



Radon and the risk of lung cancer in Aizawl district, Mizoram, India

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ABSTRACT

Aizawl district chhûngah hian radon tam lam teh a ni a. Kan tehna hmanrua atân chuan Solid State Nuclear Track Device (SSNTD) hman a ni. He SSNTD hi a bika siam plastic cylinder, a hming atâna 'dosimeter' an tih chhûngah dahin radon atanga lo chhuak alpha particles te hnuhma (nuclear track) a lo chhinchhiah a. He nuclear track tam lam hi Govt. Zirtiri Residential Science College laboratory-ah Spark counter hmanga chhiar a ni. Sik leh sa, hun pui hrang hrang, fûr, thlasik leh nipui chhûnga Aizawl district bikah in sak dân chi hrang hrang chhûnga radon tam lam danglam dân he report-ah hian târ lan a ni. Chu bâkah, in sakna hmun ram leilung awm dân te azir pawh lantir tel a ni bawk. Radon hian chuap cancer a thlen thei tih finfiah a ni tawh a; meizial tih lohah chuan a thlentu nasa ber a ni hial. India ramah hian Aizawl district hi a mi chêng tam lama teha mipa leh hmeichhe zinga chuap cancer nei tam ber pakhatna ve ve hauhtu a ni. He chuap cancer tam êm êmna chhan hi radon boruak vâng a ni thei ang em tih chu he report hi a khuh hawna atân kan hmang dâwn a ni.

Key words: Dosimeter; geological conditions; house type construction; lung cancer; radiation pollution; radon gas; seasonal variation; solid state nuclear track device.

THUHMAHRUAI

Radiation kan tih hian mita hmuh theih loh, khawih theih bawk loh, êng leh lum kan tih ang chi 'energy' chi khat a ni a. Mihringte tân hian a tângkai em em rualin mi tichhe thei a ni ve leh tlat mai. A chak dân azirin chi hnihah then a ni a: pakhat chu atom phel têt thei khawpa chakna nei (ionizing radiation) an ti a, a entir nan x-ray te, gamma ray te; a dang leh te chu atom phel têt

thei ve lo ho (non-ionising radiation), entirna atan, microwave, radar wave-te angte hi an ni leh a. Kan chhehvêl (environment) atang leh mihring taksa chhûngril atangte hian heng radiationte hi kan dawng reng mai si a. Chuvâng chuan a chanchin hi zir chian a tûl hle mai. A lo awm theih dân atangin i han chhui dâwn teh ang.

Radiation lo awm theih dân hi chi hnihin a then theih a. Khuanu siam sa (natural background) radiation leh mihringte siam chawp (man-made) te an ni. Natural background radiation kan dawna te chu: vâng sâng lam atangin, ni atangte leh boruak thengreng atangte hian

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(cosmic ray an tih) kan dawng a. Tin, leilung aṅgin kan dawng baw k a. Boruak aṅgin radon gas hmangin a dawn theih baw k. Tin, kan taksa chhūngril hian heng radiation siam chhuak thei substance chi hrang hrang a pai baw k a ni.

Mihringten damdawi atân leh inenkawl na aṅga kan siam chhuah hrang hrangte avâng hian heng radiation te hi kan dawng leh baw k a. Cancer hemna atâna siam gamma ray te, X-ray te leh damdawi ina natna lai hmuh chhuahna atâna kan hman hrang hrang aṅante paw h hian radiation hi kan dawng baw k a ni. Industry-ah te, tin, atom bomb leh nuclear bomb test avângte paw hin radiation kan dawng ṭhin. Heng hi mihringten kan siam chhuah chawp radiation kan tihte chu a ni.

Radiation kan dawn zawng zawng zingah 19% hi mihring siam chhuah chawp aṅga kan dawn a ni a. Taksa chhūng aṅ hian 11% kan dawng baw k. Hei bâkah 8% chu cosmic aṅga kan dawn hi a ni a. Chutiang zât baw k 8% chu leilung lam aṅ lo chhuak kan dawng baw k a ni. Radon avângin 54% lai kan dawng a ni. He radiation kan dawn tamna ber radon boruak hi zir chian tham a ṭling a. I han chhui bing dâwn teh ang.

RADON GAS CHU ENG NGE NI?

Radon gas chu noble gas an tih zinga pakhat a ni a. Noble gas chu element dangte nêna awl-sam taka inpawlh mai thei lo chi an ni. Radon danglamna pakhat chu radioactive gas a ni tlat hi a ni a. A hringtu bul uranium 238 hi leilunga awm a ni a. Uranium 238 a han ‘decay’ zêl hian engemawti chen chu ‘solid’ a la ni a. Radon a lo pian hian ‘gas’ a lo nih tak avângin leia la châmbâng tâwk awm mah sela, lei pâwnlâng lamah lo chhuakin lei khi kârahte leh lei thâwl laiahte an lo chhuak chho thei a. Boruakah a lo a awm ta ṭhin a ni. Tuiah a inchiah zawp theih avângin tui chhūngahte leh tuipei mawng leiahte paw h a awm thei baw k a ni. Tin, a decay pah hian alpha particle a pe chhuak baw k a ni.

ENGVÂNGIN NGE A HLAUHAWM?

Rawng nei lo, rim paw h nei lo, he radon gas hi mihringte tâna a hlauhawmna ber pakhat chu cancer thlen theitu a ni hi a ni.¹ *Meizial tih lohah chuan chuap cancer siam nasa bertu a ni.*² Meizial zûk nen a inkawp phei chuan chuap cancer vei a tiawlsam leh zual a. Amaherawh-chu, hetia boruaka a awm hi a hlauhawm hranpa lova. A chhan chu boruak dangte nen an inpawlhawp zung zung a, hlauhawm khawpin a awm khâwm (concentrate) hman lo a ni.³ In chhūngah te, pûkah te leh leihnuai aṅga thil hlu laih chhuahna (mines)-ah te a awm khâwm nasatin a lo hlauhawm thei ṭhin a ni. Kan Mizo pasaltha Khuangchera, pûk lut chhuak paw h kha an sawi zêlnaah chuan lu kawlh râwtin a na e, an ti a. Heng radon gas lo awm khâwm a tawng bua paw h a ni maithei asin! Tûnah chuan Khuangchera Pûkah he radon gas awm zât kan tehnaah chuan a tlêm hle mai. Pûk luhna lamah leh a hlet lamah paw h hlauhawm chin thleng phak a awm hau h lo.

A hlauhawmna piah lamah radon gas tam (concentration) chuan a parent element (uranium 238) hi a tam tih a entir a. Tûnlai khawvêlah uranium deposit nei ṭha ram chu ram hausa an ni mai taw h a. Fimkhur taka lâk chhuah a nih chuan mihringte tâna hlauh tur a awm lova. Amaherawhchu, fimkhur tâwk loh avângin ei leh tui in turahte ‘radiation contamination’ a awm phah fo ṭhin. Hei vâng hi alawm, Meghalaya-ah paw h uranium deposit ṭha tak a awm a, mahse a mi chêng tam takin lâk chhuah an phal tlat lo a ni!

Mihringin boruak aṅga radon gas a hip luh hian he gas leh a thlah (daughter nucleus) aṅga chhuak alpha particle te chu chuapah an châmbâng ta ṭhin a. Hei hian taksa cell te tich-hian cell inthlah chhâwng zêl a tibuai ṭhin a. Cell piansualna (mutation) siamin chuap cancer a lo awm theih phah ṭhin.

Radon boruaka a awm tam theih dân chu a awmna hmun sân dân azir te, sik leh sa azir te, leilung awm dân (geological conditions) azir te,⁴ a lo chhuahna parent nucleus tam dân azirte a ni thei a. In chhūng boruaka a lo luh theih dân hrang hrang zingah, kan in chhuat lam lei aṅga lo lût te, kan tui tlan aṅga kan in chhūnga a lo

lût te, bang âwng leh kawngkhâr, tukverh, ventilation aţang te, kan cooking gas aţang te, kan in sakna atâna kan hmanraw hman thîn, lung, brick, tile, etc. aţangte hian kan in chhûngah an awm thei thîn.⁵

He radon gas in chhûnga awm tam leh tam loh hriat hi thil tûl tak a ni ta a. Khawvêl hmun hrang hrangah pawh an lo buaipui hrep tawh a ni. India ram ngeiah pawh hian ram pum huapa radon tam lam teh chhuahna (mapping) chu kalpui a lo ni tawh a.⁶ Mizoramah pawh hmalâkna chu a lo awm ve tawh a,⁷ amaherawh-chu state pum huap tham tur anga hmalâkna chu a ni lova. Tûn tumah hian Aizawl district huam chhûnga radon tam dân zir chianna kan lo neih tawh chu kan han pho lang dân a ni.

RADON TAM LAM TEH DÂN (METHOD OF MEASUREMENT)

In chhûnga radon tam lam teh nan hian Solid State Nuclear Track Detector (SSNTD) hman a ni a. He detector hi Kodak company siam a ni. Film chi khat nuclear track te lo record thei tura duan a ni a. He film hi a tâwk têa chep thlain Bhabha Atomic Research Centre (BARC), Mumbai aţanga an siam chhuah Dosimeter⁸ an tih bâwm chhûngah dah a ni. He bâwm chhûngah hian radon lo lûtin film kan dahah khan hnuhma (track) anrawn nei ta a. Heng radon gas te bâwm chhûnga dah hi thla thum aia tlêm lo (ni 90) tal a ni tur a ni a. Hemi hun chhûng hian dosimeter pâwn lam leh a chhûng lama radon awm dân kha intluktlângin (equilibrium condition) a awmtir a. Chumi awmzia chu volume inangah kan boruak hipa radon awm zât ang tho kha dosimeter bâwm chhûngah a awm tih a entir a. Bâwm chhûnga radon tam lam kha kan boruak hipa radon tam dân lantir nân a hman theih ta tihna a ni.

Thla thum a tlin hnu chuan heng film te hi laboratory-ah spark counter hmangin nuclear track awm te chhiar (count) a ni a. Track tam dân azirin radon a tam leh tam loh kan hre thei thîn a ni.

AIZAWL DISTRICT-A RADON TAM LAM TEHNA

HMUNTE

Aizawl District chhûngah hian Aizawl, Hlimen, Seling, Saitual leh Sihphirah te heng dosimeter hi 60 lai dah a ni a. Dosimeter hi ceiling-ah khai a niin, in chhûnga chêngten che lo chang lova boruak kan hip tam berna hmun bed room ceiling thlan a ni ber a. In sak dân chi hrang hrang- R.C.C. te, Assam type-te thlan a ni a. R.C.C.-ah pawh full R.C.C. a awm laiin half R.C.C., entir nan, a chung atân rangva hmangte a awm thei bawk a. Tin, in chhâwng thenkhatah chuan chhâwng hnuai lam tân ceiling (a chung) thingphel hmangte pawh a awm thei bawk. Assam type-ah pawh a bang dâp te, tile (asbestos) te leh rangva hmangte thingphel hmang te pawh thlan bik an ni.

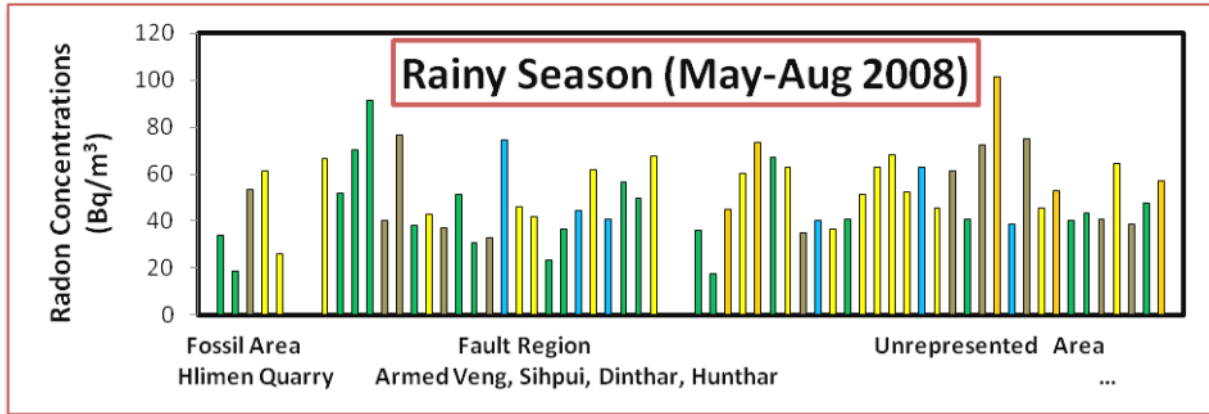
Tin, Aizawl khawpui chhûng bikah hian geological conditions hrang hrang kan hmuh theihte chhinchhiah a ni bawk a. Satellite map aţangin Aizawl khawpui chhûnga lei khi chat (fault) awmna laite chhinchhiah a ni bawk a. Chu'ngah chuan dosimeter te pawh thahnem tâwk dah a ni. Tin, Hlimen lung lâkna (quarry) hmunah sâwn kum tam tak liam taa tuifinriat sangha leh rannung dangte ruh them (fossil) kha hmuh tur a la awm nual bawk a. He hmunah pawh hian radon tam lam teh a ni bawk. Hmun dang, ram awm dân (geological condition) hriat loh hmunahte pawh dah tho an ni. Radon gas te fûr lai, thlasik leh nipui chhûnga an danglam dân hre tûrin thla li danah heng in sak dân azira kan thlan bik hmunahte hian dosimeter kan thlâk thîn a ni.

RESULT

Fig. 1-a lantir ang hi Aizawl district chhûnga fûr, thlasik leh nipui chhûnga radon tam lam teh chhuah chu a ni. Bar chart-a lantir ang hian kum 2008 fûr laia radon tam lam Aizawl district chhûnga tehnaah chuan concrete inah radon a tam ber a ni tih hmuh a ni a. Amaherawhchu full concrete ni lovin, half concrete-ah a ni. 101.6 Bq/m³ niin fault region-a tile inah a sâng ber dawttu kan hmu bawk a ni.

Fig. 2-a lantir ang hian thlasik chhûng chuan full concrete inah radon a sang ber a. 130.8 Bq/

Fûr laia radon tam lam



COLOUR CODE	
Concrete (RCC)	
Yellow	Full Concrete
Orange	Half Concrete
Assam Type	
Brown	Bamboo/Wooden Walls
Green	Asbestos Walls
Blue	G.I. Sheet Walls

Figure 1. Distribution of radon concentration in Aizawl district during rainy season 2008 (top).

Colour code showing different types of house construction (left).

Thlasik laia radon tam lam

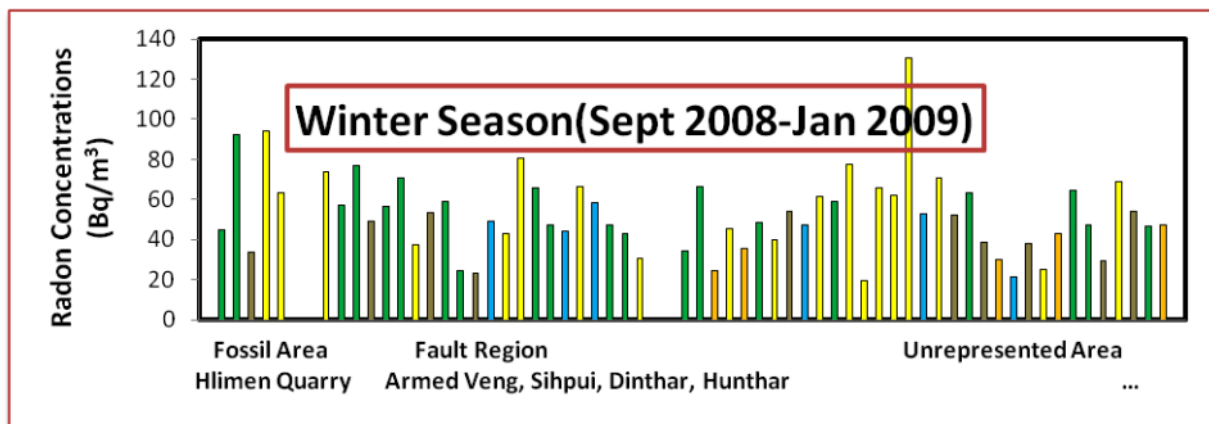


Figure 2. Distribution of radon concentration in Aizawl district during winter season (Sept 2008-Jan 2009).

Nipui laia radon tam lam

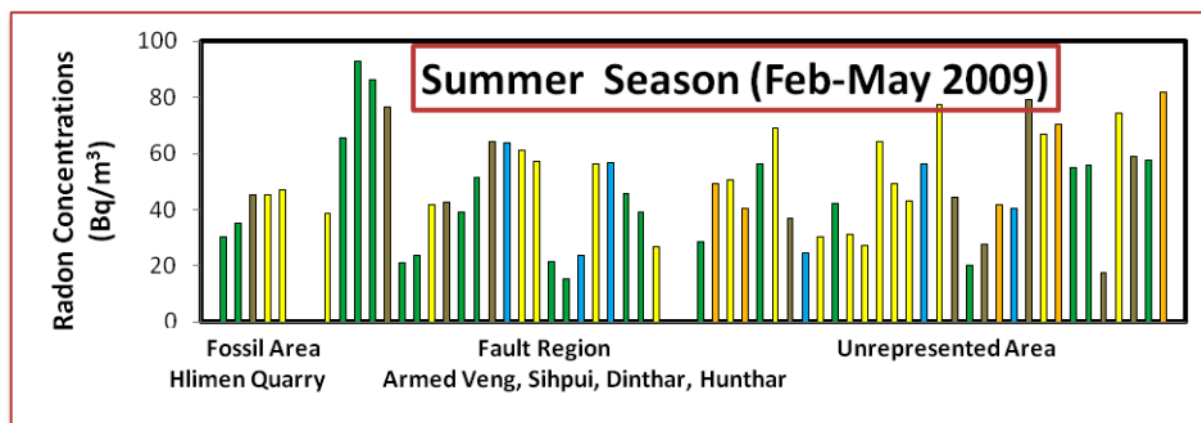


Figure 3. Distribution of radon concentration in Aizawl district during summer season (Feb-May 2009).

m³ lai hmuh a ni. Hmun dangah chuan 100 Bq/m³ pawh hmuh a ni lo va. Thlasik lai hian in chhûng tihlum duh avângin kawngkhâr, tukverh leh ventilation-te khâr khîp a ni tlângpui a, hei vâng hian season dangte ai chuan radon concentration pawh tam zâwk tura beisei a ni hrim hrim a. Assam type-in ai chuan concrete chu a tlângpuiin a lo phui duh bawk. Hei vâng hian concrete ina radon hmuh tam hi a awm hle.

Nipui lai hian fault region atangin radon lo chhuak hi a tam bik deuh niin a lang a. Fig. 3-a ka hmuh ang hian fault region-ah hian Assam type in, a bang tile hmanna hmunah radon concentration a tam ber a, 92.7 Bq/m³ hmuh a ni.

Result-a kan lantir ang hian Aizawl district-ah chuan kum tluan chhûngin radon tam lam tehna sâng ber chu 130.8 Bq/m³ a ni a. A hniam ber chu 17 Bq/m³ a ni. A tlângpui thuin 100 Bq/m³ kaina hmun chu in 3/4 vêlah chauh a ni.

DISCUSSION

Radon tam dân azira a hlauhawm theih dân bithliah hi India ramah hian siam a la ni lova. America,⁹ Europe¹⁰ leh China¹¹-a research an

neih tawh atangte chuan mihringte tâna a hlauhawm chin an bithliah tawh a, chu chu 200 Bq/m³ aian sang lo se tih a ni.¹² World Health Organisation chuan radon tlêmna hmunah pawh chuap cancer-te a thlen theih tho avângin a hlauhawm chin a bithliah tak tak theih lo ve tiin thu chhuah a siam a.¹³ Radon avânga chuap cancer vei tam zâwk te hi radon gas tam vâng ni lovin, a tlêmna hmuna mite an ni mah zâwk tiin tan chhan an siam a ni. Mahse, radon hlauhawm dân chin han bithliah chu thil tih mâkmawh a nih si avângin tûnlai chhuak scientific data hmangin radon hlauhawm chin bithliah a siam a, chutah chuan 100 Bq/m³ aia a sâng loh hian natna a thlen lo ber niin a chhût a. Amaherawhchu, hei hi pelh loh theih loh a nih chuan in chhûngah hian 300 Bq/m³ ai chuan tam lo se tiin proposal a siam bawk.

Aizawl district-ah hian India ram pumah chuap cancer vei percentage a sâng ber

Population Based Cancer Registry Report¹⁴ 2008-ah chuan Aizawl district hian a mi chêng tam dân azirin chuap cancer vei mipa leh

hmeichhiaah an tam ber a ni tih kan hmu a. Hei hi a chhan bulpui chu meizial zûk leh a kaihnewih thil vâng a ni tih a târ lang bawk. Civil Hospital, Aizawl-a damlote dam loh dân chhinchhiaahin (hospital based case-control study, Civil Hospital, Aizawl) chuan pumpui cancer leh chuap cancer Mizorama a tam em emna chhan hi kan zûk leh hmuam uar lutuk vâng leh kan chawhmeh duhzâwng maksak tak tak vâng a ni tih a lo finfiah tawh a.¹⁵ Heng cancer vei tam takte veina chhanah hian radon gas a tel ve ang em? tih chu zawnha awm thei tak a ni ta.

A chungah data kan lantir tâk aţang khian Aizawl district chhûngah radon hi tam vakin a lang lova. Amaherawhchu, in 60 thlan chhuah zingah kum tuana season hrang hrangah in thum/li vêlah chauh 100 Bq/m³ a pel a ni tih kan hmu a. Chu pawh chu season dangah chuan kha in kha radon a tam reng lo tih hmuh a ni bawk. Chuti a lo nih chuan WHO proposal ang hian i han ngaihtuah tlâng ta ila. Aizawl district-ah chuan radon gas hi hlauhawm lutuk chuan a lang lêm lo niin a lang. Amaherawhchu, a tlêm thei ang ber in chhûnga a awm chu a hrisêl ber zâwk dâwn a nih chu.

Chuap cancer tamna ber dinhmun Aizawl district-in a hauhna chhan hi a bul berah chuan kan zûk leh hmuam vâng a ni tia Eric Zomawia¹⁵ leh a thawhpuite'n an lo ziah hi a pawmawm viau. Radon gas hi a chhan pakhat a ni thei em? tih chu case-study neih hunah a chiang thei dâwn chauh a ni.

Eng pawh ni se, chuap cancer laka i invên theih nân i hriat tawh hnu tho hi kan han târ lang leh teh ang:

1. Meizial leh a behbawm lakah inthiar-fihlim rawh.
2. Mei zûk i sim thei ngang lo a nih pawhin mi dangten nangmah vânga chuap cancer an vei loh nan zial i zûk dâwnin inthiar-fihlim thin ang che.
3. Zânah tukverh leh ventilation hawng chungin mu thin ang che. Boruak tha lo in chhûnga mi kha pâwn boruakin a pawlh dal zung zung a pawimawh a ni.

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