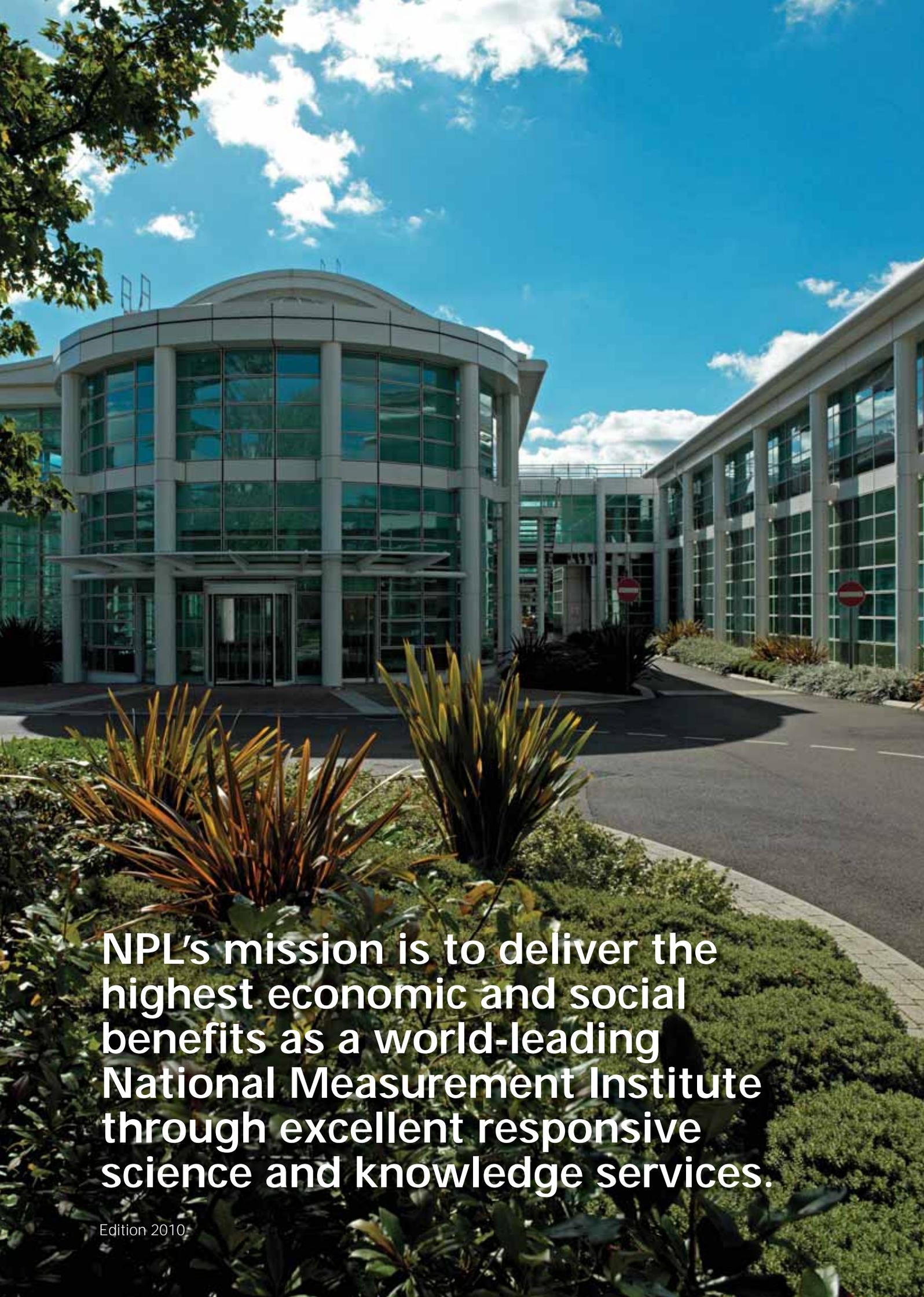




# Measurement Solutions

Details of the measurement solutions  
and testing services provided by the  
**National Physical Laboratory**

**Issue 3**



**NPL's mission is to deliver the highest economic and social benefits as a world-leading National Measurement Institute through excellent responsive science and knowledge services.**

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# Introducing NPL

## Setting the standard

NPL is a world-leading centre for the development of measurement related standards, technology and best practice. Quality of measurement is disseminated to our customers through a variety of means including collaborative research and development, technology transfer, licensing of intellectual property, various forms of consultancy, knowledge networking and through the provision of measurement services. Our capabilities underpin the UK National Measurement System (NMS), ensuring consistency and traceability of measurements in support of UK and overseas customer interests throughout the world.

## Delivering service excellence

NPL's reputation relies on the quality of support we provide, both directly and indirectly, to hundreds of thousands of users worldwide for whom maintaining traceable and fit-for-purpose measurement is vital to their business. Our commitment to scientific excellence is coupled with a determination to offer high quality and affordable measurement services that are of the greatest possible technical and commercial benefit to our customers.

## Services delivery options:

Calibration, testing and analysis of customer instruments and artefacts at our laboratories in Teddington is just one of the many ways we can deliver measurement service support to your business. In recent years, customers have also benefited from the following alternatives:

- On-site services provided on a one-off or campaign basis, whether in support of inventories of equipment and instrumentation or to solve specific measurement related problems requiring innovative or bespoke solutions.
- The provision of expert manpower support on a visiting or permanent on-site basis if long term support to measurement-critical operations is required.
- Delivery of measurement infrastructure management and maintenance: our work for DEFRA on managing the national Air Quality Network is a good example of this way of working.
- The establishment of 'bedded' out laboratory based measurement capability where a long term on-site presence, working alongside the customer organisation is desirable.
- Independent Product Assessments - NPL can reduce the risk of buying expensive equipment that may not be fit for purpose by providing a thorough pre-service evaluation of new and novel instruments before the final purchasing decision is made.

## Calibration, measurement and testing services

NPL continually strives to make its science and technology as valuable, relevant and accessible as possible to our customers. This guide summarises the range of measurement services offered, together with the relevant points of contact who will help you select and specify the services you need, provide quotations and ensure you receive the very best levels of technical and customer service available. To learn more about Measurement Services please visit at [www.npl.co.uk](http://www.npl.co.uk)

# Working with NPL

We actively encourage our customers to work with us to determine the most suitable means of doing business with NPL. Options include:

- Ad hoc or single orders for customers requiring irregular support. Our Customer Services Executives (CSEs) will help you define your support needs and provide 'immediate response' quotations for particularly urgent jobs.
- Call-off contracts designed to minimise the cost and time spent in managing and processing orders and generating invoices and customer reports. Often the agreement of a pre-authorised 'Limit of Liability' is used to enable customers to place orders quickly and effectively.
- For larger scale or longer term support arrangements, the agreement of a tailored Service Level Agreement (SLA) may offer particular support benefits. Customer-specific service levels can be agreed based upon simple Key Performance Indicators (KPIs).
- Through our established network of preferred suppliers that includes other National Measurement Institutes (NMIs) as well as a range of specialist UKAS accredited laboratories, we are able to offer a 'one stop shop' approach to meeting your high quality measurement requirements.

## **Scheduling and batching of work:**

NPL works with its customers to ensure that the timing of the work carried out is optimised to the needs of the customer's business. Due to the extremely wide range of measurement capabilities at NPL, we encourage our customers to work with us to define the most suitable date for releasing their equipment or standards into the laboratory as it helps minimise equipment downtime.

NPL is able to arrange collection and delivery of equipment to and from our customers' sites. This is particularly beneficial when high value, perhaps fragile, equipment needs to be transported across national boundaries.

# Contacting NPL

The NPL Customer Services Team (CSE) provides customers with a single contact point for doing business with NPL. Please contact the CSE at the telephone number or e-mail listed on the relevant page of this brochure for information relating to quotations, placing orders, scheduling of work and progressing orders.

The CSE will be also able to arrange contact with the laboratory expert in the relevant area.

For more general enquiries where it is not clear who best to contact, we provide a Helpline that acts as a gateway to the business, particularly for customers new to NPL.

For all general enquiries please contact:

Helpline: **+44 20 8943 7070**

Fax: **+44 20 8943 6184**

E-mail: **[measurement\\_services@npl.co.uk](mailto:measurement_services@npl.co.uk)**

# Acoustics in Air

*Accurate and consistent measurements of airborne sound fulfil a wide range of regulatory, health, safety and commercial needs both within the UK and in support of international trade. Applications arise in the measurement of environmental and workplace noise, machinery and product noise, hearing protection, audiometry, and in the quality control of acoustical devices. NPL realises the primary standard for sound pressure in the UK, and disseminates this through a range of calibration services for acoustical instrumentation, which provide traceability for the wide range of acoustical measurements that need to be conducted, leading to greater confidence and good practice in measurement.*



## Services, Instruments and Artefacts:

- Calibration and verification of sound calibrators and pistonphones
- Calibration of ear simulator systems e.g. reference couplers, artificial ears, mechanical couplers, and associated reference headphones and bone vibrators
- Consultancy services for acoustical measurement, including machinery and environmental
- Hire of acoustic facilities e.g. Anechoic chamber
- Primary pressure calibration of laboratory standard microphones
- Secondary pressure and free-field calibration of working standard microphones
- Training courses on instrumentation and measurement methods for medical ultrasound noise, and finite element modeling

## Contact

Customer Service tel: **+44 20 8943 8631**

E-mail: **[acoustics\\_enquiries@npl.co.uk](mailto:acoustics_enquiries@npl.co.uk)**

# Bio-analysis

*The bio-analytical group brings together experienced, research staff with an impressive range of instrumentation and facilities that allows us to support companies working in the drug development and manufacturing sectors. We offer many contract analysis and research services focusing on the structure, activity and physical properties of biotherapeutic products.*



## Services, Instruments and Artefacts:

- Antibody pairing and epitope specificity analysis
- Lead verification using SPR and ITC technologies
- Post-translational modification analysis
- Pre-formulation studies and down stream processing optimisation
- Protein analysis and mapping using mass spectrometry
- Protein conformational changes and aggregation: analysis, troubleshooting and quantification
- Protein structure analysis by spectroscopic methods

## Contact

Customer Service tel: **+44 20 8943 8637**  
E-mail: **bioanalytical\_enquiries@npl.co.uk**

# Bio-diagnostics

*The bio-diagnostics group at NPL is able to combine state of the art facilities with experienced staff to offer cost effective services to industry in four key areas: assay development support, regulatory support and reference standards, innovative platform technologies, and underpinning metrology. Whether you are looking to develop a new bio-diagnostic assay system or looking to improve an existing assay to ensure the highest accuracy and precision, NPL's bio-diagnostics group can help.*



## Services, Instruments and Artefacts:

- Antibody pairing and epitope specificity analysis
- Antibody-nanoparticle development and conjugate analysis
- Biacore Assay development
- Biosensor consultancy
- Electrochemical assay development
- Immunoassay development and verification including ELISA
- Lateral flow assay development and preparation for point of care devices

## Contact

Customer Service tel: **+44 20 8943 8637**

E-mail: **biodiagnostics\_enquiries@npl.co.uk**

# DC & LF Measurements

*The great majority of industrial processes and instruments rely on electrical measurements of one form or another. Whether the high power electrical measurements that support the multi-billion pound UK electricity market, or measurements of the atto-Farad capacitance levels which exist between individual cells are sufficient to quantify DNA, traceable applied electrical measurements are key to their success.*

*In support of such technology and industries, NPL develops and applies standards and methodologies to provide traceable electrical measurements from DC to 1 MHz and beyond covering voltage, current, impedance and power, magnetic materials and instruments.*



## Services, Instruments and Artefacts:

- AC (eddy current) conductivity reference standards
- AC power wattmeters and voltmeters
- AC/DC high frequency measurement, up to 1V 100 MHz
- AC/DC voltage and current transfer
- Capacitance
- Capacitance standards
- Current transformers and selective error voltage transformers.
- DC and AC resistance
- DC voltage up to 1 kV
- Harmonic and flicker analysers
- Inductive voltage dividers and strain gauge bridges
- Magnetic materials and instruments
  - o AC magnetic field meter
  - o DC magnetic field meters
  - o Characterisation of hard and soft magnetic materials
  - o Fluxgate and resonance magnetometers
  - o Flux meters and Hall effect gaussmeter
  - o Helmholtz coils, search coils and solenoids
  - o Low permeability reference standards (supply and calibration)
- Self and mutual inductance standards

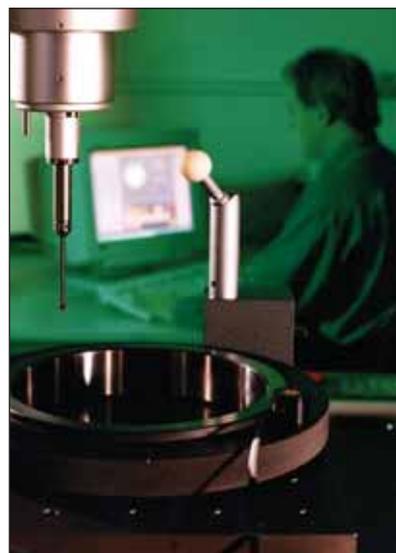
## Contact

Customer Service tel: **+44 20 8943 7166**

E-mail: **current\_enquiries@npl.co.uk**

# Dimensional

*NPL offers dimensional measurement services and the provision and calibration of transfer standards that are traceable to national standards. A comprehensive range of dimensional measurement facilities, including co-ordinate measurement machines are available for routine or one-off measurements. Other services offered include instrument development, contract research, consultancy and training.*



## Services, Instruments and Artefacts:

- Angle measurement: autocollimators, polygons, angle gauges and index tables
- Custom dimensional measurement and inspection of components
- Diameter of plain setting plugs
- Non-contact dimensional measurements
- Diameter of plain setting rings
- Extensometer calibration rigs
- Freeform surfaces
- Gauge blocks and length bars
- High Accuracy co-ordinate metrology of small components- micro CMM
- High accuracy roundness measurements
- Length bar and long gauge block thermal expansion
- Metrological Atomic Force Microscope
- On-site verification and calibration of CMMs and machine tools by Laser TRACER
- Optical flatness
- Precision scales, stage micrometers and graticules for microscopy and image analysis
- Reference master thread gauges: American Petroleum Institute (API) specifications
- Reference screws
- Step gauges
- Surface texture calibration standards
- Surface topography and nano-metrology measurements

## Contact

Customer Service tel: **+44 20 8943 8631**

E-mail: **[dimensional\\_enquiries@npl.co.uk](mailto:dimensional_enquiries@npl.co.uk)**

# Environmental Monitoring

*Environmental measurement scientists at NPL provide high quality, cost effective pollution monitoring and analysis services. NPL has an international reputation and track record based upon years of underpinning research. We also offer a range of services and gas standards for the calibration of gas analysers.*



## Services, Instruments and Artefacts:

- Ambient air quality surveys
- Analysis of ambient air and emissions samples
- Environmental consultancy
- Environmental research and policy
- Industrial impact assessment
- Greenhouse gas reporting
- Occupational air quality
- Particulates, metals, anions and PAHs
- QA/QC of air quality measurements
- Remote sensing surveys
- Stack emissions monitoring

## Contact

Customer Service tel: **+44 20 8943 8637**  
E-mail: **[environmental\\_enquiries@npl.co.uk](mailto:environmental_enquiries@npl.co.uk)**

# Fibre Optics & Photonics

*NPL's support for the optical technology sector includes a comprehensive range of calibration and measurement services for all types of optical fibre, fibre and photonic components in addition to supplying artifacts for the calibration of fibre optic test instrumentation. The breadth of our capability is sufficient to cover most fibre optic and photonic requirements.*



## Services, Instruments and Artefacts:

- Attenuation coefficient uniformity
- Chromatic dispersion
- Cut off wavelength
- Effective area
- Fibre cladding diameter
- Fibre coating diameter
- Fibre optics calibration artefacts
- Mode Field Diameter (MFD)
- Numerical Aperture (NA)
- Optical fibre refractive index
- Optical length of optical fibres
- OTDR calibration fibres
- OTDR distance scale artefact
- Polarisation Mode Dispersion (PMD)
- Return loss measurements
- Spectral attenuation

## Contact

Customer Service tel: **+44 20 8943 8637**  
E-mail: **[fibreoptics\\_enquiries@npl.co.uk](mailto:fibreoptics_enquiries@npl.co.uk)**

# Force

*Force measurement is of fundamental importance to many industrial sectors. Product liability and safety issues demand that force measurements are traceable to national standards. Competitive advantage can be gained from accurate force measurement. NPL offers traceable calibration services measurement and testing facilities with capabilities from 1.5 N to 30 MN. NPL offers a wide ranging force calibration service, accredited to ISO 17025 by UKAS, using the UK's national force standard machines – this offers our customers direct traceability to national standards.*



## Services, Instruments and Artefacts:

- DC ratio meters – calibration and adjustment
- Extensometer calibration rigs – calibration and adjustment
- Force measuring devices and systems
  - Calibration in tension and compression to ISO, BS, ASTM and customer specifications
  - Manufacture and supply of transducers
- Hire of force standard machines
  - Deadweight machines up to 1.2 MN
  - Servo-hydraulic machines up to 30 MN
- On-site calibration and verification of compressive and tensile testing machines
- Strain cylinder verification

## Contact

Customer Service tel: **+44 20 8943 6315**

E-mail: **force\_enquiries@npl.co.uk**

# Gases & Gas Analysis

*NPL specialises in producing an extensive range of gas calibration standards through a chain of direct comparisons to the National Measurement Standards. This ensures amount fractions of guaranteed uncertainty and measurement traceability at national and international levels. The current range of standards provides ultimate references for highly accurate measurements of ambient air quality, natural gas, industrial emissions, vehicle and aircraft emissions, odour measurement and occupational exposure.*



## Services, Instruments and Artefacts:

- Certification of gas mixtures
- Gas calibration mixtures
- Gas metrology software
- Gas standards for calibrating air quality monitors
- Gas standards for calibrating evidential breath-alcohol analysers
- Gas standards for calibrating stack emission monitors
- Gas standards for calibrating vehicle emission monitors
- High purity gas analysis
- Natural gas proficiency testing scheme
- Refinery gas standards and proficiency testing scheme
- Standard mixtures of volatile organic compounds

## Contact

Customer Service tel: **+44 20 8943 8637**

E-mail: **[gases\\_enquiries@npl.co.uk](mailto:gases_enquiries@npl.co.uk)**

# Humidity

*NPL is a world leader in primary realisations of humidity. The standards maintained by NPL provide the reference for humid air mixing ratio, dew point and relative humidity. Calibrations are performed at NPL or at customer premises.*



## Services, Instruments and Artefacts:

- Air temperature sensors: -40 °C to +100 °C
- Dew-point temperature -90 °C to +90 °C
- Humidity calibrations in pressurised air
- Humidity and temperature chambers
- Humidity calibration salts
- Humidity generators
- Humidity measurement consultancy
- Hygrometers of all types in terms of relative humidity, dew point, mixing ratio or other humidity quantities
- Moisture content of materials
- Relative humidity: 1%-rh to 98%-rh at temperatures from -40 °C to +100 °C
- Training in humidity measurement and calibration humidity quantities
- Water vapour flux (transepidermal water loss sensors)

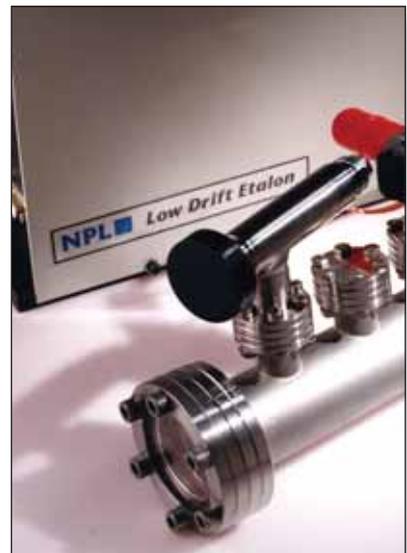
## Contact

Customer Service tel: **+44 20 8943 8681**

E-mail: **humidity\_enquiries@npl.co.uk**

# Laser Interferometry & Frequency Stabilised Lasers

*Laser interferometer systems are widely used in industry for direct precision measurement of length and displacement particularly in relation to CNC machine tool and co-ordinate measuring machine calibration. NPL offers a routine service for the verification of interferometer system accuracy.*



## Services, Instruments and Artefacts:

- Auto-compensated and uncompensated laser interferometer system calibration
- Beat frequency monitoring system
- Frequency and laser wavelength calibration
- Iodine-stabilised HeNe reference lasers
- Low drift etalons

## Contact

Customer Service tel: **+44 20 8943 6796**

E-mail: **laser\_enquiries@npl.co.uk**

# Mass & Density

*Accurate measurement of mass is vital in a wide range of applications from product design to ensuring compliance with health and safety requirements. NPL provides a calibration service for standard weights of all OIML classes and provides high accuracy, traceable precision mass measurements for all manner of artifacts.*

*Our range of consultancy work includes advice on all aspects of mass measurement and 'hands-on' training in mass metrology.*



## Services, Instruments and Artefacts:

- Calibration of weights, all OIML classes, and high precision mass measurements from 1 mg to 25 kg
- Density of liquids
- Density of solid artefacts
- Density of particulates and powders

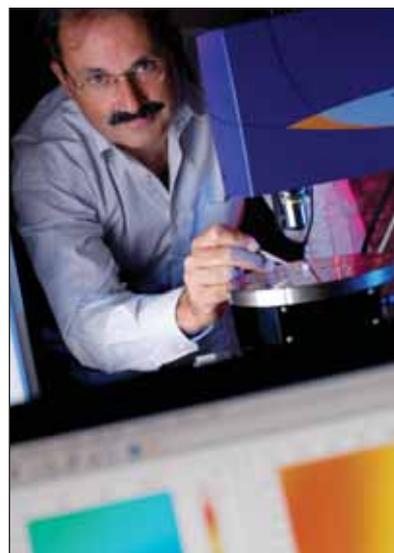
## Contact

Customer Service tel: **+44 20 8943 6245**

E-mail: **mass\_enquiries@npl.co.uk**

# Materials Biomaterials

*Expertise can be provided in materials science and physical chemistry for biomaterial applications, and cell biology. Research and implementation of innovative methods for biomaterials measurement is undertaken to support UK industry.*



## Services, Instruments and Artefacts:

- Biomaterials surface analysis and design
- Characterisation of tissue scaffolds
- Degradation of materials
- Quantification of cell-protein-surface interactions

## Contact

Customer Service tel: **+44 20 8943 8681**

E-mail: **materials\_enquiries@npl.co.uk**

# Materials

## Degradation & Life

## Prediction of Materials

*The degradation of properties is important for predicting the lifetime of materials and components. Accelerated tests are available to help understand the ageing processes in materials under a variety of conditions.*



### Services, Instruments and Artefacts:

- Exposure, environmental stress cracking
- Fatigue, thermal cycling, failure analysis
- High temperature degradation, chemical/moisture
- Lifetime assessment and structural health monitoring
- Testing materials in harsh environments - corrosion (e.g. aqueous, H<sub>2</sub>S, steam)

## Contact

Customer Service tel: **+44 20 8943 8681**

E-mail: **materials\_enquiries@npl.co.uk**

# Materials

## Electrochemical

*Measurement techniques are available to support the development and manufacture of new products, improve reliability and predict lifetime of components. Electrochemical measurements include testing of fuel cells and fuel cell components, spatial mapping of photovoltaic conversion efficiency, local scanning electrochemical techniques and standard bulk electrochemical techniques such as cyclic voltammetry and impedance spectroscopy. The teams can offer key support to industry to understand the performance and durability of electrochemical energy conversion materials and devices.*



### Services, Instruments and Artefacts:

- Fuel cell and fuel cell component testing
- Local/Bulk electrochemical techniques, scanning electrochemical microscopy cyclic voltammetry, impedance spectroscopy
- Spatial mapping of PV conversion efficiency as a function of specific wavelength, incident angle and irradiance

## Contact

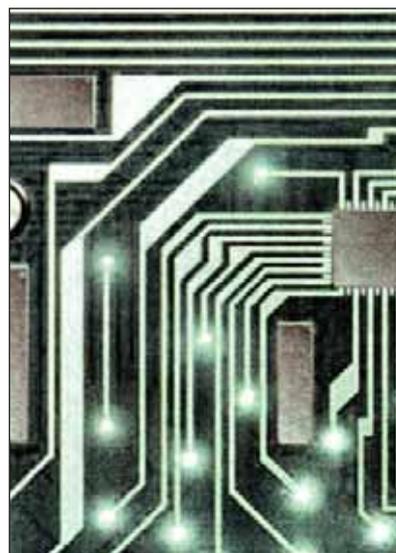
Customer Service tel: **+44 20 8943 8681**

E-mail: **materials\_enquiries@npl.co.uk**

# Materials

## Electronic Interconnection

*The Electronics Interconnection Group provides a comprehensive portfolio of test services and bespoke consultancy to the electronics industry based on over 25 years of research experience in the field.*



### Services, Instruments and Artefacts:

- Characterisation of mechanical property of solder joint
- Energy Dispersive X-ray Spectra (EDX)
- Evaluation of conformal coating to inhibit tin whisker growth
- Mechanical shock testing
- Micro-sectioning
- Scanning Acoustic Microscope (SAM)
- Scanning Electron Microscopy (SEM)
- Shear testing of solder joint
- Solder joint reliability testing
- Solderability testing
- Solvent Extract Conductivity (SEC) / Ionic Extraction Testing (IET)
- Surface Insulation Resistance (SIR) measurement
- Surface topography measurements
- X-Ray Florescence (XRF)

## Contact

Customer Service tel: **+44 20 8943 8681**

E-mail: **materials\_enquiries@npl.co.uk**

# Materials

## Mechanical Testing

*The characterisation of all classes of materials, components and materials systems can be carried out over a range of temperatures. Tests may be made on standard macro scale specimens, but increasingly miniaturised tests are being developed which can allow the testing of parts of manufactured components, where properties may vary with position. Techniques and advice on non-destructive testing and structural health monitoring are also available.*



### Services, Instruments and Artefacts:

- Composite panel and specimen manufacture
- Digital Image Correlation (DIC) Capability
- Exposure, environmental stress cracking
- Measurement of strain: extensometers, strain gauges, Fibre Bragg Gratings (FBGs), FBGs, EPSI
- Mechanical testing, static, dynamic, durability
- Non-destructive evaluation
- Physical property measurements
- Residual stress, XRD and hole drilling
- Structural health monitoring, (SHM)

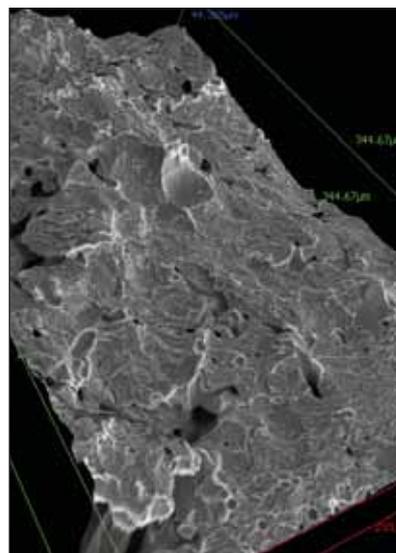
## Contact

Customer Service tel: **+44 20 8943 8681**

E-mail: **materials\_enquiries@npl.co.uk**

# Materials Microstructural Characterisation & Analysis

*NPL has an extensive range of advanced metallographic preparation and examination equipment, which underpins our materials testing as well as offering a one stop shop for microstructural characterisation. Sample preparation expertise is available for a wide range of materials ranging from polymer composites to ceramics. Subsequent analysis and characterisation methods to International Standards or in-house procedures are available. NPL actively participates in Standards Committees for the development of new characterisation and microstructural measurement techniques, which are directly traceable to primary standards.*



## Services, Instruments and Artefacts:

- 3D optical, confocal and SEM microscopy and surface topography
- Chemical analysis, Energy and Wavelength Dispersive X-ray Analysis (EDX, XRD)
- Electron Back Scattered Diffraction (EBSD)
- Fractography and failure analysis
- Metallographic preparation, cutting, polishing, etching
- Optical microscopy and image analysis
- Scanning Electron Microscopy (SEM)
- X-ray diffraction

## Contact

Customer Service: tel: **+44 20 8943 8681**

E-mail: **materials\_enquiries@npl.co.uk**

# Materials Modelling

*Finite element and finite difference simulation, structural and thermal modelling, and thermodynamic calculation of phase equilibria can be carried out to support Industry.*

*Applications of quantum mechanics, molecular dynamics, multi-physics, multi-scale, thermodynamic and FEA computational techniques are used to assess material properties at the molecular, micro and macro scales. Software solutions are also available.*



## Services, Instruments and Artefacts:

- Analysis, multi-scale and multi-physics modelling
- CoDA (composites design) – software licences and consultancy
- FEA Software (Abaqus, Ansys, Pafec, LUSAS, Moldflow, Comsol)
- Materials chemistry, thermodynamic and phase equilibrium calculations - consultancy
- MTDATA (thermodynamic and phase diagram modelling) – software licences and courses
- MTDATA thermodynamic databases for metals, oxides, mattes, semiconductors, aqueous solutions, molten salts and gases

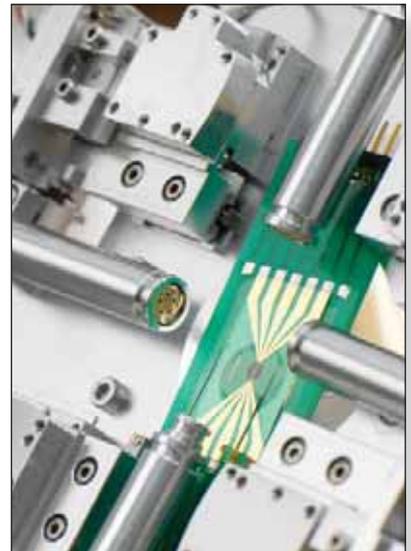
## Contact

Customer Service tel: **+44 20 8943 8681**

E-mail: **materials\_enquiries@npl.co.uk**

# Materials Nanomaterials

*NPL nanomaterials effort focuses on the development of reliable and accurate methods to measure the physical properties of nano-objects and the characterisation of transport properties in nanostructured materials.*



## Services, Instruments and Artefacts:

- Class 100 and 10,000 cleanroom facilities - thermal evaporation, e-beam and sputter desposition, optical lithography
- Nanoparticles characterisation: transmission electron microscopy with electron energy loss
- Surface characterisation on the nanoscale
- Scanning probe metrology of nano-structured materials: scanning Kelvin probe, scanning capacitance, chemical force, adhesion, and magnetic force microscopies, from ultra-high spectroscopy, dynamic light

## Contact

Customer Service tel: **+44 20 8943 8681**

E-mail: **materials\_enquiries@npl.co.uk**

# Materials

## Piezoelectric, Dielectric & Magnetic

*Work is focused in determining functional material properties in piezoelectric materials, magnetic materials, multiferroics-, and electronic ceramics. Magnetic measurements can be carried out on a wide variety of magnetic materials. The parameters and ranges offered are continuously developed to meet the needs of new applications and measurement standards. Consultancy on the choice of magnetic material and magnetic circuit design, as well as other magnetic related issues, is available.*



### Services, Instruments and Artefacts:

- AC conductivity standards
- AC measurements of magnetically soft materials: specific total loss, specific apparent power and AC permeability
- AC properties of soft magnetic materials for operational conditions of stress, temperature and electrical waveforms
- DC measurements of magnetically soft materials: normal magnetisation curve, hysteresis loop, remanence and coercivity
- Ferroelectric coefficient measurement
- Functional materials research into functional thin film materials and non-linear properties of piezoelectric materials in harsh environments
- LF electrical characterisation: dielectric properties and impedance characteristics
- Low relative magnetic permeability, feebly magnetic, measurements and reference materials: relative magnetic permeability in the range 1.002 to 1.6
- Magnetic signature measurements using the NPL low magnetic field facility
- Magnetically hard materials: demagnetisation curve, remanence, intrinsic coercivity, maximum energy product
- Modelling of electromagnetic field interactions with materials and metamaterials
- Piezoelectric coefficient measurement
- Piezoelectric displacement measurement
- RF and microwave dielectric measurement services
- RF and microwave dielectric research
- Validation of magnetic measurement systems and calibration of magnetic measurement instrumentation

## Contact

Customer Service tel: **+44 20 8943 8681**

E-mail: **materials\_enquiries@npl.co.uk**

# Materials Properties for Process Modelling

*A range of measurements are available to provide data on thermal and fluid flow properties from sub-ambient to extremely high temperatures, under controlled atmospheres, for a wide range of materials.*



## Services, Instruments and Artefacts:

- Density
- Microfluidics micro particle image velocimetry, (micro-PIV)
- Pressure volume temperature (PVT) measurements
- Rheological properties including viscosity
- Thermal analysis of materials - TMA, DSC, DMA, TGA
- Thermal expansion

## Contact

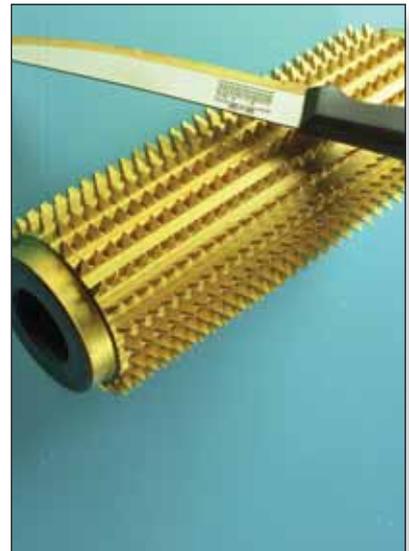
Customer Service tel: **+44 20 8943 8681**

E-mail: **materials\_enquiries@npl.co.uk**

# Materials

## Surface Engineering

*NPL offers macro to nano-scale measurements of the mechanical and tribological properties of surfaces, coatings and small volumes of material. Tests include surface texture, friction, wear, coating integrity, thickness, adhesion, fracture properties, hardness, elastic modulus and the measurement of residual stress.*



### Services, Instruments and Artefacts:

- Abrasion and erosion tests
- Coating adhesion and fracture assessment
- Atomic force microscope
- Nanomechanical testing, nano-indentation and surface acoustic wave spectroscopy
- Sliding and reciprocating wear and friction

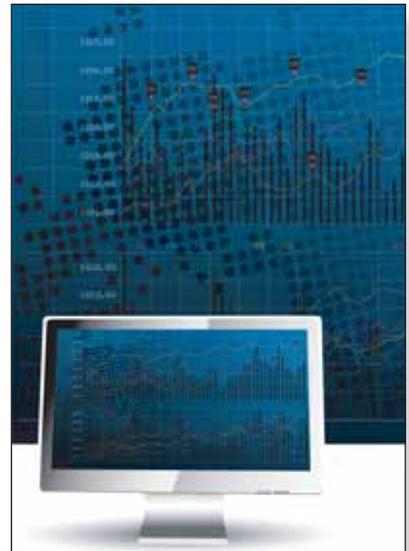
## Contact

Customer Service tel: **+44 20 8943 8681**

E-mail: **materials\_enquiries@npl.co.uk**

# Mathematical Modelling

*NPL Mathematicians offer a range of services including the development of mathematical models and the associated uncertainty evaluations to support all measurement sectors.*



## Services, Instruments and Artefacts:

- Development and implementation of mathematical models
- Black box testing and validation of the numerical correctness of mathematical models
- Advice and support on the calculation of measurement uncertainties
- Signal and data analysis
- Advice and support on commercial FR/FD modelling software

## Contact

Customer Service tel: **+44 20 8943 6796**

E-mail: **mathematical\_enquiries@npl.co.uk**

# Nanoparticle Characterisation

*NPL can provide analysis for nanoparticles within a wide variety of media. An expanding range of properties can be reliably determined for powders e.g. BET surface area analysis, Surface Chemistry; suspensions in various liquid media, e.g. Zeta Potential and as aerosols created from either powder or liquid suspension, e.g. aerodynamic size distribution.*

*For powders and suspensions, the nanoparticle characterisation expertise at NPL comes from several departments using techniques such as SEM, TEM, Dynamic Light Scattering, XPS, SIMS and Zeta Potential. Standardised nanoparticle dispersion protocols are used to create suspensions from powder samples, with new protocols being developed as required. The media can vary from simple aqueous to biological media.*

*NPL's dedicated Airborne Nanoparticle Metrology Laboratory offers services supporting the measurement and characterisation of nanoparticles in the aerosol phase. The use of state of the art instrumentation for nanoparticle generation and detection provides a high degree of confidence in the measurements we make.*



## Services, Instruments and Artefacts:

- BET surface area and related techniques including advanced micropore analysis
- Calibration, validation and evaluation of aerosol instrumentation, including size distribution and number concentration
- Characterisation of nanoparticles aerosolised from powder and solution for size distribution, number concentration and surface area
- Creation of nanoparticle liquid suspensions from powder samples
- Design and installation of experimental facilities for airborne nanoparticle research and development
- Imaging and measurement of nanoparticles in biological media such as cells and tissues
- ISO 17025 accredited service for Condensation Particle Counter (CPC) calibration, including Particle Measurement Programme-compliant models
- Nanoparticle monitoring for ambient air, occupational exposure and other applications
- SEM, TEM, DLS and Zeta Potential
- Surface chemical analysis using SIMS, XPS and other techniques instrumentation

## Contact

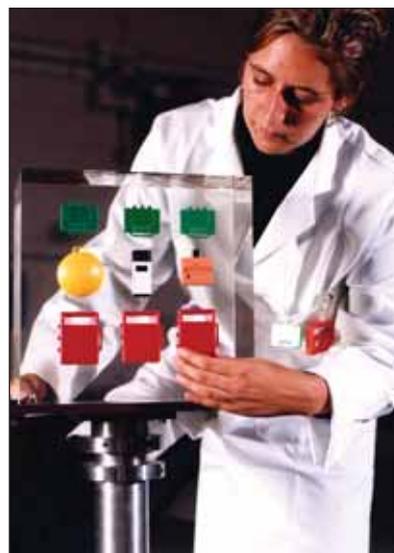
Customer Service tel: **+44 20 8943 8637**

E-mail: **nanoparticles\_enquiries@npl.co.uk**

# Neutron Measurements

*NPL hosts world-leading facilities for measuring the neutron emission rate from radionuclide sources and for performing fluence and dose equivalent calibrations with monoenergetic neutrons, thermal neutrons, and broad energy range neutrons from radionuclide sources or a simulated workplace field.*

*Services include the characterisation and calibration of neutron detecting devices, in particular personal and area dosimeters, the measurement of radionuclide neutron source emission rates and anisotropy, and also field measurements of neutron spectra and dose equivalent quantities.*



## Services, Instruments and Artefacts:

- Area survey instruments
- Fission chambers
- Hire of radionuclide neutron source
- HSE performance testing of personal dosimetry services for fast neutron radiation
- Measurement of dose quantities using microdosimetry
- Measurement of radionuclide neutron source emission rates and emission anisotropy
- Measurements of cosmic ray and other high energy fields
- Monoenergetic neutron fluence and dose standards
- Neutron personal dosimeters
- Neutron spectrometers
- Neutron spectrometry measurements
- Radionuclide source-based fluence and dose standards
- Thermal neutron fluence and dose standard
- Transfer standards for thermal neutron fields

## Contact

Customer Service tel: **+44 20 8943 8637**

E-mail: **neutron\_enquiries@npl.co.uk**

# Optical Characterisation of Materials

*NPL's support for the optical technology sector includes a comprehensive range of calibration and measurement services including reflectance, transmittance and materials characterisation. NPL also offers training, consultancy and contract research covering all aspects of optical radiation metrology including the growing area of appearance and natural perception of materials.*



## Services, Instruments and Artefacts:

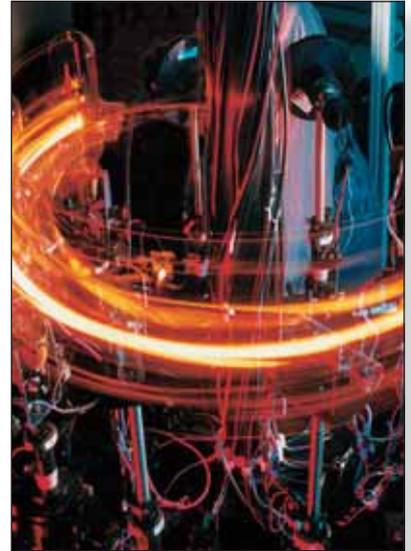
- Appearance characterisation
- Ceramic colour standards
- Colour measurements
- Diffuse / total transmittance
- Diffuse reflectance UV-vis-NIR
- Gloss measurements
- Gonio-apparent materials
- Haze measurements
- Mid/Far IR (2.5 - 56  $\mu\text{m}$ ) regular reflectance
- Neutral density & transmitted colour filters
- Polystyrene wavenumber - NPL branded standard
- Reflectance standards
- Refractive index of bulk materials
- Regular (specular) reflectance UV-vis-NIR
- Texture and pattern
- Transmittance

## Contact

Customer Service tel: **+44 20 8943 6151**

E-mail: **[optical\\_enquiries@npl.co.uk](mailto:optical_enquiries@npl.co.uk)**

# Optical Sources & Detectors



## Services, Instruments and Artefacts:

- Detector responsivity
- Fibre optic power meters and sources
- Laser power and energy
- Laser power meters
- Luminous intensity, illuminance, luminance or CCT
- Optical wavelength meters or OSA
- Properties of optical detectors
- Provision of instrumentation
- Spectral Irradiance and Radiance
- Spectral total flux and total luminous flux
- UV spectral irradiance

## Contact

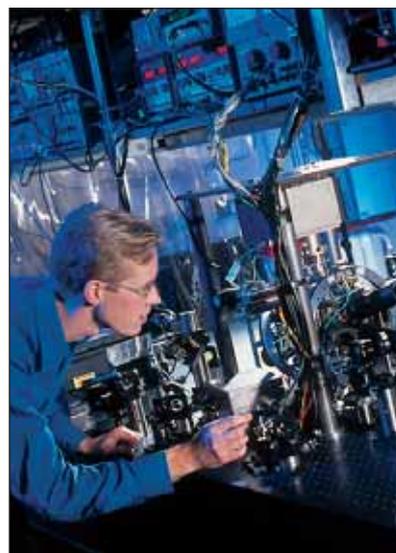
Customer Service tel: +44 20 8943 6151

E-mail: [optical\\_enquiries@npl.co.uk](mailto:optical_enquiries@npl.co.uk)

# Optics

*Calibration of lenses, scales and optical components used in imaging and dimensional measurement systems. NPL designs and supplies calibrated precision scales for the validation of image analysis and vision measurement systems. An important factor in achieving accurate production of spectacle lenses is the maintenance of consistent standards of lens power in the ophthalmic examination, lens manufacture and subsequent spectacle fitting.*

*Consistent measurements of power may be assessed in all these stages by using focimeters and spherometers which have been calibrated with suitable reference lenses.*



## Services, Instruments and Artefacts:

- High precision line scales
- Microstructured surfaces
- Non-contact dimensional measurements
- NPL reference stage graticules
- Optical flatness
- Power and radius of reference lenses (spherical, cylindrical and prismatic lenses in the range  $\pm 0.05$  dioptres to  $\pm 25$  dioptres)
- Precision scales, stage micrometers and graticules for microscopy and image analysis
- Stage micrometers
- X-Y grid plates

## Contact

Customer Service tel: **+44 20 8943 6245**

E-mail: **[optics\\_enquiries@npl.co.uk](mailto:optics_enquiries@npl.co.uk)**

# Pressure & Vacuum

*NPL offers consultancy services, pressure standards for other laboratories, and an enquiry service for pressure and vacuum related issues. NPL also runs a pressure and vacuum measurement special interest group within EMAN (the Engineering Measurement Awareness Network) called Pressmet, which is for the benefit of instrument end users, manufacturers and academics.*



## Services, Instruments and Artefacts:

- Barometry
  - o Digital (electronic) barometers
  - o Precision aneroid barometers
- High pressure, gauge and absolute
  - o Hydraulically operated pressure balances
  - o Pneumatically operated pressure balances
- Vacuum, provided through (SP Technical Research Institute of Sweden)

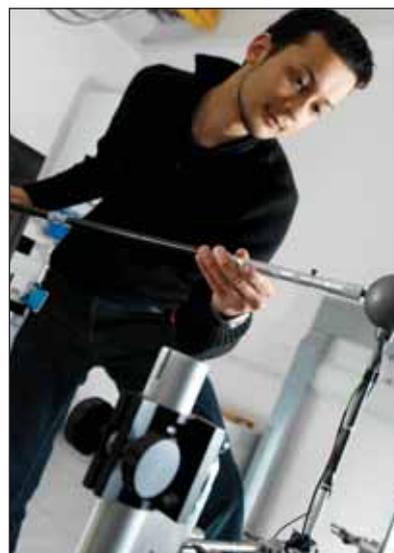
## Contact

Customer Service tel: **+44 20 8943 8681**

E-mail: **[pressure\\_enquiries@npl.co.uk](mailto:pressure_enquiries@npl.co.uk)**

# Radiation Dosimetry

*NPL deals with the dosimetry of x- and -rays, and charged particles such as electrons and protons. We develop, maintain and disseminate the UK national measurement standards for these radiations and engage in research on radiation interactions to address the needs of industry, healthcare and government. NPL is also involved in promoting the role of traceability in quality assurance, international and national specification standards and measurement protocols, for radiation dosimetry, for example through training.*



## Services, Instruments and Artefacts:

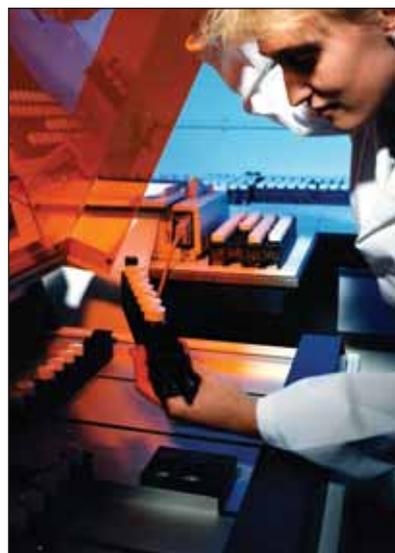
- Alanine reference dosimetry service for 1 MeV to 4 MeV electron beams
- Alanine reference dosimetry service for radiotherapy
- Diagnostic and mammographic X-ray dosimeters
- Electron beam calibration service for radiotherapy (absorbed dose)
- HDR brachytherapy
- High dose cobalt-60 irradiations
- Hire of linear accelerator facility - electron and X-ray beam irradiations
- Hire of protection level Gamma-ray facility
- Hire of therapy level Cobalt-60 facility
- Hire of X-ray facilities
- kVp meters
- Mail-order alanine reference dosimetry service for radiation processing
- Ophthalmic applicators
- Photon beam calibration service for radiotherapy (air kerma and absorbed dose)
- Protection and environmental level (air kerma)
- Radiotherapy reference dosimetry audits
- Secondary standard electrometers (charge and/or current)

## Contact

Customer Service tel: **+44 20 8943 8695**  
E-mail: **[dosimetry\\_enquiries@npl.co.uk](mailto:dosimetry_enquiries@npl.co.uk)**

# Radioactivity

*NPL is responsible for maintaining the UK primary standards of radioactivity, and disseminating these standards to users of ionising radiation in fields such as nuclear medicine, environmental radioactivity monitoring and nuclear decommissioning. NPL also provides products and services to enable organisations to comply with legislation and good practice related to ionising radiation.*



## Services, Instruments and Artefacts:

- Consultancy services
- Primary and secondary standards of a range of beta- or beta/gamma-emitting radionuclides, including standardised low-level radionuclide mixtures for periodic user proficiency tests
- Radioactive gas standards, e.g. Tritium and  $^{85}\text{Kr}$ , the provision of standards of  $^{222}\text{Rn}$  and the calibration of gas monitors.
- Radioanalytical services for the radiochemical analysis of complex waste forms such as building materials from nuclear sites.
- Secondary standardisation of customer supplied samples
- Standardised solutions of isotopically pure radionuclides, at or near the working level for use by laboratories making measurements of environmental radioactivity
- Standards of radioactive surface contamination for the calibration of surface contamination monitors.
- Tritium measurement proficiency testing
- UK hospital nuclear medicine proficiency test exercises

## Contact

Customer Service tel: **+44 20 8943 8695**  
E-mail: **radioactivity\_enquiries@npl.co.uk**

# RF & Microwave Free-Field

*RF and Microwave free-field measurements are vital to many industrial sectors, including aerospace, telecommunications, automotive, defence and EMC. To meet these needs, NPL has developed a comprehensive range of facilities and measurement techniques for calibrating and testing in the frequency range 20 Hz to 110 GHz.*



## Services, Instruments and Artefacts:

- Antenna measurements
  - Antenna factor
  - Axial ratio
  - Balun imbalance of dipoles
  - Cross-polar levels
  - Efficiency
  - Finite and infinite range gain
  - Phase centre
  - Radiation pattern
  - Reflection coefficient
  - Tilt angle
- CAI digital TV aerial benchmark testing
- Electromagnetic field site surveys
- EMC antennas (loops, monopoles, dipoles, biconical antennas, LPDAs, horns etc)
- Hire of antenna test sites
- Microwave antennas and near-field scanning probes
- Mobile phone base station antennas
- Power flux density measurements include:
  - Axial isotropy
  - Frequency response
  - Linearity
  - Sensitivity
- Radiation hazard monitors field strength probes
- SMART antenna testing range
- Specific absorption rate probes
- Test site validations
- VHF antennas, e.g. for vehicle mounting

## Contact

Customer Service tel: **+44 20 8943 6796**

E-mail: **rf\_enquiries@npl.co.uk**

*For Loop Antennas Power Flux Density and Field Strength Probes please contact:*

Customer Service: tel: **+44 20 8943 8538**

E-mail: **pdfs@npl.co.uk**

# RF & Microwave Guided Wave

*RF and Microwave guided wave measurement standards apply in transmission media, such as waveguide, coaxial lines, and planar lines in high frequency integrated circuits. Power, attenuation, impedance and noise are the four main measurement parameters within this area, all of which underpin RF and microwave manufacturing and industry. NPL offers a number of services within this sector at frequencies up to 110 GHz. NPL also offers measurement services for ultrafast (< 1 ns) electrical pulse generators and photodiodes, as well as high bandwidth ( $\geq 1$  GHz) oscilloscopes.*



## Services, Instruments and Artefacts:

- Attenuation
  - o Fixed attenuators
  - o Stepped attenuators
  - o Variable attenuators
- Dielectric measurement services
- Impedance
  - o S-parameter measurements of:
    - Fixed attenuators
    - Network analyser calibration standards
    - Network analyser verification kits
    - Matched and mismatched terminations
  - o Characteristic impedance of air lines
- Noise standards
  - o ENR and noise temperature of noise sources
- Power standards, meters and sensors
  - o Calibration factor of power sensors
  - o Power meters
- Ultrafast waveforms
  - o Additional parameter measurements on request
  - o Fast pulse electrical measurements of pulse generators and photodiodes/photoreceivers - risetime and aberrations
  - o Risetime measurements of sampling and real-time oscilloscopes

## Contact

Customer Service tel: **+44 20 8943 6796**

E-mail: **rf\_enquiries@npl.co.uk**

# Surface & Nanoanalysis

*Surface analysis techniques are key to understanding and characterising surfaces used in today's high technology and innovative industries from the microscale to the nanoscale. NPL's internationally renowned Surface and Nanoanalysis capability is able to deliver cost effective solutions to a wide range of problems in areas such as aerospace, chemicals, pharmaceuticals, health, personal care, packaging, electronics, IT equipment, polymers, sensors, transport, biofilms and nanoparticles using the latest instrumentation. Our expertise is based upon the underpinning scientific research we perform in the fields of innovation, trade, industrial competitiveness and quality of life.*



## Services, Instruments and Artefacts:

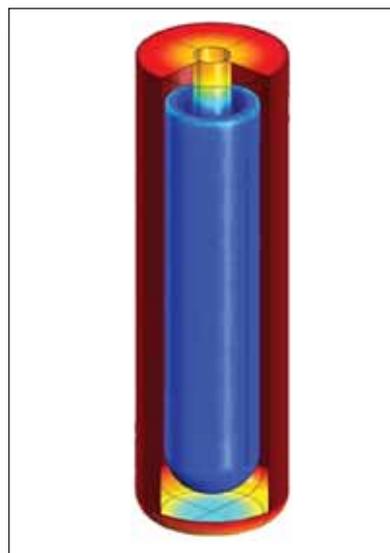
- Desorption Electrospray Ionisation (DESI)
- Drop shape analysis, wettability
- Scanned probe microscopy - atomic force microscopy, lateral force microscopy or frictional force microscopy, nanomechanics, chemical force microscopy, scanning near-field optical microscopy/nanoscale Raman spectroscopy, scanning ion conductance microscopy
- Secondary ion mass spectrometry
- Software, reference materials, data and guides, which underpin quantitative surface analysis
- Variable angle spectroscopic ellipsometry
- X-ray photoelectron spectroscopy, Auger electron spectroscopy, ultraviolet photoelectron spectroscopy

## Contact

Customer Service tel: **+44 20 8943 8637**  
E-mail: **[nanoanalysis\\_enquiries@npl.co.uk](mailto:nanoanalysis_enquiries@npl.co.uk)**

# Temperature

*NPL boasts internationally validated, independent and world-class range of reliable temperature calibration services and artefacts to meet all your needs. Our leading temperature experts have developed new metal-carbon eutectic fixed points that allow a step change reduction in measurement uncertainties, for example NPL established the world's first ISO-17025 accredited, 1324 °C (cobalt-carbon) calibration capability. NPL also offers astonishingly stable high temperature platinum-palladium thermocouples and is currently developing self-validating sensors. Ensure that your business is one of the first to benefit from these world-leading high temperature measurement capabilities available from the UK's National Physical Laboratory. In addition, we offer consultancy services and operate a training course in temperature calibration techniques.*



## Services, Instruments and Artefacts:

- Calibration and supply of platinum-rhodium thermocouples (0 °C to 1600 °C)
- Calibration and supply of pyrometric lamps (700 °C to 2300 °C)
- Calibration of blackbody sources, radiation thermometers and tympanic (ear) thermometers
- Calibration of digital indicators and industrial platinum resistance thermometers (-196 °C to 100 °C)
- Calibration of standard long-stem platinum resistance thermometers (-196 °C to 962 °C)
- Supply of cobalt-carbon (1324 °C) and palladium-carbon (1492 °C) eutectic fixed-points for calibration of thermocouples
- Supply of NPL fixed point blackbody sources (-40 °C to 3000 °C)
- Supply of platinum/palladium thermocouples
- Supply of temperature fixed-points and triple-point cells for the calibration of standard platinum resistance thermometers and thermocouples
- Supply of variable temperature blackbody sources (-40 °C to 1600 °C)
- Temperature calibration standards for nuclear magnetic resonance imaging
- Thermal imaging systems: applications and calibration

## Contact

Customer Service tel: **+44 20 8943 6315**  
E-mail: **temperature\_enquiries@npl.co.uk**

# Thermal Measurement

*NPL has a comprehensive range of world-class and nationally unique facilities for the measurement of the thermal performance of materials and structures used in buildings; pipe insulation; high temperature insulation and refractories; and engineering materials including plastics, composites, ceramics, metals and alloys.*



## Services, Instruments and Artefacts:

- Thermal Analysis
  - o Differential Scanning Calorimetry
  - o Dynamic Mechanical Analysis
  - o Thermo Mechanical Analysis
- Thermal Conductivity
  - o Axial Heat Flow Meter - Metals and alloys (50 °C to 500 °C)
  - o Guarded Heat Flow Meter - Polymers, composites, ceramics and others (-100 °C to 250 °C)
  - o Guarded Hot-Plate - Insulation up to 250 mm thick (5 °C to 40 °C)
  - o Heat Flow Meter - Insulation up to 200 mm thick (5 °C to 40 °C)
  - o High-Temperature Guarded Hot-Plate - Insulation and refractories (140 °C to 800 °C)
  - o Low-Temperature Guarded Hot-Plate - Insulation up to 60 mm thick (-170 °C to 50 °C)
  - o Thermal Conductivity Reference Materials & Transfer Standards to ISO Guide 34 - Insulation, polymers and metals
  - o Vacuum Guarded Hot-Plate Insulation, construction and engineering materials (-20 °C to 70°C)
- Thermal Transmittance
  - o Hot box test elements - U-values of windows, doors, skylights, industrial doors measured
  - o Measurement of the thermal performance of pipe insulation
  - o Measurements of the thermal performance of insulation utilising reflective surfaces
  - o NPL's Hot Box facility - U-value measurements of large non-homogeneous structures can be carried out in any orientation
  - o Provision of advice to industry on thermal performance issues
  - o Supply of glazed calibration panels as required by BS EN ISO 12567-1 and 2 to BS EN ISO 12567 Parts 1 and 2.

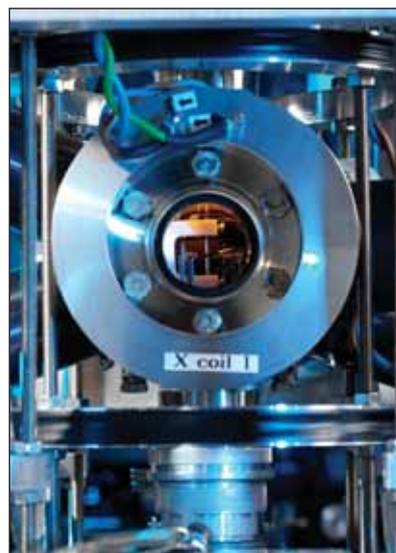
## Contact

Customer Service tel: **+44 20 8943 6245**

E-mail: **[thermal\\_enquiries@npl.co.uk](mailto:thermal_enquiries@npl.co.uk)**

# Time & Frequency

*Home of the nation's atomic time scale, NPL is the focus for time and frequency measurements in the UK. The UK atomic time scale UTC (NPL) is based on an ensemble of hydrogen masers and caesium atomic clocks. These are used to contribute to international atomic timescales and to provide the reference for time and frequency dissemination and monitoring within the UK. We have also developed a caesium fountain primary frequency standard to provide the top-level realisation of the SI unit of time, the second.*



## Services, Instruments and Artefacts:

- Characterisation service for frequency standards and GPS-disciplined oscillators
- GPS common-view time and frequency transfer service
- Time & frequency bulletins for MSF, Droitwich and GPS off-air signals
- Time synchronisation of computers to UTC (NPL)
  - dial-up telephone time service
  - internet time service using the Network Time Protocol (NTP)

## Contact

Customer Service tel: **+44 20 8943 6796**

E-mail: **timefreq\_enquiries@npl.co.uk**

# Ultrasound

*NPL provides a comprehensive range of calibration, measurement and consultancy services. These cover hydrophones, transducers, radiation force balances and characterisation of medical and industrial ultrasonic equipment to meet the stringent requirements of testing for compliance with regulatory, safety and quality standards. They provide manufacturers and users with acoustic output information at all stages of product development and manufacture.*



## Services, Instruments and Artefacts:

- Ultrasonic hydrophones
- Ultrasound power measurements and calibration of radiation force balances and ultrasound power meters.
- Measurement of the acoustic output of medical ultrasound equipment
- Acoustic property testing of materials, attenuation and speed of sound
- Supply of thermal test objects
- Supply of tissue mimicking materials
- Training courses on instrumentation and measurement methods for medical ultrasound
- Design, fabrication and supply of specialist measurement/test equipment
- Consultancy services for ultrasonic measurement, including the finite element modelling of transducer fields

## Contact

Customer Service tel: **+44 20 8943 8631**

E-mail: **[acoustics\\_enquiries@npl.co.uk](mailto:acoustics_enquiries@npl.co.uk)**

# Underwater Acoustics

*The applications of underwater sound span positioning, communications, navigation, echo sounding, geophysical surveying, water quality measurement, sonar, weapons systems, and tomographic measurements of ocean currents and temperature. Underwater acoustics is a key underpinning technology in offshore oil and gas activities, is increasingly used in oceanographic and environmental studies and continues to play a crucial role in marine defence. In addition, the accurate measurement of anthropogenic noise is key to the assessment of its effect on marine life.*



## Services, Instruments and Artefacts:

- Acoustic calibration and testing at simulated ocean conditions, in the NPL Acoustic Pressure Vessel
- Calibration of hydrophones and projectors
- Calibration and characterisation of sonar transducers and systems
- Consultancy services for underwater acoustic measurement
- In-situ measurement of radiated underwater acoustic noise
- Training courses in underwater acoustic measurement and calibration
- Underwater acoustics panel measurements

## Contact

Customer Service tel: **+44 20 8943 8631**

E-mail: **[acoustics\\_enquiries@npl.co.uk](mailto:acoustics_enquiries@npl.co.uk)**

# NPL Training

NPL has developed a Training Framework designed to up-skill learners in all aspects of measurement and its underpinning principles. In addition, NPL offers bespoke training solutions in line with customers' requirements.

A core understanding of why a measurement process is carried out, rather than just how, can result in:

- Fewer errors and increased productivity in any environment.
- Reduction in the need for expensive technical support.
- Lower waste levels and re-work time.
- Improved quality control, accuracy and repeatability.
- Promotion of decision-making, questioning and planning culture amongst staff.

The primary objective of the training is to provoke the learner in to making a difference within the workplace, giving them the opportunity to generate a return on investment for their employer as well as meet throughput requirements.

NPL is proud to offer the UK the first nationally recognised set of qualifications in metrology. The NPL Training Framework is validated by The National Skills Academy for Manufacturing (NSA-M) and accredited by EAL, a UK Awarding Body.

## Measurement Training Needs Analysis Programmes (MTNA)

NPL is also able to offer is a Training Needs Analysis (TNA) of your staff. This is sometimes referred to as the Accreditation of Prior Learning and Experience (APLE) process.

This will involve each member of staff being interviewed by an NPL Accredited Trainer. This is most effective when carried out face to face, rather than on the telephone or online. Once complete, the interview will have given the NPL accredited Trainer all of the necessary information to assess the current competency and skills sets possessed by the learner. Recommendations for appropriate training courses can then be made based on this information and specific outcomes targeted.

## NPL Training Framework - Learning Outcomes

The learning outcomes include instilling the following behaviours and attitudes:

- A questioning culture.
- A planning mentality.
- A strategic approach to measurement and calibration.
- A responsible attitude towards measurement and calibration.
- An accomplished, sound and practical understanding for the day-to-day application of metrology in the work place.
- A skilled, motivated and proficient member of staff.

For more information please visit [www.npl.co.uk/training](http://www.npl.co.uk/training), email [tom.ashby@npl.co.uk](mailto:tom.ashby@npl.co.uk) or telephone **020 8943 8672**.

# Other types of support offered by NPL:

Measurement Services represent just one way in which our customers can benefit from the wealth of scientific and technical resources at NPL. Other areas of support include:

- Consultancy: ranging from free advice over the telephone to fully or part-funded secondment of NPL experts into customer organisations
- Sale of reference artefacts, samples and measuring equipment
- Licensing of our portfolio of technology Intellectual Property, developed over many years at NPL and now accessible under a variety of exploitation arrangements
- Facility Hire: access to many of NPL's unique laboratory facilities on a pre-booked basis. Customers are able to operate these facilities under the impartial guidance of our technical experts
- Training: our established range of world-renowned measurement-related training products, delivered to meet the specific training and development needs of our customers
- Network Management, including both knowledge network facilitation and measurement infrastructure management
- Modelling of all types, using a wide-range of state-of-the-art techniques and covering the entire breadth of NPL's science and technology base
- Measurements solutions: the development and delivery of bespoke measurement techniques, practices and business solutions, especially at high levels of accuracy or for use in difficult or unusual environments
- Test and measurement instrument design, development, application and impartial evaluation
- Independent measurement, testing and validation of software and systems
- Development of specialist mathematical software for measurement and instrumentation applications.

General business enquiries concerning the above services should be referred to our dedicated Business Development team:

<b>Defence, Security &amp; Aerospace</b>	<b>Tim Prior:</b>	<b>+44 20 8943 6679</b>
<b>Environment, Transport &amp; Energy</b>	<b>Tim Prior:</b>	<b>+44 20 8943 6679</b>
<b>Low Carbon Energy (Nuclear)</b>	<b>Ray Chegwin:</b>	<b>+44 20 8943 6385</b>
<b>Space &amp; Communications</b>	<b>Tim Prior:</b>	<b>+44 20 8943 6679</b>
<b>Training</b>	<b>Tom Ashby:</b>	<b>+44 7718 198 672</b>
<b>Measurement Services</b>	<b>Andy Morris</b>	<b>+44 7738 894 855</b>

# NPL's commitment to quality

As the national measurement standards laboratory in the UK, NPL offers services at the highest available levels of accuracy. Customers depend on these to achieve direct traceability to nationally and internationally accepted standards. These services are operated within the most stringent quality and procedural requirements. To demonstrate this formally, it is NPL's policy to seek accreditation, where feasible, for its measurement services.

## ISO 9001

NPL's quality management system has been registered for scientific R & D and the provision of internal services by LRQA to ISO 9001:2000 and where appropriate in accordance with TickIT.



## ISO 17025 and ISO Guide 34

Many of NPL's standard calibration, measurement and testing services have been accredited by UKAS. The accredited capability of those services may be found in calibration and testing schedules issued by UKAS.



## CIPM MRA

Many NPL certificates now display the CIPM MRA logo and statement, indicating the mutual recognition of national measurement standards and of calibration and measurement certificates issued by national metrology institutes.



## Customer Satisfaction

At NPL we aspire to provide a world-class service to all of our customers. Your views on our performance are important to us. We would appreciate it if you would tell us how we are doing and suggest areas to us where we could improve our service to you. For more details please visit us at [http://www.npl.co.uk/customer\\_satisfaction](http://www.npl.co.uk/customer_satisfaction)

## Terms & Conditions of Business

For detailed information please refer to the Terms & Conditions page on our website:

[www.npl.co.uk/terms\\_conditions](http://www.npl.co.uk/terms_conditions)

# National Physical Laboratory

Hampton Road  
Teddington  
Middlesex  
United Kingdom  
TW11 0LW

Helpline: **+44 20 8943 6880**  
 Fax: **+44 20 8614 0446**  
 E-mail: **enquiry@npl.co.uk**  
 Web: **www.npl.co.uk**

## Public Transport



**By Rail,**  
**Teddington Station**  
 20 minutes walk to NPL.

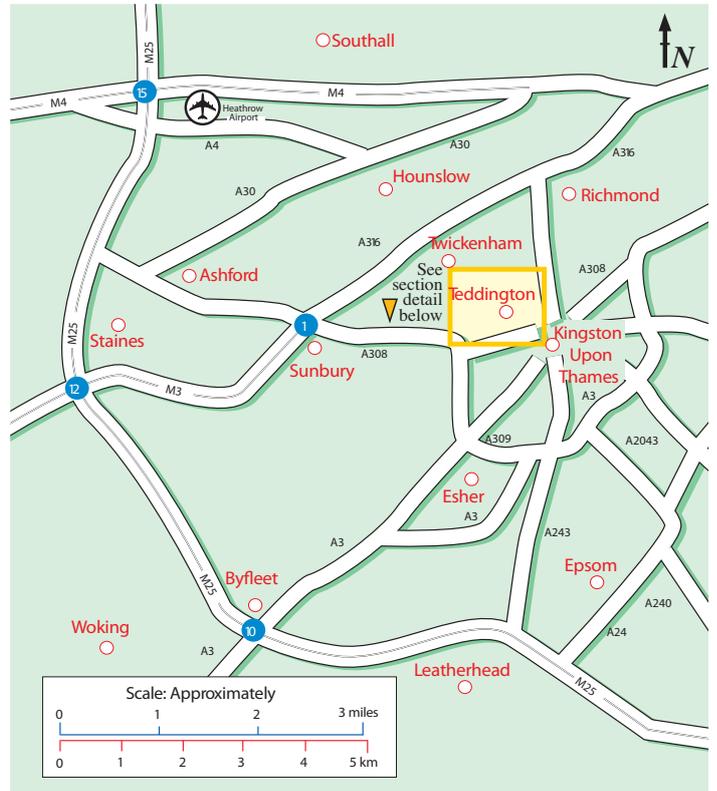


**By Air**  
**Heathrow Airport**

Bus 285 travels to Teddington and stops outside NPL. Bus X26 is faster and stops at Broad Street, a short walk from NPL. Or take a taxi, approximately 30 minutes to Teddington.



**Buses.**  
 Teddington is well served by buses from Heathrow, Kingston, Twickenham and Richmond (285, X26, 281, R68 and 33).



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Mapping sourced from Ordnance Survey

