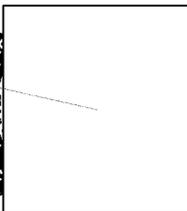


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Defense Intelligence Agency

Defense Intelligence Assessment



(U) Environmental Health Risk Assessment: Colombia

DI-1816-COL-07

15 March 2007

Information Cutoff Date: 14 March 2007

(U) This baseline intelligence assessment's Key Judgments/Executive Summary are valid until superseded. See the [country page](#) for intelligence updates, alerts, and other baseline assessments.

(U) Key Judgments

(U) Environmental contamination may present short- and long-term health risks to personnel deployed to Colombia.

(U) The greatest short-term health risks in Colombia are associated with consumption of water contaminated with raw sewage or runoff containing fecal pathogens and air pollution in urban areas, including Bogotá, Cali, and Medellín. The ingestion of water or food containing high levels of mercury or cyanide may present additional short-term health risks.

(U) The greatest long-term health risks are associated with ingestion of water or food containing elevated levels of mercury.

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(U) Physical Environment

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(U) Topography

(U) Columbia has a total land mass area of 1,038,700 square kilometers (401,044 square miles), slightly less than twice the size of Texas.

(U) The Andes Mountains consist of three distinct ranges, which run on a parallel, northeasterly axis through central Colombia. The three ranges are the Cordillera Occidental in the west, the Cordillera Central, and the Cordillera

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Map

Oriental in the east. The maximum elevation is 5,750 meters (18,865 feet). Unlike the other two ranges, the Cordillera Oriental is densely populated with most inhabitants living near mountain basins at an elevation of 2,400-2,700 meters (8,000-9,000 feet).



Hazardous Substance Summaries

(U) The three largest cities in this region, each occupying a different basin, are Bogotá, Chiquinquirá, and Sogamoso. The principal river of Colombia and a major transportation route, the 1,538-kilometer (956-mile) Magdalena River, flows north between the Cordillera Oriental and the Cordillera Central ranges and empties into the Caribbean Sea.

(U) East of the Andes, three-fifths of Colombia consists of plains and grasslands in the north and rain forest in the south. This land is part of the vast Amazon River drainage basin; the grasslands lie on the plain that drains northeast into the Orinoco River, and the rain forests drain southeast via the Caquetá River and other tributaries.

(U) The Caribbean/Atlantic lowlands of Colombia consist of plains extending north from the Panama border to an isolated mountain system, the Sierra Nevada de Santa Marta (reaching 5,791 meters or 19,000 feet). Elevations above 2,500 meters are conducive to altitude sickness, which may result in headache, nausea, dizziness, loss of appetite, malaise, and shortness of breath.

(U) The Pacific lowlands consist of jungles, swamps, and a low mountain range (less than 330 meters or 1,000 feet in elevation) along the northern coast. Bordering Panama is the Atrato Swamp, which extends outward from the 592-kilometer (350-mile) Atrato River.

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(U) Climate

(U) Colombia is an equatorial nation characterized by a tropical climate with temperature and climatic variations largely influenced by elevation. Seasonal variations in Colombia are slight.

(U) Annual average temperatures in the low regions along the coast and the deep Patía and Magdalena River valleys range from 24°C to 27°C (75°F to 81°F). From an elevation of approximately 500-2,300 meters (1,500-7,500 feet) the climate is subtropical.

(U) The climate at elevations from 2,300-3,000 meters (7,500-10,000 feet) is temperate. Temperatures at elevations above 3,000 meters (10,000 feet) are low, ranging from minus 18°C to 13°C (0°F to 55°F).

(U) In Bogotá, situated in the center of the country at an elevation of 2,645 meters (8,676 feet), the average high temperature is 20°C (68°F) in January and 19°C (65°F) in July. The high temperatures for the same months in Barranquilla, a northern city on the Caribbean Sea, are 32°C (89°F) and 33°C (91°F), respectively.

(U) Throughout the year, 3-month periods of rain and dry weather alternate. The average annual rainfall is approximately 1,060 millimeters (42 inches) in Bogotá and approximately 800 millimeters (32 inches) in Barranquilla.

(U) Bogota

(U) (b)(3):10 USC 424 Elevation 2645 meters/8675 feet)

(U) Temperature: Mean Daily Maximum/Minimum

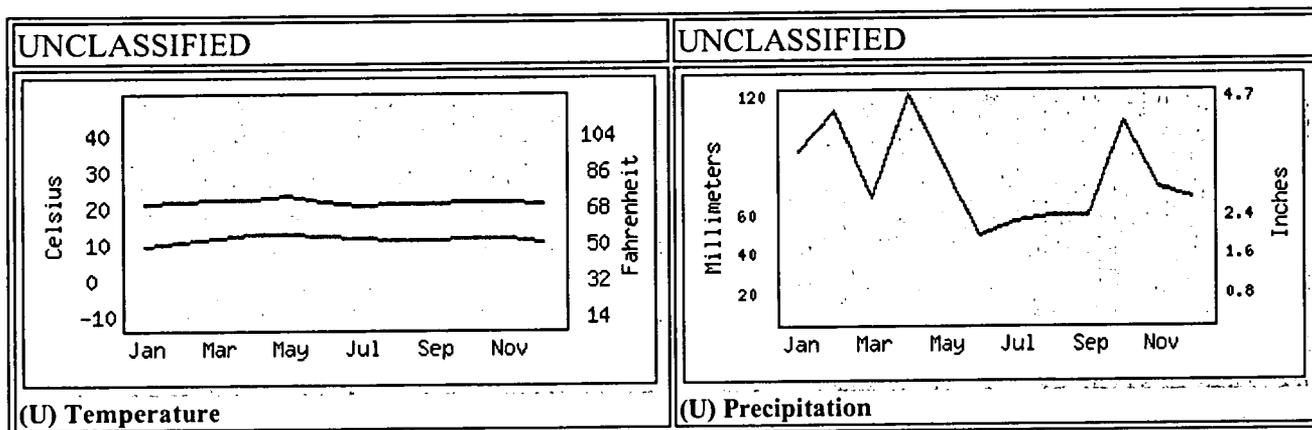
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Month	J	F	M	A	M	J	J	A	S	O	N	D
Maximum °C	18	18	19	19	20	18	17	18	18	18	18	18
Minimum °C	6	7	8	9	9	9	8	8	8	8	8	7
Maximum °F	64	65	66	66	68	65	63	64	64	65	65	64
Minimum °F	43	45	47	49	49	48	47	46	46	47	47	45

(U) Precipitation: Mean Total

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Month	J	F	M	A	M	J	J	A	S	O	N	D
Mean, mm	89	109	66	117	81	46	53	56	56	104	71	66
Mean, inches	3.5	4.3	2.6	4.6	3.2	1.8	2.1	2.2	2.2	4.1	2.8	2.6



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(U) Environmental Contamination

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(U) Background

(U) Significant environmental contamination in Colombia is due to growth in the industrial sector, intentional infrastructure destruction by insurgent groups, and indiscriminate use of chemicals associated with agriculture and cocaine production. Sources of industrial pollution include the petroleum industry, textiles production, cement plants, food processing, beverages, chemicals, and mining waste. The main industrial areas are near the cities of Medellín, Bogotá, Cali, and Barranquilla.

(U) Colombia has the second largest coal reserves in Latin America and exports high-quality coal. Colombia's coal is relatively clean burning with a sulfur content of less than 1 percent. The largest coal

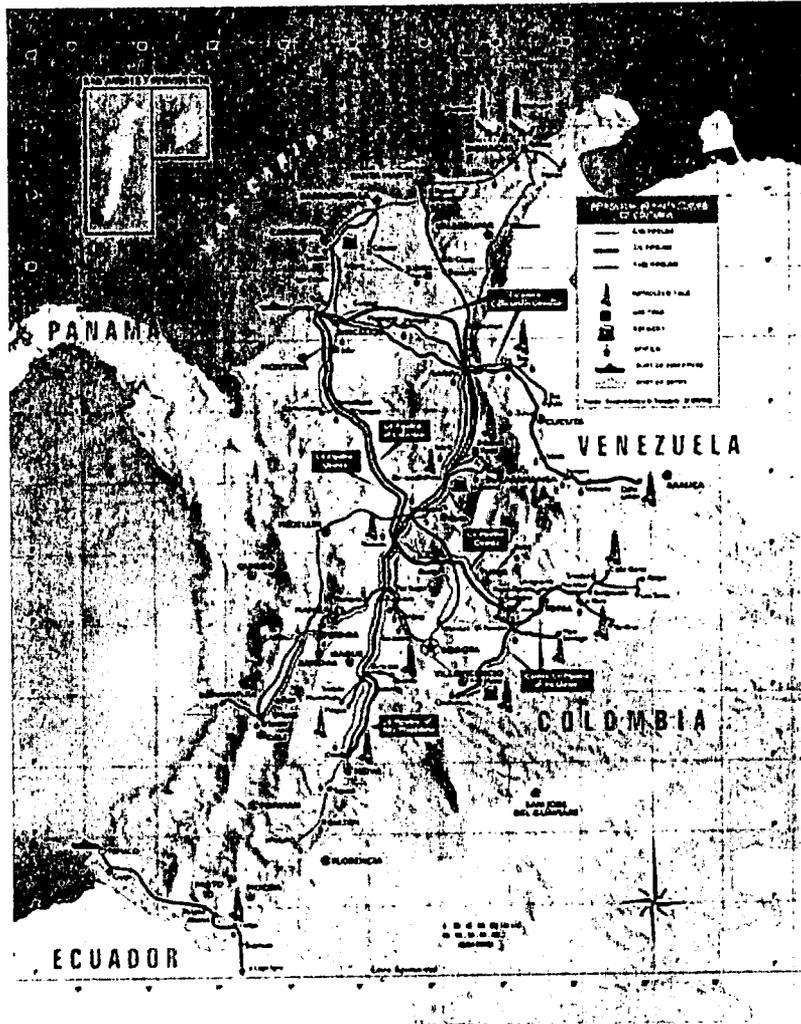
mining operation in Colombia is the El Cerrejón complex in La Guajira. Oil and natural gas are produced along the length of the Magdalena Valley, between the central and eastern Andes ranges, and along the eastern edge of Colombia. Newer oilfields are the Caño Limón oilfield in Arauca Department, bordering Venezuela, and the Cusiana/Cupiagua oilfield in Casanare, in the foothills of the eastern Andes range. Most petroleum refining occurs at Barrancabermeja, on the Magdalena River, and at the port city of Cartagena.

(U) Colombia has five major oil pipelines, four of which connect production fields to the port town of Coveñas. The fifth pipeline transports crude oil from the Orito field to the Pacific port town of Tumaco. Colombia's oil production has declined steadily since 1999, when it peaked at 830,000 barrels per day, due to a lack of sizable new reserves. Colombia exports about one-half of the oil it produces, with the majority of those exports shipped to the United States.

(U) Colombia's petroleum pipelines have been popular targets by rebel groups for sabotage and oil theft. Such attacks have resulted in lost revenue for the government and oftentimes localized contamination of soil and water resources. The number and frequency of attacks on pipelines have declined dramatically since 2002, although attacks on supporting infrastructure appear to be increasing. Most attacks and associated oil spills occur in the Arauca Department.

(U) Colombia has been relatively progressive with respect to environmental stewardship and management. The Ministry of the Environment, formed in 1993, was responsible for environmental regulatory affairs until its merger in 2003 with the Housing and Drinking Water Division of the Ministry of Economic Development, Housing and Water. Since the merger, environmentalists fear environmental protection will lose importance and business interests will take precedence as a result of the restructuring and other government initiatives. Many suggest that the Uribe administration has hindered environmental management with staff cuts and reduced funding within the Ministry. In 2003, the World Bank and the government of Colombia funded an assessment of the National Environmental System (SINA) which found that environmental legislation was progressive, yet the system still suffered from inadequate regulation, inadequate funding, and corruption within the bureaucracy.

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(U) Petroleum Infrastructure in Colombia

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(U) Air Contamination

(U) Air contamination in Colombia is generally localized to highly industrialized and urban areas, including Bogotá and Cali. The primary sources of urban air contamination are vehicle emissions with levels of nitrogen oxides, particulate matter less than 10 microns in diameter (PM-10), and sulfur dioxides often exceeding U.S. Environmental Protection Agency (EPA) National Ambient Air Quality Standards (NAAQS) (no further information available). In general, air contamination presents a low risk to human health in Colombia.

(U) Short-term exposure to nitrogen oxides, particulate matter, and sulfur dioxide above established standards presents a risk of transient acute respiratory symptoms such as coughing, wheezing, and reduced lung function, especially in asthmatic individuals.

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(U) Food Contamination

(U) Specific information on microbial or chemical contamination of food products in Colombia is limited. Contamination of food with fecal pathogens is not uncommon and may result from use of fertilizers derived from human or animal waste, unsanitary food preparation techniques, and improper handling of prepared food products. Even one-time exposure to fecal contamination in food may cause a variety of acute enteric infections. See the [\(U\) Infectious Disease Risk Assessment: Colombia](#) for further details.

(U) Chemical contamination of food may occur and can result from deposition of particulates from industrial activities, uptake of persistent chemicals in soil, pesticide and fertilizer misuse in agricultural production, and improper processing or storage. In general, low-level chemical contamination of food is a concern only for long-term exposures.

(U) Freshwater fish may be contaminated with methyl-mercury as a result of mercury releases from small-scale gold mining facilities near the Nechi and Tigui Rivers and Mina Santa Cruz marsh. Elevated mercury levels due to industrial activity also have been found in sediments from the Cartagena Bay, and may present a health risk to those who consume fish from the bay. Mercury levels in fish are dependent on the type of fish and its feeding habits. Predatory and bottom-feeding fish often have the highest concentrations of mercury.

(U) Short-term exposure to high levels of mercury in fish may cause acute health effects including damage to the nervous system and kidneys and to developing fetuses. Long-term exposure to lower levels of mercury may cause similar delayed health effects due to accumulation of mercury in the body. These health effects are generally irreversible.

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(U) Soil Contamination

(U) Soil contamination in Colombia is generally localized to specific areas surrounding industrial facilities and waste disposal sites. Even in such areas, significant exposure to contaminants in soil is unlikely in the absence of windblown dust, active digging, or migration of contaminants from soil into groundwater. As a result, soil contamination usually presents a low risk to human health.

(U) Oil pipeline sabotage has caused the loss of millions of gallons of crude oil and subsequent contamination of soil and water around pipelines, particularly in the northeast, in Antioquia and Arauca Departments.

(U) The United Nations Food and Agriculture Organization (FAO) and the Colombian Ministry of the Environment have estimated that 500 tons of obsolete pesticides are stored on sites throughout Colombia. Pesticides commonly used and frequently detected in the environment include DDT, DDE, endosulfan, hexachlorobenzene, toxaphene, methyl parathion, and ethyl parathion. Stockpiles can be found in both industrial and residential areas, and many sites do not meet basic safe storage requirements for hazardous materials. Leaking contents may contaminate soils and nearby water sources.

(U) Colombia routinely uses glyphosate, a broad-spectrum herbicide, to eradicate illegal crop production. Glyphosate is an approved U.S. EPA and U.S. Department of Agriculture (USDA) herbicide and completely biodegrades in soil; however, its use has caused controversy, especially between the governments of Colombia and Ecuador. Thus far, no scientific or medical evidence suggests that exposure to glyphosate causes significant adverse human health effects when applied according to the

manufacturer's instructions.

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(U) Water Contamination

(U) Many areas in Colombia use surface water as a source for drinking water supplies. However, surface water contamination with bacterial and/or chemical contaminants is common. Consumption of water contaminated with raw sewage or runoff containing fecal pathogens may cause a variety of acute enteric infections. See the [\(U\) Infectious Disease Risk Assessment: Colombia](#) for further details.

(U) Microbial contamination of surface water is the primary water contamination issue in Colombia. Untreated and incompletely treated domestic and industrial waste is commonly released directly into surface water. According to the Ministry of the Environment, water bodies with the highest pollution levels are the Bogotá, Cauca, Chicamocha, Magdalena, and Medellín Rivers; the Fuquene (Cundinamarca) and Sonso (Valle) lagoons; and the Luruaco (Atlántico) and Tesca (Bolívar) saltwater swamps. The city of Cartagena's uncollected raw sewage is discharged untreated into Cartagena Bay and the La Virgen in-city lake, and overflows contaminate local beaches. The Bogotá River receives wastewater and industrial discharges from the city; health authorities report more than 35,000 cases annually of illnesses related to water pollution.

(U) Attacks from insurgent groups have contributed to the pollution of waterways near oilfields and pipelines. In the past decade, about 2.9 million barrels of crude oil have been spilled throughout Colombia because of pipeline sabotage, in some cases contaminating local water sources. In 2003, at least 7,000 barrels of crude oil were spilled into the Cimitarra River, a drinking water source for the area, after Colombian rebels destroyed a section of the Caño Limón-Covenas pipeline. In August 2000, guerrillas dynamited the pipelines in the Departments of Arauca, Boyaca, and Casanare 22 times, leading to the loss of 150,000 barrels of crude oil.

(U) Pesticides, herbicides, fertilizers, and chemicals used in the planting and manufacture of illegal narcotics may also contaminate surface and groundwater resources in Colombia. These chemicals are routinely used without effective government regulation or consideration of environmental impact.

(U) Gold mines in northwest Colombia reportedly contribute to contamination of the Magdalena River with mercury and cyanide. For example, one of the largest gold mines in Colombia, the Santa Cruz Mine on the Mina Santa Cruz marsh in Bolívar Department, uses mercury to amalgamate gold from sediment, an operation that has resulted in uncontrolled releases of metallic mercury and cyanide into the environment. Mercury contamination in the lower Putumayo River, southeastern Amazonas Department, also may result from dredging vessels that extract gold from river sediments. Further information on mercury and cyanide levels released by these activities is unavailable.

(U) Short-term exposure to high levels of cyanide may cause acute health effects, including damage to the central nervous system and heart. Exposure to very high levels of cyanide can be fatal. Long-term exposure to lower levels of cyanide may cause delayed health effects, including damage to the central nervous system, reproductive system, and thyroid gland.

(U) Short-term exposure to high levels of mercury may cause acute health effects including damage to the nervous system and kidneys, and to developing fetuses. Long-term exposure to lower levels of mercury may cause similar delayed health effects due to accumulation of mercury in the body. These health effects generally are irreversible.

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(U) Hazardous Plants and Animals

(b)(3):50 USC 3024(i),(b)(6)

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(U) Appendix

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(U) Scope

(U) This baseline assessment is part of regular production analyzing potential risk to U.S. forces worldwide. It is not meant to imply planned troop deployment.

(U) The Environmental Health Risk Assessment (EHRA), which assesses environmental factors capable of adversely affecting the health of operational forces, assists in medical planning and decision-making for contingency operations. Additional country-specific (b)(3):10 USC 424 products are available on NIPRNET at (b)(3):10 USC 424 and on

Intelink at (b)(3):10 USC 424. Requests for additional information should be directed to AFMIC Operations Staff (b)(3):10 USC 424

(U) Making medical intelligence assessments on the likelihood and severity of adverse health effects from exposure to environmental contaminants is challenging because of the difficulty in obtaining accurate data, and the lack of a standardized assessment methodology. In an attempt to better support DoD's deployment exposure monitoring, health outcome surveillance, and operational risk management programs, the EHRA focuses on select air pollutants and air quality indicators, and levels and trends of contaminants in food, soil, and water.

(U) The Physical Environment section of the EHRA is provided as a general overview for basic planning purposes. Contact your local intelligence officer for more detailed information specific to your area of operation. Within the environmental media sections of the EHRA, information on specific contaminants is presented in order of human health significance, from most to least significant; if no order of significance has been assessed, the information is alphabetized.

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(U) Definition

(U) Extreme cold is defined as an average low temperature of at least minus 17°C (0°F) for at least three consecutive months.

(U) Extreme heat is defined as an average daily high temperature of at least 32°C (88°F) for at least three consecutive months.

(U) High altitude is defined as any elevation of land at or above 2,400 meters (8,000 feet) above sea level.

(U) Long-term refers to time periods longer than 14 days duration.

(U) Short-term refers to time periods less than or equal to 14 days duration.

(U) PM-10 refers to particulate matter with an aerodynamic diameter of 10 micrometers or less. Particulate matter in this size range may enter and remain within the respiratory system. Particles with a larger aerodynamic diameter are generally not able to enter the respiratory system.

(U) Maximum Contaminant Level (MCL). The highest level of a contaminant that is allowed (by the United States Environmental Protection Agency) in drinking water.

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(U) Administrative Notes

(U) Prepared by: (b)(3):10 USC 424,(b)(6)

(U) This report contains information as of 14 March 2007.

(U) This publication supersedes (U) Environmental Health Risk Assessment: Colombia, DI-1816-COL-05, dated 6 June 2005, which should be destroyed.

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