6. IMPLIMENTATION

The last chapter introduced procedures and guidelines to provide valuable stove safety knowledge to designers, manufacturers, as well as the occasional consumer. Chapter 6 discusses how the methods have been tested, how the current version can be applied, and methods of safety education to increase awareness.

6.1 TESTING SAFETY EVALUATION PROCEDURES

Testing of safety evaluation procedures occurred in several design laboratories in addition to fieldwork in Honduras. Modifications to safety measures were the primary result of an interest to include more safety concerns and better accommodate design diversity. Constant self-reviews were conducted and several exterior resources were utilized to provide insight on possible improvements.

6.1.1 Trials in Design Laboratories

Preliminary testing of safety evaluation procedures occurred in the Stove Analysis Laboratory at Iowa State University. First attempts at creating guidelines concerned only solid biomass stoves using fuelwood. Evaluation procedures were continually modified and tested to incorporate concerns over burn and scald hazards. After several modifications to these testing procedures had taken place, a metric from the American National Standards Institute (ANSI 1993, ANSI 2000) and Underwriters Laboratories (UL 1995) provided a reference for acceptable safety limits. The ANSI standards also provided information that surfaces shall be smooth to avoid risk for laceration injuries. Additional measures, such as

heat transmission to surrounding materials, were included to provide a way to rate the risk of property loss. These new methods added to the set and established a set of ten principals to rate wood stove safety.

Peer-reviewed assessments of the wood stove safety tests were conducted by Nordica MacCarty and Dean Still, long-time stove enthusiasts of Aprovecho Research Center. Their results from 18 separate stove tests showed the methods did not well adapt to stoves with fuels other than solid biomass, namely solar and liquid/gas stoves. The safety guidelines and evaluation procedures were then further modified to address this interest and incorporate cookstove fuel design types in the scope of this analysis. Some tests did not need to change, such as risk of cuts or elevated surface temperatures, but others needed major modifications to allow for complications brought by fuel diversity, as in tests three and ten which deal with fuel containment or leaks.

6.1.2 Field Work in the Developing World

At this time, the ten guidelines and evaluation procedures solidified to a well-tried and documented work that was ready for testing in the developing world. These trials were conducted during site-visits (July 22 - August 3, 2005) to rural homes (see Figure 1, Section 2.2) and manufacturing shops in Honduras while accompanied by stove producers from the Asociación Hondureña Para El Desarrollo (abbreviated AHDESA or translated as “The Honduran Association for Development”).

Results from the field tests showed that some procedures were unnecessarily complex or simply did not apply well. One modification to improve this deficiency entailed using temperature differences between the ambient air and the object being tested rather than solely temperatures of the object (reasoning given in Section 5.3.5). Other helpful additions

included the facilitation of diagrams to demonstrate how to take measurements during the tip test (Test 2) and how to evaluate area for the containment of fuel (Test 3) and chimney shielding (Test 8). The chimney shielding test was in fact created after examining stoves in Honduras that employed the protective barrier. One more modification to the set of ten guidelines taken to Honduras was the removal of a stability test for the stove. This test involved tipping the stove over or dropping it from a small height to see if it held together. This was not appropriate for traditional biomass stoves made from mud/sawdust, clay, or bricks and mortar, since they were often the only material available. Therefore the test was taken out of the analysis, and the ten guidelines introduced in Chapter 5 were the result of this removal and the addition of the chimney shielding test.

6.2 USING THE SAFETY EVALUATION

The final version of the safety guidelines and procedures were used to evaluate the safety of 23 stoves (see Appendix B). This data provides information on specific safety concerns for each stove, demonstrating to designers which aspects of a stove could use improvement. Furthermore, the overall safety ratings can be used as selection criteria when purchasing a stove or when organizations are looking to fund projects that make stoves (such as the US Environmental Protection Agency or the Shell Foundation).

An example of the safety evaluation is provided in Appendix C. This testing was conducted while in Honduras and working with stove producers from AHDESA. The Eco-Fogon is one of the stoves they began marketing in August 2005. The evaluation shows that the stove performs well with reducing cuts and abrasions, property loss, and scalds. However, stove surfaces often become hot near the cooking surface and the handles on the

griddle may collide with pots being moved from the stove. Though all things considered, the stove performed well in the safety evaluation. Improvements in some areas may be helpful, but the added cost may not be worth the effort since poor families may not be able to purchase the more expensive stove (when the original is already expensive for highly impoverished families that pay in installments). If the cost of the stove became greater, less people would be able to use the already good technology to reduce indoor air pollution, fuel use, and increase safety over that of a 3-stone fire.

The method of examining the trade-offs between fuel efficiency, pollution reduction, cooking speed, cost, size, and safety is an important design consideration in determining how to provide the most value to the customer. Since this is a complex issue and safety is not the only benefit of using an improved stoves, choices on stove designs should not be chosen off of safety alone.

6.3 EDUCATION

Effective implementation of the guidelines to regions in the developing world requires communication channels and well-planned education methods. This section introduces the connections utilized for testing in Honduras and suggests similar models for increased safety awareness and use of the evaluation procedures in other areas of the world.

If working internationally, Section 6.3.1 provides a good method for establishing contact with local persons in the developing world for utilization of the safety methods. However, if the guidelines are being applied locally, there is no need to bridge the international / cultural gap and stove safety proponents can move to Section 6.3.2 which discusses methods to motivate use.

6.3.1 Making Contact

For those who need to bridge the international gap (geographic, language, culture), communication perhaps best starts with a local or international Non-Governmental Organization (NGO). This is due to their greater likelihood for humanitarian goals and lessened bureaucracy when compared to governments. Trees, Water & People is the international NGO based out of the United States that established contact with local groups in Honduras for trials of the safety tests.

Making connections through established NGOs is often simpler and more effective than attempting to make new connections because of the time saved and trust already in place. More examples of contacts that may assist in establishing greater use of the safety guidelines include local humanitarian groups, religious organizations, or local governments, to name a few. They also can provide great resources for establishing relations within their communities.

6.3.2 Procedure Explanation and Motivation for Use

An essential part of the education process is to provide a useful and understandable explanation of the procedures while demonstrating their importance and motivating use. First, guidelines and metrics may need to be translated into another language to be implemented (the summarized version located in the Appendix D is best suitable for this). However if literacy is a problem, pictorial representations of the hazards can be created to provide useful information of potential dangers to users if testing can not take place (though the vast majority of designers and manufacturers have some technical skill enabling them to perform several tests).

It has been found that a participatory approach towards implementing foreign practices is highly effective in indigenous communities (Ranganathan et al. 2003). For the safety procedures, this would include a joint safety evaluation between designers and local or foreign persons already versed in the guidelines. As for stove users, safety awareness can be increased through community-based activities organized by local leaders. These activities would entail conversation on safety and include feedback in planning and implementing the safety measures. Of primary importance in these activities is that women and children are involved; they are most likely to notice the improvements and utilize the added hazard awareness. They will receive the direct benefits and may in turn become instigators for the implementation process by demonstrating its usefulness and persuading friends to join (Ranganathan et al. 2003).