

# Investigation of the properties of the Tc-99m radioisotope and water contaminated with Tc-99m under the influence of Taheri Consciousness Fields

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## ABSTRACT

The decay constant of radioactive materials is an inherent property of radioisotopes and an indicator of their nature. The presence of radioactive materials in the environment, including water supplies, leads to radioactive contamination, which is a potential and actual threat to the living ecosystem. Taheri Consciousness Fields (TCFs) have a different nature from the known physical fields, and their effects have been previously investigated and proven on the magnetic properties of materials and living organisms at different levels. In this study, the effects of TCFs on the radioactive properties of the technetium-99m radioisotope as well as water contaminated with this nuclear isomer have been investigated. According to the findings, and in accordance with the principles of TCFs, these Fields apparently have less significant effects on the radioactive properties of the technetium-99m radioisotope. However, importantly, in conditions where this nuclear isomer leads to pollution in the vicinity of water molecules, TCF type 2 clearly increases the effective decay constant. The results show that TCFs demonstrate significant effects on reducing and eliminating radioactive contaminants in aquatic environments.

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**Keywords:** Taheri Consciousness Fields; Technetium-99m; water radioactive pollution; radioactive material; decay constant; effective half-life

## Introduction

Radioactivity is the spontaneous transformation of the atomic nucleus that leads to the formation of new elements and is accompanied by radiations such as alpha, beta, positron, or gamma particles. There are two sources of radioactive pollution: (1) natural radioactivity, which originated either from radioactive minerals in the earth's crust or from the interactions with gasses of the atmosphere, and (2) artificial radioactivity that is a by-product of the development of atomic energy since World War II (Elsenbud, 2013). Radioactive pollution is a danger to humans' and animals' lives. According to a study, the structure of the microbial community has been changed under the influence of radioactive pollution. For example, in the soil with a  $^{137}\text{Cs}$  pollution density of 5395.5 kBq, the number of *Aeromonas*, *Pseudomonas*, and *Rhodococcus* representatives decreased, and the number of mycobacteria and fungi increased (Stepanov, 2012).

Radioactivity and its associated properties do not depend on the physical and chemical properties of the radioactive isotope. Therefore, the properties of radioactive isotopes cannot be changed, and each radioactive isotope has its own unique properties. Different isotopes decay at different rates, and each isotope has its own specific decay rate. The time it takes to reduce the number of radioactive atoms to half of its initial number is called the half-life of the radioactive isotope. This time is a measure of the decay rate of the radioactive isotope and is one of the characteristics of each radioactive isotope. The half-life of a radioactive isotope is an immutable property of that isotope. Several studies have found that decay rates of radioisotopes are constant under external conditions like temperature, pressure, electric fields, etc. (Emery, 1972; Pommé et al., 2018).

The relative decrease in the number of radioactive atoms per unit of time is called the radioactive isotope decay constant and is defined as follows:

$$(1) \quad \lim_{\Delta t \rightarrow 0} \frac{\frac{\Delta N}{N}}{\Delta t} = -\lambda$$

Where  $N$  is the number of radioactive atoms,  $\Delta N$  is the number of decaying atoms in the time interval  $\Delta t$  and  $\lambda$  is the decay constant. Radioactivity is equal to the number of nuclei that decay per unit of time:

$$(2) \quad A = -\frac{dN}{dt} = \lambda N$$

By integrating equation 2, it can be shown that the number of radioactive atoms decreases exponentially with respect to time, as shown in the following equation:

$$(3) \quad N = N_0 e^{-\lambda t}$$

Where  $N_0$  is the size of an initial population of radioactive atoms at time  $t = 0$ . Therefore, radioactivity also decreases exponentially with respect to time, as shown in equation 4:

$$(4) \quad A = A_0 e^{-\lambda t}$$

Where  $A_0$  is the initial radioactivity at time  $t = 0$ . Now, according to the definition of half-life ( $\tau$ ), it can be derived from the decay constant as follows:

$$(5) \quad \frac{A}{A_0} = \frac{1}{2} = e^{-\lambda \tau} \Rightarrow \tau = \frac{\ln 2}{\lambda}$$

Taking the natural logarithm from both sides of equation 5 results in equation 6:

$$(6) \quad \ln \left( \frac{A}{A_0} \right) = -\lambda t$$

Equation 6 shows that if the natural logarithm of relative radioactivity of a radioactive isotope is plotted with respect to time and a line is fitted to the data, the slope of the fitted line will be equal to the decay constant  $\lambda$ .



Technetium (Tc) is a silver-gray transition metal with atomic number 43, the standard atomic weight of 98, and a density of 11.5 g/cm<sup>3</sup>. Tc-99 and Tc-99m are the most common isotopes that have been widely used for medical diagnostic studies and academic research (Aaseth et al., 2016). Radioisotopes applications are growing for industrial, medical, and power production and can inevitably lead to contamination of the environment and surface water and consequently the soil, plants, and animals in their vicinity. Also, the test of nuclear weapons, radioactive accidents, and the deliberate discharge of radioactive wastes are other sources of radioactive pollution (Rahman et al., 2014). Nuclear waste disposal is a serious problem for the environment. In the past, these wastes were disposed of by digging a hole, placing them in, and then filling it. But the toxic materials were leaking into water sources and into areas where humans were living. Therefore, this method has become ineffective and obsolete (Leung, 2004). A cleanup technology has been developed named bioremediation. Bacteria are generally used for bioremediation like *Deinococcus radiodurans* (Leung, 2004; Daly, 2000). It has been reported that microalgae and aquatic plants can eliminate radioactive cesium, iodine, and strontium from the radio-polluted aquatic environment (Fukuda et al., 2014).

The nature of consciousness and its place in science has received much attention in the current century. Many philosophical and scientific theories have been proposed in this area. In the 1980s, Mohammad Ali Taheri introduced novel fields with a non-material/non-energetic nature named Taheri Consciousness Fields (TCFs). In this perspective, T-Consciousness is one of the three existing elements of the universe apart from matter and energy. According to this theory, there are various TCFs with different functions, which are the subcategories of a networked universal internet called the Cosmic

Consciousness Network (CCN). The major difference between the theory of TCFs and other theoretical concepts about consciousness is related to the practical application of the TCFs. TCFs can be applied to all living and non-living creatures, including plants, animals, microorganisms, materials, etc.

Mohammad Ali Taheri, the founder of Erfan Keyhani Halqeh, a school of thought, introduced a new science in 2020 as a branch of this school. He coined the term Sciencefact for this new science because it utilizes scientific investigations to prove the existence of T-Consciousness as an irrefutable phenomenon and a fact. Although science focuses solely on the study of matter and energy and Sciencefact, by contrast, explores the effects of the [non-material/non-energetic] TCFs, Sciencefact has provided a common ground between the two by conducting reproducible laboratory experiments in various scientific fields, and it has used the scientific approach in proving TCFs.

The influence of the TCFs begins with the Connection between CCN as the Whole Taheri Consciousness of the universe and the subjects of study as a part. This Connection called "Ettessal" is established by a Faradarmangar's mind (a certified and trained individual who has been entrusted with the TCFs). The human mind has an intermediary role (Announcer) which plays a part by fleeting attention to the subject of study and then the main achievement obtained as a result of the effects of the TCFs. These fields cannot be directly measured by science, but it is possible to investigate their effects on various subjects through reproducible laboratory experiments (Taheri, 2013).

The research methodology in the study of T-Consciousness has been founded on the process of Assumption, Argument, and Proof, in which the basic Assumption is: The Cosmos was formed by a third element called T-Consciousness that is different from matter and energy.

**The Argument:** The existence of TCFs can be demonstrated by its effects on matter and energy (e.g., humans, animals, plants, microorganisms, cells, materials, etc.)

**The Proof:** is the scientific verification of the effects of TCFs on matter and energy (according to the Argument) through various reproducible scientific experiments.

Accordingly, to investigate and verify the existence, effects, and mechanisms of TCFs, the following five research phases (Phases 0 through 4), and the aims of each phase are outlined below.

Phase-0 studies aim to prove the existence of TCFs by observing their effects. The nature of T-Consciousness and what it is will not be addressed in this phase. Phase-1 explores the varied effects of different TCFs. Phase-2 examines the reason behind the varied effects of these fields. Phase-3 investigates the mechanism of TCFs effects on matter and energy. Finally, Phase-4 draws significant conclusions, particularly with regard to the mind and memory of matter and their relation to the T-Consciousness, etc.

In previous research, the effects of the TCFs

on MCF7 cancer cell line (Taheri et al., 2020a), in vivo and in vitro models of Alzheimer's disease (Taheri et al., 2021b), spatial memory, and avoidance behavior of a rat model of Alzheimer's disease (Taheri et al., 2021c), tolerance of *Triticum aestivum* L. under salinity stress (Torabi et al., 2021), bacterial population (Taheri et al., 2021d) and viral growth (Taheri et al., 2021e), the electrical activity of the brain during Faradarmani in the Faradarmangars population (Taheri et al., 2020b) have been observed. This study aimed to investigate the properties of pure Tc-99m and water contaminated with Tc-99m under the influence of TCFs.

## Materials

In this experimental study, the following equipment is used, as shown in Figure 1. The test setup includes a Technetium-99m generator manufactured by the Atomic Energy Organization of Iran, CAPINTEC CRC-15R calibrator dose with 0.8% measurement accuracy, and Containers (vials) holding radioactive material and a lead shield.



**Figure 1.** Devices used in the present study



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## Methods

### *Application of Taheri Consciousness Fields*

TCFs were applied to the samples according to the protocols regulated by the COSMOintel research center ([www.COSMOintel.com](http://www.COSMOintel.com)). A request for Connection to the CCN to utilize TCFs can be placed through the COSMOintel website in the "Assign Announcement" section. This access is available for everyone at no cost. In order to study and experience this Connection, the researchers can register on the website at any time and in order to report the experiment to the COSMOintel research center. Certain details of the experiment must be provided to the center; for example, the characteristics or number and name of samples and controls must be specified. This entire experiment was carried out as a double-blind method where lab technicians were completely unaware of TCFs theory, and the Faradarmangar at the COSMOintel research center who established the Connection was unaware of the details of the study. Double-blind is a gold standard that is common in science experiments in the field of medicine and psychology, involving theoretical and practical testing.

In this study, two types of TCFs 1 and 2 were allocated separately to the technetium-99m radioisotope and contaminated water samples of technetium-99m. TCFs treatments are used throughout the duration of the study often lasting less than 7 hours.

#### *Test 1: Measurement of the decay constant of technetium-99m radioisotope*

The activity of a certain amount of the Tc-99m radioactive material is measured in different time periods without interference as well as un-

der the treatment of the TCFs type 1 and 2. The Napierian logarithm of the relative amount of activity measured is plotted with respect to time and the slope of the fitting line on the data is used to calculate the half-life of the radioactive material. Then, the half-life changes are monitored and evaluated.

In this test, vials containing Tc-99m are prepared based on the test setup shown in Figure 1 with approximately equal activities. One of the samples, called the control, is placed in the lead shield and is not subjected to any treatment. The second and third samples are both kept without shields and placed under the treatment of type 1 and type 2 TCFs, respectively. All three samples are measured at different time intervals with the CAPINTEC CRC-15R model with a measurement accuracy of 0.8%. Then, Napierian logarithm measurements are taken from the measured data and plotted versus time. Finally, a line is fitted to each data set and the slope of the line is used as the decay coefficient to calculate the half-life.

#### *Test 2: Measurement of effective decay of technetium-99m in contaminated water*

A certain amount of tap water was contaminated with the radioactive material Tc-99m and in the same way, as to test 1, changes in the amount of activity of the samples over time are measured by sampling the contents of contaminated water containers. By examining and evaluating the half-life changes, the effect of TCFs on the behavior of water contaminated with radioactive material was measured.

In this test, first, a certain amount of Tc-99m was poured into a container of tap water and stirred thoroughly to make a homogenous mixture. Then, three separate samples with equal volume were separated from the original container and are placed in separate vials. The vials

are labeled and numbered for subsequent tests. One milliliter was sampled from each of vials 1 to 3 and the activity of each sample was measured using a dose calibrator of the CAPINTEC CRC-15R model.

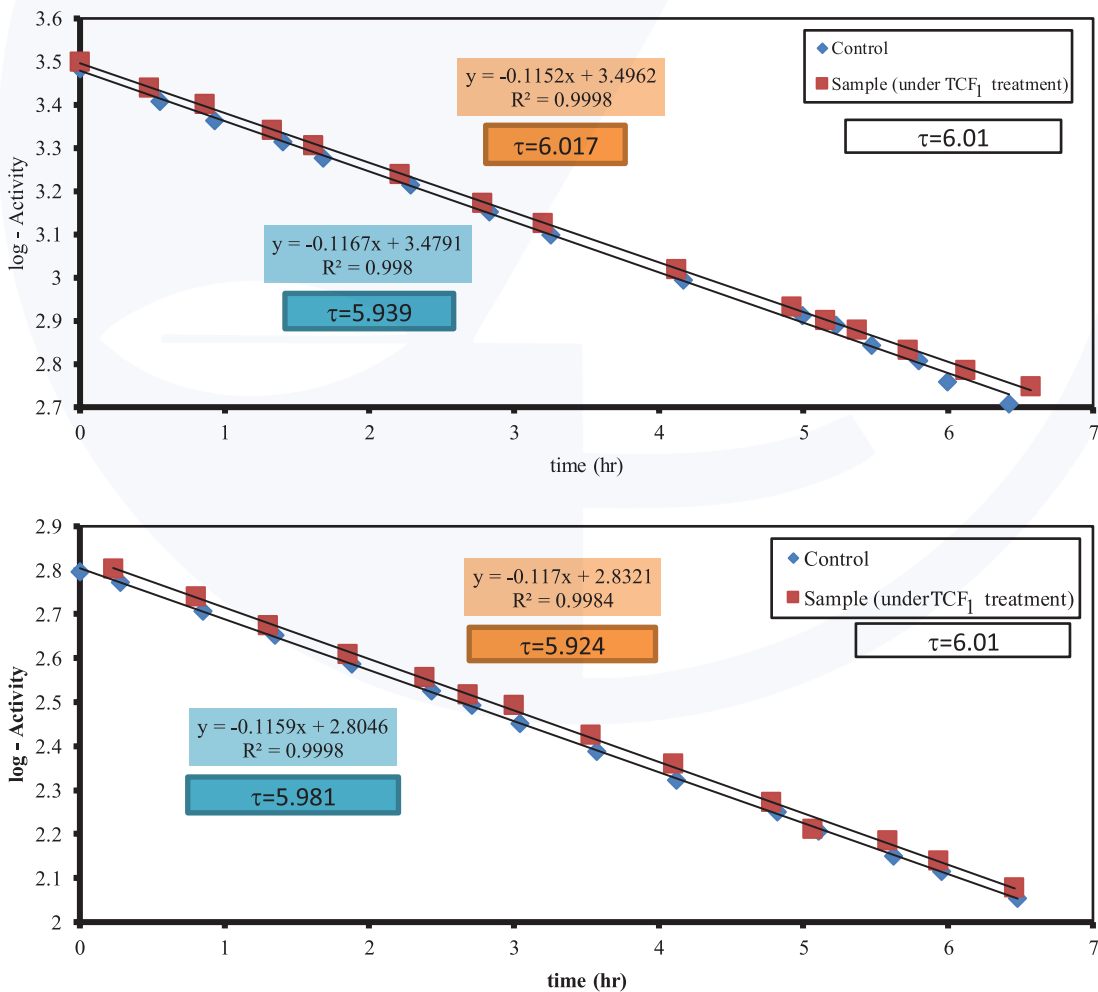
Afterwards, the first vial as control was placed inside the lead shield and not subjected to any treatment. The second and third vials were both held without a shield and placed under the treatment of type 1 and type 2 TCFs, respectively. From each of the three vials, one milliliter was sampled at different time intervals and the activity was measured with the dose calibrator device. Then, the Napierian logarithm measurements were taken from the measured data and plotted versus time. Finally, a line was fitted to each data set and the slope of the line was used as the decay coefficient to calculate the half-life. The above test was repeated twice and finally,

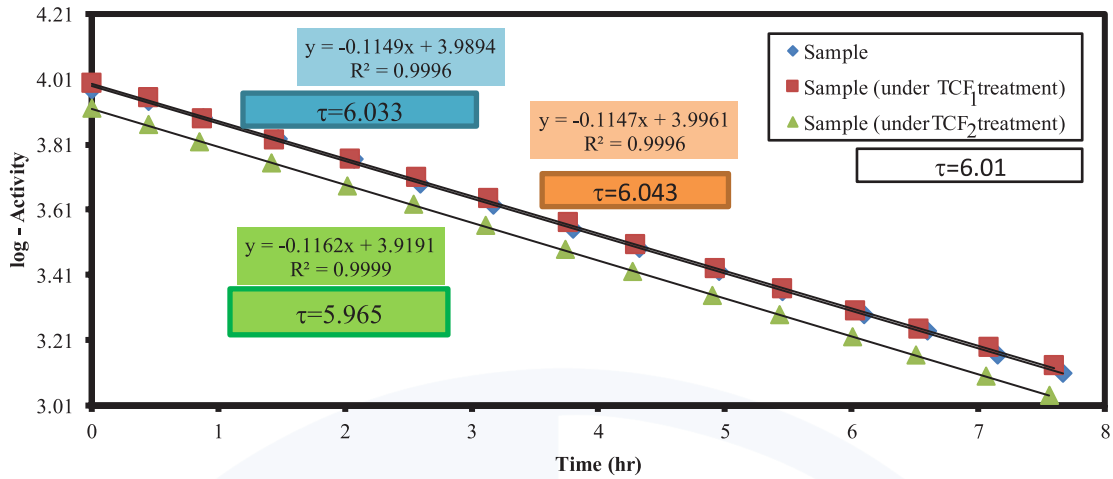
in order to ensure the accuracy of the tests and reduce the effect of experts' familiarity with the study and related biases, the third time, the samples in all three vials were tested without being subjected to the TCFs.

## Results

### Test 1

In Figure 2, the results of the logarithm of the relative amount of activity measurement are plotted versus time and the slope of the fitted line on the data is used to calculate the half-life of the radioactive material. The calculated half-life for the Tc-99m radioactive material under different conditions is presented in Table 1. As can be seen, the values obtained for the half-life of Tc-99m show a difference of less than 1.5% with the nominal half-life of this radionuclide ( $\tau = 6.01$  hr).





**Figure 2.** The logarithm of the relative amount of activity measured over time.

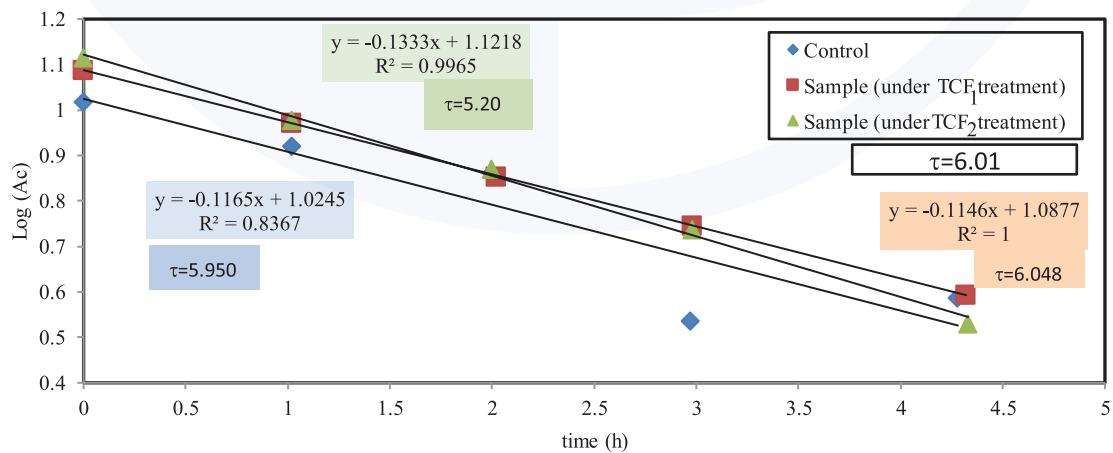
**Table 1.** Calculated half-lives for the Tc-99m radioactive material under different conditions

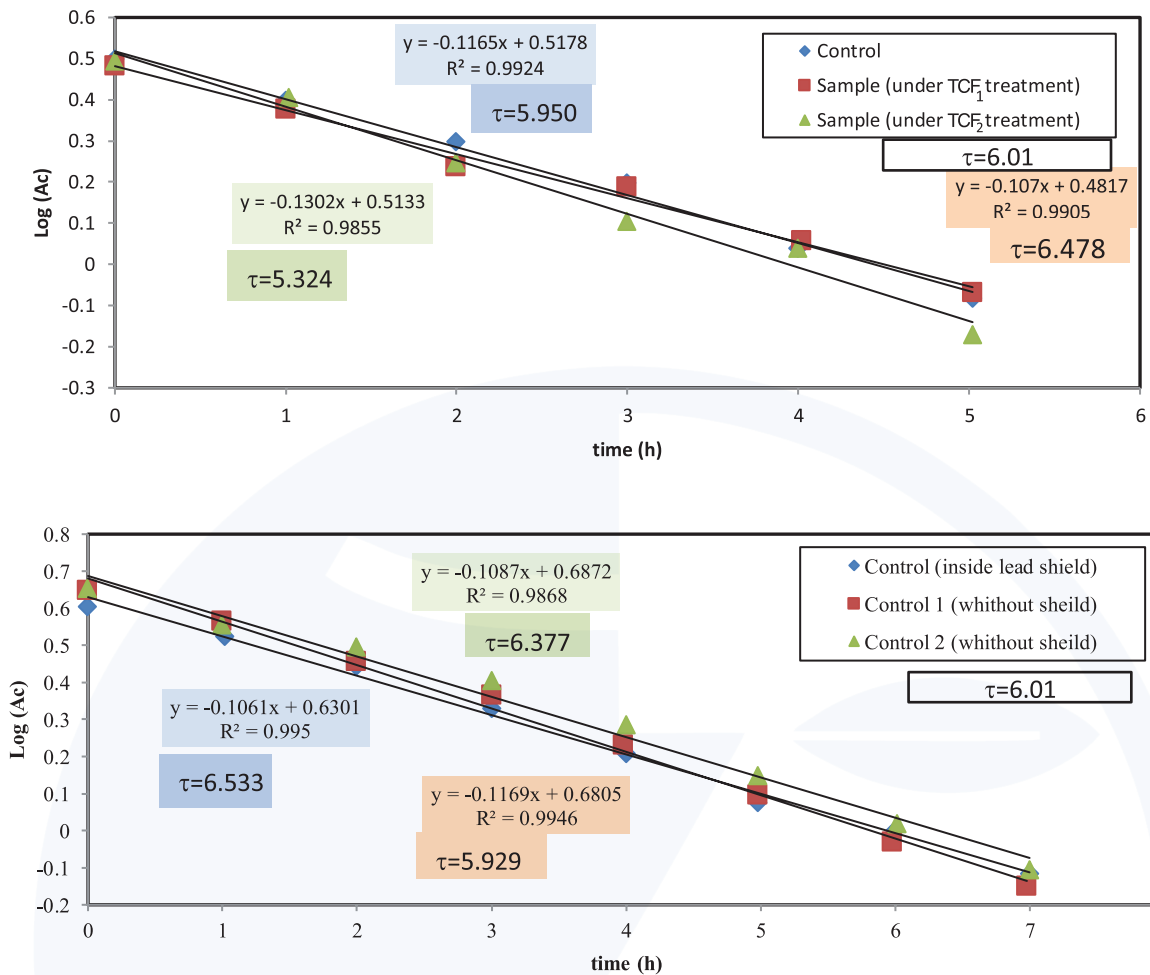
Tests	Control		The sample under treatment of TCF <sub>1</sub>		The sample under treatment of TCF <sub>2</sub>	
	Half-life (hr)	Error relative to the nominal value	Half-life (hr)	Error relative to the nominal value	Half-life (hr)	Error relative to the nominal value
1	5.94	1.16	6.02	0.17	-	-
2	5.98	0.50	5.92	1.50	-	-
3	6.03	0.33	6.04	0.50	5.97	0.67

### Test 2

In Figure 3, the results indicate that the logarithm of the relative amount of activity was measured and plotted versus time and the slope of the fitted

line on the data used to calculate the half-life of the radioactive material. The calculated half-life for the Tc-99m radioactive material under different conditions is presented in Table 2.





**Figure 3.** The logarithm of the relative amount of activity measured by contaminated water samples over time.

**Table 2.** Calculated half-lives for the Tc-99m radioactive material under different contaminated water conditions

Teat	Control		Sample under TCF <sub>1</sub> treatment		Sample under TCF <sub>2</sub> treatment	
	Line slope	Half-life (hr)	Line slope	Half-life (hr)	Line slope	Half-life (hr)
1	0.1165	5.95	0.1146	6.05	0.1333	5.20
2	0.1165	5.95	0.107	6.48	0.1302	5.32
3	0.1061	6.53	-	-	-	-
	0.1169	5.93	-	-	-	-
	0.1087	6.38	-	-	-	-

As can be seen, contaminated water samples subjected to the type 2 TCF treatment show a shorter half-life (at least 13% and an average of 17%) than other samples. To determine the

significance of the observed difference, the data were subjected to a significant confirmation test with an ANOVA test. The results of this test are presented in tables 3 and 4.

**Table 3.** The summary of comparison groups in ANOVA test of the control group and sample under treatment of TCF<sub>2</sub>

Groups	Count	Sum	Average	Variance
Control	5	30.73858532	6.147717064	0.08172
Sample under TCF <sub>2</sub> treatment	2	10.19710223	5.098551117	6.33E-05

**Table 4 .** The result of the comparison test of the control group and the sample under the treatment of the TCF<sub>2</sub>

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	1.572498836	1	1.572498836	24.0485	0.004459	6.607891
Within Groups	0.326943226	5	0.065388645			
Total	1.899442062	6				

It should be noted that a shorter half-life does not necessarily mean that the half-life of the radioactive material Tc-99m has been subjected to the TCFs. Firstly, the half-life of the Tc-99m radioisotope was not influenced by any of the Fields in the previous test, and secondly, it is possible that the water-soluble radioisotope was, to some extent, deposited under the influence of type 2 TCF. This method is out of measurement. Thus, the measured half-life, in fact, the effective half-life of the Tc-99m radioisotope in contaminated water, is under the treatment of type 2 TCF.

### Discussion and conclusions

Radioactive contamination is a serious and potential threat to the health of living beings. Every year, a huge amount of time and money is spent studying and trying to manage and reduce radioactive contamination around the world. The introduction of the novel TCFs. by Mohammad Ali Taheri (one of the authors of this study) and the introduction of their applications in different studies, led us to study the effect of two types of these TCFs on the nature of radioactive decay, in two radioisotope technetium 99m and the state causing water pollution from this radioisotope.

According to Taheri, TCFs are the Fields with the ability to influence the properties and/or level of matter and energy, and consequently, make changes to the properties and behaviors of the system under the study. Although the TCFs originated neither from matter nor energy, they can have measurable influences on both matter and energy.

Each TCF has its own specific functionality. For example, TCF<sub>1</sub> can modify and improve any system under treatment by using related data and information from the Cosmic Consciousness Network (CCN). On the other hand, TCF<sub>2</sub> can make a desired change in the system under the study by submitting a special re-quest in the form of data announced to CCN. The reason is for the required change in the system under the study by an announcer, an individual who has trained and is able to establish a Connection to CCN. According to the results of the present study, the half-life of a radioactive isotope is one of its inherent characteristics and is not affected by TCFs. Moreover, the half-life of the Tc-99m radioisotope in contaminated water under the treatment of type 1 Field is equal to the half-life of the Tc-99m radioisotope. On the other hand, contaminated water samples that have been subjected to the TCF<sub>2</sub> treatment show a shorter effective half-life than other samples. In other words, type 2 TCF causes the contaminated water to become cleaned faster.

The present study along with the previous study done by the authors of this paper (Taheri et al., 2021a) indicate the recognition of CFs with non-matter and non-energy nature with a reproducible effect in various laboratory experiments. In order to understand the effects of TCFs and their applications, further studies are strictly followed and recommended by the authors of this paper.

## Acknowledgments

The authors would like to acknowledge the Physics Department, Sharif University of Technology, Tehran, Iran, and the Radiation Applications Research School, Nuclear Science and Technology Research Institute, Tehran, Iran, for providing the data acquisition service for this research work.

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