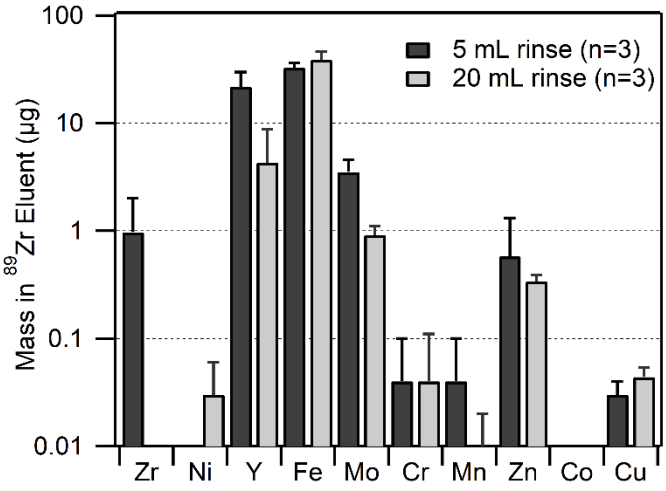
Supplementary Material

HCl Concentration (M)	K_d: Y + TBP resin (mL/g)	K_d: Zr + TBP resin (mL/g)	K_d: Y + UTEVA resin (mL/g)	K_d: Zr + UTEVA resin (mL/g)
0.27 ± 0.16	0.05 ± 0.95	0.43 ± 0.45	-0.30 ± 0.88	1.18 ± 0.45
1.23 ± 0.16	-0.04 ± 1.03	0.13 ± 0.50	-0.31 ± 0.92	0.28 ± 0.44
3.15 ± 0.16	-0.60 ± 0.98	-0.24 ± 0.48	-0.30 ± 0.80	-0.14 ± 0.37
5.07 ± 0.16	-0.21 ± 0.78	0.39 ± 0.38	0.08 ± 0.90	1.69 ± 0.44
6.99 ± 0.16	-0.14 ± 0.92	181 ± 14	-0.11 ± 0.87	213 ± 14
8.92 ± 0.16	-0.60 ± 0.98	2920 ± 1390	-0.26 ± 0.94	4840 ± 2220
10.81 ± 0.16	-0.20 ± 0.85	4760 ± 1970	-0.03 ± 0.91	2410 ± ^{89}0

Supplementary Table 1. Tabulated equilibrium coefficients (K_d) for Y and Zr on TBP and UTEVA resins.



Supplementary Figure 1. Total trace metal impurities in ^{89}Zr-chloride products, as measured by MP-AES as a function of column rinsing volume prior to elution. A significant reduction in yttrium impurity is observed when rinsing with 20 mL of 9.6M HCl compared with a 5 mL rinse volume. Values represent mean ± standard deviation for three ^{89}Zr-chloride productions from full ^{nat}Y target masses.

Production	Zr (µg)	Ni (µg)	Y (µg)	Fe (µg)	Mo (µg)	Cr (µg)	Mn (µg)	Zn (µg)	Co (µg)	Cu (µg)
1	0.07 ± 0.33	0.01 ± 0.03	9.5 ± 1.0	33.6 ± 1.7	0.77 ± 0.04	0.00 ± 0.01	0.001 ± 0.003	0.35 ± 0.02	0.00 ± 0.01	0.051 ± 0.006
2	0.00 ± 0.33	0.02 ± 0.03	1.5 ± 0.3	47.5 ± 2.4	1.13 ± 0.06	0.00 ± 0.01	0.007 ± 0.03	0.30 ± 0.02	0.00 ± 0.01	0.037 ± 0.006
3	0.00 ± 0.33	0.06 ± 0.03	1.8 ± 0.2	35.2 ± 1.8	0.83 ± 0.05	0.12 ± 0.02	0.011 ± 0.003	0.39 ± 0.02	0.00 ± 0.01	0.043 ± 0.006
Avg.	**0.02 ± 0.37**	**0.03 ± 0.03**	**4.3 ± 4.5**	**38.8 ± 7.7**	**0.91 ± 0.20**	**0.04 ± 0.07**	**0.006 ± 0.005**	**0.34 ± 0.05**	**0.00 ± 0.01**	**0.044 ± 0.008**

Supplementary Table 2. Trace metal impurities for three TBP resin-isolations of ^{89}Zr-chloride. Full ^{nat}Y target masses were employed for these production runs, and 10% of the isolated product was used for trace metal analysis. Values specified in this table are calculated to be the total metal mass burden for the separated product.

Element	TBP resin separated ^{89}Zr-chloride	Hydroxamate resin separated, QMA converted ^{89}Zr-chloride	Hydroxamate resin separated ^{89}Zr-Oxalate
Zr (µg)	0.02 ± 0.37	0.94 ± 0.31	BDL
Ni (µg)	0.03 ± 0.03	BDL	BDL
Y (µg)	4.3 ± 4.5	1.78 ± 1.82	1.82 ± 0.31
Fe (µg)	38.8 ± 7.7	BDL	0.35 ± 0.61
Mo (µg)	0.91 ± 0.20	0.42 ± 0.24	N/A
Cr (µg)	0.04 ± 0.07	BDL	N/A
Mn (µg)	0.006 ± 0.005	BDL	BDL
Zn (µg)	0.34 ± 0.05	0.25 ± 0.05	0.40 ± 0.70
Co (µg)	0.00 ± 0.01	0.29 ± 0.07	BDL
Cu (µg)	0.044 ± 0.008	BDL	N/A

Supplementary Table 3. Total trace metal impurities in ^{89}Zr products, as measured by MP-AES. Metal impurities below limits of detection are labeled "BDL," and metals which were not measured are marked "N/A." Values represent mean ± standard, corrected for the fraction of the total production activity tested. TBP resin-based isolations of ^{89}Zr-chloride (n = 3) and hydroxamate resin-based isolations of ^{89}Zr-oxalate (n = 3) were performed from full ^{nat}Y target masses. Samples converted from ^{89}Zr-chloride to ^{89}Zr-oxalate (n = 3) were obtained from an aliquot of a full production run.