

Safety in Biomass design



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Overview



- Health and safety law
- Hazard identification
- Risk assessment
- Control
- Mitigation



Key system components

- Fuel delivery
- Fuel storage
- Combustion
- Emission control
- Steam or Hot water generation
- Power generation
- Ash Handling
- Water treatment



Why

- Importer/Entrepreneurial market
- Relatively little H&S knowledge
- No H&S culture
- Poor technical knowledge
- Several explosions
- Fatalities

The legal perspective



- Health and Safety at Work Act 1974
- The Management of Health and Safety at Work Regulations 1999
- CDM 2007

Health and Safety at Work Act 1974



- Securing the health, safety and welfare of persons at work.
- Protecting persons other than persons at work against risks to health or safety arising out of or in connection with the activities of persons at work!
 - Duties of the Employer
 - Duties of the Employee
 - Duties of the designer/manufacturer

The Management of Health and Safety at Work Regulations 1999



- Generally clarifies the duties of the employer under HASAW
 - Applicable to all work activities
 - Require HAZID and RA
 - Recorded findings.



The construction (design and management) regulations 2007

- Primarily intended for construction phase
- Apply to the design and maintenance phases
- Support and underwrite HASAW₁₉₇₄/MHSWA₁₉₉₉
- Applicable to all projects including domestic projects
- Replace CDM 1994 (did not sufficiently address design)
- Particularly relevant to the design and construction of biomass



The construction (design and management) regulations 2007

- Part 1 Introduction
- Part 2 General management duties construction projects
- Part 3 Additional duties for notifiable projects
- Part 4 Health and safety on Construction sites
- Part 5 general, enforcement etc.



Duty holders ?

- The Client
- The Designer
- The Principal Contractor
- Other or sub contractors
- Workers
- The CDMC



Competence (Regulation 4)

- Places a duty of care on the duty holders (previous slide) to appoint only competent persons
- Likewise not to accept an appointment unless competent
 - Good comprehension of the hazards and allied risks
 - Sufficient knowledge of the tasks to be undertaken
 - Sufficient expertise and ability
 - Recognition of limitations
 - Knowledge of the control measures to be put in place
 - Refer to HSE guidance also

Co-operation and co-ordination

(Regulation 5 &6)



- All duty holders will seek the co-operation
- All duty holders will give co-operation
- Everyone must co-ordinate their activities to ensure the safety of others
- Avoids design and constructional clashes

Designing out Hazard



➤ General Principles of Prevention – Reg 7

General duty placed on all parties to apply the principles of prevention throughout design, planning, preparation and construction work

- Avoid risks (design them out)
- Evaluate risks which cannot be avoided
- Combating risks at source
- Replacing the dangerous by non or less dangerous
- **Developing a coherent overall prevention policy**
- Give collective protection priority over individual
- Give appropriate instructions to employees

Are you a designer ?



Architect	Functional and building use – ease of construction and maintenance, Ergonomics
Building Services Engineer	Functional control, safety interlocking, safety systems
Civil Engineer	Ground conditions, physical influences
Structural Engineer	Adverse or emergency conditions, containment
Mechanical Engineer	Functional control, safety interlocking, safety systems
Surveyors	Value engineering may compromise safety
Design and build Contractors	Product knowledge, CE marking, site specific application
Anybody with the authority to specify or alter	Regulatory authorities also !
The Client where he influences design	Client led value engineering or cost cutting
Environmental Engineers	Emission dispersion modelling, Environmental impact assessment.

Designer ? (Regulation 11)



➤ **Duties of Designers - Reg 11:**

- Not to commence design work unless Client is aware of his duties under the Reg's
- Avoid foreseeable risks to any person:
 - Constructing
 - **Operating**
 - Maintaining
 - De-commissioning
- Designs must take into account the requirements of the HASAW, MHSAW and the workplace Health Safety & Welfare Reg's
- To provide with the design sufficient information about aspects of the design of the structure, its construction or its maintenance to assist clients, other designers and contractors to comply with their duties under the Reg's



Designing for safety

- HASAW_(act), CDM _(reg), MHSAW _(reg), underpinned by regulation
- COSHH ₍₂₀₀₂₎
- Electricity at Work ₍₁₉₈₉₎
- Control of noise at work ₍₂₀₀₅₎
- Manual Handling Operations regulations ₍₁₉₉₂₎
- Work at height regulations ₍₂₀₀₅₎
- Confined spaces regulations ₍₁₉₉₇₎
- The lifting Operations and lifting equipment regulations ₍₁₉₉₈₎
- Control of asbestos regulations
- The personal protective equipment regulations
- The pressure systems safety regulations
- The provision and use of work equipment regulations
- The regulatory reform (Fire Safety) Order ₍₂₀₀₅₎

- And many others.....



Approved codes of Practice

- Regulation underpinned by British Standards
- Harmonised EU standards EN....
- Underpinned by ACOPs
- ACOPs free of charge from HSE (www.hse.gov.uk)
- Health and safety Guidance Publications (HSG) free of charge from HSE (www.hse.gov.uk)

For example:

- Pressure system – steam pipework
- Pressure Systems Safety Regulations (2000) – Apply
- **Pressure Systems Safety Regulations 2000. Approved Code of Practice.**
- Free download at www.hse.gov.uk/pubns/priced/l122.pdf

Designing out HAZARD



HAZID/OP a process requiring the co-operation of designers (architects, BS Engineers, Electrical engineers, etc) to identify potential hazards and to design these hazards out

Risk Assessment - a process requiring the co-operation of designers (architects, BS Engineers, Electrical engineers, etc) to quantify (severity and frequency) from unavoidable HAZARD and to devise and implement control measures physical and procedural to reduce the risk associated with a design

Using control measures to reduce the risk to As Low As Reasonably Practical ALARP – iterative assessment
Inc method statements to ensure a “Safe System of Work” HASAW

Mitigating the effects of ALARP being realised – By putting in place measures to control or reduce the effects of a HAZARD being realised

Safer Design

Process Overview (HSE INDG 163)



- Identify the Hazards
- Decide who will be harmed
- Evaluate the risk of harm
- Assess what measures can be put in place to reduce risk
- Record the findings
- Revise and re-assess until the risk is assessed as ALARP.



Hazard

- A hazard is something that has the potential to cause harm
 - High pressure or Working at height are hazards
- Risk is the likelihood of harm occurring from a hazard
 - Falling of a ladder is a risk
- Hazards might be Eliminated by changing a design.
 - e.g. by locating plant at lower level
- All hazard cannot be eliminated.
- But for hazard cannot be eliminated, the risk of realising the effect of the Hazard can be reduced with control.
 - e.g. by using scaffolding to access high level plant
 - Task specific risk assessment
 - By installing safety rails
 - By using a safety harness

Biomass Hazards ?



Work at height	Fuel Bunkers, chimneys
Using Electrical equipment	Explosion, Maintenance, trailing leads,
High pressures	Steam or MPHw boilers and pipework
High temperatures	Steam or MPHw boilers and pipework, combustion space, flues flue gases
Manual Handling	Ash bins, chemical storage
COSHH – Harmful substances	Ash, pellet dust, wood dust, water treatment chemicals, boiler emissions
Noise	Boiler fans, boiler house noise
Trip hazards	Fuel bunkers, congested plant space
Unguarded drops	Fuel pits, above ground bunkers
Vehicles	Delivery procedures and delivery lorries
Lack of training	Inadequate training
Fire	Combustion process
Confined spaces	Fuel stores, boiler inspection
Automated or automatically starting machinery	Fuel storage and recovery systems,
Manual intervention !	Anything and everything could happen



Hazard identification

- Who carries out the Hazard identification
 - Appropriate, knowledge, training, experience
 - Team better than individual
 - Simple projects simple approach
 - Widest perspective brainstorming
 - Co-operative approach.
 - Open but guided.



Hazard Matrix

➤ What gives rise to the hazard

- E.g. Vehicle, Pressure
- Not failure to wear PPE

➤ Who will it harm

- Specific groups e.g. operators, maintainers, pedestrians, visitors

➤ Type of hazard

- Hidden, not obvious
- Transient (e.g. resulting from unsafe behaviour)
- Latent or complex (e.g. failure of a system in a fire)

Hazard Matrix



Ref No	Hazard The process, the equipment, the place or combinations thereof	Who could be harmed? specific individuals or groups	Severity of harm (Use a defined scale)	Transient or latent (Arises from irrational or dangerous or intentional behaviour ?, Secondary effect e.g. fire destroys control cabling ?)
1	<i>Delivery lorries manoeuvring in the school playground</i>	<i>Unsupervised Children</i>	(3)	<i>Possibly enhanced risk from teenagers intentional behaviour</i>
2	<i>All steam drum and super heater pipework explosion resulting from overpressure.</i>	<i>Extent of explosion assessed to cause severe physical but localised damage – Operational or maintaining staff in immediate proximity. Principally maintenance staff or maintenance staff conducting sensor replacement.</i>	(3)	<i>Identified hazard to be part of comprehensive design safety review. Secondary effects of physical damage to be considered e.g. loss of signal cabling.</i>



Risk Assessment (Design)

- Assess significant and no routine risk

- E.g. not crossing the road

- Risk assessor

- Must be able to identify the Hazards
 - Judge the consequences
 - Determine the likelihood of harm
 - Understand and Identify risk control measures
 - Develop Method statements

Risk Matrix



RISK ASSESSMENT MATRIX					
SEVERITY	HIGH (3) (death/major injury/long term disability)		LIKELIHOOD	HIGH (3) (certain to happen)	
	MEDIUM (2) (injury/3 day injury)			MEDIUM (3) (certain or near reasonably certain to happen)	
	LOW (1) (minor injury)			LOW (1) (very seldom)	

Risk Matrix

