



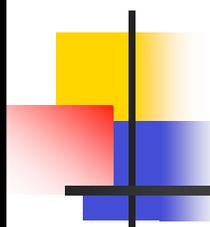
• August 15-18, 2010 • Dallas, Texas •
• Dallas Convention Center •

*Plumbing
Retrofits 101 -
Lessons
Learned*



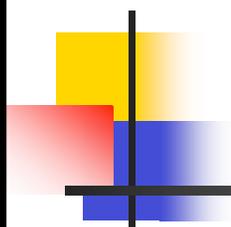
TESTING, TESTING...Trust, but VERIFY!!!

John Koeller, P.E.
Koeller & Co.



The goal -

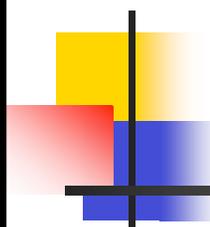
- ✓ Real water/energy savings
that are sustained
and result in a
satisfied customer



Questions we ask -

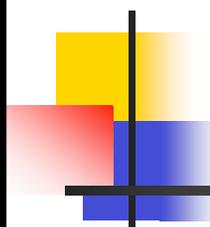
- Are “water-efficient” products *really* water-efficient?
- Do “water-efficient” products yield long-term savings?
- Do “water-efficient” products meet customer expectations?

...or ***DO THEY WORK??***



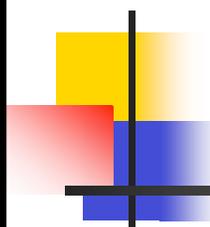
The goal....

- Real water savings
that are sustained
and result in a
satisfied customer



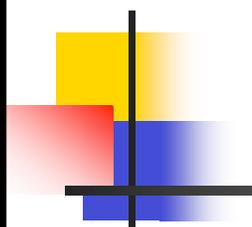
Water-efficient....*really*?

- Who says?
- Qualified and/or accredited laboratories?
 - ✓ Valid testing protocol?
 - ✓ Independently developed?
 - ✓ Represents “real world” conditions?
- Field testing & evaluation....verification?



Water-efficient....*really?*

- Look for:
 - ✓ Independent field and lab studies
 - ✓ Customer surveys
 - ✓ Authoritative data from independent sources
 - Water utilities
 - Other independent evaluators
 - Water efficiency professionals



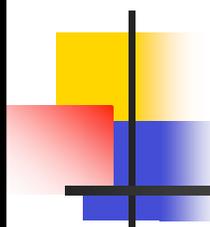
The goal....

- Real water savings

that are sustained

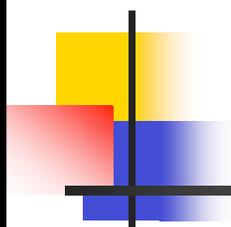
and result in a

satisfied customer



Sustained savings?

- Product maintenance reqm'ts
- Physical longevity
- Economic benefits > costs
- Savings decay
 - ✓ Behavioral changes?
 - ✓ Deferred maintenance?
 - ✓ Declining customer satisfaction?

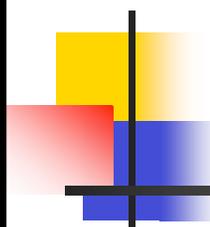


The goal....

- Real water savings
that are sustained

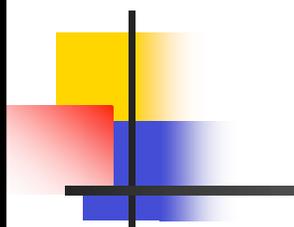
and result in a

satisfied customer



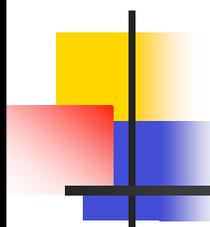
Customer Satisfaction?

- Dissatisfied customers & end-users will-
 - ✓ Tamper with the product
 - ✓ Throw product away or return for refund
 - ✓ Replace the product with an inefficient one
 - ✓ Tell everyone that all “water-efficient” products are no good!



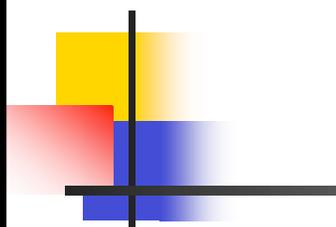
Why test?

- Establish that a product meets minimum requirements for certification
- Measure performance and efficiency
- Verify that a product works on a continuing basis and meets the intent of the product
- Compare one product with another product with a similar purpose
- Ascertain water use and water savings



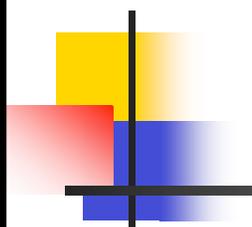
“Depth” and scope of testing?

- Guesstimate
- Engineered estimate
- Laboratory test (before entering the marketplace)
- Field trials (before entering the marketplace)
- Field test (sampling of product after installation and commissioning)
- Field test (sampling of “aged” installations, e.g., after 6 months, 1 year, 5 years, or ?)



What types of testing?

- Statistically valid testing
- Certification testing to a minimum standard; testing only for compliance
- Manufacturer testing
- Performance testing (fit for purpose), including Maximum Performance testing
- Independent testing
- Lab testing
- Field testing
- Measurement & Verification testing



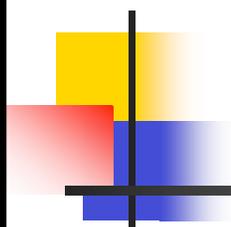
Decisions, decisions....

- ✓ WHO should test?
 - Manufacturer
 - Independent laboratory
 - Customer
- ✓ WHAT should be tested?
 - Product as a “stand-alone”
 - Product within a “system”
- ✓ WHEN to test?
 - Before the product is introduced to the marketplace
 - After the product has been installed (at commissioning)
 - During the lifetime of the product to establish durability and consistency

AN EXAMPLE...

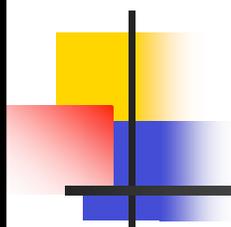
Maximum Performance Testing of Popular Toilet Models (MaP Testing)

- Cooperative Canadian & U.S. project - 2003
- Development sponsored by 22 water utilities and interested parties in U.S and Canada
- Purpose:
 - Give facilities managers, specifiers, & consumers information they needed on toilet flush performance
 - “Stimulate” manufacturers toward improved performance



Maximum Performance Testing of Popular Toilet Models (MaP Testing)

- Cooperative U.S. and Canadian project - 2003
 - East Bay Municipal Utility District
 - Los Angeles Dept of Water & Power
 - Tampa Bay Water
 - Seattle Public Utilities
 - Calif Urban Water Conservation Council
 - Toronto, Ontario
 - Winnipeg, Manitoba
 - Greater Vancouver Regional District
 - Canada Mortgage & Housing Corp.
 - B.C. Buildings Corp. Victoria B.C.
 - Capital Regional District, Victoria B.C.
 - Canadian Water & Wastewater Association (Lead)
 - Region Durham, Ontario
 - Region Halton, Ontario
 - Region Waterloo, Ontario
 - Hamilton, Ontario
 - Region Peel, Ontario
 - Calgary, Alberta
 - Edmonton, Alberta
 - Montreal, Quebec
 - Ottawa, Ontario
 - Halifax, Nova Scotia



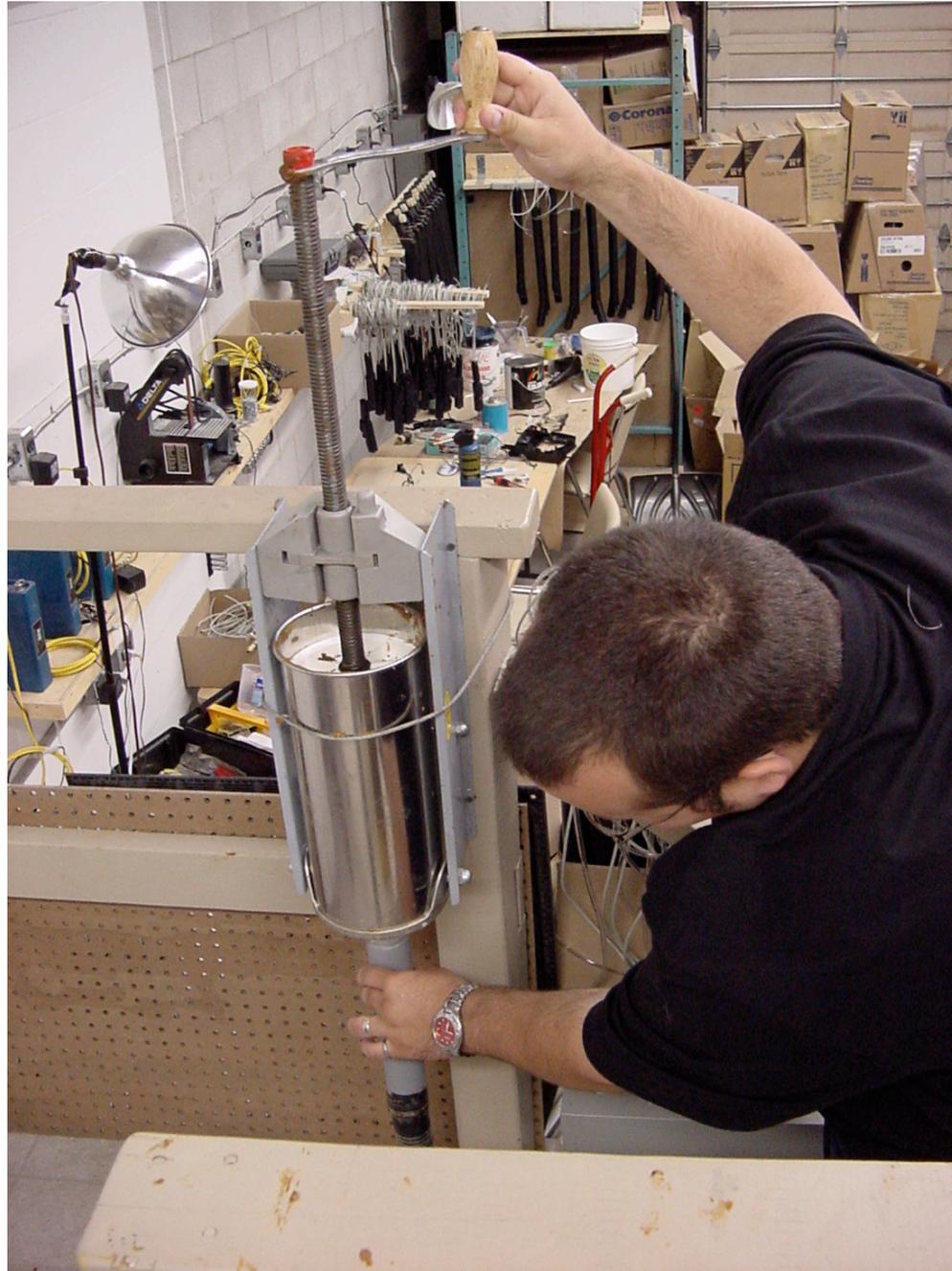
Maximum Performance Testing of Popular Toilet Models (MaP Testing)

- Why MaP?because certification testing is a very poor measure of “real world” performance of toilet fixtures....consumers & plumbers want to compare!
 - ✓ Current certif testing requires ONLY 79% waste removal!!!
- MaP Features -
 - ✓ Replicates “real world” with special test media
 - ✓ An independent measure of toilet performance
 - ✓ Scientifically based minimum performance threshold for waste removal (250 gram & 350 gram)
 - ✓ User-friendly basis for toilet selection

Test Media: Soy Bean Paste



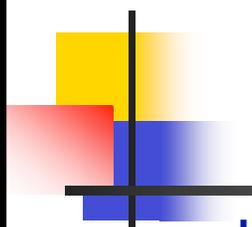






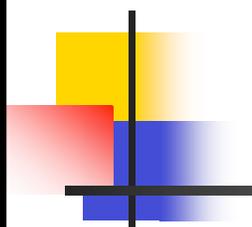






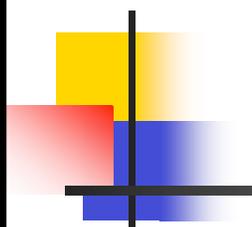
Toilet Fixture Definitions

- ULFT: Ultra-Low Flush Toilet (1.6-gal per flush)
 - Introduced in the late 1980s
 - Mandated nationwide in 1994
- HET: High-Efficiency Toilet (1.28-gal or less)
 - Four types of HET:
 - Dual-flush gravity (1999)
 - Pressure-assist single flush (2001)
 - Single flush gravity (2006)
 - Flushometer valve/bowl (2007)
 - HETs mandated in California/Texas as of 2014
 - Probably to be mandated nationwide by 2014
 - Encouraged by the U.S. EPA **WaterSense**[®] Program



Maximum Performance Testing of Popular Toilet Models (MaP Testing)

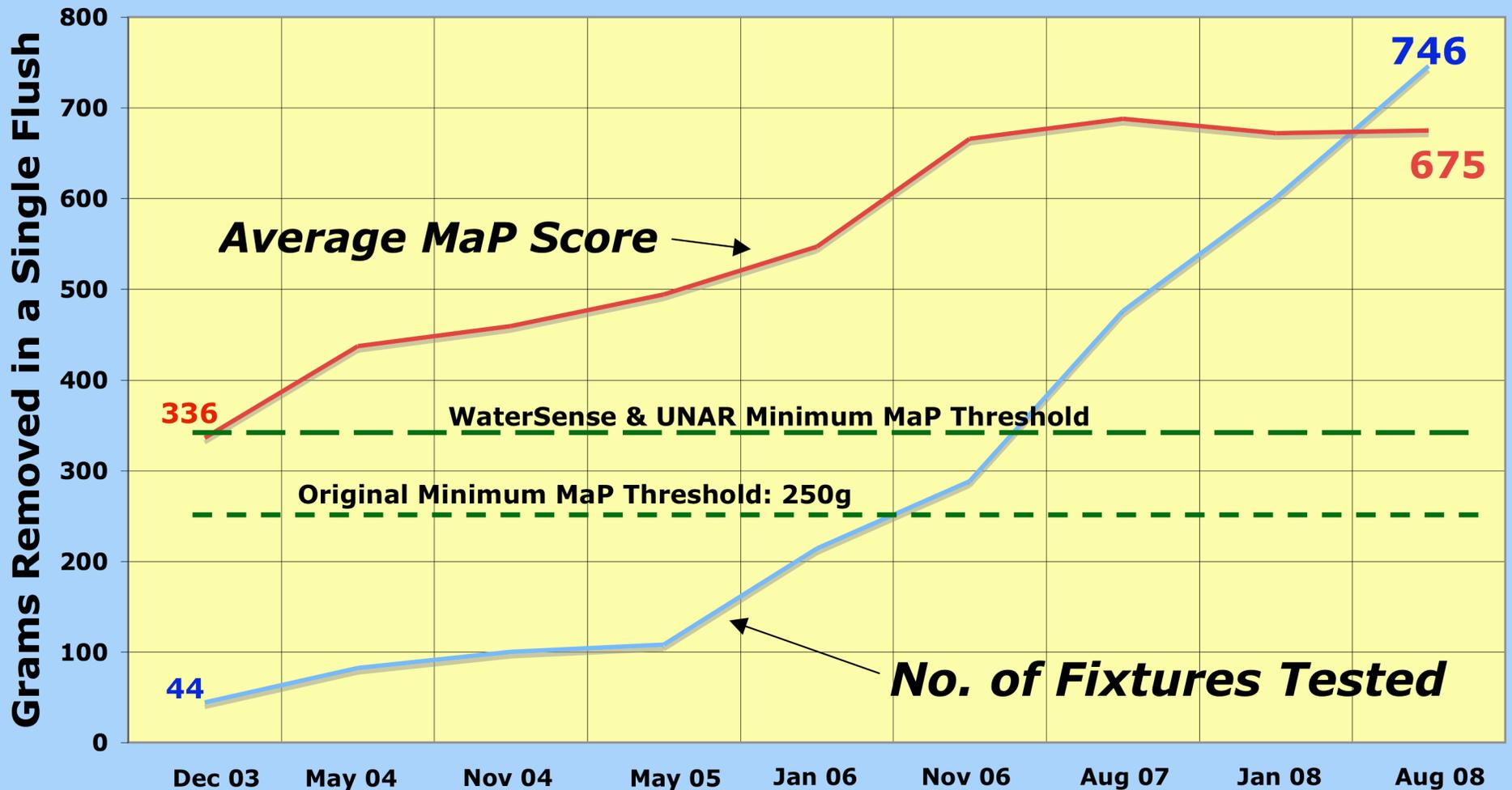
- ✓ 18th Edition - July 2010
 - 1,500+ different toilet fixture models tested and rated!!
- ✓ Used or adopted by various large production builders, designers, specifiers, retailers, water utilities, plumbers, consumers, facilities managers & others for product selection
- ✓ Manufacturers worldwide now testing to MaP
- ✓ Manufacturers submit products for independent testing
 - Numerous qualified laboratories - North America & Asia
- ✓ Used by U.S. EPA **WaterSense®** Program as basis for measuring toilet performance...
 - All **WaterSense®**-certified HETs MUST meet a 350g threshold
 - All **WaterSense®**-certified HETs are INDEPENDENTLY tested



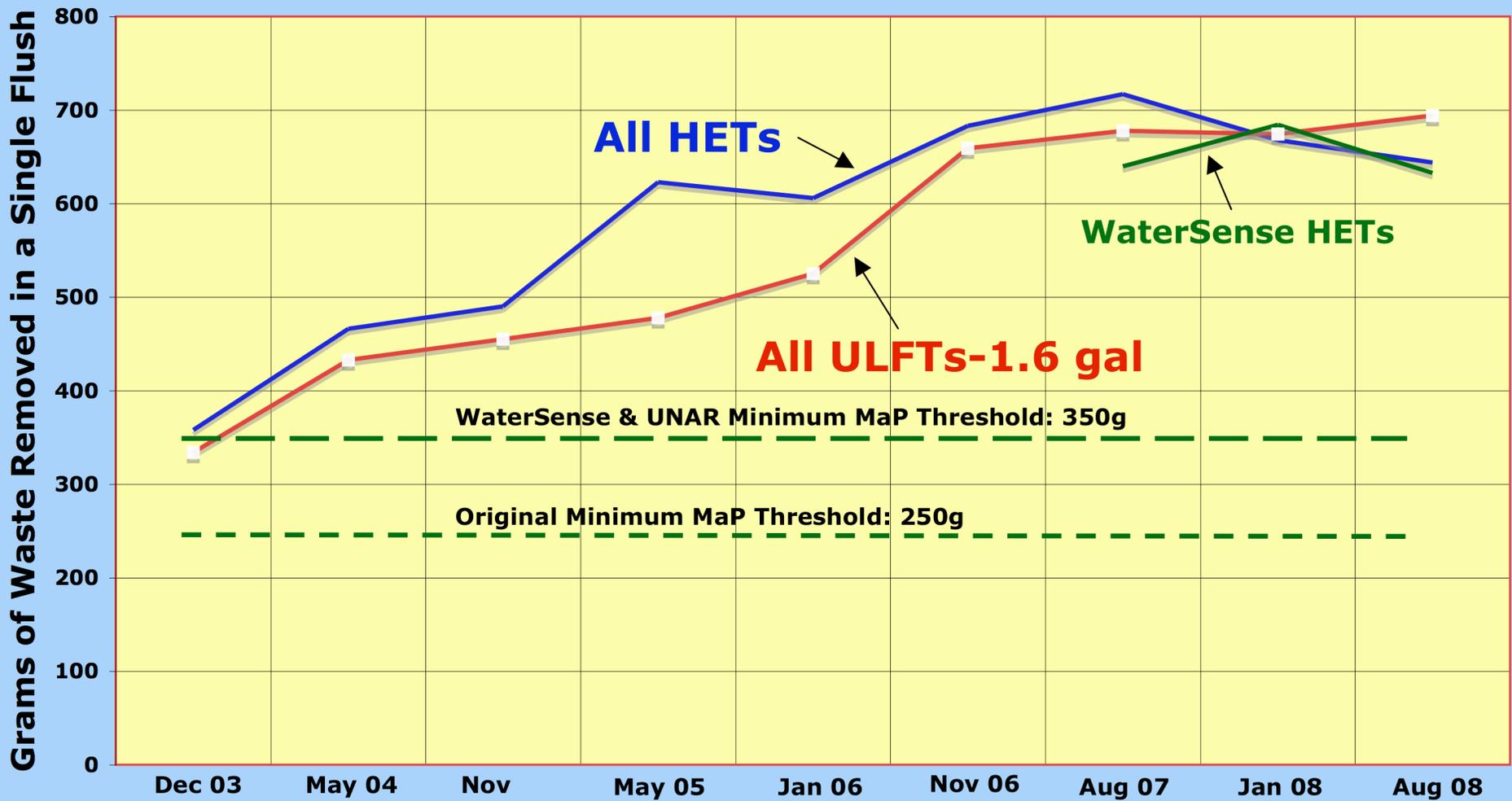
Performance Progress through MaP Testing

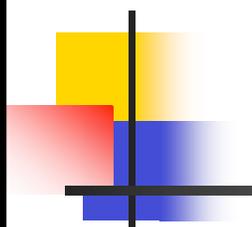
- Early ULFTs (1.6gal) - minimal testing, poor performance
- Today's ULFTs - MaP testing leads to improved performance
- New HETs (1.0 to 1.28gal) - MaP testing is leading to outstanding performance
- **WaterSense[®]**-certified HETs outperform older toilets

Toilet Fixtures Tested - Average MaP Score



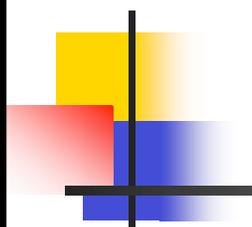
Average MaP Scores - 2003 to 2008





High-Efficiency Toilet (HET) Specifics

- ✓ August 1, 2010: 980 different HET models available
(717 are **WaterSense**[®]-certified!)
- ✓ Today's HETs outperform the 3.5-gal fixtures of the 1980s
- ✓ **WaterSense**[®]-certified HETs perform equal to or better than 1.6-gallon ULFTs
- ✓ NEW “Commercial MaP” for high-use fixtures to be released in 2010
 - Additional toilet paper
 - Toilet seat covers & paper towels
 - “Super log”



Other testing completed & in progress

- ✓ Urinals - High Efficiency Urinals (HEUs) & conventional (in progress)
- ✓ Urinal cubes (ecoBlue - complete)
- ✓ Residential humidifiers (complete)
- ✓ Dual-flush conversion kits for tank-type toilets (in progress)
- ✓ Showerheads (complete - in conjunction with WaterSense)
- ✓ Commercial drainline transport of wastes (in progress)
- ✓ 0.8 gallon (3L) toilet fixtures (in progress)
- ✓ Single-family residential drainlines (complete)
- ✓ Sensor-activated flush valves & faucets (complete)

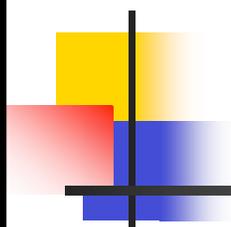
and finally....

GREEN JUICE COMICS

BY GEORGE SFARNAS AND GREENCE.COM



GJC-3 COPYRIGHT 2009



Thank you!!

John Koeller, P.E.
Koeller and Company
Yorba Linda, California
(714) 777-2744
koeller@earthlink.net

MaP Reports:

[www.a4we.org/Maximum_Performance_\(MaP\)_Testing.aspx](http://www.a4we.org/Maximum_Performance_(MaP)_Testing.aspx)

Searchable Map Databases:

Tank-type: www.veritec.ca/mid.php?code=35&top=6&option=7&img=5

Flushometer valve/bowl: www.veritec.ca/mid.php?code=34&top=6&option=7&img=5



GovEnergy 2010