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Eka Oche Ogbaji* (ogbajieka@yahoo.com), Department of Mathematics and Statistics, Federal University PMB 1020 Wukari-Nigeria, Wukari, 9600001, and **A. O. Ogunmola** (adeniyiogunmola@gmail.com), Department of Mathematics and Statistics, Federal University PMB 1020 Wukari-Nigeria, Wukari. *Mathematical Model Of Depletion Of Toxic Heavy Metals Of Drinking Water In Different Storage Vessels*. Preliminary report.

We used deterministic model to determine the depletion of water storage vessels dissolving in the stored water of pH value of 6.6×10^{-6} . Stability analysis was carried out and it showed that there is instability in the depletion of the vessels. The numerical analysis showed that the depletion is in the form of negative exponential curve. Metal Vessel depletes the most at all levels of concentration of the input of toxic metal values, followed by Earthen vessel, then Cement Reservoir and the least is Plastic vessel. Negative exponential curve well fits the generated data for each level of concentration of the input toxic metal values for each vessel. The estimated rates of depletion of vessel at each level for each vessel are also significant. The estimated rate of depletion of metal vessel is the highest, followed by the estimated rate of depletion of Earthen vessel. The least estimated rate of depletion among the four vessels is plastic. Key words: negative exponential, instability, water storage vessels and toxic metals (Received February 20, 2014)