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OUTDOOR, INDOOR (CLOSED-DOOR) AND POSTER DUST CONTAMINATIONS AND HEALTH HAZARDS

Prof. Dr. M. A. Sattar and R. Shahriar[1]
College of Agricultural Sciences
International University of Business Agriculture and Technology, Uttara, Dhaka
[1]Department of Environmental Sciences and Engineering
Jatiya Kabi Kazi Nazrul Islam University, Trishal, Mymensingh

1. ABSTRACT

This study described the outdoor, indoor and poster dust contamination sites (sources), and their hazards and/or harmful effects or problems to human health. Major outdoor dust zone/sites covered 8 zones where totally around 60 areas were identified. Again, 9 major indoor (closed door) sites areas/zones of dust contaminations covered total of around 90 sites. Four major poster dust sites recorded to sub-sides of 19 zones/areas. Dusts are the soil clay colloids (dust clay/nanoparticle; diameter size <0.0002mm in diameter) severely harmful to the human health and environment as contaminants like particulate matters (PM 2.5). Beginning and ending, arrival and departure pathway of life is not peaceful where human have to fight every moment against outdoor, indoor and/or poster dust inhalations from air-the pure/fresh the better. Dusts carry numerous toxic and hazardous chemicals including a lot of slow poison harmful heavy metals like As, Hg, Ni, Cr, Cd, Zn, Se, Pb, V, Br, Ur, Ti, Al, Mn, Fe, Co, Cu, Zn, Sb, Pb, Mo, Sr etc. Here dust related health hazards covering numerous (8-12) diseases including cancer are listed and evaluated where a wide awareness measures are recommended.

Key words: Outdoor dusts, indoor dusts, poster dusts, sources, slow poison, toxic chemicals, heavy metals, health hazards, awareness.

2. Introduction

Clay constitutes those minor soil particles-they are smaller than 0.002 mm in diameter. They are mostly the secondary minerals, mostly formed through the decomposition of original minerals or build up through sedimentation. Clays are the end products of weathering, and has been formed by hydorthermal action or deposition as sediment. Clay particles of 0.002 and 0.001 mm diameter contains primary minerals like mica, talc, hematite and quartz. Four main constituents' silica, alumina, iron and water make up 90-98% of colloidal clays. Clay is a mixture of hydrated alumino-ferro silicates of varying composition mixed in some cases with an excess of sequioxides or silica. Each clay particle is made up of a large number of plate-like structural units. Besides the plate-like structure of clay also contributes towards greater surface area on which moisture and cations are held. The finer the fraction of soil or clay, the greater the percentage of hygroscopic moisture. In Bangladesh, clay soils are available at Madhur forest, Bhaluka forest zone, Gazipur Bhawal forest, Comilla Lalmati, Moinamati hills, Rangamati districts etc. and can be treated as problematic soils. When there is land/soil there must be dusts where clay soils of all types take the major role because of its nature and human works characteristics. Practically, dusts are produced through natural and human works. Clay term implies natural, earthy fine grained material which develops plasticity when mixed with a limited amount of water. Clay contains a higher amounts of Mg, Si, Fe and smaller amounts of Ca, Na and K. Most of the soil clays are colloidal in size. There is no sharp line for demarcation or identification between clays and colloidal clays but particles less than 0.0002 mm in diameter are considered as colloidal clay. If clay colloids are examined under high power microscope, electron microscope or an X-ray their crystalline structure can be observed. Each crystalline clay is like a partial deck of magnetic cards, i.e. the clay is thinner in one dimension than/that of other two dimensions. Each card represents a layer each of which is nearly an exact replication of each other layer of that clay. Such many cards adhere together to make up a clay particle called a micelle. There are 2 oxygen sheets/layer in some clays 3 or 4 in others and 6 in still others. The common group of crystalline clay minerals with silicon

are (i) kaolinite; (ii) montmorillonite; (iii) illite; (iv) smectite; (v) vermiculite and (vi) chlorite; are known as silicate clays (Sattar, 2022).

3. Classification of clay dusts on the basis of sand, silt and clay (On the basis of percentage and diameter size)

On the basis of percentage of sand, silt and clay present in soils, Marshall's Traingular co-ordinates classified into 12 types of soils Fig. 1 where clays are listed on 6-groups like (1) clay, (2) sandy clay, (3) sandy clay loam, (4) clay loam, (5) silty clay loam and (6) silty clay. USDA system showed 7 textural clays on the basis of diameter where clay occupied 2 groups like (1) sily clay (dimeter 0.05-0.002mm) and (2) clay (diameter below 0.002 mm). International system showed 4-types of textural groups on the basis of diameter ranges where clay covers the diameter range of below 0.002 mm in size. Again, Mohr's 10-fraction classified textural types into 10 classes where clay covers 2-groups (on the basis of diameter) like clay (diameter size 0.002-0.005mm) and colloidal clay (below 0.0005mm in diameter) (Sattar, 2022). There is no universal guideline for dust clays measurement. Usually, clays below 0.0002mm in diameter can be treated as dust clay too and similarly clay colloids cover the diameter size below 0.0002mm in diameter and can also be treated dust colloidal clays. On the basis of fineness of dusts-clay/dusts can be called as types or classes of dust clays, clay dusts or nanoparticles (Sattar, 2022).

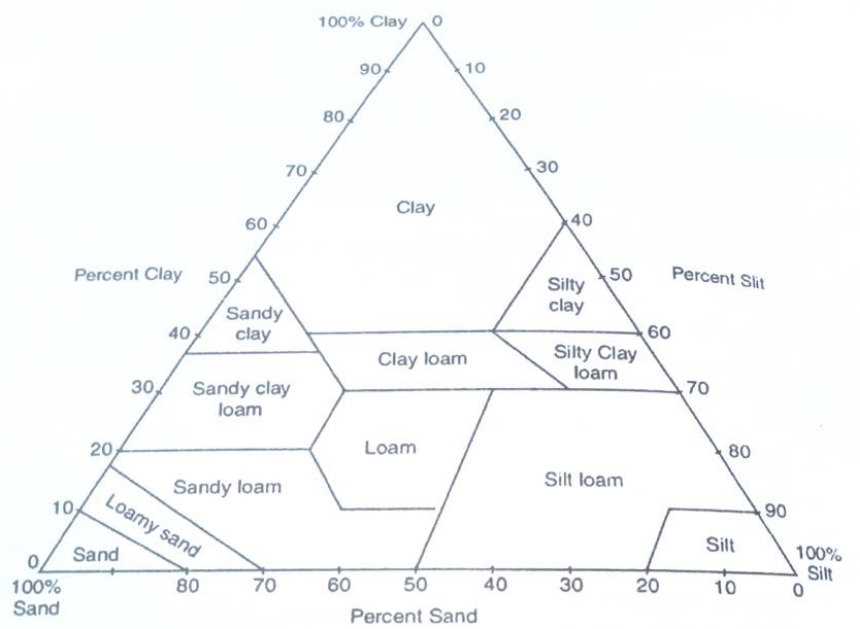


Fig. 1. Textural classes of soils showing clay groups of 6 types

4. Common group of clay minerals/colloidal clay/dust clay with their relative identity

The prominent element present in clay minerals are O, Al, Si, Mg, K, Fe etc., and they are variable on the basis of clay group including relative swelling and sickness, and again variable under natural environment conditions. The detailed descriptions of commons groups, prominent element present, relative swelling under wet, relative stickiness and visible areas of 8 categories of clays are outlined here **(Sattar, 2022)**. Dust coming from farm land differed from those of volcanic eruption, brick field industrial zone, road dusts etc. where they are widely polluted and/or contaminated and those the relative properties are also variable.

Sl. No.	Name of common groups of clays	Prominent element presence	Relative swelling under wet	Relative stickiness	Prominent zone/areas
1.	Kaolinite	O, Al, Si	Nearly none	Low/slight	Warm to hot, moist sub-humid to humid
2.	Smectite	O, Si, Al	High	High	Arid to humid low leaching
3.	Montmorillonite	O, Si, Al, Mg	High	High	Arid to humid low leaching
4.	Illite (hydrous mica)	O, Si, Al, K	Low	Low	Sub-humid to cool zone
5.	Vermiculite	O, Si, Al, Mg	High	Moderate/ medium	Sub-humid to humid rich in micas
6.	Chlorite	O, Si, Al, K, Mg, Fe	None/no	None/no	Marine sediments
7.	Sesquioxides (metal oxides)	O, Fe, Al	None/no	None/no	Wet hot old soils of tropics weathered
8.	Amorphous	O, Al, Si	None/no	Poor/slight	Young volcanic ash, under weathering

5. Sources of out-door dust (colloidal clay/nanoparticles) contaminations to human health

There are different sources for out-door dust contaminations to the human health/body and here eight major sources are listed covering a lot of sub-sources. The idential 8 major out-door dust contaminations sources are listed below:

1) Urban open field/play ground
2) Urban market
3) Zoos
4) Park at the urban residential area
5) Rural village market
6) Tourist sites
7) Car parking zone/areas
8) Direct road dusts

The sub-sources from each of the major area are listed again here (No. 1-8) on the basis of wide field, lab. survey and wide personal experiences.

1) Dust contamination sources at urban open field/play ground

a. Field/land/ground; b. Grasses; c. Major/minor plants; d. Seating place/benches/chairs; e. Gallery and f. Walking roads and sub-roads

2) Dust contamination sources at open city market

a. Ground/land; b. Walking on roads side; c. Shades of plastic body; d. Preserved/protected items; e. Various items of basket/bags; f. Seating sites/zones and g. Shops around

3) Dust contamination sources at Zoos

a. Walking roads/sub-roads; b. Plants/trees/falling leaves; c. Grasses; d. Different walls/boundaries; e. Shade of different animals/birds and f. Food shops

4) Dust contamination sources covering Parks at urban residential area

a. Walking and/or running roads/sub-roads; b. Plants/trees; c. Dust/sandy, soil floor; d. Play grounds; e. Walls; f. Chairs/tables; g. Club houses and h. Shops-around/outside

5) Dust contamination sources at rural village market

a. Open shops of different kinds; b. Walking on dusty roads/sub roads; c. A few soil contaminated sites; d. Shops under minor houses; e. Shops of plastic houses and f. Poor and high dusty shops

6) Dust contamination sources from tourist sites or areas

a. Vehicle parking sites; b. Walking roads/sub-road sites; c. Cooking sites; d. Plants/trees; e. Some major/minor dust moving contaminated sites; f. Large gathering sites; g. Shopping sites and h. Restaurants/food shops

7) Dust contamination sources at car-parking zones/areas/fields

a. Field/ground; b. Vehicles; c. Car/vehicle washing/cleaning sites; d. Public/driver/resting site/places; e. Road-road to ground and f. Seating/resting places/chairs/benches

8) Road dust contaminations

a. Main road and sub-roads; b. Road site ground/land grasses; c. Crop fields; d. Housing zones; e. Side/inside plantation; f. Walking and/or running; g. Vehicle movement; h. Road cutting; i. Road damages and j. Road cleaning

6. Sources of indoor/closed-door dust (colloidal clay/nanoparticles) contaminations to human health

The sources of closed-door or indoor dust contaminations were observed to 9 categories, and they are listed here:

1) Houses of residential/other urban area at urban zone
2) Departmental store
3) School, college, university residential area
4) Office room at work place
5) Library room
6) Computer room/zone area
7) Restaurant
8) Hotel rooms/campus
9) Museum buildings

1) Dust movement and contaminations (sources) in the rooms of houses of residential/other urban areas

a. Books, papers; b. Floor dust; c. Floor carpet/wall carpet (if any); d. Under the beds; e. Room corners; f. Around the furniture; g. Store room goods; h. Plastic bags at different sites; i. Housing plants; j. Cooking materials; k. TV screen-front and back; l. Different housing equipment's/machineries like washing machine, oven, gas burners, dish washers, roti makers, deep and normal freezers; m. Wash/bath room materials; o. Wall/inside and p. Lift-body, if any

2) Dust movement and contamination to human health/body at urban departmental store/shopping mall

a. Floor dust; b. Floor carpets; c. Rake and rake items; d. Different sites of rakes and almirahs; e. Various selling goods/items; f. Store rooms of preserving materials; g. Plastic papers/bags/shop items; h. Outside the glasses of different boxes; i. Different freezes for preserving items; j. Hanging clothes of all kinds; k. Doors and windows; l. Walls/inside glass/window screens and m. Lift body, if any

3) Dust movement and contaminations to human health/body at school, college, university or academic/nonacademic institute rooms and campus

a. Floor dust at different stairs including corridors; b. Tables, benches, chairs, almirahs etc.; c. Walls, glass, doors and windows; d. Lift and walking stairs; e. Walking of students, teachers and employee; f. Books, papers, changing of seats etc.; g. Conf. halls, lecture galleries, wash rooms; h. Kitchen, dinning rooms materials/equipment's or machine; i. Postering around inside/outside building-walls; j. Seasonal changes through wind action and k. Fans/AC boxes

4) Dust movement and contaminations to human health/body at office rooms of various organizations

a. Floor dust at different stairs and lift body; b. Bookshelf, almirah, papers; c. Table, chair, basket, show-pieces; d. Sofa sets (if any); e. Fans/AC boxes; f. Rakes of varies sizes; g. Resting beds/chair and h. Fans and switches

5) Dust movement and contaminations to human health at Book library rooms/stores

a. Old and new books, magazines, reports, journals, bulletins, posters, newspapers; b. All kinds of almirah-around all sides; c. Floor dusts; d. Glasses, windows and doors; e. Around the rake bodies; f. Fans and switches; g. Lift, stairs and corridors; h. Store house/rooms covering of books and other items and i. Chair, tables, benches, boards, posters

6) Dust movement and contaminations to human health at computer rooms

a. Floor dusts; b. Rakes and almirah with books/other items; c. Glass, windows and doors; d. Fans and switches; e. Computers and printers, boards items; f. Fans and switches; g. Computers and printers, boards; h. Lifts and stairs (related); i. Floor carpets (wall screens); j. Walking/moving with shoes and k. Wall posters, if any

7) Dust movement and contaminations to human health at restaurants from different urban areas

a. Floor dust; b. Chair, tables, table clothes, towels; c. All cooking materials and cookeries; d. Glasses, windows, doors and screens; e. Stairs, corridors, cooking rooms, lifts; f. Fans, kitchen floor/materials, food materials; g. Water drinking glasses, plates, spoons, tissue papers; h. News paper, magazines, caps, dresses of boys and i. Carpets, wall posters, wall screens

8) Dust movement and contaminations to human health at hotel rooms and hotel campus

a. Floor dust, lift, stairs, corridors; b. Bed, bed sheets, towels, paste, brushes; c. Fans, AC proper ventilation; d. Glass, door, windows, screens; e. Both rooms/wash rooms; f. Carpets, wall posters, mats and g. Desk, chair, table, sofa

9) Dust movement and contaminations to human health at museum rooms and buildings

a. Floor dust, lift, stairs and corridors; b. Museum show pieces; c. Each/every box/cupboard; d. Fans, AC, ventilation, wall screens and e. Around the all almirahs-body, corners, floors etc.

For nine major indoor sources (No. 1-9) of dust contaminations, a total of 57 areas/zones covering most of them again listed here:

7. Sources of dust contaminations at indoor (closed door) sites of the residential houses

(1**)** Bed sheet and bed covers; (2) Pillow covers; (3) Blankets; (4) Under the bed-floor space; (5) Sofa with covers if any; (6) Under sofa-floor space; (7) Reading table-cover, books, papers, floor space below the table; (8) TV-table-sides, floor, corners; (9) Dining room table, paper, books, magazines, floor space

below the table; (10) Sofa cushion, pillows; (11) Almirah-sides, floor, top-bags, suitcases, papers, clothes, (12) Dressing table-glass, sides, bottom-floor, corners; (12) Cupboard-sides, above, bottom floor, corners, boxes, cover clothes, books, magazines, if any; (13) Curtains of all different rooms covering on all doors and windows as uses; (14) Walls of different rooms; (15) Various musical instruments at houses, if any; (16) Wall mats and wall clocks; (17) Sides of different cosmetic things at different rooms; (18) All store room materials/goods-boxes, bags, clothes, kitchen aids, different food materials etc.; (19) Dinning table-covers, floors, corners, table; (20) Sides of unused doors and windows; (21) Washing machine-sides, floor and above, corners; (22) Wall calendar, wall show pieces, and wall photographs; (23) Moving roof fans and various table fans; (24) Different switch boards; (25) Top of shoes, shoe boxes and shoe cupboards; (26) Tissue boxes and open tissue papers; (27) Gaps of floors tiles at different rooms and wall tiles; (28) Kitchen drawers-front and inside covering all boxes/equipment's inside; (29) Open cooking tools/longer time stores of cooking tools; (30) Plastic/life flower batch inside including leaves of ornamental plants; (31) Box/boxes for keeping of pens/scales, rubbers, gums, taps, threads; (32) Laptops, mobiles, printers-all sides and bellow the machines; (33) Dust box/room waste boxes; (34) All false roofs of different rooms; (35) All basins-tops, bottoms and sides; (36) Boxes of table tissue covers and sides; (37) Bottom and sides of shoes after coming from outside to every person; (38) Loose clothes of everyday use; (39) Different show-pieces of different rooms-all sides; (40) Regular cleaning of all wires/wirings at different rooms; (41) Cleaning of eye glasses properly; (42) All sides of various honoured crests or other gifts; (43) Regular cleaning toys of the children; (44) TV, dish and/or AC remotes; (45) Soil floors of different sheds/rooms; (46) Grills and glasses of different rooms inside and outside the windows; (47) Use saddles during inside moving or wash legs and hands before eating and drinking or cases of high dusts on hands/begs; (48) Longer preserving/storing of unnecessary things/materials/clothes at different rides or corners of rooms; (49) During moving outside body/head, hairs carry lot of dusts. Again fens day un-washing head/body enjoys huge dusts; (50) Using of house broom; (51) Covers of bathroom (wash room) paper tissue boxes; (52) Covers and inside of boxes containing everyday used clothes for washing; (53) Lack of cleaning and/or washing house floors including proper care of corners and pill or sides; (54) Rare cleaning of brush boxes at wash rooms; (55) All the looking glasses available at different rooms-show case, almirah, wash/bath room, hand wash-sites or other fining sites at different rooms and (56) Bodies of longer storage/keeping of cosmetics/shampoos, hand wash soap etc.

Sattar (1996; 2003; 2022) reviewed some articles where the major sources of high contaminations in urban indoor and outdoor dusts are reported here:
(1) Severe uses of vehicles in roads; (2) Coal combustion, coal mining coal black dusts; (3) Melt al manufacturing and processing industries; (4) Industrial zones/areas; (5) Transportation of various raw materials; (5) Around fuel fillings/gas stations; (6) Anthropogenic activities; (7) Natural contaminations from dust emissions from cement and mining industrial operations ; (8) Long open damping of mining, steel, iron and industrial materials; (9) Processing of fertilizers, pesticides, medical or other toxic chemicals and (10) Vehicles carrying huge soil materials, sands, industrial products and byproducts storing and carrying of thousands of toxic and harmful chemicals.

8. Posters carrying dust contaminations

On general concepts, posters are classified into 5 categories and mostly treated/used as well posters except scientific conference poster in poster sessions and they are listed below:

(1) Election camping posters; (2) Posters of commercial advertising; (3) Knowledge based scientific posters; (4) Shopping mall posters and Film posters

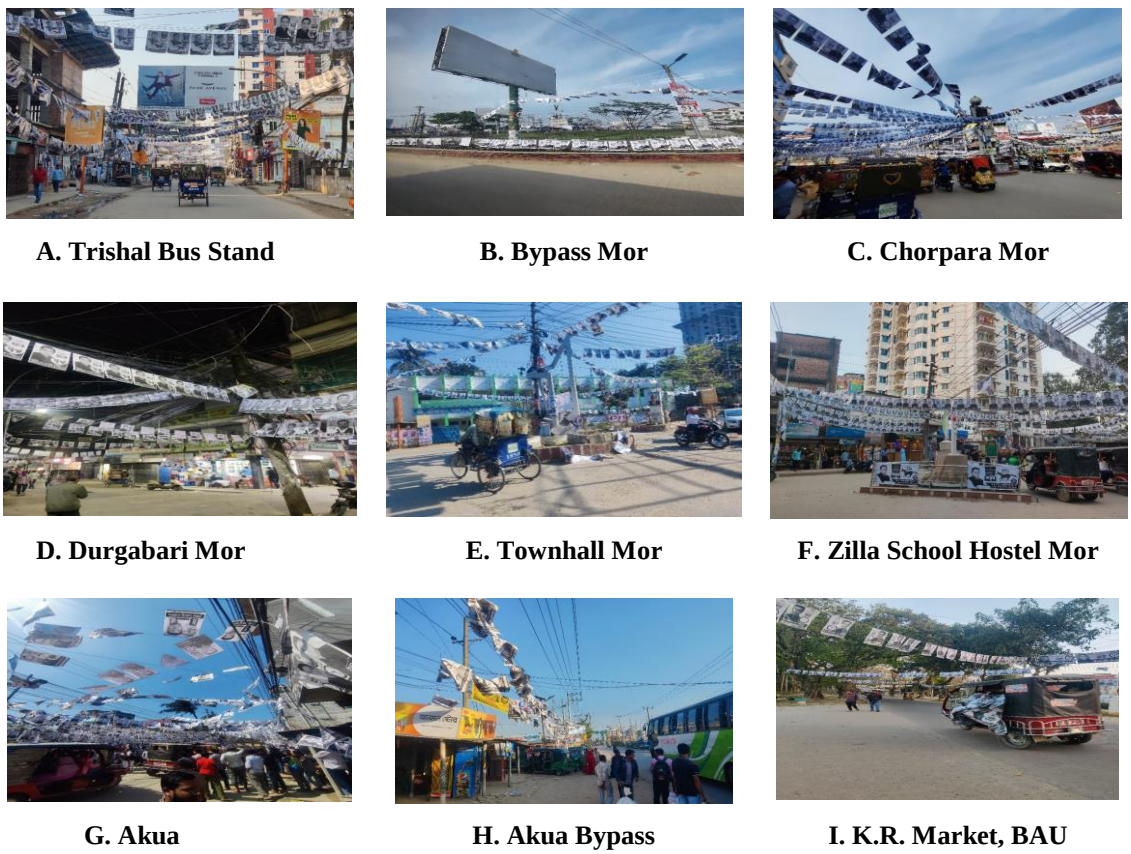
Where there is a poster there must be visible and/or invisible dust (clay colloids) contaminations, and under Bangladesh conditions the poster hanging sites (zones)/locations are listed below:

(1) Houses/building walls; (2) Boundary walls; (3) All kinds of outside pillars; (4) Plant bodies; (5) Hanging posters on highway roads; (6) Using of bamboo sticks; (7) Sides of bridges;

(8) Walking/running park sites/road sides; (9) Open market zones as handing posters; (10) Election camping sites; (11) Bus stations zones; (12) Flyover zones; (13) Posters at cinema hall regions; (14) Posters at ferry ghat zones; (15) Floor posters at selected sites; (16) Posters around the voting campus; (17) Posters on culvert walls; (18) Moving posters during camping and (19) Posters on vehicles moving around

9. Present poster dust contaminations case study observations at Mymensingh

Clay, colloidal clay, dust clay, dust colloids or nanoparticles move in air (low to high speed) on the basis of air current/movement or wind speed as developed by surrounding human and/or natural activities and finally settle down in land, field, roads, parks, forest, park, forest, plants i.e. indoor, outdoor points or to posters on the basis of sites/locations and their hanging mode.



A. Trishal Bus Stand **B. Bypass Mor** **C. Chorpara Mor**

D. Durgabari Mor **E. Townhall Mor** **F. Zilla School Hostel Mor**

G. Akua **H. Akua Bypass** **I. K.R. Market, BAU**

Fig. 2. Road side various election postering from 10 locations (A to I) at Mymensingh urban region.

Dust directly/indirectly hitting to posters stabilize as contaminants or after hitting move fall down to the ground around. The longer life the poster-the more the dusts contaminants. Even dust may attack a poster covering no poster letter, only the black/brown dust there. It is true if there is poster-they always catch or attack minor to major/severe dusts. Due to tiny or trace amount of sedimentation or attraction the contaminations or environmental degradation in relation to poster dust are not noticeable to human although they enjoying a lot through inhalation that never be ignored. Such trace dust inhalation causes a lot of diseases and health hazards to human life through a slow poison phenomena even cancer or other chronic diseases even to death (Sattar, 2022).

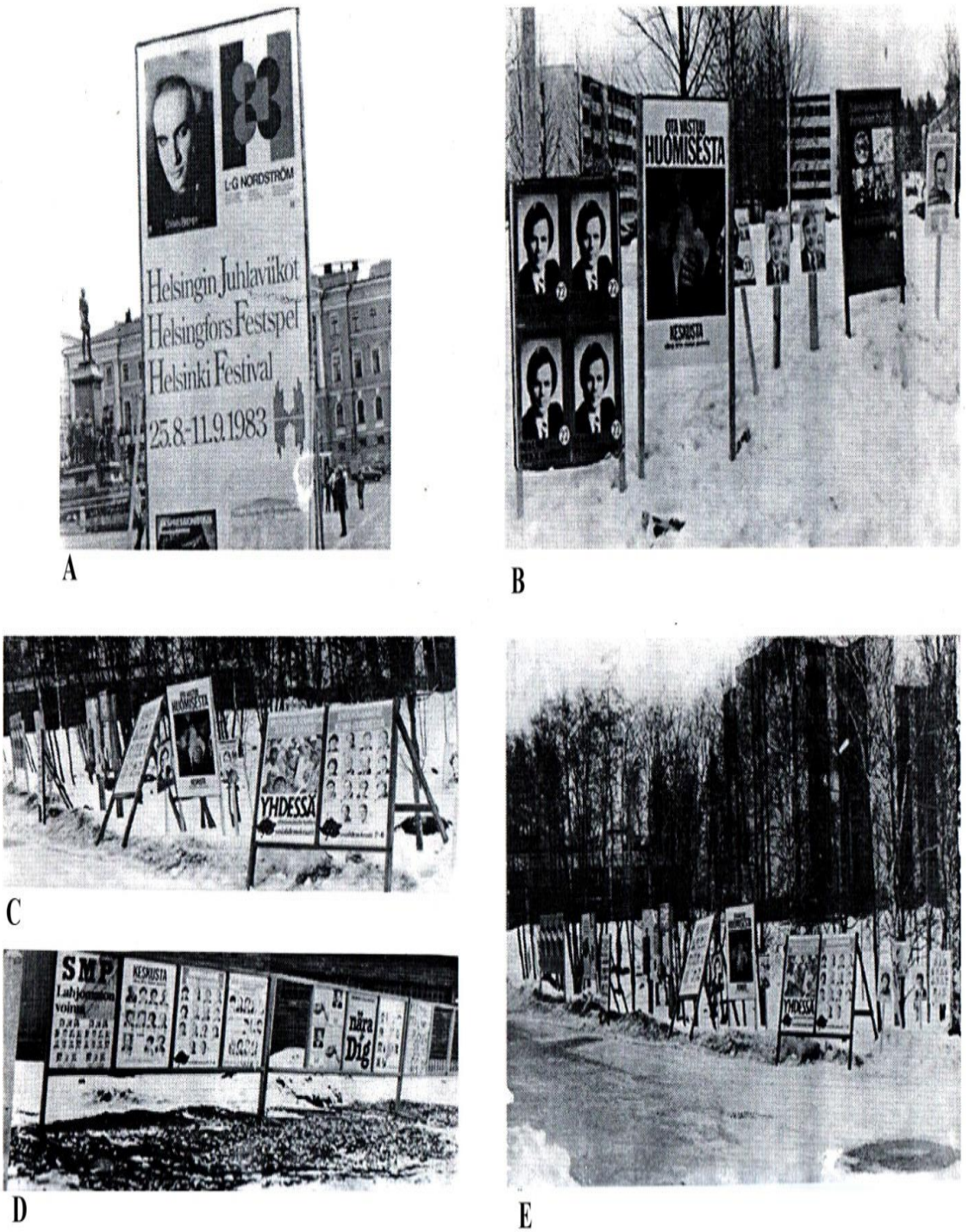


Fig. 3. Road side election postering at Jyvaskyla, Finland in 1983 from A (Festival), B, C, D and E. (Sattar, 2004)

A case study observations of dust contaminations on posters covering Mymensingh City Corporation election on 9 March 2024 upto 10 locations (Fig. 2 and Table 1) after 3, 6, 12 and 20 days of postering during the periods from 20 February to 15 March 2024. A visible minor or traces of dusts were observed on poster after 3 days (<5%), after 6 days contaminations measured to 10-15% 12 days to 20-25% and 20 days to >50% (Table 1). The numbers and contamination cases were variable on the basis of locations/sites or roads, dusts on roads/or sides roads, human and vehicle movement and types of vehicles. Some cases dusts were visible in the morning but they disappeared in the afternoon. Due to wind, froast actions, city using of water for dust protection-contaminations were variable (Table 1). A similar postering case study experiment on national election of Finland in 1983 were observed where they used only board postering and no cases of hanging or wall posters (Fig. 3). Because of the winter slowfall no dusts were visible. They used sands against snow slippery of roads (Sattar, 2004). Finnish people (Candidate) themselves or parties removed the election posters board next day after the election. Initially, immediate after fixing or hanging of posters by using ropes 98-100% posters were very much clear-and no question of dusts or dust contamination. The severity of dusts, sand or clay particles or roads or grounds also directly influenced the dust contaminations to poster papers. Moreover, lot of large vehicles in some areas including often movement and human gathering also affected the dust movement and direct and/or indirect contaminations (Sattar, 2004).

Table 1. Observation of dusts on election posters (traces to high) after 0, 6, 12, 18 days of postering at ten locations (A J) in Mymensingh urban region.

Sl/ID No.	Locations/ sites	No. of Posters hanged	Visible dust contaminations %			
			<5 (3 days)	10-15 (6 days)	20-55 (12 days)	>50 (18 days)
A	Trishal	500	35	27	18	4
B	Bypass	500	38	20	19	3
C	Charpara	700	50	27	20	2
D	Durgabari	150	20	12	8	2
E	Townhall	600	50	30	25	5
F	Zilla school	350	40	30	30	8
G	Akua	100	20	15	12	7
H	Akua bypass	1500	26	20	20	4
I	BAU	550	50	58	47	18

10. Dust contaminations and human health hazards

Sattar (2022) studied the major dust contaminated sites/sources where 13 areas are listed like: (1) Road dusts; (2) Road side dusts; (3) Road side/road island plants; (4) Urban open field/playground dust; (5) Dust at zoo campus; (6) Dusts at parks; (7) Dusts visible at gas station; (8) Dusts at village market zone; (9) Dusts at urban open markets; (10) Dusts at tourist sites; (11) Dusts at car-parking zones; (12) Dusts on plants, trees, herbs, shurbs and (13) Dusts at man-gathering sites/areas. Again, there the dust related health hazards were evaluated by Sattar (2022) where 18 major and minor diseases/health problems were observed (Fig. 4-6) like- (1) Eye/skin irritation; (2) Mental disorders; (3) Rising of tensions; (4) loss/reduction of night sleep; (5) Falling of head hairs; (6) Breathing troubles; (7) Lung or kidney diseases; (8) Ashma/broncities; (9) Rising of blood pressure; (10) Cancer; (11) Allergic diseases; (12) Vomiting/vomiting tendency; (13) Loss of appetites; (14) Diabetes growth; (15) Headache, drowniness; (16) Diarrehea; (17) Brain/Kidney diseases and (18) Hormonal disorders. Major atmospheric dust and it's sources, contaminations and diseases are well described in Fig. 4. (Sattar, 2022) and Fig. 5 (Sattar, 2003) where numerous dust related diseases and health hazards were recorded. Khan (2013) reported dust Nanoparticles related problems arises on brain, nose, lunge, skin, gut, blood, bone marrow, spieen, endothelium (Fig. 6).

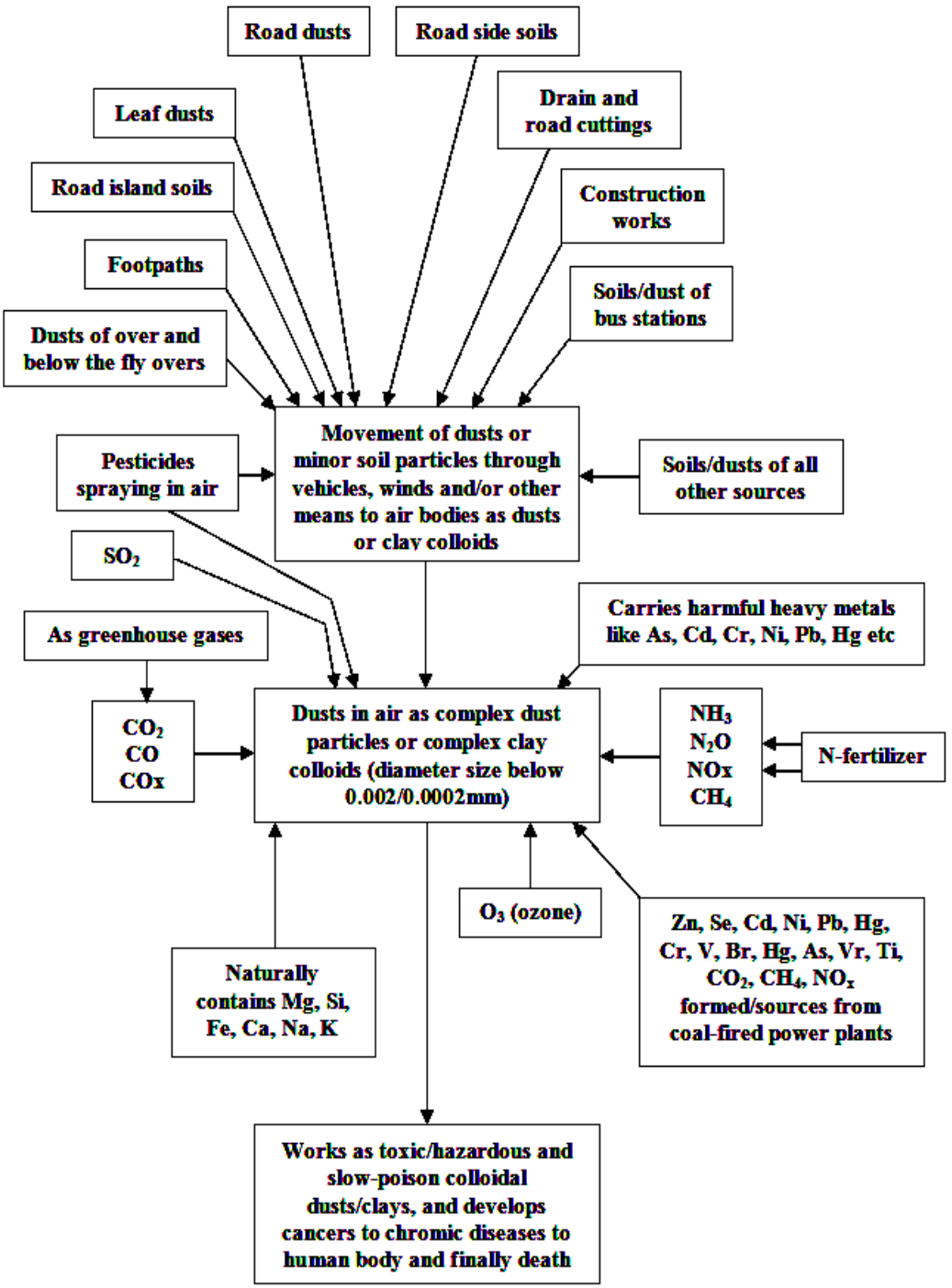


Fig. 4. Hazardous complex slow-poison atmosphic dusts or dust/clay colloids-a source of lot of chronic diseases to human body (Sattar, 2022)

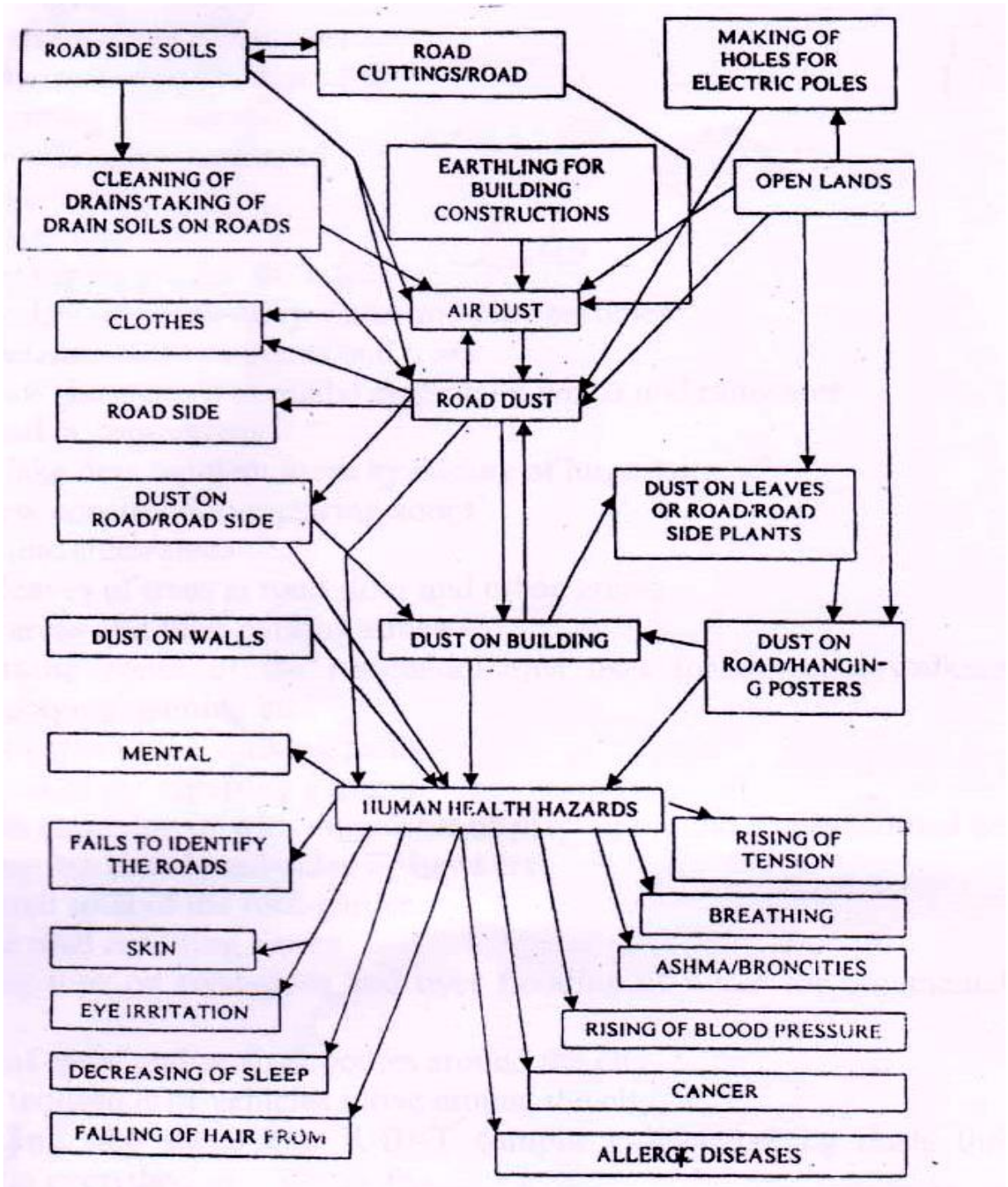


Fig. 5. Sources of dust deposition and dynamics of dust hazards to human health at metropolitan cities of Bangladesh (Sattar, 2003)

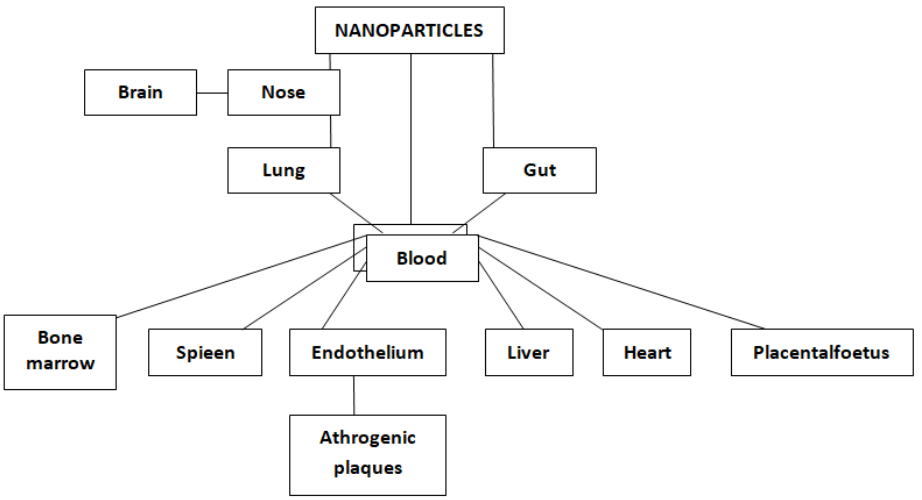


Fig. 6. Hazards of nanoparticels pathways to human health (Khan, 2013)

11. Potential toxic metals (PTM) and health hazards

PTM are widely considered on road dust hazards at the urban and industrial areas where mostly heavy metal contaminations are widely handled. Usually, it is said/treated that road dusts are mostly responsible for PTM impacts on health hazards. Road dusts are related to hundreds of factors/sources like road cuttings, constructions, renovation, road side parking, road side gardening, maintaining of drainage system, vehicles carrying of soils/sands. The atmospheric concentration and toxicity of urban dusts depends on its location, nature of sources, proximity of sources, physics-chemical composition, and seasons of the year. Urban dusts contains 2-5 times the hazardous metals than those of urban, normal/natural soils.

(1) Exposure of road dusts may cause hazardous effects to human health through inhalation, ingestion, and dermal contact absorption due to severe accumulation of PTM.
(2) PTMS are non-degradable with non-known homeostasis mechanism in the human body where PTM exposure via road dusts is a major factor where toxicity of elements and their environmental mobility and tendency to be accumulated in the living beings as chemical forms.
(3) Cd and Pb cause high potential ecological risk in road dusts.
(4) Cd, Cr, Cu, Ni, Pb and Zn are also greatly influence to human health as road dusts.
(5) Again, Hg, Pb, Zn and Mn and very rich is road dusts zones of urban soils.
(6) Sasedi *et al*. (2012) reported road dusts of South Tehran were rich in Us, Cr, Pb, Ni, Cd, Zn, Fe, Mn and Li.
(7) Dust from commercial and residential area accumulate more Cd while dust from industrials and residential areas accumulate more Pb.
(8) As there are seasonal changes in climate conditions like temperature, rainfall, humidity etc. as well as changes in types and human activities so there is the seasonal variations of PM and heavy metal concentrations.
(9) The most common metals in urban dusts include Hg, Cd, Cu, Cr, Ni, Mn, Fe, Pb, Sb and Zn.
(10) On the basis of urban conditions dust contaminations can be evaluated like as Mn>Cr>Cu>Pb>Ni>Cd.
(11) Total and available trace metals were detected from composite road dusts samples of six urban areas of Bangladesh. They are Cr, Mn, Co, Cu, Zn, As, Mo, Ag, Cd, Sn, Sb, Hg, Ti, Pb and Ni.

The trace metal concentrations varied widely within six urban areas. Usually, total Mn (281-530 $mgkg^{-1}$), Zn (199-365 $mgkg^{-1}$), Cr (51-74 $mgkg^{-1}$), Pb (57-212 $mgkg^{-1}$), Co (9-49 $mgkg^{-1}$), and Cu (20-77 $mgkg^{-1}$) were higher in most dust materials. On the basis of concentrations the total trace metals can be placed in the following order:

Mn<Zn<Pb<Cr<Cu<Co<As<Hg<Mo<Sn<Sb<Ti<Ag<Cd. A relatively low trace metal contents were detected from most samples. The different total and available trace metals showed positive or negative correlations. The average results or total and available trace metals were applied to the linear regression equation where they are well fitted to the regression line (r=0.8948) (Sattar, 2000).

(12) 15 heavy metals were detected from road dusts of 4 metropolitan cities of Bangladesh where normal to toxic/hazardous levels were recorded (Table 2, Sattar *et al*. 2005).

12. Clay or dust particles, dust or clay colloids or nanoparticles

Clay or dust particles, dust or clay colloids or nanoparticles sizes cover below 0.002mm in diameter and clay/dust colloid sizes come below 0.0002 mm 0.02μ in diameter. According to the global issue dusts come as particulate matters (PM) where they counted as PM $_{10}$ to PM $_{2.5}$ i.e. sizes cover PM $_{10\text{-}2.5\mu}$ or 0.01 mm to 0.0025mm in diameter. Normally, when dusts pollution or contaminations in air are observed then it is measured or treated as particulate matters and mostly measured or recorded under satellite measurement covering PM $_{10}$ to PM $_{2.5}$ (larger to smaller grades of clays/dusts against areas of m^{-3} size. The moving clays/dust particles or particulate matters never be counted or treated as pure clays, pure dust particles or very minute sizes of pure particulate matters. Such satellite workers never think the real contaminated matters of dusts of particulate matters.

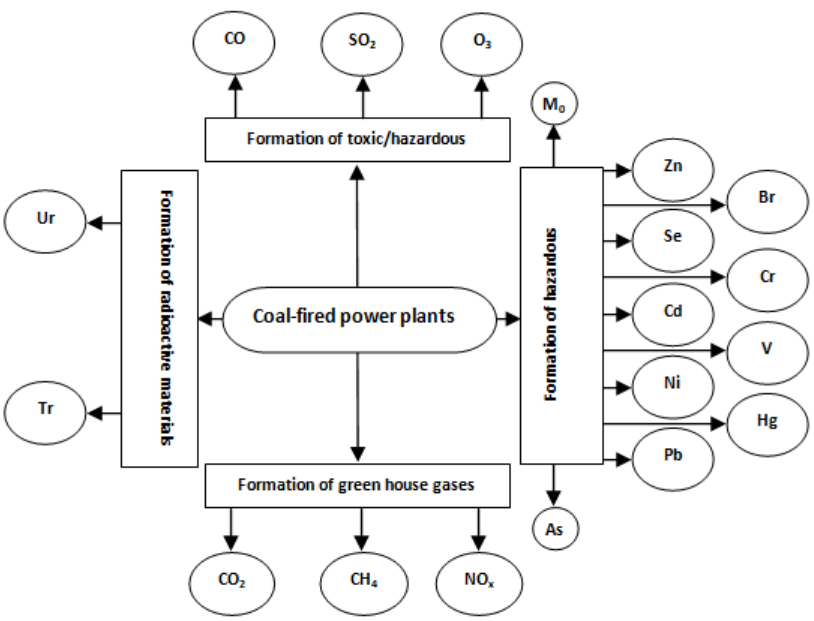


Fig. 7. Formation of various gases (hazardous and green house) and toxic/harmful heavy metals to air from coal-fired power plants (Sattar 2010).

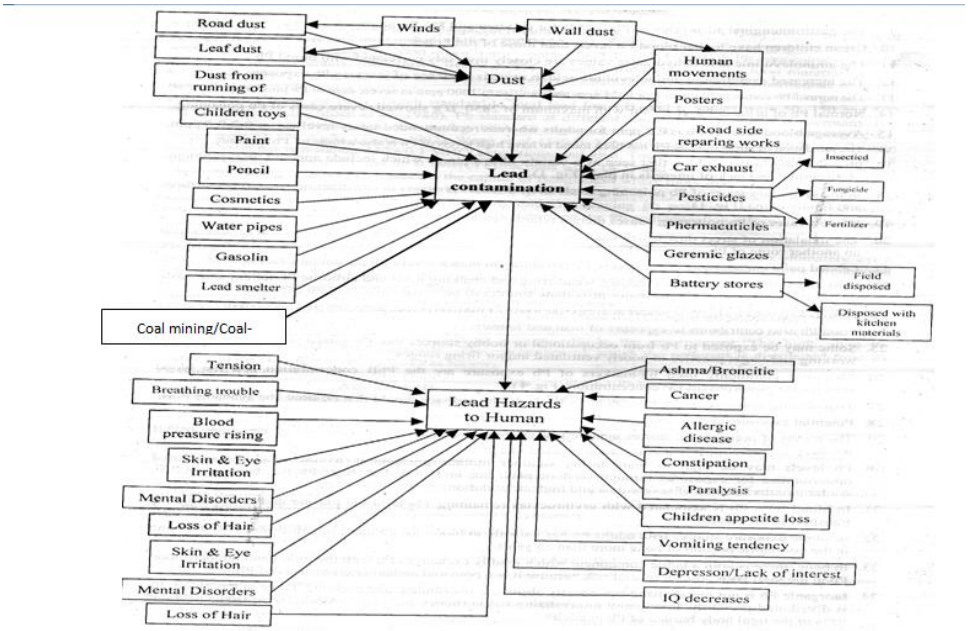


Fig. 8. A schematic outline of the lead contamination, exposures and health hazards (Sattar and Sattar, 2004)

Table 2. Heavy metal contaminations at 4 metropolitan cities of Bangladesh (Sattar *et al.* 2005)

Sl. No.	Name of heavy metals	4 Metropolitan cities							
		Dhaka (42 locations)		Chittagong (17 locations)		Rajshahi (15 locations)		Khulna (15 locations)	
		Ranges (ppm)		Ranges (ppm)		Ranges (ppm)		Ranges (ppm)	
1.	Pb	8	105	7	109	8	175	16	131
2.	Al	366	4393	1335	4279	1703	3040	1603	3356
3.	Ti	12	880	83	1195	333	1178	126	1147
4.	Cr	16	40	7	44	12	75	4	34
5.	Mn	100	498	136	959	164	783	81	1020
6.	Fe	1196	27666	2313	29866	9556	57099	1966	26566
7.	Co	4	13	2	13	3	12	4	12
8.	Ni	15	50	9	42	9	68	1	40
9.	Cu	15	101	5	92	13	213	3	228
10.	Zn	54	476	13	497	44	287	19	304
11.	Cd	2	30	0.33	3	1	6	1	3
12.	Sn	1	12	0.56	29	1	10	1	23
13.	Sb	1	6	1	7	2	5	1	162
14.	Ba	36	137	4	213	12	100	29	130
15.	Hg	2	10	0.34	7	1	8	2	9

Practically, clays/clay colloids/dusts/dust colloids/particulate matters (sizes >0.0002mm in diamter) of various sizes and sources (Fig. 7-8) move as air dusts in air where they carry pollutants/contaminants like CO_2, CO, SO_2, SO_x, N_2O, NOx (Fig. 3, Table 2), various heavy metals where 15-20-heavy metals like Pb, Al, Ti, Cr, Mn, Fe, Co, Ni, Cu, Zn, Cd, Sn, Sb, Ba, Hg, As, Mo, Sn and Zn were recorded from soils or

dusts of various locations at Dhaka, Chittagong, Khulna and Rajshahi metropolitan city (Table 2) although 5-7 heavy metals normally move in air as PM and actively participate in health hazards even cancer to death. As, Pb, Cr, Hg, Ni etc. actively move in air as dust colloids/particulate matters associated with lot of diseases of human body even cancer. Normally, various heavy metals enter the human body through foods, vegetables, air, dust, dust colloids as PM, water etc. and work as slow poison and gradually encourages diseases. Here foods and vegetables, even rice etc. contain heavy metals below the standard, and no problems of health hazards except exceptional circumstances like severe uses of heavy metal bearing fertilizers or pesticides to crops, so routine analysis is important but for questions 3-lab. analyses are required (Sattar, 2005; Sattar and Islam, 2011). Even coal fired power plants contaminate air through dusts or particulate matters where they add CO_2, CO, SO_2, O_3, CH_4, NO_x and heavy metals like Ur, Tr, As, Mo, Zn, Se, Cd, Ni, Pb, Br, Cr, V and Hg (Fig. 7), and again most of them are closely related and causes minor to major health hazards. Usually, they work as slow poison to the human body and similarly, associated with minor to major diseases like ashma, allergic, vomitting, eye and skin diseases, loss of hair, mental diseases, cancer, paralysis, breathing troubles, blood pressure etc. (Fig. 8).

13. Contaminations covering on sizes of dust particles

1) Size fractions of particle size are important determinants for both toxicity and risk of dust particles. There are highest concentrations of heavy metals in small particles than those of the larger fractions like Cr, Pb and Zn accumulate in the <50µm particles.
2) Usually Cd, Cr, Cu, Ni, Mn and Pb concentrations can be observed from fine soil particles.
3) Smaller particles penetrate deeper into the lungs than larger particles.
4) Course particle (>2.5µm) mainly deposited in the trachebronclial region while particles (<2.5µm) are mainly deposited in the pulmonary region.
5) MPPD (Multipathway Particle Desimetry Model) showed non-carcinogenic risk of less of 1 from pulmonary deposition fractions ranging 12.4-15.1% and 6.66-12.3% for fine and course dust particles respectively for 17 heavy metals.
6) MPPD model should that 40.2% particles are inhaled and deposited in human respiratory tract with 12.3% reaching in the deepest zones.
7) MPPD, ICRP (International Commission on Radiological Protection) and NCRP (National Council on Radiction Protection and Measurement) models provide more accurate hung-dose estimations by incorporating specific physico-chemical and biokinetic parameters that affect the dose of inhaled particles.
8) No-cancer risk of dust particles based on heavy metals doses calculated on the USEAA methods for risk assessment through applying of some complex equations.
9) Non-significant and non-cancer risk of dusts were reported from Mongolia, China, Iran showing highest carcinogenic risk for children than those of adults mostly from China and Iran.
10) The indoor and outdoor dust contaminations are vasied on the basis of sources, that contributed to these types of dusts like street dusts, road dusts, household dusts.
11) The distance from the source is an important factor that determines the level of risk i.e. the level of risk in relation to distance from one source can be estimated by using an exponential equation of the distance from the source.

14. Conclusions

Dust known as clays, clay colloids, dust colloids, dusts or nanoparticles contaminate human health through hundreds of outdoor, indoor and poster dust sources or as particulate matters ($PM_{2.5}$, PM_{10}) and work as slow poison producing of 5-10 or more diseases and even chronic diseases or cancer to death. They are 1. Loss of weight, loss of appetite, 2. Vomiting, vomiting tendency, 3. Headache, drowsiness, 4. Skin damages, 5. Lung cancer, 6. Dysfunction of respiratory system, 7. Poor growth or loss of hair, nail, 8.

Mental disorders, 9. Causing paralysis, 10. Pigmentation or fingers, nail, hands, foots, legs, 11. Causes diabetes, 12. Arises blindness, hormonal disorders, 13. Loss of vision, brain diseases, 14. Growth of tumers, 15. Actions of central nervous system, brain, bones, salivary glands, 16. Renal diseases, kidney stones, blood pressure and 17. Severe cases may cause even to death. Dusts are universal enemies to human health that never be ignored. So, on the basis of land, area, industry, brick field, nature-plans and management must be properly developed through minimizing outdoor, indoor and poster dust production sources. Regular proper cleaning should be done at the housing environment against indoor dust pollution and contamination. Remember dusts are the storehouse of pollution, contamination and direct and/or indirect enemies to man and life-time awareness in every step is essential for long life and safe life where 38 major/awareness were reported against outdoor dust contaminations (Sattar, 2022).

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