# Heavy Metals Contamination of Ground Water in and Around Gadchandur Area in Chandrapur District, Maharashtra

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## Abstract

*This paper in intending to be a study concerning water pollution with heavy metals in and around Gadchandur area where four cement factories are established. A total of 15 ground water samples were collected from in and around Gadchandur area. The concentration of heavy metals such as Cadmium, Mercury, Lead, Nickel and Chromium were determined using atomic absorption spectrophotometer and the results were compared with the World Health Organization (WHO 2003) standard values. This study revealed the presence of some heavy metals in most of the ground water samples and hence refers heavy metal contamination of water sources. This study suggests the preventive measures which are to be adopted to control the contamination of excess Cadmium, Lead and Nickel present in the water samples in and around Gadchandur. This study has concluded that the bore well water in and around Gadchandur area is not suiTable for drinking purpose due to its high concentration of some heavy metals than permissible limit set by WHO.*

**Key Words:** Gadchandur, heavy metals, ground water, Cadmium

## Introduction

Water is required by all living things for cell metabolism. Water is also a vital resource for agriculture, manufacturing, transportation and many other human activities. Despite its importance, water is the most poorly managed resource in the world. Groundwater is the water that percolates downward from the surface through the soil pores. Ground water is generally an excellent source of drinking, cleaning, bathing, irrigation and industrial purposes[1]. The heavy metals are present in both surface water and ground water. Heavy metals are important environmental pollutants and their toxicity is a problem of increasing significance for ecological, evolutionary and environmental reasons [2]. Heavy metals arise from unorganized industrial growth and are considered as major pollutants of natural water bodies. Anthropogenic activities like industrial production unsafe disposal of industrial wastes, agricultural wastes and domestic sewages release heavy metals into the environment. Once released in large amounts, they are soluble in water either as ions or as compound forms and thus contaminate water. Heavy metals are playing a vital role in the normal functioning of body. But their in excess than the permissible limit may harm to the vital function of the organs. The main source for the heavy metal entry in to the human body is through water resources. Hence the present study mainly aims to study the impact of cement industries in Gadchandur area on the heavy metal contamination of ground water sources.

## Materials and Methods

### Study Area

The present work is carried out in vicinity of Gadhchandur area in Chandrapur district in Maharashtra where Ultratech, Ambuja, Manikgarh and Murali cement factories are located in order to study the water quality. Cement industries are among the most polluting industries and according to central pollution control board (CPCB) comes under red category [3]. Highly toxic and carcinogenic pollutants are emitted from cement kiln. Cement dust contains Ni, Co, Pb, Cr, Cd, Mn and Zn. Raw materials, fossil fuel and waste fuel cause emissions of heavy metals like Pb, Cd and Hg [4]. Heavy metals are important environmental pollutants and their toxicity is a problem of increasing significance for ecological, evolutionary and environmental reasons [5]. Heavy metals arise from unorganized industrial growth and are considered as major pollutants of natural water bodies. Hence the present investigation has been attempted to study the heavy metal contamination of ground water in and around Gadchandur.

### Collection of samples

The ground water samples of bore wells were collected from different locations to evaluate the heavy metals contamination. The sampling locations were selected on the basis of residential areas; details of sampling locations are illustrated Table1. Samples were collected in polyethylene bottles (2.5L) which had been thoroughly washed and filled with distilled water and then taken to the sampling site. The heavy metals such as Cd, Cr, Pb, Hg, Ni, Zn and Cu were determined using atomic Absorption spectrometer and the results were compared with WHO standard values (2003).

Table.1. Description of water sampling sites.

| Site Code | Source | Location |
|---|---|---|
| W1 | Borewell | Thutra |
| W2 | Borewell | Gopalpur |
| W3 | Borewell | Manoli |
| W4 | Borewell | Bailampur |
| W5 | Borewell | Gadhchandur |
| W6 | Borewell | Pimpalgaon |
| W7 | Borewell | Bibi |
| W8 | Borewell | Nanda |

| | | |
|---|---|---|
| W9 | Borewell | Awalpur |
| W10 | Borewell | Hirapur |
| W11 | Borewell | Nokari |
| W12 | Borewell | Palgaon |
| W13 | Borewell | Hardona |
| W14 | Borewell | Uparwahi |
| W15 | Borewell | Mangi |

## Results and Discussion:

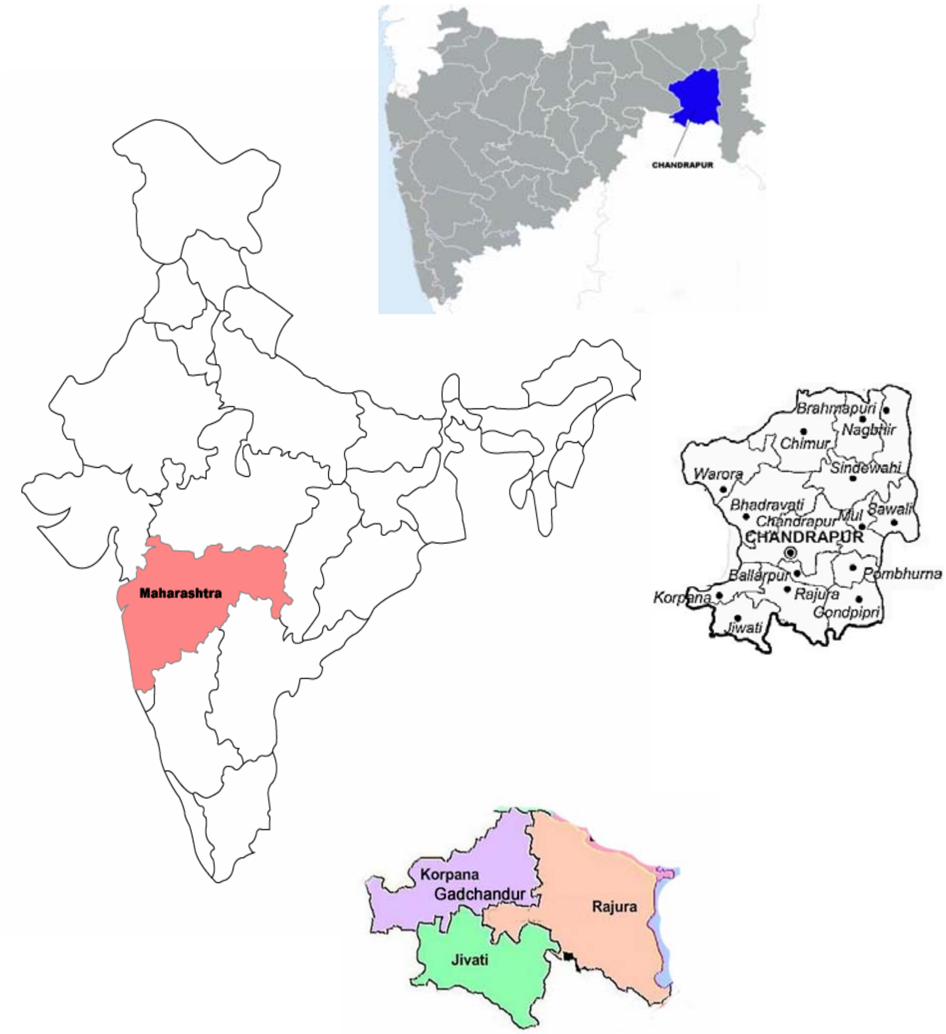
The findings of the present investigation are shown in Tables and figures below.

Table 2 Concentration of Heavy metals in Ground water of Gadchandur area

| Site code | Cadmium (ppm) | Chromium (ppm) | Lead (ppm) | Mercury (ppm) | Nickel (ppm) | Zinc (ppm) | Copper (p |
|---|---|---|---|---|---|---|---|
| W1 | 0.008 | 0.050 | 0.02 | 0.001 | 0.048 | -- | -- |
| W2 | 0.009 | 0.044 | 0.01 | 0.002 | 0.026 | -- | -- |
| W3 | 0.007 | 0.053 | 0.03 | 0.004 | 0.038 | -- | -- |
| W4 | 0.006 | 0.036 | 0.05 | 0.001 | 0.035 | -- | -- |
| W5 | 0.007 | 0.039 | 0.06 | 0.003 | 0.056 | -- | -- |
| W6 | 0.010 | 0.035 | 0.04 | 0.003 | 0.051 | -- | -- |
| W7 | 0.009 | 0.041 | 0.08 | 0.004 | 0.034 | -- | -- |
| W8 | 0.008 | 0.029 | 0.09 | 0.002 | 0.027 | -- | -- |
| W9 | 0.006 | 0.038 | 0.3 | 0.002 | 0.067 | -- | -- |
| W10 | 0.005 | 0.037 | 0.4 | BDL | BDL | -- | -- |
| W11 | 0.008 | 0.028 | BDL | BDL | 0.047 | -- | -- |
| W12 | 0.009 | 0.060 | 0.01 | 0.002 | 0.037 | -- | -- |
| W13 | 0.007 | 0.044 | 0.03 | 0.003 | 0.033 | -- | -- |
| W14 | 0.006 | 0.063 | 0.06 | 0.004 | 0.043 | -- | -- |
| W15 | BDL | 0.024 | 0.07 | 0.001 | 0.044 | -- | -- |
| WHO 1993 standards | 0.003 | 0.05 | 0.01 | 0.001 | 0.02 | 3 | 2 |

Note:- BDL – Below Detection Limit

**Fig. Map showing Location map of the Study area**



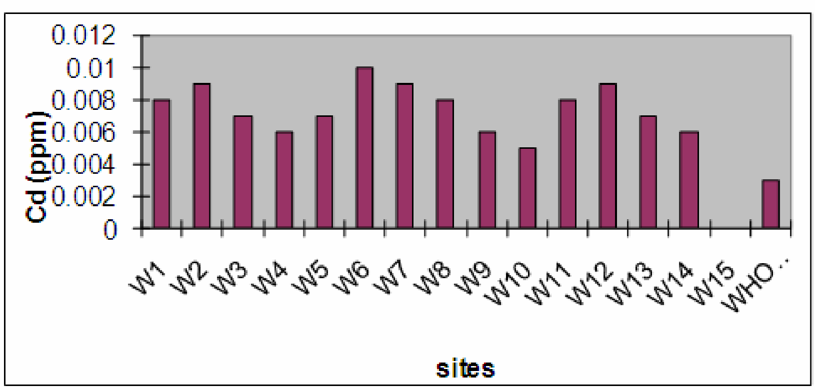




**Fig. 1 : Variation of Cadmium at different sites**

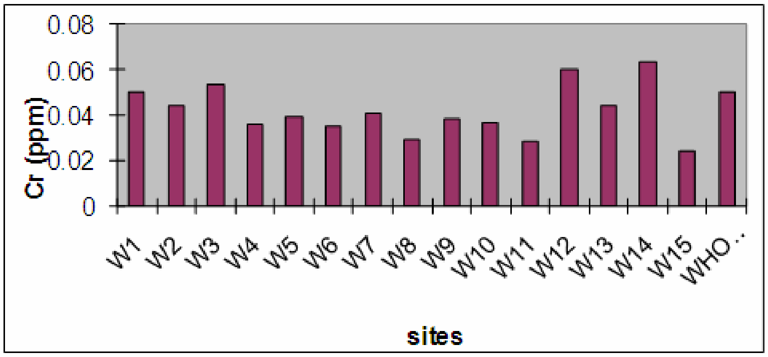



**Fig. 2 : Variation of Chromium at different sites**

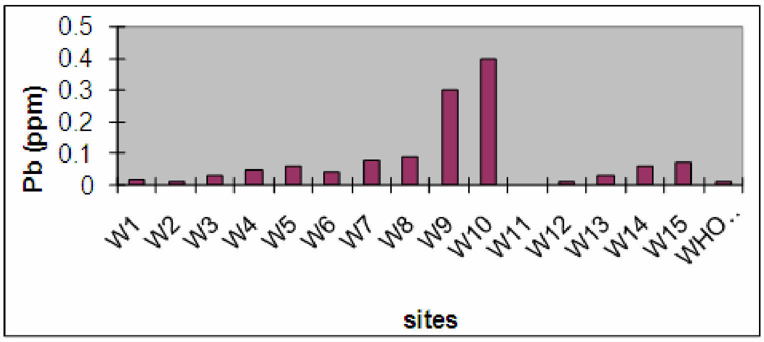



**Fig. 3 : Variation of Lead at different sites**

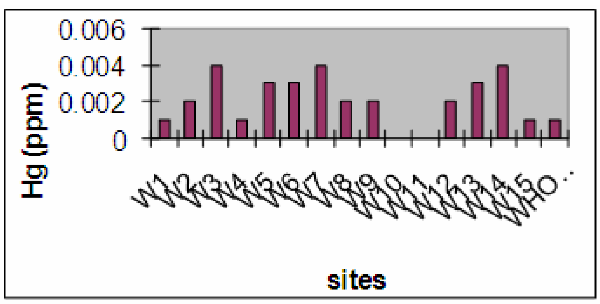



**Fig. 4 : Variation of Mercury at different sites**

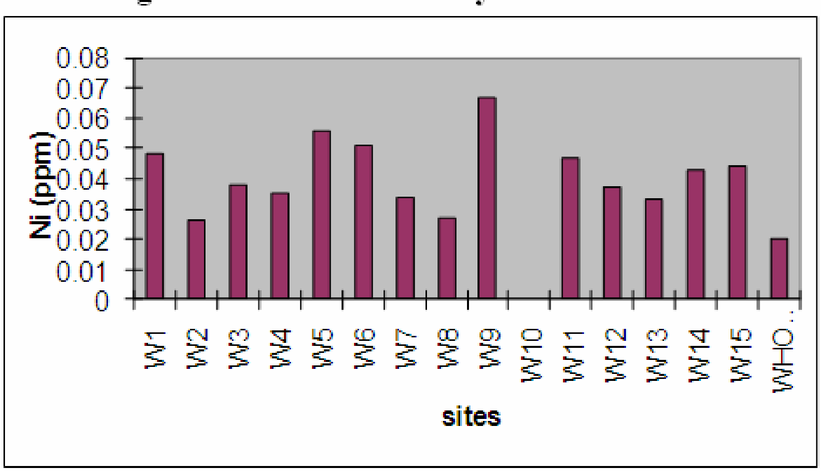



**Fig. 5 : Variation of Nickel at different sites**

**Cadmium**

Cadmium is a non essential metal that is toxic even when present in very low concentration. The toxic effect of cadmium is exacerbated by the fact that it has an extremely long biological half – life and is therefore retained for long periods of time in organisms after bioaccumulation. Cadmium is a respiratory poison and may contribute to high bloodpressure and heart diseases [6]. Cadmium has been found to be toxic to fish and other aquatic organisms. Its effect on man includes kidney damage and serves pain in bones. In our study, except W15, cadmium concentration is found to be higher than permissible limit of WHO (0.003ppm).

**Chromium**

It is an essential micronutrient for animals and plants. Chromium is considered as a relative biological and pollution significant element [7]. In the present investigation, the concentration of chromium ranges from 0.024 to 0.063ppm. In our study, except sample no. W3, W12 and W13, the chromium concentration is recorded well within the permissible limit set by WHO (0.05 ppm).

**Lead**

Lead occurs naturally in the environment. It is an undesirable trace metal less abundantly found in earths crust. Lead is also found in soil vegetation, animals and food. It is a serious cumulative body poison. Lead inhibits several key enzymes involved in the overall process of haemo-synthesis whereby metabolic intermediate accumulates. In the present investigation, the lead concentration ranges from0.01 to 0.4ppm. All the values of lead except W2 and W12 are showed higher than the permissible limit set by WHO (0.01ppm). The main sources of lead are

industrial activities, household sewage, battery and alloy [8]. Lead is highly toxic and is responsible for several cases of poisoning through food. Small quantities of lead cause adverse changes in the arteries of human kidney and cause high blood pressures, kidney damage etc [9]

**Mercury**

Mercury is considered to be the most toxic metal in the environment. Man released mercury into the environment by the actions of agricultural industry, by pharmaceutical, as pulp and paper preservatives, catalyst n organic synthesis, in thermometers and batteries, in caustic soda production. Exposure to high level of metallic, organic or inorganic mercury can permanently damage brain, kidneys and developing fetus. In organic form, it enters the human through fish. Fishes being one of main aquatic organism in food chain may often accumulate large amount of certain metals [10]. In this study, mercury content in some samples is found to be higher than permissible limit of WHO (0.001ppm). In sample nunber W10 and W11, it is below detection level.

### Nickel

Nickel occurs in natural water as a divalent cation with pH range between 5 – 9. Nickel is a natural element of earth's crust. Therefore small amounts of nickel are found in food, water and soil [11]. In the present study, except W10, nickel of all samples is found to be higher than the permissible limit set by WHO (0.02ppm). The high level of nickel may be due to mixing of variety of waste including automobile repairing shops, electroplating unit and sewage run off [12][13]. Excess of nickel in human body is toxic and causes hypertension and produces pathological changes in brain tissues [14].

## Conclusion

The heavy metal contents at different sampling sites show the variations. Heavy metals, if present beyond permissible limits in water are toxic to human beings, aquatic flora and fauna. In the present study, we found that Cd, Pb and Ni are present in relatively higher concentrations as compared to their permissible limits of WHO whereas Cr and Hg concentration is below the permissible limit prescribed by WHO. It is quite evident that these heavy metals may enter the food chain, and through bioaccumulation and bio-magnifications. Regular monitoring of the water quality is thus required to assess the heavy metal contents in water so that remedial measures can be adopted to save the ground water from heavy metal pollution.

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