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TECHNOLOGY — SOCIETY RELATION, CHALLENGE FOR FUTURE EXISTENCE

Abstract: The subject technology-society and the future have a complex and universal significance for the destiny of mankind. This requires changes in the methodology of our approach to science and its implications to society. Technological advances followed by enormous scientific contribution are a prerequisite for the future existence of mankind. Unidirectional technological development which is forced to support advanced research and innovation for the economy, followed by material progress resulted with less attention to general consequences of environmental changes and human adaptation. This includes many elements of the conference, as well as social standards and education for the future adjustment for a new society. Scientific literacy demands the ability to evaluate and address questions to scientists fully and critically interpret data and evidence narrowly supporting conclusions. Changes in scientific methodology should have more prognostic than the reductionistic approach. Could we create a person of the new society? The term „renascence man" has been used to connote a person with many talents with the accent of his profound knowledge in the broad areas of life. He is not alone. His work is welcome and initiates positive trends in society and science. Such a turn is possible only if the scientific community and entire society are capable of recognizing and supporting these individuals.

Key words: *Future, Man and Environment, Unidirectional Development, Mental Pollution, Radiation, Nuclear Weapons, Depleted Uranium*

The subject technology-society and the future have a complex and universal significance for the destiny of mankind. This requires changes in the methodology of our approach to science and its implications to society. Technological advances followed by enormous scientific contribution are the prerequisite for the future existence of mankind. Unidirectional technological development which is forced to support advanced research and innovation to general consequences of environmental changes and human adaptation.

This includes many elements of the conference, as well as social standards and education for the future adjustment for a new society. Scientific literacy demands

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an ability to evaluate and address questions to scientists fully and critically interpret data and evidence narrowly supporting conclusions.

Without getting into details, I wish to emphasize some general positions between *unidirectional technological development and side position of the human being* his lonely position in the society, in the relation to the environment.

The Relationship between Man and His Environment is comprised of three basic issues [1]. The first relates to *ontological questions* of being and existence. Traditional ontology studied existence in isolation, contemplated the world as it is apart from man and human consciousness. Marxist philosophy must be considered in relation to human practice in the broadest sense, including not only physical activity performed by humans but sensory perception, symbolic mathematical operation, logical conclusions and intuitive reasoning as well. Therefore, according to the Marxist philosophy we, in fact, study the human world as limited by human capacities, transformed by human action, comprehended in the light of human needs, using technical instrumentation and conceptual and linguistic apparatus humanly developed.

The second group of basic philosophic issues consists of *Gnostic problems*: how we acquire knowledge and how we ascertain whether cognition coincides with reality. There have been many attempts to idealize and absolute the process of cognition and in this way to dehumanize it. Knowledge has often been viewed separately from human consciousness: as absolute truth independent of man, and universal logic as a structure similar to reality. The humanistic theory of knowledge makes these questions irrelevant. Philosophers can discuss only human knowledge, the logic of human thought. The structure of reality is inevitably simplified, and truth is accordingly seen in a historical context, subject to subsequent reconsideration. Whenever philosophical aspirations are higher, they attribute absolute meaning to the limited and relative knowledge of man and only succeed in guardians against future improvement.

The third group of basic philosophical issues is composed of *axiological problems*: which alternatives we should choose to strive for. Ever since its origin, axiology has been primarily treated as a theory of absolute and transcendental values which can be taken ideally, regardless of actual human behavior. Marxists have, in general, avoided dealing with the problems of value. This is obviously a major omission for a philosophy which is directed to the future and is calling for an active change of the world in a defined direction. Marxism clearly puts forth a set of values aimed at satisfying human needs. Subsequently, in claiming that man is „a natural being" (divine and demoniac) necessarily become opposed. The existence of God is implicitly negated by Marxists. A creator who made him after his own image, that man is completely different from natural beings and is endowed with a unique capacity („spirituality") which allows him to be the master of the Earth and everything living on it.

There is also a more complex implication in the idea that man is „a natural being", that is, that he is in constant interaction with his environment in the general course of working and living. He is influenced by the world around him and also influences this world as a material force among other such forces. However, these

formulations still do not express the full implication of the idea of Man as a natural being. The basic question still remains no elucidated: What is nature? Thus far, we have only defined nature indirectly, stating that it is everything except society and culture.

The distinction between natural and non-natural (social, cultural) is convenient since it justifies the use of the term „unnatural" (artificial) relating to man-made objects (industrial, artistic, etc.). These are unnatural in the sense that man has made them serve his own purpose. From the vantage point of the human time scale, nature is relatively constant and generally more slowly changing in comparison to social dynamics which are often seemingly arbitrary or stochastic and characterized by rapid flux.

A major problem in relation to „man and his environment" is to find the optimal interaction which will ensure the harmony of man's somatic, psychological and social being [2]. Many „revolutionary" philosophies of the 19th and 20th centuries which exhorted people to destroy established values for the sake of future „progress" not only failed in achieving their aims but actually took civilization a step backward. This had long-term negative consequences of suppressing the creative, psychological potential of the broad population for several generations. The discrepancy between word and deed, aims and reality, truth and hypocrisy were the unfortunate accompaniments of many „revolutionary" movements. The disillusionment and the failure of these ideas brought can be considered as a new form of pollution — let us say a „mental" one — whose consequences for civilization are as important, if not in some cases greater, than those of a physical-chemical nature [2].

This *ideological pollution* induces the most conflicting moral crisis in individuals and the human community in general. Even if an equal level of self-deprivation could be attained for all members of the human community (which has seldom been the case), the question of purpose still remains. What would e the human purpose of sacrificing entire generations, (even in cases when the initial political and economic conditions are provided for a somewhat higher level of satisfying individual needs)? Naturally, a clement of conscious and voluntary self-sacrifice is present in each true „revolutionary" activity: this activity is always conducted on a collective level with collective aims. In order to participate and in that way experience human fulfillment, the individual exposes himself to risk and deprives himself of some of his personal aspirations. In this way, he overcomes his alienation and attaches himself to a social ideal which provides him with a profound purpose to his existence. However, in post-technological society, a total sacrifice of an entire generation for the ideal of a better life for future generations is not morally justified even if the ultimate outcome is completely favorable.

In the case of radioactivity, it is possible to see all the benefits that the swarming technology development offers. On the other hand, *the technology of nuclear weapons yields self-destructiveness as a result*. Radiation has, almost since its discovery, about 120 years ago, been used not only to provide energy, or for medical purposes. Nowadays, radiation is the most powerful weapon, the ideal, invisible killer, which, in case of the military use of depleted uranium, has already irreversi-

bly changed all natural resources, contributed to mass migration of population, destruction of social relations, and *in vivo* experimentation with the health of human population and the overall living world.

Instead of blitzkrieg as it has been the case in Hiroshima and Nagasaki in 1945, we are faced today with the consequences of repeatedly/low/slow radiation doses due to the use of depleted uranium.

Our recent study [3–5] showed that we are faced with confusing, and unpredictable phenomena in the environment: weather and climate extremes, earthquakes and volcanic eruptions… At the same time, a significant increase in the incidence of inflammatory, degenerative and malignant diseases showed the remarkable increasing trend in soldiers, as well as in civilian population in last decades all around the world.

It is almost inconceivable that in the era of unimagined technology development, databases, immeasurable knowledge, and experience, the world silently follows nearly three decades using of nuclear weapons (including the depleted uranium) in local conflicts in different parts of the world. This tendency is increasing. We should bear in mind that the conclusions on the health effects of the military uses of depleted uranium were made over the years, based on the contradictory data and statements. Nevertheless, an increasing trend in the incidence of malignant and non-malignant diseases in Serbia, Europe and globally, provides a new insight and is crucial for creating a critical attitude and ignoring the half-truths launched by quasi-experts.

After the Hiroshima and Nagasaki experience, the best scientific evidence of radiation effects on humans came unfortunately from epidemiologic studies of atomic bomb survivors (Pollycove, 1998). The primary objective of our recent publications [4, 5] is to contribute to a better understanding of the interaction of depleted uranium as a source of low dose radiation with the living world and a man in the contaminated environment. The man is the main subject of our study. Understanding of basic principles of cell biology and radiation interaction with living matter was supported by authentic medical data obtained from patients originated from the territories which were geographically close to each other (Serbia and Montenegro seaside and Bosnia and Herzegovina, the territories of the former Yugoslavia) [3, 6].

There has been increased interest in biological effects of low dose radiation after Chernobyl [7]. The uncertainty of epidemiological studies about the health effects of low-dose radiation arises from the fact that the biological effects of low-dose radiation do not relate obligatory to DNA damage. Military use of depleted uranium (DU) for decades put the problem of low-dose radiation exposure in the spotlight. The explanation related to the limited effects of α-emitting nuclear weapons, including DU, was based to some extent on the fact that alpha particles have a short track in air [8]. This paradigm has changed with the realization that nano- and micro-sized particles of DU could have a global atmospheric movement [4]. The idea about spreading of uranium particles through air masses across the globe arose from the results of measurement of air pollution [9]. Due to the uncontrolled military use of high amounts (a thousand tons) of depleted uranium, numerous unu-

sual environmental physical manifestations were recorded in the last two or three decades [4].

Natural and depleted uranium differ in their isotopic composition, but both are α, β and γ emitters, with a dominant alpha radiation emitted during their radioactive decay. DU exerts *mixed, radioactive (α, β, γ emitter's) and chemotoxic heavy metal properties* [10]. Our knowledge concerning uranium or DU toxicity has evolved since 1999 when DU was considered as a Group III agent (not classifiable as carcinogenic to humans) by the International Agency for Research on Cancer (IARC). According to [11], DU has been categorized as a Group I agent — alpha emitter (i. e., as carcinogenic to humans).

Our knowledge has been evolved from in vitro studies of radiation exposure to more comprehensive understanding of Lithosphere-Atmosphere-Ionosphere and Biosphere coupling.

Busby and Morgan (2006) [9] tried to answer the question whether the use of uranium weapons in the Second Gulf War resulted in contamination in Europe. The authors found an excess of uranium in the air along the trajectories across Europe, of some 500 nBq/m^3, assuming that uranium particles originated from the Persian Gulf battlefields. It was found about 48,000 particles of 0.25 μm diameter in one cubic meter. By the authors' approximate estimation, each person would have inhaled about 23 million particles of uranium in six weeks. One-half of the total mass of the uranium oxide consists of particles smaller than the wavelength of visible light. The behavior of DU particles may be taken approximately to that of a gas, whose dispersion may be expected to be similar to the dispersion of radioactive gasses from nuclear accidents like the Chernobyl accident.

In the 78 days of NATO bombing in March-June 1999 during Operation Allied Force, the best estimates are that 30 tonnes of DU were dropped throughout Serbia (including Kosovo).

The idea about spreading of uranium particles through air masses across the globe arose from the results of measurement of air pollution by Busby and Morgan, (2006) [9]. The authors revealed a statistically significant increase in uranium in all the filters observed in the UK, beginning at the start of the Second Gulf War and ending when it ended. One-half of the total mass of the uranium oxide consists of particles smaller than the wavelength of visible light. The behavior of DU particles may be taken approximately to that of a gas, whose dispersion may be expected to be similar to the dispersion of radioactive gasses from nuclear accidents like the Chernobyl accident.

Close to the battlefields where the blasts of projectiles with DU lead to direct contamination of the external environment and people, causing exposure to higher doses of radiation, deliberated micro or nano particles of DU, in the form of air pollution, are easily transferable to the remote distances from the place of explosion [9].

It was possible to estimate an approximate 2,400-mile radius around the Persian Gulf, as well as around Bosnia and Herzegovina and Serbia, with the putative expansion of air pollution containing DU particles, but without taking into account any geographic or meteorological peculiarities of the potentially exposed

area. Having in mind that the distance of Baghdad from Belgrade is only 1500 miles, since 1991, the territory of the Republic of Serbia has been repeatedly exposed to radioactive DU particles. The spreading of radioactive dust originating from DU from battlefields, across remote regions around the globe has been assisted by natural phenomena, including sandstorms [4, 5, 12].

Depleted uranium has been *repeatedly* used by the military, approximately every four years since 1991 (Iraq 1991, Bosnia 1994–1995, Kosovo, Serbia, and Montenegro 1999, Afghanistan 2001–2003, Iraq 2003–2011 and in numerous conflicts in North Africa or West Asia, which are just the regions where dust storms usually occur. DU has induced the *low dose* radiation (air pollution easily transferable to the remote distances from the place of explosion), *slow doses* (the DU ammunition remnants can be fully oxidized into corrosion products twenty-five to thirty-five years after impact) and its further prolonged contribution to the maintenance of alpha particles radiation [4, 5, 12].

These data support our hypothesis that after the local military conflicts during which DU ammunition was used, an unpredictably wide territory has been contaminated by aerosols, and later water and ground natural resources. From the air, the particles fall very slowly and contaminate the ground and grass, vegetables, fruit, entering the alimentary chain. From the rain, those particles could penetrate the earth and enter springs and subterranean waters [13].

More precisely, the entire territory of Europe was exposed to DU contamination at the time of military operations during which radioactive ammunition was used! The hypothesis of limited contamination after the use of nuclear weapons has been undermined by loads of evidence that we mentioned in our recent publications [4, 12].

DU induces prolonged, low/slow dose radiation in wide population, at the global level. DU exhibits a heavy-metal & radiation synergic impact on the biosystem

As in the case of other metal-oxide nanoparticles, with a higher temperature of the explosion, the DU deliberated particle size is lower. The dimensions of DU particles are inversely proportional to their penetrability. There is an evidence of exposure to the dispersion of a new type of uranium, the ceramic submicron oxide particles, especially in European countries closer to Iraq, than those in remote parts of Europe [9]. Because the ceramic DU dust particles are not soluble, they remain in the body much longer than other soluble forms of uranium. The „Trojan Horse effect", described by [14] and „lysosome-enhanced Trojan horse effect" demonstrate the importance of the fine insoluble particles that, due to high penetrability, can cause harmful effects in the cell, facilitating entering of other toxic components, or interacting with cellular structures [15, 16].

Exposure to depleted uranium can occur by inhalation of DU dust, ingestion of DU directly, or in contaminated food, soil, and water, embedding of DU fragments in the body, contamination of open wounds with DU dust, and absorption through contact with the skin [8].

The lag time in the understanding of biological effects, their extensiveness and health effects is a consequence of demanding procedure for exact detection of DU

in the tissue. Later on, Italian authors concluded that the presence of DU particle in the tissue was not obligatory to determine whether a person was exposed [5].

Even though uranium is a powerful genotoxic stressor, the health effects caused by DU radiation may not appear for years. DU is primarily an alpha emitter and inducer of a mixed radio-chemical exposure [8]. Exposure to depleted uranium can occur by inhalation of DU dust, ingestion of DU directly, or in contaminated food, soil, and water, embedding of DU fragments in the body, contamination of open wounds with DU dust, and absorption through contact with the skin. Due to long pulmonary retention of 1,470 days, as expected in the case of inhalation of uranium oxides, a wide range of clinical manifestations can occur, depending on the individual predispositions of the exposed persons. The overwhelming radioadaptive/radioprotective tissue capacity may later cause autoinflammatory/autoimmune disorders accompanied by numerous symptoms and degenerative and inflammatory diseases [17]. All tissues with oxidative metabolism were targeted, particularly kidney and bone. Cancer is one of the late consequences of low-dose radiation.

Up to 75% of DU absorbed into the blood may be excreted during the first week, followed by slow excretion for up to a year [13]. DU will be deposited in bones and organs, especially the kidneys. DU will remain in the kidneys for at least three months and in bones for at least twenty-five years [8].

The toxic properties of DU primarily affect the kidneys [18].

Due to a global spreading of contaminated air masses, the inhalation of DU particles is the most common path of internal contamination. Repeated exposures to low/slow dose radiation may induce the lupus erythematosus cell-phenomenon in the bronchoalveolar lavage specimens, what we understood as one of early health effects of depleted uranium.

Small and insoluble metal oxide particles penetrate the alveoli into the circulation from which they are rapidly distributed into the entire organism. Tissue penetration from alveoli to the blood vessels is highly particle-size dependent. Particles the size of 100 nm, when inhaled, enter the blood flow within 60 seconds and can be found in internal organs in a matter of minutes [19].

The metal oxides can cross the blood-brain barrier. Experimental exposure to DU led to impaired coordination and movement performance in rats with multisystem damage including the brain [20]. DU also crosses the placenta and is stored in the fetus [21].

Repeated exposure to low doses of alpha radiation originating from the decay of internally deposed DU particles was understood as a main contributing factor to the onset of Gulf/Balkan syndrome. Gulf/Balkan War Syndrome may not be exclusively a disease of soldiers who participated in these wars. Taking into account prolonged exposures to alpha radiation (from the blast and later due to corrosion of armaments), Gulf/Balkan syndrome can be understood as a multicausal disease with multisystem involvement and time-dependent expression of symptoms from no cancerous diseases, to cancers in later phases affecting soldiers, as well as overall civilian population [4, 5, 12].

The carcinogenic effect of tobacco smoke may act synergically with tobacco-containing radionuclides, which are mostly alpha-emitters which induce cumulative doses at bifurcations.

Cancer incidence and mortality in Serbia has been generally increasing over the 10-year period since the bombing of Serbia and Montenegro. The increasing trend of the overall cancer incidence in Serbia started immediately after the bombing of Serbia and nearby territory with DU projectiles. This might be a consequence of prolonged (since 1990) exposure to long-lived isotopes, which were released into the air in the Persian Gulf and Bosnia and Herzegovina (1994/5). Another possibility is that stress in the population, which was exhausted by the EU sanctions, bombing, social conflicts, supported the expression of some kind of maladaptation (according to Sousa, 2016, [22]), which contributed to alarmingly higher cancer incidence and mortality in Serbia than in the majority of European regions [23].

Since then, we have defined a new model which could be of importance for cancer, as well as for preneoplastic conditions [4, 5, 24]. Its role might be anticipated in the complex signaling-regulatory network, lying in damaged tissue micro-architecture in malignant and nonmalignant lung diseases. We found a dose-response relationship in smoking and low-dose-radiation exposure based on a neural network method. The method represents a step forward in achieving individualized screening and risk estimation. In terms of radiobiology, it contributes to a better orientation and distinction of protective and damaging mechanisms during carcinogenesis evoked by long-term inhalation of contaminated air.

The impact of open innovation efforts on individual scientists can vary depending on what role they play in the change of paradigm. We presented a new vista on DU and the Schumann Resonance Hypothesis based on lithosphere-atmosphere-ionosphere and biosphere coupling [5].

Light emission induced by alpha particles in the air was first observed by Sir William and Lady Huggins in the early years of the 20th century.

Given the Earth's overall diameter and the surface, the local areas of military campaigns where bombs containing depleted uranium have been used can be comprehended as the stippled sources of imprinting uranium dust into air, after which α and β particles and gamma radiation are emitted during uranium radioactive decay.

The Earth can be regarded as a nearly conducting sphere, around which the thin, dielectric atmosphere extends up to the ionosphere. The atmospheric electric discharges generate broadband electromagnetic waves that propagate between the surface and the ionosphere. Bearing in mind the proposed geometrical and atmospheric attenuation factors and adding thunderstorms roll over Earth, producing some 50 flashes of lightning every second, we have understood that each lightning burst creates electromagnetic waves that begin to circle around Earth. Some of the waves may combine to form the Schumann resonance. The Schumann Resonance is a standing wave (around 8 Hz) in the atmosphere [25].

A phenomenon, known as the Schumann resonance, was detected by satellite in space, well beyond the upper boundary of the resonant cavity which is formed by the Earth's surface and the lower edge of the ionosphere [26]. Random lightning strokes with spatial probability distribution peaking over the continents, par-

ticularly in the low latitude regions, induce development of standing waves whose wavelength is related to the radius of the cavity.

Many of these effects may be induced by a man-made ionospheric disturbance [27]. Numerous military actions, in which DU ammunition was used, occurred in low to middle latitude regions. The contamination of the environment, caused by man in the event of a nuclear war, assumes a release of the considerable amounts of different forms of uranium. Up to 70% of the DU penetrators are converted to aerosols. The repeated discharge of large amounts of the uranium oxide fumes from the battlefields in the Persian Gulf, the Balkans, Afghanistan, and other places, contributes to sudden artificial imprints of charged particles, resulting in the induced light pulses in the atmosphere. After colliding with high energy protons and nuclear fragments from cosmic rays, a „runaway process" can start inducing lightning initiation [5].

Nuclear wars may be considered as very rare events, but electromagnetic changes induced by the imprinting of charged particles in the Earth's mantle have the power to result in considerable physical phenomena (light, gradient magnetic field etc). It is possible that extremely low-frequency electromagnetic fields can be induced by artificial imprints of the unpredictable amounts of charged particles into the atmosphere during (and after) nuclear conflicts, and that these magnetic fields could interfere with living matter. The contamination caused by nuclear wars induces an unpredictable expression in the atmosphere.

This approach opens an opportunity to observe one of the key phenomena, the Petkau effect, in relation to the field of low-dose radiation, in a more comprehensive way.

In 1972, a researcher in Canada, Dr. Abram Petkau [28], found that when cells were irradiated slowly, a smaller total dose was needed to cause damage. This discovery is known as the „Petkau Effect". Dr. Abram Petkau discovered that at 26 rads per minute (fast dose rate), a total dose of 3,500 rads is required to destroy a cell membrane. However, at 0.001 rad per minute (slow dose rate), only 0.7 rads is necessary to destroy the cell membrane.

Although the Petkau effect was described in the literature as an in vitro phenomenon [29], the repeated bombing of relatively close areas in the Persian Gulf and the Balkans, with subsequent emission of ionizing radiation and a prolonged release of alpha particles, emitted during radioactive decay of DU, which originates from corroded DU armaments, provides an opportunity for the estimation of the in vivo Petkau phenomenon and its effects.

We have already discussed the hypothesis on the lithosphere-atmosphere-ionosphere and biosphere coupling and the hypothesis on the wave nature of the Petkau effect.

The low-dose radiation, originating from the charged particles or photonic radiation can interfere with the biofrequencies of cell structures, primarily the cell membrane or the endomembrane system, which results in higher cytotoxicity [5].

CONCLUSION

Having in mind all these facts, we conclude that radiation has, almost since its discovery, about 120 years ago, been used not only to provide energy, or for medical purposes. Nowadays, radiation is the most powerful weapon, the ideal, invisible killer, which, in case of the military use of depleted uranium, as we discussed in this paper, has already irreversibly changed all natural resources, contributed to mass migration of population, destruction of social relations, and *in vivo* experimentation with the health of human population and the overall living world [5].

People often refuse to accept the facts which they can't understand or they are afraid of. All this is part of the story on depleted uranium which was used in recent nuclear wars. As a consequence, the immeasurable suffering of global proportions ensued.

There are three possibilities: 1) not to accept the existence of the risk of military use of depleted uranium; 2) to accept the facts in line with the saying *'Ave, Cesare, morituri te salutant'*; 3) to embark on a comprehensive assessment of the consequences and develop a strategy for overcoming these consequences.

As for me, I am in favor of the last one. I hope that the rich collection of specimens at my disposal is going to be a foundation for some future research that can contribute to better understanding and treatment of health effects of the military use of depleted uranium.

It is necessary to raise awareness on safe handling of ionizing radiation sources to highest possible level. This entails the development of succinctly described procedures, coordinated at the international and national level, on what measures to take in case of massive contamination that can take place not only during nuclear wars but also in the case of peacetime nuclear disasters. Above all, IT IS NECESSARY TO PUT A BAN ON THE USE OF NUCLEAR WEAPONS OF ANY KIND, WITHOUT DELAY!

Could we create a person of the new society? The term „renascence man" has been used to connote a person with many talents with the accent of his profound knowledge in the broad areas of life. He is not alone. His work is welcome and initiates positive trends in society and science. Such a turn is possible only if the scientific community and entire society are capable of recognizing and supporting these individuals.

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