

# CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2019

DateRun: 07/02/2019

Experimenters: Sabrina Apel, Phillip Demers, Julie Nguyen

ClientType: Electroplating Company

ProjectNumber: Project #1

Substrates: Copper

PartType: Coupon

Contaminants: Oil

Cleaning Methods: Immersion/Soak

Analytical Methods: Gravimetric, Visual, Wipe

Purpose: To evaluate the effectiveness of six cleaning products for removing Mystery Oil and Rustlick 50/50 from copper coupons.

Experimental Procedure: Eighteen aluminum coupons, three for each cleaner and soil, were weighed before soiling halfway on one side using a hand-held swab. Dirty weights were recorded before placing three coupons at a time into a 250 mL beaker with a diluted cleaning solution. Coupons were immersed completely for 15 minutes with written observations being made every five minutes. A rinse step was added with heated water for five minutes before drying with an air gun for five minutes. A white glove test was performed using a clean swab to look for residue and final weights were taken.

1 Aquavantage 1400, 2 Emerald HD2, 3 Mirro 90, 4 Alconox, 5 Liquinox, 6 Immersion Cleaner

Results:

| Cleaner | Contaminant    | Initial wt. of cont. | Final wt. cont. | % Cont. Removed | Average |
|---------|----------------|----------------------|-----------------|-----------------|---------|
| 1       | Mystery Oil    | 0.0574               | 0.0203          | 64.63           | 88.21   |
|         |                | 0.0997               | 0.0000          | 100.00          |         |
|         |                | 0.1299               | 0.0000          | 100.00          |         |
|         | Rustlick 50/50 | 0.2147               | 0.0137          | 93.62           | 93.94   |
|         |                | 0.2042               | 0.0123          | 93.98           |         |
|         |                | 0.2534               | 0.0146          | 94.24           |         |
| 2       | Mystery Oil    | 0.1158               | 0.0010          | 99.14           | 99.14   |
|         |                | 0.1328               | 0.0005          | 99.62           |         |
|         |                | 0.1356               | 0.0018          | 98.68           |         |
|         | Rustlick 50/50 | 0.2543               | 0.0172          | 93.24           | 93.85   |
|         |                | 0.2886               | 0.0174          | 93.97           |         |
|         |                | 0.2349               | 0.0133          | 94.34           |         |
| 3       | Mystery Oil    | 0.1414               | 0.0016          | 98.87           | 97.69   |
|         |                | 0.0988               | 0.0004          | 99.59           |         |
|         |                | 0.1276               | 0.0069          | 94.59           |         |
|         | Rustlick 50/50 | 0.2532               | 0.0122          | 95.18           | 94.75   |
|         |                | 0.2762               | 0.0148          | 94.64           |         |
|         |                | 0.2729               | 0.0152          | 94.43           |         |
| 4       | Mystery Oil    | 0.0870               | 0.0096          | 88.96           | 89.60   |
|         |                | 0.1091               | 0.0079          | 92.76           |         |
|         |                | 0.1678               | 0.0217          | 87.07           |         |
|         | Rustlick 50/50 | 0.0808               | 0.0038          | 95.30           | 93.69   |
|         |                | 0.0770               | 0.0073          | 90.52           |         |
|         |                | 0.0800               | 0.0038          | 95.25           |         |
| 5       | Mystery Oil    | 0.0890               | 0.0017          | 98.09           | 96.85   |
|         |                | 0.1012               | 0.0061          | 93.97           |         |
|         |                | 0.0858               | 0.0013          | 98.48           |         |
|         | Rustlick 50/50 | 0.0888               | 0.0092          | 89.64           | 87.04   |
|         |                | 0.1495               | 0.0202          | 86.49           |         |
|         |                | 0.0940               | 0.0141          | 85.00           |         |
| 6       | Mystery Oil    | 0.1162               | 0.0013          | 98.88           | 91.91   |
|         |                | 0.0493               | 0.0102          | 79.31           |         |

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|  |                   |        |        |       |       |
|--|-------------------|--------|--------|-------|-------|
|  |                   | 0.1140 | 0.0028 | 97.54 |       |
|  | Rustlick<br>50/50 | 0.2310 | 0.0402 | 82.60 | 85.89 |
|  |                   | 0.2416 | 0.0279 | 88.45 |       |
|  |                   | 0.2444 | 0.0328 | 86.58 |       |

Visual Observations for Mystery Oil Coupons:

| Cleaner | 5 Mins   | 10 Mins   | 15 Mins  | Rinse  |
|---------|--|---|--|--|
| 1       | - soil immediately turned pale white<br>- soil floating to top of water                        | - white rim forming at top of water<br>- soil smoothly spread on coupon                                       | - soil seems to all float to the top of the water  | - very thin white rim at top of water<br>- thin white film on coupon |
| 2       | - soil immediately turned pale white<br>- water turned slightly white                          | - white rim forming at top of the water<br>- soil smoothly spread on coupon<br>- water slightly turning white | - soil seems to all float to the top of the water  | - very light streaks on coupon                                       |
| 3       | - soil immediately turned pale white<br>- soil floating off of coupon, to the top of water     | - thick white rim at top of water   | - soil seems to all float to the top of the water<br>- remaining white layer of soil on coupon | - thin white rim on top coupon                                       |
| 4       | - soil immediately turned pale white<br>- soil coming off coupon, floating to top of the water | - thin white rim forming at top of water<br>- water slightly cloudy/ white                                    | - white rim at top of water<br>- visible white streaks along coupon                            | - water slightly cloudy<br>- white streaks in water                  |
| 5       | - soil immediately turned pale white<br>- water is turning light white                         | - thick + bubbly white rim at top of water  | - soil seems to all float to the top of the water  | - very faint white film on coupon                                    |

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|   |                             |   |   |   |
|---|-----------------------------|---|---|---|
| 6 | - soil turning slight white | - very thin white rim forming at top of water<br>- visible white streaks along coupon | - think white rim at top of water<br>- visible white streaks along coupon | - water turning cloudy<br>- white rim at top of water |
|---|-----------------------------|---|---|---|

Visual Observations for Rustlick 50/50 Oil Coupons:

| Cleaner | 5 Mins   | 10 Mins   | 15 Mins  | Rinse  |
|---------|--|---|--|--|
| 1       | - streaks of soil visible moving down coupon<br>- soil detached, floating in front of coupon                     | - opaque blue rim forming at top of water<br>- soil in the middle coupon seems to be removing | - coupon looks cleaner<br>- some soil still visible on coupon              | - blue tint in water   |
| 2       | - little to no soil change<br>- water getting cloudy<br>- opaque blue rim floating at top of water               | - seems to be removing only the thin layers of soil, not thicker layer                        | - coupon looks cleaner<br>- some soil still visible on coupon              | - slight visible clouds in water<br>- water is blue<br>- effective but little chunks of soil still remain on coupon    |
| 3       | - soil slowly moving to bottom of coupon<br>- water getting cloudy<br>- opaque blue rim floating at top of water | - blue rim at top of water getting thicker<br>- increased streaks visible along coupon        | - coupon looks cleaner<br>- looks like soil is floating in front of coupon | - very thin rim forming at top<br>- slight clouds in water<br>- looks effective<br>- water is blue at top (not bottom) |
| 4       | - immediate change in soil color (lighter)<br>- streaks visible on coupon<br>- water getting slightly cloudy     | - increased streaks of soil floating along the coupon   | - blue rim forming on top of water   | - soil still remaining on coupon   |

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|   |   |   |  |                                       |
|---|---|---|--|---------------------------------------|
| 5 | - immediate change in soil color (lighter)<br>- water getting cloudy<br>- streaks visible on coupon | - blue rim forming at top of the water<br>- increased streaks of soil floating in water | - water getting cloudy                                   | - some soil still remaining on coupon |
| 6 | - soil breaking into chunks<br>- soil chunks are floating   | - blue rim forming at the top of water  | - water got cloudy<br>- chunks of soil floating in water | - thin layer of soil still on coupon  |

Summary:

| <b>Substrates:</b>                 |  | Copper            |        |             |                                     |               |
|------------------------------------|--|-------------------|--------|-------------|-------------------------------------|---------------|
| <b>Contaminants:</b>               |  | Oil               |        |             |                                     |               |
| Company Name:                      |  | Product Name:     | Conc.: | Efficiency: | Effective:                          | Observations: |
| Brulin Corporation                 |  | Aquavantage 1400  | 5%     | 91.08       | <input checked="" type="checkbox"/> |               |
| Hubbard Hall Inc                   |  | Emerald HD2       | 15%    | 96.50       | <input checked="" type="checkbox"/> |               |
| International Products Corporation |  | Micro 90 Conc.    | 2%     | 96.22       | <input checked="" type="checkbox"/> |               |
| Alconox Inc                        |  | Alconox           | 1%     | 91.65       | <input checked="" type="checkbox"/> |               |
| Alconox Inc                        |  | Liquinox          | 1%     | 91.95       | <input checked="" type="checkbox"/> |               |
| Buckeye International              |  | Immersion Cleaner | 20%    | 88.89       | <input checked="" type="checkbox"/> |               |

Conclusion:

All six cleaners were effective at removing Rustlick 50/50 and Mystery Oil from copper coupons.