SIXEP Continuity Plant (SCP)
Full Business Case - Summary

Approvals granted				
Sellafield Ltd Investment Review Panel	**Sellafield Ltd Board**	**NDA Executive Sanction**	**NDA Board**	**BEIS / HM Government**
Complete	Complete	Complete	Complete	Complete

1 Introduction

1.1 Business Case Request

The SIXEP Continuity Plant (SCP) project Full Business Case (FBC) requests additional HMG sanction of:

- **P80 cost of £868m** (bringing cumulative sanction for the project to P80 £1,182m)
    - P50 cost of £748m (bringing P50 cumulative sanction for the project to £1,007m)
- **P80 completion date of February 2033**
    - P50 completion date of January 2031

1.2 Context

Spent nuclear fuel and waste management operations on the Sellafield site produces liquid effluent. This effluent requires treatment to remove radioactivity before discharge into the sea. This treatment is a regulatory compliance requirement. It is essential for delivery of the site missions including high hazard and risk reduction activities in line with the UK Discharge Strategy and OSPAR commitments on protection of the marine environment.

Continued effluent treatment through the existing facility (or a replacement capability) is fundamental to the Nuclear Decommissioning Authority (NDA) mission to “deliver safe, sustainable and publicly acceptable solutions to the challenge of nuclear clean-up and waste management”. The availability of effluent treatment is essential until 2060 to enable the site mission of high hazard risk reduction.

Since 1985, effluent treatment is provided by the Site Ion Exchange Effluent Plant (SIXEP). SIXEP is now beyond its design life and a replacement capability is required to provide continuity of effluent treatment.

The SIXEP Continuity Plant (SCP) project will design, construct, commission and handover a new radioactive effluent treatment facility.

1.3 Why is a business case required now?

Significant progress has been made since approval of the Outline Business Case (OBC) in respect of project maturity, delivery approach, market engagement and transition to the HMG approved Programme and Project Partners (PPP) delivery model. The project has made the following progress:

- Completed the detailed design stage;
- Site ground works are complete, with concrete foundations in delivery;
- Storage tanks are ready for manufacture;
- Set the baseline for the PPP to complete SCP.

Whilst the scope has remained stable, increased maturity has led to a P50 cost and schedule variance of £432m and 21 months from the OBC submission and the project cost now exceeds the original range.

The project is ready to proceed into delivery on approval of the Full Business Case.

2 Strategic Case

2.1 Case for change

The strategic case for SIXEP Continuity Plant (SCP) remains valid, as presented in the approved OBC (2020), based on the absolute need for the effluent treatment capability and the current risk to site operations, supporting the NDA's mission to "deliver safe, sustainable and publicly acceptable solutions to the challenge of nuclear clean-up and waste management".

Programme studies concluded that the probability of failure of the existing effluent treatment process vessels and in-cell pipework increases after 2025 and is greater than 50% before 2050. Loss of the capability is intolerable and would:

- result in unacceptable consequences from an environmental perspective
- halt upstream risk reduction programmes, resulting in extended retrievals durations and time at risk
- increase fuel storage pond water activity levels / dose rates and elevate environmental discharges.

The SIXEP programme is implementing several workstreams to mitigate loss of effluent treatment capability and waste storage capacity risks. This SCP project is one of the key activities supporting the programme.

2.2 Need by date

Whilst there is a strong time driver to mitigate the time at risk of failure of the existing SIXEP facility by providing the new capability in a timely manner, the strategic need by date is principally driven by waste storage capacity for spent filtration media. Since approval of the OBC, the programme has gained approval to use additional storage (MASWEP-B) extending SIXEP operations from December 2029 to November 2034 with a most realistic position being August 2033.

2.3 Spending objectives

Project Spending objectives (Future state)	• An unconstrained effluent treatment capability provided to the Sellafield Site, required until circa 2060. • Capability to provide additional flexibility for the SIXEP programme for future effluent operations, including waste management.

2.4 Scope

Scope	• Construction of a SIXEP Continuity Plant to mitigate failure of SIXEP's Sea Discharge Treatment Plant • Additional waste storage capacity pending implementation of SIXEP Waste Management • Ability to deploy an alternative ion exchange medium. • Capability to receive from and discharge to future plants. i.e. SIXEP Waste Management. • Capability to deploy a low flow solution and a 3rd ion exchange bed if required by the programme in future. • Designed to minimise the risk of single point of failure.

2.5 Benefits

The benefits delivered by the project are:

NDA strategic objective	Sellafield Ltd Strategic objective	Benefit	Class	Beneficiary
Safe, secure and cost-effective management	Safe secure site stewardship	Enables the Site Licence holder to meet its requirements in the regulatory permit	Non-cashable Existential	Sellafield Ltd NDA
	Demonstrable progress	Provides effluent abatement to 2060 in support of site missions	Non-cashable	Sellafield Ltd

of radioactive waste (NDA Group Risks 2, 3 & 7)			Existential	NDA
	Return on investment	Best value for money solution to maintain critical infrastructure supporting the site missions, principally High Hazard Risk Reduction. Strategic opportunity to deal with future flowsheet changes and uncertainties	Cashable	Sellafield Ltd NDA

2.6 Strategic Risks

The project contributes towards mitigation of NDA Group Strategic Risks as follows.

NDA Group Strategic Risk	
NDA GSR 02	• NDA is unable to complete its mission satisfactorily due to an inability to safely, securely and cost effectively dispose of radioactive waste
NDA GSR 03	• Insufficient capability and capacity to deliver the NDA mission
NDA GSR 07	• Failure of major asset or facility leading to loss of containment

3 Economic Case

The business case remains valid for SIXEP Continuity Plant (SCP) at Full Business Case (FBC) stage despite slippage and cost increase experienced to date. This Economic Case concludes that the option selected in the OBC continues to remain the optimum solution and present value for money.

3.1 Review of the OBC options

To support this FBC, we confirm the key requirements (Critical Success Factors and required by date of December 2029 to November 2034) remain valid. Building upon the comprehensive optioneering undertaken to support the OBC, we have reviewed our short list options as part of this economic case. The options were as follows:

	Description	Status
Option 1	Do nothing	Discounted
Option 2 (SCP)	Provision of an intermediate level refurbishment solution that involves significant new build, but not a full replacement of SIXEP	Preferred option
Option 3	Full Replacement (SIXEP2)	Discounted

Our assessment concluded that Option 2 (SCP) remains the preferred option. SCP will deliver the required capability both sooner and more cost effectively than other options.

Option 3 (full new-build replacement) would deliver the same capability as Option 2 alongside replacing all ‘front-end’ pipework. We discounted this option given the complexity of this extra work. It would cost between £600m to £1,800m more than Option 2 and take much longer to complete. This increases the probability that the project would deliver the new capability too late to mitigate a SIXEP failure.

Option 1 was also discounted. We would require SIXEP to be operational for a total of 75 years with no alternative backup. As the core effluent treatment process in SIXEP ages, the risk of SIXEP failure increases. This time at risk is unacceptable to both the programme and the Office for Nuclear Regulation (ONR).

3.2 Preferred option

SCP will replace the core effluent treatment process in SIXEP and offers the best way to mitigate the long-term risk of a SIXEP failure. Doing so, enables progress by those emptying the Legacy Ponds and Silos and safely storing spent nuclear fuel. It also allows us to continue to meet our environmental discharge obligations. This is a key benefit to the taxpayer.

SCP will have greater operational flexibility compared to the current SIXEP process. Emptying the Legacy Ponds and Silos of nuclear waste is our number one priority at Sellafield. When we retrieve this waste, the level of effluent treatment required will vary. SCP removes the constraint that effluent treatment currently presents to the programmes delivering our number one priority. This is a key benefit to the taxpayer.

We will deliver SCP by January 2031 at a cost of £1,007m at the P50 confidence level. This sits within a range of £873m at base through to £1,182m P80.

We have also used Reference Class Forecasting (RCF). RCF is an external dataset that compares actual outturn performance with the forecasts made by comparable projects at a similar level of maturity to SCP. The RCF P80 for SCP is £1,250m with a completion date of October 2032. This RCF figure gives us confidence that our range for completing SCP is realistic and deliverable.

Our SIXEP programme is managing the increased risk of a SIXEP failure from 2025 until SCP becomes operational in 2031.

3.3 Value for Money

Our assessment has applied appraisal techniques consistent with the HM Treasury's Green Book to select the best economic option for SCP based on value for money and meeting programme schedule requirements. Assessment by the Department of Business, Energy and Industrial Strategy (BEIS) Accounting Officer further concludes the value for money test to be satisfied via this FBC submission.

3.4 Sustainability

With £7,000m of projects recognised to be delivered through the identified supply chain delivery vehicle, a collaborative approach to sustainability between ourselves and the supply chain will be essential to maximise the opportunities available.

Environmental

We are establishing a Sustainability Framework in partnership with the supply chain. Key areas of focus on the project are maximising the opportunity for the inclusion of energy saving features and capitalising on the reduction in greenhouse gas emissions during construction and operations.

Social Value

We are working with partners including the Local Authority to maximise the social value of the SCP project. Specific activities at this point include;

- 80% of all procurements will have early social impact involvement, procurement specific tender questions, contracting of commitments and defining outcomes.
- Development of the supply chain with all companies involved being encouraged to support the localisation agenda.
- SCP and its supply chain have a target to employ a minimum 5% of its staff as graduates, apprentices, and trainees.

4 Commercial Case

4.1 Commercial Delivery Strategy

We will deliver the SIXEP Continuity Plant Project using the Programme and Project Partners (PPP). HM Treasury approved the PPP Full Business Case (FBC) in 2018 as the dedicated 20-year delivery model for all major projects at Sellafield.

The PPP has five partners in total including Sellafield Ltd. The 4 supply chain partners consist of;

Partner	Role
KBR	Integration Partner
Jacobs	Design Partner
Morgan Sindall	Civils Construction Partner
Altrad Babcock	Process Construction Partner

The Sellafield Ltd role in this delivery model is twofold:

1. to deploy capability into delivery as a "Fifth Partner" alongside the other four partners
2. to enable and oversee PPP delivery as a "Client team" organisation.

The 5 partners create an Aligned Delivery Team (ADT) providing the 'cradle to grave' project delivery capability. This model aims to enhance delivery and improve performance. This approach will bring enhanced collaborative behaviour and "one team" mentality resulting in an improved project delivery culture.

4.2 The Incentivised Delivery Model

The PPP incentive model ensures the supply chain partners are paid modest profits during delivery, with further profit available through progressively meeting Project Wide objectives (Milestones), which collectively contribute to an Aligned Incentive Fund (AIF). Only upon successfully achieving project completion and delivering the project outcomes are the contractors paid out under the AIF.

This approach incentivises the partners to work collaboratively performing as one, ensuring they deliver a plant that meets the functional requirements both on budget and time. The model moves away from the use of punitive damages to drive performance and instead establishes a sustainable collaborative relationship to encourage all partners to invest in transforming the project delivery environment at Sellafield Ltd.

4.3 Assured Major Project Baseline (MPB)

A multi-tiered assurance strategy has been applied by Sellafield Ltd, which ensures that the MPB represents a credible and value for money baseline. Appropriate commercial tension ensures that the baseline correctly rewards performance, drives innovation and has an appropriate balance of risk/reward.

The cost estimate and schedule supporting the FBC is 'market informed' by the cost and schedule developed by PPP. The proposed cost and schedule have been reviewed and assured by PPP's Independent Assurance Panel to provide confidence to partners and to Sellafield Ltd that it is a credible baseline.

Contractually the MPB is set by the employer. The partners contribute the MPB build by providing key information, but fundamentally owned by Sellafield Ltd. This mitigates the contractors setting their own price.

4.4 Key Service Requirements

The project has identified 49 procurement packages, ranging from routine to strategic. As identified in the OBC, several key procurements have been let in advance of the Detailed Design Gate to protect the critical path and enable long lead items to be fabricated to support construction.

Procurement package	Delivery route and contract form
Completion of Design for Manufacture and interim Phase 3 support	SL DSA Framework NEC PSC
Site enabling including excavation	SL OSW Framework NEC ECC Option C
Specialist valve supply	SCP project specific competition NEC ECC Option A
Tanks and vessels	SL framework novated to PPP
Main civil construction	SCP project specific competition NEC ECC Option C
Structural steelwork and cladding	Multi Project Procurement with SRP NEC ECC Option A and C (on site)
Construction cranes supply and operation	SCP project specific competition NEC ECC Option A
Construction power supplies	SCP project specific competition NEC ECC Option A
Steel encast items to support civil construction	SCP project specific competition NEC ECC Option A
Building cranes	Task order novated to PPP Lot Partner

The following table summarises only key procurement packages left to award for the project.

Procurement package	Delivery route and contract form
Pumps	SCP project specific procurement NEC ECC Option A
Pump & Valve Modules	SCP project specific procurement NEC ECC Option A
Bulk storage tanks (on site build)	SCP project specific procurement NEC ECC Option A and C (on site)
Electrical equipment supply and installation	PPP Strategic – Goods Supply Framework and Key Delivery Partner
Pipework supply and installation	PPP Strategic – Goods Supply Framework and Key Delivery Partner
Control Systems	SL framework novated to PPP
HVAC	PPP Strategic – Key Delivery Partner
Pipe bridges	PPP Strategic – Key Delivery Partner or SCP project specific procurement
Scaffolding / insulation	PPP Strategic – Key Delivery Partner

5 Financial Case

Notwithstanding our progress, the P50 project lifecycle cost has changed from £574m to £1,007m, an increase of £432m, and the P50 schedule has increased by 21 months compared to the OBC. The P80 estimate is £1,182m.

Project Lifecycle Cost – 2020/21 monetary values					
		Prior years	**Years 1-3**	**Yr4 onwards**	**Total**
Inflated	Base (£m)	129	373	371	**873**
	P50 (£m)	129	410	468	1,007
	P80 (£m)	129	433	619	1,182

5.1 Affordability

Our cost range, including a factor to mitigate optimism bias (up to £1,250m), to deliver SCP is considered affordable given the current forward programme of work and anticipated levels of site funding. SCP is fundamental to delivering the site mission and is therefore a top priority for funding.

SCP remains a high priority and its timely delivery is critical to manage the risk associated with loss of effluent treatment capability. Therefore, even if NDA (and Sellafield Ltd) receive a reduced funding settlement, it is likely that all SCP scope will be funded. The Enterprise recognises affordability challenges near term associated with the broader portfolio to accommodate the SCP spend profile to meet the strategic need. The Enterprise has robust prioritisation processes that will be utilised to determine funding allocation across the business including SCP.

5.2 Schedule and Cost Reconciliation

The OBC was approved by HMG in July 2020 with a cost range for the project of base £486m to an upper cost range reflecting optimism bias mitigation of £1,050m. The project P50 within this range was reported as £574m (August 2028).

Limited market underpinning and inherent levels of project maturity at the time of the OBC led to a large optimism bias adjustment being applied in the OBC to the cost and schedule, to create a range that recognised likely growth as improved definition and detailed market underpinning would become available to support the FBC.

The project schedule and costs are now informed by market information following award of the PPP contract in May 2019 and transition of the project into the PPP Delivery Model in November 2019. The scope has remained largely stable since OBC, however the design has matured and PPP are now fully engaged, supported by Early Contractor Involvement with their supply chain.

Schedule

Since approval of the OBC, the key project milestone 'Ready for Active Commissioning' has moved from December 2027 to October 2029 (P50), an increase of 21 months. The schedule at the time of the OBC was necessarily limited reflecting the level of market underpinning and lower technical maturity.

Category of Change	Months
Schedule Acceleration	-4
COVID-19	4
Learning From Experience	7
Schedule Underpinning (including design maturity and constructability)	4
Commissioning Underpinning	4
Client Risk to point of Ready for Active Commissioning	6
Lifetime Schedule Variance to Ready for Active Commissioning Subtotal	**21 (P50)**
Schedule Underpinning & LFE	5
Client Risk during Active Commissioning and Close Out	2
Lifetime Schedule Variance to Close Out	**28 (P50)**

Cost

The project lifecycle range at OBC was £574m to £1,050m (2019 money values) including an allowance for optimism bias. Since OBC, the application of more appropriate Reference Class Forecasting (RCF) techniques has enabled the project to develop a lifecycle cost range at FBC of £873m to £1,250m (reflecting Reference Class Forecasting/Optimism Bias adjustment).

Since approval of the OBC, the P50 project lifetime cost has increased from £574m P50 to £1,007m P50. The £432m P50 cost increase breaks down into:

Category of Change	Cost variance
Direct costs - Engagement with the supply chain	£252m
Indirect costs - Prolongation of the developed schedule and delivery team	£24m
Contingency, supply chain incentivisation and COVID-19 up to June 2021	£87m
Escalation	£69m
Total	**£432m**

The value for money assessment, as presented within this FBC continues to be robust and when assessed against alternative proposals (including do nothing) delivers both best value in enabling our strategic mission of High Hazard Risk Reduction and to the Exchequer as a whole.

6 Management Case

6.1 Project Delivery

On the SIXEP Continuity Plant (SCP) project, the Head of Programme (now SRO) is accountable for benefit realisation and the Sellafield Ltd Project Delivery Director is accountable for project delivery. Responsibility for project delivery is discharged through the SCP Head of Project.

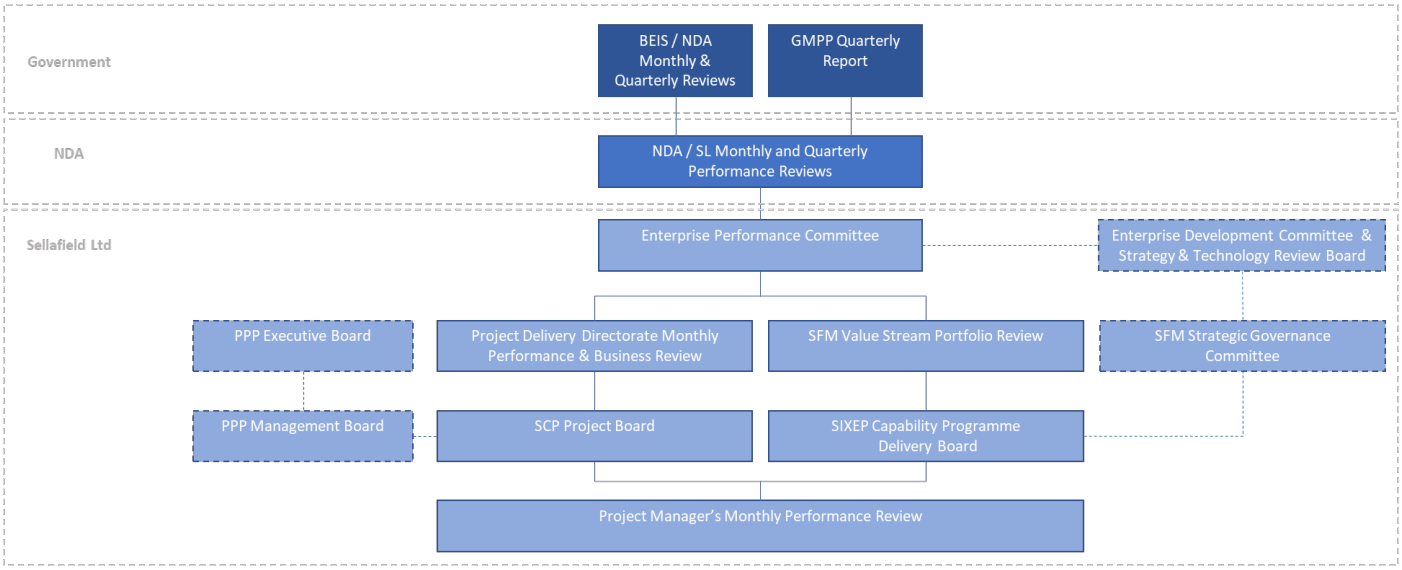
Project delivery is via the Aligned Delivery Team (ADT) and draws relevant experience from the PPP lot partners and Sellafield Ltd employees assigned to lot partners to ensure an enhanced collaborative behaviour and 'one team' mentality.

Key roles in the delivery of SCP are as follows:

Projects Delivery Director	The Project Delivery Director is responsible for assuring SCP project delivery, assurance and governance oversight arrangements are in place such that Sellafield Ltd Programme, PPP and IC deliverables are progressing as planned and that corrective action can be implemented where necessary.
Head of Projects	Accountable for the delivery of the SCP Project.
Project Manager	Responsible for the delivery of SCP Project.
Aligned Delivery Team	Project delivery comprised from the PPP lot partners and Sellafield Ltd employees assigned into delivery roles within the ADT.
PPP Management Board	The Board shall provide management oversight, assurance, performance management and leadership support to SCP Project.
Sellafield Ltd Intelligent Client	The Head of IC reports to the Projects Delivery Director the overall direction and oversight of the wider PPP performance.

6.2 Governance and Assurance

The project is subject to enhanced executive oversight which provides rapid escalation to the highest levels of Sellafield Ltd, Nuclear Decommissioning Authority and the PPP Supply Chain partners. Performance management governance is as follows.



Sellafield Ltd oversight of the project is undertaken via the following boards and committees:

Spent Fuel Management Portfolio Board	• Governs and provides oversight of all the Programmes and Nuclear Operations contained within the Spent Fuel Management Value Stream. • Specifically oversees the SIXEP Capability Programme and formally approves SCP Project Functional Specification (PFS).
SIXEP Capability Programme Board	• Oversees the verification and validation along with oversight of the SCP project in terms of delivery outcomes and management of key dependencies.
Projects Delivery Directorate (PDD) Monthly Performance Review	• Chaired by the Projects Delivery Director which has oversight of SCP project performance and holds the SCP Head of Project to account for delivery performance.
PPP Management Board	• The PPP Board provides management oversight, assurance, performance management and leadership support across PPP projects.
SIXEP Continuity Plant (SCP) Project Board	• Holds the project and programme to account and supports the project to achieve its objectives.

Executive governance and oversight of SCP is through the Monthly Project Executive Review, which is assurance conducted on behalf of the Sellafield Ltd. Board to review the health of all projects across Sellafield, including SCP. Spent Fuel Management Head of Value Stream and the Projects Director also are held to account for Programme and Project Performance.

These groups ensure the project leadership team has the right level of independent review, challenge and support. They will ensure a high-performing collaborative culture is being sustained by Sellafield Ltd and the PPP as part of the 'one-team' approach.

6.3 Intelligent Client (IC) Role

As a PPP project, the SCP project is also governed and assured by the Sellafield Ltd Intelligent Client (IC). The Head of the IC reports to the Project Delivery Director who in turn has direct oversight of the SCP project performance.

The IC is independent to the project and responsible for managing the contract, setting the Major Project Baseline (MPB) and ensuring all legal requirements for delivering work at the Sellafield site are met in accordance with the Site Licence conditions. The IC is accountable for setting the Major Project Baseline (MPB) for the SCP project, against which PPP project delivery performance is measured and incentivised under the contract model.

6.4 Benefits Management

The SIXEP Capability Programme, via the Head of Programme Delivery, is accountable for management and realisation of the benefits that come from the SCP project.

6.5 Change Management

We are, via our IC function, accountable for contract management, governance and assurance of the SCP MPB and any changes that will affect the Sellafield Ltd Operating Plan and associated changes to Sellafield Ltd Baseline (SLBL). The SPA will approve change of the project functional specification via the SIXEP Capability Programme Board and instruct the change under the PPP contract mechanism.

6.6 Risk Management

The Project ADT and IC are accountable for the management of risk and risk mitigation activities in a proactive and collaborative manner, including all project and client risks as well as programme uncertainty.

During the setting of the Major Project Baseline, project risks have been apportioned to the appropriate risk owner, being either the PPP (risks held within the MPB) or IC (risks held within the P50 and a proportion of the P80 programme and enterprise risk subject to agreement with NDA). This approach allows PPP flexibility to manage and mitigate project risks via local contingency delegated to the Head of Projects and facilitates the IC to manage the Major Project Baseline.

6.7 Contingencies

Contingencies initiated by the SIXEP Capability Programme include:

- An enhanced inspection regime for SIXEP to protect against early failure
- A programme of asset care activities to support the required lifetime of SIXEP
- Management controls on current waste storage capacity to provide additional resilience.

6.8 Learning From Experience

Extensive internal and external learning from experience has been applied helping to inform the development of the SCP project. This has provided a high degree of confidence in the underpinning cost and schedule. Learning is captured through the PPP model execution, Sellafield Ltd project functions and the project learning log.

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