CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	2014
DateRun:	03/06/2014
Experimenters:	Kathleen Tenaglia, Alicia Melvin
ClientType:	Cleaning Company
ProjectNumber:	Project #1
Substrates:	Ceramics, Plastic, Stainless Steel
PartType:	Coupon
Contaminants:	Hucker's Soil
Cleaning Methods:	Steam
Analytical Methods:	Gravimetric
Purpose:	The objective of this study was to determine the effectiveness of commercially available steam devices.

Experimental Procedure:

Four of the steam cleaning devices were acquired through retailers or from the manufacturer: the MondoVap® 2400 with TANCS® (Advanced Vapor Technologies, LLC, Everett, WA), the Shark® Lift-Away Professional Steam Pocket Mop Euro-Pro Operating, LLC (Euro-Pro Operating, LLC, Newton, MA), the Eureka® Enviro Steamer® 313A (The Eureka Company, Charlotte, NC), and the Bissell® Steam Mop™ Deluxe 31N1 (BISSELL, Grand Rapids, MI). The Falcon Peregrine 1800SV Dry Vapor Steam Generator w/ Vacuum (Clean Innovations, Columbus, OH) was a gift from the manufacturer. System characteristics are shown in Table 1.

Cleaning Testing Method
Cleaning performance was testing using standardized, simulated fecal, bathroom and kitchen soils. The fecal soil (Hucker's Soil) consists of 44.2% distilled water, 13.5% evaporated milk, 8.8% creamy peanut butter, 8.8% salted butter, 8.8% stone ground wheat flour, 8.8%, egg yolk, 0.9% printer's ink with boiled linseed oil, 2.7% saline solution 2.7% and 3.5% India ink16. The bathroom soil, developed by the Toxics Use Reduction Institute, consists of: water 51.5%, hair gel 25.6%, toothpaste 10.4%, shaving cream 5.3%, hair spray 3.7% and spray deodorant 3.5% (REF: TURI Web page). The kitchen soil (Consumer Specialty Products Association Standard DCC 17) consists of a melted blend of 33% vegetable shortening, 33% lard, 33% vegetable oil and 1% carbon lampblack (REF: CSPA standard). Kitchen soil is freshly prepared for each use. Fecal and bathroom soil are prepared in batches: a single batch was used for all testing.

Pre-weighed ceramic, stainless steel, and polycarbonate coupons were coated with soil, dried for 24 hours at 24°C, and reweighed to determine the amount of soil added. For each steam device, a triangular or rectangular tool head was wrapped in a clean cotton terry towel. A clean towel was used for each test. Devices were primed for 5 seconds. The AVT, Falcon and Shark were tested using the "medium" steam setting. The other devices had only one setting.
For testing liquid products, a Gardner Straight Line Washability unit (BYK Gardner, Columbia, MD) is used to standardize cleaning strokes. The coupons were placed on the unit and clamped in place while the steam units were manually moved back and forth over them. A secondary abrasion machine was set up as a metronome behind the machine being used to match the pace of moving the machine back and forth. Pressure on the coupons was standardized by the presence of bars on either side of the coupons.

Each combination of soil and surface type was tested in triplicate. Final weights were recorded and individual coupon and average percent removals were calculated.

Results:

	Mean Soil Removal % (95% CI for the Mean)
Device*	
Falcon	94.30 (91.62- 96.98)
AVT*	89.98 (86.50- 93.46)
Bissell*	97.80 (97.05- 98.55)
Shark	83.04 (78.52- 87.55)
Eureka	99.44 (84.30- 92.58)
Soil	
Kitchen	89.31 (86.32- 92.30)
Fecal	92.65 (89.89- 95.42)
Bathroom*	90.17 (87.09- 93.25)
Surface*	
Stainless*	92.31 (89.31- 95.31)
Polycarb	92.85 (90.42- 95.29)
Ceramic*	86.97 (83.85- 90.10)

Summary:

Substrates:	Ceramics, Plastic, Stainless Steel

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Contaminants:	Hucker's Soil				
Company Name:	**Product Name:**	**Conc.:**	**Efficiency:**	**Effective:**	**Observations:**
Water	Water	100	94.30	☑	Falcon steam unit
Water	Water	100	89.98	☑	AVT system
Water	Water	100	97.80	☑	Bissell
Water	Water	100	83.04	☐	Shark system
Water	Water	100	99.44	☑	Eureka system

Conclusion:

The majority of the cleaning data shows to be successful. The only units that did not reach the 85% mark were the Falcon with bathroom soil on ceramic coupons, (Although achieved 84% Removal), AVT bathroom soil on ceramic, and kitchen soil on ceramic, the Eureka bathroom soil on ceramic, and fecal soil on ceramic, and the Shark bathroom soil on ceramic, kitchen soil on stainless, polycarbonate, or ceramic, and fecal soil on stainless.

Device and surface both are shown to be statistically significant, but soil was not. By the nature of the statistical model, effect modification, or interactions were also looked at. Device and soil did not have a statistically significant interaction (p=.066), nor did soil and surface (p=.068), or device, soil, and surface (p=.053), respectively. Device and surface did show a possibly statistically significant interaction (p=.019). Most likely this is a result of both device and surface being statistically significant on their own. However, it may be possible that the combination of the two variables creates a greater magnitude of effect on soil removal.