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PAPER TITLE A Simple and Robust Precipitation Method for Treating Transuranic
Waste Solutions

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ABSTRACT (See instructions overleaf)

The purpose of this study was to devise a treatment method for transuranic (TRU) waste solutions that would remove the TRU elements and concentrate them into a small volume that is suitable for deep geologic disposal. A process that uses magnetite (Fe_3O_4) as a carrier for the TRU elements was developed. This compound is precipitated by adding sodium hydroxide to a solution containing Fe(III) and Fe(II) ions in a 2:1 molar ratio, respectively. It is a very efficient carrier for the TRU elements, and gives decontamination factors (DF, initial amount of TRU element in solution/amount of TRU element remaining in solution after the precipitation) of the order of 10^4 in one precipitation over a wide variety of conditions. The magnetite can be filtered, dried, and packaged for disposal or long-term storage. The remaining solution can be treated as low-level waste since it should contain <100 nCi TRU/gram. If one precipitation does not reduce the TRU concentration to this level, an additional precipitation can be performed. The magnetite can be formed by an *in situ* direct strike (the sodium hydroxide added last), by a reverse strike (the iron solution added last), or by adding pre-formed magnetite to the TRU waste solution.

Among the variables studied were the carrier concentration; the ferric to ferrous ratio; the final pH; the effect of stable anions and cations, including organic complexing agents the precipitate digestion time; initial TRU concentration; precipitation temperature; rate of precipitation; and method of precipitation. The effects of these variables on the decontamination factor will be presented.