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Readiness Evaluation for Sustained Operations

Programmatic Definition

April 2020

Stuart T Arm

U.S. DEPARTMENT OF ENERGY

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

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Abstract

Readiness evaluation for sustained operations is a continuous function that progresses from overseeing establishment of five key programmatic elements during design and construction of a production plant to monitoring the output of those elements during its commissioning and operations. Continuously assessing readiness for sustained operations becomes an important business function for the U.S. Department of Energy's Office of River Protection as competition for federal funds increases with increasing waste treatment operations throughout the Office of Environmental Management complex. The five key programmatic elements are as follows:

- **Risk management** – Risks and opportunities should prioritize continuous improvement initiatives and be informed by the design and technical authorities and stakeholder monitors.
- **Continuous improvement** – All levels of the project organization should exhibit commitment to continuous improvement and learning.
- **Continuity of design and technical authorities** – The authorities are responsible for managing knowledge for its effective use in the other elements.
- **Stakeholder monitoring** – Active and deliberate monitoring of stakeholder relationships.
- **Sustained operations integrated business planning** – Integrated business planning in a federal environment competitive for congressional funding.

Summary

Currently, the U.S. Department of Energy (DOE) stores approximately 56 million gallons of radioactive and hazardous waste in 177 underground tanks at the Hanford Site. Approximately 20 million gallons of that waste is in a liquid form (supernate), approximately 10 million gallons is in the form of insoluble sludge materials, and the remainder is in a partially soluble solid form referred to as saltcake. Treatment and immobilization of the tank waste is planned with the Hanford Waste Treatment and Immobilization Plant (WTP) being the principal plant where this will be accomplished. Waste treatment operations are planned to start in the early 2020s.

The start of waste treatment operations will mark a significant event in Hanford history. Not since the 1980s, or at least a generation of engineers, will the site have experienced the sustained operations of a multi-functional chemical process plant. Making ready for safe operations and then to demonstrably show readiness in operational readiness reviews and assessments is a well-defined process in the DOE Office of Environmental Management complex. However, there is little programmatic guidance on how to make ready and demonstrably show readiness for sustained operations. A sustained operations readiness program is not intended to replace or in any way diminish the role of operational readiness reviews and assessments as required by DOE. Rather, the intent is to build on the operational readiness concept to maximize readiness for sustained operations through commissioning and into operations and establish a culture of simultaneous operations excellence in production, safety, and environmental management.

The work reflected by this report was conducted based on the author’s professional experience, input from specific individuals, and the author’s review of public information. The work has concluded that the state of sustained operations for a complex processing plant can be objectively characterized by 12 features. These features represent the conducive culture or conditions in which the plant, paper, and people interact to produce a sustained operations state. The 12 features can be further represented by five programmatic and executable elements, described below with associated recommendations for Hanford waste treatment operations:

- **Risk management**
  - Risks and opportunities should prioritize continuous improvement initiatives and be informed by the design and technical authorities and stakeholder monitors.
  - An integrated waste treatment operations risk management program led by DOE is recommended for Hanford waste treatment operations.
- **Continuous improvement**
  - All levels of the project organization should exhibit commitment to continuous improvement and learning.
  - At Hanford, the tank farm contractor had introduced the Lean management system as a continuous improvement program. The program has yielded efficiencies in tank farm operations and waste treatment operations planning and introduced a culture of continuous improvement. A waste treatment operations program-wide continuous improvement system is recommended for Hanford waste treatment operations.
- **Continuity of design and technical authorities**
  - The authorities are responsible for managing knowledge for its effective use in the other elements.
  - Recommended for Hanford waste treatment operations is a body of technical program managers from the key technology providers chartered to provide the technical authority and a continuing

role for the WTP engineering, procurement, construction and commissioning contractor as the design authority.

- **Stakeholder monitoring**
  - Active and deliberate monitoring of stakeholder relationships.
  - Hanford waste treatment operations is characterized by complex and wide-ranging stakeholders at federal, state, and local levels of government and regulation and various public bodies.
  - Centralized and integrated stakeholder monitoring and management is recommended as an organizational element.
- **Sustained operations integrated business planning**
  - Business planning integrates and balances technical, financial and regulatory objectives. In a commercial venture this is arguably a business plan.
  - An integrated Hanford waste treatment operations business plan is recommended for the Site to most effectively compete with other sites in the current Federal environment competitive for Congressional funding.

Readiness evaluation for sustained operations is a continuous function that progresses from overseeing establishment of five key programmatic elements during design and construction of a production plant to monitoring the output of those elements during its commissioning and operations. Continuously assessing readiness for sustained operations becomes an important business function for the DOE Office of River Protection as competition for federal funds increases with increasing waste treatment operations throughout the Office of Environmental Management complex.

Acknowledgments

The work described in this report in part reflects the author's own experience of working in an operations environment and background research of public information. Additionally, however, the author acknowledges the specific advice from Christopher Phillips (formerly responsible for the commissioning of the Thermal Oxide Reprocessing Plant at Sellafield, United Kingdom), Gary Olsen of the U.S. Department of Energy, and Larry Casazza of Pacific Northwest National Laboratory.

Acronyms and Abbreviations

DFLAW	Direct Feed Low-Activity Waste
DOE	U.S. Department of Energy
IDF	Integrated Disposal Facility
ILAW	immobilized low-activity waste
LAW	low-activity waste
WTP	Waste Treatment and Immobilization Plant

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1.0 Introduction

1.1 Background

Currently, the U.S. Department of Energy (DOE) stores approximately 56 million gallons of radioactive and hazardous waste in 177 underground tanks at the Hanford Site. Approximately 20 million gallons of that waste is in a liquid form (supernate), approximately 10 million gallons is in the form of insoluble sludge materials, and the remainder is in a partially soluble solid form referred to as saltcake. Treatment and immobilization of the tank waste is planned, with the Hanford Waste Treatment and Immobilization Plant (WTP) being the principal plant where this will be accomplished. Initially, only supernate and solubilized saltcake, collectively termed low-activity waste (LAW), will be treated and immobilized in the WTP in a Direct Feed Low-Activity Waste (DFLAW) configuration.

The WTP LAW Vitrification Facility combines hazardous low-level liquid wastes with glass formers in a high-temperature melter to create a stable waste form suitable for shallow land disposal. The project includes engineering, procurement, construction, and commissioning scope to complete the WTP LAW Facility and selected other WTP facilities such as the Laboratory, Effluent Management Facility, and Balance of Facilities. The DFLAW configuration also requires a LAW feed treatment and delivery system provided by the tank farm contractor.

The tank farm contractor manages the Hanford Site tank waste and tank farms cleanup, including interfaces between the tank farms, WTP, and other Hanford Site contractors providing infrastructure support. The tank farm contractor has responsibility for the delivery of compliant feed to the WTP, managing secondary wastes, and transportation of immobilized low-activity waste (ILAW) containers to the Integrated Disposal Facility (IDF). Another contractor manages the preparations and ultimate operations of the IDF, the low level/mixed waste disposal site for ILAW and secondary solid wastes from DFLAW operations.

While the most immediate application of the concepts outlined in this report is to Hanford DFLAW operations, it is written in a general sense for wider application. The DFLAW Program is referenced throughout this plan whenever its specificity is appropriate, but otherwise the generic term “program” is used. Likewise, a program consists of individual constituent projects (e.g., the WTP Project is a part of the DFLAW Program), and the latter term is referenced in the generic sense. Recommendations are directly provided for the DFLAW Program.

1.2 Introducing Sustained Operations Readiness

The start of DFLAW operations will mark a significant event in Hanford history. Not since the 1980s, or at least a generation of engineers, will the site experience the operations of a multi-functional chemical process plant. Making ready for safe operations and then to demonstrably show readiness in operational readiness reviews and assessments is a well-defined process in the DOE Office of Environmental Management complex. However, there is little programmatic guidance on how to make ready and demonstrably show readiness for sustained operations for a plant, let alone across a complex like what constitutes the DFLAW Program.

Making ready for sustained operations represents a cultural change that must occur in the DFLAW Program. Quinn and Rohrbaugh (1983) define four models of organizations reflecting their culture in terms of focus, means, and ends. The DFLAW Program has arguably historically and primarily operated according to what the authors identify as an “internal process model.” This model is characterized by information management and communication to achieve a controlled design/construction process. The model is focused on individual or team products (design media, for example). However, the program's culture must arguably shift to a "rational goal model" for sustained operations. The rational goal model is characterized by planning and objective setting to achieve productivity and efficiency, but still in a controlled manner. It focuses on the organization as a whole to achieve its objectives (production rate, for example).

Sustained operations readiness is an integrative function in that it focuses all of a program's projects by challenging them to collectively think: How will this work upon the start of operations and beyond? In practice, it validates integration points between people, plant, and paper and identifies the conditions or culture conducive to sustained operations.

To realize the objective of sustained operations readiness means that confidence and capability for sustained operations must improve through progressive evaluation and learning as plant commissioning is completed and as operations progress. In general, then, the sustained operations readiness objectives must be defined for each project and/or function. These objectives are periodically evaluated and progress towards them tracked, monitored, and reported. By its cultural nature and notwithstanding its ultimate objective, sustained operations readiness will never be finished and never be absolute; there will always be an element of uncertainty in the program's readiness as it matures in an ever-changing environment. What is important, however, is the ability to sufficiently evaluate and ascertain the state of readiness and effectively act upon it in the prevailing social, political, and economic environment.

1.3 Purpose

This document describes the concept of sustained operations readiness and identifies the approach and processes to monitor readiness across a program with direct application to the Hanford DFLAW Program. The approach and processes are intended to act as the "engine" that drives the cultural shift from the design and construction phase to one of operations that must occur, for example at Hanford, for operations to be sustainable. As such, they are not intended to be the final word but rather the framework for dialogue and cultural transformation across the program.

1.4 Scope

The content of this document is not intended to replace or in any way diminish the role of operational readiness reviews and assessments as delineated in DOE Order 425.1 (DOE 2019). Rather, the intent is to build upon the operational readiness concept to maximize readiness for sustained operations through commissioning and into operations and establish a culture of simultaneous operations excellence in production, safety, and environmental management.

2.0 The Sustained Operations Concept

2.1 Facets of the Sustained Operations State

As described by Frei et al. (2015), the sustained operations state consists of four facets, composed of conducive conditions (or a conducive cultural environment) in which the plant, people, and paper interact. While the plant, people, and paper may be quantified and qualified as ready for operational readiness in the sense of DOE O 425.1, this program recognizes the culture/conditions as being key to sustained operations. The cultural features of the sustained operations state provide the foci for defining readiness objectives and how progress towards them is tracked, monitored, and reported. Frei et al. (2015) identify 12 principles of operational readiness, in their broad sense of the term, that constitute the "conducive conditions." These 12 cultural features of the sustained operations state are defined in Table 2.1 alongside the facets they primarily impact. Note the 12 cultural features can all be associated with the desired operations culture characterized by planning and objective setting to achieve efficient and controlled productivity as defined by Quinn and Rohrbaugh (1983).

Table 2.1. Cultural Features of Sustained Operations

Cultural Feature	Major Facet Impacted	Minor Facet Impacted
Congruence of people, plant, and paper	People, plant, and paper	
Capability to reappraise previous choices	People	Paper/plant
Risk/opportunity-informed level of effort	Paper	People
Lifecycle knowledge	Plant	Paper
Stakeholder identification	People	Plant
Congruence of cost, operations, and safety/environmental objectives	Plant	Paper
Clarity in system definition	Paper	Plant
Embracing continual improvement	People	Plant
Conserve system knowledge and the logic behind decisions	Paper	Plant
Keep subject matter experts intimately involved	People	Paper
Document analysis	Paper	Plant
Document assumed risk	People	Paper

2.2 Sustained Operations Readiness Environmental Features

Readiness for sustained operations can be progressively evaluated based on considering the available objective evidence demonstrating actualization of the 12 cultural features. The 12 features are described in detail in the following sections.

2.2.1 Congruence of People, Plant, and Paper

This feature looks to alignment and compatibility across the people-plant-procedure interfaces. For example, operations procedures must be aligned to the plant and compatible with the education and training of the people. Congruity of people, plant, and procedures at a working level may be challenging to evaluate. However, in a broad sense, there are distinguishing features that are needed to create a conducive culture for sustainably operating a first-of-a-kind plant complex incorporating enabling/emerging technologies.

2.2.1.1 People

Of the three facets, the people are key; people invent and mature technology, design and permit the plant, and run it. As Lager (2012) has pointed, commissioning of a process plant is “very much about people interacting with technology.” Furthermore, as Lager (2012) asserts, based on an extensive review of process plant commissioning projects, forming a commissioning organization commensurate with the plant type is key to success. For a turnkey-type plant, having the project organization commission the plant would be appropriate. However, experience shows having the project organization commission a first-of-a-kind plant with extensive use of new technology (e.g., WTP) leads to significant risk for plant “quality, fitness for purpose, productivity and performance as represented, warranted and guaranteed.” Instead, Lager (2012) recommends a fully integrated team of project and operations staff with representation of designers, technologists, and operators. Also important is the formation of rapid-response teams *a priori*, understanding that it is easier to disband such teams if no problems arise but more difficult to assemble them. Integrating technologists with operators also enables the latter group to directly gain the conceptual understanding of the new technologies.

As already indicated, there are three key sets of people that each must intimately and continuously contribute towards commissioning DFLAW and its subsequent operation for it to be sustainable. These sets are described in Table 2.2. Each set is intended to be multi-disciplinary in terms of engineering disciplines, environmental permitting, and safety.

Table 2.2. The Sets of People Needed for Sustained Operations

People Set	Role
Designers	The design set understands and maintains the design intent of the plant, acting as design authority. They oversee the plant to ensure it is operated within its design envelope, especially to avoid catastrophic failures. An *ongoing* design authority, therefore, is important to sustained operations.
Technologists	The technology set understands how the plant’s unique technology works, acting as technical authority. They resolve technical problems, develop opportunities for improvement, and interpret plant technical performance. Continuity of a technical authority into operations is important for its sustainability.
Operators	The operations set understands how to make the plant work in a safe and environmentally compliant fashion while maximizing its return on investment, acting as operations authority. They resolve engineering problems, develop engineering opportunities for improvement, and interpret plant engineering, safety, and environmental performance. The need for operators for a sustainable operation is self-evident but it must be complete in terms of its discipline mix.

2.2.1.2 Plant

The plant facet includes process plants (e.g., WTP), standalone equipment (e.g., ILAW transporter), and facilities (e.g., IDF). In other words, the hardware. During commissioning, hardware must necessarily be shown to fulfil its design function for it to be ready for sustained operations.

As for society, for a process plant to be sustainable, there can be no continuous accumulation or loss of material or energy:

- All identified wastes must be compliantly dispositioned. Not only must a disposition pathway be identified, but it must also be operational with operating permits and contracts.
- All products must be compliantly dispositioned. Again, not only must a disposition pathway be identified, but it must also be operational with operating permits and contracts.
- Raw material and services must be sustainably available.
- Raw feed must be sustainably available.

A complete process flowsheet depicts a sustainable operational scenario for the plant, and its actualization in terms of people and paper is a progressive indicator of readiness for sustained plant operations. Complementary to the flowsheet is a process control strategy that identifies the means by which each process requirement is satisfied using the available controls and monitoring capabilities.

Sustained operations depends on maintaining plant availability. This means a dedicated focus on sustaining/preventative plant maintenance, reliability, and spare parts management at an organizational level. A reliability-centered approach to system maintenance and health described by Brown (2020) and being introduced at Hanford is a good example philosophy for sustaining operations. The focus on plant availability and maintainability should start simultaneous with design and carry through commissioning into operations. Practicing key maintenance activities (when not required from failure) during startup and cold commissioning is important to be able to implement design and/or procedural changes before introducing chemical or radiological hazards. Otherwise, operational “work arounds” may be needed to accommodate design flaws that will impact operational sustainability. Maintenance practice on the actual plant during startup or commissioning or on mock-ups or models can be considered. Mock-ups and models can be retained for training and configuration management purposes. A capability to record equipment reliability, availability, and maintenance data is important to understanding and controlling spare parts inventory and areas for improvement. Suppliers must be available on demand and their market stability monitored to ensure alternates can be identified in good time.

2.2.1.3 Paper

The paper constituting the sustained operations culture can be considered in terms of the four sets described in Table 2.3. Paper must necessarily be shown to be complete in terms of content and approval for sustained operations.

Table 2.3. The Sets of Paper Needed for Sustained Operations

Paper Set	Role
Procedures	The procedures set describes how to run the plant.
Bases	The bases set consists of the technical and design bases of the plant.
Agreements	The agreements set actualizes partner interactions, including contracts and interface agreements as appropriate.
Authorization	The authorization set includes all legal determinations, environmental permits, and documented safety analyses.

2.2.2 Capability to Reappraise Previous Choices

This feature is particularly related to the features of “clarity in system definition,” “conserve system knowledge and the logic behind decisions,” and “document analysis.”

Reappraisal of previous choices in light of new information necessarily must involve design and technical authorities with access to and understanding of previous design and technical choices and the logic underpinning them. In reappraising those choices, operators must then document analyses performed as part of the reappraisal.

Commensurate with the reappraisal effort, appropriate test platforms must be readily available to drive resolution of technical problems and opportunities for improvement.

In terms of execution, an ongoing role for design and technical authorities (with test platforms) must be established and an operations function must be assigned to perform reappraisals. Additionally, depending on the nature of the new information, an efficient and rapid mechanism for establishing rapid response teams must be available on demand.

2.2.3 Risk/Opportunity-Informed Level of Effort

The purpose of this feature is to inform the level of effort needed to complete activities such as reappraising previous choices and pursuing continuous improvement. Its actualization relies on a rigorous risk management process that quantifies and prioritizes operations risks and opportunities that then drive risk-handling actions.

2.2.4 Lifecycle Knowledge

Details of how a process system will perform throughout its life and in all modes of operation must be known. Key to evaluating this feature will be clear definition of the system in terms of its lifecycle phases and modes of operation. Lifecycle phases may be related to feed campaigns for process plant, for example. Likewise, operational modes will include normal and standby, for example. Appropriate risks will be managed through the risk management process where this is unknown.

2.2.5 Stakeholder Identification

The sustainability of the process operation will be dependent on how stakeholder expectations are satisfied. Stakeholder expectations will be diverse and will include the expectations of contractors, regulators, unions, and government and encompass the people, plant, and paper characteristics. Therefore, stakeholders should be identified and their explicit and implicit expectations monitored against process system performance.

2.2.6 Congruence of Funding, Operations, and Safety/Environmental Objectives

Paramount to the process system will be its operation satisfying all safety and environmental requirements while constrained by funding limitations. Therefore, the sustainable rate at which feed (for DFLAW, LAW) will be delivered, treated, immobilized, and dispositioned will not only be governed by the plant’s design performance, reliability, and availability, but also by the requirements of permits and other authorization documents. Rather indirectly, arguably the people aspect determines the funding constraint via the federal government. The real sustainable rate of a process system needs to be understood and continuously monitored.

2.2.7 Clarity in System Definition

This feature essentially supports many others in that the other features will be actualized only by a clear and accurate articulation of the process system in terms of its people, plant, and paper. Additionally, a clear and accurate articulation of risks and opportunities must be actualized to facilitate continuous evaluation of readiness for sustained operations. Specifically, a risk program must address threats to performance (for DFLAW: delivery, treatment, immobilization, and disposal of LAW) satisfying specifications, a schedule, and a budget, with only those undesired outputs accepted by the owner.

2.2.8 Embracing Continual Improvement

This feature specifically addresses how change can be positively and deliberately managed. The whole operations culture should be committed to continuous learning and improvement across the following:

- Quality, with an objective of zero defects in delivering, treating, immobilizing, and disposing of tank waste.
- Lead time, with an objective of all time spent delivering on the objective. For DFLAW that would be delivering, treating, immobilizing, and disposing of LAW.
- Productivity, with an objective of all processes dedicated to product delivery (for DFLAW: delivering, treating, immobilizing, and disposing of tank waste).

Establishment of an acknowledged process such as Lean (Koenigsaecker 2013) that specifically addresses human development will actualize a culture of continuous learning and improvement. Continual improvement is strongly interrelated to a robust risk management process, as identified threats are targeted for mitigation and identified opportunities are implemented.

2.2.9 Conserve System Knowledge and the Logic Behind Decisions

This feature is related to the congruence of people, plant, and paper and embracing continual improvement. Continual improvement cannot be actualized without knowing the logic behind past decisions related to the operations, design, and technology. Furthermore, the design and technical authorities must be established to interpret that logic in the context of current improvement efforts. Nonetheless, the focus of this feature is on establishing the body of knowledge and decision roadmap (paper) underpinning the current technology, design, and operation.

2.2.10 Keep Subject Matter Experts Intimately Involved

This feature is again related to people and is focused on maintaining continuity in (DFLAW) design, technical, and operations expertise through the stages of the (DFLAW) program. Arguably, engineering and technical expertise is less called upon while a plant undergoes the final stages of construction and startup. However, this expertise will be needed for sustained operations in solving problems and improving the operation. Continuity of design, technical, and operations expertise must be positively managed for it to be available when needed.

2.2.11 Document Analysis

This is a paper feature and is related to knowledge conservation. It emphasizes the need for analysis to underpin decisions unless a conscious decision is made based on experiential judgment. The latter should not be discounted, particularly if it is based on expert judgment, but its personal bias needs to be recognized in the decision. This feature is directed to the risk/opportunity management process to temper the tendency to inform risks and opportunities only on the basis of experiential judgment.

2.2.12 Document Assumed Risk

Rigorous risk management is key to sustained operations, and this feature drives to the nexus of people and paper. This feature relates to the importance of purposefully acknowledging assumed risks (i.e., those risks identified and accepted). Risks must be analyzed (see above) to be quantified to the maximum practicable degree and deliberately accepted by the accountable and responsible manager.

2.3 Key Elements for Sustained Operations

2.3.1 Conceptual Identification of the Key Elements

The foregoing descriptions of 12 features important to a conducive sustainable operations culture makes apparent five key elements of the sustained operations state:

- Risk management
- Continuous improvement
- Continuity of design and technical authorities
- Stakeholder monitoring
- Sustained operations planning

These five key elements are outlined in Table 2.4 alongside their relationships to the 12 features. As illustrated in Figure 2.1, these five elements are of equal importance and relationship to the sustained operations state. The five elements could be considered plans or programs. However, whether a formal plan or program is developed or exists is less significant than the evidence of the actualized cultural element.

Table 2.4. The Key Elements of Sustained Operations

Element	Primary Feature(s) Addressed and Emphasized
Risk management: Risks and opportunities should prioritize continuous improvement initiatives and be informed by the design and technical authorities and stakeholder monitors.	• Risk/opportunity-informed level of effort • Clarity in system definition • Keep subject matter experts intimately involved • Document analysis • Document assumed risk
Continuous improvement: All levels of the project organization should exhibit commitment to continuous improvement and learning.	• Capability to reappraise previous choices • Lifecycle knowledge • Embracing continual improvement • Conserve system knowledge and logic behind decisions • Keep subject matter experts intimately involved
Continuity of design and technical authorities: The authorities are responsible for managing knowledge for its effective use in the other elements.	• Congruence of people, plant, and paper • Capability to reappraise previous choices • Lifecycle knowledge • Clarity in system definition • Conserve system knowledge and logic behind decisions • Keep subject matter experts intimately involved
Stakeholder monitoring: Active and deliberate monitoring of stakeholder relationships. For DFLAW, the complexity of stakeholders is extreme, being represented at federal, state, and local government, and public levels.	• Congruence of people, plant, and paper • Stakeholder identification
Sustained operations planning: The sustained operations integrated plan could be considered a business strategy in a competitive environment. For DFLAW, this is equally important as competition for federal funds increases with increasing waste treatment operations throughout the DOE complex.	• Congruence of people, plant, and paper • Congruence of cost, operations, and safety/environmental objectives

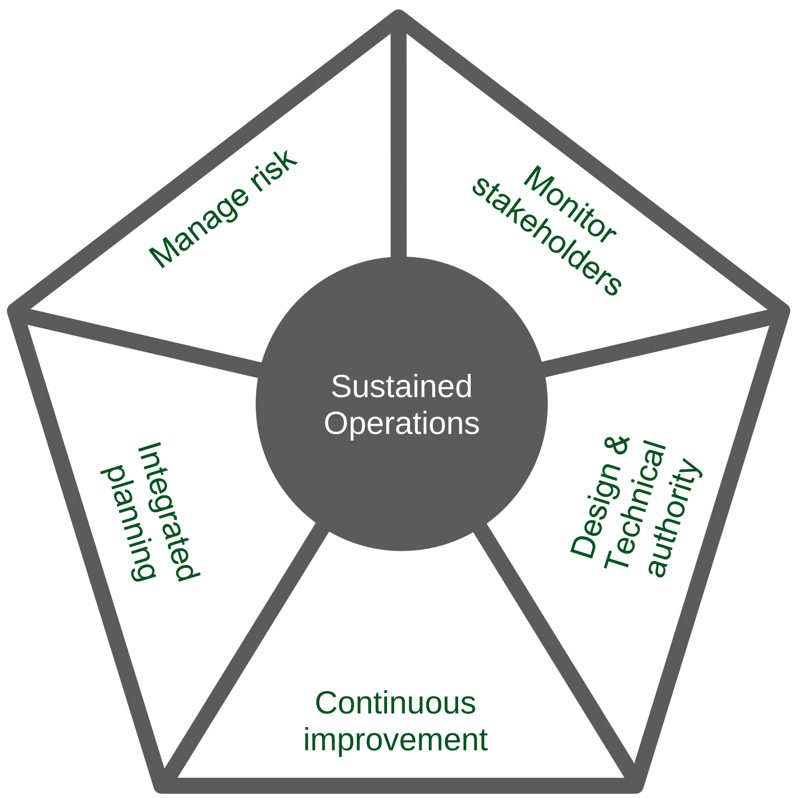


Figure 2.1. Conceptual Relationship of the Five Elements of Sustained Operations

The program is responsible for overseeing and integrating the five elements individually developed by the constituent projects, specifically as outlined in Table 2.5.

Table 2.5. Program Responsibilities for Sustained Operations Program Elements

Element	Program Responsibility
Risk management	Risks and opportunities related to project interfaces must specifically be integrated. Program-wide impacts from specific project risks and opportunities must be evaluated and integrated as appropriate.
Continuous improvement	Coordination and integration of project continuous improvement programs and initiatives using input from the projects. The program supports specific project initiatives where input from interfacing projects is desirable.
Continuity of design and technical authorities	Authorities are established as chartered boards that oversee the design and technical bases across the program. The boards consist of clients (for DFLAW, ORP) and contractors representing the projects and are chaired by client representatives. They are accountable to the program manager for recommending to the program manager technical and design decisions.
Stakeholder monitoring	Coordination and integration of stakeholder relationships using information from project managers.
Sustained operations integrated planning	The planning function is a program responsibility using information from the projects.

2.3.2 Application of the Key Elements for DFLAW Operations

Conceptual identification of the five key elements leads to recommendations in those areas for Hanford DFLAW operations.

2.3.2.1 Risk Management

An integrated waste treatment operations risk management program led by the DOE is recommended. The risk program should identify risk triggers, retirements, and mitigation. Specifically, the program should identify risk owners from DOE and be sufficiently rigorous in its risk quantification to facilitate objective programmatic decision-making.

2.3.2.2 Continuous Improvement

A continuous improvement system such as Lean is recommended for the DFLAW Program. The value in the Lean management system is that it focuses on the people to train them in thinking towards identifying and minimizing waste. A focus on the people initiates a culture of continuous improvement.

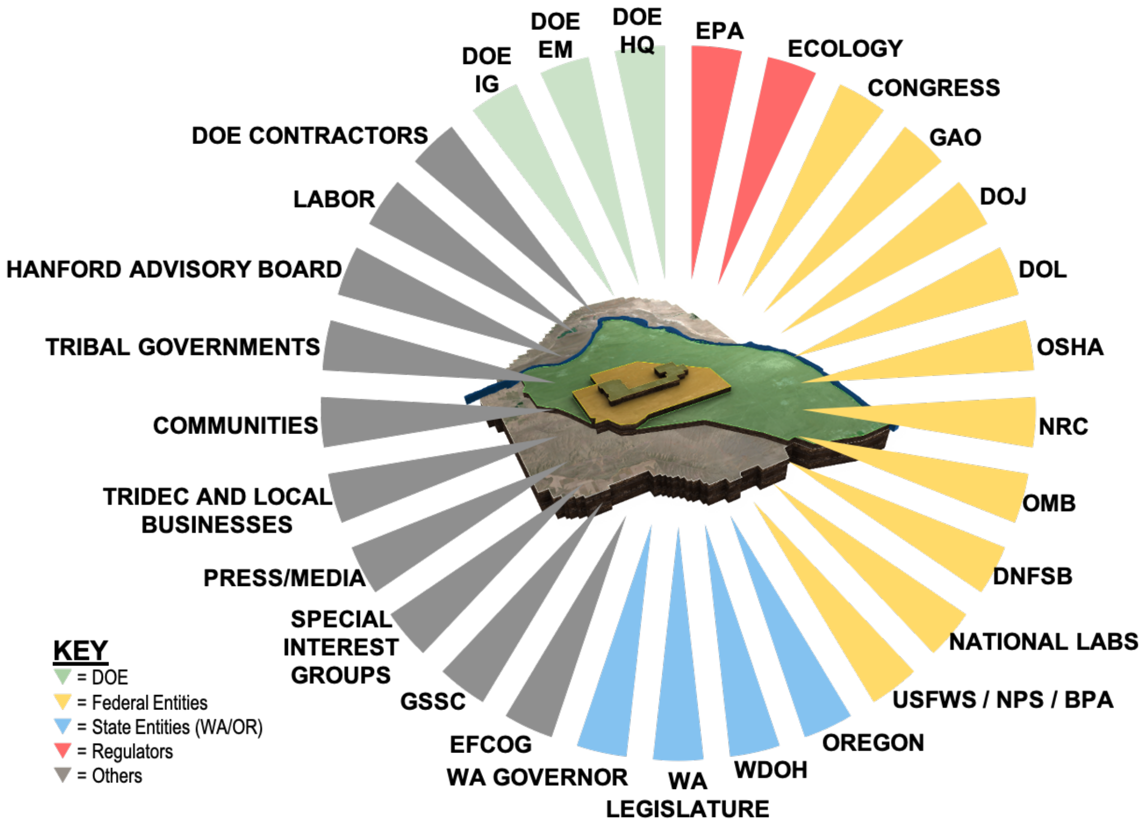
2.3.2.3 Continuity of Design and Technical Authorities

The technical authority is arguably represented today by three principal technology providers: Pacific Northwest National Laboratory, Savannah River National Laboratory, and Atkins Nuclear Solutions coupled with the Vitreous State Laboratory at the Catholic University of America. Formal organization of these three providers is recommended into a body with chartered authority on technical matters, with chairmanship provided by DOE.

Design services and authority are currently provided by the three Hanford operations contractors and the WTP engineering, procurement, construction, and commissioning contractor. The latter requires special attention because that role ends once the plant is commissioned whereas other plant and facility design authority is continued through the operations contracts. Continuous WTP design authority services is specifically recommended.

2.3.2.4 Stakeholder Monitoring

There are multiple DFLAW stakeholders covering a broad range of government, regulatory, and public bodies as illustrated in Figure 2.2. Given the number and complexity of the stakeholder relationships, a dedicated focus on stakeholder monitoring for the DFLAW Program is recommended.



BPA	Bonneville Power Administration	DNFSB	Defense Nuclear Facilities Safety Board	DOE EM	U.S. Department of Energy Office of Environmental Management
DOE HQ	U.S. Department of Energy Headquarters	DOE IG	U.S. Department of Energy Inspector General	DOJ	U.S. Department of Justice
DOL	U.S. Department of Labor	Ecology	Washington State Department of Ecology	EFCOG	Energy Facilities Contractors Group
EPA	U.S. Environmental Protection Agency	GAO	Government Accountability Office	GSSC	General Security Services Corporation
NPS	National Park Service	NRC	Nuclear Regulatory Commission	OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Administration	USFWS	U.S. Fish and Wildlife Service	WA	Washington (state)
WDOH	Washington State Department of Health				

Figure 2.2. Complexity of Hanford DFLAW Stakeholders

2.3.2.5 Sustained Operations Business Planning

The entire DFLAW system from the tank farms, through WTP, and into IDF should be considered as a whole in considering the sustainable waste treatment rate from technical, environmental, and cost perspectives.

3.0 Progressive Evaluation for Sustained Operations Readiness

Evaluation for sustained operations readiness is a continuous process that extends through design and plant startup, and into operations. Initially, during the design and into the startup phases, evaluation will be focused on establishing the five elements but will evolve into monitoring of those elements into operations.

A program plan should address making ready for sustained operations in two dimensions. Plant or services are considered in the first. For DFLAW, plant and services are broadly synonymous with contractor responsibilities because a single contractor is responsible for the key components of the DFLAW program as described in Section 1.1. The second dimension addresses readiness of each plant/service for sustained operations in terms of actualizing the 12 cultural features embodied in the five elements described above.

The commissioning process is key in demonstrating readiness for sustained operations. However, successful commissioning will be dependent on the degree to which sustained operations are targeted in designing the plant. Further, the sustainable operational rate is dependent on the degree to which sustained operations is focused on during commissioning. In any case, a reference plant or service should be identified in developing a sustained operations readiness program. For DFLAW, the WTP, and specifically its commissioning, is identified as the reference point for tracking sustained operations readiness since it represents the central capability for DFLAW.

Turning specifically to the DFLAW Program, each DOE project owner should assess their contractor's progress and provide a basis for their readiness for sustained operations against the five elements, using previously identified prerequisite activities or deliverables that should be accomplished by the date or milestone of review. For example, a prerequisite permit could be used to assess the state of relationship with a regulator as a key stakeholder.

An important milestone where the DFLAW Program must assess readiness for each project is melter heat-up. Prior to melter heat-up, each DFLAW project should brief the program manager on progress toward being ready for sustained operations. The program manager is then in a position to objectively declare their confidence in moving ahead with melter heat-up given the status on individual projects. Each DFLAW project would be assessed on an ongoing basis for its sustained operations readiness state. Oversight by DOE staff would include ongoing and planned surveillances that inform DFLAW project owners of the state of sustained operations readiness of their respective projects.

The following sections address how the specific elements can be objectively assessed for the program manager to develop a level of confidence in a project's readiness for sustained operations. The program manager, however, should note that all elements are inter-related. For example: A stakeholder relationship could be the subject of continuous improvement and risk; and, continuous improvement will only be possible with concomitant continuity of design and technical authorities and informed by risk management.

3.1 Risk Management

Each project maintains a risk management program that:

- Informs project activities
- Is unambiguous in definition
- Is expert-informed
- Is based on documented analysis
- Quantifies assumed risk and drives deliberate acceptance by the accountable and responsible manager

Assessment here could involve project managers identifying key risks with sufficient information that the program manager can then use to evaluate the project's risk management program based on the desired features above.

3.2 Continuous Improvement

Each project pursues continuous improvement that:

- Is expert-informed
- Develops people's understanding and enthusiasm for continuous improvement
- Vigorously reappraises previous decisions and processes given new information and based on complete understanding of the:
  - current system and lifecycle
  - logic underpinning past decisions

Assessment involves the project manager describing significant continuous improvement initiatives in terms of the features described above. The initiatives may not necessarily be driven by a formal program; the important part is recognition of the culture for continuous improvement and learning.

3.3 Continuity of Design and Technical Authorities

Each project deliberately maintains continuity of design and technical authorities appropriate for sustained operations that:

- Can be contractually, readily engaged as experts and capabilities (test platforms, for example, concerning the technical authority)
- Maintain the intimate involvement of subject matter experts
- Identify and maintain clarity and completeness of the design and technical bases and the logic underpinning design and technical decisions
- Underpin the reappraisal of previous technical and design decisions

Important here is the deliberate transition of the design and technical authorities from design to operations and what that transition means for the types of experts and capabilities and their accessibility. The program manager should assess a project's transition of design and technical authorities in terms of the characteristics listed above.

3.4 Stakeholder Monitoring

This element is unusual in that it correlates to only 1 (in addition to congruence of plant, people, and paper) of the 12 features. Additionally, the identity and role of a project's stakeholders are arguably the most significant contributors to a project's uniqueness. Given these characteristics, each project identifies its stakeholders, their role, and, importantly, the metrics for monitoring the relationship. This element is assessed not only based on the objective metrics, but also by the project manager's intangible insights of the relationship.

3.5 Sustained Operations Integrated Planning

This planning element is intended to integrate the other four elements with the objectives for:

- Cost of operations, understanding; for example,
  - Cost elements
  - Cost drivers
  - Cost sensitivities
- Operations, considering drivers; for example for DFLAW,
  - Maximizing LAW loading in glass
  - Maximizing LAW treatment rate
  - Minimizing secondary solid and liquid wastes
- Safety/environmental compliance, understanding; for example,
  - Principal compliance constraints
  - Technical versus legal constraints

In the context of the DFLAW Program, this element becomes especially important as the program competes with other major operating DOE waste treatment plants (e.g., the Salt Waste Processing Facility at the Savannah River Site) for federal funds. The output of the planning function is essentially a business plan.

4.0 Conclusions

The work reflected by this report has concluded that the state of sustained operations for a complex processing plant can be objectively characterized by 12 features. These features represent the conducive culture or conditions in which the plant, paper, and people interact to produce a sustained operations state. The 12 features can be further represented by five programmatic and executable elements as summarized below with associated recommendations for Hanford DFLAW operations:

- **Risk management** – An integrated waste treatment operations risk management program led by the DOE is recommended for DFLAW operations.
- **Continuous improvement** – A program-wide continuous improvement system for waste treatment operations is recommended for DFLAW operations.
- **Continuity of design and technical authorities** – Recommended for DFLAW operations is a body of technical program managers from the key technology providers chartered to provide the technical authority and a continuing role for the WTP engineering, procurement, construction and commissioning contractor as the design authority.
- **Stakeholder monitoring** – Hanford waste treatment operations are characterized by complex and wide-ranging stakeholders at federal, state, and local levels of government and regulation and the public. Centralized and integrated stakeholder monitoring and management is recommended as an organizational element.
- **Sustained operations strategy** – An integrated Hanford waste treatment operations business plan is recommended for the Site to most effectively compete with other sites in the current Federal environment competitive for Congressional funding.

Readiness for sustained operations is a continuous function that progresses from overseeing establishment of the five elements during design and construction phases to monitoring the output of those elements during commissioning and operations. Continuously assessing readiness for sustained operations becomes an important business function for DOE as competition for federal funds increases with increasing waste treatment operations throughout the Office of Environmental Management complex.

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