Safety Panel

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What is not stove safety.

- Burns from open flame
- Burns from hot surfaces
- Contact with burning fuel
- Excessive heat on surroundings
- Scalds
- Tipping, instability
- Poor construction or assembly
- Cuts from edges, points, or fasteners
- Improper fuel transport, distribution, storage
- Corrosion, distortion, and poor durability (safe end of life)
- Toxic emission levels

What does stove safety mean to you?

A safer, happier, healthier family

Stove producers are a diverse group…

Multinational companies

National companies

Non-profits, NGOs

Regional businesses

Town businesses

Individuals

Producer groups are arbitrary for discussion, not exhaustive

… and have different answers to fundamental questions

- Applicability of standards and regulation
- Incentives and benefits
- Facilities and equipment availability
- Cost vs. benefit
- Resulting actions

Each sub-industry has a different perspective that influences the path to a safer stove.

EXPERIENCES FROM MULTINATIONAL AND NATIONAL COMPANIES

Answers to fundamental questions for large-scale industry

Standards and regulation

- There are no clear standards governing bio-mass stoves. There are standards available that provide guidance on component development. Such as NEN-1860 for the burning chamber or electrical standards for batteries and adapters.

Incentives and benefits

- For large scale industry there is a huge incentive to make a safe product. As the company grows it opens itself up to law-suits. The benefit of a clearly safer product is increased trust from the consumer in the brand.

Facilities and equipment

- Extensive access to labs is available. Access to regulatory bodies is available for checks. Big design teams to perform safety checks. Complete controlled production environment.

Cost vs. benefit

- In most cases the cost of making a product safer are lower than the resulting damage to consumer and brand image.

Resulting action(s)

- Safety is an integral part of the development cycle, in terms of importance it is right behind fulfilling the functional requirements. Tools used are DFMEA and SRA. Product is reviewed by 3rd party regulatory body (Like UL).

Safety Features And Testing Philips Woodstove

Surface temperatures:

-Maximum temp handles and gripping devices 70º C @ ambient 35º C. (Plastic)

-Handles must have usable length of 80mm.

-The base/construction which is used to place the stove on the floor/table should not exceed the 100ºC during cooking

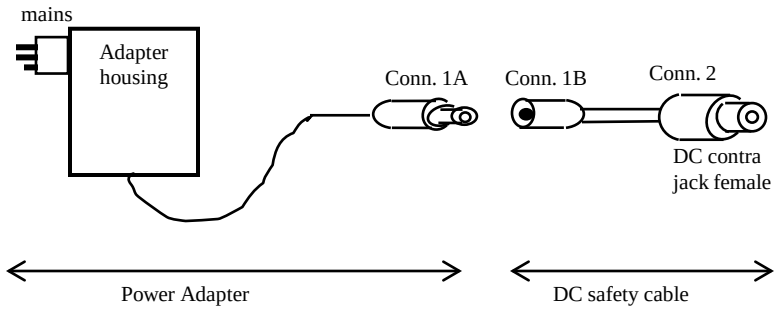
-The floor-temperature under the stove should not exceed 150º C. Based on combustion temperature of cellulose materials (230ºC).

Safety Features And Testing Philips Woodstove

Mechanical Safety:

-Safety cord

-Sharp edges



Not acceptable

Acceptable

Safety Features And Testing Philips Woodstove

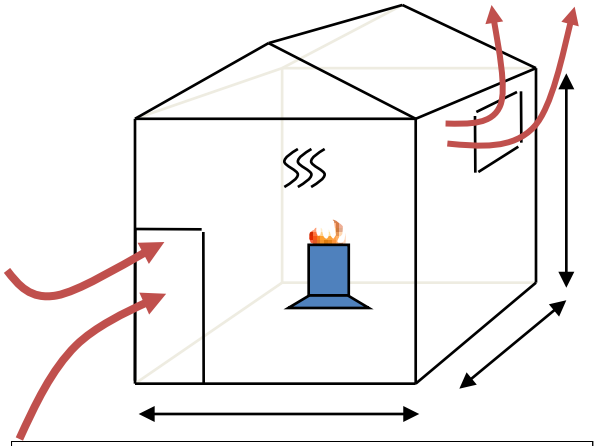
Safety testing at fire brigade

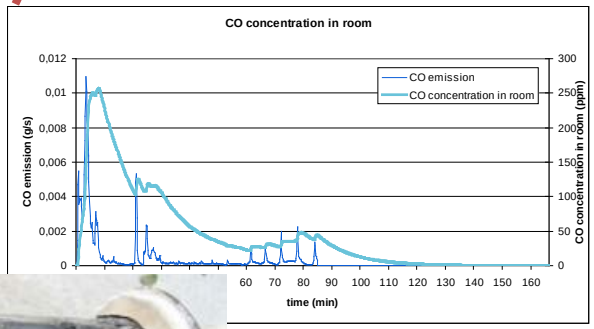
Safety Features And Testing Philips Woodstove

Emission testing:

-Risk assessment of CO poisoning.

Lifetime testing:
-12 stoves minimum.
- Testing solutions continuously for 2 years now.





Comments and experiences from the audience

Plotting the path ahead

Barriers to address, gaps to fill

- Emission safety (CO, noxious fumes)
- Required durability of construction materials (accelerated lifetime testing using Weibull distribution method)
- Supplier assessment standards
- Safe end of life requirement in standard

Determined way forward

- Philips has developed their own standard based on several safety standards and Safety Risk Assessments. The products will be evaluated against this standard by a 3rd party independent agency. At the same time we will continue to push for improved comprehensive standards.

Turning stove safety ideas into National Product Standards

EXPERIENCES FROM NON-PROFITS, NGOS, AND REGIONAL BUSINESSES

Answers to fundamental questions for non-profits, NGOs, and regional businesses

Standards and regulation: **The desire to encourage or force manufacturers to produce better, safer and more efficient products.**

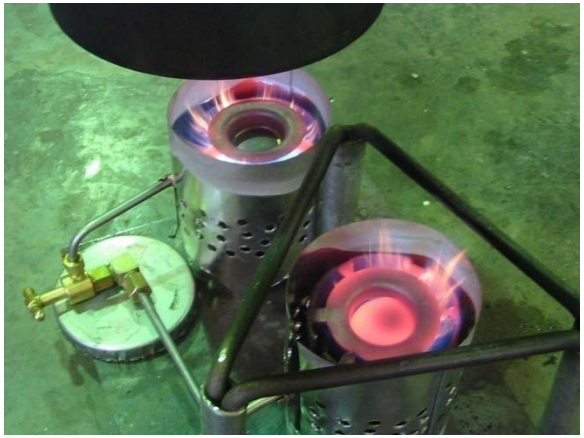
Incentives and benefits: **Protection and increased sales for those who comply; penalties – fines or losing market share - for those who do not.**

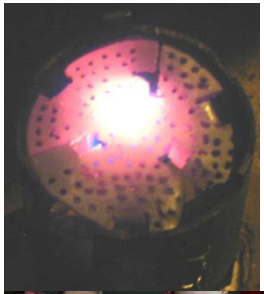
Facilities and equipment: **Testing lab with the skill to perform the tests; understanding to know what the test results mean.**

Cost v.s. benefit: **Cost is time and money; Benefit is the ability to gradually improve products and create a safer living environment.**

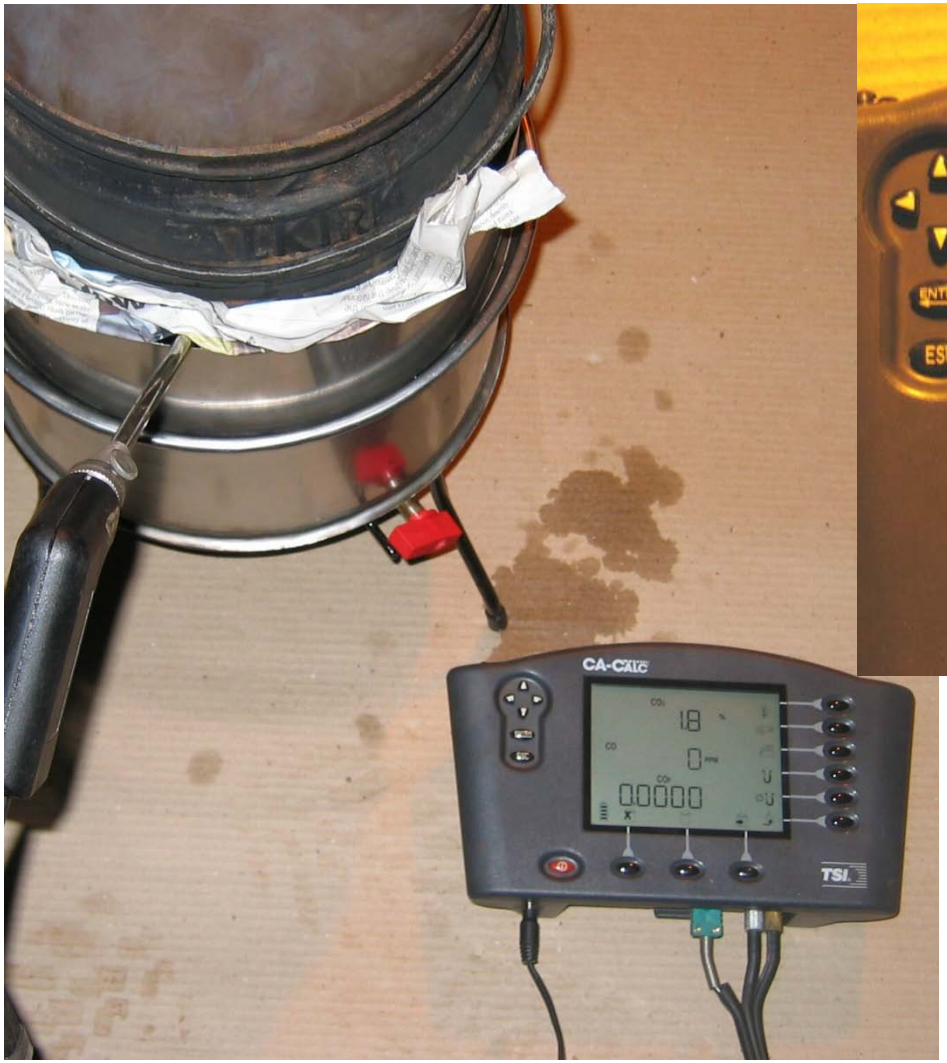
Results: **Gradual elimination over time of defective and unsafe products from the home; upraised standard of health and living.**

Paraffin stoves for low income families in South Africa are the most studied and regulated stove type.





How much better can we do?
Comments and experiences from the audience



Can the modern, regulated stoves still represent a danger to the users? If not operated correctly, yes!

Comments and experiences from the audience

Plotting the path ahead

Barriers to address, gaps to fill

- Industry reluctant to improve products (people like our products…)
- Consumer resistance (stove was good enough for my mother…)
- Feeling that if it can be done, it would have been done already
- ILO Standard drafting process subject to sectoral influence
- Unsuitable standards already exist, drafted for much larger stoves

Potential ways forward

- International cooperation leading to accurate problem descriptions
- Regulations that are applicable to the local environments
- Test procedures that relate to actual use
- Realistic assessment of potential for misuse
- Performance based, not prescriptive Standards

EXPERIENCES FROM TOWN BUSINESSES AND INDIVIDUALS

Answers to fundamental questions for town businesses and individuals

Standards and regulation **Do not exist or not enforced.**

Incentives and benefits **Little to no incentive. Is there a sales advantage? Something to distinguish my design from a competitors highly similar product?**

Facilities and equipment **Workshops are small, often working from home. Simple hand tools are used, rarely power tools. Hand-manufactured stoves.**

Cost vs. benefit **Safety is often perceived to increase cost – in highly competitive market with comparison goods you cannot raise price. In the user's viewpoint the added benefit must be *distinguishable,* and *worth* the added cost.**

Resulting action(s) **No actions taken to increase safety due to perceived added cost, absence of equipment to test and produce stoves, and lack of knowledge for alternative designs and production techniques.**

There are a lot of problems …

Lack of standards for fuel or stove lead to additional problems

Poor quality fuel

Electrocution

Difficult to ignite

Low quality, mass produced to fail

Competitive market focused on $$, not quality

Open fires on the ground…

This works, why make something different?

Developing low-cost, easy to use, and meaningful field tests

- Began as guidelines for solid fuel stoves
- 10 metrics and protocols: half based upon Western standards, half created during field work in through ETHOS
- Tailored for use by individuals, small businesses, and local producers
- Inexpensive, minimal equipment necessary
- Graded safety ratings to promote step-wise improvement, not an all-or-none approval rating
- Voluntary

Guidelines to reduce burns, scalds, cuts, and loss of property

Test 1: **Sharp Edges and Points**

Test 2: **Cookstove Tipping**

Test 3: **Containment of Fuel**

Test 4: **Obstructions Near Cooking Surface**

Test 5: **Surface Temperature**

Test 6: **Heat Transmission to Surroundings**

Test 7: **Temperature of Operational Construction**

Test 8: **Chimney Shielding**

Test 9: **Flames Surrounding Cookpot**

Test 10: **Flames/Fuel Exiting Fuel Chamber, Canister, or Pipes**

Test example – cookstove tipping

Equipment: Fuel, ruler / tape measure, calculator

Procedure:
a) Set stove on flat surface and load with fuel but do not ignite
b) Pick a side to tip towards and measure the height of its tallest point, place value into Table A
c) Slowly tip cookstove in the outward direction from the side chosen until the stove begins to tip on its own
d) Hold stove tilted where it can overturn and measure new height of the point chosen in part 'b', place value into Table A
e) Using a calculator, divide the tipped height by the standing height to find the ratio R, place into Table A
f) Repeat process as many times as there are legs on the stove (or four times for a circular base)
g) Use the largest ratio in Table A with the metric in Table B to find the most deficient rating for the result

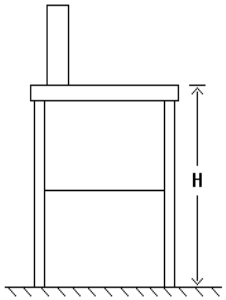
A

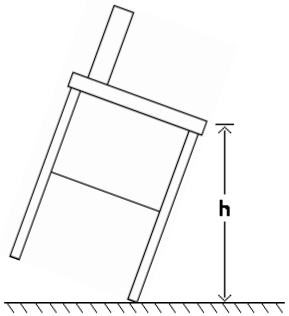
Run	Starting Height	Tipped Height	Ratio
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____
4	_____	_____	_____
5	_____	_____	_____
6	_____	_____	_____

B

Rating	Ratio
Poor	R > 0.978
Fair	0.961 < R < 0.978
Good	0.940 < R < 0.961
Best	R < 0.940

Result 2	





Comments and experiences from the audience

Plotting the path ahead

Barriers to address, gaps to fill

- No regulatory body or policy enforcement on local vendors
- Highly competitive market (I can't raise my price for added cost/safety…)
- Poor incentive structure
- No facilities or equipment to perform lab tests
- Local vendors cannot pay for testing or added cost of design/equipment

Potential ways forward

- Differentiate field testing protocols for differing fuels and stoves
- Promote testing procedures through non-profits
- Gain government sponsorship, safety programs
- Publish in academic journals, magazines, on stoves website, …
- Better convey the importance and benefit of safer stoves

STOVE SAFETY, TODAY & TOMORROW

What is the current state of stove safety?

Review of safety standards and safety literature (not exhaustive)

Solid fuel:

* EN-1860-1:2003 – Appliances, solid fuels and firelighters for barbecuing. Barbecues burning solid fuels. Requirements and test methods (European Standard)
* IS 13152 - solid bio-mass chulah (India)
* Minimal safety requirements for Philips woodstove appliances (Philips)
* Nathan Johnson thesis – Risk Analysis and Safety Evaluation of Household Stoves in Developing Countries (Nathan Johnson)
* SANS 1111:2008 – Coal-burning appliances (reduced smoke emission type) (South Africa)
* UL 737 – Fireplace Stoves. (USA)

Liquid, oil, and gel fuels:

* JIS S 2016 – Oil burning cooking stoves (Japanese)
* JIS S 2019 – Open type natural ventilating oil burning space heaters (Japanese)
* JIS S 2038 – Wicks for oil burning appliances (Japanese)
* "Project Gaia: Commercializing a new stove and new fuel in Africa" Stokes, H. C. and Ebbeson, B. (Ethiopia, Nigeria)
* "Safety Issues for Clean Liquid and Gaseous Fuels for Cooking in the Scope of Sustainable Development," Bizzo, W. A., de Calan, B., Myers, R., & Hannecart, T. *Energy for Sustainable Development.* (Comparison of local practices around the world)
* SANS 448 – Ethanol gel fuel for cooking and other gel burning appliances (South Africa)
* SANS 666 – Ethanol-gel fuelled appliances (South Africa)
* SANS 1243 – Pressurized paraffin-fuelled appliances (South Africa) -- technically covers two classes of pressure paraffin stoves: 0-4.5 kW under and over 0.2 bars operating pressure
* SANS 1906 – Non-pressure paraffin stoves and heaters (South Africa)

Electric:

* IEC 61558-1 – Safety of power transformers, power supplies, reactors and similar products (International Electrotechnical Commission)
* EN 60335 Part 2's (parts 6, 11, 21, 35, 36, 37 & 40) – Electrical Safety of Household Appliances – E.g. Domestic & Commercial Cooking Ranges, Fat Fryers, Water Heaters etc. (European Standard)

Gas:

* ANSI Z21.1 – Household cooking gas appliances (USA)
* ANSI Z21.58 – Outdoor cooking gas appliances (USA)

Summary

Out of the primary dataset of 14 standards (or guidelines) reviewed

- **Only one protocol can be performed in the field**
- **South Africa has the most regulated market for small stoves used by low-income households**
- **Standards are typically created and apply at the national level (though Europe has several standards applicable to many countries)**
- **Overlap exists between standards in regards to hazards identified (surface burns, tipping, sharp edges, durability, …), but not in how to rate or test**
- **Warning labels are a common requirement, but not testing against all possible uses**
- **Some standards actually dictate design specifications, instead of providing safety metrics or protocols applicable to a wider range of stoves**
- **Corporate entities often devise their own testing procedures, which can be different or above and beyond primary compliance**
- **Tests are fuel specific and design specific**

And what will be the state of stove safety tomorrow?

Each sub-industry has different "standards", incentives, and equipment.

This leads to divergent expectations.

Not all sub-industries may follow the same path to safer stoves.

Suggested next steps

Comments and experiences from the audience

Sign-up sheets

Generate greater recognition of the problem

- Assemble database of injury data, analyze and show hazards/risk
- More regular updates to the stove website
- Publicize results (in what ways?)
- Better characterize the benefit or "pitch" of a safer stove (data, videos, …)

Incentivize safety for producers

- Safety stamps or seals UL (USA), DIN (German), CE (European), …
- Financial incentives (funding, sponsorship, tax incentives)
- Safety competitions

Develop guidelines for the wider industry

- More NGOs showing up for regulation creation and approval
- Development of guidelines in lab and field
- Comprehensive set of guidelines for fuel and stove types
- Field testing differentiated for more classifications of fuels (solid and liquid) and stove types (portable and stationary, etc.)

Thanks for the discussion

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