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NAFTA and the Environment: Dealing with Abnormally High Birth Defect Rates among Children of Texas-Mexico Border Towns Symposium - The Environment and the United States-Mexico Border - Comment.

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NAFTA AND THE ENVIRONMENT: DEALING WITH ABNORMALLY HIGH BIRTH DEFECT RATES AMONG CHILDREN OF TEXAS-MEXICO BORDER TOWNS

KELLY L. REBLIN

"Bush and Reilly, you can't hide. We charge you with genocide."[1]

I. INTRODUCTION

Currently, along the 868-mile Texas-Mexico border[2] thousands of young women live in fear as deadly birth defects with unknown causes threaten the lives of their precious unborn children.[3] Teresa Salazar has experienced this terror first-hand.[4] In the spring of 1991 she aborted her child after a sonogram revealed that the fetus had no brain.[5] A total of ninety cases of this birth defect, called anencephaly,[6] were reported in the fourteen Texas border counties between 1986 and 1991, the "epidemic"

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1. Diane Lindquist, *Environment Is Key Trade-Pact Issue, 'Wild Card' Issue Could Doom NAFTA*, SAN DIEGO UNION-TRIB., June 27, 1992, at D1. This chant, referring to the self-proclaimed "environmental president," George Bush, and the Administrator of the Environmental Protection Agency, William Reilly, echoed throughout a border environmental summit in San Diego as United States and Mexican officials reaffirmed both governments' commitment to clean up pollution along the United States-Mexico border. *Id.* Opponents feared that congressional approval of NAFTA would encourage the growth of industry along the border, lead to rising levels of pollution, and result in increased cases of birth defects among children born along the border. *Id.*

2. *Environmental Infrastructure*, BORDER INFRASTRUCTURE (Office of the Governor, Austin, Tex.), Summer 1993, at 1.

3. *See, e.g.*, Dan Fagin, *Border Town Mystery: Why Are So Many Brownsville Babies Being Born Brainless?*, NEWSDAY, July 12, 1992, at 5 (explaining that women in south Texas are giving birth to children with anencephaly at rate higher than anywhere else in United States and many third world countries); John M. McClintock, *Texas City Alarmed by Outbreak of Babies Born Without Brains*, BALTIMORE SUN, Jan. 20, 1992, at A1 (explaining possible causes of anencephaly as lack of folic acid in mothers' diets, parental exposure to solvents, or genetic predisposition of parents); *Anencephaly in Texas Border Counties 1986-1991*, DISEASE PREVENTION NEWS (Texas Dep't of Health, Austin, Tex.), Sept. 20, 1993, at 1 (stating that rate of anencephaly, which is type of neural tube defect, was four times national average in Cameron County, Texas for years 1986 through 1991).

4. *See* David Grogan et al., *The Baby Killer*, PEOPLE, Sept. 27, 1993, at 86, 86 (describing Teresa Salazar's torment at becoming pregnant again after birth of first child with anencephaly); *cf.* Karen Hastings, *Link to Rare Birth Defects Elusive, Pace of Probe Angers Border Community*, HOUSTON CHRON., May 17, 1992, at A1 (discussing mothers' fears of giving birth to children without brains); James Pinkerton, *Cause of Border Birth Defects Remains a Mystery, New Evidence Finds Cases Show Trend, Not Epidemic*, HOUSTON CHRON., June 30, 1992, at A11 (explaining that mothers living along border with anencephalic infants are anxious for answers about cause of birth defects).

5. David Grogan et al., *The Baby Killer*, PEOPLE, Sept. 27, 1993, at 86, 86.

6. *See* David A. Stumpf et al., *Special Article: The Infant with Anencephaly*, 322 NEW ENG. J. MED. 669, 669 (1990) (defining anencephaly as "a congenital absence of a major portion of the brain, skull, and scalp, with its genesis in the first month of gestation"). Anencephaly is one of the most common types of neural tube defects. Ronald J. Lemire, *Neural Tube Defects*, 259 JAMA 558, 558 (1988).

period of this crisis.[7] In its aftermath, this human tragedy left behind feelings of guilt and fear on the part of the mothers[8] and raised many questions as to how this calamity occurred.[9]

Officially, the cause of these birth defects has yet to be determined;[10] however, researchers and residents along the Texas-Mexico border have blamed poor environmental conditions caused by the maquiladora industry and inadequate sewage facilities.[11] The Texas Department of Health

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7. *Anencephaly in Texas Border Counties 1986-1991*, DISEASE PREVENTION NEWS (Texas Dep't of Health, Austin, Tex.), Sept. 20, 1993, at 1, 1-3.

8. *See* Karen Hastings, *Link to Rare Birth Defects Elusive, Pace of Probe Angers Border Community*, HOUSTON CHRON., May 17, 1992, at A1 (quoting Salazar as saying, "When this happened I thought it was somehow my fault. But as the months passed, I began to hear that there were other children."); Dan Meyers, *Valley Population Is Certain, Baby Deaths Still a Mystery*, BROWNSVILLE HERALD, Sept. 5, 1993, at A16 (describing moral dilemma of Catholic mothers who choose to abort their fetuses afflicted with anencephaly rather than give birth to children that could not survive). One father whose daughter was born with spina bifida, another common form of neural tube defect, stated, "When she was born with this sack of nerves hanging off her back, we were scared that something evil had befallen us. Then we heard from the doctors about these other cases—these babies without brains—and we thought: we are living through a truly great tragedy." John M. McClintock, *Texas City Alarmed by Outbreak of Babies Born Without Brains*, BALTIMORE SUN, Jan. 20, 1992, at A1.

9. *See Link Between Hazardous Waste Dump, Birth Defects Targets of Government Probe*, 17 Int'l Envtl. Rep. (BNA) No. 2, at 68, 70 (Jan. 27, 1994) (reporting that disease experts have not been able to locate cause of increased incidences of birth defects in cities along United States-Mexico border). *See generally* Karen Hastings, *Link to Rare Birth Defects Elusive, Pace of Probe Angers Border Community*, HOUSTON CHRON., May 17, 1992, at A1 (indicating that it is unlikely that Texas officials will aggressively investigate industrial contamination for fear of political ramifications with NAFTA and Mexican border industry).

10. *See* TEXAS DEP'T OF HEALTH, AN INVESTIGATION OF A CLUSTER OF NEURAL TUBE DEFECTS IN CAMERON COUNTY, TEXAS 31 (1992) (concluding that test results did not uncover differences between case and control groups in studies to determine cause of cluster of birth defects in Cameron County, Texas).

11. *See* Diego Ribadeneria, *Trade Pact's Hidden Dirt: On Mexican Border, Firms Leave Perilous Filth*, BOSTON GLOBE, Mar. 21, 1993, at 77 (describing health official's suspicions of link of chemicals used in maquiladoras to anencephaly); *NAFTA Boom Is Threatening Border Ecology*, CHRISTIAN SCI. MONITOR, July 14, 1993, at 9 (reporting that member of Texas Center for Policy Studies blames environmental causes for high number of cases of anencephaly); *see also* Neil Orman, *Group Ranks Rio Grande As the Nation's Most Endangered River*, HOUSTON CHRON., Apr. 21, 1993, at A2 (reporting that environmental group called American Rivers attributed health problems, such as anencephaly, to polluted state of Rio Grande River in Brownsville-Matamoros area); *cf.* Jennifer K. Wilson, Comment, *Ecodumping: A Compromise to the Conflict of International Free Trade and Environment Responsibility*, 42 KAN. L. REV. 709, 709 (1994) (claiming that increase in birth defects is one result of environmental degradation); *A Clean America, Will People Pay the Price?*, U.S. NEWS & WORLD REP., Feb. 7, 1977, at 40, 40 (predicting that dramatic rise in chemical use that began in early 1960s may result in epidemics of chemical-related illnesses in next few decades).

and the Centers for Disease Control investigated the outbreak of anencephaly and recommended implementation of a state-wide birth defects surveillance system.[12] Subsequently, in 1993, the Texas Legislature

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12. *See* TEXAS DEP'T OF HEALTH, AN INVESTIGATION OF A CLUSTER OF NEURAL TUBE DEFECTS IN CAMERON COUNTY, TEXAS 33 (1992) (suggesting implementation of state-wide surveillance system for birth defects and calling for coordination of similar surveillance activities in Mexico); Lisa Richwine, *Ortiz, De La Garza Reintroduce Birth Defects Registry Bill*, STATES NEWS SERVICE, Mar. 10, 1993, at A1 (suggesting that Birth Defects Registry could extend Centers for Disease Control study and authorize funding for educational information on prevention of birth defects). Texas Department of Health and Centers for Disease Control investigators visited Cameron County to conduct a joint case-control study on 28 cases in which the women gave birth to children with anencephaly. *Id.* at 5. Questionnaires were administered to the case and control mothers that focused on nutritional, occupational, medical, and environmental factors. *Id.* Blood and urine specimens were analyzed for "(1) the presence of aflatoxin in the urine; (2) organic compounds (phenolic compounds and phenyglyoxylic acid); (3) inorganic ions (lead, mercury, cadmium, arsenic, selenium, zinc); and (4) red blood cell folate." *Id.* at 6. The results of the study led researchers to recommend the implementation of a state-wide birth defects surveillance system, follow-up epidemiologic studies, intervention/prevention efforts, and environmental monitoring studies. *Id.* at 33-34. *But cf.*, *Coalition Criticizes Investigation of Birth Defects in Brownsville, Texas and Calls for Immediate Action to Address Environmental Crisis July 2, 1992* (calling study conducted jointly by Texas Department of Health and Centers for Disease Control limited and narrow in focus), *in* COALITION FOR JUSTICE IN THE MAQUILADORAS, THE ISSUE IS HEALTH: TOXIC SAMPLINGS, ENVIRONMENTAL CONDITIONS AND HEALTH CONCERNS ALONG THE U.S./MEXICO BORDER 28 (1993); Abriela Flores, *Es "Limitada" Investigación de Anencefalia*, BRAVO, July 4, 1992, at 1 (stating that investigators did not look at important environmental factors when examining causes of anencephaly); Karen Hastings, *Link to Rare Birth Defects Elusive, Pace of Probe Angers Border Community*, HOUSTON CHRON., May 17, 1992, at 1 (reporting statement of professor of genetics at Texas A&M University that CDC and Texas Department of Health are not aggressively searching for information because "they have serious concerns that this has political ramifications (for the free trade agreement)"). The Coalition for Justice in the Maquiladoras criticized the study for (1) failing to investigate significant environmental factors that may be contributing influences in causing birth defects; (2) utilizing a 20-year-old standardized questionnaire while interviewing the mothers of the anencephalic children, which was not designed to take into consideration the cultural differences of the border population; and (3) excluding one-half of the epidemiological study population by not surveying Matamoros families afflicted with the birth of an anencephalic child. *Coalition Criticizes Investigation of Birth Defects in Brownsville, Texas and Calls for Immediate Action to Address Environmental Crisis July 2, 1992 in* COALITION FOR JUSTICE IN THE MAQUILADORAS, THE ISSUE IS HEALTH: TOXIC SAMPLINGS, ENVIRONMENTAL CONDITIONS AND HEALTH CONCERNS ALONG THE U.S./MEXICO BORDER 28 (1993). The Coalition called for a comprehensive investigation in the Brownsville/Matamoros area and insisted on the implementation of an immediate action plan to reduce pollution and clean up the contamination while waiting for the study's completion. *Id.* The Coalition for Justice in the Maquiladoras is a "tri-national coalition of religious, environmental, labor, Latino, and women's organizations that seeks to pressure U.S. transnational corporations to adopt socially responsible practices within the maquiladora industry, to ensure a safe environment along the U.S./Mexico border, safe work conditions inside the maquila plants, and

enacted the Texas Birth Defects Act.[13]

Progress in determining why there is an increased number of children afflicted with neural tube defects along the border has been slow.[14] Citizens and researchers living and working along the border hope that programs established through the Texas Birth Defects Act will soon begin to offer solutions.[15] In the meantime, more women along the border experience the tragedy of giving birth to brainless babies.[16]

This Comment examines the outbreak of deadly birth defects along the Texas-Mexico border, discusses the possible causes of this outbreak, and suggests a number of solutions. Part II of this Comment discusses what many suspect to be the main cause of this tragedy—pollution by the maquiladora industry. Part II also reviews attempts by the United States and Mexico to create adequate environmental regulations for the border region. Part III presents the tragedy at the border from a medical perspective and explores other possible causes of neural tube defects. Finally, Part IV proposes solutions to reduce the probability that children living along the border will suffer similar fates.

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a fair standard of living for the industry's workers." COALITION FOR JUSTICE IN THE MAQUILADORAS, 1993 ANNUAL REPORT 4 (1994).

13. TEX. HEALTH & SAFETY CODE ANN. §§ 87.001-.065 (Vernon Supp. 1996). Many states had enacted similar legislation prior to the Texas statute. *E.g.*, CAL. HEALTH & SAFETY CODE § 10806 (Deering 1995); FLA. STAT. ANN. §§ 411.201-.232 (West 1993); IOWA CODE ANN. §§ 136A.1-.7 (West 1989); KY. REV. STAT. ANN. §§ 211.651-.670 (Baldwin 1995); MICH. STAT. ANN. § 14.15(5717) (Callaghan 1995); NEB. REV. STAT. §§ 71.645-.648 (1994); N.J. STAT. ANN. § 26:8-40.21 (West 1987); VA. CODE ANN. §§ 32.1-69.1 (Michie Supp. 1995); WASH. REV. CODE ANN. § 70.58.320 (West 1992); W. VA. CODE § 16-5-12a (1995); WIS. STAT. ANN. §§ 253.12-.13 (West Supp. 1995); *see* Laura Beil, *State Birth Defect Registry May Be Operating by '94*, DALLAS MORNING NEWS, Aug. 19, 1993, at A36 (noting that many states have established some type of birth defect monitoring system).

14. *See* Gaynell Terrell, *Tragic Puzzle Grips Families on the Border*, HOUSTON POST, May 19, 1992, at A1 (claiming that official statistics may not correspond to number of people actually affected, thereby causing delay in adequately ascertaining full effects of neural tube defects tragedy).

15. *Cf. Anencephaly in Texas*, DISEASE PREVENTION NEWS (Texas Dep't of Health, Austin, Tex.), June 26, 1995, at 2 (indicating that Texas Birth Defects Act establishes Birth Defects Registry and noting that Texas Birth Defects Monitoring Division will conduct investigations involving clusters of birth defects).

16. *See Another Cluster of Brain-Defective Infants Born on Border*, AUSTIN-AMERICAN STATESMAN, June 10, 1995, at B3 (describing largest cluster of anencephaly cases since 1991 Cameron County cluster); *see also* Thaddeus Herrick, *Rash of Brain Defects in Babies Probed, Six Infants in Eagle Pass, Piedras Negras Affected*, HOUSTON CHRON., June 10, 1995, at A33 (noting that in recent four-month period, six more babies were born with anencephaly).

II. General Background: The Maquiladora Industry and United States-Mexico Environmental Agreements

The American Medical Association recently characterized the Texas-Mexico border region as "a virtual cesspool and breeding ground for infectious disease."[17] Many researchers, politicians, and citizens blame the poor environmental practices of the border's maquiladora[18] industry for the higher than normal rates of neural tube defects along the Texas-Mexico border in the early 1990s.[19] The maquiladora industry pumps 46 million liters of raw sewage into the Tijuana River daily, and an additional 76 million and 84 million tons are pumped daily into the New River and Rio Grande River, respectively.[20] However, this situation may change as a result of the joint efforts of Mexico and the United States to increase awareness of pollution problems and punish violators who disregard newly implemented environmental regulations.[21]

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17. Council on Scientific Affairs, *A Permanent U.S.-Mexico Border Environmental Health Commission*, 263 JAMA 3319, 3319 (1990); *see* Jeffrey A. Mello, *The Environmental Cost of Free Trade*, Bus. & Soc'y Rev., Fall 1994, at 18, 23 (calling Rio Grande "a drain for pesticides and cancer-causing industrial solvents and a toxic waste dump with over 100 million gallons of raw sewage pumped into it daily"). In 1991, researchers from the National Toxic Campaign Fund took samples outside of factories along the United States-Mexico border and released a scathing report which stated that "[t]he conditions observed in Matamoros were some of the most repugnant conditions that the researchers have ever seen." James Pinkerton, *Living on the Edge: Environmental Concerns Take Root Along the Border*, Houston Chron., Oct. 20, 1993, at A1 (quoting National Toxic Campaign Fund report).

18. *See, e.g.*, U.S. Envtl. Protection Agency (EPA) & Secretaria de Desarrallo Urbano y Ecologia (SEDUE), Integrated Environmental Plan for the Mexican-U.S. Border Area (First Stage, 1992-1994) II-8-9 (U.S. Gov't Printing Office 312-014/40061, 1992) [hereinafter Border Plan] (defining maquiladoras as "export-oriented processing and assembly plants located in the Mexican Border Area that use imported inputs and materials"); Dianne C. Betts & Daniel J. Slottje, Crisis on the Rio Grande: Poverty, Unemployment, and Economic Development on the Texas-Mexico Border 89 (1994) (noting that Spanish verb *maquilar*, derived from Arabic *makila*, means "to mill for a fee"); Coalition for Justice in the Maquiladoras, 1992 Annual Report 2 (1993) (discussing origin of word "maquiladora").

19. *See* Council on Scientific Affairs, *A Permanent U.S.-Mexico Border Environmental Health Commission*, 263 JAMA 3319, 3320 (1990) (discussing pollution-related health problems along United States-Mexico border).

20. *Id.*; *see* Carol Byrne, *What Is Killing These Babies?*, Minn. Star-Trib., May 2, 1993, at A1 (explaining that many people living in border area suspect that waste from maquiladora industry is to blame for birth defects); Dan Meyers, *Valley Pollution Is Certain, Baby Deaths Still a Mystery*, Brownsville Herald, Sept. 5, 1993, at A1 (targeting maquiladoras as polluters of drinking water).

21. *See Officials Expected in May to Approve Plan for Environmental Infrastructure*, Int'l Env't Daily (BNA) (Apr. 1, 1996) (reporting on proposed plan to develop environmental infrastructure border project), *available in* LEXIS, BNA Library, BNAIED File; *PROFEPA Shut 72 Industries in 1995, Temporarily Suspends Work in 219 Others*, Int'l

Complicating the recent attempts at strengthening the border environmental infrastructure is the fact that the maquiladora system is a mainstay of the Mexican economy.[22] United States and other non-Mexican corporations have established maquiladora operations along the United States-Mexico border primarily to take advantage of (1) the low wages paid to maquiladora workers; (2) the reduced transportation costs and ease of access into primary consumer markets; and (3) the duty free entry of equipment, machinery, component parts, and raw materials used in production processes.[23] Industrialization along the Mexican border originated in the early 1930s to assist the rapidly increasing border population during the Great Depression.[24] As the border population continued to expand in the next half-century, a number of programs were enacted to deal with issues along the border[25]—with none

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Env't Daily (BNA) (Jan. 3, 1996) (discussing closure of 72 maquiladoras and temporary suspension of operations in 219 other factories during 1995 by Mexico's Office of Federal Attorney General), *available in* LEXIS, BNA Library, BNAIED File.

22. *See* Michael Robins, Comment, *The North American Free Trade Agreement: The Integration of Free Trade and the Environment*, 7 TEMP. INT'L & COMP. L.J. 123, 128 (1993) (citing statistic indicating that maquiladora industry is Mexico's second largest generator of foreign revenue); *see also* Jeffrey A. Mello, *The Environmental Cost of Free Trade*, BUS. & SOC'Y REV., Sept. 22, 1994, at 18, 23 (quoting figures that maquiladora industry has surpassed tourism to become second leading derivation of foreign capital in Mexico behind oil exportation).

23. Daniel I. Basurto González & Elaine F. Rodriguez, *Environmental Aspects of Maquiladora Operations: A Note of Caution for U.S. Parent Corporations*, 22 ST. MARY'S L.J. 659, 661 (1991).

24. *See* DIANNE C. BETTS & DANIEL J. SLOTTJE, CRISIS ON THE RIO GRANDE: POVERTY, UNEMPLOYMENT, AND ECONOMIC DEVELOPMENT ON THE TEXAS-MEXICO BORDER 89 (1994) (explaining that Mexican government established free-trade-zone areas along United States-Mexico border in 1930s to insulate local retail markets from adverse impact of global depression); REGINALD L. DAVIS, INDUSTRIA MAQUILADORA Y SUBSIDIARIAS DE CO-INVERSION: REGIMEN JURIDICO Y CORPORATIVO 21 (1985) (reporting that population along United States-Mexico border increased during Great Depression because of employment opportunities for Mexican workers in United States agricultural industry). *But see* Susanna Peters, Comment, *Labor Law for the Maquiladoras: Choosing Between Workers' Rights and Foreign Investment*, 11 COMP. LAB. L. 226, 228 (1990) (contending that government of Mexico did not directly introduce maquiladoras into Mexican economy, but endorsed continued maquiladora operations through liberal trade policies).

25. *See* Agreement Respecting the Temporary Migration of Migrant Agricultural Workers, Aug. 4, 1942, U.S.-Mex., 2 U.S.T. 1048, 56 Stat. 1759 [hereinafter Bracero Program] (implementing program to promote hiring of Mexican laborers in United States); REGINALD L. DAVIS, INDUSTRIA MAQUILADORA Y SUBSIDIARIAS DE CO-INVERSION: REGIMEN JURIDICO Y CORPORATIVO 21 (1985) (explaining that Bracero Program was approved by both governments in 1942 and established basis for admission and hiring of Mexican workers in United States). The Bracero Program, however, faced many problems in its implementation and was terminated in December 1964. *Id.* at 22.

more significant than the North American Free Trade Agreement (NAFTA).[26]

NAFTA was designed to establish the world's largest free market through the integration of the economic sectors of Canada, Mexico, and the United States.[27] The passage of NAFTA in 1993 turned the maquiladoras' attention to the North for the 1990s and beyond, with the maquiladora industry's sights set on transporting duty free goods to the 360 million people living in North America.[28] Along with expectations of economic prosperity, however, came concerns about the degree of environmental degradation that could occur throughout North America as a result of NAFTA, especially along the United States-Mexico border.[29]

The Mexican government developed a number of programs to resolve problems along the border. *Id.* One program, *La Programa Nacional Fronterizo* (PRONAF), was enacted to stimulate the economy and tourism on Mexico's border. Reid A. Middleton, Comment, *NAFTA and the Environmental Side Agreement: Fusing Economic Development with Ecological Responsibility*, 31 SAN DIEGO L. REV. 1025, 1027 n.11 (1994). A final predecessor to PRONAF was the Border Industrialization Program (BIP), which allowed United States corporations to import duty free goods to manufacturing plants across the border. *Id.* at 1027. From the 1970s through the 1980s, the Mexican government refined the BIP through a series of decrees in response to the global economic environment of the times. *E.g.*, Reglamento del Párrafo Tercero de Artículo 321 del Código Aduanero, D.O., Oct. 26, 1977; Decreto para el Formento y Operación de la Industria Maquiladora de Exportación, D.O., Aug. 15, 1983; Decreto para el Formento y Operación de la Industria Maquiladora de Exportación, D.O., Dec. 22, 1989.

26. North American Free Trade Agreement, *drafted* Aug. 12, 1992, *revised* Sept. 6, 1992, U.S.-Mex.-Can., 32 I.L.M. 289 (pts. 1-3) & 32 I.L.M. 605 (pts. 4-8 & annexes) (entered into force Jan. 1, 1994) [hereinafter NAFTA].

27. *See id.* pmbl., 32 I.L.M. at 297 (resolving to "strengthen the development and enforcement of environmental laws"); Xavier C. Vasquez, *The North American Free Trade Agreement and Environmental Racism*, 34 HARV. INT'L L.J. 357, 357 (1993) (postulating that NAFTA will create integration of environmental policies of United States, Canada, and Mexico as result of integration of economic sectors).

28. *See* Lawrence Osborne, *Letter from Tijuana; Borderline Personality: Where NAFTA Meets Proposition 187*, NEWSDAY, Nov. 20, 1994, at 50 (calling economic boom attributed to NAFTA "a goldmine of jobs and investment"). *But see* Joel Simon, *On Mexican Border, Economic Boom Fizzles; Peso Crisis Leaves Both Sides Poorer*, SAN FRANCISCO CHRON., Mar. 24, 1995, at A12 (indicating that Mexico's economic crisis halted economic boom resulting from NAFTA).

29. *See, e.g.*, Scott D. Cahalan, Recent Development, *NIMBY: Not in Mexico's Backyard? A Case for Recognition of a Human Right to Healthy Environment in the American States*, 23 GA. J. INT'L & COMP. L. 409, 409-10 (1993) (addressing border residents' concerns about increased industrialization of border environment); Santos Gomez, Comment, *Environmental Risks Related to the Maquiladora Industry and the Likely Environmental Impact of NAFTA*, 6 LA RAZA L.J. 174, 197 (1993) (explaining environmental groups' belief that environmental protection and resource preservation are incompatible with unrestricted free trade); Steve Sternberg, *The Downside of Economic Expansion; Pollution, Disease Have Become Major Byproducts Along U.S.-Mexico Border*, WASH. POST, Apr. 30, 1995, at A3 (predicting that increased trade due to NAFTA will result in increased risk of

As expected, NAFTA and the resulting growth and success of the maquiladora industry have not come without costs. Anencephaly is merely one consequence of the maquiladora industry's unbridled growth.[30] Prior to the signing of NAFTA, Mexico acted singularly and in numerous joint agreements to protect the environment along the border.[31] However, environmentalists have contended that these previous attempts to police the maquiladora industry were unsuccessful.[32] Additionally, although many

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disease due to overpopulation and lack of adequate sewage treatment facilities in border communities). Canadian officials strongly contested the passage of NAFTA due to fears of environmental damage to Canada from pollution originating in Mexico. Terrance Wills, *Free Trade Environmental Review Draws Fire from the Opposition*, MONTREAL GAZETTE, Nov. 4, 1992, at E2.

30. *See* Richard Price, *Nightmare on the Border*, USA TODAY, Oct. 27, 1993, at A1 (indicating that doctors in border town of Nogales, Arizona diagnose over 40 new cancer cases per month, which is five times normal rate, and linking increase to maquiladora industry across border); Maggie Rivas, *Border Watch Has Cut Crime, Statistics Show Drop in Auto Theft, Burglary*, DALLAS MORNING NEWS, Nov. 28, 1993, at A44 (reporting birth defect detected in El Paso, Texas called gastroschisis, which leaves openings in abdominal wall from which part of intestines project, and suggesting role of maquiladoras in causing defect).

31. *See* Poder Ejecutivo, Secretaria de Desorrollo Socoial, D.O., May 26, 1992, 6-9 [hereinafter SEDESOL] (creating SEDESOL, Mexico's equivalent of United States Environmental Protection Agency); Ley General del Equilibrio Ecologico y la Proteción del Ambiente, D.O., Jan. 28, 1988 [hereinafter General Law] (granting SEDUE task of enforcing environmental legislation); Treaty Between the United States of America and Mexico Respecting Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, Feb. 3, 1944, U.S.-Mex., 59 Stat. 1219 (resulting in creation of International Boundary and Water Commission (IBWC) to focus on border water pollution problems); Convention Between the United States of America and the United States of Mexico to Facilitate the Carrying out of the Principles Contained in the Treaty of Nov. 12, 1884, and to Avoid the Difficulties Occasioned By Reason of the Changes Which Take Place in the Bed of the Rio Grande and That of the Colorado River, Mar. 1, 1889, U.S.-Mex., 26 Stat. 1512 (establishing regulatory mechanism for Rio Grande river). The goals of border environmental cooperation were defined for the first time by the "La Paz Agreement." Agreement on Cooperation for the Protection and Improvement of the Environment in the Border Area, Aug. 14, 1983, U.S.-Mex., T.I.A.S. No. 10,827, 22 I.L.M. 1025 & 26 I.L.M. 16 (annexes) [hereinafter La Paz Agreement]; *see* David Voigt, Note, *The Maquiladora Problem in the Age of NAFTA: Where Will We Find Solutions?*, 2 MINN. J. GLOBAL TRADE 323, 332 (1993) (opining that La Paz Agreement was most important environmental agreement to affect maquiladora industry). An important result of the La Paz Agreement was the Integrated Environmental Plan for the Mexico-United States Border Area (Border Plan). *See* Sal Drum, *The Final Plan: A Blueprint for Border Environmental Improvement*, MAQUILA MAG., Apr. 1992, at 12, 13 (stating that Border Plan is outgrowth of La Paz Agreement).

32. *See* U.S. GEN. ACCOUNTING OFFICE, PUB. NO. GAO/NSIAD-91-227, REPORT TO THE CHAIRMAN, COMMITTEE ON COMMERCE, SCIENCE AND TRANSPORTATION, SENATE, U.S.-MEXICO TRADE: INFORMATION ON ENVIRONMENTAL REGULATIONS AND ENFORCEMENT 2–5 (1991) (citing insufficient number of hazardous waste disposal and treatment facilities as primary obstacle to overcoming Mexico's present environmental problems); *see*

commentators have praised NAFTA for its economic ingenuity and environmental provisions,[33] others have criticized the trade agreement for failing to address the numerous environmental and health concerns associated with the alliance of the United States and Canada, two environmentally conscious countries, with Mexico, a country that has historically provided lax enforcement of its environmental standards.[34]

In the early 1990s, many people living along the border feared that Mexico's lax enforcement of environmental laws, combined with NAFTA's failure to address this deficiency, would lead to an increase of maquiladoras and an increase in pollution levels along the border.[35] Moreover, NAFTA opponents expressed concern that as more multinational corporations moved their operations to Mexico to benefit from Mexico's lax enforcement of environmental laws, the United States would lower its environmental standards as a means of remaining economically competitive.[36] In response to these concerns, apprehension by

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also Kurt C. Hofgard, *Trade and the Environment: Is This Land Really Our Land? Impacts of Free Trade Agreements on U.S. Environmental Protection*, 23 ENVTL. L. 635, 656 (1993) (reporting that Mexico's stringent environmental laws have often been ignored in effort to increase industrial production).

33. *See* Michael D. Madnick, Comment, *NAFTA: A Catalyst for Environmental Change in Mexico*, 11 PACE ENVTL. L. REV. 365, 381-82 (1993) (pledging allegiance to NAFTA's environmental provisions); Reid A. Middleton, Comment, *NAFTA and the Environmental Side Agreement: Fusing Economic Development with Ecological Responsibility*, 31 SAN DIEGO L. REV. 1025, 1032, 1044 (1994) (claiming that NAFTA and Environmental Side Agreement create most successful unification between economic and environmental concerns, and predicting that NAFTA will not cause weakening of health standards in United States). *But see* Joseph G. Block & Andrew R. Herrup, *The Environmental Aspects of NAFTA and Their Relevance to Possible Free Trade Agreements Between the United States and Caribbean Nations*, 14 VA. ENVTL. L.J. 1, 13-14, 27-28 (1994) (concluding that NAFTA was negotiated under idea that environmental concerns were secondary to economic issues, and quoting critics who argue that "increased economic activity resulting from NAFTA would exacerbate existing environmental problems").

34. *See* Roberto L. Martinez, *NAFTA's Effect on Human Rights at the Border*, 27 U.C. DAVIS L. REV. 979, 979-80 (1994) (alleging that NAFTA ignores environmental devastation caused by maquiladoras); Steve Yozwiak, *Environmental Lobby Is Splintered: Accord's Foes Funding Allies in Labor Movement*, ARIZ. REPUBLIC, Nov. 7, 1993, at A17 (quoting border resident who believed that free trade would increase pollution and other environmental problems).

35. *See Hearings on the North American Free Trade Agreement Before the Senate Finance Comm.*, 102d Cong., 1st Sess. 1 (1992) (statement of Thomas R. Donahue, Secretary-Treasurer, AFL-CIO) (proclaiming that NAFTA is "not about protecting the environment"); Michael D. Madnick, Comment, *NAFTA: A Catalyst for Environmental Change in Mexico*, 11 PACE ENVTL. L. REV. 365, 382 (1993) (addressing critics' fears that lower Mexican environmental standards will result in "mass migration" of United States businesses to Mexico).

36. *See* Joseph G. Block & Andrew R. Herrup, *The Environmental Aspects of NAFTA and Their Relevance to Possible Free Trade Agreements Between the United States and Car-*

members of Congress, and complaints from numerous environmental organizations, the United States arranged a supplemental environmental agreement to NAFTA entitled the North American Agreement on Environmental Cooperation (Environmental Side Agreement).[37]

Although the Environmental Side Agreement, like NAFTA, has been criticized for its failure to adequately address environmental problems,[38] private industry independently has attempted to control the border environment. For example, some maquiladoras have unilaterally taken steps to decrease environmental pollution along the border by implementing stricter environmental policies.[39] Additionally, some multinational corporations have adopted the same or similar environmental criteria adhered to in the United States for their factories outside the United States.[40] Such corporations may be more likely to comply with national

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ibbean Nations, 14 VA. ENVTL. L.J. 1, 28-29 (1994) (discussing hypothetical depicting lowering of United States environmental protection standards under NAFTA). Opponents also feared that NAFTA would force the United States to defend its health and safety standards. *Hearings on the North American Free Trade Agreement Before the Senate Finance Comm.*, 102d Cong., 1st Sess. 1 (1992) (statement of Thomas R. Donahue, Secretary-Treasurer, AFL-CIO).

37. North American Agreement on Environmental Cooperation, *opened for signature* Sept. 9, 1993, U.S.-Can.-Mex., 32 I.L.M. 1480 (entered into force Jan. 1, 1994) [hereinafter Environmental Side Agreement]; *see* James E. Bailey, *Free Trade and the Environment—Can NAFTA Reconcile the Irreconcilable?*, 8 AM. U. J. INT'L L. & POL'Y 839, 862 (1993) (calling Environmental Side Agreement mere attempt to appease environmental groups); Michael D. Madnick, Comment, *NAFTA: A Catalyst for Environmental Change in Mexico*, 11 PACE ENVTL. L. REV. 365, 403-04 (1993) (asserting that Environmental Side Agreement was response to criticism that NAFTA lacked adequate environmental enforcement mechanisms).

38. *See* Paulette L. Stenzel, *Can NAFTA's Environmental Provisions Promote Sustainable Development*, 59 ALB. L. REV. 423, 456 (1995) (stating that Environmental Side Agreement gives United States citizens "far less opportunity to monitor enforcement and to intervene to compel enforcement than is allowed under United States environmental laws"); *cf.* Kevin W. Patton, Note, *Dispute Resolution Under the North American Commission on Environmental Cooperation*, 5 DUKE J. COMP. & INT'L L. 87, 87 (1994) (asserting that dispute resolution mechanism of Environmental Side Agreement "has not silenced all critics").

39. *See, e.g.*, COALITION FOR JUSTICE IN THE MAQUILADORAS, 1993 ANNUAL REPORT 6-7 (1994) (describing changes in environmental policies of major chemical manufacturers located in Matamoros); GARY C. HUFBAUER & JEFFREY T. SCHOTT, NORTH AMERICAN FREE TRADE: ISSUES AND RECOMMENDATIONS 151 (1992) (detailing Ford Motor Company's environmental practices); Reid A. Middleton, Comment, *NAFTA and the Environmental Side Agreement: Fusing Economic Development with Ecological Responsibility*, 31 SAN DIEGO L. REV. 1025, 1054 (1994) (mentioning General Motors Corporation's program to spend millions on wastewater treatment plants in Matamoros and other maquiladora towns).

40. Edith B. Weiss, *Environmentally Sustainable Competitiveness: A Comment*, 102 YALE L.J. 2123, 2135 (1993); *see* Reid A. Middleton, Comment, *NAFTA and the Environ-*

environmental laws, or may even adhere to stricter environmental standards, because multinational corporations strive for uniformity among their plants.[41] While it is still too early to determine what effect voluntary self-regulation will have on the border environment, any changes that reduce pollution are bound to have a positive impact on the health and safety of border residents.[42]

III. Increased Cases of Neural Tube Defects Along the Texas-Mexico Border

Despite the potential future benefits of industry environmental policies, these policies, unfortunately, were not implemented in time to prevent the cluster of neural tube defects occurring along the border. Possibly the most frequently asked question among citizens residing in Texas's fourteen border counties is why at least ninety babies between 1986 and 1991 were born without brains.[43] No conclusive answer to this

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mental Side Agreement: Fusing Economic Development with Ecological Responsibility, 31 San Diego L. Rev. 1025, 1054 (1994) (noting General Motors Corporation's efforts to create wastewater treatment facilities for 31 of its maquiladoras). For example, Ford Motor Company's policy with regard to its Mexican maquiladoras is to enforce Ford environmental practices used at United States facilities in its maquiladoras. Gary C. Hufbauer & Jeffrey J. Schott, North American Free Trade: Issues and Recommendations 151 (1992).

41. Edith B. Weiss, *Environmentally Sustainable Competitiveness: A Comment*, 102 Yale L.J. 2123, 2136 (1993). In developing countries that lack the resources to adequately enforce environmental regulations, the multinational corporations that adhere to environmental standards which are stricter than those of the developing country may not receive regular enforcement visits from the country's foreign environmental agency. *Id.* at 2136 n.70.

42. Jeffrey A. Mello, *The Environmental Cost of Free Trade*, Bus. & Soc'y. Rev., Fall 1994, at 18, 18. The World Bank prepared a study citing three patterns that can transpire as a result of the influence that increased economic activity has on the environment. *Id.* First, in certain situations there can be a "direct positive relationship between increased income levels and local health/environmental problems relating to public health, such as sanitation and energy needs." *Id.* Second, problematic conditions, such as air and water pollution and deforestation, while worsening initially as the economy grows, will improve as incomes improve and people demand environmentally friendly policies. *Id.* Finally, some environmental conditions, such as municipal waste and nitrogen and carbon emissions, will continue to decline as incomes rise. *Id.*

43. *See, e.g.*, Karen Hastings, *Link to Rare Birth Defects Elusive, Pace of Probe Angers Border Community*, Houston Chron., May 17, 1992, at A1 (linking conception of babies born with neural tube defects to proximity of Rio Grande River); James Pinkerton, *Birth Defects on Border Still Twice U.S. Average, but Rate Falls in Cameron County*, Houston Chron., Oct. 30, 1994, at A1 (describing average rate of neural tube defects in border counties as 14 cases per 10,000 births); *Anencephaly in Texas Border Counties 1986-1991*, Disease Prevention News (Texas Dep't of Health, Austin, Tex.), Sept. 20, 1993, at 1 (citing statistics from Cameron County, Texas in which anencephaly rate peaked at 19.7 cases of anencephaly per 10,000 births between 1990 and 1991); *cf.* Maggie Rivas, *Data*

question has been offered thus far; however, recent theories suggest that either genetic factors, nutritional and dietary factors, or environmental factors have contributed to the occurrence of neural tube defects in border communities.[44]

A case revolving around the issue of the cause of a cluster of neural tube defects was recently settled in Cameron County, Texas.[45] The initial lawsuit named eighty-eight defendants, including General Motors, Fisher-Price, Zenith, and Sunbeam.[46] The wrongful death suit alleged that the

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Shed Light on Valley Birth Defects, Water Supplies in Two Counties May Harbor Pesticides, DALLAS MORNING NEWS, May 22, 1994, at A45 (citing normal rate of neural tube defects in United States as approximately eight per 10,000 births); David A. Stumpf et al., *Special Article: The Infant with Anencephaly*, 322 NEW ENG. J. MED. 669, 671 (1990) (estimating incidences of anencephaly in United States during 20th Century as varying between 0.3 and 7 per 1,000 births). *But see* Robin Alexander, *Lower Rio Grande Valley: Neural Tube Defects* (indicating that births by migrant farm workers may not be included in official figures), *in* TEXAS RURAL LEGAL AID, ECONOMIC & ENVIRONMENTAL CONDITIONS IN THE LOWER RIO GRANDE VALLEY ALONG THE TEXAS-MEXICO BORDER 7, 7 (1993). According to the Coalition for Justice in the Maquiladoras, approximately 40% of local babies in Brownsville, Texas are delivered by midwives, and midwives who are not registered with local health authorities may not report the birth of a baby born with anencephaly. *The Issue Is: Anencephaly*, *in* COALITION FOR JUSTICE IN THE MAQUILADORAS, THE ISSUE IS HEALTH: TOXIC SAMPLINGS, ENVIRONMENTAL CONDITIONS AND HEALTH CONCERNS ALONG THE U.S./MEXICO BORDER 3 (1993).

44. *See* TEXAS DEP'T OF HEALTH, AN INVESTIGATION OF A CLUSTER OF NEURAL TUBE DEFECTS IN CAMERON COUNTY, TEXAS 11-12 (1992) (listing variety of factors as possible cause of neural tube defects, including socioeconomic status, nutrition and folic acid intake, heavy alcohol use during pregnancy, exposure to occupational organic solvents, maternal diabetes mellitus, and maternal hyperthermia in first trimester); *see also* Jean D. Brender & Lucina Suarez, *Paternal Occupation and Anencephaly*, 131 AM. J. EPIDEMIOLOGY 517, 517 (1990) (concluding that fathers engaged in work associated with solvent exposure had higher possibility of having children with anencephaly); Huseyin Guvenc et al., *Low Levels of Selenium in Mothers and Their Newborns in Pregnancies with a Neural Tube Defect*, 95 PEDIATRICS 879, 879 (1995) (linking unknown genetic and environmental factors to neural tube defects); *Prevention of Neural Tube Defects: Results of the Medical Research Council Vitamin Study*, 266 JAMA 2965, 2965 (1991) (recommending folic acid supplementation before pregnancy to reduce risk of neural tube defects).

45. *See* James E. Garcia, *GM, Companies Settle Lawsuit over Brain Defects in Valley*, AUSTIN AMERICAN-STATESMAN, Aug. 26, 1995, at B9 (commenting on settlement agreements made during past two years in which all but final three defendants settled for amounts between $100,000 and $2 million); *cf.* John MacCormack, *General Motors Settles Lawsuit over Deaths of Cameron Babies*, SAN ANTONIO EXPRESS NEWS, Aug. 25, 1995, at A18 (discussing attorneys' preparation in suit alleging that birth defects were caused by General Motors maquiladoras).

46. *See* James Pinkerton, *Parents of Deformed Babies Sue, Claim 88 Companies Contaminated Valley*, HOUSTON CHRON., Mar. 27, 1993, at A1 (discussing lawsuit filed in Texas state district court by parents of 16 babies born with anencephaly). Brownsville attorney Tony Martinez believes that the materials emitted by maquiladora plants are the same ones that are suggested causes of neural tube defects. *Id.*

neural tube defect cluster was caused by the maquiladoras' negligence in "managing, handling, storing, transporting, using, and disposing of toxic compounds."[47] While the settlement of the case did not provide clear answers to the causation issues, commentators felt that the lawsuit brought publicity to this human tragedy, which may result in more investigations of neural tube defects and their causes.[48]

Since the initial rash between 1986 and 1991, the rate of neural tube defects in Cameron County has settled back down to a number closer to the national average.[49] However, the residents of Eagle Pass, Texas and Piedras Negras, Mexico received a scare in early 1995 when six babies were born with anencephaly in a four month period—the largest cluster of such birth defects in the border region since 1991.[50] Similar to the

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47. *See id.* (asserting that maquiladoras "improperly stored and discarded toxic wastes that polluted local air and water, causing the rare birth defects"). Randy Whittington, an attorney who helped organize and prepare the case for the plaintiffs, believed that there was plenty of evidence to connect the defendants to the birth defects:

> We found they were using a lot of very toxic chemicals and they don't use them in such a way that emissions are controlled and those chemicals come over in the air to Brownsville.... Our experts told us they were in concentrations that were sufficient to cause these kind of problems, and in all fairness, (the corporation's) experts disagreed.

James Pinkerton, *GM Settles Border Suit, Automaker Averts Trial in Brain Defects Case*, HOUSTON CHRON., Aug. 25, 1995, at A29. In contrast, however, one Brownsville city official suggested that no studies indicate any environmental contamination in Brownsville and that the real culprits are "a bunch of ruthless attorneys." James Pinkerton, *Parents of Deformed Babies Sue, Claim 88 Companies Contaminated Valley*, HOUSTON CHRON., Mar. 27, 1993, at A1.

48. *See* John MacCormack, *General Motors Settles Lawsuit over Deaths of Cameron Babies*, SAN ANTONIO EXPRESS-NEWS, Aug. 25, 1995, at A18 (quoting Paula Gomez, director of Brownsville Community Health Center, as saying that "the investigation opened a Pandora's box" because more questions than ever have arisen regarding anencephaly); *Birth Defects Prompt Changes*, SAN ANTONIO EXPRESS-NEWS, Aug. 23, 1995, at B4 (discussing investigations into neural tube defects, creation of Texas Birth Defects Registry, and international attention focused on neglected health and environmental issues along border arising from lawsuit).

49. *See* GREGG S. WILKINSON ET AL., EPIDEMIOLOGIC STUDY OF NEURAL TUBE AND OTHER BIRTH DEFECTS IN THE LOWER RIO GRANDE VALLEY 65 (1995) (indicating change in levels of neural tube defects in Cameron County in 1992); James Pinkerton, *Birth Defects on Border Still Twice U.S. Average, but Rate Falls in Cameron County*, HOUSTON CHRON., Oct. 30, 1994, at B1 (explaining that number of neural tube defects in Cameron County decreased by 15 cases in span of three years, making level closer to national average).

50. *See Another Cluster of Brain-Defective Infants Born on Border*, AUSTIN AMERICAN-STATESMAN, June 10, 1995, at B3 (declaring that two cases of anencephaly and one case of spina bifida were reported in Eagle Pass, Texas, while four cases of anencephaly and one case of spina bifida were reported in Piedras Negras, Mexico from December 1994 through March 1995); *see also* Thaddeus Herrick, *Rash of Brain Defects in Babies Probed, Six Infants in Eagle Pass, Piedras Negras Affected*, HOUSTON CHRON., June 10, 1995, at A33 (noting that while little is known about families affected by birth defects, surveillance of

neural tube defects in Cameron County, the exact cause of the recent cluster of neural tube defects remains a mystery.[51] In an attempt to solve this mystery, the Texas Department of Health created the Texas Birth Defects Registry.

A. *The Texas Birth Defects Registry*

The recent incidents of neural tube defects along the Texas-Mexico border have led to increased efforts to find the cause or causes of these potentially fatal birth defects.[52] The Texas Birth Defects Registry will supplement the vital statistic records with increased information on birth defects from numerous sources by using "active surveillance" techniques.[53] As part of this effort, the Texas Legislature instructed the Texas Department of Health to implement a Birth Defects Registry,[54] a state-

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Eagle Pass area is recommended); *Ongoing Birth Defect Cluster Investigations*, TEX. BIRTH DEFECTS MONITOR, (Texas Dep't of Health, Austin, Tex.), Apr. 1995, at 1, 2 (describing use of Texas Birth Defects Registry for collection of information on affected families).

51. *See* Thaddeus Herrick, *Rash of Brain Defects in Babies Probed, Six Infants in Eagle Pass, Piedras Negras Affected*, HOUSTON CHRON., June 10, 1995, at A33 (explaining that researchers do not know cause of neural tube defects, but that they suspect ethnicity and poverty as contributing factors); *see also Another Cluster of Brain-Defective Infants Born on Border*, AUSTIN AMERICAN-STATESMAN, June 10, 1995, at B3 (suggesting toxic exposure, genetic defect, and folic acid deficiencies as possible factors contributing to Eagle Pass and Piedras Negras neural tube defects).

52. *See Legislature Mandates Statewide Birth Defects Registry*, DISEASE PREVENTION NEWS (Texas Dep't of Health, Austin, Tex.), Jan. 10, 1994, at 5 (explaining that cluster of neural tube defects in Cameron County highlighted need for information on scope and magnitude of defects).

53. *See Anencephaly in Texas*, DISEASE PREVENTION NEWS (Texas Dep't of Health, Austin, Tex.), June 26, 1995, at 4 (postulating that Birth Defects Registry will be able to complement vital statistics data with other data on birth defects from many sources). Through the technique of "active surveillance," field staff travel to hospitals and other medical facilities to locate potential cases of birth defects. *Legislature Mandates Statewide Birth Defects Registry*, DISEASE PREVENTION NEWS (Texas Dep't of Health, Austin, Tex.), Jan. 10, 1994, at 5. Active surveillance includes reviewing medical records, labor and delivery logs, autopsy reports, pediatric logs, and pathology reports to identify potential cases of birth defects. *Id.* After the data is reviewed for accuracy and coded by field supervisors, it is entered into the birth defects registry database. *Id.* Many believe that active surveillance is a more accurate method of collecting data than passive surveillance, in which the burden of reporting the birth defects is on the medical care facilities and providers, usually resulting in under or delayed reporting. *Id.* at 5-6.

54. TEX. HEALTH & SAFETY CODE ANN. § 87.021 (Vernon Supp. 1995); *see* Laura E. Keeton, *Panel Urged to Authorize Birth Defects Registry*, HOUSTON CHRON., Feb. 5, 1993, at A27 (explaining that bill would authorize Texas Department of Health to investigate cases of birth defects and assemble central registry); *Birth Defects Prompt Changes*, SAN ANTONIO EXPRESS-NEWS, Aug. 23, 1995, at B4 (discussing positive effects of cluster of neural tube defects in Cameron County, Texas, including Texas Birth Defects Registry). Dr. Dennis Perrotta, Epidemiology Director at the Texas Department of Health, stated:

wide data bank created to document birth defects.[55] The bill also directs the Texas Department of Health to conduct investigations into the possible causes of birth defects.[56] The estimated annual cost of the Birth Defects Registry is approximately $750,000, which will cover pilot programs beginning in the counties stretching from Laredo to the Louisiana border.[57] On January 1, 1995, the Texas Birth Defects Monitoring Division began implementing the Birth Defects Registry in border communities with hopes of expanding the registry in late 1996.[58]

Proponents of the Registry hope that the accumulated data will provide researchers and investigators with clues to the probable causes of the birth defects that will lead to answers and preventative measures for border residents.[59] Supporters believe that the Registry will track birth defects more precisely than the previous system of submitting birth certificates to the Bureau of Vital Statistics because many birth defects are not apparent until after an infant has been released from the hospital and the birth certificate has been submitted to the Bureau.[60]

"The registry will help us identify where there are pockets of problems and then, at that point, we can move forward with investigations on what might be the causes." Laura E. Keeton, *Panel Urged to Authorize Birth Defects Registry*, HOUSTON CHRON., Feb. 5, 1993, at A27. Many believe that if a birth defects registry had been in place earlier, Texas health officials might have discovered the tragedy sooner. Laura Beil, *State Birth-Defect Registry May Be Operating by '94*, DALLAS MORNING NEWS, Aug. 19, 1993, at A36.

55. TEX. HEALTH & SAFETY CODE ANN. § 87.021(a) (Vernon Supp. 1995).

56. *Id.* § 87.021; *see Legislative Briefs*, DALLAS MORNING NEWS, May 30, 1993, at A26 (describing Texas Birth Defects Registry).

57. *See* Laura Beil, *State Birth-Defect Registry May Be Operating by '94*, DALLAS MORNING NEWS, Aug. 19, 1993, at A36; Laura E. Keeton, *Panel Urged to Authorize Birth Defects Registry*, HOUSTON CHRON., Feb. 5, 1993, at A27 (reporting that realistic implementation area would include communities from Laredo to Brownsville and Houston area). State officials targeted the border area as the first zone of implementation because of the cluster of anencephalic births in the area. Laura Beil, *State Birth-Defect Registry May Be Operating by '94*, DALLAS MORNING NEWS, Aug. 19, 1993, at A36.

58. *Anencephaly in Texas*, DISEASE PREVENTION NEWS (Texas Dep't of Health, Austin, Tex.), June 26, 1995, at 4. According to legislative estimates, a state-wide program would cost approximately $2 million per year. Laura Beil, *State Birth-Defect Registry May Be Operating by '94*, DALLAS MORNING NEWS, Aug. 19, 1993, at A36; *see* Laura E. Keeton, *Panel Urged to Authorize Birth Defects Registry*, HOUSTON CHRON., Feb. 5, 1993, at A27 (discussing Texas Birth Defects Registry's budget).

59. *See* Laura Beil, *State Birth-Defect Registry May Be Operating by '94*, DALLAS MORNING NEWS, Aug. 19, 1993, at A36 (describing how registry will provide information on several hundred abnormalities); *see also Birth Defects*, DALLAS MORNING NEWS, June 23, 1993, at A20 (listing agencies responsible for investigating causes of birth defects).

60. *Anencephaly in Texas*, DISEASE PREVENTION NEWS (Texas Dep't of Health, Austin, Tex.), June 26, 1995, at 4; *cf.* Telephone Interview with Peter Langlois, Senior Epidemiologist, Texas Bureau of Epidemiology (Nov. 10, 1995) (stating that technique of active surveillance is more accurate than collecting vital statistic records). In the case of anencephaly, however, death certificates are useful in supplying information because it is

B. *Medical Insight into the Possible Causes of Neural Tube Defects*

One function of the Birth Defects Registry is "to determine the nature and extent of the disease or the known or suspected cause of the birth defect, such as neural tube defects."[61] The phrase, "neural tube defects" is used to describe abnormalities of the brain and spinal cord that arise at various stages of gestation.[62] Although the causes of the birth defects along the border are currently unknown,[63] one chemical, valproic acid, an anti-convulsant drug, has been proven to cause neural tube defects.[64]

One of the most common forms of neural tube defects is anencephaly.[65] Anencephaly occurs when brain tissue is left uncovered on the surface of the scalp because of an imperfection in the scalp and skull.[66] The malformations usually occur between the seventeenth and

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often a fatal condition, unlike most other birth defects. *Anencephaly in Texas*, DISEASE PREVENTION NEWS (Texas Dep't of Health, Austin, Tex.), June 26, 1995, at 4.

61. TEX. HEALTH & SAFETY CODE ANN. § 87.041 (Vernon Supp. 1995).

62. *See* TEXAS DEP'T OF HEALTH, AN INVESTIGATION OF A CLUSTER OF NEURAL TUBE DEFECTS IN CAMERON COUNTY, TEXAS 10 (1992) (indicating that neural tube defects are caused by "abnormal development of brain or spine during early gestation"); Ronald J. Lemire, *Neural Tube Defects*, 259 JAMA 558, 558 (1988) (defining neural tube defect as "groups of malformations of the brain and spinal cord that originate at various times during gestation").

63. *See, e.g.*, TEXAS DEP'T OF HEALTH, AN INVESTIGATION OF A CLUSTER OF NEURAL TUBE DEFECTS IN CAMERON COUNTY, TEXAS 11 (1992) (stating that variety of factors may contribute to neural tube defects); GREGG S. WILKINSON ET AL., EPIDEMIOLOGIC STUDY OF NEURAL TUBE AND OTHER BIRTH DEFECTS IN THE LOWER RIO GRANDE VALLEY 9 (1995) (indicating that "in spite of centuries of studies, no known cause has been established" for neural tube defects); Sandra A. Geschwind et al., *Risk of Congenital Malformations Associated with Proximity to Hazardous Waste Cites*, 135 AM. J. EPIDEMIOLOGY 1197, 1197 (1992) (questioning whether chronic exposure to toxins in environment causes adverse health effects in humans); Huseyin Guvenc et al., *Low Levels of Selenium in Mothers and Their Newborns in Pregnancies with a Neural Tube Defect*, 95 PEDIATRICS 879, 879-80 (1995) (positing that neural tube defects arise from combination of unknown genetic and environmental factors).

64. *What Is Anencephaly?*, THE BORDER CAMPAIGN BACKGROUND ARTICLE #1 (The Border Campaign, Brownsville, Tex.), 1993, at 1; *see* Robin Alexander, *Lower Rio Grande Valley: Neural Tube Defects* (stating that there is increased risk of neural tube defects for insulin-dependent diabetics or parents who have previously had children with neural tube defect), *in* TEXAS RURAL LEGAL AID, ECONOMIC & ENVIRONMENTAL CONDITIONS IN THE LOWER RIO GRANDE VALLEY ALONG THE TEXAS-MEXICO BORDER 7 (1993).

65. Ronald J. Lemire, *Neural Tube Defects*, 259 JAMA 558, 558 (1988).

66. *Id.*; *see* Robin Alexander, *Lower Rio Grande Valley: Neural Tube Defects* (defining anencephaly as being "born with either incomplete or missing brains and skulls"), *in* TEXAS RURAL LEGAL AID, ECONOMIC & ENVIRONMENTAL CONDITIONS IN THE LOWER RIO GRANDE VALLEY ALONG THE TEXAS-MEXICO BORDER 7, 7 (1993). Anencephaly is a birth defect of the neural tube, which is a thin covering that encases the spinal cord and brain of an embryo during the third and fourth weeks of pregnancy. *Id.* The neural tube originally begins as a neural plate that forms as cells proliferate. Jeffrey A. Golden &

thirtieth day after conception,[67] and most fetuses with anencephaly are stillborn or die shortly after birth.[68] The numerous theories regarding the

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Gerald F. Chernoff, *Multiple Sites of Anterior Neural Tube Closure in Humans: Evidence from Anterior Neural Tube Defects (Anencephaly)*, 95 PEDIATRICS 506, 506-07 (1995). As the cells continue to multiply, the neural plate starts to fold together to form a tube-like covering. *See id.* at 506 (describing fusion process in which neural tube proceeds to close continuously in both caudal (posterior) and cephalic (head region) directions). If the fold closes completely, the neural tube forms and thereafter becomes the brain and the spinal cord. *See id.* at 506-07 (reporting that closure of neuropore completes formation of fundamental central nervous system). However, if the anterior neuropore, which forms the brain, does not close completely, anencephaly results. *Id.*

Another type of neural tube defect is spina bifida, which is defined as "a condition in which a portion of the spinal column is incompletely closed." GREGG S. WILKINSON ET AL., EPIDEMIOLOGIC STUDY OF NEURAL TUBE AND OTHER BIRTH DEFECTS IN THE LOWER RIO GRANDE VALLEY 8 (1995). Spina bifida, the most common vertebral defect, results if the posterior neuropore, the "tail," fails to close. Jeffrey A. Golden & Gerald F. Chernoff, *Multiple Sites of Anterior Neural Tube Closure in Humans: Evidence from Anterior Neural Tube Defects (Anencephaly)*, 95 PEDIATRICS 506, 506-07 (1995). Children suffering from spina bifida have severely deformed or exposed spinal cords. Robin Alexander, *Lower Rio Grande Valley: Neural Tube Defects*, *in* TEXAS RURAL LEGAL AID, ECONOMIC & ENVIRONMENTAL CONDITIONS IN THE LOWER RIO GRANDE VALLEY ALONG THE TEXAS-MEXICO BORDER 7, 7 (1993). There are various effects of spina bifida, ranging from almost no effect to mental retardation, severe paralysis, and sometimes death. John M. McClintock, *Cluster of Babies in Texas Born Without Brains*, BALTIMORE SUN, Jan. 19, 1992, at A8.

67. Ronald J. Lemire, *Neural Tube Defects*, 259 JAMA 558, 558 (1988); *see* Robin Alexander, *Lower Rio Grande Valley: Neural Tube Defects* (stating that anencephaly occurs between the 16th and 26th day after conception), *in* TEXAS RURAL LEGAL AID, ECONOMIC & ENVIRONMENTAL CONDITIONS IN THE LOWER RIO GRANDE VALLEY ALONG THE TEXAS-MEXICO BORDER 7, 7 (1993); John M. McClintock, *Cluster of Babies in Texas Born Without Brains*, BALTIMORE SUN, Jan. 19, 1992, at A8 (approximating that anencephaly occurs between third and fourth week after conception). *But see* Interview with Tony Martinez & Randy Whittington, Attorneys for Plaintiffs in Alvear v. Leonard Electric Products, in Brownsville, Tex. (Sept. 25, 1995) (indicating that "window" of exposure is not certain in scientific community, and contending that window may range anywhere from preconception exposure to 28 days after conception).

68. Jean D. Brender et al., *Epidemiology of Anencephaly in Texas, 1981-1986*, 85 TEX. MED. 33, 33 (1989); *see* Robin Alexander, *Lower Rio Grande Valley: Neural Tube Defects* (explaining that anencephalic babies commonly die at birth or within few days thereafter), *in* TEXAS RURAL LEGAL AID, ECONOMIC & ENVIRONMENTAL CONDITIONS IN THE LOWER RIO GRANDE VALLEY ALONG THE TEXAS-MEXICO BORDER 7, 7 (1993); *see also* David A. Stumpf et al., *Special Article: The Infant with Anencephaly*, 322 NEW ENG. J. MED. 669, 671 (1990) (reporting that survival for as long as 3 or 14 months has occurred in some instances); John M. McClintock, *Cluster of Babies in Texas Born Without Brains*, BALTIMORE SUN, Jan. 19, 1992, at A8 (explaining that baby with anencephaly usually dies within few days because "thinking and coordinating hemispheres of the brain are poorly developed or nonexistent").

causes of neural tube defects pose difficult problems for plaintiffs involved in toxic tort litigation.[69]

The first theory regarding the cause of neural tube defects concentrates on ethnic and genetic factors. Many researchers have conducted studies on the genetic and ethnic influence of parents of children born with neural tube defects.[70] For example, ninety-five percent of all infants born with anencephaly are born in families with no history of neural tube defects; however, once one infant is born with a neural tube defect, the risk increases two to five percent in succeeding pregnancies.[71] Additionally, based on numerous studies, there seems to be a recurring trend among various ethnic groups. Some studies have found that Hispanic births have

69. *See* L. Grant Foster, Comment, *A Case Study in Toxic Tort Causation: Scientific and Legal Standards Work Against Recovery for Victims*, 19 ENVTL. L. 141, 146-47 (1988) (suggesting that of all elements plaintiff must prove in toxic tort action, causation is most difficult); Elizabeth A. Stundtner, Comment, *Proving Causation in Toxic Tort Cases: T-Cell Studies As Epidemiological and Particularistic Evidence*, 20 B.C. ENVTL. AFF. L. REV. 335, 335 (1993) (explaining that "element of causation is difficult to establish in toxic tort cases").

70. *See, e.g.*, Sandro S. Buccimazza et al., *Prevalence of Neural Tube Defects in Cape Town, South Africa*, 50 TERATOLOGY 194, 197–98 (1994) (discussing variance in occurrences of neural tube defects among racial groups); C.O. Carter & Kathleen Evans, *Spina Bifida and Anencephalus in Greater London*, 10 J. MED. GENETICS 209, 219 (1973) (postulating that neural tube defects are genetically predisposed depending on alteration at gene loci and external environmental elements); John A. Thomas et al., *Commentary: Anencephaly and Other Neural Tube Defects*, 15 FRONTIERS IN NEUROENDOCRINOLOGY 197, 197 (1994) (indicating that there are racial and genetic differences in occurrence of neural tube defects).

71. *See* Martha L. Slattery & Dwight T. Janerich, *The Epidemiology of Neural Tube Defects: A Review of Dietary Intake and Related Factors As Etiologic Agents*, 133 AM. J. EPIDEMIOLOGY 526, 526 (1991) (explaining that women who have already delivered one child with neural tube defect are more likely to have another infant with defect); David A. Stumpf et al., *Special Article: The Infant with Anencephaly*, 322 NEW ENG. J. MED. 669, 670 (1990) (discussing maternal reproductive history that could influence prevalence of anencephaly); *see also* TEXAS DEP'T OF HEALTH, AN INVESTIGATION OF A CLUSTER OF NEURAL TUBE DEFECTS IN CAMERON COUNTY, TEXAS 12 (1992) (citing statistics indicating that mothers delivering child with neural tube defect have increased risk of second affected pregnancy).

a higher rate of anencephaly than Anglo births.[72] Genetics, however, is not the only deciding factor.[73]

The second possible cause of neural tube defects is linked to socioeconomic and nutritional factors.[74] In the 1992 joint study of the neural tube defect cluster in Cameron County conducted by the Centers for Disease Control and the Texas Department of Health, a demographic investigation was conducted to determine if there were any socioeconomic factors associated with the increased rates of neural tube defects.[75] The study corresponded with other socioeconomic studies and noted that parents with lower socioeconomic status were more likely to deliver an infant

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72. *See, e.g.*, TEXAS DEP'T OF HEALTH, AN INVESTIGATION OF A CLUSTER OF NEURAL TUBE DEFECTS IN CAMERON COUNTY, TEXAS 5 (1992) (discussing high rates of neural tube defects in Appalachian states and among Hispanics, and lower rates among African-Americans); *Anencephaly in Texas Border Counties 1986-1991*, DISEASE PREVENTION NEWS (Texas Dep't of Health, Austin, Tex.), Sept. 20, 1993, at 1, 4 (stating that annual rate in Mexico for anencephaly is reportedly 18.4 cases of anencephaly per every 10,000 births compared with 3.25 cases per every 10,000 births in United States, thus suggesting higher rate in Hispanic population). Attorneys for General Motors suggested that the high rates of anencephaly in the border region were due to the ethnic background of the parents. Interview with Tony Martinez & Randy Whittington, Attorneys for Plaintiffs in Alvear v. Leonard Electric Products, in Brownsville, Tex. (Sept. 25, 1995). This view was commonly referred to as the "Mayan Theory" because the attorneys for General Motors argued that the ancestry of the parents of the children born with the neural tube defects in Cameron County could be traced back to the ancient Mayan civilization of central Mexico where current rates of anencephalic births are considerably higher than in the remainder of Mexico. *Id.*

73. *See, e.g.*, TEXAS DEP'T OF HEALTH, AN INVESTIGATION OF A CLUSTER OF NEURAL TUBE DEFECTS IN CAMERON COUNTY, TEXAS 11-12 (1992) (indicating that variety of factors play role in cause of neural tube defects); Jeffrey A. Golden & Gerald F. Chernoff, *Multiple Sites of Anterior Neural Tube Closure in Humans: Evidence from Anterior Neural Tube Defects (Anencephaly)*, 95 PEDIATRICS 506, 506 (1995) (suggesting multifactorial causation consisting primarily of genetic and environmental components); Huseyin Guvenc et al., *Low Levels of Selenium in Mothers and Their Newborns in Pregnancies with a Neural Tube Defect*, 95 PEDIATRICS 879, 879 (1995) (hypothesizing that most cases of neural tube defects arise from combined interaction of unknown environmental and genetic factors).

74. *See, e.g.*, TEXAS DEP'T OF HEALTH, AN INVESTIGATION OF A CLUSTER OF NEURAL TUBE DEFECTS IN CAMERON COUNTY, TEXAS 11 (1992) (citing socioeconomic status as major causal factor of neural tube defects); GREGG S. WILKINSON ET AL., EPIDEMIOLOGIC STUDY OF NEURAL TUBE AND OTHER BIRTH DEFECTS IN THE LOWER RIO GRANDE VALLEY 9 (1995) (discussing possible inverse relationship between socioeconomic status and rate of neural tube defects); Huseyin Guvenc et al., *Low Levels of Selenium in Mothers and Their Newborns in Pregnancies with a Neural Tube Defect*, 95 PEDIATRICS 879, 881 (1995) (indicating that typical socioeconomic status of many mothers who give birth to children with neural tube defects is low).

75. TEXAS DEP'T OF HEALTH, AN INVESTIGATION OF A CLUSTER OF NEURAL TUBE DEFECTS IN CAMERON COUNTY, TEXAS 21 (1992).

with neural tube defects.[76] The study concluded that the dietary deficiencies of the parents, which are often a result of the parents' low socioeconomic status, may have been a primary cause of the neural tube defects.[77] Consequently, in December 1991, the Journal of the American Medical Association "firmly recommended" folic acid supplementation for all women who have had pregnancies affected by neural tube defects and suggested public health measures to ensure that all women of child bearing age maintain diets with adequate amounts of folic acid.[78] Additionally, the Centers for Disease Control and the Texas Department of Health recommended that the Texas Department of Health coordinate educa-

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76. *See id.* (concluding that parents with less than high school education have greater chance to conceive children with neural tube defects than parents who graduated from high school); *see also* Huseyin Guvenc et al., *Low Levels of Selenium in Mothers and Their Newborns in Pregnancies with a Neural Tube Defect*, 95 PEDIATRICS 879, 881 (1995) (noting low socioeconomic status of majority of mothers who give birth to children with neural tube defects); Martha L. Slattery & Dwight T. Janerich, *The Epidemiology of Neural Tube Defects: A Review of Dietary Intake and Related Factors As Etiologic Agents*, 133 AM. J. EPIDEMIOLOGY 526, 526 (1991) (concluding that either acute or chronic poverty plays key role in causation of neural tube defects); *Anencephaly in Texas Border Counties 1986-1991*, DISEASE PREVENTION NEWS (Texas Dep't of Health, Austin, Tex.), Sept. 20, 1993, at 4 (suggesting that different rates of anencephaly among various ethnic groups may be due to differing socioeconomic conditions).

77. *See* Huseyin Guvenc et al., *Low Levels of Selenium in Mothers and Their Newborns in Pregnancies with a Neural Tube Defect*, 95 PEDIATRICS 879, 881 (1995) (reporting relationship between poor diet and neural tube defects); Ronald J. Lemire, *Neural Tube Defects*, 259 JAMA 558, 559 (1988) (concluding that in evaluating causes of neural tube defects, nutritional status is more important consideration than occupational environment, pollution, exposure to infectious diseases, pregnancy planning, or rural versus urban living); *see also* Martha L. Slattery & Dwight T. Janerich, *The Epidemiology of Neural Tube Defects: A Review of Dietary Intake and Related Factors As Etiologic Agents*, 133 AM. J. EPIDEMIOLOGY 526, 526 (1991) (citing blighted potatoes, tea, low calcium intake, hard water, and nitrates as potential causes of neural tube defects).

78. *See Commissioner's Corner: Folic Acid*, DISEASE PREVENTION NEWS (Tex. Dep't of Health, Austin, Tex.), Nov. 1, 1993, at 6 (reporting that United States Food and Drug Administration issued order requiring all grain products to be fortified with folic acid); *Prevention of Neural Tube Defects: Results of the Medical Research Council Vitamin Study*, 266 JAMA 2965, 2965 (1991) (approving folic acid supplementation for all women of childbearing age who have had affected pregnancies); *see also* Ridgely Ochs, *Folic Acid Use Urged to Cut Birth Defect*, NEWSDAY, Sept. 15, 1992, at 7 (recommending that all women of childbearing age take 0.4 milligrams of folic acid daily to reduce risk of neural tube defects); James Pinkerton, *Living on the Edge, Experts Call for More Study of Birth Defect*, HOUSTON CHRON., Oct. 21, 1993, at A17 (discussing health clinics' attempts to curb neural tube defects by distributing free folic acid supplements in border communities). *But see* GREGG S. WILKINSON ET AL., EPIDEMIOLOGIC STUDY OF NEURAL TUBE AND OTHER BIRTH DEFECTS IN THE LOWER RIO GRANDE VALLEY 60 (1995) (asserting that there is little evidence to link cause of neural tube defects to folic acid deficiency).

tional programs to inform women of the advantages of ingesting folic acid as a means of preventing neural tube defects.[79]

Perhaps the most controversial theory of the cause of neural tube defects is that focusing on the influence of environmental toxins.[80] Increasingly scientific analysis has discovered links between certain toxins and birth defects.[81] Moreover, the causal connection between environmental toxins and birth defects is evident throughout many parts of the world where increasing pesticide use and heavy industry remain prevalent.[82]

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79. *See* TEXAS DEP'T OF HEALTH, AN INVESTIGATION OF A CLUSTER OF NEURAL TUBE DEFECTS IN CAMERON COUNTY, TEXAS 34 (1992) (recommending that Texas Department of Health create educational programs extolling benefits of folic acid intake as means of preventing neural tube defects). Despite this recommendation, the investigation found no significant difference in the level of folic acid between mothers who gave birth to babies with neural tube defects and those who did not. *Id.* at 23.

80. *See* Robin Alexander, *Lower Rio Grande Valley: Neural Tube Defects* (reporting that growing number of scientific studies link toxins used in maquiladoras to neural tube defects), *in* TEXAS RURAL LEGAL AID, ECONOMIC & ENVIRONMENTAL CONDITIONS IN THE LOWER RIO GRANDE VALLEY ALONG THE TEXAS-MEXICO BORDER 7, 8 (1993); *see also* Sandra A. Geschwind et al., *Risk of Congenital Malformations Associated with Proximity to Hazardous Waste Sites*, 135 AM. J. EPIDEMIOLOGY 1197, 1197 (1992) (recognizing increased concerns about environmental toxins as cause of neural tube defects).

81. *See, e.g.*, WILLIAM W. AU & MARVIN S. LEGATOR, DRUG & CHEMICAL ACTION IN PREGNANCY 335 (1986) (suggesting that as women remain in work force and pregnant women stay at work longer, fetuses and embryos are increasingly exposed to "chemical and physical stresses" during development, which could result in babies born with birth defects); Robin Alexander, *Lower Rio Grande Valley: Neural Tube Defects* (explaining that vast quantities of solvents cited as possible cause of neural tube defects, such as xylene, have been found in maquiladora plants in amounts far exceeding EPA standards), *in* TEXAS RURAL LEGAL AID, ECONOMIC & ENVIRONMENTAL CONDITIONS IN THE LOWER RIO GRANDE VALLEY ALONG THE TEXAS-MEXICO BORDER 7 (1993); Jean D. Brender & Lucina Suarez, *Paternal Occupation and Anencephaly*, 131 AM. J. EPIDEMIOLOGY 517, 517 (1990) (concluding that men working in professions associated with solvent exposure had greater tendency to father children with anencephaly); Jiri Kucera, *Exposure to Fat Solvents: A Possible Cause of Sacral Agenesis in Man*, 72 PEDIATRICS 857, 859 (1968) (linking xylene exposure of chick embryos with irregular development); Peter C. Holmberg, *Central-Nervous System Defects in Children Born to Mothers Exposed to Organic Solvents During Pregnancy*, LANCET, July 28, 1979, at 177 (discussing study linking neural tube defects to maternal exposure to solvents). *But see* Sandra A. Geschwind et al., *Risk of Congenital Malformations Associated with Proximity to Hazardous Waste Sites*, 135 AM. J. EPIDEMIOLOGY 1197, 1197 (1992) (stating that it is unclear as to whether prolonged exposure to toxic chemicals produces adverse health effects in human beings).

82. *See, e.g.*, Ruth Gilbert, *"Clusters" of Anophthalmia in Britain: Difficult to Implicate Benomyl on Current Evidence*, 307 BRIT. MED. J. 340, 340 (1993) (investigating possible link between pesticide benomyl and cluster of anophthalmia babies born with no eyes in England); Godfrey P. Oakley, *Population and Case-Control Surveillance in the Search for Environmental Causes of Birth Defects*, 99 PUB. HEALTH REP. 465, 467 (1984) (discussing outbreak of mental retardation and cerebral palsy in Japan resulting from pregnant women's consumption of fish from contaminated Minamata Bay, which was polluted from

For example, in studies conducted as early as 1968, researchers found a causal link between embryonic development and exposure to fat solvents commonly used in manufacturing plants to remove paint residue from mechanical parts.[83] Dr. Jiri Kucera, of what was then Czechoslovakia, conducted an experiment in which a total of 137 chick embryos were exposed to xylene, an organic solvent, for various exposure times.[84] Dr. Kucera concluded that the experiments supported his hypothesis that fat solvents, such as xylene, may have an adverse impact on the fetal development of the neural tube.[85] Another illustration of the causal connection between environmental toxins and birth defects is a 1979 Finnish study in which the effect of maternal exposure to organic solvents in everyday life was analyzed.[86] The study concluded that mothers who were exposed to organic solvents while pregnant were significantly more likely to bear children with birth defects.[87]

A third study, conducted by a member of the Environmental Epidemiology Program of the Texas Department of Health, attempted to link pa-

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mercury waste spilled into bay by chemical company); Kate Douglas, *Poisoned Fish Blamed for Villagers' Birth Defects; Rinya, Hungary*, NEW SCIENTIST, Mar. 6, 1993, at 11 (disclosing cluster of birth defects in Rinya, Hungary believed to be caused by local fish farm's use of pesticide); Carsten Thomassen, *Romania's Black Town; Pollution in Copsa Mica, Romania*, WORLD PRESS REV., Sept. 1993, at 43 (reporting on children in Copsa Mica, Romania, who were born near carbon-producing factory with amounts of lead in their bodies twice as high as safe limit).

83. Jiri Kucera, *Exposure to Fat Solvents: A Possible Cause of Sacral Agenesis in Man*, 72 PEDIATRICS 857, 859 (1968); *see* Robin Alexander, *Lower Rio Grande Valley: Neural Tube Defects* (indicating that increasing scientific data point to solvents that are utilized in many maquiladora processes as possible candidates for causing neural tube defects), *in* TEXAS RURAL LEGAL AID, ECONOMIC & ENVIRONMENTAL CONDITIONS IN THE LOWER RIO GRANDE VALLEY ALONG THE TEXAS-MEXICO BORDER 7, 8 (1993); Jean D. Brender & Lucina Suarez, *Paternal Occupation and Anencephaly*, 131 AM. J. EPIDEMIOLOGY 517, 517 (1990) (reporting that paternal occupation with solvent exposure increases risks of producing anencephalic children).

84. Jiri Kucera, *Exposure to Fat Solvents: A Possible Cause of Sacral Agenesis in Man*, 72 PEDIATRICS 857, 857 (1968).

85. *Id.* at 859. In the Guidelines for Developmental Toxicity Risk Assessment, the EPA stated that in almost all cases in which experimental animal studies were performed in an attempt to determine if toxic agents cause human development toxicity, the animal studies demonstrated effects similar to those found in humans. Guidelines for Developmental Toxicity Risk Assessment, 56 Fed. Reg. 63,798, 63,802–09 (1991). The EPA concluded that "this information provides a strong basis for the use of animal data in conducting human health risk assessments." *Id.* at 63,802.

86. *See* Peter C. Holmberg, *Central-Nervous System Defects in Children Born to Mothers Exposed to Organic Solvents During Pregnancy*, LANCET, July 28, 1979, at 177, 179 (discussing study involving twelve mothers who were exposed to organic solvents at work and two mothers who were exposed at home while their husbands did home improvements with organic solvents, such as car spray paint and reinforced plastics laminate).

87. *Id.* at 177.

ternal occupations with high exposure to pesticides and organic solvents to neural tube defects.[88] The study revealed that paternal occupation was a good socioeconomic indicator of the risk of anencephalic offspring because men in lower socioeconomic levels tended to be employed in occupations with greater exposure to solvents.[89] Further, the study concluded that men employed in occupations with high solvent exposure had a greater chance of fathering children with anencephaly.[90]

One commentator has suggested that the fact that there was an increase in diseases approximately thirty years after the Industrial Revolution is evidence of a nexus between environmental pollution and diseases.[91] This theory is known as the "time bomb theory."[92] According to the time bomb theory, the time lag between exposure to toxins and illness plays an important role in making the environmentally caused diseases difficult to combat.[93] A disease that is prevalent today may have arisen from the environmental toxins released into the atmosphere thirty

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88. Jean D. Brender & Lucina Suarez, *Paternal Occupation and Anencephaly*, 131 AM. J. EPIDEMIOLOGY 517, 517 (1990).

89. *Id.* at 520. In studying the socioeconomic factors that come into play, Brender found an increased risk for anencephalic offspring among Hispanic fathers when compared with their Anglo counterparts. *Id.* Brender asserts that the high disparity between Hispanics and Anglos with regard to anencephalic rates may be due to the fact that Hispanic fathers are more likely to experience increased exposure to paints and other solvents, while Anglo males are more likely to supervise the work crews and thus have less exposure to the toxins. *Id.*

90. *Id.* at 517.

91. *See A Clean America, Will People Pay the Price?*, U.S. NEWS & WORLD REP., Feb. 7, 1977, at 40 (discussing correlation between increased industrial development and increased instances of disease). Dr. Carmen Rocco, a pediatrician in Brownsville who has led the crusade against the neural tube defects in Cameron County, Texas, studied the statistics of other potentially fatal illnesses along the border region and noticed increases in childhood leukemia. Jeannie Ralston, *Among the Ruins of Matamoros*, AUDUBON, Nov. 1993, at 87, 89. After speaking to another toxicologist who supports the environmental-contamination hypothesis, Dr. Rocco issued a grim prediction for the residents of the border communities. *Id.*

92. *A Clean America, Will People Pay the Price?*, U.S. NEWS & WORLD REP., Feb. 7, 1977, at 40; *cf.* Jeannie Ralston, *Among the Ruins of Matamoros*, AUDUBON, Nov. 1993, at 87, 89 (discussing environmental-contamination hypothesis and latent effects of diseases caused by toxins).

93. *See* RACHEL CARSON, SILENT SPRING 188–89 (1962) (asserting that danger of continuous exposure is often ignored because adverse biological effects caused by chemical exposure are not immediately recognized).

years ago.[94] Similarly, today's toxins may be creating ailments that will not become apparent until thirty years from now.[95]

An example of the "time bomb theory" is illustrated by the epidemic of anencephaly that occurred in the early 1930s on the east coast of the United States.[96] In relating the "time bomb theory" to this epidemic of anencephaly, one need only count back thirty years to the turn of the century when the Industrial Revolution was in full swing, pollutants spewed forth from filthy smokestacks, and immigrants toiled in dingy, sweaty factories, inhaling the polluted air.[97] Approximately thirty years later, an epidemic of anencephaly occurred in New England, the heartland of the Industrial Revolution.[98]

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94. *See A Clean America, Will People Pay the Price?*, U.S. NEWS & WORLD REP., Feb. 7, 1977, at 40, 41 (commenting that diseases today may be product of environment of 30 years ago).

95. *See id.* (asserting that environment of today may produce diseases that will predominate 30 years from now). In her book *Silent Spring*, which exposed the horrendous effects of the use of pesticides on the environment, Rachel Carson quotes a doctor from the United States Public Health Service who said:

> We all live under the haunting fear that something may corrupt the environment to the point where man joins the dinosaurs as an obsolete form of life. And what makes these thoughts all the more disturbing is the knowledge that our fate could perhaps be sealed twenty or more years before the development of symptoms.

RACHEL CARSON, SILENT SPRING 188 (1962).

96. *See, e.g.*, TEXAS DEP'T OF HEALTH, AN INVESTIGATION OF A CLUSTER OF NEURAL TUBE DEFECTS IN CAMERON COUNTY, TEXAS 5 (1992) (noting that rates of anencephaly in Northeast United States in 1930s were as high as 50 cases per 10,000 births); Martha L. Slattery & Dwight T. Janerich, *The Epidemiology of Neural Tube Defects: A Review of Dietary Intake and Related Factors As Etiologic Agents*, 133 AM. J. EPIDEMIOLOGY 526, 526 (1991) (reporting decline in rates of anencephaly in United States after epidemic number of cases were reported in 1930s); David A. Stumpf et al., *Special Article: The Infant with Anencephaly*, 322 NEW ENG. J. MED. 669, 671 (1990) (discussing anencephaly epidemic in Boston and Providence in 1930s).

97. *See* Mark L. Glode & Beverly N. Glode, *Transboundary Pollution: Acid Rain and United States-Canadian Relations*, 20 B.C. ENVTL. AFF. L. REV. 1, 8 (1993) (recognizing that Industrial Revolution created air pollution problems); *cf.* Mark A. Gray, *The United Nations Environment Programme: An Assessment*, 20 ENVTL. L. 291, 292 (1990) (stating that some citizens during Industrial Revolution expressed concern about environment); Paul D. Barker, Note, *The Chesapeake Bay Preservation Act: The Problem with State Land Regulation of Interstate Resources*, 31 WM. & MARY L. REV. 735, 736 (1990) (acknowledging that President Theodore Roosevelt recognized importance of nature conservation during time of Industrial Revolution).

98. *E.g.*, TEXAS DEP'T OF HEALTH, AN INVESTIGATION OF A CLUSTER OF NEURAL TUBE DEFECTS IN CAMERON COUNTY, TEXAS 5 (1992); Mary L. Slattery & Dwight T. Janerich, *The Epidemiology of Neural Tube Defects: A Review of Dietary Intake and Related Factors As Etiologic Agents*, 133 AM. J. EPIDEMIOLOGY 526, 526 (1991); David A. Stumpf et al., *Special Article: The Infant with Anencephaly*, 322 NEW ENG. J. MED. 669, 671 (1990).

The situation in New England at the turn of the century is similar to that of the Texas-Mexico border in the late 1960s and 1970s because the production at the maquiladora factories increased dramatically during this time period as Mexico loosened its foreign ownership restrictions.[99] A study of neural tube defects in the Lower Rio Grande Valley investigated the relationship between the number of maquiladoras in Matamoros, Mexico and the prevalence of anencephalic births in Cameron County for the period between 1980 and 1992 and concluded that the link between environmental toxins and adverse health effects is strong.[100] Despite these studies and the plausibility of the time bomb theory, proving causation in toxic tort cases, including those involving neural tube defects, remains extremely difficult, if not impossible.[101]

C. *Difficulties in Proving Causation in Neural Tube Defect Cases*

Persons affected by the Cameron County neural tube defects cluster may appropriately be categorized as toxic tort victims.[102] As such, they

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99. *See* National Commission on Foreign Investment, General Resolution No. 1, D.O., July 11, 1973, *superseded by* National Commission on Foreign Investment, General Resolution No. 2, D.O., Aug. 30, 1984 (allowing partial ownership and supervision of maquiladoras by foreigners). The number of maquiladora plants and the number of employees at those plants in Matamoros, for example, have increased markedly since 1975, reaching their peak in the years between 1990 and 1992—the years the cluster of neural tube defects occurred right across the border in Cameron County. *See* GREGG S. WILKINSON ET AL., EPIDEMIOLOGIC STUDY OF NEURAL TUBE AND OTHER BIRTH DEFECTS IN THE LOWER RIO GRANDE VALLEY 25 (1995) (listing number of employees at maquiladora plants and number of maquiladoras between 1975 and 1993).

100. *See* GREGG S. WILKINSON ET AL., EPIDEMIOLOGIC STUDY OF NEURAL TUBE AND OTHER BIRTH DEFECTS IN THE LOWER RIO GRANDE VALLEY 59, 65 (1995) (finding that prevalence of anencephaly is related to number of maquiladoras in Matamoros). Additionally, the tissue of an anencephalic baby has been tested for environmental toxins. COALITION FOR JUSTICE IN THE MAQUILADORAS, 1992 ANNUAL REPORT 8 (1993). Positive findings of DDE, DDT, and lindane (pesticides banned in the United States), heptachloride and oxychlorane (chemical compounds), and phenylglyoxilic acid (a breakdown product of ethylbenzene and styrene, both of which are byproducts from the plastic industry) were discovered in the baby's tissue. *Id.*

101. Interview with Tony Martinez & Randy Whittington, Attorneys for Plaintiffs in Alvear v. Leonard Electric Products, in Brownsville, Tex. (Sept. 25, 1995); *see* Colin H. Buckley, Note, *A Suggested Remedy for Toxic Injury: Class Actions, Epidemiology, and Economic Efficiency*, 26 WM. & MARY L. REV. 497, 517-18 (1985) (recognizing plaintiffs' difficulty in refuting defendants' alternate causation theories). *But see* Christopher L. Callahan, *Establishment of Causation in Toxic Tort Litigation*, 23 ARIZ. ST. L.J. 605, 611 (1991) (arguing that plaintiffs' burden of proof for causation in toxic tort litigation does not differ substantially from plaintiffs' burden in traditional tort cases).

102. *See, e.g.*, TEX. CIV. PRAC. & REM. CODE ANN. § 33.011 (Vernon Supp. 1996) (defining toxic tort as cause of action sounding in tort or breach of implied warranty "arising out of exposure to . . . hazardous chemicals, hazardous wastes, hazardous hydrocar-

face daunting obstacles to recovering damages from the producers of toxic substances.[103] The primary difficulty faced by plaintiffs in toxic tort actions, including those plaintiffs involved in the Cameron County case, is proof of causation.[104]

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bons, [or] similarly harmful organic or mineral substances"); Bert Black, *A Unified Theory of Scientific Evidence*, 56 FORDHAM L. REV. 595, 602 n.29 (1988) (defining toxic tort cases as cases in which "plaintiffs seek compensation for harm allegedly caused by exposure to a substance that increases the risk of contracting a serious disease, but generally involve a period of latency or incubation prior to the onset of the disease"); Christopher L. Callahan, *Establishment of Causation in Toxic Tort Litigation*, 23 ARIZ. ST. L.J. 605, 605 (1991) (defining toxic tort as "a personal injury and related harm that is allegedly attributable to a plaintiff's exposure to a toxic (in most instances, chemical) substance"). Attorney Michael Dore has explained that plaintiffs in toxic tort cases normally must show the following:

> (1) The injuries involved allegedly arose from exposure to a harmful substance.
>
> (2) The nature of the exposure was such that there is a significant risk that a large number of people suffered comparable injuries . . . .
>
> (3) The full consequences of the exposure may not be immediately apparent . . . .
>
> (4) The connection between the exposure and the injuries suffered is open to dispute, either because of questions about the nature of the substance (was it harmful), the nature of the exposure (was it significant) or the nature of the affliction (was it one that can derive from multiple causes).
>
> (5) The identity of the particular party responsible for the agent allegedly causing injuries is an open question . . . .
>
> (6) The evidence used to establish causation is on the frontiers of medical science.
>
> (7) The injuries suffered are so serious and/or the claimant's situation so sympathetic that traditional legal defenses such as contributory negligence, statute of limitations, etc., are evaluated extremely critically by the court.
>
> (8) The actions . . . raise serious administrative and legislative problems for the judiciary . . . .
>
> (9) Insurance coverage disputes are or will be present.
>
> (10) The facts involved give rise to additional potential liability exposure such as possible application of the criminal law or imposition of individual responsibility upon corporate officials.

MICHAEL DORE, THE LAW OF TOXIC TORTS § 2.02, at 2-3 to 2-4 (1987 & Supp. 1992) (footnotes omitted).

103. *See* G. MARC WHITEHEAD, TOXIC TORT CASE ESSENTIALS: STRATEGIES, EXPERTS, MOTIONS, AND ADR 281 (1992) (explaining that one difficulty for toxic tort victims in DES cases was proving identity of manufacturers); L. Grant Foster, Comment, *A Case Study in Toxic Tort Causation: Scientific and Legal Standards Work Against Recovery for Victims*, 19 ENVTL. L. 141, 141 (1988) (relaying problem of establishing causation for toxic tort victims). One difficulty for the toxic tort victims located along the United States-Mexico border is that more than 2,000 maquiladoras are located along the border, making it difficult for the toxic tort victims to determine the exact toxic substances that harmed them. *See Devaluation, NAFTA Breathe New Life into Maquiladoras*, 12 Int'l Trade Rep. (BNA) No. 31, at 1329, 1329 (Aug. 2, 1995) (commenting that over 2,100 plants operate at border).

104. *See, e.g.*, Colin H. Buckley, Note, *A Suggested Remedy for Toxic Injury: Class Actions, Epidemiology, and Economic Efficiency*, 26 WM. & MARY L. REV. 497, 518 (1985) (explaining courts' reluctancy to grant recovery to plaintiffs who are unable to demonstrate

Generally, proof of causation in any toxic tort case is a three-step process. First, the injured party must ascertain the particular toxic substances that caused the injury.[105] Second, a risk evaluation should be performed to examine whether the defendant's actions placed the plaintiff at risk of developing the illness of which the plaintiff complains.[106] Third, the plaintiff must demonstrate a nexus between the toxic substance and the alleged injury.[107] These criteria may seem simple enough to prove. However, the difficulties for plaintiffs in substantiating these three criteria stem from the scientific community's limited ability to accurately assess the amount of damage caused by toxic waste.[108] This difficulty is compounded because medical studies are unable to identify the precise

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toxic path); L. Grant Foster, Comment, *A Case Study in Toxic Tort Causation: Scientific and Legal Standards Work Against Recovery for Victims*, 19 ENVTL. L. 141, 146 (1988) (claiming that of all elements in toxic tort cause of action, causation is most difficult to prove); Christine M. Gurry, Note, 24 SETON HALL L. REV. 447, 449 (1993) (suggesting that it may be problematic for toxic tort plaintiffs to establish direct line of causation between defendants' conduct and plaintiffs' injury because large segments of population often contract similar illnesses from nontort-related circumstances); Elizabeth A. Stundtner, Comment, *Proving Causation in Toxic Tort Cases: T-Cell Studies As Epidemiological and Particularistic Evidence*, 20 B.C. ENVTL. AFF. L. REV. 335, 335 (1993) (describing difficulty arising from difference between legal and scientific causation).

105. *See* William R. Ginsberg & Lois Weiss, *Common Law Liability for Toxic Torts: A Phantom Remedy*, 9 HOFSTRA L. REV. 859, 922–23 (1981) (noting difficulty of finding proximate cause in toxic tort cases, especially when several potentially hazardous substances are present or when there is possibility of intervening causes when disease becomes evident only after prolonged period); Myra P. Mulcahy, Note, *Proving Causation in Toxic Torts Litigation*, 11 HOFSTRA L. REV. 1299, 1301 (1983) (asserting that proof of causation requires identification of substance and violator).

106. *See* Christopher L. Callahan, *Establishment of Causation in Toxic Tort Litigation*, 23 ARIZ. ST. L.J. 605, 608 (1991) (characterizing risk evaluation as first aspect of inquiry into causation); *see also* Michael Dore, *A Commentary on the Use of Epidemiological Evidence in Demonstrating Cause-In-Fact*, 7 HARV. ENVTL. L. REV. 429, 435 (1983) (indicating that cause-and-effect relationship is needed for plaintiff to establish that defendant's conduct placed plaintiff at risk of developing complained-of illness).

107. *See* Otto Wong, *Using Epidemiology to Determine Causation in Disease*, NAT. RESOURCES & ENV'T, Spring 1988, at 20, 22 (stating that if "causal interpretation seriously conflicts with the natural history and biology of the disease, extra caution must be exercised").

108. *See* Colin H. Buckley, Note, *A Suggested Remedy for Toxic Injury: Class Actions, Epidemiology, and Economic Efficiency*, 26 WM. & MARY L. REV. 497, 501 (1985) (asserting that there is no knowledge as to amount of damages that hazardous wastes have already created); *cf.* Elizabeth A. Stundtner, Comment, *Proving Causation in Toxic Tort Cases: T-Cell Studies As Epidemiological and Particularistic Evidence*, 20 B.C. ENVTL. AFF. L. REV. 335, 339 (1993) (describing procedure in which scientists try to establish some sort of causation path through series of "hypothesis building" and then test hypothesis to establish probability of causation). One legal commentator noted that a search for distinct causes in toxic tort cases is "both artificial and misleading." Glen O. Robinson, *Probabilistic Causation and Compensation for Tortious Risk*, 14 J. LEGAL STUD. 779, 781 (1985).

paths that toxins travel.[109] Simply put, even with today's advances in scientific knowledge, toxic tort victims such as the ones in Cameron County find it nearly impossible to prove the precise cause or causes of their injuries. Consequently, the principals involved, particularly Mexico, the United States, and the numerous multinational corporations along the border, need to focus their energy on solving the multitude of environmental problems *before* they reach the courthouse doors.

IV. Proposed Solutions for Environmental Health Risks Along the Texas-Mexico Border

Many people involved in the border crisis wonder whether the maquiladora industry and border residents can peacefully coexist. The border residents' relationship with the maquiladora industry is a double-edged sword because border residents would like to see environmentally sound procedures for the handling and disposal of toxic substances enforced, but fear that the imposition of rigid standards on the maquiladoras will result in the closure or relocation of many industries that are vital to the economic stability of an impoverished area.[110] In considering solutions to this problem, the governments of Texas, Mexico, and the United States, the maquiladora industry, and those residing along the border must assume a posture of collective responsibility to protect the health and safety of the border community.[111]

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109. *Cf. Developments in the Law—Toxic Tort Litigation*, 99 Harv. L. Rev. 1458, 1619–20 (1986) (opining that injuries caused by toxic torts do not lend themselves to particularized forms of proof); Colin H. Buckley, Note, *A Suggested Remedy for Toxic Injury: Class Actions, Epidemiology, and Economic Efficiency*, 26 Wm. & Mary L. Rev. 497, 518 (1985) (commenting that courts regularly deny plaintiffs recovery because of inability to link disease to injury).

110. *See* Sloan Rappoport, Comment, *NAFTA and the Petrochemical Industry: A Disastrous Combination for Life at the U.S.-Mexico Border*, 11 Dick. J. Int'l L. 579, 590 (1993) (explaining how poor environmental compliance can result in maquiladora closures); *see also Devaluation, NAFTA Breathe New Life into Maquiladoras*, 12 Int'l Trade Rep. (BNA) No. 31, at 1329, 1331 (Aug. 2, 1995) (noting statistics showing that maquiladoras employ 614,000 workers, which is more than 10% of total manufacturing in Mexico); Chris Kraul, *Mexican Government Wants More from 'Maquiladoras;' Border Plants Increased by 13 Percent Since 1994, Now Number 2,815*, Austin American-Statesman, Nov. 26, 1995, at D2 (reporting that Mexican peso's devaluation has helped create 89,000 more maquiladora jobs and 400 new factories).

111. *See* David P. Fidler, *War, Law & Liberal Thought: The Use of Force in the Reagan Years*, 11 Ariz. J. Int'l & Comp. L. 45, 64 (1994) (assessing collective responsibility of international community for international law violators). *But see* Oscar Schachter, *Human Dignity As a Normative Concept*, 77 Am. J. Int'l L. 848, 850 (1983) (exclaiming that collective responsibility is "a denigration of the dignity of the individual, a denial of a person's capacity to choose and act on his or her responsibility").

A. *Toxic Pollution Warning System*

One possible solution to the environmental problems on the border would be to create a toxic pollution warning system which could be created under an existing agreement between the United States and Mexico. The La Paz Agreement between the United States and Mexico provides for the assessment of "regulations and policies, [and] projects that may have significant impacts on the environment of the border area, so that appropriate measures may be considered to avoid or mitigate adverse environmental effects."[112] The United States and Mexico could focus on this provision and formulate an annex to the La Paz Agreement that would establish a "Toxic Pollution Warning System," similar to the "Ozone Alert Days" or "Smog Alert Days" systems currently in operation in most large American cities.[113] Such a system would give daily warnings to the border citizens regarding the toxicity of the air so that they could take adequate precautions.

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112. La Paz Agreement, *supra* note 31, art. 6, 22 I.L.M. at 1027-28; *see* Joseph Nalven, *Transboundary Environmental Problem Solving: Social Process, Cultural Perception*, 26 NAT. RESOURCES J. 793, 809 (1986) (expressing hope that La Paz Agreement will establish framework of success with regard to environmental projects in border region); Santos Gomez, Comment, *Environmental Risks Related to the Maquiladora Industry and the Likely Environmental Impact of NAFTA*, 6 LA RAZA L.J. 174, 185 (1993) (stating that objective of La Paz Agreement is "to address environmental problems created by the growth of the border area economy and population").

113. *See, e.g.*, Marla Cone, *Southland Smog Levels Are Lowest in 4 Decades; Pollution: Stage-One Alerts Drop to 13, Compared to 23 Last Year, but Region's Air Remains Nation's Dirtiest*, LOS ANGELES TIMES, Oct. 21, 1995, at A1 (stating that ozone alerts indicate presence of unhealthy air and warn residents to avoid prolonged outdoor exposure); Ramon G. McLeod, *Bay District Criticized for Smog Alerts*, SAN FRANCISCO CHRON., Oct. 5, 1995, at A15 (discussing Bay Area Air Quality Management District and its attempts to devise regulations to reduce levels of pollution); Enedelia J. Obregon, *High Ozone Season Ends with Double 1994's Alert Days*, AUSTIN AMERICAN-STATESMAN, Nov. 1, 1995, at B3 (explaining that on Ozone Action Days in Austin, Texas, residents are encouraged to drive less, not use lawn mowers, and pump less gasoline); Timothy B. Wheeler, *Amid Record Heat, Summer Smog Worst in 4 Years*, BALTIMORE SUN, Sept. 7, 1995, at B1 (explaining that on "code red" air quality alert days, residents with respiratory problems are advised to stay indoors); *Ozone Alert Lifted After Levels Fall*, PLAIN DEALER, Aug. 19, 1995, at B2 (indicating that EPA may implement stricter pollution regulations if EPA detects levels of pollution above established limit). *But see* Yael T. Abouhalkah, *Environmental Tug-of-War: The Public Reacts to Pollution in Some Strange Ways*, KAN. CITY STAR, Oct. 15, 1995, at J1 (describing Kansas City residents' reaction to ozone alert as apathetic). The city of Detroit instituted ozone "action days" in which weather conditions that indicate possible ozone problems are announced a day in advance by the local news media. Gary Heinlein, *Air Pollution: Coalition to Alert Public When Ozone Becomes Unhealthy*, DETROIT NEWS, May 25, 1995, at E16. Approximately 100 cooperating businesses, including General Motors, who delay production while the ozone alert is in effect are sent faxes advising them of the predicted weather conditions so that they may take adequate measures to limit the amount of pollution in the air. *Id.*

Because most of the border towns that would benefit from such a system lack sufficient local media to disburse warnings,[114] usual modes of communication such as radio, television, and newspapers would not be effective. Thus, a mechanism similar to the "air raid" sirens that many cities in the United States have would need to be used.[115] Different sirens could be used to signify different levels of toxicity on a daily basis. Using this siren system, authorities would need only distribute information to residents once about the meaning of each siren and the procedure to follow in the event of a toxicity warning.

The warning system could be monitored in the United States through the Federal Emergency Planning and Community Right to Know Act.[116] This Act created a program to inform the public about hazardous and toxic chemicals located in communities and established emergency planning and notification requirements to warn the public in case of a release of toxic substances.[117] The Emergency Planning and Community Right to Know Act calls for the implementation of State Emergency Response Commissions to appoint local emergency planning committees representing a variety of employment fields, including medical personnel, elected officials, the local media, and owners or operators of facilities using chemicals.[118] The local emergency planning committees can then establish provisions for "(1) public notification of committee activities; (2) public meetings to discuss the emergency plan; (3) public comments; (4)

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114. *Cf.* Jerry Jackson, *Making Trade with Mexico More Accessible, Free-Trade Agreement to Loosen Restrictions on Imports, Exports*, ORLANDO SENTINEL TRIBUNE, Dec. 23, 1991, at 12 (describing Mexico as third world country). One maquiladora manager from the El Paso-Juárez region describes the region as "the only place on earth where Mom and the kids can live in the U.S. while Dad commutes to the Third World." Tom Hitzelboerger, *The Maquiladora Advantage*, OREGON BUSINESS, May 1988, at 85.

115. *See* Dennis Grogan, *FYI Officials in East Point OK New Alarm System*, ATLANTA J.-CONST., Dec. 14, 1995 (describing new emergency siren system with different tones and instructions for various situations), *available in* Westlaw, ATLNTAJC Database; Allison Stuebe, *Long Island Fire Scorches Over 5,000 Acres, 400 Displaced, Traffic Jammed for Miles on Expressway Leading to Region's Resort Beaches*, WASH. POST, Aug. 26, 1995, at A3 (describing air raid sirens used in New York for large fire). *But cf.* Bob Pool, *Replicas of Cold War Era: Silent Air Raid Sirens Unwanted*, LOS ANGELES TIMES, Apr. 2, 1989, at M2 (explaining how 1950s-style air raid sirens became antiquated by end of Cold War).

116. 42 U.S.C. § 11001 (1994).

117. *See* Exec. Order No. 12,856, 3 C.F.R. 616 (1993), *reprinted in* 42 U.S.C. § 11001 (1994) (discussing Emergency Planning and Community Right-to-Know Act of 1986).

118. 42 U.S.C. § 11001(a). The professions represented include, at a minimum:

> elected State and local officials; law enforcement, civil defense, firefighting, first aid, health, local environmental, hospital, and transportation personnel; broadcast and print media; community groups; and owners and operators of facilities subject to the requirements of this subchapter.

Id. § 11001(c).

response to such comments by the committee; and, (5) distribution of the emergency plan."[119] Once a response team is placed in the local community, it should operate the warning system by scientifically testing the levels of toxins emitted at the border, informing the residents of the border communities through the local media, and warning border residents of any particular dangers due to high concentrations of toxins in the air.[120]

In light of the failure of the United States and Mexican governments to compel maquiladoras to abide by already established environmental laws, this type of warning system should be created to warn border residents of pollution so that they may take adequate precautions. A warning system would give border residents vital information and would provide a warning to the residents to avoid intense physical labor on high pollution days. Additionally, in the case of expectant mothers who foster concerns about their unborn children acquiring birth defects, the system would give the mothers the opportunity to leave the area until the alert subsides. Thus, the warning system could go a long way to reduce environmental health risks on the border.

B. *Bilateral Research Commission*

Another possible solution to border environmental problems would be for the governments of the United States and Mexico to establish a bilateral research commission to study the effects of the pollution on both sides of the border.[121] The La Paz Agreement already provides for the establishment of such a commission by calling for the creation of "scientific and educational exchanges."[122] The bilateral research commission

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119. *Id.*

120. *See id.* (allowing for community coordination of procedural aspects of plan). Using the media may seem like a logical solution and, in most instances, it is; however, approximately 140,000 people live in Colonias with no running water or electricity. Clarice E. Gaylord & Geraldine W. Twitty, *Protecting Endangered Communities*, 21 FORDHAM URB. L.J. 771, 777 (1994); *see Texas Works to Improve Living Conditions for 300,000* (Nat'l Pub. Radio broadcast, Dec. 15, 1994) (indicating that Colonias lack basic necessities, such as electricity, paved roads, water, and sewage systems), *available in* LEXIS, NEWS Library, NPR File.

121. *Cf.* Memorandum of Intent Concerning Transboundary Air Pollution, Aug. 5, 1980, U.S.-Can., 32 U.S.T. 2521 (creating agreement between United States and Canada to establish bilateral research advisement committee to study long-range movement of air toxins).

122. La Paz Agreement, *supra* note 31, art. 6, 22 I.L.M. at 1027. The provision states in pertinent part:

> To implement this Agreement, the Parties shall consider and, as appropriate, pursue in a coordinated manner practical, legal, institutional, and technical measures for protecting the quality of the environmental [sic] in the border area. Forms of cooperation

could be similar to the one that Canada and the United States enacted in 1980 to study the effects of acid rain along the United States-Canada border.[123] While the creation of the United States-Canada Bilateral Research Commission on Air Pollution did not impose legal obligations on the parties, it did provide for the creation of joint United States-Canadian study groups.[124] These study groups devised tactics for decreasing air pollution, developed direct atmospheric modeling, drafted reports to introduce their findings, and determined the environmental and economic impact of implementing suggested pollution reduction procedures.[125] After the joint study groups completed their work, both governments agreed to exchange information on their programs and continue cooperative efforts to study the effects of acid rain on the environment.[126]

A similar joint United States-Mexico research commission should be created to provide answers to some of the concerns that border residents have regarding the mixture of toxins flowing along the border. The commission should bear the responsibility of testing various toxin airborne mixtures that are actually present in the border region, instead of testing on an individual chemical-by-chemical basis as required by the Occupa-

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may include: coordination of national programs; scientific and educational exchanges; environmental monitoring; environmental impact assessment; and periodic exchanges of information and data on likely sources of pollution in their respective territory which may produce environmentally polluting incidents . . . .

Id.

123. Memorandum of Intent Concerning Transboundary Air Pollution, Aug. 5, 1980, U.S.-Can., 32 U.S.T. 2521.

124. *See id.* at 2529 (establishing "technical and scientific work groups" to prepare for air pollution agreement).

125. *Id.*; *see* Barbara K. Bucholtz, *COASE and the Control of Transboundary Pollution: The Sale of Hydroelectricity Under the United States-Canada Free Trade Agreement of 1988*, 18 B.C. ENVTL. AFF. L. REV. 279, 294 (1991) (discussing cooperative study commission created by Memorandum of Intent Concerning Transboundary Air Pollution); Jeffrey L. Roelofs, Note, *United States-Canada Air Quality Agreement: A Framework for Addressing Transboundary Air Pollution Problems*, 26 CORNELL INT'L L.J. 421, 442 (1993) (indicating that although joint United States-Canadian study commission created by Memorandum of Intent Concerning Transboundary Air Pollution did not achieve much success due to political philosophies, it did provide impetus to establish agreement between United States and Canada to study long-range transboundary air pollution).

126. *See* Mark L. Glode & Beverly N. Glode, *Transboundary Pollution: Acid Rain and United States-Canadian Relations*, 20 B.C. ENVTL. AFF. L. REV. 1, 18 (1993) (discussing plans by both governments to continue research that started under 1980 Memorandum of Intent). The Memorandum of Intent Concerning Transboundary Air Pollution came to a standstill in the early 1980s after the election of President Ronald Reagan, who insisted on greater proof that the acid rain problem was such an immense dilemma that federal funding was required. James R. Vestigo, *Acid Rain and Tall Stack Regulation Under the Clean Air Act*, 15 ENVTL. L. 711, 726-27 (1985).

tional Safety and Health Administration (OSHA).[127] The commission could then create emissions standards based on this testing. Additionally, the commission could conduct research on the assorted ailments that arise in extraordinarily high numbers in the border communities, including neural tube defects. Funding for the commission's activities could be provided through the Border Plan, which states that one of its objectives is to institute cooperative efforts to better understand pollution issues in the border area.[128] Through the creation of a bilateral research commission, more information on the health risks of pollution could be compiled in an attempt to determine the causes of various ailments, including neural tube defects. This research would help doctors to determine the causes of neural tube defects and would alleviate some of the problems of proving causation.[129]

C. *Adequate Funding for Implementation of the Texas Birth Defects Registry*

Another possible long-term solution would be to fully develop the newly implemented Texas Birth Defects Registry.[130] The registry has already been implemented in two out of the eleven regions of the state—the Lower Rio Grande Valley and the Houston area.[131] The Texas Legis-

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127. *See* Occupational Safety and Health Administration Standards, 29 C.F.R. § 1910.1000 (1994) (listing acceptable ceiling concentrations for exposure to individual chemicals).

128. Border Plan, *supra* note 18, at I-3. Funding for the first stage of the Border Plan was to come from a variety of sources, including contributions from both the United States and Mexican governments, the border state and local governments of both countries, and the private sectors of both countries. *Id.* at V-50.

129. *Cf.* Elam v. Alcolac, Inc., 765 S.W.2d 42, 185 (Mo. Ct. App. 1988) (linking biological injuries to exposure of toxic chemical emissions), *cert. denied*, 493 U.S. 817 (1989). In *Elam*, a Missouri court of appeals explained that plaintiffs who allegedly suffer injuries from exposure to toxins must not only prove a "demonstrable relationship" between the ailment and the toxins, but must also prove that the diagnosed disease is consistent with exposure to the toxins emitted by the defendant. *Id.* The research conduced by the research commission could help the toxic tort victims along the border by discovering a link between the toxins emitted from the maquiladoras and the neural tube defects.

130. TEX. HEALTH & SAFETY CODE ANN. § 87.021 (Vernon Supp. 1996).

131. Telephone Interview with Peter Langlois, Senior Epidemiologist, Texas Bureau of Epidemiology (Nov. 10, 1995); *see Ongoing Birth Defect Cluster Investigations*, TEXAS BIRTH DEFECTS MONITOR, (Texas Dep't of Health, Austin, Tex.), Apr. 1995, at 1 (predicting expansion into other regions by September 1996, provided that Texas Birth Defects Monitoring Division receives appropriations from Texas Legislature). The Texas Department of Health established factors to consider when determining the areas for expansion of the Birth Defects Registry, including the demographic characteristics of the population in the region, the recurrence patterns in the region, and the concern for the number of birth defects in a particular region. *Id.*

lature has allocated money for expansion of the program, but the funding is presently inadequate to provide the entire state with the registry service.[132] In addition to funding from the Texas Legislature, the Texas Bureau of Epidemiology solicits private funding for the registry.[133] This funding typically consists of grants from foundations or donations of equipment from government and private medical organizations such as the Centers for Disease Control.[134] The private funding, however, is also not enough to establish a birth defect monitoring system in each of the eleven regions created by the Texas Department of Health.[135] Because adequate funding is the key to the effective implementation of the Texas Birth Defects Registry,[136] another source of funding must be found.

One source of possible funding may be found through the Environmental Side Agreement.[137] The Environmental Side Agreement provides for the consultation and resolution of disputes between the parties to the agreement[138] and contains a provision for the imposition of a monetary enforcement assessment (MEA) in certain circumstances.[139] The State of Texas could petition the Commission on Environmental Cooperation (CEC) and request a consultation with Mexico to determine whether there has been a continuous failure on the part of the Mexican government to enforce its environmental laws in the maquiladora industry.[140] The State of Texas or border environmental groups, acting as third parties, would be entitled to participate in the consultation upon written notification of their intent to the other parties and the Secretariat for the CEC.[141]

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132. Telephone Interview with Peter Langlois, Senior Epidemiologist, Texas Bureau of Epidemiology (Nov. 10, 1995).

133. *Id.*

134. *Id.*

135. *Id.*

136. *See Legislature Mandates Statewide Birth Defects Registry*, DISEASE PREVENTION NEWS (Texas Dep't of Health, Austin, Tex.), Jan. 10, 1994, at 5 (reporting that Senate bill proposing Birth Defects Registry only provided funding for limited pilot project); Telephone Interview with Peter Langlois, Senior Epidemiologist, Texas Bureau of Epidemiology (Nov. 10, 1995) (stating that Birth Defects Registry can only expand if there is money for growth and noting that there is currently not enough money to implement program throughout entire state).

137. Environmental Side Agreement, *supra* note 37.

138. *Id.* pt. 5, art. 22-36, 32 I.L.M. at 1490-94.

139. *Id.* pt. 5, art. 34, 32 I.L.M. at 1493.

140. *Id.* pt. 5, art. 22, 32 I.L.M. at 1490. The goal of the consultations is to resolve the dispute in a satisfactory manner. *Id.*

141. Environmental Side Agreement, *supra* note 37, pt. 5, art. 22, 32 I.L.M. at 1490.

If the consultations fail to resolve the dispute, and the reviews from a special session of Council[142] and an arbitral panel[143] lead to a determination that there was a persistent pattern of nonenforcement by Mexico, the arbitral panel may impose an action plan on the offending party to remedy past nonenforcement.[144] If the panel must reconvene because the disputing parties have not mutually agreed upon a specific action plan or the parties cannot agree on whether the offending party has implemented the action plan, the panel may impose a MEA.[145]

The Environmental Side Agreement provides that the MEA be paid in the offending party's currency and be used to "improve or enhance the environment or environmental law enforcement in the Party complained against."[146] Typically, a MEA is used by the party complained against to clean up the particular industry, however, part of the MEA should be used to help fund the implementation of the Texas Birth Defects Registry since the offending party's actions may have caused serious birth defects along the United States-Mexico border. This birth defects registry could

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142. *See id.* pt. 5, art 23, 32 I.L.M. at 1490 (calling for convening of special session of CEC in order to assist parties on reaching "a mutually satisfactory resolution").

143. *See id.* pt. 5, art. 24, 32 I.L.M. at 1490 (allowing for formation of arbitral panel upon written request of any consulting party if dispute has not been resolved within 60 days after Council has convened pursuant to Article 23).

144. *Id.* pt. 5, art. 31, 32 I.L.M. at 1492.

145. *See* Environmental Side Agreement, *supra* note 37, pt. 5, art. 34, 32 I.L.M. at 1493 (permitting imposition of MEA if offending party fails to implement action plan). A MEA may be imposed in accordance with Annex 34, which provides:

> [F]or the first year after the date of entry into force of this Agreement, any monetary enforcement assessment shall be no greater than 20 million dollars (U.S.) or its equivalent in the currency of the Party complained against. Thereafter, any monetary enforcement assessment shall be no greater than .007 percent of total trade for which data are available.

Id. annex 34(1), 32 I.L.M. at 1496; *see* Alan R. Jenkins, Comment, *NAFTA: Is the Environmental Cost of Free Trade Too High?*, 19 N.C.J. INT'L & COM. L. 143, 164 n.172 (1993) (discussing monetary provisions of MEA in Environmental Side Agreement). In determining the amount of the assessment, the arbitral panel should take into account the duration of the offending party's continuous pattern of the nonenforcement of its environmental laws; the amount of enforcement that is reasonably expected of the party when taking its resource constraints into consideration; any reasons provided by the offending party for not implementing the plan; all efforts made by the party to remedy the pattern of noncompliance, and any other factors that are relevant to the determination of the MEA. Environmental Side Agreement, *supra* note 37, annex 34(2), 32 I.L.M. at 1493; *see* Kevin W. Patton, Note, *Dispute Resolution Under the North American Commission on Environmental Cooperation*, 5 DUKE J. COMP. & INT'L L. 87, 106 (1994) (listing factors used by arbitral panel to determine amount of MEA).

146. Environmental Side Agreement, *supra* note 37, annex 34(3), 32 I.L.M. at 1493; *see* Jeffrey L. Dunoff, *Institutional Misfits: The GATT, the ICJ & Trade-Environment Disputes*, 15 MICH. J. INT'L L. 1043, 1084 (1994) (explaining use of MEA).

help advance medical research into the cause of neural tube defects and other prevalent border illnesses.

V. Conclusion

Unfortunately, no simple solution exists to the environmental tragedy that is blamed, at least in part, for the cluster of neural tube defects along the Texas-Mexico border. The large multinational corporations that operate the maquiladora industry argue that they have brought an influx of jobs, resources, technology, and capital into an area of North America that has traditionally been ignored by its citizens and the government of the United States—but at what price? Certainly, the families in Cameron County and in other border areas whose children have been written off by the maquiladoras do not believe that the benefits of the maquiladora industry are worth it.

In an attempt to alleviate the suffering of those living in border communities, cooperation between the governments of Mexico and the United States, the maquiladora industry, and border area residents is necessary. Through the implementation of a toxic pollution warning system to alert border residents of toxic contaminants in the air, a bilateral research commission to study the effects of pollution on both sides of the border, and fines to punish maquiladoras for failing to adhere to Mexican environmental regulations, steps can be taken by all parties involved to reduce pollution in the border areas. As a result, perhaps the recurrence of clusters of neural tube defects in the border communities would be eliminated.