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INNOVATIONS

Sensor-Activated Plumbing Fixtures in Commercial Applications



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Sensor-Operated Fixtures

- Typically found on:
 - Faucets,
 - Urinals, and
 - Toilets.
- Almost entirely in non-residential applications, though sensor-operated faucets becoming more popular in homes.



Sensor-Operated Fixtures

- There is some question as to the effectiveness and cost-effectiveness of using sensor-operated valves to activate toilets, urinals, or faucets.
- Quote from the CUWCC website:
 - **“Do sensor-activated commercial faucets save water?** Most water efficiency practitioners readily acknowledge that sensor-operated flush valves (for commercial toilet and urinal fixtures) save no water. In fact, they would quickly say that these devices waste water by flushing more frequently than necessary! But, what about faucets?”



Sensor-Operated Fixtures

- **No doubt** that sensor-operated fixtures are more hygienic than manually-operated valves, but do they save water?
- Do they actually use more water?
- How much water would you sacrifice for hygiene?

- Regardless of the lack of clear data regarding water savings, many websites tout these types of valves as being very “green”.



(reasonably thorough)

Internet Search

- Found **many** statements that touchless (sensor-operated) fixtures save water – most references were to faucets.
- Some sites even quantified the savings at 60-80% compared to manual valves.
- Problem – I didn't find any actual data!
- Where's the proof??



Federal Green Construction Guide for Specifiers

- Water management: Provide low flow fixtures and automatic, **sensor operated faucets and flush valves**. Provide automatic, sensor operated faucets and flush valves to comply with ASSE 1037 and UL1951.



Georgia Dept. of Natural Resources

- “An estimated **10 percent savings on sensor-operated faucets** can be calculated for LEED. Sensor-operated and self-closing faucets help to reduce water use in high-traffic areas where people may inadvertently leave faucets turned on.” (LEED EB reference guide)

The logo graphic consists of a vertical black line intersected by a horizontal black line. To the left of the vertical line are three overlapping squares: a yellow one at the top, a red one in the middle, and a blue one at the bottom. The word "TOTO" is written in a blue, sans-serif font to the right of the vertical line.

TOTO



- With contemporary styling, the TOTO™ Electronic Faucet provides cleaner restrooms and **outstanding water conservation.**



Grohe

- **Features:**
- Infrared Electronic Actuation
- Battery Operated (6 Volt Lithium included)
- 0.5 gpm (1.9 Lpm)

- **Benefits:**
- Sanitary, touch-free operation
- **Saves water and energy**
- No electrical hook-up needed



The logo consists of a vertical black line intersected by a horizontal black line. To the left of the vertical line are three overlapping squares: a yellow one at the top, a red one in the middle, and a blue one at the bottom. The word "Delta" is written in a blue, sans-serif font to the right of the vertical line.

Delta



- Hands-free activation.
- Automatic shut-off prevents overflowing and **saves water.**



Sloan (Plumbing Engineer)

re: operating costs

- Most expensive operating cost for plumbing fixtures relates to how much water it consumes.
- **Sensor-operated faucet uses ~1 gallon less than manual faucet (per use).**
 - How much water are people using to wash their hands?

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Maximizing **Water Conservation** and **Hygiene** in School Design





Many more examples...

- **Sensor faucets save up to 70%** in water usage (www.airdelights.com)
- The main conservation benefit of sensor-operated faucets is that they regulate water use - **a sensor-operated faucet can save as much as one gallon of water per use.** (Buildings.com)
- Many plumbing technologies on the market will conserve water. If more facilities installed fixtures such as **sensor-operated faucets**, indoor water consumption would drop considerably. (American School & University)
- The obvious benefit of touchless faucets is increased hygiene but **water savings** ... are how electronic faucets close the cost gap on their manual counterparts in just a short time. (Sloan)



Architectural Record

- “Since the water is not running while the person is scrubbing their hands, reaching for a towel or soap or looking for the comb in their pocket or purse, water savings of 60% to 80% can be achieved.”



Province of Ontario

- **Water Efficiency in Public areas**
- Install -
 - ultra low-flow aerators on all faucets
 - **sensor-operated faucets** in washrooms
 - **sensor-operated** urinals
 - low-flush toilets and flush-valves



Lots of Claims...

- But, unfortunately, not much verifiable data to support water savings claims.
- Found 2 references that quantified water savings related to faucet use
- Found 0 reference that quantified water savings related to urinal or toilet use.



Field Test of a Photovoltaic Water Heater

– ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers)

- Study by: A. Hunter Fanney, Ph.D., Brian P. Dougherty, John O. Richardson, P.E.
- Compare periods: November through February (data not available for full 12-month period)
- *A solar photovoltaic water heating system was installed at the Great Smoky Mountains National Park to see if it could meet the hot water needs of restroom at the park's main visitor center.*



Results – Avg. Daily Demands

- Nov. 1996 – Oct. 1997, Manually-operated faucets
 - 4.5 gpm aerators: **93 g/day**
- Oct. 1997 – Oct. 1998, Manually-operated faucets
 - 2.2 gpm aerators: **98 g/day**
- Oct. 1998 – Mar. 1999, Sensor-operated faucets
 - 2.2 gpm aerators: **155 g/day (58% increase!)**
- Mar. 1999 – Feb. 2000, Sensor-operated faucets
 - 0.5 gpm aerators: **64 g/day**



Peak flow rate vs. What is used

- Just because a faucet CAN operate at 4.5 gpm doesn't mean people WILL operate it at 4.5 gpm (lots of splashing, etc.)
 - Informal study 14 years ago identified that people adjust lavatory faucet to ~ 1 gpm
- Only achieved savings when flow rate was below the "actual use" value

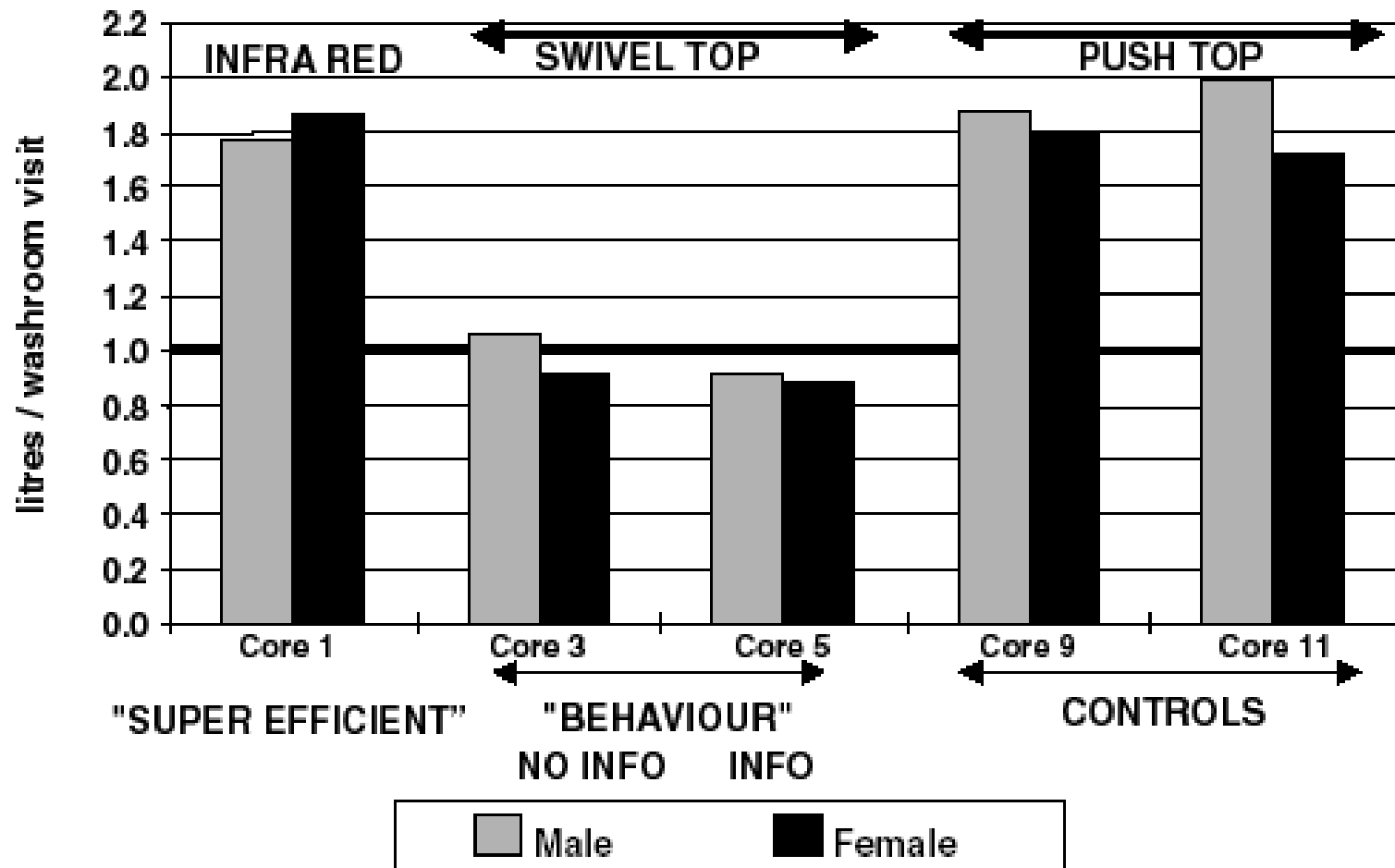
Millennium Dome, Greenwich, England



Figure 1 The Millennium Dome, Greenwich, England

Millennium Dome – UK (2002)

WATER USAGE / WASHROOM VISIT FOR HAND WASHING - ANNUAL





Faucets

- Manual Valves
 - People don't necessarily operate faucets at full rate
 - Flow rate may be more critical than system of operation (photovoltaic water heater)
- Sensor Valves
 - Sometimes flow too long (or too short)
 - Phantom flows associated with sensor valves
- Very little independent data to support claims of significant savings re: sensor-operated valves



Urinals

- Manual Valves
 - Some men don't flush after use (put your hands up)
 - Signs above urinals asking users to flush after each use
- Sensor Valves
 - Flush after each use
 - Phantom flushes (multiple flushes during same use or when moving in front of urinal)
- So, it is unlikely that there would be fewer flushes after installing sensor-operated valves



Toilets

- Manual Valves
 - Hopefully, everyone flushes after each use (don't put your hands up, please)
- Sensor Valves
 - Flush after each use
 - Phantom flushes (multiple flushes during same use or when moving in stall)
- So, it is unlikely that there would be fewer flushes after installing sensor-operated valves



Hillsborough County, Florida

- Study to verify and quantify savings or increase in water use related to the use of sensor-operated:
 - Faucets,
 - Urinals,
 - Toilets.
- Need proper data if we are to make informed decisions.

Hillsborough County, Florida

- Project Goal: to evaluate and quantify the effectiveness of sensor-operated valves to save water.
- Site – 7 storey building with manually-operated plumbing fixture valves in both the “Mens” and “Womens” washrooms
 - sub-meter & data log
 - ‘Pre-Monitor’ to ascertain baseline demands,
 - replace existing valves with sensor-operated units.
- Existing fixture valves replaced sequentially:
 - Identify changes in duty factor for each fixture type,
 - changes in water demands for each type of fixture,
 - overall difference in washroom water demands





Lavatory Faucets









Flow Rates

- Manual faucets
 - Max flow rate (full open) = 1.8 gpm
 - Throttled rate (~half open) = 1.3 gpm
- Sensor-Operated faucets
 - Flow rate = 1.2 gpm

Urinals



Toilets

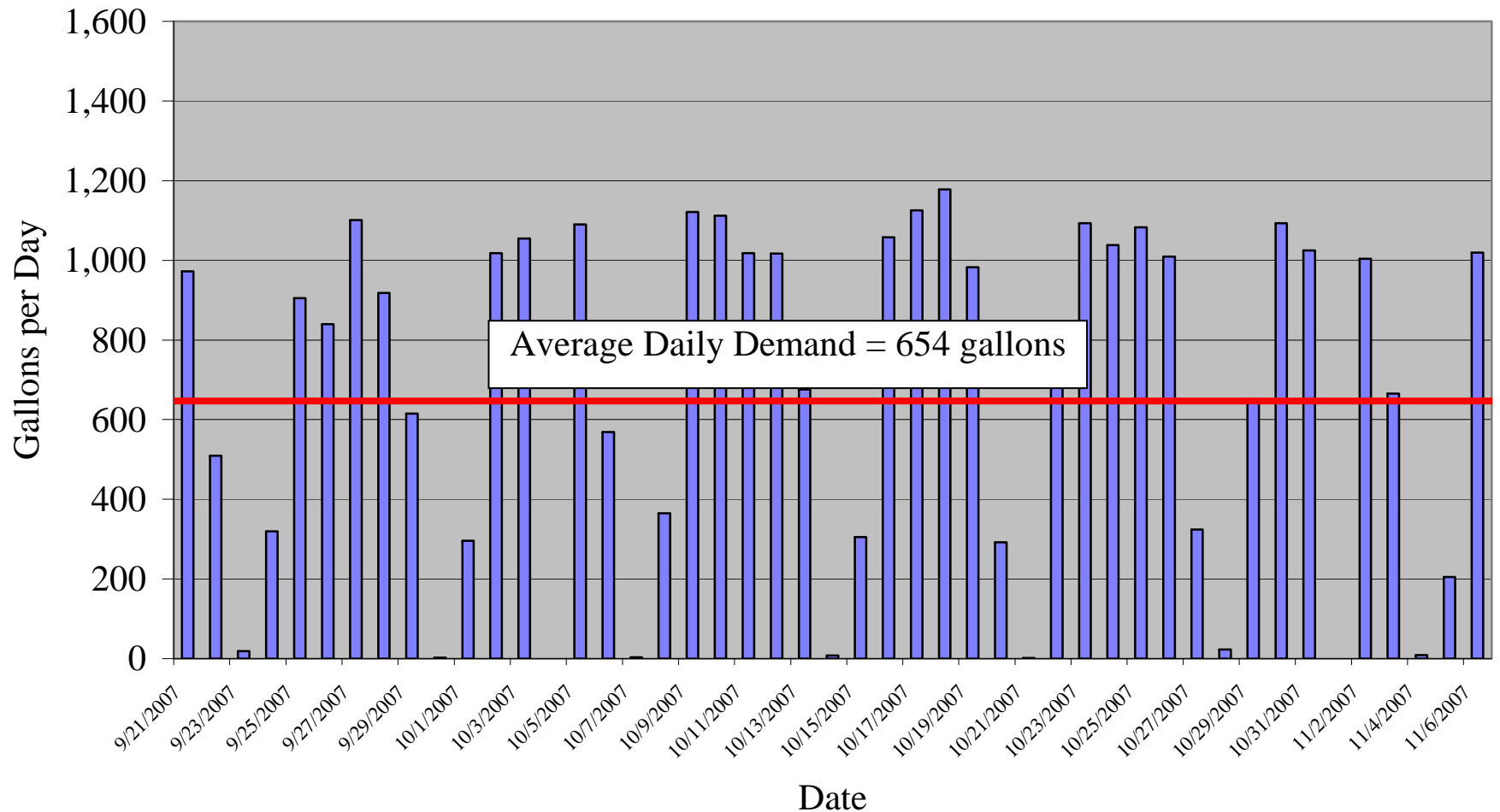




Zurn E-Z Flush Automatic Retrofit Kit

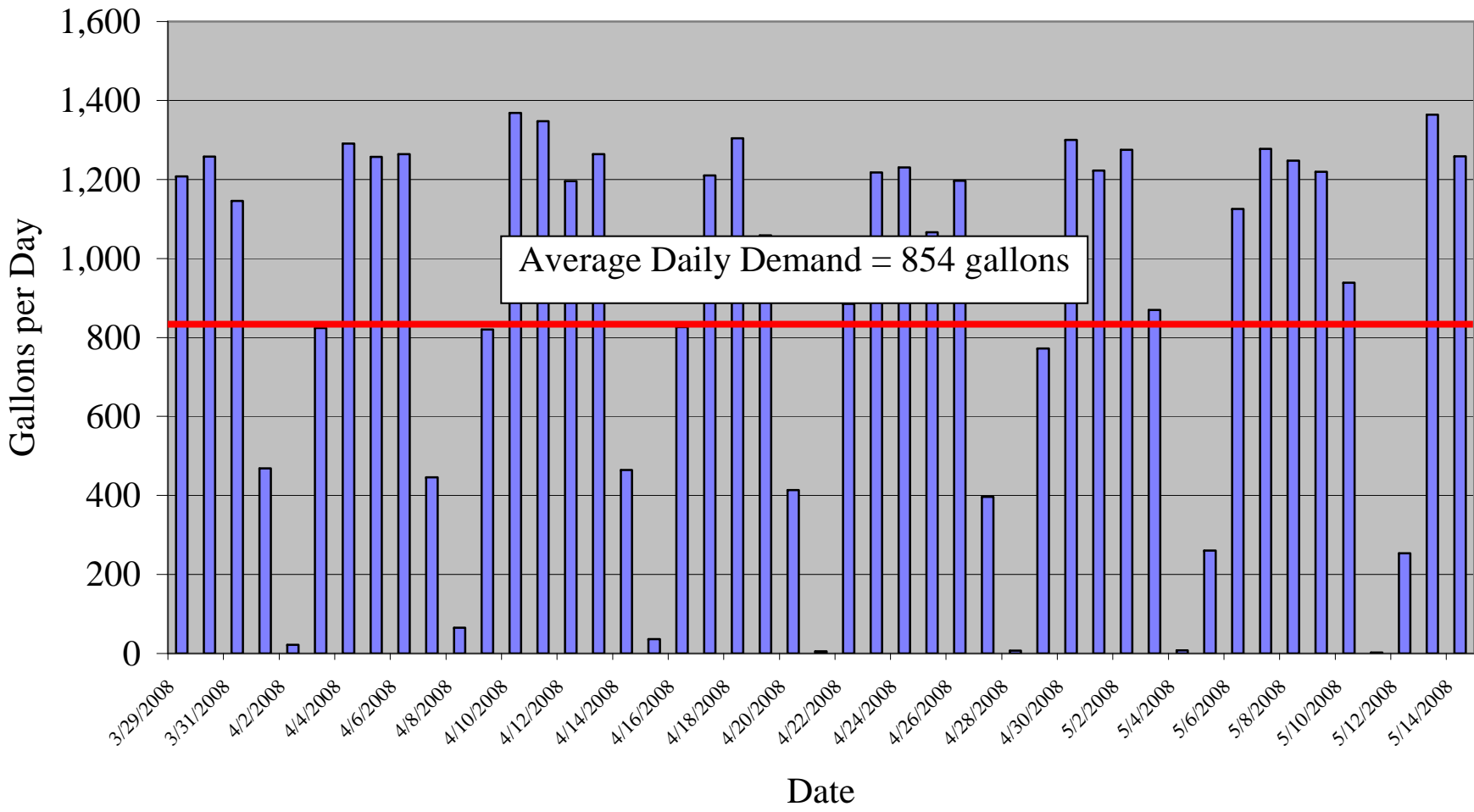
Pre-Demands

Sensor-Operated Fixture Study
Pre-Demands (Feb. 16, 2007 - Jan. 15, 2008)



Post Sensor-Operated Faucet

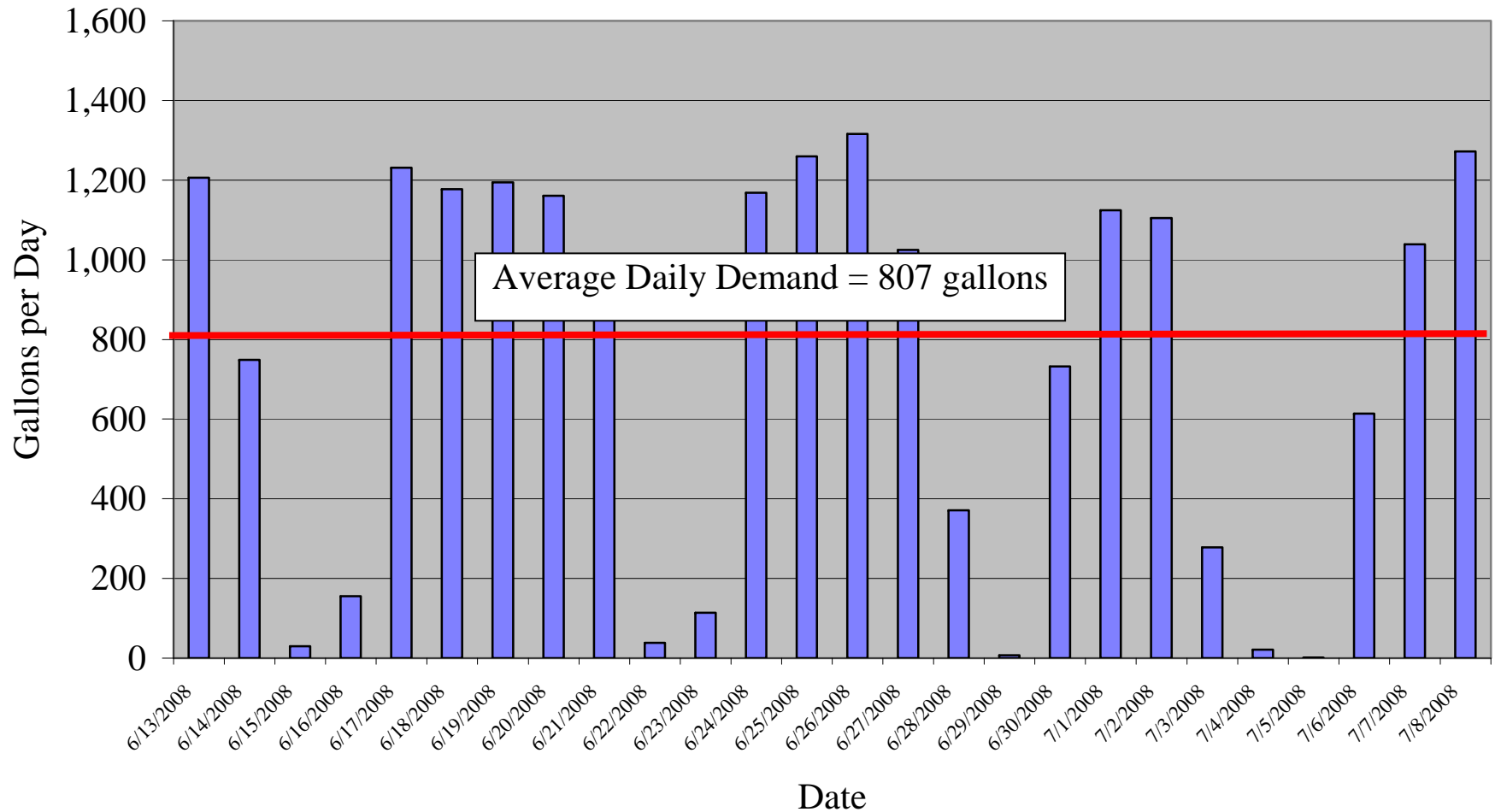
Sensor-Operated Fixture Study
Post Sensor-Operated Faucet Demands (Jan. 29, 2008 - May 28, 2008)



Post Sensor-Operated Urinal

Sensor-Operated Fixture Study

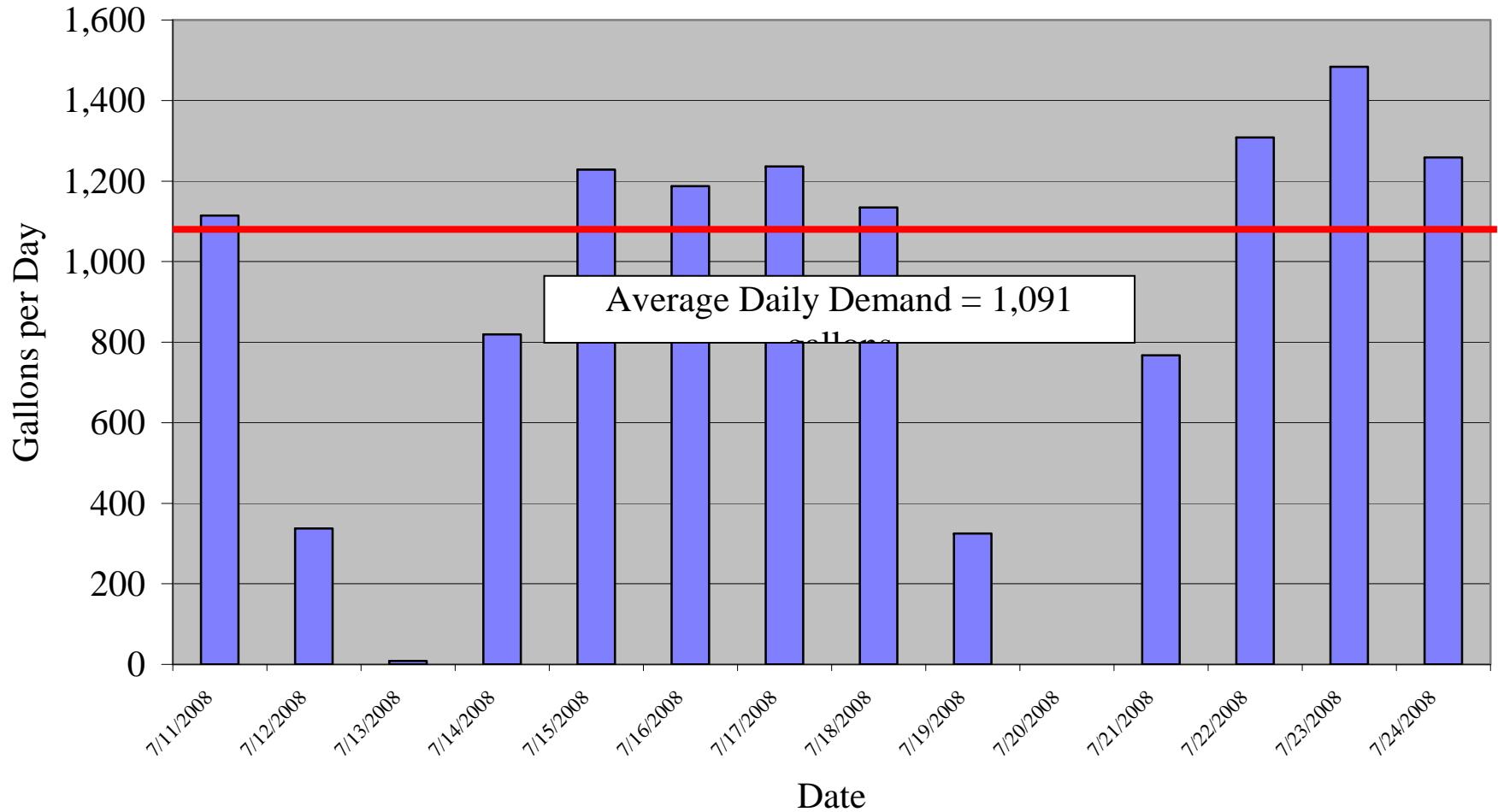
Post Sensor-Operated Urinal Demands (Jun. 12, 2008 - Aug. 21, 2008)



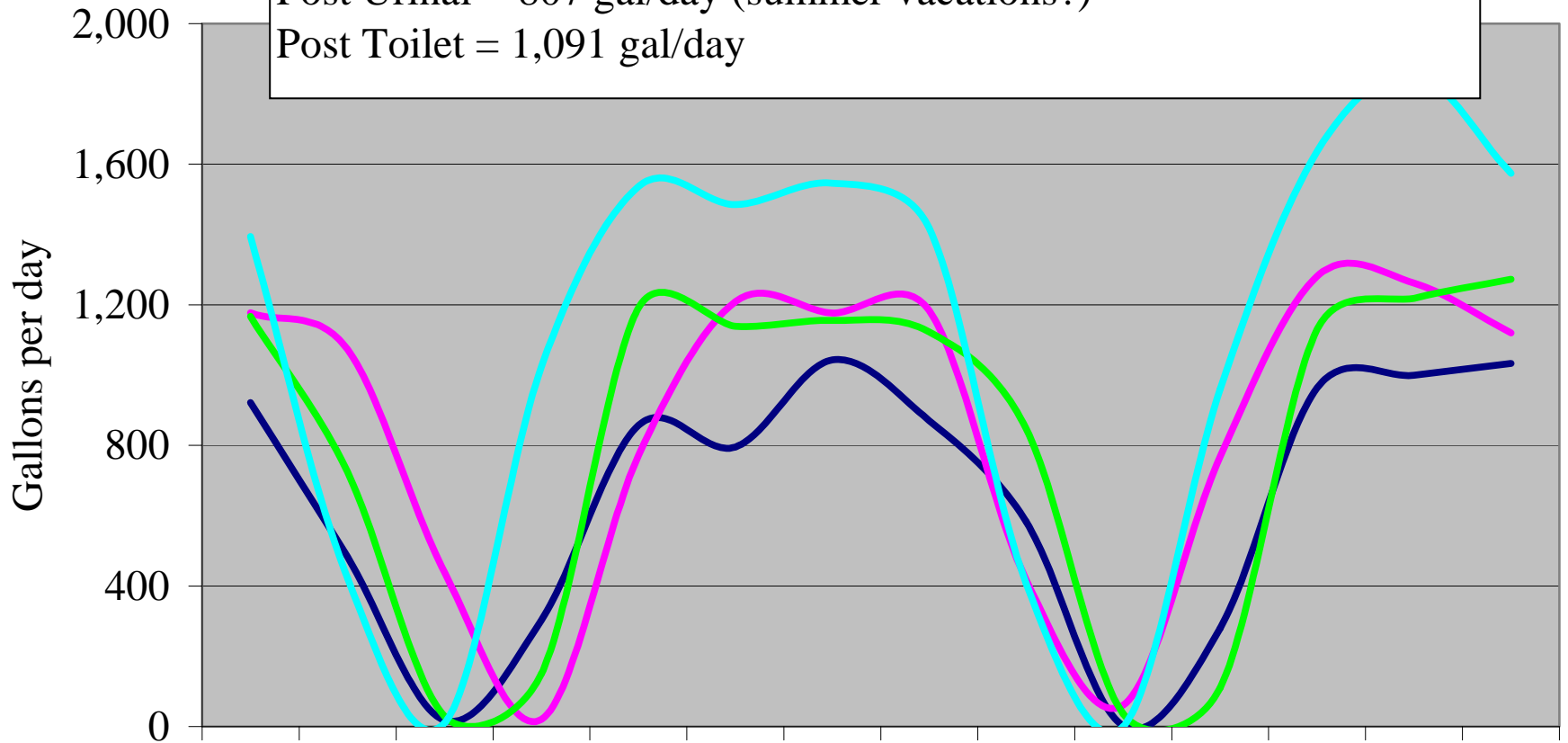
Post Sensor-Operated Toilet

Sensor-Operated Fixture Study

Post Sensor-Operated Toilet Demands (Aug. 21, 2008 - Oct. 3, 2008)



Original Demands (3.5-G toilets) = 1,312 gal/day
Pre Demands = 654 gal/day
Post Faucet = 854 gal/day
Post Urinal = 807 gal/day (summer vacations?)
Post Toilet = 1,091 gal/day



Pre Demands Post Faucet Post Urinal Post W.C.





Conclusion

- To date, maintenance staff on site have heard no negative comments about any of the sensor-operated fixtures
- Maintenance staff have heard some positive comments about the faucets
- Sensor-operated fixtures do appear to be meeting the performance needs of tenants,
- But – they do not appear to reduce water demands



Conclusion (con't)

- I was a little surprised by the extent of the demand increase
- Total increase in demands after installation of sensor-operated faucets, urinals, and toilets = 67%
- Some manufacturers claim their “new” technology will result in lower demands and this may be true.
- Do we need another study????



Final Thoughts

- This pilot study was fairly small (though it took a long time to complete)
 - Small number of fixtures, one model of each
- Increases in demands may not be indicative of what would occur in other sites
- Would not expect lower demands for urinals and toilets (expect slightly higher)
- Recommend that we either do further research OR drop sensor-operated fixtures from LEED



Thank you

Questions?

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