Vol 4 Issue 7 Jan 2015
ISSN No :2231-5063

International Multidisciplinary Research Journal

Golden Research Thoughts

Welcome to GRT

RNI MAHMUL/2011/38595 **ISSN No.2231-5063**

Golden Research Thoughts Journal is a multidisciplinary research journal, published monthly in English, Hindi & Marathi Language. All research papers submitted to the journal will be double - blind peer reviewed referred by members of the editorial board.Readers will include investigator in universities, research institutes government and industry with research interest in the general subjects.

Address:-Ashok Yakkaldevi 258/34, Raviwar Peth, Solapur - 413 005 Maharashtra, India
Cell : 9595 359 435, Ph No: 02172372010 Email: ayisrj@yahoo.in Website: www.aygrt.isrj.org

Golden Research Thoughts
ISSN 2231-5063
Impact Factor : 3.4052(UIF)
Volume-4 | Issue-7 | Jan-2015
Available online at www.aygrt.isrj.org

GRT

IMPACT OF RAINFALL ON NUCLEAR RADIATION

K.Balasubramanian[1] and G.Kumanan[2]

[1]Asst. Prof in Civil Engg , Annamalai University .
[2]Prof of Structural Engg , Annamalai University.

Abstract:-The present study is aimed to find out the significant relationship between rainfall and radiation effect. Further the research is focused to know the significant influence of radiation with reference to radial distance and direction of various locations. To test the objects secondary data were used which were collected from NPCIL report published in 2011. Based on the objectives some hypotheses were formulated. In order to test the hypotheses statistical tools such as Analysis of variance (ANOVA) and correlation were used. Result proves that there is a significant relationship between rainfall and radiation. Also result concluded that there is a significant difference in radiation based difference and direction.

Keywords: Nuclear Radiation , rainfall and radiation effect ,Analysis of variance (ANOVA).

INTRODUCTION

Kirsti Jylha (1993) conduct a study on Empirical scavenging coefficients of radioactive substances released from chernoby After the accident at the Chernobyl power plant on 26 April 1986, most parts of Europe were affected by the associated radiation pollution. In this paper the dependence of the precipitation scavenging coefficient λ (s^{-1}) on the rainfall rate R (mm h^{-1}) is studied on the basis of radioactivity and radar rainfall measurements in Southern Finland after the accident. The average scavenging coefficient weighted by the high-altitude concentrations of radionuclides involved was found to be $\lambda = 10^{-4} \; s^{-1} \; R^{0.64}$, in good agreement with earlier investigations. The results also suggest that weather radar may form an important and effective part of a real-time radiation monitoring and warning system.

Van Der Westhuizen (1989) conduct a study on Radioactive nuclear bomb fallout: A relationship between deposition, air concentration and rainfall. The importance of determining a relationship between deposited fallout, airborne concentration and rainfall is discussed. The methods of collection are described, and the relationship between deposited fallout and rainfall at Pretoria is examined. Using mean values, it has been found that the monthly pattern of deposited fallout is approximately the same as that of the rainfall. It was further found that there is a non-linear relationship between the quarterly concentration of fallout in rainwater and the rainfall. Greenfield's model for the scavenging of the air by rain is discussed briefly and it is shown that the relationship between deposited fallout, air concentration and rainfall at Pretoria is consistent with this model. A non-linear relationship has been found between the ratio of the concentration of fallout in rain and air, and the rainfall. The relationships between the different parameters are good enough to establish confidence limits for future measurements and to give an indication of the deposition if the air concentration and rainfall are known.

NUCLEAR RADIATION

G. L. Stephens (1978) The shortwave absorption, albedo and longwave emissivity of water clouds are parameterized for use in operational and climatic models of the atmosphere. The parameterization also provides the shortwave heating and longwave cooling rates within the cloud. The scheme presented in this paper assumes a prior knowledge of the broadband spectral fluxes incident on the cloud and further assumes that the atmospheric models will provide the surface albedo, solar zenith angle, cloud temperature and total vertical liquid water path. The last parameter was chosen because it likely to be available in atmospheric circulation models and both observational and theoretical evidence suggest that it is strongly related to the radiative properties of clouds (Paltridge, 1974; Platt, 1976).

The parameterization of shortwave radiation resembles a two-stream approximation which has been “tuned” to match the results from a detailed theoretical model. The longwave scheme simply involves the parameterization of effective emissivity. Both schemes have been tested and the errors investigated. The shortwave radiative properties of clouds when compared against calculations can generally be estimated by the parameterized scheme to within 5% of the incident flux at the cloud top. The longwave cooling rates are well within 0.5°C h^{-1} of the theoretical beating rate profiles. The errors in longwave cooling and shortwave absorption are much smaller than the uncertainties that may arise from variations of cloud liquid water distribution.

There are four different types of radiation:

- Alpha radiation - Very large and slow moving radiation. The least dangerous type of radiation.
- Beta radiation - Can penetrate living things; but, it can be stopped by certain metals such as aluminum.
- Electromagnetic radiation - Has a long history in the medical field including x-rays. Fast moving and can penetrate everything except concrete or lead.
- Neutron radiation -Can penetrate various types of deep matter. Very fast moving.
- The specific process by which radiation is emitted in a nuclear reaction is called fission.
- The heat produced in the fission process powers steam turbines, which in turn power generators that give us electricity.
- Radioactive waste, which is produced as nuclear reactors generate electrical power, has to be removed and stored with great care because it is detrimental to humans and the environment.
- Over a very long period of time, radioactive waste will eventually lose its radioactive qualities and will no longer be dangerous material.
- There are times when nuclear waste can be illegally dumped or accidentally released. The land and bodies of water around the dump site will become contaminated and the location will be rendered inhabitable to human beings.
- Radiation exists naturally in very low levels that the human body and the environment can sustain without being harmed.
- Radiation from nuclear reactions can cause nausea and migraines, and, as the levels increase, the effects are much more damaging.
- As the level of radiation rises, radiation can cause hair loss, loss of white blood cells (making casualties of radiation even more susceptible to infections), and can result in death.

REVIEW OF LITERATURE

Vernon E. Kousky, Mary T. Kagano and Iracema F. A. Cavalcanti (2010) In this review of the Southern Oscillation we consider oceanic and atmospheric circulation changes and related rainfall anomalies with special emphasis on the region of South America. The climate anomalies associated with Southern Oscillation—El Niño (ENSO) events are highly persistent and nearly global in extent. The persistent nature of these events derives from strong coupling between atmosphere and ocean. Although the initial causes of the oscillation are unclear, once initiated the Southern Oscillation (SO) follows a certain sequence of events with well-defined effects on rainfall over a large portion of the tropics and subtropics. Drought in Australia, Indonesia, India, West Africa and Northeast Brazil as well as excessive rainfall in the central and eastern Pacific, Peru, Ecuador and Southern Brazil are all related to the SO. ENSO events are also associated with dramatic changes in the tropospheric flow pattern over a broad area of both hemispheres. Wintertime upper tropospheric subtropical jets are especially pronounced as are changes in the low level trade wind regime of both the South Pacific and South Atlantic Oceans. Mid-latitude blocking patterns are also more frequent in certain regions during ENSO events.

J. Marshall Shepherd (2005) Precipitation is a key link in the global water cycle and a proxy for changing climate; therefore, proper assessment of the urban environment’s impact on precipitation (land use, aerosols, thermal properties) will be increasingly important in ongoing climate diagnostics and prediction, Global Water and Energy Cycle (GWEC) analysis and modeling, weather forecasting, freshwater resource management, urban planning–design, and land–atmosphere–ocean interface processes. These facts are particularly critical if current projections for global urban growth are accurate. The goal of this paper is to provide a concise review of recent (1990–present) studies related to how the urban environment affects precipitation. In addition to providing a synopsis of current work, recent findings are placed in context with historical investigations such as Metropolitan Meteorological Experiment (METROMEX) studies. Both observational and modeling studies of urban-induced rainfall are discussed. Additionally, a discussion of the relative roles of urban dynamic and microphysical (e.g., aerosol) processes is presented. The paper closes with a set of recommendations for what observations and capabilities are needed in the future to advance our understanding of the processes.

METHODOLOGY

Research Design

A research design is a master plan specifying the methods and procedures for collecting, analyzing the needed information; it is a framework for the research plan of action.

Objectives:

- To assess the significant difference in radiation with various radial distance
- To assess and identify the significant effect of rainfall in various periods.
- To formulate the significant difference in radiation in various radial zone.
- To formulate the significant relation between rainfall and radiation.

Hypotheses:

- There is a significant difference in radiation based on various radial distance.
- There is no significant difference in rainfall of various years.
- There is a significant difference in radiation based on various radial zone.
- There is no significant relationship between rainfall and radiation.

Statistical Data:

The data collected from NPCIL – Report Dated March 2011. The statistical tools such as ANOVA and correlation were utilised for this study.

Table:1 Radiation effect of different radial distance

Distance	Mean	S.D	F-value	P-value
< 2 km	0.11	0.10	3.22	0.001 (S)
2-5 km	0.09	0.02		
5-10 km	0.23	0.32		
10-15 km	0.20	0.15		
15-30 km	0.95	3.20		
Total	0.65	2.50		

S-Significant P-value -Level of Significant (Probability value) at 5% and 1%
S.D. Standard Deviation
Ho: There is no significant difference in radiation based on various radial distance.

It is inferred from the table that the calculated F-value (Analysis of Variance) is significant at 0.001 level. So the null hypothesis rejected and alternate hypothesis accepted. Therefore it is concluded that there is a significant difference in radiation based on various radial distance.

Figure:1 Radiation effect of different radial distance

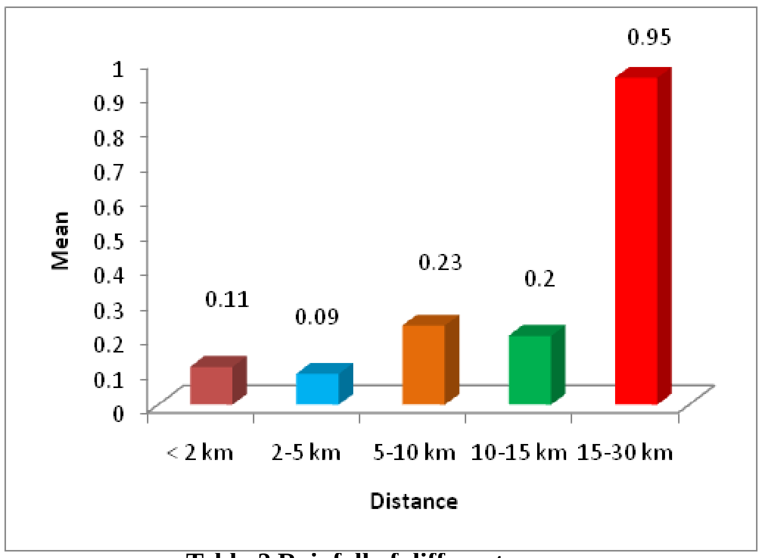

Table:2 Rainfall of different years

Year	Mean	S. D	F-value	P-value
2003	50.93	93.2	0.33	0.85 NS
2004	60.00	65.3		
2005	80.68	103.6		
2006	76.94	93.6		
2007	49.77	48.8		
Total	65.08	80.1		

NS-Not Significant
Ho: There is no significant difference in rainfall of various years.

Result shows that there is no significant difference in rainfall of various years. Since $P>0.05$. It is not significant. Hence the null hypothesis is accepted and alternate hypothesis is rejected. Therefore it is concluded that there is no significant difference in rainfall of various years.

Figure:2 Rainfall of different years

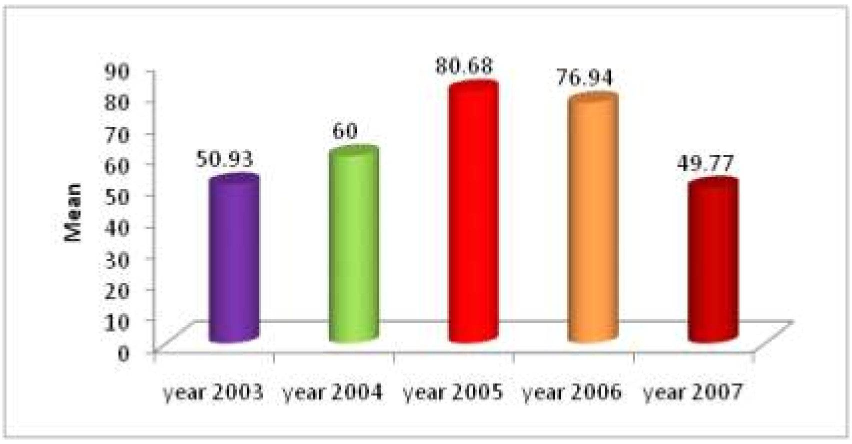

Table:3 Radiation effect of different direction at various location

Direction	Mean	S. D	F-value	P-value
NNW	18.24	11.39	2.25	0.001 S
NNE	17.93	10.71		
NW	12.50	7.74		
ENE	10.55	9.62		
WNW	10.64	5.84		
W	16.38	7.17		
NE	14.91	5.61		
WSW	18.94	3.46		
N	22.26	5.75		
Total	16.50	7.54		

S-Significant
Ho: There is no significant difference in radiation based on different direction at various location.

It is inferred from the table that the calculated F-value is significant at 0.001 level. So the null hypothesis rejected and alternate hypothesis accepted. Therefore it is concluded that there is a significant difference in radiation based on different direction at various location.

Figure:3 Radiation effect of different direction at various location

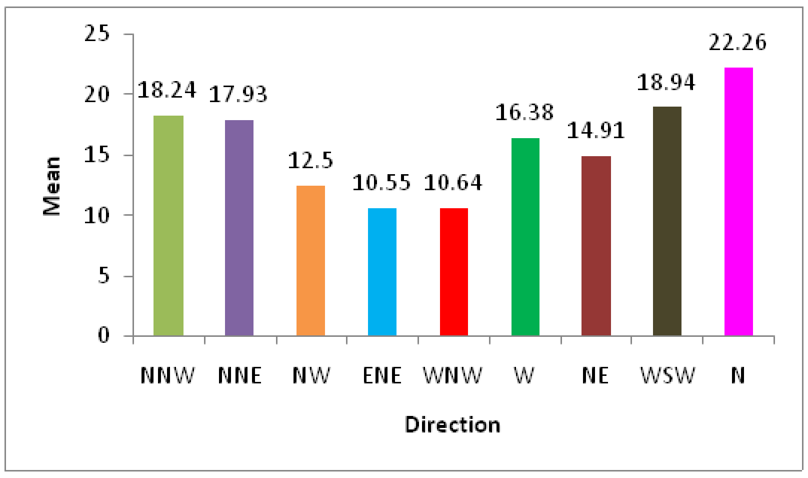

Table:4 Correlation between rainfall and radiation

Variables	Rainfall
Radiation	-0.456*

*Significant at 0.05 level
Ho: There is no significant relationship between rainfall and radiation.

The result reveals that the calculated r-value is negative and significant. So the null hypothesis is rejected. Therefore it is concluded that there is a significant relationship between rainfall and radiation. Result proves that if rainfall increased, radiation will be decreased. Since statistical result reveals inverse relationship.

RECOMMENDATIONS

- It is concluded that there is a significant difference in radiation based on various radial distance.
- It is concluded that there is no significant difference in rainfall of various years.
- There is a significant difference in radiation based on various radial zone.

- It is concluded that there is a significant relationship between rainfall and radiation.

Implications

The following implications are suggested by the researcher to overcome the radiation effect and how to manage the sources.

Evacuation

The best strategy for preventing serious exposures, if feasible, is to evacuate people from the area before the radioactive materials arrive. (Ref no: 7 "The safety of nuclear installations")

Sheltering

Placing barriers between the radioactive materials and people is effective for some releases. The most commonly available and suitable barrier is a building, the walls and roof of which attenuate to some extent the gamma radiation. The heavier the construction, the more effective the shielding; basements are particularly advantageous locations. (Ref no: 7 " The safety of nuclear installations")

Respiratory Protection

Breathing through any of a variety of materials

- facemasks, tissues, towels, or other cloth
- offers significant protection against the inhalation of particles.

(Ref no: 7 "The safety of nuclear installations")

Relocation

If large amounts of radioactivity persist in the area, sheltering is not a sufficient protective measure, and people must be moved from the area until it is decontaminated. (Ref no: 7 "The safety of nuclear installations")

Potassium iodide (KI) Prophylaxis

Iodine uptake by the body can be blocked by the ingestion of stable iodine prior to, or immediately after, exposure. If taken properly, potassium iodide will help reduce the dose of radiation to the thyroid gland from radioactive iodine, and reduce the risk of thyroid cancer. (Ref no: 7"The safety of nuclear installations")

Decontamination of people

Apart from removing people from the vicinity of radioactivity or using barriers, it is, in some situations, desirable to remove radioactive materials from the immediate vicinity of people. Decontamination includes removing contaminated clothing and washing off external contamination. (Ref no: 4 "Effects of radiation on the environment")

Decontamination of Land and Buildings

This is not generally considered an emergency response; however, it is important to remember that the significant off-site economic costs of a major accident will be for attempted decontamination and for property that is unusable because it cannot be sufficiently decontaminated. (Ref no: 6 "RBE for deterministic effects")

Protection of the Food chain

Ingestion of contaminated food and water can account for nearly half of the aggregate population's exposure to radioactivity. Food-chain interventions are thus crucial to emergency response efforts directed toward delayed health effects. (Ref no: 6 "Comparative uptake of actinides by plants and rats from the shoreline of a radioactive pond")

Medical Treatment

Finally, there is a need for medical efforts to alleviate consequences. Medical care entails screening and follow-up capabilities and the possibility of deploying a significant medical infrastructure. The most recent document IAEA from Feb. 2005 specifies more precisely the urgent protective actions and countermeasures should include the following:

Isolation of a contaminated area or radioactive source and prevention of inadvertent ingestion

- ❖ Evacuation
- ❖ Sheltering
- ❖ Respiratory protection and protection of skin and eyes
- ❖ Decontamination of individuals
- ❖ Stable iodine prophylaxis
- ❖ Protection of the food supply and prevention of the consumption of significantly contaminated foodstuffs and water
- ❖ Managing the medical response;
- ❖ Protection of international trade

REACTOR SAFETY:

a)Voda Voda Energy Reactor (VVER) is a Pressurized Light Water Cooled and Moderated reactor with four independent cooling loops. The reactor has horizontal steam generators in each loop that gives high water storage capacity. It uses hexagonal fuel assemblies which have low enriched fuel in oxide matrix, housed in sealed Zirconium- Niobium alloy tubes.
b)Kudankulam Nuclear Power Plant (KKNPP) is an advanced model of the Russian VVER 1000 that adopts the basic Russian design model marked V320 with Enhanced Safety Features to make it in line with IAEA GEN III reactors. Further, certain additional safety features were incorporated like Passive Heat Removal System taking it to GEN III+ category. Russian Federation has marked KKNPP reactor as V412.
c)The safety features of KKNPP were comprehensively reviewed by a task force of Nuclear Power Corporation of India Limited in the context of recent Fukushima accident. The report of the task force is available in the website of NPCIL and DAE.

a)Salient Normal Operating Parameters
b)Enhanced Safety Features
c)Heat Removal from Core
d)Primary Coolant Circuit (four independent loops)
e)Steam Generator (one in each loop)
f)Turbine & Condenser
g) Confinement of Radioactivity by following multiple barriers
h)Fuel Matrix and sealed Fuelclad
i)Reactor Coolant System with Chemistry control
j)Containment and Containment filtration Systems

(Ref no: 5 "Planning Basis for the Development of State and Local Government")

Radiation sources

People are exposed to natural radiation on a daily basis. Natural radiation comes from many sources including more than 60 naturally-occurring radioactive materials found in soil, water and air. Radon, a naturally-occurring gas, emanates from rock and soil and is the main source of natural radiation. Every day, people inhale and ingest radionuclides from air, food and water.

People are also exposed to natural radiation from cosmic rays, particularly at high altitude. On average, 80% of the annual dose that a person receives of background radiation is due to naturally occurring terrestrial and cosmic radiation sources. Background radiation levels vary due to geological differences. Exposure in certain areas can be more than 200 times higher than the global average.

Human exposure to radiation also comes from human-made sources ranging from nuclear power generation to medical uses of radiation diagnosis or treatment. Today, the most common human-made sources of ionizing radiation are X-ray machines and other medical devices.

CONCLUSION:

The present study aimed to find out the impact of rainfall on radiation. Further the study also try identify the significant variation between radial distance, Zone and radiation. To test the objectives the secondary data were used. Result concluded that there is a significant relationship between rainfall and radiation. Also it is concluded that there is a significant difference in radiation based on various radial zone. Further it is concluded that there is a significant difference in radiation based on various radial distance.

REFERENCE

1.Vernon E. Kousky, Mary T. Kagano and Iracema F. A. Cavalcanti (2010) A review of the Southern Oscillation: oceanic-atmospheric circulation changes and related rainfall anomalies, Article first published online: 18 JAN 2010
2.J. Marshall Shepherd, 2005: A Review of Current Investigations of Urban-Induced Rainfall and Recommendations for the Future. Earth Interact., 9, 1–27.
3.G. L. Stephens, 1978: Radiation Profiles in Extended Water Clouds. II: Parameterization Schemes. J. Atmos. Sci., 35, 2123–2132.
4.Kirsti Jylha (1993) Empirical scavenging coefficients of radioactive substances released from chernobyi Atmospheric Environment. General Topics volume 27, Issues 17–18, Pages 2695-3043
5.Van Der Westhuizen (1989) Radioactive nuclear bomb fallout: A relationship between deposition, air concentration and rainfall Atmospheric environment volume 23, Issue 12, Pages 2639-2873.