

CUBA

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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: 20.000 ppm for paint; exceptions include paint for artists and exterior paint.	a. Government of Cuba	1. Actualización del Estado Global de los Límites Legales de Plomo en la Pintura , September 2019, UNEP
	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	1994 (a) ¹
2. Rotterdam Convention on the Prior Informed Consent Procedure for certain hazardous Chemicals and Pesticides in international trade	2008
3. Minamata Convention on Mercury	2018 (a)
4. Stockholm Convention on Persistent Organic Pollutants	2007

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 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	De la Vega, Enrique; Cantelar, Jorge; Chamorro, Rita; Novas, Arelis; Cruz, Ana; Guerra, Caridad, Andreu, Maria Elena	2007	Reference values of lead in blood concentration in the working population of Havana City	<p>Introduction: Lead in whole blood concentration is today the more suitable biological biomarker of environmental lead exposure, and a necessary instrument for its evaluation and control at the workplaces and at the community. Objective: To determine the blood lead levels in the adult population of Havana City Havana, their extent, distribution and main determinants.</p> <p>Method: A probability sample of 259 healthy sub-jects was selected from the current assistants to the municipal blood banks to be representative for the population of Havana City. It was stratified according to sex, habit of</p>

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				<p>smoking or no and municipality of work and residence (Regla, Arroyo Naranjo, 10 de Octubre and Guana-bacoa). Endovenous blood samples were taken in the morning, and the determination of the lead concentration was carried out using an atomic absorption technique with flame of air-acetylene and extraction with methylisobuthylketone (MIBK) and ammonium pirrolidindithiocar-bamate (APDC).</p> <p>Results and conclusions: The average (arithmetic) concentration of lead in blood in the population was 6,33 $\mu\text{g} \cdot \text{dL}^{-1}$, and the 95th percentile 12,40 $\mu\text{g} \cdot \text{dL}^{-1}$. The arithmetic mean of lead was higher in the blood of males than of females (6,87 $\mu\text{g} \cdot \text{dL}^{-1}$ vs. 5,80 $\mu\text{g} \cdot \text{dL}^{-1}$), and also higher in smokers than in non-smokers (7,15 and 5,47 $\mu\text{g} \cdot \text{dL}^{-1}$, respectively). On the other hand, the mean lead concentrations by municipalities were 8,16 $\mu\text{g} \cdot \text{dL}^{-1}$ (Regla), 6,92 $\mu\text{g} \cdot \text{dL}^{-1}$ (Arroyo Naranjo), 4,61 $\mu\text{g} \cdot \text{dL}^{-1}$ (10 de Octubre) and 4,43 $\mu\text{g} \cdot \text{dL}^{-1}$ (Guanabacoa). The general frequency distribution of the reported values didn't differ significantly of the gaussian. The blood lead levels in blood in the general population of Havana City were comparable to those of other studies in important cities of developing countries. For the establishment of national reference values for the evaluation and control of lead exposure in workers, independently that this study was only bounded to the Cuban capital, it could be used, provisionally at least, the value of 15 $\mu\text{g} \cdot \text{dL}^{-1}$ as the superior limit of 'normality' for lead in blood concentration in adults without well-known exposure to the lead.</p>
Lead pollution	Alvarez, Alfredo; Alvarez, Juan; do Nascimento, Clistenes; Gonzales, Ivan; Rizo, Oscar; Carzola, Lazaro; Torres, Roberto; Pascual, Jorge	2017	Lead isotope ratios in lichen samples evaluated by ICP-ToF-MS to assess possible atmospheric pollution sources in Havana, Cuba	<p>Abstract: Epiphytic lichens, collected from 119 sampling sites grown over “Roistonea Royal Palm” trees, were used to assess the spatial distribution pattern of lead (Pb) and identify possible pollution sources in Havana (Cuba). Lead concentrations in lichens and topsoils were determined by flame atomic absorption spectrophotometry and inductively coupled plasma (ICP) atomic emission spectrometry, respectively, while Pb in crude oils and gasoline samples were measured by ICP-time of flight mass spectrometry (ICP-ToF-MS). Lead isotopic ratios measurements for lichens, soils, and crude oils were obtained by ICP-ToF-MS. We found that enrichment factors (EF) reflected a moderate contamination for 71% of the samples (EF > 10). The 206Pb/207Pb ratio values for lichens ranged from 1.17 to 1.20 and were a mixture of natural radiogenic and industrial</p>

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				activities (e.g., crude oils and fire plants). The low concentration of Pb found in gasoline ($<7.0 \mu\text{g L}^{-1}$) confirms the official statement that leaded gasoline is no longer used in Cuba.
	Rizo, O; Morell, D; Lopez, J; Muñoz, J; Rodriguez, K; Pino, N	2013	Spatial Distribution and Contamination Assessment of Heavy Metals in Urban Topsoils from Las Tunas City, Cuba	Abstract: Concentrations of Cr, Co, Ni, Cu, Zn, Pb and Fe in the topsoils (0–10 cm) from Las Tunas city were measured by X-ray fluorescence analysis. The mean Cr, Co, Ni, Cu, Zn and Pb contents in the urban topsoil samples (97 ± 30 , 14 ± 2 , 35 ± 36 , 94 ± 26 , 199 ± 87 and 42 ± 29 mg kg ⁻¹ dryweight, respectively) were compared with mean concentrations for other cities around the world with similar population. Cr content in school grounds, parks and residential areas exceed in 20 % the average Cr background level. Highest content for Ni was determined in residential areas, for Zn in market gardens soils and as for Pb, the highest topsoil-back-ground content ratios were observed for market gardens (2.7) and residential areas (2.3). Spatial distribution maps indicated the same behaviour for Cr–Co–Ni and Pb–Zn, respectively, whereas the spatial distribution of Cu differs from other heavy metals. On the other hand, the metal-to-iron normalisation, using (10–20 cm) bottom soil contents as background, showed that topsoils in Las Tunas city are severely enriched with lead and not enriched with the rest of the determined metals. The average values of integrated pollution index (IPI) indicated that soils are moderately contaminated by heavy metals (1.17BIPlaveB1.39), but enrichment index values shows that metal concentrations on the studied locations are not above the permissible levels for urban agriculture.
	Rizo, O; Merlo, M; Castillo, F; Lopez, J	2012	Assessment of Metal Pollution in Soils From a Former Havana (Cuba) Solid Waste Open Dump	Abstract: Concentrations of cobalt, nickel, copper, zinc and lead in the topsoils (0–10 cm) from a former Havana solid waste open dump were estimated by X-ray fluorescence analysis. The mean metal contents in the dump topsoil samples (in mg kg ⁻¹ : 8.4 ± 2.7 for cobalt, 50 ± 27 for nickel, 252 ± 80 for copper, 489 ± 230 for zinc and 276 ± 140 for lead) were compared with mean concentrations from Havana urban soils and from other solid waste disposals around the world. The comparison with Dutch

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				soil quality guidelines showed a serious copper contamination and a slight contamination with the rest of determined metals. The values of the integrated pollution index (mean index = 3.5) indicated that dump soils are highly contaminated by metals, and the enrichment index values shows that metal concentrations on the studied locations are above the permissible levels for urban agriculture.
	Rizo, O; Castillo, F; Lopez, J; Merlo, M	2011	Assessment of Heavy Metal Pollution in Urban Soils of Havana City, Cuba	Abstract: Concentrations of Co, Ni, Cu, Zn, Pb and Fe in the topsoils (0–10 cm) from urbanized and un-urbanized areas of Havana city were measured by X-ray fluorescence analysis. The mean Co, Ni, Cu, Zn and Pb contents in the urban topsoil samples (13.9±4.1, 66±26, 101±51, 240±132 and 101±161 mg kg ⁻¹ , respectively) were compared with mean concentrations for other cities around the world. The results revealed the highest concentrations of metals in topsoil samples from industrial sites. Lowest metal contents were determined in the un-urbanized areas. The comparison with Dutch soil quality guidelines showed a slight contamination with Co, Ni Cu and Zn in all studied sites and with Pb in industrial soils. On the other hand, the metal-to-iron normalisation using Earth crust contents as background showed that soils from urbanized areas in Havana city (industrial sites, parks and school grounds) are moderately enriched with zinc, moderately to severe enriched (city parks and school grounds) and severe enriched(industrial sites) with lead. The values of integrated pollution index (IPI) indicated that industrial soils are middle and high contaminated by heavy metals (1.19BIPIB7.54),but enrichment index values (EI) shows that metal concentrations on the studied locations are not above the permissible levels for urban agriculture, except soils from power and metallurgical plants surroundings.

Papers in Spanish

Topic	Authors	Year	Title	Abstract/ description
Blood-lead levels	Valera, Alina; Valdez, Juan; Abreu, Caridad; Sanchez, Yamile; Peña, Olivia; Quintana, LEanne	2009	Efectos del plomo sobre el aprendizaje en educandos del municipio Centro Habana, 2004-2006	Resumen: Se realiza un estudio transversal en el que se estudiaron 65 niños con edades comprendidas entre 7 y 10 años, en el municipio Centro Habana, seleccionados de forma opinática. A todos se les realizó la determinación de plomo en sangre, examen físico completo donde se relacionaron las pruebas de desarrollo psicomotor y problemas de aprendizaje, con la finalidad de explorar estos en las actividades educativas. Se obtuvo información por parte de los maestros del rendimiento escolar y se obtuvo que el 46,2 % de los niños tenían niveles de plomo en sangre por encima de lo permisible (10,0 µg/dL), de los cuales tuvieron problemas de aprendizaje el 67,7 % y de ellos, se encontró 1 que tuvo valores de plomo en sangre por debajo de 6 µg/dL. Se observó asociación estadística de los educandos con el aprendizaje, atención y comportamiento asociados posiblemente con los niveles de plomo en sangre. Los resultados son estadísticamente significativos.
	Vega, Enrique; Cantelar, Jorge; Chamorro, Rita; Novas, Arelis; Cruz, Ana; Guerra, Caridad; Andreu, Maria	2007	Valores de referencia de la concentración de plomo en sangre en la población en edad laboral de la ciudad de La Habana	Resumen: La concentración de plomo en sangre total es hoy el principal indicador biológico conocido de exposición medioambiental a ese contaminante y sus derivados, y un instrumento necesario para su evaluación y control en la población laboral y(o) comunitaria en riesgo. Objetivo: Determinar los valores de referencia de la concentración de plomo en sangre en la población en edad laboral de la ciudad de La Habana, su extensión, distribución y determinantes principales.
	Valdes, Juan; Bermejo, Pedro; Placeres, Manuel; Roche, Rene; Peña, Olivia; Orris, Peter	2003	Niveles de plomo en sangre y factores asociados, en niños del municipio de Centro Habana	Resumen: La exposición al plomo y la consecuente intoxicación afecta múltiples sistemas del organismo humano y constituye un problema de salud mundial. Los niños son más vulnerables y las manifestaciones precoces de afectación se presentan con niveles de hasta 10 µg/ml. La falta de estudios recientes del problema en Cuba motivó esta investigación para evaluar los niveles elevados de plomo en sangre de niños expuestos entre 3 y 8 años de edad, e identificar factores asociados con estos. Se determinó el nivel de plomo en sangre en 85 niños residentes en casas construidas antes de 1928, en el municipio de Centro Habana. Las madres respondieron un cuestionario acerca de hábitos y conductas que exponen a los niños a la intoxicación con plomo; 40 % de ellos tenían el plomo en sangre superior a

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				10 µg/dl. Los factores asociados fueron, entre otros: no lavarse las manos antes de alimentarse, jugar con juguetes de plomo, llevarse juguetes a la boca y comer tierra.
Lead exposure	Perez, LC; FG, Fernandez; Castillo, D; Martinez, B; Gutierrez, G; Pandolfi, B; Casido, R; Pupo, BJ; Lardoeyt, FR; Barroso, S; Jaime, N; Villalba, R	2015	Marcadores de estrés oxidativo y genotoxicidad en trabajadores cubanos con exposición ocupacional prolongada al plomo	<p>Objetivos: Determinar el comportamiento de los marcadores de estrés oxidativo y genotoxicidad en individuos expuestos ocupacionalmente, por tiempos prolongados, al plomo.</p> <p>Material y método: Fueron estudiados 57 sujetos, de ellos, 27 trabajadores con edades comprendidas entre 35 y 64 años, expuestos al plomo por períodos de 8 a 44 años. El grupo control estuvo conformado por 30 individuos, con edades comprendidas entre 36 y 65 años, sin exposición ocupacional conocida a agentes químicos o físicos. Todos los participantes fueron incluidos en el estudio luego de emitir su consentimiento informado. Los marcadores de daño oxidativo y de defensa antioxidante, fueron medidos mediante métodos espectrofotométricos. Además, se determinó el daño al ADN mediante ensayo Cometa.</p> <p>Resultados: En los trabajadores expuestos se observó un incremento significativo en la concentración plasmática de peróxidos totales. Por otra parte, mostraban una disminución significativa en la actividad de la glutatión reductasa.</p> <p>Conclusiones: Los resultados de este estudio permitirán el empleo de marcadores de efecto para el seguimiento de los trabajadores expuestos al plomo.</p>
	Flores, O; Caballero, Barreras; Estrada, A; Hernandez, C;	2000	Exposición de la población cubana debido a la incorporación de plomo 210 y	Abstract: Data are presented on the concentrations of lead 210 and polonium 210 in potable water and different food items collected from various locations in Cuba. The electroplating of polonium at two different times onto copper disks and further measurement of alpha activity was the method used for polonium 210 determination in foods and water. The

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	Zerguera, J; Alonso, C		polonio 210 a través de la dieta	polonium daughter is used to determine both the lead 210 and polonium 210 using the Bateman equations for radioactive growth and decay. The average lead 210 and polonium 210 concentration in potable water was 3 and 2 mBq.L ⁻¹ , respectively and concentration in total diet averaged 47.7 mBq.kg ⁻¹ for lead 210 and 131.9 mBq.kg ⁻¹ for polonium. The annual effective dose estimated due to ingestion of these nuclides contained in foods and potable water reported a value of 77.7 Sv corresponding the 95.7% to the food consuming.
Lead in water	Cazorla, Lazaro; Rieumont, Susana; Columbie, Isaida; Mederos, Daniel; Castillo, Reinaldo	2005	Niveles de plomo, zinc, cadmio y cobre en el Río Almedares, Ciudad Habana, Cuba	Resumen: El objetivo de esta investigación fue determinar los niveles de Pb, Cu, Zn y Cd existentes en el Río Almendares (Ciudad de la Habana, Cuba), para ello se establecieron 15 estaciones de muestreo a lo largo del río y se realizaron los análisis de estos metales en los sedimentos y en la planta <i>Eichhornia crassipes</i> , durante la temporada de seca de 2003 y 2004. En los sedimentos del río se encontraron contenidos de Pb entre 38.7 y 217.5 mg/kg, de Cd de <1.0 a 4.8 mg/kg, de Cu entre 32.9 y 420.8 mg/kg y de Zn entre 69.9 y 708.8 mg/kg. Se analizaron también estos metales en la raíz de la macrófita <i>Eichhornia crassipes</i> , donde se detectaron niveles entre 7.0 y 143.0 mg/kg para Pb, <1.0 y 3.9 mg/kg para Cd, de 45 a 466 mg/kg para Zn y entre 5.1 y 77.0 mg/kg para Cu, encontrándose que la distribución espacial de estos metales en la raíz de la planta fue similar a la hallada para los sedimentos en el río. De hecho, se obtuvieron correlaciones significativas (P<0.05) entre los contenidos de Zn y Cu en los sedimentos y en la raíz de la planta.
	Meilan, Mariel	2000	Evaluación sanitaria de plomo en aguas en Cuba	Resumen: Se presentan los principales resultados obtenidos en las investigaciones sobre la evaluación sanitaria de plomo en aguas en Cuba, efectuadas por el Instituto Nacional de Higiene, Epidemiología y Microbiología en los últimos años. Los estudios abarcaron análisis del metal en fuentes de abastecimiento de aguas subterráneas y superficiales destinadas al consumo humano y en redes de distribución de acueductos e instalaciones intradomiciliarias urbanas. Se presentan también los aspectos referidos a las regulaciones sanitarias de productos empleados en contacto con el agua potable, así como la legislación sanitaria nacional. Tomando en consideración los resultados obtenidos en estas investigaciones, la contribución del agua a la exposición humana al plomo resulta despreciable.

F. Blood testing in National Health Surveys

National Health Survey	Non-Communicable Diseases Risk-Factors Surveillance	Source
Purpose	Monitoring of the social determinants of health in the Cuban population residing in the country.	Encuesta sobre indicadores de prevención de infección por el VIH/Sida – 2017 , Results, Published in 2019
Sample size	The Cuban population aged 12 to 49 years old.	
Blood sample testing	To determine the existence of HIV/AIDS in blood.	
Latest round	2019	
Next round	-	