Report on Violations to the Right to Health and to a Safe Environment in Juanacatlán and El Salto, Jalisco, Mexico

The Santiago River rages.
Clouds of foam reach a height of 20 meters.
Those who walk across the bridge which joins the two towns, do so running.
Those who cross by car close their windows.
There are mountains of bubbles. The foam lifts off the river.
They are the size of pillows and they fly in the air.
The chemical clouds of foam are potent.
The surfaces of cars are stained.
Skin burns, it stings, rashes form and fingernails fall off.
Bubbles fall in the streets and children play with them.[1]

Executive Summary

The Santiago River is born in Lake Chapala, four kilometers south of the city of Ocotlán, and it flows through the municipalities of Juanacatlán and El Salto. Between the two main towns, there is a 20-meter waterfall which was once known as 'Mexico's Niagara'. However, this waterfall ceased to be a tourist site about three decades ago and, due to the fact that the Santiago River receives untreated industrial and municipal wastewater and is now one of the most polluted in the country, it has become a health risk for the residents of Juanacatlán and El Salto.

The municipalities of Juanacatlán and El Salto, Jalisco, are located just 35 kilometers from the city of Guadalajara, and together they have a population of more than 120,000, according to information from 2005. [2] In just the two main towns, the total population is 26,579 people; of these, 8,206 people live in the town of Juanacatlán and 19,794 in the town of El Salto.[3]

The industries which discharge into the Santiago before the Salto de Juanacatlán waterfall, are located in three main areas: the city of Ocotlán, the industrial corridor which starts at the Guadalajara Industrial Park and continues along the highway to El Salto and La Capilla, and the corridor installed along the Southern Ring Road of the Guadalajra Urban Area (GUA). According to the Discharge Inventory for the State of Jalisco, published by the Regional Office of the National Water Commission, there are 280 discharges, of which 266 flow into the Santiago River.[4] Of this effluent, 36.5% is derived from the chemical-pharmaceutical industry, 15% from

[1] Galindo, José, *Pueblos Veneno: El peligro que no se ve*. (Guadalajara: Red Radio Universidad de Guadalajara, 2003).
[2] According to the II *Conteo de Población y Vivienda 2005*, the population of the municipality of El Salto is 111,436, and that of Juanacatlán is 11,902.
[3] *II Conteo de Población y Vivienda 2005*. Instituto Nacional de Estadística, Geografía e Informática.
[4] AYMA Ingeniería y Consultoría, *Estudio de monitoreo y modelación de la calidad del agua de los Ríos Santiago y Verde del estado de Jalisco*, (Mexico: Comisión Estatal de Agua y Saneamiento (CEAS) Jalisco 2003) 4-18.

the food and beverage industry; the textile industry contributes 12.3%, followed by the cellulose (paper) and tequila industries.[5]

Other important industrial sectors with presence in the area include the non-metallic minerals, metalworking, electrical and electronics industries. The specific plants which contribute the most significant quantities of wastewater include: Celanese Mexico, Ciba Specialty Chemicals, IBM of Mexico, Nestlé Company, Industrias Ocotlán and Harinera de Maíz de Jalisco. While some of the major industries have wastewater treatment plants, the majority do not treat their effluent and, even where there exists wastewater treatment, studies indicate that the effluent still fails to comply with national standards.[6]

In terms of municipal discharges, in the El Ahogado sub-basin the Santiago River receives approximately 815 liters per second of raw municipal wastewater (untreated) from the southern part of the GUA, which reaches the Santiago River via the El Ahogado and Arroyo Seco canals.[7]

i. Environmental Degradation

Several studies have been carried out to calculate the Water Quality Index (WQI), a value on a scale of 0 to 100 which indicates the level of pollution of a body of water. It is obtained from the individual Quality Indicators for eighteen parameters considered of importance (dissolved oxygen, coliform bacteria, oil and grease, biochemical oxygen demand, detergents, methylene blue active substances, etc...).[8] It is used to determine whether a body of water is fit for a specific use: drinking water supply, recreation, fishing, industry or agricultural use.

A study undertaken in 2001 indicates that the WQI for the Santiago River in El Salto at the bridge which joins the two towns, is between 38.09 and 31.69. [9] With this value, the water is unacceptable as a source for drinking water supply, recreational use is possible only without contact with the water; the water requires treatment for the majority of industries and only very resistant organisms can survive in these waters.

In addition, the same study from 2001, compared results against the Water Quality Guidelines from the Federal Water Rights Law (Ley Federal de Derechos en Materia de Agua – 2003) which sets parameters for the following uses: source for drinking water supply, agricultural irrigation and protection of aquatic life – fresh water. The high level of pollution can be observed from the analyses,[10] specifically a low level of dissolved oxygen, indicating asphyxiation of the body of water, high levels of dissolved solids, the presence of grease and oil, high levels of ammonia and phosphates, concentrations of lead and zinc above the limits for the protection of aquatic life, and unacceptable levels of fecal coliforms (110 times above the limit).

In February 2004, the laboratory Grupo Microanálisis S.A. de C.V. undertook a study of the waters of the Santiago River. It is important to highlight from the study results that the samples were above permissible limits (NOM-001-ECOL-1996, NOM-003-ECOL-1997[11]) for Biological Oxygen Demand (BOD) in a range of from 100 to 1,000 %. Further, the samples were above permissible limits for direct contact (NOM-003-ECOL-1996) for the parameter Grease and

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[5] AYMA Ingeniería y Consultoría 4-19.
[6] AYMA Ingeniería y Consultoría 4-44.
[7] AYMA Ingeniería y Consultoría 4-7.
[8] Secretaría de Medio Ambiente, Recursos Naturales y pesca (SEMARNAP), *Estadísticas de Medio Ambiente*, Mexico 1999, (Mexico: SEMARNAP, 1999).
[9] Gallardo Valdez, Juan y Laure Vidal, *Estudio de la contaminación del agua y de los sedimentos del Río Grande Santiago desde su nacimiento hasta la Presa Santa Rosa* (Guadalajara: Centro de Investigación y Asistencia Tecnológica y Diseño del Estado de Jalisco (CIATEJ), 2001), 28.
[10] Gallardo and Vidal, 53.
[11] Official Mexican Standard, NOM-001-ECOL-1996, Which establishes the maximum permissible limits of contaminants in discharges of residual waters to national watercourses. Official Mexican Standard, NOM-003-ECOL-1997, Which establishes the maximum permissible limits for contaminants in treated wastewater which is reused in public services.

Oil in a range of from 25 to 150 %; the levels of Coliforms represent an open air source of infections along the route where the waters sampled flow and the samples exceeded permissible limits (NOM-127-SSA1-1994[12]) for Methylene Blue Active Substances (surfactants) in a range of from 20 to 400%.

In the *Monitoring and Modeling of Water Quality Study in the Santiago and Verde Rivers*, undertaken by AYMA Ingeniería y Consultoría at the request of the State Water and Sanitation Commission (CEAS) Jalisco, nineteen water quality parameters were evaluated in the rivers during the period from November 2002 to August 2003. For this study, the legislation from several countries was consulted and a classification was determined for surface waters based on the concentrations of BOD5, COD and ammonia nitrogen. For the El Ahogado Canal and the Santiago River in El Salto-Juanacatlán, the river is classified as 'Severely Contaminated' both during the dry season and the rainy season.[13]

In 2004, the University Centre for Exact Sciences and Engineering (CUCEI) of the University of Guadalajara undertook a study entitled *Characterization of the sediments of the Verde and Santiago rivers*. One point where samples were taken was the Salto de Juanacatlán waterfall. These samples were analyzed to determine the presence of organic compounds. At the waterfall, benzene, chlorinated benzenes and substituted benzenes, among others, were found in the waters.[14] Benzene is a carcinogenic substance, recognized as such by the International Agency for Research on Cancer (IARC).[15] This same study detected the presence of organic compounds in the sediments of the Santiago. The presence of benzene, toluene, xylene, and furans, among other compounds, were detected at the Salto de Juanacatlán site.[16] These substances are of known toxicity: benzenes and furans are recognized carcinogens, toluene affects the nervous system, and both toluene and xylene can affect the kidneys.[17] At the same time, the study concludes that the heavy metals lead, chromium, cobalt, mercury and arsenic are present in Santiago River sediments.

Violations of Standards

Several studies have been undertaken to analyze water quality for discharges to the Santiago River and its tributaries, based on which violations of the standard NOM-001-ECOL-1996 (establishing the **maximum permissible limits of contaminants in discharges of residual waters to national watercourses**) have been detected.

The study by AYMA Ingeniería y Consultoría for CEAS, characterizes the discharges of untreated municipal wastewaters in the El Ahogado canal. The results indicate that this discharge exceeds the limits of the standard NOM-001-ECOL-1996 for Biological Oxygen Demand (BOD5) and Total Suspended Solids. In the same study, water quality sampling is presented for the wastewaters discharges of four industries in the region. The four companies are Nestlé, Celanese/ Industrias Ocotlán, Cydsa Crysel and the hog farm in Tololotlán, where all but the last one have treatment plants. The results indicate that none of the discharges complies with the maximum permissible limits for contaminants (monthly average) regulated by the Official Mexican Standard (NOM-001-ECOL-1996), in terms of the parameters: biological oxygen demand (BOD5), total nitrogen and fecal coliforms.

ii. Health Impacts

[12] Official Mexican Standard NOM-127-SSA1-1994, Environmental health. Water for human use and consumption. Permissible quality limits and treatments which drinking water should undergo.
[13] AYMA Ingeniería y Consultoría, 5-62.
[14] State Water and Sanitation Commission (CEAS)/ University of Guadalajara – CUCEI, *Estudio para la caracterización de los lodos de los ríos Verde y Santiago*, (Guadalajara: CEAS, 2004), 2-50.
[15] http://monographs.iarc.fr/ENG/Classification/crthgr01.php.
[16] State Water and Sanitation Commission (CEAS)/ University of Guadalajara – CUCEI, 2-50.
[17] Agency for Toxic Substances and Disease Registry (ATSDR), http://www.atsdr.cdc.gov/es/.

In the previous section, we have established the severe contamination of the Santiago River in the area of the towns of El Salto and Juanacatlán. This pollution, beyond its impacts for aquatic flora and fauna, affects human health. Local doctors cite an increase in the incidence of different diseases, including leukemia, spontaneous abortions and congenital birth defects, among others.[18] However, in order to scientifically establish the cause and effect relationship between these health problems and the river pollution - especially for multi-factorial diseases such as cancer - epidemiological studies, which are long-term and involve elevated costs, are required.

Research done for this report indicates that, in the municipality of Juanacatlán, the main cause of death in 2005 was respiratory diseases and the second cause was different types of cancer.[19] The available health statistics do not permit us to reach definitive conclusions, however, the testimonies gathered alert us as to the gravity of the problem.[20]

In these cases, the application of the precautionary principle – included in Principle 15 of the Rio Declaration on Environment and Development (1992) is of the utmost importance. Further, when we speak of health risks, it is essential to recognize that children are more vulnerable to environmental toxins. This vulnerability is due to several factors: children drink more water, consume more food and breathe more air per kilogram of body weight than adults.

In the Santiago River, gases and odors are dispersed as the water flows over the waterfall, among which hydrogen sulfide (H_2S) stands out. Hydrogen sulfide is a colorless, poisonous and flammable gas which smells like rotten eggs.[21] According to the Agency for Toxic Substances and Disease Registry (ATSDR), of the Centers for Disease Control and Prevention (CDC) in the United States, exposure to low concentrations of hydrogen sulfide can cause: irritation to the eyes, nose or throat, and difficulty breathing for people with asthma. Exposure to low levels for long periods of time may cause fatigue, headaches, poor memory, irritability, dizziness and poor motor function. Also, people with cardiac or nervous system problems are more susceptible to the effects of this acid.[22] At higher concentrations, this substance can cause pulmonary edema, asphyxia, respiratory paralysis and death.[23]

Two studies have been undertaken which analyze the presence of hydrogen sulfide in this area and its impacts on the health of the population. From December 2004 to March 2005, Juan Gallardo Valdez monitored the presence of hydrogen sulfide in the urban areas of both El Salto and Juanacatlán. Study results indicate levels of H_2S between 0 and 7 ppm and, during the majority of the period included in the study, levels remained between 2 and 4 ppm.[24] This exposure of the general population to hydrogen sulfide, is an unforeseen event for which safe exposure limits have not been studied. Parameters only exist for working environments. In this regard, the Environmental Protection Agency (EPA), the American Conference of Governmental Industrial Hygienists (ACGIH) and the Occupational Safety & Health Administration (OSHA), all of the United States, indicate a threshold limit value (TLV), in other words the maximum allowable concentration in air for a certain substance for a defined period of time (8 hours or a 40 hour working week), of 10 ppm. However, these same institutions specify an average concentration in 8 hours without adverse effects (TWA) of 2 ppm.[25]

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[18] Personal communication, August 2003.
[19] See Appendix 2.
[20] See, for example, the documentary video produced by the Instituto Mexicano para el Desarrollo Comunitario, A.C., *Salto de Juancatlán: Donde el agua envenena...*, (Guadalajara, Jalisco: IMDEC, A.C., 2005).
[21] Agency for Toxic Substances and Disease Registry (ATSDR), http://www.atsdr.cdc.gov/es/.
[22] Gallardo Valdez, Juan, *Estudio Ambiental del Ácido Sulfhídrico como contaminante del aire en las comunidades de Juanacatlán y El Salto, Jalisco, 2004-2005*, (Mexico: University of Guadalajara, Masters Thesis, 2005) 25, 102.
[23] Gallardo, 25.
[24] Gallardo, 1.
[25] Gallardo, 19.

It is essential to emphasize in the case of the exposure in the towns of El Salto and Juanacatlán that, for practical purposes, the general population should not be exposed to any concentration of this toxin, least of all elderly people and children who, due to their physiological conditions, are more susceptible to suffer health impacts, triggered or brought about by the inhalation of this highly-irritating and toxic gas.

Near the waterfall, the elementary schools Blanco River Martyrs and María Guadalupe Ortiz, with morning and afternoon sessions, are both on El Salto side of the river. Located 100 meters from the waterfall, Blanco River Martyrs has 595 students, while María Guadalupe Ortiz, located 270 meters from the waterfall, has 962 students. The proximity of these two schools to the waterfall implies serious risks for the health of the students.

In a survey of 100 homes in the study area, where 166 children between the ages of 6 and 14 reside, it was found that 39% of the children regularly suffered from some illness. The most common illnesses presented among these children were: 49.23% respiratory illnesses, 44.61% throat infections, 4.61% skin problems, and 1.5% other types of illness. Symptoms were also reported, including headaches, nausea, throat irritation, heat rashes and conjunctivitis.[26] Gallardo concludes that: "The health effects mentioned by the population interviewed suggest that there is a constant exposure to low levels of H_2S which is affecting their health".[27]

There are studies by Dr. Kaye Kilburn, of the School of Medicine of the University of Southern California (USC), and by Dr. Marvin Legator of the Faculty of Medicine at the University of Texas, who have investigated the effects of chronic low-level exposure to H_2S. Kilburn encountered symptoms such as headaches, nausea, vomiting, depression, changes in character and difficulty breathing, and concludes that: "Hydrogen sulfide poisons the brain and the poisoning is irreversible… H_2S is dangerous whenever you can smell it".[28] Legator, an environmental toxicologist, states that there is a "tremendous information gap" with respect to the chronic effects of low levels of H_2S, a substance which he describes as a "potent neurotoxin".[29]

The second study undertaken in the area is an ecological - observational epidemiological study of two school groups between the ages of 8 and 11, including children of both sexes. The first group, A (n=50), is exposed to environmental contamination in the area with the highest concentration of hydrogen sulfide; and the second group, B (n=50), which is not exposed to the environmental contamination being studied, during the period from September 2005 to June 2006.[30]

In the study results, clinical epidemiological differences between both groups are apparent. The most significant differences are mentioned in order of frequency. With respect to the **respiratory apparatus**, the exposed group presents an average peak expiratory flow rate of 1,500 cc versus 2,000 cc for the non-exposed group. Also, **oxygen saturation** was lower in group A, in the range of 90 to 95%, versus 95 to 99% for group B. With respect to symptoms, group A presented **coughs** 45% of the time versus 23% for group B. With regard to **rhinorrhea or nasal secretion**, for group A it was present 59% of the time versus 21% for group B. For symptoms related to the **neurological apparatus**, greater irritability is observed in the children exposed, at a rate of 80% versus 18% for the non-exposed group. **Headaches** were present 51% of the time in group A, versus 21% of occasions for group B. For symptoms related to the

[26] Gallardo, 95.
[27] Gallardo, 101.
[28] Cited in Schindler, Dana, Survey of Accidental and Intentional Hydrogen Sulfide (H2S) releases causing Evacuations and/or Injury in Manistee and Mason Counties from 1980 to 2002, (Michigan: Michigan Environmental Council, 2002), 5. http://www.mecprotects.org/oilaccidents2.pdf.
[29] Morris, Jim, "New alarm over hydrogen sulfide: Researchers document lasting damage to human nervous system" in Houston Chronicle, (November 12, 1997).
[30] Parra Cervantes, Francisco Javier, *Signs, symptoms and concentration of urinary, associated with exposure to hydrogen sulfide, as the main atmospheric pollutant, in school children in Juanacatlán and El Salto, Jalisco* (Guadalajara: UNAM and IMSS, 2006).

ophthalmological apparatus, **irritative conjunctivitis** was present 41% of the time in the exposed group versus 4% of the time for group B. In terms of general symptomology, **fatigue** could be observed 38% of the time in group A, while only 8% of the time in group B. Finally, in terms of **doctor's visits** due to infectious respiratory illness, resulting in absence from school, the rate was 37% for the exposed group versus 13% for the non-exposed group.

For this same study, monitoring of the atmospheric concentrations of hydrogen sulfide was undertaken on a monthly basis in the area near both schools in El Salto, during the entire school year. Important variations in the levels of H_2S were observed, related to the temperature and the prevailing winds at the time. It could be observed that the months with the highest levels were: June with 6.10 ppm, May with 3.80 ppm, December with 3.40 ppm, and February with 2.80 ppm.

In addition to the exposure to hydrogen sulfide, the proliferation of mosquitoes, due to the stagnation of the waters behind the dam wall beside the bridge, causes discomfort for the population and increases the risk of contracting diseases transmitted by this vector, such as dengue and malaria, among others. Living in the conditions described in this report, where the Santiago River has been transformed from a tourist attraction and driver of economic development in the region to a permanent source of foul odors, disease and parasites, is a factor causing chronic stress for the affected population.

iii. National and International Legal Framework

a. Right to a Safe Environment

As demonstrated by the evidence provided, the following legal instruments have been violated.

National Laws

- The Political Constitution of the United Mexican States, articles 4 and 133.
- The General Law of Ecological Balance and Environmental Protection (LGEEPA), articles 1° and 15, 117 section II, 133 and 170.
- The Political Constitution of the State of Jalisco, article 4º.
- The State Law of Ecological Balance and Environmental Protection, article 9º, section X.
- The National Waters Law (LAN), articles 29, 44, 88 BIS, 91 BIS and 96 BIS.

International Human Rights Law

- The Additional Protocol to the American Convention on Human Rights in the area of Economic, Social and Cultural Rights (Protocol of San Salvador), article 11.
- The Declaration in Mexico on Environmental Preservation in Latin America and the Caribbean.
- The International Covenant on Economic, Social and Cultural Rights, article 12.1.
- The Declaration on Social Progress and Development, article 25.
- The Declaration of the United Nations Conference on the Human Environment adopted in Stockholm, paragraphs 1, 2, 3, 6 and 7, and Principle 6.
- The Rio Declaration on Environment and Development, Principles 10, 13, 15, and 16.

b. Right to Health

The population's right to health, recognized in the instruments mentioned below, has been and continues to be violated in these towns.

National Laws

- The Political Constitution of the United Mexican States, article 4.
- The General Health Law, articles 2º, 3 and 27.

International Human Rights Law

- The Additional Protocol to the American Convention on Human Rights in the area of Economic, Social and Cultural Rights (Protocol of San Salvador), article 10.
- The American Declaration on the Rights and Duties of Man, article XI.
- The International Covenant on Economic, Social and Cultural Rights, articles 2 and 12.
- General Comment No. 14 on the right to health, of the Committee on Economic, Social and Cultural Rights.
- General Comment No. 15 on the right to water, of the Committee on Economic, Social and Cultural Rights.
- The Universal Declaration of Human Rights, article 25.

iv. Recommendations

General:

The municipal, state and federal authorities must take urgent and immediate precautionary measures to restore the environmental and health conditions in the municipalities of Juanacatlán and El Salto.

Specific:

1. Sanitation

That in a coordinated manner the competent municipal, state and federal authorities:

- Implement a comprehensive sanitation program for the Santiago River, including all tributaries and discharges and the totality of the El Ahogado sub-basin.
- Construct the necessary wastewater treatment plants for industrial effluent which is discharged directly into the Santiago River or its tributaries.
- Treat the sludge generated in the treatment plants, both industrial and municipal, and/or confine it in accordance with the law.
- Implement programs to control the sale, use and application of agrochemicals in the Santiago River basin.

2. Monitoring

- Establish a permanent inter-institutional water quality monitoring program for the Santiago River.
- Monitor all discharges of industrial effluent which reach the Santiago River and, where there are violations of environmental standards, take the actions indicated by law.
- Establish a permanent inter-institutional air quality monitoring program for the towns of El Salto and Juanacatlán, in order to monitor the presence and concentration of H_2S and other toxic contaminants identified.

3. Protecting Public Health

- Implement the necessary urgent actions to attend to the sanitary emergency in El Salto and Juanacatlán.
- Undertake the necessary epidemiological studies to determine the health impacts of the chronic and involuntary exposure to H_2S and other toxic contaminants in the area and their relation with diseases present in the population.
- Establish a program to evacuate the population in the event of a health emergency due to the emanation of hydrogen sulfide and other toxic gases, with special attention to the effects on children.
- Undertake the necessary studies to determine the effects of chronic stress on the population of the towns of El Salto and Juanacatlán resulting from living conditions in this severely contaminated environment.

4. Establishment of Environmental Parameters

- Pass the necessary standards in order to establish the maximum permissible limits for hydrogen sulfide in open spaces and to evaluate the health risks for populations permanently exposed to said gas.
- Update environmental and health regulations, standards and laws, especially for water quality, in order to ensure the preservation of the environment and human health.

5. Legal Responsibility

- Determine the responsibility of public and/or private institutions, owing to their actions and/or omissions in terms of environmental and/or health law, as evidenced in this report, taking into account, in each case, the reparation of damages in benefit of the population and, particularly, of the affected parties.

For further information, please contact:
Instituto Mexicano para el Desarrollo Comunitario (IMDEC), A.C.
Pino 2237-A, Col. Del Fresno
Guadalajara, Jalisco
Telephone No. (52) 33 3810 45 36, ext. 113 or 116
incidencia@imdec.net or cindy@imdec.net
www.imdec.net

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