An Industrial View of ATW for the US
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1st International Workshop on Accelerator-Driven Sub-Critical Systems & Thorium Utilization

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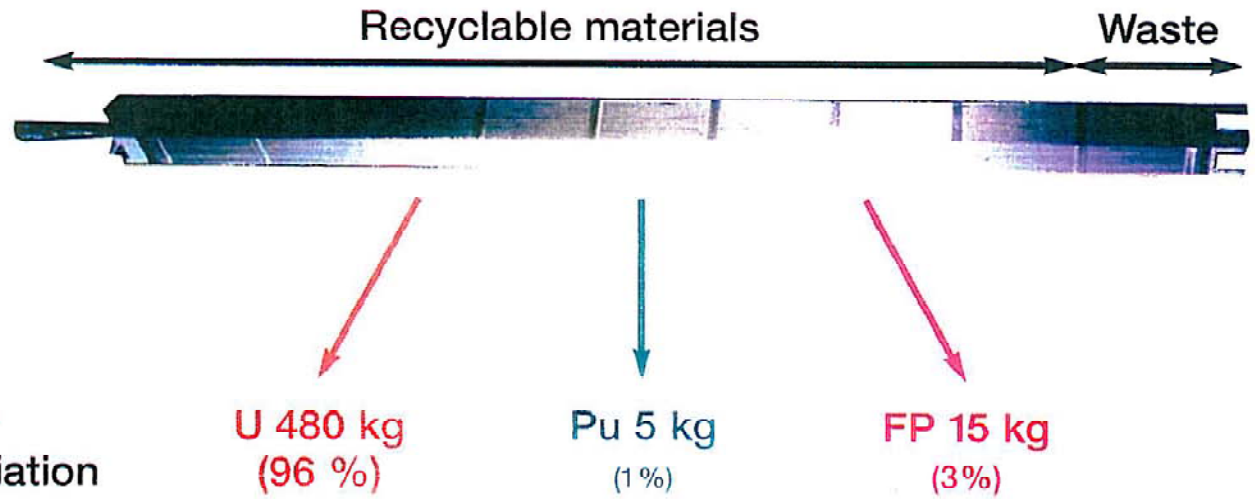
Putting Accelerator Technology to Work

Introduction

- **There has been much discussion at this meeting on Technical, Financial, and Reliability aspects of ADS systems including those utilizing thorium. We will not add to these discussion other than stating that we completely understand the importance of Thorium systems for India. For the US we believe that the more pressing problem is the mitigation of the very large waste already existing from the 103 US reactors and 40+ years of weapons programs.**
- **Hence we believe that the US should concentrate on an ADS system for mitigating the waste while simultaneously producing large amounts of electricity. We see the so called waste as a resource and not a waste.**
- **We believe that for the success of any ADS program the stakeholders must be included from the beginning**
  - **Namely: Reactor, Utility, Reprocessing and Accelerator Industries and the NRC**

Composition of the LWR Spent Fuel Assembly

1 LWR fuel assembly: 500 kg uranium before irradiation in the reactor



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The US Problem

- Long-Lived radioactive materials in high level nuclear waste (HLW) from either commercial power plants or defense operations can last for many tens of thousands of years. The present US strategy is to bury this waste in deep geological repositories (Nuclear Waste Policy Act of 1982).In addition an executive order prohibits the US from reprocessing. Public opposition to this approach has essentially eliminated this option. Revival of the US commercial nuclear power option depends on finding a solution to the waste problem.

- The charge to Secretary Chu's committee on nuclear waste is to evaluate waste mitigation options with the constraint that they must be proliferation free

- Some people's problems are opportunities to others.

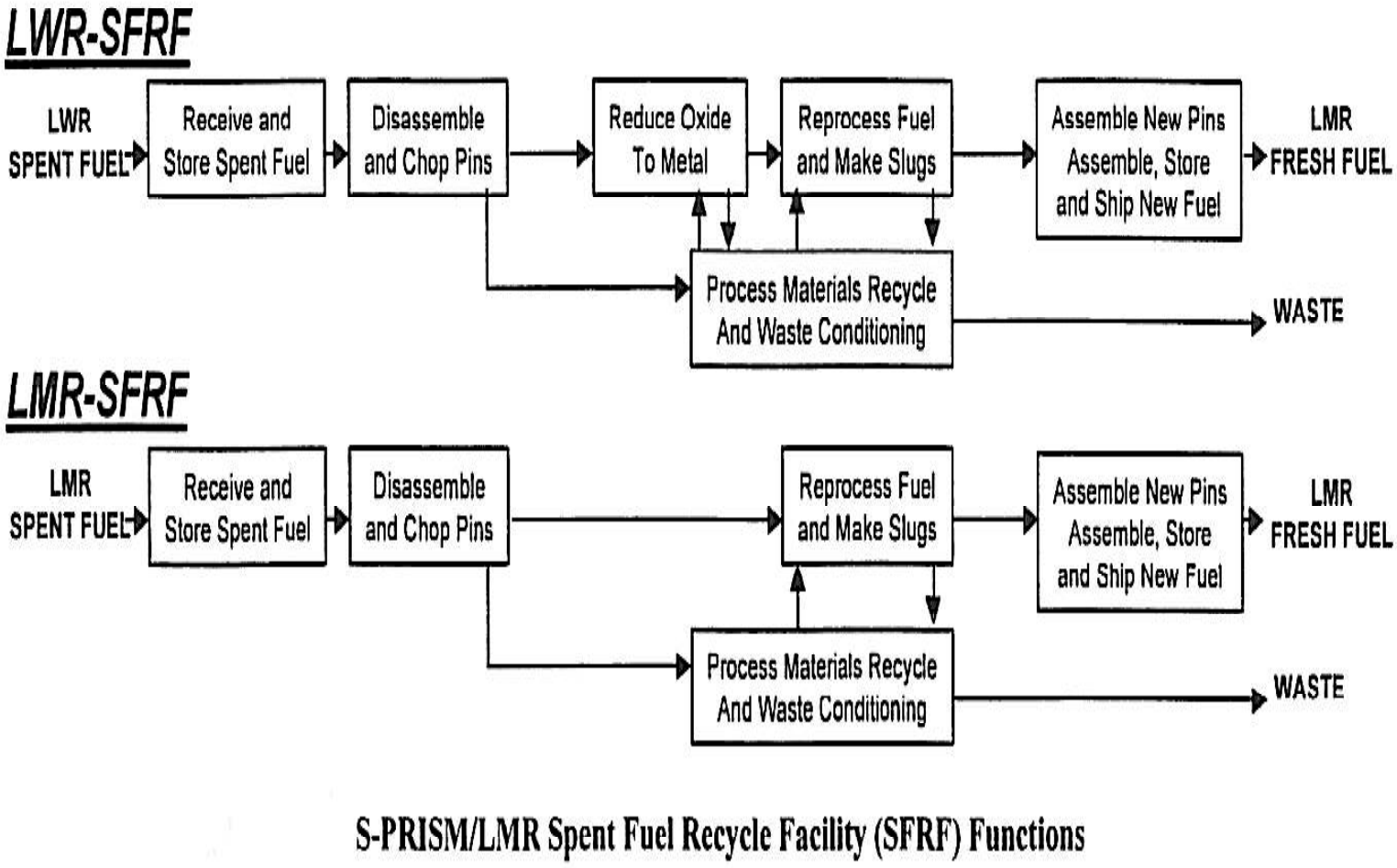
Potential Solutions

There are at least two Solutions namely:

1) The Liquid Metal Fast Breeder Reactor (LMFBR). For example General Electric's S-Prism Fuel Cycle System

2) The Accelerator Transmutation of Waste System (ATW).

Metal Fuel Cycle

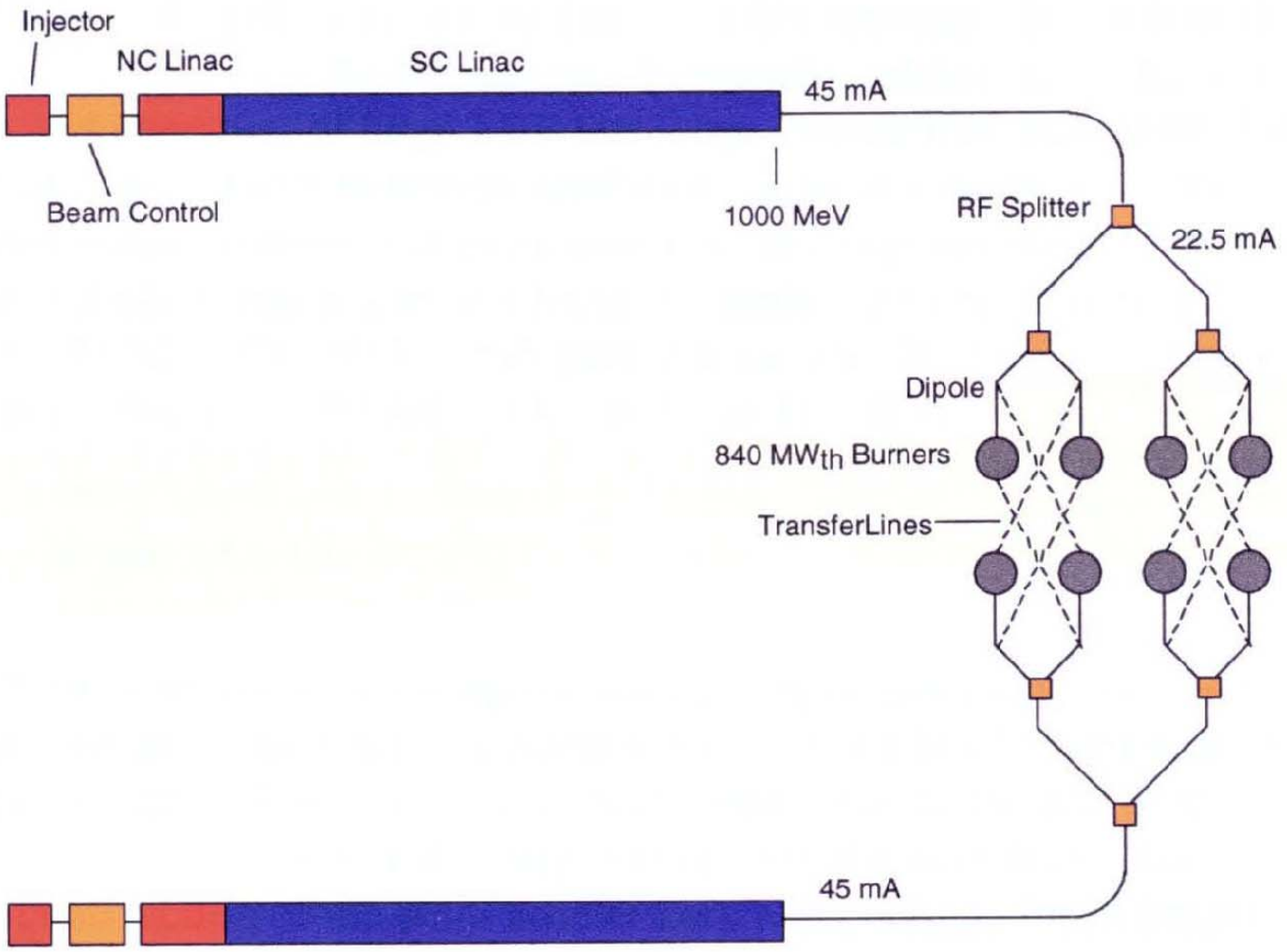


S-PRISM/LMR Spent Fuel Recycle Facility (SFRF) Functions

S-Prism Features

- Since this system does not separate the Pu from the highly radioactive fission products (FP) and actinides it is very proliferation proof.
- The period that the waste would be more toxic than the original ore would be reduced from millions of years to around 500 years.
- By removing the major heat producers the capacity of a repository such as Yucca would be increased by a factor of at least 4.
- This system utilizes the ANL developed Pyroprocessing for fabricating the fuel from LWR waste.
- While this system burns down the Pu and the actinides it does not eliminate the FP's especially the highly mobile (more likely to escape) 99Tc and 129I
- It utilizes a critical reactor

LANL ATW Road Map System



ATW Features

- High System Availability through configuration redundancy
  - For each accelerator system there will be eight subcritical assemblies producing a total 2555 MWe
  - allowing for system electrical needs enables 2175 MWe to be supplied to the grid
  - Ten sites are required to address the US commercial and defense wastes
- Non Proliferating
- Final waste stream result requires segregation for only 300 years

The US is Falling Behind

- **The US led the world on ATW efforts during the1970's, 1980's and 1990's with studies being carried out by Brookhaven National Lab. (BNL) and then by Los Alamos National Lab. (LANL). The LANL effort was the most extensive and was supported by many interested US industries (Bechtel, Grumman, Westinghouse California Power & Light and others) and other labs such as ORNL and ANL. The US DOE work ceased in 2003 due to political reasons one being that work on ATW would delay Yucca. This did not stop the work in other countries. As you have heard at this meeting Europe has its EUROTRANS program culminating in MARCH of this year with the $1.3 Billion funding of MYRHHA. Also during this meeting you have seen the large efforts being conducted in India utilizing thorium and those of other countries as detailed Stuart Henderson's excellent presentation.**

- **We believe that it is imperative that the US DOE commence a program on ATW with the goal of operating some form of a DEMO in the next decade.**

Who has evaluated ATW in the US?

- American Nuclear Society
- Massachusetts Institute of Technology

- Both reviews reported no “show-stoppers” with the system
  - But substantial development was warranted

A Suggested Approach

- **The US DOE should fund a systems study which will result in an UPDATED roadmap for developing an ATW technology for handling the US LWR nuclear Waste that incorporates all the technological improvements to date. A recommended starting point is to revisit LANL's plan published in September 1999 (LA-UR-99-3225)**

- **We recommend this study should involve all eventual stakeholders including National Labs, Universities, Reactor Companies, Utilities, Reprocessing and Accelerator Industries and the NRC.**

- **If/when Project X is approved it would provide an excellent demo for ATW studies.**

- **The R&D efforts of FRIB, ANL accelerator design studies and Project CLEAN at JLAB can address major accelerator issues.**

- **R&D, emphasis should be on: mitigating the effect of the trips so as not to cause electrical power interruption; minimizing the beam loss to prevent activation of the accelerator and cost reduction.**

- **Heavy emphasis should also be directed towards design of the sub-critical assembly with all its issues and the processing facility for the LWR waste plus the pyroprocessing system for the fuel fabrication for the ATW system.**