Evaluation of the Esporta Wash System for Cleaning Sewage-Contaminated Soft Goods

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1.0 Abstract

A study was undertaken to determine if the Esporta Wash System was capable of removing bacterial contamination from sewage-contaminated soft goods. Testing was conducted using mixed loads of contaminated and uncontaminated fabric, leather, and padded materials. The effectiveness of six varying wash cycles was evaluated to determine which cycle parameters resulted in the greatest reduction of bacterial contaminants. The efficiency of microbial load reduction was measured by collecting bulk samples of the contaminated and uncontaminated items prior to and after being washed in the Esporta Wash System. Samples were then analyzed by an independent laboratory to determine concentrations of *Escherichia coli* (*E. coli*), *Enterococci*, and total coliform bacteria. The percentage reduction of bacterial organisms was calculated for each of the items tested. The effectiveness of field equipment capable of measuring adenosine triphosphate (ATP) on surfaces was also tested to determine if the use of such equipment is a viable method for field verification of cleaning effectiveness.

The laboratory sampling data generated during the study revealed that

- The Esporta Wash System was effective in the removal of sewage contamination from fabrics and padded items, with reductions in bacterial counts from 96% to 100%. When the extended wash cycle (labeled as extra heavy by the Esporta manufacturer) was utilized, bacteria reduction effectiveness rose to a minimum of 98.5%.
- Cross-contamination of non-impacted fabric items did not occur. Only one padded item showed any evidence of possible cross-contamination during the various wash cycles.
- Reduction of bacterial contamination from leather goods was substantial, but more variable. Contamination reductions for most leather items ranged from 62% to 100%, although three leather items showed a net increase in bacteria after the washing.

Comparison of bulk sample laboratory results to the readings obtained with a field test process (Hygiena SystemSURE II ATP Hygiene Monitoring System) showed a strong correlation. Any variations were showing a false positive (*i.e.* cleaned items showing contamination when there was none) rather than a false negative.

Overall, the report concluded that the Esporta Wash System was appropriate for cleaning fabric and padded items contaminated with sewage. Given that the few discrepancies identified between laboratory and field test results recorded false positives that would require recleaning, it was further concluded that ATP monitoring is an effective tool in field verification of the effectiveness of removing sewage contamination.

The study author recommended that the manufacturer conduct further testing in regards to leather goods to determine if certain types of leather products can successfully be cleaned on a consistent basis or if cleaning performance can be improved if different wash parameters are used.

2.0 Purpose

The purpose of this study was to evaluate the effectiveness of the Esporta Wash System in cleaning soft goods impacted by sewage contamination. Due to the limited effectiveness of common cleaning techniques in removing biological contamination from sewage-contaminated soft goods and the potential impact to human health such contamination poses, the restoration industry consensus has been that these materials must be disposed.[1]

The Esporta Wash System represents a shift from the current technology of cleaning by physical agitation and instead uses hydraulic pressure to force proprietary cleaning chemicals through thick padding, foams, leathers, and other porous items. This study and sampling was intended to help determine if the Esporta Wash System is capable of removing biological contamination from sewage-contaminated soft goods, thus making cleaning an option over the current recommendation of disposal.

3.0 Goals

The four goals of this study were to determine

- If the Esporta Wash System is capable of removing biological contamination from soft goods impacted by sewage contamination
- Which combination of parameters in the wash cycle provided the highest reduction in bacterial concentration
- If field testing tools such as the ATP detectors (ATP SystemSURE II Hygiena) that are used in food preparation facilities are a reliable means for field verification of the effectiveness of cleaning efforts
- If cleaning non-impacted soft goods in the same cycle with contaminated articles has the potential for cross-contamination

4.0 Background

Solid and liquid wastes released during a sewage loss can contain a number of pathogenic organisms including bacteria, viruses, protozoa, and helminth worms. Exposure to these organisms can cause a host of diseases such as salmonellosis, bacillary dysentery, cholera, gastroenteritis, infectious hepatitis, poliomyelitils, giardiasis, and toxoplasmosis[2].

Building materials, furnishings, and personal items are often impacted during sewage losses. Impacted materials must be addressed by either sanitization techniques or disposal to eliminate sources of odors and pathogens. At times it can be difficult to tell exactly which items from a water loss have been contaminated by direct impact of grossly unsanitary liquid (known as Category 3 water in the IICRC S500) so intermingled items may end up being evaluated and processed as a batch. If cleaning of co-mingled items is attempted, such processes could lead to cross-contamination of non-impacted items.

Due to their absorbent qualities and varying degrees of density, porous soft goods (*i.e.* shoes, leather goods, clothing, pillows, stuffed toys, etc.) have been difficult to thoroughly

decontaminate by conventional means. As mentioned in Section 2.0, the industry consensus has been that sewage-contaminated soft goods must be disposed of due to the lack of effective decontamination techniques. This is especially burdensome for items with high monetary or intrinsic value.

In June 2004, testing of ZEP Manufacturing of Canada's Force Additive was conducted to determine the antibacterial efficacy against four bacterial strains[3]. The percent kill rates under laboratory conditions ranged from 99.9976% to 99.9999%.

In January 2005, testing of the Force Additive was conducted in conjunction with the Esporta Wash System to determine the antimicrobial efficacy on various types of sporting equipment under actual washing conditions[4]. While there was difficulty contaminating the equipment, the study concluded that "…Force Additive was an effective antimicrobial agent for washing of soiled sports equipment contaminated with S. *aures* and T. *rubrum* under the conditions of this study."

In May 2006, a study was released by International Personnel Protection, Inc. that was completed in conjunction with the Department of Human Ecology at the University of Alberta. The study was undertaken to compare two different laundering processes in terms of soiling removal, chemical contaminant removal, and effects on key firefighter protective clothing properties[5]. The study concluded that:

- significant differences were noted for improved soiling removal by the Esporta laundering method
- for chemical decontamination, the Esporta laundering process showed higher decontamination efficiencies compared to the conventional process
- in general, the Esporta laundering process showed less reduction of protective performance as compared to the conventional laundering process

The natural progression of previous testing has led to this study used to determine the effectiveness of the Esporta Wash System in cleaning soft goods impacted by sewage contamination. In June 2007, testing was conducted using a similar protocol and testing regiment as that outlined later in the body of this report. The data indicated a high efficiency (nearly 100%) in the reduction of viable bacteria for padded items, but little reduction for the fabric or leather items. This data seemed counter intuitive, as padded items provide greater overall surface area and more resistance, and therefore should have lower cleaning efficiencies than the fabric items. This data was also in conflict with results from the previous studies which showed the best cleaning effectiveness for fabric items.

Minor adjustments to the study protocol were made based on experiences from the June 2007 study and testing resumed in September 2007, using the same equipment that had been utilized for the earlier study. During calibration procedures on the first wash of the September study, it was observed that the depth of the wash water was very low (4" versus 15.5" required for the specified volume). Upon further investigation it was determined that the drain valve was stuck open because a large safety pin and plastic buckle were caught in the drain line. The pin was of the same type used in the previous study to secure bags for small contents. The discovery of this equipment malfunction helps to explain the previous test results, as it is likely that the safety pin jammed the drain valve open after the initial

washing of padded materials. As a result, subsequent wash cycles during the test were probably conducted with water levels too low to produce thorough cleaning, explaining the anomalies in data from the June 2007 study. (See Section 8 of this report for recommendations to address this situation and Esporta's response to the suggestions for correction.)

In order to provide full transparency of the test process, data from the June 2007 study is provided as appendices to this report. However, the focus of this document is the procedures utilized and data generated from the September 2007 study.

This study also incorporates the evaluation of the Hygiena SystemSURE II ATP Hygiene Monitoring System to determine if it is an effective field testing tool to measure the cleanliness of sanitized items. This particular test instrument was chosen because it has been used successfully by some of the study participants in evaluating the cleanliness of surfaces in food processing facilities.

Parties involved in this study included representatives from Wonder Makers Environmental, including Michael Pinto and Daniel Davis. The Wonder Makers staff members were responsible for the generation and adjustment of the testing protocol, collection of bulk samples, creation of the final report, and development of a summary document.

A number of individuals from Canstar Restorations assisted with the study. Art Johnson offered the use of their Esporta Wash System for the tests and was responsible for providing many of the contents used. Mr. Johnson also coordinated the procurement of sewage from the local wastewater treatment plant which was used to contaminate the test items, described in this report as impacted. Assistance in loading and operating the Esporta wash equipment at Canstar was provided by a number of Canstar employees.

In addition to the project participants from Wonder Makers and Canstar, assistance for the project was provided by representatives from Esporta Wash Systems Inc. Howard Sures provided overall administrative direction while Daryl Nestibo provided on-site technical support. Specifically, Mr. Nestibo was responsible for the setup and calibration of the Esporta washing machine throughout the six test wash cycles. Esporta's role was not one that could influence the outcome of the testing as the activities of Mr. Nestibo were observed and coordinated by Wonder Maker Environmental personnel.

Despite all the planning and assistance available to support the testing regiment, real world difficulties were experienced during the test process. During wash cycle number four the water heater supplying the Esporta machine malfunctioned. As such, that wash cycle was interrupted for seven hours between steps eight and nine of the cycle. The partially washed contents were left undisturbed in the machine during the delay while the water heater was bypassed and hot water piped to the machine from an alternate source. This delay did not appear to have any negative impact on the test results.

5.0 Methods

The following sub-sections outline the methodology used to fulfill the goals and purpose as described in Sections 2.0 and 3.0 of this document.

5.1 Selection of Test Parameters

Coliforms (including *E. coli*) and *Enterococci* (also known as fecal *streptococci*) are two groups of bacteria most commonly used by governmental organizations and environmental health professions to assess the presence of sewage contamination. While generally not harmful themselves, these bacterial groups are found in human and animal waste and serve as indicators for the presence of pathogenic organisms.

The majority of environmental laboratories surveyed prior to the development of the testing protocol include coliforms, *E. coli*, and *Enterococci* as the panel by which samples are evaluated for the presence of sewage contamination. EMLab P&K Laboratories was selected to conduct the analysis of fabric and template bulk samples via their sewage screen analysis (sample code B008). EMLab P&K is an EMLAP, EMPAT, and ISO/IEC 17025 certified laboratory. Bulk samples of the raw sewage and surface swabs were also sent to EMLab P&K for analysis. For detailed information on sample analysis methods see Section 5.9 of this document.
ATP is a chemical compound present in all organic material and acts as the “energy currency” during metabolic processes used in all living cells. Residual amounts of naturally occurring ATP can be found in microbial cells and can be detected via bioluminescence to indicate the level of cleanliness of various surfaces. ATP was measured using the Hygiena SystemSURE II monitor. For detailed information on how the Hygiena SystemSURE II is used, see Section 5.8 of this document.

The Hygiena SystemSURE II is comparable to ATP monitoring units from other manufacturers such as Accu-Point and Firefly. The SystemSURE II was selected as it was readily available to the parties conducting the testing.

5.2 General Approach

Three representative categories of soft contents that were selected for this study and are commonly impacted during sewage losses include fabric, padded contents, and leather goods. Appropriate laboratory tests were researched and evaluated for their ability to determine concentrations of bacterial contaminants representative of Category 3 water contamination.

A series of contaminated and uncontaminated samples of each material were tested prior to and after cleaning with the Esporta Wash System using both the ATP method and analysis by EMLab P&K, yielding the following summary of results. A contaminated and uncontaminated sample of each material was washed in the same cycle to determine if cross-contamination occurred during the cleaning process.

	Fabric	Padded	Leather
ATP (Pre-cleaning)**	Swabbing of 8 impacted & 4 non-impacted items	Swabbing of 14 impacted & 4 non-impacted items	Swabbing of 8 impacted & 4 non-impacted items
ATP (Post-cleaning)**	Swabbing of 8 impacted & 4 non-impacted items	Swabbing of 17 impacted & 4 non-impacted items	Swabbing of 8 impacted & 4 non-impacted items
Lab (Pre-cleaning)**	Removal of 8 swatches from impacted & 4 swatches from non-impacted items	Removal of 14 swatches from impacted & 4 swatches from non-impacted items	Removal of 8 swatches from impacted & 4 swatches from non-impacted items
Lab (Post-cleaning)**	Removal of 8 swatches from impacted & 4 swatches from non-impacted items	Removal of 17 swatches from impacted & 4 swatches from non-impacted items	Removal of 8 swatches from impacted & 4 swatches from non-impacted items

** For detailed instructions on sample collection and analysis methods, see Sections 5.4, 5.5, 5.6, 5.8, and 5.9 of this document.

Eight samples of impacted materials were collected from fabric and leather items for both ATP and laboratory testing as removal of material swatches was not expected to have a significant impact on cleaning effectiveness. Fourteen samples were collected from the padded materials as the number of layers and types of material (*i.e.* foam, cotton batting, synthetic batting, etc.) increased the variability of how materials responded to the cleaning process. Three padded items did not have bulk samples removed for pre-cleaning analysis, but were sampled post-cleaning, to ensure that the removal of swatches did not impact the effectiveness of cleaning padded items.

Samples sent to EMLab P&K were analyzed for concentrations of total coliforms (*i.e.* fecal coliforms/Gram-negative rods), *E. coli* (Gram-negative *bacilli*), and *Enterococci* (Gram-positive strep).

A 100 ml sample of the raw sewage was also collected and analyzed for comparison purposes to determine the type and concentration of indicator organisms (listed above) that were present in the source sewage.

5.3 Material Preparation

The soft goods utilized for the testing were obtained from two different sources. Many of the materials were provided by Canstar from personal goods which had been cashed out after a fire loss and were scheduled for disposal. Many of these contents had fire residue and smoke associated with them prior to their sewage contamination. Since many of these items were also used as materials to fill the Esporta wash cages so that each wash cycle represented real world conditions by having a full load of dirty items in the machine, the test parameters actually represented a worst-case scenario since smoke odor and residue is often more difficult to clean than normal dirty clothing. Additional clothing items, particularly the leather items that were necessary to fill the cages of the Esporta machine for two leather wash cycles, were purchased from a local secondhand thrift shop.

Raw sewage used to contaminate the soft goods was obtained by Art Johnson from the Vancouver Wastewater Treatment Plant. The sewage was recovered post-screening, but prior to chemical or biological treatment. Items were placed in large plastic bags and saturated with approximately two gallons of raw sewage. The bags were then sealed and agitated by hand to thoroughly coat the items with sewage. The bags of contaminated contents were then left to soak at room temperature for three days prior to testing.

5.4 Collection of Laboratory Samples

Clean, powder-free exam gloves were worn during the handling of each item to prevent cross-contamination and exposure to pathogenic organisms. Appropriate respiratory protection was also utilized for the protection of individuals involved in the direct collection of samples or the handling of the sewage-impacted contents prior to the cleaning process.

Since the contents were saturated with sewage and allowed to ripen for three days prior to the initiation of the sampling and cleaning process, marking of sample collection locations for the various items did not occur. Therefore a number of 100 $cm.^2$ (10 x 10 cm and 20 x 5 cm) plastic templates were utilized to collect pre- and post-cleaning samples. The sample collection templates were pre-cleaned with an alcohol swab and allowed to dry prior to collection of every sample in order to minimize the possibility of the sample collection process skewing results. In a similar fashion, a new sterile, disposable scalpel was used to collect each sample and was only handled after a clean pair of surgical-style gloves was donned by the individual collecting samples.
Sample locations were noted on the sample collection log as each individual sample was collected. Sample descriptions and numbers were also recorded on each sample collection bag. Photographs were taken of each sample item with the ATP sample reader to further document pre-and post-cleaning sample results.

5.5 ATP Sample Collection

The normal procedure for using the Hygiena ATP sampling system is to swab an area equal to 100 $cm.^2$, generally a four-by-four-inch square. However, the system is primarily designed for evaluating recently cleaned surfaces. The instructions state that "…It is important to make sure not to overload the swab bud with too much sample" and "…avoid collecting large amounts of sample on the swab bud." Since many of the samples were to be collected from grossly contaminated objects, a determination was made to reduce the recommended sample area from a four-by-four-inch square to a one-by-one-inch square. For consistency of sample collection and interpretation of the results, this smaller sample area was used for all samples, not just the ones from the contaminated items.

From the delineated one square inch sampling areas (pre- and post-cleaning), a sample was collected using the Hygiena SystemSURE II ATP Hygiene Monitoring System following the manufacturer's instructions. For materials with multiple layers (*i.e.* shoes, fabrics with a padded backing, etc.), each layer was exposed and swabbed. Samples were then analyzed using the Hygiena SystemSURE II ATP Hygiene Monitoring System. A pre-moistened Ultrasnap swab bud was rolled over a one square inch sampling area. The swab was placed back into the swab tube and the snap valve was bent back and forth and squeezed twice to

expel the liquid. The swab bud was bathed in the reagent by shaking the swab for fifteen seconds. The Ultrasnap sample media was inserted into the SystemSURE II read chamber and the lid was closed. The "OK" button was pressed to initiate reading of the sample. Results were displayed, within 15 seconds, in relative light units (RLU), with higher RLU values indicating higher levels of contamination. The sample results were recorded on the sample collection log.

5.6 Packaging and Transport of Laboratory Samples

As previously noted, appropriate respiratory protection and disposable clothing were worn during the sample collection process. A new pair of powder-free exam gloves and a new scalpel was used during the collection of each sample. Each delineated 100 $cm.^2$ section of material (pre/post-cleaning and four padded control items) was cut out with a new scalpel and placed in labeled, clean, dry, plastic re-sealable bags. For materials with multiple layers, a representative section of each layer was included with the 100 $cm.^2$ bulk sample. The bags were placed into a cooler containing fresh ice packs for overnight shipment to EMLab P&K for sample analysis.

The clean and unclean templates used for delineation of impacted materials were sealed, labeled, and placed in a plastic bag for bacterial analysis. A total of three templates were submitted for bacterial analysis with the following rationale:

- Unused and clean (field blank)
- Used and clean (to ensure the effectiveness of the template cleaning)
- Used and unclean (to determine the amount of potential bacterial transference to the sampling template during use)

A 100 ml sample of sewage/Category 3 water used to contaminate the test articles was collected while wearing appropriate personal protective equipment. The liquid was transferred to the lab in a labeled, glass sample jar. The labeled sample was placed into a cooler containing fresh ice packs for overnight shipment to EMLab P&K for sample analysis.

Biological swabs were collected from the door of cage three in the Esporta unit prior to content laundering, after content laundering, and after the unit was run with a disinfectant flush to yield quantitative amounts of viable bacterial organisms. Sterile biological swabs and collection ampules containing a general transport medium were provided by a commercial manufacturer. Samples were collected based on a 100 $cm.^2$ area by wetting the cotton end in the transport medium and then rolling the swab completely across a surface to bring the entire surface of the swab in contact with the measured surface area. Templates with predetermined dimensions were used to define the sampling area, which was then recorded on the sample collection log. The inoculated swabs were inserted into the ampules and placed into a cooler containing fresh ice packs for overnight shipment to EMLab P&K for sample analysis. Sample results were reported as most probable number per swab (MPN/swab). Swabs samples were analyzed using Idexx test kits.

5.7 Esporta Washing Protocol

A total of six wash settings were tested using varying wash parameters and concentrations of Force Additive disinfectant. The selected wash cycles are pre-programmed into the Esporta machines and designated as extra heavy wash, heavy wash, and leather wash settings. Each of the three standard wash cycles was also manually adjusted to double the amount of the Force Additive disinfectant metered into the Esporta ES3250 washer during subsequent wash cycles. This plan allowed the following six wash loads to be completed.

- Load 1 - Extra heavy wash with extra Force disinfectant
- Load 2 - Extra heavy wash with regular concentration of Force disinfectant
- Load 3 - Heavy wash with extra Force disinfectant
- Load 4 - Heavy wash with regular concentration of Force disinfectant
- Load 5 - Regular leather wash with extra Force disinfectant
- Load 6 - Regular leather wash with regular concentration of Force disinfectant

Critical performance characteristics of the machine such as water level, water temperature, and the amount of cleaners and disinfectants being added to the machine were evaluated prior to the start of the test process to ensure that the machine was functioning properly and throughout the testing process as a quality control measure. As indicated in Section 4.0 of this report, this quality control effort did uncover a mechanical difficulty. A five-by-one-inch safety pin blocked the drain valve in the open position which did not allow the water to properly fill the wash tank.

Each wash cycle was run with contents filling each of the eight cage baskets. For the first four wash cycles, fabric and padded items were interspersed throughout the cages. In order to simulate real world conditions, sewage-contaminated items were concentrated in some baskets and mixed with uncontaminated items in other cage baskets. Standard procedures were followed for enclosing small items in mesh bags with safety pin closures. Only leather goods were washed in the two leather wash cycles; however, a variety of leather goods including dress shoes, tennis shoes, winter boots, fashion boots, work shoes and boots, belts, purses, jackets, and backpacks were loaded into the machine.

In order to determine whether the loading of contaminated items could cross-contaminate areas of the Esporta wash machine, swab samples were collected from one of the wash cages after two separate wash cycles. A disinfectant flush was run between the first and second wash loads in an effort to determine if it should be part of the prescribed protocol for cleaning of sewage-contaminated items.

A detailed list of wash cycle settings is included in Appendix 10.7 of this document.

5.8 ATP Sample Analysis Methods

ATP sample analysis was conducted on site using the Hygiena SystemSURE II ATP Hygiene Monitoring System per the manufacturer’s instructions.

The Hygiena SystemSURE II is a hand-held device used to detect biological surface contamination. A swab moistened with a buffer solution (which aids in the penetration of

biofilms) is rubbed over a pre-determined sample area to collect microbial cells and other organic materials that contain ATP. The swab is inserted into a reagent which is derived from a naturally occurring enzyme (luciferase) found in fireflies. The reaction between the ATP and the enzyme causes the emission of light which is detected and quantified by the SystemSURE II luminometer. The amount of light produced is directly proportional to the amount of ATP on the sampled surface, which gives a quantitative measure of cleanliness of the sampled area.[6]

For further technical information regarding the SystemSURE II ATP Hygiene Monitoring System, please contact the manufacturer at 805-388-8007 ext. 300 or via their web site at http://www.hygiena.net/index.html.

5.9 Laboratory Sample Analysis Methods

All fabric, biological swab, template, and raw sewage samples were analyzed by EMLab P&K under their sewage screen analysis for total coliforms, *E. coli* and *Enterococci* (EMLab Sample Codes B008, S008, and W006).

According to laboratory personnel, determination of the presence or absence of organisms and their enumeration was conducted using an Idexx test kit. The procedure is applicable to swab, bulk, and fresh water samples that have not been altered by pre-enrichment or concentration. Specific reagents (Colilert or Enterolert) are added for each test type. Coliform and *E. coli* samples are incubated for 24 hours at 35 ±0.5°C and *Enterococci* samples are incubated for 24 hours at 43 ±0.5°C.

After 24 hours, each sample was examined for fluorescence by placing a 365 nm ultraviolet light within five inches of the sample in a dark environment. The results were read by comparison against the comparator dispensed into an identical vessel.

5.10 Quality Control Measures

As mentioned in previous sections, several quality control measures were implemented during the sampling process to increase data integrity.

- Organizations independent of the equipment manufacturer were used to draft the sampling protocol, collect the samples, and analyze the samples. It should be noted that Esporta provided financial support for the testing.
- Bulk samples were analyzed by EMLab P&K, an EMLAP, EMPAT, and ISO/IEC 17025 certified laboratory (Aerotech Laboratories).
- A 100 ml sample of sewage used to contaminate test materials was submitted and analyzed for comparison purposes.
- Templates were collected and submitted during various stages of the sample collection process to determine the amount of bacteria that was transferred during contact and to evaluate the effectiveness of template cleaning.
- Similar non-impacted materials were washed with the same type of impacted material to determine if cross-contamination can occur during the Esporta Wash System.

6.0 Results

The following sub-sections outline the data generated during the September 2007 testing.

6.1 ATP Sampling Results (SystemSURE II Hygiena)

The complete list of ATP sample results can be found in Appendices 10.2, 10.4, and 10.5 of this report. Data is provided for each test article taken pre- and post-wash in relative light units (RLU). Percentage reduction or increase was calculated for each test article. Data is separated into tables by material type and wash cycle and displayed with the laboratory data for ease of interpretation.

Fabrics

Initial pre-wash levels for the non-impacted control items ranged from 0 to 9 RLU. Post-wash levels for the same items ranged between 1 and 2 RLU. The most significant of the four non-impacted fabric samples was the blue patterned blouse which was reduced from 9 to 2 RLU after washing. The remaining three samples had either no increase after washing or a 1 RLU increase.

Eight contaminated, pre-washed fabrics ranged from 3 to 2,443 RLU, with an overall average of 576 RLU. Post-wash levels for the same items ranged from 0 to 33 RLU. Of the eight items, six saw significant reductions in the RLU levels (most were above 99%). Of the two items that resulted in net increases from pre- to post-wash sampling, an embroidered tablecloth went from 3 to 6 RLU, while the fitted bed sheet went from 14 to 33 RLU. Nevertheless, it should be noted that some variation in results could be related to the fact that pre- and post-washing samples were collected from different locations on the object. The determination to take samples from different spots was made in an effort to make sure that the sample collection process with the wetted swab did not impact the sample results by removing some of the bacterial contamination with the pre-wash sample. While this does control post-cleaning results being skewed by the sampling process, it introduces the variable of comparing post-cleaning samples to pre-cleaning samples from different areas of the fabric—sections of fabric that could have a higher pre-wash bacterial contamination than that of the pre-wash sample location.

Padded Items

Initial pre-wash levels for the non-impacted control items ranged from 0 to 8 RLU. Post-wash levels for the same items ranged between 1 and 10 RLU. Of the four non-impacted items, none of them saw a net decrease in RLU levels after washing. Two of the items had a 1 RLU increase, one item had no net increase, and the green winter jacket increased from 2 to 10 RLU after washing.

Contaminated, pre-washed padded items ranged from 13 to 7,911 RLU, with an overall average of 2,169 RLU. Post-wash levels for the same items ranged from 0 to 15 RLU. Of the fourteen contaminated items from which pre- and post-wash samples were collected, thirteen saw significant reductions in the RLU levels (10 of which were above 99%).

Three padded items were also tested without the collection of bulk samples prior to washing. These items were used to help determine if cutting swatches from the items had a significant impact on the efficiency of the cleaning process. As no pre-wash sampling was conducted on the items, no percentage reduction of RLU could be calculated. Post-wash levels were 0, 3, and 26 RLU, the highest of which was collected from a flowered sleeping bag.

Leather

Initial pre-wash levels for the non-impacted control items ranged from 41 to 512 RLU. Post-wash levels for the same items ranged between 0 and 23 RLU. All four of the non-impacted items saw a net decrease in RLU levels after washing (three of which had a 100% net decrease).

Eight contaminated, pre-washed leathers ranged from 22 to 602 RLU, with an overall average of 232 RLU. Post-wash levels for the same items ranged from 0 to 3 RLU. All eight of the contaminated items saw significant reductions in the RLU levels (five of which were above 99%).

Trends in RLU Levels by Wash Cycle

The wash cycle with the greatest percentage reduction in RLU for fabrics and padded items was the extra heavy wash with extra disinfectant. Three of the five contaminated items had 100% reductions. The remaining two items had reductions of 99.92% and 99.93%. The two control items had 1 RLU for both pre- and post-wash measurements, resulting in no change.

The wash cycle with the lowest percentage reduction in RLU for fabrics and padded items was the extra heavy wash with regular disinfectant. Three of the samples showed net increases after washing, including the non-impacted green winter jacket which had a 500% increase from 2 to 10 RLU. The items with net reductions ranged from 61.54% to 100%, with an overall average of 84.86%.

The wash cycle with the greatest percentage reduction in RLU for leather items was the regular leather wash with extra disinfectant. Three of the six items had reductions of 100%. The other three items ranged from 97.37% to 99.21%.

6.2 Laboratory Bulk Sampling Results

The complete list of bulk fabric sample results can be found in Appendices 10.3, 10.4, and 10.5 of this report. Data is provided for each test article taken pre- and post-wash as expressed by most probable number of bacteria per gram of material (MPN/gram). Percentage reduction or increase of each bacterial type was calculated for each test article. Data was separated into tables by material type and wash cycle for ease of interpretation.

The upper reportable limit for bacterial samples analyzed by EMLab P&K is 24,200 MPN/gram. Anything beyond this level is reported as greater than 24,200 MPN/gram (shown with the mathematical notation >24,200). The lower reportable limit is 10 MPN/gram. Anything below this level is reported as less than 10 MPN/gram (<10). For purposes of calculating percent reduction, all sample results reported as >24,200 were treated as if the

reported bacteria count was 24,000. Reported counts of <10 were treated as if the bacteria count was zero.

Fabrics

Four non-impacted control items were tested before and after being washed with sewage-contaminated items. All four samples were below the method detection limit for *E.coli*, *Enterococci*, and total coliform for both the pre- and post-wash samples.

All eight of the pre-wash, sewage-contaminated items had total coliform concentrations of >24,200 MPN/gram. *E. coli* levels were the second highest and ranged from 6,490 to >24,200 MPN/gram. Five of the eight pre-wash fabric samples had *Enterococci* levels <10 MPN/gram and the highest level of *Enterococci* was 131 MPN/gram.

Five of the eight post-wash fabric samples had bacterial concentrations of <10 MPN/gram for all three bacterial types. Of the remaining three samples, all had *Enterococci* concentrations of <10 MPN/gram. Only one sample had measurable levels of *E. coli*, with a reported concentration of 10 MPN/gram, which represented a 99.92% reduction from the pre-wash *E. coli* level of 13,000 MPN/gram. Three of the post-wash samples had measurable levels of total coliform bacteria reported after the wash cycles (20, 364, and 537 MPN/gram), with a minimum reduction of 97.78%

Padded Items

Four non-impacted control items were tested before and after being washed with sewage-contaminated items. Two of the four non-impacted pre-wash samples had bacterial concentrations below the method detection limit. Of the other two, both had total coliform concentrations of 52 MPN/gram and the green sleeping bag had 10 MPN/gram of *Enterococci*.

Three of the four non-impacted, post-wash samples had bacterial concentrations that were below the method detection limit for the laboratory. The fourth item, a green sleeping bag, had a total coliform concentration of >24,200 but had no recorded concentrations of *E. coli* or *Enterococci*.

A total of seventeen sewage-contaminated padded items were used, three of which only had post-wash samples collected to help assess if the removal of material during pre-wash sampling had any effect on wash efficiency.

All 14 sewage-impacted items had total coliform concentrations of >24,200 MPN/gram for pre-wash sampling. *E. coli* concentrations were second highest and ranged from 185 to >24,200 MPN/gram. Levels of *Enterococci* for pre-wash samples ranged from <10 to 11,200 MPN/gram, with only three of the samples having *Enterococci* levels below the method detection level.

No *Enterococci* bacteria were detected on any of the samples from the post-wash, sewage-impacted padded materials. Nine of the seventeen were below the laboratory's method detection limit for all three bacterial types. Some level of total coliform bacteria was detected

on the remaining eight items and ranged from 20 to 650 MPN/gram. Minimum reduction in total coliform bacteria was 97.31%. *E. coli* was only detected on one of the post-wash, sewage-impacted padded samples, with a 96.28% reduction shown for that sample and bacteria type. A red jacket with a lining was the only post-wash padded sample to have both *E. coli* and total coliform. *E. coli* was found to be 20 MPN/gram and total coliform was 650 MPN/gram in the red jacket sample.

Leather

Four non-impacted leather items were tested before and after being washed with sewage-contaminated items for control purposes. No measurable bacteria were recovered from three of the four samples for all three bacterial types. A black boot that had not been intentionally contaminated with sewage water had an *Enterococci* concentration of >24,200 MPN/gram for the pre-wash sample but was below the method detection limit for *E. coli* and total coliform. The post-wash sample for the black boot had >24,200 MPN/gram total coliform and 41 MPN/gram *E. coli*.

All eight of the impacted, pre-wash leather items had widely variable levels of contamination among all three bacterial types. For instance, the woman's black fashion boot had no detectable contamination for all three bacterial types, while the black hush puppy shoe had *E. coli* levels of 14,100 MPN/gram and total coliform levels of >24,200 MPN/gram. Four of the eight pre-wash items were below the method detection limit for both *E. coli* and *Enterococci*. The highest levels of contamination were found in the total coliform category, with levels recorded for three of the eight samples at >24,200 MPN/gram and seven of the eight samples showing measurable levels of total coliform.

Five of the eight post-wash leather items had no bacteria detected for all three bacterial types. Even so, it is important to point out that four of these five samples started out with low levels of contamination. Of the remaining three post-wash samples exhibiting contamination, *E. coli* and total coliform were found in significant levels. A black loafer and brown boot exhibited net increases in total coliform concentrations.

Trends by Wash Cycle

The wash cycles with the greatest percentage of reduction in bacterial levels for fabrics and padded items were the extra heavy wash with regular disinfectant and the heavy wash with extra disinfectant.

For the extra heavy wash with regular disinfectant, six of the seven impacted items were below the laboratory detection limit for post-wash samples in all three bacterial types. The single impacted item (a beige backpack) with signs of contamination after washing had a total coliform concentration of 72 MPN/gram. Although some bacteria was still present, it was significantly decreased from the concentration of >24,200 MPN/gram, a reduction of at least 99.7%. *E. coli* was reduced from 24,200 MPN/gram to completely undetectable and *Enterococci* was reduced from 11,200 MPN/gram to undetectable levels. No signs of cross-contamination were observed in the two control items as both showed no evidence of contamination for all three bacterial types in post-wash samples.

For the heavy wash with extra disinfectant, five of the six impacted items were found to have no detectable contamination for all bacterial types. The single impacted item (a green sheet) with signs of contamination after washing had a total coliform concentration of 20 MPN/gram. Since the sheet started with a contamination level in excess of 24,200 MPN/gram, the wash cycle removed at least 99.92% of the bacteria. *E. coli* concentrations were eliminated from the sheet after starting at 7,270 MPN/gram. No signs of cross-contamination were observed in the two control items as no bacteria were recovered in post-wash samples for all three bacterial types.

The wash cycle with the least efficiency was the heavy wash with regular disinfectant. Of the six impacted items washed in the cycle, five had detectable levels of bacterial contamination (most commonly total coliform). Of the two non-impacted items, the green sleeping bag saw a significant increase in the level of total coliform bacteria (from 52 to >24,200 MPN/gram). It is important to point out that the concentrations for *E. coli* and *Enterococci* in the post-wash sample for the sleeping bag were both undetectable. Because of the dense nature of the sleeping bag padding (heavy fabric cords rather than the newer fiber fill) and the fact that different sections of the padding had to be removed for pre- and post-sampling, it is possible that the sleeping bag had a pre-existing area of heavy contamination at the point of post-sampling rather than being cross-contaminated by the wash.

The leather wash cycles presented more variation in the sample results than the wash parameters used for padded objects and fabrics. Both leather washing cycles, which were significantly shorter and less aggressive than cleaning cycles used for padded materials and fabrics, produced at least one item which recorded a higher bacterial concentration after the washing as compared to the pre-wash sample. An unexpected result was both an increase and decrease in various bacterial concentrations for a black boot that was not intentionally contaminated with sewage. That a non-impacted item used as a control sample had a level of *Enterococci* that exceeded the laboratory's analytical criteria prior to washing and had none of that bacteria after the washing (but elevated counts of total coliform afterwards which were not present previously) indicates that bacterial contamination levels on shoes and boots may vary greatly across the surface of a single item. The fact that the sampling procedure called for all layers of an item to be collected increased the chance of extreme variability in bacterial concentrations recovered from shoes and boots as many of those objects had four to five separate layers of leather and other materials composited together. Indeed, the most obvious pattern of results received from the leather wash cycles was not related to the wash cycle but to the type of item being washed. Shoes and boots had a wide variation in cleaning efficiency while other objects such as purses, jackets, and belts showed 100% reduction in bacterial contamination without any cross-contamination.

Comparisons to ATP Results

While individual variations in general correlation between the ATP readings and laboratory-generated bacterial results were observed, the overall association between the two sampling methods shows that decreases in ATP results relate to decreases in bacterial concentrations, especially in padded items and fabrics. In some cases, the ATP sampling system appeared to be more sensitive than the laboratory results, but these variations were relatively minor in situations where the laboratory tests indicated no bacterial contamination was present (*i.e.* RLU readings from 1 to15, with the equipment manufacturer indicating that any rating up to

10 indicates a clean surface). Where there was a discrepancy between the two results, the ATP rating was generally higher than the comparison laboratory result.

Template Samples

Three clear plastic templates used for delineating sampling areas were submitted for sewage screen analysis to determine the effectiveness of decontamination methods and the amount of transference that could occur between the sample and the template. The three templates analyzed for *E. coli*, *Enterococci*, and total coliform included an unused template, a used template that had been cleaned, and a used template that was submitted to the laboratory without being cleaned. No bacteria was recovered from any of the three sampling templates submitted to the laboratory, suggesting that the smooth, non-porous material selected to delineate the sampling areas was not impacting the results in either a positive or negative fashion.

Swab Samples

Three viable swab samples were collected from a single cage door (the door marked with the numeral three) and submitted for sewage screen analysis to determine the effectiveness of the post-wash flush and the potential cross-contamination in the interior of the Esporta wash unit. The samples were collected prior to washing sewage-contaminated contents, post-wash after the first cycle, and after the system flush procedure. All three swab samples were <10 MPN/swab.

Raw Sewage Sample

A sample of the raw sewage was collected and sent for sewage screen analysis to determine the levels of *E. coli*, *Enterococci*, and total coliform. The concentrations were as follows:

- *E. coli*: 583 MPN/ml
- *Enterococci*: 345 MPN/ml
- Total coliform: 8,660 MPN/ml

These levels were lower than the bacterial load identified in an initial round of sampling, reflecting the difference in dilution factors when comparing sewage collected from the storage tank of a portable toilet and sewage collected from a municipal wastewater treatment facility where the waste is transported by flushing with potable water.

Additional information on sample results can be found in Appendix 10.3 of this document.

7.0 Conclusions

A careful review of the test procedures and the field/ laboratory results revealed a substantial amount of useful information. For example, both the laboratory and ATP results for some leather items indicated that non-impacted boots and shoes were as contaminated as the impacted ones. This likely is a reflection that shoes, and particularly work boots, are exposed to greater soil and bacteria loads on a regular basis. Neither the shoes/boots provided by

Canstar as part of the fire cash-out nor the boots purchased from the thrift shop appeared to have been cleaned prior to the testing.

Although the design of the ATP swab sampling procedure minimized the potential for the sampling procedure to skew the data, it did introduce a different type of potential sampling discrepancy. Both pre- and post-wash sample results indicated that there were certain items where there appeared to be substantial variation in bacterial contamination levels at different points on a single object. One such example was identified from samples collected from a non-impacted black boot that was used to evaluate the potential for cross-contamination of clean items during the wash cycles. This item started with a high bacteria concentration on the pre-wash sample and ended up with different bacteria present on the post-wash sample, despite the fact that the initial bacterial type was completely eliminated. It is likely that these results represent variations in starting conditions for some objects, especially shoes/boots. Additionally, these results emphasized the difficulty in getting such items free of contamination as compared to being visually clean since there was no obvious indication of contamination on the boot prior to the collection of either sample.

There is no indication from the sampling results that cutting swatches from test items skewed the results in either a positive or negative fashion, nor did the use of smooth plastic templates to mark the sampling areas impact the results. The fact that no bacterial contamination was recovered from any of the three templates submitted for laboratory analysis confirms the appropriateness of the material chosen for the manufacture of the templates as well as the decontamination procedures that were used between samples.

Three of the wash cycles for the padded and fabric items produced excellent results. Minimum bacterial reduction for the extra heavy wash cycle and the heavy wash cycle with extra disinfectant was 98.5%, with no indication of cross-contamination of non-impacted items. The heavy wash setting with regular disinfectant also produced good results although there was a much higher percentage of samples with residual bacterial load as well as cleaning efficiencies several points lower than experienced with the other wash cycles (*i.e.* 96.28% cleaning effectiveness). More importantly, the heavy wash cycle with regular disinfectant produced one sample where the bacterial concentration increased after the wash cycle. While this could be a result of a variation in contamination levels at different locations on the sleeping bag tested, it could also indicate cross-contamination during that particular laundry cycle. This anomaly was not detected in any of the other three wash cycles used for padded and fabric items.

As mentioned in the previous section, variations in sample results from the leather wash cycles appeared to be related to the type of object washed rather than the wash cycle or amount of disinfectant employed during cleaning. A wide range of sample results were recovered from shoes and boots as compared to other leather goods. It is also important to remember that the sampling process evaluated all layers of a particular item for both the ATP and laboratory tests. The dense padded nature of some of the leather boots and shoes would indicate that these items need to be cleaned in a wash cycle designed for multi-layered materials as compared to the gentler and shorter cycles used for softer leather goods such as belts, clothing, and purses.

When using a standard wash cycle and the manufacturer's approved disinfectant, the sample results indicated that there is little chance of cross-contamination from the interior of the machine after loading it with sewage-contaminated items. Although running the Esporta machine through a disinfectant flush after completing work on sewage-contaminated items may have psychological benefits for the machine operators, it did not appear that such extra precautions provide any substantive benefit.

The sample results clearly indicated that there was little risk in washing sewage-contaminated items with other items that may not be impacted in the same load as long as an appropriate wash cycle is utilized. Given that many restoration losses produce multiple bags or loads of contents which may not have been properly sorted at the job site, this finding has real world implications. Testing the decontamination properties with full loads in all cages of the Esporta machine and confirming that cross-contamination to clean items did not take place means that the Esporta Wash System can be used without the extra effort of carefully sorting items retrieved from a loss. Some of the items that were used as fillers during the sewage testing were fire and smoke-damaged and provided additional useful, but unintended, information. Since those items were observed to be clean and without smoke residue after the washing, it is clear that sewage-contaminated items can be mixed with smoke-damaged contents in a single load without negatively impacting the cleaning for either type of contamination.

A strong correlation between laboratory data and the ATP sampling results was observed. Given that the few discrepancies identified between laboratory and field test results for fabric and padded items recorded false positives that would require recleaning, it appeared that ATP monitoring is an effective tool in field verification of the effectiveness of sewage contamination removal in items laundered with the Esporta Wash System.

In general, the level of bacterial contamination left on items not found to have 100% elimination of contamination would be considered safe when compared to other industries. For example, the manufacturer of the ATP testing system utilized for field measurements of bacterial contamination indicates that surfaces with residual bacteria levels represented by 10 RLU or less is considered acceptable for cleaned and sanitized food preparation surfaces. Most post-cleaning sample results measured during the tests of sewage-contaminated items that had been cleaned by the Esporta Wash System were <10 RLU (11 of 44 at 0 RLU and an additional 28 between 1 and 10 RLU, with the highest of the six outliers at 33 RLU). In a similar fashion, many food processing plants are allowed a certain level of residual bacteria in their food products by the United States Agriculture Department and other food safety organizations. A level of 200 total coliform per gram of product is frequently utilized as the level that is safe for human consumption as long as no specific pathogens such as *E. coli* are present. More than three quarters (35 of 45) of the post-cleaning sample results for total coliform were less than this threshold for bacterial contamination of food products, even though the washed contents were not edible.

8.0 Recommendations

The evaluation of the effectiveness of the Esporta Wash System when cleaning sewage-contaminated contents involved

- the design of a sampling protocol
- an initial sampling set in June 2007
- minor adjustments to the sampling protocol
- evaluation of an Esporta washing machine operating in the field
- the contamination of a variety of fabric, padded, and leather items with sewage from a wastewater treatment plant
- the collection of field samples using an ATP type of measuring system
- the collection of bulk samples for laboratory analysis

A review of the information generated from these activities has led to the development of a number of recommendations related to the cleaning of sewage-contaminated soft goods. These recommendations are based on observations made during the operation of the Esporta machine during the testing, measurements collected on site by the Esporta representative regarding the operating parameters of the machine, sample analysis results, current industry information, and the professional judgment of the investigator. The recommendations may change as new information is obtained from actual field use of the equipment for the decontamination of sewage-impacted contents.

1. The manufacturers of the Esporta machine should designate particular wash cycles as appropriate for cleaning sewage-contaminated items and train equipment operators to utilize those cycles whenever sewage contamination is known or suspected.
    a. Although a variety of wash cycles produced excellent results and prevented cross-contamination of non-impacted fabric and padded items, the variability in item types and levels of bacterial contamination support the selection of the wash parameters currently known as extra heavy as the basic operating parameters for sewage-contaminated contents. Heavy wash cycles should not be used for sewage-contaminated soft goods as that cycle was the only one that resulted in a non-impacted quality control padded item showing elevated bacteria levels after the wash.
    b. The current parameters known as the leather wash produced a 100% reduction in bacterial contamination for leather items that were not shoes or boots. As such, these parameters could be designated as the appropriate operating conditions for leather belts, purses, jackets, and other leather contents other than shoes or boots.
    c. Additional testing may be necessary to determine if the use of extra Force Additive disinfectant provides any additional benefit. Given that the use of extra disinfectant does not produce a negative impact on the cleaning effectiveness, designation of extra disinfectant for sewage-contaminated loads may provide an additional safety margin.
    d. In a similar fashion, the utilization of a disinfection flush of the Esporta machine between loads does not appear to be justified by the sampling data. However, given that Esporta machines are used to clean a variety of contents and that cleaning of sewage-contaminated items is a new development in the restoration field, recommending that Esporta operators conduct a disinfection flush after all sewage-contaminated items have been washed may provide an important psychological benefit to the customer at relatively low cost.

2. The manufacturers of the Esporta Wash System should develop a quality control program that verifies, on an ongoing basis, that the equipment operators are laundering sewage-contaminated contents in a manner that allows them to replicate the decontamination success shown by these tests.
    a. Given the problems uncovered in regards to the first sampling experience related to a malfunctioning drain valve, the quality control program should measure critical equipment parameters such as water level, water temperature, amount of chemicals added, etc. on a regular basis. In fact, Esporta has implemented procedures that prevent this type of problem from occurring in the future as part of their Certified Contents Restoration Network (CCRN) program of operator training and certification.
    b. Appropriate training of operators who wish to process sewage-contaminated contents should be part of the quality control program. Training should include initial operating instructions and annual refresher training to prevent inappropriate variations from degrading such system performance. Such refresher training could be designed to be completed via the Internet.
    c. Because of the positive association between the field measuring of bacterial contamination and the laboratory results, the use of field checks through ATP testing could be built into the quality control program. Regular collection of samples for submission to a laboratory for more precise data regarding the effectiveness of the washing system could also be explored.
        i. A strong correlation between laboratory data and the ATP sampling results was observed. Given that the few discrepancies identified between laboratory and field test results for fabric and padded items recorded false positives that would require recleaning, it was further concluded that ATP monitoring is an effective tool in field verification of the effectiveness of sewage contamination.
    d. As noted in the discussion of the malfunctioning drain valve, the existing CCRN program could be adapted to include other quality control parameters.

3. The manufacturer of the Esporta equipment should conduct further testing of the wash system in regards to leather shoes and boots to determine if certain types of leather products can successfully be cleaned on a consistent basis or if cleaning performance can be improved if different wash parameters are used.

9.0 References

1. IICRC S500 *Standard and Reference Guide for Professional Water Damage Restoration*
2. *Environmental Regulations and Technology Control of Pathogens and Vector Attraction in Sewage Sludge*, United States Environmental Protection Agency, revised July 2003
3. *Antimicrobial Efficacy Test for Force Additive*, J. Jeffery Wilson, HydroQual Laboratories, June 21, 2004
4. *Antimicrobial Efficacy Test for Force Additive*, Susan Rowsell, HydroQual Laboratories, January 11, 2005

5. *Evaluation of the Cleaning Effectiveness and Impact of Esporta and Industrial Cleaning Techniques On Firefighter Protective Clothing*, Jeffrey O. Stull International Personnel Protection, Inc. with Dr. Elizabeth Crown, Department of Human Ecology at the University of Alberta, May 10, 2006
6. Hygenia website: *Frequently Asked Questions*, http://www.hygiena.netfaq-05.html

10.0 Certifications

Michael Pinto provided oversight and generated the report for this study. Mr. Pinto's post-graduate training is in Public Administration and Environmental Engineering. In addition to his scholastic achievements, Mr. Pinto holds the titles of Certified Safety Professional and Certified Mold Professional. He is a member of the American Society of Safety Engineers, American Society of Heating Refrigerating and Air Conditioning Engineers, Restoration Industry Association, American Industrial Hygiene Association, and the American Society of Testing and Materials. Mr. Pinto is the author of over 120 published technical articles and has successfully conducted industrial hygiene/indoor air quality investigations since 1988.

Michael A. Pinto, CSP, CMP
CEO

Appendix A

September 2007 Sampling Protocol

Protocol for Evaluation of the Esporta Wash System in Cleaning Sewage-contaminated Soft Goods

Purpose

The purpose of this study is to evaluate the effectiveness of the Esporta Wash System in cleaning soft goods impacted by sewage contamination. Due to the limited effectiveness of common cleaning techniques in removing biological contamination from sewage-contaminated soft goods and its potential impact to human health, the restoration industry consensus has been that these materials must be disposed of. According to IICRC S500 *Standard and Reference Guide for Professional Water Damage Restoration,* Section 12.3.12.2, "Directly contaminated, highly absorbent stuffed fabrics (pillows, stuffed animals, mattresses, box springs, upholstered furniture) must be disposed."

The Esporta Wash System represents a shift from the current technology of cleaning by physical agitation and instead uses hydraulic pressure to force proprietary cleaning chemicals through thick padding, foams, leathers, and other porous items. This study and sampling is intended to help determine if the Esporta Wash System is capable of removing biological contamination from sewage-contaminated soft goods, thus making cleaning an option over the current recommendation of disposal.

Parties Involved

Michael Pinto is responsible for the generation of testing protocol, on-site project management, final reports, and articles.

Art Johnson is responsible for testing materials, sourcing of contents, and cleaning materials.

Goals

The three goals of this study are to determine:

1. If the Esporta Wash System is capable of removing biological contamination from soft goods impacted by sewage contamination.
2. If field testing tools such as the ATP (SystemSURE II Hygiena) are a reliable means of field verification on the effectiveness of cleaning efforts.
3. If cleaning non-impacted soft goods in the same cycle with contaminated articles has the potential for cross-contamination. At times it can be difficult to tell exactly which items from a water loss have been contaminated by direct impact of Category 3 water so intermingled items may be cleaned as a batch. This could lead to cross-contamination of non-impacted items.

General Approach

Three representative categories of soft contents were selected that are commonly impacted during sewage losses, including fabric, padded contents, and leather goods. In addition,

appropriate laboratory tests were researched and evaluated for their ability to determine concentrations of bacterial contaminants representative of Category 3 sewage contamination.

A series of contaminated and uncontaminated samples of each material* will be tested prior to and after cleaning with the Esporta Wash System, using both the ATP method and analysis by an outside laboratory, and yielding the following summary of results.

	Fabric	**Padded**	**Leather**
ATP (Pre-cleaning)**	Swabbing of 8 impacted & 4 non-impacted items	Swabbing of 10 impacted & 4 non-impacted items	Swabbing of 8 impacted & 4 non-impacted items
ATP (Post-cleaning)**	Swabbing of 8 impacted & 4 non-impacted items	Swabbing of 10 impacted & 4 non-impacted items	Swabbing of 8 impacted & 4 non-impacted items
Laboratory (Pre-cleaning)**	Removal of 8 swatches from impacted & 4 swatches from non-impacted items	Removal of 14 swatches from impacted & 4 swatches from non-impacted items	Removal of 8 swatches from impacted & 4 swatches from non-impacted items
Laboratory (Post-cleaning)**	Removal of 8 swatches from impacted & 4 swatches from non-impacted items	Removal of 18 swatches from impacted & 4 swatches from non-impacted items	Removal of 8 swatches from impacted & 4 swatches from non-impacted items

*Both the contaminated and uncontaminated sample of each material will be washed in the same cycle to determine if cross-contamination will occur during the cleaning process. Each cycle will be run at full capacity with loads of mixed materials (appropriate for the wash cycle) to simulate worst-case field conditions.

** For detailed instructions on sample collection and analysis methods, see **Sampling Protocol** below.

Eight samples of impacted materials will be collected from fabric and leather items for both ATP and laboratory testing, as removal of material swatches should not impact cleaning effectiveness. Additional samples will be collected from padded materials as the number of layers and type of materials (*i.e.* foam, cotton batting, synthetic batting, etc.) may respond differently to the cleaning process. Additional samples will be collected from padded items for laboratory analysis to insure that the cutting for the swab sampling or removal of swatches for pre-cleaning analysis will not enhance the effectiveness of cleaning padded items.

Samples sent to the approved laboratory will be analyzed for concentrations of coliforms (*i.e*. fecal coliforms/Gram-negative rods), *Escherichia coli* (Gram-negative *bacilli*), and *Enterococci* (Gram-positive strep).

Contaminated items will be obtained from an actual sewage loss, after having the homeowner's permission to collect and conduct destructive testing on the items. A 100 ml sample of the sewage-contaminated water will also be collected and analyzed for comparison purposes to determine the type and concentration of indicator organisms (as listed above) that are present in the sewage-laden water. A sample of contaminated water from the same site where the contents are acquired is highly recommended. Using sewage water provided by an outside source (*i.e.* portable toilet cleaning service) introduces additional variables such as deodorizing chemicals and enzymatic liquids that may skew results. If such items are not readily available at the time of the testing, items representing a variety of contents can be saturated with sewage collected from a municipal wastewater treatment plant (sewage collected from the system at a point prior to any treatment process).

Sampling Protocol

Material Preparation

Clean, powder-free exam gloves must be worn while handling each item and collecting samples to prevent cross-contamination and exposure to pathogenic organisms. Appropriate respiratory protection is also recommended for the protection of any individual involved in the collection of samples or the handling of contents during the cleaning process. 100 $cm.^2$ templates made of a rigid, non-porous material (*i.e.* Plexiglas, plastic) will be pre-cleaned with an alcohol swab and allowed to dry. Several configurations of templates (*i.e.* 5 x 20 cm., 10 x 10 cm.) should be available to accommodate the different dimensions and proportions of materials being tested. A clean template not used for sample delineation should be labeled, sealed in a clean and dry plastic bag, and sent to the laboratory for bacterial analysis.

For each material (fabric, padded, leather, impacted, and non-impacted) two separate 100 $cm.^2$ sampling locations must be delineated and labeled for sampling prior to cleaning with the Esporta Wash System. The sampling areas should be outlined using an indelible marker and labeled with the appropriate sampling location for future reference. The template must be thoroughly cleaned with an alcohol wipe and allowed to dry completely between each use.

For the first 100 $cm.^2$ sampling area, a sample will be collected using the Hygiena SystemSURE II ATP Hygiene Monitoring System following the manufacturer's instructions (outlined in **Analysis Methods**). For items with multiple layers (*i.e.* shoes, fabrics with a padded backing, etc.), each layer should be exposed and swabbed. For the second 100 $cm.^2$ sampling area, the delineated section of material will be cut out with a heavy scissors or knife and placed in a labeled, clean, dry, plastic re-sealable bag to be sent to the approved laboratory for bacterial analysis. The blade(s) of the cutting tool must be cleaned with an alcohol swab and allowed to dry before cutting each sample. For materials with multiple layers, a representative section of each layer must be included with the 100 $cm.^2$ bulk sample.

A cleaned and unclean template used for delineation of impacted materials should be sealed, labeled, and placed in a plastic bag for bacterial analysis. At a minimum, three templates should be submitted for bacterial analysis:

- Unused and clean (field blank)
- Used and cleaned (ensures the effectiveness of the template cleaning)
- Used and not cleaned (helps determine the amount of bacterial transference to the sampling template during use)

After each material has been cleaned using the Esporta Wash System, two more 100 cm.^{2} sampling areas will be delineated and labeled as described for the pre-wash sampling method above. For the first 100 cm.^{2} sampling area, the sample will be collected using the Hygiena SystemSURE II ATP Hygiene Monitoring System as outlined in **Analysis Methods**, using the same guidelines for materials with multiple layers. For the second 100 cm.^{2} sampling area, the delineated section of material will be cut out and placed in a labeled, clean, and dry plastic bag to be sent to the approved laboratory for bacterial analysis. For materials with multiple layers, a representative section of each layer must be included with the 100 cm.^{2} bulk sample.

A 100 ml sample of sewage/Category 3 water must be collected from the location where materials were collected. Appropriate personal protective equipment must be worn while collecting the sample. The liquid will be transferred to a laboratory-approved labeled container, packaged in an insulated shipping container with a frozen pack, and delivery to the laboratory must occur within 24 hours.

Analysis Methods

Samples will be analyzed using the Hygiena SystemSURE II ATP Hygiene Monitoring System. A pre-moistened Ultrasnap swab bud will be rolled over a 10 x 10 cm. sampling area. The swab will be placed back into the tube and the snap valve firmly bent back and forth and squeezed twice to expel the liquid. The swab bud will be bathed in the reagent by shaking the swab for five seconds. The lid of the SystemSure II will be opened, the Ultrasnap sample media inserted into the read chamber, and the lid closed. The “OK” button must be pressed to initiate reading of the sample. Results are displayed within 15 seconds in relative light units (RLU), with higher RLU values indicating higher levels of contamination. The sample results will be recorded in the sample collection log.

Labeled and sealed bulk samples will be sent to a laboratory which holds EMLAP, EMPAT, and ISO/IEC 17025 certification. Appropriate paperwork such as a sample collection log and chain of custody will be included. The labeled samples will be packaged in an insulated shipping container with a frozen pack, with delivery to the lab occurring within 24 hours. The laboratory should be contacted if there are further questions about sample handling, packaging, etc.

Comparison Criteria

Sample results will be evaluated to determine if post-cleaning bacterial concentrations for impacted and non-impacted materials are below the method detection limit for the selected analysis. A determination will also be made on the order of magnitude of bacterial reduction of pre- and post-cleaned items. Non-impacted items will be evaluated to determine the net increase or decrease of bacterial contamination after being cleaned in the presence of

impacted items. ATP sample results will be compared to laboratory sample results to determine if the Hygiena SystemSURE II ATP Hygiene Monitoring System provides consistent and accurate data, making it appropriate for field verification purposes.

A qualitative comparison will also be made for post-cleaning appearance and odor.

Quality Control Measures

As mentioned in previous sections, several quality control measures will be implemented during the sampling process.

- A field blank Utrasnap swab and viable swab with transport media will be collected and analyzed to ensure that sampling media is not a source of bacterial contamination and that cross-contamination does not occur under normal handling.
- A 100 ml sample of sewage-contaminated water taken from the site where items were collected will be submitted and analyzed for comparison purposes.
- Templates will be collected and submitted during various stages of the sample collection process to determine if bacteria is transferred during contact with material being sampled and to evaluate the effectiveness of template cleaning.
- Non-impacted materials will be washed with the same type of impacted material to determine if cross-contamination can occur in the Esporta Wash System.

Appendix B

September 2007
Sample Collection Log

Wonder Makers Environmental

SAMPLE COLLECTION LOG

FABRIC

GC07-7667 Esporta Wash System September 2007

Sample Number	Type	Description	Relative Light Units (RLU)
PRE-CLEANING			
7667-01	Non-impacted EH, EF	Pillowcase	1
7667-02	Non-impacted EH, RF	Tablecloth, white with burgundy pattern	1
7667-03	Non-impacted H, EF	Blouse, blue pattern	9
7667-04	Non-impacted H, RF	Tablecloth, white	0
7667-05	Impacted EH, EF	Sheet, flower pattern	536
7667-06	Impacted EH, EF	Pillowcase, beige pattern	239
7667-07	Impacted EH, RF	Bed skirt, white	34
7667-08	Impacted EH, RF	Bed sheet, fitted	14
7667-09	Impacted H, EF	Sheet, green	1,131
7667-10	Impacted H, EF	Tablecloth, embroidered	3
7667-11	Impacted H, RF	Pillowcase, blue and white	207
7667-12	Impacted H, RF	Tablecloth, yellow	2,442
POST-CLEANING			
7667-13	Non-impacted EH, EF	Pillowcase	1
7667-14	Non-impacted EH, RF	Tablecloth, white with burgundy pattern	2
7667-15	Non-impacted H, EF	Blouse, blue pattern	2

Sample Number	Type	Description	Relative Light Units (RLU)
7667-16	Non-impacted H, RF	Tablecloth, white	1
7667-17	Impacted EH, EF	Sheet, flower pattern	0
7667-18	Impacted EH, EF	Pillowcase, beige pattern	0
7667-19	Impacted EH, RF	Bed skirt, white	4
7667-20	Impacted EH, RF	Bed sheet, fitted	33
7667-21	Impacted H, EF	Sheet, green	3
7667-22	Impacted H, EF	Tablecloth, embroidered	6
7667-23	Impacted H, RF	Pillowcase, blue and white	1
7667-24	Impacted H, RF	Tablecloth, yellow	1

H=Heavy
EH=Extra Heavy
RL=Regular Leather
RF=Regular *Force* Disinfectant
EF=Extra *Force* Disinfectant

Wonder Makers Environmental

SAMPLE COLLECTION LOG

LEATHER

GC07-7667 Esporta Wash System September 2007

Sample Number	Type	Description	Relative Light Units (RLU)
PRE-CLEANING			
7667-65	Non-impacted RL, EF	Belt, brown	41
7667-66	Non-impacted RL, EF	Tennis shoe, blue and white	69
7667-67	Non-impacted RL, RF	Purse, black	74
7667-68	Non-impacted RL, RF	Boot, black	512
7667-69	Impacted RL, EF	Dress shoe, brown	164
7667-70	Impacted RL, EF	Loafer, black	127
7667-71	Impacted RL, EF	Purse, black, suede	38
7667-72	Impacted RL, EF	Boot, black, woman's	298
7667-73	Impacted RL, RF	Jacket, black, leather	22
7667-74	Impacted RL, RF	Purse, black, leather	602
7667-75	Impacted RL, RF	Shoe, black, Hush Puppy	520
7667-76	Impacted RL, RF	Boot, brown	81
POST-CLEANING			
7667-77	Non-impacted RL, EF	Belt, brown	0
7667-78	Non-impacted RL, EF	Tennis shoe, blue and white	0
7667-79	Non-impacted RL, RF	Purse, black	0

Sample Number	Type	Description	Relative Light Units (RLU)
7667-80	Non-impacted RL, RF	Boot, black	23
7667-81	Impacted RL, EF	Dress shoe, brown	0
7667-82	Impacted RL, EF	Loafer, black	1
7667-83	Impacted RL, EF	Purse, black, suede	1
7667-84	Impacted RL, EF	Boot, black, woman's	3
7667-85	Impacted RL, RF	Jacket, black, leather	0
7667-86	Impacted RL, RF	Purse, black, leather	0
7667-87	Impacted RL, RF	Shoe, black, Hush Puppy	3
7667-88	Impacted RL, RF	Boot, brown	1

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Wonder Makers Environmental

SAMPLE COLLECTION LOG

PADDED

GC07-7667 Esporta Wash System September 2007

Sample Number	Type	Description	Relative Light Units (RLU)
PRE-CLEANING			
7667-25	Non-impacted EH, EF	Mattress cover, quilted	1
7667-26	Non-impacted EH, RF	Winter jacket, green	2
7667-27	Non-impacted H, EF	Seat cushion, salmon-colored	0
7667-28	Non-impacted H, RF	Sleeping bag, green	8
7667-29	Impacted EH, EF	Shirt, white, quilted	305
7667-30	Impacted EH, EF	Jacket, black, quilted	1,512
7667-31	Impacted EH, EF	Pillow, striped	2,627
7667-32	Impacted EH, RF	Vest, brown	27
7667-33	Impacted EH, RF	Backpack, beige	29
7667-34	Impacted EH, RF	Blanket, blue, flannel	13
7667-35	Impacted EH, RF	Towel, thick, blue/gray	52
7667-36	Impacted H, EF	Mattress pad, white, quilted	420
7667-37	Impacted H, EF	Coat, purple, fur-lined	2,158
7667-38	Impacted H, EF	Purse, padded, vinyl	584
7667-39	Impacted H, RF	Jacket and liner, red	7,911
7667-40	Impacted H, RF	Pillow, white	6,878

Sample Number	Type	Description	Relative Light Units (RLU)
7667-41	Impacted H, RF	Stuffed bear, red	6,422
7667-42	Impacted H, RF	Jacket with liner, tan	1,422
POST-CLEANING			
7667-43	Non-impacted EH, EF	Mattress cover, quilted	1
7667-44	Non-impacted EH, RF	Winter jacket, green	10
7667-45	Non-impacted H, EF	Seat cushion, salmon-colored	1
7667-46	Non-impacted H, RF	Sleeping bag, green	9
7667-47	Impacted EH, EF	Shirt, white, quilted	0
7667-48	Impacted EH, EF	Jacket, black, quilted	1
7667-49	Impacted EH, EF	Pillow, striped	2
7667-50	Impacted EH, RF	Vest, brown	0
7667-51	Impacted EH, RF	Backpack, beige	3
7667-52	Impacted EH, RF	Blanket, blue, flannel	5
7667-53	Impacted EH, RF	Towel, thick, blue/gray	1
7667-54	Impacted H, EF	Mattress pad, white, quilted	2
7667-55	Impacted H, EF	Coat, purple, fur-lined	8
7667-56	Impacted H, EF	Purse, padded, vinyl	15
7667-57	Impacted H, EF	Jacket and liner, red	11
7667-58	Impacted H, RF	Pillow, white	5
7667-59	Impacted H, RF	Stuffed bear, red	11
7667-60	Impacted H, RF	Jacket with liner, tan	5

Sample Number	Type	Description	Relative Light Units (RLU)
7667-61	Sample not collected	N/A	N/A
7667-62	Impacted EH, RF	Jacket, purple	0
7667-63	Impacted H, EF	Sweater with lining, black	3
7667-64	Impacted H, RF	Sleeping bag, flowered	26

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Wonder Makers Environmental

SAMPLE COLLECTION LOG

MISCELLANEOUS

GC07-7667 Esporta Wash System September 2007

Sample Number	Type	Description	Area
7667-89	Bulk	Unused template	N/A
7667-90	Bulk	Used, cleaned template	N/A
7667-91	Bulk	Used, non-cleaned template	N/A
7667-92	Swab	Esporta cage 7, pre-loading	100 $cm.^2$
7667-93	Swab	Esporta cage 7, after wash one and before disinfectant flush	100 $cm.^2$
7667-94	Swab	Esporta cage 7, after wash one and after disinfectant flush	100 $cm.^2$
7667-95	Water	Source water from wastewater treatment plant	100 mL

Appendix C

September 2007
EMLab P&K Sewage Screen
Bacteria Results

EMLab P&K

Report for:

Howard Sures
Esporta Wash Systems Inc.
Unit 101 1015 Crowley Ave.
Kelowna, BC V1Y 5J5 Canada

Regarding: Project: Black Water Test; GC07-7667
EML ID: 339156

Date of Analysis: 09-25-2007 to 09-25-2007

Approved by:

Lab Director
Ben Sublasky

Document Number: 200091 - Revision Number: 5

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: Esporta Wash Systems Inc.
C/O: Howard Sures
Re: Black Water Test; GC07-7667

Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	1: 7667-01 Pillow Case U, PR	2: 7667-05 Flower Sheet 1, PR	3: 7667-06 Pillow Case 1, PR	4: 7667-25 Quilt Cover U, PR
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485044-1	1485045-1	1485046-1	1485047-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	< 10	6,490	14,100	< 10
Enterococcus	< 10	10	< 10	< 10
Total coliform	< 10	> 24,200	> 24,200	< 10

Comments:

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C/O: Howard Sures
Re: Black Water Test; GC07-7667

Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	5: 7667-29 Quilt Shirt 1, PR	6: 7667-30 Quilt Jacket 1, PR	7: 7667-31 Pillow 1, PR	8: 7667-13 Pillow Case U, PO
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485048-1	1485049-1	1485050-1	1485051-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	185	1,040	12,000	< 10
Enterococcus	10	< 10	97	< 10
Total coliform	> 24,200	> 24,200	> 24,200	10

Comments:

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Date of Sampling: 09-19-2007
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Date of Report: 09-26-2007

MPN Quantitray

Location:	9: 7667-17 Flower Sheet 1, PO	10: 7667-18 Pillow Case 1, PO	11: 7667-43 Quilt Cover U, PO	12: 7667-47 Quilt Shirt 1, PO
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485052-1	1485053-1	1485054-1	1485055-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	< 10	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10	< 10
Total coliform	< 10	364	< 10	20

Comments:

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Date of Sampling: 09-19-2007
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Date of Report: 09-26-2007

MPN Quantitray

Location:	13: 7667-48 Quilt Jacket 1, PO	14: 7667-49 Pillow 1, PO	15: 7667-02 Table Cloth U, PR	16: 7667-07 Bed Skirt 1, PR
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485056-1	1485057-1	1485058-1	1485059-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	< 10	< 10	< 10	> 24,200
Enterococcus	< 10	< 10	< 10	121
Total coliform	148	< 10	< 10	> 24,200

Comments:

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Re: Black Water Test; GC07-7667

Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	17: 7667-08 Bed sheet 1, PR	18: 7667-26 Green Jacket U, PR	19: 7667-32 Brown Vest 1, PR	20: 7667-33 Backpack 1, PR
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485060-1	1485061-1	1485062-1	1485063-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	11,200	< 10	15,500	24,200
Enterococcus	31	< 10	41	11,200
Total coliform	> 24,200	52	> 24,200	> 24,200

Comments:

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Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	21: 7667-34 Flannel Blanket 1, PR	22: 7667-35 Heavy Towel 1, PR	23: 7667-14 Table Cloth U, PO	24: 7667-19 Bed Skirt 1, PO
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485064-1	1485065-1	1485066-1	1485067-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	14,100	> 24,200	< 10	< 10
Enterococcus	10	63	< 10	< 10
Total coliform	> 24,200	> 24,200	< 10	< 10

Comments:

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Date of Report: 09-26-2007

MPN Quantitray

Location:	25: 7667-20 Bed Sheet 1, PO	26: 7667-44 Green Jacket 4, PO	27: 7667-50 Brown Vest 1, PO	28: 7667-51 Backpack 1, PO
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485068-1	1485069-1	1485070-1	1485071-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	< 10	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10	< 10
Total coliform	< 10	< 10	< 10	72

Comments:

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Re: Black Water Test; GC07-7667

Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	29: 7667-52 Flannel Blanket 1, PO	30: 7667-53 Heavy Towel 1, PO	31: 7667-62 Purple Jacket 1, PO	32: 7667-03 Blue Blouse 4, PR
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485072-1	1485073-1	1485074-1	1485075-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	< 10	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10	< 10
Total coliform	< 10	< 10	< 10	< 10

Comments:

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Date of Report: 09-26-2007

MPN Quantitray

Location:	33: 7667-09 Green Sheet 1, PR	34: 7667-10 Embrodered Cloth 1, PR	35: 7667-27 Seat Cushion 4, PR	36: 7667-36 Mattress Pad 1, PR
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485076-1	1485077-1	1485078-1	1485079-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	7,270	9,800	< 10	187
Enterococcus	< 10	< 10	< 10	< 10
Total coliform	> 24,200	> 24,200	< 10	> 24,200

Comments:

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Date of Report: 09-26-2007

MPN Quantitray

Location:	37: 7667-37 Fur Lined Coat 1, PR	38: 7667-38 Vinyl Purse 1, PR	39: 7667-15 Blue Blouse U, PO	40: 7667-21 Green Sheet 1, PO
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485080-1	1485081-1	1485082-1	1485083-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	> 24,200	9,800	< 10	< 10
Enterococcus	31	1,950	< 10	< 10
Total coliform	> 24,200	> 24,200	< 10	20

Comments:

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Date of Report: 09-26-2007

MPN Quantitray

Location:	41: 7667-22 Embrodered Cloth 1, PO	42: 7667-45 Seat Cushion U, PO	43: 7667-54 Mattress Pad 1, PO	44: 7667-55 Fur Lined Coat 1, PO
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485084-1	1485085-1	1485086-1	1485087-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	< 10	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10	< 10
Total coliform	< 10	< 10	< 10	< 10

Comments:

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MPN Quantitray

Location:	45: 7667-56 Vinyl Purse 1, PO	46: 7667-63 Sweater & Liner 1, PO	47: 7667-04 W Table Cloth 4, PR	48: 7667-11 Blue Pillow Cast 1, PR
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485088-1	1485089-1	1485090-1	1485091-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	< 10	< 10	< 10	13,000
Enterococcus	< 10	< 10	< 10	< 10
Total coliform	< 10	< 10	< 10	> 24,200

Comments:

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Date of Report: 09-26-2007

MPN Quantitray

Location:	49: 7667-12 Y Table Cloth 1, PR	50: 7667-28 Sleeping Bag U, PR	51: 7667-39 Red Jacket 1, PR	52: 7667-40 White Pillow 1, PR
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485092-1	1485093-1	1485094-1	1485095-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	12,000	< 10	538	24,200
Enterococcus	< 10	10	< 10	228
Total coliform	> 24,200	52	> 24,200	> 24,200

Comments:

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Date of Report: 09-26-2007

MPN Quantitray

Location:	53: 7667-41 Read Bear 1, PR	54: 7667-Tan Jacket 1, PR	55: 7667-16 W Table Cloth U, PO	56: 7667-23 B/W Pillow Case 1, PO
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485096-1	1485097-1	1485098-1	1485099-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	15,500	17,300	< 10	10
Enterococcus	2,280	31	< 10	< 10
Total coliform	> 24,200	> 24,200	< 10	537

Comments:

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Client: Esporta Wash Systems Inc.
C/O: Howard Sures
Re: Black Water Test; GC07-7667

Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	57: 7667-24 Y Table Cloth 1, PO	58: 7667-46 Sleeping Bag U, PO	59: 7667-57 Red Jacket 1, PO	60: 7667-58 White Pillow
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485100-1	1485101-1	1485102-1	1485103-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	< 10	< 10	20	< 10
Enterococcus	< 10	< 10	< 10	< 10
Total coliform	< 10	> 24,200	650	487

Comments:

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Client: Esporta Wash Systems Inc.
C/O: Howard Sures
Re: Black Water Test; GC07-7667

Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	61: 7667-59 Red Bear 1, PO	62: 7667-60 Tan Jacket 1, PO	63: 7667-7667-64 Flowered Sleeping Bag	64: 7667-65 Brown Belt U, PR
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485104-1	1485105-1	1485106-1	1485107-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	< 10	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10	< 10
Total coliform	272	161	75	< 10

Comments:

‡ A "Version" greater than 1 indicates amended data.

EMLab P&K
1501 West Knudsen Drive, Phoenix, AZ 85027
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: Esporta Wash Systems Inc.
C/O: Howard Sures
Re: Black Water Test; GC07-7667

Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	65: 7667-66 W/B Tennis Show U, PR	66: 7667-69 Brown Dress Shoe 1, PR	67: 7667-70 Black Loafer 1, PR	68: 7667-71 Suede Purse 1, PR
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485108-1	1485109-1	1485110-1	1485111-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	< 10	< 10	52	< 10
Enterococcus	< 10	< 10	< 10	< 10
Total coliform	< 10	85	2,480	299

Comments:

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Client: Esporta Wash Systems Inc.
C/O: Howard Sures
Re: Black Water Test; GC07-7667

Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	69: 7667-72 Fashion Boot 1, PR	70: 7667-77 Brown Belt U, PO	71: 7667-78 W/B Tennis Shoe U, PO	72: 7667-81 Brown Dress Sh 1, PO
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485112-1	1485113-1	1485114-1	1485115-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	< 10	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10	< 10
Total coliform	< 10	< 10	< 10	< 10

Comments:

‡ A "Version" greater than 1 indicates amended data.

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Client: Esporta Wash Systems Inc.
C/O: Howard Sures
Re: Black Water Test; GC07-7667

Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	73: 7667-82 Black Loafer 1, PO	74: 7667-83 Suede Purse 1, PO	75: 7667-84 Fashion Boot 1, PO	76: 7667-67 Black Purse-A U, PR
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485116-1	1485118-1	1485120-1	1485122-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	20	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10	< 10
Total coliform	15,500	< 10	< 10	< 10

Comments:

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Client: Esporta Wash Systems Inc.
C/O: Howard Sures
Re: Black Water Test; GC07-7667

Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	77: 7667-68 Black Boot U, PR	78: 7667-73 Leather Jacket 1, PR	79: 7667-74 Black Purse-B 1, PR	80: 7667-75 Hush Puppy 1, PR
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485124-1	1485125-1	1485126-1	1485127-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	< 10	1,120	301	14,100
Enterococcus	> 24,200	< 10	< 10	< 10
Total coliform	< 10	> 24,200	> 24,200	> 24,200

Comments:

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Client: Esporta Wash Systems Inc.
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Re: Black Water Test; GC07-7667

Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	81: 7667-76 Brown Work Boot 1, PR	82: 7667-79 Black Purse-1 U,PO	83: 7667-80 Black Boot U, PO	84: 7667-85 Jacket 1, PO
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485128-1	1485129-1	1485130-1	1485131-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	< 10	< 10	41	< 10
Enterococcus	< 10	< 10	< 10	< 10
Total coliform	201	< 10	> 24,200	< 10

Comments:

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Client: Esporta Wash Systems Inc.
C/O: Howard Sures
Re: Black Water Test; GC07-7667

Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	85: 7667-86 Black Purse-B 1, PO	86: 7667-87 Hush Puppy 1, PO	87: 7667-88 Brown Work Boot 1, PO	88: 7667-89 Unused Template
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485132-1	1485133-1	1485134-1	1485135-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/gram	MPN/gram
E. coli	< 10	3,260	< 10	< 10
Enterococcus	< 10	< 10	< 10	< 10
Total coliform	< 10	> 24,200	2,720	< 10

Comments:

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Client: Esporta Wash Systems Inc.
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Re: Black Water Test; GC07-7667

Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	89: 7667-90 Used/Cleaned Temp.	90: 7667-91 Used/Not Cleaned Temp.	91: 7667-92 Door Cage 3 Prior To Test	92: 7667-93 Door Cage 3 Post Wash 1
Comments (see below)	None	None	None	None
Lab ID-Version‡:	1485136-1	1485137-1	1485281-1	1485282-1
Date Prepared	09/24/07	09/24/07	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07	09/25/07	09/25/07
	MPN/gram	MPN/gram	MPN/swab	MPN/swab
E. coli	< 10	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10	< 10
Total coliform	< 10	< 10	< 10	< 10

Comments:

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Client: Esporta Wash Systems Inc.
C/O: Howard Sures
Re: Black Water Test; GC07-7667

Date of Sampling: 09-19-2007
Date of Receipt: 09-21-2007
Date of Report: 09-26-2007

MPN Quantitray

Location:	93: 7667-94 Door Cage 3 Post Flush	94: 7667-95 Sewage Water
Comments (see below)	None	None
Lab ID-Version‡:	1485283-1	1485265-1
Date Prepared	09/24/07	09/24/07
Date Analyzed	09/25/07	09/25/07
	MPN/swab	MPN/ml
E. coli	< 10	583
Enterococcus	< 10	345
Total coliform	< 10	8,660

Comments:

‡ A "Version" greater than 1 indicates amended data.

Appendix D

September 2007

Data Analysis By Wash Type

Wonder Makers Environmental

DATA ANALYSIS BY WASH TYPE

EXTRA HEAVY WASH WITH EXTRA DISINFECTANT

GC07-7667 Esporta Wash System September 2007

Item Description	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Pillowcase N, F	1	1	NC	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 10	EC EN TC	NC NC NC	7667-01 7667-13
Sheet, flower pattern I, F	536	0	100	EC EN TC	6,490 10 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 100 100	7667-05 7667-17
Pillowcase, beige, pattern I, F	239	0	100	EC EN TC	14,100 <10 >24,200	EC EN TC	<10 <10 364	EC EN TC	100 NC 98.50	7667-06 7667-18
Mattress cover, quilted N, P	1	1	NC	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-25 7667-43
Shirt, white, quilted I, P	305	0	100	EC EN TC	185 10 >24,200	EC EN TC	<10 <10 20	EC EN TC	100 100 99.92	7667-29 7667-47
Jacket, black, quilted I, P	1,512	1	99.93	EC EN TC	1,040 <10 >24,200	EC EN TC	<10 <10 148	EC EN TC	100 NC 99.39	7667-30 7667-48
Pillow, striped I, P	2,627	2	99.92	EC EN TC	12,000 97 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 100 100	7667-31 7667-49

Item Description: I = Impacted, N = Non-impacted, F = Fabric, L = Leather, P = Padded
Wash Type: H = Heavy, EH = Extra Heavy, RL = Regular Leather, RF = Regular *Force* Disinfectant, EF = Extra *Force* Disinfectant
Lab Samples Pre/Post-wash: MPN = most probable number, EC = *E. coli*, EN = *Enterococci*, TC = total coliform
NC = no change
NA = non-applicable

[1]Adenosine triphosphate (ATP) levels are expressed in relative light units (RLU).
[2]Because of upper and lower limitations on laboratory analysis, certain assumptions were built into the calculations related to the reduction or increase of bacterial organisms. On substantially contaminated items, the laboratory uses an upper limit of 24,200 MPN/gram, even though the actual value may be substantially higher. This number was used as the denominator for the formula to calculate percentages of reduction or increase. In a similar fashion, the laboratory's lower reporting limits are stated as <10 MPN/gram. For calculation purposes, the lower reporting limit is interpreted as zero.

Wonder Makers Environmental

DATA ANALYSIS BY WASH TYPE

EXTRA HEAVY WASH WITH REGULAR DISINFECTANT

GC07-7667 Esporta Wash System September 2007

Item Description	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Tablecloth, white w/ burgundy N, F	1	2	+200	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-02 7667-14
Bed skirt, white I, F	34	4	88.24	EC EN TC	>24,200 121 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100% 100% 100%	7667-07 7667-19
Bed sheet, fitted I, F	14	33	+235.71	EC EN TC	11,200 31 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100% 100% 100%	7667-08 7667-20
Winter jacket, green N, P	2	10	+500	EC EN TC	<10 <10 52	EC EN TC	<10 <10 <10	EC EN TC	NC NC 100%	7667-26 7667-44
Vest, brown I, P	27	0	100	EC EN TC	15,500 41 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100% 100% 100%	7667-32 7667-50
Backpack, beige I, P	29	3	89.66	EC EN TC	24,200 11,200 >24,200	EC EN TC	<10 <10 72	EC EN TC	100% 100% 99.70%	7667-33 7667-51
Blanket, blue, flannel I, P	13	5	61.54	EC EN TC	14,100 10 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100% 100% 100%	7667-34 7667-52

Item Description	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Towel, thick, blue/gray I, P	52	NA	NA	EC EN TC	>24,200 63 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100% 100% 100%	7667-35 7667-53
Jacket, purple I, P	NA	0	NA	EC EN TC	NA NA NA	EC EN TC	<10 <10 <10	EC EN TC	NA NA NA	7667-62 (Post)

Item Description: I = Impacted, N = Non-impacted, F = Fabric, L = Leather, P = Padded
Wash Type: H = Heavy, EH = Extra Heavy, RL = Regular Leather, RF = Regular *Force* Disinfectant, EF = Extra *Force* Disinfectant
Lab Samples Pre/Post-wash: MPN = most probable number, EC = *E. coli*, EN = *Enterococci*, TC = total coliform
NC = no change
NA = non-applicable

[1]Adenosine triphosphate (ATP) levels are expressed in relative light units (RLU).
[2]Because of upper and lower limitations on laboratory analysis, certain assumptions were built into the calculations related to the reduction or increase of bacterial organisms. On substantially contaminated items, the laboratory uses an upper limit of 24,200 MPN/gram, even though the actual value may be substantially higher. This number was used as the denominator for the formula to calculate percentages of reduction or increase. In a similar fashion, the laboratory's lower reporting limits are stated as <10 MPN/gram. For calculation purposes, the lower reporting limit is interpreted as zero.

Wonder Makers Environmental

DATA ANALYSIS BY WASH TYPE

HEAVY WASH WITH EXTRA DISINFECTANT

GC07-7667 Esporta Wash System September 2007

Item Description	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Blouse, blue pattern N, F	9	2	77.78	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-03 7667-15
Sheet, green I, F	1,131	3	99.73	EC EN TC	7,270 <10 >24,200	EC EN TC	<10 <10 20	EC EN TC	100 NC 99.92	7667-09 7667-21
Tablecloth, embroidered I, F	3	6	+200	EC EN TC	9,800 <10 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 NC 100	7667-10 7667-22
Seat cushion, salmon N, P	0	1	NA	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-27 7667-45
Mattress pad, white, quilted I, P	420	2	99.52	EC EN TC	187 <10 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 NC 100	7667-36 7667-54
Coat, purple, fur-lined I, P	2,158	8	99.63	EC EN TC	>24,200 31 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 100 100	7667-37 7667-55
Purse, padded, vinyl I, P	584	15	97.43	EC EN TC	9,800 1,950 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 100 100	7667-38 7667-56

Item Description	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Sweater with lining, black I, P	NA	3	NA	EC EN TC	NA NA NA	EC EN TC	<10 <10 <10	EC EN TC	NA NA NA	7667-63 (Post)

Item Description: I = Impacted, N = Non-impacted, F = Fabric, L = Leather, P = Padded
Wash Type: H = Heavy, EH = Extra Heavy, RL = Regular Leather, RF = Regular *Force* Disinfectant, EF = Extra *Force* Disinfectant
Lab Samples Pre/Post-wash: MPN = most probable number, EC = *E. coli*, EN = *Enterococci*, TC = total coliform
NC = no change
NA = non-applicable

[1]Adenosine triphosphate (ATP) levels are expressed in relative light units (RLU).
[2]Because of upper and lower limitations on laboratory analysis, certain assumptions were built into the calculations related to the reduction or increase of bacterial organisms. On substantially contaminated items, the laboratory uses an upper limit of 24,200 MPN/gram, even though the actual value may be substantially higher. This number was used as the denominator for the formula to calculate percentages of reduction or increase. In a similar fashion, the laboratory's lower reporting limits are stated as <10 MPN/gram. For calculation purposes, the lower reporting limit is interpreted as zero.

Wonder Makers Environmental

DATA ANALYSIS BY WASH TYPE

HEAVY WASH WITH REGULAR DISINFECTANT

GC07-7667 Esporta Wash System September 2007

Item Description	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Tablecloth, white N, F	0	1	NA	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-04 7667-16
Pillowcase, blue and white I, F	207	1	99.52	EC EN TC	13,000 <10 >24,200	EC EN TC	10 <10 537	EC EN TC	99.92 NC 97.78	7667-11 7667-23
Tablecloth, yellow I, F	2,443	1	99.96	EC EN TC	12,000 <10 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 NC 100	7667-12 7667-24
Sleeping bag, green N, P	8	9	+112.5	EC EN TC	<10 10 52	EC EN TC	<10 <10 >24,200	EC EN TC	NC 100 +46,538	7667-28 7667-46
Jacket and liner, red I, P	7,911	11	99.86	EC EN TC	538 <10 >24,200	EC EN TC	20 <10 650	EC EN TC	96.28 NC 97.31	7667-39 7667-57
Pillow, white I, P	6,878	5	99.93	EC EN TC	24,200 228 >24,200	EC EN TC	<10 <10 487	EC EN TC	100 100 97.99	7667-40 7667-58
Stuffed bear, red I, P	6,422	11	99.83	EC EN TC	15,500 2,280 >24,200	EC EN TC	<10 <10 272	EC EN TC	100 100 98.88	7667-41 7667-59

Item Description	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Jacket with liner, tan I, P	1,422	5	99.65	EC EN TC	17,300 31 >24,200	EC EN TC	<10 <10 161	EC EN TC	100 100 99.33	7667-42 7667-60

Item Description: I = Impacted, N = Non-impacted, F = Fabric, L = Leather, P = Padded
Wash Type: H = Heavy, EH = Extra Heavy, RL = Regular Leather, RF = Regular *Force* Disinfectant, EF = Extra *Force* Disinfectant
Lab Samples Pre/Post-wash: MPN = most probable number, EC = *E. coli*, EN = *Enterococci*, TC = total coliform
NC = no change
NA = non-applicable

[1]Adenosine triphosphate (ATP) levels are expressed in relative light units (RLU).
[2]Because of upper and lower limitations on laboratory analysis, certain assumptions were built into the calculations related to the reduction or increase of bacterial organisms. On substantially contaminated items, the laboratory uses an upper limit of 24,200 MPN/gram, even though the actual value may be substantially higher. This number was used as the denominator for the formula to calculate percentages of reduction or increase. In a similar fashion, the laboratory's lower reporting limits are stated as <10 MPN/gram. For calculation purposes, the lower reporting limit is interpreted as zero.

Wonder Makers Environmental

DATA ANALYSIS BY WASH TYPE

REGULAR LEATHER WASH WITH EXTRA DISINFECTANT

GC07-7667 Esporta Wash System September 2007

Item Description	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Belt, brown N, L	41	0	100	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-65 7667-77
Tennis shoe, blue and white N, L	69	0	100	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-66 7667-78
Dress shoe, brown I, L	164	0	100	EC EN TC	<10 <10 85	EC EN TC	<10 <10 <10	EC EN TC	NC NC 100	7667-69 7667-81
Loafer, black I, L	127	1	99.21	EC EN TC	52 <10 2,480	EC EN TC	20 <10 15,500	EC EN TC	61.54 NC +625	7667-70 7667-82
Purse, black, suede I, L	38	1	97.37	EC EN TC	<10 <10 299	EC EN TC	<10 <10 <10	EC EN TC	NC NC 100	7667-71 7667-83
Boot, black, women's I, L	298	3	98.99	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-72 7667-84

Item Description: I = Impacted, N = Non-impacted, F = Fabric, L = Leather, P = Padded
Wash Type: H = Heavy, EH = Extra Heavy, RL = Regular Leather, RF = Regular *Force* Disinfectant, EF = Extra *Force* Disinfectant
Lab Samples Pre/Post-wash: MPN = most probable number, EC = *E. coli*, EN = *Enterococci*, TC = total coliform
NC = no change
NA = non-applicable

[1]Adenosine triphosphate (ATP) levels are expressed in relative light units (RLU).
[2]Because of upper and lower limitations on laboratory analysis, certain assumptions were built into the calculations related to the reduction or increase of bacterial organisms. On substantially contaminated items, the laboratory uses an upper limit of 24,200 MPN/gram, even though the actual value may be substantially higher. This number was used as the denominator for the formula to calculate percentages of reduction or increase. In a similar fashion, the laboratory's lower reporting limits are stated as <10 MPN/gram. For calculation purposes, the lower reporting limit is interpreted as zero.

Appendix E

September 2007

Data Analysis By Material

Wonder Makers Environmental

DATA ANALYSIS BY MATERIAL

FABRIC

GC07-7667 Esporta Wash System September 2007

Item Description	Wash Type	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Pillowcase N	EH/EF	1	1	NC	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 10	EC EN TC	NC NC NC	7667-01 7667-13
Tablecloth, white with burgundy N	EH/RF	1	2	+200	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-02 7667-14
Blouse, blue pattern N	H/EF	9	2	77.78	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-03 7667-15
Tablecloth, white N	H/RF	0	1	+	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-04 7667-16
Sheet, flower pattern I	EH/EF	536	0	100	EC EN TC	6,490 10 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 100 100	7667-05 7667-17
Pillowcase, beige pattern I	EH/EF	239	0	100	EC EN TC	14,100 <10 >24,200	EC EN TC	<10 <10 364	EC EN TC	100 NC 98.50	7667-06 7667-18
Bed skirt, white I	EH/RF	34	4	88.24	EC EN TC	>24,200 121 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 100 100	7667-07 7667-19

Item Description	Wash Type	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Bed sheet, fitted I	EH/RF	14	33	+235.71	EC EN TC	11,200 31 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 100 100	7667-08 7667-20
Sheet, green I	H/EF	1,131	3	99.73	EC EN TC	7,270 <10 >24,200	EC EN TC	<10 <10 20	EC EN TC	100 NC 99.92	7667-09 7667-21
Tablecloth, embroidered I	H/EF	3	6	+200	EC EN TC	9,800 <10 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 NC 100	7667-10 7667-22
Pillowcase, blue and white I	H/RF	207	1	99.52	EC EN TC	13,000 <10 >24,200	EC EN TC	10 <10 537	EC EN TC	99.92 NC 97.78	7667-11 7667-23
Tablecloth, yellow I	H/RF	2,443	1	99.96	EC EN TC	12,000 <10 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 NC 100	7667-12 7667-24

Item Description: I = Impacted, N = Non-impacted, F = Fabric, L = Leather, P = Padded
Wash Type: H = Heavy, EH = Extra Heavy, RL = Regular Leather, RF = Regular *Force* Disinfectant, EF = Extra *Force* Disinfectant
Lab Samples Pre/Post-wash: MPN = most probable number, EC = *E. coli*, EN = *Enterococci*, TC = total coliform
NC = no change
NA = non-applicable

[1]Adenosine triphosphate (ATP) levels are expressed in relative light units (RLU).
[2]Because of upper and lower limitations on laboratory analysis, certain assumptions were built into the calculations related to the reduction or increase of bacterial organisms. On substantially contaminated items, the laboratory uses an upper limit of 24,200 MPN/gram, even though the actual value may be substantially higher. This number was used as the denominator for the formula to calculate percentages of reduction or increase. In a similar fashion, the laboratory's lower reporting limits are stated as <10 MPN/gram. For calculation purposes, the lower reporting limit is interpreted as zero.

Wonder Makers Environmental

DATA ANALYSIS BY MATERIAL

LEATHER

GC07-7667 Esporta Wash System September 2007

Item Description	Wash Type	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Belt, brown N	RL/EF	41	0	100	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-65 7667-77
Tennis shoe, blue and white N	RL/EF	69	0	100	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-66 7667-78
Purse, black N	RL/RF	74	0	100	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-67 7667-79
Boot, black N	RL/RF	512	23	95.51	EC EN TC	<10 >24,200 <10	EC EN TC	41 <10 >24,200	EC EN TC	+ EN 100 +	7667-68 7667-80
Dress shoe, brown I	RL/EF	164	0	100	EC EN TC	<10 <10 85	EC EN TC	<10 <10 <10	EC EN TC	NC NC 100	7667-69 7667-81
Loafer, black I	RL/EF	127	1	99.21	EC EN TC	52 <10 2,480	EC EN TC	20 <10 15,500	EC EN TC	61.5385 NC +625	7667-70 7667-82
Purse, black, suede I	RL/EF	38	1	97.37	EC EN TC	<10 <10 299	EC EN TC	<10 <10 <10	EC EN TC	NC NC 100	7667-71 7667-83

Item Description	Wash Type	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Boot, black, women's I	RL/EF	298	3	98.99	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-72 7667-84
Jacket, black, leather I	RL/RF	22	0	100	EC EN TC	1,120 <10 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 NC 100	7667-73 7667-85
Purse, black, leather I	RL/RF	602	0	100	EC EN TC	301 <10 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 NC 100	7667-74 7667-86
Shoe, black, Hush Puppy I	RL/RF	520	3	99.42	EC EN TC	14,100 <10 >24,200	EC EN TC	3,260 <10 >24,200	EC EN TC	76.8794 NC NC	7667-75 7667-87
Boot, brown I	RL/RF	81	1	98.77	EC EN TC	<10 <10 201	EC EN TC	<10 <10 2,720	EC EN TC	NC NC +1353	7667-76 7667-88

Item Description: I = Impacted, N = Non-impacted, F = Fabric, L = Leather, P = Padded
Wash Type: H = Heavy, EH = Extra Heavy, RL = Regular Leather, RF = Regular *Force* Disinfectant, EF = Extra *Force* Disinfectant
Lab Samples Pre/Post-wash: MPN = most probable number, EC = *E. coli*, EN = *Enterococci*, TC = total coliform
NC = no change
NA = non-applicable

[1]Adenosine triphosphate (ATP) levels are expressed in relative light units (RLU).
[2]Because of upper and lower limitations on laboratory analysis, certain assumptions were built into the calculations related to the reduction or increase of bacterial organisms. On substantially contaminated items, the laboratory uses an upper limit of 24,200 MPN/gram, even though the actual value may be substantially higher. This number was used as the denominator for the formula to calculate percentages of reduction or increase. In a similar fashion, the laboratory's lower reporting limits are stated as <10 MPN/gram. For calculation purposes, the lower reporting limit is interpreted as zero.

Wonder Makers Environmental

DATA ANALYSIS BY MATERIAL

PADDED

GC07-7667 Esporta Wash System September 2007

Item Description	Wash Type	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Mattress cover, quilted N	EH, EF	1	1	NC	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-25 7667-43
Winter jacket, green N	EH, RF	2	10	+500	EC EN TC	<10 <10 52	EC EN TC	<10 <10 <10	EC EN TC	NC NC 100	7667-26 7667-44
Seat cushion, salmon N	H, EF	0	1	+	EC EN TC	<10 <10 <10	EC EN TC	<10 <10 <10	EC EN TC	NC NC NC	7667-27 7667-45
Sleeping bag, green N	H, RF	8	9	+112.5	EC EN TC	<10 10 52	EC EN TC	<10 <10 >24,200	EC EN TC	NC 100 +46,538	7667-28 7667-46
Shirt, white, quilted I	EH, EF	305	0	100	EC EN TC	185 10 >24,200	EC EN TC	<10 <10 20	EC EN TC	100 100 99.92	7667-29 7667-47
Jacket, black, quilted I	EH, EF	1,512	1	99.93	EC EN TC	1,040 <10 >24,200	EC EN TC	<10 <10 148	EC EN TC	100 NC 99.39	7667-30 7667-48
Pillow, striped I	EH, EF	2,627	2	99.92	EC EN TC	12,000 97 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 100 100	7667-31 7667-49

Item Description	Wash Type	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Vest, brown I	EH, RF	27	0	100	EC EN TC	15,500 41 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 100 100	7667-32 7667-50
Backpack, beige I	EH, RF	29	3	89.66	EC EN TC	24,200 11,200 >24,200	EC EN TC	<10 <10 72	EC EN TC	100 100 99.70	7667-33 7667-51
Blanket, blue, flannel I	EH, RF	13	5	61.54	EC EN TC	14,100 10 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 100 100	7667-34 7667-52
Towel, thick, blue/gray I	EH, RF	52	NA	NA	EC EN TC	>24,200 63 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 100 100	7667-35 7667-53
Mattress pad, white, quilted I	H, EF	420	2	99.52	EC EN TC	187 <10 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 NC 100	7667-36 7667-54
Coat, purple, fur-lined I	H, EF	2,158	8	99.63	EC EN TC	>24,200 31 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 100 100	7667-37 7667-55
Purse, padded, vinyl I	H, EF	584	15	97.43	EC EN TC	9,800 1,950 >24,200	EC EN TC	<10 <10 <10	EC EN TC	100 100 100	7667-38 7667-56
Jacket and liner, red I	H, RF	7,911	11	99.86	EC EN TC	538 <10 >24,200	EC EN TC	20 <10 650	EC EN TC	96.28 NC 97.31	7667-39 7667-57
Pillow, white I	H, RF	6,878	5	99.93	EC EN TC	24,200 228 >24,200	EC EN TC	<10 <10 487	EC EN TC	100 100 97.99	7667-40 7667-58
Stuffed bear, red I	H, RF	6,422	11	99.83	EC EN TC	15,500 2,280 >24,200	EC EN TC	<10 <10 272	EC EN TC	100 100 98.88	7667-41 7667-59

Item Description	Wash Type	ATP Pre-wash[1] (RLU)	ATP Post-wash[1] (RLU)	Reduction[2] (Percentage)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)		Reduction[2] (percentage)		Sample Numbers (pre/post-wash)
Jacket with lining, tan I	H, RF	1,422	5	99.65	EC EN TC	17,300 31 >24,200	EC EN TC	<10 <10 161	EC EN TC	100 100 99.33	7667-42 7667-60
Jacket, purple I	EH, RF	NA	0	NA	EC EN TC	NA NA NA	EC EN TC	<10 <10 <10	EC EN TC	NA NA NA	7667-62
Sweater with lining, black I	H, EF	NA	3	NA	EC EN TC	NA NA NA	EC EN TC	<10 <10 <10	EC EN TC	NA NA NA	7667-63
Sleeping bag, flowered I	H, RF	NA	26	NA	EC EN TC	NA NA NA	EC EN TC	<10 <10 75	EC EN TC	NA NA NA	7667-64

Item Description: I = Impacted, N = Non-impacted, F = Fabric, L = Leather, P = Padded
Wash Type: H = Heavy, EH = Extra Heavy, RL = Regular Leather, RF = Regular *Force* Disinfectant, EF = Extra *Force* Disinfectant
Lab Samples Pre/Post-wash: MPN = most probable number, EC = *E. coli*, EN = *Enterococci*, TC = total coliform
NC = no change
NA = non-applicable

[1]Adenosine triphosphate (ATP) levels are expressed in relative light units (RLU).
[2]Because of upper and lower limitations on laboratory analysis, certain assumptions were built into the calculations related to the reduction or increase of bacterial organisms. On substantially contaminated items, the laboratory uses an upper limit of 24,200 MPN/gram, even though the actual value may be substantially higher. This number was used as the denominator for the formula to calculate percentages of reduction or increase. In a similar fashion, the laboratory's lower reporting limits are stated as <10 MPN/gram. For calculation purposes, the lower reporting limit is interpreted as zero.

Appendix F

Photograph Log

Wonder Makers Environmental

PHOTOGRAPH LOG

PROJECT:	GC07-7667	**DATE:**	September 2007
PROJECT NAME:	Esporta Wash System	**SPECIALIST:**	M. Pinto

1. The Esporta machine was set up in the laundry area at Canstar Restoration in Port Coquitlam, British Columbia, where testing was conducted.

2. A representative from Esporta checked the operational parameters of the Esporta machine prior to conducting the tests, including checking the depth of the water in the tank after the first fill cycle.

3. When the water level in the Esporta wash tank was not at the correct depth, the manufacturer's representative checked the drain valve on the side of the machine.

4. The drain was found to be jammed open as a number of objects, including a six-inch safety pin and plastic snap bridle were lodged in the drain, preventing the valve from closing.

5. Swab samples were collected from the interior cage door of the Esporta machine after cleaning contaminated items to determine the potential for residual sewage contamination. None was present after the wash cycle.

6. Sewage-saturated items were sealed in durable plastic bags for three days before the testing. Because of the odor, initial sampling was conducted outside.

7. A number of uncontaminated contents were sampled prior to and after cleaning in order to determine if cleaning sewage-impacted items cross-contaminated other laundry items. No cross-contamination was observed when the extra heavy wash cycle was used.

8. Sewage-contaminated fabrics were sampled before and after cleaning.

9. Bulk samples were cut from sewage-soaked padded items, including this quilted winter vest, before cleaning. Both layers (fabric and padding) were removed for sampling.

10. Post-wash sampling was conducted indoors. A new set of gloves and a sterile scalpel were used to collect each sample.

11. A sewage-soaked leather purse was sampled with a portable ATP field test system. Note the 100 cm.^{2} patch that was cut out for laboratory sampling.

12. The same purse can be seen post-cleaning. Sampling was again conducted with the ATP field unit and a bulk sample was sent to the laboratory. Both sampling results showed a 100% reduction in bacterial contamination.

13. 100 cm.^{2} samples were collected from two sides of the same shoe for pre- and post-sampling. The work boot showed a low level of residual contamination after cleaning.

14. The tennis shoe had no residual bacterial contamination following cleaning in the Esporta Wash System.

Appendix G

Wash Cycle Parameters

Wonder Makers Environmental

WASH CYCLE PARAMETERS

LOAD 1:
EXTRA HEAVY WASH WITH EXTRA DISINFECTANT

Step	Action			Variable
1	Rotation	Turn right		Yes
		Turn left		Yes
		Wait		Yes
		Rotation time (1-250)	seconds	30
		Waiting time (1-60)	seconds	5
		Speed (1-30)	rpm	14
2	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	35
		Liters		270
3	Chemical	*Penetrator*	pump	2
		Time	seconds	125
4	Run	Time	minutes	10
5	Drain	Time	minutes	2
6	Rotation	Turn right		Yes
		Turn left		Yes
		Wait		Yes
		Rotation time (1-250)	seconds	30
		Waiting time (1-60)	seconds	5
		Rotation speed (1-30)	rpm	14
7	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	35
		Liters		270
8	Chemical	*Tak1*	pump	1
		Time	seconds	90
9	Chemical	*Penetrator*	pump	2
		Time	seconds	90
10	Run	Time	minutes	40
11	Drain	Time	minutes	2

Step	Action			Variable
12	Extract	Time	minutes	5
		Speed	rpm	120
13	Rotation	Turn right		Yes
		Turn left		Yes
		Wait		Yes
		Rotation time (1-250)	seconds	30
		Waiting time (1-60)	seconds	5
		Rotation speed (1-30)	rpm	14
14	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	35
		Liters		270
15	Chemical	*Force*	pump	3
		Time	seconds	200
16	Run	Time	minutes	10
17	Drain	Time	minutes	2
18	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	25
		Liters		270
19	Run	Time	minutes	10
20	Drain	Time	minutes	2
21	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	25
		Liters		270
22	Chemical	*Signature*	pump	4
		Time	seconds	90
23	Run	Time	minutes	10
24	Drain	Time	minutes	2
25	Extract	Time	minutes	15
		Speed	rpm	120
26	Run	Time	mintues	1

Wonder Makers Environmental

WASH CYCLE PARAMETERS

LOAD 2:
EXTRA HEAVY WASH WITH REGULAR DISINFECTANT

Step	Action			Variable
1	Rotation	Turn right		Yes
		Turn left		Yes
		Wait		Yes
		Rotation time (1-250)	seconds	30
		Waiting time (1-60)	seconds	5
		Rotation speed (1-30)	rpm	14
2	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	°C	35
		Liters		270
3	Chemical	*Penetrator*	pump	2
		Time	seconds	125
4	Run	Time	minutes	10
5	Drain	Time	minutes	2
6	Rotation	Turn right		Yes
		Turn left		Yes
		Wait		Yes
		Rotation time (1-250)	seconds	30
		Waiting time (1-60)	seconds	5
		Rotation speed (1-30)	rpm	14
7	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	°C	35
		Liters		270
8	Chemical	*Tak1*	pump	1
		Time	seconds	90
9	Chemical	*Penetrator*	pump	2
		Time	seconds	90

Step	Action			Variable
10	Run	Time	minutes	40
11	Drain	Time	minutes	2
12	Extract	Time	minutes	5
		Speed	rpm	120
13	Rotation	Turn right		Yes
		Turn left		Yes
		Wait		Yes
		Rotation time (1-250)	seconds	30
		Waiting time (1-60)	seconds	5
		Rotation speed (1-30)	rpm	14
14	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	35
		Liters		270
15	Chemical	*Force*	pump	3
		Time	seconds	100
16	Run	Time	minutes	10
17	Drain	Time	minutes	2
18	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	25
		Liters		270
19	Run	Time	minutes	10
20	Drain	Time	minutes	2
21	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	25
		Liters		270
22	Chemical	*Signature*	pump	4
		Time	seconds	90
23	Run	Time	minutes	10
24	Drain	Time	minutes	2
25	Extract	Time	minutes	15
		Speed	rpm	120
26	Run	Time	minutes	1

Wonder Makers Environmental

WASH CYCLE PARAMETERS

LOAD 3:
HEAVY WASH WITH EXTRA DISINFECTANT

Step	Action			Variable
1	Rotation	Turn right		Yes
		Turn left		Yes
		Wait		Yes
		Rotation time (1-250)	seconds	30
		Waiting time (1-60)	seconds	5
		Rotation speed (1-30)	rpm	14
2	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	35
		Liters		270
3	Chemical	*Tak1*	pump	1
		Time	seconds	90
4	Chemical	*Penetrator*	pump	2
		Time	seconds	125
5	Run	Time	minutes	40
6	Drain	Time	minutes	2
7	Extract	Time	minutes	5
		Speed	rpm	120
8	Rotation	Turn right		Yes
		Turn left		Yes
		Wait		Yes
		Rotation time (1-250)	seconds	30
		Waiting time (1-60)	seconds	5
		Rotation speed (1-30)	rpm	14
9	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	35
		Liters		270
10	Chemical	*Force*	pump	3
		Time	seconds	200

Step	Action			Variable
11	Run	Time	minutes	10
12	Drain	Time	minutes	2
13	Drain	Time	minutes	2
14	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	°C	25
		Liters		270
15	Run	Time	minutes	10
16	Drain	Time	minutes	2
17	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	°C	25
		Liters		270
18	Chemical	*Signature*	pump	4
		Time	seconds	90
19	Run	Time	minutes	5
20	Drain	Time	minutes	2
21	Extract	Time	minutes	15
		Speed	rpm	120
22	Run	Time	minutes	1

Wonder Makers Environmental

WASH CYCLE PARAMETERS

LOAD 4:
HEAVY WASH WITH REGULAR DISINFECTANT

Step	Action			Variable
1	Rotation	Turn right		Yes
		Turn left		Yes
		Wait		Yes
		Rotation time (1-250)	seconds	30
		Waiting time (1-60)	seconds	5
		Rotation speed (1-30)	rpm	14
2	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	35
		Liters		270
3	Chemical	*Tak1*	pump	1
		Time	seconds	90
4	Chemical	*Penetrator*	pump	2
		Time	seconds	125
5	Run	Time	minutes	40
6	Drain	Time	minutes	2
7	Extract	Time	minutes	5
		Speed	rpm	120
8	Rotation	Turn right		Yes
		Turn left		Yes
		Wait		Yes
		Rotation time (1-250)	seconds	30
		Waiting time (1-60)	seconds	5
		Rotation speed (1-30)	rpm	14
9	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	35
		Liters		270
10	Chemical	*Force*	pump	3
		Time	seconds	100

Step	Action			Variable
11	Run	Time	minutes	10
12	Drain	Time	minutes	2
13	Drain	Time	minutes	2
14	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	°C	25
		Liters		270
15	Run	Time	minutes	10
16	Drain	Time	minutes	2
17	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	°C	25
		Liters		270
18	Chemical	*Signature*	pump	4
		Time	seconds	90
19	Run	Time	minutes	5
20	Drain	Time	minutes	2
21	Extract	Time	minutes	15
		Speed	rpm	120
22	Run	Time	minutes	1

Wonder Makers Environmental

WASH CYCLE PARAMETERS

LOAD 5:
REGULAR LEATHER WASH WITH EXTRA DISINFECTANT

Full Force (Stage 3) Disinfectant

Step	Action			Variable
1	Rotation	Turn right		Yes
		Turn left		Yes
		Wait		Yes
		Rotation time (1-250)	seconds	30
		Waiting time (1-60)	seconds	5
		Rotation speed (1-30)	rpm	10
2	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	20
		Liters		270
3	Chemical	*Tak1*	pump	1
		Time	seconds	90
4	Chemical	*Penetrator*	pump	2
		Time	seconds	115
5	Run	Time	minutes	10
6	Drain	Time	minutes	2
7	Drain	Time	minutes	2
8	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	20
		Liters		270
9	Chemical	*Force*	pump	3
		Time	seconds	200
10	Run	Time	minutes	5
11	Drain	Time	minutes	2
12	Drain	Time	minutes	2
13	Water in	Cold		Yes

Step	Action			Variable
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	20
		Liters		270
14	Chemical	*Signature*	pump	4
		Time	seconds	90
15	Run	Time	minutes	5
16	Drain	Time	minutes	2
17	Extract	Time	minutes	10
		Speed	rpm	120
18	Run	Time	minutes	1

Wonder Makers Environmental

WASH CYCLE PARAMETERS

LOAD 6:
REGULAR LEATHER WASH WITH REGULAR DISINFECTANT

Full Force (Stage 3) Disinfectant

Step	Action			Variable
1	Rotation	Turn right		Yes
		Turn left		Yes
		Wait		Yes
		Rotation time (1-250)	seconds	30
		Waiting time (1-60)	seconds	5
		Rotation speed (1-30)	rpm	10
2	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	20
		Liters		270
3	Chemical	*Tak1*	pump	1
		Time	seconds	90
4	Chemical	*Penetrator*	pump	2
		Time	seconds	115
5	Run	Time	minutes	10
6	Drain	Time	minutes	2
7	Drain	Time	minutes	2
8	Water in	Cold		Yes
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	20
		Liters		270
9	Chemical	*Force*	pump	3
		Time	seconds	100
10	Run	Time	minutes	5
11	Drain	Time	minutes	2
12	Drain	Time	minutes	2
13	Water in	Cold		Yes

Step	Action			Variable
		Hot		Yes
		Mix		Yes
		Heat		Yes
		Temperature	˚C	20
		Liters		270
14	Chemical	*Signature*	pump	4
		Time	seconds	90
15	Run	Time	minutes	5
16	Drain	Time	minutes	2
17	Extract	Time	minutes	10
		Speed	rpm	120
18	Run	Time	minutes	1

Appendix H

June 2007

Sampling Protocol

Protocol for Evaluation of the Esporta Wash System in Cleaning Sewage Contaminated Soft Goods

Purpose

The purpose of this study is to evaluate the effectiveness of the Esporta Wash System in cleaning soft goods impacted by sewage contamination. Due to the limited effectiveness of common cleaning techniques in removing biological contamination from sewage contaminated soft goods and the potential impact to human health such contamination poses, the restoration industry consensus has been that these materials must be disposed of. According to IICRC S500 *Standard and Reference Guide for Professional Water Damage Restoration* section 12.3.12.2 "When directly contaminated, highly absorbent stuffed fabrics (pillows, stuffed animals, mattresses, box springs, upholstered furniture) must be disposed."

The Esporta Wash System represents a shift from current technology of cleaning by physical agitation and instead uses hydraulic pressure to force proprietary cleaning chemicals through thick padding, foams, leathers and other porous items This study and sampling is intended to help determine if the Esporta Wash System is capable of removing biological contamination from sewage-contaminated soft goods, thus making cleaning an option over the current recommendation of disposal.

Parties Involved

Michael Pinto
Responsible for the generation of testing protocol, final reports, and articles.

Art Johnson
Responsible for testing materials, sourcing of contents, and cleaning materials.

Steven Sewal
Responsible for collection of samples.

Goals-

Three goals of this study are to determine:

1.) If the Esporta Wash System is capable of removing biological contamination from soft goods impacted by sewage contamination.
2.) If field testing tools such as the ATP (systemsure II hygiena) is a reliable means of field verification on the effectiveness of cleaning efforts
3.) If cleaning non-impacted soft goods in the same cycle with contaminated articles has the potential for cross contamination. At times it can be difficult to tell exactly which items from a water loss have been contamination by direct impact of Category 3 water so intermingled items may end up cleaned as a batch. This could lead to cross contamination of un-impacted items.

General Approach
Three representative categories of soft contents were selected that are commonly impacted during sewage losses include fabric, padded contents, and leather goods. In addition, appropriate laboratory tests were researched and evaluated for their ability to determine concentrations of bacterial contaminants representative of Category 3 sewage contamination.

A series of contaminated and uncontaminated samples of each material* will be tested prior to and after cleaning with the Esporta Wash System using both the ATP method and analysis by an outside laboratory yielding the following summary of results.

	Fabric	Padded	Leather
ATP (Pre-Cleaning)**	Swabbing of 8 impacted & 4 unimpacted items	Swabbing of 10 impacted & 4 unimpacted items	Swabbing of 8 impacted & 4 unimpacted items
ATP (Post-Cleaning)**	Swabbing of 8 impacted & 4 unimpacted items	Swabbing of 10 impacted & 4 unimpacted items	Swabbing of 8 impacted & 4 unimpacted items
Lab (Pre-Cleaning)**	Removal of 8 swatches from impacted & 4 swatches from unimpacted items	Removal of 14 swatches from impacted & 4 swatches from unimpacted items	Removal of 8 swatches from impacted & 4 swatches from unimpacted items
Lab (Post-Cleaning)**	Removal of 8 swatches from impacted & 4 swatches from unimpacted items	Removal of 18 swatches from impacted & 4 swatches from unimpacted items	Removal of 8 swatches from impacted & 4 swatches from unimpacted items

*Note: Both the contaminated and uncontaminated sample of each material will be washed in the same cycle to determine if cross-contamination will occur during the cleaning process.

** For detailed instructions on sample collection and analysis methods, see the "Sampling Protocol" section below.

Eight samples of impacted materials are collected from fabric and leather items for both ATP and lab testing as removal of material swatches should not impact cleaning effectiveness. Additional samples are collected from the padded materials as the number of layers and type of materials (*i.e.*, foam, cotton batting, synthetic batting, etc.) may respond differently to the cleaning process. Additional samples are to be collected from padded items for laboratory analysis to insure that the cutting for the swab sampling or removal of swatches for pre-cleaning analysis does not enhance the effectiveness of cleaning padded items.

Samples sent to the approved laboratory will be analyzed for concentrations of coliforms (*i.e.*, Fecal coliforms-Gram negative rods), Escherichia coli (Gram negative bacilli), and Enterococcus (Gram positive strep).

A 100-mL sample of the sewage-contaminated water will also be collected and analyzed for comparison purposes to determine the type and concentration of "indicator organisms" (listed above) that are present in the sewage-laden water. A sample of contaminated water from the same site where the contents were acquired is highly recommended. Using sewage water provided by an outside source (i.e. portable toilet cleaning service) introduces additional variables such as deodorizing chemicals and enzymatic liquids that may skew results.

Sampling Protocol

Material Preparation

Clean, powder-free exam gloves must be worn while handling each item and collecting samples to prevent cross contamination and exposure to pathogenic organisms. Appropriate respiratory protection is also recommended for the protection of any individual involved in the collection of samples or the handling of the contents during the cleaning process. 100 cm^2 templates made of a rigid, non-porous material (i.e. plexi-glass, plastic) will be pre-cleaned with an alcohol swab and allowed to dry. A cleaned template not used for sample delineation should be labeled, sealed in a clean, dry, plastic bag, and sent to the lab for bacterial analysis.

For each material (fabric, padded, leather, impacted and unimpacted) two separate 100 cm^2 sampling locations must be delineated and labeled for sampling prior to cleaning with the Esporta Wash System. The sampling areas should be outlined using an indelible marker and labeled with the appropriate sampling location for future reference. Make sure the template is thoroughly cleaned with an alcohol wipe and allowed to dry completely between each use.

For the first 100 cm^2 sampling area, collect the sample using the Hygiena SystemSURE II ATP Hygiene Monitoring System following the manufacturers instructions (outlined in the "Analysis Methods" section below). For materials with multiple layers (i.e. shoes, fabrics with a padded backing) each layer should be exposed and swabbed. For the second 100 cm^2 sampling area, cut out the delineated section of material with heavy scissors or knife and place it in a labeled, clean, dry, plastic re-sealable bag to be sent to the approved laboratory for bacterial analysis. Clean the blade(s) of the cutting tool with an alcohol swab and allow it to dry before cutting each sample. For materials with multiple layers, make sure a representative section of each layer is included with the 100 cm^2 bulk sample.

A cleaned and uncleaned template used for delineation of impacted materials should be sealed, labeled, and placed in a plastic back for bacterial analysis. At a minimum three templates should be submitted for bacterial analysis:

- Unused and Cleaned (Field Blank)
- Used and cleaned (Ensures the effectiveness of the template cleaning)
- Used and not cleaned (Helps determine the amount of bacterial transference to the sampling template during use)

After each material has been cleaned using the Esporta Wash System, delineate and label two more 100 cm^2 sampling areas as described for the pre-wash sampling method above. For the first 100 cm^2 sampling area, collect the sample using the Hygiena SystemSURE II ATP Hygiene Monitoring System as outlined in the "Analysis Methods" section below using the same guidelines for materials with multiple layers. For the second 100 cm^2 sampling area, cut out the delineated section of material and place it in a labeled, clean, dry, plastic bag to be sent to the approved laboratory for bacterial analysis. For materials with multiple layers, make sure a representative section of each layer is included with the 100 cm^2 bulk sample.

Collect a 100-mL sample of sewage/Category 3 water from the location where materials were collected. Wear appropriate personal protective equipment while collecting the sample. Transfer the liquid to a lab approved, labeled container. Package the labeled 100 mL sample in an insulated shipping container with a frozen cold pack and assure that delivery to the lab will occur within 24 hours.

Analysis Methods
Samples will be analyzed using the Hygiena SystemSURE II ATP Hygiene Monitoring System. Roll a pre-moistened Ultrasnap swab bud over a 10cm by 10cm^2 sampling area. Place the swab back into the swab tube and firmly bend the "Snap Valve" back and forth and squeeze twice to expel the liquid. Bathe the swab bud in the reagent by shaking the swab for five seconds. Open the lid of the SystemSure II, insert the Ultrasnap sample media into the read chamber and close the lid. Press the "OK" button to initiate reading of the sample. Results are displayed within 15 seconds in "Relative Light Units" (RLU) with higher RLU values indicating higher levels of contamination. Record the sample results in the sample collection log.

Labeled and sealed bulk samples will be sent to a laboratory which holds EMLAP, EMPAT, and ISO/IEC 17025 certification. Fill out appropriate paper work such as the sample collection log and chain of custody and sample collection log. Package the labeled samples in an insulated shipping container with a frozen cold pack and assure that delivery to the lab will occur within 24 hours. Contact the laboratory if you have further questions about sample handling, packaging, ect.

Comparison Criteria

Sample results will be evaluated to determine if post cleaning bacterial concentrations for impacted and non-impacted materials are below the method detection limit for the selected analysis. A determination will also be made on the order of magnitude of

bacterial reduction of pre and post cleaned items. Non-impacted items will be evaluated to determine the net increase or decrease of bacterial contamination after being cleaned in the presence of impacted items. ATP sample results will be compared to laboratory sample results to determine if the Hygiena SystemSURE II ATP Hygiene Monitoring System provides consistent and accurate data, making it appropriate for field verification purposes.

Quality Control Measures

As mentioned in previous sections, several quality control measures will be implemented during the sampling process

- A field blank Utrasnap swab and viable swab with transport media will be collected and analyzed to ensure that sampling media is not a source of bacterial contamination and that cross contamination does not occur under normal handling.
- A 100-mL sample of sewage contaminated water taken from the site where items were collected will be submitted and analyzed for comparison purposes.
- Templates will collected and submitted during various stages of the sample collection process to determine if bacteria that is transferred during contact with material being sampled, and to evaluate the effectiveness of template cleaning
- Similar un-impacted materials will be washed with the same type of impacted material to determine if cross contamination can occur during the Esporta Wash System.

Appendix I

June 2007

Bacterial Laboratory Results

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An Affiliate of Severn Trent Laboratories, Inc.

Pacific Environmental Consulting
1336 Main St.
North Vancouver, BC V7J 1C3
Attn: Jennifer Mustard

Lab Number: 915-706-0509
AIHA EMLAP No.102297
Sewage Screen Analysis - Bulk
Aerotech Method: B008

Project ID: 7606
Date Received: 06/07/07
Date Report Revised: 06/19/07

Lab Number	1	2	3	4	5
Sample Identification	L1 Post	L2 Post	L3 Post	L4 Post	L5 Post
Date Prepared	06/08/07	06/08/07	06/08/07	06/08/07	06/08/07
Date Analyzed	06/09/07	06/09/07	06/09/07	06/09/07	06/09/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	20	120	10	< 10	31
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	>24200	905	158	24,200	5,480
Data Qualifiers					

Lab Number	6	7	8	9	10
Sample Identification	L6 Post	L7 Post	L8 Post	L10 Post	L11 Post
Date Prepared	06/08/07	06/08/07	06/08/07	06/08/07	06/08/07
Date Analyzed	06/09/07	06/09/07	06/09/07	06/09/07	06/09/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	< 10	10	20	< 10	< 10
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	>24200	5,480	>24200	10	< 10
Data Qualifiers					

Laboratory Manager: [signature]
IAQ MANUAL REPORT FORM, P1OF1, REV01, 071905, CSM

Project Manager: Marcela Hodge

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AIHA EMLAP No.102297
Sewage Screen Analysis - Bulk
Aerotech Method: B008

Project ID: 7606
Date Received: 06/07/07
Date Report Revised: 06/19/07

Lab Number	11	12	13	14	15
Sample Identification	L12 Post	F5 Post	F6 Post A	F6 Post B	F7 Post A
Date Prepared	06/08/07	06/08/07	06/08/07	06/08/07	06/08/07
Date Analyzed	06/09/07	06/09/07	06/09/07	06/09/07	06/09/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	< 10	>24200	2,050	146	5,480
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	1,790	< 10	20	< 10	259
Data Qualifiers					

Lab Number	16	17	18	19	20
Sample Identification	F7 Post B	F8 Post	F9 Post	F10 Post	P6 Post A
Date Prepared	06/08/07	06/08/07	06/08/07	06/08/07	06/08/07
Date Analyzed	06/09/07	06/09/07	06/09/07	06/09/07	06/09/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	389	>24200	1,520	3,080	< 10
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	121	379	389	109	< 10
Data Qualifiers					

Laboratory Manager:
IAQ MANUAL REPORT FORM, P1OF1, REV01, 071905, CSM

Project Manager: Marcela Hodge

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Lab Number: 915-706-0509
AIHA EMLAP No.102297
Sewage Screen Analysis - Bulk
Aerotech Method: B008

Project ID: 7606
Date Received: 06/07/07
Date Report Revised: 06/19/07

Lab Number	21	22	23	24	25
Sample Identification	P6 Post B	P6 Post C	P7 Post A	P7 Post B	P8 Post A
Date Prepared	06/08/07	06/08/07	06/08/07	06/08/07	06/08/07
Date Analyzed	06/09/07	06/09/07	06/09/07	06/09/07	06/09/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	< 10	< 10	30	20	< 10
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	< 10	10	41	41	< 10
Data Qualifiers					

Lab Number	26	27	28	29	30
Sample Identification	P8 Post B	P9 Post A	P9 Post B	P10 Post A	P10 Post B
Date Prepared	06/08/07	06/08/07	06/08/07	06/08/07	06/08/07
Date Analyzed	06/09/07	06/09/07	06/09/07	06/09/07	06/09/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	< 10	< 10	< 10	< 10	< 10
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10	< 10	< 10
Data Qualifiers					

Laboratory Manager: C Myn
IAQ MANUAL REPORT FORM, P1OF1, REV01, 071905, CSM

Project Manager: Marcela Hodge

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AIHA EMLAP No.102297
Sewage Screen Analysis - Bulk
Aerotech Method: B008

Project ID: 7606
Date Received: 06/07/07
Date Report Revised: 06/19/07

Lab Number	31	32	33	34	35
Sample Identification	P11 Post A	P11 Post B	P12 Post A	P12 Post B	L10 Pre
Date Prepared	06/08/07	06/08/07	06/08/07	06/08/07	06/08/07
Date Analyzed	06/09/07	06/09/07	06/09/07	06/09/07	06/09/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	< 10	< 10	10	216	< 10
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	< 10	< 10	10	30	< 10
Data Qualifiers					

Lab Number	36	37	38	39	40
Sample Identification	L11 Pre	F9 Pre	F10 Pre	F11 Pre	F12 Pre
Date Prepared	06/08/07	06/08/07	06/08/07	06/08/07	06/08/07
Date Analyzed	06/09/07	06/09/07	06/09/07	06/09/07	06/09/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	< 10	< 10	< 10	< 10	< 10
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10	< 10	< 10
Data Qualifiers					

Laboratory Manager: [signature]
IAQ MANUAL REPORT FORM, P1OF1, REV01, 071905, CSM

Project Manager: Marcela Hodge

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Lab Number: 915-706-0386
AIHA EMLAP No.102297
Sewage Screen Analysis - Bulk
Aerotech Method: B008

Project ID: 7606
Date Received: 06/06/07
Date Reported: 06/08/07

Lab Number	1	2	3	4	5
Sample Identification	L1 Pre	L2 Pre	L3 Pre	L4 Pre	L5 Pre
Date Prepared	06/06/07	06/06/07	06/06/07	06/06/07	06/06/07
Date Analyzed	06/07/07	06/07/07	06/07/07	06/07/07	06/07/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	>24200	>24200	< 10	< 10	< 10
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	>24200	>24200	2,140	>24200	6,870
Data Qualifiers					

Lab Number	6	7	8	9	10
Sample Identification	L6 Pre	L8 Pre	L9 Pre	L12 Pre	F1 Pre
Date Prepared	06/06/07	06/06/07	06/06/07	06/06/07	06/06/07
Date Analyzed	06/07/07	06/07/07	06/07/07	06/07/07	06/07/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	< 10	< 10	< 10	< 10	>24200
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	>24200	>24200	< 10	< 10	>24200
Data Qualifiers					

Laboratory Manager: [signature]
IAQ MANUAL REPORT FORM, P1OF1, REV01, 071905, CSM

Project Manager: Marcela Hodge

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Lab Number: 915-706-0386
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Sewage Screen Analysis - Bulk
Aerotech Method: B008

Project ID: 7606
Date Received: 06/06/07
Date Reported: 06/08/07

Lab Number	11	12	13	14	15
Sample Identification	F2 Pre	F3 Pre	F4 Pre	F5 Pre	F6 Pre A
Date Prepared	06/06/07	06/06/07	06/06/07	06/06/07	06/06/07
Date Analyzed	06/07/07	06/07/07	06/07/07	06/07/07	06/07/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	>24200	>24200	>24200	>24200	>24200
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	>24200	>24200	>24200	>24200	>24200
Data Qualifiers					

Lab Number	16	17	18	19	20
Sample Identification	F6 Pre B	F7 Pre A	F7 Pre B	F8 Pre	P1 Pre A
Date Prepared	06/06/07	06/06/07	06/06/07	06/06/07	06/06/07
Date Analyzed	06/07/07	06/07/07	06/07/07	06/07/07	06/07/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	>24200	>24200	>24200	>24200	>24200
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	>24200	>24200	>24200	>24200	>24200
Data Qualifiers					

Laboratory Manager:
IAQ MANUAL REPORT FORM, P1OF1, REV01, 071905, CSM

Project Manager: Marcela Hoage

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Lab Number: 915-706-0386
AIHA EMLAP No.102297
Sewage Screen Analysis - Bulk
Aerotech Method: B008

Project ID: 7606
Date Received: 06/06/07
Date Reported: 06/08/07

Lab Number	21	22	23	24	25
Sample Identification	P1 Pre B	P1 Pre C	P2 Pre A	P2 Pre B	P3 Pre A
Date Prepared	06/06/07	06/06/07	06/06/07	06/06/07	06/06/07
Date Analyzed	06/07/07	06/07/07	06/07/07	06/07/07	06/07/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	>24200	>24200	>24200	< 10	>24200
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	>24200	>24200	>24200	771	>24200
Data Qualifiers					

Lab Number	26	27	28	29	30
Sample Identification	P3 Pre B	P4 Pre A	P4 Pre B	P4 Pre C	P5 Pre A
Date Prepared	06/06/07	06/06/07	06/06/07	06/06/07	06/06/07
Date Analyzed	06/07/07	06/07/07	06/07/07	06/07/07	06/07/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	>24200	>24200	< 10	>24200	>24200
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	>24200	>24200	2,610	>24200	>24200
Data Qualifiers					

Laboratory Manager:
IAQ MANUAL REPORT FORM, P1OP4, REV01, 071905, CSM

Project Manager: Marcela Hodge

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Attn: Jennifer Mustard

Lab Number: 915-706-0386
AIHA EMLAP No.102297
Sewage Screen Analysis - Bulk
Aerotech Method: B008

Project ID: 7606
Date Received: 06/06/07
Date Reported: 06/08/07

Lab Number	31	32	33	34	35
Sample Identification	P5 Pre B	P6 Pre A	P6 Pre B	P6 Pre C	P7 Pre A
Date Prepared	06/06/07	06/06/07	06/06/07	06/06/07	06/06/07
Date Analyzed	06/07/07	06/07/07	06/07/07	06/07/07	06/07/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	< 10	>24200	>24200	>24200	>24200
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	>24200	>24200	>24200	>24200	>24200
Data Qualifiers					

Lab Number	36	37	38	39	40
Sample Identification	P7 Pre B	P8 Pre A	P8 Pre B	P9 Pre A	P9 Pre B
Date Prepared	06/06/07	06/06/07	06/06/07	06/06/07	06/06/07
Date Analyzed	06/07/07	06/07/07	06/07/07	06/07/07	06/07/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	>24200	>24200	< 10	>24200	>24200
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	>24200	>24200	15500	>24200	>24200
Data Qualifiers					

Laboratory Manager:
IAQ MANUAL REPORT FORM, P1OP1, REV01, 071905, CSM

Project Manager: Marcela Hodge

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Attn: Jennifer Mustard

Lab Number: 915-706-0386
AIHA EMLAP No.102297
Sewage Screen Analysis - Bulk
Aerotech Method: B008

Project ID: 7606
Date Received: 06/06/07
Date Reported: 06/08/07

Lab Number	41	42	43	44	45
Sample Identification	P10 Pre A	P10 Pre B	P11 Pre A	P11 Pre B	P12 Pre A
Date Prepared	06/06/07	06/06/07	06/06/07	06/06/07	06/06/07
Date Analyzed	06/07/07	06/07/07	06/07/07	06/07/07	06/07/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	>24200	>24200	< 10	< 10	108
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	>24200	>24200	< 10	< 10	< 10
Data Qualifiers					

Lab Number	46	47	48	49	50
Sample Identification	P12 Pre B	P13 Pre A	P13 Pre B	P13 Pre C	P14 Pre A
Date Prepared	06/06/07	06/06/07	06/06/07	06/06/07	06/06/07
Date Analyzed	06/07/07	06/07/07	06/07/07	06/07/07	06/07/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	>24200	< 10	< 10	< 10	< 10
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	< 10	10	< 10	< 10	< 10
Data Qualifiers					

Laboratory Manager:
IAQ MANUAL REPORT FORM, P1OF1, REV01, 071905, CSM

Project Manager: Marcela Hodge

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AEROTECH P&K

An Affiliate of Severn Trent Laboratories, Inc.

Pacific Environmental Consulting
1336 Main Street
North Vancouver, BC V7J 1C3
Attn: Jennifer Mustard

Lab Number: 915-706-0386
AIHA EMLAP No.102297
Sewage Screen Analysis - Bulk
Aerotech Method: B008

Project ID: 7606
Date Received: 06/06/07
Date Reported: 06/08/07

Lab Number	51	52	53	54	55
Sample Identification	P14 Pre B	P1 Post A	P1 Post B	P1 Post C	P2 Post A
Date Prepared	06/06/07	06/06/07	06/06/07	06/06/07	06/06/07
Date Analyzed	06/07/07	06/07/07	06/07/07	06/07/07	06/07/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	< 10	< 10	< 10	< 10	< 10
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10	< 10	< 10
Data Qualifiers					

Lab Number	56	57	58	59	60
Sample Identification	P2 Post B	P3 Post A	P3 Post B	P4 Post A	P4 Post B
Date Prepared	06/06/07	06/06/07	06/06/07	06/06/07	06/06/07
Date Analyzed	06/07/07	06/07/07	06/07/07	06/07/07	06/07/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	< 10	< 10	< 10	< 10	< 10
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10	< 10	< 10
Data Qualifiers					

Laboratory Manager:
IAQ MANUAL REPORT FORM, P1OF1, REV01, 071905, CSM

Project Manager: Marcela Hodge

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1336 Main Street
North Vancouver, BC V7J 1C3
Attn: Jennifer Mustard

Lab Number: 915-706-0386
AIHA EMLAP No.102297
Sewage Screen Analysis - Bulk
Aerotech Method: B008

Project ID: 7606
Date Received: 06/06/07
Date Reported: 06/08/07

Lab Number	61	62	63	64	65
Sample Identification	P4 Post C	P5 Post A	P5 Post B	P13 Post A	P13 Post B
Date Prepared	06/06/07	06/06/07	06/06/07	06/06/07	06/06/07
Date Analyzed	06/07/07	06/07/07	06/07/07	06/07/07	06/07/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	< 10	< 10	< 10	< 10	< 10
Escherichia coli	< 10	< 10	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10	10	< 10
Data Qualifiers					

Lab Number	66	67	68	69
Sample Identification	P13 Post C	P14 Post A	P14 Post B	L7 Pre
Date Prepared	06/06/07	06/06/07	06/06/07	06/06/07
Date Analyzed	06/07/07	06/07/07	06/07/07	06/07/07
	MPN/Gram	MPN/Gram	MPN/Gram	MPN/Gram
Total Coliforms	< 10	< 10	< 10	< 10
Escherichia coli	< 10	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10	1,920
Data Qualifiers				

Laboratory Manager:
IAQ MANUAL REPORT FORM, P1OP4, REV01, 071905, CSM

Project Manager: Marsha Hodge

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Pacific Environmental Consulting
1336 Main Street
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Attn: Jennifer Mustard

Lab Number: 915-706-0386
AIHA EMLAP No.102297
Sewage Screen Analysis - Bulk
Aerotech Method: B008

Project ID: 7606
Date Received: 06/06/07
Date Report Revised: 06/21/07

Lab Number	**70**	**71**	**72**
Sample Identification	Template 1	Template 2	Template 3
Date Prepared	06/19/07	06/19/07	06/19/07
Date Analyzed	06/20/07	06/20/07	06/20/07
	MPN/Gram	**MPN/Gram**	**MPN/Gram**
Total Coliforms	< 10	< 10	< 10
Escherichia coli	< 10	< 10	< 10
Enterococcus	< 10	< 10	< 10
Data Qualifiers			

Laboratory Manager:
IAQ MANUAL REPORT FORM, P1OF1, REV01, 071905, CSM

Project Manager: Marala Hodge

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Bodycote TESTING GROUP

Report Transmission Cover Page

Bill To:	Pacific Environmental Consulting	Project:	
Report To:	Pacific Environmental Consulting	ID:	7606
	1336 Main Street	Name:	
	North Vancouver, BC, Canada	Location:	
	V7J 1C3	LSD:	
Attn:	Wendy Olk	P.O.:	
Sampled By:		Acct code:	
Company:			

Lot ID:	**550646**
Approval Status:	Approved
Invoice Frequency:	by Lot
Account Status:	Active
Control Number:	314537
Date Received:	Jun 6, 2007
Date Reported:	Jun 13, 2007
Report Number:	1009446

_____ PAGES IN THIS TRANSMISSION

Notes To Clients:

Reports associated with this Lot

Id/Format/Report Date	Id/Format/Report Date	Id/Format/Report Date

If this transmission is not satisfactory, please send requirements to the address at the bottom of this page.

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Sample Custody

Bill To:	Pacific Environmental Consulting	Project:	
Report To:	Pacific Environmental Consulting	ID:	7606
	1336 Main Street	Name:	
	North Vancouver, BC, Canada	Location:	
	V7J 1C3	LSD:	
Attn:	Wendy Olk	P.O.:	
Sampled By:		Acct code:	
Company:			

Lot ID:	**550646**
Control Number:	314537
Date Received:	Jun 6, 2007
Date Reported:	Jun 13, 2007
Report Number:	1009446

Sample Disposal Date: December 20, 2007

All samples will be stored until this date unless other instructions are received. Please indicate other requirements below and return this form to the address or fax number on the bottom of this page.

☐ Extend Sample Storage Until _____ (MM/DD/YY)

The following charges apply to extended sample storage:

Storage for 1 to 5 samples per month	$ 10.00
Storage for 6 to 20 samples per month	$ 15.00
Storage for 21 to 50 samples per month	$ 30.00
Storage for 51 to 200 samples per month	$ 60.00
Storage for more than 200 samples per month	$ 110.00

☐ Return Sample, collect, to the address below via:

- ☐ Greyhound
- ☐ Loomis
- ☐ Purolator
- ☐ Other (specify) _____

Name _____

Company _____

Address _____

_____

Phone _____

Fax _____

Signature _____

Bodycote TESTING GROUP

Analytical Report

Bill To:	Pacific Environmental Consulting	Project:	
Report To:	Pacific Environmental Consulting	ID:	7606
	1336 Main Street	Name:	
	North Vancouver, BC, Canada	Location:	
	V7J 1C3	LSD:	
Attn:	Wendy Olk	P.O.:	
Sampled By:		Acct code:	
Company:			

Lot ID:	**550646**
Control Number:	314537
Date Received:	Jun 6, 2007
Date Reported:	Jun 13, 2007
Report Number:	1009446

Reference Number	550646-1
Sample Date	
Sample Location	
Sample Description	7606 - Sewage 1/2/3
Matrix	Water

Analyte		Units	Results	Results	Results	Detection Limit
Microbiological Analysis						
Total Coliforms	MPN	MPN/100 mL	350			
Fecal Streptococci/Enterococci	Membrane Filtration	CFU/100 mL	50000000			
Fecal Coliforms	MPN	MPN/100 mL	4.5			

Approved by:

Walter Brandl
Operations Manager - Surrey

Bodycote TESTING GROUP

Quality Control

Bill To:	Pacific Environmental Consulting	Project:	
Report To:	Pacific Environmental Consulting	ID:	7606
	1336 Main Street	Name:	
	North Vancouver, BC, Canada	Location:	
	V7J 1C3	LSD:	
Attn:	Wendy Olk	P.O.:	
Sampled By:		Acct code:	
Company:			

Lot ID:	**550646**
Control Number:	314537
Date Received:	Jun 6, 2007
Date Reported:	Jun 13, 2007
Report Number:	1009446

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Methodology and Notes

Bill To:	Pacific Environmental Consulting	Project:	
Report To:	Pacific Environmental Consulting	ID:	7606
	1336 Main Street	Name:	
	North Vancouver, BC, Canada	Location:	
	V7J 1C3	LSD:	
Attn:	Wendy Olk	P.O.:	
Sampled By:		Acct code:	
Company:			

Lot ID:	**550646**
Control Number:	314537
Date Received:	Jun 6, 2007
Date Reported:	Jun 13, 2007
Report Number:	1009446

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Coliforms- MPN (Enviro)	APHA	Fecal Coliform Procedure, 9221 E	12-Jun-07	BTG Calgary
Coliforms- MPN (Enviro)	APHA	Standard Total Coliform Fermentation Technique, 9221 B	12-Jun-07	BTG Calgary
Fecal Streptococci / Enterococci - MF	APHA	Fecal Streptococcus and Enterococcus Groups - Membrane Filtration Techniques, 9230 C	08-Jun-07	BTG Calgary

References

APHA Standard Methods for the Examination of Water and Wastewater

Comments:

Please direct any inquiries regarding this report to our Client Services group.

Results relate only to samples as submitted.

Appendix J

June 2007

Summary of Sampling Results

Wonder Makers Environmental

June 2007 Sampling Results by Material

FABRIC

Sample ID	Wash #	Treated / Control	Item Description	Item ID	Layer Description	ATP Pre-wash (RLU)	ATP Post-wash (RLU)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)	
F1	2	T	Sheet, cotton	1		1,252	436	TC EC EN	>24,200 <10 >24,200	TC EC EN	>24,200 <10 7,700
F2	2	T	Sweater, long, black, woolen	2		285	62	TC EC EN	>24,200 <10 >24,200	TC EC EN	>24,200 <10 5,170
F3	2	T	Blouse	3		1,371	51	TC EC EN	>24,200 <10 >24,200	TC EC EN	>24,200 <10 11,200
F4	2	T	Sweatshirt	4		2,976	547	TC EC EN	>24,200 <10 >24,200	TC EC EN	>24,200 <10 6,940
F5	1	T	Sweatshirt	5		5,175	66	TC EC EN	>24,200 <10 >24,200	TC EC EN	>24,200 <10 <10
F6 a	1	T	Blazer	6	Outside	7,349	5	TC EC EN	>24,200 <10 >24,200	TC EC EN	2,050 <10 20
F6 b	1	T	Blazer	6	Inside lining	4,700	9	TC EC EN	>24,200 <10 >24,200	TC EC EN	146 <10 <10
F7 a	1	T	Blazer	7	Outside	5,935	43	TC EC EN	>24,200 <10 >24,200	TC EC EN	5,480 <10 259

Sample ID	Wash #	Treated / Control	Item Description	Item ID	Layer Description	ATP Pre-wash (RLU)	ATP Post-wash (RLU)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)	
F7 b	1	T	Blazer	7	Inside lining	1,907	13	TC EC EN	>24,200 <10 >24,200	TC EC EN	389 <10 121
F8	1	T	Blouse	8		1,591	7	TC EC EN	>24,200 <10 >24,200	TC EC EN	>24,200 <10 379
F9	1	C	Sweatshirt	9		4	13	TC EC EN	<10 <10 <10	TC EC EN	1,520 <10 389
F10	1	C	Blazer, wooly	10		3	23	TC EC EN	<10 <10 <10	TC EC EN	3,080 <10 109
F11	2	C	Blouse	11		14	739	TC EC EN	<10 <10 <10	TC EC EN	>24,200 <10 6,870
F12	2	C	Sheet, white	12		10	443	TC EC EN	<10 <10 <10	TC EC EN	>24,200 <10 24,200

T = treated, **C** = control, **ATP** = adenosine triphosphate, **RLU** = relative light units, **MPN** = most probable number, **TC** = total coliform, **EC** = *E. coli*, **EN** = *Enterococci*

Wonder Makers Environmental

June 2007 Sampling Results by Material

LEATHER

Sample ID	Wash #	Treated / Control	Item Description	Item ID	ATP Pre-wash (RLU)	ATP Post-wash (RLU)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)	
L1	2	T	Jacket	1	4,129	439	TC EC EN	>24,200 <10 >24,200	TC EC EN	20 <10 >24,200
L2	1	T	Jacket sleeve	2	6,429	124	TC EC EN	>24,200 <10 >24,200	TC EC EN	120 <10 905
L3	1	T	Shoe, brown	3	1,365	3	TC EC EN	<10 <10 2,140	TC EC EN	10 <10 158
L4	2	T	Shoe, black, woven	4	301	129	TC EC EN	<10 <10 >24,200	TC EC EN	<10 <10 24,200
L5	1	T	Shoe, black, shiny	5	507	26	TC EC EN	<10 <10 6,870	TC EC EN	31 <10 5,480
L6	2	T	Shoe, white, woven	6	6,803	219	TC EC EN	<10 <10 >24,200	TC EC EN	<10 <10 >24,200
L7	2	T	Shoe, gold	7	2,225	80	TC EC EN	<10 <10 1,920	TC EC EN	10 <10 >5,480
L8	1	T	Shoe, white, smooth	8	6,745	40	TC EC EN	<10 <10 >24,200	TC EC EN	20 <10 >24,200

Sample ID	Wash #	Treated / Control	Item Description	Item ID	ATP Pre-wash (RLU)	ATP Post-wash (RLU)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)	
L9	*	C	Shoe, black	9	232	*	TC EC EN	<10 <10 <10	TC EC EN	* * *
L10	2	C	Shoe, brown	10	57	157	TC EC EN	<10 <10 <10	TC EC EN	<10 <10 10
L11	2	C	Jacket sleeve	11	176	254	TC EC EN	<10 <10 <10	TC EC EN	<10 <10 <10
L12	1	C	Jacket	12	215	21	TC EC EN	<10 <10 <10	TC EC EN	<10 <10 1,790

***Item 9 was not added to wash 1.**

T = treated, **C** = control, **ATP** = adenosine triphosphate, **RLU** = relative light units, **MPN** = most probable number, **TC** = total coliform, **EC** = *E. coli*, **EN** = *Enterococci*

Wonder Makers Environmental

June 2007 Sampling Results by Material

PADDED

Sample ID	Wash #	Treated / Control	Item Description	Item ID	Layer Description	ATP Pre-wash (RLU)	ATP Post-wash (RLU)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)	
P1 a	1	T	Running shoe	1	Outside	2,242	4	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P1 b	1	T	Running shoe	1	Middle (padding)	3,556	9	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P1 c	1	T	Running shoe	1	Inside	7,326	8	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P2 a	1	T	Vest	2	Outside	1,584	4	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P2 b	1	T	Vest	2	Middle (padding)	284	5	TC EC EN	<10 <10 771	TC EC EN	<10 <10 <10
P3 a	1	T	Stuffed bear	3	Outside	179	1	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P3 b	1	T	Stuffed bear	3	Middle (stuffing)	1,068	2	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P4 a	1	T	Backpack	4	Outside	5,637	2	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10

Sample ID	Wash #	Treated / Control	Item Description	Item ID	Layer Description	ATP Pre-wash (RLU)	ATP Post-wash (RLU)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)	
P4 b	1	T	Backpack	4	Middle (padding)	3,362	2	TC EC EN	<10 <10 2,610	TC EC EN	<10 <10 <10
P4 c	1	T	Backpack	4	Inside	845	4	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P5 a	1	T	Pillow	5	Outside	9,414	9	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P5 b	1	T	Pillow	5	Middle (stuffing)	8,930	3	TC EC EN	<10 <10 >24,200	TC EC EN	<10 <10 <10
P6 a	2	T	Jacket	6	Outside	144	2	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P6 b	2	T	Jacket	6	Middle (stuffing)	192	2	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P6 c	2	T	Jacket	6	Inside (lining)	1,164	2	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P7 a	2	T	Rug	7	Top	352	916	TC EC EN	>24,200 <10 >24,200	TC EC EN	30 <10 41
P7 b	2	T	Rug	7	Bottom	3,514	453	TC EC EN	>24,200 <10 >24,200	TC EC EN	20 <10 41
P8 a	2	T	Stuffed cat	8	Outside	2,643	6	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P8 b	2	T	Stuffed cat	8	Inside (stuffing)	5,672	22	TC EC EN	<10 <10 15,500	TC EC EN	<10 <10 <10

Sample ID	Wash #	Treated / Control	Item Description	Item ID	Layer Description	ATP Pre-wash (RLU)	ATP Post-wash (RLU)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)	
P9 a	2	T	Pillow, standard	9	Outside	4,016	4	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P9 b	2	T	Pillow, standard	9	Middle (stuffing)	2,704	7	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P10 a	2	T	Blanket	10	Outside	728	8	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P10 b	2	T	Blanket	10	Middle (stuffing)	819	16	TC EC EN	>24,200 <10 >24,200	TC EC EN	<10 <10 <10
P11 a	2	C	Stuffed bear	11	Outside	222	10	TC EC EN	<10 <10 <10	TC EC EN	<10 <10 <10
P11 b	2	C	Stuffed bear	11	Middle (stuffing)	5	1	TC EC EN	<10 <10 <10	TC EC EN	<10 <10 <10
P12 a	2	C	Rug, green	12	Top	265	1,200	TC EC EN	108 <10 <10	TC EC EN	10 <10 10
P12 b	2	C	Rug, green	12	Bottom	493	1,540	TC EC EN	>24,200 <10 <10	TC EC EN	216 <10 30
P13 a	1	C	Running shoe	13	Outside	115	3	TC EC EN	<10 <10 10	TC EC EN	<10 <10 <10
P13 b	1	C	Running shoe	13	Middle (padding)	93	26	TC EC EN	<10 <10 <10	TC EC EN	<10 <10 <10
P13 c	1	C	Running shoe	13	Inside	33	8	TC EC EN	<10 <10 <10	TC EC EN	<10 <10 <10

Sample ID	Wash #	Treated / Control	Item Description	Item ID	Layer Description	ATP Pre-wash (RLU)	ATP Post-wash (RLU)	Lab Samples Pre-wash (MPN/gram)		Lab Samples Post-wash (MPN/gram)	
P14 a	1	C	Pillow, green	14	Outside	686	4	TC EC EN	<10 <10 <10	TC EC EN	<10 <10 <10
P14 b	1	C	Pillow, green	14	Middle (stuffing)	922	3	TC EC EN	<10 <10 <10	TC EC EN	<10 <10 <10

T = treated, **C** = control, **ATP** = adenosine triphosphate, **RLU** = relative light units, **MPN** = most probable number, **TC** = total coliform, **EC** = *E. coli*, **EN** = *Enterococci*

Appendix K

Article by M. Pinto

Cleaning Contents from Mold-Contaminated Environments

Cleaning Contents from Mold-Contaminated Environments

by Michael A. Pinto, Ph.D., CSP, CMP

Mold growth and associated contamination in buildings continues to garner public attention. While the insurance industry is struggling to define payment restrictions, the need for professional, competent mold remediation continues to grow. Fortunately, the remediation industry is advancing to meet the evolving needs related to mold.

Every mold clean-up project has two components, one of which has received considerably less attention than the other. All knowledgeable contractors and consultants understand the need for remediation of visible mold from building components, but often these same people are less educated about the assessment and control of contents in mold-contaminated environments. An increasing awareness of the potential problems that are created when clothes and furnishings are not properly addressed as part of a mold remediation effort is forcing the industry to broaden its approach to mold cases.

Two Bad Examples

A short time ago, our laboratory received a lampshade from a woman who was in the middle of a mold remediation project. The fungal growth in her residence was severe enough that she had been advised to find an alternate living space until the remediation project was completed. Unfortunately, nobody warned her about cross contamination issues related to moving contents that had not been properly cleaned. Her continuing health problems, even after moving, led her to send a lampshade to us for analysis. Although there was no visible mold growth on the shade, or even visible dust or dirt, a microvacuum sample revealed a high concentration of spores associated with water-damaged buildings, including *Stachybotrys*.

An even more contentious case involved a contractor who conducted a mold remediation project that involved transferring all moveable items out of the house. Evaluation, cleaning, handling and documentation of the process were so poor that after the contents had been moved to a storage facility we were asked to assess their condition. Evaluation of the “cleaned” materials confirmed the presence of excessive levels of spores and fungal fragments of the types that were targeted for removal from the house. This improper handling of contents resulted in a five-figure settlement.

Guidelines Codify Field Experience

Although there is no mandatory national standard for dealing with mold, there is a standard of care that can be understood by focusing on the points where various guidance documents intersect. Currently, six of the most important documents related to mold all confirm that mold-contaminated contents should be subject to specialized cleaning.

Most of the guidance documents favor the disposal of contents made of porous materials (*e.g.*, drapes, clothes, upholstered furniture) that have visible mold growth. Several recent studies confirm the difficulty of removing the spores and growth structures from fabrics and other porous materials after growth is visible.

Contents that are contaminated by deposition of spores from adjacent growth can be cleaned. The IICRC’s S520 document refers to such

contamination as Condition 2. The dust from impacted items does not reflect a normal fungal ecology.

It Starts With Assessment and Categorization

Since proper handling of contents from a mold-impacted environment is based on the type of material and the type of contamination, an initial assessment and categorization is the first step of the cleaning process, using a tool similar to Table 1. The key is to segregate items with actual mold growth from those impacted only by spore deposition.

Once the initial segregation is completed a determination can be made on how the content cleaning will proceed. Thinking through answers to key questions will assist in the development of an effective plan.

- What amount of contents is impacted?
- What is the overall condition of the structure?
- Are there security concerns at the site?
- What cleaning techniques will be used?
- Is there adequate space on-site to set up a decontamination work area?
- Will a substantial portion of the items be processed off-site (*e.g.*, laundry or dry cleaning)?
- Is a general pack-out part of the overall job?
- How long is the structural remediation expected to take?

Determining If Content Cleaning Was Successful

Perhaps the most vexing aspect of mold remediation projects in general, and content cleaning in particular, is determining an endpoint. What is clean enough? Does it depend on the situation and the occupants? The size of the project budget?

Most knowledgeable industry professionals believe that it is crucial to evaluate and document the cleaning effectiveness. But without an accepted standard endorsed by a regulatory agency or national standards group, the suggestions for post-cleaning criteria range from the thoughtful to the ridiculous. Some evaluation methods that have been suggested or used include:

- Sensory verification – The owner conducts a visual and odor check.
- Canine sensory verification – A trained mold inspection dog is brought in to sniff the contents and react to any mold.
- Mycotoxin testing – Samples are collected and analyzed to determine if any residual poisonous chemicals are present.
- Viable spore testing – Samples are collected and analyzed by culturing, which identifies residual spores capable of growing on a specific nutrient agar.
- Total spore and fragment testing – Samples are collected by tape lift, microvacuum or air collection methods and fungal residue is identified under the microscope.

Regardless of which method is employed, a comparison criteria needs to be established at the beginning of the project, as well as the number of samples that will be collected and their timing.

At Wonder Makers Environmental we achieve content cleaning verification through a combination of visual inspection and total spore/fragment testing. Since visible growth on dust or contents signals improper cleaning, our first step in verifying content cleanliness is a visual inspection. We normally have the remediation contractor group cleaned items into batches. If a single item in a batch fails the visual inspection, the entire batch is recleaned. Once a batch of contents has passed the visual inspection, a representative number of samples are collected. Since the actual number of spores in the dust on an object is influenced by both the concentration of spores in the air and the time it has taken for the dust to collect, we began reviewing microvacuum samples to determine the percentage of spores. By recording the data as a relative number rather than an absolute count of spores, we were able to correlate analytical results with field conditions and, ultimately, with customer satisfaction.

After years and hundreds of projects we have seen that fungal spore concentrations of one percent or less of the total sample constituents (absent target fungal types) are an indication of a normal fungal ecology. Fungal spore concentrations between one and three percent are an indication of an indoor environment contaminated with settled spores, dispersed directly or indirectly (Condition 2). Fungal spores recovered at three percent or more of the total sample constituents indicate an indoor environment contaminated with the presence of actual mold growth and associated spores (Condition 3). Recovery of target fungal spore types (including *Memnoniella*, *Stachybotrys*, *Trichoderma*, *Chaetomium*, and *Fusarium*) is further indication of fungal contamination. The total percentage of fungal spores recovered and the identification of target fungal spore types are two pieces of information used to determine if contents or surfaces have been impacted by mold sources in the environment, or whether they have been properly cleaned.

Solving the Contents Conundrum

Dealing with contents from a mold-contaminated building is complicated and fraught with technical and legal pitfalls. But traps can be avoided by following these common-sense guidelines:

1. Appreciate the risk to the occupants, the remediation crew, and the environment posed by mold-contaminated contents.
2. Understand the growing consensus that the ultimate goal is for the contents of a mold-contaminated environment to have mold concentrations at levels consistent with, or less than, a normal environment.
3. Conduct a thorough assessment of contents, addressing fungal growth and spore deposition as well as the porosity of each item.
4. Implement appropriate cleaning practices and protective controls.
5. Select a defensible endpoint at the beginning of the project. This includes both the evaluation method (*i.e.*, type of inspection, number and location of samples, timing of sample collection, etc.) and the comparison criteria.
6. Utilize the percentage of spores criteria described in this article in the absence of other technically supported data as a pre-defined endpoint for determining if contents are clean following a mold remediation project.

Combining these guidelines with common sense and awareness that dealing with contaminated contents is an important aspect of each mold remediation project will protect the contractor and advance the industry as a whole.

TABLE 1
Assessment Chart for Contents from a Mold-Impacted Environment

Type of Material	Level of Contamination and Suggested Cleaning Techniques	
	Spore Deposition (Condition 2)	**Visible Growth** (Condition 3)
Porous Fabric, paper, upholstered furniture, ceiling tiles, drywall, etc.	Cleaning with a HEPA vacuum, hot water extraction with drying and HEPA vacuum, air washing, dry cleaning (perchloroethylene), laundering with bleach.	Disposal and replacement unless high value, then specialized restoration.
Semi-porous Raw wood studs, rafters, decking, unpainted cinder block, other masonry components, stucco, etc.	"HEPA sandwich" cleaning (vacuum, damp wipe, vacuum again), scraping, scrubbing, sanding, or abrasive blasting. May also include surface sealing after inspection.	Disposal and replacement if structural damage or significant rot; scraping, scrubbing, sanding, or abrasive blasting if surface contamination.
Non-Porous Metal, plastic, glass, sealed wood, etc.	HEPA vacuuming, wet wiping, washing, power washing, air washing, air blasting.	HEPA vacuuming, scrubbing, immersion washing, using ultrasonic bath, power washing, air washing, air blasting, steam cleaning.

An expanded version of this article, with references, was published in the January 2005 edition of Cleaning & Restoration magazine. *Dr. Michael A. Pinto serves as Chief Executive Officer of Wonder Makers Environmental, Inc. He can be reached at 269-382-4154 or map@wondermakers.com.*

Appendix L

Summary Evaluation

Summary of the Evaluation of the Esporta Wash System in Cleaning Sewage-contaminated Soft Goods

A study has recently been conducted to evaluate the effectiveness of the Esporta Wash System in cleaning soft goods impacted by sewage contamination. Due to the limited effectiveness of common cleaning techniques in removing biological contamination from sewage-contaminated soft goods and its potential impact to human health, the restoration industry consensus has been that these materials must be disposed of.

The Esporta Wash System represents a shift from the current technology of cleaning by physical agitation and instead uses hydraulic pressure to force proprietary cleaning chemicals through thick padding, foams, leathers, and other porous items. The study and sampling was intended to determine if the Esporta Wash System was capable of removing biological contamination from sewage-contaminated soft goods, thus making cleaning a viable option over the current recommendation of disposal.

The study involved testing a variety of fabric, leather, and padded soft goods contaminated with black water before and after cleaning in the Esporta Wash System. 100 $cm.^2$ bulk samples were cut from each item before and after wash cycles and evaluated for concentrations of *E. coli*, *Enterococci*, and total coliform bacteria to determine the total percentage reduction in bacterial load. Field verification methods were tested using a Hygiena SystemSURE II ATP Hygiene Monitoring System to see if such technology was a viable, non-destructive method for on-site quality assurance.

A total of six different cycles were tested with varying concentrations of Force disinfectant and pre-set wash/rinse parameters to determine which setting worked most effectively with each material. The loads were comprised of mixed materials, including uncontaminated items. The uncontaminated items were evaluated to determine the potential for cross-contamination during the wash process.

The results of the study showed that, under the machine's pre-set extra heavy wash setting, the Esporta Wash System was over 98% effective, and in most cases 100% effective, at removing *E. coli*, *Enterococci*, and coliform bacteria from a wide range of fabrics and padded items. Just as important, only one padded item showed any evidence of possible cross-contamination during the various wash cycles tested.

Reduction of bacterial contamination from leather goods was substantial but more variable. Contamination reductions for most leather items ranged from 62% to 100%, although three leather items showed a net increase in bacteria after the washing. A closer review of the leather samples explained this variation in sample results. Shoes and boots (leather items with the most layers and mix of materials) showed modest to poor results. In contrast, purses, belts, and even coats showed nearly 100% removal of bacterial contamination.

A strong correlation between laboratory data and the ATP sampling results was observed. Given that the few discrepancies identified for fabric and padded items recorded false positives that would require recleaning, it was further concluded that ATP monitoring is an

effective tool in field verification of the effectiveness of removing sewage contamination from items laundered with the Esporta Wash System.

The study author recommended that the manufacturer conduct further testing of the Esporta Wash System in regard to leather shoes and boots to determine if certain types of leather products can successfully be cleaned on a consistent basis or if cleaning performance can be improved when different wash parameters are used.

Summary of Laboratory Data*

Wash Cycle	Fabric		Padded		Leather Clothes		Leather Shoes/Boots	
Extra Heavy Extra Force	EC EN TC	100% 100%[1] 99.25%	EC EN TC	100% 100%[1] 99.77%	NA	NA	NA	NA
Extra Heavy Regular Force	EC EN TC	100% 100% 100%	EC EN TC	100% 100% 99.93%	NA	NA	NA	NA
Heavy Extra Force	EC EN TC	100% BMDL 99.96%	EC EN TC	100% 100%[1] 100%	NA	NA	NA	NA
Heavy Regular Force	EC EN TC	99.96% BMDL 98.89%	EC EN TC	99.07% 100%[1] 98.38%	NA	NA	NA	NA
Regular Leather Extra Force	NA	NA	NA	NA	EC EN TC	100% BMDL 100%	EC EN TC	61.54% 100% mixed[2]
Regular Leather Regular Force	NA	NA	NA	NA	EC EN TC	100% BMDL 100%	EC EN TC	92.29%[1] BMDL mixed[2]

*Average percentage reduction of bacteria on items

EC = *E. coli*, **EN** = *Enterococci*, **TC** = total coliform, **NA** = non applicable, **BMDL** = below method detection limit for pre- and post-cleaning samples

[1]All items with a measurable amount of bacterial contamination before cleaning exhibited a 100% reduction after cleaning. At least one item of the specified material type exhibited contamination below the method detection limit for pre- and post-cleaning samples.

[2]Results showed both positive and negative values for cleaning effectiveness.

Appendix M

Frequently Asked Questions

Frequently Asked Questions Regarding the Use of the Esporta Wash System for the Cleaning of Sewage-contaminated Soft Goods

Q: *Does the Esporta Wash System effectively clean sewage-contaminated soft goods?*
A: A recent study conducted by an independent company showed that the Esporta Wash System was effective at removing bacterial contamination associated with sewage losses in a variety of fabrics, padded materials, and leather items (with the exception of leather boots and shoes).

Q: *Why was the study undertaken?*
A: Due to the limited effectiveness of common cleaning techniques in removing biological contamination from sewage-contaminated soft goods and its potential impact to human health, the restoration industry consensus has been that these materials must be disposed. According to IICRC S500 *Standard and Reference Guide for Professional Water Damage Restoration,* Section 12.3.12.2, "When directly contaminated, highly absorbent stuffed fabrics (pillows, stuffed animals, mattresses, box springs, upholstered furniture) must be disposed."

Initial product testing for the Esporta Wash System and Force disinfectant showed that the system was effective in cleaning bacterial and fungal contamination from a number of soft goods at a reasonable cost. This study was intended to determine if the Esporta Wash System was a consistent and reliable means of removing biological contamination related to sewage losses, thus providing an alternative to disposal.

Q: *How effective is the Esporta Wash System at removing sewage contamination?*
A: Under specified wash settings, the Esporta Wash System is, at a minimum, 98.5% effective and in most cases, 100% effective at removing *E. coli*, *Enterococci*, and coliform bacteria from a wide range of fabrics and padded items. These types of bacterial organisms are used by many governmental agencies and environmental professionals as indicators of sewage contamination.

Q: *How was the cleaning efficiency tested? How do you know that it works?*
A: The study involved testing a variety of fabric, leather, and padded soft goods contaminated with black water before and after cleaning in the Esporta Wash System. Samples were evaluated for concentrations of *E. coli*, *Enterococci*, and total coliform bacteria to determine the reduction in bacterial load. Cleaning efficiency was also field tested using a hand-held ATP monitoring device that detects adenosine triphosphate (ATP), the "energy currency" for all living cells. ATP technology is commonly used in food processing, wastewater treatment, and laboratory settings to detect biological contamination.

A total of six different cycles were tested with varying run times and concentrations of Force disinfectant to determine which setting worked most effectively with each material. The loads were comprised of mixed materials, including uncontaminated items, to simulate real-world conditions and to determine if there was a potential for

cross-contamination to non-impacted items. The study found that, under specified conditions, cross-contamination of non-impacted items was not an issue when washed in mixed loads. As mentioned above, the cleaning efficiency was, at a minimum, 98.5% and in most cases 100%.

A strong correlation between laboratory data and the ATP sampling results was observed during the study. Given that only a few discrepancies were identified for fabric and padded items (which recorded false positives that would require recleaning), it was concluded that ATP monitoring is an effective tool in field verification of the effectiveness of sewage contamination.

The study indicated that further research is required to find wash parameters effective for boots and shoes.

Q: *I'm familiar with using the Esporta Wash System for sports equipment and regularly soiled soft goods. Are there any special procedures required for using the Esporta Wash System on sewage-contaminated soft goods?*

A: While the study used the Force disinfectant and wash cycle settings commonly used for cleaning common soft goods, correct settings and painstaking calibration and monitoring of the equipment is required. Training and guidelines are currently being developed for operators of the Esporta Wash System who intend to use it for cleaning sewage-contaminated soft goods. It is likely that these sewage-specific quality control measures will be incorporated into the current Certified Contents Restoration Network (CCRN) program.

Q: *Where can I get more information?*

A: If you have any further questions on the Esporta Wash System and its application for cleaning sewage-contaminated soft goods, please contact Esporta Wash Systems at www.esporta.ca or 1-800-881-7781.