

Points of view of Colombia regarding the establishment of thresholds- Minamata Convention
Technical Expert Group on Mercury Waste Thresholds
For meeting *On Feb 16th , 17th and 18th 2023*

Objective: The specific task of the group of experts on mercury thresholds is to recommend technical-scientific options for thresholds that allow compliance with the objective of the Minamata Convention.

Below is the point of view with supported information that is currently applied in Colombia to recommend and facilitate a decision on the waste included in subcategory 2 (c) of article 11 (waste contaminated with mercury or mercury compounds - waste from category C). Which will comprise most of the volume of waste categories, since they may include industrial waste, contaminated soil, contaminated mixed waste, etc. (In the last section of this document there is a table containing the list of these wastes: Waste contaminated with mercury or mercury compounds - Category C waste. (C: Waste contaminated with mercury or mercury compounds).

BACKGROUND:

MERCURY AS A SUBSTANCE OF SANITARY INTEREST:

Mercury is among the top 10 chemicals of greatest public health concern (Minamata Convention, 2023). Colombia prohibited the commercialization and use of mercury through Law 1658 of July 15, 2013; The purpose of the law is aimed at protecting and safeguarding human health and preserving renewable natural resources and the environment from the effects of mercury exposure. Specifically, in article 3, the measures for the reduction and elimination of the use of mercury were established, indicating its eradication throughout the national territory, in all industrial and productive processes within a period not exceeding ten (10) years and for mining in a period not exceeding ten (10) years. Maximum term of five (5) years. The effective date of the ban on the use of mercury in mining was July 15, 2018 and the date of the ban on the use of mercury in other industrial activities is July 15, 2023. The only industrial activity identified in the country, as a user of mercury and that its use is legally permitted until July 2023, is the manufacture of dental amalgams.

Among the emission sources and applications given to mercury is the combustion of oil and coal derivatives, pharmaceutical industries, dental medical units and the extraction of mineral resources to obtain precious metals such as gold.

The disposal of tailings from amalgamation processes, in mining, can contaminate groundwater and surface water sources as indicated (Barringer et al., 2005). On the other hand, Foucher, Hintelmann, Al, & Mac Quarrie, 2013, quantified concentrations of up to 150 ug/L in groundwater at the tailings base and 60 ug/L in surface water, after mercury leaching. These values exceed the admissible value for water for human consumption using conventional treatments (0.002 mg/L), water for livestock use (0.01 mg/L) and water for the preservation of fauna and flora species (0.01 mg/L), established in Decree 1076 of 2015 .

Given its physicochemical characteristics, mercury can be transformed and circulate in the environment, which is known as the mercury cycle represented in figure 1:

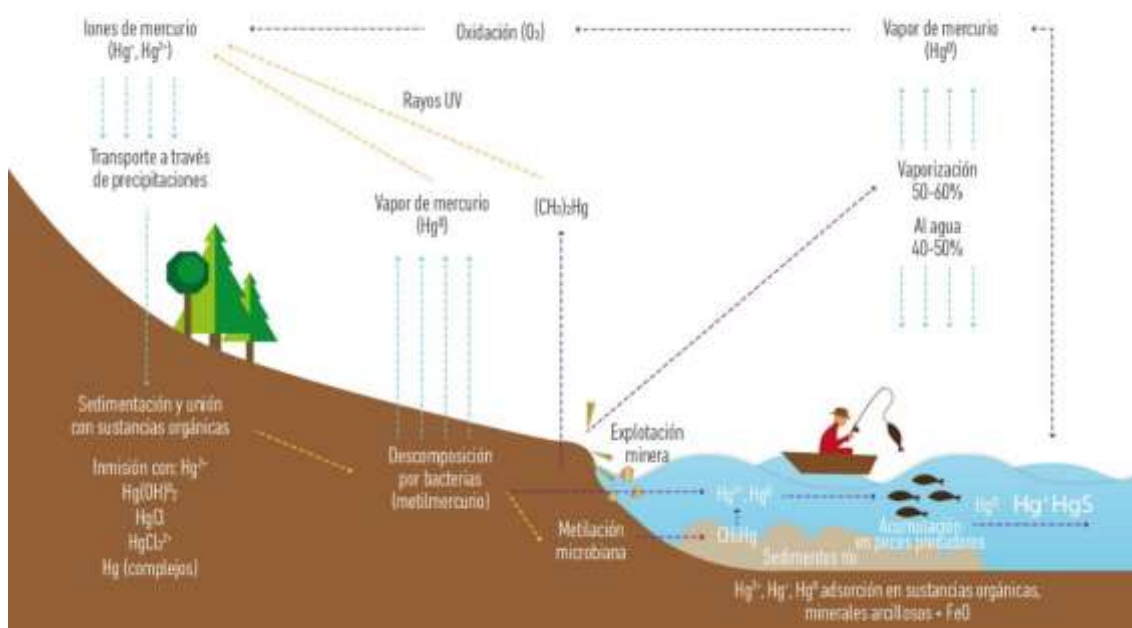


Figure 1. Biogeochemical cycle of mercury. Atmospheric, water and soil emissions. (Modf. Ruiz, V. 2016)

Initially, the mercury vapor is converted to water-soluble forms, which makes it reach the crust with rainwater. Here, this metal is reduced and returned as a vapor or deposited in sediments. In the second stage of the cycle, certain types of microorganisms give rise to a methylation reaction in which the addition of one or more methyl groups is achieved, transforming elemental mercury into methylmercury, the form in which it can enter the trophic chain. Organic mercury is captured by plankton, making it available to ecosystem organisms, hence the possibility that this element bioaccumulates, bioconcentrates, and biomagnifies (National Chemical Risk Program, 2007).

The biological properties and interactions of mercury vary for each physicochemical state and each one has different toxicological properties (Ramírez, 2008), but, in general, exposure to mercury is associated with negative health effects which are determined by factors such as dose, age of the patient, duration of exposure, and route of entry into the body. These include heart attacks, autism, fibromyalgia, fatigue, lupus, dementia, Parkinson's, Alzheimer's, multiple sclerosis, fetal malformations, and neurological, metabolic, hormonal, renal, and dermatological disorders (WHO, 2013).

Bioaccumulation is the ability of organisms to selectively accumulate pollutants in their tissues with respect to the existing concentrations in the environment in which they inhabit (Waldichuck, 1980). Mercury, in its most toxic organic form, methylmercury (HgCH_3), can bioaccumulate up to a million-fold along the aquatic food web due to its ability to cross cell membranes (Baeyens et al., 2003; Kehrig et al. al., 2017).

It is there where the concept of biomagnification arises, which is produced by the increase in the chemical concentration of a metal as it climbs in the trophic chain; thus, a compound is more toxic at higher levels due to its progressive accumulation (Bifani, 1999). Not only mercury has the capacity to bioaccumulate and biomagnify, metals such as cadmium, lead, zinc, copper and

chromium and metalloids such as arsenic can also enter the metabolism of living beings and bring unfavorable effects for the development of their functions vital.

REGULATIONS IN COLOMBIA FOR SOLID WASTE:

Taking into account the objective of the Minamata agreement, Preserving human health and the environment, from anthropogenic emissions and releases of mercury and its compounds, a review of the current regulations in Colombia has been carried out and which option 1, 2 or 3 , one could be recommended or proposed that allows the objective of the agreement to be met.

Residues or waste (Toxicity Test)

In the case of waste, a toxic residue or waste is considered to be that which, by virtue of its ability to cause undesirable or adverse biological effects, can cause damage to human health and/or the environment, with acute, delayed or chronic and ecotoxic effects. To establish this characteristic, one of the following criteria is taken into account.

a) Oral median lethal dose (LD50) for rats less than or equal to 200 mg/kg for solids and less than or equal to 500 mg/kg for liquids, of body weight; b) Dermal median lethal dose (LD50) for rats less than or equal to 1,000 mg/kg of body weight; e) Inhalation median lethal concentration (LC50) for rats less than or equal to 10 mg/l; d) High potential for eye, respiratory and skin irritation, corrosive capacity on living tissues; e) Susceptibility to bioaccumulation and biomagnification in living beings and in trophic chains; f) Carcinogenicity, mutagenicity and teratogenicity; g) Neurotoxicity, immunotoxicity or other delayed effects; h) Toxicity for higher organisms and terrestrial and aquatic microorganisms; i) Others that the competent authorities define as risk criteria for human toxicity or for the environment.

In addition, toxic residue or waste is considered to be that which, when performing a leaching test for toxicity characteristics (known as the TCLP-EPA Method 1311 test), contains Hg greater than 0.2 mg/L in the leachate:

Waste/media type	Value Hg mg/L	Approach	Test method
Hazardous waste	0.2	Leachate	USEPA method 1311 (TCLP)

Mercury in biosolids:

In Colombia, the biosolids generated in domestic wastewater treatment plants can be used as agricultural amendments. Among other metals, a maximum mercury concentration of between **10 and 20 mg/kg** on a dry basis is established (Decree 1287 of 2014).

Methods of determination of mercury at the level of instrumental analysis:

- Atomic Absorption Spectrophotometry-GH: Applies for the determination of mercury in water, soil, active sediments, sediments, etc.

- Atomic absorption spectrophotometry – Direct measurement by Au amalgamation, EPA method 7473, applied to surface water resources, contaminated water, sediments, and solids, etc. This technique has multiple applications in various fields of industry, in the environmental field it is applicable for the determination of mercury in: water, ash residue, soil, seaweed dust, slag, saline water, mud, sediments, among others.

Datos	Total Hg (ng)	Hg concentración ⁽¹⁾ (µg/kg)
Rango de trabajo ⁽²⁾	(1 ^a) 0,05 - 20 (2 ^a) 20 -1000	(1 ^a) 0,5 - 200 (2 ^a) 200 - 10000
Limite de Detección	0,005	

⁽¹⁾Peso de Muestra 100 mg
⁽²⁾Cambio Automático cuando absorbancia 1

- Ultraviolet visible spectrophotometry-Ditizona Method: For field work or places far from specialized laboratories, it would be more appropriate to have instrumentally simpler methods such as UV-visible molecular absorption spectrometry, the Ditizona method being one of the most more adequate and established, although it presents the disadvantage of using large volumes of reagents, some of which may not be easily accessible and, additionally, the preparation procedures may be complex. In this sense, Khan et al., presented a simple, ultrasensitive, and selective spectrophotometric method for the rapid determination of mercury (II) at ultratrace levels using 1,5-diphenyldithiocarbazone as a micellar reagent, at a wavelength of 490 nm. in a slightly acid solution (0.07-0.17M H2SO4).

COLOMBIA SUBMISSION PREVIOUS YEARS:

A proposal of 25 mg/Kg of Hg, as the only value applicable to the waste that was the focus of study by the group, was generated after the last COP 3 was held. Thus, Colombia through a document shared the point of view regarding this proposal when it began to interact in the group of experts: "Colombia considers the hazard approach appropriate for the determination of the threshold and particularly also finds it appropriate to define it based on category 3 for the hazard class of Acute Aquatic Toxicity established in the SGA, see figures 2 and 3.:

Clasificación		Etiquetado			Código de indicación de peligro	
Clase de peligro	Categoría de peligro	Pictograma		Palabra de advertencia		Indicación de peligro
		SGA	Reglamentación Modelo de las Naciones Unidas			
Peligro a corto plazo (agudo) para el medio ambiente acuático	Agudo 1			Atención	Muy tóxico para los organismos acuáticos	H400
	Agudo 2	Sin pictograma	No se requiere	Sin palabra de advertencia	Tóxico para los organismos acuáticos	H401
	Agudo 3	Sin pictograma	No se requiere	Sin palabra de advertencia	Nocivo para los organismos acuáticos	H402

^a En las Recomendaciones relativas al transporte de mercancías peligrosas, Reglamentación Modelo, de las Naciones Unidas, no se requiere un pictograma para la Categoría 1 si la sustancia presenta cualquier otro peligro previsto en la Reglamentación Modelo. Si no presenta ningún otro peligro, es necesario el pictograma, además de la etiqueta de la clase 9 de la Reglamentación Modelo.

Figure 2. Short-term (Acute) hazard to the aquatic environment.

Clasificación		Etiquetado			Código de indicación de peligro	
Clase de peligro	Categoría de peligro	Pictograma		Palabra de advertencia		Indicación de peligro
		SGA	Reglamentación Modelo de las Naciones Unidas			
Peligro a largo plazo (crónico) para el medio ambiente acuático	Crónico 1			Atención	Muy tóxico para los organismos acuáticos, con efectos nocivos duraderos	H410
	Crónico 2			Sin palabra de advertencia	Tóxico para los organismos acuáticos, con efectos nocivos duraderos	H411
	Crónico 3	Sin pictograma	No se requiere	Sin palabra de advertencia	Nocivo para los organismos acuáticos, con efectos nocivos duraderos	H412
	Crónico 4	Sin pictograma	No se requiere	Sin palabra de advertencia	Puede ser nocivo para los organismos acuáticos, con efectos nocivos duraderos	H413

^a En las Recomendaciones relativas al transporte de mercancías peligrosas, Reglamentación Modelo, de las Naciones Unidas, no se requiere un pictograma para las Categorías 1 y 2 si la sustancia presenta cualquier otro peligro previsto en la Reglamentación Modelo. Si no presenta ningún otro peligro, es necesario el pictograma además de la etiqueta de la clase 9 de la Reglamentación Modelo.

Figure 3. Short-term (Acute) hazard to the aquatic environment.

From the bibliographic review carried out from international databases, it was found that in fish, the acute toxicity based on LC50 is on average 0.35 mg/L and around 85% of the data are greater than 0.1 mg/L. , however, although there are fewer data available from tests on invertebrates, higher values of toxicity are reported; therefore, due to the precautionary principle as defined by the SGA, the most sensitive community should be taken as a reference, in this case the invertebrates and, therefore, with the data found, we consider that the proposal of a threshold of 25 mg/kg is consistent with this approach, excluding residues from ASGM activities.”

POSSIBLE THRESHOLD OPTIONS UNDER DISCUSSION FEB 2023: (TAKEN FROM 2 2 DRAFT COMPROMISE PAPER CLEAN)

Colombia's point of view regarding this option

According to the contributions presented by the ministry, in January 2022 regarding the definition of the mercury thresholds for type C waste of Article 11 of the Convention, we agree to support Option 1 of 25 mg Hg/kg, with the suggestion that, subsequently, the work of the group of Experts be continued to provide additional information that will eventually allow a lower threshold to be established. We consider that the threshold proposal of 1 mg Hg/kg is not viable due to the difficulty that reliable quantification of this value may have.

Additionally, we reiterate the proposal that the defined threshold be obtained based on hazard criteria, rather than risk criteria; In other words, we would not support the option of using thresholds based on values obtained by mercury leaching, but rather on the total content in the residue.

A value of 1 mg Hg/kg does not seem wrong, but here it will depend if the parties can issue national action plans or a budget for the acquisition of an infrastructure that allows the quantification of the mercury content in the waste in a practical and precise way. . At this point, the method of analysis and equipment used that allow low instrumental detection limits to quantify them depends. A portable X-ray fluorescence spectrometer is not considered an instrument with low detection limits in addition to the area it handles for measurement and the instrumental technique applied.

Option 1: COP sets a universal threshold for category C waste. The only concrete proposal put forward by the parties is a total mercury content of 25 mg/kg, although value reduction has been mentioned as a compromise solution. During the intersessional period prior to the 4th Conference of the Parties, an observer from the technical expert group submitted a proposal for a total mercury content of 1 mg/kg (IPEN: International Pollutants Elimination Network). The proposals submitted are reproduced in document UNEP/MC/WT.2/INF/1. A universal threshold using the leach test has not been proposed.

Colombian point of view:

It is not feasible to support that this category does not contain an established threshold, if the objective of the agreement is to be met.

Finally, we do not consider it appropriate to support options 2 and 3.

Option 2: COP sets different thresholds for different types of waste. It was also suggested to set different thresholds corresponding to different management/disposal methods, but this will be difficult as the management/disposal methods may be unknown when it is necessary to determine if a certain waste is mercury or not. The indicative list of category C waste may be used to establish thresholds for each type of waste. No specific proposals on waste types or threshold values have been made.

Option 3: COP do not establish thresholds for category C waste. In this case, parties must establish their own thresholds or definitions of category C wastes for which they have obligations under Article 11 of the Convention. The technical expert group could develop a guidance document for setting local thresholds, based on information on existing thresholds provided by parties (see document UNEP/MC/WT.2/3). This solution could work for the first two obligations under Article 11(3) (MEDA and recovery), but for the third obligation (transboundary movement) there may be cases where the exporting country does not consider the exported waste as mercury waste while that the importing country considers it as a mercury waste. For the latter, the expert group could recommend the practice of the Basel Convention in which exporting countries must follow the definitions of importing countries.

OTHER MAXIMUM VALUES FOR MERCURY WITH REGULATIONS IN COLOMBIA (ADDITIONAL INFORMATION NOT SOLID WASTE)

Reviewing the regulations in Colombia, in Section 9 of Chapter 3, of Title 3 of Part 2 of Decree 1076 of 2015, permissible limit values for water quality control substances are compiled and criteria are established for mercury concentrations:

Water Quality	Hg Value in mg/L	Approach	Test method	
The admissible quality criteria for the destination of the resource for human and domestic consumption are those listed below, and indicate that only conventional treatment is required for its purification	0.002	water concentration	Absortion atomic for Hg	
The admissible quality criteria for the destination of the resource for human and domestic consumption are those listed below, and indicate that only disinfection is required for its purification	0.002	water concentration	Absortion atomic for Hg	
Quality criteria for livestock use. The admissible quality criteria for the destination of the resource for livestock use	0.01	water concentration	Absortion atomic for Hg	
Quality criteria for the preservation of flora and fauna. The admissible quality criteria for the destination of the resource for the preservation of flora and fauna, in fresh, cold or warm waters and in marine or estuarine waters for mercury is the following	sweet cold water	0.01	water concentration	Absortion atomic for Hg
	sweet warm water	0.01	water concentration	Absortion atomic for Hg
	Marine and estuarine water	0.01	water concentration	Absortion atomic for Hg
Dumping into the public sewer system and minimum requirements. All discharge to a public sewer must comply, at least, with the following standard. Concentration to control the load of the following substance of sanitary interest.	0.02	water concentration	Absortion atomic for Hg	

Discharges:

The regulation in Colombia (Resolution 0631 of 2015) establishes permissible values of punctual discharges to surface water bodies and public sewage systems depending on its origin. These are summarized in the table below:

Waste/media type	Value mg/L	Approach	Test method
Wastewater (domestic sewage)	0.02	Water concentration	Absortion atomic for Hg
Wastewater (Agroindustry)	N.D.	Water concentration	Absortion atomic for Hg
Wastewater (Gold, Iron and Carbon Minery activity)	0.002	Water concentration	Absortion atomic for Hg
Wastewater (Niquel and minerals No Iron minery activity)	0.002	Water concentration	Absortion atomic for Hg
Wastewater Hydrocarbons (Exploration, production, refine, sale and distribution)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (production of food products)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (preparation of prepared animal feed)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (production of oils and fats of animal origin)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (manufacture of paper and cardboard from recycling)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (Manufacture of chemical substances and products)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (manufacture of inorganic acids and their salts)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (plastic manufacturing)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (manufacture of pesticides, detergents, paints and beads)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (manufacture of pharmaceuticals, medicinal chemicals)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (manufacture of batteries, cells and electric accumulators)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (manufacture of electrical lighting equipment)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (Treatment and coating of metals)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (Manufacture of machinery and equipment, vehicles, auto parts, steel industry)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (printing and lithography,)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (production and manufacturing of rubber products)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (Electric power generation)	0.005	Water concentration	Absortion atomic for Hg
Wastewater (waste treatment and disposal)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (recycling and similar plastic materials)	0.02	Water concentration	Absortion atomic for Hg
Wastewater (drum recycling)	0.02	Water concentration	Absortion atomic for Hg
Wastewater (attention to human health, medical attention)	0.01	Water concentration	Absortion atomic for Hg
Wastewater (funeral parlour)	0.01	Water concentration	Absortion atomic for Hg

Atmospheric emissions: Resolution 909 of 2008 describes the values in mg/m³ for emissions into the atmosphere with Mercury content:

Waste/media type	Allowable Emission Standards (mg/m ³)	Remarks	Test Method	
Cement kilns that do coprocessing waste and/or waste dangerous- Allowable Emission Standards (mg/m ³)	0.05	Permissible emission standards of air pollutants	direct measurement	
Permissible emission standards of pollutants to the air in installations of incineration of waste and/or hazardous waste. Installations of waste incineration and/or hazardous waste.	Incineration facilities with a capacity equal to or greater than 500 kg/hour	0.03	Daily average-Permissible emission standards of air pollutants	direct measurement
		0.05	Hourly average-Permissible emission standards of air pollutants	direct measurement
	incineration facilities with capacity less than 500 kg/hour	0.05	Daily average-Permissible emission standards of air pollutants	direct measurement
		0.1	Hourly average-Permissible emission standards of air pollutants	direct measurement
	Incineration furnaces in hospitals and municipalities category 5 and 6 with capacity equal to or less than 600kg/month	0.1	Daily average-Permissible emission standards of air pollutants	direct measurement
		0.2	Hourly average-Permissible emission standards of air pollutants	direct measurement

Mercury reference values for biological samples

Below are the biomarkers and reference values for the evaluation of biological samples with respect to mercury levels in the human body. Mercury reference values for biological sample

Sustancia	Matriz	Grupo poblacional	Valor de referencia para exposición ambiental	Fuente	Valor de referencia para exposición ocupacional	Fuente
Mercurio	Sangre	Rango de 15 años en adelante para exposición ocupacional.	5 µg/L	WHO 2008	15 µg/L	WHO 2008
	Orina		7 µg/L		25 µg/L	
	Cabello	Todas las edades para exposición ambiental.	1 µg/g		5 µg/g	

Source: World Health Organization, 2008

Below are the maximum levels of mercury in food and beverages, allowed by national regulations. (Taken from ABECÉ, Ministry of Social Protection, 2022)

Niveles máximos de mercurio en alimentos y bebidas, permitidos en la normatividad nacional	
12. Productos de la pesca y carne de pescado (2) (3), excluidas las especies del numeral 13 de la presente tabla. El contenido máximo para los crustáceos se aplica a la carne de los apéndices y el abdomen (4). En el caso de los cangrejos y crustáceos similares (Brachyura y Anomura), se aplica a la carne de los apéndices. ²⁰	0.5 mg/kg
13. Carne de los siguientes pescados (2) (3): Rape (Lophius species) Perro del norte (Anarhichas lupus) Bonito (Sarda sarda) Anguila (Anguilla species) Reloj (Hoplostethus species) Cabezudo (Coryphaenoides rupestris) Fletán (Hippoglossus hippoglossus) Rosada del Cabo (Genypterus capensis) Marlin (Makaira species) Gallo (Lepidorhombus species) Salmonete (Mulfus species) Rosada chilena (Genypterus blacodes) Lucio (Esox lucius) Tasarte (Orcynopsis unicolor) Capellán (Trisopterus minutus) Pailona (Centroscymnus coelolepis) Raya (Rafa species) Gallineta nórdica (Sebastes madnus, S. mentella, S. viviparus) Pez vela (Istiophorus platypterus) Pez cinto (Lepidopus caudatus), sable negro (Aphanopus carbo) Besugo o aligote (Pagellus species) Tiburón (todas las especies) Escolar (Lepidocybium flavobrunneum, Ruvettus pretiosus, Gempylus serpens) Esturión (Acipenser species) Pez espada (Xiphias gladius) Atún (Thunnus species, Euthynnus species, Katsuwonus pelamis). ¹	1.0 mg/kg
10.1 Aguas minerales naturales. ²¹	0,001 mg/kg
1.2 Sal, calidad alimentaria. ²	0,1 mg/kg

Resolution 122 of 2012. Technical regulation on the physicochemical and microbiological requirements that fishing products must meet, particularly fish, molluscs and crustaceans for human consumption.