Frequently Asked Questions (FAQ) on Pit Manufacturing Capacity

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<u>Introduction</u>

The topic of pit manufacturing capacity is inherently coupled to planning for the range of stockpile modernization alternatives anticipated in the forthcoming Nuclear Posture Review (NPR). Some of the options discussed in the NPR are likely to require the manufacture of pits and under these circumstances pit manufacturing can represent a limiting factor in the rate of stockpile transformation. The Frequently Asked Questions (FAQ) below are intended to provide information targeted toward the interface between pit manufacturing capacity, possible stockpile modernization alternatives, and facility projects.

1) ***How does pit manufacturing capacity relate to alternatives for stockpile modernization as discussed in the Nuclear Posture Review (NPR)?***

   Pit manufacturing is the rate-limiting factor in stockpile modernization alternatives *that rely on new pits being produced* (not all alternatives do). Given current plans for facility upgrades and replacement projects, the maximum rate for the production of new pits is 80 pits per year and this rate cannot be achieved before 2022. It is important to note that not all modernization alternatives require new pits to be produced – some scenarios involve the re-use of existing pits "as-is" and other alternatives reuse existing pits with modifications. In the process of planning for the NPR, stockpile modernization alternatives were closely coordinated within the limitations of pit manufacturing capacity for both the production of new pits and reusing existing pits.

2) ***What is the difference between Pit Manufacturing and Pit Reuse?***

   Pit manufacturing generally refers to the production of a pit starting with raw material (mining plutonium from old pits) and ending with a new pit. This is accomplished by execution of the complete flowsheet shown in Figure 1. In contrast, the pit reuse flowsheet is not always the same. Pit reuse always includes reusing the Special Nuclear Material (SNM) from existing pits and generally includes alterations needed to achieve modern requirements for safety and security. In Figure 1, pit reuse uses a subset of the flowsheet, mainly "Disassembly," "Assembly and Joining," and "Post Assembly, NDT." Given the difference in the breadth of the flowsheet, any pit reuse option is inherently easier to perform. Note that Pit Reuse terminology is not standardized and frequently means different things to different people. Better terminology from a manufacturing perspective is a "full flowsheet" associated with pit manufacturing and "partial flowsheet" with pit-reuse alternatives. Some reuse alternatives make only minor modifications to the pit and this work would not necessarily be done at TA-55.

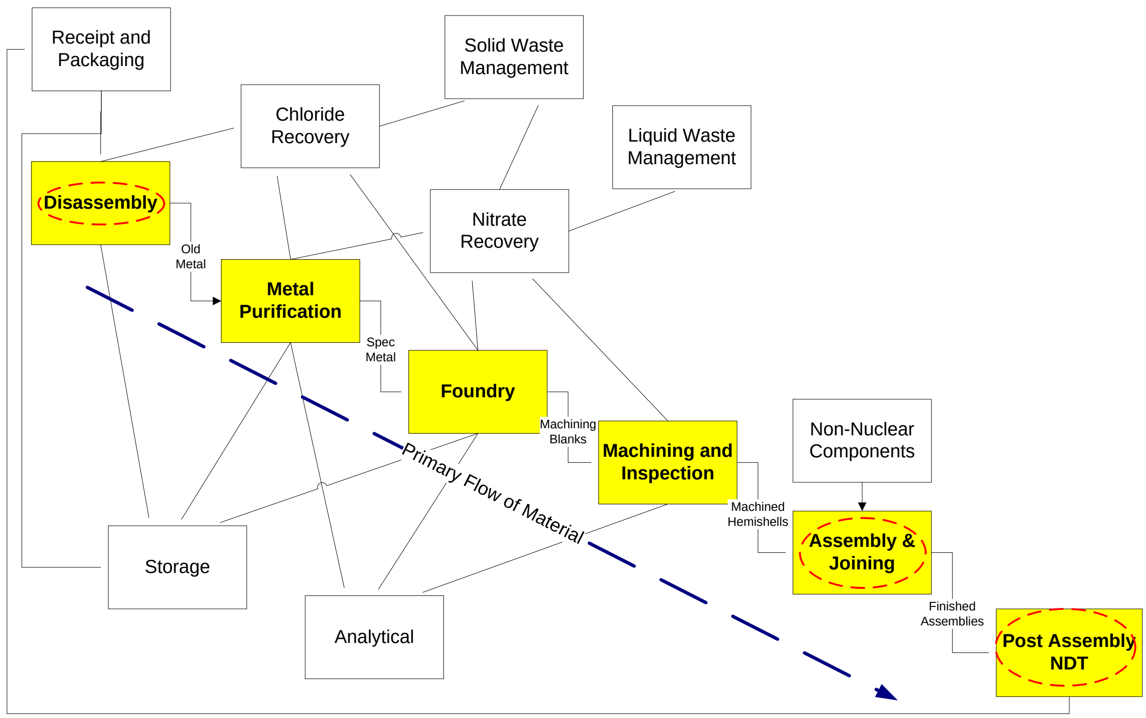

Figure 1: The generic pit manufacturing flowsheet starting with raw materials (aged plutonium) and continuing through a finished product. All of the boxes shown are used in the manufacture of a new pit while only those shown with dashed circles would be used for pit reuse. This eliminates the middle of the flowsheet, which includes most of the rate-limiting steps and the most challenging manufacturing operations.

3) What is the current capacity for the manufacture of War Reserve (WR) Pits?

Current capacity to manufacture pits is about 6-10 pits per year. A 10 pit per year rate was demonstrated by request in 2007 when 11 War Reserve (WR) pits were produced. "War Reserve" refers to a component that has met all quality requirements and can be used in the nation's stockpile. The Pit Manufacturing Program (now called "Plutonium Sustainment") will manufacture 10 more pits over the next 2 years to complete the planned production build for the W88. This will provide enough pits to allow for destructive surveillance of existing pits. At this time, there is no demand for new pits after completion of the W88 lot and current budgetary plans will result in the suspension of WR pit manufacturing capability beginning in 2012.

4) If steps were taken today to increase capacity for pit manufacturing and pit reuse, how does the capacity change as a function of time?

The general "boundary conditions" used for future scenario planning are outlined in Table 1 below. This includes values for both full-flowsheet pits (new production) and partial-flowsheet pits (pit or component reuse). Several assumptions are inherent to this type of generic planning information and in general each scenario must be examined specifically to be accurate.

Table 1. Pit Manufacturing and Reuse Capacity Planning Summary.

Year	Full-Flowsheet Pit Manufacturing Capacity (pits/y)	Partial-Flowsheet Reuse Capacity (pits/y)	Action Taken to Change Capacity
2010	6-10 WR	6-10 Development	Current program
2012	6-10 Development		Current program investments neither support *nor require* WR manufacturing in 2012
2013	10-20 WR		Increased program investment for labor
2016		40 WR	Development of pit reuse processes on existing equipment
2018		120 WR	Installation of a dedicated reuse processing line independent of existing manufacturing line
2020	50 WR		Completion of first phase process equipment installations in PF-4
2022	80 WR		Completion of nuclear facility projects and PF-4 process equipment installations

Notes:

1) The 2008 SSMPEIS evaluated the environmental impacts of up to 80 pits per year but established a production limit of 20 pits per year until the completion of the NPR[1]. Achieving rates beyond 20 pits/y in the table above would require an amended record of decision under the NEPA.
2) The values in each row are not additive until after 2018 when a dedicated reuse line could be added to the plant. Until 2018, a single line exists and must be shared between new manufacture and reuse resulting in resource interference that would reduce the overall capacity for either mission.
3) "WR" or "Development" indicates the highest quality level achievable. WR is the highest level and Development indicates manufacturing without the same level of quality controls necessary to achieve War Reserve.

[1] Final Complex Transformation Supplemental Programmatic Environmental Impact Statement Summary, DOE/EIS-0236-S4, NNSA, October 2008

5) Why is the current pit production capacity so limited?

The capacity was intended to be limited since the inception of the program, and therefore the equipment to establish a higher capacity has not been installed. Historical planning guidance was to establish an interim capability to make WR pits (commonly defined at the 10 pit per year level) until a dedicated production facility could be established. When the mission was transferred to Los Alamos circa 1996, the goal was to establish an *interim manufacturing capability* for pits until the Modern Pit Facility (MPF) could be constructed. The MPF Project was terminated by congress in 2005 due in part to the Pit Lifetimes Assessment and increasing budget pressure. In 2006, planning evolved towards the Complex 2030 Scenario wherein a new Consolidated Plutonium Center (CPC) would serve as the production center for new pits. The Stockpile Stewardship and Management Programmatic Environmental Impact Statement (SSMPEIS) Record of Decision in 2008 terminated the CPC approach, established Los Alamos TA-55 as the plutonium “Center of Excellence,” and established an upper bound on future pit manufacturing capacity at 80 pits per year. While NEPA guidance is now established, the necessary facility and process equipment upgrades to achieve this capacity are not in place, nor are they a part of the program of record.

6) Why is the pit reuse capacity higher than new pit manufacturing capacity?

It’s always easier to reuse existing SNM than to produce new components. Thus, the capacity of existing resources to conduct pit reuse always exceeds the capacity to produce new pits – the limitations in the pit-manufacturing flowsheet are generally located in the middle of the flowsheet which is not used in reuse applications. The reduced number of processing steps with pit reuse means that you can do more with the existing equipment and that the required modifications to the plant to increase capacity are considerably smaller in scope.

7) What steps need to be taken to achieve the pit manufacturing capacity established in the SSMPEIS?

- The most time-consuming action is to execute the planned nuclear facility upgrade and replacement projects established through the Integrated Nuclear Planning (INP) process. These include the TA-55 Reinvestment Project for PF-4, the Radioactive Liquid Waste Treatment Facility (RLWTF) Upgrades Project, the CMR-Replacement Nuclear Facility (CMRR NF), and the Consolidated Waste Project for solid waste. The age and condition of the existing nuclear infrastructure precludes it from providing reliable service over the coming decades. These projects are necessary for facility support to all plutonium programs independent of the level of manufacturing.
- Next, the projects to install additional process equipment in the plutonium processing facility (PF-4) need to be funded and executed. PF-4 presently

does not have enough processing equipment (e.g., lathes, furnaces, and inspection gages) to achieve a sustained rate of 50-80 pits per year. A summary of the scope involved for this activity was recently developed.[2]

- NNSA and Los Alamos need to execute an operational project to free up existing vault space in PF-4 through the Material Recycle and Recovery (MR&R) Program. This activity would allow Los Alamos to support pit reuse missions before the CMRR Nuclear Facility (which contains an SNM vault) is completed.
- Finally, NNSA needs to supplement the existing program personnel from a capability-based core of personnel to the higher level required for capacity production.

8) Is the primary purpose of the CMRR Nuclear Facility to support an expanded pit manufacturing capacity?

No, the primary purpose of the CMRR NF is not to support enhanced pit manufacturing capacity – it is to replace operations currently or previously housed in the CMR Building; however, larger pit manufacturing capacities cannot be achieved without the CMRR NF. The CMRR Nuclear Facility is necessary to reliably support *any level of programmatic activity on plutonium in PF-4* of which manufacturing is only one program. In the absence of the CMRR NF, all plutonium programs are reliant on continued operations of the aging CMR Building which incurs unacceptable risk to programs as time progresses. To reduce this risk, the existing CMR Building will be operated with a minimum of nuclear material and this limitation will preclude it from the sample throughput at higher pit production levels.

9) How long will it take to achieve the SSMPEIS capacity as outlined above?

Two projects listed above are competing as the critical path activity. The construction of the CMRR Nuclear Facility (CMRR-NF) cannot be completed before 2020, with 2022 being more likely. The process equipment upgrades to PF-4 will have at least a 10-year duration and are not presently funded, thus making 2022 the earliest achievable date for expanded pit-manufacturing capacity at 50-80 pits per year accounting for a 2-year budget cycle.

10) Can the schedule to achieve a higher capacity be accelerated?

An accelerated schedule is generally not feasible within the envelope of the existing regulatory environment. There are some practical limitations concerning both the nuclear construction projects and the refitting of PF-4 that make these

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[2] Ostic, J., et al., "Pit Manufacturing Program Execution Plan," Los Alamos National Laboratory, LA-CP-07-1186 (UCNI, Pre-Decisional Draft), April 2008.

projects difficult to accelerate. However, aggressive funding and prioritization might make a difference of a few years (2-3).

11) Why is pit manufacturing so difficult?

The nature of the product line has always presented manufacturing challenges. Pits require extremely high quality and security levels and these must be applied to a material with unique hazards and unique metallurgical behavior. Increasing challenges include an evolving regulatory envelope governing safety and security. Historically, pit performance was certified through nuclear testing which is no longer available. In the absence of nuclear testing, additional conservatism has been applied towards manufacturing conditions and tolerances. The combination of the regulatory environment and conservatism has further constrained what has always been a fragile manufacturing process at best.

12) What other programs interface with pit manufacturing and will they affect the available capacity?

Due to consolidation of nuclear facilities, Los Alamos's Plutonium Facility (PF-4) will be the nation's only multi-purpose, Security Category I, Hazard Category 2 nuclear facility for some time. Any program that works with significant quantities of bare plutonium will need support from PF-4. Current programs in PF-4 include annual assessment and pit surveillance, plutonium disposition, Pu-238 heat-sources, fuels research, and basic actinide R&D. Most programs have dedicated space, with most interfaces occurring at commonly used resources like storage (vault), waste management, and shipping/receiving. The capacity values described have taken these interfaces into consideration but close management and integration of resources will be required.

13) Is the Program of Record supporting the steps listed earlier to increase the capacity to manufacture pits?

The current Program of Record is generally supporting the nuclear facility projects like the CMRR NF and the TA-55 Reinvestment Project on an extended schedule paced by available funding. Note that the nuclear facility projects are necessary to ensure *basic capability* in plutonium programs and none of them are specifically related to manufacturing capacity. The investments for program equipment in PF-4 *are* intended to increase manufacturing capacity and they are generally not supported by the Program of Record for at least the next 5 years, which would delay the dates to achieve the listed capacities in Table 1.