

**IJCRR**

Vol 05 issue 18

Section: Healthcare

Category: Research

Received on: 12/08/13

Revised on: 02/09/13

Accepted on: 20/09/13

CEMENT FACTORIES AND HUMAN HEALTH

Syed Sana Mehraj¹, G.A. Bhat¹, Henah Mehraj Balkhi²¹Center of Research for Development and Post Graduate Department of Environmental Science, University of Kashmir, J & K, India²Department of Bio- Technology, University of Kashmir, J & K, India

E-mail of Corresponding Author: balkhisana@gmail.com

ABSTRACT

Cement is currently the most widely used construction material throughout the world. Its production is being recognized to play a hazardous role in the imbalances of the environment and producing air pollutants in the form of various oxides, particulate matter as well as heavy metals which pose a serious threat to living world including humans, plants, animals, livestock etc. Keeping in view the hazards of cement dust it is recommendable that the cement industry management, their workers and health officials should work together to adopt scientific and technical preventive measures. The stack height must be appropriate and air pollution control devices should be installed and regularly checked so that people residing around these industries may not loss their life to fatal diseases.

Keywords: Cement; hazardous; workers; industries; diseases.

INTRODUCTION

Studies on the impact of cement industries dates back to decades but the greatest bulk of research has been conducted within the past few years, not more than twenty years, when health specialists and environmentalists understood its adverse impacts on health and environment. These industries affect air quality, soil, flora and fauna of the region. Several studies have shown that the levels of SPM, NO_x and SO_x are resulting in higher incidences of respiratory diseases like tuberculosis, cardio-vascular diseases and asthma in the areas (Hart, R.H, 1970; Vestbo *et al.* 1990; Dockery *et al.* 1993; Schwartz, J., 2002). As a whole study of impact of cement dust pollution on human health is a relatively interesting field of study that has advanced rapidly during the past few years. There is extensive, diffused and scattered information on the subject in the literature. Due to essential changes caused by the atmospheric pollution are not only restricted to the one component, but also extend to the detrimental

effects on human health, vegetation, biodiversity, ecosystem dynamics and human welfare.

The physical properties including particle size and density, shape and penetrability, surface area of cement dust are more important than chemical properties influencing the respiratory tract's response to the inhaled agent (Morgan, 1984; Sheppard, 1990). People mostly in age group of 65 and older in developed countries and in developing countries 15-44 age group are more prone (Cropper *et al.*, 1860) and above this more effects are seen in children, (Hofmiester *et al.*, 1986) as main route of entry of cement dust particles in the body is respiratory tract or the gastrointestinal tract, (Green *et al.*, 1970) so firstly organs associated with these gets affected (Hart, R.H., 1970) with more hospital visits (Vestbo, *et al.*, 1990). The cancer risk due to cement exhibition showed a positive correlation to the duration of exposition (Maier *et al.*, 1991; Maier *et al.*, 1992) with increased risk of laryngeal cancer and predominantly related to

supra glottis cancer, chest pain, cough, and eye problems, (Yhdego, 1992; Yang *et al.*, 1993; Yang *et al.*, 1996).

Cement particles are respirable in size hence Portland cement is important as a potential cause of occupational lung disease. The population living around the cement plant exhibited increased urinary concentration of thallium level in the residents and also exhibited increased hair thallium levels with congenital abnormalities were cleft lip and palate, facial hemangioma, icterus neonatorum, swelling on the back of hands and feet, inguinal hernia, umbilical hernia, lumbar meningomyelocele and ventricular septal defect (Brockhaus *et al.*, 1981; Dolgner *et al.*, 1983) with an increased risk of liver abnormalities, pulmonary disorders, and carcinogenesis were found. Decreased antioxidant capacity and increased plasma lipid peroxidation have also been posed as possible causal mechanisms of disease with cardiovascular, cerebro-vascular mortality (Aydin *et al.*, 2010; Grau, 2009; Peters *et al.*, 2009) and skin irritation, the mucous membrane of the eyes and the respiratory system (Zelege *et al.*, 2010; Zyede *et al.*, 2010).

Besides local residents surrounding cement industries impacts on cement mill workers appeared to be less prominent initially and became more prominent at later stages, causing varied complications with diffused swelling and proliferation of sinusoidal (hepatic) lining cells, sarcoid type granulomas and perisinusoidal, nephron problems, oral mucosal inflammation, decreased oral health condition, more parodontal disease, pulmonary lesions, diminished lymphatic tissue, decreased DNA, RNA and total protein levels and also causes stomach ache due to presence of chromium in its hexa-valent form and causes laryngeal cancer (Kalacic *et al.*, 1973; Pimental and Menezes, 1978; Schaller 1980; Petersen and Henmar, 1988; Struzak and Bozyk, 1989; Bozyk and Owczarek, 1990; Amandus, 1986; Oleru, 1984; Olsen and Sabroe, 1984; Zhang, 1990; Tuominen, 1991; Vestbo *et al.*,

1991; Dvorianinovich *et al.*, 1993; Jakobsson *et al.*, 1993; Abou-Taleb *et al.*, 1995; Abrons *et al.*, 1995; Shortet *et al.*, 1996; Yang *et al.*, 1996). Workers which spend more time in cement factories show prominent ill impacts (Alakija *et al.*, 1990; Abuhaise *et al.*, 1997) with high prevalence of asthma in the group with the highest dust exposure. Significant increase in total protein and calcium levels with higher prevalence of respiratory symptoms among cement workers suggested that workers in the construction industry carry an increased risk for head and neck cancer (Fatima *et al.*, 1997; Mengesha *et al.*, 1998; Alvear-Galindo *et al.*, 1999; Maier *et al.*, 1999). Workers at a Portland cement plant had experienced acute eye irritations and higher prevalence of respiratory symptoms and a reduction of FVC, FEV1 and FEV1/FVC ratio among the cement workers with increased daily mortality (Sanderson *et al.*, 1999; Noor *et al.*, 2000; Samet *et al.*, 2000).

Besides respiratory symptoms, rhinitis, conjunctivitis, cardio-pulmonary and dermatitis among the workers it was seen decrease in the mean erythrocytes, lymphocyte and monocyte count. In addition a slight decrease in hemoglobin level and chromosomal aberrations and cancer was also found with pulmonary radiographic abnormalities such as interstitial lung disease, pleural thickening and chronic bronchitis (Mishra, 1991; Dockery *et al.*, 1993; Piotrowski, 1993; Krewski *et al.*, 2000; Al-Neaimi *et al.*, 2001; Fatima *et al.*, 2001; Laraqui *et al.*, 2001; Meo *et al.*, 2002; Calistus Jude *et al.*, 2002; Laraqui Hossini *et al.*, 2002; Schwartz. J., 2002; Meo, 2003; Dietz *et al.*, 2004; Mwaiselage *et al.*, 2004; Schuhmacher *et al.*, 2004; Smailyte *et al.*, 2004; Mwaiselage *et al.*, 2006; Pope and Dockey, 2006). Fugitive dust emissions from cement plants affect health and property of house owners living adjacent to the plant and found that the people of this area are badly affected by respiratory problems, gastrointestinal diseases etc with adverse impact for vegetation, human and

animal health and ecosystems with greater risks in winter months (Anglauf *et al.*, 1986; Quiros, 2005; Sabah .A. Abdul Ahab, 2006; Adak *et al.*, 2007; Baby *et al.*, 2008).

DISCUSSION

The aerodynamic diameter of cement particles makes it a potential health hazard as these are respirable in size and reaches in internal organs particularly lungs leading to occupational lung diseases. This size distribution would make the trachea-bronchial respiratory zone, the primary target of cement deposition. The main route of entry of cement dust particles in the body is the respiratory tract and/ or the gastrointestinal tract by inhalation or swallowing respectively (Green, 1970). Both routes, especially the respiratory tract are exposed numerous to potentially harmful substances in the cement mill environment. Besides cement dust various gaseous pollutants are also contributed by cement factories which cause pollution and ultimately affect human health. The various organ systems which get affected because of cement factories include:

Respiratory system: In respiratory system these causes lungs cough and phlegm production, chest tightness, impairment of lung function, obstructive and restrictive lung diseases, Pleural thickening, fibrosis, emphysema, lung nodulation, pneumoconiosis and carcinoma of lung

Gastro intestinal system: Oral cavity, mechanical trauma, mucosal inflammation, loss of tooth surface, periodontal diseases, dental caries, dental abrasion, liver diffuse, swelling and proliferation of sinusoidal (hepatic) lining cells, sarcoid type granulomas, perisinusoidal and portal fibrosis and hepatic lesions is caused in the gastro intestinal system.

Stomach: In stomach it causes stomach ache and cancer.

Central nervous system (brain): Usually causes headache and fatigue.

Lymphatic system: Spleen diminished lymphatic tissue and splenic lesions.

Other affects includes affect in eyes, skin and bones. Irritation in eyes, running eyes and conjunctivitis, skin irritation, itching, skin boil and burn, osteonecrosis, lesion of humerus, thinning of the cortex and reduction of epiphyseal cartilage.

Cement dust is a potential pollutant in the vicinities of cement producing factories creating serious pollution related diseases.

CONCLUSION

From the study it can be concluded that cement dust consists of many toxic constituents. The residents as well as workers who are employed in the cement industries are exposed to cement dust for long periods, thus from the literature it can be concluded that there is significant increase in the various diseases particularly respiratory problems both in workers as well as in the residents and need is to take proper preventive measures so that development may not be at the cost of human lives.

REFERENCES

1. Adak, M. D., Adak, S. and Purohit K.M. (2007) Ambient air quality and health hazards near min-cement plants. *Pollution Research* 26(3): 361- 364.
2. Abou-Taleb, A.N., Musaiger, A.O. and Abdelmoneim, R.B. (1995) Health status of cement workers in the United Arab Emirates. *J. R. Soc. Health*, (115): 378-81.
3. Abrons, H.L., Petersen, M.R., Sanderson, W.T., Engelberg, A.L and Harber, P. (1997) Chest radiography in Portland cement workers. *J. Occup. Environ. Med*, (39):1047-54
4. Abuhaise, B.A., Rabi, A.Z., al- Zwayry, M.A., El -Hader, A.F., El- Qaderi, S. (1997) pulmonary manifestations in cement workers in Jordan. *Int. J. Occup. Med. Environ. Health*. (10): 417-28.
5. Alvear_Galindo,M.G.,Mendez,R,I,Villegas., Rodriguez,J.A.,Chapela.,Mendoza,R., Eslava-

- Campos, C.A., Laurell, A.C., (1999) Risk indicator of dust exposure and health effects in cement plant workers. *J. Occup. Environ. Med.*, (41): 654-61.
6. Alakija, W., Iyawe V. I., Jarikre, L. N. and Chiwuzie, J.C. (1990) Ventilatory function of workers at Okpela cement factory in Nigeria. *West. Afr. J. Med.* (9): 187-192.
 7. Al-Neaimi, Y. I., Gomes, J. and Lloyd, O. L. (2001) "Respiratory illnesses and ventilatory function among workers at a cement factory in a rapidly developing country." *Occupational Medicine*, 51(6): 367-373.
 8. Amandus, H. E. (1986) Mortality from stomach cancer in United States cement plant and quarry workers. *Br. J. Ind. Med.* (43): 526-8.
 9. Anglauf, K.G., Boltenheim, K.A., Brice and Wiebe, H.A. (1986) A comparison of summer and winter measurements of atmospheric nitrogen and sulphur compounds. *Water, Air and Soil Pollution*, (30): 163-160.
 10. Aydin, S., Aydin, S., Croteau, G., Sahin, I. and Cital, C. (2010) "Ghrelin, Nitrite and Paraoxonase/Arylesterase Concentrations in Cement Plant Workers." *Journal of Medical Biochemistry* 29(2): 78 -83.
 11. Baby, S., Singh, N. A., Shrivastava, P., Nath, S. R., Kumar, S. S., Singh, D. and Vivek, K. (2008) "Impact of dust emission on plant vegetation of vicinity of cement plant." *Environmental Engineering and Management Journal* 7(1): 31-35.
 12. Bozyk, A., Owczarek, B. (1990) Incidence of parodontal diseases in workers of the Chelm Cement Plant exposed to cement dust. *Czas Stomatol* (43): 375-80.
 13. Brochhaus, A., Dolgner, R., Ewers, U., Kramer, U., Soddemann, H. and Wiegand, H. (1981) Intake and health effects of thallium among a population living in the vicinity of cement plant emitting thallium containing dust. *Int. Arch. Occup. Environ. Health* (48): 375-389.
 14. Calistus, J., Sasikala, A.L., Ashok, K., Sudha, S. and Raichel, J. (2002). Hematological and cytogenetic studies in workers occupationally exposed to cement dust. *International Journal of human genetics.* 2(2): 95-99.
 15. Cropper, M.L., Simon, N.B., Alberine, A. and Sharma, P.K. (1960). The health effects of air pollution in Delhi, India.
 16. Dietz, A., Ramroth, H., Urban, T., Ahrens, W. and Becher, H. (2004) "Exposure to cement dust, related occupational groups and laryngeal cancer risk: Results of a population based case-control study." *International Journal of Cancer* 108(6): 907-911.
 17. Dockery, D.W. and Pope, C.A. (1993) Acute respiratory effects of particulate air pollution. *Annual Review of Public Health* 1(5): 107 -132.
 18. Dockery, D.W., Schwartz, J. and Spengler, D. (1993) Air pollution and daily mortality: associations with particulates acid aerosols. *Environ. Res.*, (59): 362-373.
 19. Dockery, D.W., Pope, C.A., Xu, X., Spengler, J.D., Ware, J.H., Fay, M.E., Ferris, B.G. and Speizer, F.E. (1993) An Association Between Air Pollution and Mortality in Six U.S. Cities. *New England Journal of Medicine* (329): 1753-9.
 20. Dockery, D.W. and Pope, C.A. (1994) Acute respiratory effects of particulate air pollution. *Annual Review of Public Health* 1(5): 107 -132.
 21. Dolgner, R., Brockhaus, A., Ewers, U., Weigand, H., Majewski, F. and Soddemann, H. (1983) Repeated surveillance of exposure to thallium in a population living in the vicinity of a cement plant emitting dust containing thallium. *Int. Arch. Occup. Environ. Health*, (52): 79-94.
 22. Dvorianinovich, L.N., Lukashik, N.K. and Sachek, V.I. (1993) Effect of chrome compounds and other chemicals in the content of cement and clinker dust on

- metabolic parameters of lymphoid Organs in rats. *Med.Tr. Prom. Ekol.*(1):17-20.
23. Fatima, S. K., Ramana, C. V., Prabhavathi, P. A. and Reddy, P. P. (1997) "Blood serum protein and calcium levels in Portland cement factory workers." *Indian Journal of Environment and Toxicology* 7(2): 56-57.
 24. Fatima, S. K., Prabhavathi, P. A., Padmavathi, P. and Reddy, P. P. (2001) "Analysis of chromosomal aberrations in men occupationally exposed to cement dust." *Mutation Research/Genetic Toxicology and Environmental Mutagenesis* 490(2): 179-186.
 25. Grau, L.P. (2009) The urban health effects and impact of anthropogenic and natural air pollution.
 26. Green, G.M. (1970) The J. Burns Amberson lecture. In defense of lung. *Am. Rev. Rep. Dis.* 102: 691-703.
 27. Hart, R. H. (1970) The concept of APS: Air pollution syndromes. *Journal of South Carolina Medical Association* (66): 71-73.
 28. Hofmeister, B., Fischer, F.M., Nogueira, P., Romieu, I. (1986) Effects of air pollution on the health of children living in the city of Cubateo, Brazil.
 29. Jakobsson, K., Horstmann, V. and Welinder, H. (1993) Mortality and cancer morbidity among cement workers. *Br. J. Ind. Med.* (50): 264-272.
 30. Kalacic, I. (1973) Chronic non specific lung disease in cement workers. *Arch. Environ. Health* (26): 78-83.
 31. Krewski, D., Burnett, R.R., Goldberg, M.S., Hoover, K., Siemiatycki, J., Jerrett, M., Abrahamowicz, M., White, W.H. and Others (2000). Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Air Pollution and Mortality. Health Effects Institute.
 32. Krewski D, Burnett R, Jerrett M, Pope CA, Rainham D, Calle E, Thurston G., Thun M (2004) "Mortality and long-term exposure to ambient air pollution: ongoing analyses based on the American Cancer Society cohort". *J. Toxicol. Environ. Health A* (68): 13-14.
 33. Laraqui, H.C.H., Laraqui, H.O., Rahhali, A.E., Tripodi, D., Caubet, A., Belamalle, Verger, C., Hakam, K., Alaoui, Y.A. (2002) Respiratory symptoms and ventilatory disorders among a group of cement workers in Morocco. *French Rev. Mal. Respir.* 19(1): 183-9.
 34. Laraqui, C.H., Laraqui, O., Rahhali, A., Harourate, K., Tripodi, D., Mounassif, M. and Yazidi, A.A. (2001) Prevalence of respiratory problems in workers at two manufacturing centers of ready-made concrete in Morocco. *French Int. J. Tuberc. Lung. Dis.*, (5): 1051-1058.
 35. Maier, H. Gewelke, U. Dietz, A. Thamm, H. Heller, W.D., Weidauer, H. (1992). Laryngeal cancer and occupation: results of the Heidelberg laryngeal cancer study. *H N O.* (40): 44-51.
 36. Maier, H., Tisch, M., Dietz, A. and Conradt, C. (1999) Construction workers as an extreme risk group for head and neck cancer (47): 730-6.
 37. Meo, S.A., Azeem, M.A., Ghori, M.G. and Subhan, M.M.F. (2002) Lung function and Surface electromyography of intercostals muscles in cement mill workers. *Int. J. Occup. Med and Environ. Health* (15): 279-287.
 38. Mishra, G. P. (1991) "Impact of industrial pollution from a cement factory on water quality parameters at Kymore." *Environment & Ecology* 9(4): 876-880.
 39. Morgan, W.K.C. (1984) The deposition and clearance of dust from the lungs their role in the etiology of occupational lung disease. In: Morgan WKC and Seaton AWB. *Occupational lung diseases.* Philadelphia, Saunders, 78.
 40. Mwaislodge, J., Moem, B. and Bravert, M. (2005) Acute respiratory health effects among cement factory workers in Tanzania.

- International Achieves of occupational and environmental health (19):49-56.
41. Meo, S.A. (2003) Chest radiological findings in Pakistani cement mill workers. *Saudi.Med. J.* (24): 287-290.
 42. Mengesha, Y.A. and Bekele, A. (1998).Relative chronic effects of different occupational dusts on respiratory indices and health of workers in three Ethiopianfactories.*Am J. Ind. Med.*, (34), 373-80.
 43. Mwaiselage, J., Bråtveit, M., Moen, B. and Mashalla, Y. (2004). Cement dust exposure and ventilatory function impairment: an exposure-response study. *J. Occup. Environ. Med.*, (46): 658-67.
 44. Noor, H., Yap, C.L., Zolkepli, O. and Faridah, M. (2000).Effect exposure to dust on lung function of cement factory workers. *Med. J. Malaysia*, (55): 51-7.
 45. Oleru, U. G. (1984) Pulmonary function and symptoms of Nigerian workers exposed to cement dust. *Environ.Research* (33): 379 - 385.
 46. Oslen, J. and Sabroe, S. (1984).Occupational causes of laryngeal cancer. *J. Epidemiol. Community Health* (38): 117-21.
 47. Parada, R. Gonzalez, S. and Bergqvist, E. (1987) Industrial pollution with copper and other metals in a beef cattle ranch.*Veterinary andHumanToxicology* (29): 122-26.
 48. Park, J.E. and Park, K.(1985) Preventive and social medicine. BanarsidasBhanot (Publishers), Napier town, Jabalpur, India.
 49. Peters, S., Y. Thomassen, E. Fechter-Rink and H. Kromhout (2009) "Personal exposure to inhalable cement dust among construction workers." *Journal of Environmental Monitoring* 11(1): 174-180.
 50. Petersen, P.E. and Henmar, P. (1988) Oral conditions among workers in the Danish granite industry.*Scand. J. Work. Environ. Health* (5): 328-31.
 51. Piotrowski, W. (1993) Air pollution in Pelesdki National park caused by industrial emission according to the results of technical monitoring. *Sylwan*, 137(7): 61-65.
 52. Pimentel,J.C. and Menezes, A.P.(1978) Pulmonary and hepatic granulomatous disorders due to the inhalation of cement and mica dusts. *Thorax.* (33): 219-227.
 53. Pope,C.A. and Dockery, W.D. (2006) Health effects of fine particulate air pollution. *Air and waste manage assoc.* (56):709-742.
 54. Quiros, L. (2005) Assessment of cement dust concentrations and noise levels in a cement plant in Nicaragua.
 55. Sabah, A. Abdul-Wahab. (2006) Impact of fugitive dust emissions from cement plants on nearby communities. *Journal of Ecological Modeling*, (195):338-348.
 56. Samet, J.M., Dominici, F., Zeger, S.L., Schwartz, J. and Dockery, D. W. (2000) The National Morbidity, Mortality, and Air Pollution Study. Part I: Methods and Methodologic Issues. *Health Effects Institute Research Report* (94), Part I.
 57. Sanderson, W.T., Almaguer, D. and Kirk, L.H. (1999) Ozone- induced respiratory illness during the repair of a Portland cement kiln. *Scand. J. Work. Environ. Health*; (25): 227-232.
 58. Schwartz, J. (2002) Particulate air pollution and chronic respiratory diseases. *Environmental research*, (62): 7-13.
 59. Schuhmacher, M., Domingo, J. L. and Garreta, J. (2004) "Pollutants emitted by a cement plant: health risks for the population living in the neighborhood." *Environmental Research* (9) 52: 198-206.
 60. Short, S. and Petsonk, E. L. (1996) Non-fibrous inorganic dusts. In: Philip Harber, Marc B. Schenker and John R. Balmes. *Occupational and environmental respiratory disease*. London. Mosby: 356.
 61. Sheppard, D. Hughson, W.G. and Shellito, J.(1990) Occupational lung diseases. In:

- Joseph La Dou, Occupational Medicine, USA, Appleton and Lange: 221-236.
62. Short, S. and Petsonk, E. L. (1996) Non-fibrous inorganic dusts. In: Philip Harber, Marc B Schenker and John R Balmes. Occupational and environmental respiratory disease. London. Mosby: 356.
63. Smailyte, G., Kurtinatis, J. and Andersen, A. (2004) Mortality and cancer incidence among Lithuanian cement-production workers. *Occup. Environ. Med.*, (61): 529-3449.
64. Struzak, W.M. and Bozyk, A. (1989) Condition of the oral mucosa in cement plant workers. *Wiad Lek* (42): 641-4.
65. Tuominen, M. and Tuominen, R. (1991). Tooth surface loss and associated factors among factory workers in Finland and Tanzania. *Community Dent. Health* (2): 143-50.
66. Vestbo, J. and Rasmussen, F. V. (1990) "Long-term exposure to cement dust and later hospitalization due to respiratory disease. *International Archives of Occupational and Environmental Health* 62(3): 217-220.
67. Vestbo, J., Knudsen, K.M., Raffn, E., Korsgaard, B., Rasmussen, F.V. (1991) Exposure to cement dust at a Portland cement factory and the risk of cancer. *Br. J. Ind. Med.* (48): 803-7.
68. Yang, C.Y., Huang, C.C., Chiu, H.F., Chiu, J.F., Lan, S.J. and Ko, Y.C. (1996) Effects of Occupational dust exposure on the respiratory health of Portland cement workers. *J. Toxicol. Environ. Health* (49): 581-588.
69. Yhdego, M. (1992) "Epidemiology of industrial environmental health in Tanzania." *Environment International* 18(4): 381-387.
70. Yang, C.Y., Huang, C.C., Chiu, H.F., Chiu, J.F., Lan, S.J., Ko, Y.C. (1996) Effects of occupational dust exposure on the respiratory health of Portland cement workers. *J. Toxicol. Environ. Health*, (49): 581-88.
71. Zeleke, Z., Moen, B. and Bratveit, M. (2010) "Cement dust exposure and acute lung function: A cross shift study." *BMC Pulmonary Medicine* 10(1): 19.
72. Zeyde, K., Zeleke, E.M., Bente, And Magni, B. (2010) Cement dust exposure and acute lung function. Across shift study, *BMC, Pulmonary Medicine* (10): 19.
73. Zhang, X.Q. (1990). A pathological study of finished- cement pneumoconiosis: report of 3 autopsy cases. Article in Chinese. *Zhonghua Bing Li Xue Za Zhi* (19): 6.s