**Comparative Testing of Stoves Operating in “Steady State”**

**[ Statement about Stove Camp plans at Aprovecho in July 2013 ]**

 The 2013 Stove Camp at Aprovecho will include **developmental testing of TLUD stoves to attain Tier 2 and Tier 3 results for efficiencies and emissions**.   Dean Still wants this, and Dr TLUD (Paul Anderson) has agreed to be a co-leader to coordinate these efforts at this camp. [Note: There will also be a focus on institutional stoves plus the customary freedom for participants to undertake individual efforts.]

 **TASK A** for those who choose to participate: One approach to accomplish this goal is to obtain "comparative readings" of CO, PM, CO2 (indicator of fire power), Temperatures (incl time to rise “X” deg C in 5 liters of “mid-temperature water”), etc for a number (see below) of existing stoves that are operating in their stable manner (or “steady state”) for a period to be defined, probably between 5 and 30 minutes.  When possible to measure by direct change of weight of the stove plus fuel, fuel usage will be noted during the number of minutes of observed operation.

 This TASK A effort will give us an additional set of data for basic comparisons between the major stove categories, AND this will allow for comparisons between known stoves with defined characteristics in each major category. We will focus on the TLUD category, and observe which design variables offer the greatest opportunities for experimental variations that will improve the test results.

 **TASK B** for those willing to assist: We will then make some of those variations in TLUD stoves and observe the impact. For example, the impact of excess secondary air needs to be examined in order to optimize the entry of secondary air for better efficiency without adversely impacting the emissions. The results should be useful for all models of TLUD stoves, not just the specific model that is used to make the comparisons. In fact, any observed improvements will (to the extent possible with time and resources) be incorporated into other TLUD models to confirm (or challenge) the modification.

 **TASK C,** but only for attendees who want this experience: To facilitate these incremental changes and their testing, there will be several of the Quad 3 TLUD stoves (made in Uganda) available as flat-packs that can have individual pieces modified or totally replaced. Working on these changes will also give opportunities for detailed hands-on training of the assembly of Quad 3 TLUD stoves. A one-page info sheet about the Quad TLUD stoves is at [www.drtlud.com](http://www.drtlud.com)

[www.drtlud.com/2012/08/03/the-quad-tlud-micro-gasifier-stove](http://www.drtlud.com/2012/08/03/the-quad-tlud-micro-gasifier-stove)

 **Timetable:** Following the Monday morning introductions and basic instructions, we expect on Monday afternoon to begin TASK A with the equipment at Aprovecho. We start slowly because we are instructing the participants about the equipment and testing procedures. We then identify the individuals who will operate the various stoves for TASK A data collection, being functional by late afternoon and fully active on Tuesday. A tentative goal for TASK A is thirty (30) stoves mostly with know characteristics observed in the EPA testing by Jetter, including but not in this order and if available:

 3-Stone fire (1);

 simple cookstoves (3) of mud or buckets, found in the Aprovecho collection of stoves;

 Rocket stoves (5) incl Envirofit, Stove Tec, Prakti, Burn Tank;

 TLUD-ND stoves (5) incl Peko Pe, Servals Champion, Mwoto, Quad 3;

 Forced Air (FA) fan-assisted stoves (4) incl Philips, Biolite, Oorja;

 charcoal stoves (4) from the Aprovecho collection;

 Liquid-fuel stoves (3) for alcohol, LPG, kerosene;

 Uniquely special stoves (5) incl Jatropha-seed TLUDs, rice-husk TLUD gasifiers, Estufa Finca.

 As you can see, thirty stoves in basically two days means a constant stream of stoves being brought to the two missions hoods in their “steady state,” that is, functioning as normally as possible. Data readings will be collected, including video recordings of the stove and the computer display,to be done with new equipment brought by Anderson. All of this will require assistance from a reasonable number of Stove Camp participants; otherwise, only a few stoves will be compared. Volunteers are invited to indicate which tasks and/or specific stove(s) they would like to conduct.

 TASK C starts with the assembly of a standard (not modified) Quad 3 stove, probably getting underway on Tuesday morning (but not in conflict with other concurrent activities). Assembly with modifications for TASK B will probably begin before noon on Tuesday. By late Tuesday, some initial comparisons should be observable.

 Wednesday will be intensive for all of TASKS A B C., with plans made for final efforts on Thursday. This can include altering some additional key variables such as a change of fuel sizes (wood segments vs wood chips vs wood pellets).

 Additional efforts will be cdonducted involving the following:

1. There are two LEMS installations (allowing comparisons between them).\

2. There are additional options for testing with portable equipment.

3. We can intentionally stress the high and low power capabilities of the available stoves.

4. We can expand to include FA (forced air) versions of related stoves.

5. We can examine the challenges associated with start-up, shut-down, and transient events in stove operartions.

 So, the plan is to use the LEMS and other equipment (including some of the small portable stuff) to do experiments to improve (lower) the CO and PM emissions on TLUD stoves.   We expect to NOT run many complete water boiling tests (WBT), but to have numerous stoves (including several variations of specific changes to TLUDs) that will go under the hood for measurement and viewing of realtime readings.   Some will be at high power, others at low power.   And the testing is not just of TLUDs because we want the other stoves as points of reference when collecting measurements in similar circumstances.   In Dean's terms, we are trying to ensure Tier 2 for efficiencies and Tier 3 for emissions.

 We hope that you will attend this Stove Camp at Aprovecho on 22 – 26 July 2013 in Oregon, USA. Schedules will be available in early June. For local arrangements and registration, contact Mike Hatfield: apromike@gmail.com