Environment Agency Permit Variation
BAT assessment
Bridgnorth Flat Screen Recycling Facility
EPR EB3005KB

May 2020

Requirement		Compliance assessment
Storage and Treatment of Flat Panel Displays - A quick guide		
Storage and handling		
1	LCD displays must be stored on an impermeable surface with sealed drainage. They must also be stored under weatherproof covering or in enclosed weatherproof containers to prevent mercury contaminated rainwater being generated and to facilitate refurbishment/re-use activities.	Display units including LCD and PC screens containing CCFL backlights will be stored in a yard area prior to the first stage of processing which involves segregation / triage by individual unit type (LED, LCD, PC plasma). All dismantling activities take place internally. Drainage in the yard area used for triage will be diverted to foul sewer. All display units in this area will be stored under a flexible weatherproof covering (e.g. tarpaulin) to prevent mercury contaminated rainwater being generated. Drainage in the external residue storage area will also be diverted to foul sewer to prevent any residual contamination mobilised by rain water entering surface water systems. There are no drains internal to the factory.
2	LCDs must be carefully stored and handled to prevent breakage of the fragile internal mercury backlights. Dropping, crushing or compacting LCDs is not acceptable. To prevent breakage, LCDs should be stored in containers e.g. cages or stillages and packed to minimise movement during handling and transport. Where pallets are used, LCDs should be stacked to prevent toppling or crushing of the display units. Where stacking containers on top of each other precautions must be taken to prevent damage to the displays in containers underneath.	Incoming display units are stored in metal cages / stillages, these can be stacked two high because the upper tier is supported by the stillage and not the display units underneath. Some units arrive on pallets and where this is the case they are not double stacked to avoid crushing damage. All display screens but particularly those containing CCFL backlights are subject to sympathetic handling to prevent damage to internal components containing mercury.
3	Damaged or dropped LCDs are more likely to contain broken backlights and should be prioritised for processing. This may not be readily apparent by	Prior to the processing of any LCD display it is gently agitated in order to assess if there is any noise from within, this indicates whether there has been damage caused

	visual inspection alone, as internal backlights may have been broken by a shock pulse from dropping or shunting of a container. Shaking an LCD may give a crude indication if any internal lamps are broken. A portable mercury monitor can also be used to measure mercury levels around containers in reception areas.	to the backlighting array prior to receipt on site. If there is suspicion the tube array has been badly damaged then the unit is dismantled manually in an LEV booth rather than being offered to the distortion or cutting cell (robot 1 or 2). A portable mercury monitor will be used to determine whether fugitive mercury emissions are occuring in storage or processing areas.
4	To help distinguish between LCDs containing mercury backlights and those backlit with light emitting diodes (LEDs) which don't contain mercury, monitors may have a sticker on the back of the unit indicating their type. Where there is uncertainty it should be assumed that the display contains mercury backlights as this is the most common type of FPD.	Appropriate training is carried out to ensure operatives are able to segregate display units by technology type.
5	Visually check all waste and records received for LCDs containing mercury backlights (including laptops and notebooks) to ensure they are stored and treated separately in order to prevent any mercury contamination of other WEEE streams. The shredding or mixing/dilution of hazardous LCD displays with other small mixed WEEE streams is not BATRRT.	Appropriate training is carried out to ensure operatives are able to segregate display units by technology type.
6	Any LCD items containing lithium batteries (e.g. rechargeable lithium ion batteries in laptops) present a potential fire/explosion risk (e.g. if they short-circuit or are exposed to water) and should be stored appropriately to prevent damage (as detailed above).	Laptop batteries and household batteries are stored in dedicated, labelled containers. No treatment of batteries is carried out at the Facility.
Treatment requirements		
1	Where backlights are removed from LCDs there is potential for breakages to occur and mercury to be released either as odourless vapour, liquid droplets, amalgamated within lamp electrodes or adhered to visible powder. In order to minimise any fugitive mercury releases, the removal of backlights must be done in a controlled area/sealed booth with appropriate air extraction and abatement i.e. local exhaust ventilation (LEV) to capture all dusts and vapour. An appropriately sized and maintained HEPA dust filter and impregnated carbon filter (e.g. iodide, bromide or sulphur which forms a chemical bond with mercury) is typically used to achieve this.	See BAT 3. See also ERA (Appendix H).
2	Where the abated air is released via a point source emission to air outside of a building, this should be covered accordingly by the permit, with appropriate emission control limits as part of the operator's mercury management plan. Where the abated air is recycled inside the building the operator would also need to ensure that mercury levels comply with the appropriate workplace exposure limits regulated by the HSE.	See BAT 25 and 32. See also ERA (Appendix H).

3	Once removed, intact backlights should be packed to prevent breakage during transit and stored in securely lidded and robust weatherproof containers.	All CCFL tubes intact or broken are handled and stored either in a negative pressure environment or in a closed container with a well fitting lid. Containers with backlights inside are stored separately and labelled.
4	Whilst the aim of any manual treatment process should be the safe removal of intact lamps, due to their fragile nature, some breakages will inevitably occur. Any broken backlights must be stored in appropriate airtight sealed containers. Filling of these containers should be done in the controlled area/sealed booth to capture any mercury vapour. Airborne mercury levels within lamp storage areas can be checked using a mercury vapour indicator.	All CCFL tubes, intact or broken, are handled and stored either in a negative pressure environment or in a closed container with a well fitting lid. A portable mercury monitor will be used to determine whether fugitive mercury emissions are occuring in storage or processing areas.
5	Any residues resulting from lamp breakages (including powder, glass and lamp components) should be removed from working areas using an appropriate industrial vacuum cleaner with mercury filters. The emptying of residues collected by the vacuum cleaner should be performed in the controlled area/sealed booth.	A suite of three specialist vacuum cleaners with HEPA filters are utilised for cleaning operational areas as part of routine housekeeping. Summary of use: 1.) Mercury stations (LEV) will be cleaned using HEPA at the end of every daily shift to remove any residues resulting from lamp breakages (including powder, glass and lamp components) from working areas including manual dismantling stations under negative pressure. 2.) To clean and decontaminate any area following an accidental spillage which could contain mercury. 3.) Periodic deep cleaning of processing and storage areas where it is appropriate as a precaution to treat any accumulated dusts as if they could contain mercury. The emptying of the vacuum cleaner will be carried out in a what which controls the potential for mercury release.
6	Backlights or residues should be consigned as hazardous waste to an appropriately authorised site for further treatment to remove the mercury.	A suite of group level and site specific systems are in place to comply.
8	Appropriate Health and Safety procedures should be followed by staff undertaking manual dismantling. The operator should have a management plan including COSHH, risk assessments and the provision of information and training for staff, including the use of appropriate personal protective equipment (PPE). This would include the wearing of coveralls or disposable overalls, lightweight gloves, chemical safety glasses/goggles or a face visor and safety shoes or boots. Significantly contaminated clothing should be removed and replaced immediately. Suitable respiratory protective equipment	Veolia is externally certificated to ISO 45001. Health and safety controls are regularly reviewed and appropriate workplace exposure monitoring and health surveillance are in place.

	(RPE) may also be worn e.g. a half-face mask respirator with a Hg-P3 filter where appropriate (HSG53 states a maximum use time of 50 hours). Good hygiene procedures should also be followed to minimise exposure, such as hand washing and footwear protection in potentially contaminated areas.	
Waste treatment BREF		
General		
BAT 1	In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS).	Veolia operates under an integrated management system (BMS) that defines the business procedures, formulated to assist in meeting business objectives across the entire scope of Veolia's activities. Veolia is externally certificated to ISO 9001, ISO 14001, ISO 45001 and ISO 22301 by Lloyds Register who routinely audit a sample of sites to check compliance and adherence to the standards.
BAT 2	Measures associated with the pre-acceptance / acceptance, tracking, inventory, output quality management and segregation, compatibility and sorting of waste.	A suite of group level and site specific systems are in place to comply.
BAT 3	In order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of waste water and waste gas streams, as part of the environmental management system.	A point source release to air (gas stream) from extraction via an LEV network serving activities related to LCD processing to control particulates and mercury has been assessed by undertaking detailed air dispersion modelling. External waste storage areas drain to foul sewer and emissions are controlled by a discharge consent issued by Severn Trent Water.
BAT 4	Measures associated with the storage of waste including, optimised storage location, adequate storage capacity, safe storage operation, separate area for storage and handling of packaged hazardous waste.	The installation will operate in accordance with a Fire Prevention Plan 'FPP'. Systems are in place to monitor and manage waste storage location and quantities.
BAT 5	Measures associated with handling and transfer of waste: ▪ handling and transfer of waste are carried out by competent staff; ▪ handling and transfer of waste are duly documented, validated prior to execution and verified after execution; ▪ measures are taken to prevent, detect and mitigate spills; ▪ operation and design precautions are taken when mixing or blending wastes (e.g. vacuuming dusty/powdery wastes)	A suite of group level and site specific systems are in place to comply. See also ERA (Appendix H).

BAT 6	Measures relating to emission to monitoring emissions to water.	There are no process wastewater streams. Any fugitive emissions from external waste storage areas drain to foul sewer and are controlled by a discharge consent issued by Severn Trent Water.
BAT 7	Frequency of monitoring for emissions to water	See BAT 6.
BAT 8	Measures relating to monitoring frequency for channelled emissions to air	Monitoring of emissions to air is undertaken using MCERTS accredited methods, BS EN 13284-1 for dust and BS EN 13211 for mercury.
BAT 9	Monitor diffuse emissions of organic compounds to air from the regeneration of spent solvents, the decontamination of equipment containing POPs with solvents, and the physico-chemical treatment of solvents for the recovery of their calorific value	Not relevant for this installation, this activity is not carried out or applicable.
BAT 10	Periodic monitoring of odour emissions.	Not relevant for this installation, incoming and outgoing wastes have virtually no odour potential.
BAT 11	Monitor the annual consumption of water, energy and raw materials as well as the annual generation of residues and waste water, with a frequency of at least once per year.	A suite of group level and site specific systems will be in place to comply.
BAT 12	To prevent or, where that is not practicable, to reduce odour emissions, BAT is to set up, implement and regularly review an odour management plan, as part of the environmental management system.	Not relevant for this installation, incoming and outgoing wastes have virtually no odour potential.
BAT 13	Measures relating to odour control techniques.	Not relevant for this installation, incoming and outgoing wastes have virtually no odour potential.
BAT 14	To prevent or, where that is not practicable, to reduce diffuse emissions to air, in particular of dust, organic compounds and odour, BAT is to use an appropriate combination of the techniques given below. a. Minimising the number of potential diffuse emission sources b. Selection and use of high integrity equipment c. Corrosion prevention d. Containment, collection and treatment of diffuse emissions e. Dampening f. Maintenance g. Cleaning of waste treatment and storage areas h. Leak detection and repair (LDAR) programme	Where activities are undertaken which could result in emissions of harmful substances to air, these are undertaken in an enclosed environment under negative extraction via an LEV system and abatement system. See also ERA (Appendix H).
BAT 15	Use flaring only for safety reasons or for non-routine operating conditions (e.g. start-ups, shutdowns).	Not relevant for this installation, activities requiring these controls are not carried out.

BAT 16	Measures relating to emissions to air when flaring is unavoidable.	Not relevant for this installation, activities requiring these controls are not carried out.
BAT 17	To prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to set up, implement and regularly review a noise and vibration management plan, as part of the environmental management system	Not required for this installation on a risk basis. See also ERA (Appendix H).
BAT 18	To prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to use one or a combination of the techniques given below: ▪ Appropriate location of equipment and buildings ▪ Operational measures ▪ Low-noise equipment ▪ Noise and vibration control equipment ▪ Noise attenuation	A suite of group level and site specific systems are in place to comply. See ERA (Appendix H).
BAT 19	To optimise water consumption, to reduce the volume of waste water generated and to prevent or, where that is not practicable, to reduce emissions to soil and water, BAT is to use an appropriate combination of the techniques given below: ▪ Impermeable surface ▪ Roofing of waste storage and treatment areas ▪ Segregation of water streams ▪ Adequate drainage infrastructure ▪ Design and maintenance provisions to allow detection and repair of leaks ▪ Appropriate buffer storage capacity	The process does not consume water and both waste input and outputs are dry. External waste storage areas drain to foul sewer and emissions are controlled by a discharge consent issued by Severn Trent Water.
BAT 20	To reduce emissions to water, BAT is to treat waste water using an appropriate combination of specified techniques.	There are no stages in the process which consume water and both waste input and outputs are dry. Any fugitive emissions from external waste storage areas drain to foul sewer and are controlled by a discharge consent issued by Severn Trent Water. The discharge consent does not require treatment of water prior to discharge.
BAT 21	To prevent or limit the environmental consequences of accidents and incidents, BAT is to use: ▪ Protection measures ▪ Management of incidental/accidental emissions ▪ Incident/accident registration and assessment system	A suite of group level and site specific systems are in place to comply.
BAT 22	In order to use materials efficiently, BAT is to substitute materials with waste.	Resource management systems are established within the business at group level.

BAT 23	In order to use energy efficiently, BAT is to use both of the techniques given below. ▪ Energy efficiency plan ▪ Energy balance record	A suite of group level and site specific systems are in place to comply.
BAT 24	In order to reduce the quantity of waste sent for disposal, BAT is to maximise the reuse of packaging.	Plastic containers for transporting CCFLs are reused. Other containers, IBCs and pallets are reused where possible.
BAT conclusions for the mechanical treatment of waste		
BAT 25	Measures relating to abatement of emissions to air of dust and particulate bound metals using a combination of: ▪ Cyclone ▪ Fabric filter ▪ Wet scrubbing ▪ Water injection into the shredder	Emissions from sawing / cutting activities relating to the processing of PC monitors are captured by an LEV network and abated via a fabric filtration system followed by a carbon filter. The emission point serving all LEV in the facility has been monitored annually since 2016. This monitoring shows that the abatement system can operate within the associated emission level specified in the relevant BREF (2-5 mg/Nm^3). A conservative dispersion modelling exercise assuming continuous operation during business hours at the maximum BAT-AEL has been carried out which concludes there will be no breach of relevant air quality assessment levels. A portable vacuum cleaner with a HEPA filter will be used for cleaning activities as appropriate.
BAT 26	In order to improve the overall environmental performance, and to prevent emissions due to accidents and incidents, BAT is to use BAT 14g and all of the techniques given below: a. implementation of a detailed inspection procedure for baled waste before shredding; b. removal of dangerous items from the waste input stream and their safe disposal (e.g. gas cylinders, non-depolluted EoLVs, non-depolluted WEEE, items contaminated with PCBs or mercury, radioactive items); c. treatment of containers only when accompanied by a declaration of cleanliness.	This aspect is unlikely to be relevant to this installation on a risk basis. Incoming wastes are display screens which are all individually manually handled prior to processing. The risk that these inputs will be contaminated with dangerous items is very low, and if there were any non conforming items they would be identified prior to any manual or automatic processing activity.
BAT 27	Measures relating to emissions from deflagrations.	Unlikely to be relevant to this installation on a risk basis, see BAT 26
BAT 28	The shredder feed is equalised by avoiding disruption or overload of the waste feed which would lead to unwanted shutdowns and start-ups of the shredder	The shredder feed is equalised by avoiding disruption or overload of the waste feed which would lead to unwanted shutdowns and start-ups of the shredder. The shredder is subject to planned preventative maintenance.

BAT 29	Measures relating to emission of organic compounds to air for the treatment of WEEE containing VFCs and/or VHCs.	Not relevant for this installation, activities requiring these controls are not carried out.
BAT 30	Measures relating to explosions when treating WEEE containing VFCs and VHCs.	Not relevant for this installation, activities requiring these controls are not carried out.
BAT 31	Measures relating to emission of organic compounds to air for the mechanical treatment of waste with calorific value	Not relevant for this installation, activities requiring these controls are not carried out.
BAT 32	In order to reduce mercury emissions to air, BAT is to collect mercury emissions at source, to send them to abatement and to carry out adequate monitoring. This includes all of the following measures: — ▪ equipment used to treat WEEE containing mercury is enclosed, under negative pressure and connected to a local exhaust ventilation (LEV) system; ▪ waste gas from the processes is treated by dedusting techniques such as cyclones, fabric filters, and HEPA filters, followed by adsorption on activated carbon (see Section 6.1); ▪ the efficiency of the waste gas treatment is monitored; ▪ mercury levels in the treatment and storage areas are measured frequently (e.g. once every week) to detect potential mercury leaks.	Display units containing CCFL tubes are processed either in the case of LCD units partly mechanically by two robots designed specifically for processing display screens comprising a distortion cell and a backlight cutting / sealing cell. The cutting / sealing cell operates under negative pressure. Bisected sealed tubes are removed manually under negative extraction and handled and stored either under extraction or in closed containers with well fitting lids. Extracted air from handling of LCD units is treated through a carbon filter. In the case of PC monitors an mechanical saw is used to remove the edge of the display and remove the CCFL backlight tubes with housings. The saws operate in an enclosed environment and are lidded while they operate and are constantly under extraction. Extracted air from the saw units is treated through a fabric filter and a carbon filter. The point source emission serving all LEV in the facility has been monitored annually. This monitoring shows that the abatement system can operate within the associated mercury emission level specified in the relevant BREF (2-7 µg/Nm^3). A conservative dispersion modelling exercise assuming continuous operation during business hours at the maximum BAT-AEL has been carried out which concludes there will be no breach of relevant air quality assessment levels. The emission point has been monitored annually since 2016. This monitoring shows that the abatement system can operate within the associated emission level specified in the relevant BREF A portable mercury monitor is used a minimum of once weekly to detect possible mercury leaks in treatment and storage areas.