

## ATP Cleaning Verification Study Summaries

The following are published peer-reviewed studies validating ATP Cleaning Verification as an accepted method for hospital cleaning verification. While many methods exist for evaluating cleanliness, one of the leading methods recommended by the CDC and accepted by hospitals for monitoring and improving environmental cleanliness is ATP (adenosine triphosphate) Cleaning Verification Systems. Used by thousands of hospitals worldwide, Hygiena's ATP Cleaning Verification System is an affordable, objective, and easy-to-use method for verification of surface cleanliness. For the full text of the study summaries below, please contact Hygiena or visit [www.hygiena.com](http://www.hygiena.com)

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### Direct Feedback with the ATP Luminometer as a Process Improvement Tool for Terminal Cleaning of Patient Rooms

Branch-Elliman, W., Robillard, E., McCarthy Jr., G., & Gupta, K. *Am J Infect Control* 2014;42:195-7.

#### Summary:

This study evaluates an ATP system as a point-of-cleaning education tool. Following terminal cleaning, Infection Preventionists met with EVS personnel and used the luminometer to evaluate multiple surfaces in the room. As the study progressed, the mean proportion of clean surfaces increased significantly.

#### Conclusions:

- Monitoring tools, such as ATP cleaning verification, can be used at the point-of-cleaning to aid in the improvement of cleaning processes.
- By incorporating a monitoring tool in a positive way, Infection Preventionists can give positive feedback resulting in enhanced collaboration, communication, and education.

### Monitoring the Effectiveness of Hospital Cleaning Practices Using an ATP Bioluminescence Assay

Boyce, et al. *Infect Control Hosp Epidemiol* 2009;30:678-84.

#### Summary:

This study evaluates the usefulness of ATP testing for assessing the efficacy of daily hospital cleaning practices.

#### Conclusions:

- Poor cleaning practices can be quickly identified with ATP testing.
- ATP test results provide quantitative evidence of improved high-touch surface cleaning after intervention implementation.
- ATP can be used to provide real-time feedback to housekeeping personnel after training and for ongoing performance monitoring.
- Software analysis of ATP test results provides a long-term analysis of cleaning adequacy.



## Measuring Cleanliness to Deliver Improvement

Gauci, T., Knowles, R., Rogers, L., Cradle, B., Lusardi, G., Easter, M. *The Clinical Services Journal* 2013.

### Summary:

The detection of potential contamination using a cleaning verification tool in patient environments can help improve standards of cleanliness by giving an indication of cleaning effectiveness. In this study, Cwm Taf Health Board evaluates the use of ATP bioluminescence to provide a rapid objective measurement of cleanliness in near-patient environments.

### Conclusions:

- Cwm Taf Health Board discovered ATP bioluminescence provides an objective, quantitative measurement of cleanliness from which invisible contamination was detected, potential hazards were identified, a benchmark for cleanliness was verified and differences were detected between hospitals and wards that were previously unknown.
- Test result data also led to an improvement in the communication and understanding of cleanliness, engaged staff and provided positive reinforcement for best practices.
- ATP technology can also be used to support training initiatives, and to prioritize and optimize use of cleaning resources, thereby improving safety and productivity.

## Monitoring Hospital Cleanliness with Standardised ATP Measurements: Denmark Introduces Official Guidelines for ATP Tests

Andersen, Dennis. *Hospital Infection Society Conference (Poster)* 2015.

### Summary:

This study establishes cleaning guidelines for the Danish Standard DS2451-10, a national cleaning standard of Denmark which incorporates objective ATP testing as a measure of cleaning verification.

### Conclusions:

- Proper cleaning procedure contributes to a significant reduction in contamination as measured by ATP bioluminescence.
- Validated RLU targets of <25 RLU are achievable and can be surpassed with ultra-efficient cleaning methods.

## Measuring of ATP Bioluminescence as a Means of Assessing Washer Disinfectant Performance and Potentially as a Means of Validating the Decontamination Process

Heathcote, R., & Stadelmann, B. *Health Infection* 2009;14:147-51.

### Summary:

This study demonstrates the use of ATP testing for assessing the level of contamination on surgical instruments throughout the decontamination process. ATP tests are a good method for quantitatively assessing washer disinfectant function and potentially part of the washer disinfectant validation process.

### Conclusions:

- ATP bioluminescence provides objective, accurate and valuable data regarding washer/disinfectants efficacy.
- ATP testing contributes to quality control mechanisms and validates the efficacy of washer disinfectors.



## Comparing Visual Inspection, Aerobic Colony Counts, and Adenosine Triphosphate Bioluminescence Assay for Evaluating Surface Cleanliness at a Medical Center

Huang, et al. *Am J Infect Control* 2015;43:882-6.

### Summary:

In this study, 10-12 surfaces were sampled before and after terminal cleaning to compare various methods for evaluating environmental cleaning (visual inspection, colony counts, and ATP bioluminescence). Methods were evaluated for adequacy, sensitivity, and correlation to plate counts.

### Conclusions:

- ATP bioluminescence is a sensitive tool for monitoring environmental cleanliness in hospitals. Because of its speed, ATP testing is more appropriate method in hospitals than colony counts.
- ATP is suggested as a tool for auditing performance of contract housekeeping services.

## ATP: A Validation Target for Decontamination

Callander, S. *The Clinical Services Journal* 2014;63-5.

### Summary:

This report evaluates four separate studies where ATP bioluminescence was successfully implemented into hospital endoscopy units and sterile services departments for validation of the decontamination process.

### Conclusions:

- ATP testing can easily and effectively validate the decontamination of reusable devices.
- ATP testing can also be used for cleaning verification throughout a hospital, from monitoring equipment cleanliness to environmental cleaning.

## A Quantitative Assessment of Cleanliness in the Operating Room

Bruno-Murtha, L. A., Fridman, A., & Osgood, R. *Am J Infect Control* 2014;42:S36.

### Summary:

This study evaluates ATP bioluminescence as a quick and convenient method of assessing surface cleanliness in the operating room (OR). Microbiology cultures were collected from twelve surfaces in two OR's, before and after between-case cleaning. ATP bioluminescence tests were conducted simultaneously with the sampling of surfaces. Colony counts were compared to relative light units (RLU).

### Conclusions:

- After cleaning, colony counts and ATP test results were both below the proposed criteria classified as clean.
- ATP testing provides a quick and convenient method to assess OR cleanliness and can be used to ensure environmental surfaces are clean before the next case.
- ATP testing also provides quantitative data which can be evaluated and acted on before putting a patient at risk.



## Impact of Adenosine Triphosphate Detection and Feedback on Hospital Room Cleaning

Smith, P. W., Beam, E., Sayles, H., Rupp, M. E., Cavalieri, R.J., Gibbs, S., Hewlett, A. *Infect Control Hosp Epidemiol* 2014;35:564-9.

### Summary:

Over a 20-month period, three hospitals of varying sizes evaluated the effect of ATP testing of terminal hospital room cleaning and feedback of results to environmental service (EVS) staff to improve cleaning efficacy.

### Conclusions:

- EVS education was underscored by the poor test result baseline for high-touch surfaces in hospital rooms, with approximately half of tested surfaces failing.
- Education interventions resulted in statistically significant improvements in cleaning performance

## Use of Audit Tools to Evaluate the Efficacy of Cleaning Systems in Hospitals

Malik, R., Cooper, R., & Griffith, C. *Am J Infect Control* 2003;31:181-7.

### Summary:

The "Standards for Environmental Cleanliness" (SEC) checklist was developed by the Infection Control Nurses Association (ICNA) and the Association of Domestic Managers (ADM) to evaluate cleaning services by relying on visual assessment. The National Health Service's patient environment audit (PEA) also relies on visual assessment for determination of cleanliness. However, a new checklist was developed from the models used in the food manufacturing industry which relies on rapid hygiene monitoring. In this study, these three checklists are applied at four hospitals, comparing results from visual assessment, adenosine triphosphate (ATP), and microbiologic sampling.

### Conclusions:

- The data suggests visual assessment is a poor indicator of surface cleanliness and ATP or microbiologic sampling methods are better assessments of cleaning efficacy.
- ATP testing provides the user with a rapid and accurate indication of surface cleanliness and efficacy.
- The study recommends hospital cleaning regimes use rapid hygiene testing (ATP) to ensure surfaces are adequately cleaned.

## The Use of Educational Intervention on Cleaning Process in a Secondary Hospital

Sola, et al. *Antimicrob Resist Infect Control* 2015;4(Suppl 1):P32.

### Summary:

Cleaning thoroughness of surfaces in a 300-bed hospital was assessed using ATP testing before and after educational intervention to measure the effectiveness of cleaning methods and change in behavior.

### Conclusions:

- ATP monitoring results improved more than 27% in the study, suggesting that rapid monitoring with ATP is a useful way to measure intervention effectiveness when improving environmental cleaning thoroughness.



## Time-Dependent Influence on Assessment of Contaminated Environmental Surfaces in Operating Rooms

Saito, Y., Yasuhara, H., Murakoshi, S., Komatsu, T., Fukatsu, K., Uetera, Y. *Am J Infect Control* 2015;43:951-5.

### Summary:

In this study, contamination of operating room surfaces was measured with an ATP cleaning verification system alongside microbial tests, collecting samples from 17 surfaces in several ORs. This study aimed to measure the influence of surface features, such as touch frequency and orientation, on overall contamination.

### Conclusions:

- Microbial tests were time-sensitive, as bacteria on surfaces were undetected beyond 48 hours. In contrast, ATP test results remained stable, consistently detecting contamination over several days.
- The study acknowledged the discrepancy between microbial counts and ATP test results, pointing to human touch and/or body fluid as vectors for cross-contamination measurable by ATP testing but absent of microbial contamination.
- ATP was found to be a more reliable indicator of contamination of environmental surfaces, relatively independent of time.

## Best Practices in Disinfection of Non-Critical Surfaces in the Health Care Setting: Creating a Bundle for Success

Havill, Nancy L. *Am J Infect Control* 2013;41:S26-S30.

### Summary:

Due to growing evidence that the environment plays a critical role in infection transmission, greater emphasis is being placed on environmental services cleaning thoroughness. This study suggests a bundled approach to a successful environmental cleaning program including monitoring surfaces with an objective tool such as ATP testing and providing feedback to cleaning staff.

### Conclusions:

- Cleaning thoroughness significantly improves when objective tools are used to give quantitative feedback to cleaning personnel.
- Interdepartmental commitment and leadership are necessary to drive ongoing success in an environmental cleaning program.





## A Pilot Study into Locating the Bad Bugs in a Busy Intensive Care Unit

Whiteley, G. S., Knight, J. L., Derry, C. W., Jensen, S.O., Vickery, K., Gosbell, I.B. *Am J Infect Control* 2015;43:1270-5.

### Summary:

This study aimed to identify reservoirs of multidrug-resistant organisms (MDROs) within intensive care units. ATP bioluminescence was used to rapidly assess high-touch surfaces and soiled locations to guide microbial sampling for MDROs.

### Conclusions:

- Using ATP testing to verify cleanliness and identify residual contamination significantly improved MDRO sampling strategy and discovery rate.
- Contamination (high ATP results) and MDROs were identified from high-touch surfaces not included in common cleaning protocols, indicating a greater need to reassess thoroughness of ICU cleaning protocols.

## Comparing ATP Values with Bacterial Contamination in a Nursing Home

Overdeest, et al. *Antimicrob Resist Infect Control* 2015;4(Suppl 1):P28

### Summary:

ATP test results were compared to aerobic colony counts and presence of ESBL-producing Enterobacteriaceae in a nursing home environment.

### Conclusions:

- This study demonstrated a good correlation between ATP RLU results and bacterial contamination.
- ATP is a valid surrogate for measuring bacterial contamination on surfaces.

## Comparison of Results of ATP Bioluminescence and Traditional Hygiene Swabbing Methods for the Determination of Surface Cleanliness at a Hospital Kitchen

Aycicek, H., Oguz, U., & Karci, K. *Int J Hyg Environ Health* 2006;209:203-6.

### Summary:

The study compares ATP and traditional microbiological swabbing culture methods on various surfaces and equipment in a hospital kitchen.

### Conclusions:

- ATP monitoring method produced results more rapidly, enabled earlier corrective action against poor hygiene, and greater control of surface contamination in comparison to culturing methods.
- ATP testing offers greater benefits over traditional culturing methods with its ability to produce faster results enabling immediate corrective action.
- ATP should not serve as a substitution for culturing methods; a combination of both methods allows for a greater comprehension of surface hygiene.



## Monitoring the Effectiveness of Cleaning in Four British Hospitals

Cooper, R. A., Griffith, C.J., Malik, R. E., Obee, P., & Looker, N. *Am J Infect Control* 2007;35:338-41.

### Summary:

This study assesses the efficacy of visual inspection methods compared to ATP measurements and aerobic colony counts to evaluate cleanliness.

### Conclusions:

- Visual assessment on its own is an unreliable indicator of surface cleanliness as well as a tool for assessing the effectiveness of cleaning protocols.
- In this study, the ATP and microbiological results after cleaning were highly variable suggesting inconsistencies in the quality of cleaning.
- Simple changes to cleaning processes can achieve substantial improvements leading to a reduction in residual surface contaminants.

## Finding a Benchmark for Monitoring Hospital Cleanliness

Mulvey, D., et al. *J Hosp Infect* 2011;77:25-30.

### Summary:

This study attempts to find a benchmark that could indicate risk to patients from a contaminated environment. Visual monitoring, ATP tests, and microbiological screenings were used to test five clinical surfaces before and after cleaning.

### Conclusions:

- This study concludes that, "...ATP monitoring confirmed environmental contamination, persistence of hospital pathogens, and measured the effect on the environment from current cleaning practices."
- In addition, hospitals should use 100 relative light units (per Hygiena's ATP system) as its provisional value to assist with future evaluations of the hospital's cleanliness.

## Comparison of Fluorescent Marker Systems with Two Quantitative Methods of Assessing Terminal Cleaning Practices

Boyce, J. M., Havill, N. L., Havill, H. L., Mangione, E., Dumigan, D. G., & Moore, B. A. *Infect Control Hosp Epidemiol* 2011;32:1187-93.

### Summary:

This study compares fluorescent markers with aerobic colony counts (ACCs) and adenosine triphosphate (ATP) bioluminescence for assessing terminal cleaning practices. Fluorescent markers are useful in determining how frequently high-touch surfaces are wiped during terminal cleaning. However, many contaminated surfaces were classified as clean according to fluorescent markers whereas ACC and ATP assays were significantly less likely to classify that same surface as clean. While fluorescent markers are an indicator of how often a surface is wiped, the method does not clearly indicate actual surface cleanliness.

### Conclusions:

- ATP testing can be used to detect variations in practice to educate cleaning personnel and to provide feedback to personnel regarding their compliance with recommended practices



## Evaluating Hygienic Cleaning in Health Care Settings: What You Do Not Know Can Harm Your Patients

Carling, P., & Bartley, J. *Am J Infect Control* 2010;38:S41-50.

### Summary:

With the understanding of the importance of cleanliness in the near-patient environment in the transmission of health-care associated infections, an objective and more structured approach to monitoring such activities has recently evolved. The advantages and disadvantages of various methods of monitoring tools are examined in this study. Methods evaluated include: covert practice observation, swab cultures, agar slide cultures, fluorescent gel, and ATP bioluminescence. To choose an evaluation method, a facility must decide whether the cleaning process or the actual cleanliness of surfaces is to be monitored.

### Conclusions:

- In comparison to the other methods, ATP systems are easy to use, useful as a teaching tool, and can be used to evaluate cleaning.

## Evaluation of ATP Bioluminescence Swabbing as a Monitoring and Training Tool for Effective Hospital Cleaning

Willis, C., Morley, R., Westbury, J., Greenwood, M., & Pallett, A. *J Infect Prev* 2007;8:17-21.

### Summary:

This study evaluates the use of ATP swabs for assessing cleanliness in hospitals. ATP swabbing detection was similar in comparison to microbiological swabbing and proved to be a useful tool for educational sessions with cleaning staff due to real-time results.

### Conclusions:

- ATP swabbing is not directly equivalent to microbiological monitoring but does provide a good indication of whether or not a surface is clean.
- The use of ATP bioluminescence swabbing with other audit tools provides a complete analysis of hospital hygiene.

## Failure Analysis in the Identification of Synergies between Cleaning Monitoring Methods

Whiteley, G. S., Derry, C., Glasbey, T. *Am J Infect Control* 2015;43:147-53.

### Summary:

This study evaluates the four monitoring methods (visual inspection, microbial recovery, fluorescent marker assessment, and rapid ATP bioluminescence) used to manage the quality assurance of cleaning within hospitals. The failure mode and effects analysis (FMEA) was used to determine the failure risk for each cleaning monitoring method. FMEA is a reliable safety and quality management risk-assessment tool that identifies potential failure conditions or errors that may cause failure for products or processes.

### Conclusions:

- Monitoring methods used at the same time or in sequence mitigates the failure modes of a single monitoring method by balancing the weakness of one method with the strength of another.
- ATP bioluminescence is a favored testing method that is complimentary to the all three monitoring methods.





## A Modified ATP Benchmark for Evaluating the Cleaning of Some Hospital Environmental Surfaces

Lewis T. B., Griffith, C., Gallo M. B., & Weinbrenb, M. *J Hosp Infect* 2008;69:156-63.

### Summary:

This study tests the combination of ATP bioluminescence with microbiological analysis. This test combination was used to assess cleaning effectiveness in a 1,300-bed hospital after routine and modified cleaning protocols. The study started with an original benchmark of 50 RLU (Hygiena equivalent) but soon discovered a lower benchmark of 25 RLU (Hygiena equivalent) could also be achieved by some hospital sites.

### Conclusions:

- ATP benchmarks provide an objective and attainable measure that can be used to evaluate cleaning methods and frequencies.
- ATP testing can be used to provide instant feedback on surface cleanliness, and was found to be a powerful way of demonstrating deficiencies in cleaning protocols and techniques to staff.

## APSIC Guidelines for Environmental Cleaning and Decontamination

Ling, M., Apisarnthanark, A., Thu, L., Villanueva, V., Pandjaitan, C., Yusof, M.. *Antimicrob Resist Infect Control* 2015;4:58.

### Summary:

This document provides guidelines for environmental cleaning and disinfection developed by the Asia Pacific Society of Infection Control (APSIC). For assessing environmental cleanliness, the organization recommends monitoring residual bioburden with an objective tool such as ATP cleaning verification.

### Conclusions:

- This guideline adds to the growing list of international organizations recognizing ATP cleaning verification as a valid and useful method for assessing environmental cleanliness in healthcare environments.

## Taking the Lead with Disposable ECG Leads: Preventing Chest Incision Surgical Site Infections

Charlene, H. *Am J Infect Control* 2014;42:S34.

### Summary:

The cardiac services department of CMC-NorthEast experienced an increase in chest incision surgical site infections. The goal of the study was to evaluate the effectiveness of the cleaning and disinfection process of ECG lead wires using ATP bioluminescence and use this information to support the purchase and use of disposable ECG leads for cardiovascular surgery patients to prevent chest incision surgical infections. Samples from terminally cleaned reusable ECG lead wires and environmental surfaces in a hospital patient room were evaluated to determine the amount of organic matter using ATP.

### Conclusions:

- Results confirmed that reusable ECG wires were not being cleaned effectively in the hospital.
- Some hospitals may want to use ATP testing to validate the effectiveness of equipment cleaning.

