

# CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2018  
 DateRun: 02/20/2018  
 Experimenters: Hayley Byra  
 ClientType: General  
 ProjectNumber: Project #2  
 Substrates: Copper  
 PartType: Coupon  
 Contaminants: Lubricating/Lapping Oils  
 Cleaning Methods: Immersion/Soak  
 Analytical Methods: Gravimetric, Visual  
 Purpose: To evaluate the effectiveness of four TCE aqueous alternatives at removing lubricating oils from copper alloys.

Experimental Procedure: Nine copper coupons were tested for each cleaner. Initial weights were recorded, and three coupons were soiled for each contaminant using a handheld swab to cover the bottom third of the substrate. The coupons were then immersed, three at a time, in a beaker with 250ml of the chosen diluted cleaner at room temperature (68°F) for ten minutes. Visual observations were taken during this time, and final weights were recorded after cleaning. This process was repeated for each cleaner on all three contaminants.

| Cleaner          | Soil     | Initial wt | Final wt | %Removed | Avg %Removed | Overall % Removed |      |
|------------------|----------|------------|----------|----------|--------------|-------------------|------|
| Shopmaster       | Oak 15A  | 0.0333     | 0.03323  | 0.30     | 1.56         | 8.19              |      |
|                  |          | -0.0262    | -0.0269  | 2.67     |              |                   |      |
|                  |          | 0.0142     | 0.0132   | 7.04     |              |                   |      |
|                  | Oak 941A | 0.0731     | 0.0505   | 30.92    | 15.43        |                   |      |
|                  |          | 0.0478     | 0.0412   | 13.81    |              |                   |      |
|                  |          | 0.0254     | 0.0250   | 1.57     |              |                   |      |
|                  | M4       | 0.0790     | 0.0750   | 5.06     | 7.58         |                   |      |
|                  |          | 0.1323     | 0.1107   | 16.33    |              |                   |      |
| 0.0660           |          | 0.0651     | 1.36     |          |              |                   |      |
| 0.0689           |          | 0.0698     | -1.31    |          |              |                   |      |
| Solution 2000    | Oak 15A  | 0.0359     | 0.0414   | -15.32   | -11.03       | -2.50             |      |
|                  |          | 0.0255     | 0.0297   | -16.47   |              |                   |      |
|                  |          | -0.4644    | -0.4668  | -0.52    |              |                   |      |
|                  | Oak 941A | 0.0295     | 0.0270   | 8.47     | 3.19         |                   |      |
|                  |          | 0.0310     | 0.0305   | 1.61     |              |                   |      |
|                  |          | 0.2118     | 0.2134   | -0.76    |              |                   |      |
|                  | M4       | 0.1250     | 0.1025   | 0.00     | 0.33         |                   |      |
|                  |          | 0.1258     | 0.1236   | 1.75     |              |                   |      |
|                  |          | 0.0539     | 0.0495   | 8.16     |              | 4.02              | 2.69 |
|                  |          | 0.0365     | 0.0340   | 6.85     |              |                   |      |
| 0.0374           | 0.0385   | -2.94      |          |          |              |                   |      |
| Oak Draw 941-A   | 0.0395   | 0.0334     | 15.44    | 9.09     |              |                   |      |
|                  | 0.0474   | 0.0467     | 1.48     |          |              |                   |      |
|                  | 0.0416   | 0.0373     | 10.34    |          |              |                   |      |
|                  | 0.0406   | 0.0470     | 15.76    |          |              |                   |      |
|                  | 0.1497   | 0.1503     | -0.40    |          |              |                   |      |
| M4               | 0.0860   | 0.0851     | 1.05     | -5.04    |              |                   |      |
|                  | 0.0261   | 0.0261     | 0.00     |          |              |                   |      |
|                  | 0.0261   | 0.0261     | 0.00     |          |              |                   |      |
| Amberclean 527 L | Oak 15A  | 0.0261     | 0.0261   | 0.00     | -2.15        | 2.95              |      |

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|  |       |        |        |       |       |  |
|--|-------|--------|--------|-------|-------|--|
|  |       | 0.0448 | 0.0434 | 3.13  |       |  |
|  |       | 0.0292 | 0.0320 | -9.59 |       |  |
|  | Oak   | 0.0682 | 0.6630 | 2.79  | 10.52 |  |
|  | Draw  | 0.0568 | 0.0521 | 8.27  |       |  |
|  | 941-A | 0.0654 | 0.0520 | 20.49 |       |  |
|  | M4    | 0.1237 | 0.1251 | 1.13  | 0.48  |  |
|  |       | 0.0780 | 0.0779 | 0.13  |       |  |
|  |       | 0.0489 | 0.0477 | 2.45  |       |  |

Summary:

|                         |   |               |                    |                          |                      |
|-------------------------|---|---------------|--------------------|--------------------------|----------------------|
| <b>Substrates:</b>      | Copper  |               |                    |                          |                      |
| <b>Contaminants:</b>    | Lubricating/Lapping Oils                      |               |                    |                          |                      |
| <b>Company Name:</b>    | <b>Product Name:</b>                          | <b>Conc.:</b> | <b>Efficiency:</b> | <b>Effective:</b>        | <b>Observations:</b> |
| Buckeye International   | Shopmaster                                    |               | 8.19               | <input type="checkbox"/> |                      |
| EnviroSan Products Ltd  | Solution 2000                                 |               | -2.50              | <input type="checkbox"/> |                      |
| Gemtek Products         | SC Aircraft & Metal Cleaner Super Concentrate |               | 2.69               | <input type="checkbox"/> |                      |
| Innovative Organics Inc | Amberclean 527 L                              |               | 2.95               | <input type="checkbox"/> |                      |

Conclusion: