

Blue Phoenix
Tilbury IBA
Impervious liner – Independent review

1 Background

An Environmental Permit (EP) for the operation of the Tilbury IBA Facility (the Facility) was granted by the Environment Agency (EA) on 25 June 2012. Since it was granted, the EP has been subject to three variations. The most recent variation was granted on 6 February 2020, where the named operator was changed to Blue Phoenix.

The Facility is located at Tilbury Docks in Essex and covers an area approximately 450m long by 70m wide parallel to the Quay known as berths 36 and 38. In 2011, the site was redeveloped to provide a reception area for incinerator bottom ash (IBA) for Riverside EfW plant and storage areas for processed IBA.

Condition 3.2.1 of the EP states:

Emissions of substances not controlled by emission limits (excluding odour) shall not cause pollution. The operator shall not be taken to have breached this condition if appropriate measures, including, but not limited to, those specified in any approved emissions management plan, have been taken to prevent or where that is not practicable, to minimise, those emissions.

During a site inspection undertaken in July 2023, the EA has raised a Compliance Assessment Report (CAR) which indicates that there has been a breach of condition 3.2.1 due to subsidence within the 'ash reception area' potentially causing leachate from this area to contaminate the underlying ground.

Taking this into consideration, Blue Phoenix has requested that Fichtner undertakes a review of the Tilbury IBA Facility with respect to the design intent and integrity of the liner installed beneath the ash reception area, noting that some areas have been subjected to settlement and repair.

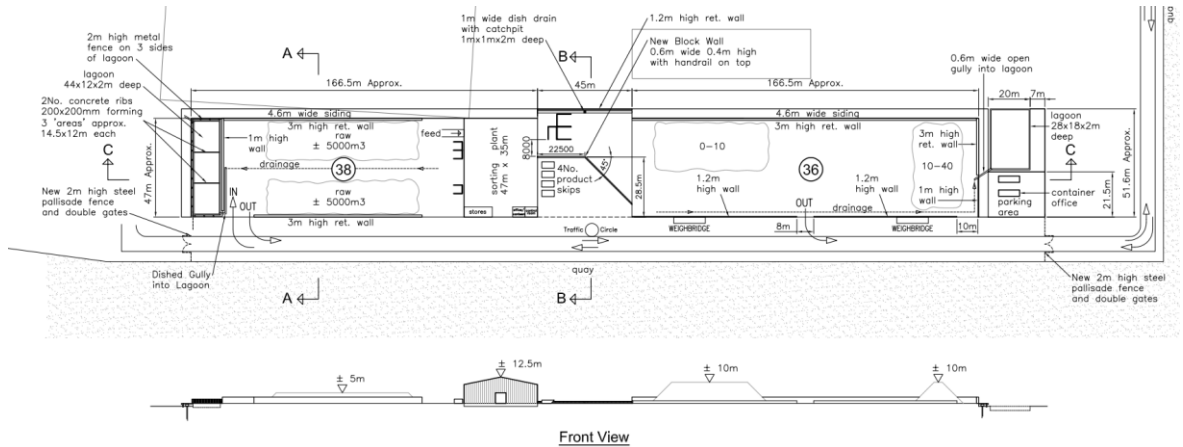
Fichtner has not inspected the ash reception area. This review has been undertaken as a desktop review based on information provided by the Blue Phoenix.

2 Design philosophy

2.1 Site layout and hardstanding construction

The site comprises external ash reception areas 36 and 38 either side of a centrally located IBA sorting building and product skip area, as shown in Figure 1. Lagoons at either end of the site are designed to capture rainwater and/ or leachate runoff from the adjacent ash reception area.

Figure 1: Site plan

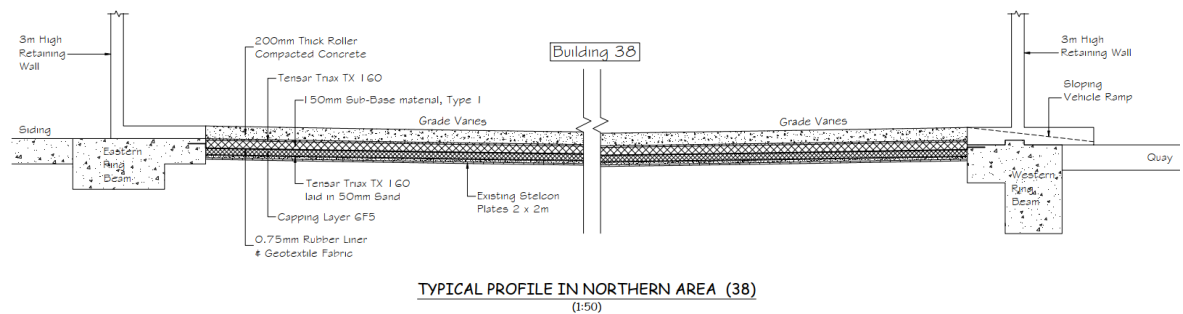


Source: Extract from Drawing 12422-001 Rev J – Tilbury Docks, Proposed Site Layout

Fichtner understands from the original as-built construction drawings provided by Blue Phoenix that the construction make-up of the ash reception area comprises the following in order from ground level downwards, as shown in Figure 2.

- **Hardstanding**[MP1] (surface wearing course) – ground bearing 200mm thick roller compacted concrete (RCC).
- Subbase course – 150mm thick layer of compacted Type 1 granular fill with a Tensor Tnax TX160 Geogrid.
- Liner – **Butyl** 0.75mm rubber liner with a high puncture resistance liner protection geotextile.[MP2] See datasheet in Appendix A.
- Capping layer – 6F5 recycled crushed aggregate, thickness unknown.
- Sand blinding – 50mm thick sand layer with a Tensor Tnax TX160 Geogrid.
- Existing floor construction - Stelcon plates (2m x 2m).

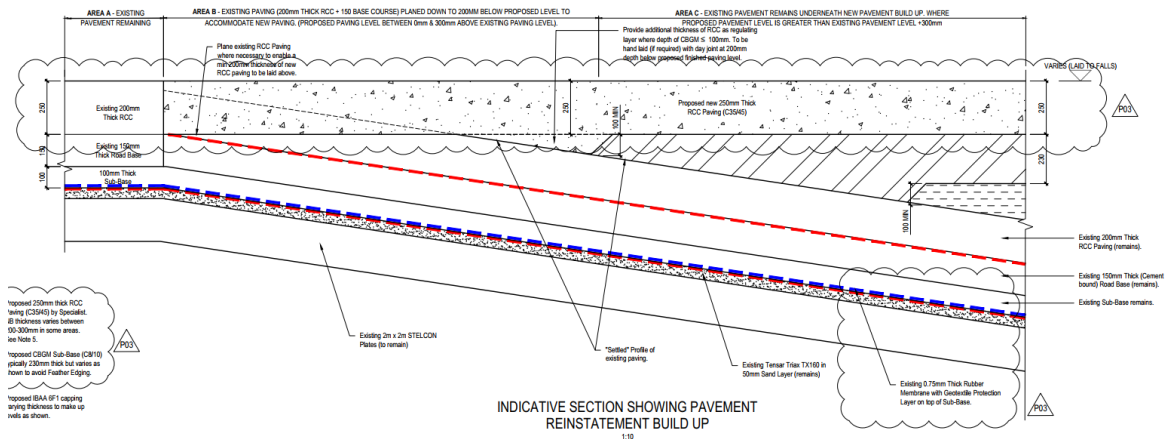
Figure 2: Typical hardstanding make-up



Source: Extract from Drawing 12422-008 Rev D – Tilbury Docks, Hardstanding Profiles

Information provided by Blue Phoenix indicates that remedial works were undertaken to the ash reception area in 2022 -2023 as the area had undergone settlement and been subject to wear to the hardstanding surface due to the ongoing operation of the Facility. The purpose of the remedial works was to raise levels and reinstate a roller compacted hardstanding surface.

Figure 3: Hardstanding reinstatement detail



Source: Extract from P20097-SMCE-ZZ-XX-DR-S0180_P03 – Option 2, Pavement Detail Sheet 1

2.2 Drainage

Fichtner has reviewed the as-built construction drawings provided by Blue Phoenix. From the drawings, Fichtner's understanding of the intent of the drainage design is that any rainwater and/or leachate run-off from the ash reception area is drained to the lagoons which are located at the low point of the hardstanding. Run-off water and leachate on the surface of the hardstanding flows by gravity to formed low points and is directed into the lagoons. Treated water from the lagoons is then discharged to a foul sewer at a controlled rate.

The subbase to the ash reception area is designed to form an impervious barrier to prevent leachate being released to ground by using an impervious butyl liner membrane beneath a roller compacted concrete hardstanding with minimal joints.

3 Assessment of liner integrity

As the liner is buried beneath concrete hardstanding it cannot be inspected without removal of the hardstanding. Therefore, Fichtner is unable to comment on the current condition of the liner. However, the original design philosophy and the products used in the construction of the ash reception hardstanding area will provide a high level of protection to prevent run-off penetrating the liner and leaching into the underlying ground. The design philosophy and protective measures are summarised as follows:

1. The 0.75mm thick butyl liner has high stretch capacity and is expected to achieve 300% elongation prior to failure [MP3]. This capacity to stretch reduces the risk of the liner failing by displacement, or being locally punctured, as the ground beneath the storage areas suffers settlement due to loading. We do not consider the current settlement issues to have caused elongation of the liner to anywhere near this extent.
2. The liner is shown to have been installed over a high puncture resistance geotextile membrane. This will reduce the likelihood that the liner was punctured during construction and will also minimise the risk that it will have been damaged following long-term differential ground settlement.
3. Differential settlement across the hardstanding would stretch the liner and impart tension into it which would increase its risk of failure if elongated beyond its limit. However, as two layers

of Tensor Tnax TX160 Geogrids have been installed beneath the hardstanding, this will provide load distribution and reduce the magnitude of differential settlement.

4. Formed joints in hardstanding surfaces typically widen as shrinkage occurs and the sealant products used to seal joints tend to perish over time. Joints are therefore undesirable as they increase the risk of water and leachate penetrating through the hardstanding and reaching the liner. The hardstanding to the ash reception area is constructed from roller compacted concrete which requires significantly fewer joints compared to other more traditional forms of hardstanding construction and therefore the potential leachate routes to the liner are greatly reduced.
5. The hardstanding is laid to falls which minimise areas of standing water on the slabs and reduces the potential for water to pass through any cracks or joints in the hardstanding.
6. The new ash reception hardstanding areas have been constructed over the existing Tilbury Docks Stelcon plates. This is expected to provide a rigid subbase to the new hardstanding and settlement is likely to be more uniform which in turn will reduce the risk of the liner failing.

Taking into consideration, the design philosophy and protective measures which have been installed, Fichtner considers that these should be sufficient to prevent failure of the liner and leachate subsequently entering the ground underlying the ash reception area.

4 Conclusion

Given the assessment above, Fichtner considers that despite the settlement issues experienced, the design philosophy and protective measures which have been installed will continue to provide an impermeable surface to the ash reception area.

Furthermore, Fichtner considers that the design philosophy and protective measures which have been installed are appropriate to prevent pollution from run-off and leachate from the ash reception areas and ensure compliance with condition 3.2.1 of the EP.

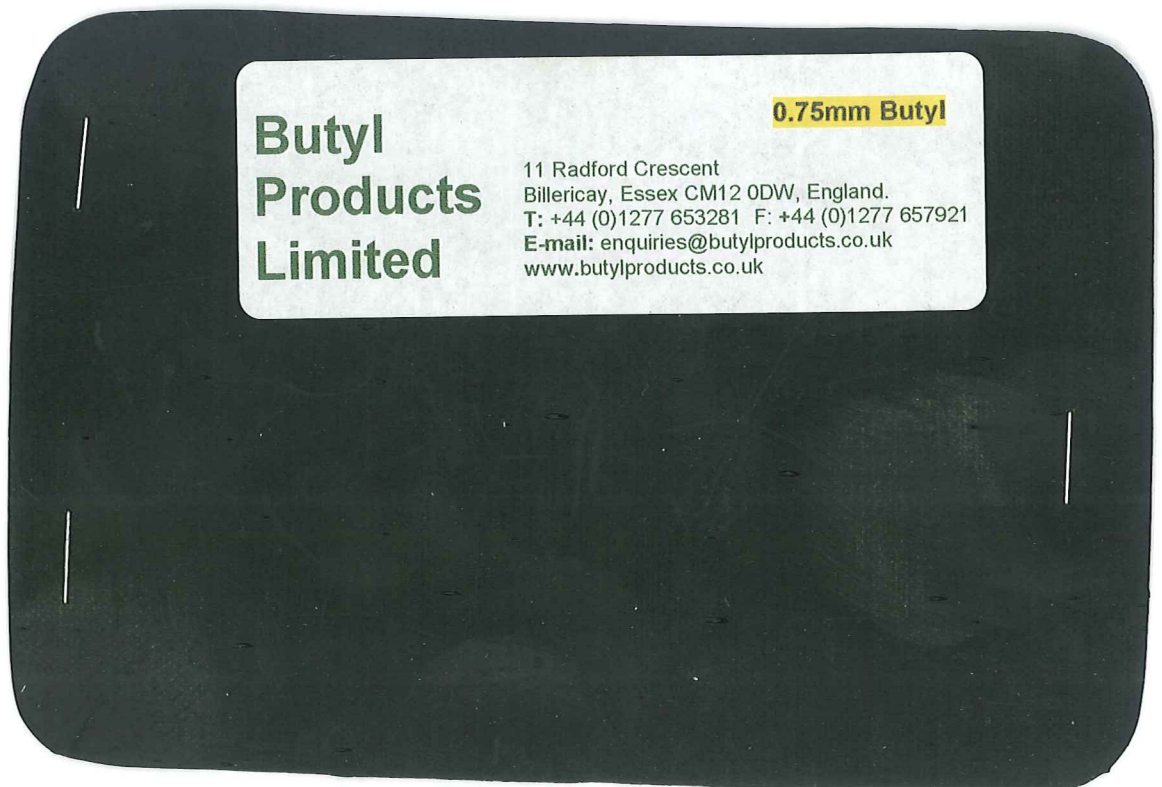
Appendices

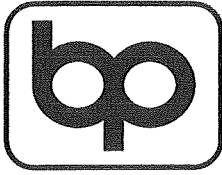
A Butyl 0.75mm rubber liner datasheet

FILE 2B - SECTION 2B.1

O&M File Information

Butyl Rubber Liner





Butyl Products Ltd.

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E-mail: enquiries@butylproducts.co.uk www.butylproducts.co.uk

BUTYL RUBBER SPECIFICATION

Typical Properties	Test Method	Specification (Typical Values)	Minimum Values
Tensile Strength	BS 903 Part A2	8.0 MPa	7.0 MPa
Modulus at 300%	BS 903 Part A2	5.5 MPa	4.5 MPa
Elongation at Break	BS 903 Part A2	350%	300%
Tear Strength	BS 903 Part A3	30 N/mm	25N/mm
Ozone Resistance (7 days/50pphm/30 Deg C)	BS 903 Part A43 Procedure A		50% extensions No cracks
Heat Aging (Retentions) (7 days @ 100 .Deg. C)	BS 903 Part A19	6.0 MPa 250%	5.6 MPa 200%
Flex Cracking	BS 903 Part A10		200.000 cycles, no crack
Specific Gravity	BS 903 Part A1	1.24 +/- 0.03	
Nominal Weight	@ 1mm thickness	1240 g/m ²	
Dimensional Stability	1 Hr at 100 .Deg C	+/- 1% Max	

Grade AA Agreement Board Certificate No 87/1884

Thickness Available 0.75mm 1.0mm & 1.5mm, Reinforced materials 1.0mm thick

Form 112 Rev. A

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HEALTH & SAFETY DATA SHEET

PRODUCT TRADE NAME		Butylite AA, AG, AG(HT), AH, AJ, AJD, AK, AM, AN, AAA, ARA, AWA, and EU grades
DESCRIPTION		Unsupported Butyl, EPDM or Butyl/EPDM sheeting
PACKAGING	TYPE OF CONTAINER	Normally on a tube wrapped in plastic film, although in some instances the sheeting may be despatched unwrapped. Slit material is usually unwrapped
	EEC END USER	None required.
TRANSPORT	AIRFREIGHT (ICAO)	Standard
	RAIL	Standard
	ROAD (ADR)	Standard
	SEA (IMO)	Standard
	PARCEL POST	Standard
STORAGE	REQUIREMENTS	Keep wrapped in a cool, dry, well ventilated atmosphere, away from direct sunlight and local source of heat
	USEFUL SHELF LIFE	12 months
MAIN APPLICATIONS		Fabrications into roofing membranes, lining, expansion jointing
COMBUSTIBILITY	EXPLOSION	No risk
	FLASHPOINT	Not applicable
	FIRE	The wrapping film will melt at around 100°C and both the rubber and the film will burn once ignited, to give dense smoke which will include harmful gases
	FIRE FIGHTING	Standard fire extinguishers

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CHEMICAL REACTIVITY HAZARDS		Inert at ambient temperatures
APPROVAL FOR USE IN APPLICATIONS INVOLVING CONTACT WITH FOOD AND DRINK		Not generally approved, although the AN grade has been certified by the Water Research Centre as satisfying their potable cold water requirements
HEALTH HAZARDS	SKIN ABSORPTION	Not hazardous
	INGESTION TOXICITY	Do not ingest
	EYE DAMAGE/ IRRITATION	Not hazardous
	INHALATION TOXICITY	Avoid inhaling fine dust particles or fumes
	DERMATOLOGICAL EFFECTS	Certain persons are sensitive to compounding ingredients. Such persons should avoid using these products
	FIRST AID	SKIN CONTAMINATION
	EYE CONTAMINATION	Wash out any foreign body with water and then seek medical advice
	INHALATION OF VAPOUR OR DUST	Seek medical advice
	INGESTION	Seek medical advice
HANDLING	GENERAL PRECAUTIONS	Wearing of gloves desirable. Wash hands with soap and water after contact
	RESPIRATORY PROTECTION	None, unless excessive fumes or dust evident
	EYE PROTECTION	Not normally necessary
	SAFETY PROTECTION	Not normally necessary
ACTION TO DEAL WITH SPILLAGE OR LEAKAGE'S		Not applicable

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WASTE DISPOSAL INSTRUCTIONS	Do not burn in a correctly designed incinerator which achieves complete combustion. Comply with local waste disposal regulations
TYPICAL PHYSICAL PROPERTIES	Refer to WCRP Product Data Sheet or Internal Product Specification
SPECIAL CONDITIONS	Fumes may occur when the rubber is heated for fabrication purposes and this operation should be carried out in a well-ventilated area. Note that rubber fume and rubber dust have a Maximum Exposure Limit in the UK and users should take the necessary precautions to ensure that this is not exceeded.

The purpose of this Data Sheet is to describe the product in terms of its safety requirements and is based on our current knowledge and experience.

The Data does not signify any warranties with regard to its properties. Customers are responsible for satisfying themselves as to the completeness and suitability of the information provided for their own particular use.