Background Radiation Natural and Manmade

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Radiation –A Constant companion in our life

- Everything originates from Panchatatvas
- Akash, Air, Water, Sun and Earth
- Radiation is present every where all the time
- Radiation Originates in Nature

Natural Background Radiation

- We are all exposed to ionising radiation from natural sources all the time. This radiation is called natural background radiation.
- This radiation is always around us whether we are indoors or outdoors, sleeping or working , eating or travelling

Main sources of natural background Radiation

- Radioactive substances in the earth's crust
- Radioactive gases coming out from earth
- Cosmic Rays from outer space, which bombard the earth
- Radioactive elements in our body

Radioactivity from the earth

- When earth was formed it contained many radioactive elements.
- Some of the radioactive elements are still present and are giving us the radiation dose constantly.

Natural Radioactivity in Building Materials in India (Bq/kg)

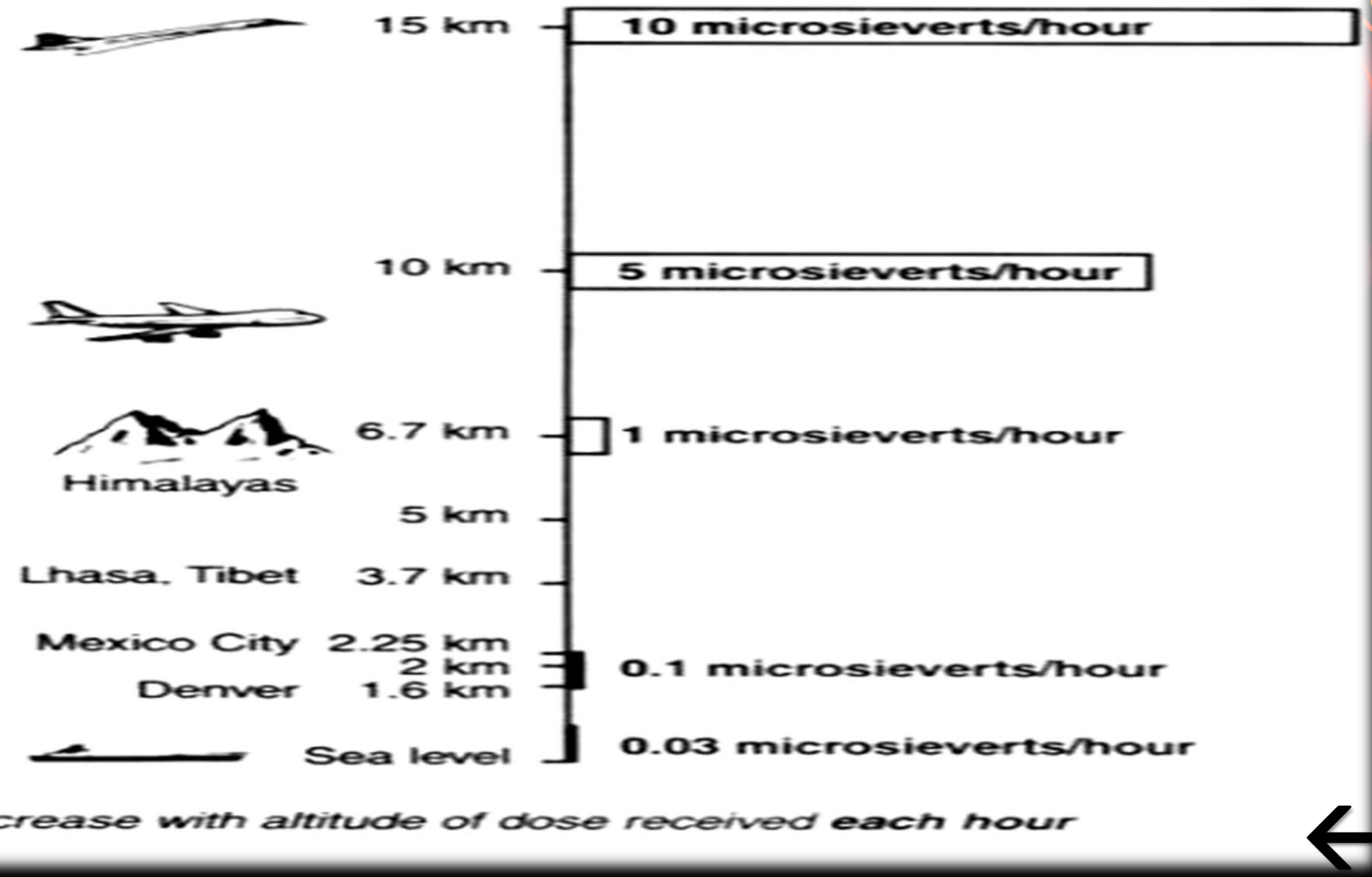
Material	Potassium [K-40]	Radium [Ra-226]	Thorium [Th-232]
Cement	385	377	78
Brick	1390	48	126
Stone	1479	155	412
Sand	1074	5047	2971
Granite	1380	98	240
Clay	477	1621	311
Fly ash	522	670	159
Lime stone	518	26	33
Gypsum	807	807	152

Upper values of the range are produced for ease of comparison. Source: RPD, 59 (2), 127 – 133 (1995), V.K.Shukla et al.

Cosmic Rays

- These are extremely energetic particles, primarily protons originating from Sun
- These react with air and finally reach us in many forms.

Cosmic radiation variation with altitude



Natural Radioactivity in the body

- Naturally occurring radioactive elements are always present inside our body. They enter our body through food we eat, water we drink and air we breath
- These isotopes are mainly Tritium, Carbon-14 and Potassium-40

Radiation from what we eat everyday…

Food Stuffs	Potassium-40 (Bq/kg)
Rice	40 – 90
Leafy Vegetables	80 – 220
Brinjal	90 – 140
Tapioca	85 – 120
Carrot	60 - 120
Beetroot	90 - 120

Radiation: Perception and Reality, BARC News letter, 2002

Radiation from what we drink everyday…

- Radioactivity in milk is 200 times compared to drinking water
- From a cup of milk ~ 180 beta particles of radioactive potassium are emitted per minute.
- From a cup of tea ~ 91 beta particles of radioactive potassium are emitted per minute from tea leaves (plus additional radioactivity due to milk and water).

Click for more…

Radiation: Perception and Reality, BARC News letter, 2002

Radiation from Man Made sources

- We also receive radiation dose due to man-made sources
- Medical radioactivity exposures during X-rays and CAT scans , nuclear medicine and radiotherapy gives very high radiation dose to us
- Dose is also received from nuclear fall-out, exposures during work and from radioactive discharges during operation of Nuclear Power Plants

Radiation Dose (micro Sv)

• Dental X-ray	10
• Chest X-ray	100
• Spinal X-ray	1500
• Abdominal X-ray	4000
• Full Body CT Scan	10000
• Heart CT Scan	15000

Average Annual Radiation Exposure (micro SV)

Type	Source	World Average	Range
Natural	Air	1260	200 – 10000
	Internal	290	200 - 1000
	Terrestrial	480	300 - 1000
	Cosmic	390	300 - 1000
	Sub-total	~2400	1000 -13000
Man Made	Medical	600	30 - 2000
	Fall-out	7	0 - 1000
	Others	5.2	0 - 20000
	Sub-total	~600	0 - 20000
Total		~3000	0 - 20000

Variations in Background Radiation

- **The background natural radiation fields are measured by INDIAN ENVIRONMENTAL RADIATION MONITORING NETWORK (IERMON) by BARC, DAE**
- **IERMON has several stations across the country. The data show that there is at least 10 % variation in the radiation fields at same place**


ERMON DAS

IERMON Records (Jan. to Oct. 2011) (micro Sv/year)

Place	Average	Max.	Min.
Bhuj	692	876	561
Nagpur	736	858	674
Kalpakkam	780	3162	456
Kudankulam	946	1148	473

Simily between radiation dose and heat

- **Just like exposure to very high temperature, acute radiation exposure of a person to a very high radiation field of the order of 10000000 micro Gy(10 Gy) will lead to death within few days after the exposure.**

Simily between radiation dose and heat cont...

- Persons live comfortable in temperatures of 0 to 45 degree Celcius just like in low radiation dose areas and a small random variation will not cause a harm
- Kitchen temperature is generally higher by few degrees but ladies who spend more time in kitchen are not harmed.

High Natural Background areas in India

- Karunagappally taluk in costal Kerala has radiation background up to 70000 micro Gy/y due to the deposits of Thorium in the sand and studies on the people of the area have shown no higher occurrence of cancer.

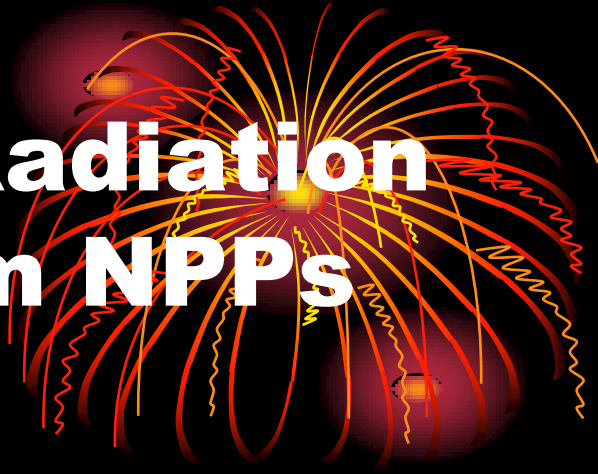
Natural High Radiation Background

- In some parts of Ramsar, a city in Northern Iran people have been receiving up to 260000 micro Sv/y dose due to natural radiation background. Cytogenetic studies show no significant differences between people in the high background compared to people in normal background areas.

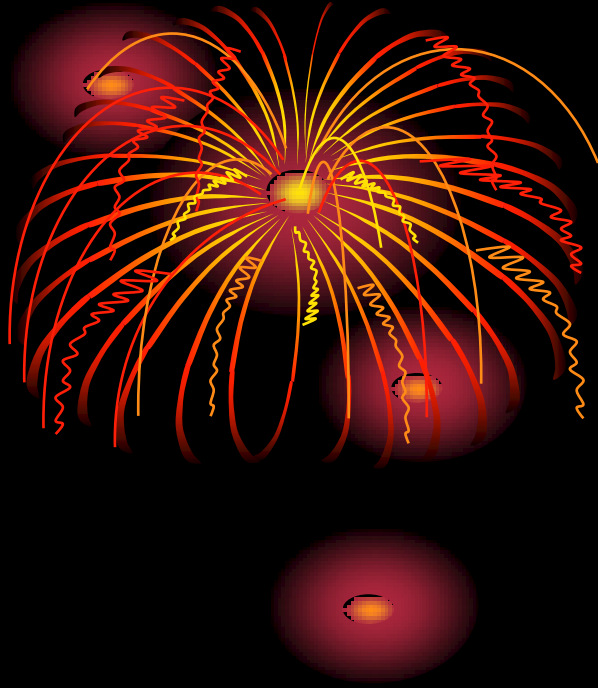
Natural Background Radiation visa-vis radiation from NPPs

- Compared to the average natural radiation background dose of 2400 micro Sv/y the radiation dose from Indian Nuclear Power Plants during 2010 was 0.42 to 39.6 micro Sv to the persons near plant boundaries .

Natural Background Radiation vis-a-vis radiation from NPPs cont....



- It can be seen that the dose to the public from Indian NPPs is insignificant compared to the natural background and the seasonal variations in natural background at any place.



Thank you