Cosmic Radiation Exposure - Airliner Crews

A brief overview of cosmic radiation cause and effect and legislative requirements for airline operators

Cosmic Radiation Source

Airliner crew cosmic radiation exposure depends on the **aircraft altitude, geographical position** and the **Sun’s activity**. (Note: Some early NASA research\(^1\) suggests, though not as yet substantiated, that composite materials provide greater shielding than alloy materials). This is because cosmic radiation at the upper regions of the earth’s atmosphere is comprised of two components, continuous ionizing galactic radiation and sporadic solar radiation component, which together contribute to the total radiation field effect. The intensity of cosmic rays is affected by the variation in the interplanetary magnetic field during an 11-year cycle of solar activity. Therefore crew exposure to cosmic radiation fluctuates over an 11 year solar cycle.

The earth’s geomagnetic field provides shielding from cosmic radiation effects. Exposure is increased with operating altitude; the higher the altitude the less cosmic shielding is provided. Similarly, the level of shielding is highest in equatorial geomagnetic regions and lowest in polar geomagnetic regions. The intensity of solar flare activities also influences cosmic radiation exposure.

Cosmic Radiation Effects Diagram

![Cosmic Radiation Effects Diagram](https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20090037429.pdf)


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\(^1\) [https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20090037429.pdf](https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20090037429.pdf)
Cosmic Radiation Exposure - Legislation for Airline Operators

The principal European and UK legislative instruments for airline operators as respects monitoring and recording crew exposure to cosmic radiation are defined in the following:

- Directive 2013/59/EURATOM - protection against ionising radiation (As of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom)

Cosmic Radiation Legislation – Key Elements

The principal elements of legislation with respect to airline operators are as follows:

- Take account of exposure to cosmic radiation of aircrew who are liable to be subject to exposure to more than 1 mSv per year.
- Assess the exposure of the crew concerned and take this into account when organising working schedules with a view to reducing the doses of highly exposed air crew.
- Inform the workers concerned of the health risks.
- Exposure to cosmic radiation for pregnant woman in the context of their employment with the airline operator are such that the equivalent dose to the child to be born will be as low as reasonably achievable and it will be unlikely that this dose will exceed 1 mSv during the remainder of the pregnancy.
- Keep a record for the period and in the manner prescribed of the exposure to cosmic radiation of air crew assessed under article 178 and the names of the air crew concerned.

Cosmic Radiation – Controls

As previously described, the effects of cosmic radiation are a direct result of aircraft altitude, geographical position and sun solar activity. To that end, monitoring these three aspects for each crew member is vital in ensuring exposure is maintained within safe levels. Solar activity is cyclical and can be generically measured by a number of on-line web applications. Crew routing and aircraft altitude information is available via the Flight Data Monitoring (FDM) capabilities of the aircraft. Finally, effective use of the airline companies Fatigue Risk Management System (FRMS), seeded with the FDM and solar data will provide the best overall picture of individual crew member’s cosmic radiation exposure levels.

Conclusion

There is a mandated regulatory requirement for airline operators to monitor the exposure of their aircraft crews to potentially harmful doses of cosmic radiation. Cosmic radiation is a formed from galactic background radiation and sporadic solar activity. The amount of crew exposure is a direct correlation between the aircraft altitude, geographical position and solar activity. Monitoring of crew exposure may best be achieved through effective use of the airline operators FRMS by populating data from the aircraft FDM and on-line solar activity web pages.
AIG’s Client Risk Solutions stands ready to help your company manage risk. For more specific information on Cosmic Radiation exposures or for general inquires:

- Contact CRS@aig.com
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