# 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 | |

# CLEANING LABORATORY EVALUATION SUMMARY

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 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:** | |

# CLEANING LABORATORY EVALUATION SUMMARY

| | | | | | |
|---|---|---|---|---|---|
| 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.