Tata Steel Strip Products UK
Port Talbot Works

Environmental Compliance Department

Review of General, Coke, Sinter, Iron and Steel processes against Iron and Steel BAT Conclusions, March 2012.

Version: 2

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1. GENERAL BAT CONCLUSIONS

Unless otherwise stated, the BAT conclusions presented in this section are generally applicable.

The process specific BAT included in the Sections 2 – 7 apply in addition to the general BAT mentioned in this Section.

1.1 Environmental management systems

1. BAT is to implement and adhere to an EMS that incorporates the following features:

I. commitment of top management (commitment of the top management is regarded as a precondition for a successful application of other features of the EMS)
II. definition of an environmental policy that includes continuous improvement for the installation by top management
III. planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment
IV. implementation of the procedures, paying particular attention to:
   i. structure and responsibility
   ii. training, awareness and competence
   iii. communication
   iv. employee involvement
   v. documentation
   vi. efficient process control
   vii. maintenance programme
   viii. emergency preparedness and response
   ix. safeguarding compliance with environmental legislation.
V. checking performance and taking corrective action, paying particular attention to:
   i. monitoring and measurement (see also the BAT Reference Document on the General Principles of Monitoring)
   ii. corrective and preventive action
   iii. maintenance of records
   iv. independent (where practicable) internal auditing in order to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained.
VI. review of the EMS and its continuing suitability, adequacy and effectiveness by top management.

Environmental management systems BAT assessment

Tata Steel Strip Products UK Port Talbot is covered by an environmental management system that has been independently certified as conforming to the requirements of ISO14001, the international environmental management systems standard. The features set out in the BAT conclusion are all requirements of ISO14001. This ensures BAT is achieved in relation to all of the above points.

BAT Achieved.

1.2 Energy management

2. BAT is to reduce thermal energy consumption by using a combination of the following techniques:

I. improved and optimised systems to achieve a smooth and stable processing, operating close to the process parameter set points by using
   i. process control optimisation including computer-based automatic control systems
   ii. modern, gravimetric solid fuel feed systems
   iii. preheating, to the greatest extent possible, considering the existing process configuration.
II. recovering excess heat from processes, especially from their cooling zones
III. an optimised steam and heat management
IV. applying process integrated reuse of sensible heat as much as possible.

Description of BAT I.i

The following items are important for integrated steelworks in order to improve the overall energy efficiency:

- optimising energy consumption.
- online monitoring for the most important energy flows and combustion processes at the site including the monitoring for all gas flares in order to prevent energy losses, enable instant maintenance and achieving an undisrupted production process
- reporting and analysing tools to check the average energy consumption of each process
- defining specific energy consumption levels for relevant processes and comparing them on a long-term basis
- identifying cost-effective energy savings opportunities by carrying out energy audits as defined in the Energy Efficiency BREF.

Description of BAT II – IV

Process integrated measures used to improve energy efficiency in steel manufacturing by improved heat recovery include:

- the recovery of waste heat by heat exchangers and distribution either to other parts of the steelworks or to a district heating network (if there are consumers in the vicinity)
- the installation of steam boilers or adequate systems in large reheating furnaces (furnaces can cover a part of the steam demand)
- preheating of the combustion air in furnaces and other burning systems to save fuel, taking into consideration adverse effects, i.e. an increase of nitrogen oxides in the off-gas
- the insulation of steam pipes and hot water pipes
- recovery of heat from products, e.g. sinter
- where steel needs to be cooled, the use of both heat pumps and solar panels
- the use of flue-gas boilers in furnaces with high temperatures
- the oxygen evaporation and compressor cooling to exchange energy across standard heat exchangers
- the use of top recovery turbines to convert the kinetic energy of the gas produced in the blast furnace into electric power.

Applicability of BAT II – IV

Combined heat and power generation is applicable for all iron and steel plants close to urban areas with a suitable heat demand.

Reduction in thermal energy reduction BAT assessment

Tata Steel Port Talbot has a dedicated Energy Optimisation Manager and team, supported by a central team of experts in Group Environment, to ensure that energy consumption is minimised across the site (Ref. I). Energy audits are a key tool in identifying improvement opportunities. There is a manned Energy Control Centre and dedicated Energy Operations Department responsible for collecting and distributing process-arising gases in the most efficient manner to ensure optimum energy consumption and optimum steam and heat management across the site. In addition, all major processes are controlled by means of computer-based systems to ensure safe operation and to achieve the most efficient overall steel production, taking into account the integrated nature of Port Talbot steelworks, the dependence of each process on the preceding processes and market demand for steel products (Ref.Ii).

Energy consumption data is gathered for the various processes around the site and compared with benchmark targets derived from best practice/best historical practice. These are publicised to the workforce of each process area to increase engagement in energy matters and improve behaviour. Additionally, across Tata Steel Group, there is in place a state-of-the-art system, which is believed to be unique in the industry, that gathers required data to report energy consumption and CO_2 emissions for every major process site (globally). This system also compares the performance of each process on each site against a best practice performance and analyses the cause of deviations from best practice to identify improvement opportunities (Ref.Ii).

Waste heat recovery boilers have been installed on the BOS gas collection system and the CAPL furnace exhaust to generate steam for use elsewhere on the site (Ref. Iiii).

The reheating furnaces on the site are fired with coke oven gas and include an unfired recuperation zone to preheat the stock using the furnace exhaust gases before the gases pass to recuperators for further heat recovery by preheating the combustion air (Ref Iii & IV).

Steam and hot water pipes are lagged to minimise energy losses (III).

In total, the measures described above are considered to realise BAT, but it is recognised that further improvements will always be possible. A state-of-the-art predictive control system (ISOLDE) is being developed and applied on the site by Tata Steel R & D to optimise the use of process gases and steam by reacting in an optimum manner to temporal perturbations in fuel production and demand. This system is expected to be operational by 2014 (Ref. Ii). Further opportunities to improve thermal energy consumption will be exploited where economic.

BAT achieved.

3. BAT is to reduce primary energy consumption by optimisation of energy flows and optimised utilisation of the extracted process gases such as coke oven gas, blast furnace gas and basic oxygen gas.

Description
Process integrated techniques used to improve energy efficiency in an integrated steelworks by optimising process gas utilisation include:

- the use of gas holders for all by-product gases or other adequate systems for short-term storage and pressure holding facilities
- increasing pressure in the gas grid if there are energy losses in the flares – in order to utilise more process gases with the resulting increase in the utilisation rate
- gas enrichment with process gases and different caloric values for different consumers
- reheating fire furnaces with process gas
- use of a computer-controlled caloric value control system
- recording and using coke and flue-gas temperatures
- adequate dimensioning of the capacity of the energy recovery installations for the process gases, in particular with regard to the variability of process gases.

Utilisation of the extracted process gases such as coke oven gas, blast furnace gas and basic oxygen gas BAT assessment

The site collects blast furnace gas (BFG), BOS gas and coke oven gas (COG) and has gas holders for each installed as part of the gas distribution and storage network on the site to maximise their utilisation. Process gas collection systems are sized to cope with the normal variations in fuel gas production and demand.

Gasses are dedusted as follows:
BOS – Via Wet Scrubbing systems, Cyclones and Wet Electrostatic Precipitator.
BF – Via Dust Catcher (BF5) & Cyclone (BF4) & Wet scrubbing systems.
COG – Regarding desulphurisation See BAT 46 – 48.8.

- *Gasholders at Port Talbot for BFG and COG represent short-term storage with the BOS gasholder a buffer for a non-continuous gas make (batch).*
- *All gasses have boosters to supply sufficient pressure to consumers.*
- *BFG is a lean fuel and has to be enriched for higher temperature processes. BOS gas is used as an enrichment fuel for BFG at the power plant and Blast furnace 4 stoves. COG is used for enrichment at the coke ovens, Blast Furnace Stoves and Power Plant boilers. COG is also used directly in most works areas for heating appliacations.*
- *Hot strip mill reheat furnaces use COG as well and Natural Gas (NG). BFG and BOS gases are not rich enough to use in reheat furnaces.*
- *Mixed gas (BFG, COG and NG) Calorific Value (CV) control is used at BF stoves and at the Power Plant. Typically mixes of BFG with BOS /COG are used. NG is used for enrichment but is kept to a minimum under normal conditions.*
- *Coke oven flue gas temperatures are continuously monitored to control combustion to the required degree.*

In total, the measures described above are considered to realise BAT, but it is recognised that further improvements will always be possible. A state-of-the-art predictive control system (ISOLDE) is being developed and applied on the site by Tata Steel R & D to optimise the use of process gases and steam by reacting in an optimum manner to temporal perturbations in fuel production and demand. This system is expected to be operational by 2014.

BAT achieved.

4. BAT is to use desulphurised and dedusted surplus coke oven gas and dedusted blast furnace gas and basic oxygen gas (mixed or separate) in boilers or in combined heat and power plants to generate steam, electricity and/or heat using surplus waste heat for internal or external heating networks, if there is a demand from a third party (the cooperation and agreement of a third party may not be within the control of the operator, and therefore may not be within the scope of the permit).

Applicability

The cooperation and agreement of a third party may not be within the control of the operator, and therefore may not be within the scope of the permit.

Use of desulphurised and dedusted gases BAT assessment

Process-arising gases not required for process heating are used in on-site boilers to generate steam and electricity for internal use.

Gasses are dedusted as follows:
BOS – Via Wet Scrubbing systems, Cyclones and Wet Electrostatic Precipitator.
BF – Via Dust Catcher (BF5) & Cyclone (BF4) & Wet scrubbing systems.
COG – Regarding desulphurisation See BAT 46 – 48.

BAT Achieved

5. BAT is to minimise electrical energy consumption by using one or a combination of the following techniques:

I. power management systems
II. grinding, pumping, ventilation and conveying equipment and other electricity-based equipment with high energy efficiency.

Applicability

Frequency controlled pumps cannot be used where the reliability of the pumps is of essential importance for the safety of the process.

Minimise electrical energy consumption BAT assessment

A number of key improvement areas have been initiated on rotating equipment. Firstly, audits of such equipment have been carried out as part of the drive-save project to identify systems where variable speed drives would make significant energy efficiency improvements. A number of these systems have had motor replacements with high efficiency versions. Presently collaborating with motor supplier to introduce new motor management practices that will increase uptake of higher efficiency motors, a policy for this is soon to be rolled out.

All power management systems electricity based equipment when replaced or procured for new applications are chosen with minimised energy consumption as key criteria. There are also policies in place to ensure energy efficient lighting is procured in place of old non-efficient lighting.

Energy Reduction is an ongoing process and has a dedicated Energy Optimisation team.

BAT Achieved.

1.3 Material management

6. BAT is to optimise the management and control of internal material flows in order to prevent pollution, prevent deterioration, provide adequate input quality, allow reuse and recycling and to improve the process efficiency and optimisation of the metal yield.

Description

Appropriate storage and handling of input materials and production residues can help to minimise the airborne dust emissions from stockyards and conveyor belts, including transfer points and avoid soil, groundwater and runoff water pollution (see also BAT No 11).

The application of an adequate management of integrated steelworks and residues, including wastes, from other installations and sectors allows for a maximized internal and/or external use as raw materials (see also BAT No 8, 9 and 10).
Material management includes the controlled disposal of small parts of the overall quantity of residues from an integrated steelworks which have no economic use.

Material management BAT assessment

Management of wastes is underpinned by a material flows hierarchy, where possible potential wastes are avoided through prevention and minimisation at the source. When these options are not feasible the emphasis is upon reuse or recycling of materials and by-products to avoid waste arisings.

Internal material flows are carefully controlled to prevent deterioration, provide adequate input quality, allow reuse and recycling and to improve the process efficiency and optimisation of the metal yield as a matter of course. Material costs form a large part of the overall costs of steel production and so efficient materials management across the site is a high priority. The integrated nature of Port Talbot steelworks, the dependence of each process on the preceding processes and market demand for steel products will all impact on management of internal material flows within each process area, with the aim being to minimise the total cost to the business.

Additional measures to minimise pollution arising from materials storage, handling and transport are detailed in the response to BAT 11.

Additional measures to maximise the internal and external use of steelworks residues are detailed in the responses to BAT 8 and BAT 9.

The small fractions of residues that have no economic use are disposed of either at an internal landfill site or externally. In all cases appropriate measures are taken to ensure that such disposals are properly controlled, for example through the use of waste transfer notes.

BAT achieved.

7. In order to achieve low emission levels for relevant pollutants, BAT is to select appropriate scrap qualities and other raw materials. Regarding scrap, BAT is to undertake an appropriate inspection for visible contaminants which might contain heavy metals, in particular mercury, or might lead to the formation of polychlorinated dibenzodioxins/furans (PCDD/F) and polychlorinated biphenyls (PCB).

To improve the use of scrap, the following techniques can be used individually or in combination:

- specification of acceptance criteria suited to the production profile in purchase orders of scrap
- having a good knowledge of scrap composition by closely monitoring the origin of the scrap; in exceptional cases, a melt test might help characterize the composition of the scrap
- having adequate reception facilities and check deliveries
- having procedures to exclude scrap that is not suitable for use in the installation
- storing the scrap according to different criteria (e.g. size, alloys, degree of cleanliness); storing of scrap with potential release of contaminants to the soil on impermeable surfaces with drainage and collection system; using a roof which can reduce the need for such a system
- putting together the scrap load for the different melts taking into account the knowledge of composition in order to use the most suitable scrap for the steel grade to be produced (this is essential in some cases to avoid the presence of undesired elements and in other cases to take advantage of alloy elements which are present in the scrap and needed for the steel grade to be produced)
- prompt return of all internally-generated scrap to the scrap yard for recycling
- having an operation and management plan
- scrap sorting to minimise the risk of including hazardous or non-ferrous contaminants, particularly polychlorinated biphenyls (PCB) and oil or grease. This is normally done by the scrap supplier but the operator inspects all scrap loads in sealed containers for safety reasons. Therefore, at the same time, it is possible to check, as far as practicable, for contaminants. Evaluation of the small quantities of plastic (e.g. as plastic coated components) may be required
- radioactivity control according to the United Nations Economic Commission for Europe (UNECE) Expert Group framework of recommendations
- The implementation of the mandatory removal of components which contain mercury from End-of-Life Vehicles and Waste Electrical and Electronic Equipment (WEEE) can be improved by: fixing the absence of mercury in scrap purchase contracts refusal of scrap which contains visible electronic components and assemblies.

Scrap Management BAT assessment

- *Strict procurement criteria have been set for internal and external purchase of scrap on cleanliness and chemistry.*
- *Harsco Metals receives scrap for the BOS plant. Harsco has a scrap inspector and work instructions for monitoring composition and standard of scrap. When scrap does not meet the standard of the BOS criteria, it is quarantined and the supplier is investigated. Investigations are documented. Scrap is sometimes returned to the supplier due to quality standards.*
- *Throughout the scrap handling process up to the point of charging into the BOS vessels, there is segregation of scrap types into clearly defined compositions/qualities/types.*
- *The Harsco run scrap bay is canopy covered with concrete base and dividing bay walls.*
- *The BOS plant utilizes a computer based program called a "Charge Balance Model" to ensure scrap composition and grades according to the hot metal quality and end steel grade quality criteria (this particularly considers sulphur and alumina contents of the scrap types.*
- *All internally generated scrap is recycled where composition and volume allows. Demolition generated scrap (e.g. Re-build of BF4) is cut and recycled through the on site "Regen" process.*
- *The scrap management at Port Talbot BOS plant is managed by Harsco through a contractor contract (Harsco Metals PT also have their own Permitted ring fenced site neighboring the PT BOS plant). The contract includes key performance indicators, regular contract review meetings etc.*
- *Contamination within the scrap e.g. plastic is minimised initially through scrap acceptance criteria (referred to earlier) but also through the scrap inspection procedures and through the scrap bays and loading to the BOS vessels. Where contamination is found scrap is quarantined and potentially sent back to the supplier.*
- *Radioactivity monitors are located on the scrap receipt weighbridges, through which the external scrap lorries must pass before discharging scrap on site. There are also radioactivity monitors at the scrap bays. There are strict procedures around the detection of radioactive materials and subsequent response plan.*
- *The scrap procurement criteria include removal of mercury containing WEEE & End-of-Life Vehicles.*

BAT Achieved.

1.4 Management of process residues such as by-products and waste

8. BAT for solid residues is to use integrated techniques and operational techniques for waste minimisation by internal use or by application of specialised recycling processes (internally or externally).

Description

Techniques for the recycling of iron-rich residues include specialised recycling techniques such as the OxyCup® shaft furnace, the DK process, smelting reduction processes or cold bonded pelletting/briquetting as well as techniques for production residues mentioned in Sections 9.2 – 9.7.

Applicability

As the mentioned processes may be carried out by a third party, the recycling itself may not be within the control of the operator of the iron and steel plant, and therefore may not be within the scope of the permit.

Management of process residues such as by-products and waste BAT assessment

Internally arising solid materials are extensively re-circulated within the plant with the result that only a small proportion of total material arising (typically <5%) requires to be disposal. In particular, iron-bearing materials - or reverts - can readily be incorporated into the sinter feed and recovered at the sinter plant, where their 'value in use' can be realised. When using reverts at the sinter plant, due care must be taken to manage the chemistry of the resultant sinter feed so as not to impact on waste gas emissions. The BOS plant is also a receiving plant for certain reverts, usually after they have been processed on-site into waste oxide briquettes (WOBs) which can comprise scales, grits and waste gas cleaning sludges from the BOS plant and blast furnaces.

Blast furnace slag (BFS) and BOS slag are by-products and are not discussed in this section.

Sludges and filter cakes from waste gas cleaning systems at the blast furnaces and BOS plant arise in large volumes and are processed and re-circulated internally wherever possible.

In the case of the blast furnaces, off-gas is first dry de-dusted using expansion (BF5) or cyclone (BF4). The dry BF flue dust is rich in iron and is used directly as a raw material at the sinter plant. This material also contains chlorides, which are thought to have a detrimental impact on sinter plant emissions, so options for washing BF flue dust to remove chlorides are being investigated. The dry de-dusted off gas is further treated in wet scrubbers, giving rise to BF sludge. This is processed in a clarifier, with the thickened sludge being further processed in a dewatering lagoon before being used as a raw material in the sinter plant, with return rates being maximised within the constraints of material chemistry (for example, a limit on the zinc input into the blast furnace).

BOS sludge is de-gritted and clarified. The coarse 'BOS grit' is used as a binder in the production of waste oxide briquettes (WOBs). Excess BOS grit is used as a raw material in the sinter plant. Dry dust from the BOS plant secondary ventilation system is incorporated into WOBs and returned to the vessels.

Materials recovered from defined areas such as ore stockyards are known as ravellings and are returned to the sinter plant. Residue materials from the BOS plant including sweepings are processed in a metal recovery (MR) plant (which is primarily used for BOS vessel slag). The non-metallic fraction is processed in a HAA plant where it is screened, washed and *graded to prepare it for use as an aggregate. In the case of the fine fraction of BOS slag based material, this is increasingly used as a lime substitute at the sinter plant. The metallic fines fraction from BOS debris processing at the MR plant is also returned to the sinter plant.*

Other revert streams include millscale and hot mill sludge and steel scrap. The latter is used in the BOS plant and the former is processed in a barrel washer, with the coarse fraction then being used at the sinter plant.

BAT Achieved.

In addition to techniques described above and in recognition that;
(i) revert generation can sometimes exceed the rate at which reverts can be consumed by the sinter plant and BOS plant,
(ii) process chemistry constraints exist on elements such as zinc, copper, manganese, phosphorus, aluminium and chloride
(iii) research suggests a link between revert chemistry and sinter emissions, which has to be controlled,
Detailed planning is underway to construct and commission a rotary hearth furnace (RHF) at Port Talbot in order to process appropriately 270,000 tonnes of iron-bearing reverts each year from around the company, including BOS and BF sludges.

9. BAT is to maximise external use or recycling for solid residues which cannot be used or recycled according to BAT 8, wherever this is possible and in line with waste regulations. BAT is to manage in a controlled manner residues which can neither be avoided nor recycled.

External use or recycling for solid residues BAT assessment

Due to the nature of the integrated steel works and recyclability of Iron and Steel residues the vast majority of solid residue materials arising at Port Talbot are already "reverted" ie consumed back within the process internally, as described in response to BAT 8.

Solid residues from both blast furnaces and BOS plant are sold into the construction industries as aggregate (some BOS solid residues are also used in the Agricultural industry to improve soil and crop yields). Solid packaging residues (Paper, Plastic and Cardboard) are sold to the packaging industry. Also alloys are sold through site "sundry sales" routes for external uses. Processing of mill solid residues by means of oil removal and treatment enables internal use of the residues in formation of construction material.

Oil & grease contaminated solid residues such as PPE, oil filters and cleaning materials are externally consigned and where practicable the oil and metal elements are recovered.

The very small fraction of residues that have no economic use are disposed of either at the internal landfill or externally. In all cases appropriate measures are taken to ensure that such disposals are properly controlled, for example through the use of transfer/consignment notes.

BAT Achieved

10. BAT is to use the best operational and maintenance practices for the collection, handling, storage and transport of all solid residues and for the hooding of transfer points to avoid emissions to air and water.

Operational and maintenance practices BAT assessment

Solid residues are treated in the same way as raw materials and the response given in respect of BAT 11 applies equally to BAT 10.

BAT not achieved.

The ongoing improvement programmes and capital investments discussed in the response to BAT 11, prioritised to tackle the sources with the greatest impact, will achieve BAT by 2016.

1.5 Diffuse dust emissions from materials storage, handling and transport of raw materials and (intermediate) products

11. BAT is to prevent or reduce diffuse dust emissions from materials storage, handling and transport by using one or a combination of the techniques mentioned below.

If abatement techniques are used, BAT is to optimise the capture efficiency and subsequent cleaning through appropriate techniques mentioned below. Preference is given to the collection of the dust emissions nearest to the source.

I. General techniques include:

- the setting up within the EMS of the steelworks of an associated diffuse dust action plan;
- consideration of temporary cessation of certain operations where they are identified as a source of PM10 causing a high ambient reading; in order to do this, it will be necessary to have sufficient PM10 monitors, with associated wind direction and strength monitoring, to be able to triangulate and identify key sources of fine dust.

General techniques BAT assessment

Tata Steel Port Talbot has an Environmental Management System. Within this system there is an overarching Steelwork's Air Quality Management Plan (AQMP) that is supported by formal objectives and goals (OGSM project management system). This plan includes scheduled improvement projects (in OGSM) and the use of the EMS for routine procedures for diffuse dust control for all works areas and key contractors (Lafarge Tarmac, Harsco and Darlow Lloyd and Sons Ltd).

On-site and off-site PM10 monitoring and weather data are utilised to predict and detect high ambient dust levels to allow for a coordinated plan to prevent diffuse dust lift off before it happens (based on forecasts) and to reduce it when it occurs. Additional dust abatement measures and cessation of activities where appropriate are recorded on shift logs in response to daily email warnings.

Slag pot tipping at the BOS plant operates via a traffic light system whereby pots should only be tipped into the pits on a green light i.e. when the wind direction is away from town and the pot has been left to stand for over 48 hours. There are also procedures for temporary cessation of the burdening stockyard operations if the concentrations at the PM10 monitors in the area are elevated. The daily PM10 communication emails also encourage work's areas and contractors to stop operations (if deemed necessary). For example, when a high PM10 alert is sent operators will review their operations and if emissions are observed operations will stop if possible.

BAT Achieved.

II. Techniques for the prevention of dust releases during the handling and transport of bulk raw materials include:
- orientation of long stockpiles in the direction of the prevailing wind
- installing wind barriers or using natural terrain to provide shelter
- controlling the moisture content of the material delivered
- careful attention to procedures to avoid the unnecessary handling of materials and long unenclosed drops
- adequate containment on conveyors and in hoppers, etc.
- the use of dust-suppressing water sprays, with additives such as latex, where appropriate
- rigorous maintenance standards for equipment
- high standards of housekeeping, in particular the cleaning and damping of roads
- the use of mobile and stationary vacuum cleaning equipment
- dust suppression or dust extraction and the use of a bag filter cleaning plant to abate sources of significant dust generation
- the application of emissions-reduced sweeping cars for carrying out the routine cleaning of hard surfaced roads.

Techniques for the prevention of dust releases during the handling and transport of bulk raw materials BAT assessment

The stockpiles in the primary iron ore stockyards (iron ore pellets and fines) and the fines bed stockpile are orientated in the direction of the prevailing wind. There is elevated terrain between the beach and coal stockyards, which provides some protection from onshore winds.

Operators of the variable boom stackers in the primary iron ore stockyard can adjust the height of the stacker in order to reduce the drop height of the iron ore. All raw materials are transported by a minimal number of conveyors to allocated areas for storage.

Most of the raw materials conveyors are covered with sheeting. Maintenance programs are in place to replace any missing sheeting.

Water sprays are currently used on the three unloaders in operation at the Harbour. Discrete dust suppression units on harbour unloaders No.4 and 5 are also planned. On the sinter screens in both ferrous stockhouses, there is water based suppression system activated when the screens are in use.

When materials are delivered into a building or silo, where practicable, the facility is de-dusted using a bag filter (e.g. lime and other various raw materials delivered to the BOS Plant). The BOS plant has a secondary ventilation system, which includes a bag filter plant to collect dust from within the building. There are fume extraction systems in the No.4 and 5 Blast furnace cast houses. A new ferrous stock house for Blast Furnace No.4 commissioned in February 2013, is fitted with an integrated dust filtration extraction plant.

There is a surfactant based dust suppression system on the sinter conveyors leading to the blast furnace ferrous stockhouses. An extension of this system to cover the inside of the ferrous stockhouses is to be installed by the end of September 2013. There is also a foam suppression system on the sinter re-claim conveyor, which runs from the sinter stockpile to the Blast Furnaces. Dry fog sprays are used to suppress dust on the lime and various material conveyors, which run to the high level bunkers at the BOS Plant.

There are three road standard sweepers and one power brush sweeper that operate on scheduled road routes every day, however they can be deployed to a specific area if requested by plant personnel. The environmental department and the sweeper drivers have developed a sweeper schedule, which ensures that the sweeping frequency of each road is *in-line with the cleaning requirement. Water bowsers are deployed on all stockyard roads when required i.e. during dry weather. There are procedures for the transport of raw materials by dumper truck in order to minimise spillages e.g. loading / unloading of materials, maximum fill levels. In addition, reclaiming of any material spillages is carried out frequently due to the high cost of the materials as well as the environmental benefits associated with removing the material. The speed limit on the stockyard roads is also lower than on other site roads (20 mph).*

BAT Achieved.

III. Techniques for materials delivery, storage and reclamation activities include:

- total enclosure of unloading hoppers in a building equipped with filtered air extraction for dusty materials or the hoppers should be fitted with dust baffles and the unloading grids coupled to a dust extraction and cleaning system
- limiting the drop heights if possible to a maximum of 0.5 m
- the use of water sprays (preferably using recycled water) for dust suppression
- where necessary, the fitting of storage bins with filter units to control dust
- the use of totally enclosed devices for reclamation from bins
- where necessary, the storage of scrap in covered, and hard surfaced areas to
- reduce the risk of ground contamination (using just in time delivery to
- minimise the size of the yard and hence emissions)
- minimisation of the disturbance of stockpiles
- restriction of the height and a controlling of the general shape of stockpiles
- the use of in-building or in-vessel storage, rather than external stockpiles, if
- the scale of storage is appropriate
- the creation of windbreaks by natural terrain, banks of earth or the planting
- of long grass and evergreen trees in open areas to capture and absorb dust
- without suffering long-term harm
- hydro-seeding of waste tips and slag heaps
- implementation of a greening of the site by covering unused areas with top
- soil and planting grass, shrubs and other ground covering vegetation
- the moistening of the surface using durable dust-binding substances
- the covering of the surface with tarpaulins or coating (e.g. latex) stockpiles
- the application of storage with retaining walls to reduce the exposed surface
- when necessary, a measure could be to include impermeable surfaces with concrete and drainage.

Techniques for materials delivery, storage and reclamation activities assessment

Lime is delivered to a large hopper that is contained within a building on three sides and curtains are fitted to the remaining side (delivery area). Within the lime plant, there is fume extraction on the lime bunkers and on the various materials (e.g. dolomet) bunkers.

Bulk handling Samson® surface feeder units have been installed, which feed iron ore pellets onto a conveyor, which then transports the pellets from the iron ore stockyard to the Blast Furnaces (Samson Feeders are designed so material is drawn from the tipping vehicle in a controlled stream and thus any dust generation is significantly reduced minimising environmental pollution).

The majority of drop heights between conveyors and from conveyors to bunkers are 0.5m or below.

In the Reverts stockyard there are fixed water sprays that cover the main blending area. There are water sprays on several conveyors at the Sinter Plant. An automated water spray system has been recently installed in the GCI yard that sprays a fine mist onto the stockyard surface.

Generally, materials move from bins or bunkers onto enclosed conveyors.

Harsco operate the main scrap storage area, which is regulated under a separate permit. However, scrap is delivered by Harsco to a scrap bay outside the south end of the BOS plant. This area is hard surfaced and also covered by a roof. In addition, the scrap delivered is usually used within a day.

The disturbance of stockpiles is generally kept to a minimum because it reduces the risk of spillage or loss of material. Also as previously mentioned, many stockpiles are covered in latex and once treated are not disturbed until the material is reclaimed for use in the process. In addition, all raw materials are reclaimed from one face of the stockpile only, so that disturbance of the stockpile is reduced and maximum latex coverage is maintained.

The shape of each stockpile is controlled by the size of the designated area within the stockyard for the stockpile. There are space restrictions within the stockyard and therefore each material has to be stockpiled in a specific location. The equipment used for stocking or reclaiming material also controls the height and general shape of each stockpile. For example, the Fines bed has maximum length determined by how far and how high the stacker machine can travel. Another example is in the reverts stockyard where there are concrete walls segregating each material which determine the maximum height and shape of the stockpiles.

Storage inside vessels and buildings is not appropriate for the scale of storage required on the site. However, external stockpiling of ferrous materials has been reduced through the construction of a new ferrous stockhouse with a capacity of more than 3000t.

A large grassed embankment with trees along the top is located between the iron ore fines bed stockyard and the town. The embankment covers almost the entire length of the stockyard.

A vegetation windbreak is located at the northeastern boundary of the site, which acts as a barrier between the site's ironmaking processes and its residential neighbours. The windbreak consists of a 400m long x 5m wide x 1.5m high earth mound planted with around 400 silver birch trees. An Urban Tree Air Quality Score (UTAQS) has been developed to rank trees in order of their potential to improve air quality. Silver birch has the highest UTAQ score or the greatest potential to improve air quality and is understood to be most efficient in capturing dust. Therefore, the most recent site greening activities have included the planting of silver birch trees.

A site greening plan was developed in October 2010 and since then many areas of the site have been grassed and trees have been planted in these grassed areas. The majority of trees planted are silver birch because these trees have the highest Urban Tree Air Quality (UTAQ) score or the greatest potential to improve air quality and are understood to be most efficient in capturing dust.

There has been extensive greening along the northern boundary of the site on previously Tata Steel owned land purchased for the construction of a Periphery Distribution Road (PDR). The greening includes grassed areas with rows of small trees on either side of the road and surrounding roundabouts. In total, over 1000 trees will be planted along the new road.

Materials are moistened with dust-binding substances during transport on conveyors rather than during storage.

Iron ore and coal stockpiles are sprayed with latex on arrival to the allocated storage area. The materials are then sprayed periodically and the frequency of spraying depends on the 'dustiness' of the material. There also are water sprays on the 200t bunker in the stockyard which transfers fine materials to the fines bed. In the BOS plant there are fog sprays on the raw materials conveyors, which deliver materials such as lime and dolomet to the high level bunkers above the BOS converter.

The reverts stockyard has recently been upgraded to include concrete walls segregating each material. Areas within the reverts stockyard such as roads; working areas and stocking bays have been concreted as part of the recent upgrades to the area. A small area of the iron ore stockyard has been hard surfaced and there are plans in place to concrete the entire stockyard.

BAT Achieved.

IV. Where fuel and raw materials are delivered by sea and dust releases could be significant some techniques include:

- Use by operators of self-discharge vessels or enclosed continuous unloaders. Otherwise, dust generated by grab-type ship unloaders should be minimised through a combination of ensuring adequate moisture content of the material is delivered, by minimising drop heights and by using water sprays or fine water fogs at the mouth of the ship unloader hopper
- Avoiding seawater in spraying ores or fluxes as this results in a fouling of sinter plant electrostatic precipitators with sodium chloride. Additional chlorine input in the raw materials may also lead to rising emissions (e.g. of polychlorinated benzodioxins / furans (PCDD/F)) and hamper filter dust recirculation)
- Storage of powdered carbon, lime and calcium carbide in sealed silos and conveying them pneumatically or storing and transferring them in sealed bags

Fuel and raw materials are delivered by sea BAT assessment

There are procedures in place to minimise the drop height of the material being unloaded and a plume index is used to control any emissions from the grab unloaders. The plume index is used by the unloader operators to decide whether any actions are required to reduce emissions. A score of 0 (no emissions) to 4 (heavy emissions) is recorded and if the score is 2 or above then water dust suppression sprays are applied around the unloader hopper. Operations are stopped if a score of 4 is recorded. A surfactant based dust suppression is currently being installed on the ship discharge conveyor (no. 801) on which all incoming materials are transported on.

Seawater is not used in the spraying of any materials used in the sinter plant.

The powdered carbon used in the lignite injection system at the Sinter plant is stored in silos and is transported to the Electrostatic Precipitator via the waste gas wind main pipe. Powdered lime used in the BOS Plant de-sulphurisation process is stored in a silo and transferred in sealed bags to the desulphurization unit.

BAT Achieved.

V. Train or truck unloading techniques include:
- if necessary due to dust emission formation, use of dedicated unloading equipment with a generally enclosed design.

Train or truck unloading techniques BAT assessment

Coal delivered to the coal handling area by train and discharged into hoppers below the rail tracks. The coal is then transported onto a conveyor to the coke oven or Granulated Coal Injection (GCI) stockyard.

BAT Achieved.

VI. For highly drift-sensitive materials which may lead to significant dust release, some techniques include:
- use of transfer points, vibrating screens, crushers, hoppers and the like, which may be totally enclosed and extracted to a bag filter plant use of central or local vacuum cleaning systems rather than washing down for the removal of spillage, since the effects are restricted to one medium and the recycling of spilt material is simplified.

Highly drift-sensitive materials BAT assessment

Various transfer points, vibrating screens, crushers and hoppers are in use and these vary in the methods for dust control. Bag filter extraction is only used in process areas where a requirement was identified during planning of construction. The sinter grading system uses extraction to the de-dust ESP. Enclosing the process and, where necessary, wetting / foam suppressant is the primary control for most transfer systems.

Plant areas have cleaning teams that prioritise removal by either returning to the process or vacuum. Bag filter plants and material transfer areas as (described in point VI) are serviced by mobile/semi mobile vacuum cleaning systems, which couple-up with existing vacuum hose/bagging on plant to remove highly drift-sensitive materials and return it to the process. Washing down spilt material is avoided due to issues created with recycling materials.

BAT Achieved.

VII. Techniques for the handling and processing of slags include:
- keeping stockpiles of slag granulate damp for slag handling and processing since dried blast furnace slag and steel slags can give rise to dust
- use of enclosed slag-crushing equipment fitted with efficient extraction of dust emissions and bag filters.

Techniques for the handling and processing of slags BAT assessment

Blast furnace slag and steel slag is handled, stored and processed on areas of the site managed by Lafarge Tarmac and Harsco Metals. Therefore, these operations are regulated under separate permits.

BAT not applicable.

VIII. Techniques for handling scrap include:

- providing scrap storage under cover and/or on concrete floors to minimise dust lift-off caused by vehicle movements

Techniques for handling scrap BAT assessment

Harsco Metals operate the main scrap storage area, which is regulated under a separate permit. However, scrap is delivered by Harsco to a scrap bay outside the south end of the BOS plant. This area is hard surfaced and also covered by a roof.

BAT Achieved.

IX. Techniques to consider during material transport include:

- the minimisation of points of access from public highways
- the employment of wheel-cleaning equipment to prevent the carryover of mud and dust onto public roads
- the application of hard surfaces to the transport roads by concrete or asphalt to minimise the generation of dust clouds during materials transport and the cleaning of roads
- the restriction of vehicles to designated routes by fences, ditches or banks of recycled slag
- the damping of dusty routes by water sprays, e.g. at slag-handling operations
- ensuring that transport vehicles are not overfull, so as to prevent any spillage
- ensuring that transport vehicles are sheeted to cover the material carried
- the minimisation of numbers of transfers
- use of closed or enclosed conveyors
- use of tubular conveyors, where possible, to minimise material losses by changes of direction across sites usually provided by the discharge of materials from one belt onto another
- good practice techniques for molten metal transfer and ladle handling dedusting of conveyor transfer points.

Material transport techniques Bat assessment

A wheel-wash is in operation at the reverts stockyard which is used by all lorries entering or leaving the stockyard. Two wheel-washes are being constructed at the entrances to the iron ore stockyards and are almost ready to be commissioned.

The ironmaking in-haul road, which is the main dumper truck route from the stockyards to the Blast Furnaces, is currently upgraded with a heavy-duty tarmac, curb stones and drainage.

There is a ditch that runs the entire length of the iron ore pellet stockyard.

An automated water spray system is currently being installed which consists of a number of water sprays that will spray a fine mist onto the upgraded road surface reducing dust lift-off.

The majority of vehicle movements are carried out by contractors and there are procedures for the filling of vehicles. If spillages are observed then it is recorded on a database or in a Supplier Improvement Request form (for contractors) and investigated further to determine how and why it happened.

There has been a 40,000 mile reduction in on-site lorry haulage through the installation of a new 800m ferrous material conveyor running from the iron ore pellets stockyard to the Blast

Furnaces. The reverts yard improvement scheme delivered a reduction in material movements.

Most of the conveyors on site are covered with sheeting. Maintenance programs are in place to replace any missing sheeting.

BOS Plant procedures ensure that molten metal poured into the BOS converter is controlled and the pour from start to finish should be no less than 90 seconds. This is to prevent thermal damage to the bagging plants and to control the volume of emissions from the pour via the secondary venting system.

BAT Achieved

In total, the measures described above are considered to a large extent to achieve BAT for the prevention or reduction of diffuse dust emissions from materials storage, handling and transport at Port Talbot. It is however, recognised that further improvements will always be possible. Areas where the risk of dust generation remains relatively high are being assessed as part of the overall Air Quality Management Plan and identified within high-level Objectives Goals and Strategy Management (OGSM). Additional measures to further prevent and reduce diffuse dust emissions are being prioritised based on reduction impact on an annual basis.

BAT Not Achieved

The ongoing improvement programmes and capital investments, prioritised to tackle the sources with the greatest impact in consultation with the NRW as appropriate, will achieve BAT by 2016.

1.6 Water and waste water management

12. BAT for waste water management includes prevention, collection and separation of the waste water types, maximising internal recycling and using an adequate treatment for each final flow. This includes techniques utilising, e.g. oil interceptors, filtration or sedimentation. In this context, the following techniques can be used where the prerequisites mentioned are present:

- avoiding the use of potable water for production lines
- increasing the number and/or capacity of water circulating systems when building new plants or modernising/revamping existing plants
- centralising the distribution of incoming fresh water
- using the water in cascades until single parameters reach their legal or technical limits
- using the water in other plants if only single parameters of the water are affected and further usage is possible
- keeping treated and untreated waste water separated; by this measure it is possible to dispose of waste water in different ways at a reasonable cost
- using rainwater whenever possible.

Applicability
The water management in an integrated steelworks will primarily be constrained by the availability and quality of fresh water and local legal requirements.

Waste Water Management BAT assessment

At Port Talbot potable water is not used for production lines and only used for human uses such as in mess rooms for drinking, washrooms, canteens etc.

The rebuild of blast furnace no. 4 (2013) is an example of an increase in number and capacity of water circulating systems when building new plants or modernising/revamping existing plant. Also when you consider the continuous casters the earliest caster No.1 gives rise to an effluent, where as the newer casters 2 and 3 do not have effluents.

The site has a large incoming freshwater reservoir for centralising distribution of incoming fresh water.

Wherever practicable water is used in processes with preference for the water quality to meet the needs of the operation for which the water is used. Cascading water quality to the use of the applications (e.g. examples of this are the use of mill process water for BOS plant and MR plant cooling). There is frequent internal monitoring of water/effluent quality against various parameters such as suspended solids and pH in order to reuse in applications such as cooling, scrubbing and abatement systems. Wherever possible treated and untreated wastewater is kept separated by means of separate pipe work, tanks and overflows from Clarifiers. Rainwater is the main source of fresh water within the Port Talbot site.

In total, the measures described above are considered to realise BAT, but it is recognised that further improvements may be possible. Studies are currently in progress within Tata Steel to investigate the use of methodologies based on process integration to identify further opportunities for water reuse in other processes, and to investigate more extensive use of rainwater harvesting.

BAT achieved.

1.7 Monitoring

13. BAT is to measure or assess all relevant parameters necessary to steer the processes from control rooms by means of modern computer-based systems in order to adjust continuously and to optimise the processes online, to ensure stable and smooth processing, thus increasing energy efficiency and maximising the yield and improving maintenance practices.

Computer Based monitoring systems BAT assessment

All major processes are controlled by means of computer-based systems to ensure safe operation and to achieve the most efficient overall steel production, taking into account the integrated nature of Port Talbot steelworks, the dependence of each process on the preceding processes and market demand for steel products.

BAT achieved.

14. BAT is to measure the stack emissions of pollutants from the main emission sources from all processes included in the specific BAT Sections 2 – 7 whenever BAT-AELs are given and in process gas-fired power plants in iron and steel works.
BAT is to use continuous measurements at least for:

- primary emissions of dust, nitrogen oxides (NOX) and sulphur oxides (SOX)
- from sinter strands
- nitrogen oxides (NOX) and sulphur oxides (SOX) emissions from induration
- strands of pelletisation plants
- dust emissions from blast furnace cast houses
- secondary emissions of dust from basic oxygen furnaces
- emissions of nitrogen oxides (NOX) from power plants
- dust emissions from large electric arc furnaces.

For other emissions, BAT is to consider using continuous emission monitoring depending on the mass flow and emission characteristics.

Continuous Monitoring BAT assessment

Continuous measurements are undertaken of the following stack emissions:

Description	BAT	Dust	NO_x	SO_2	Comments
Sinter plant primary emissions (A1)	20, 22 & 23	☐	☐	☐	**BAT achieved**
Sinter plant secondary emissions (A2)	26	☐			**Beyond BAT**
Induration strands of pelletisation plants	33 & 34	NA*	NA*	NA*	**No pelletisation plant at Port Talbot**
Blast furnace cast houses (A8A, A8B, A9)	61	☐			**BAT achieved**
BOS plant secondary emissions (A10, A10A, A14, A15, A16, A63)	78	☐			**BAT achieved**
Power plants (A50, A52A, A52B, A62)		☐	☐	☐	**BAT achieved**
Power plants (A51, A53)		☐			**BAT not achieved**
Electric arc furnaces		NA*	NA*	NA*	**No electric arc furnace at Port Talbot**

* NA – these BAT requirements are not applicable at Port Talbot as the relevant processes are not operated on the site.

Unshaded cells with bold borders represent situations where the use of continuous measurements is BAT; shaded cells represent emissions where the use of continuous measurements is not BAT, but in some cases the emission characteristics are such that additional continuous measurements have been implemented.

BAT not achieved.

BAT almost achieved, except for NOx monitoring at A51 and A53, where the feasibility of implementing continuous NOx monitoring will be investigated for full achievement by 2016.

15. For relevant emission sources not mentioned in BAT 14, BAT is to measure the emissions of pollutants from all processes included in the specific BAT Sections 2 – 7 and from process gas-fired power plants within iron and steel works as well as all relevant process gas components/pollutants periodically and discontinuously. This includes the monitoring of process gases, discontinuous monitoring of stack emissions, monitoring of polychlorinated dibenzodioxins/furans (PCDD/F) and monitoring the discharge of waste water.

Periodic Monitoring BAT assessment

1.7.1 Process gases

The composition of blast furnace gas, coke oven gas and BOS gas is measured using continuous monitoring devices.

1.7.2 Process emissions

In addition to the continuous monitoring described under BAT 14, the following measurements are undertaken periodically for other stack emissions where BAT-AELs are given:

Description	BAT	Species	Frequency
Sinter plant primary emissions (A1)	21	Mercury	2006
	25	Dioxins	6 months
Pelletisation plants	33, 34	Dust, HF, HCl	No pelletisation plant
Coal grinding	42	Dust	No relevant emission point
Pulverised coal storage	43	Dust	No relevant emission point
Land-based extraction of gases from coke oven charging	44	Dust	Not used at Port Talbot
Coke oven underfiring (A55)	49	SO_2, dust, NO_x	6 months (SO_2 & NO_x) 12 months (dust)
Minister-Stein (A56)	50	Dust	3 months
Coke grading and handling	52	Dust	No relevant emission point
Coal injection storage bunkers	59	Dust	Annually
Blast furnace stoves (A6, A7)	65	SO_2, dust, NO_x	3 months (SO_2 & NO_x) 12 months (dust)
BOS plant primary emissions – full combustion	76	Dust	Suppressed combustion used (as per BAT 75)
Slag crushing and screening	79	Dust	Not operated by Tata Steel
Electric arc furnaces	88, 89 & 90	Dust, mercury, dioxins	No electric arc furnace

Although mercury is not routinely measured in the sinter plant primary emissions at Port Talbot, a monitoring exercise in 2006 demonstrated that emissions were less than half the BAT-AEL. Furthermore, mercury emissions are routinely measured at Scunthorpe sinter plant, which uses largely the same raw materials, and concentrations are consistently less than half the BAT-AEL. On this basis, no additional monitoring at Port Talbot is deemed necessary.

BAT achieved.

1.7.3 Wastewater

Effluents from the various processes across the Port Talbot site are generally combined and are discharged to sea via a common discharge system. Spot samples are taken from all the permitted discharge points as specified in the current permit, but it has been identified that the prescribed sampling does not cover all the pollutants for which BAT-AELs are given as the BREF document assumes individual discharges. Current available information does not allow a robust evaluation on how to implement the BAT-AELs at this stage. Tata Steel met with the Environment Agency & NRW on 1st August 2013 to discuss future monitoring requirements, which will be implemented once formalised. An improvement programme is to be implemented to best evaluate how the BAT-AE's can be implemented at the Port Talbot site. In the meantime, derogation is required on precautionary grounds because it is too early to know whether the agreed approach to effluent treatment and permitting will allow Tata Steel to be compliant with all BAT-AELs by March 2016.

BAT not achieved.

1.7.4 Process Gasses

Dust levels in process gases will not be routinely monitored due to safety concerns, but where possible will be inferred from the dust concentrations in the waste gas from combustion of the gases, as detailed, for example, in the response to BAT No. 64.

It is planned to install additional sampling ports or equipment so that all stack emissions where BAT-AELs are given will be monitored by 2016.

The improvements listed above will ensure that BAT is achieved by 2016.

16. BAT is to determine the order of magnitude of diffuse emissions from relevant sources by the measurement methods mentioned below. Whenever possible, direct measurement methods are preferred over indirect methods and evaluations based on calculations with emission factors.

- Direct measurement methods where the emissions are measured at the source itself. In this case, concentration and mass streams can be measured or determined.
- Indirect measurement methods where the emission determination takes place at a certain distance from the source; a direct measurement of mass stream and concentration is not possible.
- Calculation with emission factors.

Description

Direct or quasi-direct measurement

Examples for direct measurements are measurements in wind tunnels, with hoods or other methods like quasi-emissions measurements on the roof of an industrial installation. For the latter case, the wind velocity and the area of the roofline vent are measured and a flow rate is calculated. The cross-section of the measurement plane of the roofline vent is subdivided into sectors of identical surface area (grid measurement).

Indirect measurements

Examples of indirect measurements include the use of tracer gases, reverse dispersion modelling (RDM) methods and the mass balance method applying light detection and ranging (LIDAR).

Calculation of emissions with emission factors

Guidelines using emission factors for the estimation of diffuse dust emissions from storage and handling of bulk materials and for the suspension of dust from roadways due to traffic movements are:

- VDI 3790 Part 3
- US EPA AP 42

Diffuse Emissions BAT assessment

The estimation of diffuse dust emissions from the Port Talbot site is an ongoing area of work being undertaken by Tata Steel and guided by the multi-partner Data Team, lead by the Welsh Government.

Direct emission measurements have been undertaken of fugitive releases from roof vents on No.5 blast furnace casthouse and the BOS plant. Such emissions can be very variable, but the measurement exercises were undertaken over a period of several days in each case to try to obtain representative results and are sufficient for an order of magnitude determination. Direct emission measurements have also been undertaken of releases from the sinter cooler.

Dust emissions from the main stockyard areas (ore and coal) and wharf operations have been estimated indirectly using reverse dispersion modelling techniques. Ambient dust levels were monitored for at least three months around each area to ensure a wide range of conditions were encountered to try to obtain representative estimates.

Emissions from roof vents on No.4 blast furnace casthouse (before the recent reline) have been estimated using the emission factors calculated for No.5 blast furnace. Dust emissions from coke oven operations have been estimated using emission factors derived from work undertaken elsewhere in Tata Steel.

All of the above emission estimates were included in an initial emission inventory that has been published and peer reviewed. Further work to refine the inventory is ongoing.

Emissions from other diffuse sources have not yet been estimated, but emission factors from US EPA AP 42 will be used to assess emissions from roads and slag handling operations for the next review of the dust emissions inventory. In addition, emission factors from work undertaken elsewhere in Tata Steel will be used to assess emissions from conveyors and the Hot Mill roof vents. Additional sources may also be included in the updated inventory report.

BAT Not Achieved.

Studies are already planned to improve the diffuse emissions inventory and the forthcoming review will substantially achieve this BAT. Dispersion modelling, based on the revised inventory, will be used to test whether the impacts of the emissions included match the dust concentrations measured in the environment, and a judgement will then be made whether additional sources also need to be quantified, or whether the remaining unquantified emissions have a sufficiently small impact that they can be neglected.

BAT to be achieved by 2016.

1.8 Decommissioning

17. BAT is to prevent pollution upon decommissioning by using necessary techniques as listed below.

Design considerations for end-of-life plant decommissioning:

I. giving consideration to the environmental impact from the eventual decommissioning of the installation at the stage of designing a new plant, as forethought makes decommissioning easier, cleaner and cheaper
II. decommissioning poses environmental risks for the contamination of land (and groundwater) and generates large quantities of solid waste; preventive techniques are process-specific but general considerations may include:
    i. avoiding underground structures
    ii. incorporating features that facilitate dismantling
    iii. choosing surface finishes that are easily decontaminated
    iv. using an equipment configuration that minimises trapped chemicals and facilitates drain-down or cleaning
    v. designing flexible, self-contained units that enable phased closure
    vi. using biodegradable and recyclable materials where possible.

Decommissioning BAT assessment

The design and construction of the majority of plant and equipment employed in the production of iron and steel in the UK was undertaken before the implementation of modern environmental and health & safety legislation. The Construction (Design and Management) Regulations 1994 (CDM), now require decommissioning aspects to be taken into consideration at the design stage of a project. For new Tata Steel plant and equipment, these BAT requirements will be taken into consideration at the design and build stage, wherever applicable and/or possible.

BAT techniques above have been employed in the design and procurement of materials and plant for recent projects such as the BOS OG Heat Recovery project and BF4 rebuild project. The majority of a Blast furnaces structure is made from steel. All of the recyclable steel from the demolition of BF4 was recycled back into the production of Steel at the site BOS plant.

Tata Steel site closures are planned as and when required. It is not the Company's policy to formulate site closure plans prior to the actual announcement of closure. In the majority of instances, the specific environmental implications of iron and steelmaking activities cannot categorically be established until comprehensive site investigations have been undertaken and contamination, or the lack of, determined. Rather than develop a "closure plan", which would in all likelihood be subject to major change at the actual time of closure, Tata Steel have reached the conclusion that it would be both more effective and practical to develop a "site closure environmental toolkit" to be used by all employees involved in closure activities. The environmental implications of closure activities have been assessed and guidance to prevent or minimise their impact prepared and published. The "site closure environmental toolkit" comprises both the site health & safety and environmental issues addressed within the overall remit of the Construction (Design and Management) Regulations 1994 (CDM), and the specific environmental issues addressed by Company environmental, health & safety specifications and guidance notes.

1.9 Noise

18. BAT is to reduce noise emissions from relevant sources in the iron and steel manufacturing processes by using one or more of the following techniques depending on and according to local conditions:

- implementation of a noise-reduction strategy
- enclosure of the noisy operations/units
- vibration insulation of operations/units
- internal and external lining made of impact-absorbent material
- soundproofing buildings to shelter any noisy operations involving material transformation equipment
- building noise protection walls, e.g. the construction of buildings or natural barriers, such as growing trees and bushes between the protected area and the noisy activity
- outlet silencers to exhaust stacks
- lagging ducts and final blowers which are situated in soundproof buildings
- closing doors and windows of covered areas.

Noise BAT assessment

Noise from process operations is largely controlled by enclosure within buildings and the implementation of procedures to ensure that doors are opened only when necessary so that the noise is contained as much as possible. Some of the buildings incorporate sound-proofing materials to attenuate the noise further. Fans situated outside the main buildings generally also have acoustic cladding to minimise noise.

Where potentially noisy operations are undertaken outside buildings, use is made of existing buildings and/or purpose-built barriers to provide some attenuation of noise – for instance for the slag breaking operations to the south of the BOS plant. Bunds built across the site, principally to reduce diffuse dust emissions (see BAT 11) will also attenuate noise from areas such as stockyards.

Outlet silencers are installed on the sinter plant main fans, casthouse extraction fans and BOS secondary extraction fans amongst others. Silencers are also installed on the air intakes for the sinter cooler fans.

During the rebuild of BF4 new stoves combustion air fans, pressure equalizing systems and pressure relief points fitted with 9 noise attenuating silencers to ensure <85dB(A) at 1 metre.

Generally with the works if an workplace exposure limit (WEL) of 85dB(A) TWA @ 1 metre is likely to be exceeded as a result of changes to plant through these projects then relevant noise attenuation will be put in place to ensure exposures below the WEL.

Tata Steel has operated a "Buy Quiet" policy since 1980 (Corporate standard CES27) to ensure that noise levels are taken into consideration whenever buying new equipment.

Complaints of noise from the local community are recorded and investigated to try to identify the source of the noise, if noise is attributed to an onsite source then action is taken to rectify the issue (e.g. Sinter Main Droning Noise).

BAT achieved.

1.10 General Requirements BAT Assessment Summary

Area	BAT Conclusion	Achieved?	Comments
Environmental Management Systems	1 - Implement & Adhere to EMS	Yes	-
Energy Management	2 - Reduce Thermal Energy Consumption	Yes	-
	3 - Reduce Primary Energy Consumption	Yes	-
	4 - Use Dedusted COG, BF and BOS Gas	Yes	-
	5 - Minimise electrical consumption	Yes	-
Material Management	6 - Optimise Management and Control of Internal Material Flows	Yes	-
	7 - Appropriate Selection of Scrap	Yes	-
	8 – Management of Process Residues	Yes	-
	9 – Maximise external use or recycling of residues where not used internally	Yes	-
	10. – Transportation of Raw Materials	No	The ongoing improvement programmes and capital investments discussed in the response to BAT 11, prioritised to tackle the sources with the greatest impact, will achieve BAT by 2016
Diffuse Dust Emissions	11 – Prevention of Dust Emissions from Material Storage	No	The ongoing improvement programmes and capital investments, prioritised to tackle the sources with the greatest impact in consultation with the NRW as appropriate, will achieve BAT by 2016.
Water	12 - Water & Waste Water Management	Yes	-
Monitoring	13 - Computer Based Monitoring System	Yes	-
	14 – Continuous Monitoring	No	BAT almost achieved, except for NOx monitoring at A51 and A53, where the feasibility of implementing continuous NOx monitoring will be investigated for full achievement by 2016.

General Requirements BAT Assessment Summary continued

Area	BAT Conclusion	Achieved?	Comments
Monitoring	15 – Periodic Monitoring	No	Spot samples are taken from all the permitted discharge points as specified in the current permit, but it has been identified that the prescribed sampling does not cover all the pollutants for which BAT-AELs are given. Dust levels in process gases will not be routinely monitored due to safety concerns, but where possible will be inferred from the dust concentrations in the waste gas from combustion of the gases, as detailed, for example, in the response to BAT 64. It is planned to install additional sampling ports or equipment so that all stack emissions where BAT-AELs are given will be monitored by 2016. Tata Steel will change the procedures for sampling and analysis of wastewater discharges to ensure compliance with this BAT condition.
	16 – Diffuse Emissions Monitoring	No	Studies are already planned to improve the diffuse emissions inventory and the forthcoming review will substantially achieve this BAT. Dispersion modelling, based on the revised inventory, will be used to test whether the impacts of the emissions included match the dust concentrations measured in the environment, and a judgement will then be made whether additional sources also need to be quantified, or whether the remaining unquantified emissions have a sufficiently small impact that they can be neglected.
Decommissioning	17 – Decommissioning	Yes	-
Noise	18 - Noise	Yes	-

2. BAT CONCLUSIONS FOR SINTER PLANTS

2.1 BAT for Blending/Mixing

19. BAT for blending/mixing is to prevent or reduce diffuse dust emissions by agglomerating fine materials by adjusting the moisture content (see also BAT11)

Blending/Mixing BAT assessment

A controlled amount of water is added at the mixing drum to achieve the required moisture content of the raw sinter blend, and as such, there will not be an adverse effect on downstream dust emissions.

BAT achieved.

2.2 BAT for Primary Emissions

2.2.1 BAT for Primary Emissions (Dust)

20. BAT for primary emissions from sinter plants is to reduce dust emissions from the sinter strand waste gas by means of a bag filter.

BAT for primary emissions for existing plants is to reduce dust emissions from the sinter strand waste gas by using advanced electrostatic precipitators when bag filters are not applicable.

The **BAT-associated emission level** for dust is <1 – 15 mg/Nm^3 for the bag filter and <20 – 40 mg/Nm^3 for the advanced electrostatic precipitator (which should be designed and operated to achieve these values), both determined as a daily mean value.

<u>Bag Filter</u>

Description

Bag filters used in sinter plants are usually applied downstream of an existing electrostatic precipitator or cyclone but can also be operated as a standalone device.

Applicability

For existing plants requirements such as space for a downstream installation to the electrostatic precipitator can be relevant. Special regard should be given to the age and the performance of the existing electrostatic precipitator.

Advanced electrostatic precipitator

Description

Advanced electrostatic precipitators are characterised by one or a combination of the following features:

- good process control
- additional electrical fields
- adapted strength of the electric field
- adapted moisture content
- conditioning with additives
- higher or variably pulsed voltages
- rapid reaction voltage
    - high energy pulse superimposition
    - moving electrodes
    - enlarging the electrode plate distance or other features which improves the abatement efficiency.

Primary Emissions BAT assessment

Port Talbot Sinter Plant is fitted with advanced electrostatic precipitators (ESPs). Emission concentrations (2011) were in the range 23 mg/Nm^3 to 85 mg/Nm^3, with an average of 47 mg/Nm^3.

Port Talbot Sinter Plant is fitted with advanced electrostatic precipitators (ESPs) that are state-of-the-art and were designed, built and commissioned in 2005. These advanced electrostatic precipitators are applicable to the de-dusting of primary emissions from the sinter plant because they are characterised by advanced features that include good process control, additional electrical fields, adapted strength of the electric field, adapted moisture content, conditioning with additives, higher and variably pulsed voltages, rapid reaction voltage, and high energy pulse superimposition. Bag filters are not applicable because the plant is fitted with advanced electrostatic precipitators and there are space restrictions upon further downstream installations to the advanced electrostatic precipitators.

Furthermore, installation of bag filters would be disproportionately costly compared to the environmental benefit. Based on the costs of installing bag filters at Tata Steel's IJmuiden plant, where the waste gas flow is lower than that at Port Talbot, it is estimated that the capital cost of such a scheme would be over £60M at Port Talbot sinter plant. The existing precipitators would still be used as an initial dedusting stage before the bag filters, though some planned improvement works would not be required, resulting in a small saving in the costs of upgrading the ESPs – the net capital cost would be around £60M. No data on operating costs is available from IJmuiden as the system there is not yet fully operational. The BREF (Tables 3.21 and 3.22) gives some indicative operating costs - €1.6-1.8 per tonne sinter at voestalpine, Donawitz and €3.32 per tonne at DK Recycling, Duisberg. The detailed derivation of these costs is not included in the BREF, but they may include some depreciation costs, so as a conservative estimate an operating cost of £1/tonne sinter (in addition to the existing abatement costs of the advanced electrostatic precipitators) has been assumed:

- *Total capital cost = £60M*
- *Annualised cost of capital = £6.3M (for a 25 year life and a cost of capital of 9.4%)*
- *Annual graded sinter production = 4.4M tonnes (Annual plan target for FY13/14)*
- *Annual operating costs = £4.4M*
- *Annual maintenance costs = £2.4M (assumed 4% of capital cost)*
- *Total equivalent annual cost = £13.1M*

Assuming that the mean dust concentration after upgrading the current advanced ESPs would be 30 mg/Nm³ (in order to ensure that the daily mean is consistently below 40 mg/Nm³), and that the mean dust concentration after bag filters would be 10 mg/Nm³ (allowing for periods when the bag filter is unavailable), the reduction in annual dust emissions attributable to installation of a bag filter would be 222 tonnes (assuming a waste gas flow of 395 Nm³/s and 89% operational factor in 2012). The equivalent abatement cost is therefore £13,100,000/221.73 = £59,080 per tonne dust abated.

BAT not achieved.

BAT will be achieved by 2016 through these measures:

- *Tata Steel has established a Sinter Plant IED project in the UK to achieve the BAT AELs by 2016 based on the control of chlorides in the raw sinter blend, the injection of adsorbent (activated lignite) into the waste gas stream, and refining the operation of the advanced ESPs.*
- *Extensive studies in 2010 – 2011 by Tata Steel showed that the management of chloride content and reverts in the raw sinter blend gave a typical reduction of 39% in particulate emissions, implying that the introduction of appropriate measures would have a significant impact on sinter plant particulate emissions.*
- *Studies at other sites, for example at ArcelorMittal Eisenhűttenstadt, have shown that the control of chlorides in the blend can reduce emissions by 50%.*
- *A CAPEX plan has been submitted for approval to enable engineering improvements to the advanced ESPS to reduce air in-leakage, thereby reducing particulate emissions and improving plant safety to enable the use of lignite injection.*
- *Studies will be undertaken to benchmark the current performance of the advanced ESPs and seek improvements where needed.*

2.2.2 BAT for Primary Emissions (Hg)

21. BAT for primary emissions from sinter strands is to prevent or reduce mercury emissions by selecting raw materials with a low mercury content (see BAT 7), or to treat waste gases in combination with activated carbon or activated lignite coke injection.

The **BAT-associated emissions level** for mercury is <0.03 – 0.05 mg/Nm^3, as the average over the sampling period (spot measurement, for at least half an hour).

Primary Emissions (Hg) BAT assessment

The emission concentrations at Port Talbot Sinter Plant were in the range 0.012 to 0.018 mg/Nm3 (2006), below the BAT-associated emission level for mercury.

BAT achieved.

2.2.3 BAT for Primary Emissions (SOx)

22. BAT for primary emissions from sinter strands is to reduce sulphur oxide (SOx) emissions by using one or a combination of the following techniques: waste gas by using advanced electrostatic precipitators when bag filters are not applicable.

I. lowering the sulphur input by using coke breeze with a low sulphur content
II. lowering the sulphur input by minimisation of coke breeze consumption
III. lowering the sulphur input by using iron ore with a low sulphur content
IV. injection of adequate adsorption agents into the waste gas duct of the sinter strand before dedusting by bag filter (see BAT 20)

The **BAT- associated emission level** for sulphur oxides (SOX) is <350 – 500 mg/Nm3, expressed as sulphur dioxide (SO2) and determined as a daily mean value, the lower value being associated with BAT IV.

Primary Emissions (SO_x) BAT Assessment

The sulphur content of coal charged into the coke ovens is carefully monitored and controlled. Sinter plant fuel rates are carefully controlled (including that of coke breeze consumption), which serves to limit sulphur loading into the plant and the associated SO_2 emissions. Typical emission values of SO_2 (2009 – 2011) have been in the range of 132 mg/Nm^3 to 428.9 mg/Nm^3, with an average SO_2 emission of 336.7 mg/Nm^3, thereby meeting the BAT AEL. Thus BAT will be achieved by 2016.

BAT achieved.

2.2.4 BAT for Primary Emissions (NOx)

23. BAT for primary emissions from sinter strands is to reduce total nitrogen oxides (NOx) emissions by using one or a combination of the following techniques:
process integrated measures which can include:
i. waste gas recirculation
ii. other primary measures, such as the use of anthracite or the use of low-NOX burners for ignition

The **BAT-associated emission level** for nitrogen oxides (NOX) using process integrated measures is <500 mg/Nm3, expressed as nitrogen dioxide (NO2) and determined as a daily mean value

Primary Emissions (NO_x) BAT Assessment

The principle measures employed to control NOx emissions include the use of anthracite as an alternative to coke breeze, and low-NOx burner technology installed in the ignition hood. The emission values of NOx (2009 – 2011) were in the range 155.8 mg/Nm^3 - 288.1 mg/Nm^3 with an average of 224.6 mg/Nm^3, thereby meeting the BAT AEL. Therefore further measures such as waste gas recirculation are not required.

BAT achieved.

2.2.5 BAT for Primary Emissions (PCDD/F & PCB's)

24. BAT for primary emissions from sinter strands is to prevent and / or reduce emissions of polychlorinated di-benzo dioxins / furans (PCDD/F) and polychlorinated biphenyls (PCB) by using one or a combination of the following techniques:

I. avoidance of raw materials which contain polychlorinated di-benzo dioxins/furans (PCDD/F) and polychlorinated biphenyls (PCB) or their precursors as much as possible (see BAT 7)
II. suppression of polychlorinated di-benzo dioxins / furans (PCDD/F) formation by addition of nitrogen compounds
III. using waste gas recirculation (see BAT 23)

Primary Emissions (PCDD/F & PCBs) BAT assessment

Studies have shown that raw materials contain very little PCDD/Fs or PCBs so these inputs are limited to naturally occurring amounts and therefore significant inputs are avoided. Urea addition is used in the Port Talbot Sinter Plant to suppress the formation of PCDD/Fs. Waste gas recirculation is not utilised at Port Talbot or UK sinter plants.

BAT achieved.

2.2.6 BAT for Primary Emissions using Adsorption Agents (PCDD/F & PCB's)

25. BAT for primary emissions from sinter strands is to reduce emissions of polychlorinated di-benzo dioxins / furans (PCDD/F) and polychlorinated biphenyls (PCB) by using injection of adequate adsorption agents into the waste gas duct of the sinter strand before de-dusting with a bag filter or advanced electrostatic precipitators when bag filters are not applicable (see BAT 20).

The **BAT - associated emissions level** for polychlorinated di-benzo dioxins / furans (PCDD/F) is <0.05 – 0.2 ng I-TEQ/Nm^3 for the bag filter and <0.2 – 0.4 ng-ITEQ/ Nm^3 for the advanced electrostatic precipitator, both determined for a 6 – 8 hour random sample under steady-state conditions

Primary Emissions using adsorption agents (PCDD/F & PCBs) BAT assessment

Port Talbot sinter plant is fitted with advanced electrostatic precipitators (ESPs). The mean emissions concentration (2012) was 1.44 ngI-TEQ/Nm^3.

BAT not achieved.

Measures to Achieve BAT by 2016

- *Tata Steel has established a Sinter Plant IED project to achieve the BAT AELs by 2016 based on the use of urea addition, injection of adsorbent (activated lignite) into the waste gas stream, and the control of chlorides in the raw sinter blend.*
- *Extensive studies in 2010 – 2011 by Tata Steel have shown that management of chloride content and reverts in the raw sinter blend gave a typical reduction of 50% in PCDD/F emissions, implying that the introduction of appropriate measures would have a significant impact on sinter plant PCDD/F emissions.*
- *A CAPEX plan has been submitted for approval to enable engineering improvements to the advanced ESPS to reduce air in-leakage, thereby reducing particulate emissions and improving plant safety. This will enable the safe use of lignite injection for the abatement of PCDD/Fs, and the improved ESP performance will enable the more efficient capture of lignite particles, thereby improving PCDD/F abatement. The work is targeted for the 2014 major stop.*

BAT will be achieved by 2016.

2.3 BAT for Secondary Emissions

26. BAT for secondary emissions from sinter strand discharge, sinter crushing, cooling, screening, and conveyor transfer points is to prevent dust emissions and / or to achieve an efficient extraction of dust emissions and subsequently to reduce dust emissions by using a combination of the following techniques:

I. hooding and/or enclosure
II. an electrostatic precipitator or a bag filter

The **BAT-associated emission level** for dust is <10 mg/Nm^3 for the bag filter and <30 mg/Nm^3 for the electrostatic precipitator, both determined as a daily mean value

Secondary Emissions BAT assessment

Electrostatic precipitators are currently utilised in the Port Talbot de-dust system. Emission concentrations (2010 – 2012) were in the range 9.7 mg/Nm3 to 88.8 mg/Nm3 with an average of 42.7 mg/Nm3.

BAT not achieved.

Measures will be implemented to achieve BAT by 2016

The Sinter Plant IED project plan is considering various abatement options including the refurbishment of the fields within the current ESP, or new gas cleaning equipment, and, or, fog conditioning.

BAT will be achieved by 2016.

2.4 BAT for Water & Waste Water

27. BAT is to minimise water consumption in sinter plants by recycling cooling water as much as possible unless once-through cooling systems are used.

Water & Waste Water BAT assessment

A semi-closed loop recirculation system is used for cooling the ignition hood.

BAT achieved.

2.5 BAT for Effluent Water from Sinter Plants

28. BAT is to treat the effluent water from sinter plants where rinsing water is used or where a wet waste gas treatment system is applied, with the exception of cooling water prior to discharge by using a combination of (described) techniques:

Effluent water from sinter plants BAT assessment

At Port Talbot sinter plant gas cleaning is achieved using dry electrostatic precipitators, rather than a wet system, such as Airfine. Rinsing & wet gas treatment processes do not feature at the Sinter Plant. The only waste waters from the sinter plant arise from blowdown from cooling systems. Since neither rinsing nor wet gas treatment processes are used at Port Talbot sinter plant this BAT is not applicable.

BAT not applicable.

2.6 BAT for Production Residues

29. BAT is to prevent waste generation within sinter plants by using one or a combination of the following techniques (see BAT 8):

I. selective on-site recycling of residues back to the sinter process by excluding heavy metal, alkali or chloride-enriched fine dust fractions (e.g. the dust from the last electrostatic precipitator field)
II. external recycling whenever on-site recycling is hampered.

BAT is to manage in a controlled manner sinter plant process residues which can neither be avoided nor recycled.

Production Residues BAT assessment

Current practice is to recycle all sinter plant ESP dusts back into the sintering process. Plant configuration does not allow for the exclusion of final field ESP dusts.

BAT achieved.

2.7 BAT for Recycling Residues

30. BAT is to recycle residues that may contain oil, such as dust, sludge and mill scale, which contain iron and carbon from the sinter strand and other processes in the integrated steelworks, as much as possible back to the sinter strand, taking into account the respective oil content.

Recycling residues BAT assessment

Recycling of these materials is maximised (as per BAT 8) to the restrictions described in BAT 31.

BAT achieved.

2.8 BAT for Lowering Hydrocarbon Content of the Sinter Feed

31. BAT is to lower the hydrocarbon content of the sinter feed by appropriate selection and pre-treatment of the recycled process residues.
In all cases, the oil content of the recycled process residues should be <0.5 % and the content of the sinter feed <0.1 %.

The input of hydrocarbons can be minimised, especially by the reduction of the oil input. Oil enters the sinter feed mainly by addition of mill scale. The oil content of mill scales can vary significantly, depending on their origin. Techniques to minimise oil input via dusts and mill scale include the following:

- limiting input of oil by segregating and then selecting only those dusts and mill scale with a low oil content
- the use of 'good housekeeping' techniques in the rolling mills can result in a substantial reduction in the contaminant oil content of mill scale
- de-oiling of mill scale by:
- heating the mill scale to approximately 800 °C, the oil hydrocarbons are volatilised and clean mill scale is yielded; the volatilised hydrocarbons can be combusted.
- extracting oil from the mill scale using a solvent

Lowering hydrocarbon content of the sinter feed BAT assessment

There are strict controls over materials to be introduced to the sintering process with specific emphasis on oil content, which is limited to less than 0.5% in any input materials. From an understanding of the relative contribution of millscale to total sinter feed, it is thereby ensured that the level in the total feed is less than 0.1%.

BAT achieved.

2.9 BAT for Energy for Sinter Plant

32. BAT is to reduce thermal energy consumption within sinter plants by using one or a combination of the following techniques:

I. recovering sensible heat from the sinter cooler waste gas
II. recovering sensible heat, if feasible, from the sintering grate waste gas (see BAT 23)
III. maximising the recirculation of waste gases to use sensible heat (see BAT 23)

Description

Two kinds of potentially reusable waste energies are discharged from the sinter plants:

- the sensible heat from the waste gases from the sintering machines
- the sensible heat of the cooling air from the sinter cooler.

Partial waste gas recirculation is a special case of heat recovery from waste gases from sintering machines and is dealt with in BAT 23. The sensible heat is transferred directly back to the sinter bed by the hot recirculated gases. At the time of writing (2010), this is the only practical method of recovering heat from the waste gases.

The sensible heat in the hot air from the sinter cooler can be recovered by one or more of the following ways:

- steam generation in a waste heat boiler for use in the iron and steel works
- hot water generation for district heating
- preheating combustion air in the ignition hood of the sinter plant
- preheating the sinter raw mix
- use of the sinter cooler gases in a waste gas recirculation system.

Applicability

At some plants, the existing configuration may make costs of heat recovery from the sinter waste gases or sinter cooler waste gas very high.

The recovery of heat from the waste gases by means of a heat exchanger would lead to unacceptable condensation and corrosion problems.

Energy BAT assessment

BAT I

The temperature of the sinter cooler waste gas varies significantly along the cooler, with the air from the entry end of the cooler, where sinter temperatures are highest, offering the greatest potential for heat recovery.

Recovering sensible heat in the form of steam to generate additional electricity has been assessed but is not economically feasible. At Port Talbot, it was estimated that the cost of necessary modifications to the sinter cooler to minimise air leakage would be around £8M and the heat recovery installation itself would cost around £11M (based on experience from Tata Steel in Ijmuiden. In addition, a boiler (£2M) and superheater (£2M) would be required to generate steam suitable for electricity generation, thus the total capital cost would be around £23M. Taking into account the cost of blast furnace gas used for superheating and the potential benefit of the steam generated, such a scheme could show a net profit, but this depends on sufficient electrical generating capacity being available to fully utilise the additional steam produced. Improved energy efficiency across the site and increases in steel production over recent years mean that the amount of process gas available for electricity generation has increased and there is limited capacity to utilise the additional steam that could be generated by recovering sensible heat from the sinter cooler waste gas.

BAT II

The sintering grate waste gas contains acid gases such as SO_2, SO_3, NO, NO_2, HCl and HF and it is necessary to maintain waste gas temperatures above the dew point to avoid downstream corrosion. This makes heat recovery from these gases infeasible, as is recognised under "Applicability" above. Furthermore, reducing the waste gas temperature would result in a less buoyant plume and less effective dispersion of pollutants from the sinter plant main stack.

BAT III

Recirculation of a proportion of the waste gases back to the sintering process would lower the oxygen content of the gases drawn through the sinter bed which can adversely affect productivity. Waste gas recirculation is not utilised at Port Talbot or other UK sinter plants.

SUMMARY

The techniques described above have been investigated but the existing configuration makes the costs of heat recovery from the sinter waste gases or sinter cooler waste gas very high. In addition, it is necessary to maintain waste gas temperatures above the dew point to avoid unacceptable corrosion problems, and lowering the waste gas temperature would also lead to less effective dispersion of the sinter plant plume.

BAT I not achieved - not economically feasible at present time.

BAT II not achieved - not feasible.

BAT III not applicable.

Overall – BAT achieved.

2.10 Sinter Plant BAT Assessment Summary

Area	BAT Conclusion	Achieved?	Comments
Blending Mixing	19 – Blending to reduce dust emission	Yes	-
Primary Emissions	20 – Dust emissions	No	Bag filters no applicable, advanced ESP's fitted at Port Talbot Engineering improvements and ESP refining required along with lignite injection to meet BAT AEL by March 2016
	21 – Mercury emissions	Yes	-
	22 – SOx emissions	Yes	-
	23 – NOx emissions	Yes	-
	24 – PCDD/F & PCB control (raw material inputs)	Yes	-
	25 – PCDD/F & PCB emissions	No	Engineering improvements and ESP refining required along with lignite injection to meet BAT AEL by March 2016
Secondary Emissions	26 – Dust emissions	No	Various abatement projects being considered to meet BAT AEL by March 2016
Water & Waste Water	27 – Water consumption	Yes	-
	28 – Effluent	N/A	-
Production Residues	29 - Production residues	Yes	-
Recycling Residues	30 – Recycling residues	Yes	-
Hydrocarbon Reduction in Feed	31 – Hydrocarbon content in sinter feed	Yes	-
Energy	32 – Energy consumption	Yes	-

3 BAT CONCLUSIONS FOR PELLETISATION PLANTS

No pelletisation plant is operated at Port Talbot Works, therefore BAT conclusions 33 to 41 are not applicable.

4. BAT CONCLUSIONS FOR COKE OVEN PLANTS

4.1 Air Emissions

Coal Grinding Plant

42. BAT for coal grinding plants (coal preparation including crushing, grinding, pulverising and screening) is to prevent or reduce dust emissions by using one or a combination of the following techniques:

I. building and/or device enclosure (crusher, pulveriser, sieves) and
II. efficient extraction and use of a subsequent dry dedusting systems.

The **BAT-associated emission level** for dust is <10 – 20 mg/Nm^3, as the average over the sampling period (spot measurement, for at least half an hour).

Coal Grinding Plant BAT assessment

Morfa Coke Ovens operates a fully contained coal crusher which is fed by conveyors from a fully enclosed surge bunker. All conveyor systems are enclosed with side sheeting where practicable, transfers points are also covered. Since 2004 the Secondary Coal Crusher (emission point A58) has been non-operational. The coal grinding operation in place has no associated emissions.

BAT achieved.

4.2 Storage and Handling of Pulverised Coal

43. BAT for storage and handling of pulverised coal is to prevent or reduce diffuse dust emissions by using one or a combination of the following techniques:

I. storing pulverised materials in bunkers and warehouses
II. using closed or enclosed conveyors
III. minimising the drop heights depending on the plant size and construction.
IV. reducing emissions from charging of the coal tower and the charging car.
V. using efficient extraction and subsequent dedusting.

When using BAT V, the BAT-associated emission level for dust is <10 – 20 mg/Nm^3, as the average over the sampling period (spot measurement, for at least half an hour).

Storage and Handling of Pulverised Coal BAT assessment

Morfa Coke Ovens use wet, granular coal, which presents less of a fugitive emission issue than pulverised coal. Granular coal is stored in fully contain bunkers (closed to atmosphere) and transported to charging points via a conveyor network and transfer points which are enclosed with side sheeting. Coal charging unit uses volume charging to ensure the correct percentage of each coal blend is fed. This reduces the potential for fugitive emissions while charging. No extraction systems or subsequent dedusting is in place.

BAT achieved.

4.3 Charging

44. BAT is to charge coke oven chambers with emission-reduced charging systems.

Description

From an integrated point of view, 'smokeless' charging or sequential charging with double ascension pipes or jumper pipes are the preferred types, because all gases and dust are treated as part of the coke oven gas treatment.

Morfa Coke Oven operates an integrated charging system, considered "smokeless" by using screw feed charging and double ascension pipes.

If, however, the gases are extracted and treated outside the coke oven, charging with a land-based treatment of the extracted gases, in the form of an efficient extraction of the emissions with subsequent combustion to reduce organic compounds and the use of a bag filter to reduce particulates, is the preferred method.

The BAT-associated emission level for dust from coal charging systems with land-based treatment of extracted gases is <5 g/t coke or <50 mg/Nm^3, as the average over the sampling period (spot measurement, for at least half an hour).

Morfa Coke Ovens does not operate a land-based treatment of the extracted gases outside the coke oven

The duration associated with BAT of visible emissions from charging is <30 seconds per charge as a monthly average.

Charging emissions are monitored and measured using BCRA methods, as defined in Tata's Environmental Permit BL7108.

Charging BAT assessment

See comments above

BAT achieved.

4.4 COG Extraction

45. BAT for coking is to extract the coke oven gas (COG) during coking as much as possible.

COG Extraction BAT assessment

The Morfa battery has a twin collector main system for receiving crude gas from the ovens during the carbonisation process.

The ramside collecting main is divided at the centre of each battery, and each section of the main is fitted with an offtake main to remove the crude gas and liquor from the process to the coke ovens by products plant. Fitted in each off take main is an automatically controlled butterfly valve which regulates the pressure within the collector main. In the event of failure of the collecting process, the coke oven gas cannot be extracted and must be bled or flared at the battery top. Coke Oven Gas (COG) is a valuable process gas commodity used in other areas of the steelmaking process, maximising the extraction and collection of COG is crucial to the business.

In the event of there being insufficient storage capacity available in the COG gas holder, excess COG may be flared, but the measures already employed to optimise utilisation of process gases, along with the future application of a state-of-the-art predictive control system (ISOLDE) will minimise losses through flaring (see BAT 3).

BAT achieved.

4.5 Visible Emission Reduction

46. BAT for coke plants is to reduce the emissions through achieving continuous undisrupted coke production by using the following techniques:

I. extensive maintenance of oven chambers, oven doors and frame seals, ascension pipes, charging holes and other equipment (by carrying out a systematic programme by specially-trained detection and maintenance personnel)
II. avoiding strong temperature fluctuations
III. comprehensive observation and monitoring of the coke oven
IV. cleaning of doors, frame seals, charging holes, lids and ascension pipes after handling (applicable at new and, in some cases, existing plants)
V. maintaining a free gas-flow in the coke ovens
VI. adequate pressure regulation during coking and application of spring-loaded flexible sealing doors or knife-edged doors (in cases of ovens O5 m high and in good working order)
VII. using water-sealed ascension pipes to reduce visible emissions from the whole apparatus which provides a passage from the coke oven battery to the collecting main, gooseneck and stationary jumper pipes
VIII. luting charging hole lids with a clay suspension (or other suitable sealing material), to reduce visible emissions from all holes
IX. ensuring complete coking (avoiding green coke pushes) by application of adequate techniques
X. installing larger coke oven chambers (applicable to new plants or in case of a complete replacement of the plant on the old foundations)
XI. where possible, using variable pressure regulation to oven chambers during coking (applicable to new plants and can be an option for existing plants; the possibility of installing this technique in existing plants should be assessed carefully and is subject to the individual situation of every plant)

The percentage of visible emissions from all doors associated with BAT is <5 –10 %.
The percentage of visible emissions for all source types associated with BAT VII and BAT VIII is <1 %.

The percentages are related to the frequency of any leaks compared to the total number of doors, ascension pipes or charging hole lids as a monthly average using a monitoring method as described below.

For the estimation of diffuse emissions from coke ovens the following methods are in use:

- the EPA 303 method
- the DMT (Deutsche Montan Technologie GmbH) methodology
- the methodology developed by BCRA (British Carbonisation Research Association).
- the methodology applied in the Netherlands, based on counting visible leaks of the ascension pipes and charging holes, while excluding visible emissions due to normal operations (coal charging, coke pushing).

Visible Emission Reduction BAT assessment

The 11 BAT conclusions above are in place at Morfa Coke Ovens through the application of maintenance schedules, detailed temperature monitoring and BCRA assessments/spot samples to observe and monitor the process. Knife edge doors, water-sealed ascension pipes and the luting of charging hole lids is also in place. BAT conclusions X & XI are considered not applicable to Morfa Coke Ovens. Visible emissions are monitored and measured using BCRA methods (as defined in Tata's Environmental Permit BL7108). Visible emissions are also monitored through black push and continuous opacity monitoring, as well as spot sampling.

Visible emissions from doors, ascension pipes (BAT VII) and charge holes (BAT VIII) are assessed using a BCRA methodology as referenced above and are reported as a Door Leakage Control Factor (DLCF) and Top Leakage Control Factor (TLCF – includes both ascension pipes and charge holes). The BCRA methodology distinguishes different severities of leakage, ranging from minor (Grade 1) to extremely severe (Grade 4), whereas the BAT-associated standard makes no such distinction, which makes it impossible to precisely correlate the two measures.

It is proposed to re-examine methods of assessing visible emissions in collaboration with other UK coke oven operators and to develop procedures that will allow comparison to the BAT-associated standard (i.e. yielding a result in terms of percentage of visible emissions). This work will be completed by December 2014 .

BAT achieved.

4.6 Gas Treatment Plant

47. BAT for the gas treatment plant is to minimise fugitive gaseous emissions by using the following techniques:

I. minimising the number of flanges by welding piping connections wherever possible
II. using appropriate sealings for flanges and valves
III. using gas-tight pumps (e.g. magnetic pumps)
IV. avoiding emissions from pressure valves in storage tanks by
connecting the valve outlet to the coke oven gas (COG) collecting main or by collecting the gases and subsequent combustion.

Gas Treatment Plant BAT assessment

All the techniques above are in place at Morfa Coke Ovens

BAT achieved.

4.7 Reducing Sulphur Content of COG

48. BAT is to reduce the sulphur content of the coke oven gas (COG) by using one of the following techniques:

I. desulphurisation by absorption systems
II. wet oxidative desulphurisation.

The residual hydrogen sulphide (H2S) concentrations associated with BAT, determined as daily mean averages, are <300 – 1000 mg/Nm3 in the case of using BAT I (the higher values being associated with higher ambient temperature and the lower values being associated with lower ambient temperature) and <10mg/Nm3 in the case of using BAT II.

Reducing Sulphur Content of COG BAT assessment

Parameter	***BAT-associated emission level***	***Morfa Coke Ovens emission level (currently not using BAT I or II)***
Hydrogen sulphide (H_2S)	*<300 – 1000 mg/Nm^3 in the case of using BAT I*	*2010 mean – 2520 mg/Nm^3* *2011 mean – 2627 mg/Nm^3* *2012 mean – 1783 mg/Nm^3* *2013 YTD – 2350 mg/Nm^3*

BAT Achieved by 2017.

Plans have commenced to install a coke oven gas desulphurisation unit to treat the gas arising from the coke ovens in Port Talbot, subject to the capital planning process within Tata Steel. To date, provisional financing arrangements remain to be confirmed although detailed engineering studies are on-going.

Installation of COG desulphurisation is a substantial and complex project involving considerable engineering and technological resource. An assessment undertaken in August 2013 indicates that December 2017 is the earliest feasible date for commissioning of the planned coke oven gas desulphurisation unit.

By the end of 2017 therefore, the Port Talbot Morfa coke ovens will meet BAT.

4.8 Coke Oven Underfiring

49. BAT for the coke oven underfiring is to reduce the emissions by using the following techniques:

I. preventing leakage between the oven chamber and the heating chamber by means of regular coke oven operation (only applicable to existing plants)
II. repairing leakage between the oven chamber and the heating chamber (only applicable to existing plants)
III. incorporating low-nitrogen oxides (NOX) techniques in the construction of new batteries, such as staged combustion and the use of thinner bricks and refractory with a better thermal conductivity (only applicable to new plants)
IV. using desulphurised coke oven gas (COG) process gases.

The BAT-associated emission levels, determined as daily mean values and relating to an oxygen content of 5 % are:

- sulphur oxides (SOX), expressed as sulphur dioxide (SO2) <200 – 500 mg/Nm^3
- dust <1 – 20 mg/Nm^3
- nitrogen oxides (NOX), expressed as nitrogen dioxide (NO2) <350 – 500mg/Nm^3 for new or substantially revamped plants (less than 10 years old)and 500 – 650 mg/Nm^3 for older plants with well maintained batteries and incorporated low- nitrogen oxides (NOX) techniques.

Coke Oven Underfiring BAT assessment

BAT conclusions I & II are achieved through regular refractory maintenance and the use of airborne sealing surface powder to ensure leaking is minimised. Single stage burners are in place at Morfa Coke Ovens, however BAT conclusion III only applies to new plants (NA). No COG desulphurisation plant is currently in operation (see BAT 48 comments above), but blast furnace gas, with intrinsically low sulphur content, is normally used for underfiring and the SO_2 emissions are well below the relevant BAT-AEL. In the event that COG is used for underfiring because insufficient BFG is available, the BAT-AEL would not be achieved until such time as the COG desulphurisation plant described in the response to BAT 48 has been commissioned.

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Parameter	***BAT-associated emission level***	***Morfa Coke Ovens emission level (Morfa Main-A55) @ 5% O2 (ref)***
Sulphur oxides (SOX)	*<200 – 500 mg/Nm^3*	*2012 mean – 64 mg/Nm^3*
Dust	*<1 – 20 mg/Nm^3*	*2011 – 5.58 mg/Nm^3*
Nitrogen oxides (NOX),	*500 – 650 mg/Nm^3*	*2012 mean – 1002 mg/Nm^3*

BAT achieved for SO_x and dust.
BAT for SO_x not achieved in the event of COG firing.
BAT not applicable for NO_x.

4.9 Pushing

50. BAT for coke pushing is to reduce dust emissions by using the following techniques:

I. extraction by means of an integrated coke transfer machine equipped with a hood
II. using land-based extraction gas treatment with a bag filter or other abatement systems
III. using a one point or a mobile quenching car.

The **BAT-associated emission level** for dust from coke pushing is <10 mg/Nm^3 in the case of bag filters and of <20 mg/Nm^3 in other cases, determined as the average over the sampling period (spot measurement, for at least half an hour).

Applicability

At existing plants, lack of space may be constraining the applicability.

Pushing BAT assessment

Morfa Coke Ovens operates a Minister-Stein coke-side arrestment system which consists of a moveable hood which is attached to the guide machine, a duct running the length of the battery to connect the hood to the scrubbing plant, and three venturi scrubbers with induced draught fans located in an enclosed fan house at the south end of the battery.

Parameter	***BAT-associated emission level***	***Morfa Coke Ovens emission level (Ministerstein- A56)***
Dust	*<20 mg/Nm^3*	*2010 mean – 10.9 mg/Nm^3* *2011 mean – 23 mg/Nm^3* *2012 mean – 4.8 mg/m^3* *2013 mean YTD – 11.4*

BAT achieved.

4.10 Quenching

51. BAT for coke quenching is to reduce dust emissions by using one of the following techniques:

I. using coke dry quenching (CDQ) with the recovery of sensible heat and the removal of dust from charging, handling and screening operations by means of a bag filter

Description of BAT I
For the continuous operation of coke dry quenching plants, there are two options. In one case, the coke dry quenching unit comprises two to up to four chambers. One unit is always on stand by. Hence no wet quenching is necessary but the coke dry quenching unit needs an excess capacity against the coke oven plant with high costs. In the other case, an additional wet quenching system is necessary. For retrofitting wet quenching plants, the existing wet quenching system can be used.
Such a coke dry quenching unit has no excess processing capacity against the coke oven plant.

II. using emission-minimised conventional wet quenching

Description of BAT II
Existing quenching towers can be equipped with emissions reduction baffles. A minimum tower height of at least 30 m is necessary in order to ensure sufficient draught conditions.

III. using coke stabilisation quenching (CSQ).
Applicability of BAT III
As the system is larger than that necessary for conventional quenching, lack of space at the plant may be a constraint.

The BAT-associated emission levels for dust, determined as the average over the sampling period, are:

- <20 mg/Nm^3 in case of coke dry quenching
- <25 g/t coke in case of emission minimised conventional wet quenching
- <10 g/t coke in case of coke stabilisation quenching.

Quenching BAT assessment

Coke dry quenching is currently not in place at Morfa Coke Ovens. The use of emission-minimised conventional wet quenching is operated through the use of a quencher tower at Morfa Coke Ovens.

Parameter	***BAT-associated emission level***	***Morfa Coke Ovens emission level (New Quencher Tower)***
Dust	*<25 g/t coke in the case of using BAT II*	*2010 commissioning sampling- 10.5 g/t coke*

BAT achieved.

4.11 Coke Grading and Handling

52. BAT for coke grading and handling is to prevent or reduce dust emissions by using the following techniques in combination:

I. use of building or device enclosures
II. efficient extraction and subsequent dry dedusting.

The BAT-associated emission level for dust is <10 mg/Nm^3, determined as the average over the sampling period (spot measurement, for at least half an hour).

Coke Grading and Handling BAT assessment

Coke conveyor system are enclosed with side sheeting where practicable, transfers points are also covered. Coke bunkers are not sheeted. No associated extraction system is used in coke handling operations.

I. BAT Achieved – coke conveyor systems are enclosed with side sheeting where practicable transfers points are also covered.
II. BAT not achieved – alternative controls in place as per Air Quality Management Plan (AQMP).

4.12 Water and Waste Water

4.12.1 Quenching Water

53. BAT is to minimise and reuse quenching water as much as possible.

Quenching Water BAT assessment

Morfa Coke Ovens reuse quenching water by recalculating water not evaporated back into the process via a 100% closed system. Solids are removed in settling bays.

BAT achieved.

4.12.2 Reuse of Process Water

54. BAT is to avoid the reuse of process water with a significant organic load (like raw coke oven waste water, waste water with a high content of hydrocarbons, etc.) as quenching water.

Reuse of Process Water BAT assessment

The quencher tower's water system (described above) is run and topped up on 100% service water. Process water is treated in the by-products plant.

BAT achieved.

4.12.3 Pre-treatment of Waste Water

55. BAT is to pretreat wastewater from the coking process and coke oven gas (COG) cleaning, prior to discharge to a waste water treatment plant by using one or a combination of the following techniques:

- I. using efficient tar and polycyclic aromatic hydrocarbons (PAH) removal by using flocculation and subsequent flotation, sedimentation and filtration individually or in combination
- II. using efficient ammonia stripping by using alkaline and steam

Pretreating wastewater BAT assessment

I. Tar and contaminated waste waters are removed from the coke oven gas in the downcomer, detarrers and at other points within the by-products plants. All these streams are fed to the tar/liquor separators, where the tar is removed by sedimentation and the tar-free liquors are either recycled to the process as flushing liquor or are further treated before discharge to the coke oven effluent treatment plant. The majority of the PAH loading in the waste waters is associated with the tar content, and so this process also removes PAHs.

II. Ammonia is stripped from the strong liquor using steam in the free and fixed ammonia stills, with caustic soda added to react with any fixed ammonia species (such as ammonium sulphate) to form easily-removed ammonium hydroxide.

BAT achieved.

56. BAT for pretreated waste water from the coking process and coke oven gas (COG) cleaning is to use biological waste water treatment with integrated denitrification/nitrification stages.

The BAT-associated emission levels, based on a qualified random sample or a 24-hour composite sample and referring only to single coke oven water treatment plants, are:

• chemical oxygen demand (COD)	<220 mg/l
• biological oxygen demand for 5 days (BOD5)	<20 mg/l
• sulphides ($S2^-$)	<0.1 mg/l
• thiocyanate (SCN^-)	<4 mg/l
• cyanide (CN^-) (easily released)	<0.1 mg/l
• polycyclic aromatic hydrocarbons (PAH) (sum of Fluoranthene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, Indeno[1,2,3-cd]pyrene and Benzo[g,h,i]perylene)	<0.05 mg/l
• phenols	<0.5 mg/l
• sum of ammonia-nitrogen ($NH4^+$-N), nitrate-nitrogen ($NO3^-$-N) and nitrite-nitrogen ($NO2^-$-N)	<15 – 50 mg/l.

Regarding the sum of ammonia-nitrogen ($NH4^+$-N), nitrate-nitrogen ($NO3^-$-N) and nitrite-nitrogen ($NO2^-$-N), values of <35 mg/l are usually associated with the application of advanced biological waste water treatment plants with predenitrification/nitrification and post-nitrification.

Pre-treatment of Waste Water BAT Assessment

Tar and PAH removal is achieved through various processes including sedimentation in the by-products plant. Ammonia stripping is in place at Morfa Coke Ovens. Biological waste-water treatment is also standard operation for process effluent.

Effluents from the various processes across the Port Talbot site are generally combined and are discharged to sea via a common discharge system. Spot samples are taken from all the permitted discharge points as specified in the current permit, but it has been identified that the prescribed sampling does not cover all the pollutants for which BAT-AELs are given as the BREF document assumes individual discharges. Current available information does not allow a robust evaluation on how to implement the BAT-AELs at this stage. An improvement programme is to be implemented to best evaluate how the BAT-AELs can be implemented at the Port Talbot site. In the meantime, derogation is required on precautionary grounds because it is too early to know whether the agreed approach to effluent treatment and permitting will allow Tata Steel to be compliant with all BAT-AELs by March 2016.

BAT not achieved

4.13 Production Residues

57. BAT is to recycle production residues such as tar from the coal water and still effluent and surplus activated sludge from the waste water treatment plant back to the coal feed of the coke oven plant.

Production Residues BAT assessment

Heavy tar solids removed in the by-products plant are recycled back in to the coal preparation plant.

BAT achieved.

4.14 Energy for Coke Oven Plant

58. BAT is to use the extracted coke oven gas (COG) as a fuel or reducing agent or for the production of chemicals.

Energy BAT assessment

COG is preferential works process gas used in other areas of the steelmaking process, maximising the extraction and collection of COG is crucial to the business.

BAT achieved

4.14 Coke Ovens BAT Assessment Summary

Area	BAT Conclusion	Achieved?	Comments
Air Emissions	42- Coal Grinding Plant	Yes	-
	43- Storage and Handling of Pulverised Coal	Yes	-
	44- Charging	Yes	-
	45- COG Extraction	Yes	-
	46- Visible Emission Reduction	Yes	-
	47- Gas Treatment Plant	Yes	-
	48- Reducing Sulphur Content of COG	No	No desulphurisation plant is in place at Morfa Coke Ovens although this is planned.
	49- Coke Oven Underfiring	No	In normal operation BAT is achieved, as BFG with a low sulphur content is used for underfiring. In the event that COG has to be used, BAT is not achieved as no desulphurisation plant is in place at Morfa Coke Ovens although this is planned.
	50- Pushing	Yes	-
	51- Quenching	Yes	-
	52- Coke Grading and Handling	No	Coke bunkers are not sheeted and no associated extraction system is used in coke handling operations.
Water and Waste Water	53- Quenching Water	Yes	-
	54- Reuse of Process Water	Yes	-
	55 & 56- Pre-treatment of Waste Water	Yes	-
Production Residues	57- Production Residues	Yes	-
Energy	58- Energy	Yes	-

5. BAT CONCLUSIONS FOR BLAST FURNACES

Unless otherwise stated, the BAT conclusions presented in this section can be applied to all blast furnaces.

5.1 Air emissions

5.1.1 Coal Injection Unit

59. BAT for displaced air during loading from the storage bunkers of the coal injection unit is to capture dust emissions and perform subsequent dry dedusting.

The **BAT-associated emission level** for dust is <20 mg/Nm^3, determined as the average over the sampling period (spot measurement, for at least half an hour).

Coal Injection Unit BAT assessment

All silos and hoppers at the GCI Plant are fitted with pulse-jetted bag filters. The pulse-jetted system prevents the bags from becoming blocked with dust and then over-pressurising the filter. Collected dust is returned to the silo.
Emissions from the bag filters are monitored annually and generally achieve levels below 20 mg/Nm^3 (Fluidised Bed Dryer2 (FDB2) A38 annual DCM 2012 = 2.0mg/Nm^3/ FBD1 A37 annual 2013 = 19.0mg/Nm^3). The bags are changed regularly, this task being a scheduled activity within the local maintenance planning system. Where breaches of this level have been recorded, faults have immediately been identified and corrected.

BAT achieved.

5.1.2 Burden Preparation

60. BAT for burden preparation (mixing, blending) and conveying is to minimise dust emissions and, where relevant, to extract emissions with subsequent purification by means of an electrostatic precipitator or bag filter.

Burden Preparation BAT assessment

The ferrous material and coke is transferred to the stock-houses via conveyors before charging into the Blast Furnaces. The new iron ore pellet stock-house for No.4 BF is fitted with extraction, but there is no dust extraction or filtration on the conveyor systems or on the older stock-houses. However there is a foam dust suppression system installed on the ferrous transfer conveyors leading to the transfer house. There is also water suppression on the sinter screens. It must be noted though that H_2O content of materials being charged to Blast Furnaces must be monitored. This is due to the potential for process instability as a consequence of moisture affecting burden decent within the Blast Furnace. Stability in a Blast Furnace is critical to minimise bleeder openings and emissions associated with such instances.

The net effect of all these techniques is to reduce dust emissions from burden preparation and conveying, though there is room for further improvement and additional dust suppression systems are planned in this area.

Conveyor systems are generally contained by cladding, although recent surveys have identified missing cladding sheets which are now being reinstated.

BAT not achieved.

To achieve BAT, further assessment of the use of water and/or foam suppression systems will be undertaken, particularly in relation to the ferrous stockhouses and sinter screens. Capital expenditure schemes will be implemented where appropriate to minimise dust emissions for example the sinter screens are presently being fitted with more effective water sprays to include a suppressant addition.

BAT will be achieved by 2016

5.1.3 Casting House

61. BAT for casting house (tap holes, runners, torpedo ladles charging points, skimmers) is to prevent or reduce diffuse dust emissions by using the following techniques:

I. covering the runners
II. optimising the capture efficiency for diffuse dust emissions and fumes
with subsequent off-gas cleaning by means of an electrostatic precipitator or bag filter
III. fume suppression using nitrogen while tapping, where applicable and where no collecting and dedusting system for tapping emissions is installed.

The **BAT-associated emission level** for dust is <1 – 15 mg/Nm^3, determined as a daily mean value.

Casting House BAT assessment

- *I. All secondary runners at both Blast Furnaces are covered. Primary runners at No. 4 BF are covered, but those at No. 5 BF are not currently covered.*
- *II. Fume from the cast-houses on both Blast Furnaces is extracted and cleaned in bag filters.*
- *III. Since fume from tapping emissions is collected and dedusted, fume suppression when tapping is not required.*

BAT associated emission levels for dust, determined as a daily mean value. Continuous emission monitoring levels from cast house fume extraction are:

	A8A	A8B	A9
July	3.2 mg/Nm^3	1.0 mg/Nm^3	0.4 mg/Nm^3
August	3.8 mg/Nm^3	1.0 mg/Nm^3	0.8 mg/Nm^3
September	2.2 mg/Nm^3	0.6 mg/Nm^3	1.7 mg/Nm^3
October	4.6 mg/Nm^3	1.1 mg/Nm^3	1.0 mg/Nm^3
November	5.5 mg/Nm^3	1.5 mg/Nm^3	0.8 mg/Nm^3
December	3.5 mg/Nm^3	1.4 mg/Nm^3	0.6 mg/Nm^3
January	1.3 mg/Nm^3	1.3 mg/Nm^3	1.6 mg/Nm^3
February	8.4 mg/Nm^3	2.8 mg/Nm^3	0.8 mg/Nm^3
March	4.3 mg/Nm^3	2.7 mg/Nm^3	0.4 mg/Nm^3
Max	8.4 mg/Nm^3	2.8 mg/Nm^3	1.7 mg/Nm^3
Average	4.1 mg/Nm^3	1.5 mg/Nm^3	0.9 mg/Nm^3

The BAT-AEL for dust from the casthouse dedusting systems is achieved.

BAT achieved.

5.1.4 Runner Linings

62. BAT is to use tar-free runner linings.

Runner Lining BAT assessment

All runners in the Port Talbot Blast Furnaces are tar free.

BAT achieved

5.1.5 Minimise Release of Blast Furnace Gas

63. BAT is to minimise the release of blast furnace gas during charging by using one or a combination of the following techniques:

I. bell-less top with primary and secondary equalising
II. gas or ventilation recovery system.
III. use of blast furnace gas to pressurise the top bunkers.

Applicability of BAT II

Applicable for new plants. Applicable for existing plants only where the furnace has a bell-less charging system. It is not suited to plants where gases other than blast furnace gas (e.g. nitrogen) are used to pressurise the furnace top bunkers.

Minimise Release of Blast Furnace Gas BAT assessment

I. Port Talbot Blast furnaces both have bell-less top systems with equalisation
II. Blast Furnace gas is not currently recovered from the bell less tops on either furnace at Port Talbot
III. Blast Furnace gas is used to pressurise the top bunkers

BAT achieved.

5.1.6 Reduction of Dust Emissions

64. BAT is to reduce dust emissions by using one or a combination of the following techniques:

I. using dry prededusting devices such as:
- i. deflectors
- ii. dust catchers
- iii. cyclones
- iv. electrostatic precipitators.

II. subsequent dust abatement such as:
- i. hurdle-type scrubbers
- ii. venturi scrubbers
- iii. annular gap scrubbers
- iv. wet electrostatic precipitators
- v. disintegrators.

For cleaned blast furnace (BF) gas, the residual dust concentration associated with **BAT** is <10 mg/Nm^3, determined as the average over the sampling period (spot measurement, for at least half an hour).

Applicability
At new plants, a modern system with a low-pressure drop and low water and energy consumption can be applied. It is sometimes possible to replace the existing 'old fashioned' scrubber with a more modern one, but this should be considered in conjunction with the application of a top gas pressure turbine (see BAT 73), which depends on the operating pressure of the furnace, amongst other factors.

Reduction of Dust Emissions BAT assessment

I. *No. 4 Blast Furnace is equipped with a cyclone and No. 5 BF is equipped with a dust catcher to dedust the dry blast furnace gas prior to further dust removal. The dust is recovered for use in the sinter plant*

II. *Subsequent dust abatement of blast furnace gas is undertaken via a wet scrubbing system. The suspended solids in the gas washing water from both furnaces are removed by the clarifiers (known as the Dorr ponds) and the resultant sludge recovered*

The measurement of dust concentrations in cleaned BF gas is difficult to achieve owing to safety concerns when attempting to measure in a positively pressurised gas stream containing approximately 22% carbon monoxide. Although it is not recommended to perform them on a regular basis, experienced personnel using personal protective equipment such as breathing apparatus have attempted measurements in the past for commissioning purposes and were found to be <10 mg/Nm^3.

Other than the commissioning trials following a blast furnace reline, it is proposed to use dust emissions from blast furnace stoves as a surrogate for measuring dust concentrations in the blast furnace gas itself.

BAT achieved.

5.1.7 Hot Blast Stoves Emissions

65. BAT for hot blast stoves is to reduce emissions by using desulphurised and dedusted surplus coke oven gas, dedusted blast furnace gas, dedusted basic oxygen furnace gas and natural gas individually or in combination.

The **BAT-associated emission levels**, determined as daily mean values related to an oxygen content of 3 %, are:

- sulphur oxides (SOx) expressed as sulphur dioxide (SO2) <200 mg/Nm^3
- dust<10 mg/Nm^3
- nitrogen oxides (NOx), expressed as nitrogen dioxide (NO2) <100mg/Nm^3

Hot Blast Stoves Emissions BAT assessment

The Hot Blast Stoves are fired on Blast Furnace and enriched by coke oven gas and natural gas. Blast Furnace gas is de-dusted as described for BAT 64. Coke oven gas is dedusted in the by-products plant, but there is no coke oven gas desulphurisation at Port Talbot works. Nevertheless, the proportion of coke oven gas used at the hot blast stoves is low enough (typically 5% of the total gas volume) that the BAT-AEL for sulphur dioxide can still be achieved. Typical average emissions from the stoves between 2009-12 are:

A6 - Blast Furnace 4 stoves

SOx 6 mg/Nm^3	*Max: 33 mg/Nm^3*
NOx 38 mg/Nm^3	*Max: 73 mg/Nm^3*
Particulate: 4 mg/Nm^3	*Max: 4.25 mg/Nm^3*

A7 - Blast Furnace 5 stoves

SOx 53 mg/Nm^3	*Max: 145 mg/Nm^3*
NOx 46 mg/Nm^3	*Max: 82.5 mg/Nm^3*
Particulate: 4.1 mg/Nm^3	*Max: 6 mg/Nm^3*

Values above are provided reference conditions of @3% O2)

BAT achieved.

5.2 Water and Waste Water

5.2.1 Water Consumption

66. BAT for water consumption and discharge from blast furnace gas treatment is to minimise and to reuse scrubbing water as much as possible, e.g. for slag granulation, if necessary after treatment with a gravel-bed filter.

Water Consumption BAT assessment

Water from the gas scrubber system flows into clarifiers, where solids are removed from the system. Water is then re-circulated back into the system until the water chemistry demands make-up water, which is currently treated dock water. The overflow from the clarifiers is currently discharged into the works effluent system prior to discharge to sea. A proportion of works effluent is recycled – see BAT 12.

BAT achieved.

5.2.2 Waste Water Treatment

67. BAT for treating waste water from blast furnace gas treatment is to use flocculation (coagulation) and sedimentation and the reduction of easily released cyanide, if necessary.

The **BAT-associated emission levels,** based on a qualified random sample or a 24-hour composite sample, are:

suspended solids	<30 mg/l
iron	<5 mg/l
lead	<0.5 mg/l
zinc	<2 mg/l
cyanide, easily released	<0.4 mg/l

Waste Water Treatment BAT assessment

Suspended solids are removed from the waste water by sedimentation in the Dorr ponds and are generally maintained to a control level of <20 mg/l. The wastewater then mixes with other process effluents and site drainage waters before discharge to the environment. Cyanide levels in the wastewater are recorded to be between 0.05 to 0.3 mg/l so no additional cyanide reduction is necessary.

Long Sea Outfall discharge concentrations 2012 (daily 24hour composite samples for each day of 2012)

suspended solids (LSO)	*33 mg/l*
suspended solids (BFs Effluent)	*31 mg/l*
iron (total)	*3.1 mg/l*
lead (total)	*0.08 mg/l*
zinc (total)	*1.2 mg/l*
cyanide, easily released	*0.04 mg/l*

Effluents from the various processes across the Port Talbot site are generally combined and are discharged to sea via a common discharge system. Spot samples are taken from all the permitted discharge points as specified in the current permit, but it has been identified that the prescribed sampling does not cover all the pollutants for which BAT-AELs are given as the BREF document assumes individual discharges. Current available information does not allow a robust evaluation on how to implement the BAT-AELs at this stage. An improvement programme is to be implemented to best evaluate how the BAT-AELs can be implemented at the Port Talbot site. In the meantime, derogation is required on precautionary grounds because it is too early to know whether the agreed approach to effluent treatment and permitting will allow Tata Steel to be compliant with all BAT-AELs by March 2016.

BAT not achieved.

5.3 Production Residues

5.3.1 Prevention of Waste

68. BAT is to prevent waste generation from blast furnaces by using one or a combination of the following techniques:

I. appropriate collection and storage to facilitate a specific treatment
II on-site recycling of coarse dust from the blast furnace (BF) gas treatment and dust from the cast house dedusting, with due regard for the effect of emissions from the plant where it is recycled
III. hydrocyclonage of sludge with subsequent on-site recycling of the coarse fraction (applicable whenever wet dedusting is applied and where the zinc content distribution in the different grain sizes allows a reasonable separation)
IV. slag treatment, preferably by means of granulation (where market conditions allow for it), for the external use of slag (e.g. in the cement industry or for road construction).

BAT is to manage blast furnace process residues which can neither be avoided nor recycled in a controlled manner.

Prevention of Waste BAT assessment

I. Blast Furnace gas cleaning/clarifier sludge is pumped over to the Betsi lagoons for water separation. When dewatered, it is taken to the burdening reverts area. There is an element of moisture retained within the solids, therefore dust lift off is minimised. Not all arising clarifier sludge from settlement ponds is currently recycled into the sinter plant due to the need to control the zinc loading and is the remainder is stockpiled.

II. Dust from BF5 catcher is dispensed daily into the dust catcher booth which employs water deluge systems to reduce dust lift-off. The dust is recovered and transported into the revert yard for use in the sinter plant (See BAT 11).
Dust from BF4 Cyclone is dispensed routinely through a wetted pugmill to prevent dust lift-off into large material movement vehicles. The toothpaste like material is then transported into the reverts yard for use in the sinter plant (See BAT 11).

III. Hydrocycling of sludge is not currently undertaken at Port Talbot works, further dewatering of clarifier sludge is carried out by settling lagoons.

Slag granulation undertaken at Port Talbot works with the aim of achieving at least 80% slag granulation. The granulators are designed to handle all the slag from casting at one taphole *on each furnace; on occasions, two tapholes may be used and in this instance a proportion of the slag will be treated in slag pools instead. Granulated slag is ground and sold into the cement industry and slag from pools is cooled, dug out and used as a replacement for aggregate.*

BAT achieved.

5.3.2 Odour Reduction

69. BAT for minimising slag treatment emissions is to condense fume if odour reduction is required.

Odour Reduction BAT assessment

Slag granulators are covered by a separate permit owned by Lafarge permit. Odour complaints at Port Talbot are not generally associated with granulator operations, and hence no odour reduction is required.

BAT not applicable.

5.4 Resource Management

5.4.1 Resource Management

70. BAT for resource management of blast furnaces is to reduce coke consumption by directly injecting reducing agents such as pulverised coal, oil, tar, oil residues, coke oven gas (COG), natural gas and wastes such as metallic residues, used oils and emulsions, oily residues, fats and waste plastics individually or in combination.

Applicability

Coal injection: The method is applicable at all blast furnaces equipped with pulverised coal injection and oxygen enrichment.

Gas injection: Tuyère injection of coke oven gas (COG) is highly dependent upon the availability of the gas that may be effectively used elsewhere in the integrated steelworks.

Plastic injection: It should be noted that this technique is highly dependent on the local circumstances and market conditions.

Direct injection of used oils, fats and emulsions as reducing agents and of solid iron residues: The continuous operation of this system is reliant on the logistical concept of delivery and the storage of residues. Also, the conveying technology applied is of particular importance for a successful operation

Resource Management BAT assessment

Coal injection is utilised at both furnaces at Port Talbot.

BAT achieved.

5.5 Energy for Blast Furnaces

5.5.1 Smooth Operation

71. BAT is to maintain a smooth, continuous operation of the blast furnace at a steady state to minimise releases and to reduce the likelihood of burden slips.

Smooth Operation BAT assessment

Daily process reviews are undertaken to maintain smooth operation of both blast furnaces; any burden slips are subject to investigation and corrective actions to prevent re-occurrence. Process stability work streams have been initiated to further improve to situation and minimise slips.

BAT achieved.

5.5.2 Extracted Gas as a Fuel

72. BAT is to use the extracted blast furnace gas as a fuel.

Extracted Gas as a Fuel BAT assessment

Blast furnace gas is utilised whenever possible. Primarily in the blast furnace stoves and power pants. Flaring of BFG is monitored constantly and efforts are taken to minimise this. Typical gas usage is approximately 85 - 90%.

BAT achieved.

5.5.3 Energy Recovery of Top Blast Furnace Gas Pressure

73. BAT is to recover the energy of top blast furnace gas pressure where sufficient top gas pressure and low alkali concentrations are present.

Applicability
Top gas pressure recovery can be applied at new plants and in some circumstances at existing plants, albeit with more difficulties and additional costs. Fundamental to the application of this technique is an adequate top gas pressure in excess of 1.5 bar gauge.

At new plants, the top gas turbine and the blast furnace (BF) gas cleaning facility can be adapted to each other in order to achieve a high efficiency of both scrubbing and energy recovery.

Energy Recovery of Top Blast Furnace Gas Pressure BAT assessment

Energy recovery of top blast furnace gas pressure is not currently utilised at Port Talbot At No. 5 blast furnace there is insufficient pressure to allow effective recovery. Provisions for future retrofitting of a top gas pressure recovery system were also studied throughout BF4 rebuild project 2012. It has been determined that due to the size of the BF and resultant top pressure it is not economically viable.

BAT not applicable.

5.5.4 Pre-heating of Hot Blast Stove Fuel or Combustion Air

74. BAT is to preheat the hot blast stove fuel gases or combustion air using the waste gas of the hot blast stove and to optimise the hot blast stove combustion process.

Description
For optimisation of the energy efficiency of the hot stove the following techniques can be applied:

- the use of a computer-aided hot stove operation
- preheating of the fuel or combustion air in conjunction with insulation of the cold blast line and waste gas flue
- use of more suitable burners to improve combustion
- rapid oxygen measurement and subsequent adaptation of combustion conditions.

Pre-heating of Hot Blast Stove Fuel or Combustion Air BAT assessment

Pre-heating of fuel or combustion air in hot blast stoves is not currently utilised in Port Talbot. The stoves at No. 4 blast furnace will be progressively renewed over the coming period, which will result in more efficient combustion. A programme of reconstructing burners at No. 5 blast furnace will also improve efficiency.

Provisions are being installed for the future retrofitting of heat recovery during the BF4 rebuild project. Infrastructure is being installed for preheating to be fitted when market conditions allow.

Computer-aided stove control is utilised at both blast furnaces.

BAT achieved.

5.6 Blast Furnace BAT Assessment Summary

Area	BAT Conclusion	Achieved?	Comments
Air Emissions	59- Coal Injection Unit	Yes	Bag-filters fitted, not meeting BAT-AEL
	60- Burden Preparation	Generally	Dust extraction and abatement or on conveyors and stock-houses, some dust suppression systems
	61- Casting House	Yes	
	62- Runner Linings	Yes	-
	63- Minimise Release of Blast Furnace Gas	Yes	• Blast Furnace Gas not recovered from bell-less top system • Transportation and storage of process residues from Blast Furnace to sinter plant • Hydro cycling of gas cleaning (Betsi) sludge
	64- Reduction of Dust Emissions	Yes	-
	65- Hot Blast Stoves Emissions	Yes	-
Water and Waste Water	66- Water Consumption	Yes	
	67- Waste Water Treatment	Yes	-
Production Residues	68- Prevention of Waste	Yes	Some Blast Furnace gas treatment sludge (Betsi) is stockpiled
	69- Odour Reduction	N/A	Subject to separate permit
Resource Management	70- Resource Management	Yes	Coal injection being used
Energy	71- Smooth Operation	Yes	-
	72- Extracted Gas as a Fuel	Yes	-
	73- Energy Recovery of Top Blast Furnace Gas Pressure	NA	Insufficient top gas pressure
	74- Pre-heating of Hot Blast Stove Fuel or Combustion Air	No	Not currently pre-heating fuel or combustion air to stoves

6. BAT CONLCLUSIONS FOR BASIC OXYGEN STEEL MAKING AND CASTING

Unless otherwise stated, the **BAT** conclusions presented in this section can be applied to all basic oxygen steelmaking and casting.

6.1 Air Emissions

6.1.1 Basic Oxygen Furnace Gas Recovery

75. BAT for basic oxygen furnace (BOF) gas recovery by suppressed combustion is to extract the BOF gas during blowing as much as possible and to clean it by using the following techniques in combination:

I. use of a suppressed combustion process
II. prededusting to remove coarse dust by means of dry separation techniques (e.g. deflector, cyclone) or wet separators
III. dust abatement by means of:
  i. dry dedusting (e.g. electrostatic precipitator) for new and existing plants
  ii. wet dedusting (e.g. wet electrostatic precipitator or scrubber) for existing plants.

The residual dust concentrations associated with **BAT**, after buffering the BOF gas, are:

- 10 – 30 mg/Nm^3 for **BAT III.i**
- <50 mg/Nm^3 for **BAT III.ii.**

Basic Oxygen furnace Gas Recovery BAT assessment

Tata Steel Port Talbot's BOS gas recovery is a suppressed combustion process. Dedusting is carried out through wet scrubbing, PA venturi and cyclonic separators. Recovered gas is dedusted further by wet electrostatic precipitator (WESP).

BAT III.ii. – Tata Steel Port Talbot BOS gas recovery was installed in 2009. The manufacturers defined a particular matter emission of <5mg/Nm^3.

The BOS gas passes through a Wet Electrostatic Precipitator prior to discharge into the distribution main. The manufactures of the precipitator calculated that he outlet concentration of particulates would be less than 3 mg with a guaranteed concentration of less than 5 mg.

BOS gas is utilised within the power plant and 2012 particulate emissions were all measured at < 10 mg/Nm^3.

BAT achieved.

6.1.2 BOF Gas Recovery by Full Combustion

76. BAT for basic oxygen furnace BOF gas recovery during oxygen blowing in the case of full combustion is to reduce dust emissions by using one of the following techniques:

I. dry dedusting (e.g. ESP or bag filter) for new and existing plants
II. wet dedusting (e.g. wet ESP or scrubber) for existing plants.

The **BAT-associated emission levels** for dust, determined as the average over the sampling period (spot measurement, for at least half an hour), are:

- 10 – 30 mg/Nm^3 for **BAT I**
- <50 mg/Nm^3 for **BAT II.**

Basic Oxygen Furnace Gas Recovery by Full Combustion BAT assessment

Tata Steel Port Talbot's BOS gas recovery is a suppressed combustion process. Thus full combustion is not applicable

BAT not applicable.

6.1.3 BOF Lance Hole

77. BAT is to minimise dust emissions from the oxygen lance hole by using one or a combination of the following techniques:

I. covering the lance hole during oxygen blowing
II. inert gas or steam injection into the lance hole to dissipate the dust
III. use of other alternative sealing designs combined with lance cleaning devices.

BOF Lance Hole BAT assessment

Tata Steel Port Talbot's BOS lance holes are covered during oxygen blowing by means of bung/plug (meeting points I. & II.) and inert gas (Nitrogen) purge and camera surveillance to ensure seal.

BAT achieved.

6.1.4 Secondary Dedusting

78. BAT for secondary dedusting including the emissions from the following processes:

- reladling of hot metal from the torpedo ladle (or hot metal mixer) to the charging ladle
- hot metal pretreatment (i.e. the preheating of vessels, desulphurisation, dephosphorisation, deslagging, hot metal transfer processes and weighing)
- BOF-related processes like the preheating of vessels, slopping during oxygen blowing, hot metal and scrap charging, tapping of liquid steel and slag from BOF and
- secondary metallurgy and continuous casting,

is to minimise dust emissions by means of process integrated techniques, such as general techniques to prevent or control diffuse or fugitive emissions, and by using appropriate enclosures and hoods with efficient extraction and a subsequent off-gas cleaning by means of a bag filter or an ESP or any other technique with the same removal efficiency.

The overall average dust collection efficiency associated with **BAT** is >90 % as a daily mean value.
The **BAT-associated emission level** for dust, as a daily mean value, for all dedusted off-gases is <1 – 15 mg/Nm^3 in the case of bag filters and <20 mg/Nm^3 in the case of electrostatic precipitators.

If the emissions from hot metal pre-treatment and the secondary metallurgy are treated separately, the **BAT-associated emission level** for dust, as a daily mean value, is <1 – 15 mg/Nm^3 for bag filters and <20 mg/Nm^3 for electrostatic precipitators.

Description
A general emission prevention technique is to maintain the lid on when the hot metal ladle is not in use and to clean and undo the hot metal ladles of skulls on a regular basis. An alternative to maintaining the lid on is to apply a roof extraction system.

Applicability
In existing plants, the design of the plant may restrict the possibilities for proper evacuation.

Secondary Dedusting BAT assessment

Tata Steel Port Talbot has secondary fume extraction for the reladling of hot metal from torpedo to charging ladle, hot metal pre-treatment desulphurisation, BOS process and secondary metallurgy. See table below for details.

Process & Emission point	***Integrated techniques used***	***Capture Type***	***Abatement Type***	***EPR Permit Ref***	***% Complied with AEL***	***BAT Status***
Hot metal pour & Prep (desulph) fume extraction stack	*Yes*	*Hood/ enclosure*	*Dry bag Filter*	*A10*	*91.5%*	*Not achieved at >99%*
Hot metal Fume extraction Number 2	*Integrated*	*Hood*	*Dry bag Filter*	*A10A*	*100%*	*Achieved*
BOS Secondary fume extraction stack North (+CAS1)	*Integrated & Diffusive*	*Hood & enclosure*	*Dry bag Filter*	*A14*	*99.7%*	*Achieved*
BOS Secondary fume extraction stack Centre (+CAS1)	*Integrated & Diffusive*	*Hood & enclosure*	*Dry bag Filter*	*A15*	*100%*	*Achieved*
BOS Secondary fume extraction stack South (+CAS1)	*Integrated & Diffusive*	*Hood & enclosure*	*Dry bag Filter*	*A16*	*100%*	*Achieved*
Secondary Metallurgy RD Degasser stack	*Integrated*	*Enclosure*	*Wet Spray*	*A17*	*NA – Not ESP or Bag Filter*	*NA*
Secondary Metallurgy RH Degasser stack	*Integrated*	*Enclosure*	*Wet Spray*	*A18*	*NA – Not ESP or Bag Filter*	*NA*
Secondary Metallurgy CASOB/Desulph fume extraction plant	*Integrated*	*Hood*	*Dry bag Filter*	*A63*	*Not operational*	*Working Towards*

Hot metal ladles are not lidded but there is roof extraction in the charging bay from supplied by the Secondary fume extraction, however the design of the plant does limit evacuation. Ladles are cleaned maintained and de-skulled on a regular basis.

Further assessments will be undertaken to establish capture efficiencies following improvements in the extraction systems are carried out.

BAT Achieved by 2016.

6.1.5 On-site Slag Processing

79. BAT for on-site slag processing is to reduce dust emissions by using one or a combination of the following techniques:

I. efficient extraction of dust emissions from the slag crusher and use of
screening devices with subsequent off-gas cleaning, if relevant
II transport of untreated slag by shovel loaders
III. extraction or wetting of conveyor transfer points for broken material
IV. wetting of slag storage heaps
V. use of water fogs when broken slag is loaded.

The **BAT-associated emission level** for dust in the case of using BAT I is <10 – 20 mg/m^3, determined as the average over the sampling period (spot measurement, for at least half an hour).

On-site Slag Processing BAT assessment

Slag Processing is carried out by metal recovery contractor or slag processing contractor on neighbouring ring fenced sites operated under different permits owned by the contractors (who are also regulated through a permit under EPR). Thus this part of the BAT assessment is not applicable to Tata Steel Port Talbot.

BAT not applicable

6.2 Water and Waste Water

6.2.1 Reduce water consumption

80. BAT is to prevent or reduce water use and wastewater emissions from primary dedusting of basic oxygen furnace (BOF) gas by using one of the following techniques as set out in BAT 75 and BAT 76:

- dry dedusting of basic oxygen furnace (BOF) gas;
- minimising scrubbing water and reusing it as much as possible (e.g. for slag granulation) in case wet dedusting is applied.

Waste Water from BOF Primary Dedusting BAT assessment

At Tata Steel Port Talbot BOS off gas scrubbing water is reused following wastewater treatment via De-gritting, polymer dosing and clarification. Excess cleaned scrubbing water overflows to the effluent system. The effluent is cleaned further through pH buffering, polymer dosing and sedimentation before release at the integrated works effluent discharge point (W1).

BAT achieved

6.2.3 Water Discharge from Continuous Casting

81. BAT is to minimise the waste water discharge from continuous casting by using the following techniques in combination:

I. the removal of solids by flocculation, sedimentation and/or filtration
II. the removal of oil in skimming tanks or any other effective device
III. the recirculation of cooling water and water from vacuum generation as much as possible.

The **BAT-associated emission levels,** based on a qualified random sample or a 24-hour composite sample, for waste water from continuous casting machines are:

- suspended solids — <20 mg/l
- iron — <5 mg/l
- zinc — <2 mg/l
- nickel — <0.5 mg/l
- total chromium — <0.5 mg/l
- total hydrocarbons — <5 mg/l

Waste Water discharge from continuous casting BAT assessment

Effluents from the various processes across the Port Talbot site are generally combined and are discharged to sea via a common discharge system. Spot samples are taken from all the permitted discharge points as specified in the current permit, but it has been identified that the prescribed sampling does not cover all the pollutants for which BAT-AELs are given as the BREF document assumes individual discharges. Current available information does not allow a robust evaluation on how to implement the BAT-AELs at this stage. An improvement programme is to be implemented to best evaluate how the BAT-AELs can be implemented at the Port Talbot site. In the meantime, derogation is required on precautionary grounds because it is too early to know whether the agreed approach to effluent treatment and permitting will allow Tata Steel to be compliant with all BAT-AELs by March 2016.

BAT not achieved.

6.3 Production Residues

6.3.1 Waste Generation

82. BAT is to prevent waste generation by using one or a combination of the following techniques (see BAT 8):

I. appropriate collection and storage to facilitate a specific treatment
II. on-site recycling of dust from basic oxygen furnace (BOF) gas treatment, dust from secondary dedusting and mill scale from continuous casting back to the steelmaking processes with due regard for the effect of emissions from the plant where they are recycled
III. on-site recycling of BOF slag and BOF slag fines in various applications
IV. slag treatment where market conditions allow for the external use of slag (e.g. as an aggregate in materials or for construction)
V. use of filter dusts and sludge for external recovery of iron and non-ferrous metals such as zinc in the non-ferrous metals industry

Applicability of BAT V
Dust hot briquetting and recycling with recovery of high zinc concentrated pellets for external reuse is applicable when a dry electrostatic precipitation is used to clean the BOF gas. Recovery of zinc by briquetting is not applicable in wet dedusting systems because of unstable sedimentation in the settling tanks caused by the formation of hydrogen (from a reaction of metallic zinc and water). Due to these safety reasons, the zinc content in the sludge should be limited to 8 – 10 %.
VI. use of a settling tank for sludge with the subsequent recycling of coarse fraction in the sinter/blast furnace or cement industry when grain size distribution allows for a reasonable separation.

BAT is to manage basic oxygen furnace process residues, which can neither be avoided nor recycled in a controlled manner.

Waste Generation BAT assessment

Tata Steel Port Talbot recycle BOS filter cake from gas treatment and secondary dedusting dust through reverting waste oxide briquettes into the BOS process. Continuous caster Mill scale is recycled via the sinter plant.
BOS slag and slag fines is recycled on site through various routes including sinter and construction aggregates. BOS slag is also treated by a contractor (HARSCO Metals authorised under EPR Permit), who occupy an neighbouring ring fenced site and used externally for various applications including aggregate for construction and soil conditioning in the agricultural industry.
Filter dusts are used onsite in the blend of waste oxide briquettes.

Recovery of zinc by briquetting is not applicable in Tata Steel Port Talbot due to wet dedusting systems in place. Zinc levels in sludge are typically <8%. The coarse fraction of BOS gas treatment sludge is removed by degritter and reverted to the sinter plant.

BAT achieved

6.4 Energy

6.4.1 BOF Gas

83. BAT is to collect, clean and buffer BOF gas for subsequent use as a fuel.

Applicability

In some cases, it may not be economically feasible or, with regard to appropriate energy management, not feasible to recover the BOF gas by suppressed combustion. In these cases, the BOF gas may be combusted with the generation of steam. The kind of combustion (full or suppressed combustion) depends on local energy management.

BOF Gas BAT assessment

Tata Steel Port Talbot BOF (BOS) gas recovery is through suppressed combustion. Gas is collected and mixed with other process gasses before being combusted in the site power plant to produce energy. *See BAT 3 response on BOS gas utilisation.*

BAT achieved

6.4.2 Ladle-Lid System

84. BAT is to reduce energy consumption by using ladle-lid systems.

Applicability

The lids can be very heavy as they are made out of refractory bricks and therefore the capacity of the cranes and the design of the whole building may constrain the applicability in existing plants. There are different technical designs for implementing the system into the particular conditions of a steel plant.

Ladle-Lid System BAT Assessment

At Tata Steel Port Talbot ladle lids are used in secondary metallurgy area to retain heat in teeming ladles delayed from going straight to continuous casting. Continuous casting use ladle lids to retain heat in teeming ladles on the caster turn tables.

BAT achieved

6.4.3 Direct Tapping

85. BAT is to optimise the process and reduce energy consumption by using a direct tapping process after blowing.

Description

Direct tapping normally requires expensive facilities like sub-lance or DROP IN sensor-systems to tap without waiting for a chemical analysis of the samples taken (direct tapping). Alternatively, a new technique has been developed to achieve direct tapping without such facilities. This technique requires a lot of experience and developmental work. In practice, the carbon is directly blown down to 0.04 % and simultaneously the bath temperature decrease to a reasonably low target.
Before tapping, both the temperature and oxygen activity are measured for further actions.

Applicability

A suitable hot metal analyser and slag stopping facilities are required and the availability of a ladle furnace facilitates implementation of the technique.

Direct Tapping BAT Assessment

Tata Steel Port Talbot BOS plant use a direct tapping process as described in the BAT above.

BAT achieved

6.4.2 Continuous Near Net Shape Strip Casting

86. BAT is to reduce energy consumption by using continuous near net shape strip casting, if the quality and the product mix of the produced steel grades justify it.

Description

Near net shape strip casting means the continuous casting of steel to strips with thicknesses of less than 15 mm. The casting process is combined with the direct hot rolling, cooling and coiling of the strips without an intermediate reheating furnace used for conventional casting techniques, e.g. continuous casting of slabs or thin slabs. Therefore, strip casting represents a technique for producing flat steel strips of different widths and thicknesses of less than 2 mm.

Applicability

The applicability depends on the produced steel grades (e.g. heavy plates cannot be produced with this process) and on the product portfolio (product mix) of the individual steel plant

Continuous Near Net Shape Strip Casting BAT Assessment

Tata Steel Port Talbot's continuous casters do not cast slab to <15mm thinkness.

BAT not applicable.

6.5 Basic Oxygen Steelmaking and Casting BAT Assessment Summary

Area	BAT Conclusion	Achieved?	Comments
Air Emissions	75- Basic Oxygen Furnace Gas Recovery	Yes	-
	76- BOF Gas Recovery by Full Combustion	N/A	Tata Steel Port Talbot's BOF gas recovery is a suppressed combustion process. Thus full combustion is not applicable.
	77- BOF Lance Hole	Yes	-
	78- Secondary Dedusting	Mostly	See Section 5.4.1.1
	79- On-site Slag Processing	N/A	Slag Processing is carried out by contractors on a neighbouring ring fenced site operated under a different permit owned by the contractora. Thus this part of the BAT assessment is not applicable to Tata Steel Port Talbot.
Water and Waste Water	80 - Waste Water from BOF Primary Dedusting	Yes	-
	81- Waste Water Discharge from Continuous Casting	No	See Section 5.2.2.1
Production Residues	82- Waste Generation	Yes	-
Energy	83- BOF Gas	Yes	-
	84- Ladle-Lid System	Yes	-
	85- Direct Tapping	Yes	-
	86- Continuous Near Net Shape Strip Casting	NA	NA

6 BAT CONLUSIONS FOR ELECTRIC ARC FURNACE STEELMAKING AND CASTING

There are no electric arc steelmaking processes at the Port Talbot Works, therefore BAT conclusions 87 to 95 are not applicable

BAT Not Applicable.