DPAG

Plutonium-Pit Production in the 21st Century

Salient features of DPAG study - prepared for LSPF workshop on
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Study Performance and Requirements

DPAG

- Study performed 2/98 - 11/98
  - sponsored by DOE/AL (Earl Whiteman)
  - concluded that a LSPF is needed
    - limited capacity at LANL not adequate over long-term
- Top-Level Requirements
  - DEVELOPED OUR OWN - DPAG's task was to look at a continuum of possible futures. Within that continuum, the study team chose a realistic "base case" for purposes of illustration:
    - baseline production nominally 150 WR-pits/yr, but up to 225 WR-pits/yr (single shift); total capacity (baseline + contingency) up to 450 WR-pits/yr (2 shifts)
      - total capacity selected based on realistic stockpile future, realistic contingency and augmentation requirements, practical operational constraints for pit fabrication facility, current stockpile age, and potential pit lifetimes
    - 40 hr. work week / 8 hrs. per shift / 5 shifts per week / 40 weeks per year
      - balance of year used for major maintenance, inventory, & vacation shutdown
    - sprint (3rd shift) production not considered realistic
      - unsustainable

Assumptions

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- revert to active-only stockpile
- B83 ignored
- fabrication modeling assumed casting technology (not wrought)
- all pits have same yield lifetime
  - W62 age ignored in considering production need dates
- all pits have same fabrication difficulty
  - modeling based on production of bonded pits
- Pu feedstock assumed available as strategic reserve pits (GFE)
- non-Pu pit components assumed GFE
- facility designed to allow completion of contingency production within 3-5 years after identification of need
  - production level based on presumed DOD requirements

Scope

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- range of stockpile sizes
  - START I to "small START III" (active-only)
- pit fabrication operations modeled in detail (Pu components only)
  - Extend software package
  - production operations only (no added capacity for R&D)
  - variety of single shift and two shift production levels
  - detailed equipment lists, but no detailed floor layouts developed
- "balance of plant" activities not independently studied
  - "balance of plant" defined as non-nuclear coating, analytical chemistry, Pu processing, storage, and waste handling
  - no balance of plant activities housed within fabrication facility
  - SRS aqueous-based Pu processing technology assumed for convenience
- "Brownfield" site
  - all estimates assumed at least some degree of pre-existing site infrastructure (roads, utilities, and the like)
- D&D costs not considered
- supplemental PEIS not costed

Level of Redundancy

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- byproduct of Extend modeling
  - workstations added as needed until predetermined production rate was achieved with acceptable equipment utilization (set at maximum of 70%) at every station
  - each piece of identical equipment assumed to be utilized equally
  - detailed lists of required equipment for various 1- and 2-shift production rates were developed
- single production line
- single material transfer system
  - realistic transfer times embedded in modeling
- single pit design in production at any one time
  - team opinion is that two at a time would be possible by going to 2 shifts, but at the price of reduced efficiency (say, down to ~80%) for both

Level of Detail

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- below pre-CDR scope and quality
  - costing built on foundation of prior estimates
    - some topics not re-examined
      - » staffing levels, salary structures
  - important topics left unaddressed
    - workforce acquisition and training
    - NEPA issues
    - exposure limits
- expansive in number of topical areas considered
  - pit yield lifetime
  - implementation timeline
  - stockpile size
  - facility modeling
  - siting
  - costing

Potential Timeline

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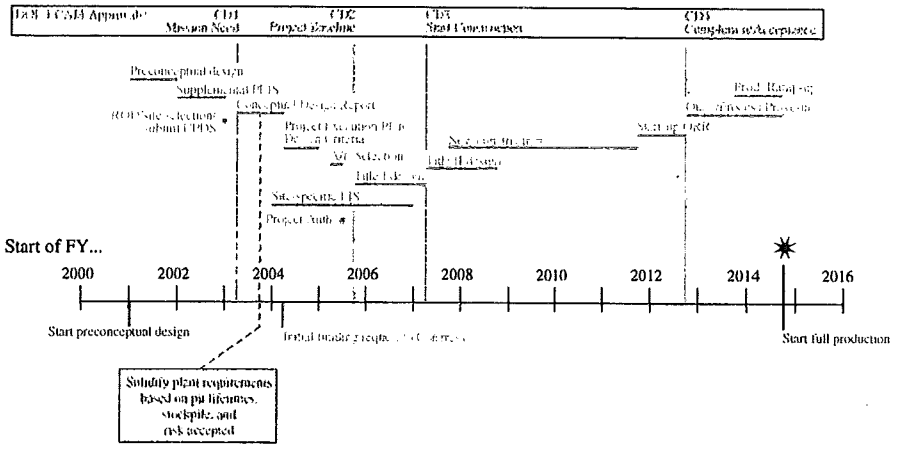
- Barring a national emergency, $\Delta t \cong 14$ years from start of preconceptual design until start of full production



Pit Fabrication Facility*

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- Base Case
  - big enough to allow elimination of inactive stockpile
  - 450 WR-pits/yr 2-shift capacity
    - single shift capacity falls at ~225 WR-pits/yr
  - ~81,000 sq. ft. hardened (Cat I) space
    - ~19,000 sq. ft. of this is actual manufacturing space
      - foundry
      - machining
      - welding & assembly
      - final assembly (including radiography)
  - ~62,000 sq. ft. soft space
- Single shift capacity of 150 WR-pits/yr
  - only ~10% smaller than base case overall
    - ~71,000 sq. ft. hardened (Cat I) space
      - ~16,000 sq. ft. for actual manufacturing
    - ~58,000 sq. ft. soft space

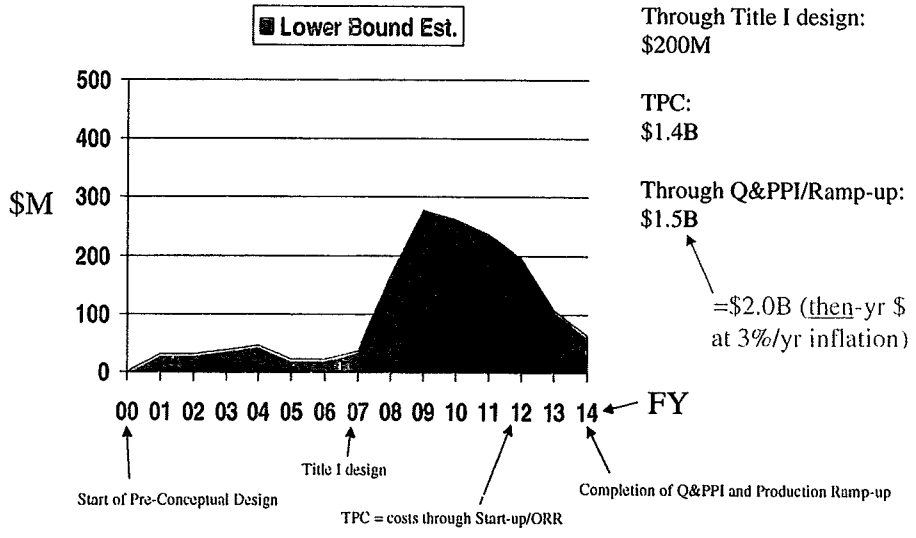
*No balance of plant activities included

Cost to Implement Total Base Case Plant* — *DPAG*

- Lower Bound
  - Virtually all of the balance of plant infrastructure required to support a new base case pit fabrication facility is pre-existing at the chosen site, and is readily available and adaptable to the pit manufacturing mission
- More Realistic
  - A greater percentage of the balance of plant must be capitalized, which includes not only pit fabrication, but plutonium processing, analytical chemistry, and some of the other supporting infrastructure as well.
- Upper Bound
  - A Greenfield alternative - NOT DONE
    - would include provision for a new waste handling facility - reasonable estimate of capital cost not obtainable until completion of NEPA process

*All balance of plant included

Base Case Plant - Constant FY00$ (1) — *DPAG*



Through Title I design: $200M

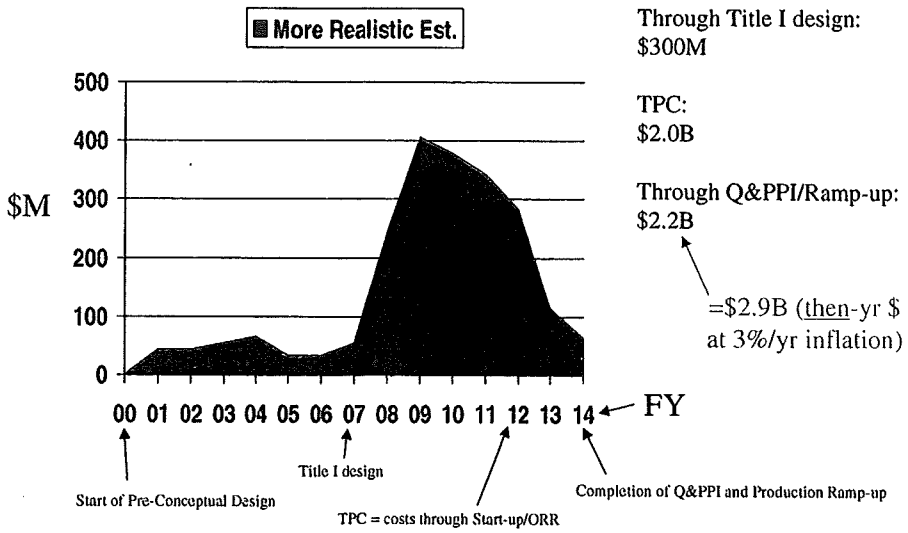
TPC: $1.4B

Through Q&PPI/Ramp-up: $1.5B

=$2.0B (then-yr $ at 3%/yr inflation)

Base Case Plant - Constant FY00$ (2)

DPAG



Through Title I design:
$300M

TPC:
$2.0B

Through Q&PPI/Ramp-up:
$2.2B

=$2.9B (then-yr $ at 3%/yr inflation)

Sensitivity of Results

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- base case plant has sufficient capacity to support a wide range of potential future stockpiles, and pit lifetimes anywhere within current planning windows
- cost for in-place contingency capacity (included in base case plant) is small (on the order of ~10% of the total)
- if the start of production is delayed, the required plant capacity is increased because the date for pit EOL is fixed
  - five year delay could impact required baseline production rate by ~20% or more (depending on size of stockpile supported)

Study Attributes

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- Breadth of Treatment
  - includes references to political risks
- No Externally Imposed Constraints
- A Continuum of Results
  - not a point solution, therefore, shows interrelationships between important parameters and sensitivities
    - conveys a thought process to assist decision makers
- Illumination of Concepts
  - dramatic economic benefit of <u>not</u> supporting an inactive stockpile
    - modest up-front capital investment in base-case capacity would allow savings of <u>many billions</u> in future production campaign costs
      - savings somewhat reduced if future augmentation and/or reliability replacement production needed
    - "lower bound" study approach helps defensibility of this conclusion
  - no IS would make needed plant capacity driven most strongly by stockpile size, not pit lifetimes
    - need for contingency capacity would be the driver
  - Category I space as a Complex-wide resource