TRITIUM CONTENT IN 1962 – 1963 FALLOUT AT MOSCOW

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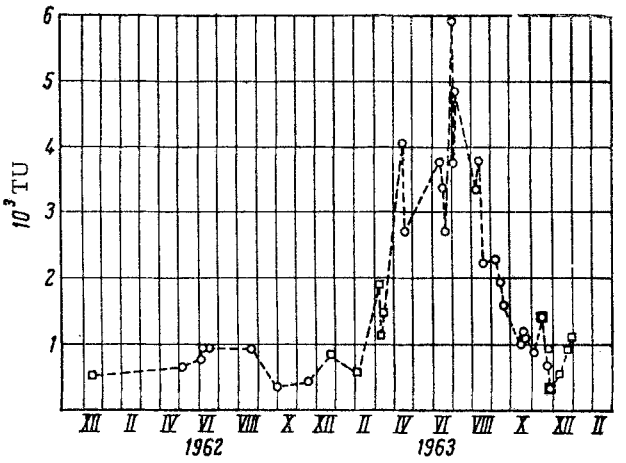
Tritium of natural origin is oxidized in the atmosphere and appears on the surface of the ground in the form of the radioactive constituent of rain water with a concentration on the order of several tritium units (one TU = 1 atom of tritium per 10^{18} hydrogen atoms [1]). Because of thermonuclear tests, the tritium level in atmospheric fallout (and as a consequence in the surface waters and other sources) rose appreciably [2]. By the present time, the tritium content in atmospheric fallout has experienced an increase of two orders of magnitude and on occasion reaches several thousand tritium units.

Tritium Content in Atmospheric Fallout

Sampling date	Fallout form	Tritium content, TU
December 15, 1961	Snow	523
May 2, 1962	Rain	655
June 3, 1962	»	705
June 5, 1962	»	934
June 16, 1962	»	927
August 20, 1962	»	926
Sept. 30-Oct. 1, 1962	»	352
November 17, 1962	»	423
Dec. 31-Jan. 7, 1963	Snow	830
February 3, 1963	»	567
March 6-7, 1963	»	1895
March 9, 1963	»	1140
March 13-14, 1963	»	1480
April 15, 1963	Rain	4050
April 18, 1963	»	2700
June 13, 1963	»	3780
June 17, 1963	»	3375
June 18, 1963	»	2710
July 1, 1963	»	5890
July 3, 1963	»	3750
July 4, 1963	»	4840
August 10, 1963	»	3360
August 12, 1963	»	3780
August 20, 1963	»	2220
September 8, 1963	»	2280
September 15, 1963	»	1940
September 20, 1963	Hail and rain	1570
October 16, 1963	Rain	997
October 20, 1963	»	1180
October 23, 1963	»	1080
October 29, 1963	»	884
November 13, 1963	Snow and rain	1400
November 20, 1963	Rain	682
November 21, 1963	»	936
November 23, 1963	Snow and rain	316
December 9, 1963	Snow	618
December 21, 1963	»	912
December 28, 1963	»	1125



Tritium content in atmospheric fallout from December 1961 through December 1963: ○ — rain; □ — snow.

The amount of tritium falling out at a certain point on the earth's surface depends on the distance from the explosion site, the distance from significant masses of ocean water, the geographic location, weather conditions, and some other factors [3,4].

The force of the thermonuclear blast drives reaction products into the upper-lying layers of the atmosphere to form what could be justly termed a tritium reservoir. This reservoir is capable of lasting a protracted period, causing contamination of the atmosphere near the earth's surface. As an example, in 1963 we recorded a very high tritium content in atmospheric fallout, even though tests had been terminated in the summer of 1962. A similar phenomenon had been observed in 1962 following the 1961 tests [4].

An increase in tritium content in atmospheric fallout during the spring-summer period had been noted almost universally in the Northern hemisphere. Even in surface sea waters, the concentration of tritium was found to rise slightly, to 6-10 TU [5] compared to the 1-2 TU found in 1952 [6].

Systematic monitoring of tritium content in atmospheric fallout at Moscow was initiated by the authors in December,1961.

A stage consisting of three electrolysis stages with a total compression ratio of 10^4 is employed to concentrate the samples. This cascade arrangement provides for automatic temperature maintenance and automatic switch-off of the temperature as the required compression ratio in each stage is reached. In the enriched concentrate, the deuterium content is determined by the drop method, the tritium content by tritium activity in hydrogen. A small amount of water was converted to hydrogen gas without isotope fractionation for the purpose. The water was decomposed in vacuum-sealed capsules, over a magnesium amalgam at 450°-500°C. The hydrogen was used to fill a standard internally filled SBM-8 counter with no anticoincidence circuit. A conventional upright lead castle provided shielding. Ethyl ether was employed for quenching. The plateau extended 400 to 500 V; it was very flat with virtually no slope at all. The counter background was on the order of 30 cpm.

The reproducibility of the method was estimated by repeated analyses of the same sample (tap water taken in April,1963). Error was ±10%. At a compression ratio of 10^4 and effective tritium separation factor $\alpha_T = 15$, the sensitivity of the method was (20 ± 10) TU.

To rate the performance of the cascade under unfavorable conditions, when the tritium level in the sample is very low, parallel experiments were run with the same amount of sample, but of artesian water. The results of the determinations are as follows: 44.0; 45.2; 39.6 TU. The excess above background in measurements of the activity of these samples amounted to about 8 cpm.

The results of the analyses of atmospheric fallout sampled at Moscow, December,1961 through December,1963, appear in the table and in the diagram.

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