EMBARGOED TILL 05 MARCH 2005
11:00 AM IST; 5:30 AM GMT

RADIATION MONITORING AROUND MADRAS ATOMIC POWER STATION

VT Padmanabhan and NP Nakul

All life forms on the Earth are constantly and continuously exposed to ionizing radiation coming from three sources. They are radioactive elements like Uranium, thorium and potassium in the soil and rocks, cosmic radiation and the radio-elements present inside our bodies. All these are collectively known as the natural background radiation. There are man-made radiations also. Splitting of a uranium atom in a nuclear power station or an atom bomb produces heat, neutrons and one of the 200 odd elements which are known as fission products. These fission products are radioactive. They are also nano-particles, their size is less than one-billionth of a meter. They can enter into the bodies with air, food and water. ^{90}Strontium, ^{131}iodine and ^{139}cesium are the prominent, well known fission products. These are produced as single atoms, they can float in the air and get transported to long distances. They can enter the food chain from water, air and soil and get transported to far away places.

From the natural sources, each one of us receive a dose of one milli-sievert a year. With this dose, each one of the hundred trillion cells in a an adult human body receives one hit a year. In just one second, 3 million cells in a human body receive one hit. These hits can lead to (a) cell death or (b) a damage to the DNA of the cell. Damages are usually repaired by the cell. However, some damages remain unrepaired. A damaged, un-repaired sperm or egg cell may produce a child with genetic disorders like mental retardation. Genetic changes are permanent, the defect will be carried over generations. A cancer originates from a single, mutated stem cell. It is generally accepted that a minimum of two mutations in a single cell are needed for the transformation of a normal cell into a malignant one.

Any increase in the environmental radiation load will result in the increase in genetic disorders and cancers. The rule is that every dose is an overdose.

We carried out a radiation dosimteric expedition through Coimbatore, Chengelpet , Chennai, Mahabalipuram and Kalpakkam with a portable gamma counter. Majority of the measurements were done in public places like beaches and roads between Chennai-Puthupattanam. The monitored places also included a residential school, a national science research institute, a cancer hospital, some resorts on the eastern side of the East Coast Road. Readings were all within normal levels in these areas. There were higher readings in beaches, fields and built-in areas within a radius of 20 kms from the Kalpakkam Atomic campus.

The mean annual exposure in the rural areas of Coimbatore is 1.0 milli-Sievert. This can be considered as the natural background radiation -emanating from uranium, thorium and pottassium in the soil and our bodies and from cosmic radiation. Readings twice higher than the natural were obtained in several places in the Chennai-Kalpakkam-Chengelpet

triangle. Readings at 77 spots showed an annual dose of 2 milli-Sievert or above. Mean of all the abnormal readings is 4.4 mSv yr. (see chart 1). More than a third of the readings were four times the normal.

Highlights:

There were more abnormal readings on the coastal areas than in the inland region. The readings in 7 places were above 10 milli-Sieverts/year. The highest recorded reading was 54.5 milli-Sv/ year.

The highest reading obtained in an inland region was 8 milli-Sv/year near a pond, about two kilometers south of MAPS stacks. Abnormal readings were recorded in paddy fields, other farmlands and stream nearby.

A reading, five times the natural was obtained inside the Sadras Fort, in an area that was probably undisturbed (not ploughed or swept) for years. The readings outside the wall were within normal limits.

Throughout the beaches, and in the adjacent village areas, patches of dull black sands were seen. According to villagers, these were brought in by the tsunami. Readings near these deposits were invariably higher than those in the adjacent areas.

The debris brought in by tsunami also included plastics, clothes and shoes. The local authorities had cleared such debris and dumped them on one side of a road, from where it has spilled over to the adjacent farmland. The reading near this dump was about 5 times the reading obtained from the other side of the road.

Many of the high measurements were obtained from places near built-in areas of high population density.

There were wide variations between the readings taken from the same spots. This indicates that the source of radiation is not in the ground, but is floating and flying in the air.

Impressions:

The natural background radiation emanates from large sized particles of thorium and uranium, which usually stay in the ground. The fission of uranium creates single atoms of fission products that are pico-particles. Current scientific knowledge extends only to the level of nano-particles and nothing is known about pico-particles. These smallest particles, which were not found on earth before 1945 can float in the air, travel long distances and also enter our bodies through the nano-pores of the normal intact skin. They also travel through the food chain.

A GM counter can detect only gamma radiation in the environment. The nuclear processes also generate auger emitters, alpha particles and beta emitters. Prominent among these are tritium(^{3}H) – a beta emitter, calcium (^{41}Ca)- an auger emitter and

plutonium (^{239}Pu) an alpha emitter. In order to estimate the load from these particles, sand samples have been collected from places of abnormal readings. These are being analyzed and the findings will be reported in due course.

Kalpakkam houses four nuclear reactors, two waste reprocessing plants, a centralized waste management facility and a tritium plant. It can be considered as the most radiologically intensive site in South Asia.

The environmental surveillance laboratory of MAPS has discontinued the publication of their findings since 1998.

All the facilities other than the Advanced Technology Vehicle (prototype nuclear submarine testing facility) at Kalpakkam are civilian installations owned by the Nuclear Power Corporation. The secrecy surrounding these installations is out of sync with the reality in modern times.

There are about 50,000 people living in DAE Township, all of whom should be receiving their share of enhanced exposure. Only less than a fifth of these people are required for running all the facilities. The non-occupational exposure of the radiation workers and the environmental exposure of their families and the population living in highly contaminated regions can be avoided by shifting them to areas with normal radiation.

An ultimatum by the state government to install rain-harvesters in all institutions was flouted by MAPS authorities. We appreciate this radio-protective measure. This concern should have been extended to other non-DAE institutions as well.

There are several places in advanced countries where contamination level is much higher. India contributes only less than 1% of the total global radiological pollution load. The higher pollution load from MAPS has nothing to do with the efficiency level of the operating staff either. The plants were all designed well before 1970, when permissible exposure limits were ten times that of today and our understanding of health effects of low-level radiation was rudimentary.

Recommendations.

An independent monitoring of the soil, air, water and food samples from all the nuclear facilities in the country will go a long way in reducing the exposure. Heavily contaminated sites can be cleaned. Shifting of population to normal areas may also be considered if the contamination level is high.

Media people are often exposed to unnecessary and harmful doses from nuclear facilities and other sources of artificial radiation. Possession of monitoring devices will by reporters can reduce their own and the population exposure in cases of radiological emergencies.

Local environmental monitoring networks will also help reduce the population exposures considerably.

VT Padmanabhan is a researcher in health effects of radiation. He has led epidemiological investigations among people exposed to high radiation in Kerala. He has also studied the occupational radiation hazards among workers of Indian Rare Earths, genetic effects of children exposed to MIC gases in Bhopal, health hazards to workers in a viscose rayon unit in Madhyapradesh and reduction of birth weight of babies near a beverage bottling plant in Kerala. He has visited several contaminated sites in Belarus and Japan and had extensive interactions with the survivors. His papers have been published in International Journal of Health Services, Journal of American Medical Association, International Perspectives in Public Health, the Lancet and Economic and Political Weekly. Padmanabhan learned the political economy of health from Prof Dr D Banerji (Delhi), and health effects of ionizing radiation from Dr Rosalie Bertell (New York) and late Dr Alice Stewart. He is a member of the European Commission on Radiation Risk, an independent body of experts appointed by the Green MEPs in Europe. Last year, he participated in the deliberations of the Committee Examining the Radiation Risks from Internal Emitters, appointed by the UK Ministry of Environment.

NP Nakul is a student of National Open School.

Address:
VT Padmanabhan,
PO Pathakunnu,
Tellicherry 670691
India

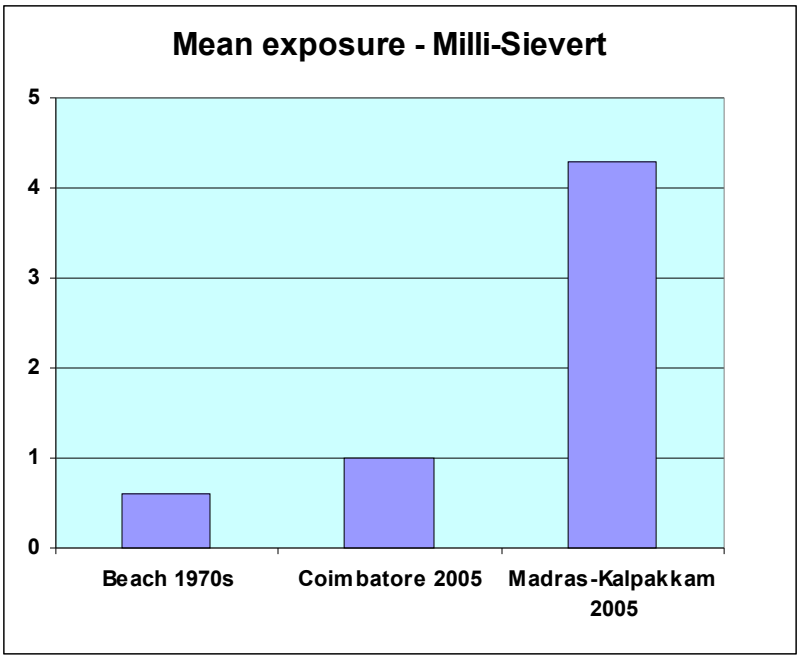

Chart 2 provides annual exposures in different dose groups.