

Public Perceptions About Atomic Energy Myths Vs. Realities

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*This may well be a good **presentation**
but I've got two problems with
nuclear power . . .*



*. . . I know absolutely
nothing about it . . .*



**. . . and I don't trust
those who know!**



Major Public Perceptions About Atomic Energy

Answering deeply rooted public concerns about nuclear energy means challenging four wide spread myths

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- 1. Nuclear energy fosters nuclear weapons proliferation.**
- 2. Nuclear reactors are not safe.**
- 3. Nuclear waste disposal is an insoluble problem.**
- 4. Radiation is deadly. So any technology involving radiation is inherently dangerous and the products of such technology are essentially radioactive.**

The first myth- 'Nuclear reactors are likely to breed weapons' has little foundation in experience.

Question : When did Hiroshima and Nagasaki happen ?

Answer : 6th & 9th August, 1945 respectively.

Question : How many Nuclear Reactors were operational then ?

Answer : None

- **The first five countries to build Atomic bombs did so before moving to electricity generation through nuclear power.**
- **Thus, technically speaking, power reactors were and are not necessary intermediate steps for making nuclear bomb.**

The second myth is that a nuclear power plant itself is like a bomb-likely, in case of an accident, to explode or to release massively fatal doses of radiation. These fears are based on the collective memories of accidents at Three Miles Island and Chernobyl.

The simple truth about Three Miles Island is that public health was not at all endangered. Despite a series of mistakes which seriously damaged the reactor, the only outside effect was an inconsequential release of radiation which was negligible when compared to natural radiation in the atmosphere.

The Chernobyl accident was a tragedy with serious human and environmental consequences. The reactor lacked the safety technology, the procedures and the protective barriers considered normal elsewhere. But we must remember that even this accident involving massive release of radiation did not result anywhere comparable to an atomic explosion.

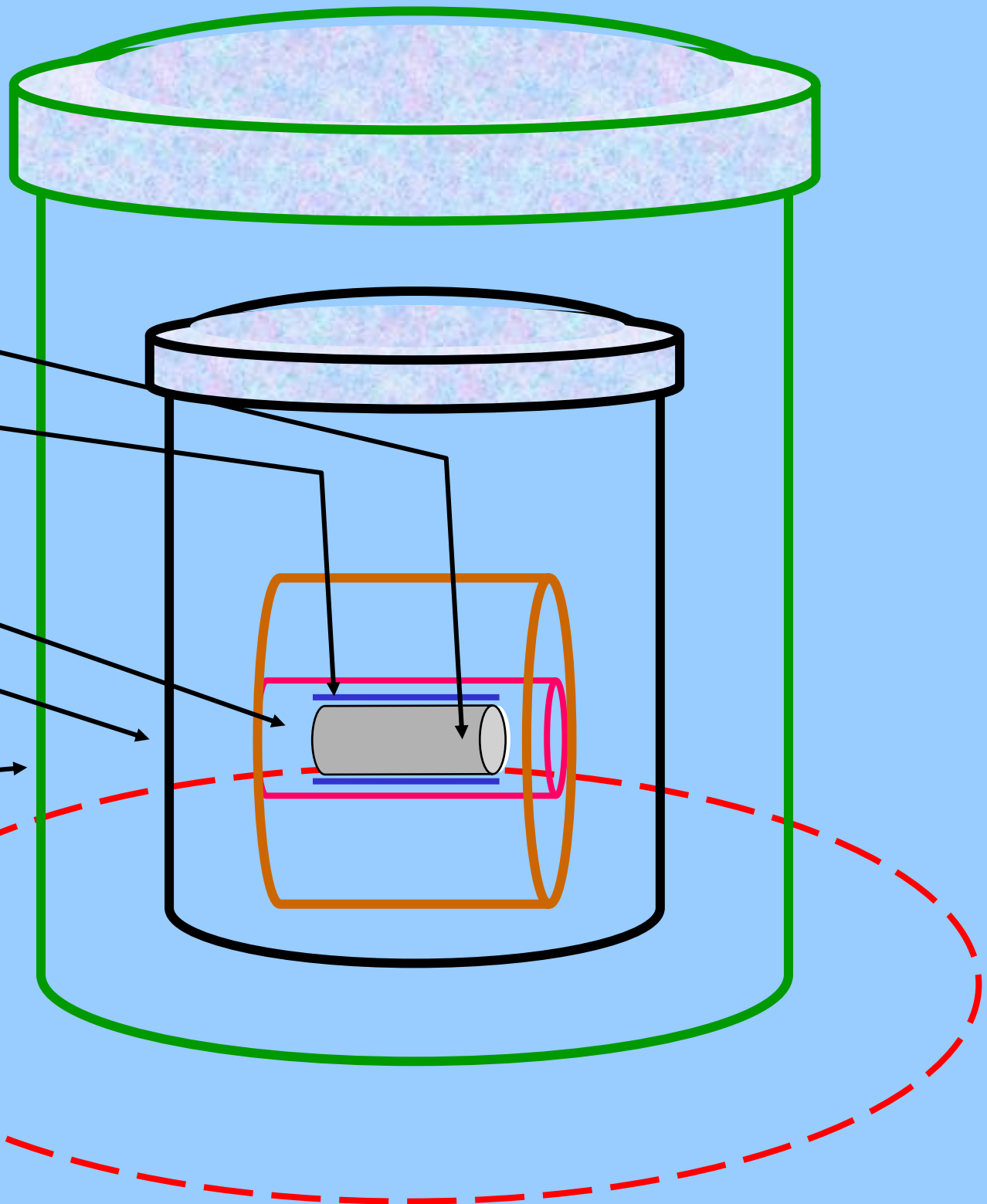
The global nuclear industry with about 440 operating reactors, is having about 10,000 reactor years of operational time and has produced just one serious accident with not a very large number of casualties immediately or even many years after the accident.

Meanwhile, production and consumption of fossil fuels yields a constant flow of accidents and disease, in addition to the green house gases.

As per a WHO report, about three million people die each year due to air pollution from the global energy system dominated by fossil fuels.

BARRIERS

1. PELLET
2. CLADDING
3. PHT
4. PRIMARY CONTAINMENT
5. SECONDARY CONTAINMENT
6. EXCLUSION ZONE



If a life threatening dose (50% probability) is illustrated by the height of the Eiffel tower (over 300 meters), the dose limit for occupational workers in the nuclear industry corresponds to the height of a man (2 meters) and the limit for the public to the thickness of a brick (0.1 meters).

← *Life threatening dose - more than 3000 mSv*

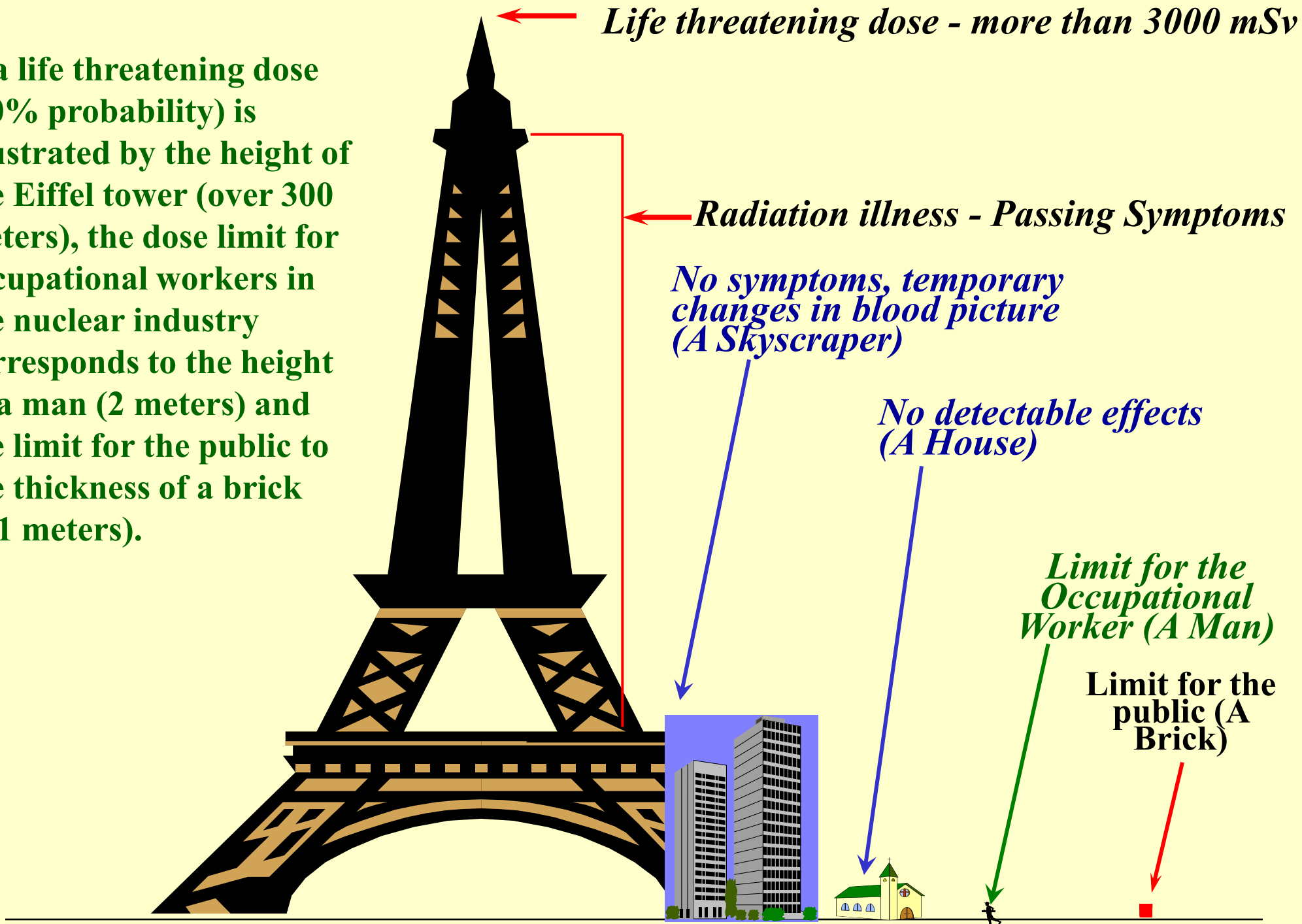
← *Radiation illness - Passing Symptoms*

No symptoms, temporary changes in blood picture (A Skyscraper)

No detectable effects (A House)

Limit for the Occupational Worker (A Man)

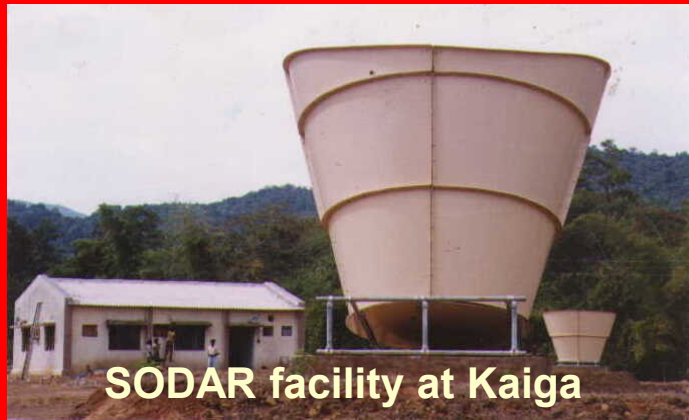
Limit for the public (A Brick)



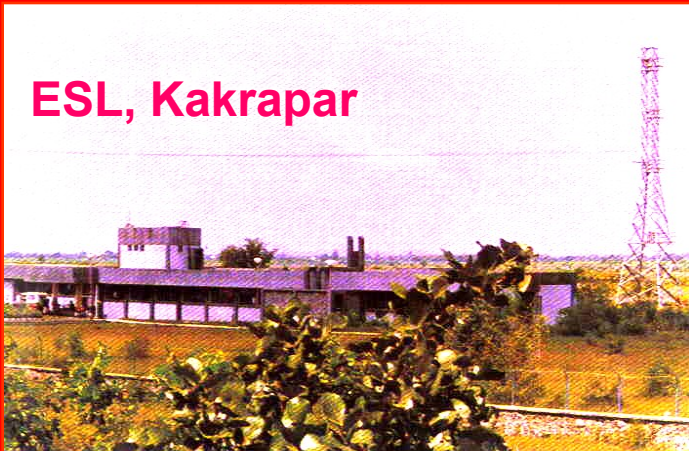
Radiological Safety



Environmental Survey Laboratories are set up before any major nuclear facility is established. These laboratories continue to monitor the surrounding environment throughout the period of the existence of the facility.

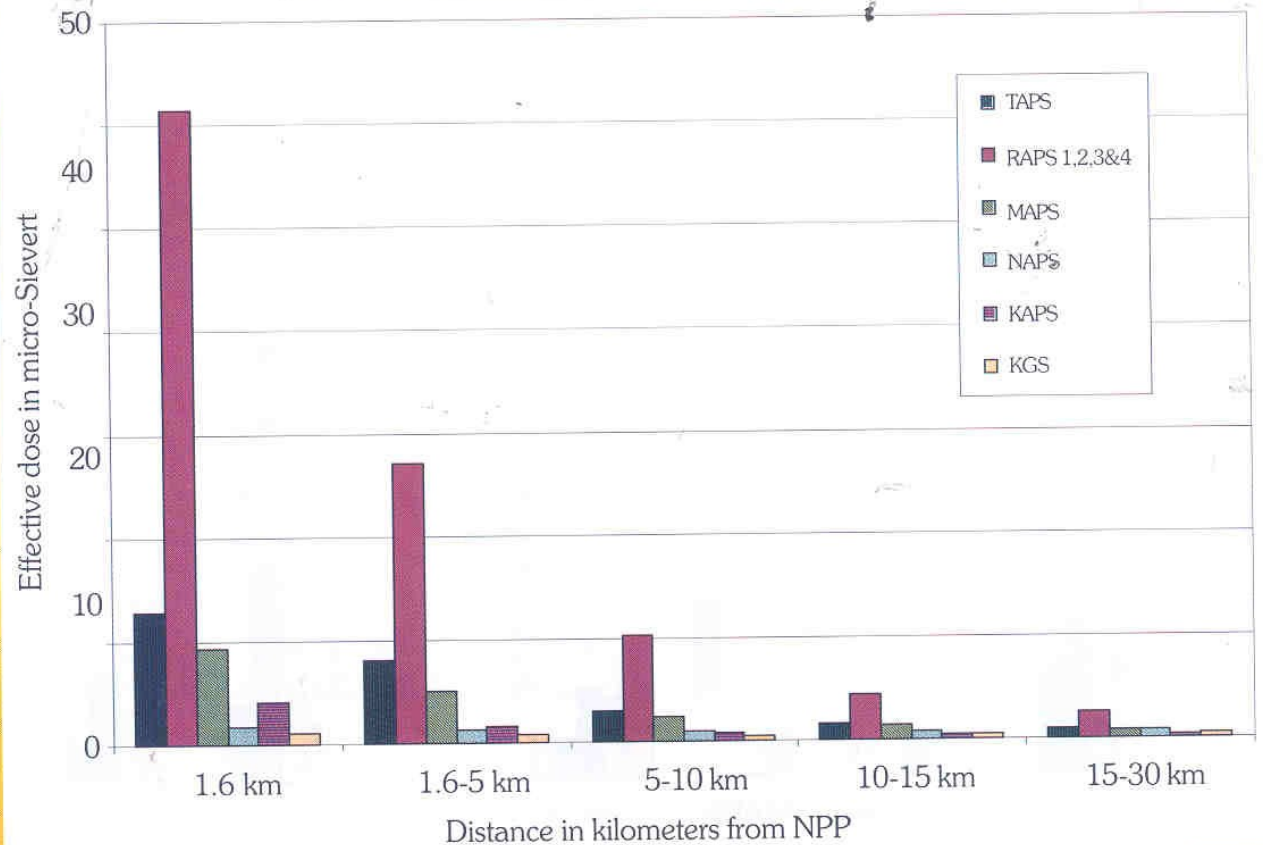


SODAR facility at Kaiga



ESL, Kakrapar

Fig 4.2b: Total Effective Dose in Different Zones during the Year 2004
(AERB Prescribed Annual Limit is 1000 micro-Sv)



What would have happened, if all safety systems had failed?

The facts are: We had a burst pipe. The safety systems worked properly, the leakage was stopped, the emergency systems started, and the power station is now in a completely safe condition. Let's talk about what happened not what could have happened.

Yeah right, but back to the question: What would have happened if . . .



Nuclear Waste Management

Many a times it is commented that nuclear waste is an insoluble problem- a permanent and accumulating environmental hazard.

The reality is that of all the energy forms capable of meeting the world's expanding energy needs, nuclear power yields the least and most easily managed waste.

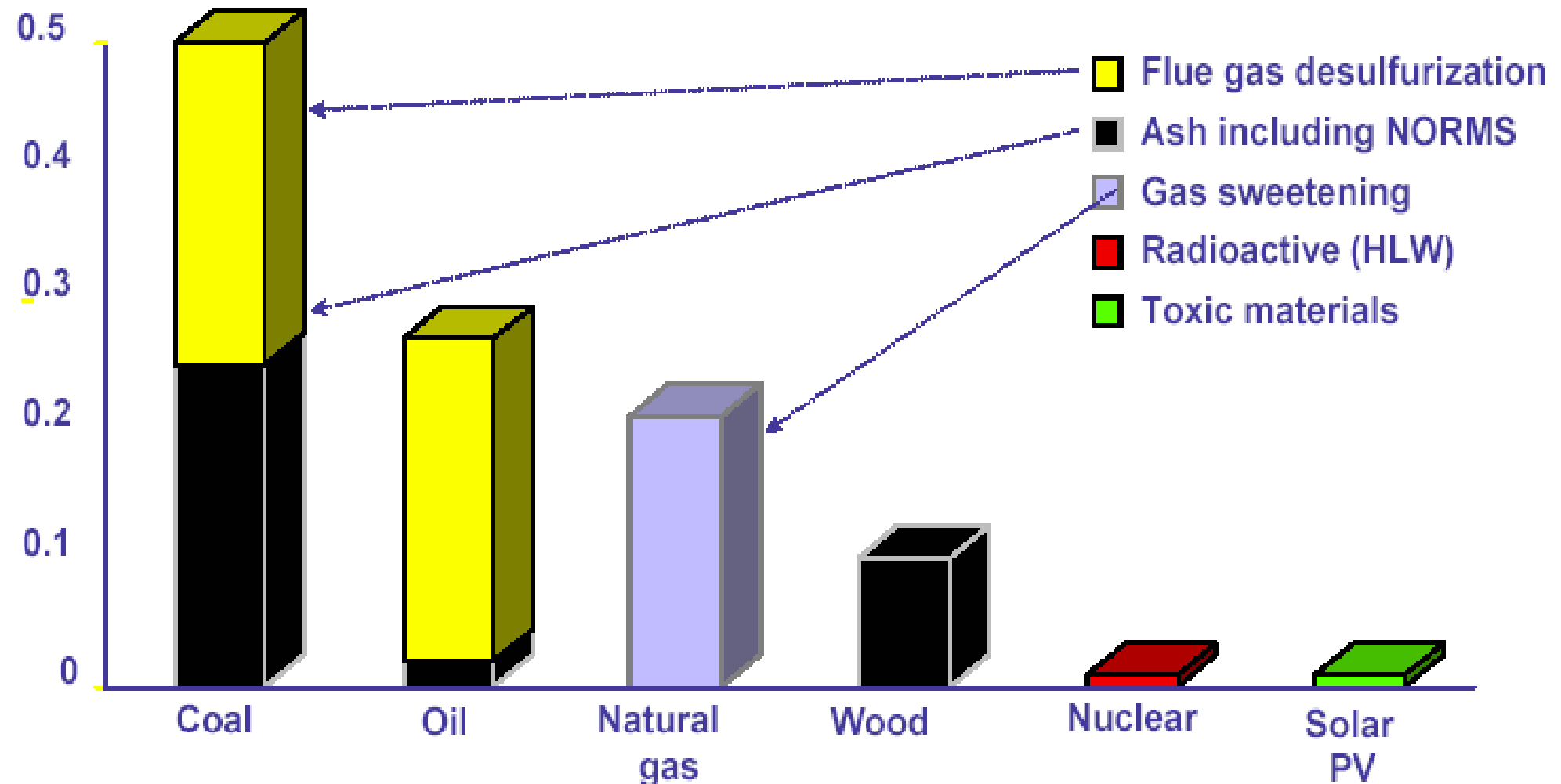
On the contrary, it is the fossil fuel and not nuclear power that presents an insoluble waste problem. This has two aspects -

1. The huge volume of waste products primarily gases and particulate matter.
2. Method of disposal which is dispersion in to atmosphere.

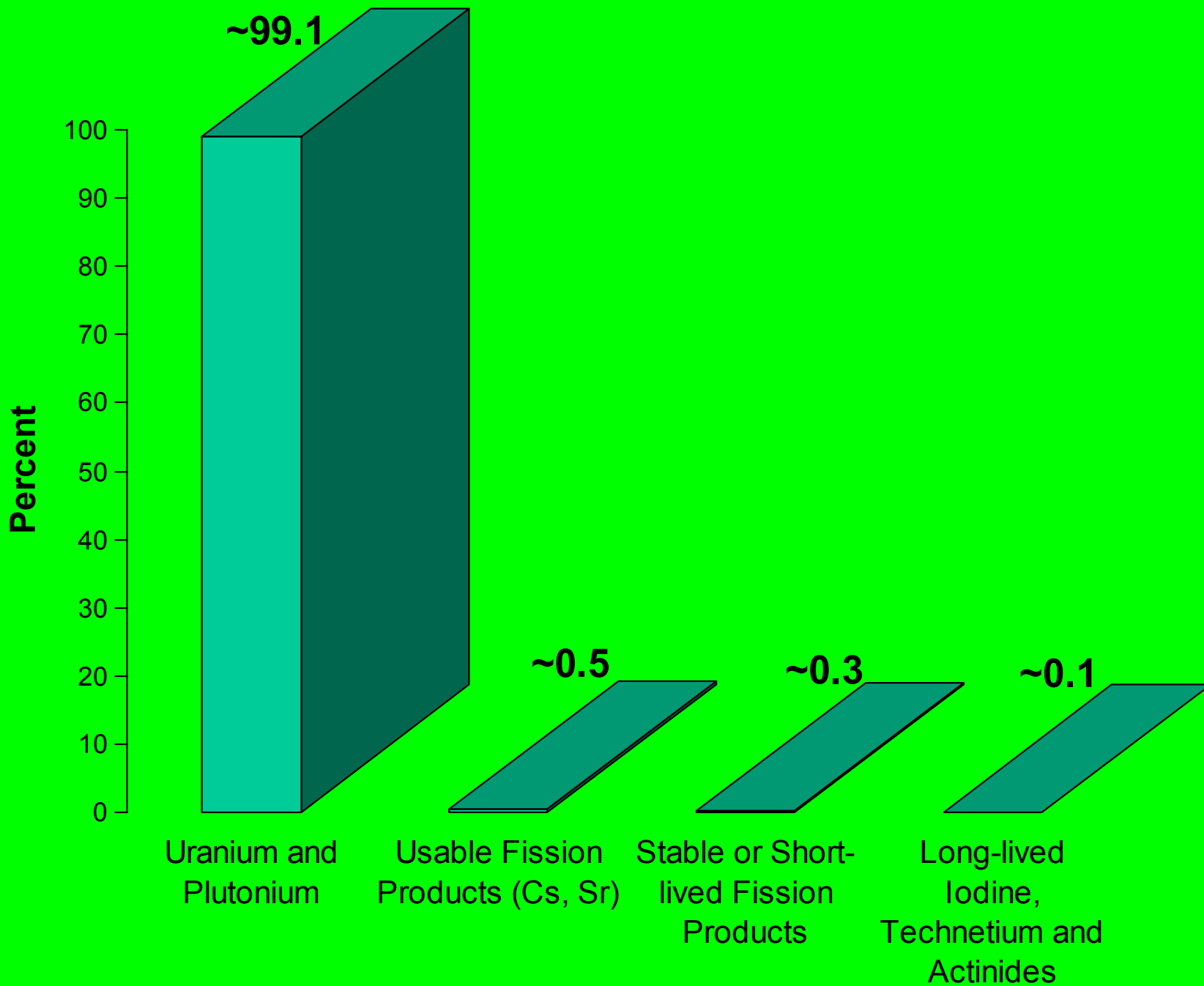
Neither of the above two problems seems subject to amelioration through technology.

Wastes in Fuel Preparation and Plant Operation

Million tonnes
per GWe yearly



CONSTITUENTS OF SPENT NUCLEAR FUEL



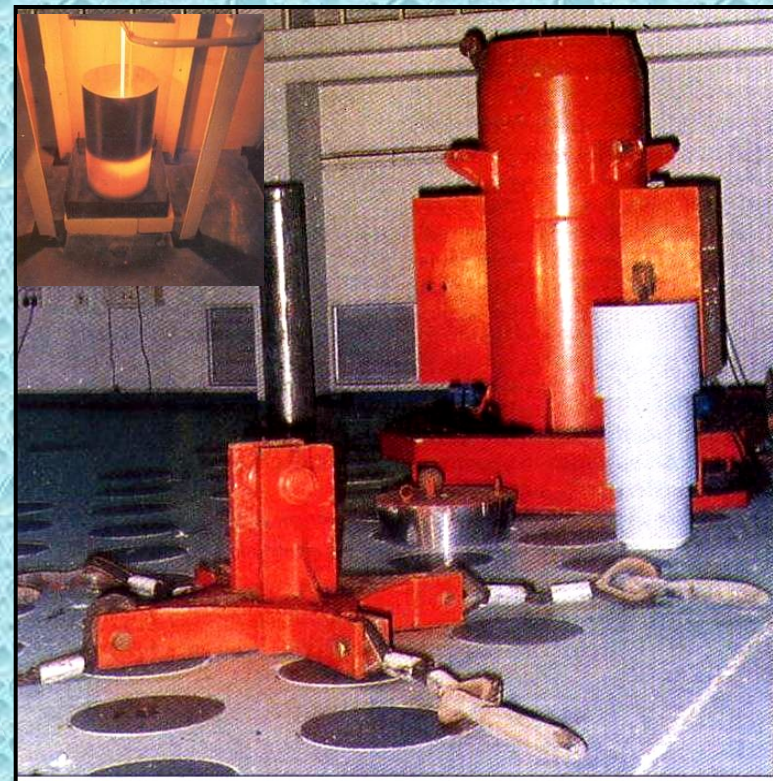
Nuclear Fuel Cycle: Back End

KARP

- ↳ *Reprocessing plants at Trombay, Tarapur and Kalpakkam*
- ↳ *Waste Immobilisation Plants at Tarapur and Trombay*
- ↳ *Solid Storage Surveillance Facility, Tarapur*



- ↳ *SSSF can store solid waste generated during the operation of two nuclear reactors, 220 MWe each, for 40 years.*
- ↳ *India is the fourth country to have such a facility.*
- ↳ *Thorium based fuels can go to high burn-ups and so waste generated is much lower*





Did you say that the bedrock will endure millions or billions of years?

Billions

Thank God...

NUCLEAR
WASTE
CONFERENCE

The fourth myth is about radiation and any thing associated with it. No doubt, exposure to large doses of radiation can be dangerous as they may cause two types of biological effects-

- 1. Somatic effect - where person exposed is affected, and**
- 2. Genetic effect - which occur in the descendants of the exposed persons.**

Toxic chemicals released from chemical and petrochemical industries, coal fuelled power stations and burning of fire wood and cow dung can also cause similar biological effects.

We must remember that -

- Radiation has always been a part of the natural environment.**
- The effects of radiation are better understood and the regulations and safety measures are more complete and advanced compared to all other potentially harmful agents.**
- The benefits of the use of radiation and radioactive materials under controlled conditions greatly outweigh the risks.**

Element Formation in Stars

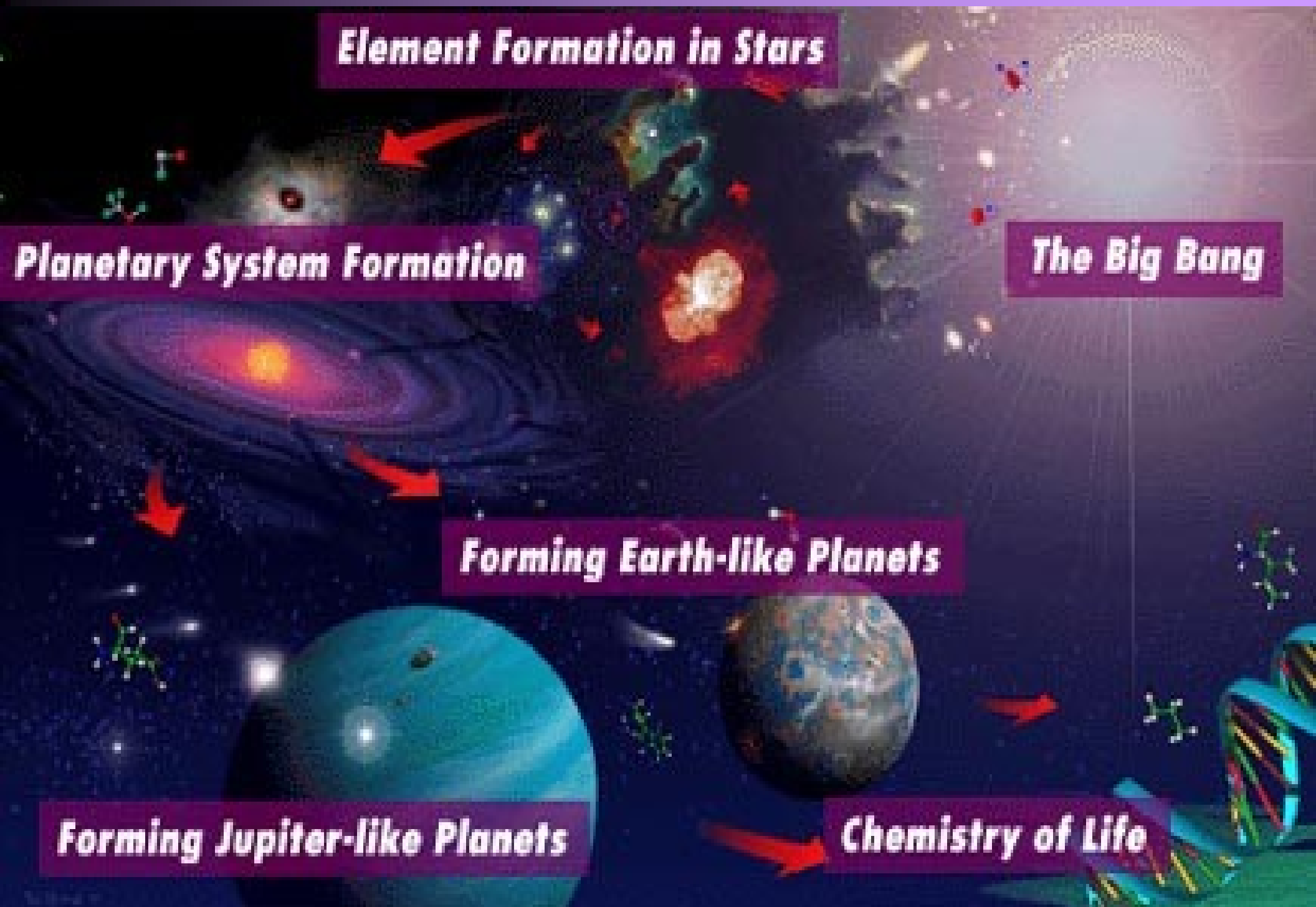
The Big Bang

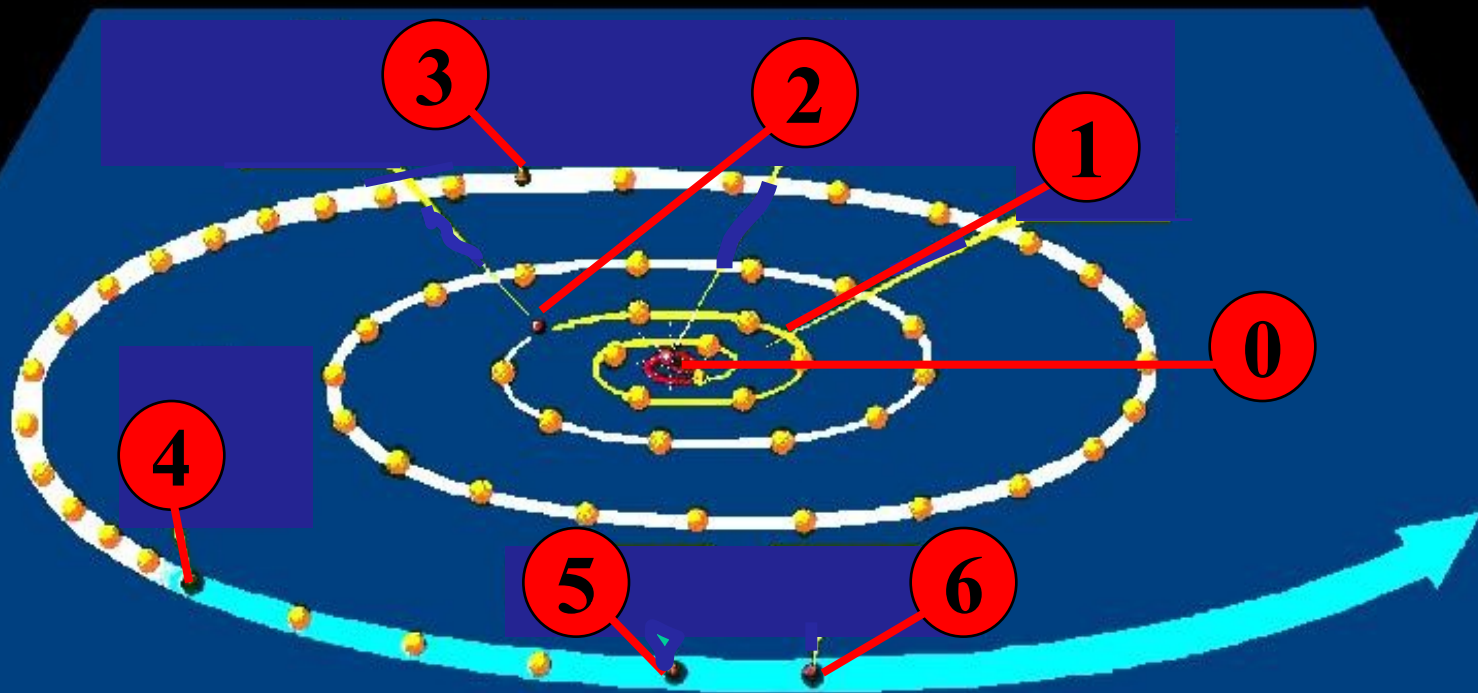
Planetary System Formation

Forming Earth-like Planets

Forming Jupiter-like Planets

Chemistry of Life





- 0** The Big Bang explosion begins **0 sec.**
- 1** Inflation begins **10^{-43} sec.**
- 2** Inflation ends **10^{-35} sec.**
- 3** Light nuclei forged **100 sec.**
- 4** Epoch of last scattering atoms form, Universe becomes transparent **300 000 years.**
- 5** Galaxies form **3 billion years**
- 6** Humans evolve **30 billion years**

- Yellow bar** Vacuum dominated
- White bar** Radiation dominated
- Cyan bar** Matter dominated

ANNUAL WORLD AVERAGE VALUES OF THE EFFECTIVE DOSE FROM NATURAL SOURCES OF RADIATION

S.NO.	ELEMENTS OF EXPOSURE	ANNUAL DOSE mSv.Y⁻¹
1	COSMIC RAYS	0.4
2	TERRESTRIAL GAMMA RAYS	0.5
3	INTERNAL RADIATION	0.3
4	RADON & ITS DECAY PRODUCTS	1.2
	TOTAL	2.4

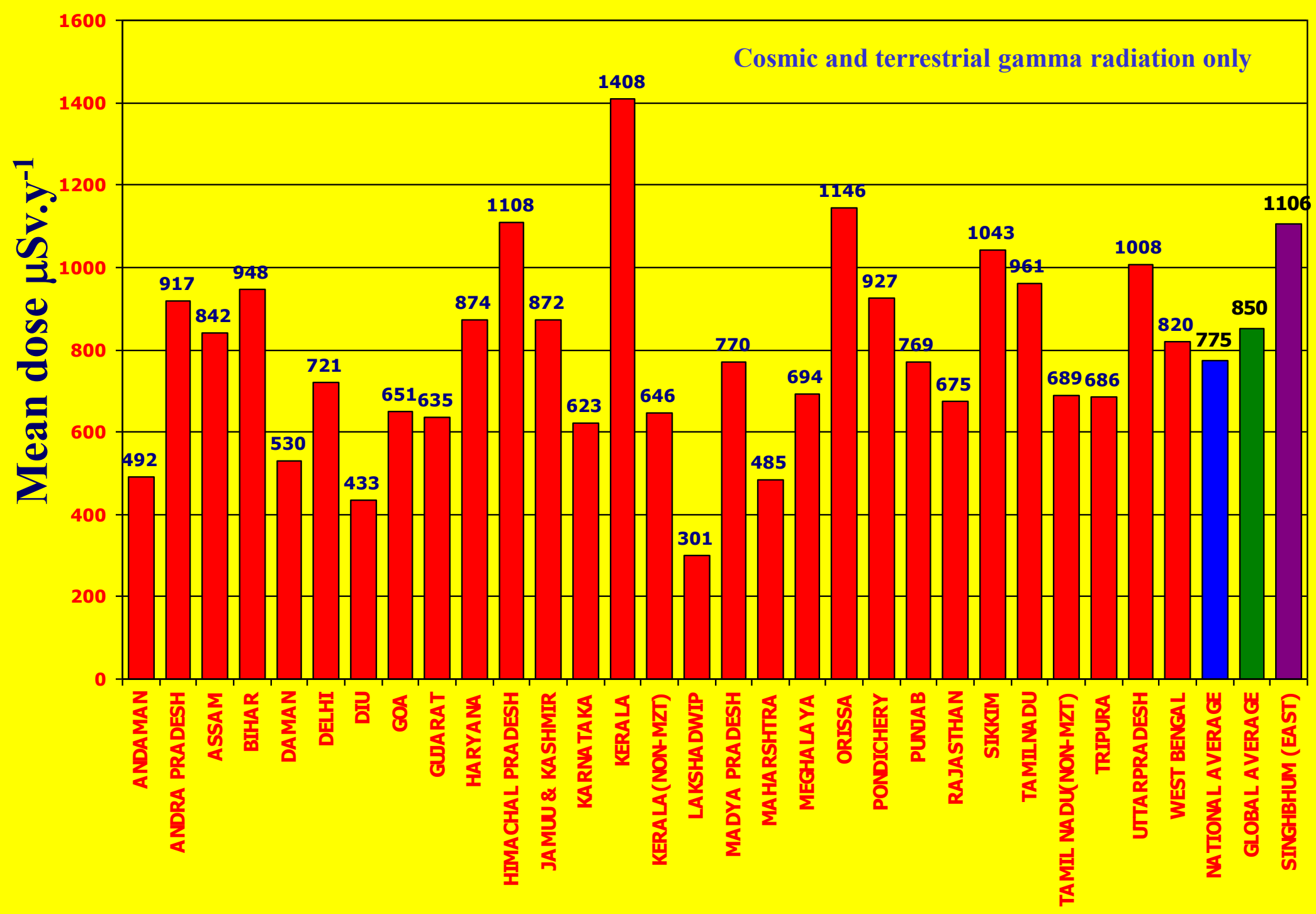
Natural High Background Areas Around The World

Country	Area	Dose * mSv.y⁻¹	Remarks
Brazil	Guarapari	24.5	Monazite sands
China	Yangjiang	3.2	Monazite particles
India	Kerala	15.7	Monazite sand
Iran	Ramsar	7 - 35	Spring water
Italy	Orvieto town	4.9	Volcanic soil

* Average values are given, except for Iran

* UNSCEAR, 2000

AVERAGE NATURAL RADIATION BACKGROUND LEVELS IN DIFFERENT STATES OF INDIA

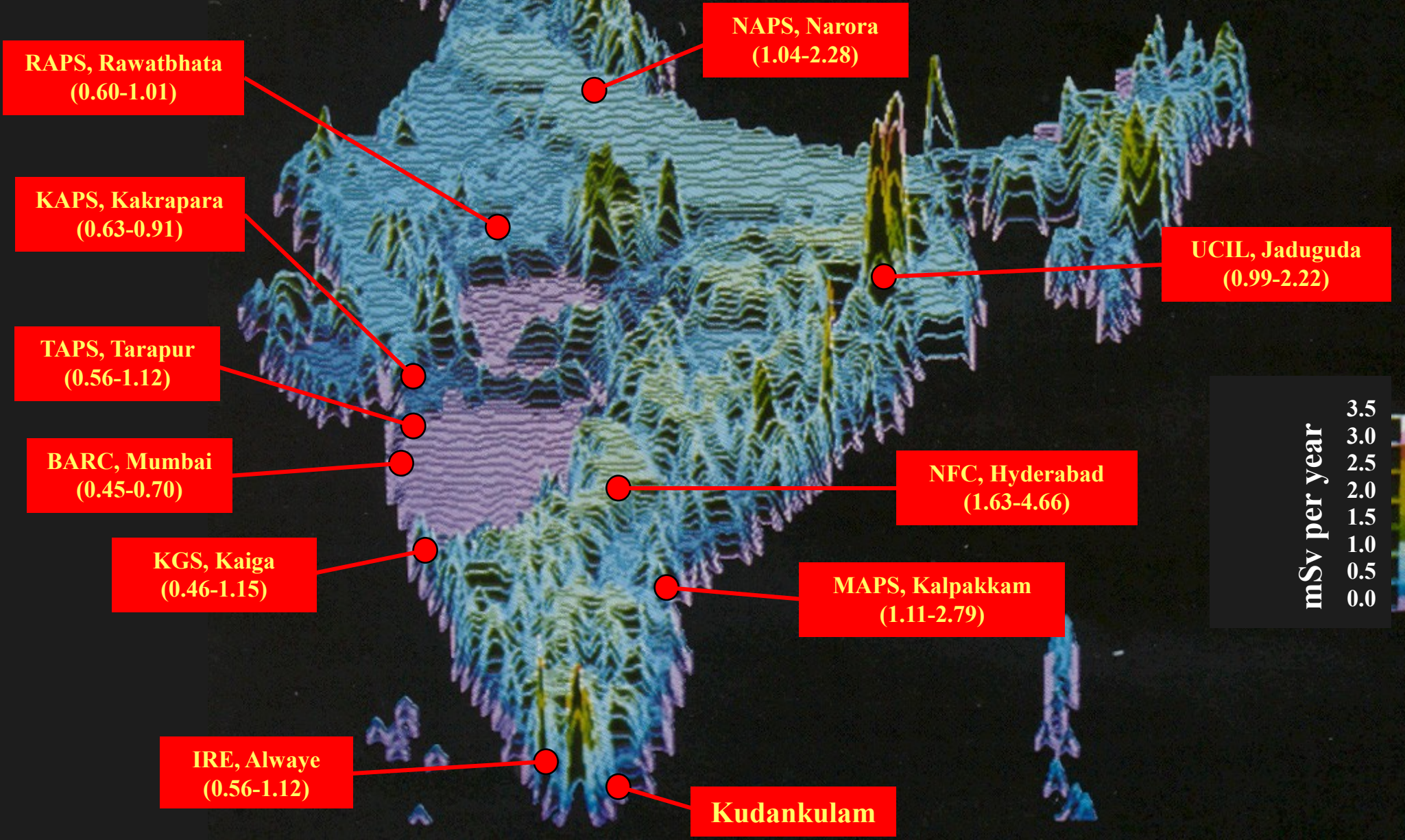


Radioactivity in Food Materials and Drinking Water (mBq.kg⁻¹)

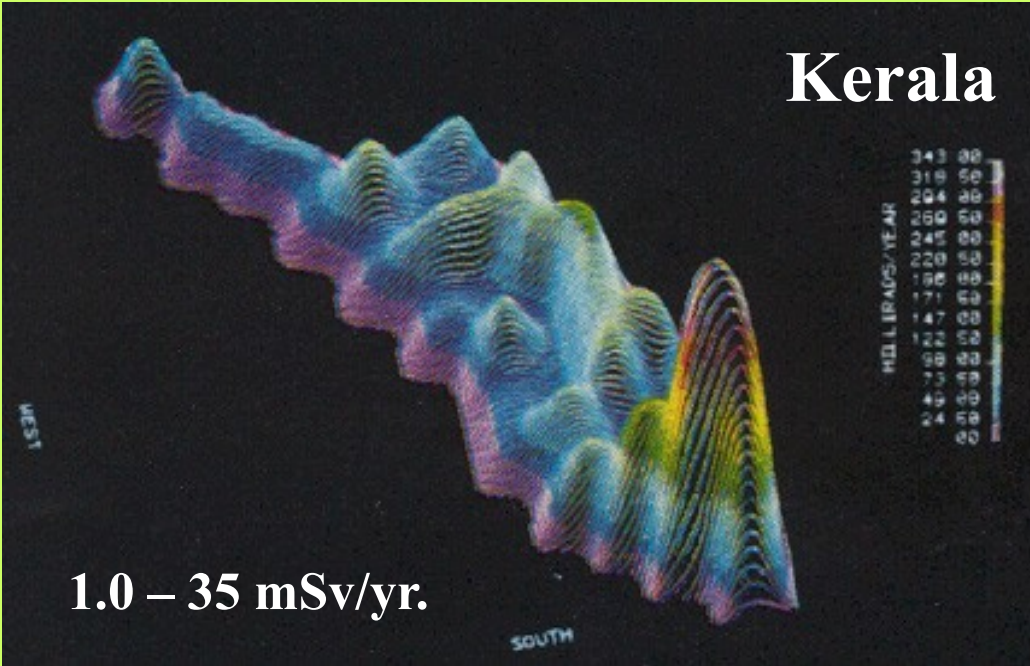
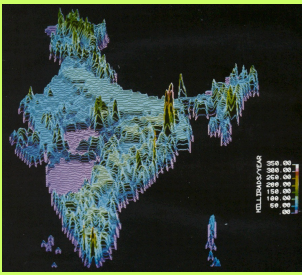
Items	U-238	Po-210
Milk products	17	15
Meat products	NA	440
Grain Products	7.4-67	15-120
Leafy Vegetables	61-72	320
Fruits	0.4-77	16-140
Drinking Water	0.09-1.5	NA

Terrestrial Radiation Map of India

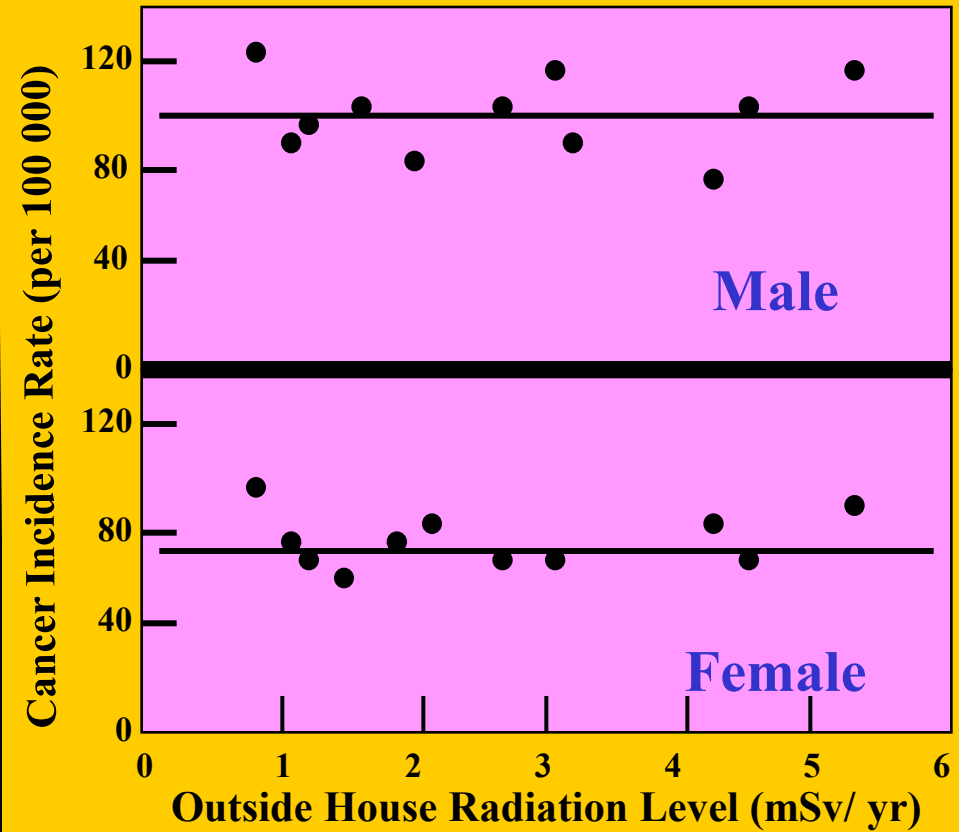
Natural Background Radiation at Some of the DAE Installations (mSv/yr)



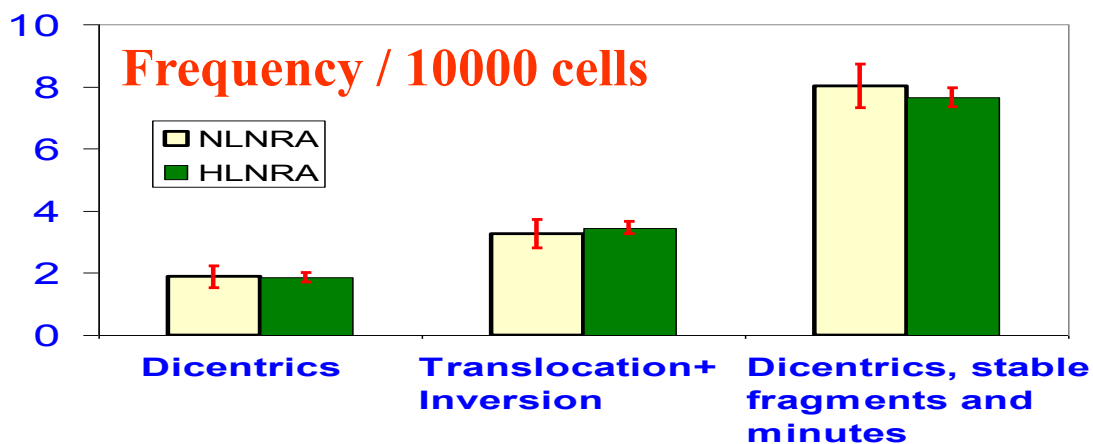
mSv per year
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0



Cancer Incidence Rate Vs Outside House Radiation Levels in Karunagappally (Kerala)



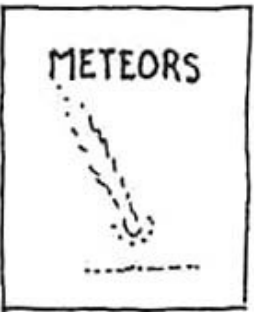
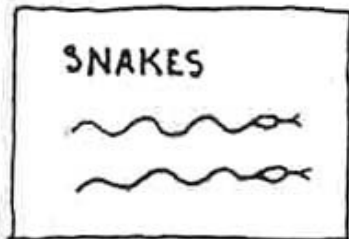
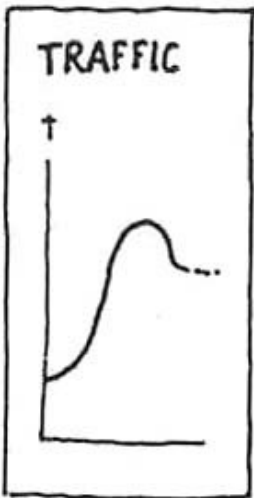
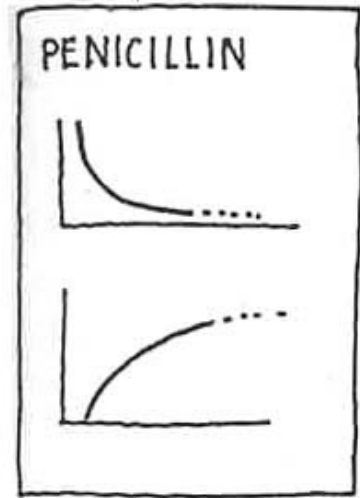
Somatic chromosomal aberrations



Conclusion

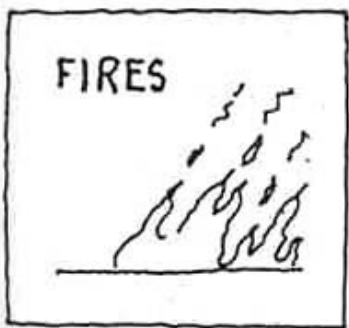
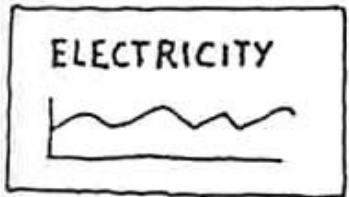
There is no increased risk of developing cancer among those exposed to the radiation levels as obtained in Karunagappally (Up to 6 mSv/yr).





THE PILL

ALCOHOL



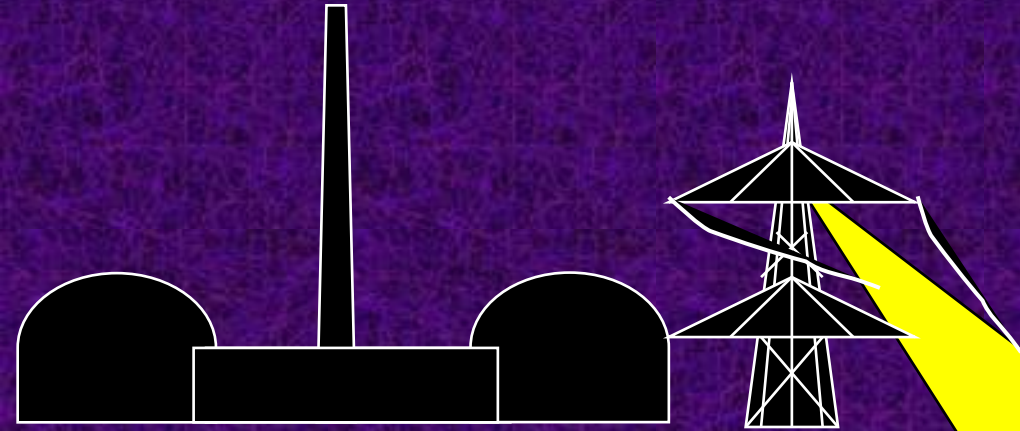
Oh damn it!
The risk associated
with small radiation doses
is so minimal that there
is now way to
measure it . . .



D1116



FACE OF NUCLEAR TERROR: A demonstrator is wearing a mask to protest against the climate summit in Bonn, Germany on Wednesday.



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Thank You !