CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	1999
DateRun:	11/09/1999
Experimenters:	Carole LeBlanc, Jason Marshall
ClientType:	Cleaning Equipment Mfr
ProjectNumber:	Project #1
Substrates:	Steel
PartType:	Coupon
Contaminants:	Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil
Cleaning Methods:	Ultrasonics
Analytical Methods:	OSEE
Purpose:	To evaluate cleaning efficiency of new system which uses no chemistries.

Experimental Procedure:

Two sets of OSEE readings were made. The first was to determine a baseline level for the supplied substrate and the second set was to evaluate cleaned parts. 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).

The set of coupons were initially weighed and then cleaned using Dawn Dishwashing Soap and a nylon brush. After rinsing and drying, the coupons were weighed again. This process was to ensure the samples were completely cleaned. The baseline coupons were then analyzed using the OSEE instrument. Five readings were taken for each coupon. The coupons were then coated with the insoluble oil using a swab. OSEE readings were taken again in the same five areas of the coupons. Any differences in the clean and dirty readings were recorded and would be used in the evaluation of the client cleaned parts. OSEE readings were measured for the clean coupons from the client. Values were compared to both the baseline values.

SUBSTRATE MATERIAL: Hot Rolled Steel ASTM A-56
CONTAMINANTS: Oil-Chem Ecol Insoluble Cutting Oil
CONTAMINATING PROCESS USED: Parts received clean. Baseline samples coated using swab.

Results:

Initial observations made during the baseline determination yielded a decreased OSEE reading when the coupons were coated with the oil. Table 1 lists the readings made for each coupon and the average values.

Table 1. OSEE READINGS Baseline Determination

Coupon #	Left	Right	Bottom	Top	Middle	Average	Difference
19C	352	424	379	359	297	362.2	
19D	314	305	299	276	224	283.6	78.6
20C	337	374	380	353	295	347.8	
20D	290	330	312	307	243	296.4	51.4
21C	314	301	334	304	285	307.6	
21D	295	265	302	291	265	283.6	24
22C	386	333	329	395	296	347.8	
22D	340	281	282	332	258	298.6	49.2
23C	406	444	420	348	328	389.2	
23D	332	299	332	275	255	298.6	90.6
24C	329	310	349	338	296	324.4	
24D	258	284	211	277	256	257.2	67.2
25C	329	316	346	334	294	323.8	
25D	317	293	309	290	256	293	30.8
26C	333	375	429	380	325	368.4	
26D	314	314	284	267	258	287.4	81
27C	396	376	481	395	367	403	
27D	324	333	308	302	263	306	97
28C	413	337	398	346	355	369.8	
28D	283	280	300	292	260	283	86.8
29C	378	346	343	393	328	357.6	

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29D	297	304	296	264	258	283.8	73.8
30C	344	364	387	366	337	359.6	
30D	285	306	325	306	264	297.2	62.4
31C	336	347	348	376	314	344.2	
31D	320	286	288	331	254	295.8	48.4
32C	306	280	301	283	272	288.4	
32D	243	260	290	277	261	266.2	22.2
33C	339	323	356	331	319	333.6	
33D	283	283	314	288	268	287.2	46.4
34C	369	385	363	462	391	394	
34D	287	337	326	288	274	302.4	91.6
35C	335	272	328	328	289	310.4	
35D	266	230	262	275	253	257.2	53.2
36C	310	339	357	397	301	340.8	
36D	302	296	280	258	252	277.6	63.2
Average Clean						348.5	
Average Dirty						286.4	
Average Difference							62.1

It was assumed that the OSEE readings for the client cleaned coupons would be in the middle 300 range based on the baseline determination. The actual readings for these cleaned coupons were much lower than the baseline values. The readings were even lower than the dirty OSEE readings. Table 2 lists the readings made and the averages for each coupon.

Table 2. Client Cleaned Coupons

Coupon #	Left	Right	Bottom	Top	Middle	Average
1	223	182	226	214	224	213.8
2	210	198	202	216	215	208.2
3	225	204	187	192	215	204.6
4	228	224	223	225	224	224.8
5	200	228	176	215	220	207.8
6	207	207	221	208	218	212.2
7	217	193	220	223	220	214.6
8	223	208	229	216	228	220.8
37	227	222	222	224	228	224.6
10	212	200	213	207	208	208
11	224	203	220	220	207	214.8
12	216	203	181	217	206	204.6
13	204	219	212	202	206	208.6
14	211	206	204	216	212	209.8
15	203	213	224	203	203	209.2
16	211	210	224	203	205	210.6
17	209	218	211	213	213	212.8
18	194	209	219	202	227	210.2
			Average OSEE Readings			212.2

One coupon from the client cleaned coupons was used in a check of the effects of the oil on the Hot Rolled steel coupons. OSEE readings were made in four locations on the numbered side of the coupon. The coupon was then coated with oil as in the baseline evaluation. Four more readings were made and then the oil was wiped off the parts and a final set of OSEE readings were taken. As seen in Table 3, the oil made the readings go up on the client supplied coupons.

Table 3. Reevaluation of Oil Effects on Substrate

	L	R	T	M	Average
Clean	178	183	214	192	191.8
Dirty	223	260	261	259	250.8
Re-clean	190	214	168	166	184.5

Summary:

Substrates:	Steel					
Contaminants:	Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil					
Company Name:	**Product Name:**	**Conc.:**	**Efficiency:**	**Effective:**	**Observations:**	

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Water	Water	100	0.00	☐	

Conclusion:

Using the non-client cleaned coupons as a baseline for the evaluation of cleaning effectiveness of the system proved inadequate. Two problems were identified with the method. The first was the change in clean OSEE readings observed for the client cleaned coupons as compared to the non-client cleaned coupons were dissimilar. Secondly, the oil had different effects on OSEE readings for the two coupon types. The oil made readings go down for the non-client cleaned coupons and up for the client cleaned samples.

In order to accurately measure cleaning efficiency of the new system, a consistent analysis method needs to be identified. Gravimetric analysis would be ideal only if the balance is accurate enough to observe the small changes in weight due to the addition of oil. A balance that can read 0.0001 grams has proven effective at the Surface Cleaning Lab.