

ALGERIA

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A. Regulation on sources

Source of lead	Relevant legislation/regulation	Government agencies	Data source
1. Lead in paint	1. As of 2019, total limit of lead content in paint: 5000 ppm lead limit for manufacture, import and sale of paint.	a. Government of Algeria	1. Update on the Global Status of Legal Limits on Lead in Paint , September 2019, UNEP
2. Lead in fuels	1. From 1 st of July 2021, unleaded fuel will become the only available gasoline on the Algerian market. All fuels with lead will be taken out.	1. Ministry of Energy and Mines	1. Sans-plomb sera la seule essence sur le marché , June 2021
	No other standards found at this time for lead.		

B. International Agreements

Agreement	Year Ratified
1. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	1998 (a) ¹
2. Rotterdam Convention on the Prior Informed Consent Procedure for certain hazardous Chemicals and Pesticides in international trade	2020
3. Minamata Convention on Mercury	-
4. Stockholm Convention on Persistent Organic Pollutants	2006

¹ Accession (a)

C. Blood lead-level monitoring programs

Details	Data source
1. No details of a national or regional level structured program for blood lead level testing found. However, published studies point to some presence of testing programs at the local level.	1. Refer to section E on scientific papers that perform blood lead-level sampling

D. Inventory of toxic sites (Toxic Sites Identification Program (TSIP), Pure Earth)

No sites yet identified at this time.

E. Scientific papers on lead exposure (Please contact info@gahp.net for information on studies not in the public domain)

Topic	Authors	Year	Title	Abstract/ description
Blood-lead levels	Demmouche, Abbassia; Moussaoui, Faiza	2020	Relation between low birth weight and Maternal blood lead levels in Sidi Bel Abbes, Algeria: a case-control study	<p>Background: Several epidemiological studies have investigated high lead (Pb) exposure and pregnancy outcomes, but few studies have investigated the association of low lead exposure and low birth weight (LBW). The aims of this study were to estimate the maternal blood lead levels (BLL), to identify determinants for BLL among parturient woman and to evaluate the association of maternal BLL and LBW.</p> <p>Methods: From July 2017 to February 2018, we carried out a case control study in the gynecology and obstetrics hospital of Sidi Bel Abbes, Algeria. Lead concentrations in maternal blood samples collected at delivery were measured in 29mother who delivered term LBW cases group and 29mother who give birth to a term normal weight baby matched control. Blood lead levels were analyzed by inductively coupled plasma mass spectrometry.</p>

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				<p>Results: Mean maternal BLL were higher among normal groups than in mothers of LBW, but this difference was not significant ($23,076 \pm 16,120$, versus $18,086 \pm 6,641$ ug/l $p=0.247$). Our results indicate that the mean lead level was not higher in LBW neonates, and the whole blood lead was not related to the birth weight. In addition, there was interaction of daily kohl use and maternal BLL.</p> <p>Conclusion: This study suggests that maternal BLL was not significantly associated with LBW. Mothers with daily use of kohl during pregnancy were more likely to have elevated blood lead concentrations.</p>
	Bouhadiba, Hadjer; Demmouche, Abbassia	2020	Relation between Concentrations of Lead, Cadmium and Mercury in Cord Blood and Prematurity in the Sidi Bel Abbes Region (West of Algeria)	<p>Background: Exposure to heavy metals such as lead, cadmium and mercury during pregnancy carries a great risk to the mother as well as the fetus.</p> <p>Methods: Lead, cadmium and mercury were measured in umbilical cord blood samples of 3 groups women (30 women's for lead, 30 cadmium and 10 from mercury) in maternity of Sidi Bel Abbes region in Algeria between 2016 and 2017. The objective of this study was to measure in the blood of the umbilical cord the concentration of lead (Pb), mercury (Hg) and cadmium (Cd), and to evaluate the relationship between these levels and prematurity. The lead, cadmium and mercury levels were measured by atomic absorption.</p> <p>Results: The study showed obvious variations in, maternal characteristics. The results revealed several factors predisposing to prematurity. The mean concentrations of cord blood lead, cadmium and mercury were; $18.97 \mu\text{g/L}$, $0.26 \mu\text{g/L}$, and 6.20 nmol/L, respectively. There was a highly significant direct correlation between cord lead concentrations and gestational age ($r=0.43$; $P = 0.017$), and we found that gestational age and birth weight inversely correlated with cord mercury concentration ($r=0.44$ and $r=0.57$ respectively). No correlation was observed between cord cadmium concentrations and gestational age.</p> <p>Conclusion: This study has shown that pregnant women in this region were exposed to high levels for heavy metals which need an intervention.</p>

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Lead concentrations	Sellami, Seifeddine; Zeghouan, Ouahida; Lassaad, Mechi; Moussaoui Younes; Kebabi, Brahim	2020	Determination of lead concentrations in the soils of Setif City, Eastern Algeria	Abstract: This study describes the determination of lead and pH in Setif soils. Soil samples from the town of Setif were taken from a total of 100 subsurface soils, systematically sampled (regular 1 × 1 km grid). The lead concentration was determined by atomic absorption and the average lead concentrations ranged from 24 to 384 mg kg ⁻¹ . The distribution of the different concentrations of lead and iso-concentration was distributed on the map of the exchange site with Arc GIS software. Compared with their local soil background values, higher concentrations of Pb were observed to different extents. The distribution of Pb concentrations has been explained by urban traffic.
	Ismahene, G; El-Hadi, K.M.	2012	Assessment of heavy metal concentrations (lead, cadmium and zinc) in three Crustacean species fished for in two regions of eastern Algeria	Abstract: This work aims to assess the state of marine ecosystem and the degree of contamination by heavy metals in two regions of eastern Algeria (Bejaia and Jijel). Compared to Jijel, Bejaia is an area with intense seaport activity. Concentration of three heavy metals (Lead (Pb), Cadmium (Cd) and zinc (Zn)) was determined by atomic absorption in three species of shrimps: <i>Aristeus antennatus</i> , <i>Parapenaeus longirostris</i> and <i>Palaemon serratus</i> (Crustacean, Decapoda), fished for in Bejaia and Jijel. Obtained results showed the presence in crustacean flesh of the three heavy metals with concentrations listed in the order Zn > Pb > Cd for all species studied. Although heavy metal concentrations evaluated in this study were less than of European norms (CE No 466/2001), the risk of bioaccumulation exists. Moreover, the highest concentration of metals was found in the species fished for in Bejaia coast probably because of the proximity of the port of Bejaia. Cd concentrations were significantly higher in flesh males than females in all crustacean examined while zinc concentrations were higher in the flesh of female crustaceans studied. These results showed not only the presence, in small quantities, of heavy metals in crustacean meat but also the risk that these metals accumulate in these foods really exists. To this end, coastal biomonitoring is recommended to avoid metal toxicity by consumers of these foods.

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Lead exposure	Allouche, Lynda; Hamadouche, Mohamed; Touabti, Abderrezek; Khennouf, Seddik	2011	Effect of Long-term Exposure to Low or Moderate Lead Concentrations on Growth, Lipid Profile and Liver Function in Albino Rats	Abstract: Effect of long-term exposure to low or moderate lead acetate (PbAc) on growth, serum lipid profile and some biochemical parameters was investigated. Male albino rats were divided into five groups and given 0, 0.025, 0.05, 0.1 and 0.3% PbAc in drinking water for 11 months. There was a significant decrease in bodyweight in rats given 0.1 % PbAc at the third month of lead treatment ($p < 0.01$) compared to the control group, while the body weight gain was significantly increased at the end of experiment in animals exposed to 0.05 %PbAc ($p < 0.05$). Serum concentrations of total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol and triglyceride remain unchanged in all lead exposed groups compared to the control group. Similarly, no significant alteration was observed in serum aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, lactate dehydrogenase activities and glycemia in all lead treated groups. In conclusion, the long-term exposure to low lead concentration may conduct to high weight gain and obesity risk. However, no evident for disturbance of serum lipid profile or biochemical liver parameters was observed after long-term lead exposure. Therefore, long term-exposure to low or moderate lead concentrations should not be incriminated to risk of atherosclerosis or impairment of liver function.
Lead in food	Cherfi, Abdelhamid; Abdoun, Samira; Gaci, Ouardia	2014	Food survey: Levels and potential health risks of chromium, lead, zinc and copper content in fruits and vegetables consumed in Algeria	Abstract: A food survey was carried out with the aim to investigate the levels of lead (Pb), zinc (Zn), copper (Cu) and chromium (Cr) in various fruits and vegetables sold in Algeria. Concentrations (mg/kg dry wt.) in selected foodstuffs were detected within the following ranges: 4–29.49, 11.17–49, 12.33–39.33 and 3–16.33 for Cu, Zn, Pb and Cr respectively. The food ingestion rate of the selected items was investigated by self-administered questionnaires which were filled by a total of 843 people randomly recruited at the exit of markets. The potential health risk for consumers was investigated by estimating the daily intake (EDI) and the target hazard quotient (THQ) for each heavy metal. For all foodstuffs, the EDI and the THQ were below the threshold values for Cu, Zn and Cr while they exceeded the thresholds for Pb (EDI: 15.66 $\mu\text{g Pb/kg body weight/day}$; THQ: 4.37), indicating an obvious health risk over a lifetime of exposure.

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	Badis, Benededdouche; Rachid, Zellagui; Benededdouche, Esma	2014	Levels of Selected Heavy Metals in Fresh Meat from Cattle, Sheep, Chicken and Camel Produced in Algeria	<p>Aims: Levels of selected heavy metals iron, copper, zinc, lead, cadmium and mercury were determined in fresh meat from cattle, sheep, chicken and camel produced in Algeria.</p> <p>Methodology: We are using atomic absorption spectrophotometry in some different samples of beef (n=120), sheep (n=120), chicken (n=120) and camel (n=120) of fresh meat collected in two areas north and south from Algeria.</p> <p>Results: The order of the levels of the trace elements obtained was iron >zinc >copper> lead >cadmium >mercury. The highest concentration of iron and lead were found in the chicken meat (246.83µg/g, 8.80µg/g respectively) while camel's meat maintained the lowest values of most studied metals except values of lead (3.21µg/g) and zinc (4.17µg/g) in southern area. Samples from the north area are more contaminated due to massive industrialization and agricultural practices.</p> <p>Conclusion: The concentrations of all essential elements in the selected products were high and often exceeded legal limits set by health authorities</p>
Lead in makeup	Aissa, Lakhdari; Keloufi, Benabdeli	2012	Determining the Heavy Metal Pollution in Mascara (Algeria) by Using Casuarina equisetifolia	<p>Abstract: In this study, Casuarina equisetifolia needles were evaluated as the possible bio monitors of heavy metal air pollution in Mascara (Algeria). The needles were sampled from seven locations with different degrees of metal pollution (near roads) and from a control site. The concentrations of lead, zinc, copper and nickel were measured by using a flame atomic absorption spectrophotometer. The maximal values of these four metals were found in the samples collected near the roads and the minimal values were found in the control site. Furthermore, sites with high traffic density and frequency of cars stoppage showed high heavy metal concentrations. However, the comparison of concentrations of all metals showed that the zinc one had the highest concentration of all. The cluster analysis divided the selected sampling sites in three distinct clusters. With regard to the results of this study, Casuarina equisetifolia can be successfully applied in biomonitoring of air pollution.</p>

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Lead in water	Balli, N; Leghouchi, E	2018	Assessment of lead and cadmium in groundwater sources used for drinking purposes in Jijel (Northeastern Algeria)	Abstract: Groundwater is one of the important sources of drinking water in Jijel (northeastern Algeria). Various analyses have shown critical concentrations of lead and cadmium in several groundwater sources used for drinking. The aim of this study is to evaluate the contamination by lead and cadmium of boreholes and hand-dug wells located in the catchment of the Nile River. Therefore, chemical analysis was performed on drinking water samples from eight boreholes; tow hand dug wells and one spring supplying Jijel city in drinking water. The water samples were examined for the presence of cadmium and lead using the SAA-6200 Atomic Absorption Spectrophotometer (Shimadzu Corporation). The results of this study show high concentrations of lead (ranged from 72.84±0.26 to 458.95±0.55 µg.L-1) and cadmium (ranged from 12.41±0.88 to 33±0.38 µg.L-1) in all water samples. These concentrations far exceeded permissible values according to the WHO's drinking water posing a potential health risk for the public. The water quality in the studied area of Nile River basin must be considered very low.
Lead pollution	Attoucheik, Lynda; Jordanova, Neli; Bayou, Boualem; Lagroix, France; Jordanova, Diana; Maouche, Said; Henry, Bernard; Boutaleb, Abdelhak	2017	Soil metal pollution from former Zn–Pb mining assessed by geochemical and magnetic investigations: case study of the BouCaid area (Tissemsilt, Algeria)	Abstract: Former zinc and lead mines that have been operating for half a century are located in the massif of BouCaid (Tissemsilt, Algeria). Hazardous heavy metals emitted from the mines are abundant in the surrounding soil and cause strong metal pollution in the region. This paper investigates the extent of lead and zinc mine activity derived pollution by characterizing both magnetic and geochemical properties of samples collected in the vicinity of the mines. The results of the magnetic study show the coexistence of magnetic minerals such as magnetite, hematite and goethite. Analyses on surface soils and weathered rocks suggest that hematite and goethite have ore-related lithogenic origins. Magnetic susceptibility shows a positive correlation with lead content when presenting low-to-medium concentrations ($100-500 \text{ mg/kg}$). At higher lead concentrations, there is no correlation with magnetic susceptibility. The relationship between magnetic susceptibility and zinc content is not straightforward. These observations are explained by the higher affinity of Pb to iron oxides at lower pollution levels and their preferential bonding to carbonates when Pb and Zn contents are extremely high, as demonstrated by Lavazzo et al. (J Geo-chem Explore 113:56–67,2012) in a study of former Zn–Pb mine in Morocco. Based on

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				the general features of the spatial maps of field-measured magnetic susceptibility, mass-specific magnetic susceptibility, Pb and Zn contents, it is concluded that field magnetic measurements provide a good qualitative proxy of pollution spread out of the mining galleries, while laboratory measurements afford a more detailed investigation of the links between iron oxides and the main heavy metals in the ore.
	Brahmia, Zahra; Scheifler, Renaud; Crini, Nadia; Maas, Samuel; Giraudoux, Patrick; Benyacoub, Slim	2013	Breeding performance of blue tits (<i>Cyanistes caeruleus</i> ultramarinus) in relation to lead pollution and nest failure rates in rural, intermediate, and urban sites in Algeria	Abstract: The breeding parameters and the egg and nestling morphology of <i>Cyanistes caeruleus</i> populations from rural, intermediate, and urban sites in Algeria and the relationships of those variables with lead contamination were studied during three consecutive years. Breeding success was explained only by predation and vandalism rates. Predation was higher in the rural area, whereas vandalism was higher in the urban site. The other measured breeding parameters and egg characteristics were relatively insensitive to study site. The morphology of urban nestlings exhibited a trend toward smaller body size and mass compared to individuals from intermediate and rural sites. Although lead concentrations were higher in the tissues of urban birds than in intermediate and rural individuals, we did not detect a clear influence of this variable on nestling morphology. We conclude that urbanization influenced blue tit breeding parameters through predation and vandalism and nestling morphology through mechanisms other than lead pollution.
	Krika, Abderrezak; Rached, Oualida; Du Laing, Gijs	2013	Assessment of atmospheric lead contamination of banks soils using soils tamarisk grove. Case study of the Kebir-Rhumel (Algeria)	Abstract: In order to know the role of the tamarisk grove in the soil contamination by lead (Pb) fallout, ten stations were randomly selected along the Kebir-Rhumel wadi which skirts a heavy traffic road. In each site, the sampling stations were chosen so as to contain a vegetation plot nearby a bare plot. All the stations were localized on the roadside. Two soil's samples were taken in the middle, the road and wadi side of each plot. Tamarisk leaves were the object of an average sampling. Pb concentration was measured, by (ICP-OES) in washed ($0.53\mu\text{g.g}^{-1}$) and unwashed leaves ($1.23\mu\text{g.g}^{-1}$), and in total extracts of soils ($18.0\mu\text{g.g}^{-1}$), which were also the object of organic matter (OM), pH, electrical conductivity (EC), total CaCO_3 , cation exchange capacity (CEC) and particle sizes analysis. Significant differences were noted between washed and unwashed Pb

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				leaves contents, suggesting an atmospheric contamination source, apparently from the road traffic. Pearson correlation coefficients indicate that total Pb soil contents were significantly and positively related to OM (3.30%) and clay (10.20%) in vegetation plots, and to pH(7.82), CEC(17.60cmol+.kg-1) and silt(30.90%) in the bare plots. Analysis of variance (ANOVA) and Scheffe's test reveals Pb, OM and clay contents in vegetation plots (especially in the middle of tamarisk grove) are significantly greater than in bare plots. The results show that the tamarisk grove, through the generated OM rates and the clay catching, would allow the retention of Pb in the soils, thus its mobility will decrease towards the stream water.
	Maizi, Naila; Alioua, Amel; Tahar, Ali; Semadi, Faten; Fadel, Djamel	2010	The use of inferior plants as bioindicators of automobile lead pollution in the area of Annaba (Algeria)	Abstract: Lead pollution in particular has constantly evolved over time, due to the increase in the number of vehicles on the market. Our research is based primarily on the use of a lichen species " Ramalina farinacea " as indicator of organic pollution in the region of Annaba. An appropriate sampling strategy, a spatio-temporal monitoring and measuring certain physiological parameters combined determination of lead allowed us to evaluate not only the state of air quality but also the impact of this pollution on the environment caused by heavy traffic in this area. Statistical analysis of the results brings up correlations ranging from significant to very highly significant between the parameters measured and the levels of lead in the bio-indicator in time and space.

F. Blood testing in National Health Surveys

National Health Survey	Non-Communicable Diseases Risk-Factors Surveillance	Source
Purpose	STEPS is a household-based survey to obtain core data on the established risk factors that determine the major burden of NCDs.	Algeria STEPS Noncommunicable Disease Risk Factors Survey 2016-2017 STEPS 2016, Algeria
Sample size	Adults aged 18-69 years.	

Blood sample testing	Fasting blood glucose tests.	
Latest round	2017	
Next round	-	