Annual Limit of Intake (ALI)

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For occupational exposures, the 1990 recommendations of the ICRP limit the effective dose to 100 mSv in a 5 y period (giving an annual value of 20 mSv). The derived limit, ALI, for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year is then

$$ALI = 0.02/e(50)$$

where $e(50)$ is the effective dose coefficient.

A useful quantity in connection with radiation exposure is the Annual Limit of Intake or ALI value. The ALI value is the Annual Limit of Intake for a particular radionuclide and can be obtained by dividing the reference annual average dose of 20 mSv by the dose coefficient, i.e.

$$ALI(Bq) = 0.02 \cdot Sv/e(50)$$

(Publication 60 of the ICRP recommends an occupational committed effective dose limit of 20 mSv per year. For members of the public 1 mSv is the recommended value). The ingestion and inhalation radiotoxicities (RT) are given by

$$RT_{ing} = A \cdot e_{ing}(50), RT_{inh} = A \cdot e_{inh}(50),$$

where A is the specific activity and e the effective dose coefficient. As an example, the annual limits of intake for the main by-products of nuclear waste are given in the table.

The ALI is a calculated value based on the primary dose limit and gives only the annual limit of intake. It is sometimes more useful to establish the limits on the concentration of a radionuclide in air or water which would lead to this intake. For this purpose the derived air concentration (DAC) is introduced for airborne contaminants. The DAC is the average atmospheric concentration of the radionuclide which would lead to the ALI in a reference person as a consequence of exposure at the DAC for a 2000 hour working year. A

reference person inhales 20 litres of air per minute or 2400 m^3 during the working year. The derived air concentration is

Isotope	Annual Limit of Intake (Becquerel)	Annual Limit of Intake (mass)
Plutonium-239	8.0×10^4	30 μg
Minor actinides MA		
Neptunium-237	1.82×10^5	7 mg
Americium-241	1.00×10^5	0.8 μg
Curium-244	1.67×10^5	0.06 μg
Selected fission fragments		
Technetium-99	3.13×10^7	40 mg
Iodine-129	1.82×10^5	30 mg
Caesium-135	1.00×10^7	0.2 g

Annual Limits of Intake (ALI) which results in a dose of 0.02 Sv for the main radioactive by-products of nuclear waste. The values are given in both Becquerel and mass units.

$$DAC(Bq/m^3) = ALI_{inh}(Bq)/2400m^3$$

^{137}Cs, for example, has an $ALI_{inh} = 3.0 \times 10^6$ Bq. It follows that the DAC = 1250 Bq/m^3. Similarly the derived water concentration (DWC) is given by

$$DWC(Bq/litre) = ALI_{ing}(Bq)/913litre$$

Based on a water intake of 2.5 litre per day. For members of the public, the values obtained for the DAC and DWC should be further reduced by a factor 20 corresponding to a dose limit of 1 mSv per year.

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- This page was last modified on 11 October 2012, at 09:30.