ON THE DEPLETION OF $^{235}\text{U}$ AND $^{234}\text{U}$ IN COMMERCIALLY AVAILABLE URANIUM COMPOUNDS: A SURVEY USING LOW ENERGY $\gamma$-RAY SPECTROMETRY

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A survey of the situation regarding depletion of $^{235}\text{U}$ and $^{234}\text{U}$ in nine commercially available uranium compounds is reported. It was done by using a low energy $\gamma$-ray counting method, based on peak area ratio and dilute uranium solution. This survey shows that in Canada and USA there may be a large inventory of uranium compounds inadequately labelled regarding their isotopic composition; this situation is likely to be prevalent in many other countries.

INTRODUCTION

Uranium salts are a convenient source of $\gamma$-rays for the determination of the counting efficiency of low-energy $\gamma$-ray detectors. For this application and other nuclear investigations a knowledge of their isotopic composition is required. Normally, the natural isotopic composition would be assumed, unless there is an indication to the

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contrary; unfortunately, it is not always the case. Barnes et al.\(^1\) seem to have been the first ones to have observed the variable isotopic composition of uranium compounds by mass spectrometric measurements on NBS standards. Ganapathy\(^2\), using neutron activation technique, found that many reagent grade uranium salts were depleted in $^{235}\text{U}$. This information found its way in the 7th edn of Table of Isotopes edited by Lederer and Shirley\(^3\). In fact, it can be assumed that nearly all uranium compounds marketed in North America since the late forties are $^{235}\text{U}$ and $^{234}\text{U}$ depleted as they were likely prepared from the uranium tailings of a $^{235}\text{U}$ enrichment plant; Stansbury\(^4\) reported that 2700 tons of enriched uranium is processed annually by the nuclear industry while another 9000 tons of depleted uranium is processed and used for other purposes. It has been our experience that for salts purchased in 1983 from two different suppliers mention was made regarding their depletion, but this information was lacking for those acquired before that year as also noted by Ganapathy\(^2\) for salts used in his investigation. From these observation, it is estimated that uranium compounds supplied for many years have not been adequately labelled regarding their variable isotopic composition and their inadvertent use in nuclear investigations could lead to erroneous results. As we needed uranium salts of low and natural abundance in $^{235}\text{U}$ in some of our work\(^5,6\), we were led to investigate the $^{235}\text{U}$ and $^{234}\text{U}$ depletion in uranium compounds that we had in the laboratory and those available from our regular suppliers of chemical products. It is the purpose of this paper to report the results of this survey and also to describe the simple and convenient γ-ray counting technique used to make these measurements. The principle of the method, based on comparing area ratio of gamma peaks, is similar as