Title: Euratom Nuclear Safeguards **IA No:** BEIS032(F)-17-ESNM **RPC Reference No:** RPC-4180(1)-BEIS **Lead department or agency:** BEIS **Other departments or agencies:** ONR and DExEU	Impact Assessment (IA) **Date:** 08/12/2017 **Stage:** Final **Source of intervention:** Domestic **Type of measure:** Primary legislation **Contact for enquiries:** Joel Davis, BEIS
Summary: Intervention and Options	**RPC Opinion: Green**

Cost of Preferred (or more likely) Option				
Total Net Present Value	**Business Net Present Value**	**Net cost to business per year** (EANDCB in 2014 prices)	**One-In, Three-Out**	**Business Impact Target Status**
n/a	n/a	n/a	Not in scope	n/a

What is the problem under consideration? Why is government intervention necessary?

The civil nuclear sector is subject to robust international non-proliferation measures, which include nuclear safeguards. Nuclear safeguards are reporting and verification processes by which states demonstrate to the international community that civil nuclear material is not diverted into military or weapons programmes. These safeguards consist of processes including nuclear material accounting and inspections at civil nuclear sites. Nuclear safeguards arrangements are essential to enable the UK to engage in civil nuclear trade, allowing nuclear generation to play an important role in energy security and decarbonisation objectives, and to fulfil international standards as a responsible nuclear state, which are an important part of the international non-proliferation regime to prevent the spread of nuclear weapons. The UK's current nuclear safeguards obligations are fulfilled through the UK's membership of the European Atomic Energy Community (Euratom). A new safeguards regime is needed to continue meeting international standards following withdrawal from the Euratom Treaty. Leaving Euratom is as a result of the decision to leave the EU as they are uniquely legally joined. There are no precedents for a non-EU Member State being a Member State of Euratom, so when we formally notified our intention to leave the EU we also commenced the process for leaving Euratom.

What are the policy objectives and the intended effects?

The policy objective is to ensure arrangements are in place to fulfil international nuclear safeguard standards. These arrangements form an essential part of the global nuclear non-proliferation regime, to which the UK is committed. Our future arrangements will need to be robust and as comprehensive as the current Euratom regime to enable public confidence in the continued high standards and give international partners confidence in engaging in civil nuclear trade with the UK, many of whom require this to agree nuclear cooperation agreements; to support the UK's ongoing commitment to the global non-proliferation regime; show that the UK is a responsible nuclear state, and; to avoid weakening the UK's international reputation as a non-proliferation leader.

The primary legislation this impact assessment supports will not impose any obligations on holders of nuclear material or on the nuclear industry, thus the impacts of primary legislation are zero. This Bill enables the UK to set up a domestic safeguards regime. This Bill also ensures the Office for Nuclear Regulation (ONR) will be in a position to take on the role and responsibilities required to help ensure the UK's domestic civil nuclear safeguards regime meets international safeguards standards. The secondary legislation will implement the specific requirements on industry. This impact assessment provides indicative impacts of safeguards: however, our assessment will be subject to further refinements for secondary legislation.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

For the UK to fulfil international standards on nuclear safeguards and non-proliferation once it leaves the EU, the existing legislative framework must be amended, with a new regime set out in new secondary legislation. In the absence of amending frameworks and work to implement new safeguards measures, the UK would be without an effective nuclear safeguards regime. This scenario is the relevant counterfactual for policy appraisal given the decision to leave Euratom has already been taken and domestic safeguards appraised here are not dependant on the future relationship with the EU. However we have also included a counterfactual of 'current Euratom regime' to compare impacts relative to the current regime under Euratom. The UK's withdrawal from Euratom has already been triggered so this is only included as baseline for consistency with other EU exit related measures where legislation may be dependent on the negotiated outcomes on future relationship with the EU.

Two core options have been considered:

Option 1 Adopt domestic standards of nuclear safeguards of broad equivalence to those adopted by Euratom. This would ensure that sites to which safeguards apply remain subject to detailed oversight and that the UK continues to maintain the highest standards of nuclear safeguards. *This is the preferred option as it best retains industry, public and international confidence in a robust safeguard regime. The Nuclear Safeguards Bill, and the regime that we propose to implement through it, will work to deliver this option*

Option 2 which fulfils nuclear safeguards standards, without replicating Euratom's standards. All civil nuclear facilities to which safeguards apply would remain subject to a robust safeguards regime. This option would however entail a reduction in the frequency and intensity of inspection at UK nuclear facilities, while still maintaining compatibility with IAEA standards.

Will the policy be reviewed? It will be reviewed. If applicable, set review date: April/2024

Does implementation go beyond minimum EU requirements?		N/A		
Are any of these organisations in scope? (under option 1)	**Micro** Yes	**Small** Yes	**Medium** Yes	**Large** Yes
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)		**Traded:** n/a	**Non-traded:** n/a	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible : Richard Harrington **Date :** 11/12/2017

Summary: Analysis & Evidence

Policy Option 1

Description: **Replication of standards broadly equivalent to Euratom Safeguards Standards**

FULL ECONOMIC ASSESSMENT

Price Base Year: 2012	PV Base Year: 2012	Time Period Years: 38	Net Benefit (Present Value (PV)) (£m)		
			Low: n/a	**High:** n/a	**Best Estimate:** n/a

COSTS (£m)	Total Transition (Constant Price) Years		Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	n/a	n/a	n/a	**n/a**
High	n/a		n/a	**n/a**
Best Estimate	n/a		n/a	**n/a**

Description and scale of key monetised costs by 'main affected groups'

The monetised costs include the administrative expenditure of governing a safeguards regime to ONR (Office for Nuclear Regulation). These costs span items such as staff costs, expenses for inspections, governance and insurance. The costs of providing safeguards are based on an extrapolation of Euratom costs and remain constant going forward. The high cost scenario is higher due to some reduction in economies of scale. There are estimated to be one-off transitional costs as the UK creates the necessary institutional arrangements for the ONR to provide safeguards. It is assumed in this IA that these costs will continue to be funded by the taxpayer although this is not a definitive statement of policy. Relative to the 'Do Nothing' counterfactual these costs are estimated to be £9.5m pa with an additional £2.5m for a transition period of 2 years. Relative to the 'current Euratom regime' counterfactual, costs are just the estimated transition costs of £2.5m for 2 years.

Compliance costs faced by nuclear operators include: nuclear material accounting and reporting; facilitating verification inspections and the provision of the systems supporting safeguards. It should be noted that this burden is a very small proportion of the overall costs and benefits. These combined impacts are estimated to cost around £5m pa relative to the 'Do Nothing' counterfactual. Relative to the 'current Euratom regime' counterfactual there are no additional monetised compliance costs.

Other key non-monetised costs by 'main affected groups'

There will be familiarisation costs relative to both policy options. We expect these to be minimal as secondary legislation is being designed in consultation with industry to minimise changes for them. However, relative to the 'current Euratom regime' counterfactual there are potential efficiency gains from the regulator delivering more services in parallel to the industry as the ONR already provides services for nuclear safety, security, and transport regulation.

BENEFITS (£m)	Total Transition (Constant Price) Years		Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	n/a	n/a	n/a	**n/a**
High	n/a		n/a	**n/a**
Best Estimate	n/a		n/a	**n/a**

Description and scale of key monetised benefits by 'main affected groups'

The benefits relative to the 'Do Nothing' counterfactual where the UK has no nuclear safeguards regime in place relate to the avoidance of costs. These avoided costs could be very large but we have not monetised them here; they are summarised in the non-monetised benefits box below. There are minimal impacts from the policy options relative to safeguards under the current Euratom regime as both options provide safeguards and allow the nuclear sector to continue functioning.

There are no monetised benefits of the policy option relative to the 'current Euratom regime' counterfactual.

Other key non-monetised benefits by 'main affected groups'

Relative to the 'do nothing' counterfactual, the benefits measured here relate to the avoidance of very large costs in a scenario where the UK has no nuclear safeguards regime in place. These costs include the loss of trade in nuclear material and equipment, and its impact on the power sector (including generation costs, associated fuel industry, R&D, decommissioning) reputational impacts and the risk of nuclear proliferation. In addition the removal of nuclear power from the electricity generation mix in the counterfactual may reduce the UK's optionality for ensuring security of supply and decarbonising the power sector. Potentially a greater share of future decommissioning costs will need to be recovered from the government in the absence of funds from new nuclear.

Maintaining standards broadly equivalent to Euratom's high standards will ensure that the UK maintains the highest standards of nuclear safeguards and enable us to continue to take a leading role in future non-proliferation negotiations. For example, on the Iran nuclear deal where the UK played a leading role in extending IAEA coverage and verification activities in Iran. Future relationships with the EU are still to be negotiated but the UK continues to support Euratom. The Government has made clear it wants a constructive and mutually beneficial relationship in the future. Benefits of Option 1 relative to the counterfactuals are therefore to enable public, trading partner and international confidence of a robust safeguards regime as comprehensive as that currently provided by Euratom. These benefits of maintaining standards broadly equivalent to Euratom's are why Option 1 is preferred to Option 2 despite slightly higher monetised costs.

Key assumptions/sensitivities/risks	**Discount rate (%)**	3.5%

The Government's published position on power sector decarbonisation has been used. In the absence of nuclear generation in the counterfactual, the risks to security of supply are partially managed through the Capacity Market.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:	**Score for Business Impact Target (qualifying provisions only) £m:** Insert

Summary: Analysis & Evidence

Policy Option 2

Description: **Compatibility with IAEA standards (less intensive standards than Euratom equivalent)**

FULL ECONOMIC ASSESSMENT

Price Base Year: 2012	PV Base Year: 2012	Time Period Years: 38	Net Benefit (Present Value (PV)) (£m)		
			Low: n/a	**High:** n/a	**Best Estimate:** n/a

COSTS (£m)	Total Transition (Constant Price) Years		Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	n/a	n/a	n/a	**n/a**
High	n/a		n/a	**n/a**
Best Estimate	n/a		n/a	**n/a**

Description and scale of key monetised costs by 'main affected groups'

The costs of providing safeguards are again based on an assessment of current costs and an assessment by the ONR. In this option, the costs are similar to Option 1 although both the frequency of and industry engagement during nuclear site inspections will be less intensive than at present, which is estimated to reduce the operating costs. Relative to the 'Do Nothing' counterfactual these costs are estimated £7m pa with an additional £2.5 for a transition period of 2 years. Relative to the 'current Euratom regime' counterfactual, there are cost savings estimated at £2.5m pa and transition costs of £2.5m for 2 years.

The cost of the compliance with nuclear material accounting and reporting and the provision of the systems supporting safeguards will be in line with Option 1. There is a marginal reduction for operators in the cost of facilitating verification inspections. It should be noted that this burden is a very small proportion of the overall costs and benefits. These combined benefits are estimated to be in the region of around £2m pa relative to the 'Do Nothing' counterfactual. Relative to the 'current Euratom regime' counterfactual there are compliance costs savings of £3m pa.

Other key non-monetised costs by 'main affected groups'

There will be familiarisation costs relative to both counterfactuals. We expect these to be minimal as secondary legislation is being designed in consultation with businesses to minimise changes for them. However, relative to the 'current Euratom regime' counterfactual there are potential efficiency gains from the regulator delivering more services in parallel to the industry as the ONR already provides services for nuclear safety, security, and transport regulation

BENEFITS (£m)	Total Transition (Constant Price) Years		Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	0	0	0	**0**
High	0		0	**0**
Best Estimate	0		0	**0**

Description and scale of key monetised benefits by 'main affected groups'

The benefits relative to the 'do nothing' counterfactual where the UK has no nuclear safeguards regime in place relate to the avoidance of costs. These avoided costs could be very large but we have not monetised them here; they are summarised in the non-monetised benefits box below. There are minimal impacts from the policy options relative to safeguards under the current Euratom regime as both options provide safeguards.

There are no monetised benefits of the policy option relative to the 'current Euratom regime' counterfactual.

Other key non-monetised benefits by 'main affected groups'

Relative to the 'Do Nothing' counterfactual, the benefits measured here relate to the avoidance of very large costs in a scenario where the UK has no nuclear safeguards regime in place. These costs include the loss of trade in nuclear material and equipment, and its impact on the power sector (including generation costs, associated fuel industry, R&D, decommissioning) reputational impacts and the risk of nuclear proliferation. In addition the removal of nuclear power from the electricity generation mix in the counterfactual may reduce the UK's optionality ensuring security of supply and decarbonising the power sector. Potentially a greater share of future decommissioning costs will need to be recovered from the government in the absence of funds from new nuclear.

This would reduce the burden on industry and the regulator due to a reduction in site inspections, although it should be noted that this burden is a very small proportion of the overall costs and benefits. This approach is consistent with

what is done in some other nuclear weapon states such as the USA. This is a proportionate approach and will allow the UK to comply with international standards for nuclear weapon states.

Future relationships with the EU are still to be negotiated. Benefits of Option Two relative to the counterfactuals are therefore to enable public, trading partner and international confidence of a robust safeguard regime although without the added benefit of Option 1 where it is robust and as comprehensive as Euratom standards as possible.

Key assumptions/sensitivities/risks	**Discount rate (%)**	3.5%

The Government's published position on power sector decarbonisation has been used. In the absence of nuclear generation in the counterfactual, the risks to security of supply are partially managed through the Capacity Market.

BUSINESS ASSESSMENT (Option 2)

Direct impact on business (Equivalent Annual) £m:			**Score for Business Impact Target (qualifying provisions only) £m:** n/a
Costs: n/a	Benefits: n/a	Net: n/a	

1. Overview

1.1 On March 29th 2017 the UK Government formally notified the European Commission of its intention to withdraw from the European Union (EU) and the European Atomic Energy Community (Euratom) and. This notification was authorised by Parliament through the European Union (Notification of Withdrawal) Act 2017. Leaving Euratom is as a result of the decision to leave the EU as they are uniquely legally joined. There are no precedents for a non-EU Member State being a Member State of Euratom, so when we formally notified our intention to leave the EU we also commenced the process for leaving Euratom.

1.2 Euratom covers a range of areas of civil nuclear activity. The focus of this assessment is on safeguards, non-proliferation arrangements, and its interdependencies with nuclear trade. Other areas covered by the Euratom Treaty, but largely outside the scope of this Impact Assessment, include nuclear safety, research and development, transport and waste. In order for the UK to continue to meet its international commitments following its withdrawal from Euratom, an alternative nuclear safeguards regime is be required. **The scope of this IA is limited to establishing a new domestic safeguards regime following the withdrawal from Euratom.** Although there are several other aspects to Euratom, the scope of this IA is limited to the scope of the Bill it supports. The broader Euratom withdrawal programme considers issues such as Nuclear Cooperation Agreements; negotiations with Euratom on issues including ownership of fissile material; research and development; transport regulations; and impact on overseas territories. Where appropriate further impact assessments covering these other aspects of Euratom withdrawal will be undertaken.

1.3 The Bill this Impact Assessment supports will not itself impose any obligations on holders of nuclear material or on the nuclear industry, nor will it impose reporting or inspection requirements until the domestic regime is put in place by secondary legislation. Therefore the impacts of primary legislation are zero. This Bill will provide the appropriate powers to implement a domestic safeguards regime through secondary legislation, to be regulated by the ONR. Secondary legislation will implement the details of the regime and will impose reporting obligations on industry. We provide an assessment of the costs and benefits of having a safeguard regime within this impact assessment. The associated secondary legislation for the proposed regime will provide refined estimates and be subject to consultation and a further developed impact assessment.

Euratom

1.4 The European Atomic Energy Community (Euratom) was established by the Treaty of Rome in 1957 to form a common market for the development of the peaceful uses of atomic energy. It was founded with the purpose of creating a specialist market for nuclear power in Europe, developing nuclear energy and distributing it to its member states while selling the surplus to non-member states, and for ensuring common standards of safety and non-proliferation.

1.5 Euratom has provisions for nuclear safeguards, common market trade arrangements for nuclear goods and products, Nuclear Cooperation Agreements with non-EU states, simplified export licences, free movement of workers in the civil nuclear sector, and nuclear R&D.

1.6 The UK wants to work closely with the European Commission to ensure a smooth transition to its new arrangements. The unique and important nature of the civil nuclear sector means that there is strong mutual interest in ensuring that the UK and Euratom Community continue to work closely together in the future. While the UK is withdrawing from the Euratom Treaty, our ambition is to maintain a close and effective relationship with the Euratom Community and the rest of the world which harnesses our shared expertise and maximises our shared interests.

Nuclear Safeguards

1.7 Nuclear safeguards are the non-proliferation reporting and verification processes by which nation states demonstrate to the international community that civil nuclear material is not diverted into military or weapons programmes. Nuclear safeguards arrangements are essential to enable civil nuclear trade and also in demonstrating that the UK is a responsible nuclear state. As a responsible Nuclear Weapons State (NWS), the UK has voluntarily accepted the application of civil nuclear safeguards by the International Atomic Energy Agency in accordance with international nuclear safeguards and non-proliferation standards. The UK's existing obligations are currently met through the UK's membership of Euratom. Therefore, a new domestic safeguards regime will need to be established following withdrawal from the Euratom Treaty which, in turn, will allow for continued trade with international nuclear market.

1.8 The UK is committed to robust international non-proliferation measures, which include nuclear safeguards.

1.9 The core provisions of nuclear safeguards apply to nuclear material and cover special fissionable material (for example: isotopes of plutonium and uranium) and source material (from which special fissionable material can be obtained). Nuclear safeguards provisions do not cover other radioactive material such as medical radioisotopes which are out of the scope of both this Bill and Impact Assessment.

International Atomic Energy Agency (IAEA)

1.10 A critical component of the global non-proliferation regime is providing reassurance to international partners. This is primarily achieved through compliance with international safeguards standards governed by the International Atomic Energy Agency (IAEA). This compliance is achieved through nuclear material accounting, reporting and IAEA inspections in nuclear states.

1.11 The IAEA currently implements safeguards in the UK jointly with Euratom, allowing them to inspect at reduced cost. The UK currently has a Voluntary Offer Agreement and Additional Protocol with the IAEA which set out information, provision and oversight arrangements. These agreements are trilateral between the UK, IAEA and Euratom and, as such, need to be replaced with UK-IAEA bilateral agreements when the UK leaves Euratom.

1.12 Nuclear safeguards generally cover a range of nuclear activities where there is a proliferation risk. These include activities using special fissionable material and source material in addition to covering such items that are especially designed or prepared for use in nuclear installations. By way of example, this could include the following activities: nuclear power generation; nuclear research and development; mining; conversion; fuel fabrication; reprocessing; processing; enrichment (and isotopic separation); separate storage; and non-nuclear activities for the production or concentration of heavy water, deuterium and deuterium compounds.

1.13 As discussed, these sites comply through nuclear material accounting, reporting and verification inspections. The full range of coverage differs between the Euratom regime and the IAEA standards – this is one way in which the Euratom regime may be considered more "robust". For example the Euratom regime includes uranium ores, whereas the IAEA standards do not extend to ores (on the basis that they cannot easily be directed into a weapons programme without significant further processing which does fall within the scope of the IAEA safeguards measures).

Role of nuclear power

1.14 Central to the government's energy objectives is providing secure, affordable and clean electricity for UK consumers. Significant challenges in achieving this are moving to a low carbon electricity mix, the UK's aging electricity infrastructure and the potential for electricity demand to grow significantly with electrification of heat and transport sectors.

1.15 Nuclear generation is an important part of dealing with these challenges as it provides continuous, reliable and low carbon electricity that is not dependent on the weather. There are currently 15 nuclear reactors operating at 8 sites across England, Scotland and Wales, providing around 25% of the electricity generated in Great Britain. Much of this is scheduled to close in the mid-to-late 2020s with the potential for this capacity to be replaced and significant additional capacity from new nuclear.

1.16 In the absence of safeguards, the entire nuclear industry would be severely disrupted; we would not be able to import fuel or parts and equipment needed at nuclear sites. After running down stock piles, current plant would no longer be able to import further fuel to generate and it would not make sense for new plant to commission. This would therefore pose potential threats to security of supply and affordability in the short term and threats to decarbonisation and affordability in the longer term. More details of the counterfactual ("Do Nothing") are provided in **Section 2**.

2. Objectives

Rationale for Intervention

2.1 'Nuclear safeguards' are vital to prevent nuclear proliferation and demonstrate international confidence that civil materials are not being diverted to military use, Ensuring the movement of nuclear material across borders provides the industry with the ability to continue to operate its existing nuclear generating capacity and build new nuclear capacity, which is a key low carbon option in the Government's strategy for tackling climate change and maintaining energy security. Without safeguards, the UK would have to be self-reliant for all aspects of nuclear power, which is not feasible. It is a global industry where the supply, waste and reprocessing chains cross multiple national borders. EDF (part owned by the French Government), which is the operator of all UK nuclear power stations, has given us commercially sensitive examples of this chain, which provides clear evidence of the complexity and mutual reliance between nations of their supply chain. This could not function if the UK did not have necessary safeguards in place which is why establishing a domestic safeguards regime is so important. This is equally true of other companies involved in uranium enrichment, fuel fabrication and research facilities.

2.2 Any significant weakening or removal of safeguards arrangements will impact on the UK's international reputation and potential negotiating capital on non-proliferation issues. For example, the UK was also amongst the architects of, and has strongly supported, the Iran nuclear deal to extend IAEA coverage and verification activities in Iran. For the UK to continue to take a leading role in such discussions, it is important that it continues to demonstrate its commitment to a high standard of nuclear safeguards.

2.3 The absence of nuclear safeguards would impact the UK's ability to achieve diversity and security of supply in power generation. Diversity of electricity supply sources is desirable from a resilience point of view to avoid over-reliance on a particular technology or energy supply. Greater diversity generally makes the electricity system less susceptible to fossil fuel supply shocks. In the absence of nuclear power - a likely consequence of no nuclear safeguards regime in the UK - the market may favour one or a small group of technologies and under-value energy diversity benefits to the UK. As a very low carbon source of electricity, nuclear could also have an important role in meeting climate change targets in the most cost-effective way.

Economic Rationale for Intervention

2.4 There is a clear economic rationale for seeking to prevent nuclear proliferation. The introduction of nuclear safeguards agreements between countries helps to correct ***negative externalities*** imposed on individuals by ensuring civil nuclear activities do not lead to the proliferation of nuclear weapons.[1] In addition safeguards help to correct ***information failures*** that may exist between countries whereby a seller of civil nuclear material is unclear on the buyers intended use of the material; without the verification procedures provided by safeguards, there may be a lower level of nuclear trade as nations fail to ensure material is not used in proliferation.

2.5 Where the absence of nuclear safeguards impacts on the UK's ability to generate electricity via civil nuclear power stations there is a ***residual carbon externality*** with implications towards lowering the UK's greenhouse gas emissions by 2050; by itself, the current market framework does not reduce the production of greenhouse gasses associated with fossil fuel combustion. Nuclear power gives the Government an option to provide low-carbon generating capacity and reduce the harmful impacts associated with carbon dioxide.

2.6 Taking no action would lead to substantially increased energy bills and wider disruption to the economy, causing structural unemployment. Thus there is also economic rationale for intervention on the grounds of cost avoidance in the energy sector and avoidance of wider disruption to the economy.

Policy Objectives

2.7 The policy objectives for a future safeguards regime are:

- To ensure arrangements are in place to comply with international standards to demonstrate that we are not allowing nuclear material from our civil nuclear programme to be used for military weapons purposes;
- To establish a domestic regime which will deliver to broadly equivalent Euratom standards to retain public and trading partner confidence in the nuclear industry;

[1] An externality occurs as a consequence of a transaction whereby a group not involved in the activity is impacted. This unintended effect on the group is referred to as the externality.

- To ensure these arrangements are adequate to give international partners the confidence to engage in civil nuclear trade with the UK, as safeguard arrangements are very important for enabling civil nuclear trade and other parts of the supply chain, which makes nuclear electricity generation in the UK possible;

- To provide adequate support towards the UK's on-going commitment to the global non-proliferation regime, and not weaken the UK's international reputation as a non-proliferation leader; and

- To support the UK's ongoing commitment to accept the application of similar IAEA safeguards standards on its civil nuclear facilities to those in Non-Nuclear Weapons States (NNWS).

2.8 These objectives will be achieved by legislating to ensure a robust domestic nuclear safeguards regime is in place and that the Office for Nuclear Regulation (ONR) will be in a position to take on the required role and responsibilities in regulating that regime, which we intend to set out in further detail as the Bill proceeds through Parliament and put into effect through secondary legislation made under powers in the Bill. These roles and responsibilities are to ensure accounting and inspection of nuclear materials – more detail is provided in the **Annex**. These measures should provide confidence that the UK will continue to have effective safeguards and non-proliferation measures in place, and also support international negotiations.

3. Options Appraisal

3.1 This section sets out the options under appraisal and also the methodology used to assess them. As noted above, primary legislation will not place any obligations on industry, however we have provided indicative estimates that will be refined for secondary legislation. For the purpose of indicative estimates, we have considered three scenarios in this Impact Assessment:

"Do Nothing" Counterfactual:

: **No Nuclear Safeguards** from April 2019. In this counterfactual scenario, on leaving the EU and Euratom, the UK operates without nuclear safeguards for an indefinite period of time.[2] We do not consider the counterfactual a viable option and it is only included here as a baseline for assessing the impact of Options 1 and 2.

"Current Euratom regime" Counterfactual:

Current Euratom membership with its current services including the provision of a civil nuclear safeguards regime. The UK's withdrawal from Euratom has already been triggered so this is only included as baseline for consistency with other EU measures where it may be more relevant and to understand policy option impacts relative to provision for safeguards under Euratom membership historically.

Policy Option 1:

Standards broadly equivalent to Euratom's Standards. In this scenario, the UK's objective for its regulatory regime for safeguards is that it will be broadly equivalent to Euratom's standards. *This is the preferred option. The Nuclear Safeguards Bill, and the regime that we propose to implement through it, will work to deliver this option.*

Policy Option 2:

International Compliance the UK adopts a regulatory regime from April 2019 that is consistent with international standards set by the International Atomic Energy Agency, subject to negotiation with the IAEA, but it is reasonably certain what is expected by way of safeguards from a weapons state such as the UK and such requirements are less intensive than those required by the Euratom regime, in frequency and in scope in terms of the reporting and inspection activities required.

3.2 We have not considered any non-regulatory policy options as viable as they would not be capable of providing the confidence required of nuclear non-proliferation measures.

"Do Nothing" Counterfactual

3.3 This counterfactual refers to a situation where the UK no longer has nuclear safeguards in place on withdrawal from the European Union and Euratom. This would directly impact on its ability to trade nuclear materials leading to difficulty in importing parts and equipment required by the operators of nuclear sites and research facilities This leads to earlier closure of nuclear power stations, nuclear supply chain businesses and research facilities. This is due to the UK's reliance on nuclear material and parts imports, the international nature of the supply chains and the movement of expertise.

3.4 The UK continues to be bound by its carbon targets and ensuring security of supply but has to manage these without access to nuclear power. We attempt to still meet carbon targets through a combination of renewable generation and CCS (Carbon Capture Storage) and to ensure the security of supply through a combination of using up stocks of nuclear fuel already in GB and procuring other capacity through the Capacity Market (largely extending the life of coal and gas plant in the immediate term and building new gas plant in the longer term).

"*Current Euratom regime" Counterfactual*

3.5 This counterfactual refers to use of the services and costs as currently reported under Euratom. The UK has formally notified the EU of its decision to leave the EU and Euratom. In light of the purpose of this Bill (enabling a domestic civil nuclear safeguards regime to be established), the "Do Nothing" counterfactual is more relevant for considering implementation for policy options. However, we have also included this counterfactual of the "current Euratom regime" to compare impacts relative to the current regime under Euratom, for consistency with other EU exist related measures, where legislation may be dependent on the negotiated outcomes on future relationship with the EU.

[2] The UK has formally notified the EU of its decision to leave the EU and Euratom. When Parliament discusses this Bill, they will be debating on whether or not to grant enabling powers to have nuclear safeguards within the UK.

Option 1: Standards broadly equivalent to Euratom's Standards

3.6 In both this Option and in Option 2, the UK will transition to a new domestic safeguards regime with responsibilities for regulating the regime granted to the ONR. The distinguishing feature of this Option is that the obligations placed on persons subject to the regime, and the role of the ONR in regulating the regime, will be broadly equivalent to the Euratom regime. This will include:

a) Facilitating IAEA reporting and inspection activities. This is constant under both options.

b) Regular and detailed inspection of UK civil nuclear sites. These inspections will include; checking nuclear materials accountancy reports, the evaluation of operator measurement systems, records verification, verification of declared nuclear material flows, verification of declared nuclear material inventories, material balance evaluation and audits.

3.7 These domestic inspection activities would go beyond what are expected to be the UK's core commitments under its future international agreements in respect of safeguards. This would be in line with the Government's commitments to retain "the highest standards of nuclear safeguards" on leaving Euratom. Such a regime will ensure that sites remain subject to detailed oversight and that safeguards standards are broadly equivalent to those under Euratom.

3.8 The Nuclear Safeguards Bill, and the regime that we propose to implement through it, will work to deliver this option.

Option 2: International Compliance

3.9 In this scenario the UK transitions to new safeguards arrangements that are determined by any international obligations which are agreed bilaterally between the UK and the IAEA. Current expectation is that this will mean a regime which is fully effective in delivering its international objectives but requires fewer and less intensive inspections at UK nuclear sites, and a narrower scope overall than the current Euratom safeguards regime (Option 1). This will require:

a) Facilitating IAEA reporting and inspection activities. This is constant under both options.

b) Undertaking inspections at sites. This option would require fewer such inspections than under option 1 and therefore fewer inspectors.

3.10 This option ensures the necessary level of compliance with IAEA standards but does not include as comprehensive a regime as one broadly equivalent to the full range of activities and oversight currently undertaken by Euratom. The lower levels of activity would result in lower ongoing costs of administrating the safeguards.

Analytical Methodology

3.11 We have undertaken a qualitative assessment of costs of the policy options across the nuclear industry, including power plant, supply chain businesses and research facilities. Monetised costs consist of costs to the ONR of administering the scheme and to the nuclear industry of compliance with the regime. The benefits assessed here relative to the 'Do Nothing' counterfactual relate to the avoidance of costs in a scenario where the UK has no nuclear safeguards regime in place. These costs include the loss of trade in nuclear material and equipment, and its impact on the nuclear industry (including generation costs, associated fuel industry, R&D, decommissioning) reputational impacts and the risk of nuclear proliferation.

3.12 Our analysis extends from the present day until 2050. This is to properly account for specific carbon emissions intensity targets which use 2050 as a target date.

Assessing the Options

3.13 Options 1 and 2 are assessed against the 'Do Nothing' and the 'current Euratom regime' counterfactuals. The table below outlines the main impact categories when comparing each of the options and a description over the direct costs to business:

Table 2: Summary of Impact Categories (to include)

Impact Category	Main Approach	Summary of impacts by main affected group
Administration Costs	Continuation of Euratom equivalent scheme costs	A. Cost to ONR of administering the new regulatory regime. B. Cost to nuclear businesses of living under different regulatory circumstances (familiarisation cost) e.g. changes to being inspected, maintaining accounting system, form filling, compliance.
Power Sector Impacts	Qualitative assessment	C. Aggregate changes to the cost of providing electricity to both industrial and household users (including the consumer bill) D. Changes to security of electricity supply E. Ability to meet our decarbonisation target F. Changes to the revenue of existing nuclear fleet
Wider impacts: nuclear industry and reputation	Trade data and consultation with stakeholders	G. Macroeconomic H. Fuel Production & Enrichment I. Non-monetised power sector impacts (e.g. mothballing, financial risk, Impact of withdrawing from new nuclear programme) J. Decommissioning & Waste Management K. Research & Development

Administration Costs

3.14 In the "Do Nothing" counterfactual the administration costs are assumed to end once the UK leaves Euratom. Administration costs cover the direct cost of operating the safeguards regime that is absorbed both by the ONR and the nuclear site operators. These costs are primarily estimated using data from the European Union budget, as well as an assessment by the UK nuclear regulator the Office for Nuclear Regulation, and information we have been supplied by the NDA. In this context, administration costs covers the following activities associated with the safeguards regime:

a) expenses for half-yearly planned inspections and short-notice inspections;

b) expenditure on Training, international meetings, insurance;

c) purchase and maintenance of monitoring and IT equipment; and

d) staff costs.

3.15 It is estimated that the EU apportions around €23.8m (to which the UK contributes) to the first three of these nuclear safeguard expenditures across the EU. Based on the proportion of person-days spent inspecting, the UK is estimated to account for around 26% of these costs or €6.2m – around £5.5m per annum.[3] In addition the staff costs are covered separately: there are currently around 160 members of staff in Euratom covering inspectors, technicians, administrators and managers that cost around €17.2m per annum. This equates to a UK share of around €4.5m per annum - or around £4m per annum. This figure was checked with bottom-up estimations produced by the ONR and they broadly agree with these estimates. .

3.16 Once the UK is responsible for running its own safeguards regime, the ongoing costs associated with providing nuclear safeguards will vary depending what future safeguard arrangements are adopted; additionally any change to the current nuclear safeguards regime will likely incur one-off transition costs in ensuring the UK nuclear regulator is equipped to carry out the inspections itself. Under Option 1 and 2 the ONR estimates these costs to be around £2.5 million over a two year period (range £0 million to £5 million). These costs will cover the recruitment and training of inspectors and the procurement of a Safeguards Information Management System (SIMS) in order to provide reporting data to the IAEA.

[3] Exchange rate assumed at 1.1 EUR to £1

3.17 The future safeguards arrangements will apply to all facilities and other such locations where nuclear material is customarily used which include power plant, fuel enrichment and fabrication, research centres and storage (a full list is provided in the Annex).

3.18 The main discernible differences in Options 1 and 2 are due to the frequency of nuclear site inspections. Under existing Euratom arrangements, nuclear facilities are subject to regular and detailed inspections. This is to provide the European Commission with assurance on safeguards arrangements and in order to verify reporting. The number of inspections varies depending on the type of facilities; power reactors provide an illustrative example where there are there is least two inspections per reactor per year. In Option 2 where the UK moves to IAEA standards this could fall to around one inspection per year. The ONR estimate that this could reduce current levels of expenditure by around 25%. This reduction is looked at in the range of 0% to 50%.

3.19 In Option 1 the UK establishes broadly equivalent standards as those under Euratom so is assumed to face the same ongoing cost; however in the 'high' cost sensitivity for this option we have increased this estimate by 20% to account for reduction in economies of scale based on an internal assessment of the fixed cost components. Initial estimates suggest there is no large scope for reduction in economies of scale, which is why this has not been included in the central estimate, but we intend to further refine our assumptions for secondary legislation.

3.20 At present these administration costs are covered by the UK Government (via Euratom) under general taxation. It is assumed in this IA that these costs will continue to be funded by the taxpayer. Existing legislation provides the power, through regulations, to recoup these costs from industry although no decision to do this has been made.

Table 3a- Summary table of cost assumptions of administering the policy options relative to the 'Do Nothing' counterfactual.

£pa	**Option 1**			**Option 2**		
	low	central	high	low	central	high
One-off Transition (training and IT)	0	2.5	5	0	2.5	5
Ongoing (inspections and staff costs)	9.5	9.5	11.5	4.75	7	9.5

Table 3b- Summary table of cost assumptions of administering the policy options relative to the 'current Euratom regime' counterfactual. Negative numbers are cost savings.

£pa	**Option 1**			**Option 2**		
	low	central	high	low	central	high
One-off Transition (training and IT)	0	2.5	5	0	2.5	5
Ongoing (inspections and staff costs)	0	0	2	-4.75	-2.5	0

Cost of Compliance by Nuclear Sector

3.21 There are around 100 facilities that hold radioactive material and fall in scope of the current safeguard regime under Euratom. These include sites involving activity all through the nuclear industry life cycle covering fuel enrichment and fabrication, active generating plant, decommissioned sites, waste facilities and research facilities. Monitoring and inspections are required between all areas for which material is moved known as 'balance areas'. There are around 200 of these in total which are summarised in the Annex. Under Euratom around 200 inspections were undertaken in 2014.

3.22 We have informally consulted the ONR and a range of industry experts with relevant experience covering over 75% of affected businesses on the magnitude of these costs that we have scaled across to the whole industry. The cost of compliance includes covers both a) the costs associated with monitoring and reporting to the ONR (Office of Nuclear Regulation), and b) the time spent by staff preparing for and executing inspections. Throughout the analysis, industry wage rates are given by ONS data for nuclear industry employees and, in the central estimates, there is assumed no real productivity growth in the sector.

3.23 The cost of monitoring is based on the current number of employees required to carry out the monitoring activities at different types of sites across the industry. Annual costs under Option 1 are estimated at around £3.0m per annum. It is suggested that under IAEA standards there will be a 25% reduction in monitoring activity, reducing annual costs to around £2.3m per annum. Under a no safeguards scenario the costs would be around 75% lower; as under the Environmental Permitting Regulations 2010 (with respect to England and Wales) and the Radioactive Substances Act 1993 (with respect to Scotland and Northern Ireland) those handling radioactive material are still required to record the flow of radioactive substances, which would still apply to decommissioned assets - the cost of doing so is estimated to be around £0.8m per annum.

3.24 The cost to prepare for and receive inspections is built up from estimates of the varying number of days and staff required across the industry. This data makes use of EU data on the average length of inspection across site type and also the number of current inspections taking place across the nuclear industry – this frequency is assumed to remain static over time. The principle driver in inspection costs between the two options is that under Euratom guidelines the amount of activity associated with inspections is estimated on aggregate to be a four times that under IAEA guidelines, in part reflecting differences in the frequency of inspections but also a reduction in the activity caused by each inspection; it is expected by industry that around 4 FTE days of work is needed per one day of inspections, whereas under IAEA rules this falls to around 1 FTE day of work per inspection, with the frequency of inspections themselves estimated at half of that under Euratom. The annual cost of inspection under Option 1 is around £2.5m and for Option 2 is around £0.6m. We have created low and high estimates to reflect the uncertainty in staff costs. Table 3 below shows the difference in cost of compliance of the two policy options relative to the "Do Nothing" counterfactual in 2019.

3.25 The table below outlines the annual cost of compliance. Discussions with the senior industry representative suggested wage costs could fall within a range; based on this advice under low options wage costs are assumed 20% lower, while under high costs they are assumed 20% high and factor in 2% real annual wage growth.

Table 4a – Changes to Annual Cost of Compliance relative to the 'Do Nothing' counterfactual (2012 prices, not including wage growth)

	Option 1: Standards broadly equivalent to Euratom Standards			**Option 2: Meeting International Standards**		
	Low	Med	High	Low	Med	High
Cost of Monitoring/Reporting	1.7	2.2	3.7	1.1	1.5	2.5
Cost of Inspections	2.0	2.5	3.0	0.2	0.3	0.4
Total	**3.7**	**4.7**	**6.7**	**1.3**	**1.8**	**2.9**

**Figures may not sum due to rounding. Low, Central, High variation due to variation in wages*

Table 4b – Changes to Annual Cost of Compliance relative to the 'current Euratom regime' counterfactual
(2012 prices, not including wage growth)

	Option 1: Standards broadly equivalent to Euratom Standards			Option 2: Meeting International Standards		
	Low	Med	High	Low	Med	High
Cost of Monitoring/Reporting	0.0	0.0	0.0	-0.6	-0.7	-1.2
Cost of Inspections	0.0	0.0	0.0	-1.8	-2.2	-2.6
Total	**0**	**0**	**0**	**-2.4**	**-2.9**	**-3.8**

**Figures may not sum due to rounding. Low, Central, High variation due to variation in wages*

4. Options Assessment

4.1 This section outlines the assessment of the options. The impacts directly from the primary legislation are zero as they do not implement safeguards regime but puts ONR in a position to fulfil safeguard obligations that secondary legislation will implement. However, we provide qualitative information on what the costs and benefits of having a safeguard regime will be, which will be refined in the impact assessment that accompanies future SIs. Impacts are split into the benefits and costs. Costs of the options are monetised across the whole nuclear industry. Benefits across the whole nuclear industry are discussed although monetisation has only been possible in nuclear power generation.

Benefits

4.2 The nuclear industry makes a significant contribution to the UK economy. This section considers the benefits in the form of the avoided losses to the nuclear industry relative to the "Do Nothing" counterfactual of no nuclear safeguards and how these benefits vary across the policy options. Relative to the "current Euratom regime" counterfactual, the main benefit of policy options is to enable public, trading partner and international confidence of a robust safeguard regime. Benefits of option 1 in this regard are greater than option 2 as it will demonstrate the continued robust nature of the UK's safeguards regime at a high standard broadly equivalent to current Euratom standards. We would also expect some small administrative cost savings of option 2 which are discussed under the cost section below.

4.3 In 2014 the GVA (Gross Value Added) of the UK's civil nuclear energy sector was £3.5bn (0.2% of total UK GVA in that year). Nuclear electricity generation accounts for around a fifth of the total UK electricity generation, which in turn has an estimated GVA of £18bn (1.1% of UK total). ONS statistics show that all sectors of the economy save one have positive intermediate consumption of goods and services produced by the electricity sector and therefore depend on its effective functioning. In particular 3.9% of total intermediate demand is spent on the electricity, distribution and transmission sector (Sector 35.1 in official ONS labelling).

4.4 There are currently around 50,000 people working in the nuclear industry. The data is unavailable for median hourly pay[4] and it is not possible to provide a single figure on salaries due to broad spectrum of roles within the sector. However the estimated median average salary for a nuclear engineer is £47,000[5] which is higher than the UK median average salary (£28,200). It should also be noted that geographically the nuclear sector is concentrated in the North West of England, including west Cumbria (43%), the South West (12%) and South East (9%)[6]. Therefore disruption to the nuclear industry will affect these areas more heavily.

4.5 The UK nuclear industry covers the full life-cycle of fuel production and enrichment, generation, decommissioning and waste management, supported by R&D. This section discusses the benefits to each sector before focusing in on benefits to generation where it has been possible to monetise the benefits.

4.6 **Fuel production and enrichment –** In the absence of safeguards in the "Do Nothing" counterfactual, we would expect the loss of this sector to the UK. Therefore both policy options broadly avoid these costs. Fuel orders for these UK based services are generally long-term (up to 10 years). There may be some costs involved in ensuring existing orders and future orders are appropriately covered by new safeguard arrangements.

4.7 *Option 1 is preferred as*: Standards broadly equivalent to Euratom standards are least likely to cause disruption to these orders as it aligns most closely to what the UK and its trading partners are used to. A potential consequence of not having well aligned safeguards with trading partners is that fuel service providers could transfer orders to their sister facilities overseas to make administration easier. For example Urenco may consider moving their UK based operations to sister facilities in USA, Netherlands and Germany to mitigate any potential disruption.

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4 https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/annualsurveyofhoursandearnings/2016provisionalresults - there are soc codes (occupation codes) that refer to nuclear but the published data is not detailed enough to give data of the specified nature

5 *https://nationalcareersservice.direct.gov.uk/job-profiles/nuclear-engineer (mean £47,000), http://www.payscale.com/research/UK/Job=Nuclear_Engineer/Salary (mean £52,903), https://www.prospects.ac.uk/job-profiles/nuclear-engineer (mean £45,000)- Median salary for a nuclear engineer*

6 *Nuclear Industry Association (NIA) Civil Nuclear Jobs Map 2017 – figures shown only include those that are members of NIA, but that constitutes 95% of civil nuclear sector.*

4.8 **Power generation -** In the absence of safeguards, we expect the nuclear power generators would be severely disrupted by the inability to import fuel or parts and equipment needed at nuclear sites. Current plant would be forced to cease generating and new plant would not commission. In addition this would have an impact on the UK's plans for future nuclear new build, impacting construction timetables for Hinkley Point C and investor confidence in the viability of other proposed projects. This would therefore pose potential threats to security of supply and affordability in the short-term and threats to decarbonisation and affordability in the longer-term. Both policy options avoid these costs.

4.9 *Option 1 is preferred as:* although there is no significant direct difference to power generators of a different safeguard regime, option 1 causes least administrative disruption to a number of the sectors the power sector is reliant on as discussed above and below in the other parts of this section.

4.10 **Decommissioning and waste management** – in the absence of safeguards, costs in this sector would increase as the decommissioning of some sites would be brought forward. This is because nuclear plant and other active nuclear sites would not be able to continue due to not being able to import nuclear fuel and would need to be decommissioned earlier. Decommissioning plans for new nuclear projects facilitate cost reduction for existing plant. Whilst funding plans for new builds are such that they are able to independently finance their own decommissioning, certain contributions, particularly towards a geological disposal facility, would reduce equivalent costs for current plants. In the absence of safeguards, were new plants not constructed, these economies of scale would be lost. UK waste management sites also reprocess and store spent fuel for other countries. In the absence of safeguards, the UK could expect to lose this business as international partners would not be able to send their spent fuel to us. In the short term, disruption to the nuclear industry may preserve or increase employment in this sector, currently estimated at 21,000[7], but in the longer term the requirement for this sector would decrease.

4.11 *Option 1 is preferred as:* we expect that under standards broadly equivalent to Euratom standards it will be easier to preserve business with international partners, as described above, as our safeguards regime will more closely align with what the UK and its trading partners are used to.

4.12 **Research and development** - In the absence of nuclear safeguards, the lack of a nuclear industry beneficiary and inability to import fuel or equipment would mean severe disruption to research programmes. International collaboration in nuclear research is vital in making progress where the science is challenging. In particular nuclear fusion research being undertaken at Joint European Torus (JET) Project in Culham, Oxfordshire and its replacement the International Thermonuclear Experimental Reactor (ITER) currently under construction in France. UK R&D will therefore benefit from the UK's future safeguards regime being aligned with overseas partners to enable easier collaboration.

4.13 *Option 1 is preferred as:* it may be viewed as more favourable by EU research partners due to its closer alignment with their own regimes.

4.14 Overall this qualitative discussion of benefits of the policy options shows that option 1 is preferred to option 2, as it is most aligned with what the UK and its trading partners are currently used to and so will cause least disruption to the nuclear industry. Maintaining Euratom's high standards will ensure that the UK maintains the highest standards of nuclear safeguards and enable us to continue to take a leading role in future non-proliferation negotiations. Option 1 also meets the policy objective of maintaining public, trading partner and international confidence in the industry of a robust safeguards regime of broadly equivalent standards to Euratom standards, which is less likely under option 2.

Benefits in power generation in further detail

4.15 Both Options 1 and 2 are indistinguishable in terms of scope of electricity market impacts. The importance of this analysis is in qualitatively measuring the value of having safeguards relative to the "Do Nothing" counterfactual. **We do not expect there to be any significant power sector impacts of both policy options relative to the "current Euratom regime" counterfactual**.

4.16 The analysis compared options relative to the "Do Nothing" counterfactual scenario, where nuclear no longer plays a part in the generation mix. In this counterfactual, we assume that enough, Offshore Wind, Onshore Wind, Solar and CCS are brought online to replace generation from nuclear. This allows us to meet a trajectory for decarbonisation that is consistent with our 2050 decarbonisation targets, although this is likely to be at a significantly higher cost than if nuclear generation were present. However there is uncertainty over the feasibility of delivering this volume of these types of new electricity generation capacity due to pressures on site availability and supply chain capacity. Options 1 and 2 continue with a diverse generation mix of technologies including nuclear.

7 Source: Nuclear Energy Skills Alliance, Nuclear Workforce Assessment 2015
http://www.cogentskills.com/about-cogent-skills/research-policy/nuclear-workforce-assessment/

4.17 While nuclear generation has high capital costs per MW associated with it compared to other low carbon technologies, this is offset by higher costs of the electricity network (particularly due to onshore and offshore wind) and balancing market costs (particularly for offshore wind and solar). In addition, the marginal amount of generation provided by renewable generation decreases significantly at the volumes required to replace nuclear to still meet 2050 decarbonisation targets. This is because renewable generation is intermittent and highly correlated within technology types (e.g. when the wind isn't blowing most wind turbines are affected). Therefore a large volume of renewables would need to be built in the absence of new nuclear generation over a sustained period of time, which would subsequently lead to significantly increased costs associated with building, connecting and operating an intermittent technology dominated energy system (although as noted below high deployment of renewables may lead to lower electricity wholesale prices which is just one element of the consumer electricity bill).

4.18 In the counterfactual, as nuclear generation is replaced by "higher marginal cost" fossil fuels generators (such as coal and gas) in the short term, you would expect the wholesale price of electricity to rise. This leads to our importing electricity through the interconnectors (flow of electricity from areas of low price to areas of high price). This effect could reverse over the longer term as the UK significantly increase our build of renewables which has an effect of depressing the wholesale price, as they have much lower marginal costs of generation. In Options 1 and 2, having generation from nuclear generation means lower prices in the short term leading to importing less electricity through interconnectors. In the longer term as wholesale prices are higher due to large volumes of renewables not being needed to decarbonise we import more electricity through interconnectors compared to the counterfactual.

4.19 Compared to the counterfactual, significant savings would be made by introducing Options 1 or 2, as a result of having a more secure, resilient and diverse energy generation mix, with nuclear providing electricity. In the "Do Nothing" counterfactual the capacity market can bring on large new capacity with 4 years notice to mitigate impacts to security of supply, but the system will be reliant on keeping on existing capacity for longer for the first few years after leaving Euratom in the absence of safeguards, and we would be less likely to meet acceptable levels of energy security. In the longer term "Do Nothing" counterfactual would create a high amount of intermittent capacity to meet decarbonisation targets, resulting in higher costs of ensuring security of supply and reliance on any one technology supply chain.

Costs

4.20 Table 5 outlines the impacts against the 'Do Nothing' and 'current Euratom regime' counterfactuals. We look at both the scheme administration costs to ONR and the costs of compliance to nuclear businesses. These on-going costs are anticipated to last in perpetuity over an appraisal period that spans to 2050. We are not accounting for unforeseen future changes in governing or implementing safeguards and assume the cost base remains unchanged in real terms throughout the projection period. We use the annual cost assumptions detailed in section 3, and also take into account the change in sites under scope over time as new nuclear plant commission and existing plant decommission.

4.21 The administrative and compliance costs of implementing safeguards out to 2050 is greater under Option 1 at around £220m in the central case as the UK seeks to adopt similar safeguard arrangements to that provided by Euratom, where in comparison the administrative cost under Option 2 is lower at around £140m in the central case.

Table 5a: Changes to Administration and Compliance Costs relative to 'do nothing'

Option	Administrative Costs out to 2050 (£m NPV 2012 prices, discounted to 2012)		
	Low	Central	High
Scheme Administration Costs			
Option 1	£150	£150	£180
Option 2	£70	£110	£150
Compliance Costs			
Option 1	£50	£70	£140
Option 2	£20	£30	£60
Totals			
Total option 1	£200	£220	£320
Total option 2	£90	£140	£210
Difference between policy options	***£110***	***£80***	***£110***

*Note figures rounded to nearest £10 and may not sum precisely

Table 5b: Changes to Administration and Compliance Costs relative to the 'current Euratom regime' counterfactual

Option	Administrative Costs out to 2050 (£m NPV 2012 prices, discounted to 2012)		
	Low	Central	High
Scheme Administration Costs			
Option 1	£0	£2	£4
Option 2	-£70	-£30	-£30
Compliance Costs			
Option 1	£0	£0	£0
Option 2	-£30	-£40	-£80
Totals			
Total option 1	£0	£2	£4
Total option 2	-£110	-£80	-£110
Difference between policy options	***£110***	***£80***	***£110***

*Note figures rounded to nearest £10 and may not sum precisely

Un-monetised Costs: familiarisation costs

4.22 As with any change in regulatory regime, business is bound to be impacted. However, officials are working closely with the regulator and relevant stakeholders to minimise this impact. Officials are currently working on draft regulations, which will be subject to further consideration and detailed consultation with the regulator and industry.

Under both policy options, businesses will have to familiarise themselves with a new safeguards regime. However, where possible, secondary legislation is being designed to minimise changes for businesses. We note that businesses will still need to build a new relationship with the administrator of the safeguards regime (ONR), but in this instance businesses already engage with ONR on a range of other issues (for nuclear safety, security, and transport regulation, and to a limited degree on safeguards inspections) so we expect these costs to minimal.

4.23 **Impacts to businesses:** The business impact target for this parliament still needs to be agreed. Table 6a below shows indicative impacts from secondary legislation to businesses, relative to the 'do nothing' ordered from most direct to least direct where it has been possible to monetise them. Table 6b shows the same impact categories relative to the 'current Euratom regime' counterfactual, although there are only monetised impacts (cost savings) to Option 2. By direct we mean that that the impact is incurred as a result of the policy option without further actions by government or industry as a conscious response. Once the new metric is decided for the business impact target, further work will be undertaken on estimating the business impact from this change.

4.24 Table 6 below shows indicative impacts from the domestic regime to businesses ordered from most direct to least direct where they have been to monetised and a qualitative description and direction of impact for those we have not monetised. By direct we mean that that the impact is incurred as a result of the policy option without further actions by government or industry as a conscious response. Once the new metric is decided for the business impact target, further work will be undertaken on estimating the business impact from this change.

4.25 The most direct costs to businesses are the cost of compliance from site inspections, monitoring and reporting of around £70m and £30m to 2050 under policy options 1 and 2 respectively. Less direct are the costs to non-nuclear plant that under the policy options do not benefit from making higher profits in a market without nuclear. Our analysis shows that the most direct benefit to business of the policy options is the avoided lost profits[8] to existing nuclear plant. We also consider the impact to business consumers of energy. Consumers are largely affected by the pass through of costs in energy markets that are relatively automatic. For example, in the short term should less nuclear be available, we would expect bids for more expensive electricity from other forms of generation in the market to be accepted by suppliers and passed on to consumers energy bills. But there are a number of steps here before it impacts the consumer and so it not considered as direct.

Table 6 – Impact to businesses from most to least direct. Costs are represented as negative numbers and benefits as positive numbers

£m	**NPV to 2050**		
	Low	**Central**	**High**
Option 1 - Cost of compliance	£55	£70	£140
Option 2 – Cost of compliance	£20	£30	£60
Nuclear businesses profits	+ Large		
Non-nuclear plant profits	- Large		
Business consumer bills	+ Large		

4.26 **Small and Micro Business impact**: As described in the sections above, relative to the 'do nothing' counterfactual of having to cease civil nuclear operations in the absence of safeguards, we expect businesses to incur significant net benefits. The main direct cost to business also as discussed above is the cost of compliance. Relative to the 'current Euratom regime' counterfactual we do not expect any significant impacts on businesses.

4.27 Under policy Option 2 relative to the 'Do Nothing' where IAEA compliant safeguards are adopted, no small or micro businesses will be affected as they will not meet the size threshold for these safeguards to apply to them. Relative to the 'current Euratom regime' counterfactual there would be benefits from Option 2 to businesses that no longer fall into scope of a safeguards regime.

4.28 Under Option 1 where standards broadly equivalent to Euratom standards are adopted, businesses with small nuclear holdings which mainly consist of research institutes will incur costs relative to the 'Do Nothing' counterfactual, but there will be no significant impacts under the 'current Euratom regime' counterfactual. It is unclear at this stage which if any of these research institutes will classify as a small or micro business. Primary legislation that this impact assessment will support will not directly incur these costs and we intend to clarify their status for impact assessment that will accompany secondary legislation. However, we do not expect these businesses costs to change significantly from what they current incur under the Euratom regime.

4.29 **Equalities impact**: We have considered the impacts of the policy on the groups with protected characteristics as defined within the Equalities Act 2010 and do not consider that there would be disproportionate impact on them. This is because this policy is not expected to incur any costs on these groups directly and direct costs of implementing this regime are not expected to be significantly different to the cost of safeguards as currently provided through Euratom. However, relative to the 'do nothing' counterfactual generally Options 1 and 2 will result in lower energy bills for consumers and therefore benefit consumers across all groups.

Summary

4.30 Overall, relative to the 'Do Nothing' counterfactual both Options 1 and 2 have significant benefits associated with avoiding significant disruption across the nuclear industry consisting of around 50,000 jobs heavily concentrated in particular regions. Implementing a new safeguards regime that is most aligned with what the UK and its EU trading partners are currently used to will cause least disruption. We have estimated that there could be significant power generation net benefits relative to a "Do Nothing" scenario of no future safeguards and therefore no future nuclear generation. These benefits are largely avoided costs attributable to needing large volumes of renewable generation in the counterfactual to still meet decarbonisation objectives, and the associated costs of connecting it from distant locations and operating a more intermittent system. The costs we estimate of administering the scheme and compliance incurred by ONR and industry respectively are far outweighed by these benefits.

4.31 Option 1 has slightly higher administration and compliance costs due to the establishment of domestic standards broadly equivalent to the existing higher standards of Euratom. However Option 1 is the preferred policy as it will minimise any transition disruption to the industry and will preserve the strong reputation and leadership the UK currently shows in non-proliferation. The Nuclear Safeguards Bill, and the regime that we propose to implement through it, will work to deliver this option

Annex

Requirements on ONR for a Safeguards Regime

Implementing a domestic safeguards regime will require the ONR to establish a State System of Accounting and Control (SSAC). This will have three core functions:

a) Providing and handling data from sites subject to IAEA safeguards coverage. This will require setting up and procuring a Safeguards Information Management System (SIMS) to handle and submit the required data. This is consistent under both options.

b) Supporting IAEA verification activities in the UK. This will cover a wide range of coordination, communication, planning and other activities necessary to enable effective and efficient IAEA verification activities in the UK. This is consistent under both options.

c) Provide assurance about the quality of data provided to the IAEA; and oversight of the civil nuclear sectors safeguards arrangements. The scope of the assurance activities is the subject of a domestic decision and is considered in this impact assessment.

The activities required to facilitate IAEA reporting and inspection is constant under all options. This is as the UK is required to provide the IAEA with the information necessary for the implementation of safeguards. This means that the IAEA shall be provided with the following accounting reports for each material balance area:

a) **Inventory change reports** (ICR) showing all changes in the inventory of nuclear material. The reports shall be despatched as soon as possible and in any event within the time limits specified in the Subsidiary Arrangements;
b) **Material balance reports** (MBR) showing the material balance based on a **physical inventory listing** (PIL) of nuclear material actually present in the material balance area. The reports shall be despatched as soon as possible and in any event within the time limits specified in the Subsidiary Arrangements.
c) **Special Reports** are made if the Community believe that there is or may have been loss of nuclear material that exceeds the limits specified in the Subsidiary Arrangement.

Facilities subject to safeguards

For the purposes of the application of safeguards these facilities are split into "Material Balance Areas" meaning an area such that: the quantity of nuclear material in each transfer into or out of each material balance area can be determined; and the physical inventory of nuclear material in each material balance area can be determined when necessary in accordance with specified procedures, in order that the material balance for IAEA safeguards purposes can be established. There are currently 199 material balance areas[9] in the UK subject to safeguards under the UK's membership of Euratom:

Balance areas	
Research Centre and Reactors, Zero Energy	9
Mines, Concentration, Conversion	1
Enrichment	2
Fuel Preparation and fabrication	8
Reprocessing	10
Power Reactors	21
Storage	38
Waste Storage and Treatment	1
Spent Fuel Final Repository	0
U Recovery	0
Nuclear and Non-Nuclear LOFs	109
Transporters, Intermediaries	0
CAM Holders	0
Total	199

9 *Source: Euratom Safeguards Implementation Report;* https://ec.europa.eu/energy/sites/ener/files/documents/20151211%20Annual_Report%202014.pdf

Key Power sector assumptions for qualitative analysis

Assumption	Policy options 1 and 2	Counterfactual - No future safeguards
Time without safeguards	No disruption to Safeguards.	No safeguards indefinitely from March 2019.
Existing Nuclear	- AGR Reactors continue to operate (7.8GW), steadily reaching retirement between 2024 and 2030. -Sizewell B (1.2GW) in operation beyond 2050	- Reactors assumed to be half way through fuel cycle (9months left in reactor) based on the assumption that the fuel they have left follows a normal distribution. - 6 month Stockpiles at AGR reactors and Sizewell B to stop after fuel cycle informed by discussions with EDF. - Once stockpiles have run out all plants close indefinitely.
Future Nuclear	-HPC in Q2 2025. -Continued investment in new nuclear projects	No new nuclear
Security of supply	-Security of supply maintained through Capacity Market -Coal closures in force by 2025 (unless it risks security of supply)	-Earliest large gas plant can come through CM in response to nuclear closures is 4 years ahead. Before then, gap filled with small plant and keeping existing plant on – more likely to lead to unmet demand in the short term.
Consequential change in UK low-carbon policy	-Renewables spend consistent with Low Carbon Framework and statements made in Budgets. -2050 power sector emissions fall to 25gCO2/kWh with balanced mix of low-carbon technologies	-No compensatory change in policy short-term policy. -Longer-term ensure enough offshore/onshore/solar/CCCS is built to meet emissions targets subject to build limits