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Plumbing Efficiency Research Coalition

Memorandum of Understanding on Plumbing Research

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The Need for Research

- **The Good News:** New water efficient technologies are being developed
  - *Demand generated by: utility rebate programs, green building rating systems, green consumerism*
- **The Not-So-Good News:** In some areas we lack data to ensure continued:
  - *Health and Safety*
  - *Systemic Efficacy*
  - *Code Compliance*
- **January, 2008:** IAPMO and AWE agree to foster development of a Plumbing Research Coalition

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Why is a Coalition a Good Idea?

- Alignment of efforts among a number of organizations
- While some good work has been accomplished, the aligning of industry sectors will yield:
  - *Development of superior research proposals through more diverse interest involvement*
  - *Transparent research processes*
  - *More accurate results*
  - *Universal acceptance of results*
  - *Faster inclusion into plumbing codes*
  - *Quicker, successful market transitions*

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Memorandum of Understanding

- February – December, 2008: PMI, PHCC and the ICC contacted
  - *All express interest in joining*
  - *MOU developed and ultimately accepted*
- January, 2009: MoU signed at EPA Headquarters – Administrator Stephen Johnson presiding

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Memorandum of Understanding

- Establishes framework for PERC as “a mechanism for voluntary cooperation on plumbing-related research projects that pertain to water efficiency” between the premier associations in the plumbing and water efficiency industries
- Non-binding and non-exclusive
- Research Projects will have separate specific agreements

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Memorandum of Understanding

- Details the management of PERC research programs:
  - *Obtaining funding – Grant applications, AWE leads*
  - *Establishment of technical committees and project coordinators*
  - *Establishes technical requirements for test labs, universities and other potential partners*
  - *Sharing of data*
  - *Apportionment of costs*
  - *Requires interaction with pertinent consensus standards developing organizations*

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MoU – Potential Projects

1. **Drainline Carry Research**
   - *Commercial Installations*
   - *Residential Installations*
2. **Water Re-use Systems and Safe Applications for Re-use Water**
   - *Gray Water Systems*
   - *Rain Water Harvesting Systems*
3. **Non-water Consuming Urinals**
   - *Evaluation of Field Installations*
   - *Accurate Cost-Benefit Analysis*
   - *Accumulation of Urine Salts*
   - *Improvements in Installation Practices to Minimize Buildup*
4. **Sizing of Water Efficient Plumbing Systems**
   - *Residential and Commercial*
   - *Engineering Solutions - efficiency, flow velocity, water hammer*

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The First Research Project

- In March, 2009 – PERC agrees to make drainline carry the first project because of increasing concern about the potential effects of reduced water flows
- Press release issued, May 2009 announcing the project
- Why was Drainline Carry chosen to be the first PERC project?

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PERC Drainline Project

- Transition from 3.5 gpf toilets to 1.6 gpf never fully researched in commercial applications
- HET's remove another 20% from flush discharge volumes
- HE Urinals @ 0.5 gpf – Zero gpf and Commercial faucet flow rates @ 0.5 gpm will no longer assist in transport of solids
- New efficient technologies in medical, food service and other commercial / institutional applications
- In residential applications, faucet and showerhead flow rates being reduced

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PERC Drainline Carry Project

- Discharges from clothes washers and dishwashers being reduced
- Advent of gray water systems in residential applications
- CA and TX already have passed legislation to move to HET's/HEU's
- Problems emerging in Australia
- Where's the tipping point?

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PERC Drainline Carry Project

- Technical committee formed: John Koeller (AWE), Shawn Martin (PMI), Lawrence Snow (PHCC), Bernie Soesilo (ICC), Pete DeMarco (IAPMO – Project Coordinator)
- May, 2009 – Scope of Work determined and agree upon
- Unique approach: Three interacting elements of research

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Project Components

1. **Computer modeling** – Use of Computational Fluid Dynamics (CFD) or other modeling software to predict solids interactions in waste lines

2. **Laboratory testing** – Conduct drainline carry experiments in a large drainline test apparatus in a lab setting

3. **Field testing** – Video record actual building drains employing EPAct level plumbing fixtures, retrofit with High Efficiency Fixtures and monitor systems for changes

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Predictive Computer Modeling

Element Leader: Shawn Martin, PMI

- **Objectives:**
  - Develop or refine an existing predictive model of drainline transport under cumulative loading for commercial applications.
  - Assess and validate the model relative to the results of the laboratory and field elements of this study.
- **Work Plan:**
  - Literature search
  - Identify universities partner
  - Evaluate existing computer
  - Select the most appropriate predictive tool or combination of tools
  - Evaluate the predictive model against field and laboratory data
  - Refine and tune the model as required
  - Assess range of applicability and uses
- **Deliverables:**
  - Model Assessment Report and Recommended Model Design
  - Predictive Model and Evaluation Results

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Laboratory Testing

Element Leader – John Koeller, AWE

- **Objectives:**
  - Supplement computer modeling element
  - Determination of minimum transport distances achieved by high efficiency toilets
- **Work Plan:**
  - Literature search
  - Determine laboratory partner
  - Drainline diameters: 3-, 4- and 6-inch, Drainline slopes: 0%, 1%, 1.5% and 2%, material types: Cast iron and PVC
  - Media types: Uncased soy bean paste, toilet paper, seat covers, paper towels, hygiene products
  - Drainline geometry: straights, 90 degree elbows, 45 degree elbows, Y's, dips and sags; quantities and distances (150ft, 175ft, or 200ft)
  - Flush volumes: 3L, 3.8L, 4.8L, and 6L (0.8gal, 1.0gal, 1.28gal, 1.6gal)
- **Deliverables:**
  - Review data to verify or revise predictive computer modeling results
  - Provide recommendations to aid design professionals that maximize drainline transport in sanitary waste systems, and conversely, recommendations on what to avoid.

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Field Testing

Element Leader: Ike Casey, PHCC

- **Objective:**
  - Visual evaluation of actual sanitary waste systems to determine systemic effect of High Efficiency fixtures
- **Work Plan:**
  - Identification of plumbing systems for evaluation
    - Use patterns and geometry are appropriate for study (long horizontal runs to sewer)
    - Isolated WC's
    - Consider partnering with US Military organizations (such as NAVFAC, Army Corps of Engineers) if possible
    - Consider partnering with construction / maintenance / service organizations such as Roto Rooter
- **Deliverables:**
  - Review data to verify or revise predictive computer modeling results and laboratory results
  - Design recommendations towards maximized drainline transport in sanitary waste systems, and conversely, recommendations on what to avoid.

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Status
(September, 2009)

- **Predictive Modeling and Laboratory Elements:**
  - Request for Qualification documents (RFQ's) have been developed and have been sent to qualified independent test laboratories and universities
  - Feedback from the RFQ's will help determine cost
  - Majority of cost will be associated with the laboratory tier due to the extremely large apparatus footprint
  - Labs must conform to ISO requirements
  - Several universities that specialize in multi-phase flow simulation and / or free surface CFD applications have been identified

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Status
(September, 2009)

- **Field Study Element**
  - NAVFAC – July 2009 Port Hueneme visit
  - Partnering with military will:
    - provide easy access to numerous candidate plumbing systems
    - greatly curtailing costs associated with the field study tier
  - Discussions are ongoing
- **For Detailed Information**
  - Visit www.plumbingefficiencyresearchcoalition.org

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The Need…

- **Funding**
  - PERC is searching for funding this project
  - Cost estimates range between $1M and $2M, subject to feedback from the RFQ's and project partners
  - Majority of cost is associated with the laboratory study element due to cost of constructing and housing the large test apparatus and the long duration of testing (6 to 9 months)

- **Questions?**

THANK YOU!

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Alliance for Water Efficiency

IAPMO

ICC INTERNATIONAL CODE COUNCIL

PHCC PLUMBING-HEATING-COOLING CONTRACTORS ASSOCIATION

pmi PLUMBING MANUFACTURERS INSTITUTE

www.plumbingefficiencyresearchcoalition.org