

IAQA Annual Meeting & Exposition

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October 25-26, 2006 • Nashville, TN



Real-Time Microbial Detection..... The Future of Mold, Bacteria and Water Damage Testing

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Goals of Discussion

- Define “Real Time Microbial Detection”
- The Ideal Condition
- Background on Technology
- ATP & the IICRC S520 – Study Results
- The Present and Future of ATP

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What is meant by “Real Time?”

- Real time microbial detection is the collection and measurement of biological contaminant within seconds or minutes.
- Surface, Air, Bulk, or Liquid Sample Types

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Bio-Remediation...The Ideal Condition

- Primary objective is to physically remove bio-debris or contamination from surface or substrate.
- Perform testing to verify surface hygiene
- Ideal test includes measurement of total bio-burden (fungi, bacteria & bio-film)
- Bio-burden testing allows for fast, easy and relatively accurate determination

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The Ideal Condition - Surface Hygiene

Hygiene

- A condition promoting sanitary practices
- The science concerned with the prevention of illness and maintenance of health
- What it practically means...**CLEANING**
(Gross debris removal + detailed cleaning + application of disinfectant/sanitizer = hygienic surface)

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The Ideal Condition – continued

- After cleaning, surfaces appear visibly clean but organic residue may still remain at measurable concentrations
- Organic residue = anything living or once living (fungi, bacteria, bio-film, somatic cells, etc.)

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The Technology and Background

- Using ATP bioluminescence as a bio “Marker” or means of total bio-burden measurement (fungi, bacteria, bio-films).
- Adenosine Tri-Phosphate (ATP) is present in ALL living organic material

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Technology and Background

- When living organisms eat they are providing 'fuel' for their cells to function. This fuel, in a cellular form, is called ATP (found in Krebs Cycle)
- The presence of ATP indicates either:
 - (1) life (anything from microbes to man)
 - (2) nutrient source that can support life (food)No ATP = lack of any life or food source

**No ATP means the surface must be
BIOLOGICALLY CLEAN**



Technology....How it Works

- ADENOSINE TRI-PHOSPHATE
- Fire Fly enzyme - use ATP to produce LIGHT
- The enzyme used is LUCIFERIN LUCIFERASE

LUCIFERIN LUCIFERASE
+
ATP



The reaction is called BIOLUMINESCENCE and is measured in RELATIVE LIGHT UNITS (RLU)

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Technology and Background

- Bioluminescence testing allows for the following:
 - Easy, rapid method of assessing the hygiene level (cleanliness) of a surface
 - Results available in under 1 minute allowing immediate corrective action (*Real time*)
 - Reduces need for culture testing – (*long turnaround time avoided and <10% cost*)
 - Tests are easy to perform (*no specific skills or formal training are required*)

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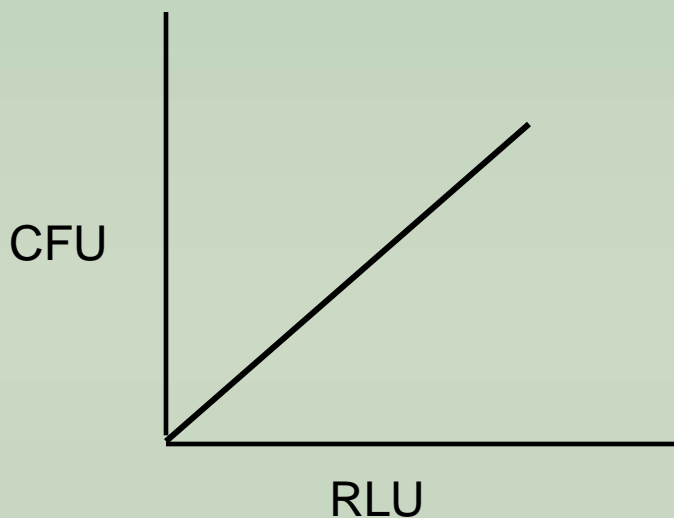
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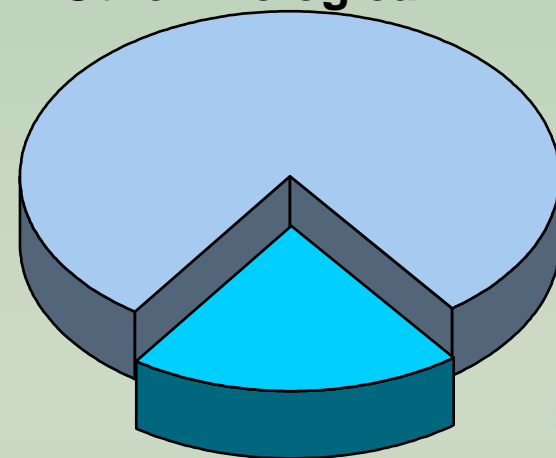
Technology and Background

CFU / ATP correlation



With pure culture of micro-organisms, without other residues, RLU correlate well with CFU (ie: bacteria)

Other Biological ATP



Microbial ATP

With these typical proportions of ATP on a swab, RLU does not correlate with CFU but with “cleanliness” or **potential for pathogens on unhygienic surfaces** (typical environment)

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Technology and Background

- ATP bioluminescence is currently used and has been accepted by the USDA and FDA in some of the following industries:
 - Food Mfg and Processing Industry
 - Pharma
 - Industrial Mfg (Petrol, Paint, etc.)
 - Healthcare – Infection Control, Env. Services, etc.

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ATP and the IICRC S520

- Purpose:
 - Use ATP bioluminescence as a method of biological measurement to provide numerical quantification of surface contamination per Conditions 1, 2 and 3 of the IICRC S520

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ATP and the IICRC S520

- Methodology:
 - Study performed by gathering field data (~1,000 ATP samples) on project sites with visual consistencies as defined by the IICRC S520 Conditions 1-3.
 - Surfaces sampled include unpainted wood framing, unpainted wood plywood, unpainted OSB, painted and unpainted gypsum board, various hard surface flooring and table tops, etc.

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Methodology - continued

- Moisture content testing was performed of sampled surfaces.
- Sampling area was 4" sq.
- Bio-reveal® ATP bioluminescence testing system (luminometer and ATP collection device swabs) was used for the study.

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Study Findings

Surface Condition	Moisture Content (%)	ATP Results (RLU)	IICRC S520 Condition
No visible growth	<15	1 – 150 * *housekeeping dependent	1
No visible growth – w/in areas of visible growth	<15	50 – 150	2
Visible growth	<15	> 150	3

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Study Findings

Surface Condition	Moisture Content (%)	ATP Results (RLU)	IICRC S520 Condition
No visible growth	<15	1 – 150 * *housekeeping dependent	1
No visible growth – w/in areas of visible growth	<15	100 – 500	2
Visible growth	>15	> 500	3

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Study Conclusions

- Sampled material type was insignificant to results obtained
- Moisture content was significant factor of measured ATP in Condition 3 situations (water activity increased “life” of growth)
- Condition 1 surfaces were dependent on housekeeping

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Study Conclusions - continued

- Condition 2 surfaces were significantly dependent based on growth activity of Condition 3 surfaces in the area
- ATP testing appears to provide some verifiable quantification of biocontamination of Conditions 1-3
- Some level of experience is required to adequately identify Conditions present and relate that to ATP results
- ATP testing is a fast, low cost (\$2-3 per test) and scientifically reliable method of measuring surface biocontamination.

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The Present and Future of ATP

- Presently, ATP testing is widely used in other industries and has been for decades.
- The luminometers are portable, low cost (\$1,000) and durable.
- The swab reagents are very stable, easy to use and cost effective (<\$3 per test)
- The use of ATP technology in other industries is paving the way for future uses and validation.

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The Future.....

- Real time and Rapid methods will gain more ground in the industry.
- Other similar types of technology exist presently and are being utilized in the IAQ market.
- Time is money and these technologies allow for savings of both.

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The End

Questions ???????

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