Abstract—The Kowsar dam supply water for different usages such as drinking, industrial, agricultural and aquaculture farms usages and located next to the city of Dehdasht in Kohgiluye and Boyerahmad province in southern Iran. There are some towns and villages on the Kowsar dam watersheds, which Dehdasht and Choram are the most important and populated cities in this area. The study was undertaken to assess the status of water quality in the urban areas of the Kowsar dam. A total of 28 water samples were collected from 6 stations on surface water and 1 station from groundwater on the watershed of the Kowsar dam. All the samples were analyzed for Cd concentration using standard procedures. The results were compared with other national and international standards. Among the analyzed samples, as the maximum value of cadmium (1.131 μg/L) was observed on the station 2 at the winter 2009, all the samples analyzed were within the maximum admissible limits by the United States Environmental Protection Agency, EU, WHO, New Zealand, Australian, Iranian, and the Indian standards. In general results of the present study have shown that Cd mean values of stations No. 4, 1 and 2 with 0.5135, 0.4733 and 0.4573 μg/L respectively are higher than the other stations. Although Cd level of all samples and stations have had normal values but this is an indication of pollution potential and hazards because of human activity and waste water of towns in the areas, which can effect on human health implications in future. This research, therefore, recommends the government and other responsible authorities to take suitable improving measures in the Kowsar dam watershed’s.

Keywords—Kowsar dam, Drinking water quality, Cadmium, Maximum admissible limit, World health organization,
Cadmium concentrations in unpolluted natural waters are usually below 1 µg/litre [5]. Median concentrations of dissolved cadmium measured at 110 stations around the world were <1 µg/litre, the maximum value recorded being 100 µg/litre in the Rio Rimao in Peru [6]. Average levels in the Rhine and Danube in 1988 were 0.1 µg/litre (range 0.02–0.3 µg/litre) [7] and 0.025 µg/litre [8], respectively. In the sediments near Rotterdam harbour, levels in mud ranged from 1 to 10 mg/kg dry weight in 1985–1986, down from 5–19 mg/kg dry weight in 1981 [9]. Although earth's crust concentration of cadmium is 0.1 to 0.5 mg/kg, but accumulation in sedimentary rocks, marine phosphate and phosphorites may be much as high as 500 mg/kg [10]. Due to weathering and erosion of rocks, it is estimated that 15000 metric tonnes of cadmium is transported to oceans through rivers (WHO, 1992; OECD, 1994) [10]. Volcanic activity and forest fires are also major natural sources of cadmium release to the atmosphere.

**Anthropogenic Emissions**

Man-made emissions of cadmium either from the manufacture, use and disposal of cadmium containing products. The cadmium containing products included:

- Nickel- Cadmium Batteries
- Cadmium pigmented plastic, ceramics, glasses, paints and enamels
- Cadmium stabilized Polyvinyl chloride (PVC) products
- Cadmium coated ferrous and Non-ferrous products
- Cadmium alloys
- Cadmium electronic compounds
- Cement
- Phosphate fertilizers
- Phosphate fertilizers

Cadmium metal is used mainly as an anticorrosive, electroplated onto steel. Cadmium sulfide and selenide are commonly used as pigments in plastics. Cadmium compounds are used in electric batteries, electronic components and nuclear reactors [5,9].

**II. MATERIALS AND METHODS**

The main goal of this paper is to determine the levels/concentration of the Cd as a heavy metal in water in different parts of the Kowsar dams watershed to compare the values with the national and international organization (like WHO) recommended drinking water standards (Table.1). The dam will supply water to the Persian Gulf littoral cities and ports for nearly 20 years. It will offer water to 2.4 million habitants in south of Iran. Kowsar Dam will flow 70 million cubic meters of water to farmlands in Lishter, Boneh and Zeidoun deserts. The dam can hold 684 million cubic meters of water per annum. In order to evaluation of water quality of the Kowsar dam water sampling were done with seasonally duration on the Kowsar dam reservoir and its watersheds as have been shown in figure no.3.

A standard method was used for sampling. Water was collected in polyethylene bottles 0.5 m below the surface. All glass and plastic ware used for sampling and analyses were rinsed with milli-Q water.

Cadmium have been determined by atomic absorption spectroscopy using either direct aspiration into a flame or a furnace spectrometric technique. The detection limit is 5 µg/litre with the flame method and 0.1 µg/litre with the furnace procedure [11,12,13,14].
TABLE I

<table>
<thead>
<tr>
<th>Standards</th>
<th>Cd</th>
<th>µg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>USEPA 2008</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>EU,1998</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>WHO,2008</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Iranian,1997</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Australian,1996</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Indian,2005</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>New zealand,2008</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

The situation of stations No. 1, 2 and 4 in the watershed of the Kowsar dam were showed in figures 4 to 6.

III. RESULTS AND DISCUSSION

First statistical parameters of values such as mean, maximum, minimum, standard deviation, skewness, Kurtosis, were determined. The values of Cadmium concentration and their statistical parameters of the water samples are illustrated in Table II and III.

Based on measured value of all stations an seasons, maximum cadmium concentration (1.131 µg/L) was recorded in station 2 from a groundwater well near Dehdasht at winter 2009, and stations 1 and 5 have had minimum value (0 µg/L) at autumn 2010. Comparison of mean values were illustrated in figure 8. As this chart shows, mean values of Cadmium concentration during 4 seasons in station 4, 1 and 2 have had higher level related to other stations. Station 1 is located on the main waste water collecting canal of Dehdasht, and station 4 is located on the Komlishi stream at the downstream of Choram. Cadmium levels in station 4, 1 and 4 were increase because of rising in human activity near the mentioned station.

IV. CONCLUSION

The study was done to evaluate the status of Cadmium concentration in the upstream watershed of the Kowsar dam. A total of 28 water samples were collected from 6 stations on surface water and 1 station from groundwater on the watershed of the Kowsar dam.
The results were compared with other national and international standards. Among the analyzed samples, as the maximum value of cadmium (1.131 μg/L) was observed on the station 2 at the winter 2009, all the samples analyzed were within the maximum admissible limits by the United States Environmental Protection Agency 2008 (5 μg/L), the EU 1998 (5 μg/L), the WHO 2008 (3 μg/L), the New Zealand (4 μg/L), the Australian, 1996 (2 μg/L), the Iranian, 1996 (10 μg/L) and the Indian, 2005 (10 μg/L). In general, results of this present research have shown that Cd mean values of stations No. 4, 1 and 2 with 0.5135, 0.4733 and 0.4573 μg/L respectively are higher than the other stations. Although Cd level of all samples and stations have had normal values currently, but this is an indication of pollution potential and hazards because of human activity and waste water of towns in the areas, which can effect on human health implications in future. This research, therefore, recommends the government and other responsible authorities to take suitable improving measures in the Kowsar dam watershed’s.

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