November 2003 Updates
for
"Aircrew Radiation Exposure"
***on APA Aeromedical Committee Web page,* "Radiation"**
and
Flight Line ***archive, April, May, June 2000 issue***

Editor's note: *Since this article's publication in Spring 2000, some changes have occurred. The article remains informative and relevant for helping to educate aircrew on the issue of in-flight radiation exposure and it is still highly recommended reading. What follows are the updates:*

- The ICRP limit for radiation exposure to a pregnant woman was lowered from 2 mSv to 1 mSv. All of the references to the ICRP pregnancy limit should now be 1 mSv.
- Under the subtitle "Regulatory Quagmire", 5th paragraph, the internet-available computer model mentioned for calculating in-flight radiation exposure does not adjust for the added exposure received during a solar flare. About a month after a significant solar event, a mathematical correction would be available on that Web site to adjust exposure calculations for that particular event.
- Under the subparagraph "Exposure Limitations," 10th paragraph, thanks to efforts specifically made with aircrew wellbeing in mind, technology has since been developed to notify airborne crews in the event of a solar storm strong enough to be a health concern. Plans are currently underway to have it implemented at AA. In the very next paragraph, "19.0 mSv to 30.7 mSv" should read "19.0 uSv to 30.7 uSv".
- Under the subparagraph "In Summary," second paragraph, it has since been clearly shown in studies that airline pilots have three to four times the incidence of malignant melanoma (the most serious form of skin cancer) compared to the general population, and more than even those groups of individuals who make a living working outdoors. Therefore, this high rate of skin cancer is felt to not be from lifestyle factors (not from leisure time spent outdoors). Since windshields on aircraft built since the early 1950s screen out most ultraviolet rays, it is not suspected that the melanoma is caused from that. Other less dramatically clear associations have been shown in other studies regarding higher rates of certain types of cancer in air crewmembers, such as breast and thyroid. In a group of European Airline Pilots, another study showed three times the normal rate of chromosomal aberrations. Chromosome damage has previously been clearly linked to radiation exposure.
- Under "What Is Being Done?" second paragraph, the system referred to is now available and in the process of being implemented at American! On the Web sites mentioned, it is only "S3, S4, or S5" radiation that causes in-flight health concern. "R" and "G" radiation may affect radio operation, but are not directly physically harmful to aircraft inhabitants.

AIRCREW RADIATION EXPOSURE:

Do you know the risk?

The purpose of this article is to educate our membership, not to alarm, frighten or anger the pilot group. This topic is not one which is blessed with overwhelming scientific data to support drastic action. We do feel, however, that significant data exists to support some action...sooner rather than later. The threat is real, especially to our female pilots, and to all other pilots, too, as our exposure to radiation multiplies through our years of employment. Please visit the APA Web Site for links to other pertinent information.

— Captain John Walker, ORD, National Aeromedical Committee Chairman

AIRCREW RADIATION EXPOSURE

BY CAPTAIN JOYCE MAY, LGA AND FIRST OFFICER ROSS STANDIFER, DFW
NATIONAL AEROMEDICAL COMMITTEE AD HOC MEMBERS

The FAA acknowledged as early as 1967 that on average, airliner crewmembers receive the highest exposures to radiation of nearly any occupationally exposed workforce.

THE AVERAGE dosage received by most jet cockpit and cabin crewmembers exceeds that of atomic plant workers, whose exposures are carefully monitored and controlled. While FAA Advisory Circular 120-61 published in May 1994 recommended all air crewmembers receive training in the hazards associated with radiation exposure, no regulatory actions have been taken by the FAA or any US government agency to properly address the radiation health hazards posed to air crewmembers.

Europe is at the forefront in addressing radiation exposure of airline crewmembers. In May 2000 European carriers will be required to begin informing their aircrews of the radiation doses they receive and the associated risks. Airline operators will be required to alter flying schedules as necessary to reduce exposure levels, particularly for pregnant cabin or cockpit crewmembers. Similar protections are unlikely to materialize in the United States without a vocal outcry from cockpit and cabin crews.

The International Federation of Airline Pilots Associations (IFALPA), an organization which includes most ALPA carriers and many foreign carriers, has a policy proposal that would mandate an annual exposure limit of 6 millisieverts (mSv) per year, the equivalent of approximately 67 typical one-view chest x-rays. (Each chest x-ray represents approximately 0.09 mSv.)

Due to the vulnerability of a fetus to radiation a lower exposure limit is proposed for pregnant crewmembers. If 67 chest x-rays sounds like a lot, the current level recommended by the International Commission on Radiological Protection (ICRP) allows you the equivalent of 222 chest x-rays annually, and the acceptable dose recommended by the US's National Council on Radiation Protection and Measurements (NCRP) allows 556!

Radiation Sources

Our planet receives a constant stream of cosmic radiation emanating from sources deep in outer space, known as galactic radiation, as well as from our sun, known as solar radiation.

Ionizing radiation is defined as any radiation of energy sufficient to knock an orbiting electron from an atom. To a living organism, this translates to free radical production in tissue cells. Free radicals have been linked to the type of genetic damage associated with increased incidence of degenerative diseases such as cancer and increased occurrences of birth defects in the offspring of the exposed organisms. The types of ionizing radiation present at jet cruising altitudes are many and include x-rays, radon, gamma-rays, protons and neutrons.

Between the two sources of cosmic radiation, it is the solar radiation levels that occur more sporadically and cause occasionally large variations in the radiation exposure levels at jet cruising altitudes. For reasons unknown, the sun follows an activity cycle that lasts about 11 years. For a duration of approximately one year during this 11-year cycle, scientists have noted that a marked increase in solar flares, or storms, occur. During these Solar Cosmic Ray (SCR) events, while they do not cause an appreciable increase in radiation levels on the Earth's surface, at jet cruising altitudes, it's a different story.

It is not unusual for radiation doses at cruising altitudes to go up 10 to 20 times more than usual during a solar flare. Levels higher than that can occur but are relatively rare. Although a solar flare event is difficult to accurately predict and can occur at any time during this 11-year cycle, solar flares do occur with greater frequency during this approximately one-year duration. This is of timely concern because we are currently entering the solar cycle phase of increased frequency of SCR events, which was due to begin ahead of schedule in May 2000, according to Dr. Wallace Friedberg, team leader of the Radiobiology Research Group at the FAA's Civil Aeromedical Institute (CAMI).

Aircrew Exposure Factors

It is noteworthy that while actual radiation doses increase at higher altitudes as the atmosphere thins (the dose doubles with each 6,500 feet), doses are also significantly higher at the higher latitudes. The increase at higher latitudes results from the earth's magnetic field, which tends to pull ionic particles away from the equator and more toward the poles. At latitude 70° N, the atmospheric radiation exposure levels are four times higher than at 25° N, at any given altitude.

Some of you may be saying, "So if I fly night legs I won't have to worry, right?" To the uninformed this may sound plausible, but in reality when solar activity is high, radioactive particles are more readily scattered to both the dark and light sides of the earth. Therefore, flying at night affords little or no protection from the associated exposure hazard. Generally, the increased radiation levels associated with most solar events last for several hours, then return to more normal levels; however, SCR events lasting a full day or more have been recorded. As a result, the geographical routes (polar vs. more equatorial), altitudes, and amount of flying we do, especially during this next year or so, will be particularly critical in how it impacts our overall radiation exposure. This issue is even more important for pregnant women, whose recommended exposure levels (out of regard for the fetus) are much lower. The topic of pregnancy and flying will be covered in more detail later.

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Radiation Exposure Limit Recommendations

	ICRP	NCRP
General Public (annual)	1 mSv	1 mSv
Infrequent Exposure for GP	--	5 mSv
Occupational Exposure		
Annual	20 mSv	50 mSv
Cumulative Lifetime Limit	--	10 mSv x age
During Pregnancy	2 mSv	5 mSv – no more than 0.5 mSv/mo.

Average for all radiation workers per year – 2.3 mSv

Regulatory Quagmire

Although air crewmembers have never been officially categorized by the government as radiation workers, it is acknowledged by most authorities on the subject, including the FAA, that we in fact most definitely are.

Dr. Robert J. Barish, a medical physicist and specialist in oncology radiation and noted expert on in-flight radiation, addresses this subject extensively in his book The Invisible Passenger. Another health physicist, Dr. Edward T. Bramlitt, petitioned the FAA in 1984 to classify aircrew as radiation workers in order to get us the training, exposure monitoring, and protection that he felt was needed.

After going back and forth with the FAA for five years and finally being told that the Administrator's decision to deny his petition was final, he joked about his efforts with the FAA saying "jousting with windmills would have been easier." His efforts were not entirely in vain, however. His attempts along with those of others apparently planted the seed of conscience in the proper place, for now the FAA does acknowledge that we are an occupationally exposed work group to radiation, and that we should be properly educated and protected.

The FAA, largely due to the work of Dr. Freidberg and associates, has produced figures showing the estimated exposures one could receive on an average day flying on a particular route at a given altitude. *(See table on next page.)*

Even more useful to crewmembers is a computer model that Dr. Freidberg and associates have produced which is accessible on the Internet. The web site provides an accurate exposure calculation — given the actual parameters of a flight — and accounts for the effects of cosmic variations, such as solar flares, as they actually occurred on a particular day and time. Advisory Circular 120-61, published in May 1994, makes recommendations to air carriers for educating crewmembers, but stops short of anything designed to actually limit crew exposure. (Note: AA is the only airline to comply with this advisory circular.)

It is still left completely up to the crewmember to determine his or her exposure level and what to do to keep it within safe limits. Given the importance of the issue, I'm sure that most of you would agree that you feel poorly armed to make these kinds of determinations and decisions for yourself. Yet that is just what, at least presently, you are expected to do.

Exposure Limitations

The National Council on Radiation Protection and Measurements (NCRP) and their international counterpart, the International Commission on Radiological Protection (ICRP) are committees of experts who, among other functions, make recommendations regarding radiation exposures, which regulatory agencies generally follow. None of the radiation exposure limitations shown in the table on the previous page include any of the radiation received from "background" sources, which are the relatively low amounts of radiation emanating from the soil, building materials, our food, home smoke detectors (to name a few sources), and even that amount of cosmic radiation that reaches ground level.

These agencies also refer to routine medical procedures such as the occasional dental or body part x-ray as "background radiation." In the US, the normal background radiation dose varies from about 1.6 mSv to 5.6 mSv per year with variations resulting from a number of factors. Elevation above sea level and the presence of large amounts of certain types of rock formations (such as granite) are two major contributors to higher dose variation sources.

The amount set by both committees for the general public (not including sources from background radiation) is 1 mSv per year, with the NCRP allowing a higher 5 mSv per year amount for so-called "infrequent exposure" for members of the general public.

You can see from the table on the previous page that the ICRP's recommended limits are more conservative than the NCRP's, particularly when we look at the occupational exposure limits, with the NCRP allowing as much as 50 mSv per year (556 chest x-rays!) vs. the ICRP's 20 mSv per year. For a pregnant woman, since her dose is assumed to be the same as that which her unborn child receives, this lower dose limit is really for the fetus. Since a fetus (as well as young children) have fewer cells than an adult, and their cells are dividing much more rapidly as part of their growth process, they incur much more harm from the cell-destructive power of radiation, particularly in the first trimester of pregnancy when the major organs of the body are still developing.

As far as the rationale for setting the exposure limit to the general public so much lower than that for those occupationally exposed, the logic used by the regulators, according to Dr. Barish, is that the benefits of employment are considered to be offset by the additional health risks incurred by the employee. These additional risks of higher exposure, however, are also supposed to be held in check, at least somewhat, by careful exposure monitoring and health exams in order to be able to correlate the development of any associated medical problems with dose history, and to track ways to minimize future exposure potential.

A quick review of the estimated exposure levels shows that while most aircrew most of the time are well below both the NCRP and ICRP dose limit recommendations for occupationally exposed individuals, almost all of us would definitely range above the annual 1 mSv limit for the general public limit.

The exception, again, is the pregnant flier. Some quick math calculations will show that on more than half of these routes, if she flew as many as 600 hours during her pregnancy she would exceed the recommended dose level and overexpose her unborn child to excess amounts of radiation, if using the more conservative ICRP limit of 2 mSv for her entire pregnancy, but not if using the NCRP 5 mSv limit. However, because the NCRP puts a limit of no more than 0.5 mSv to the fetus in any given month, this one-month restriction limit could cause doses to be exceeded on the more high exposure routes.

Additionally, take a careful look at the footnotes for the parameters in the table on the next page under "Effective Dose," the numbers shown in parentheses are referring to a range of measured dose levels, taken over a period of time from January 1958 to December 1999, and the 100 block-hour estimate is based on the mean over that time period.

The numbers given in the "Doses" table, however, have left out one very critical part of the exposure-level equation for aircrew, and that is the additional doses received from solar flares. Remember how it was pointed out earlier that a solar flare can increase radiation levels 10 to 20 times more than usual?

Solar flares

Since we are now entering a one-year period of anticipated increased solar flare activity, your chances of encountering the increased exposure levels from a solar flare, while infrequent most of the time, are much more likely during the next 12 months or so. While dose levels do vary somewhat depending on where you are located inside a jetliner, there is no place that is safe from these radioactively charged particles; everyone on board gets dosed.

Doing some quick calculations with the doses, on more than a third of the flights shown, if a solar flare occurred which produced 20 times the "normal" doses given, just that one flight alone would be enough to instantly exceed the NCRP monthly maximum dose limit of 0.5 mSv for a pregnant crewmember, and substantially raise the effective dose for any crewmember. Given the solar flare notification procedures to airborne flight crewmembers currently in place (none!), the crew would have no way of knowing how badly they had all just been dosed until after the fact, if then.

Remember, too, how the doses would vary given a change in the cruising altitudes from those shown. Using the Washington, DC to Los Angeles, CA flight as an example, if we flew it at FL390 instead of FL350, remembering the rule of thumb of an approximate doubling of the dose for each 6,500 feet of altitude, we could expect the estimated dose to increase from 19.0 mSv to 30.7 mSv on one flight, or from 0.38 mSv to 0.61 mSv per 100 block hours.

On this example route, with this 4,000-foot higher altitude difference over the course of 100 block hours, that equates to an additional three chest x-rays. (Seven chest x-rays at FL390 instead of four chest x-rays at FL350.) Again, that is excluding any additional dose effect from a concurrent solar flare. While you are studying these estimated dosages in the table with the caveat that they do not reflect the increased dose that a solar flare could cause, remember that the average exposure for the typical non-aircrew radiation worker, who is carefully regulated, is about 2.3 mSv per year. This is significantly less than what most of us as aircrew, who are not specifically monitored or dose controlled in any way, get exposed to annually in the course of our flying duties.

Radiation

Effective Doses of Galactic Cosmic Radiation Received on Air Carrier Flights

	SINGLE NONSTOP ONE-WAY FLIGHT				
Origin – Destination	Highest Altitude, feet in thousands	Air Time, hours	Block Hours	Effective Dose, microsieverts[1]	Millisieverts Per 100 Block Hours[2]
Seattle, WA – Portland, OR	21	0.4	0.6	0.17 (0.13 - 0.18)	0.03
Houston, TX – Austin, TX	20	0.5	0.6	0.17 (0.14 - 0.18)	0.03
Miami, FL – Tampa, FL	24	0.6	0.9	0.39 (0.34 - 0.42)	0.04
St. Louis, MO – Tulsa, OK	35	0.9	1.1	1.69 (1.31 - 1.87)	0.15
San Juan, PR – Miami, FL	35	2.2	2.5	5.17 (4.56 - 5.49)	0.21
Tampa, FL – St. Louis, MO	31	2.0	2.2	4.76 (3.81 - 5.21)	0.22
New Orleans, LA – San Antonio, TX	39	1.2	1.4	3.24 (2.70 - 3.45)	0.23
Los Angeles, CA – Honolulu, HI	35	5.2	5.6	14.5 (13.0 - 15.0)	0.26
Denver, CO – Minneapolis, MN	33	1.2	1.5	3.91 (2.90 - 4.45)	0.26
New York, NY – San Juan, PR	37	3.0	3.5	9.88 (8.28 - 10.8)	0.28
Honolulu, HI – Los Angeles, CA	40	5.1	5.6	16.5 (14.7 - 17.1)	0.29
Chicago, IL – New York, NY	37	1.6	2.0	6.54 (4.78 - 7.54)	0.33
Los Angeles, CA – Tokyo, JP	40	11.7	12.0	43.2 (36.3 - 45.9)	0.35
Tokyo, JP – Los Angeles, CA	37	8.8	9.2	33.5 (27.7 - 35.8)	0.36
Washington, DC – Los Angeles, CA	35	4.7	5.0	19.0 (14.8 - 21.1)	0.38
New York, NY – Chicago, IL	39	1.8	2.3	8.91 (6.46 - 10.3)	0.39
Minneapolis, MN – New York, NY	37	1.8	2.1	8.47 (6.09 - 9.86)	0.40
Lisbon, ES – New York, NY	39	6.5	6.9	29.0 (22.5 - 32.8)	0.42
London, GB – Dallas/Ft. Worth, TX	39	9.7	10.1	43.6 (31.6 - 50.7)	0.43
Dallas/Ft. Worth, TX – London, GB	37	8.5	8.8	39.6 (28.5 - 46.2)	0.45
Seattle, WA – Anchorage, AK	35	3.4	3.7	16.9 (11.9 - 19.9)	0.46
Chicago, IL – San Francisco, CA	39	3.8	4.1	19.3 (14.6 - 21.6)	0.47
Seattle, WA – Washington, DC	37	4.1	4.4	22.3 (16.0 - 25.9)	0.51
London, GB – New York, NY	37	6.8	7.3	37.3 (26.7 - 43.7)	0.51
San Francisco, CA – Chicago, IL	41	3.8	4.1	20.8 (15.6 - 23.5)	0.51
New York, NY – Seattle, WA	39	4.9	5.3	28.0 (19.7 - 32.8)	0.53
Tokyo, JP – New York, NY	41	12.2	12.6	69.7 (49.6 - 82.0)	0.55
New York, NY – Tokyo, JP	43	13.0	13.4	75.1 (54.6 - 87.1)	0.56
London, GB – Los Angeles, CA	39	10.5	11.0	61.5 (43.4 - 72.3)	0.56
Chicago, IL – London, GB	37	7.3	7.7	42.9 (30.0 - 50.7)	0.56
London, GB – Chicago, IL	39	7.8	8.3	47.5 (33.1 - 56.4)	0.57
Athens, GR – New York, NY	41	9.4	9.7	61.5 (45.9 - 70.2)	0.63

1 Mean effective dose (the first and second numbers in parentheses) are the minimum and maximum dosages based on data from January 1958 through December 1999.

2 Based on the mean effective dose for the one-way flight.

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Identifying the Risks To Human Health

It is difficult for scientists to accurately predict the harm that an individual may incur from doses of radiation below 100 mSv (accurate statistical samples of human populations have so far not been identified). Despite this, they have been able to glean certain trends from epidemiological studies done on smaller populations of exposed individuals. This along with studies done on animals and extrapolation from known higher dose effects backwards to the lower doses using a linear dose versus effect formula, is how the NCRP and ICRP have arrived at their dose limit recommendations.

Of interest is that it was in response to a study published in 1990 by the National Academy of Sciences entitled *Health Effects of*

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Radiation Exposure & Consequences

BY CAPTAIN ARLIE APPLER, DFW

We face many hazards during the conduct of our profession. While we are trained to deal with most of the risks and minimize the effects, sometimes we are blindsided by those beyond our control. I experienced such an event in 1984 while pre-flighting an aircraft before departure. Unfortunately, the inbound crew failed to secure the radar after landing, thus allowing a radiation hazard to exist.

The encounter lasted for several minutes while I was determining the source of an unusual noise around the radome. The cockpit radar display was obscured by paperwork and nighttime dimming. Otherwise, the inbound might have returned the unit to standby per procedure. I realized the serious consequences the following day when my skin was severely burned about my face and neck. AA Medical evaluated my condition and documented the injury before referring me to an outside physician. This became critical information many years later during grievance proceedings, a workmen's compensation claim, and a civil product liability action.

The intent of this letter is not to cast blame upon crewmembers or recount the very long ordeal of seeking medical treatment or a legal remedy. The purpose is to make fellow pilots aware of this very real and potentially career-threatening injury. American Airlines sought the opinion of two separate specialists who found that the exposure, if not solely responsible, was certainly causal in the chronic skin cancer condition I developed two years later. Coincidentally, my skin cancer has been confined to my head and neck where the burn was noted by AA Medical.

While our exposure potential has been minimized by new generation radar, we are routinely exposed by inflight radiation.

The FAA discovered my condition through Class I physical reporting and has taken a very active interest in my health. They have obligated me to comply with the FAR directing a pilot not to fly with a "known medical deficiency." Thus, to comply with their specific directive I must remove myself from schedule anytime a new lesion is detected, treated, or medicated. This very restrictive condition has placed me in a position whereby a violation could occur without a very careful and conservative self-evaluation.

For those crewmembers who think they may have had a direct exposure in the past, may I suggest you consult a dermatologist if any suspicious lesion exists. We are beginning to learn of the many consequences of ionizing radiation. While our exposure potential to this type of hazard has been minimized by new generation radar, we are routinely exposed by inflight radiation. The best defense is aggressive use of high SPF sunscreens and sunshades. However, this type of intervention will not completely eliminate our exposure. This fact has driven many medical studies and yet to be acted upon findings.

The consequences of not screening for skin cancer and taking reasonable precautions to prevent the onset are potentially severe. Inform yourself through the many available sources of information and aggressively protect yourself and family.

Exposure to Low Levels of Ionizing Radiation (which increased estimates of the incidence of fatal cancers from exposure to low levels of ionizing radiation upwards by about four times from previously estimated amounts) that prompted the ICRP to lower its annual dose limit from its previous level of 50 mSv to its now lower 20 mSv amount. The trend in dose limits for radiation has always been that as more information is obtained, the recommended limits for exposure keep getting lowered.

There are three governmentally recognized risk categories associated with radiation exposure:

- Increased risk of **fatal cancer** to the exposed individual
- Increased risk of **harm to an unborn child** exposed in utero
- Increased risk of a **birth defect** to a child before conception resulting from parental exposure

Fatal Cancers: Addressing the cancer risk, only fatal cancers are considered in the current risk estimate figures used by the NCRP and ICRP. Dr. Wallace Friedberg at the FAA's CAMI says that more current data is in the process of being evaluated to hopefully increase the accuracy of the estimates, but due to the many human and environmental variables that can't always be factored out, some degree of guesswork will always be present. As of four years ago, the expected fatal cancer rate for the general population was 22%, i.e. 22% of the population's cause of death would be listed as cancer. So using the linear model of risk calculation, if a crewmember were exposed to 5 mSv per year for 20 years, 2,240 out of 10,000 could be expected to die from cancer instead of the 2,200 expected in the general populace. An interesting omission in this risk estimate model is that it says nothing about the ages at which these deaths can be expected to occur.

Fetal Damage: With the rapid cell division that occurs all throughout the body of a child, and most especially in a fetus where the organs are still in the formation process, it becomes easy to see why the young are more sensitive and more easily harmed by radiation than adults. In any living organism, it is usually the rapidly dividing cells in the body that are the most easily destroyed by exposure to radiation.

The FAA recommended in 1986 that pregnant crewmembers alter their flying schedules during pregnancy so as to stay below the NCRP limits of 0.5 mSv per month maximum. Without any monitoring procedures currently in place, and since it is also a real possibility that a fetus could be overexposed on a single flight if airborne during the occurrence of a solar flare (on a flight of more than about three hours at our normal cruise altitude), something needs to be done.

Birth Defects From Preconception Exposure: With the third risk consideration of increased incidence of a birth defect before conception, what this is really referring to is the likelihood that a harmful genetic mutation will occur as the result of radiation exposure to either parent, which results in damage to the respective sperm cell or ovum. If conception was able to occur with either damaged sperm or ovum cell, this could be passed on to the baby once conceived.

Another aspect to consider regarding possible harm to offspring is that official risk assessment statistics do not address any possible increased incidences of miscarriages due to radiation exposure — both those that occur once the pregnancy was known, and those that occur so early that the pregnancy was never even detected before the miscarriage happened.

In Summary

The FAA admits that we are an occupationally exposed work group to radiation, and the numbers in the table on page 31, generated by the FAA's Civil Aeromedical Institute, reflect that. Despite this, we are incurring these risks of exposure without any of the safety nets of exposure monitoring and control in place. Nor do we have the benefit of health monitoring or adequate epidemiological studies being done that could determine if the amounts we are being exposed to, though mostly below current limits for non-pregnant crew, may still be too high. Outside of the aviation community, there is no other group of radioactively exposed individuals who are exposed to as many different types of radiation as we are. Nearly every other population of radiation worker is exposed to mainly one specific form of radiation, i.e. the x-ray technician to x-rays or the atomic plant worker to plutonium, etc.

Very few actual studies of possible health risks to aircrew have been done, and even those were on small populations compared to the total numbers of aircrew. The few studies that have been done, despite the small sample population size that the studies used, do point to a possible increase in the incidence of brain cancer, Hodgkin's Disease, leukemia, rectal cancer, and non-melanoma skin cancers among pilots.

Most of us would probably agree that we did not know that we were radiation workers when we were hired, or knew of the associated risks that being exposed to these higher levels of radiation can bring. One thing is for sure — we will never have the answers to any of these questions unless more is done than is presently being addressed. The Europeans are on the right track with monitoring procedures to track dosages, with the aim being to reduce the higher exposures, and to overall keep dosages as low as practical.

A solution to minimize or stop completely the flying duties of a pregnant crewmember, without unfair monetary penalty to her, needs to be addressed and resolved. The humanitarian concern that a pregnant non-crewmember (passenger) should be aware of the serious harm she could be doing if she chose to fly could be addressed by making the medical community aware of this issue. Presently, most physicians are very misinformed about this concern and routinely tell their patients that flying while pregnant is not a problem. Medical studies of health and fertility issues specific to air crewmembers are needed, but minimizing exposure levels as mentioned above should not be further delayed in the time it would take for these studies to take place.

Outside of the aviation community, there is no other group of radioactively exposed individuals who are exposed to as many different types of radiation as we are.

What Is Being Done?

The FAA continues to gather data to further assess and make recommendations on this issue. There are also four governmental studies currently underway through the National Institute for Occupational Safety and Health (NIOSH) in collaboration with the FAA and other agencies, which are examining cancer rates among aircrew, reproductive problems experienced by female flight attendants, and radiation levels and other harmful contaminants on aircraft. These studies will take several more years to be conclusive, but are just the kind of studies that are needed.

Additionally, at the prompting of APA in conjunction with other aircrew unions, the governmental agency which tracks and measures cosmic radiation activity — the Space Environment Services Center (SESC) of the National Oceanic and Atmospheric Administration (NOAA) — is working on a system that would provide real-time information to pilots as pertinent cosmic events occur, much like a sigmet does.

In the meantime, a number of web sites are currently available that can be used to help estimate the radiation dose received on a given flight as part of an overall dose assessment. These sites will also enable one to analyze the cosmic forecast condition prior to each flight.

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