**Supplementary Materials**

**for**

**Fluoride and human health: Systematic appraisal of sources, exposures, metabolism, and toxicity**

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E:\Ph.D\P\P2\Revision CRCEST\ppt pic\Mitigation of F prob.tif **Fig. S1:** Strategy for prevention and mitigation of fluoride induced toxic health effect

**Table S1**: General properties of fluoride

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Property** | | **Description** | **Property** | | **Description** |
| Atomic number | | 9 | Radius | Ionic (-1) | 0.133 nm |
| Atomic mass | | 18.9984 | Normal | 0.071 nm |
| Number of stable isotopes | | 1 | Electron affinity | | 332.6 KJ/mol |
| Atomic configuration | | 1S2 2S2 2P5 | Vanderwaals radius | | 0.135 nm |
| Density (at 20°C) | | 1.8 ×10-3 g/cm3 | Electronegativity | | 3.9 eV |
| Ionization energy | First | 1680.6 KJ/mol | Standard potential | | -2.87 V |
| Second | 3134 KJ/mol | Melting point | | -218.6 °C |
| Third | 6050 KJ/mol | Boiling point | | -188.6 °C |

[**Source:** (Fuge 1988; Schneider and Christe 1998)]

**Table S2:** Excessive groundwater fluoride concentration in different regions of the world

|  |  |  |
| --- | --- | --- |
| **Location** | **Fluoride Level (mg L-1)** | **Reference** |
| Alberta | >3-5 | (Grisak et al. 1977) |
| Algeria | >1.5-3 | (Messaïtfa 2008) |
| Southern Algeria | >1.5-3 | (Messaïtfa 2008) |
| Southeast Regions, Argentina | >10 | (Paoloni et al. 2003) |
| Chaco-Pampean, Argentina | >5-10 | (Nicolli et al. 2012) |
| Almirante Brown, Argentina | >3-5 | (Buchhamer et al. 2012) |
| Pampian Plain, Argentina | >10 | (Cabrera et al. 2001) |
| Buenosaires Province, Argentina | >3-5 | (Kruse and Ainchil 2003) |
| Australia | ≤1.5 | (Riordan and Banks 1991) |
| Gadabay, Azerbaijan | >3-5 | (Baghal Asghari et al. 2017) |
| Khulna, Bangladesh | >1.5-3 | (Fazlul Hoque 2013) |
| Rajshahi, Bangladesh | >1.5-3 | (Fazlul Hoque 2013) |
| Benin | ≤1.5 | (Silliman et al. 2007) |
| Bhutan | ≤1.5 | (Deki 2013) |
| Botswana | >3-5 | (Sabone 1994) |
| São Paulo, Brazil | >5-10 | (Martins et al. 2018) |
| Burkina Faso | ≤1.5 | (Kagambega and Galvez 2014) |
| Mayo Tsanaga River Basin, Cameroon | >10 | (Fantong et al. 2010) |
| North Cameroon | >10 | (Fantong et al. 2010) |
| Maria, Canada | >5-10 | (Boyle and Chagnon 1995) |
| Manitoba, Canada | >10 | (Desbarats 2009) |
| Lake Chad basin, Chad | ≤1.5 | (BGR (Bundesanstalt für Geowissenschaften und Rohstoffe) 2017) |
| Jilin Province, China | >5-10 | (Zhang et al. 2003) |
| Shanxi Province, China | >5-10 | (Wang et al. 2009) |
| Yuanmou County, China | >3-5 | (Chen et al. 2012) |
| Cambodia | ≤1.5 | (Irvine et al. 2006) |
| Anoumabo, Ivory Cost | >10 | (Osemwegie et al. 2013) |
| Croatia | ≤1.5 | (Lincir and Rosin-Grget 1993; Rosin-Grget and Lincir 1995) |
| La Salud, Cuba | ≤1.5 | (Künzel and Fischer 2000) |
| Las Tunas, Cuba | ≤1.5 | (Luna and Melián 2003) |
| Democratic Republic of Congo | >1.5-3 | (Laurent and Marie 2010) |
| Bønnerup Strand, Glesborg, Denmark | >1.5-3 | (Larsen et al. 1989) |
| Egypt | >1.5-3 | (Abdel-azeem 2009) |
| Eritrea | >3-5 | (Srikanth et al. 2002) |
| Estonia | >5-10 | (Indermitte et al. 2009) |
| Lowveld, Swaziland, Eswatini | >10 | (Manyatsi and Brown 2009) |
| Ethiopia | >10 | (Rango et al. 2012) |
| Ethiopia | >10 | (Rango et al. 2012) |
| Finland | >1.5-3 | (Lahermo et al. 1991; Sehn 2008) |
| Gabon | ≤1.5 | (Kut et al. 2016) |
| Georgia | ≤1.5 | (Windom 1971) |
| Germany | >5-10 | (Queste et al. 2001) |
| Upper Regions of Ghana | >3-5 | (Salifu et al. 2012) |
| Bongo District | >10 | (Antwi et al. 2011) |
| Bolgatanga Area, Northern Ghana | >3-5 | (Apambire et al. 1997) |
| Vounargo Area, Greece | ≤1.5 | (Karapanos et al. 2011) |
| Narssaq, Greenland | >1.5-3 | (Larsen et al. 1989) |
| Hordaland | >5-10 | (Bårdsen et al. 1996) |
| Assam, India | >10 | (Chakraborti et al. 2000) |
| Rajasthan, India | >10 | (Vikas et al. 2009) |
| Agra, India | >10 | (Gupta et al. 1999) |
| Haryana, India | >5-10 | (Meenakshi et al. 2004) |
| Tamil Nadu, India | >5-10 | (Karthikeyan et al. 2010) |
| Orissa, India | >3-5 | (Das et al. 2012) |
| Madhya Pradesh, India | >3-5 | (Thakur et al. 2013) |
| Asembagus, Indonesia | >3-5 | (Budipramana et al. 2002) |
| Indonesia | >3-5 | (Heikens et al. 2005) |
| Maku, Iran | >5-10 | (Asghari Moghaddam and Fijani 2008) |
| Isfahan, Iran | >1.5-3 | (Keramati et al. 2018) |
| Bushehr, Iran | >1.5-3 | (Keramati et al. 2018) |
| Shush, Iran | >1.5-3 | (KheradPisheh et al. 2016) |
| Ireland | ≤1.5 | (Clarkson and McLoughlin 2000) |
| Israel | >1.5-3 | (Biswas et al. 2017) |
| Italy | ≤1.5 | (Angelillo et al. 1998) |
| Japan | >5-10 | (Biswas et al. 2017) |
| Jordan | ≤1.5 | (Abu Rukah and Alsokhny 2004) |
| Kazakhstan | Not Found |  |
| Lemongo Spring, Kenya | >10 | (Thole 2013) |
| Gilgil, Kenya | >10 | (Kut et al. 2016) |
| Bondo-Rarieda, Kenya | >5-10 | (Wambu et al. 2014) |
| Upper East Region Nairobi area, Kenya | >10 | (Coetsiers et al. 2008; Thole 2013) |
| Kuwait | ≤1.5 |  |
| Al Zawia and Al Zahara, Libya | >10 | (Nasr et al. 2014) |
| North-east Libya | ≤1.5 | (Nair et al. 2006) |
| Alagilat City, Libya | >3-5 | (Elmabrok 2015) |
| Al Zawia, Libya | >5-10 | (Nasr et al. 2014) |
| Benghazi, Libya | ≤1.5 | (Huew et al. 2011) |
| Nsanje, Malawi | >5-10 | (Thole 2013) |
| Zomba, Malawi | >5-10 | (Thole 2013) |
| Lilongwe, Malawi | >5-10 | (Thole 2013) |
| Nkhotakota, Malawi | >5-10 | (Thole 2013) |
| Karonga, Malawi | >5-10 | (Thole 2013) |
| Southern Malawi (Zomba, and Mangoch) | >5-10 | (Sajidu, S. M. et al. 2008) |
| Balaka, Malawi | >5-10 | (Pritchard et al. 2008) |
| Chikwawa, Malawi | >10 | (Grimason et al. 2013) |
| Machinga, Malawi | >5-10 | (Sajidu et al. 2012) |
| Malaysia ((bottled drinking water) | ≤1.5 | (Rahim et al. 2014) |
| Taoudenni, Mali | >1.5-3 | (Kut et al. 2016) |
| Durango, Mexico | >5-10 | (Ortiz et al. 1998) |
| La Lagunera, Mexico | >3-5 | (Razo et al. 1993) |
| Laguna El Cuervo, Mexico | >5-10 | (Reyes-Gómez et al. 2015) |
| Myingyan, Myanmar | >1.5-3 | (Bacquart et al. 2015) |
| La Victoria Region, Mexico | >5-10 | (Valenzuela-Vásquez et al. 2006) |
| Mindanao | Not Found |  |
| Moldova | >10 | (Toma et al. 1999) |
| Inner Mongolia | >1.5-3 | (Xu et al. 2013) |
| Ben Guerir, Morocco | >3-5 | (Garmes et al. 2002) |
| Namibia | >1.5-3 | (Kut et al. 2016) |
| Bhaktapur, Nepal | >1.5-3 | (Thakur et al. 2015) |
| Netherland | ≤1.5 | (El-Gohary et al. 2010) |
| Tibiri, Niger | >5-10 | (Kut et al. 2016) |
| Langtang, Nigeria | >3-5 | (Wongdem et al. 2001) |
| Bomo, Nigeria | >1.5-3 | (Kut et al. 2016) |
| Maiduguri, Nigeria | >5-10 | (Kut et al. 2016) |
| Zango, Nigeria | >5-10 | (Tukur and N. 2014) |
| Enugu, Nigeria | ≤1.5 | (Akpata et al. 2009) |
| Norway | >1.5-3 | (Reimann et al. 1996) |
| Nunavut | Not Found |  |
| Ontario | ≤1.5 | (Howard and Beck 1993) |
| Tehsil Mailsi, Pakistan | >5-10 | (Rasool et al. 2015) |
| Lahore, Pakistan | >10 | (Farooqi et al. 2007; Rasool et al. 2015) |
| Tharparkar and Nagarparkar, Pakistan | >10 | (Naseem et al. 2010; Brahman et al. 2013) |
| D.G. Khan, Pakistan | ≤1.5 | (Malana and Khosa 2011) |
| Sialkot, Pakistan | ≤1.5 | (Ullah et al. 2009) |
| Tharparkar, Pakistan | >10 | (Brahman et al. 2013) |
| Khairpur Mir, Pakistan | >3-5 | (Ahmed Baig et al. 2009) |
| Manchar lake, Pakistan | ≤1.5 | (Kazi et al. 2009) |
| Mailsi, Pakistan | >5-10 | (Rasool et al. 2015) |
| East Punjab, Pakistan | >10 | (Farooqi et al. 2007) |
| Mithi, Pakistan | >10 | (Rafique et al. 2008) |
| Naranji area, Northwest Frontier Province, Pakistan | >5-10 | (Shah and Danishwar 2003) |
| Gaza Strip, Palestine | >5-10 | (Abu Jabal et al. 2014) |
| Philippines | Not Found |  |
| Poland | ≤1.5 | (Czarnowski et al. 1996) |
| Portugal | >1.5-3 | (Cordeiro et al. 2012) |
| Romania | Not Found |  |
| Russia | Not Found |  |
| Huye and Nyamagabe, Rwanda | ≤1.5 | (Nsengimana et al. 2012) |
| Al Baha, Saudi Arabia | >1.5-3 | (Alabdulaaly et al. 2013) |
| Eastern Province, Saudi Arabia | >3-5 | (Alabdulaaly et al. 2013) |
| Makkah Al-Mukaramma, Saudi Arabia | >1.5-3 | (Alabdulaaly et al. 2013) |
| Madina Al-Munnawara, Saudi Arabia | >1.5-3 | (Alabdulaaly et al. 2013) |
| Al Qassim, Saudi Arabia | >5-10 | (Alabdulaaly et al. 2013) |
| Riyadh, Saudi Arabia | >5-10 | (Alabdula’aly 1997) |
| Sine Saloum Region, Senegal | >5-10 | (Brouwer et al. 1988) |
| Vranjska Banja, Serbia | >10 | (Mandinic et al. 2010) |
| Valjevo, Serbia | ≤1.5 | (Mandinic et al. 2010) |
| Bombali District, Sierra Leone | ≤1.5 | (Kelman and Denenberg 2014) |
| Singapore | ≤1.5 | (Loh 1996) |
| Shabeellaha Dhexe, Somalia | >3-5 | (Kut et al. 2016) |
| Limpopo, South Africa | >10 | (Kut et al. 2016) |
| South Africa | >10 | (Rasool et al. 2018) |
| Geumsan County, South Korea | >5-10 | (Ahn 2012) |
| Gimcheon, South Korea | >1.5-3 | (Kim et al. 2011) |
| Province of Soria, Spain | >1.5-3 | (Pérez and Sanz 1999) |
| North Central Province, Sri Lanka | >5-10 | (Jayawardana et al. 2012) |
| Udawalawe, Sri Lanka | >5-10 | (Van Der Hoek et al. 2003) |
| Polonnaruwa, Sri Lanka | >10 | (Dharmagunawardhane and Dissanayake 2007) |
| Abu Groon, Sudan | >1.5-3 | (Ibrahim et al. 1995b) |
| Nubian, Sudan | >10 | (Hussein 2004) |
| Northern Sudan | >3-5 | (Ibrahim et al. 1995a) |
| East of Blue Nile Communities, Sudan | >5-10 | (Abdellah et al. 2012) |
| Karrary Locality, Sudan | ≤1.5 | (Salim et al. 2014)s |
| Gadderas, Paskallavik and Billesholm, Sweden | >5-10 | (Forsman 1974) |
| Syria | Not Found |  |
| Thailand | >3-5 | (Chuckpaiwong et al. 2000) |
| Taiwan | >3-5 | (Wu et al. 2010) |
| Tajikistan | Not Found |  |
| Arusha Maji ya Chai, Arumeru District, Tanzania | >10 | (Thole 2013; Kut et al. 2016) |
| Shinyanga Region, Tanzania | >10 | (Ghiglieri et al. 2012) |
| Zanzibar Island, Tanzania | >10 | (Mohamed et al. 2014) |
| Kpogan, Lome, Togo | ≤1.5 | (Tanouayi et al. 2016) |
| Gabes, Tunisia | >3-5 | (Ketata et al. 2011) |
| Gafsa, Tunisia | >3-5 | (Ketata et al. 2011) |
| La Louza, Tunisia | >3-5 | (Nasr et al. 2011)n |
| Middle and Eastern Part, Turkey | >10 | (Azbar and Türkman 2000) |
| Turkmenistan | Not Found |  |
| Western Region, Uganda | >1.5-3 | (Rwenyonyi et al. 1999, 2000) |
| Ukraine | >10 | (Biswas et al. 2017) |
| United Arab Emirates | ≤1.5 | (Walia et al. 2017) |
| United Kingdom | >1.5-3 | (Hillier et al. 2000) |
| Ohio, USA | >3-5 | (Reyes-Gómez et al. 2015) |
| Pennsylvanian, USA | >3-5 | (Senior and Sloto 2006) |
| Kentucky, USA | >10 | (Reyes-Gómez et al. 2015) |
| Texas, USA | >3-5 | (Segreto et al. 1984) |
| Nebraska, USA | >1.5-3 | (Gosselin et al. 1999)go |
| Venezuela | ≤1.5 | (Acevedo et al. 2007) |
| Ho Chi Minh, Vietnam | ≤1.5 | (Thuy et al. 2003) |
| Taiz city, Yemen | >3-5 | (Aqeel et al. 2017) |
| Sana'a, Yemen | >3-5 | (Al-Akwa and Al-Maweri 2018) |
| Zambia | >1.5-3 | (Bäumle et al. 2007) |
| Zimbabwe | >1.5-3 | (Mamuse and Watkins 2016) |

**Table S3:** Distribution of fluoride in various region of India

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **State** | **Location** | **Fluoride Level**  **(mg L-1)** | **Latitude** | **Longitude** | **Reference** |
| Andhra Pradesh | Lower Vamsdhara River Basin | ˃3-5 | 18.506124 | 83.972875 | (Rao 1997) |
| Anantapur District | ˃5-10 | 14.641809 | 77.495265 | (Rao and Devadas 2003) |
| Sarada River basin | ˃1.5-3 | 17.775418 | 82.937412 | (Devadas et al. 2007) |
| Varaha River Basin | ˃1.5-3 | 17.553997 | 82.722495 | (Rao 2009) |
| Talupula | ˃5-10 | 14.243041 | 78.253820 | (Nagaraju et al. 2017) |
| Gummanampadu Sub-basin | ˃3-5 | 16.329897 | 79.659768 | (Rao et al. 2013) |
| Coastal region between Chirala and Ongole | ˃1.5-3 | 15.673999 | 80.222546 | (Rao et al. 2017b) |
| Anantapur | ˃5-10 | 14.349920 | 77.996989 | (Reddy et al. 2015) |
| Chittoor | ˃3-5 | 13.217369 | 79.090784 | (Rao et al. 2014) |
| Guntur | ˃ 10 | 16.301763 | 80.432568 | (Rao et al. 2017a) |
| Hyderabad | ˃5-10 | 17.431237 | 78.437659 | (Udayalaxmi et al. 2010) |
| Krishna | ˃5-10 | 16.631158 | 80.808560 | (Saxena and Ahmed 2003) |
| Kurnool | ˃1.5-3 | 15.807376 | 78.021623 | (Rao et al. 2014) |
| Mahbubnagar | ˃1.5-3 | 16.753125 | 78.006141 | (Adimalla and Venkatayogi, 2017; CGWB, 2013) |
| Prakasam | ˃5-10 | 15.610269 | 79.405628 | (Sudarshan et al. 2018) |
| Nalgonda | ˃5-10 | 17.043785 | 79.258208 | (Kumar et al. 2017) |
| Assam | Guwahati | ≥5-10 | 26.141688 | 91.695284 | (Das et al. 2003) |
| Kamrup | ˃ 10 | 26.088629 | 91.393334 | (Lakshmi et al. 2017) |
| Diphu | ≤1.5 | 25.838504 | 93.416949 | (Kumar et al. 2016) |
| Goalpara | ≥3-5 | 26.084566 | 90.452954 | (Mazumdar et al. 2015) |
| Brahmaputra flood plains | ≤1.5 | 26.121659 | 91.982944 | (Das et al. 2017) |
| Karbianglong | ˃ 10 | 26.172421 | 93.277067 | (Kotoky et al. 2008) |
| Bihar | Rohtas | ˃1.5-3 | 25.045351 | 84.135387 | (Ray et al. 2000) |
| Gaya | ˃ 10 | 24.783153 | 84.979139 | (Yasmin et al. 2014) |
| Sabour | ≤1.5 | 25.247857 | 87.041462 | (Verma et al. 2017) |
| Aurangabad | Not Found | 24.752945 | 84.370780 |  |
| Banka | Not Found | 24.907229 | 86.852209 |  |
| Buxar | Not Found | 25.560227 | 84.003830 |  |
| Jamui | Not Found | 24.878605 | 86.206290 |  |
| Kaimur (Bhabua) | Not Found | 25.042078 | 83.598415 |  |
| Munger | Not Found | 25.370697 | 86.474708 |  |
| Nawada | Not Found | 24.884177 | 85.543197 |  |
| Supaul | Not Found | 26.242764 | 86.805552 |  |
| Chhattisgarh | Raigarh | ˃5-10 | 22.256226 | 83.408234 | (Beg et al. 2011) |
| Durg | ˃ 10 | 21.264905 | 81.367855 | (Giri et al. 2013) |
| Rajnandgaon | ˃ 10 | 20.998721 | 80.785514 | (Patel et al. 2017) |
| Bastar | ˃5-10 | 19.136037 | 81.814881 | (Vilasrao et al. 2014) |
| Ambikapur | ˃5-10 | 23.129021 | 83.165733 | (Vilasrao et al. 2014) |
| Balrampur | ˃3-5 | 23.753249 | 83.678467 | (Vilasrao et al. 2014) |
| Kanker | ˃1.5-3 | 20.170922 | 80.968785 | (Vilasrao et al. 2014) |
| Korba | ˃3-5 | 22.503651 | 82.487216 | (Vilasrao et al. 2014) |
| Surajpur | ˃ 10 | 23.411423 | 82.966674 | (Vilasrao et al. 2014) |
| Bilaspur | Not Found | 22.412066 | 82.056753 |  |
| Dantewada | ˃1.5-3 | 18.841293 | 81.409804 | (Anshumali et al. 2018) |
| Janjgir-Champa | Not Found | 21.924402 | 82.778019 |  |
| Jashpur | Not Found | 22.734064 | 83.815249 |  |
| Koriya | Not Found | 23.362404 | 82.316967 |  |
| Mahasamund | Not Found | 21.116520 | 82.101125 |  |
| Raipur | Not Found | 21.327593 | 81.836289 | (Khan and Jhariya 2017) |
| Surguja | Not Found | 22.967236 | 83.237352 |  |
| Delhi | Delhi | ˃3-5 | 28.660820 | 77.104053 | (Kumar et al. 2006) |
| National Capital Territory of Delhi | ˃ 10 | 28.735662 | 77.083230 | (Dash et al. 2010) |
| Roop Nagar | ˃5-10 | 28.686504 | 77.204065 | (Shekhar and Sarkar 2013) |
| East Delhi | Not Found | 28.623689 | 77.317074 |  |
| North West Delhi | Not Found | 28.755578 | 77.007180 |  |
| South Delhi | Not Found | 28.463349 | 77.209056 |  |
| South West Delhi | Not Found | 28.590776 | 76.971993 |  |
| West Delhi | Not Found | 28.667063 | 77.061482 |  |
| Kanjhwala | Not Found | 28.726491 | 76.999446 |  |
| Najafgarh | ˃ 10 | 28.612203 | 76.965991 | (Kumar et al. 2006) |
| Alipur | Not Found | 28.800342 | 77.135090 |  |
| Gujarat | Ahmadabad | ≤1.5 | 23.020118 | 72.581330 | (Barot 1998) |
| Mehsana and Banaskantha | ˃5-10 | 24.031804 | 72.094717 | (Barot 1998) |
| Mehsana | ˃5-10 | 23.611914 | 72.367209 | (Dhiman and Keshari 2006) |
| Kadi | ˃1.5-3 | 23.298342 | 72.333389 | (Salve et al. 2008) |
| Amreli | ˃5-10 | 21.610774 | 71.225489 | (MDWS 2018) |
| Anand | ˃3-5 | 22.556311 | 72.942650 | (MDWS 2018) |
| Banaskantha | ˃5-10 | 24.384757 | 71.901621 | (MDWS 2018) |
| Bharuch | ˃3-5 | 21.736690 | 72.990763 | (MDWS 2018) |
| Bhavnagar | ˃3-5 | 21.761753 | 72.157319 | (Mishra et al. 2009) |
| Dohad | ˃5-10 | 22.848915 | 74.255567 | (MDWS 2018) |
| Junagadh | Not Found | 21.514592 | 70.453568 |  |
| Kachchh | ˃3-5 | 23.421737 | 69.933987 | (Trivedi et al. 2012) |
| Narmada | ˃5-10 | 22.194433 | 76.809757 | (MDWS 2018) |
| Panchmahals | ˃5-10 | 22.727234 | 73.660999 | (MDWS 2018) |
| Patan | ˃ 10 | 23.847707 | 72.113379 | (MDWS 2018) |
| Rajkot | ˃1.5-3 | 22.268393 | 70.787929 | (Dhiman 2014) |
| Sabarkantha | ≤1.5 | 23.848574 | 73.061043 | (Acharya et al. 2008) |
| Surat | ˃1.5-3 | 21.185335 | 72.851294 | (Desai and Desai 2012) |
| Surendranagar | ˃3-5 | 22.865817 | 71.647802 | (MDWS 2018) |
| Vadodara | ˃3-5 | 22.294144 | 73.180899 | (MDWS 2018) |
| Haryana | Jind | ˃5-10 | 29.310866 | 76.306740 | (Meenakshi et al. 2004) |
| Hisar | ˃ 10 | 29.164256 | 75.739398 | (Ravindra and Garg 2006) |
| Pataudi | ˃1.5-3 | 28.324411 | 76.783468 | (Singh et al. 2007) |
| Haily Mandi | ˃5-10 | 28.345444 | 76.756066 | (Singh et al. 2007) |
| Harsaru | ˃1.5-3 | 28.452694 | 76.930839 | (Singh et al. 2007) |
| Motipura | ˃ 10 | 23.576329 | 72.957886 | (Garg et al. 2009) |
| Sirsa | ˃1.5-3 | 29.540858 | 75.021797 | (Mor et al. 2009) |
| Sainiwas | ˃ 10 | 28.826839 | 75.536594 | (Garg et al. 2009) |
| Faridabad | ˃1.5-3 | 28.436239 | 77.346854 | (MDWS 2018) |
| Gurgaon | ˃1.5-3 | 28.425878 | 77.011152 | (MDWS 2018) |
| Jhajjar | ˃5-10 | 28.611363 | 76.667930 | (Gupta and Misra 2018) |
| Kaithal | ˃5-10 | 29.757715 | 76.345594 | (MDWS 2018) |
| Kurushetra | ˃5-10 | 29.965994 | 76.893270 | (Dhankhar and Singh 2015) |
| Mahendragarh | ˃5-10 | 28.181004 | 76.230663 | (Saini 2017) |
| Panipat | ˃5-10 | 29.413666 | 76.986136 | (Bishnoi and Malik 2008) |
| Rewari | ˃5-10 | 28.199940 | 76.618700 | (Haritash et al. 2008) |
| Rohtak | ˃1.5-3 | 28.784217 | 76.566562 | (Bishnoi and Arora 2007) |
| Sonepat | ˃5-10 | 28.948338 | 77.063990 | (Haritash et al. 2008) |
| Siwani | ˃ 10 | 28.906241 | 75.610580 | (Haritash et al. 2008) |
| Jharkhand | Damodar River basin | ˃3-5 | 23.660357 | 86.021849 | (Singh et al. 2008) |
| Chukru | ˃ 10 | 23.172924 | 85.379007 | (Patel et al. 2014) |
| Jammu & Kashmir | Bishnah | ≤1.5 | 32.610664 | 74.857970 | (Khanna 2015) |
| Doda | ˃3-5 | 33.148498 | 75.545468 | (Arya et al. 2013) |
| Rajauri | ˃ 10 | 33.372798 | 74.320440 | (MDWS 2018) |
| Kargil | ˃1.5-3 | 34.546732 | 76.129010 | (MDWS 2018) |
| Karnataka | Gulbarga | ˃5-10 | 17.325547 | 76.823805 | (Latha et al. 1999) |
| Raichur | ˃5-10 | 16.217978 | 77.333849 | (Latha et al. 1999) |
| Bellary | ˃5-10 | 15.131952 | 76.893898 | (Latha et al. 1999) |
| Kolar | ˃3-5 | 13.141686 | 78.128917 | (Latha et al. 1999) |
| Tumkur and Chitradurga | ˃3-5 | 13.348541 | 77.114622 | (Latha et al. 1999) |
| Kheru | ˃ 10 | 17.318651 | 76.813192 | (Shivashankara et al. 2000) |
| Ilkal | ˃5-10 | 15.959254 | 76.110674 | (Tirumalesh et al. 2007) |
| Tamkur | ˃5-10 | 13.348545 | 77.084574 | (Mamatha and Rao 2010) |
| Shivani watershed area | ˃1.5-3 | 13.871990 | 76.199913 | (Kantharaja et al. 2012) |
| Bangalore | ˃ 10 | 12.932437 | 77.467308 | (Prakash and Somashekar 2006) |
| Markandeya River basin | ˃1.5-3 | 16.000154 | 74.700282 | (Ravikumar et al. 2011) |
| Bellary | Not Found | 15.125817 | 76.904888 |  |
| Bidar | Not Found | 17.901834 | 77.504665 |  |
| Bijapur | ˃1.5-3 | 16.818951 | 75.698828 | (Hiremath et al. 2011) |
| Chamarajanagar | ˃1.5-3 | 11.865805 | 76.909739 | (Basavarajappa and Manjunatha, 2016) |
| Chikmagalur | Not Found | 13.306403 | 75.775149 |  |
| Chitradurga | ˃1.5-3 | 14.216358 | 76.394627 | (Basavarajappa and Manjunatha 2015) |
| Davangere | ˃1.5-3 | 14.450384 | 75.907195 | (Manjappa et al. 2003) |
| Gadag | ˃ 10 | 15.218932 | 75.645919 | (Manjappa et al. 2003) |
| Mysore | Not Found | 12.291154 | 76.609645 |  |
| Farhatabad | ˃5-10 | 17.185040 | 76.791071 | (Kumar et al. 2011) |
| Tumkur | ˃3-5 | 13.339187 | 77.086635 | (Mamatha and Rao 2010) |
| Kerala | Palghat | ˃5-10 | 10.498712 | 76.500172 | (Shaji et al. 2007) |
| Palakkad | ˃1.5-3 | 10.782936 | 76.636230 | (Kukillaya and Narayanan 2014) |
| Malappuram | ˃ 10 | 11.060087 | 76.049756 | (MDWS 2018) |
| Kozhikode | ˃ 10 | 11.235548 | 75.851954 | (MDWS 2018) |
| Pathanamthitta | ˃5-10 | 9.261956 | 76.751352 | (MDWS 2018) |
| Wayanad | ˃ 10 | 11.712611 | 76.140794 | (MDWS 2018) |
| Thrissur | ˃ 10 | 10.486382 | 76.241218 | (MDWS 2018) |
| Maharashtra | Amravati | ˃5-10 | 20.912403 | 77.735977 | (MDWS 2018) |
| Chandrapur | ˃5-10 | 19.976385 | 79.276871 | (Dubey et al. 2018) |
| Dhule | ˃1.5-3 | 20.890196 | 74.755696 | (Patil et al. 2010) |
| Gadchiroli | ˃1.5-3 | 19.836531 | 79.959306 | (MDWS 2018) |
| Gondia | ˃1.5-3 | 21.445838 | 80.210213 | (MDWS 2018) |
| Jalna | Not Found | 19.842056 | 75.877022 |  |
| Nagpur | ˃5-10 | 21.065689 | 79.011907 | (Arif et al. 2015) |
| Nanded | ˃3-5 | 19.122275 | 77.289747 | (Pandith et al. 2017; MDWS 2018) |
| Gad River Basin | ˃3-5 | 16.249773 | 73.749850 | (Duraiswami and Patankar 2011) |
| Yavatmal district | ˃ 10 | 20.146848 | 78.202045 | (Pandith et al. 2016) |
| Madhya Pradesh | Chandidongri | ˃3-5 | - | - | (Chatterjee and Mohabey 1998) |
| Chhatarpur | ˃1.5-3 | 24.911611 | 79.588321 | (Avtar et al. 2013a) |
| Bhind | Not Found | 26.560041 | 78.795975 |  |
| Chhatarpur | ˃1.5-3 | 24.920800 | 79.603967 | (Avtar et al. 2013b) |
| Chhindwara | ˃ 10 | 22.041537 | 78.929900 | (MDWS 2018) |
| Datia | Not Found | 25.701045 | 78.629001 |  |
| Dewas | Not Found | 22.960744 | 76.058270 |  |
| Dhar | ˃ 10 | 22.593307 | 75.304885 | (MDWS 2018) |
| Guna | ˃ 10 | 24.634882 | 77.316152 | (MDWS 2018) |
| Gwalior | ˃3-5 | 26.182597 | 78.177877 | (MDWS 2018) |
| Harda | Not Found | 22.349674 | 77.096106 |  |
| Jabalpur | ˃5-10 | 23.148548 | 79.974489 | (MDWS 2018) |
| Jhabua | ˃5-10 | 22.766384 | 74.592455 | (MDWS 2018) |
| Khargaon | ˃5-10 | 21.820374 | 75.616840 | (MDWS 2018) |
| Mandsaur | Not Found | 24.071490 | 75.063662 |  |
| Rajgarh | Not Found | 23.870294 | 76.526598 |  |
| Satna | Not Found | 24.559370 | 80.802693 |  |
| Seoni | Not Found | 22.087466 | 79.546098 |  |
| Shajapur | Not Found | 23.418255 | 76.278602 |  |
| Sheopur | Not Found | 25.665852 | 76.697633 |  |
| Sidhi | Not Found | 24.065821 | 81.813536 |  |
| Shivpuri | ˃3-5 | 25.430654 | 77.685421 | (Singh and Kadam 2007) |
| Manipur | Imphal | ˃1.5-3 | 24.783033 | 93.951211 | (Oinam et al. 2012) |
| Thoubal | ≤1.5 | 24.537594 | 93.973126 | (Oinam et al. 2012) |
| Orissa | Nayagarh | ˃ 10 | 20.256005 | 84.923141 | (Kundu et al. 2001) |
| boden | ˃5-10 | 19.810819 | 82.773157 | (Dey et al. 2012) |
| Karlakot | ˃3-5 | 19.773009 | 82.931292 | (Patel et al. 2014) |
| Angul | ˃1.5-3 | 20.814302 | 85.129933 | (Reza and Singh 2013) |
| Balasore | ˃5-10 | 21.492916 | 86.912300 | (Das et al. 2012) |
| Bargarh | ˃5-10 | 21.348339 | 83.619628 | (MDWS 2018) |
| Bhadrak | Not Found | 21.062375 | 86.496448 |  |
| Bandh | Not Found | 22.327765 | 83.965855 |  |
| Cuttack | ˃1.5-3 | 20.484948 | 85.843004 | (MDWS 2018) |
| Debagarh | Not Found | 21.536122 | 84.725053 |  |
| Dhenkanal | Not Found | 20.662755 | 85.503181 |  |
| Jajpur | Not Found | 20.919215 | 86.165688 |  |
| Keonjhar | Not Found | 21.533077 | 85.659938 |  |
| Sonapur | Not Found | 20.846429 | 83.894879 |  |
| Punjab | Patiala | ≤1.5 | 30.311100 | 76.381884 | (Kumar et al. 2007) |
| Muktsar | ˃1.5-3 | 30.467234 | 74.505664 | (Kumar et al. 2007) |
| Amritsar | ˃3-5 | 31.616851 | 74.858432 | (MDWS 2018) |
| Bhatinda | ˃1.5-3 | 30.205765 | 74.968858 | (MDWS 2018) |
| Faridkot | ˃3-5 | 30.634693 | 74.756595 | (MDWS 2018) |
| Fatehgarh Sahib | ˃ 10 | 30.647369 | 76.396926 | (Vikas et al. 2009) |
| Firozepur | Not Found | 30.927079 | 74.619953 |  |
| Gurdaspur | ˃1.5-3 | 31.943366 | 75.275524 | (MDWS 2018) |
| Mansa | Not Found | 29.997671 | 75.401132 |  |
| Moga | ˃1.5-3 | 30.828714 | 75.182590 | (MDWS 2018) |
| Muktsar | Not Found | 30.465308 | 74.506695 |  |
| Ghanaur | ˃5-10 | 30.332922 | 76.611623 | (MDWS 2018) |
| Sangrur | ˃3-5 | 30.237302 | 75.847468 | (MDWS 2018) |
| Rajasthan | Pushkar valley | ˃ 10 | 26.489417 | 74.550397 | (Datta et al. 1999) |
| Ajmer | ˃3-5 | 26.446928 | 74.625171 | (Vikas et al. 2009) |
| Hanumangarh | ˃3-5 | 29.585134 | 74.332722 | (Suthar et al. 2008) |
| Bhilwara | ˃ 10 | 25.341879 | 74.625392 | (Hussain et al. 2012) |
| Nagaur | ˃5-10 | 27.202380 | 73.733291 | (Arif et al. 2012) |
| Pokhran | ˃3-5 | 26.924633 | 71.901583 | (Singh et al. 2011) |
| Alwar | ˃3-5 | 27.563779 | 76.631135 | (Mudgal et al. 2015) |
| Banaswara | ˃3-5 | 23.542034 | 74.434897 | (Choubisa 2001) |
| Barmer | ˃3-5 | 25.772602 | 71.400789 | (Saxena and Ahmed 2003) |
| Bharatpur | Not Found | 27.220645 | 77.503690 |  |
| Bhilwara | ˃5-10 | 25.344828 | 74.625054 | (Hussain et al. 2012) |
| Bikaner | Not Found | 28.029747 | 73.316156 |  |
| Bundi | ˃3-5 | 25.436523 | 75.641097 | (MDWS 2018) |
| Chittaurgarh | Not Found | 24.886744 | 74.637330 |  |
| Churu | ˃ 10 | 28.299762 | 74.964950 | (MDWS 2018) |
| Dausa | ˃3-5 | 26.899022 | 76.341872 | (MDWS 2018) |
| Dhaulpur | Not Found | 26.696432 | 77.874669 |  |
| Dungarpur | ˃3-5 | 23.853797 | 73.713526 | (Choubisa 2001) |
| Ganganagar | ˃ 10 | 29.913857 | 73.879065 | (MDWS 2018) |
| Hanumangarh | Not Found | 29.581104 | 74.329631 |  |
| Jaipur | ˃5-10 | 26.910803 | 75.792004 | (MDWS 2018) |
| Jaisalmer | ˃3-5 | 26.900659 | 70.889621 | (MDWS 2018) |
| Jalor | ˃5-10 | 25.123455 | 72.345615 | (MDWS 2018) |
| Jhunjhunun | ˃5-10 | 28.123551 | 75.393831 | (MDWS 2018) |
| Jodhpur | ˃ 10 | 26.270019 | 73.010948 | (MDWS 2018) |
| Karauli | ˃3-5 | 26.494235 | 77.017948 | (MDWS 2018) |
| Kota | ˃3-5 | 25.205055 | 75.886342 | (MDWS 2018) |
| Nagaur | ˃ 10 | 27.203755 | 73.723533 | (MDWS 2018) |
| Pali | ˃5-10 | 25.769328 | 73.314992 | (MDWS 2018) |
| Rajsamand | ˃5-10 | 25.065349 | 73.871090 | (MDWS 2018) |
| Sirohi | ˃3-5 | 24.894858 | 72.836717 | (MDWS 2018) |
| Sikar | ˃5-10 | 27.622868 | 75.134880 | (MDWS 2018) |
| Sawai Madhopur | ˃3-5 | 26.036262 | 76.362220 | (MDWS 2018) |
| Tonk | Not Found | 26.167166 | 75.794064 | (MDWS 2018) |
| Udaipur | Not Found | 24.630496 | 73.698008 | (Choubisa 2001) |
| Tamil Nadu | Salem and Namakkal | ˃ 10 | 11.177624 | 78.201064 | (Periakali et al. 2001) |
| Chennai | ˃1.5-3 | 13.013788 | 80.159751 | (Giridharan et al. 2008) |
| Neyveli | ˃ 10 | 11.544746 | 79.467655 | (Jayaprakash et al. 2008) |
| Tirupur | ˃1.5-3 | 11.124737 | 77.353162 | (Arumugam and Elangovan 2009) |
| Dindigul | ˃3-5 | 10.372497 | 77.972728 | (Viswanathan et al. 2009) |
| Erode | ˃5-10 | 11.346613 | 77.701026 | (Karthikeyan et al. 2010) |
| Thirumanimuttar sub-basin | ˃3-5 | 11.047952 | 77.972554 | (Vasanthavigar et al. 2010) |
| Kancheepuram | ˃3-5 | 12.833700 | 79.700948 | (Dar et al. 2011) |
| Manur | ˃3-5 | 08.856212 | 77.651657 | (Gopalakrishnan et al. 2012) |
| Mettur | ˃3-5 | 11.789206 | 77.805911 | (Srinivasamoorthy et al. 2012) |
| Thoothukudi | ˃3-5 | 8.844327 | 77.793709 | (Singaraja et al. 2014) |
| Krishnagiri | ˃5-10 | 12.524206 | 78.205700 | (Manikandan et al. 2014) |
| Madurai | ˃1.5-3 | 09.930150 | 78.129392 | (Thivya et al. 2017) |
| Dharmapuri | ˃5-10 | 12.127749 | 78.153285 | (Jagadeshan et al. 2015) |
| Pambar River basin | ˃3-5 | 12.327295 | 78.522857 | (Brindha et al. 2016) |
| Perambalur | ≤1.5 | 11.239126 | 78.876089 | (Ahamed et al. 2013) |
| Puddukotai | ≤1.5 | 10.382884 | 78.818733 | (Ilangeswaran et al. 2009) |
| Ramanathapuram | ˃1.5-3 | 9.370200 | 78.841092 | (Sivasankar et al. 2013) |
| Tondiar river basin | ≤1.5 | 12.329728 | 79.500943 | (Ramesh and Elango 2012) |
| Vellore | ˃1.5-3 | 12.898960 | 79.099485 | (Kumar et al. 2014) |
| Tiruchirapally | Not Found | 10.818861 | 78.708317 |  |
| Telangana | Siddipet | ˃1.5-3 | 18.100986 | 78.845209 | (Narsimha and Sudarshan 2017a) |
| Basara | ˃3-5 | 18.877127 | 77.949783 | (Narsimha and Sudarshan 2017b) |
| Nalgonda | ˃ 10 | 17.221459 | 79.302287 | (Brindha et al. 2016) |
| Vaniyar River basin | ˃5-10 | 12.120655 | 78.328670 | (Brindha et al. 2016) |
| Ranga Reddy | ˃3-5 | 17.246780 | 78.011597 | (Sujatha 2003) |
| Ranga Reddy (South Eastern part) | ˃3-5 | 17.020667 | 78.626266 | (Sujatha 2003) |
| Maheshwaram | ˃3-5 | 17.133256 | 78.425674 | (Sreedevi et al. 2006) |
| Kurmapalli watershed | ˃ 10 | 16.899773 | 78.720009 | (Mondal et al. 2009) |
| Wailapally watershed | ˃5-10 | 17.079846 | 78.859682 | (Reddy et al. 2010) |
| Adilabad | ˃3-5 | 19.659835 | 78.533076 | (Narsimha and Sudarshan 2017b) |
| Medak | ˃5-10 | 17.901479 | 78.193927 | (Narsimha and Sudarshan 2018) |
| Karimnagar | ˃1.5-3 | 18.443276 | 79.138692 | (Ramesh and Kavitha 2016) |
| Khammam | ˃1.5-3 | 17.257194 | 80.162424 | (Shanthi et al. 2014) |
| Uttar Pradesh | Agra | ˃ 10 | 27.181315 | 78.005031 | (Gupta et al. 1999) |
| Saidabad | ˃1.5-3 | 25.369567 | 82.114567 | (Misra and Mishra 2007a) |
| Mat | ˃1.5-3 | 27.633406 | 77.710564 | (Misra and Mishra 2007b) |
| Kanpur | ˃5-10 | 26.470465 | 80.329016 | (Sankararamakrishnan et al. 2008) |
| Unnao | ˃ 10 | 26.550547 | 80.494302 | (Jha et al. 2009a, b) |
| Varuna River Basin | ˃1.5-3 | 25.249951 | 82.499641 | (Raju et al. 2009b) |
| Sonbhadra | ˃5-10 | 24.448327 | 83.037884 | (Raju et al. 2009a) |
| Marks Nagar | ˃ 10 | - | - | (Jha et al. 2010) |
| Upper Panda River basin | ˃5-10 | 24.335247 | 83.338540 | (Raju et al. 2012) |
| Bundelkhand | ˃3-5 | 25.453254 | 78.608927 | (Avtar et al. 2013a) |
| Aligarh | ˃1.5-3 | 27.908193 | 78.071093 | (Rahman and Nasir 2017) |
| Etah | ˃1.5-3 | 27.559964 | 78.658879 | (Saxena and Ahmed 2003) |
| Firozabad | ≤1.5 | 27.165012 | 78.383121 | (Verma et al. 2000) |
| Rae Bareli | ˃3-5 | 26.248818 | 81.041901 | (Kanaujia et al. 2013) |
| Kannauj | Not Found | 27.045440 | 79.914502 |  |
| Mahamaya Nagar | Not Found | 27.578068 | 78.138215 |  |
| Mainpuri | Not Found | 27.229205 | 79.014289 |  |
| Mathura | ˃3-5 | 27.483170 | 77.678280 | (Razdan et al. 2017) |
| Mau | Not Found | 25.941811 | 83.558190 |  |
| Janghai | ˃1.5-3 | 25.551531 | 82.310622 | (Saxena and Ahmed 2003) |
| Uttara khand | Nainital | ≤1.5 | 29.388044 | 79.451555 | (Jain et al. 2010) |
| West Bengal | Nalhati | ˃1.5-3 | 24.293254 | 87.834283 | (Gupta et al. 2006) |
| Hooghly | ≤1.5 | 22.877680 | 87.925261 | (Kundu and Mandal 2009) |
| Bankura | ˃ 10 | 23.180409 | 87.230710 | (Chakrabarti and Bhattacharya 2013) |
| Rampurhat | ˃ 10 | 24.182302 | 87.786689 | (Mondal and George 2015) |
| Junidpur and Nowapara | ˃ 10 | 24.278303 | 88.003235 | (Mondal et al. 2016) |
| Haringhata | ≤1.5 | 22.960438 | 88.568000 | (Datta et al. 2014) |
| Palta | ˃1.5-3 | 22.785711 | 88.371503 | (Datta et al. 2014) |
| Rondiha | ˃1.5-3 | 23.389632 | 87.480580 | (Datta et al. 2014) |
| Midnapore Town | ≤1.5 | 22.432163 | 87.310361 | (Datta et al. 2014) |
| Hijli | ≤1.5 | 22.322198 | 87.330348 | (Datta et al. 2014) |
| La0manpur | ≤1.5 | 23.440944 | 87.008741 | (Datta et al. 2014) |
| Purulia | ˃ 10 | 23.234825 | 86.543831 | (Bhattacharya and Chakrabarti 2011) |
| Bardhaman | Not Found | 23.249367 | 87.853528 |  |
| Dakshindinajpur | Not Found | 25.396382 | 88.574972 |  |
| Malda | Not Found | 25.154292 | 88.097088 |  |
| Nadia | Not Found | 23.361636 | 88.535848 |  |
| Uttardinajpur | Not Found | 25.724712 | 88.099894 |  |

**Table S4**: Form of fluoride present near the earth surface

|  |  |
| --- | --- |
| **Gaseous form** | **Particulate form** |
| Hydrogen fluoride (HF), Sulfur hexafluoride (SF6), Hexafluorosilicic acid (SiF6 2−), Silicon tetrafluoride (SiF4) | Calcium fluoride, Sodium hexafluorosilicate, Sodium aluminum fluoride, Aluminum fluoride, Calcium phosphate fluoride and Lead fluoride |

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