



Health and Safety in Biomass Boilers

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Boilerhouse

Boiler-houses are dangerous places, hence the two CEA courses:

- BOAS Boiler Operative Accreditation Scheme
- Biomass Boiler Operative Accreditation Scheme

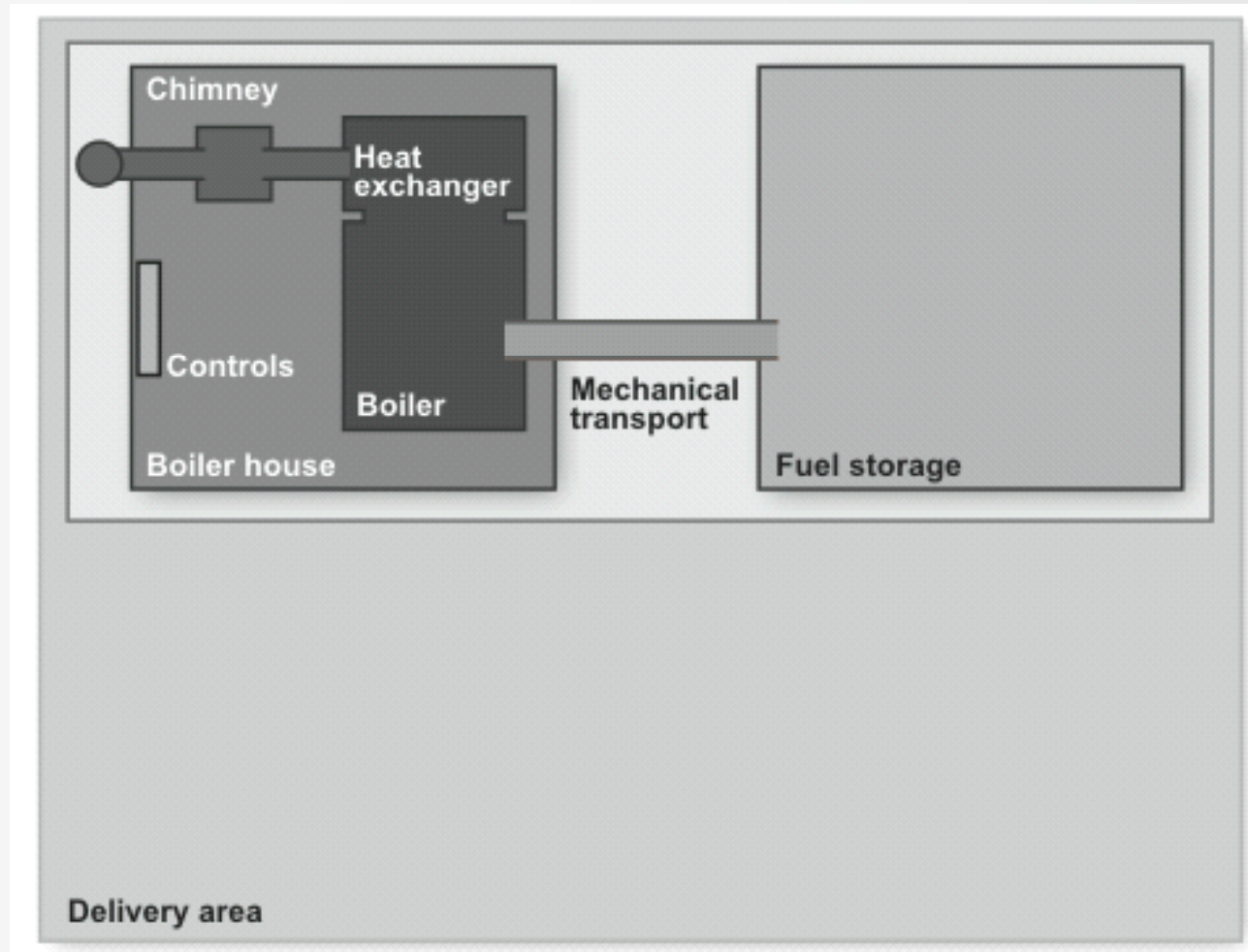
Risks

The risks from biomass boilers are very real:

- 7 explosions in Eire in 2007
- Serious explosion in Cornwall
- Significant explosion in S Wales in 2009
- Anecdotal evidence of a large number of 'pops & bangs'
- Regular fatalities on farms in automatic handling equipment and silos

These risks are not theoretical

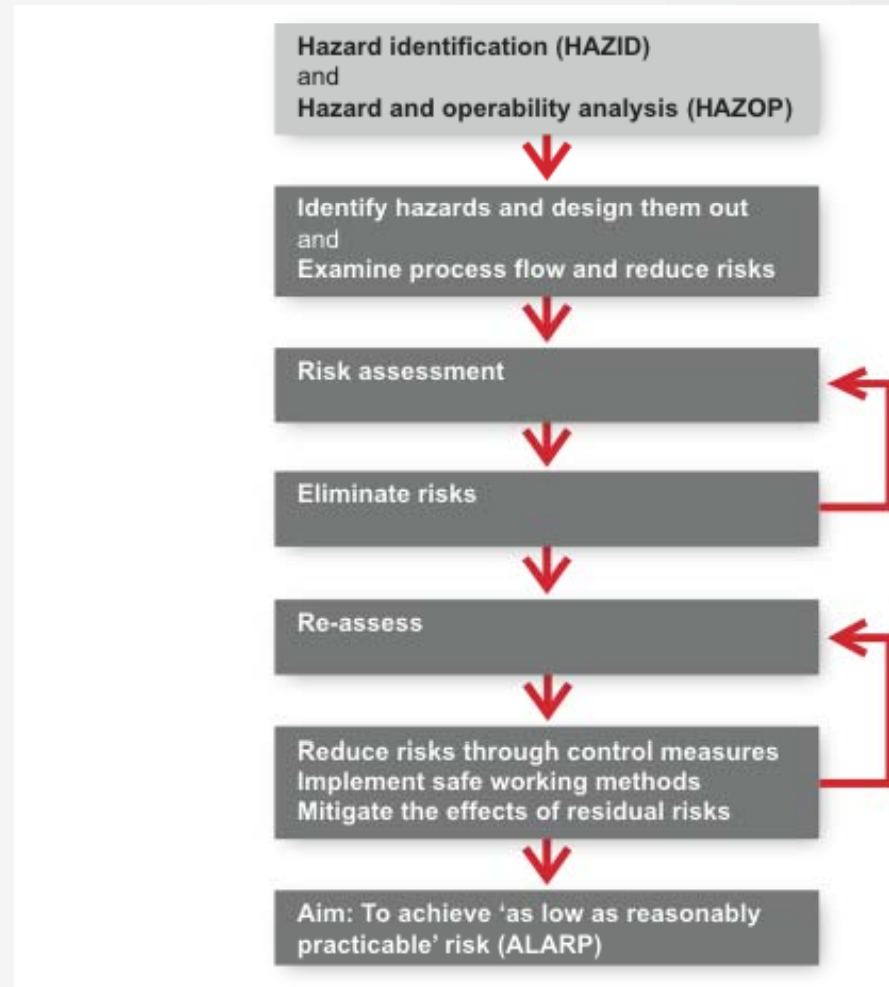
Typical system



Comparison with oil and gas

- Solid fuel domestic appliances are about 40 times more dangerous, in respect of CO poisoning, than an oil or gas appliance because:
 - They are not room sealed
 - They have a lot of unburned fuel present
 - They inherently have higher CO levels in the flue

Risk assessment and reduction



Lorry reception

A full risk assessment must be carried out on how to receive fuel vehicles safely



Examples:

- Is it a tractor without reversing horn?
- Is the area likely to be frequented by pedestrians?
- Is the access route suitable for a typical lorry driver?
- Is there a suitable up-stand against which to reverse?

Lorry reception



Source: Neil Harrison

Lorry reception



Source: Neil Harrison

Fuel delivery



Source: Neil Harrison

Fuel delivery



Source: Gastec at CRE

Fuel delivery



Source: Gastec at CRE

Fuel delivery



Source: Neil Harrison

Storage

Except for open storage on a barn floor **ALL** chip and pellet storage areas are extremely hazardous because:

- 1) They are confined spaces with a connection to a combustion system that produces CO
- 2) They contain large and very dangerous mechanical equipment
- 3) There is scope for falls from height



Significant numbers of people are hurt within them, a few are killed

The designer/constructor's responsibility...

- To carry out a risk assessment, and prepare access method statement

- To install suitable site-specific safety systems that include:
 - The ability to lock off machinery
 - Appropriate and suitably fixed ladders, rails, bars, meshes to prevent or reduce the risk of injury from falls
 - Correctly installed and maintained CO detectors
 - Anchor points for safety harness

Risk of explosion within bunkers

- The risk of explosion is dependent on the level of dust and a source of ignition
- The following statements **ONLY** refer to logs, chip or pellet; they do not refer to sawdust which is known to be a source of explosions
- Ordinary mechanical handing - No risk of explosion
- Pneumatic handling:
 - Chip - No risk
 - Pellet - No risk **IF** the pellet is purchased in good condition and the handling system is designed to minimise breakage. Badly broken pellet does offer a theoretical risk. Construct all delivery pipes from steel, only include very long radius bends and choose suitable pellet air separator if there is risk of impingement e.g. rubber sheet or rubber cyclone

Risk of explosion within bunkers

Electrical risk

There are theoretical risks from the build up of static within bunkers and any electrical equipment within bunkers should be suitably ATEX approved

- To avoid electrical problems:
 - Earth all steelwork especially delivery pipes
 - Remove all electric luminaires, sockets, switches etc from bunkers
 - Bunkers should be inspected using battery operated lamps

Risk of over-bed explosion

All biomass boilers carry a risk of build up of hydrocarbons and CO if operated in a very fuel rich fashion

Allowing air into the boiler will then create a rapid gaseous ignition which can be sufficiently dramatic to cause structural damage

This air can come from:

- 1) Natural ingress by the action of the chimney
- 2) Operation of a fan
- 3) Opening the door

Risk of over-bed explosion

- Anecdotally, over-bed explosion is unknown for boilers under automatic control unless there is a power supply interruption
- Most explosions occur following manual intervention; these can best be avoided by:
 - Reference to detailed method statements
 - Adherence to manufacturer's operating instructions
 - Staff training, both initial and on-going

Risk of over-bed explosion

- Design robust ductwork
- Restrain any clean-out doors etc with chains
- It is not recommended that this problem is addressed through additional interlocks or other control systems. These explosions frequently occur when the unit is under fault condition and at such times additional complex interlocks are unhelpful

Boiler fumes

- Boiler fumes are hazardous
- High concentrations of CO must not escape from the boiler plant into the boiler house
- Do not use a flue gas analyser on a biomass boiler without proper sample handling/clean-up equipment

Steam and water side explosions

- These of course are dramatically serious



Steam and water side explosions

- Steam boilers
 - All systems should comply with appropriate codes and all boiler operatives should be suitably trained

- Hot water boilers
 - All boilers should be designed to cater for power supply and pump failure ie suitably sized pressure and temperature operated relief valves

Chimney care

- Ensure flue is cleaned through whole length from back of boiler to top of flue
- After cleaning make sure all components are re-secured eg bolts on inspection plate
- Close visual inspection of flue draft stabiliser (can suffer cracking through repeated mechanical action)
- Replace lagging where removed to aid cleaning
- Check for corrosion from condensation
- Fix it or report it and note in log book

Chimney fires

- Let a chimney fire burn!
- Stop boiler firing
- Cut air off – ensure all fans are switched off and jam flue draft stabilisers closed
- Have flue checked and cleaned professionally

Communications

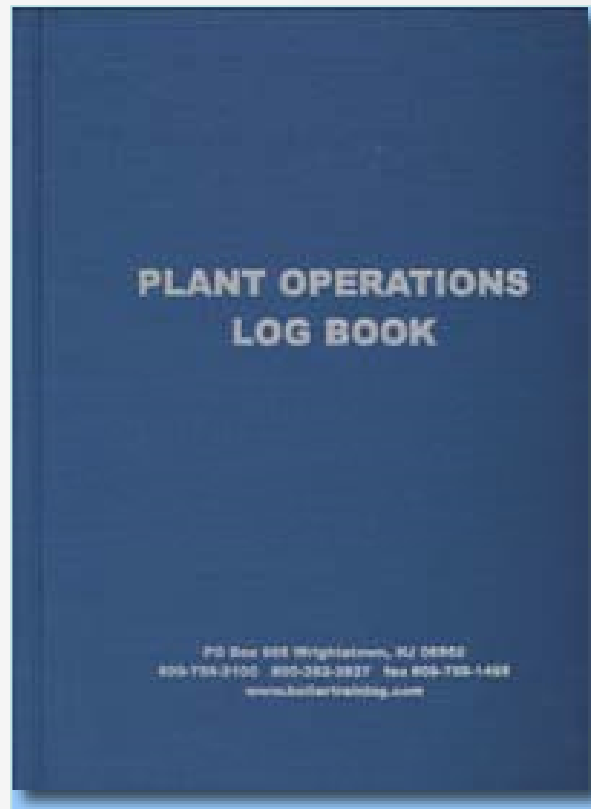
Boiler houses with biomass and gas or oil boilers are much more complex than a single fuel installation

Record:

- All fuel deliveries
- Breakdowns
- Thermostat and time clock adjustments
- Heat meter readings
- All other changes to the plant

Communications

Use a simple hard back book - keep it in the boiler house



Summary

- Biomass boilers present significant risks and safety aspects that need to be addressed
- With the right control, monitoring and reporting procedures, **together with properly trained operatives**, biomass boilers can be a safe and extremely cost effective renewable energy solution

Thank You