mmHg@20°C	331	290	375	210
Liquid Density	1.56	1.55	1.41	1.52
Solubility of H2O (ppm by wt)	110	420	490	95
Solubility in H2O (ppm by wt)	170	210	140	10
8 HR Exposure Limit (ppm)	1000	50	200	600
Category	CFC	HCFC	HFC	HFE
Ozone Depleting Potential (Max=1.0)	0.8	0.03	0.0	0.0
Global Warming Potential	High	Lo	Lo	Lo
Flammable	No	No	No	No
Auto-Ignition Temperature Issue	No	No	Yes	No

** Scheduled for phase out in 2015; may be accelerated. Exposure limits may be lowered due to recent exposure incidents involving HCFC's..*

Solvent Performance Characteristics

FLUID	Contaminant, Percent Removed					
	DC-33	Braycote 601	Mil-H- 83282	Mil-H- 5606	Houghto- Draw	Titanlube
None	3	0	0	78	0	1
CFC-113	80	91	100	100	100	100
AK-225	85	87	100	100	100	16
Vertrel MCA	60	12	100	92	100	51
HFE-7100	16	85	34	86	1	4
<i>Dual Solvent Strategy</i> <i>(Vertrel MCA & HFE-7100)</i>	60	85	100	92	100	51

- Table reflects data extracted from BNA Laboratory Test Report, LTR 6887-4097, with the exception of the Dual Solvent Strategy data which is a combination of the solvency data of both the Vertrel MCA and the HFE-7100.

The Next Step

- *We Need to Prove the Strategy*
 - *Define Manpower and Equipment Requirements*
 - *Select Test Hardware*
 - *Build a Test Plan*
 - *Perform Tests*
 - *Present Results*

Required Equipment Procurements For Testing

Note: Maximum Use Made Of Available Facilities And Equipment

■ *2 drums each of Vertrel MCA & HFE-7100*

■ *Required Equipment For Component Refurbishment*

- *Desiccator w/desiccant*
- *Small vented oven*
- *Chiller Bath For Flash evaporator*
- *Balance*
- *Vacuum Pump*
- *4 - Millipore Flasks*

■ *Required Equipment For Chemical Analysis*

- *Gas Chromatograph With TCD Detector*
- *8 - 100ml Platinum Crucibles*
- *2 - 1000ml Glass Separator Funnels*
- *2 - Tongs With Platinum Shoes*
- *2 - GC Columns, Fused Silica 105m*
- *1 - Injector - 9000 Split/Splitless 120V*
- *1 - Quartz Liner*

Outside Support

- *BOC Life Support For Breathing Air.*
- *Environmental Health For Air Sampling Plan.*
- *SFOC Environmental Engineering For Environmental Permit Requirements.*
- *SFOC Generator Shop Support To Power The Ventilated Flow Booth.*
- *Solvent Procurement In-Work By NASA LO-SOD.*

Test Hardware

- *Complex parts with internal passages*
 - *Dead-end bourdon tube gages*
 - *Teflon lined flexhoses*
 - *Convolute flexhoses*
 - *Valve Assemblies*
 - *Quick Disconnects*
- *Complex parts with no internal passages*
 - *Omni Seals*
 - *Swivel fittings*
- *Simple parts with all surfaces exposed*
 - *Simple fittings*
 - *Softgoods*

Test Plan

- *Test solvent flush, flow and dip methods against appropriate test hardware*
- *Start with a certified clean test specimen*
- *Contaminate the test specimen*
- *Clean the test specimen with the dual-solvent process to level 100A*
- *Perform a rinse analysis with CFC-113 and compare the results to level 100A*
- *Test Both the Solvent-Solvent and the Aqueous-Solvent Plan*