

MEMORANDUM TO: Eric J. Leeds, Chief  
Special Projects Branch  
Division of Fuel Cycle Safety  
and Safeguards

THRU: Joseph G. Giitter, Chief  
Enrichment Section **/RA/**  
Special Projects Branch, FCSS

FROM: Timothy C. Johnson  
Senior Mechanical Systems Engineer  
Enrichment Section  
Special Projects Branch, FCSS

SUBJECT: JANUARY 23, 2002, MEETING SUMMARY: U.S. ENRICHMENT  
CORPORATION LEAD GAS CENTRIFUGE CASCADE

On January 23, 2001, U.S. Nuclear Regulatory Commission (NRC) staff met with staff from the U.S. Enrichment Corporation (USEC) to discuss USEC's plans and schedule for submitting a license application for a gas centrifuge lead cascade. I am attaching the meeting summary for your use.

Docket No: 70-7003

Attachment: USEC Gas Centrifuge Lead  
Cascade Meeting Summary

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Docket No: 70-7003

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**ADAMS:** PKG NO: ML020350690 MEMO(INCLUDING MTNG SUMM): ML020350691

Attendee List: \_\_\_\_\_ USEC Ltr: \_\_\_\_\_ USEC Handout: \_\_\_\_\_

**G:\SPB\TCJ\USECGCMTGSUM.WPD** \*SEE PREVIOUS CONCURRENCE

<b>OFC</b>	SPB*		SPB*		SPB*	
<b>NAME</b>	TCJohnson:dw		DHoadley		JGiitter	
<b>DATE</b>	1 / 25 /02		1/ 29 /02		1 / 30 /02	

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U.S. Enrichment Corporation Gas Centrifuge  
Lead Cascade Meeting Summary

Date: January 23, 2002

Place: U.S. Nuclear Regulatory Commission (NRC) Offices; Rockville, Maryland

Attendees: See Attachment 1

Purpose:

The purpose of this meeting was to discuss the U.S. Enrichment Corporation's (USEC's) plans and schedule for submitting a license application for a gas centrifuge lead cascade.

Discussion:

Following introduction of individuals attending the meeting, USEC staff provided a letter to the U.S. Nuclear Regulatory Commission (NRC) indicating that USEC would submit a license application for a gas centrifuge lead cascade in the fourth quarter of calendar year (CY) 2002 (see Attachment 2). USEC staff then discussed the planned gas centrifuge program and licensing plans (see Attachment 3).

The lead cascades will be based on U.S. Department of Energy (DOE) Advanced Gas Centrifuge technology. USEC staff indicated that in the 1980's more than 1300 gas centrifuges were installed and 700 operated with uranium hexafluoride at the Gas Centrifuge Enrichment Plant in Piketon, Ohio. About 100 machines operated for 9 months. The USEC objective is to replicate the existing technology and reduce costs using advances in carbon fiber and other material and manufacturing technologies. It is not to develop a new technology.

The program is being performed in three phases: a demonstration program under DOE auspices and regulatory control; the lead cascade phase; and a commercial deployment phase. The demonstration phase is intended to obtain detailed test data for the gas centrifuge machines. The lead cascade program is intended to provide reliability information on the machines and auxiliary systems as it would be used in commercial operations. The plant would recycle tails and product with no production withdrawals except for sampling. Up to 240 gas centrifuge machines would be used in the lead cascade and have a possession limit of 250 kg uranium hexafluoride at an enrichment level consistent with the current gaseous diffusion plants. The commercial plant would have a capacity of 3.5 million Separative Work Units (SWU) per year with up to 10 percent enrichment.

USEC staff indicated that it would provide in-house centrifuge manufacturing, assembly, and repair. USEC would partner with a fabrication firm to do these activities at the deployment site. USEC staff indicated that the gas centrifuges would be designed so that selective maintenance could be performed if needed.

At this time, USEC has not decided on a site for the facility. A siting decision would be made as part of preparing the license application. USEC staff indicated that seismic impacts on the operation of the gas centrifuges would be considered and it is possible to design the facility for

seismic events. USEC staff noted that it has the right of first refusal to lease the buildings housing the Gas Centrifuge Enrichment Plant at the Portsmouth Gaseous Diffusion Plant.

USEC staff proposed a licensing schedule that is based on NRC preparing an environmental assessment versus an environmental impact statement (EIS). The application would be based on the facility purpose for test and analysis only, not it being an "Enrichment Facility." USEC plans to leverage programs (e.g., fire protection, criticality, etc.) already approved for the gaseous diffusion plants to facilitate the review effort. USEC staff indicated it would submit its environmental report with the application. Their schedule is based on one or no rounds of requests for additional information (RAIs). USEC staff also expects to begin fabrication of gas centrifuge equipment 90 days after the submittal of its environmental report. Based on these assumptions, USEC staff projects a 1-year license review period.

USEC staff indicated it wants to obtain a commercial license in CY 2006 and begin commercial operations in CY 2008. This would mean an application would be needed in about CY 2004.

USEC staff indicated that it has not yet completed an agreement with DOE for the demonstration phase. Slips in completing this agreement would directly affect the lead cascade schedules.

For the lead cascade licensing, USEC staff indicated that it would not need a gas centrifuge standard review plan (SRP) supplement. It believed that the Part 70 guidance for fuel cycle facilities in NUREG-1520 would be sufficient. USEC staff indicated that it might be useful to factor in lead cascade lessons learned into an SRP supplement for the commercial-scale license.

USEC staff suggested that a set of intermediate licensing milestones be agreed upon to enable issues to be resolved early. USEC staff also suggested that draft RAIs and safety evaluation report sections should be provided to USEC for review as early as possible.

USEC staff will provide, probably next month, a list of topics and a schedule for planned pre-application discussions.

Action Items:

None

Attachments: 1. Attendee list  
2. January 23, 2002 letter to NRC from USEC  
3. January 23, 2002 USEC meeting handout

March 18, 2002

MEMORANDUM TO: Chairman Meserve  
Commissioner Dicus  
Commissioner Diaz  
Commissioner McGaffigan  
Commissioner Merrifield

FROM: William D. Travers */RA/*  
Executive Director for Operations

SUBJECT: STATUS OF NUCLEAR FUEL CYCLE FACILITY OVERSIGHT  
PROGRAM REVISION

In SECY-99-188, the staff informed the Commission of its initiative to revise the fuel cycle facility inspection program. In SECY-00-0222, and during the December 20, 2000, Commission briefing on this subject, the staff informed the Commission of the current status of its efforts in this initiative and its plans to revise the fuel cycle oversight program. The Staff Requirements Memorandum resulting from the Commission briefing stated that the "...revision of the fuel cycle oversight program should proceed as planned. However, the staff should ensure that these efforts, and the resources associated with them, do not negatively impact full implementation of the recently revised 10 CFR Part 70 and its associated guidance."

At that time, the staff intended to continue interactions with stakeholders to develop an oversight process that would emulate the one developed for regulatory oversight of nuclear power plants. Some of the risk-informed features contemplated for use in fuel cycle oversight included:

- cornerstones of safety, safeguards and security, which would outline the most risk-significant licensee performance attributes for use in focusing inspections and performance assessments;
- significance determination processes (SDPs), which would be risk-informed tools for assessing the significance of events, inspection findings, and enforcement actions; and
- performance indicators to measure licensee performance in each of the cornerstone areas, with associated performance thresholds for adjusting the level of inspection in those areas.

CONTACT: P. Castleman, NMSS/FCSS  
(301) 415-8118

In addition to these features, the staff planned to develop:

- a new licensee performance assessment process (including an action matrix);
- revised policy and guidance for treating licensee corrective action programs; and
- revisions to inspection manual chapters, inspection procedures, and the enforcement policy. Since the December 2000 Commission briefing, the staff has been deliberate in its efforts to complete this initiative. The staff finalized the project's communications plan, developed drafts of the enforcement policy and of the safeguards and security cornerstones, and began work on developing SDPs. Two public workshops with the industry were held: one, in February 2001, covered the revised project work plan and communications plan; the other, in May 2001, addressed the role of licensee corrective action programs in the revised fuel cycle oversight process. In accordance with the project's communications plan, four local public meetings were held near six of the ten fuel cycle licensees. In addition, the staff monitored other efforts, such as the implementation of the Office of Nuclear Reactor Regulation's new Reactor Oversight Process (ROP) and the activities of the Office of Nuclear Material Safety and Safeguards Risk Task Group (RTG), for lessons-learned that could be applied to fuel cycle oversight.

On the basis of continued stakeholder interactions, our experiences in developing the program revisions described above, progress in implementing the revisions to Part 70, and lessons-learned from the initial implementation of the ROP (SECY-01-0114) and the activities of the RTG, the staff has revised the project's scope, objectives, and milestones. Issues or lessons-learned supporting the revisions include:

- Because the Agency and its licensees are in the early stages of implementing the new Part 70 requirements, the transformation to risk-informed oversight of fuel cycle facilities will have to be evolutionary.
- Industry has recommended that we revise the Licensee Performance Review (LPR) process to make it risk-informed and more timely, objective, and transparent; industry does not support the broader program revisions as described in SECY-00-0222.
- Before establishing policies to credit licensee corrective action programs, the Agency and its licensees need to implement a consistent, license-based approach toward these programs under the management measures required by the recent revisions to Part 70. This need is driven by the fact that, currently, fuel cycle facilities have differing levels of commitment to corrective action programs, and it would be more efficient, effective, and equitable to implement such policies after more consistency has been established among Part 70 licensees.
- Revisions to the oversight of fuel cycle safeguards and security should account for changes in this area that may result from the Agency's response to the September 11, 2001, terrorist attacks.

For the reasons discussed above, many essential features of the risk-informed framework articulated in SECY-00-0222 should be deferred until after the Part 70 revisions have been implemented. For example, the development of SDPs, as well as the associated enforcement policy changes and action matrix, would depend on the maturation of risk information and risk-informed methods in the fuel cycle arena.

The staff does, however, intend to review and revise Inspection Manual Chapter 2604, "Licensee Performance Review," to make the LPR process more timely and efficient. These changes will be developed in consultation with, first, internal NRC stakeholders (e.g., regional offices), and then with external stakeholders. Upon completion of the LPR revisions, the staff will revise, consolidate, and make more risk-informed the inspection manual chapters governing the fuel cycle inspection program by the end of FY 2002, at which point the oversight revision project will be closed out. Thereafter, as part of normal maintenance of the oversight program, the staff will make risk-informed revisions to the fuel cycle inspection procedures and other program components consistent with the implementation of the Part 70 revisions, as resources permit. In making these program changes, the staff intends to build upon the improvements to effectiveness and efficiency that have already been made to the fuel cycle oversight process in recent years: for example, the planned program for FY 2003 should be as effective and about 27% more efficient than the program in FY 1999 (21.8 versus 29.8 FTE).

cc: SECY  
OGC  
OCA  
OPA  
CFO

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cc: SECY  
OGC  
OCA  
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Package - ML 010910009 - Letter ML012770063

\*SEE PREVIOUS CONCURRENCE

OFC	SSSB*	SSSB*	SSSB*	SSSB*	FCSS*
NAME	PCastleman:mm	WSchwink	CHaney	EKraus	MWeber
DATE	9/28/01	9/28/01	10/2/01	9/21/01	10/3/01
OFC	OCFO*	OGC*	NMSS*	DEDS*	EDO
NAME	JFunches N/A	STreby	MVirgilio	CPaperiello	WTravers
DATE	10/31/01	10/11/01	10/28/01	02/14/02	03/18/02

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January 23, 2002  
GDP 02-0004

Mr. Martin J. Virgilio  
Director, Office of Nuclear Material Safety and Safeguards  
Attention: Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

**Paducah Gaseous Diffusion Plant (PGDP)  
Portsmouth Gaseous Diffusion Plant (PORTS)  
Docket Nos. 70-7001 and 70-7002, Certificate Nos. GDP-1 and GDP-2  
Intent to Submit a License Application for a Centrifuge Lead Cascade Facility**

Dear Mr. Virgilio:

The purpose of this letter is to inform the Nuclear Regulatory Commission (NRC) of USEC Inc.'s (USEC) intent to submit a License Application for a centrifuge Lead Cascade facility in the fourth quarter of calendar year 2002.

As we have told the NRC, the Lead Cascade will be a test facility, specifically designed for analytical purposes. The Lead Cascade will consist of up to 240 centrifuge machines in recycle operation, where the product and tails streams are recombined. Except for sampling, there will be no removal of enriched product. The objectives of the Lead Cascade are to evaluate the reliability and efficiency of full-scale components, evaluate the integrated operation of centrifuge machines and provide a basis for plant capital and operating cost estimates.

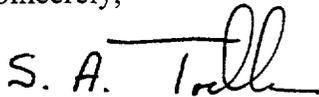
The design of the centrifuge machines installed in the Lead Cascade is based on previously tested machines developed by the Department of Energy (DOE). The DOE machines were highly reliable and had superior performance compared to any other commercially deployed centrifuge in the world. USEC's design builds on the more than \$3 billion invested in this U.S. technology. USEC is looking forward to the prospect of deploying this U.S.-developed technology to supply economic and reliable fuel to the nuclear industry.

Finally, it is important to note that the fourth quarter 2002 submittal is contingent upon USEC reaching agreement with DOE on the rights to centrifuge technology and the use of DOE facilities. We will keep the NRC informed in a timely manner of any changes in our scheduled submittal date.

Mr. Martin J. Virgilio  
January 23, 2002  
GDP 02-0004, Page 2

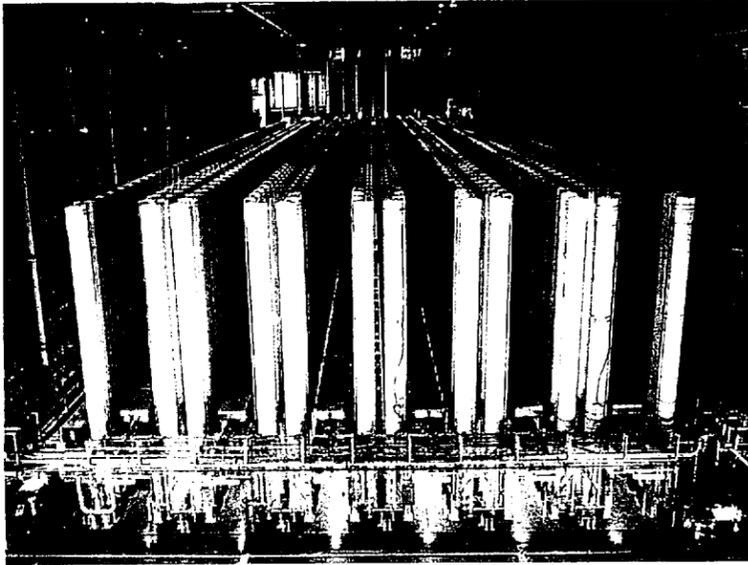
Please contact the Manager of Advanced Technology Licensing, Mario Robles at (301) 564-3408, if you have any questions regarding this subject. There are no new commitments contained in this submittal.

Sincerely,

A handwritten signature in black ink that reads "S. A. Toelle". The signature is written in a cursive style with a long horizontal line extending from the end of the name.

Steven A. Toelle  
Director, Nuclear Regulatory Affairs

cc:  
W. D. Travers, NRC  
C. J. Paperiello, NRC  
M. Weber, NRC  
E. Leeds, NRC  
H. Astwood, NRC  
D. Martin, NRC  
NRC Resident Inspector, PGDP  
NRC Resident Inspector, PORTS  
P. Hiland, NRC Region III



**USEC/NRC  
Pre-Application Meeting  
for the  
Centrifuge  
Lead Cascade  
Facility**

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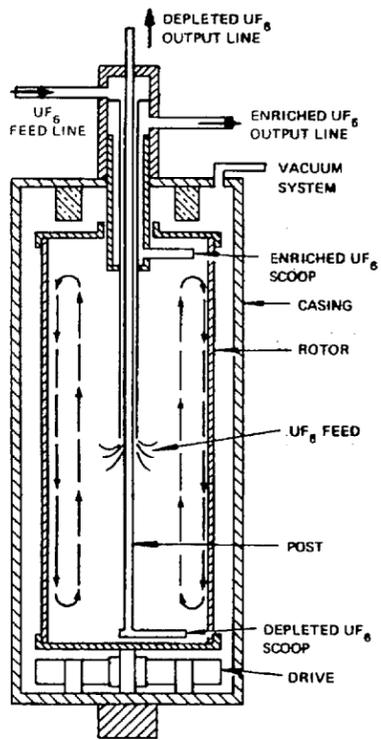
**NRC Headquarters  
Rockville, Maryland  
January 23, 2002**

# AGENDA

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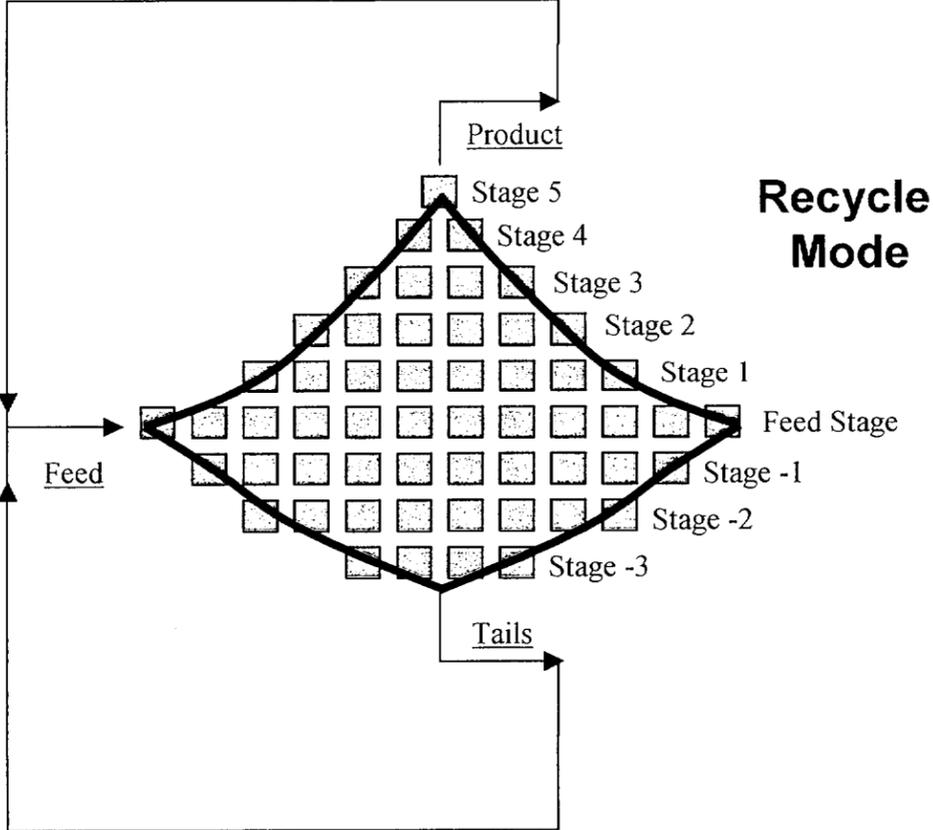
- **Demonstration and Deployment Plan**
- **Application Scope and Schedule**
- **Regulatory Issues**
- **Conclusion and Future Actions**

# Centrifuge Process

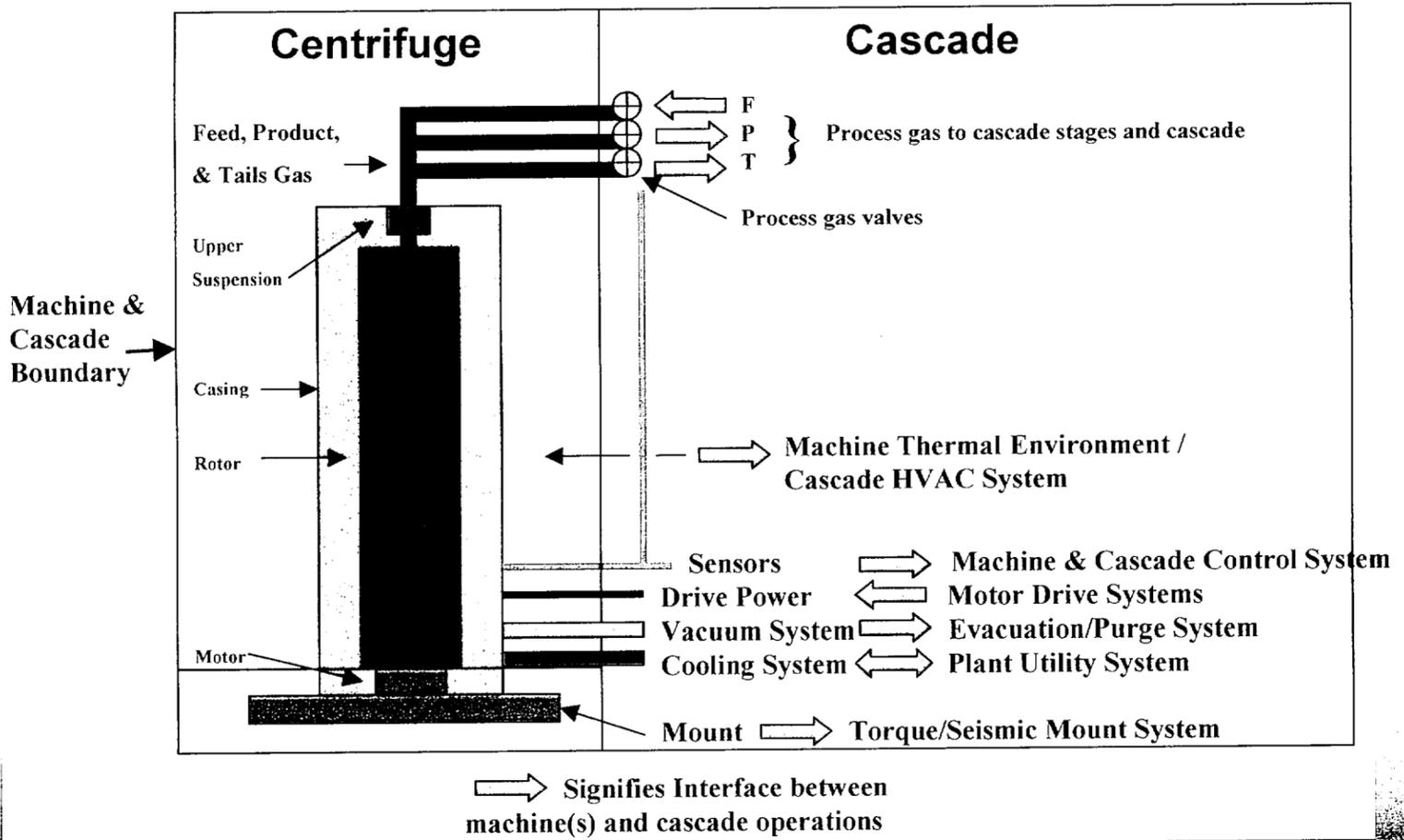


- The rotor, containing  $\text{UF}_6$  gas, spins at high speed inside a vacuum casing
- Centrifugal force concentrates the heavier  $^{238}\text{U}$  molecules at the outer wall and lighter  $^{235}\text{U}$  molecules toward the rotor center
- Gas circulation cells are created that carry product and tails to opposite ends of the machine
- Enrichment levels and capacity are increased by connecting centrifuges in series and parallel, i.e. "cascades"

# Cascade Operation

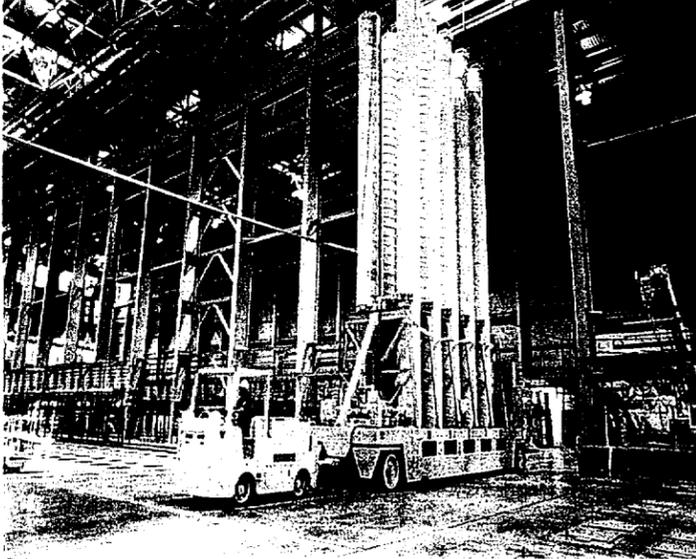


# Centrifuge and Cascade Interaction



# U.S. Centrifuge Performance is Proven

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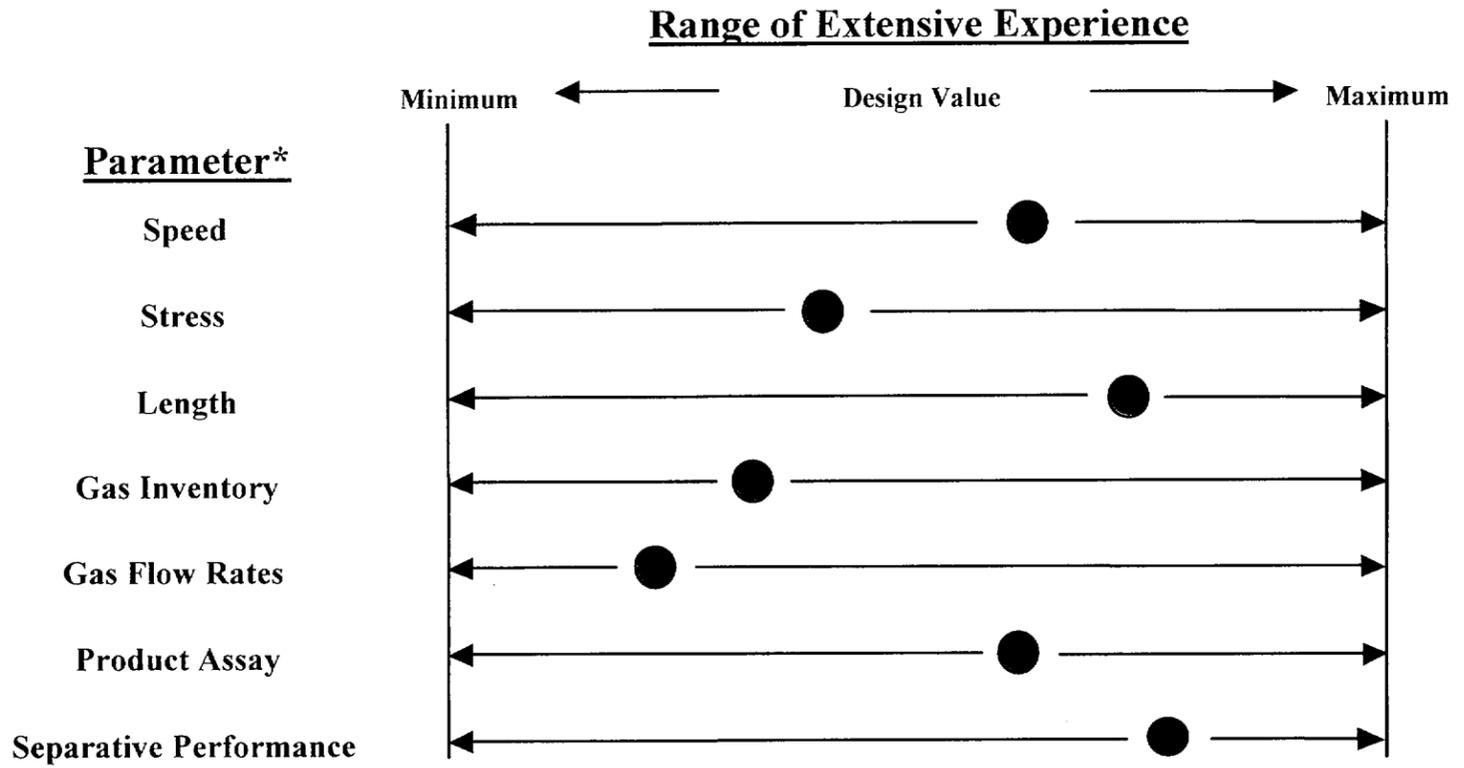


- USEC's design builds upon the \$3B+ investment by DOE in centrifuge technology
- More than 1300 GCEP machines were installed at Portsmouth
- 200 SWU/machine demonstrated in GCEP, with 300+ SWU/machine in AGC
- Reliability exceeded expectations over millions of machine hours of operation
- Some advancements and many cost reductions are achievable today

**GCEP** = Gas Centrifuge Enrichment Plant = Design used at Portsmouth, shown in picture above

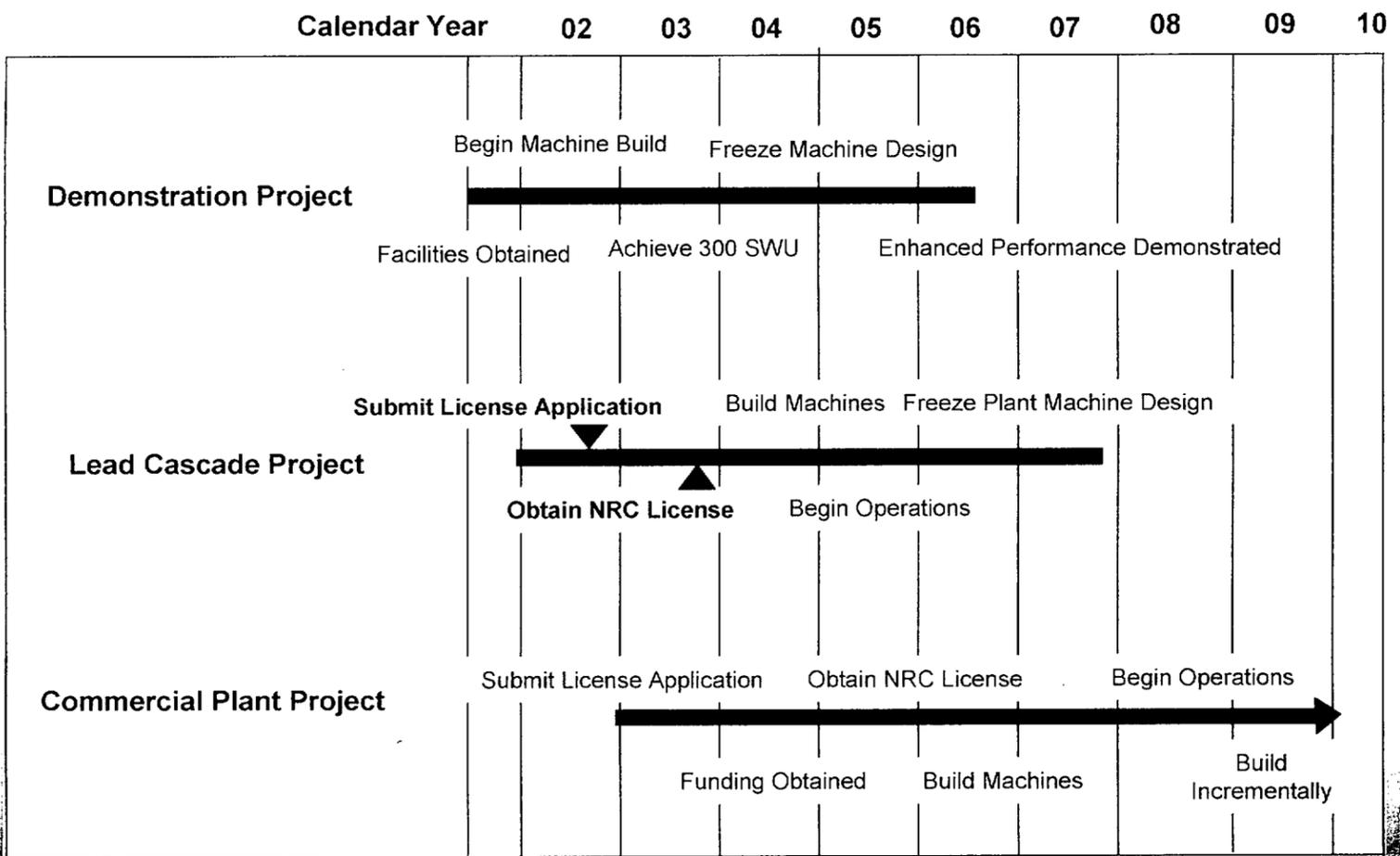
**AGC** = Advanced Gas Centrifuge = Design under development by DOE in the early 1980s

# Demonstration Parameters



\* These parameters affect cost, reliability, and performance

# Demonstration and Deployment Plan



# Risk Reduction Strategy

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- **Demonstrate centrifuge machine performance of 300+ SWU/yr, which is well within the performance envelope demonstrated in the 1980's. USEC will:**
  - Freeze the design when acceptable economic performance is demonstrated
  - Complete centrifuge testing as economically and as quickly as possible
- **Achieve cost reductions through an economic approach to design and manufacturing through:**
  - Incorporation of technological advancements (advanced composites, drive motor, instruments and controls) which achieve improved centrifuge performance at significantly reduced cost
  - Automation of manufacturing processes through partnering with commercial companies
  - Partnering with Universities to perform value engineering and improve manufacturing processes, supported by grant funding where possible

# Demonstration Project

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- Refurbish the K-1600 facility at East Tennessee Technology Park (ETTP) for fabrication and testing of critical centrifuge components and complete centrifuge machine performance testing
- Build up to 30 complete centrifuges and test them in highly-instrumented K-1600 test stands
- Evaluate both the centrifuge machine's mechanical and separative performance
- Obtain initial centrifuge machine reliability data
- Provide design requirements, operating parameters and specifications for the Lead Cascade and Commercial Plant
- Demonstrate centrifuge performance over a wide range of operating conditions

## Key Deliverables

- Demonstrate centrifuge machine performance of 300+ SWU per year
- Provide a solid basis for centrifuge machine cost estimates
- Obtain initial reliability data from operation of up to 30 centrifuge machines

# Lead Cascade Project

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- **Complete the Lead Cascade final design, specifications, and procurement packages based on Demonstration Project**
- **Manufacture centrifuges for the Lead Cascade using:**
  - Use Demonstration equipment and personnel to perform rotor manufacturing
  - Components from vendors where applicable
  - Use Lead Cascade equipment and personnel for final assembly, testing, and installation
- **Design, construct, and operate up to 240 centrifuge machines**
  - Operation will provide essential data on design, operation and reliability of a commercial plant
  - Operating staff will be the core group to design, build and operate a commercial plant

## Key Deliverables

- Demonstrate centrifuge machine reliability while maintaining 300+ SWU per year performance
- Provide a solid basis for the commercial plant capital and operating cost estimates
- Improve regulatory predictability for commercial plant licensing

# Commercial Plant Project

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- **Design, construct, and operate a 3.5 million SWU/year plant**
  - Produce product meeting ASTM specifications
  - Designed and licensed for 10% assay
- **Operate a Manufacture/Assembly/Repair (MAR) Facility**
  - Manufacture and balance rotors
  - Assemble and perform select testing on centrifuges
  - Perform select repair of centrifuges
- **Operate and maintain support utilities**

## Key Deliverables

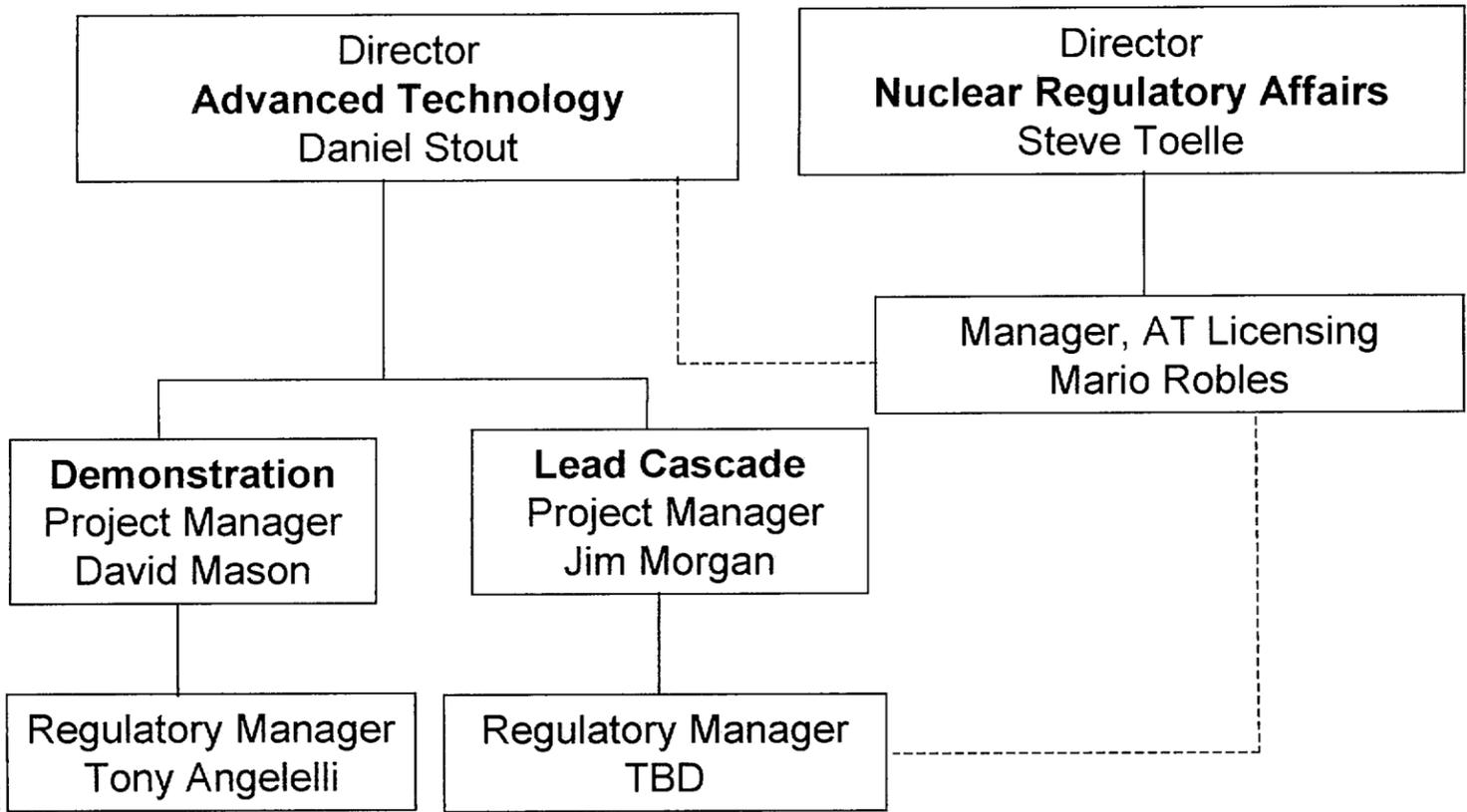
- Initial plant output of 3.5 million SWU per year with expansion capability
- Reliably deliver customer orders

# Path Forward

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- **Demonstrate U.S. centrifuge technology prior to deployment**
  - Complete technology demonstration of performance, reliability and cost
    - Confirm centrifuge performance from Demonstration operation ----- CY04
    - Generate reliability and cost data from Lead Cascade operations ----- CY05+
  - Execute deployment after technology demonstration success
    - Obtain NRC license ----- CY06
    - Begin commercial plant production ----- CY08
  
- **Implement affordable and flexible financing approach**
  - U.S. centrifuge technology demonstration could be self-funded
    - Partnering opportunities will be considered
  - Deployment funded via project financing and/or partnering
    - Capacity can be incrementally financed
    - USEC's commitment and demonstration results improve partnering prospects

# Project Organization



## Application Scope

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- **USEC will request a Part 70 for the Lead Cascade to possess and use both Source and Special Nuclear Material**
- **Consistent with NRC letter dated 9/14/01, the Lead Cascade will not be considered a Uranium Enrichment Facility**
- **Lead Cascade is a laboratory scale facility that is designed and used for experimental and analytical purposes only**
- **To facilitate the NRC review the License Application will utilize, incorporate or reference many applicable GDP programs already reviewed and approved by the NRC under Part 76**

# Application Scope

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- **Possession Limit**

- 250 kg UF<sub>6</sub> (Process Area 15,000 ft<sup>2</sup>)
- Enrichment limit consistent with GDP

- **Authorized Uses**

- Enrichment for sampling only; no other withdrawal of enriched product
- Receipt, filling, storage, cleaning, inspection

# Application Schedule

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- **Consistent with feedback provided by the NRC, USEC will submit the Environmental Report with the License Application**
  
- **USEC plans to submit the License Application as early as the 4<sup>th</sup> Quarter of 2002 (NRC FY03)**
  
- **NRC review**
  - **Environmental Review**
    - 9-12 months for an Environmental Assessment
    - 16-20 months for an Environmental Impact Statement
  
  - **Safety Review**
    - 12-16 months for Safety Evaluation Report

# Regulatory Issues

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- **Information Security**
- **Site Selection**
- **Environmental Review**
- **Regulatory Interfaces**
- **Facility Work**
- **Standard Review Plan Supplement**
- **Intermediate Milestones**

# Information Security

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- **USEC takes its national security responsibilities seriously and those involved in this project need to ensure classified information associated with centrifuge technology is properly safeguarded**
  - USEC personnel with access to centrifuge technology are U.S. citizens with DOE clearances working under an NRC or DOE approved classified matter protection plan
  - Contractors needing access to centrifuge technology also need to be DOE-cleared individuals
  - Similarly, the NRC reviewers to be assigned to this effort must have appropriate clearances

## Site Selection

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- **USEC is currently evaluating where to locate the Lead Cascade**
  - Factors being considered are cost, schedule, availability of existing facilities, trained work force in UF6 handling, environmental data
  - Consistent with Section 9 of NUREG-1520, the Environmental Report will discuss alternative sites considered and eliminated
  - We are working with DOE regarding access to sites

## Environmental Review

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- **USEC believes that the Lead Cascade only requires an Environmental Assessment under 10 CFR 51.21**
  - The Lead Cascade does not qualify for a categorical exclusion under 10CFR 51.22
  - The Lead Cascade is not a Fuel Fabrication, Scrap Recovery, Converter of Uranium Hexafluoride, or Uranium Enrichment Facility and an Environmental Impact Statement under 10 CFR 51.20(b)(7) or (10) is not automatically triggered
  - The Lead Cascade also does not appear to require an EIS under 10 CFR 51.20(b)(14) as a major Commission action that would significantly affect the quality of the human environment because of its limited size, scope and the sites under consideration

## Part 76 Interfaces

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- **USEC understands that even if the Lead Cascade is located in areas leased from the DOE, Part 76 requirements would not apply**
  - The NRC has limited the application of Part 76 to gaseous diffusion technology
  - There remains a need to clearly establish the regulatory requirements that are applicable in areas where different regulatory requirements interface
  - Some cases may require coordination between DOE, NRC and USEC

# Facility Work

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- **USEC anticipates that “de minimis” physical work related to the Lead Cascade can be performed before issuances of the NRC license**
  - Consistent with 10 CFR 51.101, if the adverse environmental impact is de minimis, physical work can be performed with prior notification and consultation with the NRC staff
  - USEC would like to begin such notification and consultation as early as 90 days after submittal of the Environmental Report
  - An example of potentially de minimis work is the manufacture and assembly of centrifuge components and support systems
  - No Special Nuclear Material introduced until after issuance of license

# Standard Review Plan Supplement

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- **USEC believes that the limited scope of the Lead Cascade application does not require the development of a separate supplement to NUREG-1520**
  - NUREG-1520, “Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility” is the guidance used by the NRC staff to perform a review of applications for generic fuel cycle facilities
  - USEC does plan to use this document to prepare the License Application for the Lead Cascade
  - USEC is ready to assist the NRC to develop a supplement to NUREG-1520 to be used for the licensing of a Uranium Enrichment Facility
  - Lessons-learned from the Lead Cascade review will be factored into the supplement

## Intermediate Milestones

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- **USEC believes that establishing intermediate milestones with the NRC has proved to be a successful way to provide early indication of issues that could adversely affect the schedule**
  - This approach was successfully used in the Higher Assay Upgrade Project
  - USEC would like to provide the NRC with pre-application briefings as the License Application is being completed
  - USEC requests that the NRC similarly consider providing Request for Additional Information and draft Safety Evaluation report (SER) sections as the review is being completed

## Conclusion and Future Actions

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- **USEC has committed to a plan to demonstrate and deploy US centrifuge technology**
- **USEC requests that the NRC take action to support the review of the centrifuge Lead Cascade License Application**
  - Feedback on today's presentation
  - Identify any additional issues
  - Tour demonstration facilities at the ETTP
  - Assign a Project Manager
  - Allocate review resources
  - Continue candid, clear and consistent communication

**Sign-up Sheet  
NRC/USEC  
Gas Centrifuge Meeting  
January 23, 2002**

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