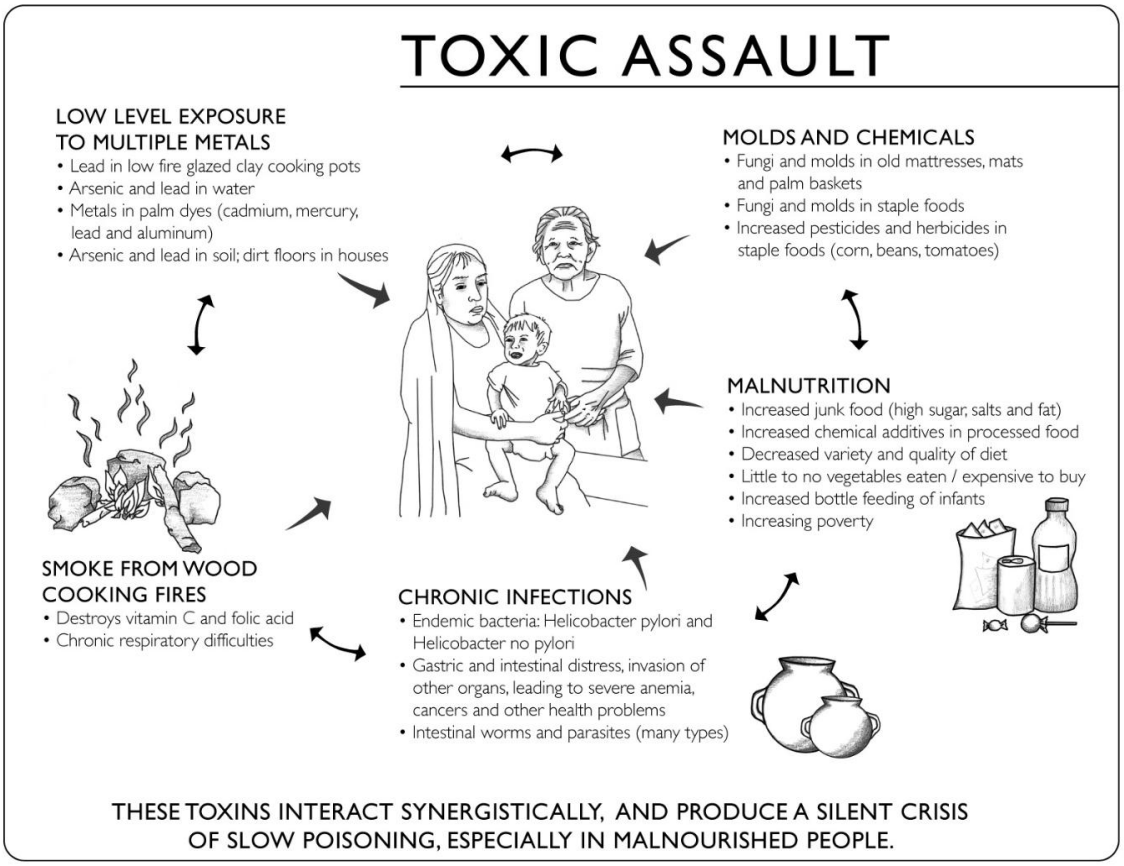
ATZIN DESARROLLO COMUNITARIO, A.C.
www.atzin.org
Water and Contamination
Situation Summary
Tlamacazapa, Guerrero, Mexico

Conclusion: **Tlamacazapa constitutes a multi-factor situation. There are multiple sources of contamination combined with acute poverty and malnutrition. The majority of poor villagers are malnourished and underhydrated and are therefore vulnerable to the harmful effects of chronic exposure to low levels of multiple metals and toxins. These factors indicate a situation of "toxic negative synergy" in which the overall harmful effect of individual metals and toxins is more than the sum of the parts.**

Risks. At risk are those who are exposed to multiple sources of toxins, that is, the poor weaver who eats a basic diet of tortillas and salsa, dyes palm and then weaves coloured palm, drinks and cooks with well water or Los Sabinos water, lives in a dirt floor hut, and cooks in a low fire glazed clay pot. Particularly at risk is the pregnant woman and fetus, and the young child who live in these conditions.

Why is the Tlamacazapa situation important? The "toxic synergy" caused by the interactions of toxins and their subsequent effects on the human body is an important concept internationally, as is research on the accumulative effects of metals and toxins on human health. The Atzin focus on "people" and "social process" as well as on the technical aspects of water and other environmental contamination exemplifies the integrated approach that is necessary to achieving a safe and sufficient water supply for all with appropriate maintenance, and the subsequent decrease of overall risk to health.



Major Phases

- **1997-2000** Establishment of presence in village. Bridge activities, knowledge of context and dynamics, slow formation of trusting relationships with villagers; evolution of programming. First water samples taken in mid 2000, with arsenic (As) and lead (Pb) findings.

- **2001-2003** Conduction of small scale programming in three areas: health and healing; water and sanitation; income generation. Development of NGO culture of inquiry; action research. Conduction of small scale research. Dissemination of initial findings.

- **2004-2007** Build up of evidence. Formation of strategic alliances in town and externally. Creative special projects. Continuation of programming in three areas; startup of community education program in 2006.

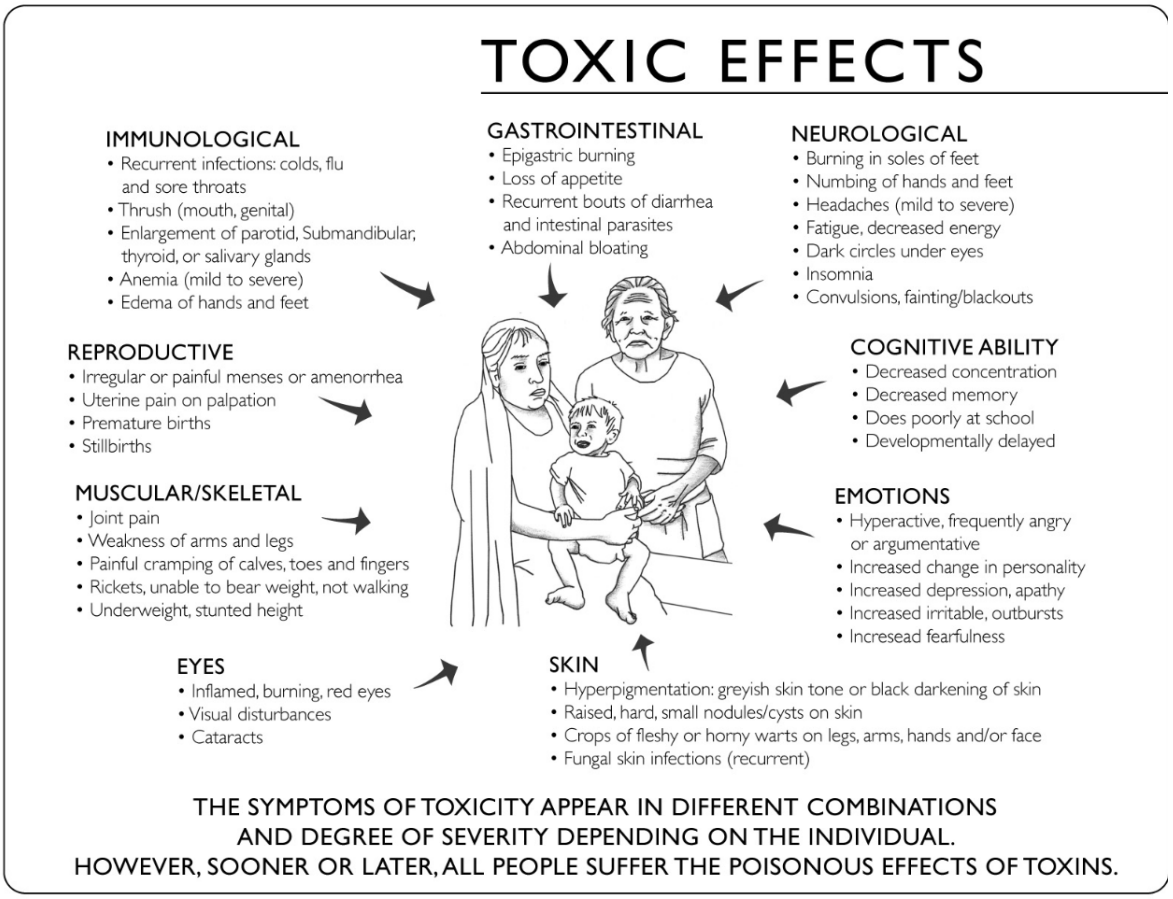
Strategy (2008 – present).

- **Build up convincing evidence** of contamination. Conduct research and monitoring, with documentation and dissemination of findings.

- **Emphasize service and developmental programs** in Tlamacazapa. Concentrate on construction of dry toilets and tanks and other health and income generation programs in order to respond to acute need and to be of service with the continued creation of good will. Also, to upgrade preparation of villagers through the conduction of training and education sponsorship. Conduct community education through the provision of information: one-on one and in small groups.

- **Form selected local and external alliances** in Mexico and internationally: Instituto Geofisica de UNAM; OPIRG (Ontario); Groundwater Analytical (Mass, USA); catechism youth group in Tlama, Atzin Canada, Atzin USA.

- **Work creatively** to document and disseminate information: article in *Hydrogeology Journal*; "Reweaving a Life" Art Exhibition (2006-2008); "Reweaving a Life" educational and promotional DVD (2010, 12 minutes); articles in *La Jornada*, a national newspaper; information packages with summaries of results; publication of *Kokonemeh Children of Tlamacazapa, Mexico* (2011 in English; 2012 in Spanish); "Tlamacazapa" Photo Exhibition by Cruz that toured in Mexico (2010-2012). Publication *Iguatlanesti Here Comes the Dawn* (2015), 54 pg book with colour plates. "We are your future: creativity and resilience among women weavers in Tlamacazapa, Guerrero," an art and palm exhibition that toured in Mexico and Canada (2015-2017).



What do we know about the water?

- The town wells are unsafe with pathogens, nitrate/nitrite and heavy/intermediate metals, and cannot be made safe simply by stopping surface runoff from entering the well. Possibly, well #1 (Tlamapa) could be covered and protected, providing that no one is permitted to live or animals graze on the mostly empty land on the well's upper side. The other wells should be abandoned completely for any household use.
- The entire town is highly vulnerable to pollution of water resources (surface water and groundwater) due to **thin soil cover, shallow water table and fractured rock aquifer**. This means all groundwater below the town is vulnerable to pollution and is already polluted. Sanitation measures must take special precautions not to leach pollution to water table.
- Los Sabinos is 4.5 kilometers from Tlama, is the source for the pumped water, and is a relatively natural area. Its water quality recently is likely compromised by cow grazing and insecticide/ herbicide use in surrounding fields. Both lead and arsenic levels above norm have been detected in Los Sabinos water albeit irregularly.
- Water quality results (2003-2010). Analysis of lead (Pb) and arsenic (As) conducted monthly by Groundwater Analytical (Buzzards Bay, Mass.) – available in yearly summary tables.

Toxin	**Wells**	**Los Sabinos**	**WHO/EPA Norm**	**Mexican Norm (2004, still current)**
Arsenic (As)	0 to 0.110 ppm (mg/L)	0 mg/L to .06 ppm (mg/L)	*0.01 ppm (mg/L)*	*0.025 ppm (mg/L)*
Lead (Pb)	0 to 0.15 ppm (mg/L)	0 to 0.19 ppm (mg/L)	*0.01 ppm (mg/L)*	*.01 ppm (mg/L)*

Nitrate/Nitrite	Yes, above norm in wells 2, 3, 4.	No, but at risk.	*0*	*0*
Fecal Coliform	Yes, heavy contamination in wells 2, 3, 4.	No, but at high risk.	*0*	*0*

- Current water distribution to villagers via the Los Sabinos pumping system in terms of quantity remains well below the WHO standard of a minimum of 20-25 liters per day per person.
- Arsenic found in water, rock and soil samples, suggesting ore-rich rock is original source. Bioavailability of arsenic from water and from soil dust is of particularly concern.
- Lead found in water and soil mainly (very low levels in rock) suggesting possible air transportation of lead to water as well as contamination from dumping of dyes and other material on the ground with subsequent transport to wells. However, this doesn't satisfactorily answer the periodic finding of lead in Los Sabinos.
- Government officials have not been and continue to not be responsive in any effective manner to this toxicity situation in Tlamacazapa.

What could the water system look like?

- Piping in from sources at great distance from Tlama not likely feasible due to likely extensive contamination heavy metal problems in regions and prohibitive costs.
- Rainwater harvesting is a good supplement and emergency source but only easily available in rainy season (June to October). Large scale catchment and storage would need piloting.
- Los Sabinos currently requires treatment for heavy metals/toxins as well as expansion of quantity to adequately supply the entire town. Two hydrogeological studies need to be conducted at Los Sabinos: 1. pilot toxin/metal removal/ treatment, 2. evaluation of water volume, that is, the sustainable (maximum long-term) yield of the aquifer(s) feeding Los Sabinos vis a vis waters needs of Tlamacazapa and other villages downstream of Los Sabinos. If greater amounts of water are available, the entire system including reservoirs and piping would need upgrading.

Priorities

1. Technical (Water and Sanitation)

Level	Focus	Condition
Community	• Feasible?: Pilot project: Permeable Reactive Barrier (PRB) in Los Sabinos. • Feasible?: Pilot project: Rainwater harvesting - large scale, above well #1. • Continuation of water monitoring of selected elements.	TA: expert consultation State and town formal approval and collaboration. Continued in-kind water analysis.
	• Census 2005 report production and dissemination.	---
Household	• Household filters with Fe (removal of As). Investigation into (simultaneous) Pb removal using same filter. • Pilot sand filter in Atzin Centre with testing of water pre and post filter.	New funding; would require high subsidization as an intensive initiative with family/ group education and frequent family follow-up.
	• Rainwater harvesting -- tank construction (7,800 liters). • Dry toilet construction. Subsidized family program with education on need, use and maintenance.	Ongoing. Requires continuation of funding and partnerships.
Priority Studies	• Seasonal volume of water in Los Sabinos (UNAM).	UNAM completed study. Don't have copy.

	• Hydrogeological assessment of LS (UNAM).	UNAM completed study. Have partial copy.
	• Census 2005 (done) – data analysis done, graphics - production and dissemination. Beneficial: repeat census 2011.	Atzin
	• Social Management and Economy of Water	Atzin/ Chris Wenman – due end 2010.
	• Water Distribution. Evaluation of existing system. Recommendations for improvement.	Need government permission, local and municipal, that will be difficult to obtain, as well as an implemetning partner. New funding.
	• Parasites (Human and Animal) (some done on Helicobacter).	Atzin + pathology partner.
	• Quality of air (not written): kitchens, yards.	Need implementing partner. New funding.
	• Nutritional status (not written).	Atzin and partner. New funding.

2. Reduction of Risk: Individual and Community Education

Level	Focus	Conditions
Individual and community	**Replacement of low fire glazed cooking pots** – availability, affordability, willingness. One-on-one explanations. Group information: mass, women's Saturday literacy classes.	ONGOING. Atzin persistence with continuous education. Promoter training schools.
	Elimination of use of chemical dyes for palm. Emphasis on use of natural palm and safe decorative features. Safe use of dyes, however, near impossible to safely dispose of dyes on site. One-on-one explanations. Group information: mass, women's Saturday literacy classes.	
	Education about contamination/toxins, including water, and effects on health over time. One-on-one or small group explanations. Production of learning resources for distribution. Education on use and maintenance of dry toilets and tanks, hygiene and rainwater collection. Possible ways to prevent/ reduce toxicity.	
	Nutritional status improvement. Junk food reduction. Vegetable and fruit increased consumption. One-on-one explanations. Group information: demos, mass, women's Saturday literacy classes. Input into primary and telesecondary schools.	

	Reduction of kitchen smoke. Promotion and sales of economical and ecological wood rocket cooking stoves. One-on-one explanations. Weekly group demos. Stove promoters with bonus for each sale. Group information: weekly announcements, flyers, women's literacy classes. Outreach (June and November 2010) to La Montaña region of Guerrero, 70+ women in attendance. * Improved kitchen ventilation. Not written.	

Toxic Synergy Silent Crisis

Metals occur naturally in the environment, and even at low levels, their presence in water, soil, food and air can seriously affect the human body. In Tlamacazapa, problematic metals are found in the water (arsenic, lead), soil (arsenic, lead and others), glazed clay cooking pots (lead), and in the chemical palm dyes used to colour palm (lead, mercury, cadmium, aluminium). Also, few houses have toilets; human and animal excrement further pollutes the village with an abundance of parasites and microorganisms.
Many families live in acute poverty, and are malnourished and dehydrated. They are very vulnerable to the harmful effects of metals.

Risks. People who are exposed to metals/ toxins usually incur health problems. At risk is the poor weaver who eats a basic diet of tortillas with little protein, vegetables and fruit; dyes and weaves coloured palm; drinks and cooks with contaminated water; lives in a dirt floor hut; and cooks in a glazed clay pot. Particularly at risk are the pregnant woman and her fetus as well as the young child. They are less able to expel toxins and instead, absorb them. Many are increasingly unwell because of an accumulation of these poisons in their bodies. The serious combination of malnutrition and multiple metals constitutes a toxic synergy whereby the harmful effects multiply drastically.

Effects. Even low levels of lead poisoning in children can cause permanent decreased intelligence, delayed development, short stature and impaired hearing. Arsenic affects nearly all organ systems and is strongly associated with blood and nerve changes in the limbs as well as lung and skin cancers. Chronic exposure to arsenic can result in blackening of the skin and lips; wart crops; muscle weakness and paralysis; and other problems. Symptoms of lead and arsenic mimic other body conditions: fatigue; headache, severe abdominal pain; vision disturbances; degeneration of liver and kidneys; weak memory and concentration; imbalance and non-coordination; hypertension; anemia. Increased frequency of spontaneous abortions and congenital malformations are linked to toxic exposure. High levels of lead and/or arsenic can lead to convulsions, coma and death.

Why is Tlamacazapa important? Globally, we must learn more about toxic synergy and its effects on health, especially among malnourished people. As in Tlamacazapa, communities everywhere need access to sufficient, clean water; effective, affordable treatment for toxicity; and low cost technologies for water purification and environmental protection. Caminamos Juntos focuses on "people," "social process" and the alleviation of poverty coupled with technical analysis of a complex environment, exemplifying an integrated approach to community development and human wellness.

Photos: 1. painful numbing of feet, loss of coordination, memory loss, joint weakness in 55 year old woman (multiple metals); 2 & 3. Painful lip gangrene with sloughing of skin in two women (arsenic); 4. Skin blackening in 50 year old woman due to chronic exposure to arsenic; 5. Gum lead line in 24 year old woman also with skin blackening (lead, arsenic); 6. blackening of both arms (arsenic) 7. Convulsions, severe anemia and eventually, tuberculosis in malnourished 20 year old woman (multiple metals).