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PROCESS DESIGN CAPABILITIES

Phoenix has extensive experience ranging from the design, construction, commissioning and operation of many on-site leachate treatment plants, in the UK and overseas, to providing what we consider to be an optimum solution for our Clients. Our designs are based on unrivalled experience in the design, construction and operation of many types of leachate treatment systems.

Our specialised experience in the design of a range of aerobic biological treatment processes for treatment of landfill leachates, includes a number of recent plant. These treat larger volumes of leachate each day, and achieve reliable and complete removal of Nitrate-N using an innovative and award winning process design.

Since our Process Director, Howard Robinson, first developed the modified Sequencing Batch Reactor (SBR) process for leachate treatment during the late 1970s, and applied it on a full scale at the Bryn Posteg Landfill in 1982, this process has become the most widely-adopted and successful leachate treatment system in the UK.

Although in many recent designs, our robust extended aeration biological treatment process has been adapted to incorporate membrane separation of solids, particularly where additional COD removal has been required, or where very low levels of solids are critical in treated leachate discharges, we continue to design and build many simple, low-maintenance plants based on our tried and tested modified SBR process.

Our leachate treatment plant designs are always based on sound state-of-the-art technical knowledge, and where that knowledge has been lacking, then we have undertaken innovative research and pilot-scale treatment trials to obtain it. This has allowed us to continually refine the operation of SBR plants for treatment of leachates, and advances include an extensive array of fail-safe process controls, remote interrogation and recording of plant operations, and alarm systems. All of these facilities act to minimise the required inputs from a plant operator. Our staff have received national and international awards for this knowledge-based innovation over several decades.

As part of our knowledge development program we are working with research organisations and industry on R & D projects for removal of trace elements and metals to be ready for discharge consent changes expected to be applied in the future.

Our Process Director has written most of the UK Government guidance on leachate composition and treatment during the last 25 years and been responsible for process designs of more than 100 leachate treatment plants in the UK and overseas. Data from

those plants has informed the design of all our new plants in many ways, including optimum reactor sizing and aeration provision, achievable effluent quality and, most importantly, in providing real confidence that plants we design will work robustly and reliably.

We are also very experienced in training and providing a high level of support to leachate treatment plant operators, from a variety of backgrounds. These range from plant operators with degrees in chemistry, to weighbridge operators, or farm labourers.

There are no textbooks available to provide leachate-specific treatment process data. Although generic wastewater treatment kinetic data may provide broad guideline values, the nature of each wastewater is such that a design based on actual leachate treatment plant operating data is far more reliable. For example, kinetic data based on mg of ammoniacal-N nitrified per g of MLSS or MLVSS per hour, fundamentally depends on assumptions about how well the measures of MLSS and MLVSS reflect the concentrations of nitrifying bacteria within any given biological sludge. We know that biomass in a domestic wastewater treatment works is very different in nature from that which we acclimatise within a leachate treatment plant, and so we treat “textbook” data for treatment rates and kinetics, derived from sewage treatment systems, with some caution.

We fundamentally believe that it is vital to test out process design calculations against real operational data from leachate treatment plants where we have treated similar landfill leachates reliably and consistently over many years.

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CIVIL ENGINEERING CAPABILITIES

Phoenix undertakes all civil engineering works associated with our treatment plant contracts.

SOME OF OUR RECENT CIVIL ENGINEERING WORKS HAVE INCLUDED:

- Foundation design and earthworks, including installation of CFA piles through landfill waste to Environment Agency approval, driven steel tubular piles and geogrid reinforcement;
- Extensive reinforced concrete and asphalt hard standing construction;
- In-situ and pre-cast, post-tensioned sectional concrete tanks;
- Structural steel design, fabrication and installation, including access steps, gantries and walkways;
- Landscaping;
- Other miscellaneous civil engineering works associated with hard landscaping, fencing and drainage.

Our services include full contract management, site establishment, sub-contractor coordination and supervision plus undertaking Principal Contractor role under the CDM Regulations.

Phoenix places a high emphasis on staff and welfare. Working to our ISO 9001 and 140001 policy and procedures ensure contracts are managed in a manner to satisfy client expectations. Specialist sub-contractors are regularly assessed for competence and items such as up to date insurances.

Health and Safety on site is a constant concern and Phoenix takes their responsibilities in this area very seriously. Many systems are in place on our sites to ensure all are made aware of their responsibilities and company practices.

Accreditation to CHAS, Safe Contractor, Avetta, Achilles and NICEIC acknowledges our commitment in this area. All staff have access to a specialist safety advisor and larger contracts have independent safety inspections.

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A NITRIFICATION AND DE-NITRIFICATION TREATMENT PLANT WITH ULTRA FILTRATION

WORKS INCLUDED:

- 190 x 500mmØ x 25m deep, concrete piles;
- 1000m³ of concrete;
- Formation of pile caps;
- Tank bases;
- Sectional concrete tanks;
- Bunded chemical storage area;
- Plant & bridge foundations;
- Below ground tanks & pumping stations;
- Pipe lines & cable ducts;
- Draw pits & valve chambers;
- Tarmac road & curbs;
- Concrete hard standing;
- Drainage and sumps.
- High voltage transformer bases;
- Earthworks.

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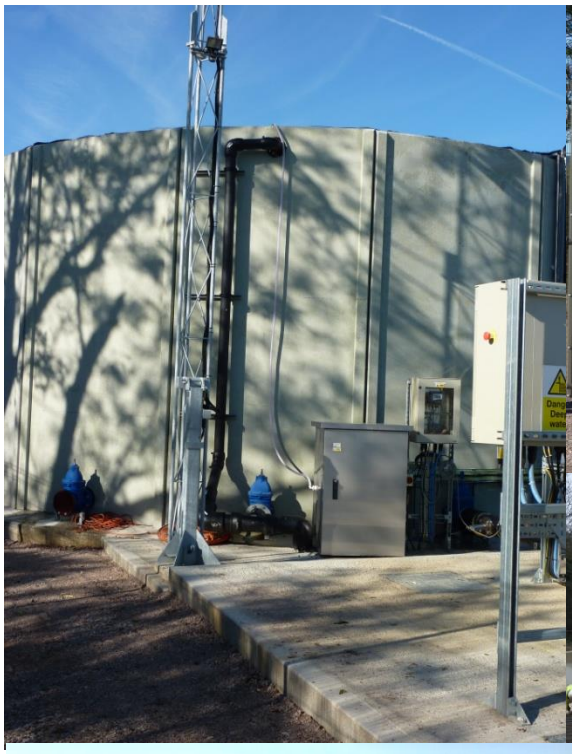
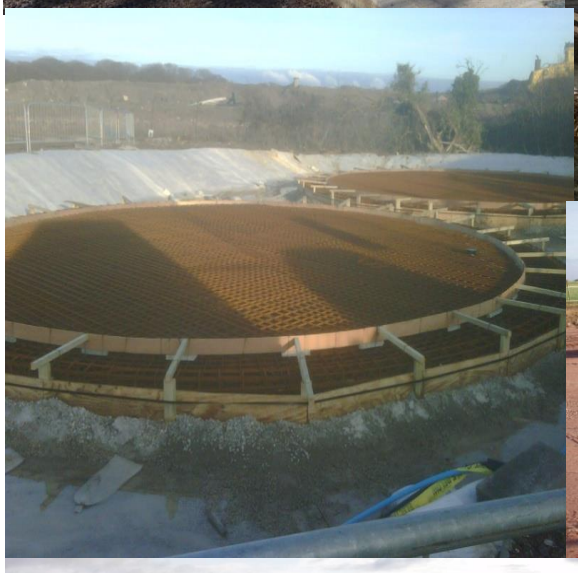
CONSTRUCTION WORK EXAMPLES

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MECHANICAL CAPABILITIES

Phoenix design and install systems in HDPE, MDPE, Ductile Iron, PVC-C, PVC-U, ABS, Polypropylene and Stainless Steel.

Pump sets are assembled onto job specific skids manufactured and tested at our fabrication works.

We offer a design and build service for pumping systems or can build and install to customer designs.

WORKS UNDERTAKEN BY PHOENIX MECHANICAL INCLUDE:

- Delivery pipeline and pumping systems;
- Process pumping and pipe lines;
- Aeration systems;
- Mixing systems;
- Chemical dosing plants;
- Bunded and trace heated pipelines;
- Discharge pumping and pipe lines;
- Borehole pumping;
- Head works;
- “Up slope riser” systems.

PHOENIX ENGINEERS HAS EXTENSIVE EXPERIENCE IN MANY PUMP TYPES, THEIR SELECTION AND INSTALLATIONS INCLUDING:

- Submersible;
- Close coupled;
- Submersed venturi aerators;
- Air blowers;
- Dosing;
- Borehole;
- Self-priming;
- Booster pump sets;
- Positive displacement;
- Rotary lobe.

Working within our ‘in-house’ fabrication unit, Phoenix can design and install bespoke support frames and brackets when required.

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MECHANICAL WORK EXAMPLES






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FABRICATION CAPABILITIES

CNC FOLDING AND GUILLOTINING
We can handle up to 3000mm x 4mm in stainless steel and 6mm in mild steel.

STAINLESS STEEL
Our Engineers have a wealth of experience with the manufacture and installation of process pipe work, tanks and support structures.

MILD STEEL, STRUCTURAL STEELWORK
We undertake all forms of steel fabrication.

DESIGN & BUILD
Working with our partners we offer a full design & build package.

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ELECTRICAL CAPABILITIES

Over the life of the company Phoenix has undertaken Electrical works in many disciplines. The wiring regulations have and continue to change. It is a core activity for Phoenix to keep its staff and systems up to date with current regulations and best practice. Continuing Professional Development forms part of our ethos and ensures that client have projects designed and installed to the latest regulations.

SOME OF OUR INSTALLATION SERVICES:

- LV Distribution cabling;
- HV supplies to 11,000 volt;
- Ring Main Unit & Transformer installations;
- Lighting installation & upgrades;
- Three phase electrical power supplies & infrastructures;
- Ladder rack and tray work containment;
- Plant & machinery installations;
- Water & Sewage treatment plants;
- Power Factor Correction units;
- Fire Alarms installers to BS5839;
- Emergency lighting installers to BS5266;
- Data Communications & UPS supplies;
- CCTV / Door entry systems;
- Electrical Maintenance / Breakdown / Faults.

Phoenix is a **NICEIC** Approved Contractors Company. **NICEIC** is the UK electrical contracting industry's independent voluntary body. "Electricians registered by **NICEIC** are assessed on a regular basis to ensure that they are competent and capable of meeting the relevant technical and safety standards, codes of practice and rules of the Schemes they are registered to".

Qualified Engineers project manage the highly skilled electrical installation teams on any size of new or existing electrical installation.

Phoenix is a registered Institution of Engineering Technology business partner.
The **IET** encompasses the old Institute of Electrical Engineers.

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RECENT INDUSTRIAL ELECTRICAL INSTALLATIONS:

- Waste Transfer Stations;
- In Vessel Composting Plants;
- HV site supplies;
- 11,000 volt transformers and controls;
- Leachate Treatment Plants;
- Admin Offices;
- Street Lighting;
- Pumping Stations;
- Gantry Crane;
- Site Lighting.

Our **ISO 9001** Quality Assurance System covers “The design, manufacture, installation, commissioning and servicing of electrical and mechanical installations and control systems”.

THE LOW VOLTAGE SECTION OF A 1MW 11,000 VOLT SUPPLY FOR A COMPOSTING FACILITY

- All design work is undertaken “in house” using the latest cable sizing software.
- The larger (Form 4) panels are built by specialists to our design.
- All smaller panels are built by our own staff.

Specification, integration and installation design is all undertaken by our engineers. This ensures a co-ordinated design that encompasses the requirements of all disciplines on the larger projects.

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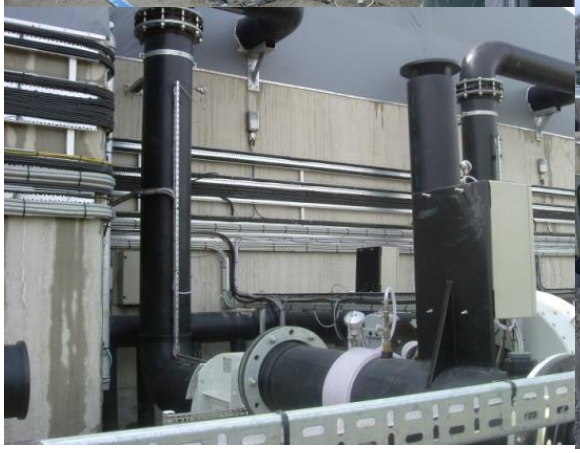
ELECTRICAL WORK EXAMPLES







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ULTRA-FILTRATION CAPABILITIES

Ultra-Filtration as employed by Phoenix is for the removal of solids and COD from treated effluent.

The discharge consents enforced by the Environment Agency have become more stringent and will continue to do so. One major restriction is in the quantity of suspended solids permitted. After filtration the resultant permeate has virtually no solid content.

The Phoenix UF plant is a containerised unit that can be retro-fitted to almost any existing treatment plant and has the added advantage that the existing plant can then treat for 24 hours a day 7 days a week. In most cases a 20% increase in treatment capacity.

We manufacture the units in our own fabrication works using our own labour, allowing close control of build quality.

The Phoenix engineers have employed their knowledge over many years of plant design and working with clients and their operators to produce a flexible and largely automatic plant. The need for flushing and CIP (Cleaning in Place) is automated as is the process itself.

Units are split into two lanes allowing one lane to be shut down when less treatment is required. This will extend the life of the filter membranes and save running costs. Another benefit of the two lane system is that permeate production continues during membrane cleaning albeit at half capacity.

Hot and cold water cleaning storage tanks are housed behind an insulated bulkhead at the far end of the unit. A bunded area in front of the bulkhead houses the cleaning chemical storage.

Operator interfacing is by way of a control panel mounted touch screen graphic display giving access to all parameters and logged data. Remote access is available via the internet for remote observation, set up changes or download of logs. All via secure tunnelled access and security codes.

Clients are welcome to visit our works and see their plant in production. Modification to suit client specific requirements can be accommodated in most cases.

As the plant is containerised delivery is a simple matter of offloading from the lorry onto prepared ground.

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Treated effluent before filtration with 6,000 mg/l of suspended solids.

Treated effluent after filtration (Permeate) with 20 mg/l of suspended solids.

A two lane unit to treat 200 m^3/day.

A four lane unit to treat 300 m^3/day.

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CHEMICALS & INSTRUMENTATION CAPABILITIES

EXPERIENCE

Phoenix has gained experience through many years of working with different chemicals in the food and waste industries. Some installations require a number of chemicals to be stored and pumped in close proximately to each other. Our knowledge and experience has enabled us to design and install many practical and safe chemical dosing systems.

CHEMICALS EMPLOYED ON CONTRACTS:

- Sodium Hydroxide;
- Ferric Chloride;
- Chlorine gas;
- Hydrochloric acid;
- Phosphoric acid;
- Glycerol;
- Methanol;
- Anti-foam;
- Maglime;
- CIP cleaning agents.

PARAMETERS MEASURED ON CONTRACTS:

- Hydrogen Sulphide;
- Methane;
- Carbon Dioxide;
- Oxygen & dissolved Oxygen;
- Chlorine;
- Suspended solids;
- Nitrates;
- Nitrites;
- Oxidation Reduction Potential;
- Flow volume & velocity for air & liquids;
- Depth in liquids & powders;
- Temperature in air, solids and various liquids;
- Conductivity;
- pH – value;
- Explosive atmospheres;
- Pressure;
- Vacuum;
- Proximity.

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Bunded chemical storage tanks & Dosing pumps being installed at Milton Keynes.

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LEACHATE TREATMENT PLANTS

(A) Large SBR Treatment Plants

Landfill Site	End User	Operational	Capacity	Disposal To
• Seater	Highland Council	July 2018	140 m^3/d	watercourse
• Redhill	Biffa Waste Services	January 2018	160 m^3/d	sewer
• Bleakdown	Aggregate Industries	June 2017	50 m^3/d	watercourse
• Shelford SBR	Viridor Waste Management	2016	100 m^3/d	sewer
• Hatfield SBR	CEMEX	2016	50 m^3/d	sewer
• Westmill SBR	Biffa Waste Services	2015	150 m^3/d	sewer
• Brookhurst Additional SBR	Biffa Waste Services	2014	50 m^3/d	sewer
• Brookhurst	Biffa Waste Services	Autumn 2013	100 m^3/d	sewer
• Masons (denitrification)	Viridor Waste Management	August 2012	200 m^3/d	sewer
• Bletchley (denitrification)	Waste Recycling Group	June 2011	200 m^3/d	sewer
• Connon Bridge rebuild (denitrification)	SITA	Summer 2010	300 m^3/d	watercourse
• Small Dole	CEMEX	Autumn 2009	240 m^3/d	watercourse
• Rigmuir	Viridor Waste Management	Winter 2008	200 m^3/d	sewer
• Ardley upgrade	Viridor Waste Management	Winter 2008	250 m^3/d	sewer
• Winterton (denitrification)	Waste Recycling Group	Spring 2009	140 m^3/d	watercourse
• Auchencarroch	Barr Environmental	Spring 2009	150 m^3/d	watercourse
• Frampton-on-Severn	CEMEX	Autumn 2008	100 m^3/d	sewer
• Garlaff, Ayrshire	Barr Environmental	Autumn 2008	200 m^3/d	watercourse
• Parkwood	Viridor Waste Management	Mid 2006	200 m^3/d	sewer
• Pilsworth	Viridor Waste Management	Spring 2005	400 m^3/d	sewer
• Winterton (pre-denitrification) [8]	Waste Recycling Group	Autumn 2004	150 m^3/d	sewer
• Ardley	Viridor Waste Management	Winter 2003	150 m^3/d	sewer
• Efford	Hampshire County Council	Autumn 2002	150 m^3/d	sewer
• Arpley [1,8]	Waste Recycling Group	Autumn 2001	450 m^3/d	watercourse
• Brookhill	A D Waste Ltd	Summer 2001	100 m^3/d	sewer
• Lord St Helens	Cory Waste Management	Spring 2001	80 m^3/d	sewer
• Shelford	Brett Waste Management	Spring 2001	130 m^3/d	sewer
• Whitehead	Viridor Waste Management	Summer 2000	150 m^3/d	sewer
• Ballymacvea[1]	Ballymena District Council,	Autumn 1999	120 m^3/d	watercourse
• Trecatti II	Biffa Waste Services	Autumn 1998	150 m^3/d	sewer
• Sundon[1]	Bedfordshire County Council	Spring 1997	550 m^3/d	sewer
• Connon Bridge[2]	County Environmental Services, Cornwall	Spring 1997	150 m^3/d	watercourse

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• Hempsted B	The Waste Company (now Cory WM)	Spring 1996	280 m^3/d	estuary
• Trecatti	Biffa Waste Services	Autumn 1995	200 m^3/d	sewer

(B) **Simple, smaller, Tank-based SBR Systems**				
Landfill Site	**End User**	**Operational**	**Capacity**	**Disposal To**
• Gremista	Shetland Islands Council	Spring 2006	50 m^3/d	sea
• Portree	Skye & Lochalsh District Council	Spring 1996	100 m^3/d	watercourse
• Borth	Ceredigion District Council	Summer 1995	50 m^3/d	watercourse

(C) SBR Lagoon Systems				
Landfill Sites	**End User**	**Operational**	**Capacity**	**Disposal To**
• Harewood Whin	Yorwaste	November 2019	150 m^3/d	sewer
• Bennadrove upgrade	Western Isles Islands Council	Autumn 2007	130 m^3/d	watercourse
• Winterton (temp. plant)	Integrated Waste Management	Spring 2001	80 m^3/d	sewer
• Cowpen Bewley	Cleveland County Council	Spring 1996	100 m^3/d	sewer
• Deep Moor	Devon Waste Management	Summer 1994	130 m^3/d	sewer
• Bennadrove	Western Isles Islands Council	Autumn 1993	130 m^3/d	watercourse

(D) Other Leachate Treatment Systems				
Landfill Site	**End User**	**Operational**	**Capacity**	**Disposal To**
• Longford [4]	CEMEX	November 2020	50 m^3/d	Sewer
• Shirley [1]	Gloucestershire County Council	August 2013	70 m^3/d	Watercourse
• Rueval	Western Isles Islands Council	Autumn 2008	260 m^3/d	watercourse
• Midgeland [4]	Lancashire County Council	Spring 2005	1800 m^3/d	sewer
• Adswood	Greater Manchester Waste Disposal Authority	Autumn 2004	1000 m^3/d	sewer
• Barlow Hall	Greater Manchester Waste Disposal Authority	Autumn 2004	1000 m^3/d	sewer
• Mont Cuet	States of Guernsey	Summer 2003	450 m^3/d	sea
• Plank Lane[4]	Greater Manchester WDA	April 2003	50 m^3/d	sewer
• Amberswood[4]	Wigan Borough Council	March 2003	100 m^3/d	sewer
• Drinkwater Park[4]	Greater Manchester WDA	October 2002	150 m^3/d	sewer
• Ravenscraig[1,7]	British Steel	Autumn 1999	1,000 m^3/d	watercourse
• Red Moss[4]	Greater Manchester WDA	Spring 1999	1000 m^3/d	sewer
• Monument Hill[1]	Wiltshire County Council	Summer 1996	250 m^3/d	watercourse

• Hempsted A[4,6]	The Waste Company (now Cory WM)	Autumn 1994	700 m^3/d	sewer

Notes

1) Includes reed bed polishing
2) Plus grass and percolation plot irrigation
3) Woodland irrigation
4) Methane stripping/H_2O_2 dosing
5) Ozonation treatment included
6) Hydrogen peroxide dosing/sulphide removal
7) Includes cyanide oxidation and oil removal
8) Includes dissolved air flotation

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The Phoenix approach to Services

Installations from a simple conveyor control panel to a full design and build factory or treatment plant. Phoenix has the experience and the staff to complete your project to specification and on time. Through partnerships with other companies, we offer a complete installation to cover civil and building works, mechanical and electrical.

We can offer a range of installations from a full package to upgrades, control only, panels only or software.
Electrical installations are to BS7671 (the IEE wiring regs).

We can provide fact sheets on many of our completed projects.

- Design and build
- Computer generated information
- Experience team
- Many long-standing customers

Maintenance with sites spread throughout the UK, we have brought together a network of companies able to undertake our maintenance work.

The majority of contracts carry a 12 month repair extension after handover. However, most clients then sign up for our competitively priced ongoing maintenance contracts. Some clients choose to cover the main installation in-house, but sign up for software support with site visits for maintenance on the computer hardware.

- Comprehensive package deals
- Telephone and internet backup
- Local cover

Support is available for all aspects of an installation.
Nationwide cover through our association with other companies.

We offer telephone and remote access support for software.
We try to ensure that an engineer is available at all times to answer questions and to dial in for problem diagnoses.

Technical data is kept on file for all installations to enable informed support for our customers. Our database, particularly of PLC control code, enables us to assist in fault finding and upgrade work.

Having total commitment to engineering excellence

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