CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	1999
DateRun:	07/12/1999
Experimenters:	Jason Marshall
ClientType:	Metal Working
ProjectNumber:	Project #1
Substrates:	Aluminum
PartType:	Part
Contaminants:	Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil
Cleaning Methods:	Immersion/Soak
Analytical Methods:	Gravimetric, OSEE
Purpose:	To clean client supplied parts using the three best cleaners.

Experimental Procedure:

The three cleaners were made into 5% solutions by volume using DI water in 600 mL Pyrex beakers and heated to 130 F on a hot plate. Nine parts were selected from the supplied cleaned parts and nine from the supplied dirty parts. All eighteen were analyzed using Optically Stimulated Electron Emissions (OSEE). Optically Stimulated Electron Emission or PEE, Photo Electron Emission is based on the principle that metals and certain surfaces emit electrons upon illumination with ultraviolet (UV) light. These electrons can be collected, measured as current, converted to a voltage and digitally displayed. A surface contaminant will either enhance or attenuate this signal, depending on it own photoemissive nature. While OSEE will not identify a contaminant, it is a good comparative tool to determine the degree of contamination. This method is best suited for thin films (oils, etc.) and not particulate matter (dust, for example).

Several readings were taken from the shiny side and from the dull side in order to establish a baseline. The nine clean coupons were also weighed prior to contaminating with the lubricant/oil mix. After the application of the contaminants, these nine coupons were weighed again. Three clean parts were immersed into a beaker and cleaned for five minutes using stir-bar agitation. Parts were rinsed in 120 F tap water for 30 seconds and dried using a Master Appliance Corp, Hot-air gun model HG-301A at 500 F for one minute. Final weights were measured and cleaning efficiencies were calculated.

The nine dirty parts were cleaned, rinsed and dried in the same manner as the clean parts. After all the parts were dry, final OSEE readings were taken and compared to the baseline values.

SUBSTRATE MATERIAL: Aluminum Parts (5052)
CONTAMINANTS: Tuf Draw Vanishing Film 2889 (CAS #: 64741-65-7); Lubricant Mix [Hydroil AW-3 (petroleum hydrocarbon), Express Gear Lubricant F]

Results:

Gravimetric analysis revealed that all three cleaners removed over 95% of the added contaminants with US Polychem removing the most. It was noted that the US Polychem cleaned parts were not as shiny as they other supplied clean parts. Table 2 lists the cleaning efficiencies for all three cleaners.

Table 2. Cleaning Efficiencies

	Oakite	Calgon	US Poly
Coupon 1	99.64	99.63	99.58
Coupon 2	96.91	99.88	100.4
Coupon 3	98.64	98.45	99.06
Average	98.4	99.32	99.68

Initial OSEE readings showed that the clean and approved parts had higher readings than the dirty parts. The shiny side had the highest values for both the clean and dirty parts. Table 3 shows the average values for the dull and shiny sides of the clean and dirty parts.

Table 3. Baseline Readings

	Clean	Dirty
Dull	330.47	192.58
Shiny	450.64	245.93

The dirty parts cleaned in the Calgon solution had the highest OSEE values after cleaning. These readings were also
higher than the baseline values. The Oakite OSEE readings were closest to the original clean values. US Polychem were not much better than the baseline dirty levels. Table 4 lists the Dull and Shiny readings for the parts cleaned in each solution as well as the baseline clean and dirty readings.
Figure 1 graphically represents the listed data.
Table 4. Dirty Parts After Cleaning vs Baseline Values

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	BL Clean	Oakite	Calgon	US Poly	BL Dirty

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Dull	330.47	389.73	532.73	263	192.58
Shiny	450.64	449.87	580.13	226.33	245.93

The Clean parts that were contaminated with the lubricant mix were all lower than the baseline values recorded
prior to contamination. Table 5 lists the after cleaning and baseline OSEE values for the nine coupons. Figure 2 shows the comparison visually.

Table 5. Original Clean Parts

	Oakite	Calgon	US Poly
After contamination & cleaning	237.07	287.53	321.93
Base line readings	389.73	484.53	477.67

Summary:

Substrates:	Aluminum				
Contaminants:	Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil				
Company Name:	**Product Name:**	**Conc.:**	**Efficiency:**	**Effective:**	**Observations:**
Oakite Products	Inproclean 3800	5	98.40	☑	
US Polychem Corporation	Polyspray Jet 790 XS	5	99.68	☑	
Calgon Corporation	SMS 206 K	5	99.32	☑	

Conclusion:

Even though the US Polychem product removed 99.7% of the contaminant, the surface appearance was altered. It was no longer clear and shiny. The OSEE readings were also the lowest of the three cleaners tested. The Oakite sample had lower efficiency (98.4%) but had good OSEE readings (near baseline levels). The Calgon product had excellent removal (99.3%) and excellent OSEE readings (compared to the baseline levels).