In this issue

Nuclear weapon accidents and plutonium dispersal

Nuclear weapons face risks of accidents in assembly, storage or deployment as any other weapon of mass destruction. Tens to hundreds of accidents are said to have occurred during the past five decades in the West in the case of assembled weapons. Although one cannot quantify the probability with which an accident can occur, 'were such an accident to happen, its consequences are serious'. It can lead to contamination of the surroundings due to release of plutonium and consequent biological effects over the environment including humans. It is against this background that the article by Zia Mian *et al.* (**page 1275**) examines the implications of an accident in the South Asian Region. After classifying the accidents into four categories, the article goes into the nature of public health risks in the event of plutonium release to the near and far environment. One category of accident, classified as category III, involving high explosive in the weapon (this excludes the nuclear explosive itself) detonation converting the fissile nuclear material into aerosol is discussed in detail. (It is to be noted that Category IV accidents involve nuclear explosion itself. This is *not* the subject matter of the paper). The authors have used an analytical model referred to as a 'wedge model', which provides an estimate of the aerosol containing plutonium deposited upwind of the site of detonation as a function of height and distance. Thereby the human and animal population that may be exposed to plutonium containing aerosol can be estimated depending on the population density and other factors. In the following section, the health impact due to inhalation by the humans is examined. The case studies applicable to densely populated urban conglomerates and semi-urban locales deal with estimates of long-term casualties.

K. R. Rao

Eschew pan masala

'Chewing of betel leaves, prepared with cloves, camphor, nutmeg, areca-nuts and lime paste or with similar preparations after bath and meals, cleanses and deodorizes the mouth, checks excessive salivation, benefits the teeth, tongue and throat and acts as a tranquilizer to the bodily system' (The 24th chapter of *Cikitsasthana, Susruta Samhita*).

The chewing quid or *tambula* has been a popular socially acceptable custom and a cause for post-prandial delight to the Indian from ancient times. In modern times, the inconvenience of preparation of the traditional pan and the annoying aspect of pan chewing, the red, trickling spittle spattered on the streets and walls are irksome to the upwardly mobile. In the nineteen seventies, pan masala with all the ingredients of betel quid except betel leaf, hit the market in convenient sachets. They were well suited for the fashionable young Indian middle class and the rich alike. Aggressive marketing led to its popularity even among school children. Currently, the pan masala industry is estimated to be over 1000 crores of rupees. Nearly 50 brands of the product are available in the market.

Appallingly, as the pan masala fad is spreading, studies indicate the birth of an epidemic of oral sub mucous fibrosis (OSMF), an incurable and irreversible disease that results in the shrinkage of the mouth cavity. The evidence for the link is definitive. The scary aspect is, patients with OSMF have a 400 times greater risk of becoming victims of oral cancer, than normal people.

A study done several years ago, by the Regional Cancer Center (RCC) in Thiruvananthapuram in association with the Johns Hopkins University in the United States had revealed that 19 out of 22 popular brands of pan masala contain mutagens above the safety level. This report prompted a review of the health hazards of pan masala by an expert committee of the Director General of Health Services, New Delhi. The critical appraisal concluded that 'human studies on pan masala containing tobacco (PM-T) like mixtures and the limited studies on PM-T suggest that PM-T is likely to be carcinogenic' (*Nat. Med. J. India*, 1999, **12,** 21–27).

Despite evidences for the association of tobacco chewing with oral leukoplakia and for malignant transformation of oral leukoplakia to oral cancer, from prospective studies in humans, the business lobby is callous. When the RCC study appeared in the press, a manufacturer who has built a multicrore-pan masala empire was quoted to have remarked 'Gulab jamuns and chocolates taken in excess are also harmful. Why single out pan masala?' Policy makers have also been reticent to restrict wide use of pan masala. It is argued that neither an association of pan masala with oral cancer nor carcinogenicity of pan masala in animals has been reported.

The study by National Institute of Occupational Health, Ahmedabad published in this issue (**page 1306**) evaluates the cancer producing potential of pan masala. Hopefully the health administrators would chew on the findings.

C. C. Kartha

The OCEANSAT-1 and global climate

The printing press, telecommunication including satellite communication and the digital revolution (the synergy of computers with telecommunication) are said to be three major waves of technological changes in communication. There is

also growth in the satellite remote sensing and geographic information system (GIS) computer software technologies that obtain, store, and analyse information about Earth using nearly 50 Earth observation missions.

Since the first manned flights to the moon in the 1960s, the astronauts and cosmonauts have been wonder-struck by the sight of Earth, a fragile blue planet suspended in the vast black emptiness of space. It provided a global view and a new perspective. As stated by one of the astronauts: 'Most people do not get to see how widespread some of the environmental destruction is. From up there, you look around and see that it's a worldwide rampage'.

A growing number of satellites capture a variety of images of human activities on Earth. Together with on-ground-monitoring and other data, the GIS software images can help researchers examine pollution and other environmental hazards, identify areas rich in particular resources, and model changes to the environment. Satellites are unique in being able to collect detailed information about parts of Earth that are otherwise difficult to get to: 'the far reaches of the atmosphere, the depths of the oceans, the icy polar regions, and forest interiors'. The remote-sensing instruments aboard Earth-orbiting satellites can record changes over large areas and long periods of time. A fleet of Earth observation satellites have monitored fires in Indonesia, floods in China, dust storms in the Sahara and Gobi Deserts and the African haze.

The first effort to monitor Earth was based on hand-held cameras, carried by the earliest astronauts, limited to the visible range of the electromagnetic spectrum. Systematic observations began in 1972, with the launch of the satellite named Landsat. The Landsat sensors could also record heat and reflected energy invisible to the human eye. Subsequent Landsats have continuously provided data from 1972 to the present.

In 1985, a combination of observations from both sky and land proved essential to revealing the damage to the ozone shield that protects Earth from ultraviolet radiation. The initial weak satellite data on ozone were rejected as system errors. Thus an instrument on the ground in Antarctica was the first to detect the ozone 'hole'. The satellite data were then recovered to provide a more complete picture of how widespread the ozone depletions were.

Most satellite sensors measure either reflected light or heat, but a few relatively new systems use radar transmitting short bursts of microwave energy to Earth and recording the strength of the reflected energy that comes back. Microwaves can penetrate the atmosphere in all conditions, so radar can 'see' in the dark and through haze, clouds, or smoke. In the 1990s such data have been used mainly to detect changes in the freezing of sea ice in northern latitudes.

The Indian remote sensing satellite OCEANSAT-1 (nee IRS-4) launched in 1999 contains two sensor payloads, namely, an ocean colour monitor (OCM) and a multi-frequency scanning microwave radiometer (MSMR). On **page 1319**, Vyas *et al.* describe how MSMR senses the Earth's microwave emissions across a wide spectrum of frequencies. The satellite collects data world-wide repeatedly every two days and downloads the same to a Hyderabad-based ground station during the satellite's pass over this region. The data (July–October 1999) have revealed open water and sea-covered regions. Several levels of ice concentration in the Antarctic Circumpolar region have been differentiated. The authors state that 'the consistency and availability of MSMR data serve as a very useful tool in all-weather day–night monitoring of the Antarctic region'.

But why Antarctic region? 'The polar-ice is potentially a sensitive indicator of the effects of the global climate change ... Continuous monitoring of the state of the polar cryosphere is therefore of paramount importance'.

K. R. Rao