What WRWA does with your waste

In May 2002 WRWA entered into a long-term contract, known as the Waste Management Services Agreement (WMSA), with Cory Environmental Limited (now trading as Cory Riverside Energy). This contract is helping WRWA to realise its aim of maximising reuse and recycling and providing a greener future for management of its waste.

The waste management services provided by WRWA and Cory involve waste and recyclable material being delivered to the Authority's two transfer stations, at Smugglers Way in Wandsworth and Cringle Street in Battersea, for either reuse, recycling or treatment.

Western Riverside Transfer Station, near Wandsworth Bridge, can handle over 6,500 tonnes of waste and recyclables per week. WRWA's second transfer station, Cringle Dock, is located next to Battersea Power Station and can handle over 6,000 tonnes of waste and recyclables every week.

Both transfer stations use state-of-the-art technology in waste containerisation and operate efficiently and to the highest environmental standards.

Cory takes advantage of spare capacity at the transfer stations for the receipt of local trade and commercial waste.

WRWA currently provides an integral Household Waste and Recycling Centre (previously known as a Civic Amenity Site) at its Smugglers Way transfer station and Lambeth Council also provides its own, additional, Reuse and Recycling Centre at Vale Street, West Norwood.

WRWA receives co-mingled and separated recyclables at its transfer stations and a new Materials Recycling Facility (MRF) was constructed at Smugglers Way in 2010/11, so that most of the separation and baling process is now carried out on site and the baled materials are then transported on to their various market outlets elsewhere in the UK or abroad.

Green Waste collected kerbside by the constituent councils and at WRWA's Household Waste and Recycling Centre is bulked at the transfer stations for onward transportation to a number of centralised composting facilities within, or just outside, the London area.

Most of the waste that cannot be reused or recycled is compacted into containers before being loaded onto barges for their onward river journey. Historically, this was to Cory's landfill site located on the Thames Estuary at Mucking, Essex, but since the completion of the Riverside Resource Recovery Limited's (RRRL) Energy from Waste Facility at Belvedere, in the London Borough of Bexley, the waste has been used for energy recovery. The Authority is now sending "zero waste" direct to landfill and is generating enough electricity to power over 100,000 homes.

Collaborative negotiation between the Authority and Cory Riverside Energy led, in March 2017, to a successful restructuring of the Belvedere Energy from Waste (EfW) Facility's long term borrowing which will generate significant financial savings for the Authority as a consequence. The Facility will, for decades to come, ensure a secure and environmentally sound treatment method for that portion of waste which cannot be reused or recycled.

In November 2017 Cory published plans to build an integrated, low-carbon energy park at its site in Belvedere, South East London. This would complement Cory's existing Riverside EfW Facility and comprise a range of technologies, including waste energy recovery, anaerobic digestion, solar panels, and battery storage.

It would also enable more of London's residual "black bag" waste to be converted into green electricity, particularly during times of peak usage, and produce cheap heat for export to nearby homes and businesses. In addition, it would continue to convert the residual ash left over at the end of the process into construction materials useful for building London's homes and roads. The application is expected to be submitted to the Government's Planning Inspectorate in late 2018 and, if the planning process is successful, construction is targeted to begin in 2021, with the Energy Park to be fully operational by 2024.

Year-on-year increases in the rate of landfill tax mean that the **landfilling** of waste has become an **uneconomic proposition** as well as one which is found

The Government's Waste Hierarchy

Prevention

Preparing for Reuse

Recycling

Other Recovery

Disposal

Recovery

The journey by river

An integral part of WRWA's contract with Cory is the use of the River Thames for transporting its residual waste that cannot be reused or recycled. The waste is loaded by crane onto one of Cory's barges in sealed containers – each of Cory's 47 barges has a 300 tonne capacity and is pulled by a tug, which tows them some 20 miles downriver to the Riverside Resource Recovery Energy from Waste facility in Belvedere. The river operation is governed by the tides. Craft containing full containers go downstream on the ebb tide and empty containers are taken back upstream on the flood tide.

Transporting waste by river is occasionally difficult, particularly when there are high winds or fog, but from an environmental point of view it is an excellent method of transport. The four hour journey from the transfer stations to Belvedere, negotiating bends, bridges and currents, requires an experienced skipper at the wheel. Although commercial river traffic has declined, the tugs' crews need to keep a watchful eye for pleasure craft and other users of the River.

Cory's fleet is headed up by its four new tugs which have been in operation since Autumn 2010. The tugs Reclaim, Recovery, Redoubt and Resource are just the latest in a long line of Cory tugs that have been operating on the River Thames for over 110 years and in June 2012 they led the working boats section of the Queen's Jubilee Pageant.

Overall Cory transports around 600,000 tonnes of waste a year on the Thames, thus saving more than 100,000 heavy vehicle movements a year on the capital's already congested roads.

Left: An integral part of WRWA's contract with Cory is the use of the River Thames for transporting its residual waste.

Right: The Belvedere Energy from Waste facility is the largest in the UK and generates 72MW of power.

To complete the process, the Incinerator Bottom Ash (IBA) produced at the Riverside facility is taken back on Cory's barges in specially designed containers to a new IBA processing facility at Tilbury Docks, developed by Ballast Phoenix. This can process 170,000 tonnes of IBA a year to recover metals and produce a construction aggregate currently being used on the M25 widening scheme and many other road and construction projects.

Belvedere Energy from Waste plant

The Belvedere Energy from Waste plant (EfW) plant is owned and operated by Riverside Resource Recovery Limited (RRRL), a wholly owned subsidiary of Cory. The Facility provides for the incineration of waste, and the use of the heat from the process to generate electricity through steam generation in boilers.

It is the largest EfW Facility in the UK and one of the largest in Europe, which generates 72MW of power (6MW of which is used on site and the remaining 66MW is exported to the National Grid). The facility is consented to receive up to 785,000 tonnes of residual waste each year and RRRL became fully responsible for its operation in 2011.

Use of the EfW plant does not artificially limit WRWA's ability to reduce or recycle its waste. Whilst WRWA has the benefit of a guaranteed level of capacity at the facility it remains free to reduce or recycle its waste without limitation. WRWA is not required to supply any guaranteed level of tonnage to the facility, or make any minimum payment. Indeed, the Authority receives a royalty for any capacity it gives up and is therefore positively incentivised to make such reductions.

Overall Cory transports around **600,000 tonnes of waste a year** on the Thames, thus **saving more than 100,000 heavy vehicle movements** a year on the capital's already congested roads.

The planning permission only allows for 195,000 tonnes per annum to be delivered to the Facility by road, with all the remaining waste to be supplied by river. All but 115,000 tonnes of the river waste (transferred via the Port of Tilbury) must originate from within Greater London. The majority of the waste is therefore transferred to the facility via the Authority's Transfer Stations at Smugglers Way and Cringle Dock, the City of London's Transfer Station at Walbrook Wharf and the Transfer Station at Northumberland Wharf in Tower Hamlets.

The Facility is designed to have the capability of providing waste heat for use by nearby homes or commercial premises, but no suitable outlets have as yet been identified.

However, the Incinerator Bottom Ash (IBA) is being processed at Ballast Phoenix Limited's IBA recycling plant at Tilbury Docks which was constructed to recycle the bottom ash produced at the Facility.

Over 150,000 tonnes per annum of the inputs to Belvedere (approximately 28%) will end up as bottom ash and this is transported from Belvedere by river barge to Tilbury. Ferrous and non-ferrous metals are reclaimed during processing, with the remaining material being processed into aggregate, destined primarily for new road schemes.

The Riverside facility was officially opened by Her Royal Highness The Princess Royal in May 2012 and it is one of the UK's most efficient energy recovery plants and an important strategic waste management facility for the capital.

The Energy from Waste Process

When the tugs arrive at the facility's jetty the waste containers are unloaded by two goliath gantry cranes and placed on the back of dock tractors and trailers.

These vehicles deliver the waste containers into the tipping hall of the plant and also take containers of Incinerator Bottom Ash from the facility back to the jetty for onward processing and recycling at Tilbury.

The Energy from Waste Process

Tipping hall

1. Waste arrives in the tipping hall in containers on the back of RRRL's fleet of dock tractors and trailers and in a variety of waste collection vehicles from the surrounding area.

2. The waste is tipped into one of 12 tipping bays. Each bay has a hydraulically operated door which minimises noise and odour during the tipping operations. Lights on each tipping bay indicate to the drivers of the vehicles which bay is available to receive waste.

DID YOU KNOW?
The facility processes an average of 585,000 tonnes a year of waste over design life. Each container holds 12-14 tonnes of waste.

Waste bunker

1. The waste bunker is 30m deep, 61m long and 16m wide. It can hold up to around 10,000 tonnes of waste – enough to fuel the whole plant at full capacity for five days.

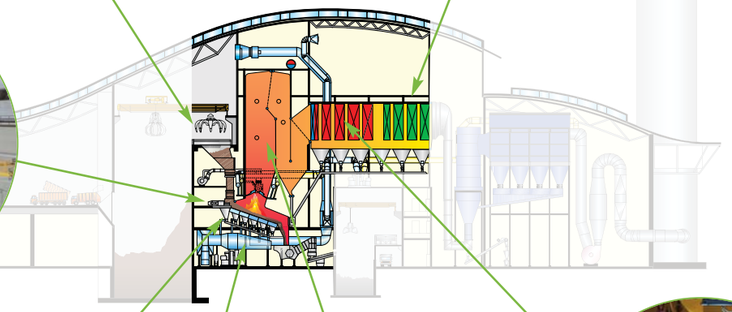
2. Overhead waste cranes mix the waste so it maintains a similar heating value throughout. The waste cranes feed each of the three combustion lines ensuring that each of the boilers has the required feedstock for continuous 24-hour operation.

DID YOU KNOW?
Infrared cameras detect any hot spots. If any hotspot exceeds 85ºC water cannons will automatically operate.

Waste combustion

1. Waste is fed into one of the three feed hoppers by the overhead cranes. The waste then travels down the chutes and onto a horizontal feeder table.

2. Hydraulically operated ram feeders push the waste onto the sloping grate.



3. The sloping stoker grate consists of alternate rows of fixed and moving cast steel bars. Through the forward movement of these bars the waste tumbles slowly down the burning waste bed. The resulting burnt out product – Incinerator Bottom Ash – falls from the base of the grate into a quench bath.

4. Primary heated combustion air drawn from above the waste bunker is distributed into the waste bed through holes in each cast steel grate bar. This process dries the waste and provides the correct amount of air to allow good combustion of the waste bed. In compliance with the Waste Incineration Directive, the combustion process operates at <850ºC.

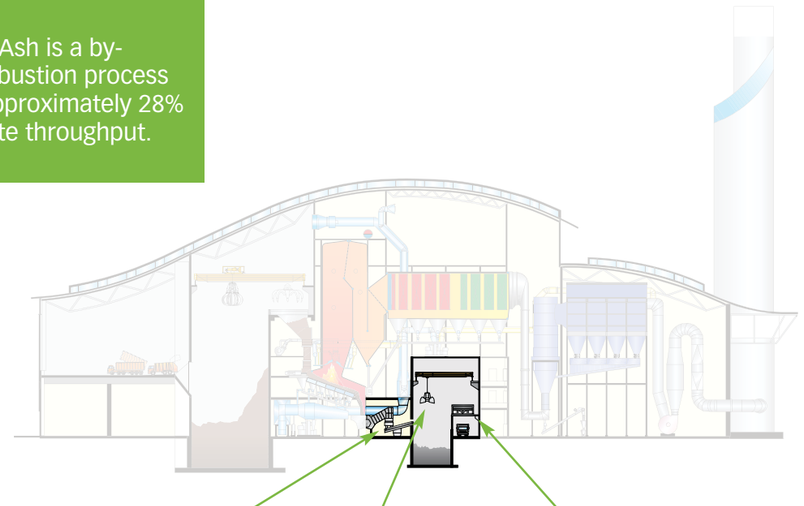
5. Secondary swirling air introduced above the grate through cylindrical nozzles ensures that the gases in the waste are thoroughly mixed. This results in a fully optimised combustion process and encourages low levels of toxicity in the gases leaving the combustion chamber. NOx levels are reduced by ammonia injection to the levels required in the Environmental Permit.

6. Heat from the flue gases heats the water in the boiler tubes turning the water into super heated steam. This steam drives the turbine which in turn drives the generator, producing electricity.

7. Gases and smoke produced during combustion are drawn through the gas passes of the boiler by an induced draught fan.

Incinerator Bottom Ash (IBA)

DID YOU KNOW?
Incinerator Bottom Ash is a by-product of the combustion process and accounts for approximately 28% of the facility's waste throughput.



1. The Incinerator Bottom Ash which drops from the grate into a quench bath is then pushed by hydraulic rams onto vibrating conveyors and from there falls into the ash bunker.

Any oversized metal or other objects fall off the conveyor into skips to be recycled.

2. The Incinerator Bottom Ash is moved by overhead ash cranes from the ash bunker into elevated loading hoppers which are positioned over an internal roadway.

3. Incinerator Bottom Ash is discharged from the hoppers into ash containers.

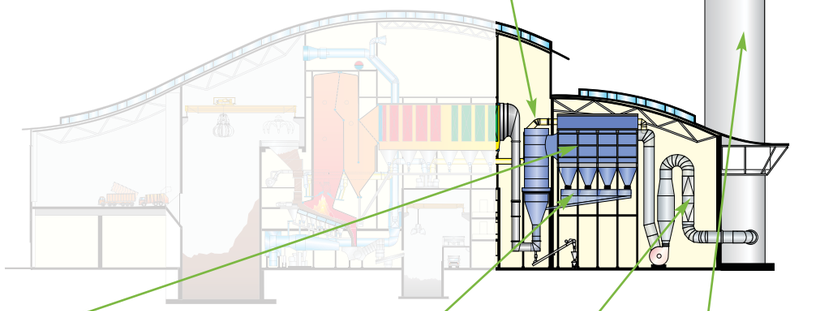
These containers are transported to the jetty on dock tractors and trailers and placed on barges to be taken to the IBA processing facility at Tilbury.

Around 170,000 tonnes of ash per year is sent for processing.

Flue gas treatment

1. Flue gases leave the boiler and pass into a Turbosorp® reactor tower where hydrated lime, powdered activated carbon and water are injected into the swirling gas flow. These help neutralise acids and capture heavy metal particles.

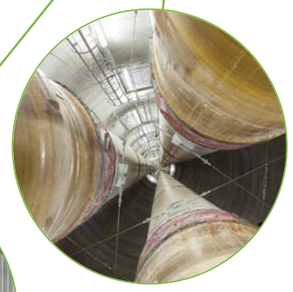
DID YOU KNOW?
The Air Pollution Control Residue (APCR) is a by-product of the combustion process and accounts for approximately 4% of the facility's waste throughput.



2. Gases from the Turbosorp® reactor tower are drawn into one of three fabric bag filters which each consist of 2,048 6m long cylindrical fibre bags on steel wire cages. The clean gases pass through the filters and the Air Pollution Control Residue (APCR) collects on the outer surface of the bags.

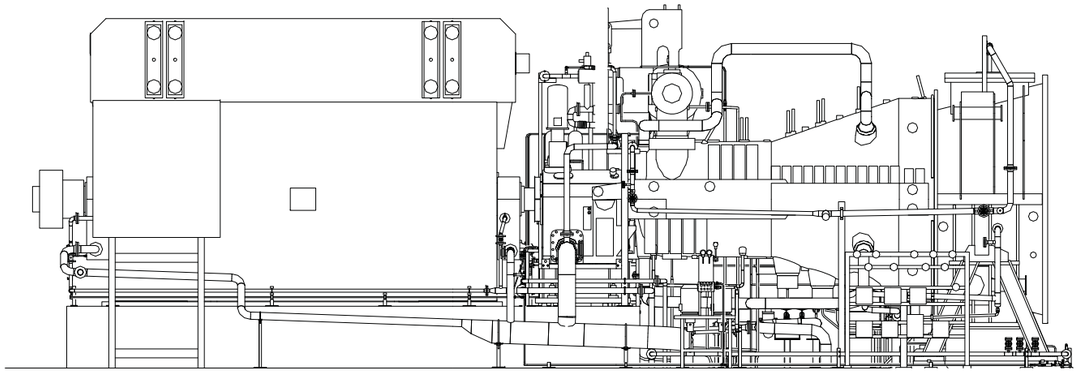
3. Compressed air pulses shake off the APCR into silos. The APCR is removed from the site by road tanker.

4. Clean hot gas is drawn out of the fabric filter bags through a heat exchanger which allows heat to be transferred from the gas into the boiler feed water.



5. An induced draught fan for each of the three lines draws clean cooled gas up the 85 metre stack where it is discharged into the atmosphere. Emissions equipment continually monitors plant performance in relation to the environmental permit.

Steam turbine and generator



1. High pressure steam from each of the three boiler drums is directed onto rings of fixed blades causing the turbine to rotate at high speed.

2. The steam turbine is coupled to the electric generator which rotates at the same speed as the turbine. This produces high voltage electricity which is sent to the 132kv substation and on to the National Grid. The plant produces enough electricity to power around 100,000 homes.

3. Exhaust steam leaves the turbine and is cooled in an air cooled condenser. The resulting condensate is then returned to the boilers as boiler feed water.