RADIOACTIVE WASTE MANAGEMENT PROGRAMMES IN OECD/NEA MEMBER COUNTRIES

UNITED KINGDOM
[2011]

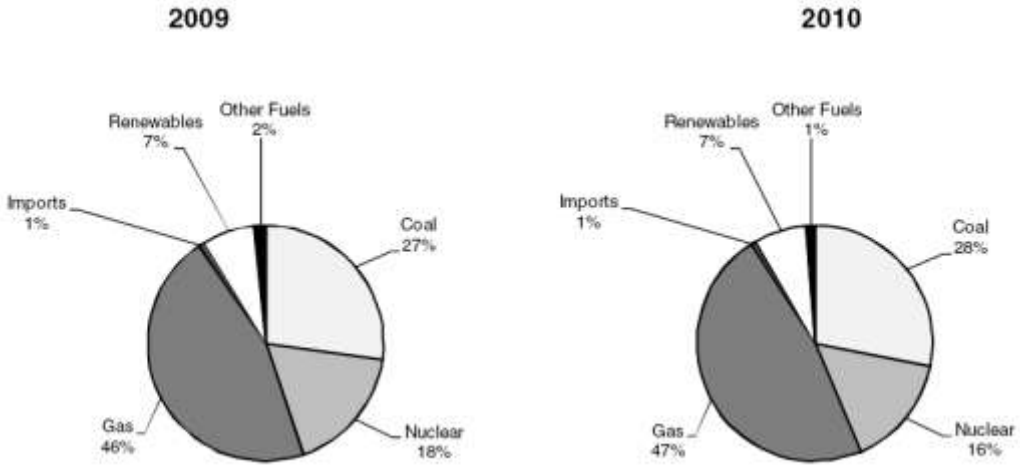
NATIONAL NUCLEAR ENERGY CONTEXT

Commercial utilisation of nuclear power in the United Kingdom started in 1956 and as of 2009 there are 23 nuclear power units connected to the electricity grid.

The UK Government published its Energy White Paper "**Meeting the energy challenge: a white paper on nuclear power**" in January 2008. This stated that nuclear should be part of the UK's low-carbon energy mix, that companies should have the option of building new nuclear power stations, and that the UK Government should take facilitative actions to enable this to happen.

Against the challenges of climate change and security of supply the UK Government believes that nuclear is an important part of our energy policy, alongside reducing our energy use, increasing renewables, and investing in new technologies.

Breakdown in electricity sources by % (From DUKES, 2011)



SOURCES, TYPES AND QUANTITIES OF WASTE

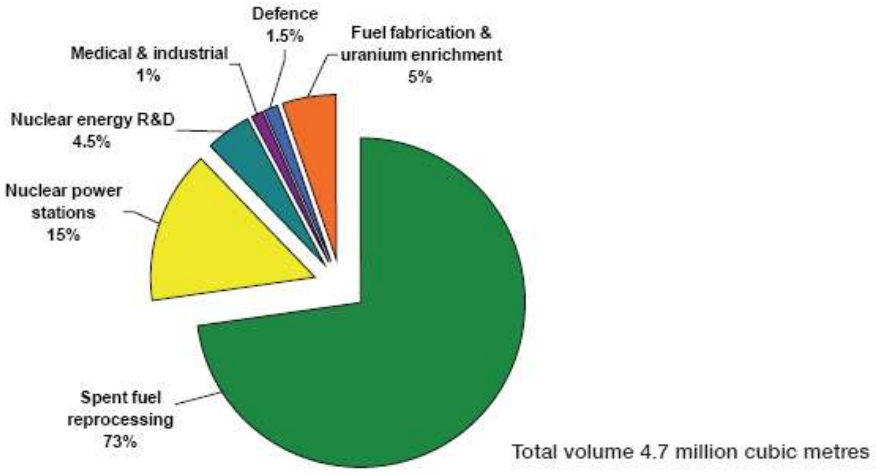
Radioactive wastes arise from the generation of electricity in nuclear power stations and from the associated fuel cycle, from the use of radioactive materials in industry, medicine and research, and from military nuclear programmes. There is a wide range of wastes, from those that contain high concentrations of radioactive materials, to general industry and laboratory wastes which are only lightly contaminated with activity. They can arise in solid, liquid or gaseous form. Some wastes, mainly gases and liquids containing very low concentrations of activity, may be routinely discharged to the environment in accordance with UK Government regulatory arrangements in the UK. Discharges are made within authorised limits, usually after some form of treatment. Radioactive wastes with higher contents of activity, which could lead to these limits being exceeded, cannot be discharged. In accordance with Government policy, these non-dischargeable wastes are either disposed of as solid wastes at authorised sites for low-level waste, or where suitable sites are not yet available, held in storage until such sites are developed for the long-term management of intermediate- and high-level waste.

In the UK, radioactive waste is classified under the following broad categories, according to its heat-generating capacity and activity content: as high-level, or heat-generating waste (HLW); intermediate-level waste (ILW); low-level waste (LLW); and very low-level waste (VLLW). Two sub-categories are recognized: low volume VLLW arising from, for example, hospitals and universities, that can be safely disposed of with ordinary refuse (so-called "dust-bin disposal") and high volume VLLW arising from, for example, nuclear decommissioning, which requires controlled disposal.

Stocks and forecast future arisings of radioactive wastes are recorded in the UK Radioactive Waste Inventory, compiled periodically by the Department Energy and Climate Change (DECC) and the Nuclear Decommissioning Authority. The 2010 UK Radioactive Waste Inventory recorded that approximately 5.03 million m^3 of radioactive waste existed as at 1 April 2010 or was predicted to arise from the future operation of existing facilities (volumes expressed in terms of packaged waste). Of this 4.55 million m^3 was LLW, 488,000 m^3 was ILW and 1330 m^3 as HLW.

Expressed in terms of stored volume the total of all waste categories is about 4.7 million m^3 and 97% of this total has already been produced. Some waste has been processed, and is being held in stores, but most of it is contained within existing nuclear reactors and other nuclear facilities and will not be processed until these are shut down and dismantled. This waste is the legacy of past and current civil and military nuclear programmes.

As stored waste volumes from each activity from existing facilities (as of 1 April 2010) is as follows:



More information on the UK's radioactive waste inventory is available from http://www.nda.gov.uk/ukinventory/

RADIOACTIVE WASTE MANAGEMENT POLICIES AND PROGRAMMES

Waste management policies

The UK is a Contracting Party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management and its Convention on Nuclear Safety. As a Member State, it is also legally bound to adhere to the laws and standards of the European Union in the way its radioactive wastes are managed. The key principles are as follows:

- Radioactive wastes are not unnecessarily created.
- Wastes are safely and appropriately managed and treated.
- These wastes are safely disposed of at appropriate times and in appropriate ways.
- The policy for the management of radioactive waste is devolved in the UK to the Scottish, Welsh and Northern Ireland governments. The UK Government is responsible for policy in England. The term "the Government" is used where statements apply to all four governments.

Managing Radioactive Waste Safely

In October 2006 the Government accepted the recommendations of the independent Committee on Radioactive Waste Management (CoRWM) on geological disposal, coupled with safe and secure interim storage for legacy wastes. It also supported the recommendation to explore how a site selection approach based on voluntarism (an expression of interest by local communities in hosting a facility) and partnership with local communities could work in practice.

In June 2008 the UK Government and devolved administrations for Wales and Northern Ireland published the Managing Radioactive Waste Safely (MRWS) White Paper setting out a framework for implementing geological disposal for higher activity wastes. The Welsh Government reserved its position on the policy of geological disposal in the 2008 White Paper.

The process to site a facility will be staged and based on voluntarism and partnership with local communities. Coupled with the White Paper, Local Authorities in England were invited to enter discussions with Government, without commitment, about hosting a geological disposal facility. Welsh authorities were informed, and may choose to enter into discussions, though the Welsh Government has currently reserved its position on geological disposal. The Scottish Government is not a sponsor of the geological disposal element of the MRWS programme but continues to support long-term interim storage for higher activity radioactive waste and an on-going programme of research and development.

To date three local authorities have expressed an interest in entering into, without commitment, discussions with Government about the possibility of hosting a geological disposal facility for higher activity waste. These discussions are continuing.

The White Paper also set out that the Nuclear Decommissioning Agency (NDA) will be the implementing organisation, responsible for planning and delivering the geological disposal facility. The NDA already provides interim storage of waste on its sites and will continue to do so for as long as it takes to site and construct a geological disposal facility. The NDA will also undertake a programme of research and development to support optimised delivery of geological disposal and interim storage.

The Scottish Government did not sponsor the MRWS White paper and has developed it own policy which it published in January 2011. The Scottish Government Policy is that the long-term management of higher activity radioactive waste should be in near-surface facilities. Facilities should be located as near to the site where the waste is produced as possible. Developers will need to demonstrate how the facilities will be monitored and how waste packages, or waste, could be retrieved.

The Scottish Government published its policy on higher-activity radioactive waste in January 2011 that the long-term management of higher-activity waste (HAW) should be in near-surface facilities. Facilities should be located as near as possible to the site where the waste is produced, and developers will need to demonstrate how the facilities will be monitored and how waste packages, or waste, could be retrieved. All long-term waste management options will be subject to robust regulatory requirements.

The Scottish Government continues to support the CoRWM recommendations for a robust programme of interim storage for higher-activity wastes and an ongoing programme of research and development and continues to endorse the UK-wide low-level waste policy (LLW) published in March 2007[14].

Low-level waste policy

In 2007 the Government issued a UK policy for managing solid low level radioactive waste in the UK setting out priorities for managing existing and future wastes from the nuclear energy industry and other sources.

The NDA published the UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry in August 2010. Also in line with the policy, Government is planning to publish a non-nuclear industry strategy.

The NDA will also develop and publish a plan for the optimal use of the country's existing LLW repository near Drigg, Cumbria

Finally, the revised UK Strategy for Radioactive Discharges 2002-2020 was published in July 2009 with the aim of achieving progressive and substantial reduction of radioactive discharges and discharge limits so as to meet the UK's commitments under the OSPAR Convention.

PROGRAMMES AND PROJECTS

Low-level waste (LLW)

Most LLW is routinely disposed of at the LLW Repository Ltd near Drigg in Cumbria. Disposal of some LLW, mainly from outside the nuclear industry, is permitted at suitable landfill sites. In early 2011, the Environment Agency granted environmental permits for disposal of high volume very LLW at two landfill sites, one at Lillyhall in Cumbria and one at Kingscliffe in Northamptonshire. Most of the high volume very LLW for disposal at these two sites will arise from decommissioning of nuclear sites.

Planning consent was granted on 21 April 2009 for the construction of a new LLW disposal facility adjacent to the decommissioning reactor research site at Dounreay. In November 2010, the Scottish Environment Protection Agency (SEPA) received an updated application under from DSRL for an authorisation to dispose of solid low-level radioactive waste in the proposed new disposal facilities. SEPA is reviewing the application and planning to start a public consultation on the draft authorisation in October 2011.

Intermediate-level waste (ILW)

Most ILW is stored at the site where it has been produced. Of the ILW stocks declared in the 2010 UK Inventory (wastes arisen by April 2010), 70% was at Sellafield. Much of the rest is held at nuclear power stations of the Magnox design, the nuclear research sites at Dounreay, Harwell and Winfrith, and the Atomic Weapons Establishment at Aldermaston. Waste treatment and packaging programmes are underway and, up to April 2010, about 23% of declared stocks had been conditioned. There is an emphasis on putting the waste into a passively safe form that will be placed in interim storage until final long-term management options have been identified and implemented under the "Managing Radioactive Waste Safely" programme.

High-level waste (HLW)

HLW arises from the reprocessing of spent nuclear fuel. In 2010, all the existing UK stock is held at Sellafield. The HLW from reprocessing arises in liquid form and thereafter undergoes conditioning for long-term management by conversion into a glass, by a process called vitrification. The mass of conditioned HLW at 1 April 2010 was 2,000 tonnes. A further 1,300 tonnes of liquid waste remained to be conditioned by being converted into a glass form. Once all waste at 1 April 2010 and projected future arisings of liquid waste and contaminated scrap items are conditioned the total mass will be 3,300 tonnes. This does not include HLW that will be returned to reprocessing customers in line with Government Policy. Current Government policy is that the vitrified waste should be stored for at least 50 years to allow the heat to decline so as to make long-term management less complex. This should provide sufficient time for a final management solution for the waste to be implemented under

the “Managing Radioactive Waste Safely” programme.

Other potential wastes

In February 2011, the UK Government published, for public scrutiny and consultation, its proposed approach to the long-term management of civil plutonium. This proposed approach recognises that, in view of the non-proliferation and security concerns in relation to plutonium, the Government has a duty to develop a long-term vision for its future handling.

The UK’s current policy is for long-term storage in safe and secure purpose-built facilities, pending a final decision on the best management solution. The UK Government’s preliminary view is that the best prospect of delivering a long-term solution for plutonium management is through reusing the plutonium to make MOX fuel. This preliminary view will be conditional in that it will have to be tested to show that it is affordable, deliverable and offers value for money, taking into account safety and security requirements, before the UK Government will be in a position to take a final view.

RESEARCH and development

FUNCTIONS and responsibilities

Within the UK, each of the component parts of industry, the regulatory bodies and the Government have responsibility for commissioning and funding the research and development necessary to support their respective functions in relation to radioactive waste management.

The NDA also has supplemental functions in this area under the Energy Act 2004 of “carrying out research into matters relating to the decommissioning of nuclear installations, the cleaning up of nuclear sites and the other activities in relation to which it has functions.” To help with this role a Research Board on Decommissioning and Clean-up in the UK is being established.

The UK Government recognises that, in addition to research to support the day-to-day work of the industry, the regulators and Government, there is a need for basic research of a more strategic and long-term nature. Such work is funded by various Research Councils, whose role is to sponsor such work within a range of academic, educational and training organisations.

DECOMMISSIONING AND DISMANTLING POLICIES AND PROJECTS

The Government believes that, in general, the process of decommissioning nuclear plants should be undertaken as soon as reasonably practicable, taking account of all relevant factors. Such factors include the potential hazards posed to the public, workers and the environment, and the benefits obtainable from radioactive decay in this regard, the availability of disposal routes for the wastes and, subject to ensuring public safety, the financial implications of proceeding on different timescales.

Each operator is expected to produce and maintain a decommissioning strategy and plans for its sites. The Government expects that those strategies and plans will take into account the views of stakeholders (including relevant local authorities, public and stakeholder groups). Strategies should include a comprehensive site decommissioning plan for safely carrying out the decommissioning process with due regard to security and protection of the environment. Each plan should take into account any proposed future use of the site in question.

Decommissioning activities at many of the UK's older nuclear sites are now well underway. Some examples are:

- The identification of preferred end states for each of the NDA's sites following engagement with local communities.
- Successful demolition of the former plutonium criticality facility at Dounreay, the completion of the isolation of the Dounreay shaft and the disposal of bulk sodium coolant from the Prototype Fast Reactor.
- Demolition of the former uranium purification facility at Sellafield and the commencement of construction of the sludge packaging plant which will enable safer storage of legacy wastes.
- The first movement of sludge from the Windscale Pile fuel Storage Pond to interim buffer storage, starting the process of desludging one of the highest hazard facilities at Sellafield.
- The completion of the post operational clean out of the Magnox fuel Fabrication Plant and Springfields and the commencement of its decommissioning.
- Demolition of redundant diffusion plant structures at Capenhurst completing all demolition projects on the site.
- Completion of the decommissioning of the Active Handling facility at Winfrith and the release of land for the development of a Science and Innovation Campus at Harwell. .
- Removal of all remaining fuel skips at Hunterston and Hinkley Point A and the emptying of all the residual reactor waste form the vaults at Trawsfynydd. The commissioning of the Intermediate Level Waste Store at Hunterston.
- the explosive demolition of the cooling towers at Chapelcross and Calder Hall decommissioning power stations.
- Planning permission has been secured for the LLW facility at Dounreay and the construction of Vault 9 has begun at the LLW Repository near Drigg in Cumbria.

Responsibility for decommissioning the UK's publicly-owned civil nuclear sites resides with the NDA.

TRANSPORT

Transport of radioactive material, including waste and spent fuel, is controlled by a comprehensive set of regulations covering transport by road, rail, air and sea, for which the Department for Transport is currently responsible (see Competent Authorities below). The basis for these regulations is the International Atomic Energy Agency Regulations for the Safe Transport of Radioactive Materials.

At present, radioactive waste is transported for storage at suitable facilities, for disposal at the LLW disposal facility near Drigg or at landfill sites, or by incineration. Waste is generated by a large number of organisations ranging from nuclear installations to hospital radio-pharmacies.

At present, with the exception of small amounts of ILW, only low-level radioactive waste is transported. Such movements are not notifiable to the UK competent authority under UK law. The majority of waste is transported by road, and only small amounts are transported by rail.

COMPETENT AUTHORITIES

In February 2011, the UK Government announced its intention to bring forward legislation to create a new independent nuclear regulator, the **Office for Nuclear Regulation (ONR)**. ONR, which was formed on 1 April 2011 as an Agency of the **Health and Safety Executive (HSE)**, will function as a sector-specific regulator of the nuclear industry. It has taken on the relevant functions previously carried out by the HSE's Nuclear Directorate and the Department for Transport's Radioactive Materials Transport Team, which is responsible for the transport of radioactive, material by road, rail or inland waterway, thereby bringing together civil nuclear and radioactive transport safety and security regulation into one place.

As an interim measure and until the legislation can be enacted, ONR will operate as an Agency of the HSE. When the legislation comes into force (expected to be in April 2013), the ONR will become a separate statutory body and will be formally responsible in law for delivering its regulatory functions.

These changes to the regulatory body will not affect the current regulatory requirements or standards with which the nuclear industry must comply.

The **Office for Nuclear Regulation (ONR),** an Agency of the **Health and Safety Executive (**HSE), regulates the management of radioactive waste on nuclear sites, including disposal facilities. ONR issues nuclear site licences under the *Nuclear Installations Act 1965 (NIA65)*. Under NIA65, no site can be used for the purpose of installing or operating a nuclear installation unless a nuclear site licence is currently in force, granted by ONR. Before being licensed, the operators must show that the site will be run safely and that they will be able to deal with the liabilities when the site is finally shut down. ONR must consult the **Environment Agency**, for England and Wales, and the **Scottish Environment Protection Agency**, for Scotland, before granting a licence. In addition to the responsibilities mentioned above, ONR provides advice on matters within their remit as required, or when requested, to other bodies, government and the public. ONR takes an active part in international co-operation and development, contributing to international standards, taking part in meetings of European and world regulators, and negotiating and implementing bilateral information exchange agreements with other national regulators.

The **Office for Nuclear Regulation (ONR)**, as an Agency of the HSE, regulates the management of radioactive waste on nuclear sites. The ONR issues nuclear site licences under the *Nuclear Installations Act 1965 (NIA65)*. Before being licensed, the operators must show that the site will be run safely and that they will be able to deal with the liabilities when the site is finally shut down. The ONR must consult the **Environment Agency**, for England and Wales, and the **Scottish Environment Protection Agency (SEPA)**, for Scotland, before granting a licence.

Disposal of radioactive waste from nuclear licensed sites and radioactive waste disposal facilities are regulated by the Environment Agency in England and Wales under the Environmental Permitting (England and Wales) Regulations 2010 (EPR10) and by SEPA in Scotland under the Radioactive Substances Act 1993 (RSA93). There are no nuclear sites in Northern Ireland.

The environment agencies (The Environment Agency, the Scottish Environment Protection Agency for Scotland and the Northern Ireland Environment Agency) are also responsible for regulation of non-nuclear facilities such as hospitals, universities and manufacturing industries. Such facilities must have an environmental permit under the EPR10 in England and Wales or an authorisation under RSA93 in Scotland and Northern Ireland for the keeping and use of radioactive materials and for the accumulation and disposal of radioactive waste.. Users of mobile radioactive apparatus must hold an environmental permit under EPR10 in England and Wales or be registered under the RSA93 in Scotland and

Northern Ireland. Environmental permits, authorisations, and registrations granted by the environment agencies set out limitations and conditions relating to the control of radioactive materials and waste.

Under the EPR10 in England and Wales, the developer of a geological disposal facility would require an environmental permit to be granted by the Environment Agency before starting intrusive site investigation, such as drilling boreholes, at any candidate site.

The **Nuclear Decommissioning Authority (NDA)** was established in 2005 to take responsibility for the sites operated by BNFL and UK Atomic Energy Authority. These sites are now managed under contracts with the NDA and both the LLW Repository near Drigg and Sellafield have been subject to open competition. The programme to complete the Dounreay site has begun and will be followed by a competition for the Magnox North and South sites and the Reactor Research Sites in England.

FINANCING

General policy in the UK is that producers and owners of radioactive waste are responsible for bearing the costs of managing and disposing of their waste, including the costs of regulation and of any regulatory-related research undertaken by themselves or by the regulatory bodies. They should calculate the cost of radioactive waste management and disposal liabilities before these are incurred and make appropriate financial provisions for meeting them. They should also regularly review the adequacy of these provisions. Producers and owners of radioactive waste are also responsible for developing their own waste management strategies, and for consulting the Government, regulatory bodies and disposal organisations as appropriate.

The costs of reprocessing and storage of spent nuclear fuel, and the long-term storage, treatment and eventual disposal of radioactive waste from reprocessing fuel, are to be met by the utilities that own it. The UK policy for funding research and development is that each of the component parts of the nuclear industry, the regulatory bodies and the Government itself should continue to be responsible for commissioning and funding the research and development necessary to support their own respective functions in relation to radioactive waste management.

The NDA has responsibility for contracting the operation of commercial and waste management operations on designated sites and for the eventual decommissioning of those sites. The current estimate for the cost of the clean-up programme for these sites is around £50 billion and the programme is likely to take over 100 years to complete. NDA is exploring ways in which the cost can be reduced and the timescales shortened, whilst still maintaining safety, security and environmental standards.

The NDA is funded directly by the UK Government and from income from commercial operations such as electricity generation, fuel fabrication and spent fuel management on its sites. Initially it is revenue from commercial operations made up approximately half of the NDA's total budget although this proportion will reduce over time as operational facilities enter decommissioning.

As part of the Government's 2010 Spending Review, NDA received a budget in the region of £3 billion a year, some of which depends on the level of receipts from commercial activities such as electricity generation, fuel fabrication and spent fuel management. Revenue from commercial operations will make up approximately 40% of NDA's total budget although this proportion will reduce over time as currently operational facilities move into the decommissioning phase.

PUBLIC INFORMATION

For more information, the websites of the relevant authorities and organisations are listed below.

Government

Department of Energy and Climate Change
London
Website: http://www.decc.gov.uk/
E-mail: enquiries@decc.gsi.gov.uk

Department for Environment, Food and Rural Affairs
Radioactive Substances Division London
Website: www.defra.gov.uk
E-mail: helpline@defra.gsi.gov.uk

Department for Transport
Radioactive Material Transport Division
London
Website: http://www.dft.gov.uk/

Scottish Government Radioactive Waste Team
Environmental Quality Division
Edinburgh
Website: http://www.scotland.gov.uk/
E-mail: radioactivewasteteam@scotland.gsi.gov.uk

Welsh Government
Sustainable Places Division
Cardiff
Website: http://www.wales.gov.uk/
E-mail: webmaster@wales.gsi.gov.uk

Office for Nuclear Regulation
An agency of HSE
Bootle
Website: http://www.hse.gov.uk/nuclear/index.htm

Environment Agency
Radioactive Substances Regulation,
Bristol
Website: www.environment-agency.gov.uk
E-mail: enquiries@environment-agency.gov.uk

Scottish Environment Protection Agency
Radioactive Substances Regulation
Stirling
Website: www.sepa.org.uk
E-mail: public.relations@sepa.org.uk

Northern Ireland Environment Agency
Industrial Pollution and Radiochemical Inspectorate
Radioactive Substances Regulation
Belfast
Web site: www.doeni.gov.uk/niea/
E-mail: ipri@doeni.gov.uk
E-mail:nieainfo@doeni.gov.uk

Northern Ireland Environmental Policy Division
Belfast
Web site: www.doeni.gov.uk/

Nuclear Decommissioning Authority

Cumbria
Website: www.nda.gov.uk
E-mail: enquiries@nda.gov.uk
Food Standards Agency
Radioactivity in Food
London
Website: http://www.foodstandards.gov.uk/
E-mail: radiation@foodstandards.gsi.gov.uk

Industry
UKAEA Ltd
Didcot,
Oxfordshire
Website: http://www.ukaea.co.uk/
British Energy plc
Gloucester
Website: www.british-energy.com
Sellafield Limited
Seascale,
Cumbria
Website: http://www.sellafieldsites.com/