CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2001

DateRun: 06/19/2001

Experimenters: Jason Marshall

ClientType: Metal

ProjectNumber: Project #1

Substrates: Aluminum, Carbon Steel, Stainless Steel, Steel

PartType: Coupon

Contaminants: Cutting/Tapping Fluids, Lubricating/Lapping Oils, Dirt, Fingerprints, Oil

Cleaning Methods:

Analytical Methods:

Purpose: SUMMARY OF FINDINGS

Experimental Procedure: Four cleaning products were found to be very successful in removing the various metal working fluids used at Ruland Manufacturing. The products and manufacturers are listed in Table 1.

Table 1. Successful Cleaning Products

Manufacturer	Product
Envirosolutions	Green Stuff
Oakite Products	Inproclean 3800
Today & Beyond	Beyond 2001
WR Grace	Daraclean 283

Results: Ultrasonic energy increased the effectiveness of the four solutions resulting in quick cleaning times, under two minutes, and an average cleaning efficiency of 99.83%. Table 2 lists the results from the different contaminant removal trials.

Table 2. Summary of Cleaning Trials

Contaminant	WA Wood C-Eblis Cutting Oil	WA Wood C-Eblis Cutting Oil	Chemtrol 331	Spartan Chemical MOAC 2945	Hubbard Hall Inc Metal Guard 270	WA Wood #30 Lube Oil	Precision Finishing Chemtrol 229	Milacron Cimperial 1070	MOAC 2945, pH Boost, Anti Foam,CA-12
Equipment	Immersion	Ultrasonic	Ultrasonic	Ultrasonic	Ultrasonic	Ultrasonic	Ultrasonic	Ultrasonic	Ultrasonic
Inproclean 3800U	80.92	98.72	100.05	99.98	99.91	99.07	99.68	100.01	100.10
Daraclean 283U	80.79	99.76	99.97	99.89	100.1	98.26	99.94	100.09	100.19
Green StuffU	75.67	100.9	100.08	100.08	99.92	99.79	99.40	100.10	100.04
Beyond 2001U	75.01	99.83	99.99	100.08	99.42	99.19	99.90	100.08	100.10
Shopmaster	65.35	N/T	N/T	N/T	N/T	N/T	N/T	N/T	N/T
Formula 815 GD	72.45	N/T	N/T	N/T	N/T	N/T	N/T	N/T	N/T
Armakleen E 2001	73.22	N/T	N/T	N/T	N/T	N/T	N/T	N/T	N/T
ND 17	74.03	N/T	N/T	N/T	N/T	N/T	N/T	N/T	N/T
Water	N/T	55.13	N/T	N/T	N/T	N/T	N/T	N/T	N/T

The C-Eblis oil was found to be the most difficult contaminant to remove from the steel coupons due mainly to its physical characteristics (i.e. viscosity, insoluble in water). Two other contaminants, Metal Guard 270 and #30 Lube Oil, were also not soluble in water. However these two oils had lower viscosity (based on visual analysis) than the C-Eblis oil and were easier to remove from the surface. Both of these fluids needed less than one minute of ultrasonic cleaning, whereas C-Eblis needed around 2 minutes. Based on the results of the cleaning trials, it would be recommended to clean parts coated in the C-Eblis oil using ultrasonic energy to ensure proper cleaning. As stated, all four cleaning products performed equally effective in removing the different contaminants.

From the trials conducted, Green Stuff had the highest cleaning efficiency five times and Daraclean 283 had the highest 3 times. Beyond 2001 had the second highest efficiency 4 times and Inproclean 3800 at 3

times. Overall, Green Stuff had the most overall successful cleaning trials. Table 3 lists the ranking of products.

Table 3. Ranking Of Cleaning Products

Ranking	1	2	3	4	# Top 2 Cleaning
Inproclean 3800	1	3	3	2	4
Daraclean 283	3	2	2	2	5
Green Stuff	5	1	2	1	6 U
Beyond 2001	1	4	2	2	5

Parts Cleaning in Laboratory

The cleaning of the supplied parts yielded the same consistent cleaning by all four cleaning solutions. The Envirosolutions Green Stuff and Today & Beyond 2001 showed the most signs of cleaning taking place. This could be attributed to either better cleaning of the parts or simply, just dirtier parts.

Possible Process Modifications

According to the basic routings utilized at the facility, C-Eblis is cleaned in eleven different steps and on all three substrate types (Carbon Steel, Stainless Steel and Aluminum). After each use of C-Eblis, the parts are degreased. In the majority of the manufacturing process, the rings are made using the oil, cleaned and then worked on further with more C-Eblis. Would it be possible to eliminate the cleaning step after the initial formation of the ring and proceed directly to the countersink, milling, drilling and tapping steps?

There are six cleanings areas that are removing the water-soluble contaminants from the various substrates. Each of these fluids was easily removed using ultrasonic cleaning. Due to the ease of cleaning, ultrasonic cleaning may not necessarily be needed. Therefore a second form of mechanical energy could be used in place, such as spray washing or vibrational/tumbling immersion systems. Table 4 lists the steps involved in the manufacturing process with the new cleaning processes inserted in place of the vapor degreasing with TCE.

Table 4. Proposed Cleaning for Basic Routings

Carbon Steel parts are 80% of volume
Aluminum parts are 5% of volume

Stainless Steel parts are 15% of volume

64% Carbon parts	Chemical Used	12% Stainless parts	Chemical Used	2.5% Aluminum parts	Chemical Used
Making ring from bar	C-Eblis (some #30 lube oil)	Making ring from bar	C-Eblis (some #30 lube oil)	Making ring from bar	C-Eblis (some #30 lube oil)
Cleaning (remove?)	Ultrasonic	Cleaning (remove?)	Ultrasonic	Cleaning (remove?)	Ultrasonic
Counter sink, Mill, Drill, Tap	C-Eblis	Counter sink, Mill, Drill, Tap	C-Eblis	Counter sink, Mill, Drill, Tap	C-Eblis
Cleaning	Ultrasonic	Cleaning	Ultrasonic	Cleaning	Ultrasonic
Grind	Chemtrol 311 10%	Grind	Chemtrol 311 10%	Grind	Chemtrol 311 10%
Stamp		Stamp		Stamp	
Tumble	Chemtrol 311 10%	Tumble	Chemtrol 311 10%	Tumble	Chemtrol 311 10%
Blacken	Sodium hydroxide	Oil to displace water	Metal Guard 270	Oil to displace water	Metal Guard 270
Oil	Metal Guard 270	Cleaning	Either spray or U.S.	Cleaning	Either spray or U.S.
Assemble		Assemble		Assemble	
16% Carbon parts		3% Stainless parts		2.5% Aluminum parts	
Making ring from bar	C-Eblis (some #30 lube oil)	Making ring from bar	C-Eblis (some #30 lube oil)	Making ring from bar	C-Eblis (some #30 lube oil)
Cleaning	Ultrasonic	Cleaning	Ultrasonic	Cleaning	Ultrasonic

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Countersink, Mill, Drill, Tap	MOAC 10%	Countersink, Mill, Drill, Tap	MOAC 10%	Countersink, Mill, Drill, Tap	MOAC 10%
Oil to displace water	Metal Guard 270	Oil to displace water	Metal Guard 270	Oil to displace water	Metal Guard 270
Cleaning	Spray or U.S.	Cleaning	Spray or U.S.	Cleaning	Spray or U.S.
Grind	Chemtrol 331 10%	Grind	Chemtrol 331 10%	Grind	Chemtrol 331 10%
Tumble	Chemtrol 331 10%	Tumble	Chemtrol 229 20%	Stamp	
Hone	C-Eblis	Oil to displace water	Metal Guard 270	Tumble	Chemtrol 229 20%
Stamp		Hone	C-Eblis	Oil to displace water	Metal Guard 270
		Stamp			
Cleaning	Ultrasonic	Cleaning	Ultrasonic	Cleaning	Spray or U.S.
Blacken	Sodium Hydroxide			Some to anodize	
Oil	Metal Guard 270				
Assemble		Assemble		Assemble	

Summary:

Conclusion:

SCL Process Recommendations
Using any of the four products would result in successful cleaning of all the metal working fluids involved in the manufacturing process at Ruland. Due to the design of the parts containing holes and threads, ultrasonic cleaning would provide the best mechanical agitation. Drying of the supplied parts demonstrated the need to be able to remove the water located inside the threads of the different parts. The laboratory utilized a heat gun that removed the water with some difficulty. To further enhance the drying, a convection oven would provide proper drying at a faster rate.