NUCLEAR INNOVATION AND RESEARCH ADVISORY BOARD

Review of nuclear new build approval processes

NIRAB-3-303

September 2022

Executive Summary

The Nuclear Innovation and Research Advisory Board (NIRAB) has undertaken a review of the statutory approval processes for new nuclear in the UK, and their applicability to Advanced Nuclear Technologies (ANTs). Each approval process has been examined and given a Red-Amber-Green (RAG) rating based on the readiness to enable deployment of ANTs in the UK and suggestions made on how these could be optimised, which is summarised below:

Approval process	Current status	Suggested improvements for applicability to SMR and AMR
Regulatory Justification	AMBER	The current system for regulatory justification is project specific and HMG should be prepared to undertake the assessment of potentially multiple submissions in parallel, to prevent delays to the acceleration of new nuclear projects. HMG should undertake a review to consider Regulatory Justification of technology groups (e.g. PWR, HTGR) rather than individual designs and ensure the process is streamlined and avoids duplication with other approvals.
Planning	RED	HMG should update nuclear specific siting policy urgently and ensure that it is applicable to ANT including multiple energy vectors and co-generation. HMG should review the current threshold approach and the feasibility of non-DCO planning routes for nuclear facilities.
Generic Design Assessment (GDA)	AMBER	Regulators should review the GDA process to ensure it enables entry and assessment of innovative and novel designs including both the reactor and heat take off mechanisms. Regulators should produce guidance on re-use of submission from other countries in the GDA process and explore harmonisation between design assessment processes.
Early regulatory engagement	AMBER	Regulators should embed and offer early pre-GDA engagement to industry to de-risk entry into GDA, licensing and permitting.
Nuclear licensing	AMBER	ONR should produce guidance on non-traditional nuclear deployment models, including for alternative protection and control strategies, multi-unit sites, co-generation and cross-boundary regulatory approaches.

Environmental permitting	AMBER	The Environment Agency (working with other UK environmental agencies where appropriate) should ensure an integrated approach between radioactive and non-radioactive assessment and permitting processes and avoid any duplication between processes (including planning and Habitats Regulation). The Environment Agency should also consider implications on non-traditional deployment models (e.g., multi-unit sites and shared services).

Cross-cutting areas including design maturity, organisational capability, financing, supporting infrastructure and cross-regulatory boundary issues are also discussed and suggestions to overcome any potential delays identified. Specifically:

- Design maturity is a key factor which determines the readiness for entry and progress through approval routes. HMG should clarify and provide certainty on nuclear policy to encourage vendors to invest and undertake the necessary R&D to progress designs.
- The capability of the future operator is a key assessment area for licensing and environmental permitting. At this time, the UK does not have an Operator ready to deploy ANTs. HMG should support the development of UK ANT operator capability by through supporting financing and policy activities.
- Given the importance of financing to progress any nuclear project HMG should review the applicability of existing models and explore future models suited to novel designs.
- ANT will require new infrastructure to support deployment (i.e. fuel and waste routes) which must be developed in advance of reactor deployment. HMG should encourage integrated working between reactor vendors, developers, fuel fabrication and waste infrastructure industries to ensure that a suitable supply chain is developed to enable deployment of ANT.
- Non-electricity applications (e.g. direct heat, co-generation etc.) will require collaboration between regulatory bodies in order to avoid duplication and provide clarity to prospective designers and operators. HMG should facilitate the discussion of cross-boundary regulatory issues and work with responsible bodies and organisations to clarify expectations to ANT developers.

NIRAB has concluded that although there are opportunities to optimise statutory approval processes to support delivery of ANT these in isolation would not reduce the time for deployment significantly as it is the cross-cutting areas that drive the pace of progress and HMG should ensure that government support, including financing and policy, is in place to reduce the barriers for vendors and developers.

Contents

1. Introduction

The Nuclear Innovation and Research Advisory Board (NIRAB) provide independent advice to the Department for Business Energy and Industrial Strategy (BEIS). NIRAB has been working to address the question:

- How does the UK deliver an AMR demonstrator to the timescales required, by early 2030's? How can this be achieved using innovative methods while maximising UK content?

NIRAB considered that the nuclear regulatory approval processes could be a rate determining step for delivery and this should be assessed to look at potential risk mitigation. NIRAB has undertaken a review of the statutory approval processes for new nuclear in the UK, and their applicability to Advanced Nuclear Technologies (ANTs). NIRAB has also considered cross-cutting areas that could also impact on the timelines for delivery, including design maturity, organisational capability, financing, supporting infrastructure and cross-regulatory boundary issues. This paper discusses the regulatory approval processes and other factors and provides suggestions for overcoming the potential delays identified.

There have been many reports considering the delivery timeline of not just AMRs but new nuclear in general, however they tend to collapse the approval processes into a single 'licensing task', which can be over simplified. NIRAB has considered an 'AMR decision timeline' detailing all required approval and decisions needed to build an Advanced Modular Reactor (AMR) demonstrator (i.e., not only the nuclear regulatory steps). This enabled scrutiny of the timeline as a whole and consideration of when activities could be undertaken, and decisions made (whether by BEIS or influenced by BEIS) in order to achieve the mid-2030s deployment objective [1].

There are several approval processes which new nuclear projects must successfully complete prior to build and these are not limited to nuclear regulatory process such as licensing and permitting but also include planning and Regulatory Justification of Practices. Furthermore, who can enter these processes and what needs to be in place is specific for each process, for example any reactor designer could enter the Generic Design Assessment (GDA) process without a detailed design or a specific site however only a future operator (e.g., someone who wants to hold a nuclear site license (NSL) and environmental permits) can enter the Office for Nuclear Regulation's (ONR's) nuclear licensing and the Environment Agency's permitting process. Additionally, to progress through these the potential operator must have a site and a specified design and be financially capable of maintaining safe operation and covering all liabilities.

To explore how AMR delivery can be accelerated it is critical that all the required approval processes, including nuclear regulatory and planning, are identified before then exploring what the options are to accelerate. This also includes policy decisions by government, for example on siting, which are needed prior to formal nuclear regulatory processes and planning.

This report details the full suite of approval processes, detailing who is responsible for applying, who is the decision maker and what the pre-requisites are. It also uses Red-Amber-Green (RAG) scoring to indicate whether all necessary enabling steps are in place to accelerate the approval (i.e. Green) for an AMR demonstrator or whether improvements can be applied to accelerate (e.g. Red or Amber).

2. AMR decision timeline

Approval of new nuclear build differs internationally. In the UK the nuclear regulatory framework is 'goal-setting' which means there are limited prescriptive requirements and mostly a set of principles which a licensee / permit holder must demonstrate compliance against. In addition, the UK has other approval processes which are not the responsibility of the nuclear regulators, e.g. Regulatory Justification of Practices and Planning.

Although these approval processes are set out in primary and secondary legislation it is government policy on energy needs, siting, financing etc. which ultimately determines the appetite and ability of private vendors to progress in the UK. However it is recognised that given the inherent differences in the UK approval system compared to many other countries it in itself could present a barrier or create delays as new entrants to the UK develop the necessary awareness of these processes.

Other work on delivery timelines have found that ~13 years is potentially the shortest route to deploying a Small Modular Reactor (SMR) / AMR in the UK. This is therefore unlikely to achieve the government's desired timeline [2]. There are also increasing calls to accelerate nuclear deployment and in the British Energy Security Strategy the government has committed to reviewing approval process in the UK to identify any duplication or efficiencies [2].

An approval processes timeline is shown in Figure 1. Granting of an NSL does not give the licensee permission to begin nuclear safety-related construction (first nuclear safety-related concrete) or operation [3]. ONR's licence condition 19 (LC19) sets out the expectations for the construction and installation of new nuclear plants post NSL grant. This requires that the licensee divide the construction and installation into appropriate stages, with the licensee required to seek ONR's consent to progress between stages [4]. These stages are outside the scope of this report but an indicative timeline is shown in Figure 2.

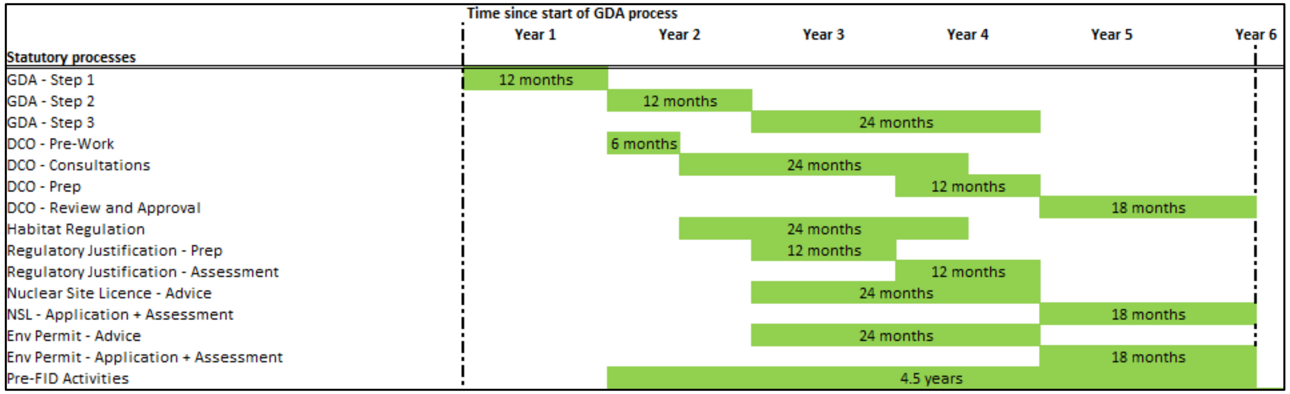
A description of the approval process, current status and options for acceleration of an AMR are detailed in

Appendix 1: Nuclear new build approval processes. The NIRAB Delivery Working Group (NDWG) discussed the processes and concluded that the majority are AMBER, meaning that there is a process in place but changes would be needed to accelerate deployment of ANT in the UK. The exception is planning (which includes Development Consent Order (DCO) and Town and Country Planning (T&CP)) which was scored as RED, meaning that the current process is not suitable for ANT.

Full details of justification for scoring of current processes and views on how to improve can be found in

Appendix 1: Nuclear new build approval processes. Table 1 provides a high-level summary.

Figure 1: Indicative approval timeline up to the NSL grant and beginning of construction (note that duration and start point of each process



assumes a relatively mature design and organisation capability)

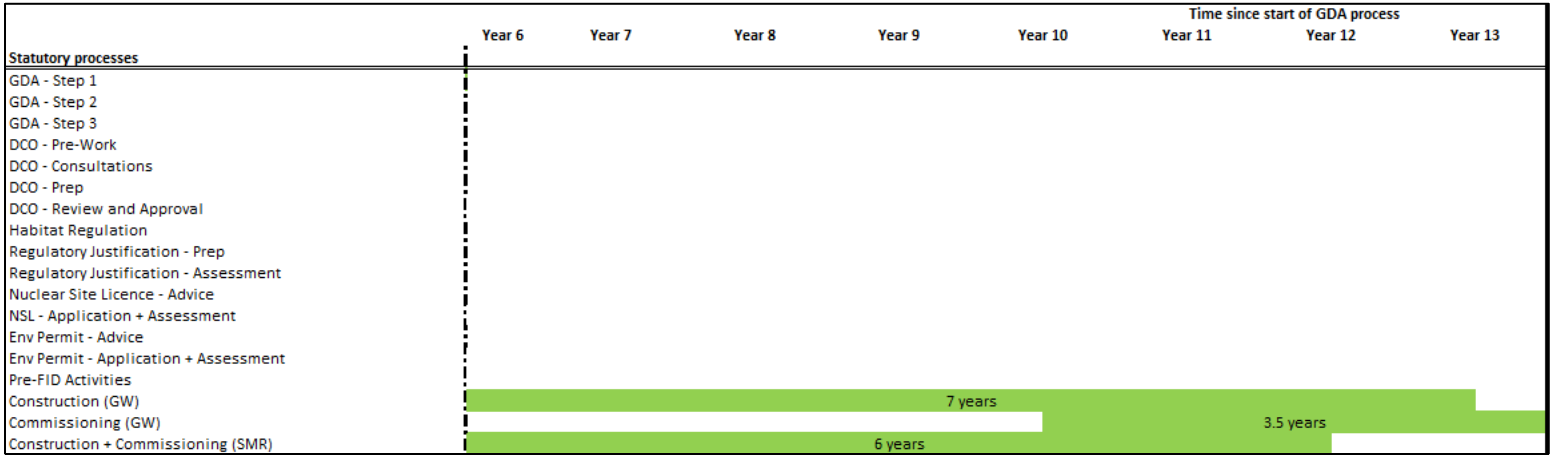


Figure 2: Indicative post NSL grant construction timeline up to operation

Table 1: High-level summary of statutory processes / approvals for new nuclear build, RAG rated for applicability for ANT.

Approval process	Current status	Suggested improvements for applicability to SMR and AMR
Regulatory Justification	AMBER	The current system for regulatory justification is project specific and HMG should be prepared to undertake the assessment of potentially multiple submissions in parallel, to prevent delays to the acceleration of new nuclear projects. HMG should undertake a review to consider Regulatory Justification of technology groups (e.g. PWR, HTGR) rather than individual designs and ensure the process is streamlined and avoids duplication with other approvals.
Planning	RED	HMG should update nuclear specific siting policy urgently and ensure that it is applicable to ANT including multiple energy vectors and co-generation. HMG should review the current threshold approach and the feasibility of non-DCO planning routes for nuclear facilities.
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Early regulatory engagement	AMBER	Regulators should embed and offer early pre-GDA engagement to industry to de-risk entry into GDA, licensing and permitting.
Nuclear licensing	AMBER	ONR should produce guidance on non-traditional nuclear deployment models, including for alternative protection and control strategies, multi-unit sites, co-generation and cross-boundary regulatory approaches.
Environmental permitting	AMBER	The Environment Agency (working with other UK environmental agencies where appropriate) should ensure an integrated approach between radioactive and non-radioactive assessment and permitting processes and avoid any duplication between processes (including planning and Habitats Regulation).

3. Cross-cutting considerations

Design Maturity

One of the key attributes which determine whether a nuclear new build project is ready to enter a particular approval process, and what pace it will progress through it, is the maturity of the design.

There is no internationally agreed terminology to define design stages of nuclear reactors however the World Nuclear Association (WNA) recently produced a report in which it defined design maturity as [6]:

- Phase 1: **Conceptual Design (Pre-FEED)**; major risks are identified, mitigations proposed, design optioneering undertaken and documents(s) produced outlining the design, safety principles and key decisions taken with rationale.
- Phase 2: **Plant-level engineering design (Pre-FEED)**; key design parameters of all key structures, systems and components (SSC) are defined. This is generally focused on reactor core including coolant system, safety systems and key balance of plant. The output will be document(s) defining the key design parameters of the safety related SSCs and safety features of the reactor design, alongside several preliminary assessments of impact.
- Phase 3: **System-level engineering design (Pre-FEED)**; the SSCs and their requirements and parameters are further refined, and all other plant systems are defined such as reactor chemistry and waste management infrastructure. The key differentiation between this Phase and the next is that the information produced is not necessarily sufficiently detailed to allow manufacture. It is assumed that this is the Phase of the design which will require significant increase in the design organisation capability with staff increases and support from the supply chain.
- Phase 4: **Component-level engineering design (FEED)**; it is during this phase that the final detailed design is completed to allow manufacture and production of documentation suitable for submission to licensing processes. This Phase is often referred to as the **Detailed design phase**.

The phases above could be applied to any new nuclear design whether it is a GEN-III gigawatt design or an SMR / AMR, however the likely novelty of SMRs and AMRs mean that they are at lower design phases and will have greater challenges transiting to later phases.

For example, an SMR design may make use of GEN-III PWR technology (e.g. a ‘standard’ PWR fuel design which has an established manufacturing route and years of proven reactor and storage performance) but include novelty such as the geometry of the fuel, reactor coolant or materials used in exposed structures. This would limit the applicability of available PWR Operational Experience (OPEX) and present a gap in the evidence base for regulatory submissions. The novelty of AMR designs is likely to increase the OPEX gap with little or no evidence base for these designs.

The UK's goal-based regulatory framework means that there is no fundamental impediment to licensing and permitting of a novel design as it is sufficiently flexible to allow engagement with designs of low maturity. However, the responsibility will always remain with the requesting party (RP) in GDA / operator (licensing and permitting) to justify that its design is safe, secure and protects the environment.

As well as OPEX the concept of Relevant Good Practice (RGP), e.g. recognition that specific codes and standards have been judged by the regulators, through assessment, as satisfying the minimal requirements for licensing and permitting, is also important. This means that SMR / AMR vendors could demonstrate compliance with a particular code or standard as part of demonstration of the ALARP (As Low as Reasonably Practicable) and / or BAT (Best Available Techniques) principles. However, ONR and the environment agencies are clear that meeting a particular code and / or standard or RGP is not necessarily in itself a demonstration of ALARP and / or BAT.

It is therefore likely that SMR / AMR designers will need to undertake R&D to produce underpinned and evidence-based submissions as part of GDA and licensing and permitting. Depending on the novelty and OPEX available this could include significant R&D and / or demonstration plants.

It is often the case that vendors are overconfident in the readiness of their designs to enter regulatory processes or assume because they have engaged with the regulatory processes in one country it will be acceptable in another. In its report the WNA has attempted to illustrate how the regulatory processes in different countries align with the design maturity phases described above, see Figure 3.

As is clear in Figure 3 the readiness of a nuclear reactor design for regulatory processes is not the same for each country or process and therefore a design progressing through the Canadian vendor design review (VDR) process is not necessarily ready for the UK's GDA process etc.

The modernised GDA process now has the option for an RP to complete only part of the process or submit parts of the design for review, assuming that the assessment remains meaningful [7]. The level of design submitted will limit the potential outcome (e.g. a 'GDA statement' rather than a Design Assessment Confirmation (DAC) and Statement of Design Acceptability (SoDA)) but will give a clear statement of regulatory confidence of the design which could be useful for vendors seeking further investment. The modernised GDA potential options are detailed in Figure 4.

Early engagement between reactor vendors and regulators can help potential vendors better understand the UK regulatory framework and what is required so that they can address any gaps and plan submissions which are likely to meet the requirements. Furthermore, early engagement will allow identification of areas which will receive priority regulatory scrutiny as part of a formal assessment process. This type of pre-engagement has cross-cutting benefits as it allows the regulators to identify what skills and competencies they will require if the proposed design is progressed in the UK.

This type of early engagement has already been undertaken by the regulators in the UK (ONR and the Environment Agency) funded by BEIS. This has ranged from introductory and high-level overview meetings of 1-2 days to several technically focused sessions to discuss areas of novelty with the ultimate objective to de-risk GDA[1] entry.

As well as clarifying the regulatory requirements in terms of design maturity for entry and progressing through the UK regulatory processes another key consideration is the willingness of a vendor to fund design development. Certainty of deployment, and therefore investment returns, will be significantly influenced by government policy.

In summary, design maturity will determine the readiness of a vendor to enter the regulatory processes. The UK regulators goal-based approach allows engagement with less mature designs to enable entry to later more formal processes. However there is currently no agreed description on level of design maturity required for entry and progress to different regulatory processes, ONR and EA should consider agreeing design terminology which could be used to specify entry conditions for each regulatory process.

Design maturity is a key factor which determines the readiness for entry and progress through approval routes. HMG should clarify and provide certainty on nuclear policy to encourage vendors to progress designs.

[1] UKRI funded 18 engagements between the Rolls Royce SMR consortium and ONR and the Environment Agency. Technical topics were agreed in advance and each meeting consisted of a technical presentation from UKSMR followed by discussion with relevant ONR and Environment Agency technical experts.

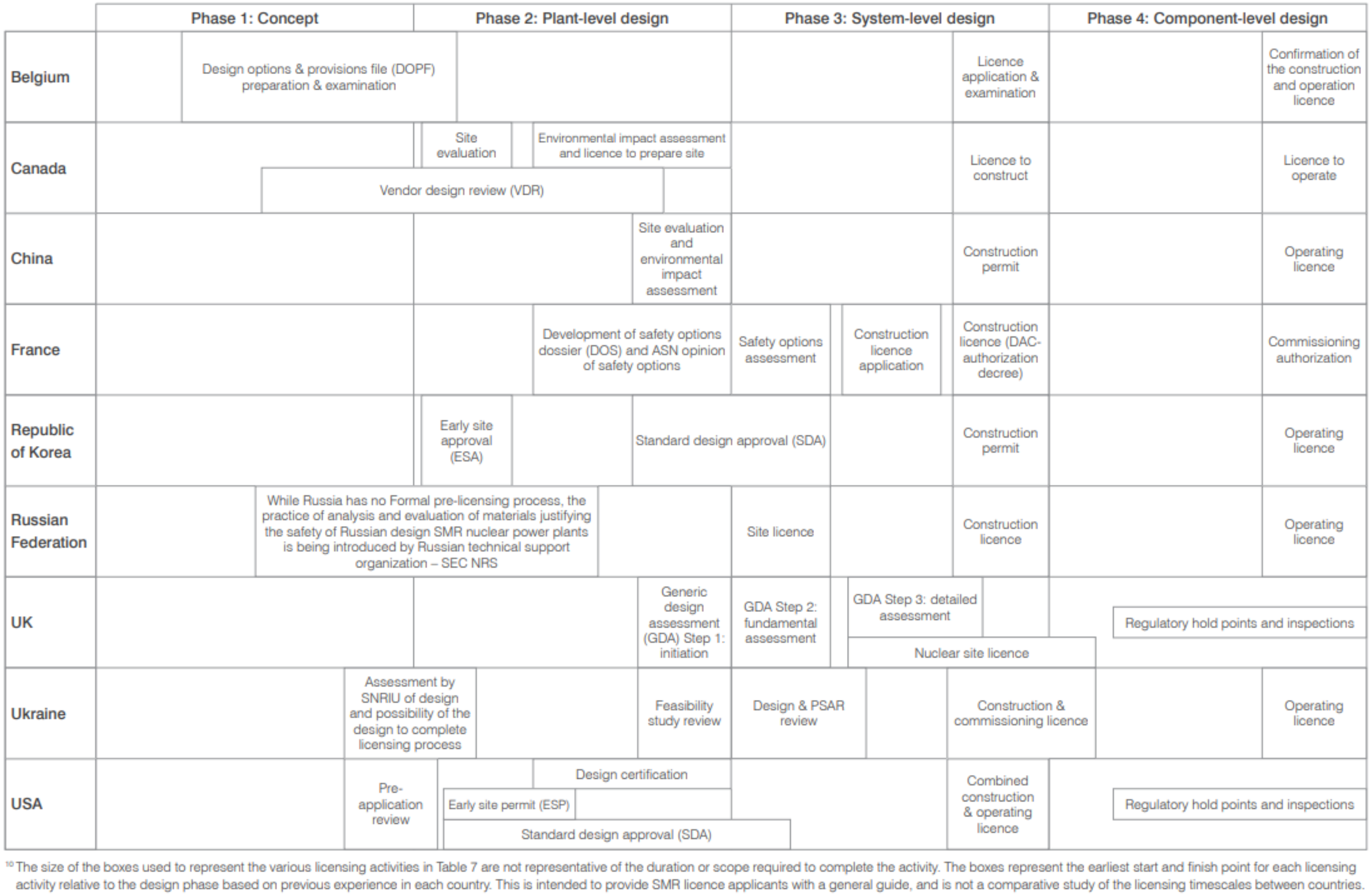

Figure 3: Comparison of several countries regulatory processes [6]

Example	Technical Assessment Topics	Steps	Output
Full plant (well developed) design	All	1, 2 and 3	**DAC, iDAC** or no DAC
Major portions of a well-developed plant design (for example; one complete reactor module of a multi-module design where the interactions between modules are potentially safety significant but are declared out of scope by the RP)	All	1, 2 and 3	**Statement**
Major portions of the plant design (of limited design maturity)	Most	1 and 2	**Statement**
Conceptual full plant design	Most	1 and 2	**Statement**
Partial plant design (for example, a design where the deployment model relies on out of scope supporting SSCs)	Assessment not meaningful – no GDA undertaken		
Distinguishing safety system (for example, the control and instrumentation technology and architecture)	Assessment not meaningful – no GDA undertaken		

Figure 4: Modernised GDA options [7]

Organisational capability

The organisational capability and capacity to hold a NSL and associated environment permits, and growth through the build lifecycle, is a fundamental requirement for licensing and permitting. The regulators will scrutinise this as part of the nuclear licensing and environmental permitting applications processes. Ultimately the UK regulatory framework places responsibility on the licensee / permit holder to ensure the safety, security and environmental protection performance of all operations on the site for which the NSL and permits are held. This includes conventional as well as radiological hazards during normal operation and appropriate mitigation and planning for accident scenarios and liability.

This is a significant responsibility, and the regulators will normally seek to engage with a potential licensee / permit holder in advance of formal submission of a NSL and permit applications. The length of any pre-application advice period will depend on the organisational capability of the applicant but could be several years for a new and developing organisation.

Organisational capability includes the ability of the organisation to construct, commission, operate and decommission all the facilities on the nuclear licenced site (NLS) and act as an intelligent customer for its supply chain. Staff capability, management systems, processes etc. will all be assessed as part of this, more detail is given in ONR's licence condition 36 (LC36) [4] and the Environment Agency's radioactive substances regulation (RSR) objectives and principles [8].

Previously the prospective licensee / permit holder has sought to engage with the regulators in parallel with the GDA process, although the RP and potential licensee / permit holder have been different corporate organisations they have to date shared common parent bodies but this may not always be the case. GDA was designed to allow a RP to undertake GDA and then offer their design to multiple licensees / permit holders, a model which may limit the opportunities to work in parallel.

Currently EDF Energy Nuclear Generation is now the sole organisation operating nuclear power stations in the UK, with NNB GenCo (HPC) Ltd the future operator of Hinkley Point C, although there are other organisations who hold NSLs and environmental permits, for example the NDA which may have residual operating capability in the Magnox part of its estate. The limited operational experience in the UK means that a new operator will need significant time to develop before it is ready to submit a NSL application. Rolls Royce have license to operate both a research reactor and demonstration reactor site for non-civil areas.

Organisational capability could be built in the absence of a specific or mature design and could therefore be decoupled from the design aspects and progressed in parallel. Although the organisation could not apply for a NSL or environmental permits without a detailed design and site it could develop the generic capabilities needed in anticipation of eventual application thus reducing the overall timeline. However, it is unlikely that a private organisation would be willing to take on this risk without certainty that a design would be accepted and with clarity on government plans for nuclear deployment. Therefore, it is likely that some form of government oversight or support for a UK development organisation would be needed to kick-start this process which could then be transferred to a private organisation.

The capability of the future operator is a key assessment area for licensing and environmental permitting. At this time, the UK does not have an Operator ready to deploy ANTs. HMG should support the development of UK ANT operator capability by through supporting financing and policy activities.

Financing

Nuclear projects require significant upfront investment to progress design and construction with returns not being made until later in operations. Financing of design development, organisational capability and construction is required as well as the direct costs of regulatory engagement. Financing of SMRs and AMRs may need different models, as timescales and expenditure levels ahead of the final investment decision (FID) may be different and different future energy contracts may be needed.

The UK's Nuclear Energy Financing Act (NE(F)A) 2022 implements the Regulated Assets Base (RAB) model for nuclear projects to encourage private investment. Furthermore, the Rolls Royce SMR is partly funded by the UKRI's Lost Cost Nuclear (LCN) initiative for the initial steps of GDA.

The ANT industry has also benefited from several past projects, such as the AMR Feasibility and Development (AMR R&D) project which provided funding to engage with regulators and undertaken design specific R&D.

Given the importance of financing to progress of any nuclear project HMG should review the applicability of existing models and exploration of future models suited to novel design.

Supporting infrastructure

Nuclear power stations require supporting infrastructure to manufacture components and fuel as well as waste management routes to store, treat and dispose of wastes. The UK has experience of operating a wide range of nuclear facilities including fuel fabrication and waste treatment and disposal. However, the novelty of AMRs means that the required infrastructure may be significantly different, for example, an HTGR will require a TRISO fuel manufacturing route which the UK does not currently have.

In addition, despite the experience with Dragon fuel the UK does not have a route for disposal of higher burnup / higher volumes of TRISO fuel [9]. Another significant challenge will be procurement and disposal of graphite. Although graphite has been extensively studied and new graphite grades developed there is no large-scale supply chain for this nor is there a disposal route in the UK, both would have to be developed to enable a HTGR AMR fleet. Other AMR technologies would have similar challenges but could also include the need for a fuel recycle / reprocessing capability.

It is likely that the development of a fuel route for TRISO would need to be started well in advance of a HTGR reactor being commissioned. Areas will include development of new manufacturing facilities and processes which themselves may be subject to regulatory approval.

In the UK this could be further complicated by the fact that the fuel manufacturing facilities are located on NDA land and therefore have limitations on operations as set out in primary legislation, namely the Energy Act 2004, which may need to be amended if a new non-AGR fuel route is to be supported.

Development of fuel infrastructure many years in advance of a detailed reactor design, and regulatory approval of that design, would represent a significant financial risk for a private organisation and may therefore need some form of government support or at least clarity on future market before this would be actioned. This is similar to the large-scale manufacture of graphite components. The nuclear regulators require that new nuclear designs have a management route (which includes storage, treatment, conditioning and disposal) of all wastes and that they avoid generation of any wastes which do not have a management route in the UK. The UK has a significant legacy of wastes which cannot be currently disposed of which have originated from historic reactor and research sites, most of which is now stored at the Sellafield nuclear site. These wastes have created a burden on future generations. Government policy now requires that private vendors are wholly responsible for the development and funding disposal of all wastes from operations. Specifically, Section 45 of the Energy Act 2008 [10] requires operators of new nuclear power stations in the UK to produce a plan describing how the plant will be decommissioned and the wastes treated and stored (the Decommissioning and Waste Management Plan (DWMP)) as well as a plan on how this will be funded by the operator (the Funded Decommissioning Programme (FDP)).

BEIS will need to consider if the current expectations in the Energy Act 2008 for the DWMP and FDP are applicable to ANT, including shorter life demonstrations plants which will not operate for 40 years (and therefore generate sufficient income to fund waste management) as assumed in the Energy Act 2008 and what implications this will have for expectations and if changes are required.

The UK does have waste management routes for all categories of radioactive wastes, although currently Intermediate Level Waste (ILW) and High Level Waste (HLW) are stored awaiting the future development of a Geological Disposal Facility (GDF)[2]. The expectation for designers and future operators is that they identify all wastes which will be produced during construction, commissioning, operation and decommissioning and present credible management plans ensuring that they demonstrate BAT for disposal and ALARP for management on site.

For GDA the requirement is that RP's gain early advice from waste infrastructure owners, e.g. Nuclear Wastes Services (NWS) which is the body responsible for the operation of the Low Level Waste Repository (LLWR) Ltd and the future GDF. This early advice will be scrutinised by the regulators. Importantly this is not full acceptance of the wastes by NWS but rather a review of the likely risk to future acceptance and a response on how this will be de-risked by the RP, therefore wastes management only

[2] Note that deep geological disposal is the policy in England and Wales for ILW and HLW while Scottish policy is for near site near surface management of ILW.

needs to be developed to a relatively high level at GDA, but will need to be detailed at licensing and permitting.

If wastes from an AMR demonstrator are significantly different to that seen previously in the UK there will not be an established waste management route which would mean no design could progress through GDA or licensing and permitting without the development of new approaches. Therefore, it is important that all novel wastes are identified as early as possible and engagement held between designers / operators / regulators and operators of waste management infrastructure to identify what these wastes are and possible management solutions.

ANT will require new infrastructure to support deployment (i.e. fuel and waste routes) which must be developed in readiness for a reactor. HMG should encourage integrated working between reactor vendors, developers, fuel fabrication and waste infrastructure industries to ensure that a suitable supply chain is developed to enable deployment of ANT.

Cross-regulatory boundary issues

There is increasing interest in the use of nuclear to support non-national grid electrical production applications, such as direct heat or local electricity connections for industrial processes. There is no fundamental impediment to hosting major industrial processes on a NLS and there is experience of regulating such complex sites. However, given the additional hazards associated with major hydrogen production for example, this is likely to require additional mitigations to ensure risks are ALARP which could increase costs and add time to deployment due to increased assessment by ONR.

This may drive siting of linked facilities to be near to, but outside, the NLS. ONR regulates facilities on a NLS while the Health and Safety Executive (HSE) regulate facilities on non-NLS sites (with the relevant environmental regulator). If facilities were located off the NLS ONR would assess what potential impacts it could have on the safety of the site and vice versa (e.g. external hazards), there may also be security implications.

In addition, if the energy vector being produced was heat, there could be a transfer of steam off and then back to the NLS, which would need arrangements to avoid transfer of radioactive material across the site boundary.

The potential variety of siting options would require integrated working between ONR, HSE and EA (or equivalent). The regulators have strong working relationships and Memorandums of Understanding (MOUs) however specific guidance on siting of major industrial facilities on or off a NLS and the expectations of each regulator is needed to avoid developer uncertainty and duplication which could both cause delays to deployment. Such guidance on expectations would inform developers of likely time and cost for different deployment options to allow them to select the option which best meets their requirements.

Non-electricity applications (e.g. direct heat, co-generation etc.) will require collaboration between regulatory bodies in order to avoid duplication and provide clarity to prospective designers and operators. HMG should facilitate the discussion of cross-boundary regulatory issues and work with responsible bodies and organisations to clarify expectations to ANT developers.

4. Conclusions

NIRAB has conducted a review of the statutory processes required for approval of new nuclear in the UK. Each approval process has been given a Red-Amber-Green rating and advice on how to ensure each is suitable for future nuclear deployment has been provided.

It is not unexpected that the mostly goal-setting UK regulatory framework can be relatively easily adapted for novel ANT designs, however specific suggestions have been made where there is the possibility to reduce costs and time of deployment.

Of note is the feedback for Planning, assessed as RED, which suggests changes are needed to enable the deployment of ANT. All other areas have been assessed as AMBER, meaning there is a process in place although it is not optimised.

Cross-cutting areas including design maturity, organisational capability, financing, supporting infrastructure and cross-regulatory boundary issues are also discussed and suggestions to overcome any potential delays identified.

NIRAB has concluded that although there are opportunities to optimise statutory approval processes to support delivery of ANT these in isolation would not reduce the time for deployment significantly as it is the cross-cutting areas that drive the pace of progress and HMG should ensure that government support, including financing and policy, is in place to reduce the barriers for vendors and developers.

5. References

[1] BEIS, "Energy White Paper: Powering our Net Zero Future," 2020.

[2] HMG, "British energy security strategy," 2022.

[3] ONR, "Licensing nuclear installations," 2021.

[4] ONR, "Licence condition handbook," 2017.

[5] NIRO, "Declaration of commercial operation in new nuclear plants," 2022.

[6] World Nuclear Association, "Design Maturity and Regulatory Expectations for Small Modular Reactors," 2021.

[7] ONR, "Generic Design Assessment (GDA) of new nuclear power stations," 2021. [Online]. Available: https://www.onr.org.uk/new-reactors/.

[8] HMG, "Radioactive substances regulation (RSR) guidance," 2011. [Online]. Available: https://www.gov.uk/government/publications/radioactive-substance-regulations-rsr-guidance.

[9] NIRO, "Pathway for disposal of spent fuel from HTGR," 2022.

[10] HMG, "Energy Act 2008," 2008. [Online]. Available: https://www.legislation.gov.uk/ukpga/2008/32/section/45.

Appendix 1: Nuclear new build approval processes

<table>
<tr><th colspan="5">Regulatory justification</th></tr>
<tr><td colspan="5">Regulatory Justification is a process required under the Justification of Practices Involving Ionising Radiation Regulations 2004, under which the DEFRA Secretary of State (Welsh Minister in Wales) must decide whether a new class or type of practice resulting in exposure to ionising radiation is justified by its economic, social or other benefits in relation to the health detriment it may cause.
Typically, each nuclear reactor design requires Regulatory Justification and this is expected to be the case for SMRs and AMRs. Previously reactors (e.g. AP1000, EPR etc) have justified the use of nuclear fission for electricity production only, SMRs and AMRs will need to include other uses if seeking approval for co-generation activities, e.g. hydrogen production and / or industrial heat along with electricity generation.
It is important to note that Regulatory Justification is an independent process to 'nuclear regulation' processes such as GDA, licensing and permitting. The social, economic and other benefits which form part of the Regulatory Justification assessment are not considered in detail by the nuclear regulators in their processes.</td></tr>
<tr><th>Applicant</th><th>Decision making body</th><th colspan="3">Process & Timescales & prerequisites</th></tr>
<tr><td rowspan="3">Private vendor, although Nuclear Industry Association (NIA) has applied on behalf of some reactor vendors in the past.</td><td rowspan="3">DEFRA SoS (or equivalent in devolved administrations)</td><td>Regulatory justification preparation & submission</td><td>12 months</td><td>Detailed design and assessment of impacts with clear use-case.</td></tr>
<tr><td>Examination (including non-public consultation)</td><td>12 months</td><td></td></tr>
<tr><td>Decision</td><td>N/A</td><td></td></tr>
<tr><th colspan="5">Potential duplication with other processes</th></tr>
<tr><td colspan="5">The submission will contain design detail and impacts therefore there is likely to be significant duplication with other submissions specifically those for GDA and licensing / permitting.</td></tr>
<tr><th colspan="2">Current status- AMBER</th><th colspan="3">Acceleration -GREEN</th></tr>
<tr><td colspan="2">• Process in place but each individual technology must be justified rather than single application per technology family.</td><td colspan="3">• Optimised Justification with automatic approval of technology family, i.e. PWRs, HTGRs etc and all potential use-cases.</td></tr>
</table>

• Must ensure non-electric uses included if likely to be in use-case, otherwise may need to seek a later additional Justification for other uses. • DEFRA is the decision making body, although all recent decisions taken by BEIS, therefore question of timeframe for DEFRA to develop processes / capability. • Indications that the UK ABWR 180-page submission is the 'standard'. • Possibility that different processes (e.g. pumped flow versus natural circulation) for the same technology (e.g. BWR) would need separate Justification which suggests Justification process remains project specific.	• Re-use of submissions from other processes and / or explanation of what is already covered by licensing and permitting to consider what value Justification adds. • Ensure that DEFRA is ready to receive and assess any future submission to de-risk potential delays. • Challenge the assumption that '180-page' UK ABWR application is the 'standard' to ensure that process is proportionate.

Benefits of acceleration for: DEMO	**FOAK**	**NOAK**
Potential simplification of submissions, but insignificant benefits in terms of acceleration as can be undertaken in parallel with other processes.	Same benefits as DEMO	Assuming generic submission made for reactor type this would eliminate the need for Regulatory Justification for Nth of a kind (NOAK) / different reactor designs of same technology family / different use-cases.

<table>
<tr><th colspan="5">Planning</th></tr>
<tr><td colspan="5">SMR and AMR projects which plan to generate electricity over 50 MWe in England and 350 MWe in Wales will be designated as Nationally Significant Infrastructure Projects (NSIP) with policy for planning decisions detailed in an overarching NPS, EN-1, and specific nuclear NPS, EN-6.

NSIPs require a Development Consent Order (DCO) which is decided by the BEIS SoS. This is effectively the large-scale planning permission for the project and will consider risks and impacts and the proposed mitigation. An important area that the DCO considers is demonstration that identified stakeholders, both statutory and non-statutory, have been consulted and their views taken into account in the project. For reactors below the thresholds stated above, the current route will be via Town and Country Planning Act (T&CP). There is also a statutory requirement for a strategic environmental assessment (SEA) as part of the planning authorisation process for a nuclear facility. Depending on the location a Habitats Regulation Assessment (HRA) may be required.

The government has recently consulted on EN-1 but has not yet updated EN-6 which lists eight sites in England as suitable for new nuclear developments. These are currently in areas adjacent to existing NLSs. A future review of EN-6, if it takes into account siting criteria for multiple energy vectors, may identify a different list of sites or may set out site criteria rather than a list of specific sites.

If a nuclear reactor produces heat only (or co-generates with electricity) the current DCO thresholds will need to be examined to determine how this non-electricity production will be factored into the existing or future thresholds; similar considerations will need to be considered for other energy production forms.</td></tr>
<tr><th>Applicant</th><th>Decision making body</th><th colspan="3">Process & Timescales (months) & prerequisites</th></tr>
<tr><td rowspan="4">Potential Licensee</td><td rowspan="4">BEIS SoS if NSIP or Local Authority (LA) if not (although BEIS SoS can ‘call decision in’)</td><td>Step 1a: Pre-application stage (preparation)</td><td>6</td><td>Detailed design & Habitats Regulation Assessment (HRA)</td></tr>
<tr><td>Step 1b: Pre-application stage (Consultation(s))</td><td>24</td><td>Consolation responses to Step 1a</td></tr>
<tr><td>Step 1c: Pre-application stage (respond to consultation & prepare final documents)</td><td>6</td><td>Applicant submits final application</td></tr>
<tr><td>Step 2: Acceptance stage</td><td>1</td><td></td></tr>
</table>

		Step 3: Pre-examination stage	3	PINS panel in place and Interested Parties registered
		Step 4: Examination stage (including engagement with Interested Parties)	6	Review and engagement sessions undertaken
		Step 5a: Recommendation & Decision	3	
		Step 5b: SoS review	3	
		Step 6: Post Decision stage	1.5	Opportunity to challenge final decision

Potential duplication with other processes

There is potential for duplication between information required in DCO (e.g. site characteristics and impacts of construction and operation) and other approval processes such as GDA, licensing and environmental permitting including Habitats Regulation Assessment (HRA) etc.

Current status- RED	Acceleration -GREEN
• Current EN-6 written for GW-scale not SMR and unsure if applicable for non-electricity energy production • EN-6 does not exclude the need for a project specific DCO or some form to be completed • DCO requires a specific design for a specific site. DCO is a long process and costly to developers (without guarantees) • DCO is a lengthy and costly process and likely not proportionate if it has to be applied to each reactor in a fleet of SMRs or AMRs • Particular issue may be the significant costs for smaller projects • Assessment historically never delivered to required timescales • Thresholds for DCO are MWe. Therefore, not applicable to heat or other co-gen	• EN-6 (or equivalent policy) for ANT and non-electricity energy production • Consider how to prevent duplication of DCO application requirements for designated sites / sites fitting a set criteria in NPS • Design specificity removed so that a DCO envelope is sufficient (seek learning from US and Canadian process). • More weight to net zero, energy security and resilience as justification • Remove duplication of submissions (between DCO - permitting etc) • HMG starts and / or underwrites DCO risk (however noting that cost-recovery could impede reducing costs of electricity at point of sale) • Make thresholds related to MWth and standardisation across UK nations e.g. Wales has 350 MWe threshold versus 50MWe in England

• Planning process in place for below thresholds, however, no nuclear has ever been taken through T&CP, therefore risk that it is not suitable route / decision is 'called-in' by BEIS SoS and likely to include a lengthy Planning Enquiry • Note that currently a DCO (or T&CP equivalent) would be required for each site. If nuclear sees significant expansion then multiple DCO assessments would require increased PINS capacity to progress	• Make all nuclear a NSIP (i.e. not through T&CP) to avoid potential risk of BEIS SoS 'call-in' later, need for LA to upskill and time required for Planning Enquiry. • PINS (or LA) capacity would need to match demand

Benefits of acceleration for: DEMO	FOAK	NOAK
• Siting can be progressed in advance of a specific design being chosen / without a detailed design thus potentially decoupling design development from siting. Although this would not reduce the overall time of DCO it would allow it to begin sooner. • Ensuring that any duplication is removed would introduce efficiencies for the applicant which would reduce the preparation time for other processes such as environmental permitting. • Increasing the significance of net-zero / climate emergency / energy security as justifications for new nuclear would strengthen the benefits over detriments and may potentially clarify consultation engagement. • HMG support / owning of risk would reduce private industry risk	• Same benefits as DEMO	• A DCO envelope and HMG lead siting for a fleet would significantly reduce burden and uncertainties for private industry. Although site specific and design specific impacts would still be required on a case-by-case basis the principle of acceptance if within the envelope would simplify the process significantly, in particular the initial Stages 1a & 1b. • Could also include option for HMG to recover costs as part of handover / FID / operation.

• Clarifying 'MWe thresholds' and impacts for MWth co-generation is needed to give DEMO flexibility of production • Classifying all nuclear projects as NSIPs would reduce uncertainty and risk the T&CP route not suitable		

Generic Design Assessment (GDA)
GDA is not a mandatory process, however BEIS anticipates that it will usually be requested for a new nuclear power station. GDA is intended to assess whether a proposed technology could be constructed, operated and decommissioned in Great Britain while meeting the high standards for safety, security and environment protection. GDA was created after HMG requested that regulators review their processes after findings from the Public Enquiry into the licensing/ permitting of Sizewell-B (SZB). It is a joint process operated by ONR and the Environment Agency, and Natural Resources Wales (NRW) in Wales, with entry controlled by BEIS. Although it is not a legal process the regulators have stated that they will not re-assess anything agreed in GDA unless site-specific or operator decisions warrant this. GDA decisions are valid for 10 years but can be extended. The regulators have recently modernised the GDA process to ensure it is suitable for mature SMRs and AMRs, but this may require further revision or be complimented with suitable early engagement processes for less mature designs which are not yet ready to enter GDA. GDA is a non-prescriptive process and submissions made to other countries nuclear approval processes can be re-used in the UK, but it is likely that there will be UK-specific gaps, e.g., demonstration of ALARP / BAT, which will need to be addressed. The modernised GDA process includes 'GDA statements' which give the outcomes as a vendor progresses through GDA. It is also now possible for vendors to submit only part of their design for review and seek a GDA statement rather than a full GDA, in these cases additional technical assessment would need to be carried out in licensing / permitting to address the gaps. However, any GDA must be 'meaningful' for both the regulators and the RP and represent a credible technical assessment. Other countries have developed similar processes as the UK GDA, for example Canada's Vendor Design Review (VDR) process, but these are not necessarily of equivalent technical scope and should not be compared without context. It is important to note that a reactor designer (vendor) can apply for GDA regardless of whether they will be a future operator. This is in contrast to licensing and permitting, for which only an operator, with a site, can apply.

Applicant	Decision making body	Process (lead organisations) & Timescales & prerequisites		
Private vendor, known as a 'Requesting Party (RP)'. To date this has been a separate entity from the future operator of the design, but they have shared parent organisations and it was assumed staff from the RP would transfer to the future operator.	BEIS SoS and Regulators	Application to enter GDA (RP)	(N/A- dependent on RP- evidence to date is approx. 6 months)	At least a conceptual design, with all information as required by GDA entry guidance which includes information on financing, staffing, security etc
		Review of GDA application (GDA entry panel (BEIS, ONR, EA, NIRO))	3 months	
		GDA Step 1 (RP & Regulators)	Normally 12 months but project dependent	Entry approved by GDA entry panel and BEIS SoS requests regulators begin GDA. Charging agreement between RP and regulators.
		GDA Step 2 (RP & Regulators)	Normally 12 months but project dependent	Successfully completion of Step 1 and technical submissions as required. Design progressing to Detailed Design.
		GDA Step 3 (RP & Regulators)	Normally 24 months but project dependent	Successfully completion of Step 2 and technical submissions as required. Detailed Design and Design-freeze.
Potential duplication with other processes				
The submission will contain design detail and impacts, therefore there is likely significant possibility of duplication between submission, specifically those for licensing / permitting.				

Current status- AMBER	Acceleration -GREEN
• Modernised GDA process in place and entry open. • Regulatory resources limit the number of GDAs. • Some in industry claim that GDA is expensive and too long. • Uncertainty of what submissions from other regulatory regimes can be re-used and lack of guidance on re-use. • Only limited consideration of non-radiological factors. • UK GDA is comparatively technically detailed and there is a lack of a formalised pre-GDA process to enable less mature design to entry.	• Embed pre-GDA engagements to de-risk GDA entry and limit failed applications. • Ensure that GDA process supportive of innovation/novelty with processes such as 'sand-boxing' etc. • Guidance on use of international submissions which could shorten GDA assessment. • Harmonisation of GDA with international best practice, minimising bespoke UK requirements.

Benefits of acceleration for: DEMO	FOAK	NOAK
Benefits of GDA are maximised for fleet roll out and therefore the process may not be suitable for Demo which may change substantially before a fleet roll-out, although the general concepts may represent a generic approach to design assessment.	Maximising clarity on regulatory approach to innovation would help RPs with 'right first time' submissions and limit re-work. Time saved will depend on the GDA outcome being sought (e.g., full GDA or Step 2 only? Partial GDA?) but early engagement and clarity on regulatory approach to novel aspects would ensure process is as efficient as possible.	A full FOAK GDA would allow NOAK to be built without the regulators re-opening issues unless there are site specific aspects; removing the need for any GDA type assessment. Some form of harmonisation internationally would maximise export opportunities.

Regulatory early engagement / innovative regulatory processes for less mature designs

In 2017 HMG and the regulators recognised that a new approach was needed for advanced nuclear technologies (ANT) given the novelty and lack of OPEX common across the designs.

HMG funded the regulators to engage with both SMR and AMR designers. The regulators developed new early engagement processes suitable for these types of technologies. The benefits of early engagement were that regulators could provide vendors with clarity on expectations and vendors could discuss areas of novelty with the regulators getting early indication of likely areas of regulatory focus in later formal regulatory processes.

A process suitable for mature SMR designs was developed with UKRI. This involved a series of regulator-vendor technical workshop style sessions based on a single technical topic per session, e.g. novel safety systems, new fuel designs etc. The objective of these sessions was to de-risk the vendors entry into GDA and inform priority areas for assessment in GDA.

Another process was developed to support the BEIS AMR Feasibility and Development (F&D) study. This consisted of regulatory review of a feasibility report of a maximum of 250 pages. The regulators had specified criteria which included topics such as waste management, management of safety and quality assurance (MSQA), security etc. which the vendors were expected to respond to. The regulators then reviewed and provided a RAG score for each of the criteria with a short explanation of the score. The regulators were careful to clarify that a Green did not mean that the design would be accepted in the UK as this was not a formal assessment, and conversely a Red meant that there was insufficient information supplied to undertake the review rather than a definitive conclusion that the design could not be built in the UK.

These processes were funded by BEIS but have not yet been embedded in regulatory processes and are therefore not available to industry without BEIS intervention. However, feedback from all parties involved was that these were beneficial to both industry and regulators and should be offered in future in the UK.

Regulators are also exploring the option for ‘sand-boxing’ / innovation-cells which would allow ongoing engagement between designers and regulators who are still exploring design choices. This would allow early discussion of potential novel areas which would inform both the design choices and regulatory development of updated guidance etc. for novel areas. This type of engagement is in place in other regulatory regimes but not yet for nuclear.

Applicant	Decision making body	Process (lead organisations) & Timescales & prerequisites		
Private vendor taking part in an HMG funded process.	Regulators	Pre-GDA technical engagements	6-9months of 15-20 one day technical sessions.	BEIS charging agreements to allow regulatory cost recovery.

		AMR type review- submission	3 months	Concept design and vendor of sufficient competency to address all regulatory criteria.
		AMR type review- review	3 months	Regulatory resource
		AMR type review- outcome	1 month	Regulatory report with RAG scoring and short narrative.

Potential duplication with other processes
Given the high-level nature of the engagements / submission there is unlikely to be significant duplication with other processes, although AMR type submissions could be suitable for GDA Step 1 scoping discussions.

Current status- AMBER	**Acceleration -GREEN**
• Processes have been developed and run under BEIS programmes but have not yet been embedded in normal regulatory offer.	• Process published and effective charging route established (fully funded by HMG or regulator activities funded by private vendors). • Offer the 'sand-boxing' / innovation-cell approach to support designs as they mature and allow regulators to produce guidance / approaches to areas of novelty, thus supporting innovation.

Benefits of acceleration for: DEMO	**FOAK**	**NOAK**
Early engagement process to discuss novelty / innovation with the regulators to de-risk design, build and formal regulatory approval would reduce uncertainty in entry and progress through formal approval processes.	Same as for DEMO	NOAK assumes that DEMO / FOAK already approved and built and therefore early engagement / innovative regulatory engagement would be unlikely to be beneficial or needed for NOAK.

<table>
<tr><th colspan="5">ONR Nuclear Site Licensing</th></tr>
<tr><td colspan="5">ONR are responsible for regulation of nuclear safety, security, safeguards and transport in Great Britain. A Nuclear Site Licence (NSL) is required to undertake a Prescribed Activity. A NSL is a legal document, issued for the full life cycle of the facility. Licences are issued under the Nuclear Installations Act 1965. The act provides for a NSL to be granted to a named corporate body to install or operate specified nuclear installations in a defined location (including nuclear power stations, research reactors, and nuclear fuel manufacturing). The licence will be issued with a set of 36 Standard Licence Conditions (LCs), covering design, construction, operation and decommissioning. These conditions require licensees to implement adequate arrangements to ensure compliance.

It is possible for an operator to undertake their activities on an existing NLS under another licensee’s arrangements (See LC-3 (tenants and lease arrangements)). In these situations, the operator would undertake their operations on discrete parts of the site, but the licensee remains in overall control. This would result in the licensee incurring a cost associated with operating arrangements for tenants higher than similar enterprises on a non-nuclear licensed site.

Siting of nuclear reactors closer to urban or industrial locations (if required for multiple energy vectors) and closer to chemical plants etc., which may have an increased risk of adverse events such as explosion, may present more challenging conditions from an internal / external hazard and security perspective, however this would be assessed by ONR for a specific site and local conditions and does not necessarily restrict siting of nuclear facilities.</td></tr>
<tr><th>Applicant</th><th>Decision making body</th><th colspan="3">Process (lead organisations) & Timescales & prerequisites</th></tr>
<tr><td rowspan="5">Prospective licensee (i.e. operator)</td><td rowspan="5">ONR</td><td>Pre-application advice</td><td>12</td><td>Corporate body capable of becoming a Licensee (Operator). Site.</td></tr>
<tr><td>Step 1: Preparation</td><td>12-24</td><td></td></tr>
<tr><td>Step 2: Collation of license application dossier</td><td>12-24</td><td></td></tr>
<tr><td>Step 3: License application</td><td>N/A</td><td></td></tr>
<tr><td>Step 4: Assessment of the application & (non-public) consultation</td><td>18-24</td><td></td></tr>
</table>

<table>
<tr><td></td><td></td><td>Step 5: Granting License</td><td>N/A</td><td></td></tr>
<tr><td colspan="5">Potential duplication with other processes</td></tr>
<tr><td colspan="5">Nuclear site licensing is the legal process required before a nuclear facility can be constructed in the UK. It requires a detailed design, designated site and organisation which is deemed to be capable of holding a nuclear license indefinitely. Given the detail there is likely to be duplication across a number of other processes such as planning (DCO) and environmental permitting, however it is unlikely that given the significance of nuclear safety and security that any requirements would be removed from ONR's expectations although it is possible that sections of submissions can be re-used in other processes.</td></tr>
<tr><td colspan="2">Current status- AMBER</td><td colspan="3">Acceleration -GREEN</td></tr>
<tr><td colspan="2">• Process in place but based on licensing traditional (large) nuclear.
• No SMR or AMR has yet been licensed although ONR have reviewed its processes and deemed them appropriate. However, SMR / AMR will present new challenges, such as co-locating several reactors, co-locating major chemical plants, siting closer to urban locations and alternative protection and control strategies.</td><td colspan="3">• Clear guidance on expectations for non-traditional nuclear licencing should be produced by ONR and clarity on expectations on licence variation if multiple reactors to be deployed at a site over a number of years / co-located with major chemical facilities / co-generation / non-traditional siting / alternative protection and control strategies.
• Clarity on multi-regulatory requirements and potential 'lead regulator' status would avoid conflicting assessments / duplication.
• Split Management and siting assessments, allowing siting work to progress in advance of developer organisation assessment.
• Although noting that UK already has a flexible approach and experience of co-location, therefore onus for acceleration will likely remain with potential licensee.</td></tr>
<tr><td colspan="2">Benefits of acceleration for: DEMO</td><td colspan="2">FOAK</td><td>NOAK</td></tr>
<tr><td colspan="2">A new more flexible approach to licensing may be required to allow the design to develop during construction and operation. This would allow a designer and operator to retain flexibility to maximise demonstration opportunities such as co-generation and potential for multiple fuel designs being tested while maintaining safety</td><td colspan="2">Same as for DEMO</td><td>In the UK a specified organisational is given a licence to operate a specific design at a specific site. GDA provides some certainty that a design will be accepted but it is not a legal process and there is no guarantee. The SMR / AMR potential build model (i.e. lots of reactors of the same design) may mean that an adaptive approach to</td></tr>
</table>

through extra mitigations for example. However this approach would need to be adequately justified to avoid perception that 'standards' were being relaxed.		licensing to give more weight to the design acceptance would significantly reduce what each operator has to do at each site but unless there is a change to Primary Legislation (NIA65) each operator at each site will need to apply separately.

Environmental Permitting				
Operators who will dispose of radioactive wastes will require a radioactive substances regulation (RSR) permit under the Environment Permitting Regulations 2016 (EPR-16) in England and equivalent in the devolved nations of the UK. The issuing of an EPR permit is dependent on a satisfactory assessment by the relevant environment agency and public consultation. A successful application will result in a RSR EPR16 permit which will set conditions and limits on an operator to minimise and mitigate aerial and liquid discharges and solid waste disposals to protect and enhance the environment. Several other non-radioactive EPR16 permits will be required during construction, operation and decommissioning. The Environment Agency will assess the impact on people and the environment from a nuclear site. If a site were to be placed closer to an urban or industrial location the Environment Agency would assess the impacts taking into account public dose limits and principles of optimisation. This does not necessarily restrict siting of nuclear facilities as impacts will depend on the activity and volume of radioactive wastes disposals, local population conditions and habits. The Environment Agency also regulate the discharge of cooling water at coastal sites and both the abstraction and discharge of cooling water from inland water bodies in England. Impacts to the environment from abstraction of large volumes of water and / or discharge of heated water (regardless of radiological inventory) will need to be assessed taking into account local environmental conditions and impacts to wildlife. Consideration of impacts from co-located facilities (e.g. those making use of direct heat etc) would also need to be assessed with the combined impact from all operations on the local environment.				
Applicant	**Decision making body**	**Process (lead organisations) & Timescales & prerequisites**		
Prospective Permit holder (i.e. operator).	Environment Agency (or equivalent in the devolved nations of the UK).	Pre-application advice	12	Corporate body capable of becoming holding a Permit. Site identified.
		Preparation	12	Prepare documentation, perform dose / impact assessment & HRA
		Submission of application	N/A	Submit application to EA
		Consultation on application	3	Consult Public & Stakeholders on Application

		Application Determination	8	Consider consultation responses and assess application
		Draft Permits & Consultation	3	Consult on Draft Decision
		Final Assessment	6	Consider consultation responses
		Grant Permits	N/A	Permits with Conditions and Limitations

Potential duplication with other processes
There will likely be some duplication across permit applications, DCO and Regulatory Justification, however the level of duplication will depend on when applications are made (e.g. DCO applications tend to be earlier than permitting).

Current status- AMBER	**Acceleration -GREEN**
• Process in place but no recent experience of in-land location or permitting multiple reactors on a single site over a number of years (e.g. NuScale deployment model for example). • Potential duplication with other processes.	• Ensure an integrated permitting process (between radiological and non radiological) • Permitting process incorporates approach to innovation. • HMG Direction on consideration of importance of net zero, energy security and sustainability as justification for nuclear power. • Investigate any potential for duplication of submissions (between DCO, permitting etc) • HMG underwrites permitting risk

Benefits of acceleration for: DEMO	**FOAK**	**NOAK**
A new more flexible approach to permitting may be required to allow the design to develop during construction and operation. This would allow a designer and operator to retain flexibility to maximise demonstration opportunities such as co-generation and potential for multiple fuel	Same as for DEMO	In the UK a specified organisation is given a Permit to operate a specific design at a specific site. GDA provides some certainty that a design will be accepted but it is not a legal process and there is no guarantee. The SMR / AMR potential build model (i.e. lots of reactors of the same

designs being tested. Removal of duplication would reduce burden on developer and potential save cost and reduce time. Clear guidance on inland water usage would de-risk alternative siting.		design) may mean that an adaptive approach to Permitting to give more weight to the design acceptance would significantly reduce what each operator has to do at each site.