

## **Studies on Exposure to the Atmospheric Ionizing Radiation Environment at the Italian National Institute of Health (ISS)**

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The largest source of data on human exposure to low dose rate radiation may be airline flight personnel, if enrolled for studies on health effects induced by the cosmic-ray-generated atmospheric ionizing radiation, whose total dose, increasing over the years, may cause delayed health effects, due to its so typical high-LET and highly ionizing neutron component. A follow-up on all ongoing research activities at the National Institute of Health of Italy (Istituto Superiore di Sanita' – ISS) is shown. The Italian civilian airline flight personnel is being studied by analyzing their radiation exposure and associated effects. The study population includes all Italian civilian airline flight personnel, both cockpit and cabin crewmembers, whose work history records and actual flights (route, aircraft type, and date for each individual flight for each person where possible) were available. The dose calculations were performed along specific flight legs, taking into account the actual flight profiles for all different routes and the variations with time of solar and geomagnetic parameters. Dose values for each flight are applied to the flight history of study participants in order to estimate the individual annual and lifetime occupational radiation dose. Comparative study with the exposure patterns of other crewmember populations are being performed. An analysis of particle spectra, dose rates and cumulative doses to crewmembers in relationship with different health outcomes for the considered aircrew groups is in progress. A new Atmospheric Ionizing Radiation (AIR) model is in development, in collaboration with the NASA Langley Research Center and the Bartol Research Institute of the University of Delaware, to compute particle spectra and dosimetric quantities all throughout the Earth's atmosphere for radiation dose evaluation of current aircrew member doses as well as in epidemiological studies targeted to atmospheric flight personnel such as civilian airlines crewmembers. The incoming particles are filtered with a new fully angular dependent geomagnetic cut-off rigidity model, as a function of latitude, longitude, arrival direction, altitude and time. Some preliminary validations of the particle transport technique, the flight route profile analysis, the epidemiological interface and the new angular dependent geomagnetic cut-off rigidity model will be also described.// Keywords: Radiation; Earth; atmosphere; modeling; doses; aircraft.