



UK Atomic
Energy
Authority

Annual Report and Accounts **2016/17**



HC 295







United Kingdom Atomic Energy Authority
Annual Report and Accounts
2016/17

Presented to Parliament pursuant to Sections 3(5)
and 4(3) of the Atomic Energy Act 1954

Ordered by the House of Commons
to be printed on 19 July 2017

HC 295





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This publication is available at <https://www.gov.uk/government/publications>

Print ISBN 9781474147972
Web ISBN 9781474147989
ID 10071745 07/17

Printed on paper containing 75% recycled fibre content minimum

Printed in the UK by the Williams Lea Group on behalf of the Controller of Her Majesty's Stationery Office





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Chairman's Statement

This has been a year of change and new beginnings for UKAEA. In October 2016, we bid farewell to Professor Steve Cowley, CEO of seven years, and welcomed Professor Ian Chapman at the helm. Ian is one of the youngest people to head up a major national science laboratory. He already has impressive academic credentials including 110 journal papers to his name and a number of awards, most recently the European Physical Society Early Career Prize in 2014 and the Institute of Physics Paterson Medal in 2013. He has proved adept at participating in complex discussions with government in what has been tumultuous political year, whilst also enthusing youngsters in one of the 2016 Royal Society Christmas lectures.

This year has seen the public decide in a national referendum in June 2016, that the UK should exit from the European Union. The subsequent government bill stated that this will also mean withdrawal from EURATOM. UKAEA operates JET, currently the world's leading fusion device, under a contract with the European Commission as part of the EURATOM framework programme. JET has just had the best performance in five years, undertaking important experiments for ITER, the international fusion device currently under construction in France, with a programme set to run to at least the end of 2020. Fusion is now entering the delivery stage and JET remains a critical device. The UK government has been very supportive of UKAEA's mission and in continuing to keep the UK at the forefront of fusion.

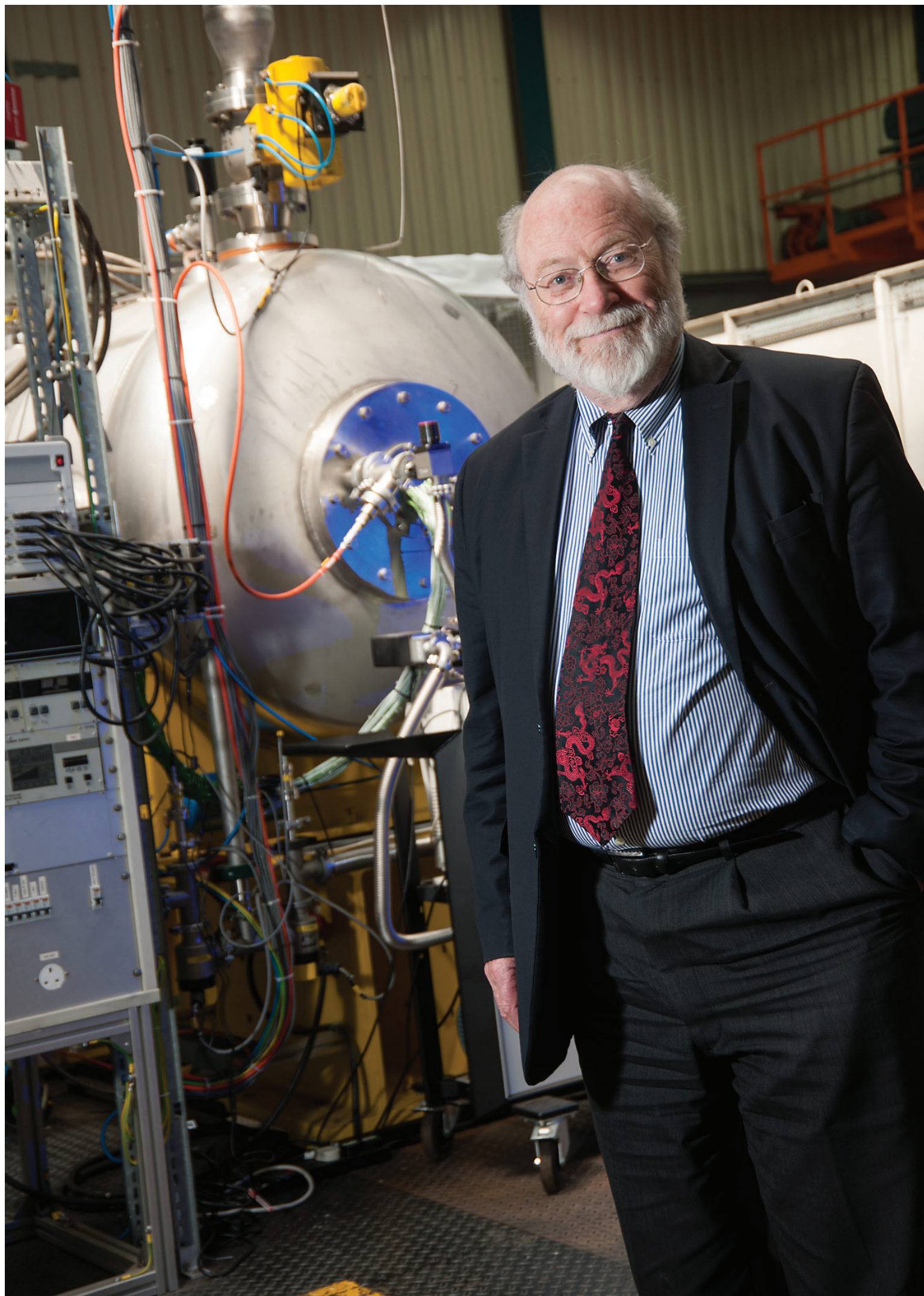
This year has also seen the expansion of UKAEA's activities. Our new Materials Research Facility (MRF) and centre for Remote Applications in Challenging Environments (RACE), which were officially opened by the Science Minister in May 2016, have both successfully completed their first full year of operations. Following on the heels of UKAEA apprentices winning the Brathay Apprentice team of the year, we opened a new training facility Oxfordshire Advanced Skills (OAS) in September 2016, to provide highly skilled apprentices to high technology companies in Oxfordshire. This is set to grow over the coming years, with a brand new building due to open in 2019. Another change occurred behind the scenes with the transition to a new finance, procurement and HR system, which was no small feat.

Our expansion will continue next year as we start operating the new Material Detritiation Facility, which was constructed this year. The facility will close the fusion fuel loop by recovering tritium and also reducing waste costs. We are also due to complete the MAST Upgrade and start operations of this successor to MAST. The new super-X divertor configuration, in particular is attracting international interest due to its ability to study the high energy exhausts from any fusion reactor and possibly allow for more compact fusion reactor designs. These are all key technical challenges for fusion.

As well as sky-line changes at Culham, we continue to develop the Harwell Campus with our joint venture partners, and construction of new commercial and scientific buildings will continue in the coming years. Both sites are important employment centres and are set to grow further, with the creation of even more jobs.

We are looking forward to working with our industrial and academic partners to support the government's emerging industrial strategy, so essential to the wealth and prosperity of the nation after Brexit. This has been an eventful year, not always for the best of reasons, and I expect 2017-18 to be equally demanding.

**Professor Roger Cashmore, CMG, FRS
Chairman
13 July 2017**





Performance Report Overview

Chief Executive's Statement

On the 29 March 2017, the UK government wrote to the European Commission declaring an intention to withdraw from the European Union, and more importantly for UKAEA, also from the Euratom Treaty. UKAEA operates JET, the largest European science facility on UK soil with well over half of our turnover coming from the European Commission, so this decision undoubtedly leads to uncertainty and threat to the organisation. That said, the UK government have made a number of supportive statements about UKAEA, JET and fusion research. For instance, Jo Johnson MP, Minister of State for Universities, Science, Research and Innovation stated that:

"The research done at Culham Centre for Fusion Energy is rightly recognised as world class and it has driven UK leadership in fusion R&D for many years. The Government has no intention of compromising this position following the decision to withdraw from the Euratom Treaty. Maintaining and building on our world-leading fusion expertise and securing alternative routes into the international fusion R&D projects such as the Joint European Torus (JET) project at Culham and the ITER project in France, will be a priority".

I must pay great testament to our staff, whose enthusiasm and commitment have been undiminished by our exposure to Brexit, and instead have focussed on progressing fusion. For instance, this year we have far surpassed the performance records on JET since installing the ITER-like wall in 2011 (indeed, nearly doubling the record!) as we prepare to operate with deuterium-tritium fuel in 2019. We also broke the record for injected heating power into JET with hardware performance really excelling. JET remains the best machine in the world and will be the best place to prepare for ITER operation, due to begin in 2025.

After 3.5 years of hard work, the MAST Upgrade vessel assembly was finally completed with a successful first vacuum test. We are on course for first plasmas in early 2018 after a period of commissioning the substantial amount of new hardware. The whole community is excited to see the first physics results from MAST Upgrade, which has the potential to transform how we might exhaust heat from fusion reactors. In preparation for these experiments, we held the inaugural MAST Upgrade Research Forum and had proposals from all over the international community and a massive oversubscription of experimental time. But we're not standing still – we already have plans to do more and have already won €11m from EUROfusion to complement UK funding to double the heating power, install a cryoplat and many new diagnostics and fuelling systems by 2020.

Our new centre for Remote Applications in Challenging Environments (RACE) goes from strength to strength. The team has doubled to 120 during this year, and as well as working with industry to win robotics contracts from ITER, we are also delivering the robotics solutions for the European Spallation Source Hot Cell amongst many other contributions to the broader UK needs. RACE is developing into a key facility for ITER and this year we agreed to host the ITER Robotics Test Facility, co-funded by UK Government and ITER, to test robotics solutions for ITER before the facility moves permanently to ITER in 2022.

The Materials Research Facility (MRF) is also developing well. After formally opening in May 2016 we have been doing non-active work on our fully-subscribed materials testing instruments whilst in parallel preparing for active operations. We have recently received our Environment Agency permit to operate and will be taking irradiated samples in 2017.

Finally, 2016/17 marked the final year of UKAEA's grant from EPSRC to deliver the fusion research programme. I am delighted that we have been awarded a new five-year grant until 2022 which will provide £131.6m, showing continued support from the Research Councils for the UK's internationally-leading fusion R&D. This programme grant will enable us to operate an increasingly capable MAST Upgrade facility, to lead the scientific exploitation of JET, and to continue to grow fusion technology programmes, including exploitation of RACE and MRF, as we move towards the commercialisation of fusion.

I was deeply honoured to take over as CEO in October 2016. My predecessor, Prof Steve Cowley, left the organisation in good health and I hope to build on his excellent work. He is a great role model for all of us at Culham – ambitious, enthusiastic and devoted to realising fusion – and I am delighted that he remains a close collaborator. I count myself enormously fortunate to be able to lead UKAEA forward on the path to delivering fusion, a mission about which I am deeply passionate.

UKAEA is a real jewel in the crown of UK science and innovation and Culham is home to unparalleled facilities and some of the best and brightest fusion R&D talent in the world. Fusion can be a great success story as the UK leaves the European Union and an opportunity to coalesce strength in sectors which are priorities within the industrial strategy, thereby changing the world and driving our economy.

Professor Ian Chapman
Chief Executive and Accounting Officer
13 July 2017





Purpose

The United Kingdom Atomic Energy Authority (UKAEA) was formed in 1954 when the British Government set up a new body to oversee the nation's nuclear research programme. UKAEA is a non-departmental public body (NDPB), under the Department for Business, Energy and Industrial Strategy (BEIS).

UKAEA's principal mission is to lead the commercial development of fusion power and related technology and position the UK as a leader in sustainable nuclear energy.

UKAEA undertakes a world-leading programme in tokamak operations, plasma physics, materials science and in technology research and development (R&D), which is undertaken at its fusion laboratory, the Culham Centre for Fusion Energy (CCFE). UKAEA operates JET (Joint European Torus), the world's largest

fusion facility, under a bilateral contract with the European Commission, as part of the EUROfusion work programme. CCFE also participates in the JET scientific programme as a EUROfusion member.

One of the scientific priorities for CCFE is to support ITER, a new international experimental fusion device, currently under construction in France. ITER is a key step in the European roadmap to the realisation of fusion energy and will lay the path for a demonstration power plant DEMO, which will for the first time supply fusion electricity to the grid.

UKAEA is currently in the final stages of construction of a multimillion experimental fusion device MAST Upgrade (MAST-U), successor to MAST (Mega Amp Spherical Tokamak). Its innovative design is aimed at furthering the route to smaller, cheaper, fusion reactors.

During the year, two new research facilities were opened at Culham – the Materials Research Facility (MRF) and the centre for Remote Applications in Challenging Environments (RACE).

The scientific research programmes are primarily funded by European funds and the Engineering and Physical Sciences Research Council (EPSRC). There is also strong input from over 20 UK universities and collaborations with major international industrial and academic players in fusion and fission.

Key Risks

UKAEA is undertaking novel scientific research and cutting-edge design and engineering work which creates inherent technical risks. UKAEA continues to manage risks and opportunities proactively in line with the framework laid out in the Governance Statement. Risks and opportunities are assessed in accordance with the appetite for risk agreed by the Board and, to the extent reasonably practicable, effective mitigations are put in place where threats exist.

External factors beyond the UKAEA's immediate control continue to influence the risk landscape. The UK's plan to exit the European Union and Euratom agreements has created uncertainty within the fusion community. The current contract between

UKAEA and the Commission for the operation of JET covers the period to 31 December 2018. The UKAEA and BEIS are working closely to seek solutions for future collaborations/funding for the longer term.

Attracting and maintaining specialist expertise in the organisation continues to be a significant challenge. Challenges in competing with market pay rates due to government pay constraints and uncertainty surrounding freedom of movement following UK's exit from Europe is impacting UKAEA's ability to attract and retain key specialist skills. These external factors affect UKAEA's ability to deliver its goals.

The UKAEA has secured funding in some key areas including additional EPSRC/

EUROfusion funding, which will keep MAST-U at the world forefront of exploring plasma exhaust physics for many years. Opportunities also exist in securing funds from the government's Industrial Challenge Fund.

UKAEA's business development strategy promotes technology growth in the UK, with new enterprises acting as a catalyst for UK industry and enabling broader utilisation of skills now and in the longer term. The strategy is informed by the opportunity and risk identification, assessment and mitigation process and is actively tracked by the Executive Committee.

Further information on the management and governance of risk is provided in the Governance Statement.





Performance Report Overview



Performance Summary

UKAEA's mission and vision are encapsulated in five goals – key achievements against these in 2016/17 are highlighted below.

Goal 1 - Maintain the UK's position as a world leader in fusion research:

- Following recognition of the world-class magnetic confinement programme in the UK in a review of fusion and fission research in the UK, UKAEA was awarded a 5-year grant by EPSRC, starting in April 2017.
- The MAST-U project, which will give the UK a world-leading fusion device is nearing completion and already attracting interest from international laboratories. A £21m programme of further enhancements has been agreed, which will be jointly funded by EPSRC and EUROfusion.

Goal 2 - Enable skills and jobs growth in UK industry:

- To date UKAEA has helped UK industry win around €500m in ITER contracts, including the largest fusion robotics contract. Further growth is targeted through the RACE centre. The UK government and ITER are jointly funding ca. €10m for an ITER Remote Handling Test Facility at RACE.
- Oxford Advanced Skills (OAS) Phase 1 was opened in September 2016 as an interim step to a £12m facility, funded by BEIS, which will train up to 250 high tech apprentices per year.

Goal 3 - Grow the UK's nuclear materials and technology capability:

- MRF was official opened in May 2016 by Jo Johnson MP, Minister of State for Universities and Science. It is part of the National Nuclear Users Facility (NNUF) and Henry Royce Institute initiatives.
- Construction of the Material Detritiation Facility (MDF) was completed, which will remove tritium from solid waste, solving a key technology challenge for fusion and providing wider applications.

Goal 4 - Design the first fusion power plants:

- UKAEA continues to play an integral role in EUROfusion's power plant physics and technology programme and DEMO design activities.
- A small virtual engineering centre was completed in March 2017.

Goal 5 - Develop Harwell and Culham sites as Science and Innovation Centres:

- Engagement with potential private sector investors about commercial development at Culham.
- Significant development at the Harwell Campus of new infrastructure, laboratory, office and engineering space.

UKAEA has a balanced scorecard for its corporate performance measures, which encompass all main activities and support the five corporate goals. Performance is tracked through the year by the Executive. There has been good/excellent performance across all measures, with threshold targets and in some cases stretch target achieved, except in the case of MAST-U.

The MAST-U project started the year well, then encountered technical complications with construction, including on the central rod and issue with tight tolerances requiring redesign of some components, which resulted in the two milestones due at Christmas being missed. While a lot of the work was done on preparation for commissioning of the coils, unforeseen technical complications and a lack of electrical resource meant that two milestones due at the year-end were also missed.

A summary of performance is provided in Table 1. More details on performance against the UKAEA's different activities are provided in the Performance Analysis.

Table 1 – Outturn against the corporate performance measures

Performance Measures	Goal	Target	Provisional Outturn
Key Scientific and Engineering Measures			
Deliver the UK Fusion Programme milestones agreed with EPSRC	1	80-100%	37 out of 46 (80%) milestones achieved
Deliver the JET Operations milestone targets agreed with the European Commission	1	80-100%	31 out of 37 (84%) milestones achieved
Deliver the Tier 1 MAST-U project milestones	1	Targets for each measure	2 milestones achieved + 4 milestones missed
Deliver the Technology & Engineering milestones	2, 3, 4	80-100%	10 out of 11 milestones (91%) achieved
Key Business and Financial Measures			
Deliver new scientific equipment and achieve operating balance (loss) for MRF	1, 3, 5	Budget figures	£1m of new equipment delivered and operating loss less than budgeted
Achieve income target and operating balance (loss) for RACE	1-5	Budget figures	Income exceeded budget target and operating loss at budgeted level
Achieve the income target for external business development (Special Techniques Group & Technical Consultancy)	2, 3	Budget figure	Income exceeded budget target
Achieve the operating profit targets from commercial property management at Culham	5	Budget figure	Profit exceeded budget target
Key Process and Cultural Measures			
Deliver the Safety, Health, Environment, Quality & Security Improvement Programme	1-5	80-100%	11 out of 11 (100%) milestones achieved
Deliver Project Management process improvements	1-5	80-100%	6 out of 7 (86%) milestones achieved
Deliver the SAP replacement, Payroll migration and Pensions projects	1-5	Targets for each measure	All targets achieved
Deliver the capability programme	1-5	Targets for each measure	All targets achieved



Performance Report Performance Analysis

Tokamak Science Programme

The aim of the Tokamak Science area is to advance our understanding of the processes that govern the performance and scale of fusion reactors, through experiments, theory and modelling, in order to bring us closer to commercial fusion energy production. The programme is focused on the following key issues for ITER and future fusion power stations:

- developing integrated operating scenarios to optimise performance and carrying out world-leading integrated modelling in support of JET and ITER;
- optimising performance of the pedestal, the area which lies between a burning plasma core and the exhaust region;
- exploring innovative solutions to the exhaust of power and particles from the core plasma; and
- studying fast particles, heating and current drive in order to optimise fusion performance and avoid or mitigate instabilities.

In preparation for experiments on JET with a deuterium-tritium fuel mixture, which will be used in ITER and future reactors, the Tokamak Science programme has concentrated on optimising the plasma performance. Improvements in JET plasma performance were achieved through increasing the temperature in the centre of the plasma through strong auxiliary heating with highly energetic neutral beams and radio frequency heating at the ion cyclotron resonance frequency, together with careful optimisation of the plasma configuration. Performance limiting instabilities were avoided by tailoring the plasma current distribution and gas fuelling of the plasma was minimised to avoid cooling the plasma. These improvements resulted in the neutron production in the plasma achieving record levels since the installation of the metallic ITER-like wall.

Use of strong auxiliary heating results in steep gradients in temperature and density near the edge of the plasma, which reduce losses of heat and particles from the plasma core, and improves the overall plasma performance. The heating power needed to access this improved confinement mode is sensitive to a number of factors, including the strength of the magnetic field, the number of particles in the plasma for a given volume, the surface area of the plasma and the particle species, such as hydrogen, deuterium, tritium or helium. This sensitivity to particle species has been studied in detail in dedicated experiments on JET, to enhance our ability to predict the performance of experiments with a deuterium-tritium fuel mixture. Experiments varying the fuel mixture from pure hydrogen to increasing concentrations of deuterium found a strong sensitivity to fuel mixture in concentrations from 0-20% and 80%-100% deuterium. A similar trend was found in mixed hydrogen-helium plasmas. This provides important insights into the effect of mixed species on access to improved confinement and provides guidance for future JET and ITER operations.

Magnetic fields are good at confining plasmas, but they are not perfect and some particles and heat escape from the edge of the plasma, in what is known as the exhaust. In the next generation of reactors such as ITER, this exhaust energy can be mitigated through radiation, thus spreading the power over a much larger area than would otherwise be possible. This regime, known as detachment, will be studied in detail in MAST-U. Simulations carried out with the state-of-the-art SOLPS code predicts that the unique Super-X configuration in MAST-U will significantly outperform a “conventional” configuration by significantly expanding the operating window where divertor detachment occurs.

The high confinement mode can give rise to intermittent edge localised modes (ELMs)

instabilities at the edge of the plasma, which can deposit significant quantities of energy to the tokamak divertor. Studies using infra-red cameras have shown that as the number of filaments from an ELM increases, the area of the divertor where the ELM energy is deposited increases. This is supported by simulations that model the motion of these ELM filaments. ELMs in MAST are observed to produce 5 to 15 filaments when the instability is triggered, leading to an increase in the area of the divertor receiving its energy by a factor of 3 to 6 times higher than is observed between each ELM. In ITER, ELMs may produce fewer filaments due to possible differences in the dominant magnetohydrodynamic instabilities thought to give rise to ELMs in both devices. This has important implications for the peak divertor power loads that are experienced during an ELM in ITER and correspondingly the level of ELM control required.

One of the primary sources of auxiliary heating in tokamak experiments is neutral beam injection, where a beam of highly energetic particles enters the plasma causing heating through collisions with the plasma. If these particles are lost from the plasma before they undergo a significant number of collisions, this can result in a degradation of the plasma performance and heating of solid surfaces close to the plasma. Non-axisymmetric fields are a promising means of controlling or avoiding ELMs. Extremely high fidelity simulations were carried out to determine the heating of internal components in ITER due to the presence of magnetic fields intended to control ELMs, and the plasma response to these fields, including a full 3D description of the device, using high performance Graphics Processing Units. These simulations indicate that components shielded from direct plasma exposure are heated by energetic particles striking their surface, however when the plasma response is accounted for, this is not expected to pose a risk to ITER.





Performance Report Performance Analysis



JET Operations

Last year, high-voltage transmission system problems seriously affected neutral beam heating performance in JET. These have been overcome through an intervention and period of recommissioning and a highly successful period of JET operations followed.

In July 2016, a successful rehearsal for the deuterium-tritium (DTE2) campaign was undertaken. Key technical and operating procedures required for DTE2 were carried out using deuterium only but under similar managerial controls that will be adopted for tritium operation.

In August 2016, the hydrogen campaign C37 commenced, in which 65 out of the planned 66 sessions were completed. The JET machine operated very reliably during this period and an exceptionally high pulse rate was achieved.

In October 2016, the deuterium experimental campaign C36B commenced, dedicated to the development of the plasma scenarios that will be required for DTE2. During the five week campaign an impressive 68 high power pulses were generated, the highest achieving 28.2MW from the neutral beams, and a total heating power of 33.7MW was obtained with combined neutral beams and ion cyclotron heating. This is more than the entire number of high power pulses obtained over the previous five years. Significant progress was made towards the set of physics and technical key performance indicators agreed by the EUROfusion General Assembly.

The good machine reliability at high power has led to some excellent physics results, breaking the record for fusion neutrons produced since the installation of the ITER-like wall and returning to stored energy levels which will extrapolate to high fusion gain in ITER.

In November 2016, an external ad hoc review of JET reliability took place, in view of the technical problems experienced in the previous year and need for consistent reliable high power operation in the preparation and execution of the DTE2 campaigns. The review provided a clear endorsement of UKAEA's management of JET operations, recognised the progress in restoring JET technical performance and strongly endorsed the remedial actions and refurbishments already implemented or planned for improved machine reliability to 2020.

Preparations for DTE2

Also in November 2016, JET went into a formal shutdown to undertake the final technical preparations for the tritium and DTE2 campaigns scheduled to take place in the 2018-20 period. As well as the planned in-vessel work, there is large programme of ex-vessel work. The major objectives are the completion of installation work related to the DTE2 project, but also implementation of the substantial programme of reliability improvement actions. In addition, a Shattered Pellet Injector will be installed to test the device for disruption mitigation, on behalf of the US ITER Domestic Agency.

Progress against the shutdown programme has been very good and at the end of the reporting year, there was less than one-week of slippage against the plan. Some highlights included:

- commencement of in-vessel remote handling activity, which will see the removal of approximately 200 tiles;
- removal of the Octant 4 neutral beam central support column assembly, which is being prepared for fitting of the updated new 'J-plate' components and refurbishment of the calorimeter;

- removal of the Octant 8 assembly and refurbishment of the neutral beam water system and the rotary high vacuum valve; and
- preparation of the tritium gas introduction modules.

Material Detritiation Facility (MDF)

During the year the MDF was constructed, which will provide a unique thermal detritiation capability, enabling on-site removal of tritium from JET components, especially in-vessel components. It will close the fusion fuel cycle on JET and reduce the liability arising from tritiated JET waste, further demonstrating the potential of fusion as a clean, environmentally responsible source of power.

Following commissioning of MDF's furnace, inactive trials to prove the safety of the system are due to start in summer 2017.



Performance Report Performance Analysis



MAST Upgrade

The end of 2016 marked the completion of the MAST-U tokamak boundary with all four modules successfully assembled in their final location within the bio-shield. The process began with the installation of the completed lower end plate in the MAST-U pit in May 2016. This was quickly followed by the installation of the partially completed 50T outer cylinder, positioned above the lower end plate on its new support legs. The joining of these two modules was confirmed by a successful leak test of the vacuum joint.

In December 2016, the centre tube and upper end plate modules were lifted into position. All told, over 130,000 new components had been successfully assembled by the end of the year with the project poised to begin pump down and leak test of the completed tokamak, one of the last major milestones before restart and first plasma.

The centre column module was completed and successfully installed in March 2017. This is a new and critical piece of the tokamak's magnet infrastructure which contains the solenoid, toroidal field centre rod as well as some additional shaping coils which will greatly enhance the capability of the new machine. During final inspection in early 2017, an issue was discovered with parts of the solenoid restraint system which required some rapid R&D to establish a more robust bonding arrangement. This remedial action avoided a likely failure in early operations, which could have put back operations by over six months, though unfortunately extended the construction critical path by six weeks.

The majority of the power supplies have now been installed and locally commissioned and most of the electrical distribution and earthing infrastructure is now in place for energising and commissioning the key support services.

The upgraded Neutral Beamlines are mechanically complete following an extensive refurbishment, allowing the team to focus on completion of the control systems and commissioning of all services prior to neutral beam power supplies commissioning, the final step before beam extraction. This work has been slower than planned due to some unforeseen technical issues and lack of sufficient resources.

The completed tokamak boundary included a significant number of embedded diagnostics, including 850 Langmuir probes, 800 magnetic sensors and 200 thermocouples, as well as mounts and periscopes for many of the ex-vessel diagnostics such as high speed cameras, beam emission spectroscopy and charge exchange recombination spectroscopy. Work continues to progress on the major ex-vessel diagnostics, including the core and divertor Thomson scattering systems, CO₂ interferometer and others, many in collaboration with UK universities and other fusion associations.

Progress has been made in the areas of machine control, protection and data acquisition, although this has been delayed in some areas due to unexpected levels of complexity and continues to present some of the greatest risks given the challenges involved in safely operating and exploiting the potential of this new exciting facility. Highlights during the year include completion of the control and data acquisition systems for the gas fuelling system, successful laboratory testing of the new Real Time Protection system and activation of the new MAST-U network.

MAST-U Operation

In parallel with the MAST-U construction project, preparations for machine operations have been progressing, including approval of the safety case for initial operations. The first campaign will be part funded internally and part where MAST-U operates as a EUROfusion Medium Sized Tokamak. Eurofusion's call for proposals was overbid by a factor of 7, highlighting the interest from the fusion community in the opportunities presented by this new machine.

A major £21m programme of enhancements to MAST-U has been approved as part of the EUROfusion Plasma Exhaust Strategy. The main components will be two additional neutral beam injectors, doubling the auxiliary heating power by providing an additional 5MW of heating; a cryoplant to serve the installed divertor and beam box cryopumps; a high frequency pellet injector; upgrades to the control hardware and software; and additional diagnostics to fully exploit the capabilities of understanding plasma exhaust.

The primary goal of the MAST-U enhancement project is to provide necessary input for a divertor test tokamak assessment of key issues, e.g. heat load reduction with alternative divertors, ahead of a 2022 target date. Funding will be phased in during MAST-U operation from 2017-2022 and will come equally from EUROfusion and EPSRC.



Performance Report Performance Analysis





Technology Programme

UKAEA's contribution to the design of the EUROfusion DEMO reactor has continued with major investment in hardware during 2016. The impact of UKAEA on the systems integration project has continued with development of a systems model for the tritium breeding blanket. The power plant modelling code, PROCESS, is the subject of a collaboration with the Chinese Academy of Science's Institute of Plasma Physics and with Oak Ridge National Laboratory in the US. The divertor project has delivered prototypes for plasma facing components that were successfully tested in high heat flux facilities.

The divertor prototypes were developed with assistance from the Virtual Engineering programme started within the Technology Programme to bring together different disciplines for the benefit of UKAEA. This combined design optimisation techniques, x-ray tomography imaging and finite element modelling to refine design and processing through the development cycle. These techniques, developed in the Technology Programme, allow the choice of structure and materials to be optimised and the integrity of manufacture to be analysed. Flaws in the first manufacturing were revealed and modelling showed that the component would fail under operation. A revised manufacturing process was successful and the prototypes passed all qualification tests of 20MWm⁻² and 25MWm⁻² heat flux for 100 cycles. This was the first demonstration of Virtual Engineering in the design lifecycle at UKAEA.

Virtual Engineering was again at the forefront when VORTEX, an immersive 3D virtual reality space for nuclear facilities developed by UKAEA, won a prize at the Symposium on Fusion Technology in September 2016. VORTEX combines UKAEA's expertise in radiation transport and dose rate modelling with an engineering

model of the plant to show in real time the radiation dose from different systems. The user can move around, perform activities on the virtual plant whilst the software monitors total dose. This is essential for planning maintenance and emergency routines for humans and machines.

A dedicated Virtual Engineering Centre has been created to combine projects in Technology, Advanced Computing and Robotics and to showcase UKAEA's expertise. Discussions with a number of high power computing centres are in progress to investigate synergies.

A new tritium permeation test facility is under construction, partly funded by EUROfusion. The facility will be used to investigate tritium permeation barriers such as Al₂O₃ for DEMO. The barrier materials are provided by ENEA, the Italian National Agency for New Technologies, Energy and Sustainable Economic Development, and will be used in the tritium breeding blanket with the intention of preventing tritium passing from the breeder volume into the coolant loop. Permeation is very sensitive to temperature, so tests must be conducted at temperatures up to 800K using mass spectrometry, beta-induced x-ray spectrometry and an ionisation chamber for measurement of low levels of tritium that have permeated through the barrier.

The materials technology laboratory has expanded to include two pneumatic load frames, one of which can test materials under vacuum, a facility unique in the UK and essential for fusion. The laboratory is investigating the small punch test as a method for obtaining material property data, particularly creep, from small samples and the properties of additively manufactured materials. Collaborations with the National Nuclear Laboratory (NNL), University of Oxford, University of Sheffield and the Chinese Southwestern Institute of Physics

are ongoing. The testing facilities are now enhanced by HIVE, a radio frequency induction high heat flux testing rig for DEMO relevant conditions.

During the year UKAEA has also been working with the French Alternative Energies and Atomic Energy Commission (CEA) to review jointly produced conceptual designs for three test devices, which could ultimately be used within the Jules Horowitz Reactor; a 100MW experimental reactor currently under construction at Cadarache, France. The test devices have the potential to offer important insights into the materials and engineering challenges of the fusion community.





Performance Report Performance Analysis



Materials Science Programme

The development of robust structural and plasma-facing materials is a big challenge in the development of fusion power, as these materials will have to withstand years of intense fluxes of neutrons and plasma exhaust heat and their mechanical and thermal properties will inevitably degrade with time. The objective of the Materials Science programme is to generate fundamental understanding of how materials behave in the fusion environment to inform choices for the design of fusion technology components. This wide ranging objective is tackled as part of EUROfusion, IAEA and other international programmes and through collaborations with several UK universities.

The programme has four strands:

- modelling materials damage especially microstructural evolution, hydrogen isotope retention, and embrittlement mechanisms;
- nuclear data codes for calculating radioactive inventories & radiation transport,
- plasma-facing materials in JET; and
- experiments investigating radiation damage phenomena.

The last of these is a new programme, established to exploit the new MRF at Culham. During the year, the strategy for this strand was agreed; it has two main components, designing new techniques suitable for testing radioactive materials, and using these and other methods in the MRF to characterise samples damaged by both neutrons and (as a proxy for neutrons) high energy ions.

MRF's role is to allow UK fission and fusion scientists to process and analyse samples far too radioactive for university premises but not requiring the facilities of a nuclear licensed site:

<http://www.ccf.ac.uk/mrf.aspx>

During the year, universities and UKAEA have used its scientific equipment for a range of tests on inactive or low activity samples. In parallel, the MRF hot cells have been commissioned to enable specimen processing using master slave manipulators, new shielded rooms have been built to house the scientific equipment, and £1m (funded by the Henry Royce Institute) has been spent on new instruments, mainly for mechanical and thermo-physical testing. In November 2016, the MRF User Panel, which has members from universities, industry and other national laboratories, met for the first time; its function is to provide independent advice on investments and strategy. In 2017/18, work with radioactive specimens will gradually expand for a range of customers, and £2m is planned to be spent on additional equipment, funded by the Henry Royce Institute.

The various research strands come together in joint projects. For example, the EUROfusion-funded TRICEM project on the behaviour of gases in irradiated material utilises capabilities deployed on modelling, JET and MRF experiments. The first results from TRICEM were achieved during the year; these showed that retention of gases is stronger in irradiated than in undamaged material, with possible consequences for gas embrittlement of components and for the tritium inventory in a fusion power station. Experiments using tritium are due to start in 2017/18.

There were many other notable results including:

- Use of theoretical models to shed light on the unexpected phenomenon in which radiation is observed to cause very low concentration rhenium to precipitate into clusters in tungsten. This is important because neutrons in a fusion power station will transmute some tungsten to rhenium, and if clusters form they are likely to make machine components more brittle;
- A breakthrough, published in Nature Scientific Reports, in the theory of "dislocation self-climb", a phenomenon thought to play a role in the thermal recovery of radiation damage;
- With Oxford University, use of MRF for the first microstructural analysis of JET beryllium tiles revealed precipitations at grain boundaries and also voids and bubbles in amorphous deposits (beryllium is toxic, so this required special precautions in the MRF); and
- A major new release of UKAEA's FISPACT-II inventory simulation platform & libraries, for fusion and many other applications, and release of the new website: <http://fispact.ukaea.uk/>

Fission R&D has many phenomena, topics and techniques in common with fusion R&D. We are part of consortia awarded new EURATOM grants on steels for fission and fusion and on Generation-IV fission materials. Finally, we are increasingly working with NNL nuclear metallurgists located at Culham on developments of mutual interest, as part of NNUF, Royce and other initiatives.



Performance Report Performance Analysis



RACE

RACE has had a really successful first year of operations; the team has grown from 75 to over 120. One of the main aims behind RACE is to leverage the 20-years' experience of operating JET's fully-integrated remote handling systems to enhance UK industry competitiveness. The biggest opportunities currently lie within the ITER programme. To date UKAEA has helped UK industry win around €500m in ITER contracts, including the €174m construction management-as-agent ITER contract awarded, earlier this year, to a consortium led by Amec Foster Wheeler in partnership with Assystem and KEPCO Engineering and Construction Company.

Another major success was by the Airbus Safran Launchers/Nuvia Limited/Cegelec led consortium, which was awarded a contract worth nearly €100m to supply ITER remote handling services to Fusion for Energy (F4E). This is considered to be the single biggest robotics deal to date in the field of fusion energy. RACE's part will be to help develop the ITER Cask and Plug Remote Handling System.

UKAEA and the ITER Organization have entered into a technical collaboration which will see RACE host an ITER Remote Handling Test Facility for a period of at least five years. The UK Government is investing ca. €5m, matched by the ITER Organization. The facility will perform testing of critical remote handling operations necessary for the maintenance of components for ITER and provide operational feedback into the final component designs.

During the year, RACE continued to progress the Active Cells Facility for the European Spallation Source, currently under construction in Lund. This represents the majority of the UK's in-kind contribution to this European project, which is being managed by Science & Technology Facilities Council (STFC). In November 2016, an industry day was held in conjunction with STFC, to which the supply opportunities were presented to 60 attendees from industry.

RACE also supports UK industry through the provision of standardised test facilities for evaluation, development and training in remote robotic systems. The development of these facilities is being carried out in collaboration with the National Institute of Standards and Technology (NIST) in the US, giving UK users access to recognised international test methods. These facilities also provide an opportunity to run technical challenges for skills development for schools and apprentice training centres.

RACE continues to play a significant role in the development of Remote Handling technology for the EUROfusion DEMO project with a dedicated project office in the RACE building. The coming year will see a number of conceptual designs built for test and evaluation.

Autonomous Systems

UKAEA is interested in the technology behind autonomous vehicles as this has direct application to remote systems and technology required for fusion and other hazardous areas. The government has selected Oxfordshire as one of eight regions to carry out a science and innovation audit and RACE will lead the autonomous vehicles strand. During the year PAVE (People in Autonomous Vehicles in Urban Environment), a consortium comprising RACE, Siemens, Amey, Oxbotica and Westbourne, undertook a feasibility study funded by Innovate UK and the Centre for Connected Autonomous Vehicles (CCAV). The study validated Culham Science Centre as a test site for autonomous vehicles.

Oxbotica, a tenant in RACE, is already using the Culham Science Centre to test its autonomous vehicles and has successfully led the DRIVEN consortium, winning over £8m in funding from the CCAV, with the aim of developing and operating a fleet of vehicles on public roads within the next two and half years.



Performance Report Performance Analysis



Property Development

Founded on its assets and expertise, one of UKAEA's five goals is to develop the Harwell Campus and Culham Science Centre as significant centres for science and innovation, thereby supporting growth and jobs.



Culham Science Centre

Culham Science Centre is one of the three internationally significant science and business centres in southern Oxfordshire, which underpin the County's economic development. UKAEA continues to maintain a consistently high level of occupancy and the site now supports over 2,000 jobs in a high quality working environment benefitting from a range of amenities and facilities. Looking to the future, Culham Science Centre is earmarked for significant further growth in the emerging Local Plan and UKAEA is planning to enable at least a further 1,000 jobs.

The long term strategy for Culham Science Centre is to provide:

- UKAEA with a suitable environment for its role as a key global centre for fusion and related technology, engineering and design, looking beyond JET operations; and
- significant growth in employment by attracting additional co-located business activity.

Both aims will require investment and property development. To support its own programmes, UKAEA has already completed and commissioned three new facilities during the last 2 years – RACE, MRF and MDF – signalling its ambitions both in relation to the future of fusion work but also with regard to economic impact and collaboration with industry and academia. Further new facilities are planned. In addition OAS opened in

September 2016, which is providing much needed apprentice training facilities in support of Oxfordshire and UK business. A new facility to house OAS Phase 2 is under development and is due to open in 2019.

To enable growing commercial activity on the site, planning permission has been secured for a first phase of new development and the UKAEA is in the process of identifying and attracting potential partners who can fund this development. The aim is to establish and realise the commercial investment potential of the site whilst protecting the UKAEA's future operational and strategic interests. It is hoped that a partnering arrangement can be put in place and marketing of the development opportunity be initiated during the latter part of 2017.

Culham Science Centre is becoming an increasingly important component of the growth strategy for South Oxfordshire District. The proposed Local Plan provides for significant residential development adjacent to the site. Properly planned and implemented, this could further enhance the future of the site by providing sought-after housing for employees and, for example, improved transport infrastructure. UKAEA is already working with the developers working on this scheme.



Harwell Campus

UKAEA is using its significant property assets to support the development of the Harwell Campus as one of the largest and most significant science and innovation centres in the world. Together with STFC, UKAEA also holds and manages the public sector's share in the joint venture Partnership that has been established to develop the Campus.

During 2016/17, the Partnership significantly raised the national and international profile of the Campus, completed the drawdown of two pieces of land which has enabled the construction of one new building and the refurbishment of another to get underway, both due to be complete in 2017/18. The Partnership has also attracted a suite of new tenants and a pipeline of interest and is putting in place plans to drawdown additional land to develop up to three buildings in 2017/18. The government has also announced £100m funding for the Rosalind Franklin research institute, to improve health through physical science innovation, which will have its main hub at Harwell.

The integrated mixed-use masterplan for the Campus also provides for residential development to help with the development of a vibrant work/life environment at the Campus.



Assurance

Health & Safety

UKAEA was once again awarded a prestigious Gold Medal by the Royal Society for the Prevention of Accidents (RoSPA) in recognition of its sustained commitment to accident and ill-health prevention. The RoSPA Gold Medal is presented following five or more consecutive RoSPA Gold Awards, and recognises the achievement of all on site delivering on safety.

The UKAEA continues to meet its safety and health goals, focussing on maturing a strong safety culture among both employees and contractors. This is achieved via proactive programmes of monitoring and training such as the Zero Injury Programme tours, management walkabouts, a highly effective near-miss and incident reporting system and a robust, peer-led behavioural safety programme.

Health and wellbeing remains a strong focus for the UKAEA and for the third year running a calendar of initiatives were undertaken, aligning with national programmes such as 'National Heart Month' and 'Gut Health'. In addition, there have been activity based programmes including two 'fun-runs' that encourage people to get out and exercising as well as raise money for local charities.

An excellent safety and health record has been maintained during 2016/17. The accident frequency rate (defined as the ratio of work related lost time injuries per 100,000 hours worked averaged over the year) is 0.13 (for employees and contractors combined), down from 0.18 in the previous financial year (see below). This figure compares very favourably when benchmarked with other similar organisations.

Robust radiation control strategies are in place. The average radiation dose to the 681 monitored/classified workers during 2016/17 was 0.001mSv for employees and 0.002mSv for contractors, which is less than 1% of both the legal limit (20mSv/year), the site dose constraint (5mSv/year) and average background radioactive dose received by members of the public (2.7mSv). The highest individual cumulative radiation dose this year was 0.20mSv, 1/10th of the site limit and 1/100th of statutory limits.

UKAEA Accident Frequency Rate (Employees and contractors)

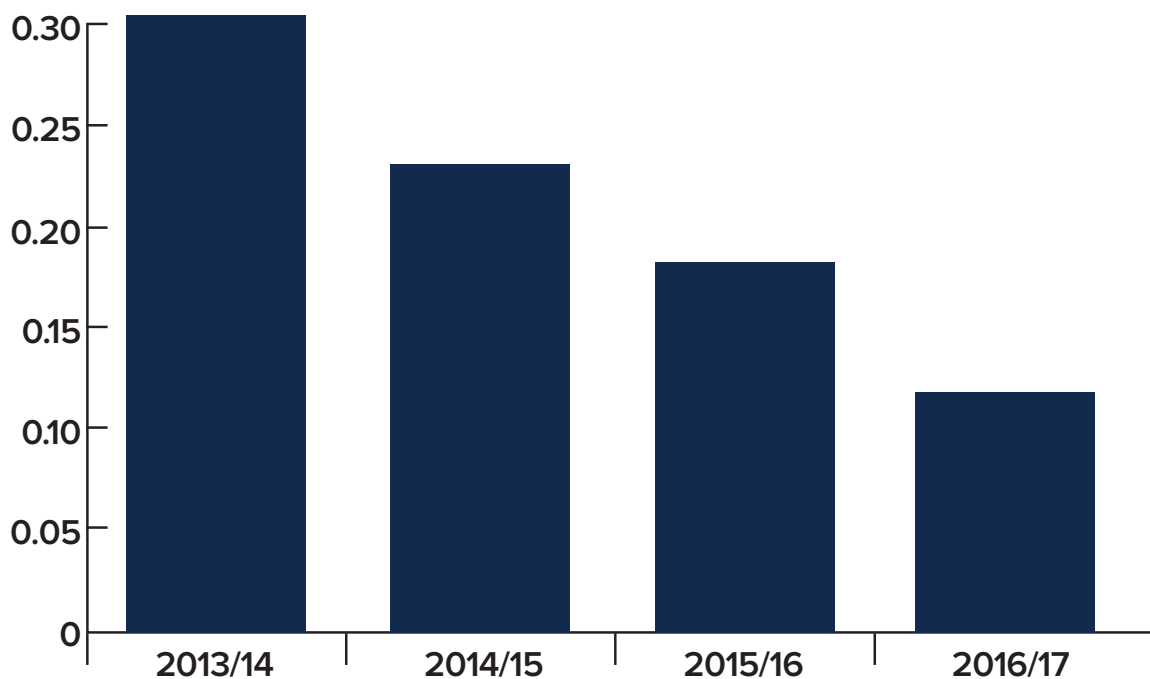


Figure 1 Accident frequency rate (employees and contractors)

Environment and Sustainability

UKAEA's annual carbon footprint has reduced for the second consecutive year. The 18% reduction is primarily due to the continued decline in use of fluorinated gases. A significant reduction in gas consumption by 40% also aided the overall figures. A mild winter and a programme of boiler and control upgrades explain the reduction. The majority (78%) of the carbon footprint for 2016/17 comprises emissions due to non-pulsed electricity consumption. Waste figures show a reduction in the total volume of all waste types generated by 10%.

Table 2 – Summary of financial and non-financial sustainability information for 2016/17

Area		2013/14	2014/15	2015/16	2016/17
Greenhouse gas emissions (1,000 tCO ₂ e)		60.8	67.2	31.0	25.4
Estate Energy	Consumption (mill kWh)	671	65.8	65.8	59.9
	Expenditure (£k)	5,180	4,560	5,669	5,418
Estate Waste	Amount (tonnes)	802.1	693.1	693.5	626.5
	Expenditure (£k)	219	110	241	190
Estate Water	Consumption ('000 m ³)	99.8	110.5	79.8	97.52
	Expenditure (£k)	216	217	126	165

Note:

1. More detail is provided in Tables 3-5. The information has been prepared in accordance with guidelines laid down by HM Treasury in 'Public Sector Annual reports' https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/591469/Sustainability_Reporting_Guidance_2016-17.pdf
2. Figures which have been partially or entirely estimated or revised are in bold italics. See also Note 4 to Table 3.

Table 3 – Greenhouse gas emissions

Greenhouse gas emissions		2013/14	2014/15	2015/16	2016/17
Non-financial indicators (1,000 tCO ₂ e)	Total emissions (Scope 1-3)	60.76	67.2	31.04	25.40
	Gross emissions Scope 1 (direct)	32.84	41.22	3.95	1.67
	Gross emissions Scope 2 & 3 (indirect)	27.92	25.95	27.09	23.73
Related energy consumption (million kWh)	Electricity: Non-Renewable	53.69	45.78	54.03	52.70
	Electricity: Renewable	–	–	–	–
	Gas	13.38	14.22	11.76	7.24
	LPG	–	–	–	–
	Other	–	–	–	–
Financial indicators (£k)	Expenditure on Energy	5,180	4,560	5,669	5,418
	CRC Licence expenditure	412	402	465	438
	Expenditure on accredited offsets	–	–	–	–
	Expenditure on official business travel	525	509	394	445

Note:

3. The greenhouse gas emissions were calculated (from the raw data) using DEFRA/DECC conversion factors: <https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting>
4. Figures which have been partially or entirely estimated or revised are in bold italics. Explanations of each estimate follow:
 - i. Electricity consumption and Scope 2&3 emissions – 2015/16 figures updated due to inclusion of an estimate for one month in the previous report.
 - ii. CRC Licence Expenditure – The estimated figure for 2015/16 has been updated. The 2016/17 figure is an estimate.

Table 4: Waste Disposal

Waste		2013/14	2014/15	2015/16	2016/17	
Non-financial indicators (tonnes)	Total waste disposed of	802.06	693.07	693.50	626.48	
	Hazardous waste	Total	37.27	36.83	50.99	32.34
		Non-hazardous waste	Landfill	149.32	52.98	14.96
	Reused/Recycled		470.09	434.62	422.56	377.23
	Composted		24.96	27.04	37.44	39.32
	Incinerated (energy recovery)		95.24	115.90	97.30	99.5
	Incinerated (no energy recovery)		–	0.05	26.14	4.06
	Total non-hazardous waste		739.61	630.59	598.41	541.22
	Radioactive	Produced	129.72	46.89	31.05	39.44
		Disposed	19.07	18.66	44.10	52.92
	OSR (see note below)	Produced	28.77	13.19	10.90	10.18
		Incinerated (no energy recovery)	6.90	6.99	–	–
Total Radioactive / OSR waste disposed of		25.97	25.65	44.10	52.92	
Financial Indicators (£k)	Total disposal cost	203	110	241	190	
	Hazardous waste disposal cost		37	22	92	15
	Non-hazardous waste disposal costs	Landfill	35	7	9	10
		Reused/recycled	(102)	(81)	28	25
		Composted	2	2	2	3
		Incinerated (energy recovery)	14	10	11	20
		Incinerated (no energy recovery)	–	–	–	–
	Radioactive	Disposed	209	138	99	117
OSR	Incinerated (no energy recovery)	7	13	–	–	

Note:

- The figure for 'Compost' is food waste sent for anaerobic digestion. Negative financial figures for 'Reused/Recycled' reflect rebates received from scrap metals.
- Out of Scope of Regulations (OSR) waste is material where the activity is low enough to fall below the threshold set by the Environmental Permitting Regulations to be classified as radioactive waste.

Other improvements made in 2016/17 include:

- Improved waste reporting
- Lowest recording of fugitive emissions in reporting history
- Increase in proportion of staff trained in Environmental Awareness due to conversion of course to Computer Based Training (CBT)

The planned transition of the Environmental Management System to the new ISO 14001:2015 standard is progressing and is in line with the timescale for recertification.

The planned transition of the Environmental Management System to the new ISO 14001:2015 standard is progressing and is in line with the timescale for recertification.

Energy and water consumption and waste disposal volumes all vary year on year due to changes in plant operations, and this therefore affects the total greenhouse gas emissions. During periods of plant shutdown, waste production and staff numbers increase. During operational periods, electricity and water use increase,

however water consumption in 2016/17 did not follow the normal trend. This was due to a combination of factors including a fault on the main cooling towers, higher evaporation due to the air temperature and an extensive maintenance period. The latter part of year returned to normal water consumption levels anticipated for a shutdown period. Previously, fugitive emissions would also have increased in operational periods but this has now been proven to have been decoupled.

Table 5: Finite Resource Consumption

Finite resource consumption		2013/14	2014/15	2015/16	2016/17	
Non-financial indicators ('000m ³)	Water consumption (whole site)	Supplied	99.77	110.54	79.79	97.52
		Abstracted	N/A	N/A	N/A	N/A
		Supply per FTE	0.09	0.10	0.07	0.09
	Average number FTE staff/contractors	998	1,090	1,080	1,046	
	A4 paper reams equivalent	5,800	8,200	5,600	4,300	
Financial indicators (£k)	Water supply costs (whole site)	216	217	126	165	
	Paper supply cost	13	17	11	8	

Management Systems and Quality

UKAEA operates an integrated management system and is certified to the internationally recognised core ISO Management Standards. The UKAEA successfully maintains a combined certificate to ISO 9001, 14001 and OHSAS 18001, which is subject to independent audit by AFNOR. In addition, Health Physics Group is accredited to ISO17025, the international standard for testing laboratories.

The internal audit programme provides assurance to management and stakeholders that the required standards are being maintained and where areas requiring improvement are identified these are actively tracked and reported to management.

The quality management system is subject to a programme of continuous improvement. A formal project is in place to improve the style of documentation and how it is accessed by the users, including planning for a new intranet platform and transition to a new Electronic Document Management System. The focus of these changes is to better serve the delivery of the fusion programme and UKAEA's other strategic objectives.

Security

The UKAEA maintains an effective level of security at Culham Science Centre aligning closely with the BEIS Security Strategy. Audits and the annual Department Security Health Check continue to show that the security standards are being maintained. The Security Policy framework provides a balanced set of security requirements and a number of improvements have been delivered during the year to include access control. In addition a number of security related emergency exercises have been undertaken demonstrating that arrangements are robust.

Information security and related risks are actively managed and monitored by the Information Assurance Steering Committee. Ongoing behavioural education for users remains key in the protection against ever present cyber threats. Investment is also being made to improve UKAEA's IT resilience.

Capability

UKAEA's continued world class reputation relies on the ability to attract, retain and develop first-class talent. 2016/17 has seen an increase in employee numbers, with further increases forecast in the coming years. Recruitment is being focussed on building UKAEA's capability for the future in specialist skills areas in science, engineering, technology and project management.

UKAEA is committed to developing all its employees, and offers a wide range of programmes. This includes a highly valued two-year graduate scheme certified by IMechE, IET, and IoP, that provides a talent stream of committed, high performing graduates to take up permanent posts across the business. Similarly accredited continuous professional development schemes encourage employees from all disciplines to become professionally recognised. PhD and MSc opportunities are offered.

Each employee has structured job descriptions through the career framework. There is an annual performance management cycle, which includes cascading of objectives, based on corporate goals and deliverables.

UKAEA continues to work on an action plan to improve and promote gender equality and will be seeking to retain its bronze Athena SWAN award. In addition, UKAEA continues to provide role models and promote women in science and engineering. This includes contributing to the IET's #9percentisnotenough campaign in December 2016 and the UNESCO International Day of Women and Girls in Science in February 2017.

Apprenticeships

UKAEA apprentices continue to demonstrate the world class quality of UKAEA's training programme. During the reporting period UKAEA apprentices won the Brathay apprentice team of the year, three apprentices won IMechE Whitworth scholarships, and UKAEA were 2nd placed in the highly prestigious IET apprentice of the year competition.

UKAEA's apprenticeship scheme has continued to diversify and expand in preparation to meet the government 2.3% public sector target and in September 2017, 23 new start apprenticeships are targeted. In addition to traditional engineering apprenticeships future apprenticeships will include electricians, project management, business admin and photography, and will range from level 2 intermediate to degree apprenticeships.

In September 2016, UKAEA and STFC opened phase 1 of OAS and commenced training of 19 apprentices from an elite group of employers including Oxford Instruments, University of Oxford, Nuvia and Reaction Engines. Phase 2, a new purpose built apprentice training building will open in 2019 with the capacity to train 250 apprentices. The aims of OAS are to raise the standard of apprenticeships by training in context and to provide a skills pipeline to help solve the critical skills shortage in the high-tech sector.

University Collaborations

UKAEA's links with UK universities are continually expanding and encompass not only plasma physics but materials science, advanced computing, technology and engineering. There are presently

collaborative links with over 20 UK universities and with a far greater number of university departments. There are over 120 PhD students presently working on magnetic fusion projects, an increase of 50% in recent years. UKAEA helps to fund many of the studentships and a number of key university posts. Many of the students are part of the EPSRC-funded Fusion Centre for Doctoral Training, which is led by the University of York and also involves the Universities of Durham, Liverpool, Manchester and Oxford. The Fusion centre was rated highly in the recent review and it was noted that "Engagement with other fusion research institutions is excellent, both nationally and internationally". Studentships are expanding in scope and include involvement in RACE activities. In 2016, UKAEA also hosted over twenty undergraduate and master students undertaking projects as part of their course.

Collaboration with UKAEA gives universities an opportunity to leverage EUROfusion funding for Enabling Research, Research on JET and Medium Sized Tokamaks, for Educational Support and for post-doctoral researcher fellowships. They also have access to other facilities at Culham such as MRF, RACE and the ADRIANA facility. Several universities have EPSRC grants of their own for research projects with UKAEA as a collaborator.

Each Summer UKAEA holds an event showcasing the work of PhD students and each Autumn hosts a PhD recruitment event organised in conjunction with a number of universities.



Performance Report Performance Analysis



Stakeholder Engagement

Outreach and Public Engagement

UKAEA's external relations during 2016/17 were dominated by the UK's decision to leave the European Union. The referendum result in June 2016 and its potential effect on UKAEA's operations meant that establishing an effective dialogue with central government on the issue was a high priority. An intensive public affairs programme led by CEO Steve Cowley and his successor Ian Chapman was supported by the Communications Group as UKAEA sought to understand the impact of 'Brexit' on the organisation's future. This became particularly important as it became clear that the UK would also withdraw from the Euratom treaty, under which the UK operates JET and participates in ITER.

Throughout the rest of the reporting period, UKAEA worked closely to assess possible scenarios with its key stakeholders in UK government and in EUROfusion, and this work will continue during 2017/18. The outcome of the referendum led to an intense period of media interest for UKAEA, as it became clear that JET will be one of the science facilities most affected by the UK's decision to leave the Euratom treaty. Almost 100 media reports on the story ranged from the BBC News at Ten, the Financial Times and the Guardian through to the science, engineering and energy media and the local press.

UKAEA has undertaken much work to promote UKAEA's new facilities and ambitious plans for the future at Culham. Jo Johnson, Minister of State for Universities & Science visited the site in May 2016 to open the new RACE and MRF buildings. Local

MPs John Howell and Nicola Blackwood have both taken a keen interest in the OAS centre and have met apprentices and employers at OAS.

UKAEA has been especially active in publicising apprenticeships during 2016/17 through its success in the Brathay Apprentice Challenge. UKAEA was named England's apprentice team of the year at the final in Cumbria in June 2016. The winning team members acted as apprenticeship ambassadors in a series of national promotional events run by the National Apprenticeship Service following the Brathay contest. This included the team leader attending a special All Party Parliamentary Group during National Apprenticeships Week 2017.

UKAEA's education and outreach programme included two particular highlights in 2016/17:

- In September 2016, scientists and engineers from Culham took part in the first New Scientist Live event in London. This is a major new science fair aimed at families, and UKAEA participated for the full four days, talking to hundreds of people about fusion and the other research programmes at Culham. Outgoing CEO Steve Cowley also gave a talk at the event; and
- UKAEA appeared in the famous Royal Institution Christmas Lectures, screened on BBC TV on 26 December. CEO Ian Chapman used interactive exhibits built by Culham engineers to explain the principles of plasma and fusion to host Saiful Islam and to the millions watching on television and online.

In addition, the busy programme of visits, tours and talks for students continued, along with Open Days and Open Evenings for the public to find out about the work at Culham – reaching over 3,000 people during the year.



Performance Report Performance Analysis



Financial Review

Operating Performance

Revenue for the year was £98,632k (2016: £88,813k). This increase mainly related to the Fusion operating segment. The Group made an operating loss of £1,467k (2016: loss of £2,119k) owing to a combination of factors; higher staff and raw materials costs in 2017 were partially offset by provisions adjustments and Group consolidation adjustments totalling £4,969k. The retained profit for the year after financing but before income tax was £632k compared with a loss in 2016 of £2,198k, largely due to a £1,980k share of profits in the HSIC Joint Venture, which had made a loss of £225k the previous year. Profit for the year after taxation was £5,125k compared with £7,879k in 2016, for taxation-related reasons explained below.

Taxation

Current Tax

UKAEA has adopted the Research and Development Expenditure Credit ("RDEC"), which has replaced the previous R&D tax relief regime and is mandatory from 1 April 2016. The RDEC will generate extra income for UKAEA and offset any non-trading profits from property and other activities. A tax credit of £3,575k relating to 2016/17 has been recognised in the Accounts. The change to RDEC in the 2015/16 accounting year resulted in total current tax credits to the income statement of £6,716k in 2015/16 as RDEC claims for 2014/15 and 2015/16 were recognised in the Accounts. Further details are at note 10 of the Accounts.

Deferred Tax

The total deferred tax credit in the income statement is £918k. £594k of the credit relates to tax rate changes and revaluation adjustments, which have reduced the deferred tax provision in the Accounts. The remaining £324k is due to an increase in the deferred tax asset recognised. Further details are in Note 19.

Site restoration provision

The estimated cost of decommissioning and environmentally restoring the JET facilities at UKAEA's Culham site is £305,106k. This cost is in 2016/17 money values after discounting at rates and using the methodology advised by HM Treasury, as at the date of the Statement of Financial Position. It is expected that the part of the Culham site on which the facilities are located will be designated to the NDA after the current research programme has ended and the liabilities will be transferred to NDA at that time. Further details of the provision, and the effect of certain key factors on the estimate, are disclosed in Note 20.

Professor Ian Chapman
Chief Executive and Accounting Officer
13 July 2017



Accountability Report

Corporate Governance Report

Directors' Report

The Directors of the Board, and where appropriate the period for which they served during the year, are set out below.

Chairman

Professor Roger Cashmore, CMG, FRS

Executive Directors

Professor Ian Chapman, Chief Executive Officer (CEO) (from 1 October 2016)

Non-Executive Directors

Professor Sir Keith Burnett, CBE, FRS

Norman Harrison

Dr Jim Hutchins

Peter Jones, FCCA

Chris Theobald

Authority Secretary

Catherine Pridham, ACA

Biographical details of the Directors are included on pages 34 to 36. The responsibilities of the Directors are included on page 38.

The Executive Team

Professor Ian Chapman, Chief Executive Officer (CEO)

Martin Cox, Director

David Martin, Chief Operating Officer

Catherine Pridham, Director of Finance and Corporate Affairs and Authority Secretary

The Executive Team listed above are members of the wider UKAEA Executive Committee which comprises UKAEA senior managers.

Biographical details of the Executive team members above are included on page 36 to 37. Their remuneration has been included in the Remuneration Report.

Chairman and Non-Executives

1



1 Professor Roger Cashmore, CMG, FRS

Appointed Chairman of the UK Atomic Energy Authority on 30 July 2010. He is a Fellow of the Royal Society and in 2010 led the Royal Society working group on Nuclear Proliferation. He is a former Principal of Brasenose College in Oxford, and is a Professor of Experimental Physics in Oxford.

Before returning to Oxford, he was Director of Research and Deputy Director General of CERN, the European high energy physics laboratory in Geneva, Switzerland, where he was responsible for the experimental programme at the Large Hadron Collider. Before leaving for CERN he was Chairman of Physics in Oxford and during his teaching and research career he has more than 200 publications in learned journals. He has been a Visiting Professor in Tsukuba in Japan, Brussels, Padua, Fermilab in the United States and holds an Honorary Doctorate from the Joint Institute of Nuclear Research in Dubna, Russia. He was awarded the C V Boys Prize of the Institute of Physics (IOP) and a Research Award by the Alexander von Humboldt Foundation in Germany.

In 2004 he was made a Companion of the Order of St Michael and St George (CMG) for services to international particle physics.

2



2 Professor Sir Keith Burnett, CBE, FRS

Appointed to the UKAEA Board on 1 November 2010. He is Vice-Chancellor of the University of Sheffield (since 2007). Previously he was Head of the Division of Mathematical, Physical and Life Sciences at the University of Oxford. Before this he was Chairman of the Physics department at Oxford.

His research is in the area of ultra-cold atomic physics. His direct involvement in fusion science policy started when he was head of Physics at Oxford and chaired the review of fusion science for the DTI. This report led to EPSRC taking up the funding role for the UK effort in fusion research. He was from 2001 to 2007 Chair of the Fusion Advisory Board which advised EPSRC, and hence the UKAEA, on fusion strategy. He later chaired the expert group that helped develop the Research Councils UK Fusion strategy, and had the opportunity to assess the UK's programme for the years ahead.

Keith is a member of the Prime Minister's Council for Science and Technology. He was knighted for services to science and Higher Education in 2013. He is a member of the Higher Education Funding Council for England Board.

3



3 Norman Harrison

Appointed to the UKAEA Board on 1 March 2016. He is currently a Trustee and Director of the Nuclear Liabilities Fund and the Deputy Chair of the Board of Governors at Manchester Metropolitan University. He also runs his own consultancy business.

He has 35 years' experience in the power and nuclear power sector. He has a long track record of successfully running nuclear power stations including Heysham 1 and Sizewell B. He delivered a major change programme at Dounreay and was CEO of UKAEA from 2006 to 2010 and led on the privatisation programme for UKAEA.

Norman is a Chartered Chemist and holds Fellowships with Nuclear Institute, Royal Society of Chemistry and Royal Society of Arts.



4 Dr Jim Hutchins

Appointed to the UKAEA Board on 1 March 2016. He was recently a Non-executive Director and chairman of the Technology Advisory Board of Keronite Ltd, a member of the Oxfordshire Local Enterprise Partnership and Chair of Science Vale.

He is an experienced senior manager from the high technology sector, with a track record of converting R&D into marketable and profitable income streams. From 1991 to 2013 he held senior roles in Oxford Instruments, his most recent as Chief Technical Officer where he was responsible for the technical and R&D functions and helped grow it from an SME to a FTSE 250 listed company with 2000 employees worldwide.

Jim has a DPhil in Experimental Physics and is a Fellow of the Institute of Physics



5 Peter Jones, FCCA

Appointed to the UKAEA Board on 1 November 2010. He was a non-executive director of NNL and Chairman of its Audit Committee from 2009 to 2014. He was a Reporting Panel member of the Competition Commission from 2005 to 2013. He was appointed a non-executive director of a start-up company developing a customer loyalty product using financial technology in February 2017.

His previous roles have included: Principal Private Secretary to the Chairman of the National Coal Board, and during a subsequent 19 year career in Corporate Finance at Samuel Montagu & Co. Limited and HSBC Investment Banking, as a senior adviser to the Department of Trade and Industry during the 2003-4 strategic review of BNFL, as a senior adviser to Scottish Power and British Coal during their respective restructurings and privatisations and to British Nuclear Fuels Ltd during the implementation of the strategic review and also as a consultant to the Shareholder Executive and Department of Trade and Industry during the final preparations for the restructuring of the civil nuclear clean-up sector in 2004-2005.

Peter is also a qualified Chartered Certified Accountant and has had exposure to a wide range of financial management and planning issues in a variety of sectors varying from financial services to electricity production.



6 Chris Theobald

Appointed to the UKAEA Board on 1 March 2016. He is a senior executive from the nuclear, energy and defence markets. During the last 15 years he has held leadership roles including MD of Serco's nuclear consulting business and Divisional MD at a joint venture between BAE Systems and Finmeccanica. Previously he held senior roles in BAE Systems Avionics and GEC-Marconi. He led the £140m sale of Serco's nuclear consulting business to AMEC in 2012. He served as a board director for the UK Low Level Waste Repository at Drigg, Cumbria and was a founding member of the board for the National Skills Academy for Nuclear. He was recently Vice- President UK/Europe for BWXT Inc (formerly Babcock and Wilcox) leading business development in the civil nuclear market.

Chris has a degree in Aeronautical Engineering and is a Member of the Royal College for Defence Studies.

Executive Team



1 Professor Ian Chapman

Appointed Chief Executive Officer and Accounting Officer for the UKAEA on 1 October 2016. He joined in 2004, becoming Head of Tokamak Science in 2014. He has also held a number of international roles in fusion. He was a Task Force Leader for JET from 2012 to 2014. He was appointed a member of the programme advisory committee for US experiment NSTX-U in 2013. He has chaired international working groups for ITER and led work packages within the EU fusion programme. He has published over 110 journal papers and given 30 invited lead-author presentations at international conferences.

He has won a number of international awards, including the European Physical Society Early Career Prize in 2014, the Institute of Physics Paterson Medal in 2013, the IUPAP Plasma Physics Young Scientist Prize in 2012 and the Cavendish Medal for Best early-career UK physicist awarded by SET for Britain in 2011.

He was made a Fellow of the Institute of Physics in 2013 and became a visiting Professor at Durham University in 2015.



2 Professor Steve Cowley, FRS, FEng

Joined the UKAEA in September 2008 as Director of Culham and was appointed to the Board as Chief Executive Officer and Accounting Officer for the UKAEA on 31 October 2009. On 31 September 2016 he left UKAEA to become President of Corpus Christi College, University of Oxford.

A qualified physicist and Fellow of the American Physical Society and the IOP, Professor Cowley started his career at Princeton University in 1987 following his post-doctoral work at Culham. In 1993, he joined University of California, Los Angeles (UCLA) and became a Professor in 2000. From 2001, he led the plasma physics group at Imperial College, London for three years. In 2004, he was appointed Director of the Centre for Multi-scale Plasma Dynamics at UCLA and held this position before joining the UK Atomic Energy Authority in 2008. He recently co-chaired the US National Academy's decadal assessment of, and outlook for, plasma science. He has published over 120 papers and articles covering theory of fusion plasmas, the origin of magnetic fields in the universe, the theory of plasma turbulence and explosive behaviour in both laboratory and astrophysical plasmas.

In 2012, he was awarded the Glazebrook Medal from the IOP. In 2014, he was elected a Fellow of both the Royal Society, and the Royal Academy of Engineering.



3 Catherine Pridham, ACA

Appointed as Chief Financial Officer, Director of Support Division and Secretary of the United Kingdom Atomic Energy Authority in January 2014, she previously held the role of Head of Finance, Contracts and Integrated Planning, from 2012. She was appointed Director of Finance and Corporate Affairs in December 2014. She qualified as a chartered accountant with Arthur Andersen and has worked in the pharmaceutical sector for SmithKline Beecham, Amersham PLC and GE Healthcare, where she supported a number of different business areas including a commercial clinical trials business, a large R&D portfolio and a Joint Venture looking to exploit research capabilities commercially with large pharmaceutical companies. Prior to joining the UKAEA she completed several finance restructuring and process improvement projects for the Ministry of Justice and Department of Transport.

4



4 David Martin

Appointed Chief Operating Officer in March 2016. He is a Chartered Mechanical Engineer and Fellow of the Institution of Mechanical Engineers who joined Culham after completing an apprenticeship at Harwell in 1979. Following a role in the build and operation of the Neutral Beam Testbed on JET, he joined the Engineering Group in Neutral Beams before establishing the Engineering Analysis Section. He became Engineering Group Leader and then Department Manager in 2008. In 2011 he was appointed Head of Physics and Engineering Development Division. He has held other senior engineering posts such as Engineer in Charge and Deputy Chief Engineer. In 2013 he was appointed Operations Director.

David is committed to staff development and has initiated many of the training schemes presently being run at CCFE – including the apprentice and graduate programmes – helping to achieve accreditation by IET, IMechE and the Power Academy.

5



5 Martin Cox

Appointed Director and Project Sponsor for the MAST Upgrade Project in 2015, his main responsibility is for ensuring the successful delivery of MAST-U. He also has a key role regarding the contract with the EU Commission to operate JET on behalf of Europe. He was previously appointed to the UKAEA Board as Chief Operating Officer on 1 November 2010, when he was responsible for the day-to-day running of the UK's fusion research programme, and for the operation of JET on behalf of EURATOM and fusion laboratories across Europe.

Martin is a theoretical physicist who joined Culham upon graduating, working on plasma modelling. He then became involved in the operation of the experimental facilities. In 1994 he was appointed the Project Manager for the design and construction of the MAST device. From 2000, when the UKAEA assumed responsibility for the operation of JET on behalf of the European Fusion community, he became manager of the Machine Operations Department, overseeing the operation of most of the JET facilities as well as MAST. In 2007 he was appointed Senior Manager for all aspects of JET operation and in 2008 was appointed Assistant Director (Operations). He was appointed Operations Director on 1 November 2009.



Statement of Accounting Officer's Responsibility

Section 4(3) of the Atomic Energy Authority Act 1954 requires the United Kingdom Atomic Energy Authority to prepare a statement of accounts for each financial year in the form and on the basis set out in the Accounts Direction. The financial statements are prepared on an accruals basis and must give a true and fair view of the state of affairs of the Authority and of its net resource outturn, application of resources, change in taxpayers' equity and cash flows for the financial year.

In preparing those financial statements, the Accounting Officer is required to comply with the requirements of the Government Financial Reporting Manual and in particular to:

- observe the Accounts Direction issued by HM Treasury, including the relevant accounting and disclosure requirements, and apply suitable accounting policies on a consistent basis;
- make judgements and estimates that are reasonable and prudent;
- state whether applicable accounting standards as set out in the Government Financial Reporting Manual have been followed, and disclose and explain any material departures in the financial statements; and
- prepare the financial statements on a going concern basis.

The Accounting Officer of the Department for Business, Energy and Industrial Strategy (BEIS) has appointed the Chief Executive as Accounting Officer of the United Kingdom Atomic Energy Authority. The responsibilities of an Accounting Officer, including responsibility for the propriety and regularity of the public finances for which the Accounting Officer is answerable, for keeping proper records and for safeguarding the Authority's assets, are set out in Managing Public Money published by HM Treasury.

The Accounting Officer confirms that:

- the Annual Report and Accounts as a whole are fair, balanced and understandable; and
- as Accounting Officer he takes personal responsibility for the Annual Report and Accounts and the judgements required for determining that they are fair, balanced and understandable.

External audit

The Accounting Officer and Directors also confirm that:

- there is no relevant audit information of which the auditors are unaware;
- all relevant steps have been taken to ensure that they are aware of relevant audit information; and
- all steps have been taken to establish that the auditors are aware of the information.

Details of the remuneration of the Group's auditors are set out in Note 7.

Governance Statement

Scope of Responsibility

As Accounting Officer, I have responsibility for maintaining a sound system of governance and internal control that supports the achievement of the United Kingdom Atomic Energy Authority's policies, aims and objectives, whilst safeguarding the public funds and assets for which I am personally responsible, in accordance with the responsibilities assigned to me in Managing Public Money. I am assisted in this across the Authority (UKAEA) Group as a whole by the Director of Finance and Corporate Affairs

Purpose of the Governance Statement

The Governance Statement, for which I am personally responsible, sets out how I have discharged my responsibility to manage and control UKAEA's resources during the year. It also sets out the governance framework and control structure of UKAEA, its stewardship and corporate governance, and the framework for and effectiveness of the risk management process in place.

The Authority's Governance Framework and Structure

The Board

The United Kingdom Atomic Energy Authority is controlled through its Board of Directors, who are appointed by the Secretary of State of BEIS. The Board's main role is to establish UKAEA's vision, mission and values, set strategy and structure, and exercise accountability to UKAEA's stakeholders.

The Board, which met five times during the year, has a schedule of matters reserved for its approval. This includes: establishing the overall strategic direction of UKAEA within the policy and resources framework agreed with the responsible Government Minister; reviewing UKAEA's corporate objectives and goals; approving the annual accounts, budget and corporate plan; reviewing and approving proposals to start new activities or to discontinue existing activities; ensuring that high standards of corporate governance are observed at all times; and reviewing the safety, environmental and security performance of UKAEA.

The Board delegates responsibility for day-to-day and business management control to the Chief Executive who is assisted by key senior managers comprising the Executive Committee. The Executive Committee meets monthly. Specific responsibilities delegated to the Executive Committee include: development of UKAEA performance measures; implementation of the strategies and policies as determined by the Board; monitoring of the operating and financial results against plans and budgets; developing and implementing risk management systems, and reviewing progress on major projects.

Following my appointment as Accounting Officer, I reviewed the terms of reference of the Executive Committee and of the sub-committees reporting to it. The sub-committees now make formal reports regularly to the Executive Committee.

The roles of the Chairman and Chief Executive

The division of responsibilities between the Chairman of the Board and the Chief Executive is clearly defined and has been approved by the Board. The Chairman leads the Board in the determination of its strategy and in monitoring the achievement of its objectives.

The Chief Executive has direct charge of UKAEA on a day-to-day basis and is accountable to the Board for the financial and operational performance of UKAEA and its subsidiaries. The Chief Executive is also UKAEA's Accounting Officer and is responsible to Parliament through the Committee of Public Accounts and other Select Committees for the stewardship of resources. His responsibilities are set out in a letter from the BEIS Permanent Secretary and the accompanying Accounting Officer Memorandum. The Accounting Officer has a personal responsibility for the propriety and regularity of the public finances for which he is answerable; for the keeping of proper accounts; for prudent and economical administration; for the avoidance of waste and extravagance; and for the efficient and effective use of all available resources. He is also responsible for taking formal action by issuing an Accounting Officer Direction, if the UKAEA Board is contemplating a course that would infringe these requirements. No Directions were issued during the year.

Change of Accounting Officer

My appointment as Accounting Officer began on 1 October 2016. As an existing UKAEA employee, I was able to receive a structured handover from my predecessor Steve Cowley. This handover has provided me with assurance that UKAEA's governance, controls and accountabilities remained in place throughout the period to 1 October. I also attended Civil Service College training on public accountability for new Accounting Officers in November 2016.

Directors and Directors' independence

During the year, the Board comprised the Chairman, one Executive Director and five independent Non-Executive Directors. The Director of Finance and Corporate Affairs was in attendance as Authority Secretary. The composition of the UKAEA Board is in line with other bodies that report to BEIS. A list of Board members and their biographical details is included in the Directors' Report.

The Non-Executive Directors constructively challenge and help develop proposals on strategy, and bring strong, independent judgement, knowledge and experience to the Board's deliberations. The independent Directors are of sufficient calibre and number that their views carry significant weight in the Board's decision making.

The Board considers all its Non-Executive Directors to be independent in character and judgement.

No Non-Executive Director:

- has been an employee of UKAEA within the last five years;
- has, or has had within the last three years, a material business relationship with UKAEA or its former or current subsidiaries;
- receives remuneration from the Authority other than a Director's fee;
- has close family ties with any of UKAEA's advisers, Directors or senior employees;
- holds cross-directorships or has significant links with other Directors through involvement in other companies or bodies; or
- has served on the Board for more than nine years.

Board Committees

Attendance

The number of full Board meetings and committee meetings attended by each Director during the year was as follows:

	Board	Remuneration Committee	Audit Committee
Roger Cashmore	5 (5)	3 (3)	4 (4)
Keith Burnett	3 (5)	1 (3)	1 (4)
Ian Chapman	2 (2)	–	–
Steve Cowley	3 (3)	–	–
Norman Harrison	5 (5)	3 (3)	4 (4)
Jim Hutchins	5 (5)	3 (3)	4 (4)
Peter Jones	5 (5)	3 (3)	4 (4)
Chris Theobald	4 (5)	3 (3)	4 (4)

Figures in brackets indicate the maximum number of meetings in the period in which the individual was a Board member.

Remuneration Committee

The Remuneration Committee met three times during the year. All its members are independent Non-Executive Directors. Where necessary, non-committee members are invited to attend.

The Committee's principal responsibility is to make recommendations to BEIS on the level of Directors' remuneration. In addition, the Committee regularly reviews UKAEA's executive remuneration policy in relation to its competitors and industry norms and contract periods. The Committee also advises on any Human Resources policy issue or any proposed change to remuneration arrangements or terms and conditions of UKAEA staff generally which would require the agreement of Government.

As the members of the UKAEA Board are appointed by BEIS, UKAEA does not maintain a nominations committee.

Audit Committee

The Audit Committee met four times during the year. All its members are independent Non-Executive Directors.

During the year, the Committee had at least one member possessing what the Smith Report describes as recent and relevant financial

experience (Peter Jones). It will be seen from the Directors' biographical details included in the Directors' Report that the other members of the Committee brought to it a wide range of experience from positions at the highest level in the UK scientific and business community.

Under its terms of reference, the Committee is responsible for: monitoring the effectiveness of the external audit process and overseeing the terms of engagement and remuneration of the external auditor; endorsing UKAEA's policy on the provision of non-audit services by the external auditor (none were provided in 2016/17); monitoring and reviewing the effectiveness of the internal audit programme and the implementation of recommendations arising from it; reviewing the actions and judgements of management in relation to annual and other financial statements before submission to the UKAEA Board; reviewing annually the system of internal control and the processes for monitoring and evaluating the risks facing UKAEA; and reviewing UKAEA's procedures for detecting and preventing fraud and its whistleblowing policy.

Key areas considered by the Audit Committee during the year were:

- The workplan of and key areas of focus for Internal Audit;
- UKAEA's new transaction processing system, including key controls and proposed audits;
- Progress with completion of internal audit actions;
- The fraud landscape and counter-fraud measures taken by UKAEA;
- The accounts and management of UKAEA's pension schemes; and
- UKAEA's statutory accounts, including assumptions for the site restoration provision.

Other Committees reporting to the Board

The Culham Programme Advisory Committee (CPAC), which has an external chairman and membership, all of whom have backgrounds in fusion and industry, provides expert external scrutiny of UKAEA programmes and strategy, and reports directly to the Board. The key role of the committee is to review the UKAEA corporate strategies and scientific programme, and provide guidance and advice to the Executive on the implementation and planning for these, as well as independent assurance to the Board that the whole UKAEA programme is soundly-based and achievable. Reviews of UKAEA's MAST Upgrade project are carried out by a sub-committee under the same chairman and are reported to CPAC. CPAC met once during the year.

The Board Assurance Committee, chaired by one of the non-executive directors, is intended to strengthen Board oversight of assurance matters and met twice during the year. The Committee includes expert external members, in addition to the non-executive chair, to bring independent views on relevant issues. The committee looked at a number of topics including preparation for future tritium operations, waste strategy, mandatory safety training and assuring good scientific research.

Corporate Governance Review Processes

UKAEA's corporate governance arrangements are kept under constant review to ensure that they are compliant with best practice as applicable to the public sector, and with any additional Treasury requirements. In addition, the Board keeps its own performance under review. It made a formal assessment during the year of its compliance against the code of good practice for government, and concluded that UKAEA met the requirements of the code. The Board also conducted a self-assessment of its own performance, based on a template developed by the NAO and Non-Executive Directors' Group. The results indicated generally good performance. Recommendations for improvement in 2017/18 included improved reporting to the Board on major projects and project management, more frequent risk reporting to the Board and additional consideration of strategic capability.

During the year the Board held a strategy meeting with UKAEA senior managers to discuss UKAEA's future plans. Board members have also attended an all-staff talk.

The Remuneration Committee and Audit Committee also conduct regular self-assessments of their performance. Following recommendations from the Triennial Review of UKAEA in 2015, the Remuneration Committee introduced a performance review process for Non-Executive Directors in 2016. In addition, a small number of actions arising from the Committee's 2015/16 self-assessment were followed up, including a review of the senior level Succession Plan. A further self-assessment review was carried out for 2016/17 and concluded that further work on senior level succession planning and capability planning was required. This will be taken forward during 2017/18.



The Audit Committee's self-assessment of its performance concluded that the Committee was performing satisfactorily. Two recommendations for improvement were made, on timeliness of the issue of papers and an improved overview of key risks when considering the Internal Audit annual plan and the draft statutory accounts.

The Board also reviewed the effectiveness of the Remuneration and Audit Committees, and concluded that both Board committees were operating satisfactorily.

UKAEA's subsidiary, AEA Insurance Ltd, has appropriate governance arrangements in place. These are formally reviewed and updated as necessary by its Board of Directors, which includes UKAEA's Director of Finance and Corporate Affairs. A compliance and company secretarial summary is tabled for review at each Board meeting. A risk register and provisions for an annual internal audit of controls and risks are also in place.

The UKAEA Group has a 50% interest in a joint venture, Harwell Science and Innovation Campus Public Sector Limited Partnership (HSIC PubSp), the public sector partner in Harwell Science and Innovation Campus Ltd Partnership (HSIC), which is responsible for the development of the Harwell Campus. Both HSIC PubSp and HSIC have appropriate and fully documented governance arrangements in place, covering such matters as membership of and decisions made by their Boards of Directors, appointment and removal of Directors, funding and confidentiality. The Director of Finance and Corporate Affairs is on the Boards of both HSIC PubSp and HSIC. In addition, BEIS as sponsor is kept regularly informed of developments on the Campus.

Internal Review of corporate governance framework

A current project, led by the Head of Assurance, is reviewing UKAEA's corporate governance framework in relation to its Integrated Business Management System. Work has begun to develop a number of new corporate policies to complement those already in place, the first of which is an Ethics Policy. Annual reviews of compliance with the corporate policies are being set up where necessary, and responsibilities for delivery of these reviews are being formally allocated.

The Risk and Internal Control Framework

The Board has delegated day-to-day responsibility for risk management to the Chief Executive who is responsible for ensuring that a sound system of risk management is in place.

On behalf of the Chief Executive, the Head of Assurance has been appointed to co-ordinate deployment of the risk management arrangements, ensure consistency of approach and periodically report risk to the Executive Committee and Board. Ownership of divisional or functional risk registers is assigned to relevant senior managers, and individual risks are owned by the most appropriate manager. The Corporate Risk Review Group, which meets quarterly, provides oversight of corporate and major project risks. It reviews the status of the risk register and the progress of mitigations identified by the risk owners.

The UKAEA Director of Finance and Corporate Affairs is nominated as the Senior Information Risk Owner (SIRO), with special responsibilities for information risks.

The Board formally reviews key risks biannually in conjunction with UKAEA's risk appetite statement. The risk landscape is used to inform the business strategy and aid the management of the delivery of business objectives. Performance of major projects includes current status, risk and financial metrics, and is also reviewed on a regular basis.

Information Assurance

Information risks are overseen by an Information Assurance Steering Committee (chaired by the SIRO), which feeds significant risks into the Corporate Risk Review Group. During the year Responsible for Information e-learning was undertaken by all relevant employees, further training was rolled out to local information managers, several emergency exercises were held and the information security internal communications campaign continued. Progress continues to be made with preparations for accreditation to Cyber Essentials, a Government-backed cyber security certification scheme. Funding was received from BEIS to invest in IT infrastructure and IT/information business continuity; this work will continue over the next few years.



There have been no reportable data breaches or data loss incidents during the year. UKAEA was subject to a ransomware attack in July 2016, but the situation was contained and data recovered from back-up. Technical controls have been strengthened and communications undertaken on “phishing.” There have also been some non-reportable data security incidents, which have been handled within UKAEA. All such incidents are treated with the utmost seriousness and immediate corrective actions were taken.

Key Risks

Key risks can be grouped into the following areas:

- funding (including the impact of changes in the Euro: Sterling exchange rate) and the development of existing and future programmes and business development activities that enable future growth;
- recruitment and retention of employees with key skills and capabilities required for the success of the organisation;
- technical aspects of scientific research and delivery of bespoke engineering solutions;
- implementation of and follow up actions relating to major projects including completion of MAST upgrade, new capabilities such as RACE, MRF and DT operation and UKAEA's new transaction processing system; and
- Maintenance of UKAEA's reputation as a world leader in fusion research and the extension of JET Operations.

The UK's plan to exit the EU and Euratom agreements has created considerable uncertainty and this is impacting across the UKAEA risk landscape. Although external risks are beyond its direct control UKAEA seeks to influence them through all available channels.

Going Concern

The financial statements have been prepared on a going concern basis. UKAEA currently relies on funding from the European Commission to finance the operation of the JET programme, which represents approximately 50% of UKAEA's total revenue. The current contract between UKAEA and the Commission for the operation of JET covers a five year period to 31 December 2018. Following the EU referendum on 23 June 2016, the UK will be withdrawing from the European Union and the European Atomic Energy Community (Euratom), leading to increased uncertainty relating to the future funding of JET. However, JET is strategically important to the European fusion programme, in particular the development of ITER, and is the only existing fusion device capable of operating with deuterium-tritium fuel. In UKAEA's opinion the European Commission are supportive of the continuation of the JET programme to 2020. Our sponsor department, BEIS, have also confirmed that they are very supportive of the UK fusion programme and will be working to find a way to continue to operate JET and remain part of ITER after we have left Euratom. In April 2017, the UK Minister of State for Universities, Science, Research and Innovation wrote a letter to the European Commission outlining the UK Government's commitment to supporting the JET programme beyond 2018 and to work with the Commission to deliver this. The BEIS Secretary of State has written to the Commission again in June 2017 confirming the UK Government's commitment to provide funding to meet its fair share of JET costs until the end of 2020 in the event of the JET contract extension being approved.

In addition, EUROfusion, who manage the European fusion programme, approved the first phase of its contribution to a series of additional upgrades of the MAST facility which will take place from 2018 to 2022. The Board, Executive team and I therefore believe that the commitment of Europe and the UK Government to fusion research is sufficient to support continuing operations for the foreseeable future.

UKAEA's Statement of Financial Position includes liabilities of over £352m for site restoration and restructuring costs. Matching reimbursement receivables are recognised for the majority of these liabilities on the basis of assurances from BEIS that it continues to accept responsibility in principle for these costs, and provides for them in the BEIS departmental resource accounts. These assurances are re-confirmed annually.

New developments during the year

EPSRC Programme and Funding

UKAEA was pleased to receive confirmation of its EPSRC grant funding for five years from April 2017. This is a major vote of confidence in its science programme. The Programme Managers have reviewed and recommended a forward programme that is consistent with the funding that has been made available. This programme has been reviewed and confirmed by CPAC (see above under Board Committees.)

BEIS provided further funding to optimise the timing of completion of the project to upgrade the MAST facility. To ensure that this was used effectively, I asked CPAC to advise the Board and me on the project priorities.

The MAST Upgrade project has now made major steps forward (as described in detail on page 14). A number of technical issues have delayed the project, but most of these have now been overcome. A 'lessons learnt' review of this major project will take place during 2017/18 when the project is completed.



Additional funding for specific projects

UKAEA received additional funding from BEIS as part of the Comprehensive Spending Review for 2016/17 to 2020/21. This is to support a number of specific projects related to UKAEA's programmes, which are not funded directly as part of the UK fusion programme, including:

- a new building for Oxford Advanced Skills;
- other property infrastructure developments, such as the installation of access control in all UKAEA buildings on the Culham site;
- IT Infrastructure investments; and
- funding for business development.

UKAEA has set up appropriate governance and control arrangements for internal approval and monitoring of these projects, and regular reports are provided to BEIS on progress.

UKAEA has also received further funding for the Materials Research Facility (MRF) at Culham as part of the Government's announcement on funding for the Henry Royce Institute and National Nuclear User Facility. This is being used to purchase equipment and extend facilities in the MRF.

Project Management

During the year, work has continued on UKAEA's new Integrated Delivery Process (IDP), which aims to bring together all UKAEA's current project management processes into a single simple framework. Work on developing this will continue during 2017/18, with the aim of going live with the new process in late 2017. IDP will reduce the current duplication and paperwork associated with managing complicated technical projects, and free up time for delivery.

New transaction processing system and payroll system

UKAEA's new finance, procurement and HR transactional system went live in September 2016. The immediate priorities of paying employees and suppliers, together with a new procurement process, were successfully achieved. Issues related to management reporting and training of staff in new processes have now been resolved in time to provide assurance about the integrity of the year end Annual Accounts process. A post-implementation project has been set up to complete outstanding actions and training.

Two other major projects were managed during the year. The first, to deliver a new online payroll interface, went live successfully in February 2017, with first payments from the new system. The second, to manage the closure of the present UKAEA pension final salary scheme, and the move of affected staff to the Civil Service career average 'alpha' scheme, was ready for implementation in April 2017, but was paused on instruction from HM Treasury. We anticipate the move may now take place in 2018, subject to HM Treasury approval.

Triennial Review

The Board reviewed progress on the Triennial Review at its September 2016 meeting, and confirmed that the majority of recommendations were complete. It agreed a number of actions with the Executive to close the remaining recommendations.

Other Matters

UKAEA has robust processes in place to comply with the current austerity measures introduced across the public sector, which aim to reduce expenditure and monitor use of limited public sector resources. Acting on behalf of the Accounting Officer, the Director of Finance and Corporate Affairs reviews and signs off monthly data-sets of accounts payable transactions, with particular emphasis on procurement, travel, events and hospitality.

During the year under review, UKAEA has reviewed the tax arrangements of all its off-payroll appointments. All contractors within the scope of this exercise have been required to provide evidence of tax compliance. All off-payroll appointments were tax compliant as at 31st March 2017. UKAEA also has arrangements in place to ensure that any future off-payroll appointments are fully tax compliant.



Completion of Internal Audit recommendations and actions

The following table summarises progress during the year on completing recommendations and actions arising from Internal Audit reviews:

Carried forward from previous years	23
2016/17 Internal Audit recommendations raised	9
Completed on time	14
Completed late	14
Overdue at 31 March 2017	1
Total actions outstanding but not overdue at 31 March 2017	3

The overdue recommendation at 31 March 2017 was completed by the end of April 2017, within one month of the due date. 6 of the 14 2016/17 audit recommendations completed late were completed within one month of the due date.

A UKAEA performance metric on Internal Audit recommendations is being reintroduced for 2017/18 to refocus attention on timely completion.

Review of effectiveness of risk management and internal controls

As Accounting Officer, I have responsibility for reviewing the effectiveness of the systems of risk management and internal control. My review of the effectiveness of these systems is informed by the work of the internal auditors and the senior managers within UKAEA who have responsibility for the development and maintenance of the internal control framework, the SIRO's report on how risks to information are being managed and controlled, and comments made by the external auditors in their management letter and other reports.

UKAEA has an internal audit function which operates in accordance with Public Sector Internal Audit Standards and an Audit Charter approved by the Audit Committee. The work of Internal Audit is determined by analysis of the risks to which UKAEA is exposed. The annual internal audit programme is based on this analysis and additionally includes a 3 year rolling programme to test key financial controls. It includes reviews which test and challenge the effectiveness of the management of risks and information.

During the year, Internal Audit work has focussed on the introduction of UKAEA's new transaction processing system Unit Four Business World (U4BW) to ensure the adequacy of controls both during the design of the system and following go-live. The majority of the U4BW system processes have been audited post go-live by the Government Internal Audit Agency and have received Moderate Assurance with no major control weaknesses found. As some of these audits took place towards the end of the financial year, actions arising will be raised in 2017/18.

The Head of Internal Audit provides me, as Accounting Officer, with regular reports on internal audit activity in UKAEA. These reports include an independent opinion on the adequacy and effectiveness of UKAEA's system of risk management and internal control. Internal audits undertaken during the year took into account an assessment of where the greatest control risks were, and this approach resulted in the following classifications:

Classification	Substantial Assurance	Moderate Assurance	Limited Assurance
Number of reports	1	10	nil

The Head of Internal Audit has concluded that, based on the audit work undertaken and taking into account all available evidence, there is generally a sound system of internal control, governance and risk management, and an effective control environment within UKAEA. This confirmation took into account the risk based approach to the audit plan and the level of assurance gained from the audits undertaken. Recommendations and controls relating to key risk areas identified in last year's Governance Statement (MAST Upgrade and Project Management) were implemented during 2016/17. Measures have been taken by UKAEA management to improve the timely completion of audit actions in 2017/18.

I have considered the evidence provided to support the annual Governance Statement. My conclusion is that UKAEA's overall governance and internal control structures are generally sound and fit for purpose.

Professor Ian Chapman
Chief Executive and Accounting Officer
13 July 2017



Accountability Report

Remuneration and Staff Report

Remuneration Policy

The remuneration of Directors is set by the Secretary of State for BEIS with the approval of HM Treasury in accordance with the Atomic Energy Authority Act 1954. The UKAEA Remuneration Committee makes recommendations to BEIS on the overall remuneration package for Executive Directors. The Non-Executive Directors who form the Committee are not involved in decisions relating to their own remuneration.

In reaching its recommendations, the Committee has regard to the following considerations:

- the need to recruit, retain and motivate suitably able and qualified people to exercise their different responsibilities; and
- the funding available to UKAEA.

The Committee takes account of the evidence it receives about wider economic considerations and the affordability of its recommendations.

Service contracts

Executive Directors are appointed by the Secretary of State for BEIS. This is normally for a three year term that may be renewed upon expiry in accordance with the guidelines issued by the Commissioner for Public Appointments.

Remuneration and pension entitlements

The individual components of the remuneration packages are:

Salary and fees

The CEO as Executive Director receives a basic salary which is reviewed annually by UKAEA's Remuneration Committee. The Chair and Non-Executive Directors receive fees for their services. Members of the Executive Team also receive a basic salary which is reviewed annually by the Remuneration Committee. The Remuneration Committee makes recommendations to BEIS as appropriate.

Benefits

The previous CEO was entitled to certain benefits under the terms of his service contract. These comprised private health care, financial advice and relocation assistance. An advance of salary for house purchase of £35,156 was repaid in full on leaving UKAEA on 30 September 2016.

Members of the Executive Team receive a car allowance.

Executive Directors, and members of the Executive Team, are also reimbursed for reasonable expenses incurred in line with the policy for UKAEA's employees. These reimbursements are not included in the table below.

Performance related bonuses

The performance bonuses for Executive Directors are calculated in accordance with performance against agreed objectives, confirmed by BEIS on the basis of recommendations from the Remuneration Committee. The total bonus is made up of two components: the performance of UKAEA against specific quantified targets, and the performance of the individual against specific targets. Members of the Executive Team receive bonuses based on formulae that are agreed each year by the Remuneration Committee, and which are subject to approval by BEIS where applicable. The performance-related bonuses for 2016/17 shown in the table below are subject to approval by BEIS.

Accountability Report Remuneration and Staff Report

Individual Directors' remuneration for the year is shown in the table below, with salaries disclosed on an accruals basis. This part of the report is subject to audit.

2016/17	Salary/ Fees £	Benefits^(b) £	Annual Bonus £	Pension benefit^(c) £	2016/17 Total £
Chairman					
Roger Cashmore	25,000	–	–	–	25,000
Non-Executive Directors					
Keith Burnett	15,000	–	–	–	15,000
Norman Harrison	15,000	159	–	–	15,159
Jim Hutchins	15,000	412	–	–	15,412
Peter Jones	15,000	2,310	–	–	17,310
Chris Theobald	15,000	2,661	–	–	17,661
Executive Directors					
Steve Cowley (to 30 September 2016) ^(a)	102,500	1,442	13,568	13,645	131,155
Ian Chapman (from 1 October 2016) ^(a)	82,500	–	11,147	147,231	240,878
Members of the Executive Committee					
Martin Cox	114,101	5,000	9,770	11,525	140,396
David Martin	124,965	6,060	11,918	8,494	151,437
Catherine Pridham ^(a)	119,333	6,060	14,560	31,367	171,320
	643,399	24,104	60,963	212,262	940,728

2015/16	Salary/ Fees £	Benefits^(b) £	Annual Bonus £	Pension benefit^(c) £	2015/16 Total £
Chairman					
Roger Cashmore	25,000	–	–	–	25,000
Non-Executive Directors					
Keith Burnett	15,000	–	–	–	15,000
Norman Harrison (from 1 March 2016)	1,250	51	–	–	1,301
Jim Hutchins (from 1 March 2016)	1,250	41	–	–	1,291
Stephen McQuillan (to 31 January 2016)	12,500	405	–	–	12,905
Peter Jones	15,000	2,353	–	–	17,353
Chris Theobald (from 1 March 2016)	1,250	403	–	–	1,653
Executive Directors					
Steve Cowley	205,000	4,971	20,911	38,762	269,644
Members of the Executive Committee					
Martin Cox	114,119	5,000	7,247	24,613	150,979
David Martin	125,739	6,060	10,838	140,191	282,828
Catherine Pridham	114,000	6,060	10,978	29,523	160,561
	630,108	25,344	49,974	233,089	938,515

Notes:

- (a) Figures disclosed for Ian Chapman are from his appointment as CEO on 1st October 2016. His annual salary is £165,000. The bonus figure disclosed also relates to the period after he was appointed CEO. Catherine Pridham's salary increased from £114,000 to £122,000 with effect from 1st August 2016. Steve Cowley's annual salary was £205,000. The annual salaries of Martin Cox and David Martin were £114,119 and £125,000 respectively.
- (b) Expenses disclosed for the Chairman and Non-Executive Directors in 2017 and in the comparatives for 2016 relate to travel for Board and other meetings at Culham and include the tax liability on these expenses which was met by UKAEA.
- (c) The value of pensions benefits accrued during the year is calculated as (the real increase in pension multiplied by 20) plus (the real increase in any lump sum) less (the contributions made by the individual). The real increases exclude increases due to inflation or any increase or decrease due to a transfer of pension rights. Figures for pensions benefit have been rounded to the nearest £ where applicable.

Remuneration ratios

These figures are subject to audit.

	2016/17 £	2015/16 £
Highest Paid Director's Total Remuneration	176,147	230,882
Median Total Remuneration	43,632	41,643
Ratio	4.0	5.5

Reporting bodies are required to disclose the relationship between the remuneration of the highest paid director in their organisation and the median remuneration of the organisation's workforce.

The remuneration of the highest paid director in UKAEA in the year 2016/17 was £176,147 (2015/16: £230,882). This was 4 times (2015/16: 5.5 times) the median remuneration of the workforce, which was £43,632 (2015/16: £41,643). The change in ratio was mainly due to a reduction in the remuneration of the highest paid director.

No employee received remuneration in excess of the highest-paid Director in either 2016/17 or 2015/16.

Total remuneration includes salary, performance-related pay and benefits in kind. It does not include pensions benefit, employer pension contributions and the cash equivalent transfer value of pensions.

The range of staff remuneration included in the calculation above was £11,624 to £176,147 (2015/16: £11,200 to £230,882).

Pension entitlements

Executive Directors and members of the Executive Committee are members of the United Kingdom Atomic Energy Authority Combined Pension Scheme that pays an annual pension based on pensionable final earnings together with a lump sum at normal retirement age. Benefits are also payable in the event of death or ill health retirement. UKAEA also operates an unfunded pension arrangement for three former Chief Executives to take account of pensionable pay above the earnings cap introduced by the Finance Act 1989.

Further details of the pension schemes and unfunded pensions can be found later in the Remuneration and Staff Report.

The pension entitlements shown in the table below (which is subject to audit) are those that would be paid annually on retirement based on service to 31 March 2017 and include the value of added years paid for by Directors.

	Accrued Pension 2015/16 £	Lump sum 2015/16 £	Real increase in accrued pension ^(a) £	Real increase in lump sum ^(a) £	Accrued Pension 2016/17 £	Lump Sum 2016/17 £
Executive Directors						
Steve Cowley ^(b)	14,618	43,854	856	2,568	15,620	46,860
Ian Chapman ^(b)	–	–	6,810	20,431	17,760	53,280
Members of the Executive Committee						
Martin Cox	51,867	155,602	908	2,723	53,294	159,882
David Martin	56,105	168,314	815	2,444	57,480	172,441
Catherine Pridham	8,593	25,779	2,114	6,341	10,792	32,377
	131,183	393,549	11,503	34,507	154,946	464,840

Notes:

(a) The real increase has been calculated after subtracting inflation.

(b) Figures quoted for Steve Cowley relate to the position on 30th September 2016 when he left UKAEA. As Ian Chapman was appointed as CEO on 1st October 2016 his pension and lump sum at 31 March 2016 are not included in the comparative.

Accountability Report Remuneration and Staff Report

The following table (which is subject to audit) sets out the Cash Equivalent Transfer Value (CETV) of the Executive Directors' and Executive Team members' accrued pension entitlements which have been calculated by the Scheme managers in accordance with the Occupational Pension Schemes (Transfer Values) Regulations 1996 as amended, having taken actuarial advice. The transfer values do not represent sums paid or payable to the Directors or Executive Committee members but represent a potential liability of the pension scheme or UKAEA.

	CETV at 31 March 2016 £	Real increase in CETV £	CETV at 31 March 2017 £
Executive Directors:			
Steve Cowley ^(a)	317,794	13,050	348,461
Ian Chapman ^(a)	–	74,025	217,558
Members of the Executive Committee			
Martin Cox	1,209,224	12,151	1,247,014
David Martin	1,208,120	7,991	1,270,465
Catherine Pridham	153,311	21,452	197,641
	2,888,449	128,669	3,281,139

Notes:

- (a) Figures quoted for Steve Cowley relate to the position on 30 September 2016 when he left UKAEA. As Ian Chapman was appointed as CEO on 1 October 2016 his CETV at 31 March 2016 is not included in the comparative.

Members of the pension scheme have the option to pay Additional Voluntary Contributions; neither the contributions nor the resulting benefits are included in the above tables.

Staff Report

This section is subject to audit.

Staff costs

Staff costs comprise:

	2017 £k	2016 £k
Permanently employed staff:		
Salaries, bonuses and allowances	33,153	29,618
Social security costs	3,758	2,680
Pension costs	4,425	4,084
	41,336	36,382
Other staff	19,081	17,528
	60,417	53,910

Staff numbers

The average number of full-time equivalent staff during the year was as follows:

	2017	2016
Directly employed	694	667
Other staff	352	413
	1,046	1,080

Directly employed staff included 10 senior staff.

Other staff are hired staff. The majority of these are used to carry out specialist work in UKAEA's scientific facilities.

Staff composition

At 31 March 2017, all seven of UKAEA's Board members were male. A female trainee non-executive director attended board meetings as part of the government's Women Onboard scheme.

Three of the Executive Team were male and one female. Four of the eleven members of the wider Executive Committee were female.

UKAEA has a total of 10 senior grade staff, of whom 8 were male and 2 female. At 31 March 2017, 574 (77.5%) of employees were male and 167 (22.5%) were female, compared with 534 (78%) male employees and 150 (22%) female employees at 31 March 2016.

Sickness absence

The average sickness absence per employee for UKAEA during the 2016/17 year was 6 days per person, compared with 4.5 days in 2015/16. This is considerably lower than the public sector average of 8.5 days per employee for all public services workers as disclosed in the Chartered Institute of Personnel and Development 2016 Absence Management annual survey report.

UKAEA Pension Schemes

(a) Defined benefit schemes

UKAEA has three defined benefit schemes: the Combined Pension Scheme (CPS), the Principal Non-Industrial Superannuation Scheme (PNISS) and the Protected Persons Superannuation Scheme (PPSS). These schemes have members from other employers as well as UKAEA. No information in these financial statements relates to other employers participating in the CPS, PNISS or PPSS, although the Group has overall responsibility for the management of the schemes. No contingent liability is expected to arise from this responsibility.

In common with other public sector schemes, the CPS, the PNISS and the PPSS do not have many of the attributes of normal pension schemes. All contributions are paid to and benefits paid by HM Government via the Consolidated Fund. Any surplus of contributions made in excess of benefits paid out in any year is surrendered to the Consolidated Fund and any liabilities are met from the Consolidated

Fund via the annual Parliamentary vote. The Government does not maintain a separate fund and actuarial valuations are based on a theoretical calculation as to how a typical UK pension scheme would have invested the historical surplus of contributions over payments.

In accordance with the FReM, the schemes are accounted for as defined contribution schemes.

Employer contributions are calculated in accordance with HM Treasury methodology “Superannuation Contributions Adjusted for Past Experience” and are based on the expected cost of members’ benefits as they accrue. The total contributions paid by the Group during the year were £4,406k (2016 : £4,065k).

(b) Defined contribution schemes

UKAEA manages two defined contribution schemes, the Additional Voluntary Contribution (AVC) scheme and the Shift Pay Pension Savings Plan (SPPP) scheme, both of which are fully insured schemes administered by Prudential Assurance Company Ltd to whom contributions are paid.

The AVC scheme includes members from UKAEA and from other employers who are members of CPS or PPSS and who have opted to pay additional voluntary contributions. No employer contributions are made to this scheme.

The members of the SPPP scheme include shift working employees of UKAEA and other employers who are members of CPS or PPSS. The costs of the SPPP scheme, which are directly linked to shift pay earnings, are charged to the statement of comprehensive income at the time the shift pay is paid. The total contributions paid by UKAEA during the year were £17k.

(c) Unfunded retirement benefits

Three former UKAEA chief executives have unfunded retirement benefits which are not included in the UKAEA pension schemes.

The movement in the liability for these benefits is shown below:

	Group and Authority	
	2017	2016
	£k	£k
At 1 April	1,986	2,057
Change in discount rate	362	(17)
Interest on liability	70	72
Benefits payable	(78)	(78)
Actuarial (gain) loss	(17)	(48)
	2,323	1,986

The interest on liability is included in the statement of comprehensive income and the actuarial loss is included in taxpayers’ equity. The closing liability, discounted at the appropriate pensions liability discount rate, is included in other provisions for liabilities and charges in the statement of financial position (Further details of provisions are given in Note 20).

Staff Policy

UKAEA has an equal opportunities policy which requires that all job applicants enjoy equal opportunity for employment on the basis of ability, qualifications, experience and suitability for the work. We deliver in-house training on diversity and equality, unconscious bias and specific recruitment training. Both courses cover diversity and equality, ensuring that line managers are aware of their responsibilities towards, and the benefits of, these topics.

UKAEA’s equal opportunities policy provides a framework for ensuring that equality is considered throughout the employment of staff. For those who become disabled during their employment, we provide occupational health facilities which provide direct support to the employee and also advise line managers on modifications and restrictions which are required. In addition to the training mentioned above, HR Business Partners provide coaching on flexible working and unconscious bias to ensure that disabled persons are given equal opportunity in training, career development and promotion.

Expenditure on consultancy

There was no expenditure on consultancy in either the current or the previous year.

Off-payroll appointments

(a) Off-payroll engagements as of 31 March 2017, for more than £220 per day that last for longer than six months

Number of existing engagements as of 31 March 2017 52

Of which:

Number that have existed for less than one year at time of reporting 11

Number that have existed for between one and two years at time of reporting 4

Number that have existed for between two and three years at time of reporting 4

Number that have existed for between three and four years at time of reporting 5

Number that have existed for more than four years at time of reporting 28

(b) New off-payroll appointments, or those that reached six months in duration, between 1 April 2016 and 31 March 2017, for more than £220 per day and that last for longer than six months

Number of new engagements, or those that reached six months in duration, between 1 April 2016 and 31 March 2017 15

Number of the above which include contractual clauses giving the department the right to request 15

assurance in relation to income tax and National Insurance obligations

Number for whom assurance has been requested 15

Of which:

Number for whom assurance has been received 15

Number for whom assurance has not been received –

Number that have been terminated as a result of assurance not being received –

(c) Off-payroll engagements of board members, and/or senior officials with significant financial responsibility, between 1 April 2016 and 31 March 2017

Number of off-payroll engagements of board members, and/or senior officials with significant financial responsibility, during the financial year –

Total number of individuals on payroll and off-payroll that have been deemed “board members, and/or senior officials with significant financial responsibility during the financial year 11

Exit packages paid to employees

There were no exit packages paid to employees in 2016/17 or the previous year, and therefore no resource cost.

On behalf of the Board

Professor Sir Keith Burnett, CBE, FRS
Chairman of Remuneration Committee
13 July 2017

Professor Steve Cowley, FRS, FEng
Chief Executive and Accounting Officer
13 July 2017



Accountability Report Parliamentary Accountability and Audit Report

The Certificate and Report of the Comptroller and Auditor General to the Houses of Parliament

I certify that I have audited the financial statements of the United Kingdom Atomic Energy Authority for the year ended 31 March 2017 under the Atomic Energy Authority Act 1954. The financial statements comprise: the Group and Authority Statements of Comprehensive Net Expenditure, Financial Position, Cash Flows, Changes in Taxpayers' Equity; and the related notes. These financial statements have been prepared under the accounting policies set out within them. I have also audited the information in the Remuneration and Staff Report that is described in that report as having been audited.

Respective responsibilities of the Board, Accounting Officer and auditor

As explained more fully in the Statement of Accounting Officer's Responsibility, the Board and the Accounting Officer are responsible for the preparation of the financial statements and for being satisfied that they give a true and fair view. My responsibility is to audit, certify and report on the financial statements in accordance with the Atomic Energy Authority Act 1954. I conducted my audit in accordance with International Standards on Auditing (UK and Ireland). Those standards require me and my staff to comply with the Auditing Practices Board's Ethical Standards for Auditors.

Scope of the audit of the financial statements

An audit involves obtaining evidence about the amounts and disclosures in the financial statements sufficient to give reasonable assurance that the financial statements are free from material misstatement, whether caused by fraud or error. This includes an assessment of: whether the accounting policies are appropriate to the Group's and the United Kingdom Atomic Energy Authority's circumstances and have been consistently applied and adequately disclosed; the reasonableness of significant accounting estimates made by the United Kingdom Atomic Energy Authority; and the overall presentation of the financial statements. In addition I read all the financial and non-financial information in the Annual Report to identify material inconsistencies with the audited financial statements and to identify any information that is apparently materially incorrect based on, or materially inconsistent with, the knowledge acquired by me in the course of performing the audit. If I become aware of any apparent material misstatements or inconsistencies I consider the implications for my certificate.

I am required to obtain evidence sufficient to give reasonable assurance that the expenditure and income recorded in the financial statements have been applied to the purposes intended by Parliament and the financial transactions recorded in the financial statements conform to the authorities which govern them.

Opinion on regularity

In my opinion, in all material respects the expenditure and income recorded in the financial statements have been applied to the purposes intended by Parliament and the financial transactions recorded in the financial statements conform to the authorities which govern them.

Opinion on financial statements

In my opinion:

- the financial statements give a true and fair view of the state of the Group's and the United Kingdom Atomic Energy Authority's affairs as at 31 March 2017 and of the Group's and Authority's net income for the year then ended; and
- the financial statements have been properly prepared in accordance with the Atomic Energy Authority Act 1954 and Secretary of State directions issued thereunder.



Opinion on other matters

In my opinion:

- the parts of the Remuneration and Staff Report to be audited have been properly prepared in accordance with Secretary of State directions made under the Atomic Energy Authority Act 1954; and
- the information given in Performance Report and Accountability Report for the financial year for which the financial statements are prepared is consistent with the financial statements.

Matters on which I report by exception

I have nothing to report in respect of the following matters which I report to you if, in my opinion:

- adequate accounting records have not been kept or returns adequate for my audit have not been received from branches not visited by my staff; or
- the financial statements and the parts of the Remuneration and Staff Report to be audited are not in agreement with the accounting records and returns; or
- I have not received all of the information and explanations I require for my audit; or
- the Governance Statement does not reflect compliance with HM Treasury's guidance.

Report

I have no observations to make on these financial statements.

Sir Amyas C E Morse

Comptroller and Auditor General

National Audit Office

157-197 Buckingham Palace Road

Victoria, London, SW1W 9SP

17 July 2017



Consolidated Statement of Comprehensive Income

for the year ended 31 March 2017

	Note	Group		Authority	
		2017 £k	2016 £k	2017 £k	2016 £k
Income					
Revenue	5	98,632	88,813	97,912	88,084
Other Income		1,657	714	3,074	2,478
Share of revenue of joint venture		(660)	(635)	–	–
		99,629	88,892	100,986	90,562
Expenditure:					
Raw materials and consumables		21,726	18,979	21,726	18,979
Other external expenses		23,648	26,544	23,648	26,544
Staff costs	6	60,417	53,910	60,417	53,910
Depreciation, amortisation and impairment		1,245	735	1,245	735
Other expense		(97)	3,238	1,306	3,765
Costs charged to provisions		(2,987)	(786)	(2,987)	(786)
		103,952	102,620	105,355	103,147
Revaluation adjustment		973	(1,484)	973	(1,484)
Costs capitalised		(3,829)	(10,125)	(3,829)	(10,125)
		101,096	91,011	102,499	91,538
		(1,467)	(2,119)	(1,513)	(976)
Operating (loss)/profit					
Finance income	8	221	182	151	89
Finance expense	8	(98)	(36)	(98)	(36)
Loss on disposal of assets		(4)	–	(4)	–
Share of profit (loss) of joint venture after tax	13	1,980	(225)	–	–
		632	(2,198)	(1,464)	(923)
Profit/(loss) before tax					
Current tax credit – RDEC	10	3,575	6,716	3,575	6,716
Deferred tax credit	19	918	3,361	918	3,361
		5,125	7,879	3,029	9,154
Profit for the year					
Other comprehensive income					
Net gain (loss) on revaluations		1,358	(372)	834	821
Actuarial gains (losses) on defined benefit pension plans		(345)	67	(345)	67
Income tax (debit)/credit relating to components of other comprehensive income		(1,672)	215	(1,672)	215
Other comprehensive income for the year		(659)	(90)	(1,183)	1,103
		4,466	7,789	1,846	10,257
Total comprehensive income for the year					

The notes on pages 59 to 81 are an integral part of these financial statements

Consolidated Statement of Financial Position

as at 31 March 2017

	Note	Group		Authority	
		2017 £k	2016 £k	2017 £k	2016 £k
Non-current assets					
Property, plant and equipment	11	37,662	33,678	37,662	33,678
Investment property	12	60,840	61,692	60,840	61,692
Financial assets	13	14,152	11,648	13,523	13,523
Other receivables	15	349,585	325,565	349,585	325,565
Total non-current assets		462,239	432,583	461,610	434,458
Current assets					
Inventories		11	10	11	10
Trade and other receivables	15	26,632	18,864	27,230	19,516
Financial assets	13	7,196	7,745	–	–
Cash and cash equivalents	16	57,168	50,825	54,872	48,160
Total current assets		91,007	77,444	82,113	67,686
Total assets		553,246	510,027	543,723	502,144
Current Liabilities					
Trade and other payables	17	54,771	40,140	54,763	40,127
Provisions for liabilities and charges	20	6,493	9,572	5,402	7,398
Total liabilities		61,264	49,712	60,165	47,525
Total assets minus current liabilities		491,982	460,315	483,558	454,619
Non-current liabilities					
Other payables	17	1,620	1,510	1,620	1,510
Deferred income	18	5,767	6,042	5,767	6,042
Deferred income tax liabilities	19	8,837	8,082	8,837	8,082
Provisions for liabilities and charges	20	361,797	338,262	359,887	336,460
Total non-current liabilities		378,021	353,896	376,111	352,094
Assets less liabilities		113,961	106,419	107,447	102,525
Taxpayers' equity					
General reserve		13,658	13,658	13,658	13,658
Revaluation reserve		11,606	12,766	11,606	12,766
Retained earnings		88,697	79,995	82,183	76,101
		113,961	106,419	107,447	102,525

The notes on pages 59 to 81 are an integral part of these financial statements.

The Financial Statements on pages 55 to 81 were approved by the Board on 13 July 2017 and were signed on its behalf by:

Professor Ian Chapman
Chief Executive and Accounting Officer
13 July 2017

Consolidated Statement of Cash Flows

for the year ended 31 March 2017

		Group		Authority	
	Note	2017 £k	2016 £k	2017 £k	2016 £k
Cash flows from operating activities					
Profit for the year		5,125	7,879	3,029	9,154
Adjustments for non-cash transactions:					
- Depreciation, amortisation, and impairment		1,245	735	1,245	735
- Deferred income released	18	(275)	(179)	(275)	(179)
- Change in fair value of investment property	12	974	(1,484)	974	(1,484)
- Loss on disposal of property, plant and equipment		4	-	4	-
- Net finance income recognised		(123)	(146)	(53)	(53)
- Income tax debit (credit)	10	(4,493)	(10,077)	(4,493)	(10,077)
- Share of loss (profit) of joint venture		(1,980)	225	-	-
Changes in working capital:					
- Increase/(Decrease) in trade and other receivables		(4,316)	1,348	(4,262)	1,212
- (Increase)/Decrease in inventories		(1)	(2)	(1)	(2)
- (Increase)/Decrease in current financial assets		549	1,973	-	1,052
- Increase/(Decrease) in trade and other payables		14,743	25,931	14,748	25,931
- Use of provisions		(3,885)	164	(2,910)	573
Net cash inflow/(outflow) from operating activities		7,567	26,367	8,006	26,862
Cash flows from investing activities					
Purchase of property, plant and equipment	11	(4,521)	(11,258)	(4,521)	(11,258)
Net cash inflow/(outflow) from investing activities		(4,521)	(11,258)	(4,521)	(11,258)
Cash flows from financing activities					
Grant from sponsoring department		3,076	8,055	3,076	8,055
Interest received		221	182	151	89
Net financing		3,297	8,237	3,227	8,144
Net increase/(decrease) in cash and cash equivalents in the period		6,343	23,346	6,712	23,748
Cash and cash equivalents at the beginning of the period		50,825	27,479	48,160	24,412
Cash and cash equivalents at the end of the period		57,168	50,825	54,872	48,160

The notes on pages 59 to 81 are an integral part of these financial statements.

Consolidated Statement of Changes in Taxpayers' Equity

for the year ended 31 March 2017

Group	General reserve £k	Revaluation reserve £k	Retained earnings £k	Total £k
Balance at 1 April 2015	13,658	12,042	64,875	90,575
Changes in Taxpayers' Equity 2015/16				
Capital Grant from sponsoring department	–	–	8,055	8,055
Total comprehensive income for the year	–	1,036	6,753	7,789
Depreciation transfer	–	(312)	312	–
Balance at 31 March 2016	13,658	12,766	79,995	106,419
Changes in Taxpayers' Equity 2016/2017				
Capital Grant from sponsoring department	–	–	3,076	3,076
Total comprehensive income for the year	–	(838)	5,304	4,466
Depreciation transfer	–	(322)	322	–
Balance at 31 March 2017	13,658	11,606	88,697	113,961

Authority	General reserve £k	Revaluation reserve £k	Retained earnings £k	Total £k
Balance at 1 April 2013	13,658	12,042	58,513	84,213
Changes in Taxpayers' Equity 2015/2016				
Capital grant from sponsoring department	–	–	8,055	8,055
Total comprehensive income for the year	–	1,036	9,221	10,257
Depreciation transfer	–	(312)	312	–
Balance at 31 March 2016	13,658	12,766	76,101	102,525
Changes in Taxpayers' Equity 2016/17				
Capital grant from sponsoring department	–	–	3,076	3,076
Total comprehensive income for the year	–	(838)	2,684	1,846
Depreciation transfer	–	(322)	322	–
Balance at 31 March 2017	13,658	11,606	82,183	107,447

Notes to the Financial Statements

1 General information

UKAEA is an NDPB and was established by the Atomic Energy Authority Act 1954. The address of UKAEA's registered office is Culham Science Centre, Abingdon, Oxfordshire, OX14 3DB. Its sponsoring government department is the Department for Business, Energy and Industrial Strategy. UKAEA and its subsidiaries are referred to as "the Group".

2 Basis of preparation

The financial statements comply with the provisions of the Atomic Energy Authority Act 1954 and the Accounts Direction issued by HM Treasury. The latter requires the financial statements to be prepared in accordance with the Government Financial Reporting Manual (FRoM) issued by HM Treasury as updated annually. The accounting policies contained in the FRoM apply International Financial Reporting Standards (IFRS) as adapted or interpreted for the public sector. Where the FRoM permits a choice of accounting policy, the accounting policy which is judged to be most appropriate to the particular circumstances of the Group for the purpose of giving a true and fair view has been selected.

The financial statements have been prepared on a going concern basis. UKAEA currently relies on funding from the European Commission to finance the operation of the JET programme, which represents approximately 50% of UKAEA's total revenue. The current contract between UKAEA and the Commission for the operation of JET covers a five year period to 31 December 2018. Following the EU referendum on 23 June 2016, the UK will be withdrawing from the European Union and the European Atomic Energy Community (Euratom), leading to increased uncertainty relating to the future funding of JET. However, JET is strategically important to the European fusion programme, in particular the development of ITER, and is the only existing fusion device capable of operating with deuterium-tritium fuel. In UKAEA's opinion the European Commission are supportive of the continuation of the JET programme to 2020. UKAEA's sponsor department, BEIS, have also confirmed that they are very supportive of the UK fusion programme and will be working to find a way to continue to operate JET and remain part of ITER after we have left Euratom. In April 2017, the UK Minister of State for Universities, Science, Research and Innovation wrote a letter to the European Commission outlining the UK Government's commitment to supporting the JET programme beyond 2018 and to work with the Commission to deliver this. The BEIS Secretary of State has written to the Commission again in June 2017 confirming the UK Government's commitment to provide funding to meet its fair share of JET costs until the end of 2020 in the event of the JET contract extension being approved.

In addition, EUROfusion, who manage the European fusion programme, approved the first phase of its contribution to a series of additional upgrades of the MAST facility which will take place from 2018 to 2022. The Board, Executive team and Accounting Officer therefore believe that the commitment of Europe and the UK Government to fusion research, combined with the acceptance by BEIS of responsibility for costs associated with UKAEA site restoration and restructuring liabilities, is sufficient to support continuing operations for the foreseeable future.

The financial statements are presented in pounds sterling, which is UKAEA's functional currency, and have been prepared under the historical cost convention, except for land and buildings, investment properties, assets held-for-sale and derivative financial instruments which are stated at fair value.

The preparation of financial statements in conformity with IFRS requires judgements, estimates and assumptions to be made that affect the application of accounting policies and the reported amounts of income, expenses, assets and liabilities. Estimates and underlying assumptions are reviewed on an ongoing basis. Revisions to accounting estimates are recognised in the period in which the estimates are revised and in any future periods affected. Information about significant areas of estimation uncertainty and critical judgements in applying accounting policies that have the most significant effect on the amounts recognised in the consolidated financial statements is included in the notes to the financial statements.

3 Significant accounting policies

The principal accounting policies applied by UKAEA in the preparation of these financial statements are set out below. These policies have been applied consistently in dealing with all items that are considered material to the financial statements.

3.1 Provisions

Provisions are recognised when: the Group has a present legal or constructive obligation as a result of past events; it is probable that an outflow of resources will be required to settle the obligation; and the amount has been reliably estimated.

UKAEA's site restoration provision is the most significant area of estimation uncertainty in the financial statements. Full details are in Note 20.

Where there are a number of similar obligations, the likelihood that an outflow will be required in settlement is determined by considering the class of obligations as a whole. A provision is recognised even if the likelihood of an outflow with respect to any one item included in the same class of obligations may be small.

Provisions are measured at the present value of the expenditures expected to be required to settle the obligation using real rates of interest. The change in the provision due to passage of time is recognised as finance expense or finance income as appropriate.

Where assurances have been received from another party that they will reimburse some or all of the expenditure required to settle a provision, and the requirements for recognition of IAS 37.53 are met (i.e. it is virtually certain that reimbursement will be received if the obligation is settled) a reimbursement asset will be recognised to the extent of the amount expected to be reimbursed. The reimbursement asset is shown separately from the related provision in the statement of financial position.

3.2 Consolidation

(a) Subsidiaries

Subsidiaries are entities controlled by the Group. Control exists when the Group has the power to govern the financial and operating policies of an entity so as to obtain benefits from activities and actually exercises this power. In assessing control, potential voting rights that are currently exercisable are taken into account. The financial statements of subsidiaries are included in the consolidated financial statements from the date that control commences until the date that control ceases. The accounting policies of subsidiaries are changed when necessary to align them with the policies adopted by the Group.

(b) Joint ventures

Joint ventures are those entities over which the Group exercises joint control through a contractual arrangement. The results, assets and liabilities of joint ventures are incorporated in the consolidated financial statements using the equity method of accounting. Investments in joint ventures are initially carried in the statement of financial position at cost and subsequently adjusted by post-acquisition changes in the Group's share of the net assets of the joint venture, less any impairment in the value of individual investments. Losses of joint ventures in excess of the Group's interest in those joint ventures are not recognised, except where the Group has made a commitment to make good those losses.

(c) Transactions eliminated on consolidation

Intra-group transactions, balances and unrealised gains and losses on transactions between Group companies are eliminated on consolidation.

3.3 Revenue recognition

Revenue is recognised when the amount can be reliably measured, it is probable that future economic benefits will be received and when specific criteria have been met as described below. The amount of revenue is not considered to be reliably measurable until all contingencies relating to the sale have been resolved. Revenue is shown net of value added tax, returns, rebates and discounts.

(a) Service contracts

Revenue from cost recovery contracts for managing the UK's fusion research programme and the European Union's JET facility is recognised to the extent of costs incurred in the period that are expected to be recoverable from customers.

Revenue from other service contracts is recognised under the percentage-of-completion method. Revenue is generally recognised based on the services performed to date as a percentage of the total services to be performed. If circumstances arise that may change the original estimates of revenues, costs or extent of progress toward completion, estimates are revised. These revisions may result in increases or decreases in estimated revenues or costs and are reflected in income in the period in which the circumstances that give rise to the revision become known.

(b) Rental income

Rental income from investment properties is recognised in the statement of comprehensive income on a straight-line basis over the term of the lease. Lease incentives granted are recognised as an integral part of the total rental income over the term of the lease.

(c) Grant-in-aid

Grant-in-aid relating to revenue expenditure is recognised in the statement of comprehensive income in the same period as the related expenditure that it is intended to fund.

This departure from the specified treatment in the FReM has been agreed with HM Treasury.

Capital grants from UKAEA's sponsoring department are recognised as financing and credited to reserves in line with the FReM.

3.4 Research expenditure

Expenditure on research activities, undertaken with the prospect of gaining new scientific or technical knowledge and understanding, is recognised in the statement of comprehensive income when incurred.

3.5 Employee benefits**(a) Short-term employee benefits**

Short-term employee benefits are recognised in the year in which the related service is provided. A liability is recognised for the amount expected to be paid under short-term bonus arrangements if the Group has a present legal or constructive obligation to pay this amount as a result of past service provided by employees and the obligation can be estimated reliably.

(b) Termination benefits

Termination benefits are payable when employment is terminated by the Group before the normal retirement date, or whenever an employee accepts voluntary redundancy in exchange for these benefits. The Group recognises termination benefits when it is demonstrably committed to either: terminating the employment of current employees according to a detailed formal plan without possibility of withdrawal; or providing termination benefits as a result of an offer made to encourage voluntary redundancy. Benefits falling due more than 12 months after the reporting date are discounted to their present value.

(c) Retirement benefits

Obligations for contributions to defined contribution schemes are recognised as an expense when they are due. The Group has no further payment obligations once the contributions have been paid.

The Group operates three defined benefit schemes for the benefit of its employees. Two of these are closed to new members. The schemes are unfunded multi-employer defined benefit schemes. In accordance with the FReM, these schemes are accounted for as defined contribution schemes in these financial statements and the obligations recognised are limited to the contributions due.

The Group also has a separate liability in respect of unfunded retirement benefits relating to three individuals. The liability recognised in the statement of financial position is the present value of the defined benefit obligation at the reporting date, together with adjustments for unrecognised past-service costs. The defined benefit obligation is calculated annually by independent actuaries using the projected unit credit method. The present value of the defined benefit obligation is determined by discounting the estimated future cash outflows using a real rate of interest set by HM Treasury. Actuarial gains and losses arising from experience adjustments and changes in actuarial assumptions are charged or credited to equity in the period in which they arise.

3.6 Segment reporting

Operating segments are reported in a manner consistent with the internal reporting provided to the chief operating decision-maker. The chief operating decision-maker, who is responsible for allocating resources and assessing performance of the operating segments, has been identified as the UKAEA Board.

3.7 Foreign currency translation

Transactions in foreign currencies are translated to the functional currency of the Group using the exchange rates at the dates of the transactions. Monetary assets and liabilities denominated in foreign currencies at the reporting date are retranslated to the functional currency using the exchange rates at that date. Foreign exchange gains and losses resulting from the settlement of transactions and from the translation of monetary assets and liabilities are recognised in the statement of comprehensive income except when deferred in taxpayers' equity as qualifying cash flow hedges.

3.8 Property, plant and equipment

Land and buildings are occupied by the Group and are shown at fair value, based on periodic, but at least quinquennial, valuations by external independent valuers, less subsequent depreciation for buildings. In the intervening years, these valuations may be updated by the Group with the assistance of independent advice as required. A valuation of all the properties was carried out in February 2015.

Fair value is based on market values for existing use as there are no alternative uses for the land and buildings. Where this basis is not applicable because of the specialised nature of the asset, valuations are carried out on a depreciated replacement cost basis.

Increases in the carrying amount arising on revaluation of land and buildings are credited to the revaluation reserve. Decreases that offset previous increases of the same asset are charged against the revaluation reserve; all other decreases are charged to the statement of comprehensive income. Each year the difference between depreciation based on the revalued carrying amount of the asset charged to the income statement and depreciation based on the asset's original cost is transferred from the revaluation reserve to retained earnings.

In accordance with the FReM, other classes of property, plant and equipment with short useful lives or low book values are stated at historical cost less depreciation as a proxy for current valuations. Subsequent costs are included in the asset's carrying amount or recognised as a separate asset, as appropriate, only when it is probable that future economic benefits associated with the item will flow to the Group and the cost of the item can be measured reliably. All other repairs and maintenance are charged to the statement of comprehensive income during the financial period in which they are incurred.

Land is not depreciated. Assets under construction are not depreciated until they are in use. Depreciation on other assets is calculated using the straight-line method to allocate their cost or revalued amounts to their residual values over their estimated useful lives, as follows:

- Buildings up to 40 years
- Plant, machinery and equipment up to 10 years

The assets' residual values and useful lives are reviewed, and adjusted if appropriate, at each reporting date.

Property, plant and equipment may have component parts with different useful lives. In accordance with the provisions of IAS 16 Property, plant and equipment, each part of any newly recognised item of property, plant and equipment with a cost that is significant in relation to the total cost of the item is depreciated separately.

An asset's carrying amount is written down immediately to its recoverable amount if the asset's carrying amount is greater than its estimated recoverable amount (Note 3.11).

Gains and losses on disposals are determined by comparing the proceeds with the carrying amount and any amounts to be released from deferred income on disposal and are recognised in the statement of comprehensive income. When revalued assets are sold, any amounts included in the revaluation reserve are transferred to retained earnings.

3.9 Investment property

Investment property, comprising freehold land and buildings, is held either for rental yields or capital appreciation and is not occupied by the Group. Investment property is carried at fair value, representing open market value determined annually by external independent valuers.

Fair value is based on active market prices, adjusted, if necessary, for any difference in the nature, location or condition of the specific asset. In the absence of current prices in an active market, the valuations are prepared by considering the aggregate of the estimated cash flows expected to be received from renting out the property. Valuations reflect the allocation of maintenance and insurance responsibilities between the Group and the lessee and the remaining economic life of the property.

Changes in fair values are recognised in the statement of comprehensive income.

3.10 Intangible assets

Intangible assets comprise acquired computer software licences and are stated at cost, net of amortisation and any provision for impairment. The cost of intangible assets, less estimated residual value, is amortised on a straight line basis over their estimated useful lives of up to five years.

3.11 Impairment of non-financial assets

Assets that are subject to depreciation or amortisation are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount may not be recoverable. An impairment loss is recognised for the amount by which the asset's carrying amount exceeds its recoverable amount. The recoverable amount is the higher of an asset's fair value less costs to sell and value in use. For the purposes of assessing impairment, assets are grouped at the lowest levels for which there are separately identifiable cash flows. Non-financial assets that suffered impairment are reviewed for possible reversal of the impairment at each reporting date.

3.12 Inventories

Inventories are stated at the lower of cost and net realisable value. Cost is determined using the first-in, first-out method. The cost of work in progress comprises raw materials, direct labour, other direct costs and related production overheads. Net realisable value is the estimated selling price in the ordinary course of business, less applicable selling expenses.

3.13 Cash and cash equivalents

Cash and cash equivalents includes cash in hand, deposits held at call with banks and other short-term highly liquid investments with original maturities of three months or less.

3.14 Current and deferred income tax

The tax charge or credit for the period comprises current and deferred tax. Tax is recognised in the income statement, except to the extent that it relates to items recognised directly in equity. In this case, the tax is also recognised in equity.

Current tax is the expected tax payable or receivable on the taxable income for the year, using tax rates enacted or substantially enacted at the reporting date, and any adjustment to tax payable in respect of previous years.

RDEC credits payable by HM Revenue and Customs are treated as tax credits in line with the provisions of IAS12, and disclosed separately in the income statement.

Deferred tax is recognised, using the liability method, on temporary differences arising between the tax bases of assets and liabilities and their carrying amounts in the consolidated financial statements. Deferred tax is determined using tax rates (and laws) that have been enacted or substantially enacted by the reporting date and are expected to apply when the related deferred tax asset is realised or the deferred tax liability is settled.

Deferred tax assets are recognised only to the extent that it is probable that future taxable profit will be available against which the temporary differences can be utilised.

3.15 Financial instruments

Non-derivative financial instruments comprise trade and other receivables, investments, cash and cash equivalents and trade and other payables and are recognised initially at fair value. Subsequent to initial recognition, non-derivative financial instruments are measured as described below.

Loans and receivables are non-derivative financial assets with fixed or determinable payments that are not quoted in an active market. They are included in current assets, except for maturities greater than 12 months after the reporting date which are classified as non-current assets. The carrying values, less impairment provision, of loans and receivables are assumed to approximate their fair values.

Other financial liabilities are non-derivative financial instruments with fixed or determinable payments that are not quoted in an active market. They are included in current liabilities, except for maturities greater than 12 months after the reporting date which are classified as non-current liabilities. The carrying values of other financial liabilities are assumed to approximate their fair values.

3.16 Operating leases

Payments made under operating leases are recognised in the statement of comprehensive income on a straight-line basis over the term of the lease. Lease incentives are recognised as an integral part of the total lease expense over the term of the lease.

3.17 New and Amended Accounting Standards

Certain new standards, amendments and interpretations to existing standards have been published but are not effective on UKAEA's accounting period.

The following new standards, amendments and interpretation to existing standards are not yet effective or are not yet effective in HMT's 2016/17 FReM and have not been early adopted by the Authority:

IFRS 9 – Financial Instruments (IAS 39 replacement – Financial Instruments: Recognition and Measurement) – effective date 1 January 2018

IFRS 15 – Revenue from Contracts with Customers (IAS 18 replacement – Revenue) – effective date 1 January 2018

IFRS 16 – Leases (IAS 17 replacement – Leases) – effective date 1 January 2019 (not yet EU adopted)

IFRS 17 – Insurance Contracts (IFRS 4 replacement – Insurance Contracts) – effective date 1 January 2021 (not yet EU adopted)

The Board anticipate that the adoption of these standards and interpretations in future periods will have no material impact on the financial statements of the Authority.

4 Financial Risk Management

Due to the nature of its activities, the Group is not exposed to the same degree of financial risk faced by other business entities. Financial instruments play a much more limited role in creating or changing risk and generally financial assets and liabilities are generated from day-to-day operational activities and not held to change the risks facing the Group in undertaking its activities. While the Group has significant financial liabilities relating to decommissioning and restructuring, most of the risks attached to these liabilities do not rest with the Group as they are broadly matched by reimbursement assets.

(a) Foreign exchange risk

Foreign exchange risk arises when future commercial transactions or recognised assets or liabilities are denominated in a currency that is not the Group's functional currency. The Group operates internationally and is exposed to foreign exchange risk arising from various currency exposures, primarily with respect to the Euro. To manage foreign exchange risk, the Group may use forward contracts for the purchase or sale of foreign currencies.

(b) Interest rate risk

As the Group has no borrowings or significant interest-bearing assets, the Group's income and operating cash flows are substantially independent of changes in market interest rates. Cash balances on deposit are held in highly rated fixed term deposits and the exposure to interest rate risk is minimal and appropriately managed.

(c) Credit risk

The Group's income is received primarily from public sector bodies in the UK and Europe and the exposure to credit risk is therefore considered to be low.

(d) Liquidity risk

The Group is primarily financed by income from other public sector bodies, in the UK and in Europe. Uncertainties about the timing and amount of some of this income, particularly income from Europe, expose the Group to liquidity risk. The Group has a facility to request temporary working capital funding from the Department for Business, Energy and Industrial Strategy should the need arise.

5 Segment information

As the majority of the Group's activities do not represent the provision of public services, segment information in accordance with IFRS 8 is included in these financial statements. The fees and charges analysis required by the FReM does not apply to UKAEA.

5.1 Reportable segments

The Group has two reportable segments, as described below, which are the Group's main business areas reported to the Authority Board. The business areas offer different services and are managed separately because they require different strategies and have different funding streams.

The following summary describes the operations in each of the Group's reportable segments:

- (a) Fusion research – research into using fusion to create a new source of energy that is safe and environmentally benign
- (b) Property management – management and development of the Culham and Harwell campuses for future scientific use.

Other segments include grant-in-aid funding and insurance. None of these segments meets any of the criteria for determining reportable segments in 2017 or 2016. The results of these segments are included in the "other" column in the segmental analyses below.

The segment information for the reportable segments for the years ended 31 March 2017 and 31 March 2016 is as follows:

	Fusion research £k	Property management £k	Other £k	Total £k
Year ended 31 March 2017				
External segment revenue	87,655	4,251	6,726	98,632
Less: share of revenue of joint venture	–	(660)	–	(660)
Other income	1,101	3	553	1,657
Expenditure	(88,631)	(3,594)	(7,898)	(100,123)
Investment property revaluation	–	(973)	–	(973)
Operating profit/(loss)	125	(973)	(619)	(1,467)
Finance income	151	–	70	221
Finance expense	–	–	(98)	(98)
Loss on disposal of fixed assets	–	–	(4)	(4)
Share of profit (loss) of joint venture	–	1,980	–	1,980
Profit/(loss) before income tax	276	1,007	(651)	632
Year ended 31 March 2016				
External segment revenue	80,791	4,578	3,444	88,813
Less: share of revenue of joint venture	–	(635)	–	(635)
Other income	351	62	301	714
Expenditure	(81,142)	(4,005)	(7,348)	(92,495)
Investment property revaluation	–	1,484	–	1,484
Operating profit/(loss)	–	1,484	(3,603)	(2,119)
Finance income	89	–	93	182
Finance expense	–	–	(36)	(36)
Share of profit/(loss) of joint venture	–	(225)	–	(225)
Profit/(loss) before income tax	89	1,259	(3,546)	(2,198)

Revenue from external parties is measured in a manner consistent with that in the statement of comprehensive income.

Reconciliation between Reportable Segments and Statement of Comprehensive Income

	2017 £k	2016 £k
Revenues		
Total revenue for reportable segments	91,906	85,369
Other revenue	6,726	3,444
Consolidated revenue per Statement of Comprehensive Income	98,632	88,813
Profit or loss		
Total profit or loss for reportable segments	1,283	1,348
Other profit or loss	(651)	(3,546)
Consolidated profit before income tax per Statement of Comprehensive Income	632	(2,198)

Geographical segments

In presenting information on the basis of geographical segments, segment revenue is based on the geographical location of customers.

Group

	2017 £k	2016 £k
United Kingdom	35,985	32,001
Europe	62,546	56,711
Rest of the world	101	101
	98,632	88,813

Revenue from major customers

	2017 £k	2016 £k
European Commission	55,929	46,314

Revenue from the European Commission is attributable to the fusion research segment.

6 Staff Costs and Operating profit**6.1 Staff costs**

Staff costs comprise:

	2017 £k	2016 £k
Permanently employed staff:		
Salaries, bonuses and allowances	33,153	29,618
Social security costs	3,758	2,680
Pension costs – defined contribution plans (see below)	4,425	4,084
	41,336	36,382
Other staff	19,081	17,528
	60,417	53,910

Full details of UKAEA's pension schemes are given in the Remuneration Report. The total contributions paid by the Group to the CPS during the year were £4,406k (2016: £4,065k). The total contributions paid by UKAEA during the year to the SPPP were £17k.

Operating profit has been arrived at after charging/(crediting):

	2017 £k	2016 £k
Change in fair value of investment property	973	(1,484)
Net foreign exchange losses (gains)	(147)	(94)
Operating lease rentals – plant, machinery and vehicles	211	196
Non-cash items:		
–Depreciation	1,245	735

7 Auditor's remuneration

The total remuneration of the Group's auditor, National Audit Office, for services provided to the Group was:

	2017 £k	2016 (restated) *
Audit fees	£k	£k
UKAEA	58	56

*The comparative for 2016 has been restated from £53k as additional audit fees were charged for the 2015/16 audit.

Audit of subsidiary and joint venture.

The audit fee paid to the auditors of AEAIL was £8k (2016: £10k). The audit fee paid to the auditors of HSIC PubSP, in which UKAEA has a share of one half, was £12k (2016: £18k – restated from £14k as additional audit fees were charged). The audit fee paid to the auditors of HSIC LP, in which UKAEA has a share of one quarter via HSIC PubSP, was £25k (2016: £15k).

8 Finance income and expense

	Group		Authority	
	2017 £k	2016 £k	2017 £k	2016 £k
Income				
Interest on term bank deposits	221	182	151	89
Expense				
Revalorisation of provisions:				
– Roll forward of discount rate schedule and unwinding of discount (see below)	(1,256)	6,872	(1,256)	6,872
– Escalation of reimbursement receivables	1,284	(6,908)	1,284	(6,908)
Interest on unfunded retirement benefits	70	72	70	72
	98	36	98	36

A £1,284k credit to the income statement in 2016/17 (2016: debit of £6,908k) relates to the provision for the decommissioning of JET, and is matched by adjustments to the reimbursement receivable. It is the net of £1,604k discount charge and a credit of £2,888k unwinding of discount (2016: net of £8,601k discount charge and a credit of £1,693k unwinding of discount). Full details are provided in Note 20.

9 Analysis of Net Expenditure

	Group and Authority	
	2017 Total £k	2016 Total £k
Income		
Income from activities	98,632	88,813
Other income	1,657	714
Interest receivable	221	182
Share of revenue of Joint Venture	(660)	(635)
Share of profit(loss) of joint venture	1,980	(225)
	101,830	88,849
Expenditure		
Raw Materials and Consumables	21,726	18,979
Other External Expense net of costs capitalised	19,819	16,419
Staff costs	60,417	53,910
Other expense ^(a)	(97)	3,238
Cost charged to provisions	(2,987)	(786)
Revaluation adjustment	973	(1,484)
Non-cash items:		
– Depreciation	1,245	735
– Finance expense	98	36
– Loss on fixed asset disposal	4	–
	101,198	91,047
Net Expenditure after Interest and before tax	632	(2,198)

(a) The £97k credit against Other Expense in Group relates to Group consolidation adjustments

10 Income tax (expense)/credit

	Group and Authority	
	2017	2016
	£k	£k
Current tax		
Current tax credit	3,575	3,208
Current tax credit – adjustment relating to 2014/15	–	3,508
	3,575	6,716
Deferred tax		
Origination and reversal of temporary differences	594	607
Recognition of deferred tax asset (Note 19)	324	2,754
	918	3,361
Total income tax (expense)/credit	4,493	10,077

The current tax on the Group's profit before tax differs from the theoretical amount that would arise using the weighted average tax rate applicable to profits of the consolidated entities as follows:

	2017	2016
	£k	£k
Profit/(loss) for the year	5,125	7,879
Income tax expense/(credit)	(4,493)	(10,077)
Profit/(loss) excluding income tax	632	(2,198)
Tax calculated at the standard UK corporation tax rate of 20% (2016 – 21%)	126	(440)
Tax effects of:		
– Reversal of timing differences	213	111
– Expenses not deductible	297	367
– R&D expenditure credit under s104A CTA 2009	894	802
– Brought forward losses set against trading profits	(1,307)	(929)
– Non-trading profits offset by RDEC credit	(200)	(166)
– Net RDEC claim 2016/17	(3,575)	–
– Net RDEC claim 2015/16	–	(3,208)
– Net RDEC claim 2014/15	–	(3,508)
– Tax losses for which no deferred income tax asset was recognised	(23)	255
Current tax expense (credit) for the year	(3,575)	(6,716)

The income tax charged/(credited) to equity during the year is as follows:

	2017	2016
	£k	£k
Fair value gains on property, plant and equipment	1,673	(215)

UKAEA early adopted RDEC, which replaces the previous R&D tax relief regime and has been mandatory from 1 April 2016, and has submitted claims for the RDEC since the year ended 31 March 2015.

11 Property, plant and equipment

Group and Authority	Land £k	Buildings £k	Plant and equipment £k	Assets under construction £k	Total £k
Cost or valuation					
At 1 April 2015	10,603	8,620	4,931	4,221	28,375
Additions	-	-	1,133	10,125	11,258
Disposals	-	(3)	(245)	-	(248)
Revaluation	614	207	-	-	821
Transfers	-	10,703	283	(10,986)	-
At 31 March 2016	11,217	19,527	6,102	3,360	40,206
Additions	-	-	704	3,817	4,521
Disposals	-	(153)	(205)	-	(358)
Revaluation	637	197	-	-	834
Transfers	-	30	143	(173)	-
At 31 March 2017	11,854	19,601	6,744	7,004	45,203
Depreciation and impairment					
At 1 April 2015	-	3,106	2,934	-	6,040
Depreciation charge	-	391	345	-	736
Disposals	-	(3)	(245)	-	(248)
At 31 March 2016	-	3,494	3,034	-	6,528
Depreciation charge	-	723	522	-	1,245
Disposals	-	(153)	(201)	-	(354)
Transfers	-	122	-	-	122
At 31 March 2016	-	4,186	3,355	-	7,541
Net book value					
At 31 March 2016	10,603	5,514	1,997	4,221	22,335
At 31 March 2017	11,854	15,415	3,389	7,004	37,662

All property, plant and equipment is owned by the Group.

There was £342k capital expenditure contracted for at the reporting date but not recognised in the financial statements. (2016 : £19k). This related mainly to assets in course of construction.

12 Investment property

	Group and Authority	
	2017 £k	2016 £k
At 1 April	61,692	60,208
Change in fair value	(974)	1,484
Correction of legacy depreciation balance	122	–
At 31 March	60,840	61,692

Investment properties were valued at fair value at 28 February 2017 by independent valuers. The valuations were undertaken by Carter Jonas in accordance with the Valuation Standards of the Royal Institute of Chartered Surveyors, IFRS and guidelines in HM Treasury's FReM. The Group has adopted this valuation at the reporting date on the grounds that there were no material changes between the valuation date and the reporting date.

Investment properties are held for their investment potential. Rental income from tenants outside the Group is negotiated at arm's length. The following amounts have been recognised in the income statement:

	Group and Authority	
	2017 £k	2016 £k
Rental income	1,985	1,818
Direct operating expenses:		
– Investment properties that generated rental income	1,677	1,586
– Investment properties that did not generate rental income	235	400

13 Financial Assets

	Group		Authority	
	2017 £k	2016 £k	2017 £k	2016 £k
Non-current				
At 1 April	11,648	13,064	13,523	13,523
Revaluation	2,504	(1,416)	–	–
At 31 March	14,152	11,648	13,523	13,523
Investment in subsidiary undertakings	–	–	3,000	3,000
Investment in joint venture	14,152	11,648	10,523	10,523
	14,152	11,648	13,523	13,523
Current				
Term bank deposits	7,196	7,745	–	–
	7,196	7,745	–	–

a) Investment in subsidiary undertakings

Name	Country of incorporation	Ownership interest %	
		2017	2016
AEA Insurance Limited	Isle of Man	100	100

All subsidiary undertakings are included in the consolidation. The proportion of voting rights in the subsidiary undertakings held directly by the Group does not differ from the proportion of shares held.

(b) Investment in joint venture

The Group has a 50% interest in a joint venture, Harwell Science and Innovation Campus Public Sector Limited Partnership (HSIC PubSp), the public sector partner in Harwell Oxford, which is responsible for the development of the Harwell Oxford Campus. The interest in the joint venture is accounted for using the equity method in the Group financial statements.

	Group	
	2017 £k	2016 £k
At 1 April	11,648	13,064
Share of profits(loss) net of tax	1,980	(225)
Additions	524	(1,191)
At 31 March	14,152	11,648
Analysed as follows:		
Cost or valuation	13,095	12,571
Share of retained profits(losses)	1,057	(923)
	14,152	11,648

The £1,980k share of profits of the joint venture (2016: loss of £225k) represents UKAEA's share of the operating profit of Harwell Oxford via HSIC PubSp, which was due to the effect of reductions in operating costs and revaluation adjustments. The increase in investment compared with 2016 was mainly due to an increase in UKAEA's share of the non current assets in the joint venture, and related to Harwell Oxford investment properties and assets under construction.

The following amounts represent the Group's share of the income, results, assets and liabilities of the joint venture. They are included in the Statement of Comprehensive Net Income and Statement of Financial Position:

	2017 £k	2016 £k
Profit/(loss) net of tax		
Income	2,122	153
Expenses	(142)	(378)
	1,980	(225)
Assets		
Current assets	7,218	9,030
Non-current assets	12,138	7,382
	19,356	16,412
Liabilities		
Current liabilities	714	1,138
Non-current liabilities	4,490	3,626
	5,204	4,764
Net assets	14,152	11,648

There are no contingent liabilities relating to the Group's interest in the joint venture, and no significant contingent liabilities of the venture itself.

(c) Term bank deposits

Term bank deposits are held with major UK banks. The average interest rate on the deposits held at 31 March 2017 was 0.63% (2016: 0.99%). The credit risk associated with these investments is considered to be low because of the size and status of the banks involved.

14 Financial instruments by category

Term deposits (Note 13(c)) are categorised as held to maturity investments. With the exception of UKAEA's interest in its subsidiary and joint venture (Notes 13(a) and 13(b)), which are exempted from the application of IAS 39, all other financial assets of the Group and the Authority were categorised as loans and receivables at both 31 March 2017 and 31 March 2016. All financial liabilities of the Group and the Authority were categorised as other financial liabilities at both 31 March 2017 and 31 March 2016.

The majority of financial instruments relate to contracts to buy non-financial items in line with the Authority's expected purchase and usage requirements and the Authority is therefore exposed to little credit, liquidity or market risk.

15 Trade receivables, financial and other assets

	Group		Authority	
	2017 £k	2016 £k	2017 £k	2016 £k
Amounts falling due after more than one year				
Reimbursement receivables (Note 20):				
– Site restoration	304,937	281,639	304,937	281,639
– Restructuring	44,648	43,926	44,648	43,926
	349,585	325,565	349,585	325,565
Amounts falling due within one year				
Trade receivables	2,032	2,444	2,032	2,444
Reimbursement receivables (Note 20):				
– Site restoration	170	166	170	166
– Restructuring	3,275	3,402	3,275	3,402
Prepayments and accrued income	12,132	4,685	12,115	4,657
VAT	1,940	917	1,940	917
Corporation Tax	6,948	6,881	6,948	6,881
Other receivables	135	369	750	1,049
	26,632	18,864	27,230	19,516

There are no impaired assets in any of the classes of trade and other receivables.

The reimbursement receivables have been discounted at the rates applicable to the provisions to which they relate. Further details of these rates are disclosed in Note 20.

16 Cash and cash equivalents

	Group		Authority	
	2017 £k	2016 £k	2017 £k	2016 £k
Balance at 1 April	50,825	27,479	48,160	24,412
Net change in cash and cash equivalent balances	6,343	23,346	6,712	23,748
Balance at 31 March	57,168	50,825	54,872	48,160
The following balances were held at 31 March:				
Commercial banks and cash in hand	57,168	50,825	54,872	48,160
Balance at 31 March	57,168	50,825	54,872	48,160

	Group		Authority	
	2017 £k	2016 £k	2017 £k	2016 £k
17 Trade payables and other current liabilities				
Amounts falling due after more than one year				
Payments received on account	1,620	1,510	1,620	1,510
Amounts falling due within one year				
Trade payables	830	1,104	830	1,104
Accrued costs	10,863	7,519	10,855	7,506
Payments received on account	41,339	29,886	41,339	29,886
Social security and other taxes	1,170	889	1,170	889
Corporation tax	166	166	166	166
Other payables	403	576	403	576
	54,771	40,140	54,763	40,127

18 Deferred income

The majority of UKAEA's deferred income relates to capital grants for the construction of the RACE building and for the purchase of equipment for the Materials Research Facility. Both these buildings are on the Culham site.

	Group and Authority	
	2017 £k	2016 £k
At 1 April	6,042	3,314
Deferred income received	–	2,907
Released to income statement	(275)	(179)
As at 31 March	5,767	6,042

19 Deferred income tax

Group and Authority	Investment property £k	Land and buildings £k	Total £k
Deferred Tax Liability			
At 1 April 2015	8,727	2,932	11,659
Income statement debit/(credit)	(607)	–	(607)
Charged directly to equity	–	(216)	(216)
At 31 March 2016	8,120	2,716	10,836
Income statement debit/(credit):			
- Revaluation	(150)	–	(150)
- Effect of change in tax rate	(444)	–	(444)
Charged directly to equity:			
- Revaluation	–	1,931	1,931
- Effect of change in tax rate	–	(258)	(258)
At 31 March 2017	7,526	4,389	11,915
Deferred Tax Asset			
At 31 March 2016			2,754
Increase in deferred tax asset			324
At 31 March 2017			3,078
Net Deferred Tax Liability at 31 March 2016			8,082
Net Deferred Tax Liability at 31 March 2017			8,837

Deferred Tax Liability

A change to the UK corporation tax rate from 20% to 19% was substantively enacted on 26 October 2015, with effect from 1 April 2017, and a further reduction to 18% was enacted on the same date with effect from 1 April 2020. An additional reduction to 17% for periods from 1 April 2020 was enacted on 6 September 2016. The closing deferred tax liability has therefore been recalculated at 17% as the liability is not expected to unwind before 1 April 2020.

Deferred Tax Asset

Deferred income tax losses are recognised for tax depreciation and tax loss carry-forwards to the extent that the realisation of the related tax benefit through future taxable profits is probable. The adoption of the RDEC (see Note 10) means that previous trading losses are brought into the annual corporation tax computation. UKAEA now therefore expects to utilise its remaining carried forward losses over the years 2017/18 and 2018/19. A deferred income tax asset of £1,520k has therefore been recognised in the Accounts, calculated at the tax rate expected to be in force in each of these years.

In addition, UKAEA has now recognised a deferred income tax asset of £1,558k in respect of RDEC set-off amounts that can be carried forward against future taxable income. Under the RDEC rules, these can only be utilised after existing trading losses have been exhausted. However, it is now expected that UKAEA will utilise these in 2018/19 and 2019/20.

The total deferred tax asset of £3,078k has been netted off UKAEA's deferred tax liability in the Accounts as it fulfils the conditions for offsetting in IAS12.

20 Provisions for liabilities and charges

Group	Site Restoration £k	Restructuring £k	Other £k	Total £k
At 1 April 2015	256,525	16,166	15,153	287,844
Changes in price levels	1,681	–	40	1,721
Unwinding of discount	(1,693)	210	(88)	(1,571)
Discount charge ⁽¹⁾	22,811	–	–	22,811
Provided in the year	2,631	40,122	1,357	44,110
Provisions not required written back	–	–	(1,911)	(1,911)
Provisions utilised in the year	(150)	(4,073)	(947)	(5,170)
At 31 March 2016	281,805	52,425	13,604	347,834
Changes in price levels	6,790	537	89	7,416
Unwinding of discount	(2,888)	718	(47)	(2,217)
Discount charge ⁽¹⁾	16,370	–	–	16,370
Provided in the year	3,090	4,625	681	8,396
Provisions not required written back	–	(1,099)	(1,391)	(2,490)
Provisions utilised in the year	(61)	(3,813)	(3,145)	(7,019)
At 31 March 2017	305,106	53,393	9,791	368,290

Note:

(1) The £16,370k discount charge in the table above includes £1,604k which is the result of rate changes in years 5 and 10 when the unwinding of the discount rate is calculated at 2016 discount rates rolled forward by one year in line with HMT guidance. The £22,811k discount charge in the previous year included £8,601k which is the result of rate changes in years 5 and 10. Further details are disclosed in the text below.

At 31 March 2016

Non-current	281,639	48,556	8,067	338,262
Current	166	3,869	5,537	9,572
	281,805	52,425	13,604	347,834

At 31 March 2017

Non-current	304,937	49,670	7,190	361,797
Current	169	3,723	2,601	6,493
	305,106	53,393	9,791	368,290

(a) Site restoration

The decommissioning provision represents the estimated costs of decommissioning fusion research facilities at UKAEA's Culham site, including the storage, processing and eventual disposal of radioactive wastes.

Calculation of the liabilities is based on the technical assessments of the processes and methods likely to be used in the future to carry out the work. Estimates are derived from the latest technical knowledge and commercial information available, taking into account current legislation, regulations and Government policy. Summary figures are built up by aggregating detailed estimates for individual liabilities. Allowance is also made for infrastructure costs, which are an appropriate share of site running costs and other overhead costs attributable to plant and buildings. The calculation is reassessed annually.

The last detailed Life Time Plan (LTP) for decommissioning, funded by the Nuclear Decommissioning Authority (NDA), was drawn up in 2007/08. Since then UKAEA has each year carried out a high level assessment of changes to the assumptions made in the previous LTP. For example, the provision includes estimates for the decommissioning of facilities built since 2007/08, and an assessment of the effect of changes to some key assumptions such as the date of JET closure.

The approach taken, until a further LTP is prepared, and the fact that much of the work required to deal with the liabilities will not be undertaken until well into the future, means that there is at present a significant uncertainty as to the amount of the provision and the associated receivable due from BEIS which is described later in this Note. This significant uncertainty does not impact on either net assets or the net profit reported in the financial statements.

The best estimate of the cost of dealing with the liabilities at 31 March 2017 is discounted to the reporting date at real discount rates advised by HM Treasury. The rates now applied are set out below, together with the rates applying at 31 March 2016:

	2017 Rate %	2016 Rate %
Short term – 0 to 5 years from the date of the Statement of Financial Position (SFP)		
2017/18	-2.70	-1.55
2018/19	-2.70	-1.55
2019/20	-2.70	-1.55
2020/21	-2.70	-1.55
2021/22	-2.70	-1.00
Medium term – 5 to 10 years from the SFP		
2022/23	-1.95	-1.00
2023/24	-1.95	-1.00
2024/25	-1.95	-1.00
2025/26	-1.95	-1.00
2026/27	-1.95	-0.80
Long term – greater than 10 years from the SFP		
2027/28 and subsequent financial years	-0.80	-0.80

The unwinding of discount in the year to March 2017 represents the difference between the cashflows for the years from 2017/18 onwards discounted to 31 March 2017 at the 2016 rates and those cashflows discounted back to 31 March 2016 using the same discount rates for each financial year. The discount charge for the year to 31 March 2017 represents the effect of changes in the discount rates applying to each financial year as advised by HM Treasury. The charge has been calculated as the difference between the net present value of the liabilities at the SFP and the sum of (i) the net present value of the same liabilities discounted to 31 March 2016 at the 2016 rates and (ii) the unwinding of discount calculated as described above. The most significant factor affecting the discount charge is the increase in the negative discount rates applying to years 2017/18 – 2026/27 in accordance with the new HM Treasury discount rate schedule.

The provision is expressed in 2016/17 money values using an inflation rate of 2.3% to uplift the provision from 2015/16 values. The analysis of expected timing of discounted flows is as follows:

	Group and Authority	
	2017	2016
	£k	£k
Not later than one year	169	166
Later than one year and not later than five years	52,029	18,846
Later than five years and not later than ten years	143,930	146,248
Later than ten years and not later than twenty years	92,809	100,374
Later than twenty years and not later than fifty years	16,169	16,171
	305,106	281,805

The best estimate of the undiscounted cost of dealing with the liabilities is £266,374k (2016: £257,842k).

A letter issued by the then Secretary of State for Energy in 1986 stated that the Government was prepared to continue to accept responsibility in principle for those costs which the Authority incurs in treating and disposing of nuclear wastes and in decommissioning plant arising from:

- (i) programmes carried out by the Authority and its predecessors prior to 1 April 1986; and
- (ii) programme agreement work undertaken for BEIS and its predecessors after 1 April 1986.

These assurances were reconfirmed by BEIS in June 2017. On the basis of these assurances a matching receivable is included in the statement of financial position.

The 2017 provision includes the costs of decommissioning two new facilities - a Material Detritiation Facility (constructed during 2016/17) and a Water Detritiation System, a small extension to an existing building which was completed during 2015/16. The discounted costs of decommissioning the two facilities are estimated to be £3,090k.

UKAEA has assessed the impact of the date of JET closure, which is a key variable, on the best estimate recognised in the 2016/17 Annual Accounts. This gives a range of undiscounted and discounted costs (including the best estimate) as follows:

Undiscounted costs	£266,183k to £266,621k (2016: £257,916k to £257,655k)
Discounted costs	£301,223k to £305,178k (2016: £279,174k to £289,432k)

(b) Restructuring

The restructuring provisions represent termination benefits payable under early retirement arrangements to employees who had retired early, or had accepted early retirement, before 31 March 2017. These benefits continue at least until the date at which the employee would have reached normal retirement age, and in many cases part of the benefit is payable for life. The restructuring provisions are discounted to the reporting date at the discount rate for pension liabilities advised by HMT, which is 0.24% in 2016/17 (2016: 1.37%). The undiscounted cost of the group provisions is £54,477k (2016: £58,825k) and the benefits are estimated to be payable over a period up to 35 years.

The analysis of the expected timing of discounted flows is as follows:

	Group and Authority	
	2017	2016
	£k	£k
Not later than one year	3,723	3,869
Later than one year and not later than five years	14,094	14,190
Later than five years	35,576	34,366
	53,393	52,425

Part of the expenditure required to settle the restructuring liabilities will be reimbursed by other parties as follows:

- (i) Lump sums paid to employees on early retirement are refundable to the Group from the appropriate pension scheme at or after the date on which the individual concerned would have reached normal retirement age.
- (ii) Assurances covering restructuring provisions made before 1 April 2004 have been received from BEIS, and reconfirmed in June 2017, and expenditure related to these provisions is reimbursed by BEIS.

On the basis of these reimbursement arrangements, receivables have been included in the statement of financial position.

(c) Other provisions

The largest single provision is for £3,167k and relates to the disposal of operational waste arising from UKAEA's previous contract to operate JET, which ended in December 2014. The provision was discounted at the Treasury rates for general provisions referred to in note 20(a) above. The undiscounted cost of the provision is £3,090k. In addition, UKAEA has made provision of £535k for the eventual decommissioning of the MRF at its Culham site. The remaining provisions mainly comprise unfunded retirement benefit obligations and claims relating to industrial-related injuries.

21 Operating leases

(a) The Group as lessee

Non-cancellable operating lease rentals are payable as follows:

	2017	2016
	£k	£k
Not later than one year	204	210
Later than one year and not later than five years	17	211
Later than five years	–	–
	221	421

The Group leases vehicles and office equipment under operating leases.

(b) The Group as lessor

The Group leases its investment property with lease terms of between 0.5 and 25 years. The leases contain market review clauses in the event that the lessee exercises the option to renew. The lessee does not have an option to purchase the property at the expiry of the lease period.

The future minimum lease payments under non-cancellable leases are as follows:

	2017 £k	2016 £k
Not later than one year	967	1,375
Later than one year and not later than five years	2,065	2,629
Later than five years	55	163
	3,087	4,167

Rental income received during the year is disclosed in Note 12.

22 Related-party transactions

UKAEA is an NDPB sponsored by BEIS which is regarded as a related party. On 14 July 2016, following a machinery of Government change, a number of additional central government bodies were transferred to BEIS.

During the year, UKAEA had various material transactions with BEIS and with other entities for which BEIS is regarded as the responsible department, in particular EPSRC. STFC is UKAEA's partner in the Harwell Science and Innovation Campus Public Sector Limited Partnership (Note 13). Other material transactions took place with the Civil Nuclear Constabulary and the NDA, organisations now within the BEIS Group.

No Board member, key manager or other related party has undertaken any material transactions with the Group during the year.

23 Statutory borrowing limit

During 2016/17, the statutory borrowing limit set by Section 3 of the Atomic Energy Authority Act 1986 as amended by The United Kingdom Atomic Energy Authority (Limit on Borrowing) Order 1991 remained at £200m. There were no borrowings by UKAEA during the current or previous year.

24 Events after the reporting period date

In accordance with the requirements of IAS10, Events after the reporting period, post Statement of Financial Position events are considered up to the date on which the Accounts are authorised for issue. This is interpreted as the same date as the date of the Certificate Report of the Comptroller and Auditor General.

There were no reportable events after the reporting period date.

Glossary

AVC	Additional Voluntary Contribution	JET	Joint European Torus
AEAIL	AEA Insurance Ltd	MDF	Materials Detritiation Facility
BEIS	Department for Business, Energy and Industrial Strategy	MRF	Materials Research Facility
CRC	Carbon Reduction Commitment Energy Efficiency Scheme	MAST/MAST-U	Mega Amp Spherical Tokamak and its successor device
CETV	Cash Equivalent Transfer Value	NNUF	National Nuclear Users Facility
CEO	Chief Executive Officer	NDPB	Non-Departmental Public Body
CERN	European Laboratory for Particle Physics	NDA	Nuclear Decommissioning Authority
CCAV	Centre for Connected Autonomous Vehicles	NI	Nuclear Institute
CPS	Combined Pension Scheme	OAS	Oxfordshire Advanced Skills
CCFE	Culham Centre for Fusion Energy	OSR	Radioactive and Out of Scope of Regulations
CPAC	Culham Programme Advisory Committee	PMO	Project Management Office
DEMO	Demonstration fusion power station	PPSS	Protected Persons Superannuation Scheme
DTE2	Deuterium-tritium campaigns	PNISS	Principal Non-Industrial Superannuation Scheme
ELMs	Edge Localised Modes (plasma instabilities)	RACE	Remote Applications in Challenging Environments facility
EPSRC	Engineering and Physical Sciences Research Council	R&D	Research & Development
FReM	Government Financial Reporting Manual	RDEC	R&D Expenditure Credit
FTE	Full Time Equivalent	RAS	Robotics and Autonomous Systems
F4E	Fusion for Energy	RoSPA	Royal Society for the Prevention of Accidents
HSIC PubSp/LP	Public/private sector partnership for the Harwell joint venture	STEM	Science, Technology, Engineering and Maths
IAS	International Accounting Standards	STFC	Science & Technology Facilities Council
IET	Institution of Engineering and Technology	SIRO	Senior Information Risk Officer
IMechE	Institution of Mechanical Engineers	SPPP	Shift Pay Pension Savings Plan
IoP	Institute of Physics	SFP	Statement of Financial Position
IFRS	International Financial Reporting Standards	UKAEA	UK Atomic Energy Authority
ITER	Next generation international experimental fusion reactor		





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