27th June 12.

Radiation Pollution and environmental biotechnology

→ Radiation Pollution

→ Pollution

According to odum in 1971, pollution is undesirable change in the physical, chemical or biological characteristics of our land air, and H_2O that may or will harmfully effect human life or that of desirable species, our industrial process leaving cond? and an cultural assest.

→ Types of Pollution

- Air
- water
- soil (Land)
- Noise (sound)
- Radiation

Pollution
→ Defination
→ source of pollution
→ Effect of living organism
→ control of pollution
→ Conclusion

02 2012 January Monday

JANUARY 2012

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→ RADIATION POLLUTION

It is defined as increase ~~due~~ in the natural background due to human activity, involving the use of naturally occuring or artificially produce radio-active materials such that it becomes harmful for living organism.

→ Radioactive

The elements which emitts α, β, γ rays are called radioactive element and phenomenon is called radioactive

→ DISCOVERY OF RADIOACTIVE

Henery Becaverel in 1895

→ Radiation

γ	x-ray	U.V	visible ray	I.R	Microwave	Radiowaves

$< 1nm$ $100nm$

Red → Wavelength more Energy less.

Violet → less wavelength Energy more.

Wavelength $\propto \frac{1}{\text{Energy}}$

Radioactive materials has increased considerably in the form of nuclear testing power generation, medical application radioactive tracer, nuclear accident and radioactive waste disposal

→ Half life period
Radio active element has a definite rate of decay known as the half life period ($T_{1/2}$)

Half life period of any element = $\frac{0.693}{\lambda}$

where
λ = disintegrated const. or decay const.

→ Radioactive rays α, β, γ rays were pronounced their name by Rutherford

→ Properties of 3 rays.

Properties	α	β	γ
(i) Charge.	+ve	-ve	neutral
Mass	4 unit	9.11×10^{-28} mass	No mass
Velocity	1/10 of Vel. of light in Vaccum	1.6×10^{10} cm/sec to 2.8×10^{10} cm/sec.	Equal to vel. of light in Vaccum.

04 2012 January Wednesday

Properties	α	β	γ
Penetration Power	Less	More	Maximum
wavelength	Maximum	More	Less
Harmfull effect	Not harmfull	Not more harmfull	Most harmfull
Energy	Less	More	Maximum

→ Types of radioactives elements

→ Two types of " "

(1°) Natural radioactive elements

(2°) Artificial radioactive elements.

→ Natural radioactive elements

Po (84) → Polonium

At (85) → Astatine

Rn (88) → Radon

Ac (89) → Actinium

Th (90) → Thorium

Pa (91) → Protactinium

U (92) → uranium

→ Artificial radioactive elements

08 Np (93) → Neptunium

09 Pu (94) → Plutonium

10 Ha (105) → Hahnium

11 7th July 12.

12 → unit of radioactivity and measurement of toxic dose

01 unit of radioactivity measurement is the curie (ci). The amt. of radioactivity material

02 in which 3.7×10^{10} disintigration occur/sec.

03 → Different unit of measurement

04 (i) Millicuric (mci) = 10^{-3} ci

05 (ii) Microcuric (uci) = 10^{-6} ci

06 (iii) Picocuric (pci) = 10^{-12} ci

(iv) Becquerel (BQ) = 2.7×10^{-11} ci

→ Becquerel → is the S.I unit of radioactivity and it is defined as the amt. of radioactivity material that has 1 nuclear disintegration / sec.

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→ Radiation dose / Toxic dose

It is the amt of radiation received per unit time

→ Different scale of measurement of the dose rate

(i) Rad → Absorbed dose of 100 ergs of tissue

(ii) Rodentgen → unit of x Rays & γ rays intensity.

The amt of radiation that will produce 1 electrostatic unit of electricity in 1 cubic cm of dry air at NTP

(iii) Rem (Rodentgen equivalent mass).

The amt of radiation that will produce 1 electrostatic unit of electricity in 1 cubic cm of dry air at

(iii) Rem (Rodentgen equivalent mass.

The amt of radiation that will produce an energy dissipation in man i.e biologically equivalent 1 Rodentgen of radiation of x-rays.

Note — 1 Rodentgen = 10 rads. (1000 ergs/gm)

(iv) gray → It is the S.I unit of radiation & equal to 100 rads.

08

1 gray = 100 rads.

09

10 → Radiation energy is measured in e⁻ volt (eV)

11 An e⁻ volt. is defined as the energy acquired by an e⁻ or a proton in moving through a potential difference of 1 volt and this is equivalent to

12 01 1.6×10^{-12} ergs or 1.6×10^{-9} joule

02 EV = 1.6×10^{-12} ergs or 1.6×10^{-9} Joule.

03

→ # Types of radiation

04

05

Ionizing radiation (X-rays, B rays, Y rays

Non-ionizing radiation (U.V rays

06

Sunday 08

Source

Natural resource.

Artificial resource (Manmade radiation)

(i) Nuclear fission in nuclear reactor
(ii) Fission fragment
(iii) Nuclear fission
(iv) Radio nuclides
(v) Nuclear weapon
(vi) Radio isotopes

(i) Radio frequency
(a) Radio & TV broad
(b) Induction heating
(ii) Microwave
(a) Radar
(b) Industrial application
(c) Microwave oven
(d) Power transmission

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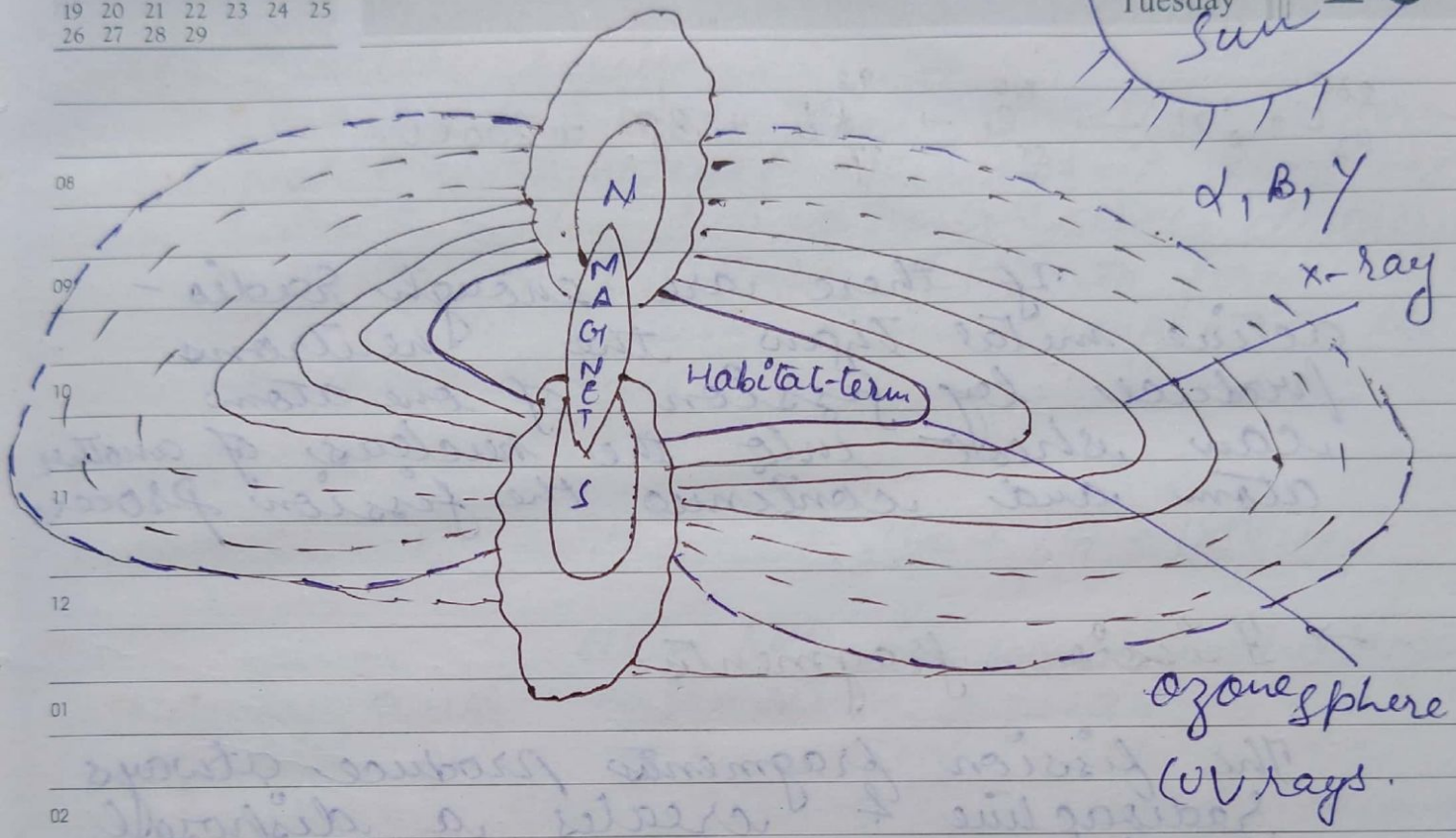
→ Natural resource

(i) cosmic rays
They are mixture of corpuscular and electromagnetic radiation. The intensity of cosmic rays in low in the biosphere but they are a measure hazard in the space travel.

12th July 12.

→ Natural radiation
cosmic rays continously bombeard into almosphere to produce radioactive materials metals and natural radiation where nucleus in the atmo. is scrubed by a energy cosmic rays particles. It gains large amo. of energy & then disruption into a no. of small nuclides. mostly prolons & neutrons these particles lead the site of collision with high energy

$$^{14}_{7}N + ^{1}_{0}n \longrightarrow ^{14}_{6}C + ^{1}_{1}H$$



Man-Made Radiations

→ Man-made radiation originates from different activities including radio Nucleitide, testing of nuclear weapon, Power generations, medical application & other field.

(i) Nuclear fission in atom reacter
The atomic ~~rea~~ nucleus is broken into two lighter nuclei of abt. the same size along with the generation of heat & additional neutrons

ELISA → Enzyme Linked Immunosorbent assay

RIA → Radio immunoassay

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11

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$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{140}_{55}Cs + ^{93}_{37}Rb + 3^{1}_{0}n + 200\,eV.$$

If there are enough Radio-active metal than the neutrons produce by fission of one atom can shoot into the nucleus of another atom and continue the fission process

→ Fission fragments.

The fission fragments produce always radioactive & creates a disposal problem. The fission fragments usually includes &

(i) Cesium 137 → which concentrate in muscles

(ii) Strontium 90 → which concentrate in bones

(iii) Iodine 131 → which concentrate in thyroid

NOTE.

Direct ELISA → To detect antigen

Indirect ELISA → To detect antibody

(2°) Nuclear fussion

Two nuclei are joint together to form just one nucleus, Typically it involves the fussion two atoms such deutarium & Tritarium (isotopes of H) to form a single helium atom along with the release energy.

$$_1^2H + _1^3H \longrightarrow _2^4He + _0^1n + 18MeV.$$

This RK? is used in hydrogen bond and extensive research. are ~~we~~ ~~bigl~~ being connected use of the RK? as an alternative energy resource

→ Radio nucleides.

some atomic nuclei are unstable and gradually decay. During decay, spontaneous changes takes place with in the nucleus and various form of radiation are emitted

Ex. uranium $_{92}^{235}U$ ~~235~~ receives a neutron and is transfer into plutonium

$$_{92}^{235}U + n \xrightarrow{\alpha\text{-Particle}} _{92}^{239}U \xrightarrow{\beta\text{ Particle}} _{93}^{239}U$$

$$_{92}^{235}U + n \xrightarrow{\alpha\text{-Particle}} _{92}^{239}U \xrightarrow{\beta\text{-Para}} _{93}^{239}Np \xrightarrow{\beta} _{94}^{239}Pu$$

This plutonium along with several colour long life radiation reflects make a dangerous radioactive nuclear waste.

19th July 12.

Radio isotope – Application

(i) Radio iodine is used to detect any side effect appears inside the thyroid gland.

(ii) Radiophosphorus is used today incurin bone marrow disease.

(iii) Radio sodium is used to measure the speed blood flow in human body.

(iv) The radio iron is used to detect the disease anemia, tuberculosis & other man made nutrient.

(v) The cancerous cell are destroyed completely by the use of radio isotope Ex- Cobalt-60 is today frequently used in therapy of cancer in destroying brain tumour. The element radium has been used for burning & destroying cancerous cells

→ Nuclear fission
Test explosion or explosion of nuclear weapon is another important source of ionising radio active isotope.

→ Non-ionising radiation

It is related to FM. The non-ionising radiation may of 2 types.

(i) Radio frequency

(ii) Microwave.

Radio frequency
There are several sources of radio frequency

(a) Radio & TV Broadcasting →
There are a good no. of radio & TV broadcasting station including both AM & FM. The ERP (Effective radiated Power) of AM station ranges from 100 watt to 50 K watt. The ERP of F.M & T-V st. are even greater, due due to growing population homes & business

houses are located in vicinity of the antena in-stallation

ECG- is inst. Cram → recorder.

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(b) Induction heat

Radio frequency is used for induction heating which is applied in melting & soldering operation during the process of substancial amt of energy is lady heated into the surrounding space.

(c) Effect of R.F radiation

Person who have been prolonically exposed to radio frequency radiation, radios blood pressure, slow heart beat & ECG changes it is postulated that these change in cardiovascular system are due to the direct electromagnetic energy on the surface receptor of the nervous regulatory system.

(d) Microwaves.

It is the 2nd form of non ionising radiation

(i) Radars

Radars are used in military operation for different purpose, in air port for air traffic control, in ships to avoid collison with other ship

Radar are used & tested for automatic breaking of automobile to avoid collison. People are exposed to micro-wave radiation every day

(ii) Industrial Application
It is used for drying paper, leather and pharmastatical products.

(iii) Microwave oven
The most notorious & potential source of harmful M.W radiation

(iv) Power transmission
Substancial amt. of power may be transmitted by means of microwave, Now a days synchronous & big satellite are ~~us~~ power are used for MW power transmission. The satellite converts solar energy to d.C. (Direct current)

→ EFFECT of Microwave radiations

(i) Most evident effect of microwaves has been recognised cataract.

(ii) M.W radiation are known to cause cardiovascular disturbance.

Milory & Michaelsom in 1972 reported enlargement of thyroid gland with increase absorption of iodine in a worker exposed M.V radiation

(iii) U.V Rays.
whenever we exposed by U.V Rays it leads to dimer formation & cause mutation

26th July 2012.
→ Effect of ionising radiation.

→ Mechanism
All forms of ionizing radiation are dangerous to living things. These radiation when enters to the tissue excite the e^- of the molecule and may remove them causing ionization. Thus the molecules become unstable resulting in the # brokage of the chemical bonds and other molecule damage.

Low level exposure can cause somatic & genetic changes somatic damage increase the risk of cancer to organism having oncogenes. It causes higher risk of leukemia, sterility cataract

PYRIMIDINE = CRC.
PYORINE = ART.

and reduction in life span genetic damage brings abt mutation in the chromosomes.

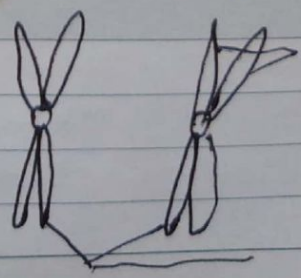
→ EFFECT ON HUMAN BEINGS.

SOMATIC EFFECT
This effect leads to shorting of the span loss of hair and cancer

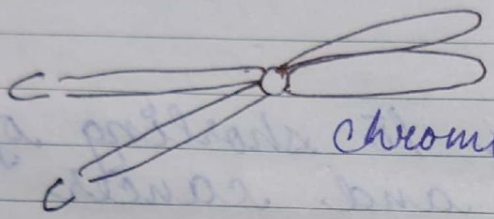
Genetic effect
This genetic effect includes chromosomal abberation which are carried on the subsequent generation such effect may lead to the death of embryo neo-natal death or birth of offspring with abnormalities

→ chromosomal abberecation (deletion)
chromsal abberation of all kind in cells naturally occur in small proportion irradiation

Aberration that involves both sister chromatid at any one position along the chromosome and those that involves only one sister chromatid is called chromatid abb aberration.

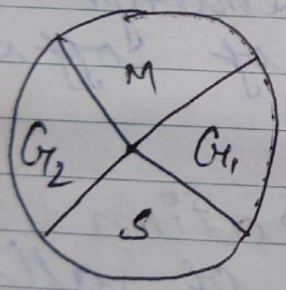


chromosome aberration are found in cells that are irradiated reporter chromosome had replicated themselves (Prior to S-phase)



Chromosomal aberration

Chromatid aberration



▷ DNA - replication happen in S-phase.

→ GENE MUTATION

▷ Depending on the dose of irradiation the rate of gene mutation can be enhanced by thousand folds or more as compared to spontaneous mutation.

→ Damage in DNA (X-rays & γ rays)

X-rays → X-rays break single strand DNA

γ-rays → damage double-strand DNA break

NOTE → Irradiation cause various type of damage in DNA. Irradiation in lower does bring abt the change in physical structure of DNA. such as cross linking with in or b/w molecule of and break of sugar phosphate chain

DNA is genetic material
It is not auto catalysed (can not break itself) 5' phosphate gr 3'-OH grp

→ EFFECT ON ECOSYSTEM (TREES & PLANTS)
Effect of γ-radiation on ockpine forest was studied at national level tree on long island (New york)
T-source usually either cobalt (60) Or Cs(137) have been placed in the field of forest at long Island.

Sunday 22

* Co(60) USED TO KILL CANCEROUS CELL
This resulting were as under certain has shrub & grasses were less resist- wild pines were more sensitive than oaks. Pines didnot resprout when terminal bud were killed.

Any radioactive substances with long half life introduced into environment anywhere in biosphere will sooner or later find it way into mans body. Radioactive substance disposed in environment may become concentrated in living organism during food change transfer by a process is called Biological magnifical.

→ EFFECT ON AQUATIC ECOSYSTEM.
In aqeatic org. effect of ionising radiation also occurs on the basic of dose such as LD50. Lower organism like bacteria, Protozoa and algae are generally much tolrent than higher organism. In earlier stage higher org tends to be more sensitive than later stage

* Protein immuno blot
Western blot detects → Protein / electrophoresis
Northern → RNA
Southern → DNA
get used.

→ CONTROL AND MANAGEMENT OF RADIATION POLLUTION

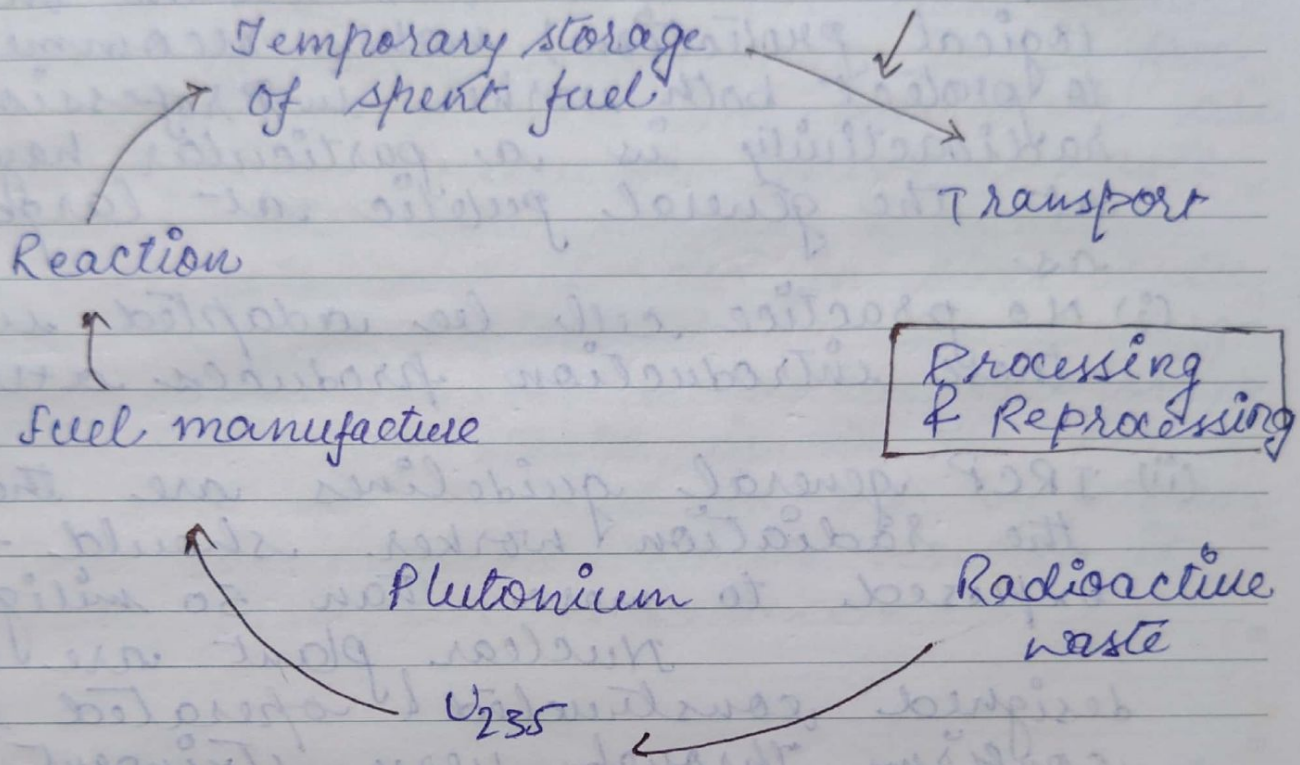


Fig. Hazard are involved at every steps, in the process of generation of Nuclear power from mining to waste materials produced during the operation.

Effluent from mixing & refining of ores contain a small % age also involved a small % age of leakage, show does transportation and reprocessing of spent fuel.

5th Week • 025-341

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→ Management of radiation pollution

IRCP (International commission on radiological protection) makes recommendation to protect both worker in profession were radioactivity is a particular hazard at the general public at large such as

(i) No practice will be adapted unless these introduction produces a +ve benefit

(ii) IRCP general guidelines are that of the radiation worker should not be exposed to more than 50 miligray

Nuclear plant are located designed constructed & operated to confirm through very stringent safety standard to ensure that the risk associated with atomic energy is extremely low. An exclusion zone of 1.6 km radius around the reactor established which is free habitation

→ WASTE DISPOSAL

The waste products are stored in a special shielded tanks long term storage of nuclear waste relies on the use of multiple barries to prevent

radiation escape one method of disposal consist of a series of chamber dug deep in the ground that has been checked to make sure that it is free form of geological. The chamber are atleast 60m below the surface waste packed in the steel drums & concern in concrete are loaded in other outer cases and a stocked in the underground chamber. Another method of storing higher level of waste is in the liq. form. This is reduced in vol. by process called vitrification, which convert it into a glass like substance.

NOTE – Radio activity may be measured by a Geiger – muller counter.