

Petrochemical environmental services



RSK Group and petrochemical industry – a long history

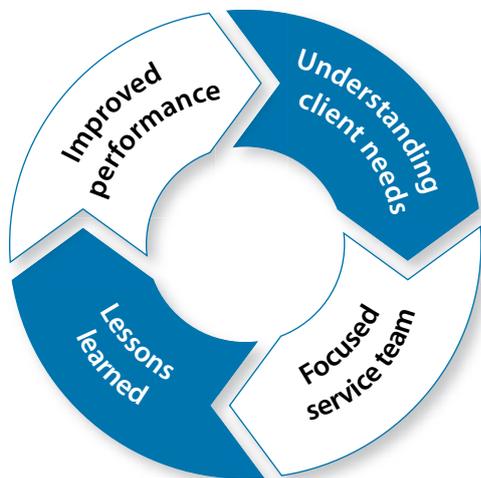
RSK Group plc and its subsidiaries RSK Geoconsult Ltd (RSK Geoconsult), RSK Remediation Ltd and RemedX Ltd (RemedX), the Group's UK-based geo-environmental and remediation service providers have a long and successful record supplying environmental and remediation services to the global oil majors, independent station owners, and the contractors that work for them.

RSK Geoconsult and RemedX offer a wide range of environmental services comprising site assessment, soil validation, waste classification, risk assessment and modelling as well as a variety of remediation services. Remediation services comprise pilot testing for most *in-situ* remediation technologies (dual phase extraction, multiphase extraction, soil vapour extraction, air sparging and groundwater pumping), bench-scale tests for chemical oxidation and biological processes, and full-scale remediation design using *in-situ* and *ex-situ* remediation technologies.

Account partnership approach

RSK underpins our key client relationships with a partnership approach. At the centre of this partnership is a commitment to manage projects using a stable integrated support team. The objectives of this team are to

- understand the client's business drivers and needs, so that we can provide a tailored service delivery
- apply the lessons we learn through focused account service team operations, so that we can improve the value we provide
- build on our project experience and knowledge to ensure high levels of quality and health and safety performance
- apply account-specific performance indicators, so that we deliver continuous performance improvements.



Key performance indicators

Area	KPI	Assessment Method	Target
Communications	Customer satisfaction	Customer feedback	100% feedback above a score of 3.5
Scheduling	On-time delivery	Measure actual delivery against target date as recorded on the MS Project Gantt chart	85% projects on or ahead of time, 98% of projects within 7 days of target
Quality Control	Getting it right first time	Assessing the number of review iterations by the client	Target 95% of all deliverables having only one review iteration
	Adherence to the QA sign off	Quality audit of document sign off	Target of 100% adherence to sign-off standard
Data Management	Adherence of data management, numbering system and data filing	Quality audit	Target of 100% of jobs adhering to the system
Cost Control	Budget control	Management review checking final billed cost to target project cost	95% of projects within budget and 100% within 110% or budget
H&S	Prevent major traffic accidents (defined as costing over £10,000 damage)	Accident report and collation of data on miles travelled	Zero accidents
	Underground utility strikes	Incident report and collation of locations drilled	Less than one strike per 1000 locations
Project Efficiency	Design to action efficiency	Measure ratio of remedial design cost to total cost of remedial action	Target to reduce ratio by 5% every six months
	Reduce the cost of gaining regulator authorisations	Track the average cost of gaining authorisations	Reduce the average cost per authorisation by 5% every six months



Services

RSK Group

The assessment of contaminated land is one of our key areas of expertise. This may be as part of a redevelopment programme, the evaluation of operational liabilities or due diligence for a property transfer.

RSK provides clients with a comprehensive service spanning the investigation, risk assessment, remedial design and remediation contracting process. The services are designed to add value by considering the property value and remedial liabilities that face the client so that solutions can be cost-efficient and effective. In this manner, RSK can design an assessment and remedial programme that is site specific and aligned to a client's business needs whilst still fulfilling the requirements of regulators.

RSK is experienced in assisting clients throughout the risk management process outlined in current UK guidance: 'Model Procedures for the Management of Contaminated Land', Contaminated Land Report Number 11 (CLR11), September 2004. This document formalises the risk-based approach for contaminated land management.

RSK Geoconsult

RSK has extensive expertise in the provision of site assessment, remedial design, development engineering and remediation programme management services worldwide. Together with RSK's in-house organics laboratory and mechanical plant division, we are able to cover the full range of environmental assessment scenarios. Local personnel can draw upon additional support and specialist expertise from the resources of our European office network as well as our US centres of excellence. This is of particular relevance where experience of particular remedial technologies is required. Our networking ability ensures we can deliver state-of-the-art technology and expertise locally.

RSK Remediation

RSK undertakes most remediation contracts using equipment from its own fleet. Owning our own equipment means that we are able to provide competitive prices in our tenders/offers. This equipment is also available for hire and is utilised by an extensive external client base.

Occasionally, RSK may not have the equipment required for a project, in which case we will endeavour to purchase it or, using approved suppliers, hire the equipment. All equipment is kept fully serviced and maintained in order to ensure maximum performance and safety when being used. RSK can offer the following services:

- thirty ton excavator with Allu screening bucket for bio pile remediation and tank extraction
- trial pitting with mini & midi excavator
- vacuum excavation for non-intrusive investigation
- windrow sampling and well installation with Archway competitor percussive type rig
- windrow turning for large site *ex-situ* remediation projects.

RSK Land, Development and Engineering (LDE)

LDE specialises in the provision of the turnkey engineering design and construction management services necessary to deliver sustainable platforms for both residential and commercial development markets. Key services include

- provision of civil and structural design for foundation, site levels and access infrastructure
- sustainable design, planning and construction of in-ground utilities, including drainage, power and telecommunications
- provision of cost estimations and programme optimisation services for site acquisition and project planning purposes.



Structural Soils

Structural Soils Ltd is a site investigation contractor that for over 40 years has provided comprehensive site investigation and ground investigation services in the UK and Europe. Using a wide variety of techniques including fieldwork, *in-situ* testing, *in-situ* monitoring, geophysics, desk studies, laboratory testing and interpretive reporting we can accommodate any size of site investigation contract.

Our in-house fleet of drilling apparatus (cable percussion drilling, rotary drilling and window sampling) coupled with other exploratory techniques such as trial pitting and dynamic probing support our teams of engineers and geologists on site and our large in-house UKAS accredited Bristol laboratory provides soil testing, rock testing, aggregate testing and concrete testing capabilities. Our environmental department undertakes environmental and historical desk studies and has extensive experience in environmental consultancy. Our experienced geotechnical and geo-environmental staff can also provide consultancy and expert witness services.

Envirolab

The RSK laboratory, Envirolab, is a specialist, accredited facility for the assessment of contaminated land and dioxin analysis. It offers a range of analytical services and guarantees the highest standards of quality with a fast, reliable and confidential service at all times.

Consultants, regulatory authorities, industry and testing laboratories utilise our expertise in this area, whether for routine compliance monitoring of discharges, environmental impact surveys or fundamental research. Our quality assurance and quality control systems guarantee the integrity of the analytical results. Accreditation assures our clients of a professional service of the highest quality and reinforces our commitment to quality throughout the business.



Remediation case study 1

Site challenges

The site comprises made ground, underlain by silty sands and gravels to depths of 2.4 mbgl. Groundwater is present at between 2 and 4m bgl and between 7 and 8m bgl, suggesting perched water is present on site.

Hydrocarbon contamination is present in the zone soils. This contamination extends to 12m bgl, suggesting two or more sources of contamination. Significant phase fuel hydrocarbons are present throughout the site with maximum thickness of 1.1m.

Remediation strategy

Using the ground conditions and contaminant distribution data, RemedX proposed two designs. The wells would be used to delineate the plume and source, subsequently allowing targeted remediation by the MPE system.

The wells would be installed alternately with screened sections intercepting two different levels targeting the shallow perched water and the deeper groundwater. During early stages of well

installation, a remediation pilot test would be conducted. The final array would depend upon the concentration of contaminants and the permeability of the ground.

Three technologies were tested at Tile Cross – soil vapour extraction (SVE), multi-phase extraction (MPE) and dual phase extraction (DPE).

Remediation design

The final scheme used 13 wells for DPE and 13 for SVE, which were installed to 13m bgl. Due to high VOC levels, an ATEX rated high vacuum unit was used. One catalytic oxidiser was installed in the vacuum system outlet to treat vapours before discharge. Pumps were installed in the DPE wells and connected to a water treatment unit.

Remediation case study 2

Site challenges

The site lies over London Clay, a minor aquifer. Groundwater is five metres below ground level.

The BTEX and TPH contamination on site is thought to be from old underground storage tanks. Site investigations and risk assessments were conducted by RSK, identifying the remedial targets for the site.

Remediation strategy

RemedX selected multi-phase extraction to remediate the site given the medium to low hydraulic conductivity, and the physical and chemical properties of the contaminants, which is favourable to vacuum extraction technologies. MPE would gradually dewater the aquifer and expose a larger mass of soil to vacuum and therefore to airflow. The airflow within the unsaturated soils would be responsible to enhance volatilisation and transport of vapour-phase hydrocarbons towards the remediation well.

Remediation design

Seven remediation wells were installed to a depth of 7m within the remediation area. The radius of influence was 4m, based on RemedX's experience using the MPE technology in similar ground conditions. The remediation system comprises a high vacuum unit, vapour phase carbon filters, sand filter and aqueous phase carbon filter.

Results:

After six months of operation at the Harlington site the MPE system recovered approximately 1500kg of VOC in the vapour phase. The TPH concentration in groundwater reduced from 22,000ug/L to 6300ug/L (71% reduction) whilst total BTEX reduced from 5050ug/L to 2330ug/L (85% reduction).

Oil major experience

Inno
solu

Multi-phase Extraction and *Ex-situ* Chemox – UK

On a remediation contract below a former factory site in preparation for residential development, RSK's use of controlled multi-phase excavation followed by application of chemical oxidants achieved clean-up targets in less than two years.

Anaerobic Degradation – Belgium
RSK led this EU-sponsored technology demonstration, designed to validate the full-scale application of the Enhanced Reductive Dechlorination technique.



RSK Group – key sector experience

BP RM

RSK provides remedial assessment, quantitative risk assessment, remedial design and remediation project management services to assist BP RM (BP's internal remediation management team) to manage large liability issues associated with soil and groundwater remediation throughout the UK. The primary objective is to extinguish liabilities associated with past manufacturing operations.



Shell European Oil Products

RSK provides site assessment, quantitative risk assessment and remedial design support relating to soil and groundwater impacts associated with leakages from underground storage tanks at numerous service stations across the UK, Ireland, Belgium and Netherlands. In addition, detailed assessment and remediation support is provided for regulator liaison and remediation of impacts associated with large storage and transfer depots

National Grid

RSK was asked to provide site assessment and remedial services at eleven 400KV super grid transformer sites that were being heavily impacted by transformer oil. Initial estimates of clean up ranged from £3.0M to £4.0M. RSK is currently completing the remediation of these sites with an estimated spend of £900K.

The primary savings were derived as follows:

- Much of the perceived risk was associated with the presence of TPH dissolved in groundwater. RSK was able to prove that the dissolved phase impact was caused by bailing, whereby NAPL had been dragged into the water column. RSK used low flow sampling to show that dissolved phase impact was only observed where there was cable oil and hydrocarbon chain lengths were less than C₁₂.
- RSK undertook targeted site assessments to prove to the regulator that the sources originated from localised hot spots around an oil plant, and that the impact was concentrated at the ground-soil interface and within the capillary fringe.
- Previous risk assessment models assumed a constant infinite source due to the presence of NAPL. RSK modelled the sites with a depleting source as we proved that the NAPL was effectively insoluble. Our assessment model proved seven of the sites did not require active remediation; these sites have now been closed without the authorities using monitored natural attenuation.
- Previous remedial designs comprised selective excavate and dispose with treatment costs per m³ varying between £200 and £300, with much of the cost assigned to the care of in-ground utilities and disposal of the spoil. RSK has used *in-situ* MPE techniques and ISCO technology to reduce remedial costs to *circa* £70 per m³.

DuPont CRG

RSK, along with two other partners, were selected to provide DuPont's Corporate Remediation Group with support in site assessment and remedial design across its property portfolio in Europe, the Middle East and Africa. RSK's dedicated team is responsible for those sites located in the UK, Ireland and Benelux countries. The key issues of concern faced by CRG are the presence of contaminated soil and groundwater below chemicals complexes in Ireland, Belgium and the Netherlands.

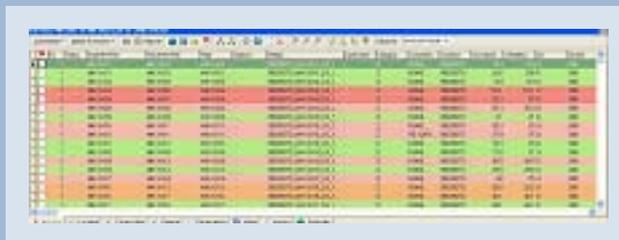
Petrochemical sector know-how and experience

Innovative solutions

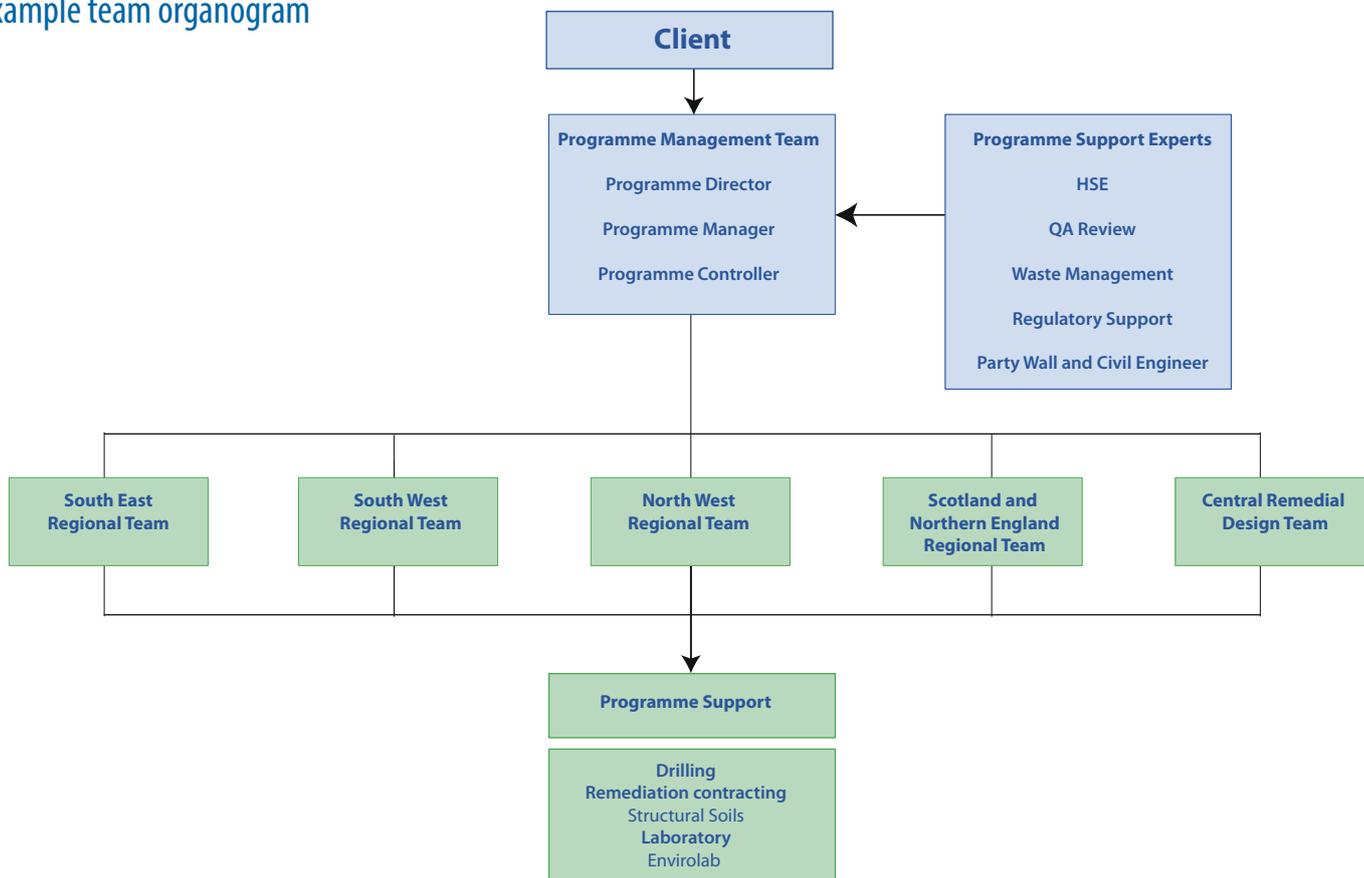
RSK PipeSight links GIS positioning technology with drainage CCTV survey techniques to provide innovative solutions for drainage leak detection.



RSK has numerous GIS/ADMS data management programmes.



Example team organogram



Relevant experience

Remediation experts

Richard Croft

Richard Croft is Managing Director of RSK Remediation Ltd. He specialises in large-scale soil and groundwater remediation projects, remediation design, and contaminated land assessment. He has an MSc in Hydrology for Environmental Management and a BEng (Hons) in Mining Engineering, from the University of Nottingham.

Felipe Couto

Felipe Couto is a Principal Remediation Engineer and has been working for RSK as a Remediation Project Manager since 2005, prior to which he co-ordinated the Integrated Site Closure Department in ENSR Brazil. He studied Civil Engineering, with emphasis in Environmental & Geotechnical Engineering at Catholic University, Rio de Janeiro.

Frank Westcott

Frank Westcott is an Associate Director of RSK Remediation Ltd with 25 years' experience in remediation, civil and geo-environmental engineering, project and site management, design and construction. He has a BSc (Hons) in Civil Engineering from the University of Leeds, and a Master of Business Administration (MBA) Distinction from the University of Bradford.

Dr Gareth Thornton

Gareth Thornton is Principal Environment Scientist and has over 12 years' experience in a broad range of environmental pollution issues, specialising in remediation of contaminated soils and waters. He has a BSc (Hons) in Physical Geography from the University of Reading, and a PhD in Environmental Geochemistry.

Simon Jackman

Simon Jackman is an Associate Director of RSK Remediation Ltd. He is involved in investigations of contaminated land for reclamation and redevelopment, groundwater remediation, site supervision and audit of remediation works, and health and safety. He has an MSc in Environmental Science from the University of Surrey and a Postgraduate Diploma in Advanced Environmental Science.



Programme managers

Sam Preece

Sam Preece is an Associate Director and Principal Geo-Environmental consultant. Sam has ten years' experience in environmental consultancy. Sam has a BSc (Hons) in Applied Environmental Geology from the University of Portsmouth, and an MSc in Environmental Management from Imperial College at Wye, University of London. Sam has programme managed the RSK Shell UK and Ireland contracts for the last three years.

David Anchor

David Anchor is an Associate Director with 14 years' experience in environmental consulting. He has particular experience in petroleum hydrocarbon and solvent contamination on complex industrial and commercial facilities and bulk distribution terminals. David has a BSc in Environmental Geology from the University of London. David has programme managed the BP and Chevron contracts for RSK.

Dr Ian Goodacre

Dr Ian Goodacre is an Associate Director at RSK with eight years' experience in environmental consultancy, principally in contaminated land investigation, risk assessment and remediation design. Ian has a PhD in Environmental Bio-geochemistry from Aberdeen University and a BSc (Hons) in Geoscience from the University of St Andrews. Ian has programme managed the RSK National Grid contract for the last five years.

QRA

Dr John Andrews

John Andrews is a Principal Risk Analyst and expert in vapour intrusion with over 15 years' experience in the environmental sector. John has two masters in chemistry and environmental technology and a PhD in organic chemistry.

Dr Louise Paul

Louise Paul is Principal Risk Assessor who joined the Geosciences division of RSK in 2005 and has undertaken risk assessments for contaminated land site investigations and redevelopment for corporate and local authority clients. She has a PhD in Geochemistry from Imperial College London, and a BSc (Hons) in Chemistry from University College London.

Gavin Saddington

Gavin Saddington is a Principal Hydrogeologist at RSK with over ten years' experience as an environmental consultant in the contaminated land and groundwater resources sector. He has a BSc (Hons) in Geology with Biology from Staffordshire University, and an MSc in Hydrogeology from the University of East Anglia.

Lucy Thomas

Lucy Thomas is Principal Geo-environmental Consultant. She has eight years' experience in designing site-specific intrusive investigations and exercising Preliminary, Generic and Detailed Quantitative Risk Assessments. She has a BSc (Hons) in Applied Environmental Geology from the University of Portsmouth.



Directors

Peter Witherington

Peter Witherington, BSc (Hons) CEng MICE and Director of RSK Group, has over 30 years' experience in the design and implementation of site assessment and remediation of contaminated land. Peter has worked on numerous research projects as both a contractor and steering group member.

Dr Paul Upton

Dr Paul Upton is Director of RSK Remediation. He has over 20 years' consulting and engineering experience in addressing the environmental needs of a wide variety of multinational industrial clients. He has a PhD in Geology, and a BSc (Hons) in Applied Earth Sciences.

HSE

Phil Parkinson

Phil Parkinson is a Director (Safety, Health and the Environment) for the RSK Group. Phil gained 23 years' experience in environmental planning with British Gas before coming to RSK in 1996. He has a BSc (Hons) in Geography from London University.

Chris Smith

Chris Smith is a Senior Consultant and Chartered Health and Safety Practitioner. He is an experienced health, safety and environmental professional with over 30 years' experience in industry. Chris joined RSK Group after a long career as a pipeline engineer and health and safety officer.

John Robinson

John Robinson is a Senior Consultant in RSK Health and Safety Ltd. He has 28 years' experience in the construction industry and, over the last 11 years, has specialised in construction health and safety and CDM Planning Supervision. John has a BSc (Hons) in Civil Engineering.

Office locations

RSK has found that delivery of project support on national programmes are delivered most efficiently from a control, schedule and cost point of view through local teams. This approach:

- Minimises mobilisation time and costs
- Maximises local buy-in of the personnel
- Utilises the local knowledge of the professionals involved.



Health and safety

RSK places significant emphasis on workplace health and safety. In the UK, we have OHSAS 18001 and ISO 14001 certified Safety, Health and Environmental Management System (SHEMS) activities. This commitment to a safety-based operating culture arises from a concern to ensure the health and safety of our own employees and to maintain the health and safety reputation of our clients. We fully understand and embrace the liability concerns that our clients have regarding the HSSE performance of its contractors and subcontractors, and how workplace accidents can directly impact the bottom line.

Top HSSE Performance

RSK has been the winner of BP Health and Safety awards in each year of operations during our term contract for BP Remediation Management in the UK. The Diamond Award was developed to recognise contractors who demonstrated top HSSE performance through innovative and leadership practises.

RSK also scores in the top quartile on the [Achilles Verify](#) database where our team has achieved greater than 80% performance marks for quality, H&S management and environmental management, as assessed by independent auditors. RSK's recent Achilles audit showed an improved performance across all categories improving the company average from 75% to 83%:

- Management System Evaluation H&S 90%, Environment 82.5%, Quality 96%
- On-site Assessment H&S 89%, Environment 77%, and Quality 90%.

The above scores show an improvement on the previous years' audit scores.

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