

## REFERENCES

1. Abu-Jarad, F., Fremlin, J. H., and Bull, R., (1980), "A Study of Radon Emitted from Building Materials using Plastic Track Detectors," *Phys Med Biol*, 25, pp. 683–694.
2. Agricola, G., (1556), "De Re Metallica," Basel 1556, New York: Dover Publications, English reprint (Hoover translation), pp. 214.
3. Andrews, J.N., and Wood, D.F., (1972), "Mechanism of Radon Release in Rock Matrices and Entry into Groundwaters," *Trans. Inst. Min. Metall. Sect., B* 81, pp. 198–209.
4. Al-Saleh, F. S., (2007), "Measurement of Indoor Gamma Radiation and Radon Concentration in Dwellings of Riyadh City, Saudi Arabia," *Appl Radiat Isot*, 65, pp. 843–848.
5. Auvinen, A., et al., (2005), "Radon and Other Natural Radionuclides in Drinking Water and Risks of Stomach Cancer: A Case–Cohort Study in Finland," *International Journal of Cancer*, 10, pp. 109–113.
6. Bala, P., Kumar, V., Mehra, R., (2017), "Measurement of Radon Exhalation Rate in Various Building Materials and Soil Samples," *J Earth Syst Sci.*, doi:10.1007/s12040-017-0797-z.
7. Ball, T.K., Cameron, D.G., Colman, T.B., and Roberts, P.D., (1991), "Behaviour of Radon in the Geological Environment: A Review," *Quarterly Journal of Engineering Geology and Hydrogeology*, 24, pp. 169–182.
8. Banjanac, R., Dragic, A., Grabec, B., Jokovic, D., Markushev, D., Panic, B., Udovicic, V., Anicic, I., (2006), "Indoor Radon Measurement by Nuclear Track Detectors: Applications in Secondary Schools," *Facta Universities Series: Physics, Chemistry and Technology*, 4(1), pp. 93–100.
9. Bangotra, P., Jakhu, R., Mehra, R., Kaur, K., Pandit, P., Kanse, S., (2017), "Estimation of Radon Exhalation Rate and Assessment of Radiological Risk from the Activity Concentration of Ra-226, Th-232 And K-40," *Journal of Geochemical Exploration*, XX.
10. BEIR IV (Report of the committee on the biological effects of ionizing radiation), (1988), *Health Risks of Radon and Other Internally Deposited Alpha Emitters*, Natl. Res. Council. Acad. Press, Washington.

11. BEIR VI (Report of the Committee on the Biological Effects of Ionizing Radiation), (1999), "Health Effects of Exposure to Radon," National Academy Press, Washington, D.C. ISBN: 978-0-309-05645-8.
12. Bennet, W. D., Zeman, K. L., et al., (2003), "Nasal Distribution to Breathing with Exercise: Effect of Race and Gender," *J Appl Phy soil*, 95(2), pp. 497–503.
13. Bonotto, D. M., Caprioglio, L., (2002), "Radon in Groundwater from Guarany Aquifer, South America: Environmental and Exploration Implications," *Applied Radiation and Isotopes*, 57(6), pp. 931-940.
14. Bourai, A. A., Gusain, G. S., Rautela, B. S., Joshi, V., Prasad, G., Ramola, R. C., (2012), "Variations in Radon Concentration in Groundwater of Kumaon Himalaya, India," *Radiat Prot Dosim*, 152, pp. 55–57.
15. Brudecki, K., Li, W. B., Meisenberg, O., Tschiersch, J., Hoeschen, C., Oech, U., (2014), "Age Dependent Inhalation Dose to Members of the Public from Indoor Short-Lived Radon Progeny," *Radiat Environ Biophys*, 53(3), pp. 535-549.
16. Brutsaert, W. F., Norton, S. A., Hess, C. T., Williams, J. S., (1981), "Geologic and Hydrologic Factors Controlling Radon-222 in Ground Water in Maine," *Groundwater*, 19, pp. 407-417.
17. Butterweck, G., Schuler, C., Vessu, G., et al., (2002), "Experimental Determination of the Absorption Rate of Unattached Radon Progeny from Respiratory Tract to Blood," *Radiat Prot Dosimetry*, 102, pp. 343–348.
18. Central Ground Water Board, Ministry of Water Resources, Government of India, Western Region, Jaipur, (2013).
19. Chahuan, R. P., Kumar, A., Chuhan, N., et al., (2016), "Ventilation Effect on Indoor Radon-Thoron Levels in the Dwellings and Correlation with Soil Exhalation Rates," *Indoor and Inbuilt Environment*, 25(1), pp. 203-212.
20. Chamberlain, A. C., Dyson, E. D., (1956), "The Dose to the Trachea and Bronchi from the Decay Products of Radon and Thoron," *Br J Radiol*, 29, pp. 317–325.
21. Chen, J., Bergman, L., et al., (2015), "Results of Simultaneous Radon and Thoron Measurements in 33 Metropolitan Areas of Canada," *Radiat Prot Dosim*, 163(2), pp. 210–216.
22. Chen, J., (2019), "A Discussion on Issues with Radon in Drinking Water," *Radiation Protection Dosimetry*, 185(4), pp. 526–531.
23. Cothorn, C.R., Leppenbush, W.L., and Michel, J., (1986), "Drinking Water Contribution to Natural Background," *Health Phys.*, 50, pp. 258-262.

24. Darby, S., Hill, D., Auvinen, A., et al., (2005), "Radon in Homes and Risks of Lung Cancer: Collective Analysis of Individual Data from 13 European Case-Control Studies," *British Medical Journal*, 330(7485), pp. 223-226.
25. Dowdall, A., Murphy, P., et al., (2017), "Update of Ireland's National Average Indoor Radon Concentration-Application of a New Survey Protocol," *J. Environ. Radioact*, 169-170, pp. 1-8.
26. Duggal, V., Rani, A., Mehra, R., (2012), "In Situ Measurements of Radon Level in Groundwater in Northern Rajasthan, India," *Advances in Applied Science Research*, 3(6), pp. 3825-3830.
27. Duggal, V., Mehra, R., Rani, A., (2013), "Analysis of Radon Concentration in Drinking Water in Hanumangarh District of Rajasthan, India," *Radiation Protection and Environment*, 36(2), pp. 65.
28. Durrani, S. A., and Ilić, R., (1997), "Radon Measurements by Etched Track Detectors. Applications in Radiation Protection, Earth Sciences and the Environment," *World Scientific Publishing Co. Pte. Ltd., Singapore*.
29. Elster, J., Geitel, H., (1901), *Physik Z.*, 2, pp. 590-593.
30. Eappen, K.P., Mayya, Y.S., (2004), "Calibration factors for LR-115 (Type-II) based radon thoron discriminating dosimeter," *Radiat. Meas*, 38, pp. 5-17.
31. Eppan, K. P., Sapra, B. K., Mayya, Y. S., (2007), "A Novel Methodology for Online Measurement of Thoron Using Lucas Scintillation Cell," *Nucl Instrum Methods Phys Res*, 572, pp. 922–925.
32. Epinoso, G., Golzarri, J. I., et al, (1999), "Distribution of Indoor Radon Levels in Mexico," *Radiat Meas*, 31, pp. 355–358.
33. EURATOM, (2013), "Laying Down Basic Safety Standards for Protection Against the Dangers Arising from Exposure to Ionising Radiation," *Council Directing 2013/59/EURATOM*.
34. Fardoas, S., Saleh, A., Badriah, A. B., (2007), "Measurement of Natural Radioactivity in Some Kinds of Marble and Granite Used in Riyadh Region," *J. Nucl. Rad. Phys.*, 2, pp. 25-536.
35. Fleischer, R. L., Price, P. B., and Walker, R. M., (1975), "Nuclear Tracks in Solids: Principles and Applications," *University of California press, Berkley*.
36. Folger, P. F., Nyberg, P., et al., (1994), "Relationship Between Rn222 Dissolved in Groundwater Supplies and Indoor Rn222 Concentration in Some Colorado Front Range Houses," *Health Phys*, 67, pp. 245–253.

37. Garcis-Tober, J., (2018), "A Comparative Study of Indoor Radon Levels between Two Similar Dwellings Using CONTAM Software," *Environment*, 5, pp. 59.
38. Girault, F., Perrier, F., Tadeusz, A., Przylibski, (2016), "Radon-222 and Radium-226 Occurrence in Water: A Review Geological Society, London," *Special Publications*, 451, pp. 131-154.
39. Gish, O.H., (1951), "Compendium of Metrology," Edited by Thomas, P. Matone, American Metrological Society, Boston Massachusetts, 101.
40. Gusain, G. S., Prasad, G., Prasad, Y., Ramola, R. C., (2009), "Comparison of Indoor Radon Level with Radon Exhalation Rate from Soil in Garhwal Himalaya," *Radiation Measurements*, 44, pp. 1032-1035.
41. Gaware, J. J., Sahoo, B. K., and Sapra, B. K., "Development of Online Radon and Thoron Monitoring Systems for Occupation and General Environment", *BARC News Letter*, 318, pp. 45–51.
42. Hamilton, E. I., (1971), *Am. Ind. Hyg. Ass, J.*, 32, 6.
43. Harting, F. H. and Hess, W., (1879), "Der Lungenkrebs, die Bergkrankheit in den Schneeberger Gruben, Vierteljahrsschr," *f. gerichtl. Mee. U. offentel. Gesundheitwissen*, NF 30, No. 296, pp. 31.
44. Hassan, N. M., Tokonami, S., Fukushima, M., (2011), "A Simple Technique for Studying the Dependence of Radon and Thoron Exhalation Rate from Building Materials on Absolute Humidity," *J Radional Nucl Chem*, 287, pp. 185–191.
45. Henshaw, D. L., Eatough, J. P., Raichanderson, R. B., (1990), "Radon as a Causative Factor in Induction of Myeloid Leukemia and Other Cancers," *Lancet*, 355, pp.1008– 1015.
46. Hess, C.T., Michel, J., Horton, T.R., Prichard, H.M., and Coniglio, W.A., (1985), "The Occurrence of Radioactivity in Public Water Supplies in the United States," *Health Physics*, 48(5), pp. 553-586.
47. Hill, D. S. D., et al., (2004), "Radon in Homes and Risk of Lung Cancer, Collaborative Analysis of Individual Data from 13 European Case Control Studies," *Br J Cancer*, 330, pp. 223.
48. Hussein, Z. A., Jaafar, M. S., Ismail, A. H., (2013), "Measurement of Indoor Radon Concentration Levels in Iraqi Kurdistan Region," *Arch Appl Sci Res*, 5(2), pp. 72–78.

49. IAEA, (International Atomic Energy Agency), (1989), "Facts About Low Level Radiations," IAEA/PI/A9E 85-00740. American Nuclear Society, Washington, DC.
50. IARC, (International Agency for Research on Cancer), (1988), "Man-made Mineral Fibres and Radon," IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. IARC, Lyon, France, 43.
51. IARC, (International Agency for Research on Cancer), (2001), "Monographs on the evaluation of carcinogenic risks to humans," Ionizing radiation. Part 2: Some internally deposited radionuclides. Lyon, France, 78.
52. ICRP, (International Commission of Radiological Protection), (1987), "Lung cancer risks from indoor exposures to radon daughters," Annals of ICRP, 16, Publication No. 50, Pergamon press, Oxford.
53. ICRP, (International Commission on Radiological Protection), (1993), "Protection against radon-222 at home and at work," Oxford: Pergamon Press; Publication 65; Ann ICRP 23(2).
54. ICRP, (1990), "Recommendations of International Commission on Radiological Protection" Publication 60. Ann. ICRP 21 (1-3), Pergamon Press, Oxford.
55. ICRP, (1994), "Human Respiratory Tract Model for Radiological Protection," Publication 66 Ann. ICRP 24 (1-3).
56. ICRP, (International Commission on Radiological Protection), (2009), "Statement on Radon" ICRP Ref 00/902/09.
57. ICRP, (2017), "Occupational Intakes of Radionuclides: Part 3," ICRP Publication 137 Ann. ICRP 46(3/4).
58. ICRP, (International Commission on Radiological Protection), (2018), "Radiological protection against radon exposure," ICRP Publication ref 4836-9756-8598. ICRP, Stockholm, Sweden.
59. Ilani, S., Minster, T., Kronfeld, J., Even, O., (2006), "The Source of Anomalous Radioactivity in the Springs Bordering the Sea of Galilee, Israel," Journal of Environmental Radioactivity, 85, pp. 137-146.
60. Iyer, R. H., (1972), "Solid State Track Detectors. A Novel Tool for the Study of Fission Phenomena," J. Chem. Educ., 49(11), pp. 742-745.
61. Jobbágy, V., Chmielewska, I., Kovács, T., and Chalupnik, S., (2009), "Uranium Determination in Water Samples with Elevated Salinity from Southern Poland by

- Micro Coprecipitation Using Alpha Spectrometry,” *Microchem. J.*, 93, pp. 200-205.
62. Jonsson, G., (1981), “The angular sensitivity of Kodak LR film to alpha particles,” *Nucl. Instruments Meth.*, 190 (2), pp. 407-414.
  63. Kaliprasad, C. S., Narayana, Y., (2018), “Distribution of Natural Radionuclides and Radon Concentration in the Riverine Environs of Cauvery South India,” *J Water Health*, 16(3), pp. 476–486.
  64. Kandari, T., Aswal, S., et al., (2016), “Study of Radiation Exposure Due to Radon, Thoron and Their Progeny in The Indoor Environment of Rajpur Region of Uttarakhand Himalaya,” *Radiation Protection Dosimetry*, 171(2), pp. 204–207.
  65. Kandel, G.M. and Smith, T.J. (2002), “Dose to Organs and Tissues from Radon and Its Decay Products,” *Jour. Radio. Prot.*, 22, pp. 389-406.
  66. Kansal, S., Mehra, R., Singh, N. L., (2011), “Measurement of Indoor Radon Concentration in the Dwellings of Western Haryana, India, for Health Risk Assessment,” *Int. J. Low Radiation*, 8(2), pp. 122-134.
  67. Kansal, S., Mehra, R., Singh, N. P., (2011), “Uranium Concentration in Groundwater Samples Belonging to Some Areas of Western Haryana, India Using Fission Track Registration Technique,” *Journal of Public Health and Epidemiology*, 3(8), pp. 352-357.
  68. Kansal, S., Mehra, R., et al., (2014), “Assessment of Indoor Radon Concentration in Air Using RAD7 and Radon Exhalation Rate Measurement in Soil Samples,” *J Appl Phys*, 5(2), pp. 80–84.
  69. Kansal, S., and R, Mehra., (2015), “Evaluation and Analysis of Ra-226, Th-232, K-40 and Rn-222 Exhalation Rate in the Soil Samples for Health Risk Assessment,” *Int. J. Low. Rad.*, 10(1), pp. 1-13.
  70. Kant, K., Gupta, R., Kumari, R., Gupta, N., and Garg, M., (2015), “Natural Radioactivity in Indian Vegetation Samples”, *International Journal of Radiation Research*, 13(2), 143-150.
  71. Kaur, K., Kumar, A., Mehra, R., et al., (2018), “Study of Radon/Thoron Exhalation Rate, Soil-Gas Radon Concentration and Assessment of Indoor Radon/Thoron Concentration in Siwalik Himalayas of Jammu & Kashmir,” *Ecol Risk Assess Int J.*, doi:10.1080/10807 039.2018.14437 93.

72. Kaur, K., Mehra, R., Bhagotra, P., and Jakhu, R., (2017), "Assessment of Radiological Dose due to Radon in Faridkot District of Punjab".
73. Kaur, M., Kumar, A., Kaur, S., et al., (2018), "Assessment of Radon/ Thoron Exhalation Rate in the Soil Samples of Amritsar and Tarn Taran District of Punjab State," *Radiat Prot Environ*, 41(4), pp. 210.
74. Kendall, G. M., Smith, T. J., (2003), "Doses to Organs and Tissues from Radon and Its Decay Products," *J Radio Prot.*, 22(4), pp. 389-406.
75. Khan, F. M., Gibbons, J. P., (2014), "Khan's the Physics of Radiation Therapy," 5th edn. Lippincott Williams & Wilkins, Philadelphia.
76. Kolthoff, I. M., and Philips, J., Evings, (1966), "Treaties of Analytical Chemistry," 4 part II", 219.
77. Krewski, D., Lubin, J. H., et al., (2005), "Residential Radon and Risk of Lung Cancer: A Combined Analysis of 7 North American Case Control Studies," *Epidemiology*, 16(2), pp. 137–145.
78. Kumar, A., and Kaur, A., (2014), "A Study of Radon Concentration in Water and Radon Exhalation Rate in Soil Samples Belonging to Kapurthala District, Punjab, India," *Advanced in Applied Science Research*, 5(1), pp. 43-47.
79. Kumar, A., Vij, R., Sharma, S., Sarin, A., Narang, S., (2016), "Assessment of Radionuclide Concentration and Exhalation Studies in Soil of Lesser Himalayas of Jammu and Kashmir, India," *Acta Geophys*, 66, pp. 1195-202.
80. Kumar, K. M. B., Nagaish, N., Mathews, G., (2018), "Study on Influence of Soil and Atmospheric Parameters on Radon/Thoron Exhalation Rate in the Bangalore University, Bengaluru," *Radiat Prot Environ*, 41(1), pp. 8–11.
81. Kumar, M., Kumar, P., Agarwal, A., Sahoo, B. K., (2022), "Radon Concentration Measurement and Effective Dose Assessment in Drinking Groundwater for the Adult Population in the Surrounding Area of a Thermal Power Plant," *Journal of Water and Health*, 20(3), pp. 551.
82. Kumar, T. S., Revanna, S., Ramchandra, M. N., Ashok, G. V., Ningappa, C., and Gowda, S., (2019), "Measurement of Radon Soil Gas in and Around Bharathinagara, Mandya District", *Radiation Protection Dosimetry*, pp. 1-5.
83. Lubin, J. H., Boice, J. D., et al., (1995), "Lung Cancer in Radon-Exposed Miners and Estimation of Risk from Indoor Exposure," *J Natl Cancer Inst*, 87(11), pp. 817–827.

84. Lubin, J. H., Boice, J. D., et al., (1997), "Lung Cancer Risk from Residential Radon: Meta Analysis of Epidemiological Studies," J Natl Cancer Inst, 89, pp. 49–57.
85. Loomis, D. P., (1987), "Radon-222 Concentration and Aquifer Lithology in North Carolina," Groundwater Monitoring & Remediation, 7(2), pp. 33-39.
86. Love, S. K., (1951), "Natural Radioactivity of Water," Industrial & Engineering Chemistry, 43(7), pp. 1541-1544.
87. Ludewig, P., and Lorenzer, S., (1924), "General and Physical Chemistry," Z. Physik., 22, 127-156.
88. Mahajan, S., Singh, H., et al., (2005), "A Study of Groundwater Radon Concentration in Punjab and Himachal Pradesh States, India," Indoor Inbuilt Environ, 14(6), pp. 481-486.
89. Malik, S. R., and Durrani, S. A., (1974), "Spatial distribution of uranium in meteorites, tektites and other geological materials by spark counter," Int. J. Appl. Rad. and Isotopes 25, pp. 1-8.
90. Mayya, Y. S., Eappen, K. P., and Nimbi, K. S. V., (1998), "Methodology for Mixed Field Inhalation Dosimetry in Monazite Areas Using a Twin- Cup Dosimeter with Three Track Detectors," Radiation Protection and Dosimetry, 77 (3), pp. 177-184.
91. Mayya, Y. S., Mishra, R., et al., (2010), "Wiremesh Capped Deposition Sensors: Novel Possessive Tool for Coarse Fraction Flux Estimation of Radon Thoron Progeny in Indoor Environments," Sci Total Environ, 409, pp. 378–383.
92. Mayya Y.S., Mishra R., Prajith R., (2012), "Deposition-Based Passive Monitors for Assigning Radon, Thoron Inhalation Doses for Epidemiological Studies," Radiation Protection Dosimetry, 152(1-3), pp. 18-24.
93. Mehra, R., Singh, S., Kumar, S., (2009), "Measurement of Indoor Radon Levels in Dwellings of Sirsa District, Haryana and Estimation of Average Annual Dose," J Environ Sci Engg, 51(2), pp. 103–106.
94. Mehra, R., Bangotra, P. and Kaur, K., (2015), "222Rn and 220Rn Levels of Mansa and Muktsar District of Punjab, India," Frontiers in Environmental Science, 3:37.
95. Mehra, R., et al., (2015), "Estimation of Attached and Unattached Progeny of Rn-222 and Rn-220 Concentration Using Deposition-Based Progeny Sensors," Radiat Prot Dosim, pp. 1–5.



96. Mehra, R., et al., (2016), "Estimation of Radiological Dose from Progeny of  $^{222}\text{Rn}$  and  $^{220}\text{Rn}$  using DTPS/DRPS and Wire-mesh Capped Progeny Sensors," Dose Response. doi:10.1177/155932581660883.
97. Meijer De, R. J., Stoop, P., and Put, L., (1992), "Contribution of Radon Flows and Radon Sources to the Radon Concentration in A Dwelling," Radiat. Prot. Dosim., 45(1-4), pp. 439-442.
98. Milner, J., Shrubsole, C., et al., (2014), "Home Energy Efficiency and Radon Related Risk of Lung Cancer: Modelling Study," British Medical Journal, 48, pp. 1–12.
99. Mirbeg, A., Poursani, A. S., (2018), "Indoor Radon Measurement in Residential/ Commercial Buildings in Isfahan City," J Air Pollut Health, 3(4), pp. 209–218.
100. Mishra, R., Mayya, Y. S., (2008), "Study of Deposition- Based Direct Thoron Progeny Sensors (DTPS) Technique for Estimating Equilibrium Equivalent Thoron Concentration (EETC) in Indoor Environment," Radiation Measurement, 43, pp. 1408-1416.
101. Mishra, R., et al., (2010), "Response of Direct Thoron Progeny Sensors (DTPS) to Various Aerosol Concentrations and Ventilation Rates," Nucl Inst Methods Phys Res B, 268, pp. 671–675.
102. Mishra, R., Sapra, B.K., Mayya, Y. S., (2014), "Multi Parametric Approach towards the Assessment of Radon and Thoron Progeny Exposure," Review of Scientific Instruments, 85(2). doi:10.1063/1.4865165.
103. Mishra, R., Prajitha, R., (2020), "Effect of air velocity of inhalation dose due to radon and thoron progeny in a test chamber," Radiation Protection Dosimetry, pp. 1-5.
104. Misdaq, M. A., Merzouki, A., Elabboubi, D., Aitnouh F., Berrazzouk, S., (2000), "Determination of Radon Equivalent Alpha- Doses in Different Human Organ from Water Ingestion Using SSNTD and Dosimetric Compartment Models," J. Radional Nucl Chem, 245(3), pp. 513-520.
105. Mittal, S., Rani, A., Mehra, R., (2015), "Estimation of Radon Concentration in Soil and Groundwater Samples of Northern Rajasthan, India," Journal of Radiation Research and Applied Sciences, 9(2). doi:10.1016/j.jrras.2015.10.006.
106. Nazir, S., Simnani, S., Sahoo, B. K., Mishra, R., Sharma, T., and Mashood, S., (2020), "Dose Estimation of Radioactivity in Groundwater of Srinagar City,

- Northwest Himalaya, Employing Fluorimetric and Scintillation Techniques,” *Environ Geochem Health*, doi:10.1007/s10653-020-00576-5.
107. Nazir, S., Simnani, S., et al., (2020), “Thermal Springs and Groundwater of Pir Panjal, Jammu and Kashmir, for Radon Contamination,” *J Radioanal Nucl Chem*, 326, pp. 1915–1923.
  108. Nguyen-Thuy, D., Van Nguyen, H., et al., (2019), “<sup>220</sup>Rn (Thoron) Geohazard in Room Air of Earthen Dwellings in Vietnam,” *Geofluids*, doi:10.1155/2019/7202616.
  109. Nazaroff WW., Nero Jr. A.V., (1988), “Radon and its decay products in indoor air,” New York; John Wiley and Sons.
  110. NEA/OECD (Nuclear Energy Agency/ Organization for Economic Co-operation and Development), (1979), “Exposure to Radiation from the Natural Radioactivity in Building Materials,” Expert Group Report, OECD. Paris.
  111. Nero, A. V. Jr., (1989), “Earth, Air, Radon and Home,” *Physics Today*, April, pp. 32-39.
  112. NCRP, (1984), “Evaluation of Occupational and Environmental Exposure to Radon and Radon Daughters in the United States,” National Council on Radiation Protection and Measurements, Report No. 78.
  113. NCRP, (2009), “Ionising Radiation Exposure of the Population of the United States,” Report No. 160, ISBN: 13:978-0-929600-98-7.
  114. Nikolopoulos, D., Louizi, A., (2008), “Study of Indoor Radon and Thoron in Drinking Water in Greece and Cyprus: Implication to Exposure and Dose,” *Radiat Meas*, 43, pp. 1305–1314.
  115. NRC (National Research Council), (1999), “Committee on Risk Assessment of Exposure to Radon in Drinking Water,” National Academic Press, Washington, USA.
  116. Nuccetelli, C., Rusconi, R., and Forte, M., (2012), “Radioactivity in Drinking Water: Regulations, Monitoring Results and Radiation Protection Issues,” *Annali dell'Istituto superiore di sanità*, 48, pp. 362-373.
  117. Otton, J. K., (1992), “The Geology of Radon,” Washington: Government Printing Office.
  118. Prasad, M., Bossew, P., et al., (2017), “Dose Assessment from the Exposure to Attached and Unattached Progeny of Radon and Thoron in Indoor Environment,” *Acta Geophys.*, doi:10.1007/s11600-018-0111-801234-56789.

119. Porstendorfer, J., (1996), "Radon: Measurement Related to Dose," *Environ Int*, 22(1), pp. 563–583.
120. Porstendorfer, J., (2001), "Physical Parameters and Dose Factors of the Radon and Thoron Decay Products," *Radiat Prot dosim*, 94(4), pp. 365–373.
121. Pouloupoulos, S. G., (2016), "Atmospheric Environment," *Environmental and Development*, Chap. 2.
122. Prajith, R., Rout, R. P., Kumbhar, D., et al., (2019), "Measurements of Radon ( $^{222}\text{Rn}$ ) and Thoron ( $^{220}\text{Rn}$ ) Exhalations and Their Decay Products Concentrations at Indian Stations in Antarctica," *Environ Earth Sci*, doi:10.1007/s12665-018-8029-7.
123. Pynngrope, A., Khardewsaw, A., et al., (2020), "Study of Indoor Radon, Thoron and Their Progeeny in South West Khasi Hills District of Meghalaya. India," *Radiat Prot Dosim*, 189(3), pp. 347–353.
124. Pynngrope, A., Saxena, A., et al., (2021), "Effect of Soil's Porosity and Moisture Content on Radon and Thoron Exhalation Rates," *Journal of Radioanalytical and Nuclear Chemistry*, doi:10.1007/s10967-021-08168-y.
125. Quindos, L. S., Fernandez, P L., Soto, J., Rodenos, C., and Gomez, J., (1994), "Natural Radioactivity in Spanish Soils," *Health Physics*, 66, pp. 194-200.
126. Radhakrishna, A. P., Somasekarapa, H. M., Narayana, Y., and Siddappa, K., (1993), "A New Natural Background Radiation Area on the Southwest Coast of India," *Health Phys.*, 65, pp. 390–395.
127. Rani, A., Mehra, R., and Duggal, V., (2013), "Radon Monitoring in Groundwater Samples from Some Areas of Northern Rajasthan, India, Using a RAD7 Detector," *Radiation protection dosimetry*, 153(4), pp. 496-501.
128. Rani, S, Kansal, S., Singla, A. K., Mehra, R., (2021), "Radiological Risk Assessment to the Public Due to the Presnece of Radon in Water of Barnala District, Punjab, India," *Environ geochem health*, doi:10.1007/s10653-021-01012-y.
129. Ramachandran, T. V., Sahoo, B. K., (2009), "Thoron ( $^{220}\text{Rn}$ ) in Indoor Environment and Work Places," *Indian J Phys*, 83(8), pp. 1079-1098.
130. Ramola, R.C., Gusain, G.S., Rutela, B.S., Sagar, D.V., (2012), "Levels of Thoron and Progeny in High Background Radiation Area of Southeastern Coast of Odisha, India," *Radiat Prot. Dosimetry*, 152(1-3), pp. 62-65.

131. Ramola, R. C., Prasad, M., Kandari, T., et al., (2016), "Dose Estimation Derived from the Exposure to Radon, Thoron and Their Progeny in the Indoor Environment," *Sci Rep.*, doi:10.1038/srep31061.
132. Reddy, U.K., Ningappa, C., Sannappa, J., Rangaswamy, D. R., Srinivasa, E., (2017), "Concentration of Radon and Physiochemical Parameters in Underground Water Around Kolar Gold Fields, Karnataka, India," *J Radioanal Nucl Chem.*, 314, pp. 907-915.
133. Rout, R.P., Mishra, R., et al., (2014), "Measurement of  $^{222}\text{Rn}$  and  $^{220}\text{Rn}$  Decay Product Deposition Velocities Using SSNTD Based Passive Detectors," *J Radional Nucl Chem*, 302, pp. 1495-1499.
134. Sahoo, B. K., Nathwani, D., (2007), "Estimation of Radon Emanation Factor in Indian Building Materials," *Radiation Measurements*, 42 (8), pp. 1422-1425.
135. Sahoo, B. K., Sapra, B. K., Gware, J. J., Mayya, Y. S., (2011), "A Model to Predict Radon Exhalation from Walls to Indoor Air Based on the Exhalation from Building Material Samples," *Science of Total Environment*, 409, pp. 2635-2641.
136. Sahoo, B. K., Sapra, B. K., (2013), "A New Pinhole Discriminated  $^{222}\text{Rn}/^{220}\text{Rn}$  Passive Measurement Device with Single Entry Face," *Radiation Measurement*, 58, pp. 52-60.
137. Saini, K, Sahoo, B. K., Bajwa, B. S., (2018), "Estimation of Indoor Radon, Thoron and Their Decay Products Concentration Along with Annual Inhalation Dose in Dwellings of Punjab, India," *Indoor Built Environ*, 27, pp. 380–389.
138. Sapra, B. K., Kothalkar, P. S., et al., (2011), "Mitigating Particulates Emitted by Mosquito Coils Using Unipolar Ionisers: Implication to Human Respiratory Tract System," *Indoor and Inbuilt Environ*, 22(2), pp. 347–259.
139. Sapra, B. K., Sahoo, B. K., Mishra, R., Rout, R. P., Kanse, S. D., Agarwal, T. K., et al., (2016). *Handbook on Radon Transport Models and Measurement Methods*. Mumbai.
140. Sharma, S., Duggal, V., Srivastava, A. K., Mehra, R., Rani, A., (2017), "Radon Concentration in Groundwater and Associated Effective Dose Assessment in Western Haryana, India," *Internat. Jour. Inn. Res. Sci. Engg.*, 3, pp. 69-78.
141. Sharma, S., Kumar, A., et al., (2018), "Assessment of Progeny Concentrations of  $^{222}\text{Rn}/^{220}\text{Rn}$  and Their Related Doses During Deposition Based Direct Progeny Sensors," *Environ Sci Pollut Res*, 25, pp. 11440–11453.

142. Singh, N. L., Agarwal, S., et al., (1990), "Comparative Study of Pre-Equilibrium Models and Mechanism of Alpha Particle Induced Reactions," *Journal of the Physical Society of Japan*, 59(11), pp. 3916-3924.
143. Singh, B., Kant, K., et al., (2019), "A Study of Seasonal Variations of Radon, Thoron and Their Progeny Levels in Different Types of Dwellings in Faridabad District, Southern Haryana, India," *Journal of Radioanalytical and Nuclear Chemistry*, doi:10.1007/s10967-019-06544-3.
144. Singh, B., Kant, K., Garg, M., Singh, A., Sahoo, B. K., Sapra, B. K., (2019), "A Comparative Study of Radon Levels in Underground and Surface Water Samples of Faridabad District of Southern Haryana, India," *Journal of Radioanalytical and Nuclear Chemistry*, 319(3), pp. 907-916.
145. Singh, B., Kaint, K., Garg, M., Sahoo, B. K., (2020), "Quantification of Radon/Thoron Exhalation Rates of Soil Samples Collected from District Faridabad of Southern Haryana, India," *Journal of Radioanalytical and Nuclear Chemistry*, doi:10.1007/s10967-020-07365-5.
146. Singla, A. K., Kansal, S., and Mehra, R., (2021), "Quantification of Radon Concentration in Drinking Water of Rajasthan, India," *Journal of Radioanalytical and Nuclear Chemistry*, 327(3), pp. 1149-1157.
147. Singh, P., Siaini, K., et al., (2015), "Attached, Unattached Fraction of Progeny Concentrations and Equilibrium Factor for Dose Assessments from  $^{222}\text{Rn}$  and  $^{220}\text{Rn}$ ," *Radiat Environ Biophys*, doi:10.1007/s00411-016-0656-3.
148. Skeppström, K., Olofsson, B., (2007), "Uranium and Radon in Groundwater," *Eur Water*, 17, pp. 51–62.
149. Sonkawde, R. G., Ram, R., (2003), "Radon in Tube-Well Drinking Water and Indoor Air," *Indoor and Inbuilt Environment*, 13, pp. 383-385.
150. Soh. T., Saidu., et al., (2019), "Simultaneous Measurements of Indoor Radon and Thoron and Inhalation Dose Assessment in Douala City, Cameroon," *Isot Environ Health Stud*, 55(5), pp. 499–510.
151. Srinivasa, E., Rangaswamy, D. R., Sannappa, J., (2015), "Determination of Radon Activity Concentration in Drinking Water and Evaluation of the Annual Effective Dose in Hassan District, Karnataka State, India," *Journal of Radioanalytical and Nuclear Chemistry*, 305(2), pp. 665-673.

152. Srinivasa, E., Rangaswamy, D. R., Sannappa, J., (2019), "Measurement of Radon Concentration and Evaluation of Total Dose in Drinking Water of Chikmagalur City, Karnatka," *Journal of Geological Society of India*, 94, pp. 100-104.
153. Sundar, S. B., Chitra, N., Vijaylakshmi, I., et al., (2015), "Soil Radioactivity Measurements and Estimation of Radon/Thoron Exhalation Rate in Soil Samples from Kalpakkam Residential Complex," *Radiat Prot Dosim.*, doi:10.1093/rpd/ncv313.
154. Suman, G., Reddy, K. V. K., Reddy, M. S., Reddy, C. G., and Reddy, P. Y., (2020), "Indoor Radon and Thoron in the Vicinity of Proposed Uranium Mining Site: A Case Study at Dasarlapally Village, Telangana State, India," *Radiation Protection Dosimetry*, doi:10.1093/rpd/ncaa032.
155. Suresh, S., Sannappa, J., Srinivasa, E., (2020), "Estimation of Attached and Unattached Fraction of Radon and Thoron Progeny Concentration and Equilibrium Factor for Inhalation Dose Assessment," *International Journal of Management, Technology and Engineering*.
156. Statistics Korea, "Lung Cancer Incidence Data," (2011–2013), <https://kosis.kr/wnsearch/total/totalsearch.jsp>. Accessed 04 Jan 2016.
157. Stojkovic, Z.S., Svare-Gajic, J.V., Dorevic, M.Z., Grahva, N.L., Vasin, J.R., Duorvic, A.D., Kravic, S.Z., (2015), "Study on the quality of ground, spring and river waters in South-East Serbia," *Hem Ind*, 69, pp. 185-192.
158. Tanner, A. B., (1980), "Radon Migration in Ground: A Supplement Review," In *The Natural Radiation Environment III* (Eds. T.F. Gesell And W.M. Lowder), National Technical Information Service, Springfield, V.A. CONF- 780422, 1980, pp. 5-56.
159. Tokonami, S., Young, M., Yonehara, H., (2002), "Simple Discriminative Measurement Techniques for Radon and Thoron Concentrations with A Single Scintillation Cell," *Rev Sci Instrum.* 73, pp. 69.
160. Tsiyoglou, E. C., Ayer, H. E., Holaday, D. A., (1953), "Occurrence of Non-Equilibrium Atmospheric Mixture of Radon and Its Daughters," *Nucleonics*, 11(9), pp. 40.
161. UNSCEAR, (United Nations Scientific Committee on the Effects of Atomic Radiation), (1982), "Ionizing Radiation: Sources and Biological Effects," United Nations Ed., New York, E.82.IX.8.

162. UNSCEAR, (1993), "Report Sources and Effects of Ionizing Radiation," Report to the General Assembly with Scientific Report, United Nations, New York.
163. UNSCEAR, (2000), "Sources and Effects of Ionizing Radiation," Report to the General Assembly with Scientific Annexes, United Nations Scientific Committee on the Effects of Atomic Radiation, New York. 1, Annex B: Exposure from Natural Radiations Sources.
164. UNSCEAR, (United Nations Scientific Committee on the Effect of Atomic Radiation), (2006), "Report to the General Assembly with Scientific," Annexes Vol II, Scientific annexes C, D, E. United States, New York.
165. UNSCEAR, (United Nations Commission on the Effect of Atomic Radiation), (2008), "Sources of Ionizing Radiations," United Nations, New York.
166. USEPA, (1991), "Federal Register 40 parts 141 and 142; National primary Drinking Water regulations; Radionuclides; Proposed Rule (U.S. Environmental Protection Agency)," U.S. Government Printing Office.
167. USEPA, (1999), "Cancer Risk Coefficients for Environmental Exposure to Radionuclides," Federal Guidance Report No. 13. EPA 402-R-99-001, United States Environmental Protection Agency, Washington, DC.
168. USEPA, (2000), "Radionuclides Notice of Data Availability, Technical Support Document. United States Environmental Protection Agency.
169. USEPA, (U.S. Environmental Protection Agency), (2014), U.S. Government Printing Office.
170. Viktor, J., Timotheos, A., Petya, M., Vessa, T., and Mikeal, H, (2017), "A Brief Overview on Radon Measurements in Drinking Water," J Environ Radioact, XXX, pp. 1-7.
171. Voronov, A.N., (2004), "Radon-Rich Waters in Russia," Environ Geol, 46, pp. 630-634.
172. WHO, (2004), "Guidelines for Drinking-Water Quality," Third Edition, Volume 1, Recommendations, Geneva.
173. WHO, (2008), "World Health Organization Guidelines for Drinking Water Quality," In: Incorporating First and Second Addenda, Third ed. WHO Press, Geneva. (2008), 2008, 3rd ed. World Health Organisation, Geneva, Switzerland.
174. WHO, (2009), "WHO Handbook on Indoor Radon: A Public Health Perspective," Geneva, World Health Organization.

175. WHO, (World Health Organization), (2018), Management of Radioactivity in Drinking Water.
176. Ye, W., et al., (1998), "Mortality and Cancer Incidence in Misasa, Japan, A Spa Area with Elevated Radon Levels," Japanese Journal of Cancer Research, 89(8), 789–796.
177. Yoon, J. Y., Lee, J. D., et al., (2016), "Indoor Radon Exposure and Lung Cancer: A Review of Ecological Studies," Annals Occup Environ Med, 28, pp. 15.
178. Yashwini, T., Ningappa, C., et al., (2020), "Studies on Radon and Thoron Levels in Few Dwellings of Kabini River Basin, Karnatka State, India," Journal of Radioanalytical and Nuclear Chemistry, doi:10.1007/s10967-020-07328-w.



## Author's Bio-data

---

### AMIT KUMAR SINGLA

(Research Scholar, Department of Physics, MRSPTU, Bathinda)

Email: [amitalicesingla@gmail.com](mailto:amitalicesingla@gmail.com)

Phone: +91 98141 33348

### **ACADEMIC QUALIFICATION:**

- **Ph.D (Thesis submitted)** in June, 2022 to Maharaja Ranjit Singh Punjab Technical University, Bathinda.

*Title of the thesis:*

**“Natural Radioactivity Studies in the Environs of Northern Rajasthan”**

- **M.Sc.** (Physics), IKGPTU, Jalandhar, India (2016).
- **B. Sc** (Non-Medical), Punjab University Chandigarh, Punjab, India (2013).

### **PROFESSIONAL ACHIEVEMENT:**

- Work experience as Junior Research Fellow (JRF) for two years from 10.11.2016 to 10.11.2018 and as Senior Research Fellow (SRF) for one year from 11.11.2018 to 31.11.2019 on the project titled ***“Measurement of radon, thoron & their progeny distribution in the different type of houses & natural radioactivity in soil in Hanumangarh, Churu & Sri Ganganagar districts of Rajasthan”*** with financial support from Board of Research in Nuclear Sciences (BRNS) Mumbai, Department of Atomic Energy (DAE), Government of India (GoI).
- Research publications: 6
- Papers presented in conferences: 5
- Dissertation work on the topic “Measurement of uranium concentration in drinking water samples by LED Fluorimeter” during M.Sc. 4<sup>th</sup> semester curriculum in 2016.
- Well trained in dealing with performing and handling of various lab equipment like Smart RnDuo, DRPS/DTPS, Single Entry Pinhole Dosimeter, Constant Temperature Bath Unit, Spark counter in research lab (as a part of Ph.D.).
- **Computer proficiency:** MS Office, Origin.

## Research Publications in Journals

1. **Amit Kumar Singla**, Sandeep Kansal, Rohit Mehra (2021), “Quantification of Radon Contamination in Drinking Water of Rajasthan, India,” *J Radioanal Nucl Chem*, 327(3), pp. 1149-1157. Impact factor: 1.37
2. **Amit Kumar Singla**, Sandeep Kansal, Rohit Mehra (2021), “Dose Distribution to Individual Tissues and Organs Due to Exposure of Alpha Energies from Radon and Thoron to Local Population of Hanumangarh District Rajasthan, India,” *J Radioanal Nucl Chem*, 327(3), pp. 1073-1085. Impact Factor: 1.37
3. **Amit Kumar Singla**, Sandeep Kansal, Rohit Mehra (2021), “Radiological Risk Assessment Due to Attached/Unattached Fractions of Radon and Thoron Progeny in Hanumangarh District, Rajasthan,” *J Radioanal Nucl Chem*, 330, pp. 1473-1483. Impact factor: 1.37
4. **Amit Kumar Singla**, Sandeep Kanse, Sandeep Kansal, Supriya Rani, Rohit Mehra (2022), “A Comprehensive Study of Radon in Drinking Waters of Hanumangarh District and the Assessment of Resulting Dose to Local Population,” *Environ Geochem Health*, <https://doi:10.1007/s10653-022-01304-x>. Impact Factor: 4.60
5. Supriya Rani, Sandeep Kansal, **Amit Kumar Singla**, Rohit Mehra (2021), “Radiological Risk Assessment to the Public due to Presence of Radon in Water of Barnala District, Punjab, India,” *Environ Geochem Health*, <https://doi:10.1007/s10653-021-01012-y>. Impact Factor: 4.60
6. Supriya Rani, Sandeep Kansal, **Amit Kumar Singla**, Rohit Mehra (2021), “A Comprehensive Study of Exhalation Rates in Soil Samples to understand the High Risk Potential Area in Barnala and Moga Districts of Punjab, India,” *J Radioanal Nucl Chem*, 331, pp. 1889-1897. Impact factor: 1.37

## Paper Presented in Conferences

1. **Amit Kumar Singla**, Sandeep Kansal and Rohit Mehra (2019), “Measurement of Radon Concentration in Water Samples for Dose Assessment Using Smart RnDuo”. *Indo-European Seminar on High Nuclear energy Physics, Central University of Punjab, Bathinda, India*. Presented under Poster Presentation.
2. **Amit Kumar Singla**, Sandeep Kansal and Rohit Mehra (2019), “Measurement of Radon Concentration in Water Samples for Dose Assessment Using Smart Rnduo”. *National conference on “Growth Points in Physics-II, University of Kashmir, Kashmir, India*. Presented under Poster Presentation.
3. **Amit Kumar Singla**, Sandeep Kansal and Rohit Mehra (2019), “Measurement of Radon Concentration in Water Samples for Dose Assessment in Sri Ganganagar District, Rajasthan”. *22<sup>nd</sup> National Symposium on Radiation Physics, Jawaharlal Nehru University, New Delhi, India*. Presented under Poster Presentation.
4. **Amit Kumar Singla**, Sandeep Kansal and Rohit Mehra (2021), “Estimation of Radon and Thoron Concentration in Soil Samples of Shri Ganganagar District of Rajasthan. *Solid State Nuclear Track Detector (SSNTD-22), Delhi University, Delhi, India*. Presented under Oral Presentation.
5. **Amit Kumar Singla**, Sandeep Kansal, Supriya Rani and Rohit Mehra (2021), “Estimation of Attached and Unattached Fraction and Deposition Based Progeny Sensors Using Wiremesh DTPS/DRPS”. *Radiation Awareness and Detection in Natural Environment. RADNET-03, Tehri Garhwal, UK, India*. Presented under Oral Presentation.