2nd International Conference on Air Pollution and Control (CAPAC-II)
September 19-23, 2011
Antalya, Turkey

Assessment of Environmental Gamma Radiation Dose Rate in Ardabil and Sar Ein

Sadegh Hazrati[1]*, Soheila Rahimzadeh[2], Fatemeh Rahimzadeh[3]

[1*] Corresponding Author, Department of environmental Health, School of Public Health, Ardabil University of Medical Sciences, Daneshgah St., Ardabil, Iran
[2]Ardabil provincial health center, Ardabil University of Medical Sciences, Daneshgah St., Ardabil, Iran
[3] Education Office of Tehran Province, Tehran, Iran

E-mail addresses: S.hazrati@Arums.ac.ir, S_R_K1375@yahoo.com

ABSTRACT – Gamma rays, the most energetic photons within the any other wave in the electromagnetic spectrum, pose enough energy to form charged particles and adversely affect human health. Provided that the external exposure of human beings to natural environmental gamma radiation normally exceeds that from all man-made sources combined, environmental gamma dose rate and corresponding annual effective dose were determined in the cities of Ardabil and Sar Ein. Outdoor environmental gamma dose rates were measured using an Ion Chamber Survey Meter in 100 selected locations (one in city center and the remaining in cardinal and ordinal directions) in Ardabil and Sar Ein. Measurements of gamma radiation dose rate were performed at 20 and 100 cm above the ground for a period of one hour. Average outdoor environmental gamma dose rate were determined as 265 and 219 $nSv\ h^{-1}$ for Ardabil and Sar Ein, respectively. The annual affective dose for Ardabil and Sar Ein residents were estimated to be 1.45 and 1.39 mSv, respectively. Calculated annual effective dose of 1.49 and 1.35 nSv are appreciably higher than the population weighted average exposure to environmental gamma radiation worldwide and that analysis of soil content to different radionuclide is suggested.

Keywords: *Gamma, Effective Dose Rate, Ardabil.*

INTRODUCTION

Natural ionizing radiation is emitted as a result of spontaneous nuclear transformations of unstable radionuclides naturally occurring in the earth's crust (i.e. terrestrial origin) as well as those coming from outer space into the atmosphere (i.e. extraterrestrial origin). Gamma radiations as electromagnetic rays often accompany with emission of alpha or beta particles from a nucleus.

The majority of human exposure to ionizing radiation occurs from natural sources including cosmic rays and terrestrial radiation [1]. Exposure to extraterrestrial origin radiation, galactic cosmic rays and energetic particles from solar particle events depends mostly on geographical characteristics of a place such as altitude, latitude, and solar activity [2, 3]. The interaction of cosmic radiation with atoms in the atmosphere produce a range of radionuclides that can give rise to human exposure by inhalation or by ingestion after their uptake by plants [4].

Natural radionuclides of terrestrial origin have very long half-lives or driven from very long-lived parent radionuclides which have been created in stellar processes before the earth formation. Naturally occurring primordial radionuclides mainly include ^{238}U, ^{235}U, and ^{232}Th series and ^{40}K [3, 5], which present at trace levels in all environmental compartments. Most radionuclides in the uranium and thorium series and ^{40}K emit gamma radiation giving rise to exposures from gamma rays outdoor. Gamma ray accounts for the majority of external human exposure to radiation from all source types due to its high penetration ability [2, 6]. Gamma radiation has sufficient energy to eject one or more orbital electrons from atoms in the human body and hence break chemical bonds through non-thermal process, thus inducing chemical changes that may be biologically important for the normal functioning of body cells. Physical and chemical processes occurring following the radiation exposure involve successive changes at the molecular, cellular, tissue, and whole body levels that may lead to a wide range of health effects varying from simple irritation, radiation-induced cancer, and hereditary disorders to immediate death [2].

Great variations have been observed in environmental radiation levels and that several national and international studies have been characterized gamma dose rates both in