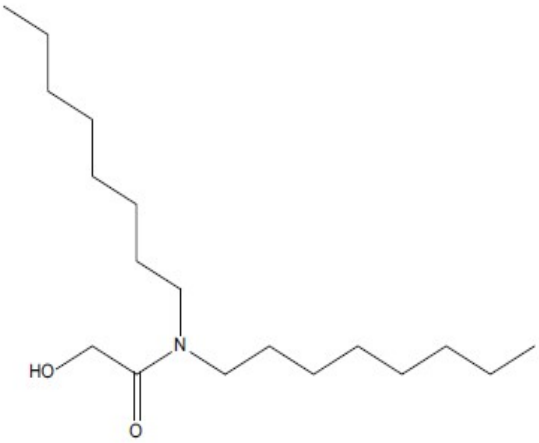
Supporting Information

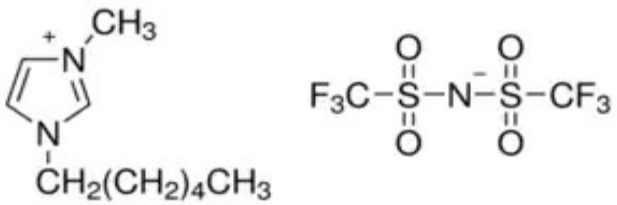
Figure S.I. 1. Chemical structures of the components used for preparing the supported liquid membrane.

(a)

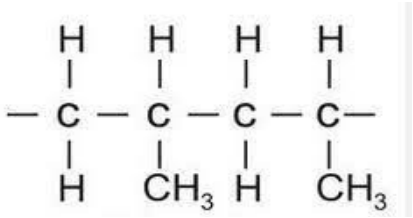


N,N'-dioctyl-α-hydroxyacetamide (DOHA)

(b)



1-hexyl-3-methylimidazolium bis(trifluoromethyl-sulfonyl)imide
$[C_6mim][NTf_2]$



Polypropylene (PP)

Table S.I. 1 Isotopic composition of uranium solutions.

Standard / Spike	Nuclide	Atom % abundance
SRM 950b natural Uranium	^{234}U	0.005
	^{235}U	0.720
	^{238}U	99.27
^{233}U – spike solution	^{233}U	99.703
	^{234}U	0.237
	^{235}U	0.014
	^{238}U	0.047

Table S.I. 2 Abundance of plutonium isotopes of NIST–SRM–947

Isotope	Atom % abundance	
	Certified [31] (as on 01st January, 1982)	Decay corrected (as on 01st June, 2022)
$^{238}Pu/^{239}Pu$	0.00361 ± 0.00008@	0.00264 ± 0.00006*
$^{240}Pu/^{239}Pu$	0.2414 ± 0.0003@	0.24068 ± 0.0003*
$^{241}Pu/^{239}Pu$	0.03659 ± 0.00008@	0.0054 ± 0.0001#
$^{242}Pu/^{239}Pu$	0.01559 ± 0.00005@	0.01561 ± 0.00005*

@ Based on the propagation of the uncertainties quoted for the respective abundances

*** Based on the similarities in the magnitude of the certified values**

 # Since the magnitude has been drastically changed a RSD of ~ 2% has been chosen similar to that $^{238}Pu/^{239}Pu$ in the certified value

Table S.I. 3 Specifications of TIMS instrumentation used in the present study.

Parameter	**Thermal Ionization Mass Spectrometer**
Model	Thermo Fisher make TRITON Plus model single focusing thermal ionization mass spectrometer
Acceleration voltage	10 kV
Ion source	Thermal ionization
Filament geometry & dimensions	Flat, high-purity rhenium filaments arranged as double filament assembly
Filament dimensions	10mm X 1mm X 0.04 mm
Filament resistance	8 Ω /10 mm filament length
Detectors	Nine variable Faraday cup transducers, designated as L4, L3, L2, L1,Ax (reference cup), H1, H2, H3, H4 each coupled to a 10^{11} ohms resistor SEM ion counter
Mass resolution (ΔM/M) at 10% valley	450 at m/z 238 a.m.u.
Abundance sensitivity	20 ppb (at m/z = 237)

Table S.I. 4 The compositions of various samples encountered in a nuclear fuel cycle.

Sample	**U:Pu weight ratio**
(U,Pu)C fuel	**0.33**
(U,Pu)O_2 fuel	**25**
Dissolver solution of PHWR fuel	**200**
Dissolver solution of RR fuel*	**1000**