CLEAN ENERGY TECHNOLOGIES

NRCan HOT WATER USE STUDY

(FIELD TEST)

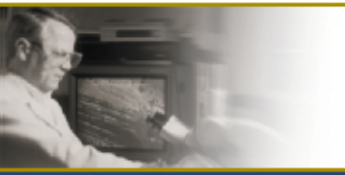
Presented By: M.Thomas, M.Sc., C.Eng.

Project Team: A.C.S.Hayden, M.Eng., P.Eng.

K. Wittich, MASc. & D. Mackenzie

IES Laboratory, SBC, CETC-Ottawa.

Canada



RATIONALE

In Canada Approx. 330 PJ of Energy or 9 Billion Cubic Meters of Natural Gas Equivalent are Used to Heat Water for Residential & Commercial Use on an Annual Basis.

This Leads to Approx. 17 Mega-Tonnes of Carbon Dioxide Equivalent GHG Emissions.

The Current Performance Test Standard May Be Out Of Date

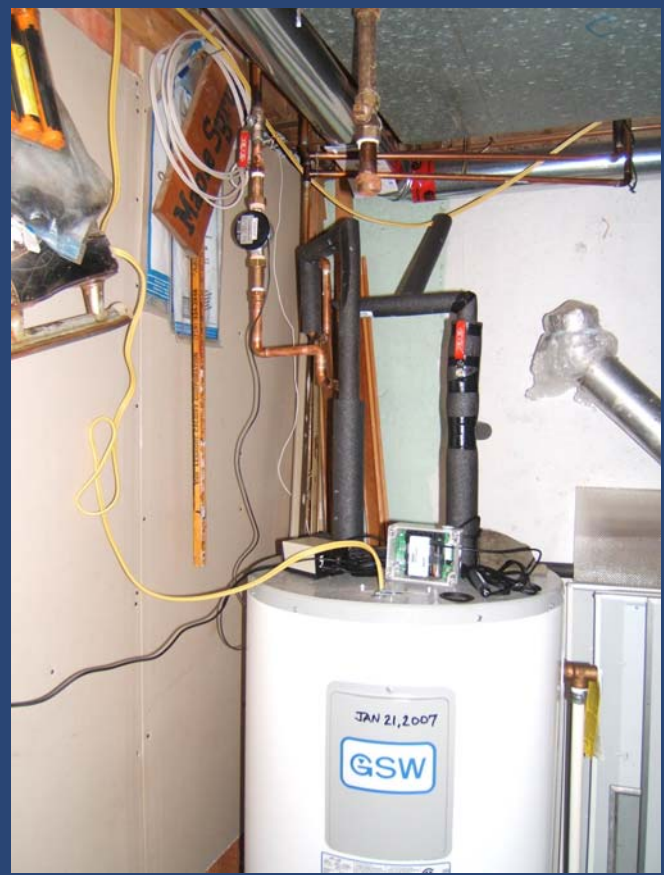
The basis for the current water heating appliance performance Standards was established many years ago (~17 years).

i.e. 6 draws of 40.6 litres at a rate of 10.4 litres per minute, each an hour apart. The total volume of water used in the test (243.4 litres) was established as being typical for a US family of four.

One step in the answer to this question is to compare the real life hot water use from a new field study.

FIELD TEST OUTLINE

- Recruit 40 – 60 Volunteers from NRCan.
- Use Ontario Licensed Plumber to Install a Flowmeter.
- Use a ½ or ¾ inch pulsed output flowmeter with 1 pulse per 0.025 or 1 pulse per 0.050 litres
- Use a low cost data logger to scan every second and record every 2 seconds.
- Download data at least once every 8 days
- End Use/Household Questionnaire.



FIELD TEST COSTS

10 Sets of Equipment used at one time with 5 Spare Sets

- **Plumber ~$220 per site (Install & Remove)**
- **Flowmeters ~ $245 each**
- **Data Loggers ~ $200 each**
- **Electronic Pulse Input Interface ~ $80 each**
- **Power Supplies / Surge Protection ~ $30 each**
- **Software 1 Copy ~ $99**
- **NRCan Labour Costs ~ $ 3,000 per site**

DATA ANALYSIS

Form of Raw Data from Loggers: weekly files with data read every 2 sec (~300,000 records each week). 3 weeks typically.

Pre-Analysis Data Processing:

- remove null records >>leaves about 50,000 records / user.

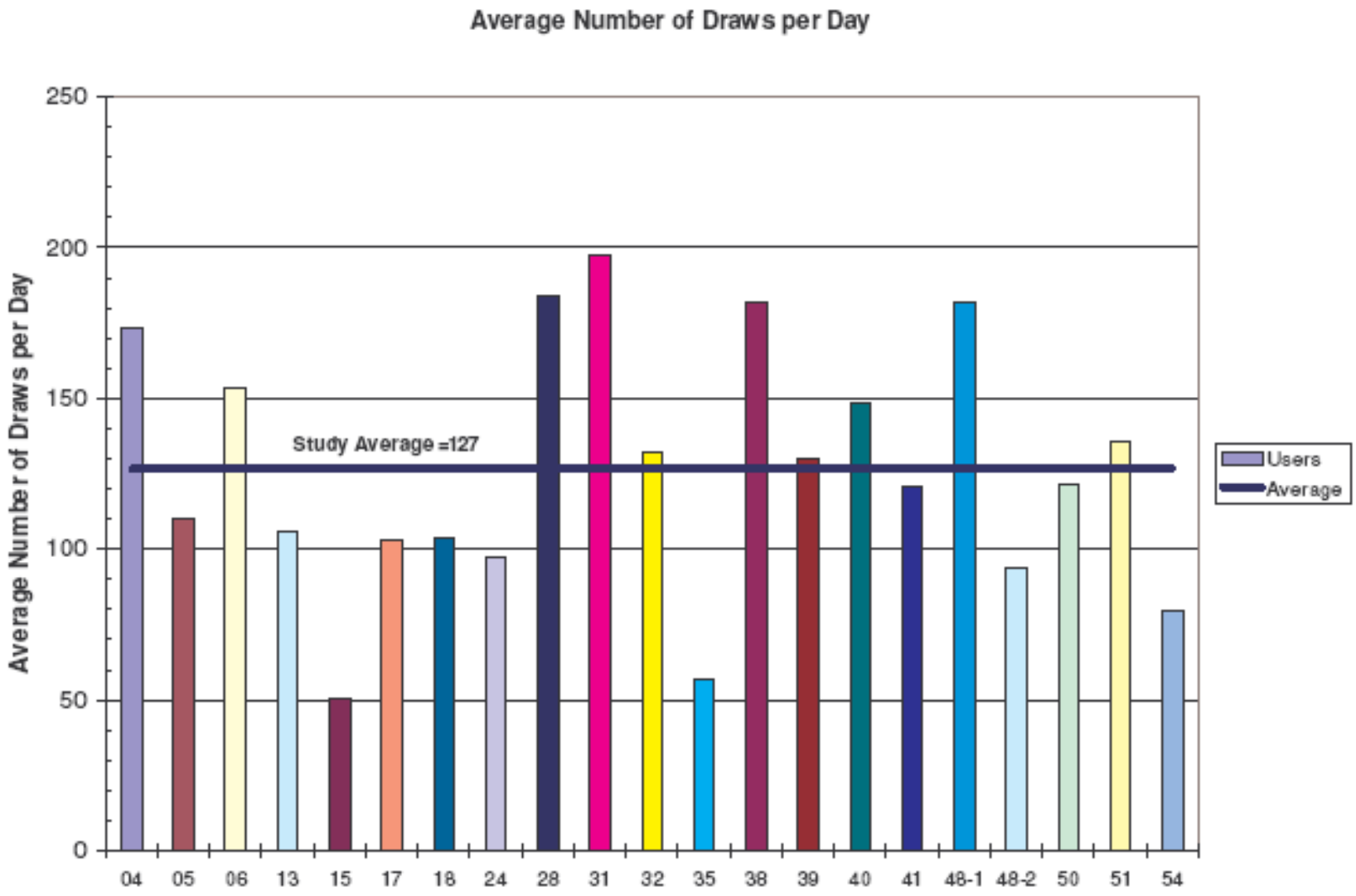
Analysis Data Processing:

- Compile "per draw" and daily data;
- Generate Histograms (about 1 million formulae);
- Generate day-by-day analysis graphs; and
- Compile individual user data into multi-user Average graphs.

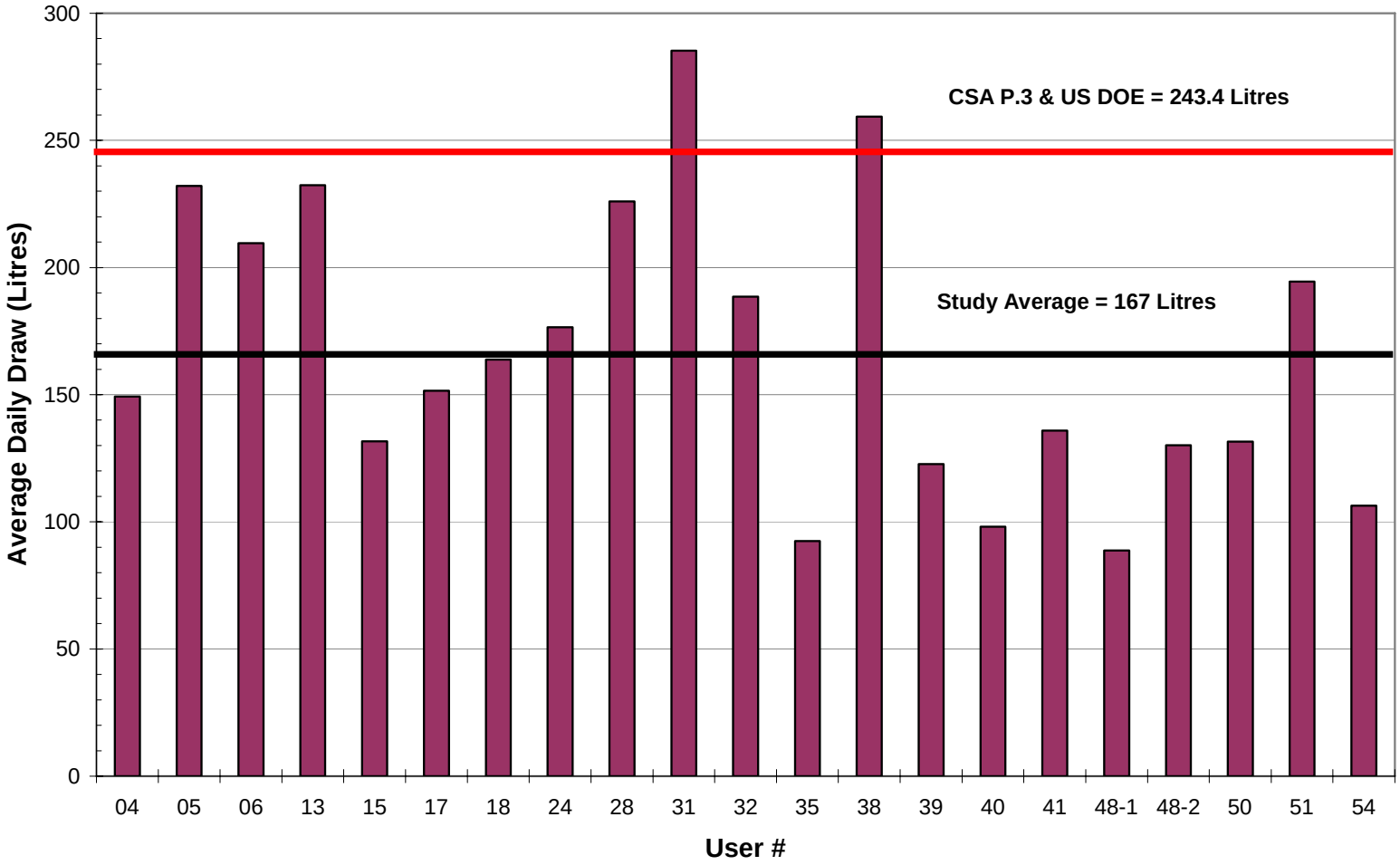
Data Analyzed so far : ~30 households.

Problematic Data : 8 Households. Error codes from Data loggers.

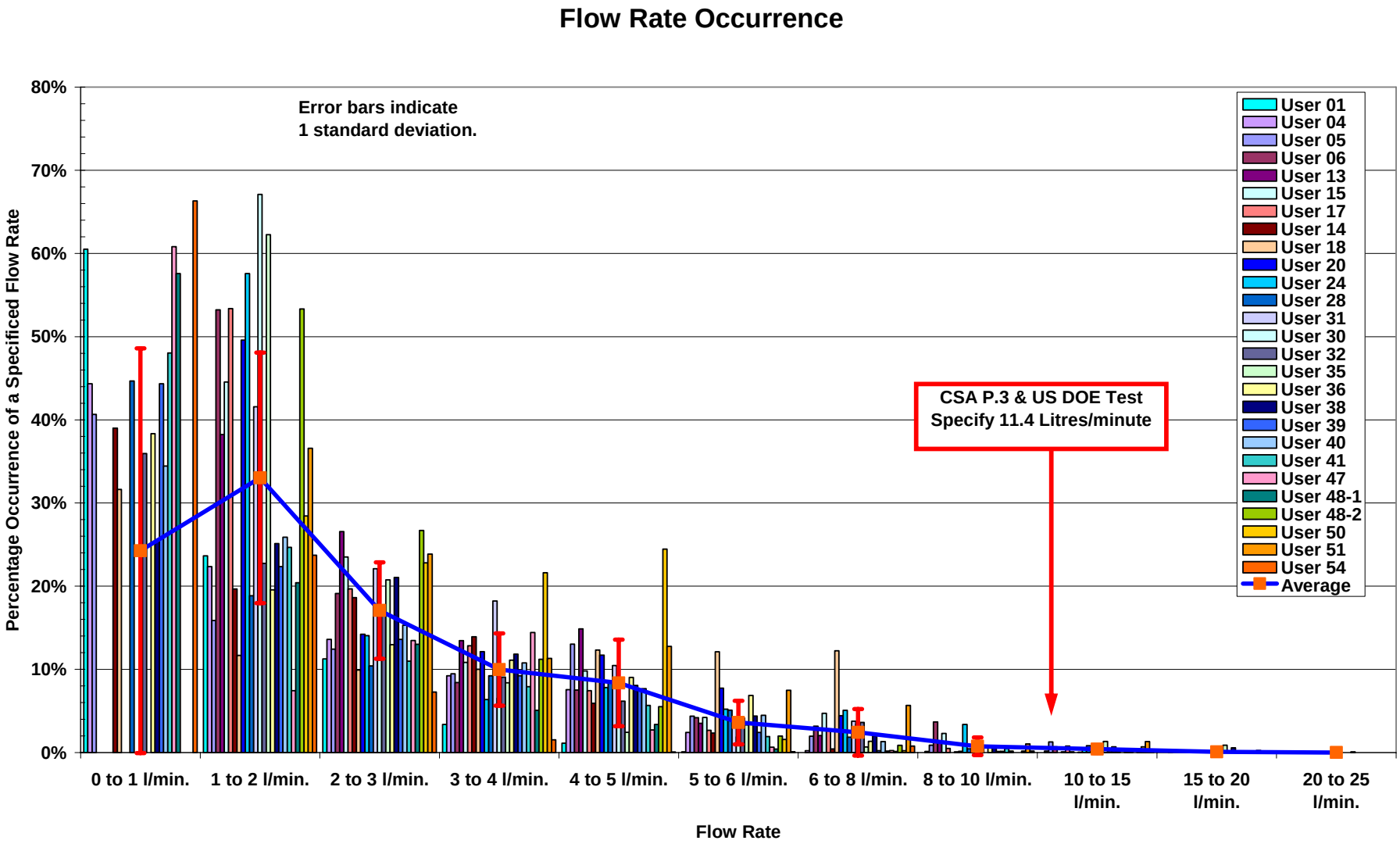
FIELD TEST RESULTS



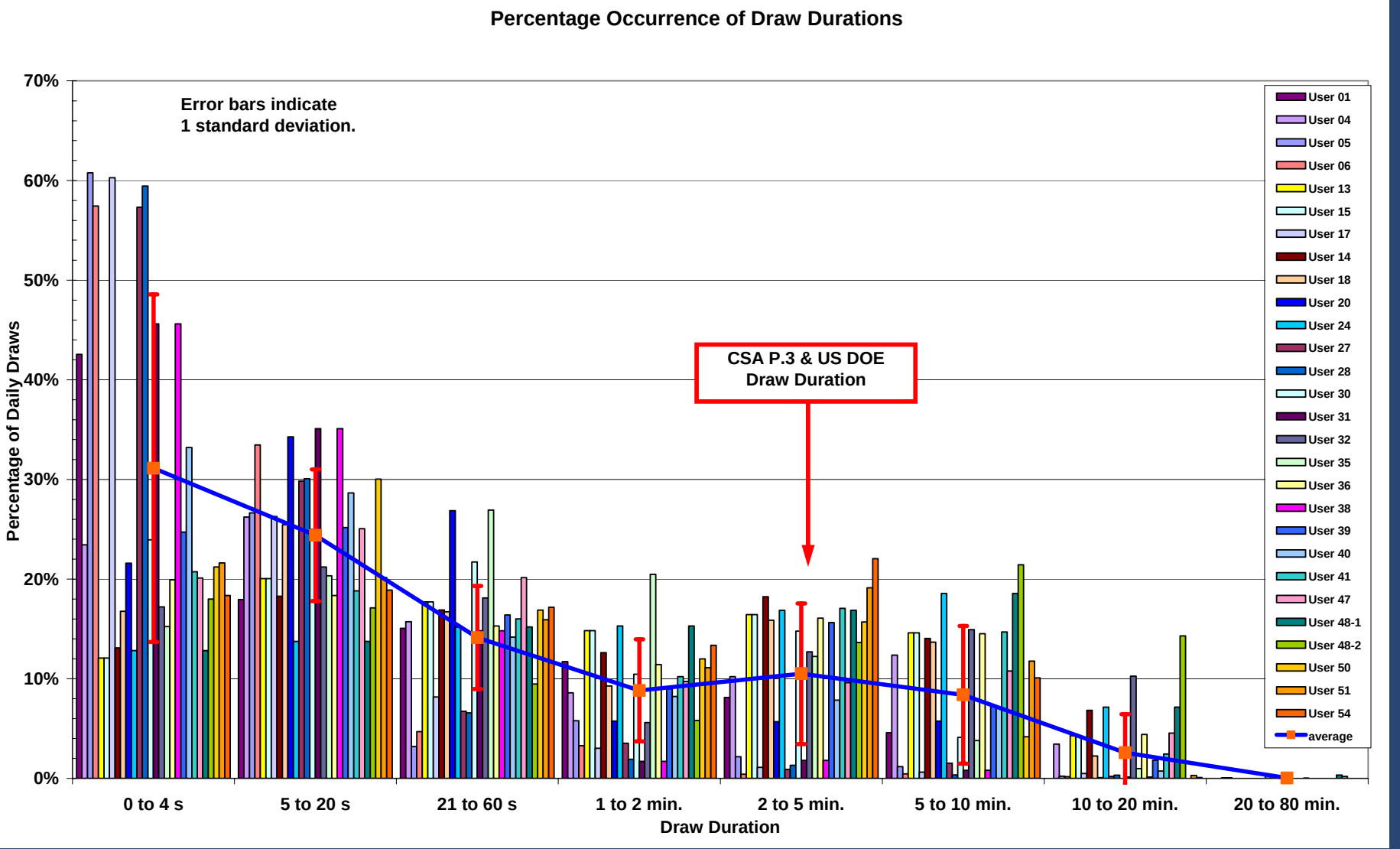
FIELD TEST RESULTS



FIELD TEST RESULTS



FIELD TEST RESULTS



NEXT STEPS

CHANGE THE TEST STANDARDS ?

- There is a strong case for changing the total daily volume of hot water used.
- There is a strong case for changing the hot water delivery flow rate.
- There is a strong case for changing the Number and Duration of Draws Made During the Test.

QUESTIONS TO THINK ABOUT

- How much data is enough (when do we stop) ?
- Should we look at other parameters as well as hot water use (at an increased cost) ? Partners ?
- Are there other studies that will complement ours ?
- Ultimately can we develop a more realistic performance test and at the same time simplify it ?