Underfeeding at Urenco‘s Gronau uranium enrichment plant results in reasons for tails exports to Russia becoming obsolete

by Peter Diehl

Abstract

Urenco Deutschland GmbH has disclosed that it is underfeeding its Gronau (Germany) uranium enrichment plant since 2004: while from 1991 to 2002, the natural uranium feed consumption of the plant virtually followed the continuous capacity increase of the plant, the feed consumption no longer followed the capacity increase from 2004 - it even began to decline. Urenco explains this with changes in product and/or tails assays, without giving any details.
Given the rapid increase of the price of fresh uranium, underfeeding may make sense, since it allows to reduce natural uranium consumption at the expense of increased separation work. A closer analysis shows that the observed decline in feed consumption must be mainly caused from a reduced tails assay.
As most of Urenco‘s depleted uranium tails are exported to Russia for re-enrichment, a reduced assay of the tails exported has serious consequences on the viability of any re-enrichment of these tails. It turns out that the assay of the tails delivered to Russia comes close to the assay that Urenco most likely has contracted with Russia for re-enrichment on Urenco‘s behalf. Therefore, unless the contractual arrangements have been changed, almost nothing remains to be re-enriched in Russia on these tails on Urenco‘s behalf, and the amount of recovered natural uranium sent back to Urenco tends towards zero.
This means that the official justification for sending the tails to Russia (recovery of usable uranium from the tails) has become obsolete. Since the transfer of tails to Russia rather continues, this can be seen as a further hint on the true reason for these exports: to provide a cheap tails disposition route to Urenco.

Urenco‘s disclosure

In its 2005 environmental declaration [Urenco 2005] and the related 2006 update [Urenco 2006], Urenco Deutschland GmbH shows diagrams disclosing the capacity and natural uranium feed throughput of its Gronau uranium enrichment plant for the years 1990 to 2005.
Based on Urenco‘s diagrams, Fig. 1 shows the increase of separation work capacity and feed consumption, with the 1991 data normalized to 100. For this diagram, estimated annual average capacity values have been used rather than the year end capacities given by Urenco, to better reflect the plant‘s real production capability. It can be seen that the feed consumption closely followed the capacity increase for the years 1991 to 2002. In 2003, however, the feed consumption no longer followed the capacity increase in full; and in 2004 and 2005, the feed consumption even declined, in spite of further capacity increases. Urenco explains this with changes in product assays and/or tails assays, without giving any details.

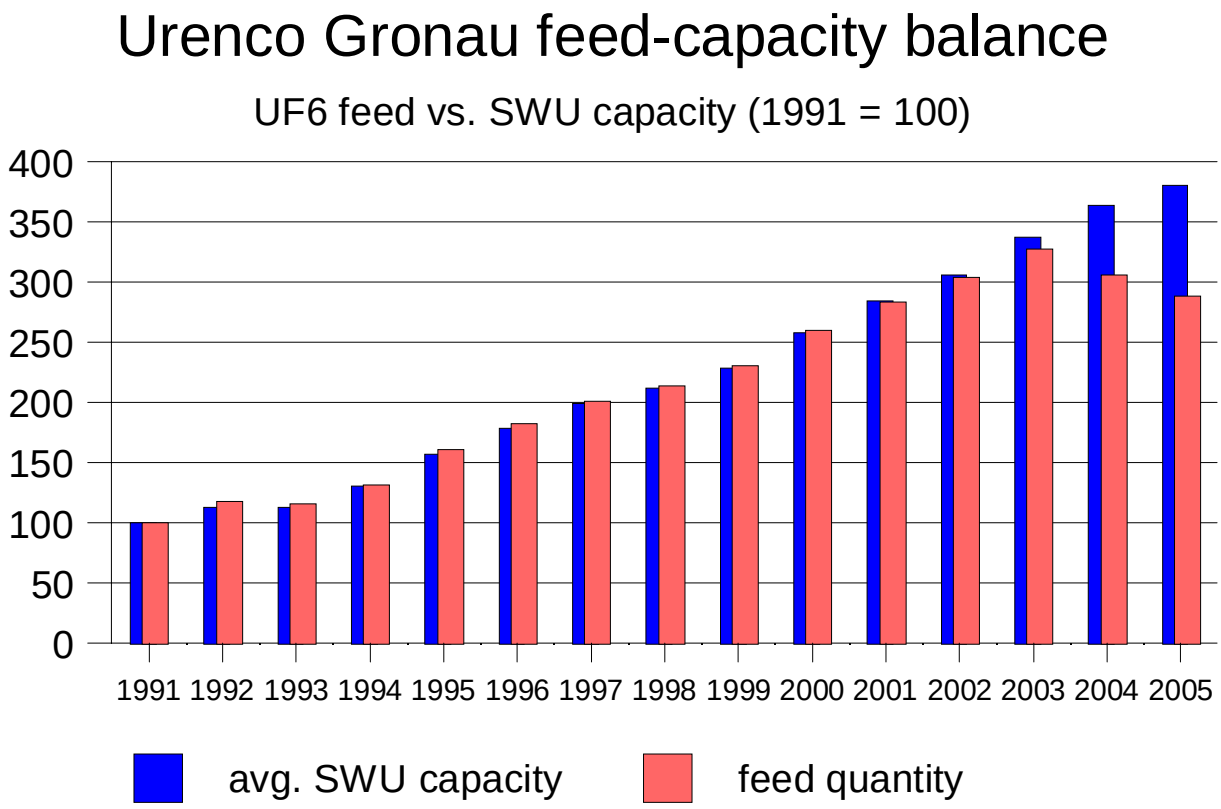

Fig. 1: Urenco Gronau feed-capacity balance (after [Urenco 2006])

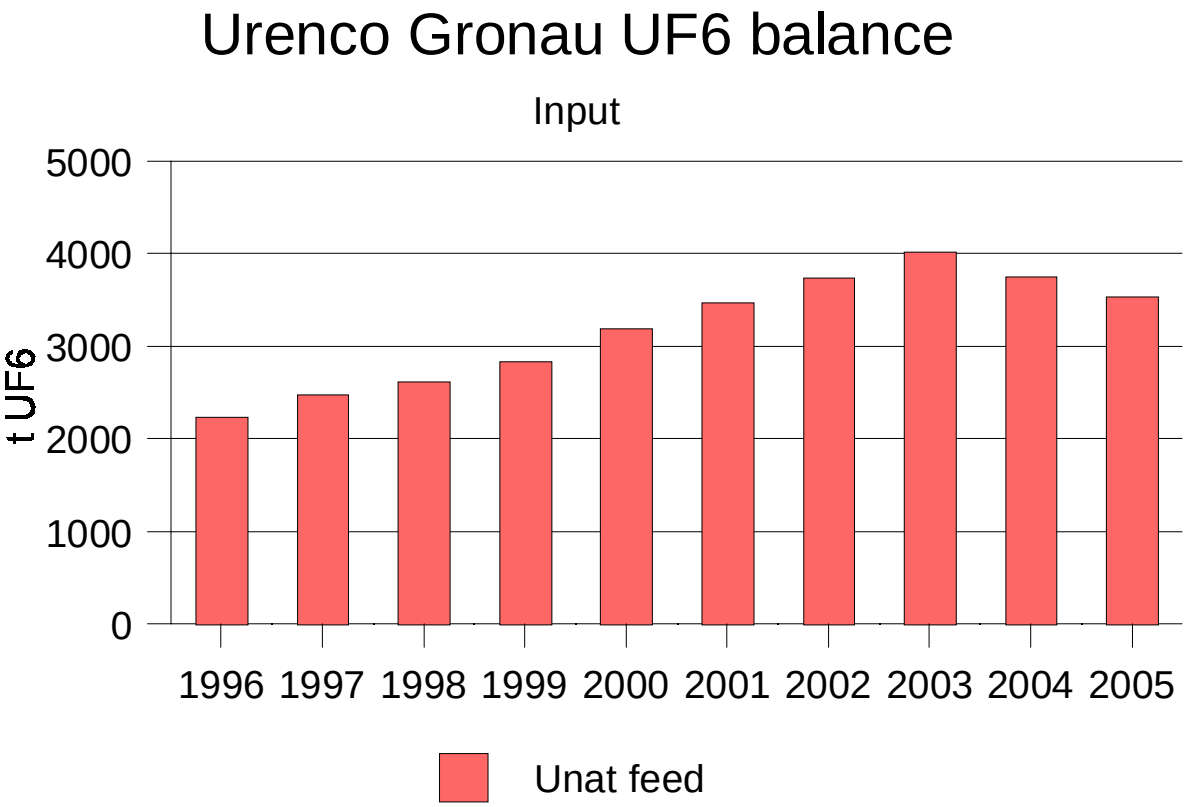

Fig. 2: Urenco Gronau UF6 feed input (after [Urenco 2006])

Resulting material balance

Fig. 2 shows the natural uranium feed input to the Gronau enrichment plant, as given in [Urenco 2006]. Fig. 3 shows the enriched uranium product output and the amount of depleted uranium tails generated from this feed input. This diagram is based on an assumed product assay of 3.6 wt-% (weight-percent U-235). The tails assay is assumed at 0.3 wt-% until 2003. To account for the feed reduction, the tails assay is determined to drop to 0.259 wt-% in 2004 and 0.234 wt-% in 2005. It can be seen that the product quantity remains rather constant in 2004 and 2005, although there was a further capacity increase. So, the same amount of product was obtained from less feed uranium - at the expense of higher separation work. The capacity increase of 2004 and 2005 thus was used to save feed uranium rather than increase enriched product output. This so-called underfeeding makes sense in view of the recent rise of the world market price for natural uranium.

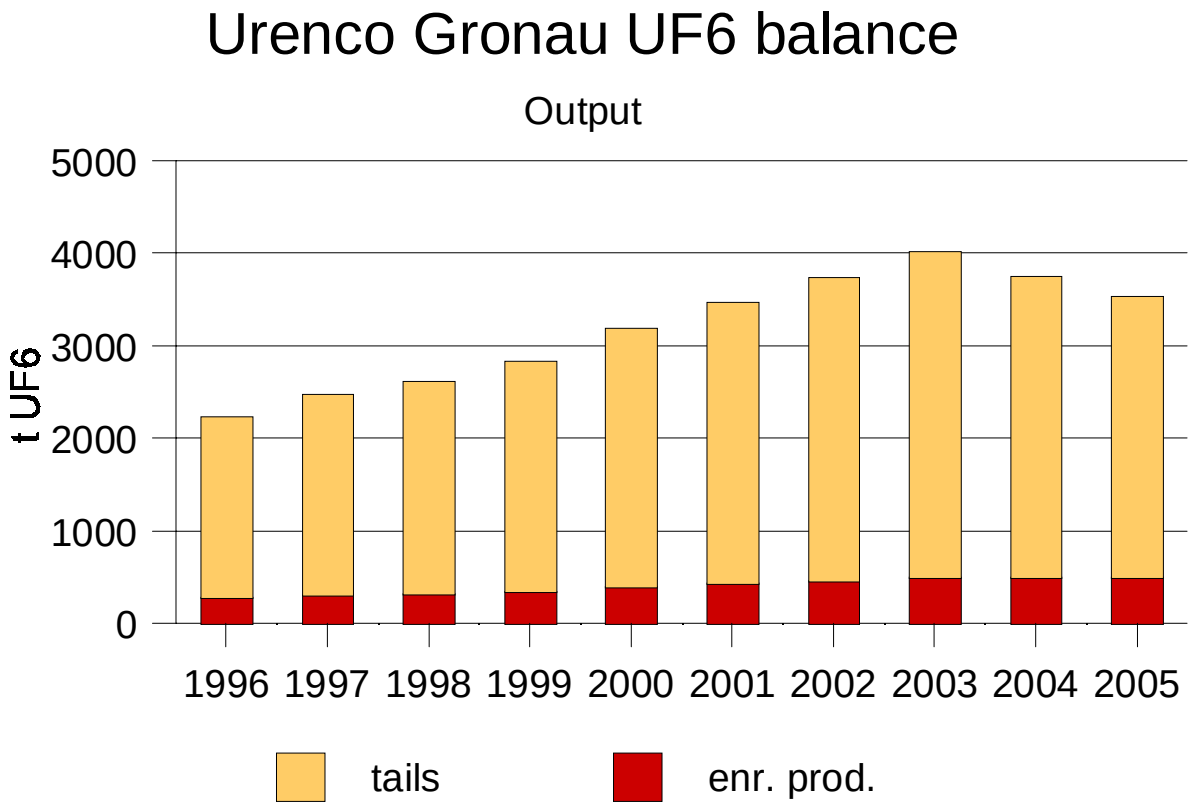

Fig. 3: Urenco Gronau output balance, assuming 3.6% product assay

Impacts on re-enrichment of tails uranium

Since 1996, Urenco has been exporting major portions of its depleted uranium tails to Russia - for re-enrichment, as is officially being stated. In Russia, surplus enrichment capacities are used to re-enrich (or upgrade) Urenco‘s tails to natural-equivalent assays. This natural-equivalent uranium is sent back to Urenco, while the secondary depleted uranium tails generated during this process remain in Russia. As shown in [Diehl 2004], there are several indicators suggesting that the main purpose for this Urenco-Russia deal is the fact that the secondary tails remain in Russia, relieving Urenco from a

serious waste management problem.

Fig. 4 shows the combined output of the Gronau enrichment plant and the tails enrichment performed in Russia, assuming that all depleted uranium tails generated in Gronau are re-enriched in Russia to natural-equivalent uranium. Here again, it is assumed that the Gronau product assay is 3.6 wt-%. The Gronau tails assay is assumed at 0.3 wt-% until 2003; the tails assay is determined to drop to 0.259 wt-% in 2004 and 0.234 wt-% in 2005, to account for the feed reduction. The secondary tails assay of the tails left in Russia is assumed at 0.224 wt-%, as suggested by a mass balance estimate presented in [Diehl 2004]. So, in the past two years, the Gronau tails assay has decreased close to the value presumably contracted by Urenco for re-enrichment in Russia. The assay difference left for Russian re-enrichment thus is tending towards zero, and, in turn, the amount of re-enriched natural-equivalent uranium sent back to Urenco (unless Urenco has changed the contracts with Russia to lower secondary tails assays).

Since Urenco gives no details on how much of the feed reduction is attributable to lower tails assays or higher product assays, another case is presented in Fig. 5: here, the Gronau feed reduction is not completely attributed to a lower tails assay, but partly to a higher product assay of 4.5 wt-% (in 2004 and 2005). In this case, the Gronau tails assay is determined to drop to 0.279 wt-% in 2004 and 0.253 wt-% in 2005. Though the assay difference left for re-enrichment remains somewhat higher than in the previous example, the impact of the higher product assay is only minor. So, even in case of a higher product assay, the feed reduction results in massively lowered tails assays.

Another hint for a decreased production of re-enriched uranium in Russia can be found in the data supplied by the Euratom Supply Agency: Fig. 6 shows the deliveries of re-enriched uranium from Russia to EU-15 utilities, as given in [ESA 2006]. These figures comprise re-enriched uranium produced from tails of all three Urenco plants and from Areva‘s Tricastin plant, but they don‘t necessarily comprise all uranium produced from these tails. Therefore, these figures are not directly comparable to those presented here for Urenco Gronau, but a strong decrease of re-enriched uranium deliveries in 2004 and 2005 is also found in Euratom‘s figures.

Conclusions

It has been shown that the reduction of natural uranium feed consumption reported by Urenco can mostly be attributed to a decreased tails assay. Consequently, the re-enrichment work to be performed in Russia on Urenco‘s tails decreases and is tending towards zero, unless the contractual arrangements for the secondary tails assays in Russia have been changed. In turn, the amount of re-enriched uranium sent back to Urenco also tends towards zero. So, Urenco no longer can claim that it sends its depleted uranium tails to Russia for recovery of residual uranium (Russia, however, might re-enrich those tails further on its own account, but this is a different story, see [Diehl 2004]). Since the transfer of tails to Russia rather continues, this can be seen as a further hint on the true character of these exports: to provide Urenco with a cheap tails disposition route.

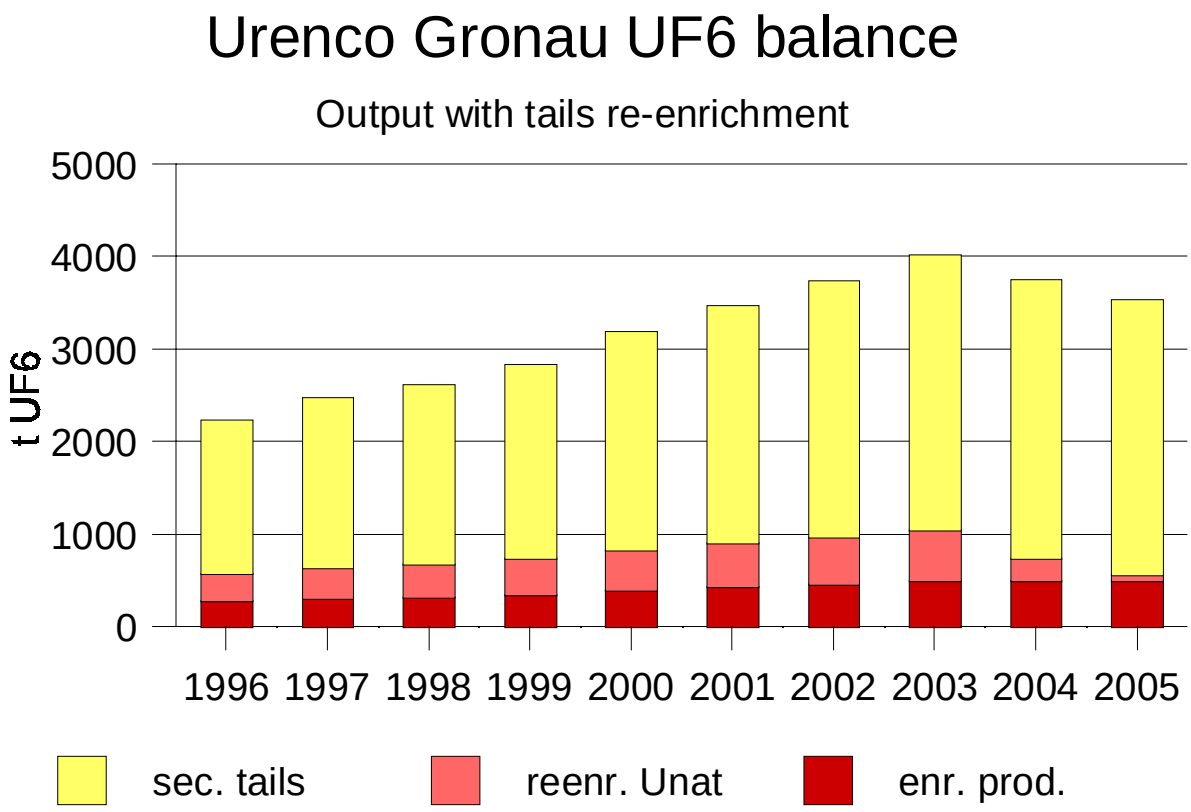

Fig. 4: Urenco Gronau output balance, including re-enrichment, assuming 3.6% product assay

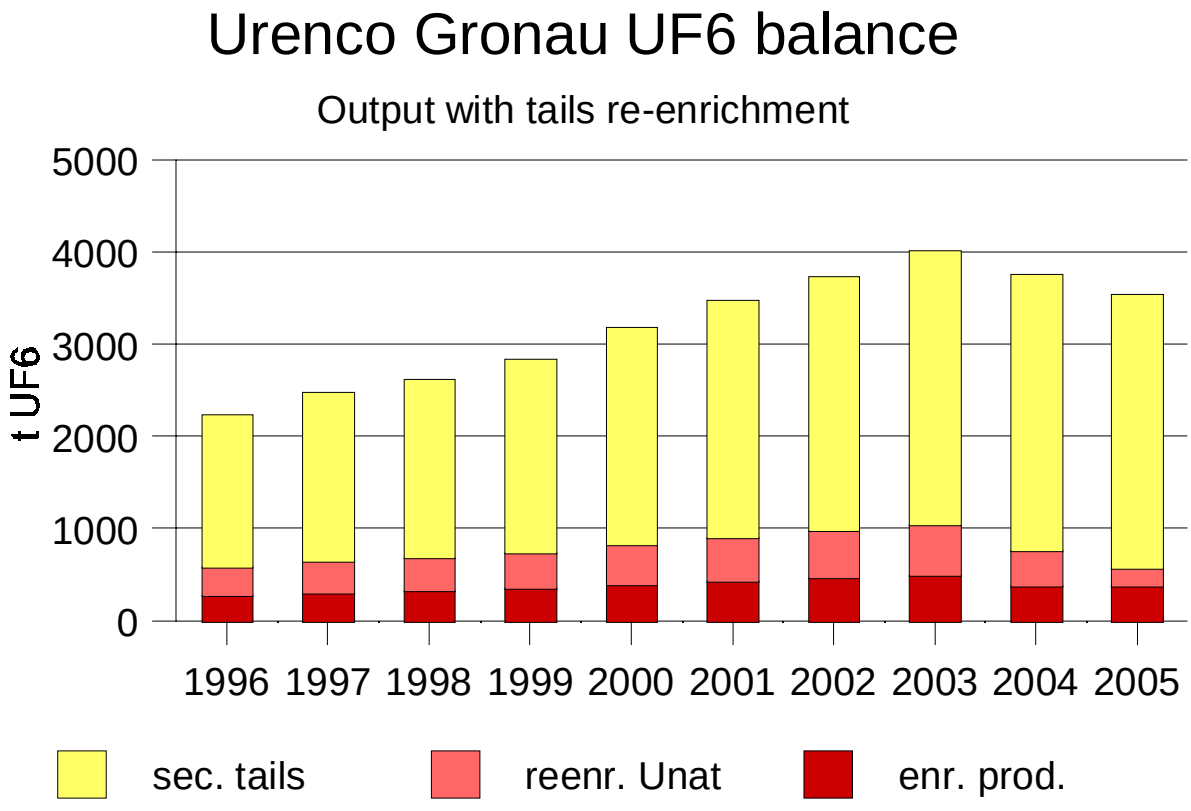

Fig. 5: Urenco Gronau output balance, incl. re-enr., prod. assay 3.6% to 2003, 4.5% from 2004

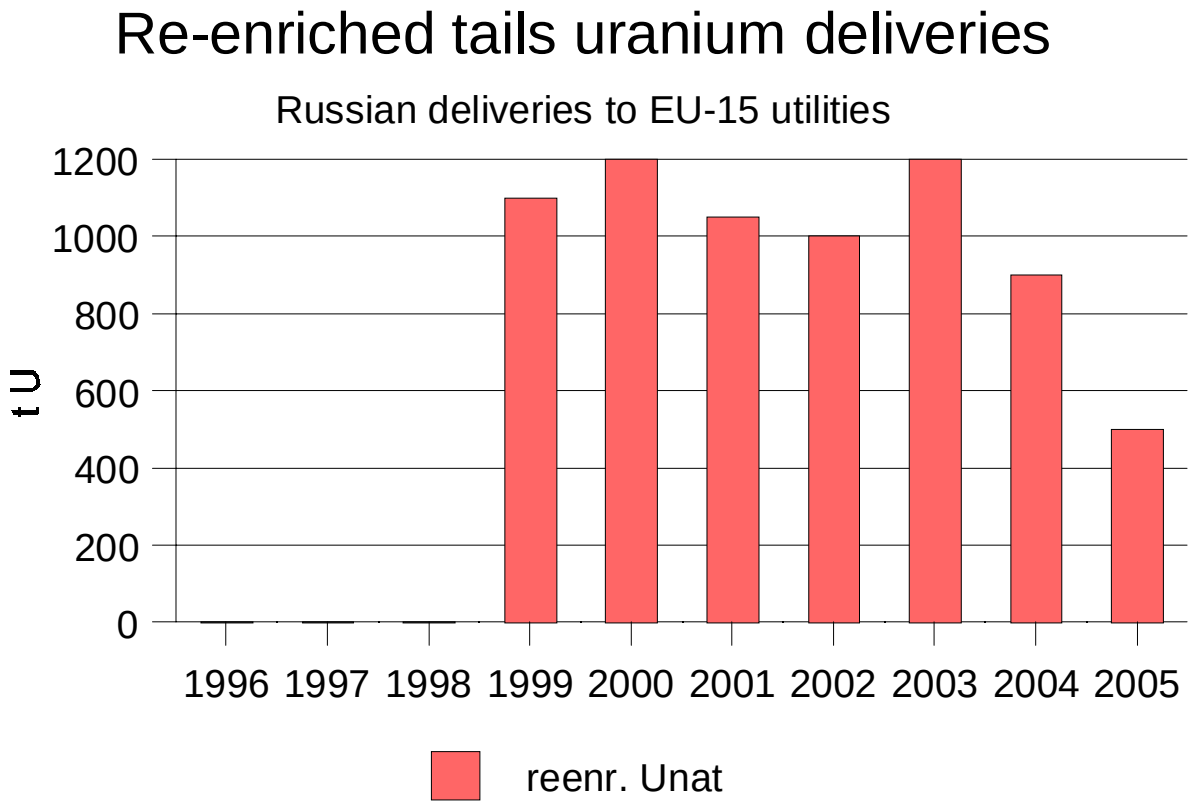

Fig. 6: Re-enriched tails uranium deliveries to EU-15 utilities (after [ESA 2006], no explicit data given for 1997 and 1998)

References

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