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EFFECTS OF CLIMATIC CHANGES DUE TO RADIATIONS RELEASED FROM THE NUCLEAR REACTOR ACCIDENTS

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Abstract: Nuclear energy is generated by the process of molecular fission, molecular fusion and molecular decay. Uncontrolled formation of such energy leads to nuclear disasters. These disasters significantly affect the population and its effects are observed for years. Radioactivity leads to cancer, genetic disorders and death in the affected area for decades. A single nuclear accident can cause loss of life, long term illness and destruction of property in a large scale. Most of the commercial nuclear power plants release gaseous and liquid radiological effluents into the environment as a by product of the elements. The planet at present where are living have witnessed three major nuclear accidents have changed the environmental conditions of both biotic and abiotic. The first incidence occurred at Three Mile Island in 1970. The second accident took place at Chernobyl located in Ukraine in the year 1986.The finally, the Fukushima accident occurred in Japan due to tsunami in the year 2011 resulting in hydrogen gas explosions and partial meltdowns. The total amount of radioactivity released through this method depends on the nuclear power plants.

The nuclear energy is the direct cause of global warming and climate change in many ways. The heat released by the nuclear reactors. Once the energy is released from uranium , the fuels of the nuclear reactor then it radiates out in to the outer space as long wave radiation and the rest goes into the air, waterways , glaciers which intern increases the atmospheric temperature, thus it leads to the reasons for the Global warming. There are 400 nuclear plants all over the world to generate electric power all of them are generating considerable amount of nuclear wastes which increases the earth's Antarctica glaciers. Nuclear power is unreliable for fighting global warming. Scandals, natural disasters and accidents can shut down numerous plants simultaneously. When one of these problems occurs, without sustainable alternative energy sources, fossil fuel plants must kick in which spikes greenhouse gas emissions. For centralized, large systems like nuclear generation, utilities must install a "reserve margin" of extra capacity ready for instant use. For example, in Japan every new nuclear power plant requires additional fossil-fuel-fired capacity. Nuclear power plants and fossil fuel plants come in tandem. If the number of nuclear power plants could be doubled, which is impossible, their total contribution to world energy use would only increase to 12%. Thus, it is untrue to say that nuclear energy is greenhouse friendly.

Key words: Radioactive, greenhouse friendly, Uranium, CFC, Fukushima, Inhalation exposure, Ground-level external exposure and Atmospheric external exposure., etc.

I. INTRODUCTION

Every step of the nuclear power cycle involves the expenditure of energy derived from fossil fuels, which nuclear generated electricity cannot replace. The factories, the transport, and the materials are made using fossil fuels. In particular, plants are made with concrete, which is a CO_2 intensive material [1].

Nuclear power is controversial method of producing electricity. Many people and the Environmental organisations are very concern about the radioactive fuel to its need. There have been serious accidents with small number of nuclear of nuclear power stations. The accidents at Chernobyl in 1986, led to 30 people being killed and over 100000 people being evacuated. In the preceding year another 20000 people were resettled away from the radioactive area. Radiation was even detected over a thousand miles away in the UK. Nuclear power station do not burn fuels to produce electricity and consequently they do not produce in damaging polluting gases. Many developed countries such as the USA and the UK no longer want to rely on oil and gas imported from middle east.

1.1 *All Nuclear Plants and Facilities are a Source of Global warming*

It is established scientific fact that trees and plankton in the ocean create most of the oxygen in the world, and soak up a massive amount of CO_2, but not nearly enough to make up for what humanity is releasing due to carbon burning, to the

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tune of 1 cubic mile of oil per year. The most worrying factor is that plankton are declining in number over time and the health of forests is declining with more and more trees getting sick and/or dying earlier and more often. These plankton concentrate mineral elements from the water, and it has been found that radioactivity may be concentrated in this manner by as much as a thousand fold[2]. For an example, one gram of plankton could contain a thousand times as much radioactivity as a gram of water adjacent to it. The radioactivity from these plankton which form a portion of fish diet tends to concentrate in the liver of the fish, and, if sufficiently high levels of contamination are encountered, could have a marked effect upon the ecology of an ocean area.

1.2 *Putting radiation risks in context*

The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) exposures of the public and workers to various sources of radiation, including natural sources, enhanced sources of naturally occurring radioactive material, manufactured sources for peaceful purposes such as nuclear power production and medical use of radiation, and manufactured sources for military purposes including nuclear testing.

According to UNSCEAR's latest report [3], the average worldwide public exposure from globally dispersed radionuclides from nuclear fuel cycle installations is estimated to be 0.18 μSv per person per year of operation. Average annual exposure to local populations is 25 μSv for mining and milling (within 100 km of the site), 0.2 μSv for uranium enrichment and fuel fabrication, 0.1 μSv for nuclear power reactors and 2 μSv for fuel reprocessing (within 50 km of the site). The World Health Organization released a report on 23 May 2012 assessing radiation exposure for the first year following the Fukushima–Daiichi accident. In the two areas with the highest impact within Fukushima prefecture, the dose is between 10 and 50 μSv. Outside of these two areas, but within Fukushima prefecture, the dose is estimated to be between 1 and 10 μSv.

Estimates for exposure in the rest of Japan are between 0.1 and 1 μSv and for the rest of the world are below 0.01 μSv [4]. Radiation exposure levels stemming from uranium mining, refining and nuclear power generation facilities are significantly lower than naturally occurring radiation exposure levels. In the case of a major nuclear accident, radioactive contamination of the environment close to the site can be severe, but exposure levels within areas nearest Fukushima–Daiichi are significantly below natural background radiation levels. Major sources of *external* exposure are cosmic rays from outer space and natural terrestrial radionuclides existing in the Earth's soil and in building materials such as granite and marble. The level of exposure to cosmic rays depends primarily on latitude and altitude. Exposure also arises from the intake of radionuclides in the Earth's soil by inhalation due mainly radon and ingestion in the form of food and drinking water. Altogether, worldwide exposure to natural radiation sources for an average individual is 2420 μSv per year, with a typical range of between 1000 and 13 000 μSv per year [5].

1.3 *Nuclear Plants emit radiation Carbon 14 , Global warming element*

Carbon is used by all plants and humans as almost all life on Earth is based on the carbon cycle. Since all nuclear reactors and nuclear reprocessing as well as other facilities emit massive amounts of carbon 14, this man made artificial element has a negative effect on all living things.

The most notable routes for radioactive Carbon 14 is production by thermal neutron irradiation of targets The above-ground nuclear tests that occurred in several countries between 1955 and 1980, dramatically increased the amount of carbon-14 in the atmosphere and subsequently in the biosphere, after the tests ended, the atmospheric concentration of the isotope began to decrease. One side-effect of the change in atmospheric carbon-14 is that this has enabled some options, Carbon-14 atoms react rapidly to form 14 CO , which subsequently oxidizes at a slower rate to form 14 CO2, radioactive carbon dioxide 14. The gas mixes rapidly and becomes evenly distributed throughout the atmosphere[6].

1.4 *Nuclear Plants emit acid creating Carbon dioxide causing Global Warming.*

Besides releasing massive quantities of radioactive Carbon 14, radioactive CO2 14, and radioactive Krypton, all nuclear plants are responsible for emitting a large amount of regular carbon dioxide, during the whole fuel cycle and all the through to the storage of the spent fuel and nuclear garbage produced[4]. The nuclear plants emits NO carbon dioxide, but that is only true if one ignores the entire fuel chain, all of the above radioactive elements, and all of the radioactive elements released by hundreds of accidents all around the world, which include massive amounts of global warming radioactive gases. Nuclear power plants release up to 9 times more CO2 than Solar, Water, or Wind Power.

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1.5 *Nuclear Industry for the massive release of CFC*

It is a little known fact that Uranium Enrichment accounts for a VERY large percentage of global warming CFC gases released in the USA. The United States Enrichment Corporation's sites in both Ohio and Kentucky released 800,000 pounds of CFC-114 in 1999, according to official records. This is around 95% of all CFC's released in the USA.

II. THE CHERNOBYL ACCIDENT

In April 1986, it was decided to use the Chernobyl power plant for an electrical engineering experiment on its turbine-generator, the machinery used to convert the energy of steam into electricity. The purpose was to develop a system for utilizing the rotational inertia of the turbine-generator to operate water pumps if electric power should be lost. The only function of the reactor was to get the rotation of the turbine and generator up to speed before beginning the experiment. Since no experimentation with the reactor was involved, no reactor experts were on hand.

Electrical engineers supervised the experimental work while the reactor was run by the regular operators. Many of the firemen and helicopter pilots, as well as some of the workers inside the plant, received radiation doses of more than a million millirems. In all, 31 men died, two of them killed immediately by the explosions, and the rest as a consequence of burns and radiation sickness .While these deaths among workers at the plant were horribly tragic, it is perhaps worth noting that an average of 50 deaths occur every day due to occupational accidents in the United States, and single accidents that kill more than 31 workers occur frequently in coal mine[7].

2.1 Effects on the Public

There has been no direct evidence of injury to any member of the public as a result of the Chernobyl accident, but there were substantial doses of radiation. The city of Pripyat, with a population of 45,000, mostly families of plant workers, extends from near the plant to 2 miles away. However, exposure in that area averaged only 3,300 mrem, because radioactive materials projected high into the air did not descend rapidly enough to affect those close by.

The largest exposures, averaging 50,000 mrem, were received by the 16,000 people who lived from 2 to 6 miles away. The 8,200 people living from 6 to 9 miles away also received substantial doses, averaging 35,000 mrem. The 65,000 people living from 9 to 18 miles away received only about 5,000 mrem. All of these 135,000 people were evacuated over the first few days to avoid further exposure from radioactive material deposited on the ground as well as from that still being released from the reactor.

For the most-exposed 16,000 who averaged 50,000 mrem, their risk of dying from cancer as a result is about 4%, raising their total risk of dying of cancer from the normal 20% to 24%. This is less than some of the variation in cancer risk from living in different U.S. states. A Soviet scientific team has announced plans to carefully keep track of these highly exposed people to determine how many cancers actually do appear. After the accident, the winds carried the radioactive dust over Finland and Sweden. On the third and fourth day, the wind shifted to bring it toward Poland, Czechoslovakia, Austria, and Northern Italy. It then shifted further southward to deposit the material over Rumania and Bulgaria.

People all over the world were exposed to external radiation from radioactive gases and dust suspended in the air and settled on the ground. They were also exposed internally by inhaling these materials or eating foods contaminated with them.

The average radiation doses to the public in millirems during the first year after the accident were 76 in Bulgaria, 67 in Austria, 40 to 60 in Greece, Rumania, and Finland, 30 to 40 in Yugoslavia, Czechoslovakia, and Italy, 20 to 30 in the USSR, Poland, Switzerland, Hungary, Norway, and East Germany, 10 to 20 in Sweden, West Germany, Turkey, and Ireland, and less than 10 elsewhere. No country was the exposure higher than one-fourth of that due to natural radiation during that year[8].

Some of the material on the ground will continue to be radioactive for many years, exposing people externally and internally through the food supply. The estimated average total exposure in millirems after the first year[3] will be 120 in south eastern Europe, 95 in North and Central Europe, 81 in the USSR, 15 to 19 in Western Europe and Southwest Asia, 8 in North Africa, and less than 2 elsewhere . The sum of exposures to people all over the world will eventually, after about 50 years, reach 60 billion mrem, enough to cause about 16,000 deaths. Note that this is still less than the number of deaths caused every year by air pollution from coal-burning power plants in the United States.

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III. THREE MILE ISLAND NUCLEAR POWER ACCIDENT

The second nuclear accident occurred in the Three Mile Island power station is near Harrisburg, Pennsylvania in USA. It had two pressurized water reactors. One PWR was of 800 MWe (775 MWe net) and entered service in 1974. It remains one of the best-performing units in USA. Unit 2 was of 906 MWe (880 MWe net) and almost brand new. The accident to unit 2 happened at 4 am on 28 March 1979 when the reactor was operating at 97% power. It involved a relatively minor malfunction in the secondary cooling circuit which caused the temperature in the primary coolant to rise. This in turn caused the reactor to shut down automatically. Shut down took about one second. At this point a relief valve failed to close, but instrumentation did not reveal the fact, and so much of the primary coolant drained away that the residual decay heat in the reactor core was not removed. The core suffered severe damage as a result. The operators were unable to diagnose or respond properly to the unplanned automatic shutdown of the reactor. Deficient control room instrumentation and inadequate emergency response training proved to be root causes of the accident[10-11].

3.1 Health effects of power generation

All these shows that nuclear is distinctly the safer means of electric power generation in this respect. A major reason for coal showing up unfavourably is the huge amount of it which must be mined and transported to supply even a single large power station - some 20,000 times as much coal as uranium from the mine. Mining and multiple handling of so much material of any kind involves hazards, and these are reflected in the statistics.

IV. THE THIRD MAJOR NUCLEAR ACCIDENT AT FUKUSHIMA

A major earthquake on 11 March 2011 caused a 15-metre tsunami to strike the Fukushima Daiichi nuclear power plant on Japan's Tohoku coast, disabling the power supply and heat sinks, thereby triggering a nuclear accident. Without cooling water, the cores of units 1, 2 and 3 overheated and largely melted in the first three days. Hydrogen generated by this high-temperature process caused explosions in the upper service floors of reactor buildings at units 1 and 3. Unit 4 had not been operating, but was affected by a hydrogen explosion due to gas back-flow from unit 3. All four reactors are written off. Two other reactors at the plant were not involved in the accident[12].

The major accident was rated at Level 7 on the International Nuclear Event Scale due to high radioactive releases to air in the first few days. The bulk of releases occurred with the explosions, while a leak of contaminated water to sea continued for two months. Further releases of radioactivity to the air were brought to insignificant levels before the end of 2011, although much radioactivity remains dispersed on the ground in the surrounding area.

4.1 Effects on people

Significant amounts of radioactivity were released, but prompt evacuation from the immediate area made sure that no member of the public received enough exposure to cause harm. Some 160,000 people were evacuated from their homes and only in 2012 were some allowed limited return. Certain areas are still off limits but the Japanese government has announced it is ready to lift the evacuation order on the first nearby town in April.

Radiation was never expected to have any measureable effect on the health of the population and this was confirmed in 2013 by an estimation from the UN Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) that no person in Fukushima prefecture would be exposed, through the environment or their food, to more than 10 mSv in their entire lifetime.

This is one tenth of the level at which health effects are known to become more likely, and therefore no measureable increase in cancer rates is expected. The government continues to monitor the health of all Fukushima residents. Stress, worry and the social problems of relocation have been repeatedly identified as the only likely causes of ill health Table. 1. Groundwater travels naturally from the land to the sea and, in doing so is believed to mingle with heavily contaminated water in the basements of the power plant buildings. This continues to sea and a major effort is underway to identify the routes it is taking and manage groundwater to reduce this to the maximum extent possible.

A silt fence has long been in place to prevent contamination reaching the open sea and the diluting effects of ocean currents mean that radioactivity cannot be detected in seawater beyond the plant harbour. Radioactive material continues to run off from the land through rivers to the sea and can be found in certain species of fish. However, all food from affected areas has been strictly monitored since the accident and prevented from sale if in excess of highly conservative standards[13-14].

Table 1 Estimated I-131 and Cs-137 emission rates (Bq per day) from Fukushima Daiichi over the period 12 March 2011 to 12 April 2011.

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Date	I-131 emissions (Bq per day)	Cs-137 emissions (Bq per day)
03/12/11	$3.0X\ 10^{15}$	$7.5\ X\ 10^{13}$
03/13/11	$4.0\ X\ 10^{15}$	$1.0\ X\ 10^{14}$
03/14/11–03/15/11	$2.5\ X10^{16}$	$5.0\ X\ 10^{15}$
03/16/11–03/19/11	$1.0\ X10^{15}$	$7.5\ X\ 10^{14}$
03/20/11–03/26/11	$5.0\ X\ 10^{14}$	$5.0\ X\ 10^{14}$
03/27/11–04/04/11	$7.5\ X\ 10^{13}$	$2.5\ X10^{13}$
03/27/11–04/04/11	$1.0\ X\ 10^{13}$	$7.5\ X\ 10^{12}$
Total (Bq)	$6.526\ X\ 10^{16}$	$1.696\ X\ 10^{16}$

V. RESULT AND DICUSSION

It is the increase in the earth's average atmospheric temperature that causes corresponding changes in climate and that may result from the greenhouse effect. Sun's output Incoming solar radiation is the main climate driver. Its energy output increased about 0.1% from 1750 to 1950, increasing temperatures by 0.2°F (0.1°C) in the first part of the 20th century. But since 1979, when we began taking measurements from space, the data show no long-term change in total solar energy, even though Earth has been warming. Volcanic eruptions Huge volcanic eruptions can cool Earth by injecting ash and tiny particles into the stratosphere. Greenhouse gases Changes in the concentration of greenhouse gases, which occur both naturally and as a result of human activities influence Earth's climate. Greenhouse gases absorb and emit radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. Damage to coral reefs, Pacific The severity of periodic warming due to El Nino in 1997 in the Pacific led to the most serious death in coral ever known. It is estimated that about 10% of the Earth's coral reefs were dead, another 30 % were seriously affected and another 30% were degraded. The Global Coral Reef Monitoring Network Townsville, Australia, has predicted that all the reefs could be dead by 2050. Butterfly populations in the United Kingdom Global warming is leading to an early arrival of butterflies in Britain. Scientists say that butterflies can now be spotted much earlier every year in the last two decades. Some, like the red admiral, can now be seen a month earlier than was the case in the mid – 1970s. Others, like the peacock and the orange tip are appearing between 15 and 25 days earlier than in the past. Future rise in temperature is likely to have a detrimental effect on these butterflies. Some butterflies which need cooler temperatures might suffer[15].

Excess lifetime mortalities and morbidities from radioactivity released from Fukushima Daiichi by region. The middle value provides the best estimate and the upper and lower values provide the uncertainty in the health effect based on uncertainties in the biokinetic, dosimetric, and absorption models used. The ''Percent Total After End Simulation'' is the percent of mortalities or morbidities (Table.2).

Table.2.

Si.No	Country	Inhalation exposure	Ground-level external exposure	Atmospheric external exposure
1	Asia	3.0–58–774	10–39–153	0.26–1.0–39
2	North America	0.04–0.61–5.6	0.20–0.76–2.9	0.00–0.01–0.05
3	Europe	0.02–0.27–2.4	0.02–0.27–2.4	0.02–0.27–2.4
4	Japan	2.9–57–761	9.3–36–140	0.25–0.99–3.8
5	China	0.03–0.50–4.5	0.43–1.7–6.5	0.00–0.01–0.04 .
6	United States	0.02–0.40–3.7	0.17–0.66–2.5	0.00–0.00–0.03
7	Worldwide	3.1–60–785	11–41–159	0.27–1.0–4.0
8	Worldwide total mortality incl. ingestion 15–125–1110			
9	Worldwide total morbidity incl. ingestion 24–178–1800			

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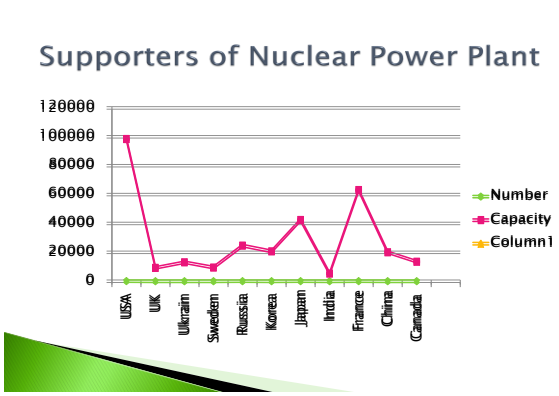
VI. GLOBAL WARMING IN THE YEAR 2050

Today there are 435 nuclear plants worldwide, which produce 16 percent of the planet's electricity. In comparison, fossil fuels generate 66 percent of the world's electricity. Global electricity demand is projected to double by 2030 and triple by 2050, based on business-as-usual usage. Much of this demand growth will occur in the developing world. The almost threefold increase in nuclear power by 2050 would increase the global proportion of nuclear energy use from 16 percent to ~20 percent, given the projected increased demands for electricity. As a consequence, this modest increase in contribution from nuclear energy alone would not decrease the emissions of greenhouse gases[16-18]. Under this very ambitious scenario, each new reactor would have to come online at a rate of less than one per week over the next four decades. By 2025 half of today's nuclear plants will be too old to operate capacity will decrease, not increase. Using current nuclear power plants to fight global warming would require an impossible increase in utilized capacity. The industry's scenario is fundamentally flawed, because current nuclear power plants are aging. They are going to require more maintenance and will break down more often. Thus, nuclear power is unreliable for fighting global warming. Scandals, natural disasters and accidents can shut down numerous plants simultaneously. When one of these problems occurs, without sustainable alternative energy sources, fossil fuel plants must kick in which spikes greenhouse gas emissions. For centralized, large systems like nuclear generation, utilities must install a "reserve margin" of extra capacity ready for instant use. For example, in Japan every new nuclear power plant requires additional fossil-fuel-fired capacity.



Power Production –Nuclear reactors

Country	No of Reactors	Power in MW
USA	99	98476
UK	16	9243
Ukrain	15	13107
Sweden	10	9470
Russia	34	24654
Korea	23	20688
Japan	48	42388
India	21	5308
France	58	63130
China	24	20056
Canada	19	13500

VII. CONCLUSION

Climate change may further increase the risk of nuclear accidents. Heat waves, which are expected to become more frequent and intense as a result of global warming, can force the shut down or the power output reduction of reactors. Too dirty- Greenhouse gas emissions from mining, enrichment, transport and infrastructure. Too slow-It takes at least 15 years to build a nuclear power reactor. Too dangerous-Nuclear waste is dangerously radioactive now and for hundreds of thousands of years. There is no safe way to store it and it poses a security threat. Too expensive- Nuclear power generation is seven times more expensive than energy reductions. Nuclear energy can only exist in a society that runs on cheap fossil fuels. Planning and building new nuclear power plants will NOT contribute to combating global warming over the next decade. Over the next decade there will be ZERO additional contribution from nuclear power in the fight to combat global warming.

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