Cosmic radiation, aircrew and WHS obligation

David Chitty

Solar radiation exposure is an inflight hazard, which whilst rare in normal latitudes exposure, can be significantly increased in the polar-regions. The legislative requirement for an employer to monitor the health of employees, where identified hazards exist, is beyond doubt and includes those which occur inflight.

BACKGROUND

Cosmic radiation exposure is not a “new” workplace hazard. Increasingly, here in Australia, people are reminded of the dangers of solar radiation each and every day, for example the “slip, slop, slap” campaigns and the associated high-levels of reported melanoma and various skin cancers. However, one associated area that probably escapes the attention of the travelling public at large, and possibly domestic authorities, is the risk and hazard of excessive exposure to cosmic radiation caused by space-weather events, particularly during “solar highs”, such as the extreme event that occurred in 2012 and is only now (as of 25 July 2014) being reported in the public domain.

Regulators, including aviation authorities and nuclear energy agencies, in many jurisdictions (except current Australian aviation legislation) have express requirements for airlines to monitor the radiation dosage their employees, specifically flight crew (frequent flyers may also be exposed in limited extreme cases), are exposed to during a defined reporting period, whether monthly, quarterly or annually, with maximum recommended exposure limitations outlined, especially for pregnant flight crew.

These limits for individuals are recommended by the Australian Radiation Health Committee under the Australian Radiation Protection and Nuclear Safety Agency Act 1998 (Cth), and are produced in Table 1 below:

<table>
<thead>
<tr>
<th>Occupational exposure</th>
<th>Members of public exposure</th>
<th>Pregnant crew exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum of 20mSv/yr (average max 5 years)</td>
<td>Maximum of 1mSv/yr</td>
<td>Maximum of 2mSv/yr (1mSv/yr occupational)</td>
</tr>
</tbody>
</table>

mSv/yr = milliSievert per year.

Examples of typical route exposure are well documented and it is noteworthy how the southern latitudes (those flights where the most efficient routes take the aircraft into the south polar-regions) have the highest recorded dosage, as outlined in Table 2:

1 The sun goes through cycles of high and low activity that repeat approximately every 11 years. Solar minimum refers to the several Earth years when the number of sunspots is lowest; solar maximum occurs in the years when sunspots are most numerous.


3 While Australian flight crews fall well below international limits for radiation dosage, greater caution must be exercised by pregnant crewmembers. A 1990 study by the International Commission on Radiological Protection (ICRP) recommends a limit for unborn children of 1mSv from the declaration of the pregnancy to full term: Civil Aviation Safety Authority, “In-Flight Radiation”, Flight Safety Australia (1999).

### Route estimates

<table>
<thead>
<tr>
<th>Route</th>
<th>Dose/Flight (µSv)</th>
<th>Flights for 1 mSv</th>
</tr>
</thead>
<tbody>
<tr>
<td>Darwin-Perth</td>
<td>16</td>
<td>62</td>
</tr>
<tr>
<td>Perth-Broome-Darwin</td>
<td>8</td>
<td>131</td>
</tr>
<tr>
<td>Darwin-Singapore</td>
<td>9</td>
<td>107</td>
</tr>
<tr>
<td>Frankfurt-Singapore</td>
<td>39</td>
<td>25</td>
</tr>
<tr>
<td>Melbourne-Johannesburg</td>
<td>71</td>
<td>14</td>
</tr>
<tr>
<td>Melbourne-Singapore-London</td>
<td>65</td>
<td>15</td>
</tr>
<tr>
<td>London-Singapore-Melbourne</td>
<td>42</td>
<td>23</td>
</tr>
<tr>
<td>Sydney-Buenos Aires</td>
<td>68</td>
<td>15</td>
</tr>
<tr>
<td>Buenos Aires-Sydney</td>
<td>80</td>
<td>13</td>
</tr>
</tbody>
</table>

1 mSv = 1000 µSv

Some comparative examples of international regulation include:


2. Operators of public transport aircraft registered in Hong Kong shall, in respect of any flight by that aircraft during which it may fly at an altitude in excess of 26,000 feet, keep a record of the total dose of cosmic radiation to which the crew are exposed together with the names of that crew. The crew has the meaning assigned to it by Art 98(4) of the Air Navigation (Hong Kong) Order 1995 (Hong Kong).

Note that the Federal Aviation Administration in the United States does not include specific requirements for cosmic radiation monitoring.

### Australian environment

The current aviation legislative framework within Australia is a patchwork of antiquated Regulations and Orders dove-tailed with contemporary regulatory reform initiatives, known as the Civil Aviation Safety Regulations (CASRs), which are subsequently supported by various complimentary documents, such as the Manual of Standards for various operational Parts, which are quasi-legislative in nature and provide detail and guidance on how operators and authorised persons satisfy the various CASR requirements.

To ensure compliance, an aircraft operator and/or individual (for example, the pilot-in-command) must interpret and navigate through legislation that is: struggling to keep up with technological advancements; being amended in a piece-meal manner; and new legislation that is struggling to transition from industry consultation stage to assent and implementation. The opportunities for statutory interpretation errors are not insignificant.

A detailed description and commentary on how aviation legislation is structured within Australia was provided by Stone and Moore JJ in *Heli-Aust Pty Ltd v Cahill*, where their Honours stated that:

The [Civil Aviation Act 1988 (Cth)] and Regulations together create a regulatory framework to ensure the safety of civil aviation. The Act “binds the Crown in right of the Commonwealth, of each of the

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5 See Civil Aviation Regulations 1988 (Cth); Civil Aviation Safety Regulations 1998 (Cth).
States, of the Australian Capital Territory, of the Northern Territory and of Norfolk Island” (s 5) and extends to foreign aircraft flying in Australian territory (s 7). It establishes the Civil Aviation Safety Authority (CASA). The role of CASA in maintaining air safety is addressed in detail in ss 9, 9A and 11.6

Under s 9(2) of the Civil Aviation Act 1988 CASA also has the following safety related functions:

(a) encouraging a greater acceptance by the aviation industry of its obligation to maintain high standards of aviation safety, through:

(i) comprehensive safety education and training programs; and

(ii) accurate and timely aviation safety advice; and

(iii) fostering an awareness in industry management, and within the community generally, of the importance of aviation safety and compliance with relevant legislation;

(b) promoting full and effective consultation and communication with all interested parties on aviation safety issues.

The substantive question(s) that arose in Heli-Aust included: at what point does the Commonwealth legislation cease to “cover the field” (that is, regulating the safety of civil aviation) and the Occupational Health and Safety Act 2000 (NSW) impose obligations for the control of a safe workplace?

The history of Commonwealth regulation of civil aviation and its connection with associated international obligations, the main object of the Civil Aviation Act with its emphasis on safety and on preventing air accidents, and the detailed provisions in the Civil Aviation Act 1988 and CASRs concerning the regulation of air safety all suggest that the Act and CASRs are intended to regulate the safety of civil aviation in Australia comprehensively, and are not intended to operate in conjunction with State legislative schemes directed to the same end.

However, there are a number of additional obligations which may arise when transporting passengers in a civil aviation context; an aircraft is a place of work for many people, for example on an Airbus A380 there may (depending upon the operator) be in excess of 20 crew on board. Obligations relating to the monitoring of crew-health, discrimination and workplace bullying may also arise, which by their nature, sit outside of the Commonwealth aviation safety regulatory framework. Therefore, State legislation can extend its reach into the flight deck and cabin of aircraft in flight. This is where an operator or employers current obligations to monitor cosmic radiation dosage, an identified hazard in the workplace arises.

CIVIL AVIATION SAFETY REGULATIONS

The current aviation legislation framework does not expressly require aircraft operators to monitor radiation exposure of crew or passengers. However, cosmic radiation, as a hazard, is considered in an operational environment. For example, Civil Aviation Order 82.0 (Cth), r 3BD.2 (CAO) which refers to Polar Operations7 only with approval of CASA in accordance with Appendix 6. It is of interest to note that this Appendix includes the following requirement:

(d) a plan for mitigating flight crew and passenger exposure to radiation during solar flare activity.

Consequently, CASA has identified a potential hazardous exposure8 that requires the aircraft operators to include mitigation plans for the periods of solar flare activity. The plans for this mitigation may include limiting the flight altitude to below 28,000 feet during periods of identified solar activity. For flights in the southern latitudes (for example, Australia to South Africa or South America) however, this altitude limitation imposes significant costs in additional fuel burn. Other options could include the installation of measuring equipment on the flight deck.


7 Defined to be above 78°N or below 60°S (degrees latitude).

The draft, *Civil Aviation Safety Regulation* (Cth), Pt 119 (Air Transport Operators – Certification and Management), which is currently waiting Notice of Final Rule Making, includes at Table 119.360, Item 20 (Retention Periods – Personnel Records) a requirement for operators to maintain radiation exposure records of flight crew:

A record about cosmic radiation dosage for a flight crewmember or a cabin crew member required by regulation [121.685 – Note: Draft yet to receive industry comment]

The period ending on the earlier of:

(a) the end of 3 years after the record was created; or
(b) 12 months after the day on which the cabin crew member ceases to be employed by the operator.

The specific aviation legislative requirement for the monitoring of flight crew exposure to radiation will eventually be found within *Civil Aviation Safety Regulation* (Cth), Pt 121 (High Capacity Air Transport Operations), however, the regulatory reform program is far behind schedule and a Parliamentary Review into Safety Regulation in Australia has published its Report containing 37 recommendations. Industry is currently waiting for a government response.

**MODEL WHS LEGISLATION**

The *Work Health and Safety Act 2011* (NSW) (WHS Act) which came into force in NSW on 1 January 2012 requires a person conducting a business or undertaking to ensure, so far as reasonably practicable, the health and safety of workers and or other persons who may be put at risk by the business or undertaking. Section 19(1) provides that:

(1) A person conducting a business or undertaking must ensure, so far as is reasonably practicable, the health and safety of:

(a) workers engaged, or caused to be engaged by the person, and
(b) workers whose activities in carrying out work are influenced or directed by the person, while the workers are at work in the business or undertaking.

The WHS Act then specifically requires at s 19(3):

(3) … a person conducting a business or undertaking must ensure, as far as reasonably practicable:

... (f) the provision of any information … that is necessary to protect all persons from risks to their health and safety arising from work carried out as part of the conduct of the business and undertaking, and

(g) that the health of workers and the conditions are monitored for the purposes of preventing illness or injury of workers arising from the conduct of the business or undertaking.\(^9\)

**REASONABLY PRACTICABLE TEST**

Whilst the “new” WHS Act is in its infancy and an absence of authority exists in dealing specifically with s 19(1), a number of cases do exist which have considered similar provisions. This includes *Edwards v National Coal Board*, where Lord Asquith said:

Reasonably practicable is a narrower term than “physically possible” and it seems to me to imply that a computation must be made by the owner, in which the quantum of risk is placed on one scale and the sacrificed involved in the measures necessary for averting the risk (whether in money, time or trouble) is placed in the other; and that if it be shown that there is a gross disproportion behaviour then – the risk being insignificant in relation to the sacrifice – the defendant’s discharge the onus on them.\(^11\)


\(^10\) Emphasis added.

\(^11\) *Edwards v National Coal Board* [1949] KB 704 at 712.
Then in *Slivak v Lurgi (Aust) Pty Ltd* Gaudron J set out three general propositions on the meaning of “reasonably practicable”:

- The phrase “reasonably practicable” means something narrower than “physically possible” or “feasible”;
- What is “reasonably practicable” is to be judged on the basis of what was known at the relevant time; and
- To determine what is “reasonably practicable” it is necessary to balance the likelihood of the risk occurring against the cost, time and trouble necessary to avert that risk.

The High Court stated in *Kirk v Work Cover Authority NSW* that:

- The measures which must be taken are those which are reasonably practicable. The term is not defined in the *(Occupational Health and Safety Act 1983 (NSW)),* but it may often involve a common sense assessment.¹³

Applying these authoritative judicial tests to the obligations imposed by s 19 of the WHS Act where the provision of information and monitoring the health from adverse affects of exposure of employees to a recognised hazard (especially for pregnant flight crew), namely cosmic radiation exposure, it is reasonably practicable, weighing the risk versus “money, time or trouble” for an employer to implement a programme of radiation monitoring for its employees and procedures to follow should a crew member approach or reach the recommended maximum dosage.

Once the new *Civil Aviation Safety Regulation* (Cth), Pts 119 and Pt 121 become effective (however, who knows when?) the monitoring requirements (under aviation legislation) will be mandatory, but in the interim, State WHS legislation obligations *require* an operator/employer to ensure adequate monitoring and the provision of information to workers of this *inflight* workplace hazard.

David Chitty is barrister at Denman Chambers and has previously held a senior executive position at Qantas Airways Ltd as Head of Compliance and Industry Relations (Operations). David has also held industry positions on regulatory reform committees within the Civil Aviation Safety Authority.

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