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Partitioning of High Level Liquid Waste

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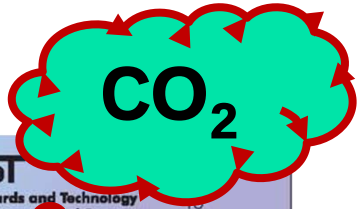
Global 2011, Dec. 11-16, 2011

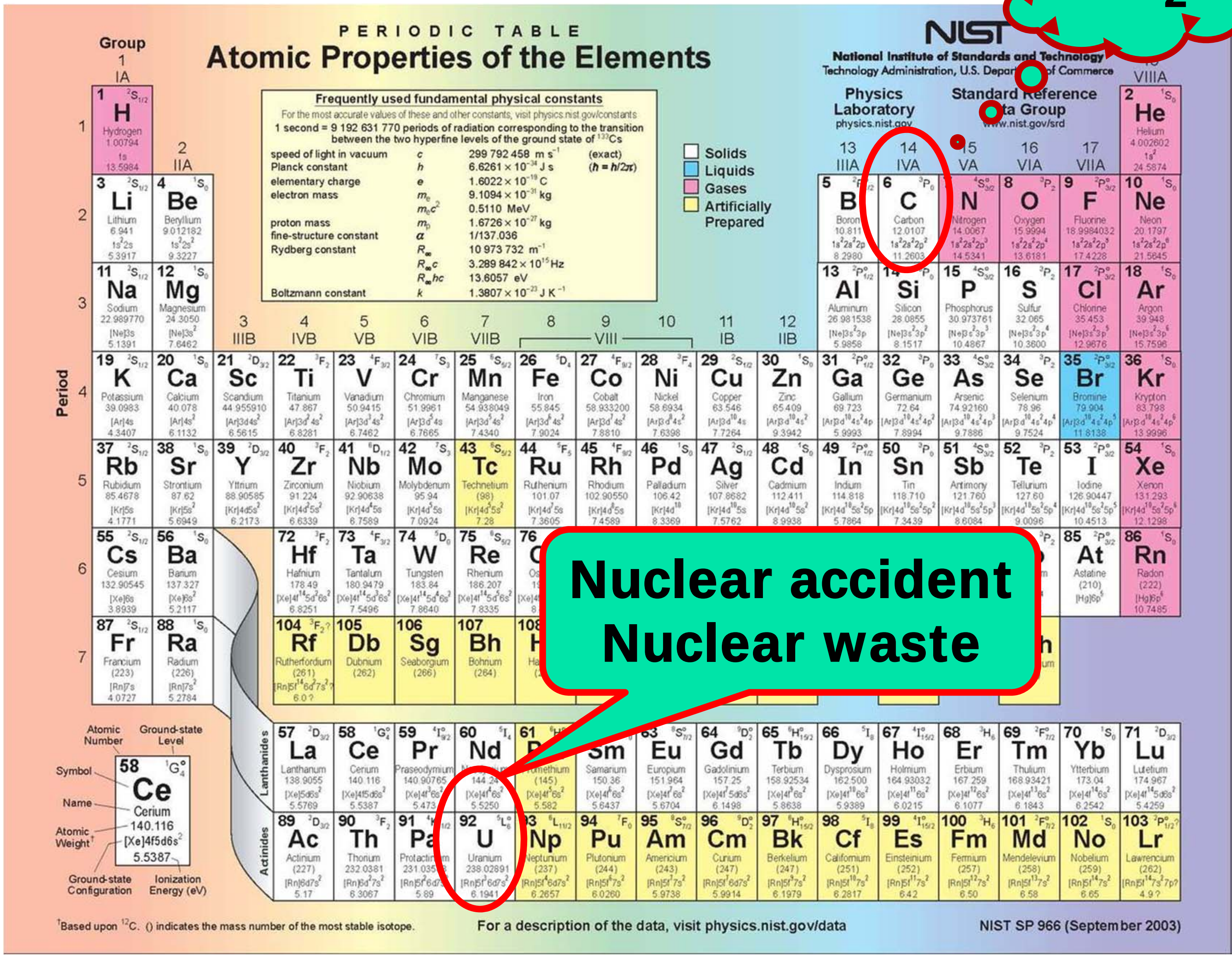
INET

Contents

- Practical objective
- Overview of partitioning in China

Energy - two devils





High level liquid waste

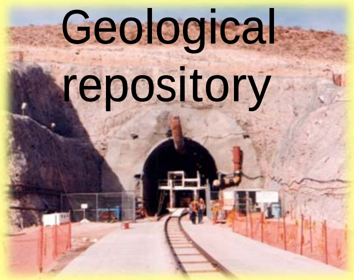
Spent fuel

Reprocessing

HLW

Vitrification

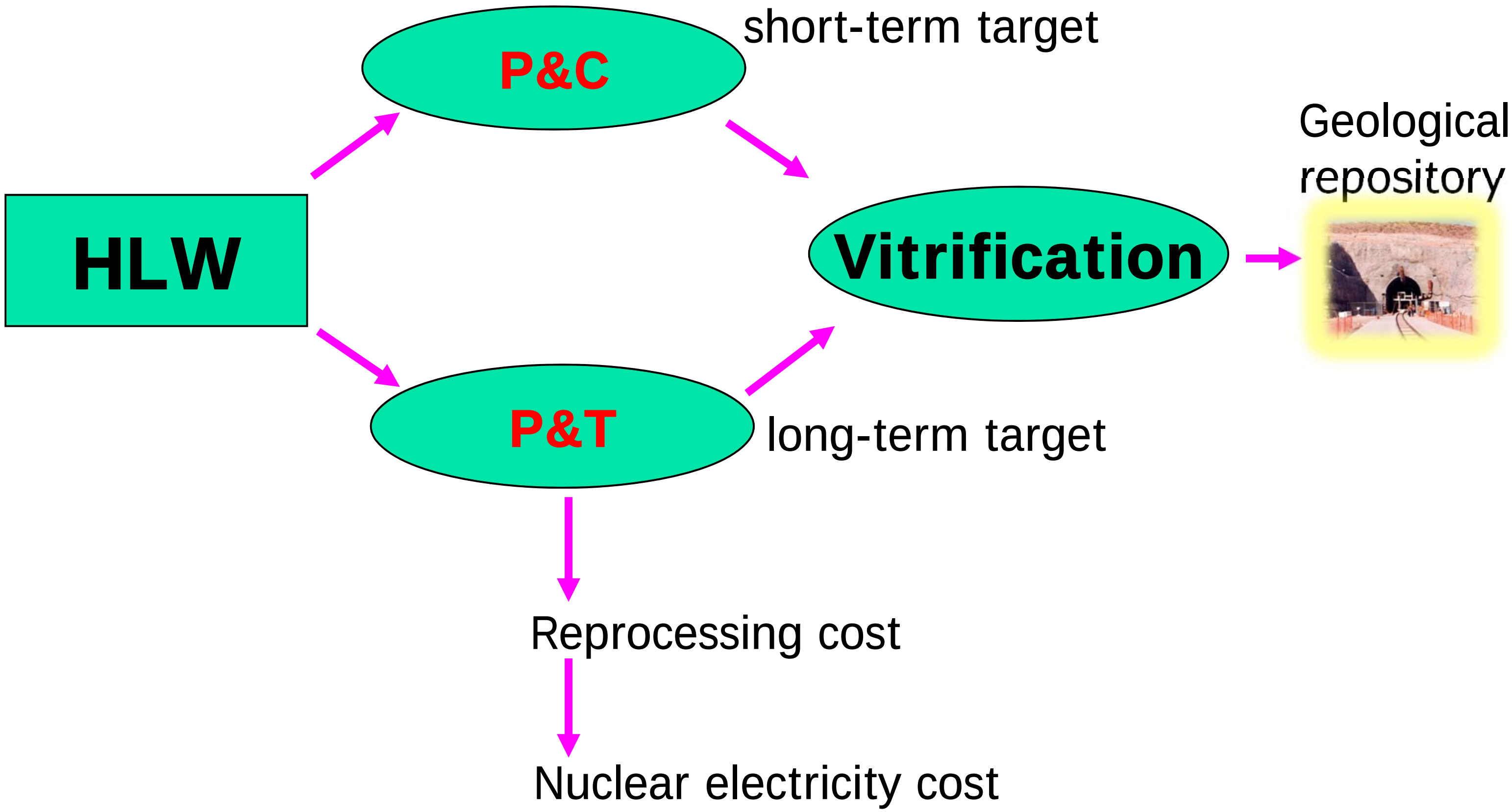
U, Pu



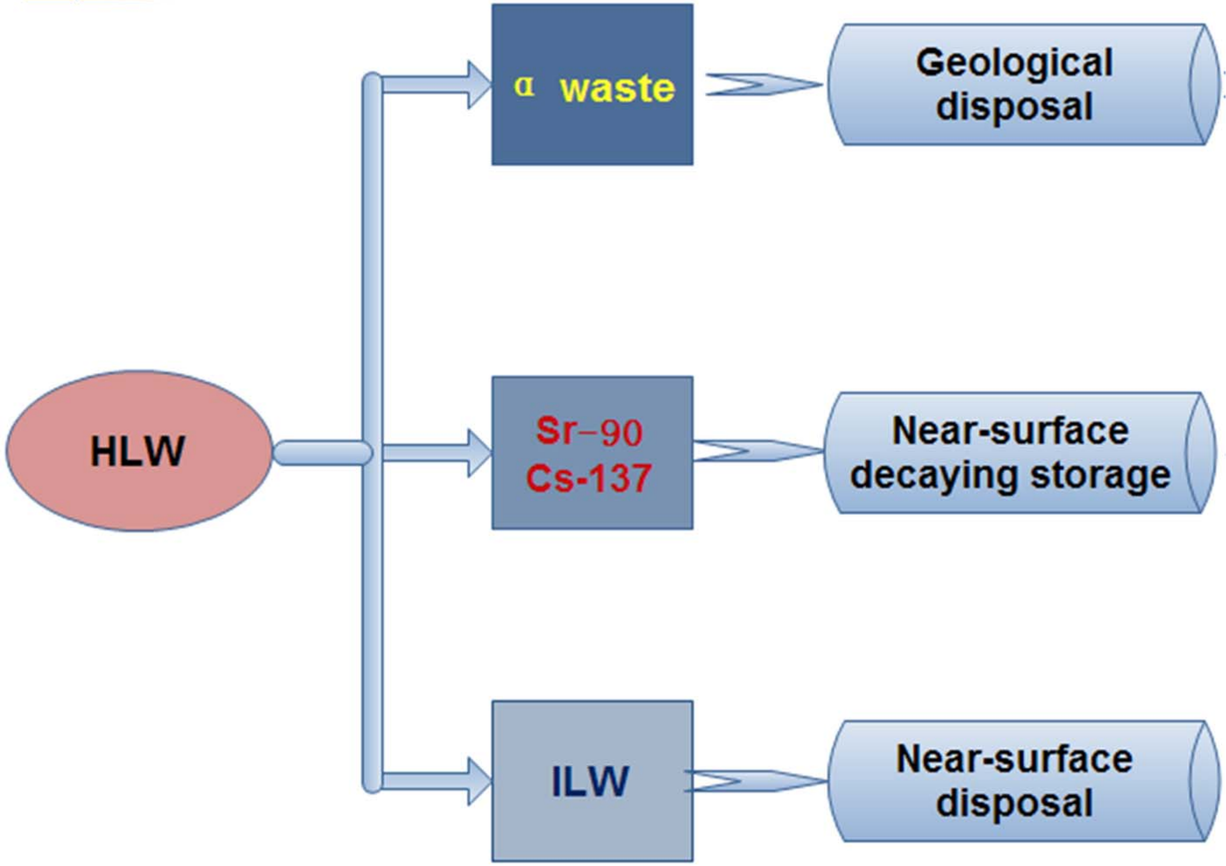
Long-term risk ?

More repository ?

HLW management strategy



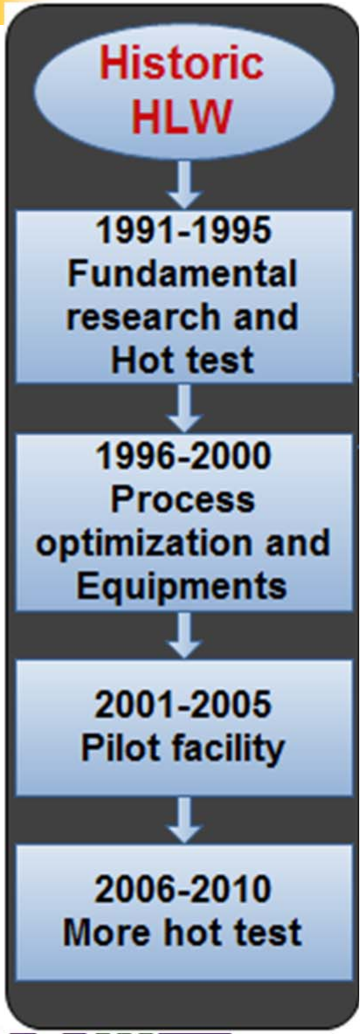
HLW partitioning objective

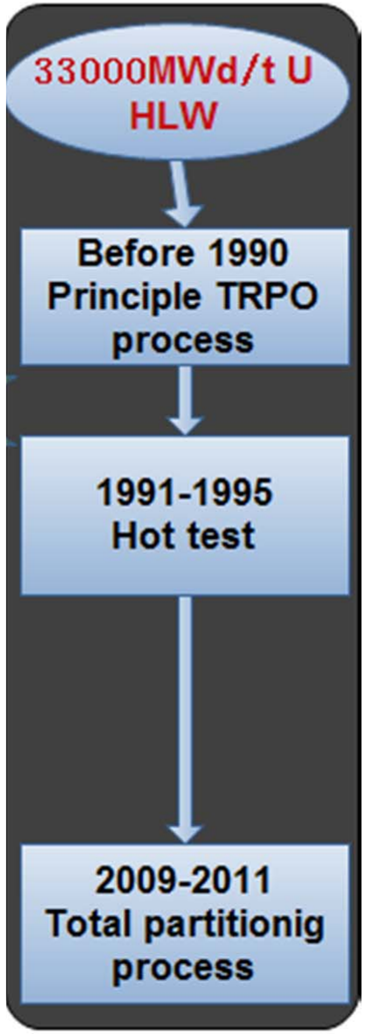


Partitioning objective in China

- α decontamination factor
  - >10^5 for commercial HLW
  - >100 for historic HLW
- Sr-90/Cs-137 decontamination factor
  - >1000 for commercial HLW
  - >50 for historic HLW

Overview of partitioning





Partitioning process by Tsinghua

HLW

An removal by
TRPO extraction

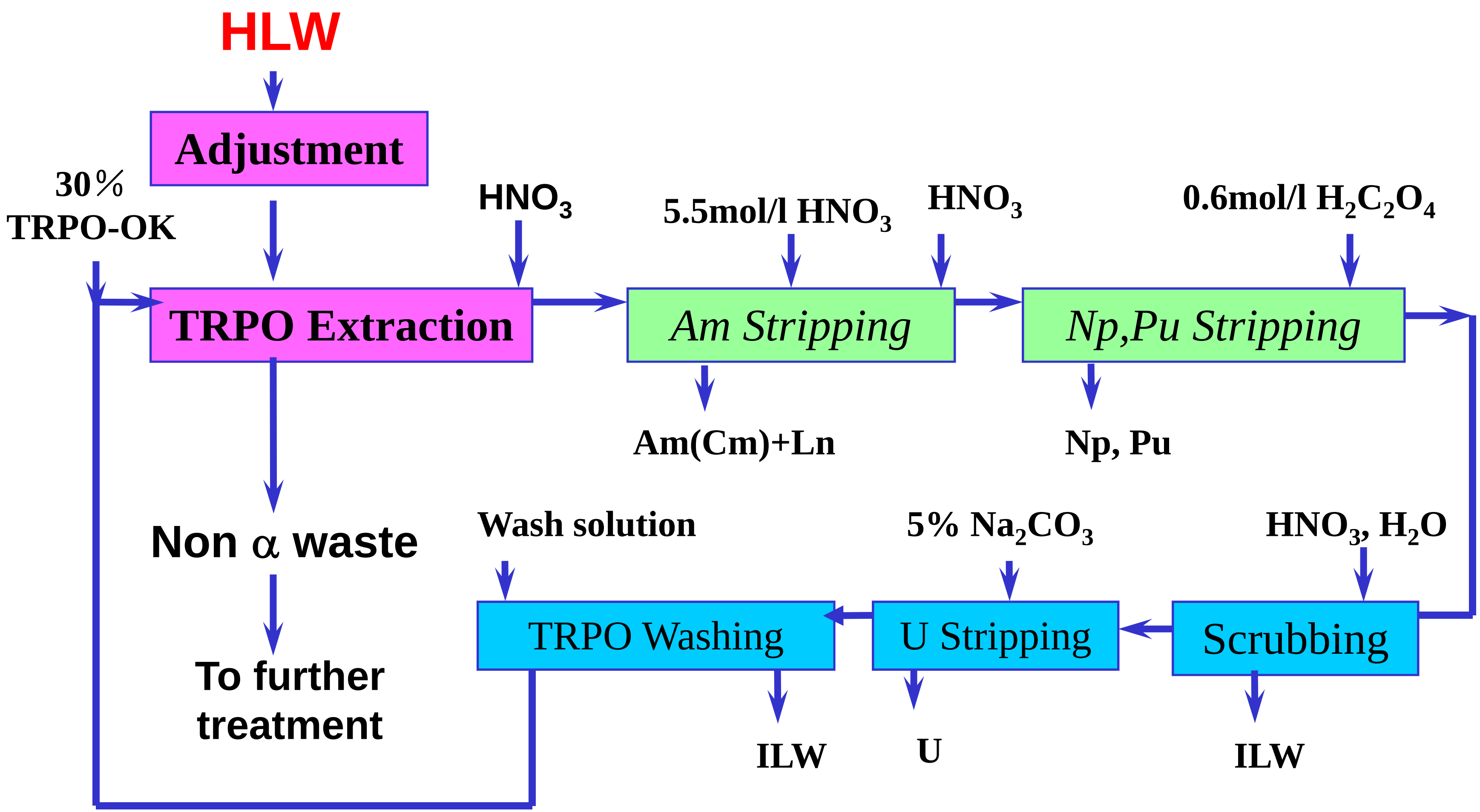
^{90}Sr removal by
crown ether extraction

^{137}Cs removal by
potassium titanium
hexacyanoferrate (II)

Non-α ILW

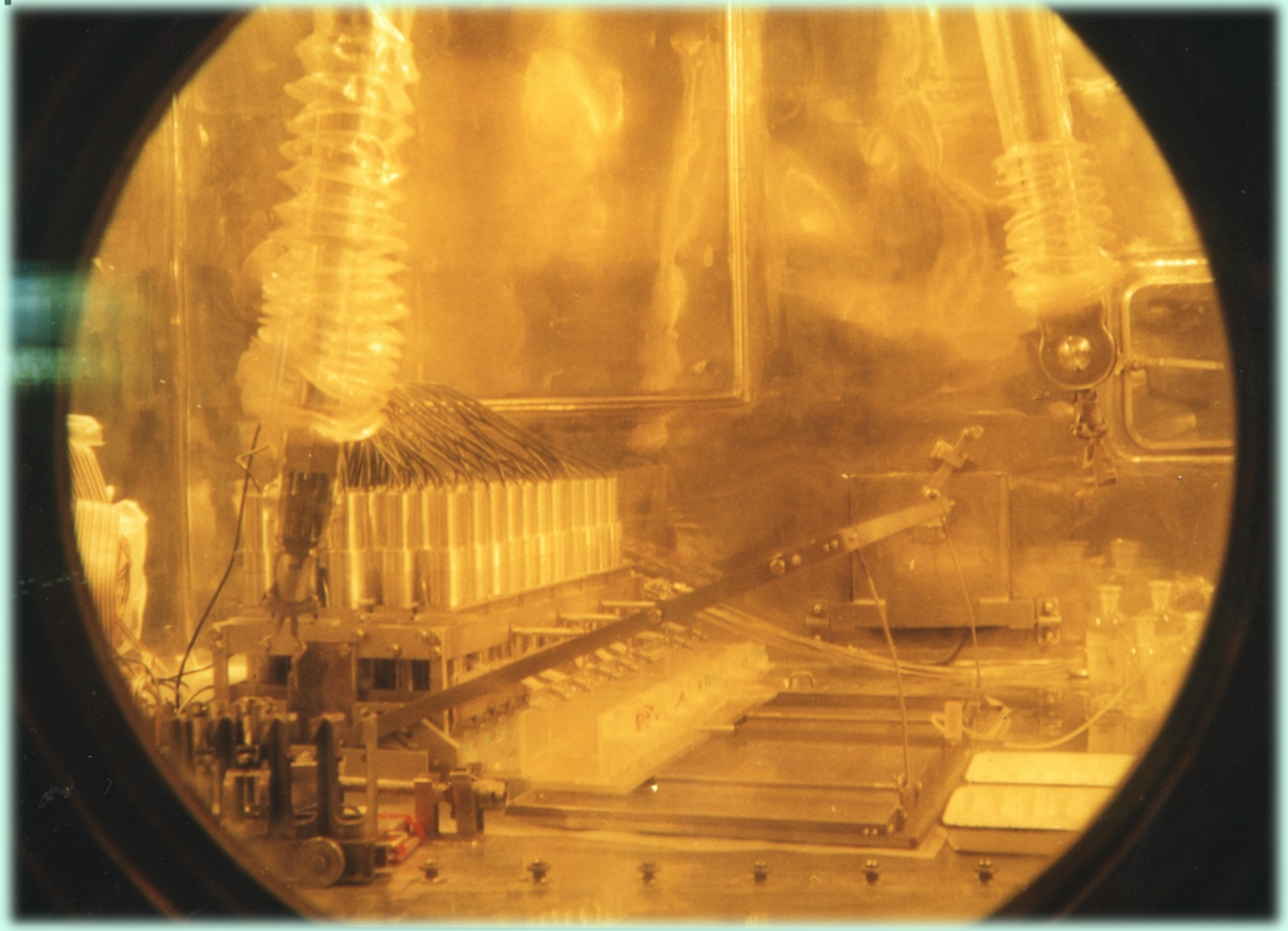
two extraction cycles
+ ion exchange

The flow-sheet of the TRPO process



TRPO: trialkylphosphine oxide

Hot test at Tsinghua University (1996)



50-stage miniature centrifugal contactors

Chinese HLW

Partitioning results for historic HLW

Nuclide	Total α	^{241}Am	^{239}Pu	^{237}Np	U	^{90}Sr	^{137}Cs
D. F.	588	666	695	15. 2	10^4	>2500	>200

The pilot test facility (2005)

>80 hours continuous operation

Exchange column

Centrifugal contactors

Pulsed column

Results of pilot test

Nuclide	D.F.
U	＞3000
Nd（Am）	＞500
Zr（ Pu）	＞1000
Sr	～160
Cs	～100

Problem in Cs removal

- **It is difficult to control the operation of ion exchange under high radioactive circumstance compared with solvent extraction.**
- **It is difficult to treat the spent ion exchanger. For example, cyanogen release.**

Modified partitioning process

HLW

An removal by solvent extraction

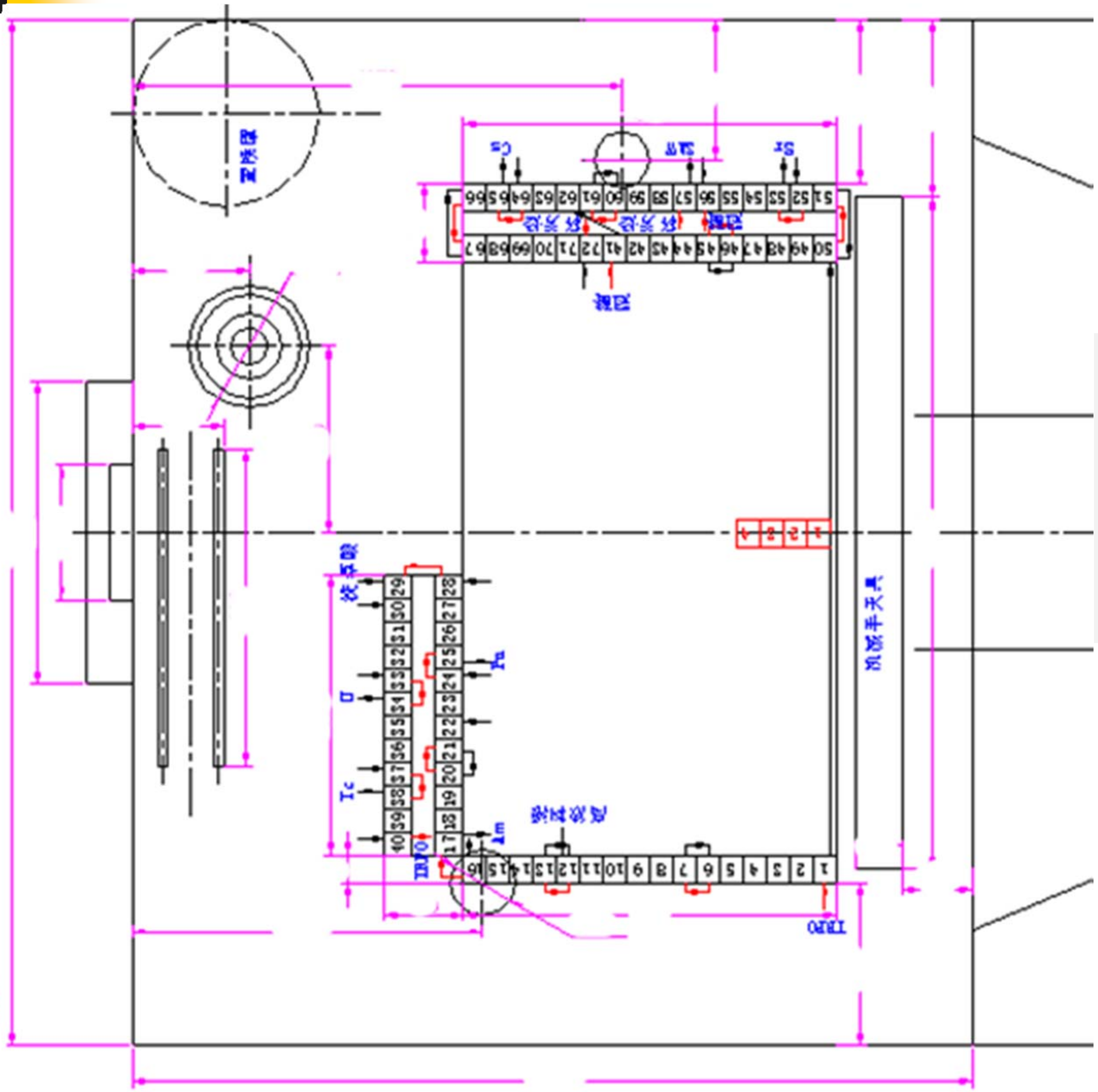
^{90}Sr removal by crown ether extraction

^{137}Cs removal by calixarene extraction

Three extraction cycles

Non-α ILW

Hot test for modified process (2009)

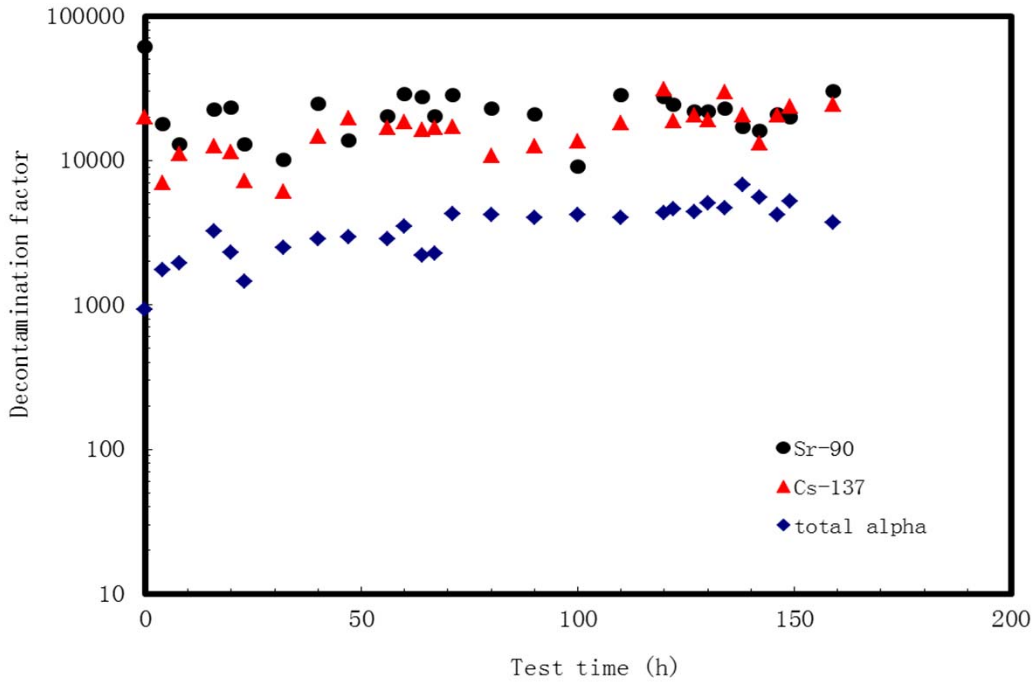


Employing 72-stage miniature centrifugal contactors developed by INET

Facility in hot cell

Hot test for modified process

- ~200 hours continuous operation, partitioning ~300Ci HLW
- Average decontamination factors (DF) are >3000 for An, and >10000 for Sr-90 and Cs-137.



Enough to change historic HLW into non-α ILW

Future of partitioning

- **Reliability**
- **Safety**
- **Cost-effectiveness**

Demonstration pilot facility

Thank you !