The Reactor handbook discusses the distribution ratio per contact of TBP. Graphs are provided indicating this quantity:

In our situation with TBP, this translates to:

Where “T” refers to the TBP phase and H refers to the HNO3 phase.

Solving for PPB:

(1)

**1 Contact TBP:**

is the stock solution to be decontaminated, it has an initial concentration. is the contamination that TBP brings to the mix with each contact. Subsequent will indicate concentrations in the TBP phase at each stage.

Mass initial equals mass final:

Notice I am assuming that the densities and volumes do not change upon mixing, this is not true, because upon mixing some heat is released, and the density of the mixture isn’t exactly an average of the two phases (see reactor handbook Volume II Fuel Reprocessing pg 128 & 129). This assumption gets worse with smaller samples (as we have here), but I’m going to roll with it.

Solving for the new respective concentrations (substituting (1)).

Notice the percent of mass in each phase is a function of volume (and not density):

**2 Contact TBP:**

Concentrations after 1 contact are given as (repeated from above)

The percent of constituent removed when TBP is removed from the system:

Where TVR stands for the percent of TBP volume removed.

Some contamination is added with the addition of TBP so that the total mass for the second contact is:

During this contact, the concentrations are given as:

Where:

The concentration of TBP in the combined solution is:

**3 Contact TBP:**

Some contamination is added with the addition of TBP so that the total mass for the third contact is:

Where: