The development of a technology for an accelerate reduction of the radioactivity of nuclear waste
The experimental Proof of Concept (PoC)

This project addresses the development of a technology for an accelerate reduction of the radioactivity of nuclear waste. This in a sustainable way. This by use of a renewable energy source. Such a new technology can be presently developed.

A prototype of this new devices already exists, see attachment 1 in *External links*. This prototype has a volume of about 1 m^3 and weighs about 150 kilograms. This prototype is located in Bavaria, Germany.

The accelerate reduction of the radioactivity of radioactive samples can be demonstrated by this prototype (TRL 3 – 4). This prototype can be scaled up and can be optimized in various ways during the development of this new technology.

A.
The present state-of-the-art technology and the worldwide nuclear capacity

Presently the radioactive waste from nuclear power plants is stored in special temporary storage sites and permanent disposal sites placed underground until the radioactivity of nuclear waste reaches the level of the environmental radioactivity. This underground storage of radioactive waste is necessary for a time span of at least 200,000 years, see attachment 2 in *External links*.

Presently, more than 400 nuclear power plants are in operation, see link (1) in *External links*. More than 70 nuclear power plants are under construction, see link (2) in *External links*.

At the world climate conference from December 2023 in Dubai (COP28) 22 countries have decided to triple their nuclear capacity by 2050, see link (3) and (4) in *External links*. The importance of nuclear power for the world community was emphasized and included in the COP28 Decision Text, see links (5), (6) and (7) in *External links*. In order to address the worldwide increasing demands for nuclear power, the development of new sustainable technologies like Gen. IV reactors, see link (8) in *External links* and of the technology presented below are important.

B.
The R&D goals of the new technology

The reduction of radioactivity of nuclear waste should not be accomplished in a passive way, as by the presently used technical concept of temporary storage sites and permanent disposal sites placed underground. The reduction of radioactivity of nuclear waste should be instead accomplished in an active way. This by an energetic process that leads to the reduction of radioactivity.

By applying an energetic process that leads to the reduction of radioactivity the time-span in which the radioactivity of nuclear waste reaches the level of natural radioactivity should be reduced in a significant way to a time span of one generation (18 – 20 years) or even less (*This is a preliminary evaluation based on the experimental data gained during several years with the prototype*). Addressing the UN's Sustainable Development Goal 15 (SDG 15 – environmental sustainability) is the primary, overarching goal of this new technology.

C.
Brief description of the new technology

The development of a technology with the above mentioned R&D goal can't be accomplished in the framework of the presently used technical concepts. The presently used concept of the quantum field that defines the present technical possibilities and concepts is not yet enabling such a technology.

However, such a technology can be presently developed. This by applying two new physical phenomena that were found at the beginning of this century. And secondly, by applying an enlarged concept of the quantum field in order to enable R&D and in order to present the working principle of this new technology in a comprehensible cause – effect relation.

By normal progress in science two new radioactivity phenomena were found at the beginning of this century. These new phenomena are characterized by a significant change of the radioactivity of radioactive samples.

These two new radioactivity phenomena are worldwide under research. For example, at the Brookhaven National Laboratory (BNL) in the USA and at the Physikalisch-Technische Bundesanstalt in Braunschweig (PTB) in Germany.

These new radioactivity phenomena, that are under research since more than two decades, are applied for the first time in this new technology. These new radioactivity phenomena are presented on the landing page (Home) of my website in the bottom area. This in the English version of my German patent in the paragraphs [0010] to [0051], see website : https://newsuntech.de/ .

Before these two new radioactivity phenomena were found, such kind of phenomena that are able to influence the level of radioactivity of radioactive samples were not expected to exist. Until the two new radioactivity phenomena were found, no energy source and no particle form was known that is able to influence the level of radioactivity of nuclides.

The radioactivity was considered as a phenomenon that can't be influenced by anything, except by time. For this reason, the radioactive waste from nuclear power plants is presently stored in temporary storage sites and permanent disposal sites placed underground until the radioactivity of nuclear waste reaches the level of the environmental radioactivity, see attachment 2 in *External links*.

The two new radioactivity phenomena that are under research since more than two decades are indicating that a new renewable energy source apparently exists and acts in nature and that this energy form is able to influence the level of radioactivity of nuclides. Especially the presence of these two radioactivity phenomena for an unlimited period of time by using an optimal experimental set-up and secondly, the found regular pattern of these new radioactivity phenomena, that is indicating the presence of law-governed processes, are leading to this conclusion.

The new technology that can be developed by applying these two new radioactivity phenomena is based on the energetic influence of the radioactive decay of nuclides. The radioactive decay is energetically influenced inside these new devices.

This by an apparently new renewable energy source that is acting on the radioactive decay of nuclides. And secondly, by applying certain advantageous design and constructional features in the new devices which are enabling a constant reductive effect of this new renewable energy source on the radioactivity of the radioactive material placed inside these devices.

The new technology that can be presently developed by application of these two new radioactivity phenomena is presented on the above indicated website in the section *Anwendungen (applications).* The working principle of this new technology and the experimental data gained with the prototype are presented there.

In order to present this new technology in a comprehensible cause – effect relation, an alternative concept of the quantum field is applied. This alternative and enlarged concept of the quantum field was initially proposed by Albert Einstein and by the French physicist Louis de Broglie, see link (9) in *External links*, but this theoretical concept was not developed further due to missing experimental data at that time in the 1920s. The two new radioactivity phenomena were of course not known during the lifetime of Albert Einstein and Louis de Broglie.

Presently, the existence of the two new radioactivity phenomena is a fact that requires a certain reevaluation of the quantum field theory that is applied today in physics and technology. In the light of the two new radioactivity phenomena found at the beginning of this century, the enlarged concept of the quantum field proposed by Albert Einstein and by the French physicist Louis de Broglie seams more suitable then the present used concept of the quantum field for a comprehensible presentation of the energetic processes in the quantum field. In the framework of this enlarged concept of the quantum field, the two new radioactivity phenomena and the working principle of the new technology can be well presented in a logical cause – effect relation.

This enables efficient R&D as well as a professional presentation and marketing of this new technology. This alternative concept of the quantum field proposed by Albert Einstein and Louis de Broglie is presented on the above indicated website under *Spezieller Teil (special section) > Die Substruktur des Quantenfelds (the substructure of the quantum field)*.

The new renewable energy source that apparently causes the two new radioactivity phenomena is apparently emitted from the sun and from the earth, respectively from the earth surface. Therefore, this energy source is apparently also contained within the earth atmosphere day and night.

This new renewable energy source that is contained within the troposphere can apparently also cause an excitation effect on the atomic shell of elements, respectively can cause several new luminescence phenomena. This previously unknown property of the troposphere to contain an energy form that is able to perform an excitation effect on the atomic shell of elements is presented and applied in my German patent, see attachment 3 in *External links*. The first technical applications of the new renewable energy source that apparently exists in nature and that is contained within the troposphere are presented in my German patent, see attachment 3 in *External links*.

The new renewable energy source that apparently exists in nature and that apparently causes the two new radioactivity phenomena as well as several new luminescence phenomena found in the first two decades of this century can be considered as a climate-neutral and environmental-friendly energy source. This similar to the electromagnetic radiation from the sun that is used in solar cells.

This new renewable energy source, that apparently exists in nature, possesses several unique features and properties that are not found in connection with other energy forms, like the electromagnetic radiation from the sun, electricity or magnetism. The energetic influence on the radioactive decay is the most striking unique feature of this renewable energy source. The unique features of this new renewable energy source that were found until now are presented on my website

under *Spezieller Teil (special section) > Die Alleinstellungsmerkmale (the unique features)*.

The know-how required for the development of this new technology has been already acquired during the last two decades in which the new renewable energy source is experimentally under research and during the development of the German patent, see attachment 3 in *External links*, in which the first technical applications of this new renewable energy source are described. Under *Spezieller Teil (special section) > Die Gesetzmäßigkeiten (the laws)* on my website, the technically relevant physical laws of this new renewable energy source found until now are presented.

Due to the existence of the two new radioactivity phenomena, of the prototype, of the theoretical concept regarding the working principle of this new technology and of the technical know-how required for the development of this new technology, presently it became possible to develop this new technology successfully. It also became possible to present this new technology in a rigorous scientific manner so that it can be placed on the market. This new technology would apply the new renewable energy source that apparently exists in nature for the first time on a large industrial scale.

D.
The demonstration of the prototype (the experimental Proof of Concept – PoC)

1. Introduction

In the present time in which fake news and deep fake are common and are a quite serious social problem, any kind of graphical presentation or video presentation regarding the above mentioned prototype and regarding the experimental data gained with this prototype are not able to convince a research partner (university, research institute, etc.) of the existence of the prototype and of the experimental data gained until now with the prototype. Pictures, videos and technical reports are not convincing enough, because such thinks can be presently a fake.

The only way to convince a research partner of the existence of the prototype and of the technical feasibility of the proposed project consists in the demonstration of the prototype at work. The scientists and the technical managers in charge of research and development have to see with their own eyes the prototype at work. Then they can evaluate and judge this project professionally.

It is quite difficult to evaluate this project without seeing the prototype at work. The question “Is the idea feasible?” can’t be answered theoretically, by simulations or by presently common known and accessible experimental data.

This because the proposed new technology possesses a different physical concept compared with the one used presently in science and technology. A different concept

of the quantum field, two new physical phenomena, a new renewable energy source and a new working principle are applied in this new technology.

A market for this technology certainly exists. But to validate the practicality of the idea and the technical feasibility, a demonstration of the prototype is crucial and indispensable. A professional evaluation of this project is only possible through the evaluation of the prototype at work.

2. The experimental set-up

The experimental set-up consists of the prototype, the radioactive samples and the gamma-ray spectrometry device.

2.1. The prototype

The prototype, see attachment 1 in *External links*, possesses a wall that is about 25 mm thick. This wall possesses an inside layer made of a non – metallic material. This wall has also an outside layer made of steel, which is 9.0 mm thick.

The prototype is inside empty. Just surrounding air at normal temperature and pressure are contained inside the prototype. The prototype can be divided respectively can be opened in two symmetrical parts in order to load the radioactive material inside the prototype.

2.2. The radioactive samples

In the experimental PoC the half-lives of 8 nuclides are tested inside the prototype.

2.2.1 The Potassium sample (Potassium-40 sample)

A Potassium-40 sample (K-40 sample) is used in the experimental PoC together with 7 other radioactive samples described in 2.2.2.

The Potassium-40 sample consists of 1,000 grams Potassium chloride see link (24) and (25) in *External links*. The 1,000 grams Potassium chloride powder are filled up in a 500 ml jar see link (13a) and (13b) in *External links*. On the top of the jar that contains the Potassium chloride sample, respectively on the lid of this jar, an identical jar with 7 different disc type gamma samples described in 2.2.2. is mounted.

Potassium-40 (K-40) is a primordial nuclide, see link (26) in *External links*. Potassium-40 has a half-life of 1.25 billion years, see link (27) in *External links*. The radioactive decay of Potassium-40 in the Earth's mantle ranks third, after Th-232 and U-238, as the source of radiogenic heat, see link (28) in *External links*.

The total activity of the K-40 contained in the 1,000 grams Potassium chloride is 16.350 kBq, see link (29) and (30a or 30b) in *External links*. 10.72 % of this total activity is emitted as gamma rays at 1.460 MeV, see link (29) in *External links*. The expected gamma ray emission of the K-40 sample contained in the 1,000 grams Potassium chloride is therefore approx. 1.750 kBq.

2.2.2. The disc type gamma standards

Seven different disk type gamma standards are also used in the experimental PoC, respectively are placed temporarily in the center of the prototype. These 7 different radioactive samples are disk type gamma standards type D from Eckert & Ziegler, each with 2.54 cm diameter and 0.64 cm high, see link (10), (11) and (12) in *External links*.

These disk type gamma standards contain the following nuclides: Natrium-22 (Sodium-22), Cobalt-60, Barium-133, Cesium-137, Europium-152, Americium-241and Radium-226. These disk – type gamma standards are placed inside a jar and are distributed on 4 (four) levels inside the jar. Each level consists of 10 disks, total 40 disks. The jar is made of polycarbonate a has a volume of 500 ml, see link (13a) and (13b) in *External links*.

The first 2 (two) bottom disk levels inside the jar consists each (each level) of one gamma standard in disk shape of Natrium-22 (Sodium-22), Cobalt-60, Barium-133, Cesium-137, Europium-152 together with 5 gamma standards in disk shape of Americium-241.

The Americium-241 (Am-241) sample consists therefore of 10 (ten) disk type gamma standards with an activity of 3.7 MBq each, distributed on the 2 bottom levels. The total activity of the Am-241 sample is 37 MBq. This is required due to the relative weak gamma emission line of 59.5 keV of Am-241 that has to be detected and measured through the 9 mm steel wall of the prototype. This setup enables the detectability of Am-241.

The other disk standards on the 2 bottom levels, respectively the Natrium-22 (2 disks), Cobalt-60 (2 disks), Barium-133 (2 disks), Cesium-137 (2 disks) and Europium-152 (2 disks) have each an activity of 3.7 MBq. Total activity of these 10 disk standards is 37 MBq.

The upper 2 (two) disk levels inside the jar consists each of 10 gamma standards in disk shape of Radium-226 (total 20 disks). Each Radium-226 gamma standard has an activity of 370 kBq (kiloBq). Total activity of the 20 disk standards is 7.4 MBq.

The use of 20 disk standards of Ra-226 is necessary due to the relative weak activity of each disk standard of 370 kBq and due to the fact that the gamma emission of the Ra-226 disk standards is measured through the 9 mm steel wall of the prototype by

the 186.2 keV – emission line of Ra-226 with a quite low emission probability of 3.6 %. This setup enables the detectability of Ra-226.

The total activity of all disk type gamma standards inside the jar is 81.4 MBq. This total activity is < 10 GBq and is classified by the IAEA as a week activity level, see link (14a) or (14b) the PDF – page 25, Fig. 5 in *External links*.

Radium-226 is a natural isotope which gave the name to the element Radium. Natrium-22 (Sodium-22) is a cosmogenic isotope (natural isotope) as well as an artificial isotope contained in nuclear waste from NPPs (nuclear power plants). Americium-241, Europium-152, Cesium-137, Barium-133 and Cobalt-60 are artificial isotopes contained in nuclear waste from NPPs, see link (15a) or (15b) and (16a) or (16b) in *External links*.

2.3. The gamma-ray spectrometry device

The portable gamma-ray spectrometry device type MIRION MicroGe, see attachment 4 and links (17) and (18) in *External links* should be used for this experiment. The main advantage of this device is that this device enables a laboratory – grade gamma spectrometry with a High Purity Germanium detector (HPGe – detector). A laboratory – grade gamma spectrometry of the activity of the 8 nuclides placed inside the prototype can be performed in Bavaria, Germany, where the prototype is presently located.

The curves of the activity of the 8 nuclides placed inside the prototype are displayed on the computer screen of the MIRION MicroGe – system, see link (19a) or (19b) in *External links* [The MIRION CSM GR-1 spectrometry device presented in link (19a) or (19b) uses the same graphical software as the MIRION MicroGe spectrometry device]. Each 12 hours a new set of data regarding the activity of the 8 isotopes placed inside the prototype are displayed on the computer screen of the MIRION MicroGe system in counts.

The MIRION MicroGe unit should be mounted on a tripod in front of the prototype. The MIRION MicroGe unit performs the gamma spectrometry of the radioactive material placed inside the prototype through the 9.0 mm thick steel wall of the prototype.

Due to the fact that the radioactivity of the samples is measured outside the prototype, through the 9.0 mm steel wall of the prototype, a scan time (counting time) of 12 hours is necessary in order to improve the MDA (Minimal Detectable Activity) of the MIRION MicroGe device and in order to obtain reliable results. The position of the detector head must remain unchanged respectively unmoved during the whole time span of the experiment so that the geometry between the radioactive material placed inside the prototype and the detector head remains absolutely unchanged.

3. The experimental procedure

First, the level of the background radiation inside the experimental room, were the prototype is located, has to be precisely measured. When low radioactivity levels are measured, background activity must be accurately measured and subtracted from the measurements to ensure the quality and defensibility of the results.

This primarily for the Potassium-40, Uran-235 and Cs-137 isotopes. The obtained activity levels of Potassium-40, Uran-235 and Cs-137 inside the experimental room define the reference level for the experimental data gained in the subsequent main experiment with the K-40, Ra-226, Cs-137 and the other 5 nuclides placed inside the prototype.

Uran-235 possesses its main emission line at 185.7 keV which could interfere respectively that is processed in the same digital channel of the MIRION MicroGe device as the Ra-226 emission line at 186.2 keV that is measured during the subsequent main experiment. Therefore, the Uran-235 background radiation has to be known precisely.

The measurement of the background radiation should be performed with two empty jars (two empty jars with no radioactive material inside which are of an identical type as those two jars used in the subsequent main experiment with the radioactive samples inside). This measurement has to be performed with a scan time (counting time) at least equal to the scan time of the subsequent main experiment with the radioactive samples inside the jars, respectively minimum 12 hours. The position of the detector head relative to the empty jars placed inside the prototype has to remain unchanged in the subsequent main experiment with the jars filled up with the radioactive samples inside the prototype.

The ICOCS software of the MIRION MicroGe device, see attachment 4 in *External links*, as a theoretical modeling software, can be helpful to define the geometry of the radioactive material placed inside the prototype. But this software can’t replace a precise measurement of the background radiation with the two identical empty jars as those used in the subsequent main experiment with the 8 radioactive samples.

After the reference measurement is performed, the main measurement with the two jars containing the 8 radioactive samples is performed. The two jars with the radioactive samples are brought into the experimental room and are placed inside the prototype. The two symmetrical parts of the prototype are put together and the prototype is closed. The energetic process inside the prototype starts.

The portable gamma spectrometry device type MIRION MicroGe placed in front of the prototype starts the gamma spectrometry. Scan time (counting time) is 12 hours. The obtained measurements are expressed in “counts”. The time span of the experiment is 7 days.

The 8 different isotopes used in this experimental PoC have a clear defined half-life. The half-life of these isotopes lies between 2.6 years (950.6 ± 2.3 days) for Na-22 and 1.250 billion years for Potassium-40 (K-40).

During an experiment of 7 days the graphs of the activity of the 8 isotopes placed inside the prototype should show absolutely straight horizontal lines without any visible deviation from the x-axis (a horizontal line) on the computer display of the gamma spectrometry device. These results are expected and required by the radioactive decay law from 1902 for a 7 – day experiment with the above indicated isotopes.

The decrease of the radioactivity for the Na-22 – isotope (half-life is 950 days) during 7 days is 0.37 % of its initial activity. This reduction is not visible on the computer display of the spectrometry device.

Regarding the clear defined half-life of the nuclides used in this experiment see link (10), (11), (12) and the link (20a) or (20b) on the PDF – file pages 29 to 135 in *External links*. See also the IAEA – App *Isotope Browser* for iOS and Android.

If the radioactivity level of at least one isotope used in this experiment decreases by 4.00 % (four percent) or more from its initial level at the end of the 7 days – experiment, the existence of a new technical applicable and renewable energy source that can be put to use in a new technology for an accelerate reduction of the radioactivity of nuclear waste can be proven and supported by experiment. This, since no particle or energy form is presently known to exist that is able to decrease the half-life of nuclides and by doing so to decrease the radioactivity of nuclides with long half-lives in a significant way.

The working principle of the prototype and of the new technology can be proven by this 7 days – experiment and the development of the new technology can start. This by scaling up the prototype and by optimizing the various features and design properties of the prototype.

By following the activity lines of the 8 isotopes on the computer display of the gamma spectrometry device anyone interested in this project can see the prototype at work. This demonstration is able to add valuable experimental data to the evaluation process of the proposed project. This enables a professional evaluation of the project.

If the above proposed experimental demonstration is successful, a second experiment within a hot-cell, see link (21) in *External links*, could be scheduled. This in order to obtain more experimental data.

For this hot-cell experiment industrial radiation sources with a long half-life, for example Am-241, Cs-137, Ba-133, Na-22, Co-60 and Eu-152 with an activity of 370 MBq each, could be used, see link (22) in *External links*. The total activity of the

above mentioned 6 radiation sources is 2.22 GBq, respectively is < 10 GBq and is therefore classified by the IAEA as a week activity level, see link (14a) or (14b) on the PDF file – page 25, Fig. 5 in *External links*.

The activity of the 6 different industrial radiation sources indicated above should be precisely measured with a High Purity Germanium detector (HPGe – detector) in the lab before the samples are placed inside the experimental device and after the samples are removed from the experimental device at the end of the experiment. The time span for this hot-cell experiment can be chosen between 1 and 2 weeks. After the end of the experiment, a technical report should be worked out by the project manager and this report should be used in the assessment of the project.

Since the total activity of the above mentioned industrial radiation sources is classified by the IAEA as a week activity level, the portable MIRION MicroGe device (see attachment 4 in *External links*) could be also used in this experiment. The MIRION MicroGe unit is suitable for high gamma-ray flux environments, see attachment 4 in *External links*. In this case the MIRION MicroGe detector head should be placed together with the prototype inside the hot-cell for the time of the experiment.

4. The division of labor / the task sharing

The experiments with the prototype in Bavaria and in the hot-cell are able to prove that a new renewable energy source exists in nature and that this energy form can influence the radioactive decay of isotopes and therefore it can be put to use in a new technology for an accelerate reduction of the radioactivity of nuclear waste. This project would enable the application of this new renewable energy source for the first time on a large industrial scale. Therefore, the proposed experiments are important in the present time.

It would be very helpful for this project, if for this experimental Proof of Concept, a division of labor could be attained.

On our side we would provide the experimental device (the prototype) and the experimental method and procedure for the PoC. Regarding the entire project, we would provide the theoretical concept of the new renewable form of energy that is applied in this new technology as well as the working principle of this new technology.

This enables R&D and professional marketing and application of this new technology. We would also provide the technical know-how required and necessary for the R&D till the pilot plant stage of this project.

It would be very helpful for this project, if our research partner would provide in a first step the Potassium chloride sample and the radioactive gamma standards in disc shape for the experimental demonstration in Bavaria as well as the above indicated

jars (4 identical jars – two for the Potassium chloride sample and for the 7 disc samples and other two identical jars for the reference measurement). Our research partner should also enable the 7 – day demonstration with the portable MIRION MicroGe device in Bavaria.

MIRION has a special department that makes such test on demand, see link (23) in *External links*. Such kind of test are often performed by MIRION in NPPs (Nuclear Power Plants).

By this division of labor regarding the experimental Proof of Concept, a professional evaluation of this project is possible. MIRION should work out a technical report regarding the 7 – days experiment in Bavaria in which the experimental data gained in the experiment are presented and commented by the MIRION application engineer. This MIRION expert report should be used in the professional evaluation of this project.

This project needs a strong and motivated research partner with great commitment to progress in science and technology, to sustainability and to renewable energies and new technologies. I would like to develop this new technology from the lab to the pilot plant stage and to the production stage. I would like to see these devices at work during my lifetime.

The professional assessment and evaluation of this project is quite a challenge. It is absolutely crucial to understand the two new radioactivity phenomena that are applied in this new technology and the working principle of the proposed new technology. Therefore, please consider to get help in the evaluation process from a German speaking expert (e.g. physicist, engineer) who can read and understand the above indicated sections of my German website related to this project.

E.
Challenges / Criticalities

Two new radioactivity phenomena found at the beginning of this century and a new renewable energy source that apparently causes these new radioactivity phenomena are applied in this new technology. Due to the existence of these two new radioactivity phenomena certain concepts of quantum physics require a reevaluation.

Conservatism could cause temporarily certain problems. Conservatism has already caused considerable delays in R&D. Conservatism is quite often connected with new technologies but the advantages of scientific and technical progress are always counting more for the society in the long run.

If you have any questions regarding this project, please feel free to contact me by e-mail under info@newsuntech.de.

Best regards,
Eugen Mihailescu

The external links used in this description are presented here:

https://drive.google.com/file/d/1NR9J9WMd6bCTAazBNj2-KuDyNl5HqCmZ/view?usp=drive_link