Performance requirements for Energy from Waste plants

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Growth of the energy from waste sector

- Increasing cost of landfill and limited availability
- Renewable energy technologies so help government achieve EU targets
- Increasing number technologies being developed
- 62 plants listed as operational in England
- 85 further plants due to become operational by end 2020

Mersey Waste Processing Centre - UK

System manufacturer:
Eurobond

Colorcoat® Product:
Colorcoat HPS200 Ultra®

Colour: White

Energy from waste technologies

Waste collection, segregation and fuel preparation

Combustion

the residual waste burns at 850°C and the heat energy recovered is used directly or for electricity generation

Gasification and pyrolysis

the fuel is heated with little or no oxygen to produce “syngas” which can be used to generate energy or as a feedstock for producing methane,

Anaerobic digestion

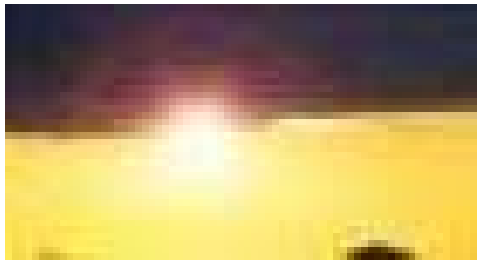
uses microorganisms to convert organic waste into a methane-rich biogas that can be combusted to generate electricity and heat or converted to biomethane. This technology is most suitable for wet organic wastes or food waste. The other output is a biofertiliser

All technologies require initial waste sorting and separation

Durability performance of coatings

Ability to withstand attack from different sources

- Water, oxygen and salts
  - Coastal sites will be far more demanding of the product than urban or rural sites.
- Sunlight
  - Most destructive to organic coatings. will eventually lead to a loss of gloss, fading, chalking, brittleness and eventually loss of coating adhesion.
- Chemicals and pollutants
  - As well as accelerating corrosion, attacks the chemical bonds which make up the paint polymers. Also attacks metallic pigments.
- Abrasives, such as wind-blown sand and salts
  - The thickness of the coating and scratch resistance contribute greatly to its robustness in resisting abrasion.



Understanding the local corrosion environment
Internal vs External environments

- External environments are generally well understood
- Little variation in corrosion rates between similar locations
- Tata Steel have over 30 years experience in durability of cladding systems in normal exterior environments
- Usually just split into Inland or Coastal

- Internal environments much more variable and less understood
- Local corrosion environment will be specific to the operations within the building
- Internal operations of a building can change

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Internal environments

Corrosion environment categories BS EN ISO 12944-2

Corrosivity category and risk	Low-carbon steel Thickness loss (µm)[a]	Examples of typical environments in a temperate climate (informative only)	
		Exterior	Interior
C1 very low	≤ 1.3	-	Heated buildings with clean atmospheres, e.g. offices, shops, schools, hotels
C2 low	> 1.3 to 25	Atmospheres with low level of pollution Mostly rural areas	Unheated buildings where condensation may occur, e.g. depots, sports halls
C3 medium	> 25 to 50	Urban and industrial atmospheres, moderate sulphur dioxide pollution Coastal area with low salinity	Production rooms with high humidity and some air pollution e.g. food-processing plants, laundries, breweries, dairies
C4 high	> 50 to 80	Industrial areas and coastal areas with moderate salinity	Chemical plants, swimming pools, coastal, ship and boatyards
C5-I very high (industrial)	> 80 to 200	Industrial areas with high humidity and aggressive atmosphere	Buildings or areas with almost permanent condensation and high pollution
C5-M very high (marine)	> 80 to 200	Coastal and offshore areas with high salinity	Buildings or areas with almost permanent condensation and high pollution

Corrosion rate for zinc coatings

Corrosion class	Weight loss g/m²/yr	Thickness loss microns/yr	Coating life yrs (275g coating)
C1	≤0,7	≤0,1	>50
C2	>0,7 to 5	>0,1 to 0,7	>25
C3	>5 to 15	>0,7 to 2,1	10 to 25
C4	>15 to 30	>2,1 to 4,2	5 to 10
C5-I	>30 to 60	>4,2 to 8,4	2 to 5
C5-M	>30 to 60	>4,2 to 8,4	2 to 5

A typical 0.5mm pre-painted wall cladding sheet is 460um thick with 20um metallic coating on each side

Without a paint coating in a C5 environment this would be completely corroded in less than 10 years

Structural steelwork galvanising thickness typically up to 100 microns so provides up to ~20 years protection in C5 environment

The range of internal environments in EfWs

Corrosivity categories according to EN ISO 12944-2	Plant section / Room
C2	The weighing house (inside)
C2	All sanitary rooms (lavatory, showers, etc.)
C2	Crane operator's cabin (inside)
C2	All electrical equipment rooms
C2	Corridors and stairwells in plant sections
C3	Waste bunker
C3 [1)]	Boiler house
C3	Complete waste receiving hall and residue hall
C3	Battery rooms (UPS) build in container
C3	Emergency diesel build in container or similar
C3	Turbine table
C3	Turbine cellar
C3	Turbine oil room
C3	Complete flue gas treatment
C3	Room feed water pumps
C3	Rooms with demineralised / -and feed water pumps
C3	Separate hydraulic rooms
C3	Emission measurement container (Inside installation)
C3	Ventilation system (HVAC)
C4	Silo (outside of silo) for outside placement area
C4	Ash loading
C4	All containers for outside installation
C4	Handling and transport of consumables (e.g. HOK, lime etc.)
C4	ACC consisting of steel construction, uninsulated piping and wind partition walls (exclusive heat exchanger elements)
C4	All equipment installed outside
C4	Transformer (transformer boxes, outdoor installation)
C4	Water lances (FGT)
C4	Water basin for cleaning (FGT)
C4	Stack
C5-I	Room of waste water basin
C5-I	Bottom ash extractor
C5-I	bottom ash transport (Belt conveyor, vibration conveyor, etc.)
C5-I	Waste water treatment
C5-I	Process water tanks and basins
C5-I	Chemical storage and handling (e.g. NH4OH etc.)
C5-I	Equipment exposed to humid area, out from ambient air
C5-I	Residue handling / - treatment with danger of gaseous chemicals and salt deposition
C5-I	Equipment with partial wetting by liquid chemicals (e.g. NH4OH etc.)

- Specification provided for EfW in South of England
- Combustion process

Internal Environments

The internal environment (ambience) of a building is often a unique microclimate

Corrosive Criteria	
Non Aggressive	No chemical aggressivity. Neutral cleaning > once a month
Low Aggressive	No chemical aggressivity. Neutral cleaning > once a week
Medium Aggressive	Low chemical aggressivity. Cleaning pH 5-9 > once a week
Aggressive	Chemical agressivity or risk of moulds. Cleaning pH 5-9 > once a day
Very Aggressive	High chemical aggressivity or high risk of moulds. Cleaning pH 5-9 ≥ once a day
Cleaning Criteria	
Routine upkeep	Periodical cleaning. Neutral products. No pressure washing
Non intensive cleaning	Cleaning with neutral products < 30°C, spraying at low pressure
Intensive cleaning	Cleaning with prodcuts pH 5-9, temeprature <40°C and a pressure
Humidity Criteria	
Low hygrometry	W/n ≤ 2.5 g/m^3
Medium hygrometry	2.5 < W/n < 5 g/m^3
High hygrometry	5 < W/n ≤ 7.5 g/m^3
Humid	High hygrometry and risk of condensation
Very Humid	Very high hygrometry and frequent risk of condensation (1)

W = quantity of vapour produced inside the building in g/m³/h. n = hourly air renewal rate

(1) Condensation is considered frequent if it can be detected daily on interior surfaces but the duration of humidity is generally short, < 2 hours

Internal Environments

EN10169:2010 classifies internal environments from categories A1 to A5

	Defining criteria of atmosphere			Examples of Building Use
	Corrosiveness	**Cleaning**	**Humidity**	
A1	Non Aggressive	Routine upkeep	Low hygrometry	Office buildings, Schools, Residential (not kitchens and bathrooms)
A2	Low Aggressive	Routine upkeep	Medium hygrometry	Sports halls, supermarkets
A3	Medium Aggressive	Non intensive cleaning	High hygromentry	Industrial buildings with dry processes
A4	Aggressive	Non intensive cleaning	Humid (risk of condensation)	Swimming pools, Factory buildings with wet processes
A5	Very Aggressive	Intensive cleaning	Very humid (frequent risk of condensation)	Paper mills, sea food processing, Mushroom culture, cheese factory

Design and installation factors

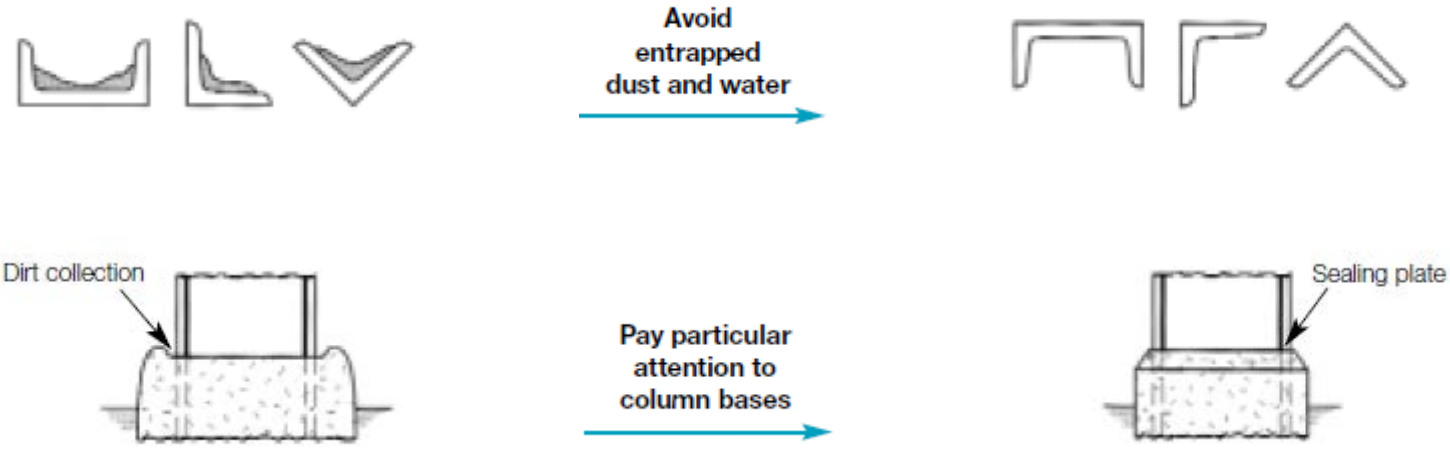
Structural steelwork

- Minimising the risk of areas of local dirt/moisture entrapment
- Minimising direct contact between liquid/solid waste and steelwork/cladding
- Adequate protection
- Issues associated with “boxing in” steelwork

Material selection and considerations

Structural steelwork

- Steelwork design



- Galvanising
- Additional factory or site applied paint coating system for more aggressive areas

Staffordshire Energy from Waste

Over 40m clear spans
Up to 40m high
Fully galvanised structure
60 year design life in a C3 environment

Staffordshire Energy from Waste

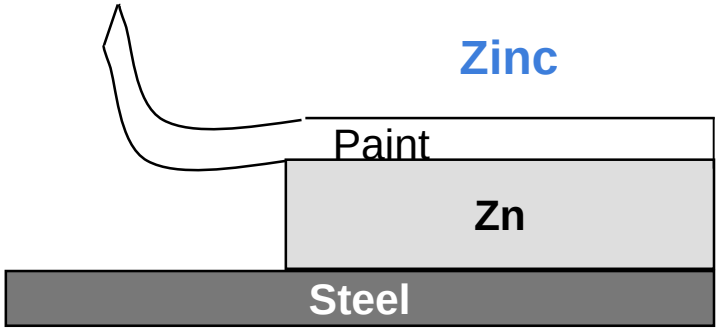
Galvanised structural steel

Material selection and considerations
Building envelope

- General robustness of the coating
- Resistance of the coating to the corrosion environment
- Performance of the cladding at cut edges and joints
- Manufacturers statement of performance
- Approach to extending the cladding functional life

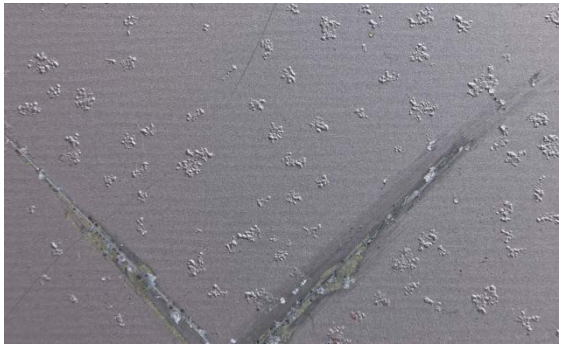
Prefinished steel cladding specification and performance.

Zinc

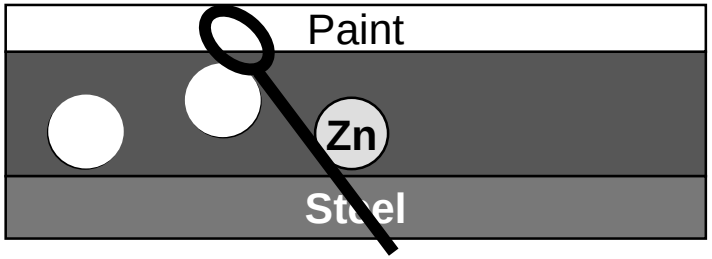


5000hrs humidity exposure

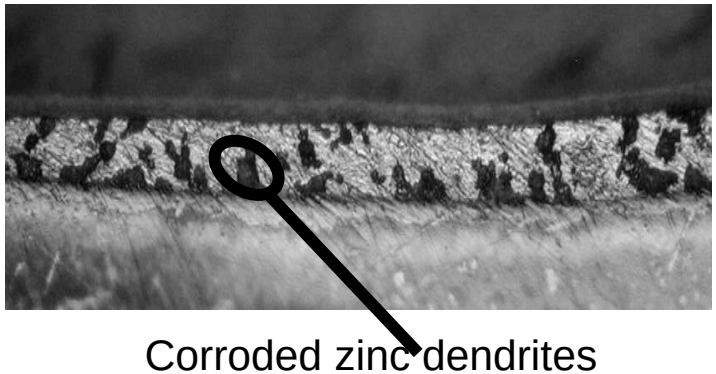
Polyester



Galvalloy 95.5% Zn / 4.5% Al



Paint remains adhered to eutectic structure



Corroded zinc dendrites

HPS200 Ultra®

Greater Manchester Waste – Manchester - UK

Europe’s largest EfW Project

Internal condition information prior to issuing a cladding SOP

Details of all chemicals and concentrations likely to be present

Internal temperature and humidity

Frequency of internal washdown

Method of washdown and any chemicals/detergents used

Only available with Colorcoat HPS200 Ultra®

Do not cover cut edges and recommend use of an edge laquer

All details recorded and reviewed to maintain consistency

Energy from waste. Material specifications

- Typically requesting 30+ years operating life. The building will require upkeep and maintenance
- Tata Steel typically provide a statement of performance up to 15 years on the internal building envelope for Colorcoat HPS200 Ultra® with guidance on actions which can be taken to extend the functional life
- Galvanising of primary structure can provide a good degree of protection around 20+ years
- For most demanding areas, consider additional paint system coating
- Use of post or pre painted secondary steelwork sheeting rails and purlins) will significantly enhance performance

Developing knowledge and understanding of internal environments

- Tata Steel have been involved with EfW projects for ~ 5 years
- Quality of internal environment information being provided has improved dramatically
- Comparison of environment specified and actual environment by use of a program of corrosion coupons
- Evaluation of internal cladding performance
- Evaluation of structural steelwork protection. General performance and entrapment areas