

USE OF MEXICO'S RETC DATA TO EVALUATE PUBLIC HEALTH RISK FROM TOXIC EMISSIONS

by

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MEXICO'S REGISTRO DE EMISIONES Y TRANSFERENCIA DE CONTAMINANTES (RETC)

- First mandatory reporting year: 2004 (Canada 1993; US 1987). From 2014 onward, data have been collected via a web application and are available publicly
- Industrial activities or sectors covered: 21 (Canada and US are broader). Establishments that produce ≥ 10 tonnes of hazardous waste annually
- Number of pollutants subject to reporting: 200 (Canada 346; US 595)
- Employee threshold: None (Canada and US: ≥ 10 full-time equivalent employees)
- Substance “activity” or “release” thresholds: Except for greenhouse gases, “release” thresholds range from 1kg to 1000kg; “activity” thresholds range from 5kg to 5000kg. (Canada and US are generally higher) For greenhouse gases, the threshold is 25,000 tonnes CO₂ equivalent or below. (Registro Nacional de Emisiones (RENE) obligates facilities to report above this threshold)
- Types of releases and transfers covered: On-site releases to air, water and land; transfers off-site for disposal, recycling, reutilization, energy recovery, treatment, co-processing and sewage. (Canada and US are similar, but also include underground injection)

EPA's Risk-Screening Environmental Indicators (RSEI)

- RSEI modeling inputs include several primary datasets:
 - Chemical toxicity data
 - [Toxics Release Inventory \(TRI\)](#) release and transfer quantities
 - Locations for people and facilities
- RSEI models TRI chemical releases to air and water releases from TRI reporting facilities, as well as transfers from TRI reporting facilities to publicly-owned treatment works (POTWs) and off-site incineration.

EPA's Risk-Screening Environmental Indicators (RSEI)

- Three main RSEI results :

Risk-related results (scores)	Surrogate Dose x Toxicity Weight x Population
Hazard-based results	Pounds x Toxicity Weight
Pounds-based results	TRI Pounds released

 **We will focus on hazard-based results to simplify the analysis.**

- **What is a RSEI Hazard?**

A RSEI Hazard, also called toxicity-weighted pounds, is a result that accounts for the size of the release and the chemical's toxicity. Unlike RSEI Score, RSEI Hazard does not include fate and transport modeling or adjustments for population exposure

- **What are RSEI Modeled Pounds?**

These results ("TRI Pounds") reflect only the number of pounds released or transferred that are reported to TRI, and are available for all releases and transfers.

RSEI Hazards

Hazard-based results (“hazards”) are calculated by multiplying the pounds released by the corresponding chemical-specific toxicity weight (the toxicity weight also depends on the exposure pathway). There are two types of hazards:

Cancer Hazard: The pounds released or transferred, weighted by the chemical's toxicity for carcinogenic effects (IUR or OSF).

- Direct water releases and transfers to publicly-owned treatment works (POTWs) use a toxicity weight based on the oral slope factor for the chemical. Air releases and off-site transfers to incineration use a toxicity weight based on the chemical's inhalation unit risk (IUR).

Non-Cancer Hazard: The pounds released or transferred, weighted by the chemical's toxicity for noncarcinogenic effects (RfC or RfD).

- Direct water releases and transfers to publicly-owned treatment works (POTWs) use a toxicity weight based on the reference dose for the chemical. Air releases and off-site transfers to incineration use a toxicity weight based on the chemical's reference concentration.

Selection of Toxicity Weights

	Air Releases	Water Releases	POTW Transfers	Fill in Tox Data Gaps?
Hazard	Higher of IUR tox weight or RfC tox weight.	Higher of OSF tox weight or RfD tox weight.	Higher of OSF tox weight or RfD tox weight.	Yes. If a chemical has no data in one exposure route, use data from other route.
Cancer Hazard	IUR tox weight.	OSF tox weight.	OSF tox weight.	No. If no route-specific cancer tox weight, then cancer hazard is zero.
NonCancer Hazard	RfC tox weight.	RfD tox weight.	RfD tox weight.	No. If no route-specific noncancer tox weight, then noncancer hazard is zero.

- RSEI toxicity weights range from 0.02 to 1,400,000,000.
- The RSEI model only addresses chronic human toxicity (cancer and noncancer effects, such as developmental toxicity, reproductive toxicity, neurotoxicity, etc.) associated with long-term exposure and does not address concerns for either acute human toxicity or environmental toxicity.

How do we calculate hazards using RETC?

- 1) For each chemical released, assign a chemical-specific toxicity weight.
- 2) Convert RETC released chemicals to pounds, as toxicity weights are applied to pounds.
- 3) Add “Agua” and “Suelo” released chemicals.
- 4) Calculate cancer and non-cancer hazards by multiplying the water and air chemicals emitted by their corresponding weights.
- 5) Aggregate hazards at the plant or firm level by adding individual hazards.

Example:

RETC:

	NRA	NOMBRE	SECTOR	CAS	SUSTANCIA	UNIDAD	AIRE	AGUA	SUELO	REUTILIZACIÓN	RECICLADO
18	AAU1903900165	Autokam Automotriz S.A. de C.V.,	Otros	Ni	Níquel (compuestos)	Kg	0	0	0	0	0
19	AAU2112800014	AUDI MEXICO, S.A DE C.V.,AUDI	Automotriz	Cd	Cadmio (compuestos)	Kg	0	0	7.7842	0	0
20	AAU2112800014	AUDI MEXICO, S.A DE C.V.,AUDI	Automotriz	Cr	Cromo (compuestos)	Kg	0	0	19.4605	0	0
21	AAU2112800014	AUDI MEXICO, S.A DE C.V.,AUDI	Automotriz	Ni	Níquel (compuestos)	Kg	0	0	58.9654	0	0
22	AAU2112800014	AUDI MEXICO, S.A DE C.V.,AUDI	Automotriz	Pb	Plomo (compuestos)	Kg	0	0	35.0289	0	0
23	AAU2112800014	AUDI MEXICO, S.A DE C.V.,AUDI	Automotriz	101-68-8	Metileno bis(fenilisocianato)	Kg	13429.37	0	0	0	0
24	AAU2112800014	AUDI MEXICO, S.A DE C.V.,AUDI	Automotriz	124-38-9	Bióxido de carbono	Kg	16760262.32	0	0	0	0
25	AAU2112800014	AUDI MEXICO, S.A DE C.V.,AUDI	Automotriz	1330-20-7	Xileno (mezcla de isómeros)	Kg	171395.68	0	0	0	0

Chemical-specific toxicity weight:

1	CASNumbe	CASStanda	ChemicalN	TRChemID	MetalCom	SortCAS	Chemical	Added	ToxicitySou	RfCInhale	RfCUF	RfCMF	RfCConf	RfCSource	RfCListingC	RfCToxWei	RFDOral	RfDUF	RfDMF	RfDConf	RfDListingC	RfDSource
590	1330207	1330-20-7	592	1330207	592	1330207	Xylene (mixed isomers)	1987	IRIS 11/200	0.1	300	1	M	IRIS	2/21/03	35	0.2	1000	1	M	2/21/03	IRIS
591	87627	87-62-7	593	87627	593	87627	2,6-Xylidine	1987														
592	7440666	7440-66-6	594	7440666	594	7440666	Zinc	1987	IRIS 4/1997	0.035				CalEPA	Jul-90	100	0.3	3	1	M	10/1/92	IRIS
593	N982	N982	595	N982	594	982	Zinc compounds	1987	IRIS 4/1997	0.035				CalEPA	Jul-90	100	0.3	3	1	M	10/1/92	IRIS

For Xileno, the corresponding non-cancer air hazard is :
(171395.68*2.2046)*35

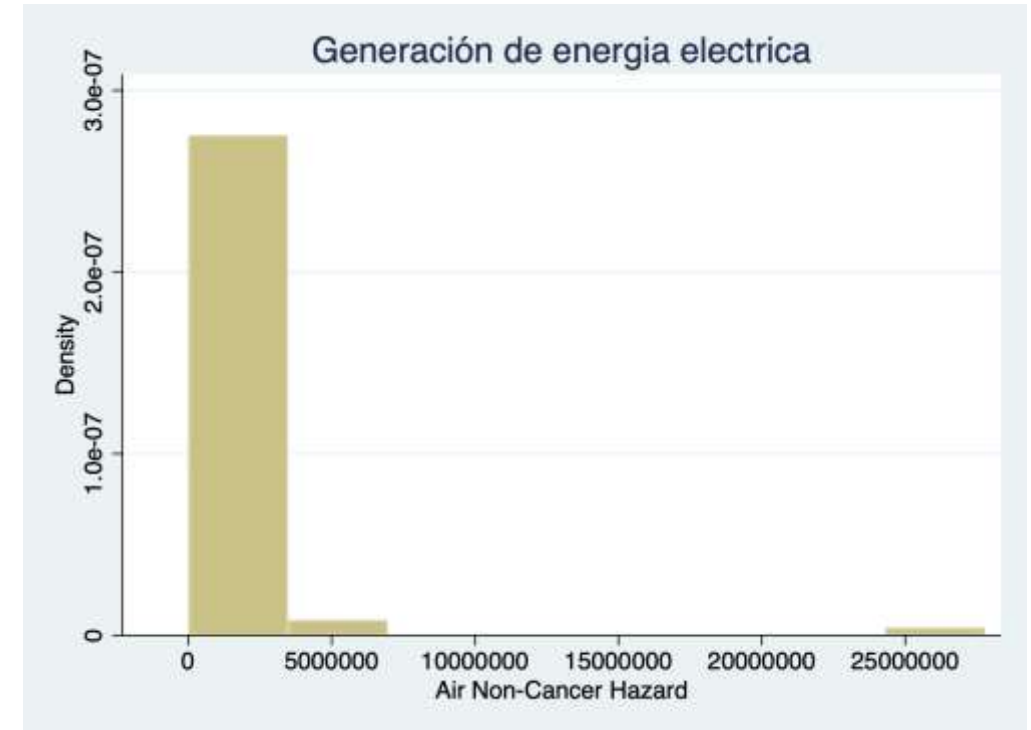
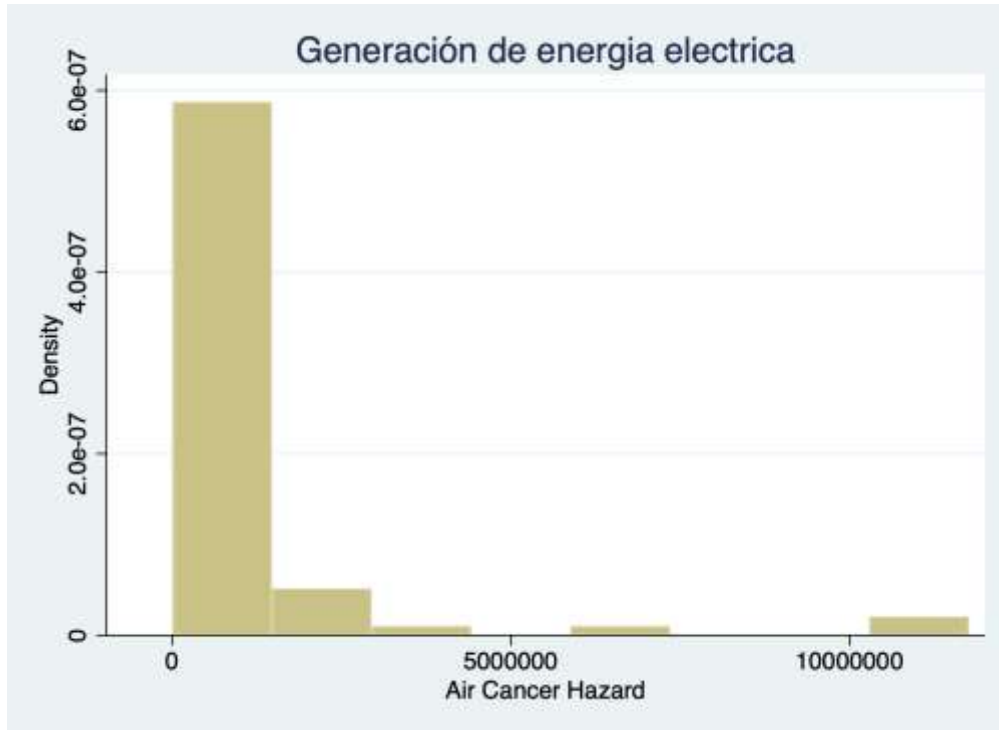
ANALYSIS OF HAZARDS BY SECTOR

- There were 2605 plants listed in the 2017 RETC, organized into 21 industrial sectors.
- For each sector we compute the hazards for 5 on-site emissions categories: air cancer-causing, air non-cancer-causing, water cancer-causing, water non-cancer-causing, and carbon dioxide plus methane.
- We tabulate but do not report releases to land, which make up less than 1% of Mexico's on-site releases. By way of contrast, 68% and 70% of on-site releases in the US and Canada, respectively, are to land.
- The vast majority (98%) of on-site releases in Mexico are to the air, of which 52% come from electricity generation, 16% from petroleum, and 11% from metallurgy.

ANALYSIS OF HAZARDS BY SECTOR (CONT.)

- Within each category, we compute a measure of the relative performance for each plant, which is the number of standard deviations its hazard value is from the sector mean (denoted “STD”).
- Across sectors we compare the relative hazards in each category, culminating in a list of worst polluters and the toxic substances that are primarily responsible for their high hazard values.
- We concentrate the presentation on those sectors with either the largest numbers of plants or the worst polluters. Results are available for all 21 sectors.

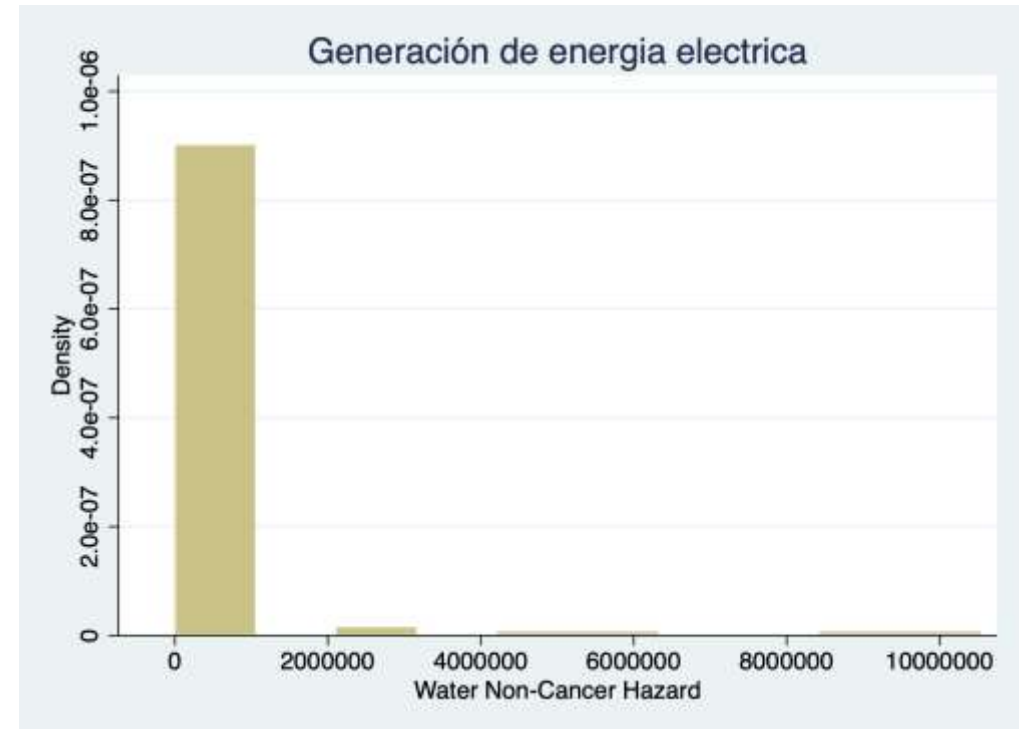
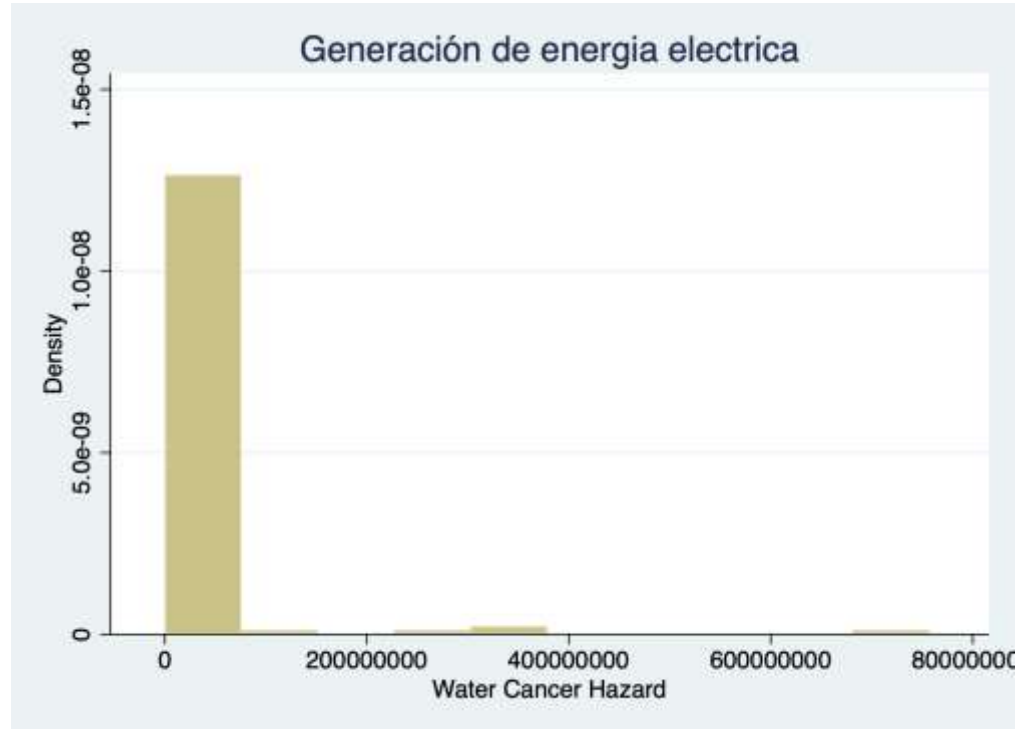
SECTOR 11: GENERACION DE ENERGIA ELECTRICA (120 plants; 2 with no emissions)



As with Sector 9, this sector is putting out a lot of toxic air emissions. Worst polluters for air cancer are the two Termoelectrica plants (del Golfo and Peaoles) at 11.8M (+3.6 STD) and 11.0M (+3.3 STD) hazard value, and CFE Generacion Guadalupe (6.1M hazard and +1.6 STD).

For air non-cancer the worst polluters are: CFE Generacion Cerro Prieto (27.8M hazard and +5.6 STD), CFE Generacion Humeros (6M hazard and +1.0 STD), and Geothermica para de Desarrollo (3.8M hazard).

SECTOR 11: GENERACION DE ENERGIA ELECTRICA

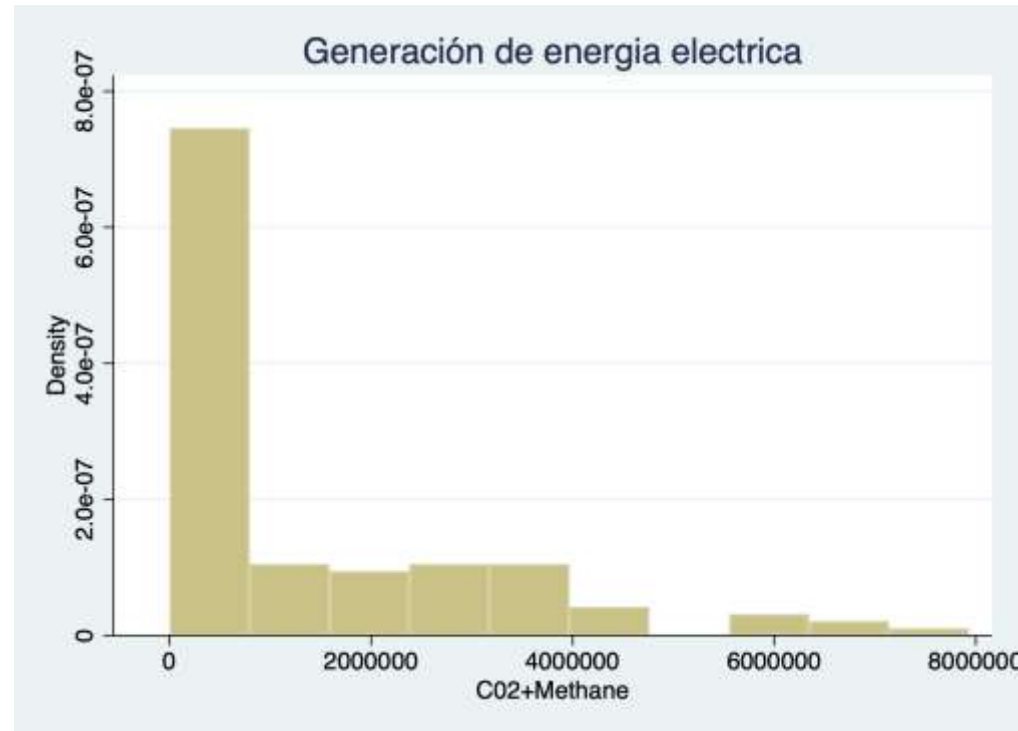


Of the 12 worst polluters overall in the water cancer and non-cancer categories, 10 are found in this sector, with some huge hazard values.

Worst polluters: Mexicana Mexhidro (757M and +4.7 STD; 10.5M and +3.9 STD), CFE Generacion Puerto Libertad (366M and +2.1 STD; 5.8M and +2.0 STD), Comision Federal Laguna Verde (344M and +1.9 STD), Hidroelectricidad del Pacifico (289M and +1.6 STD; 9.3M and +3.4 STD), Proveedora de Occidente (80M), Comision Federal Manzanillo (75M; 5.2M and +1.7 STD).

Four others with hazard values in the range 15-20M for air cancer.

SECTOR 11: GENERACION DE ENERGIA ELECTRICA

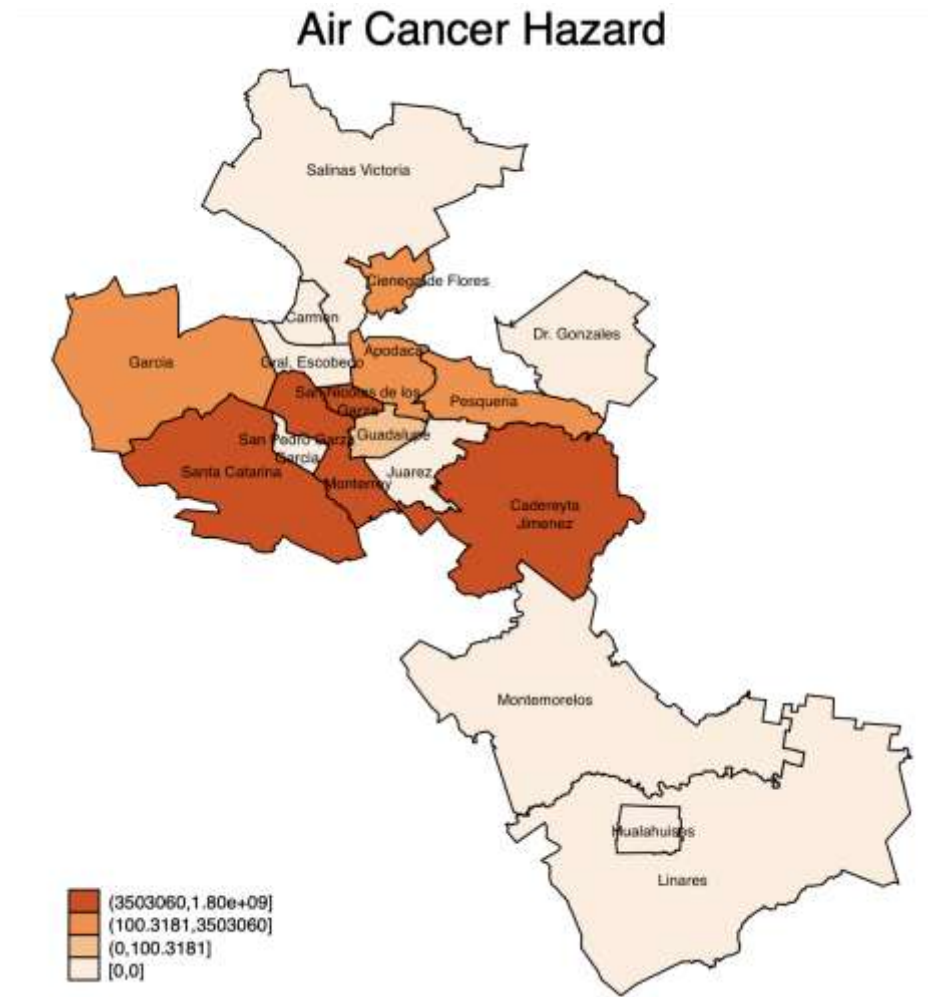


All six of the worst emitters overall come from this sector.

Worst emitters: CFE Generacion II (3.6M tonnes and +4.2 STD), Fuerza y Energia Hermosillo (3.1M tonnes and +3.4 STD), Iberdola Altamira (3M tonnes and +2.7 STD), Iberdola del Golfo (2.7M tonnes and +2.3 STD), Iberdola Tamazunchale (2.6M tonnes and +2.3 STD), Techgen SA (2.5M tonnes and +2.1 STD).

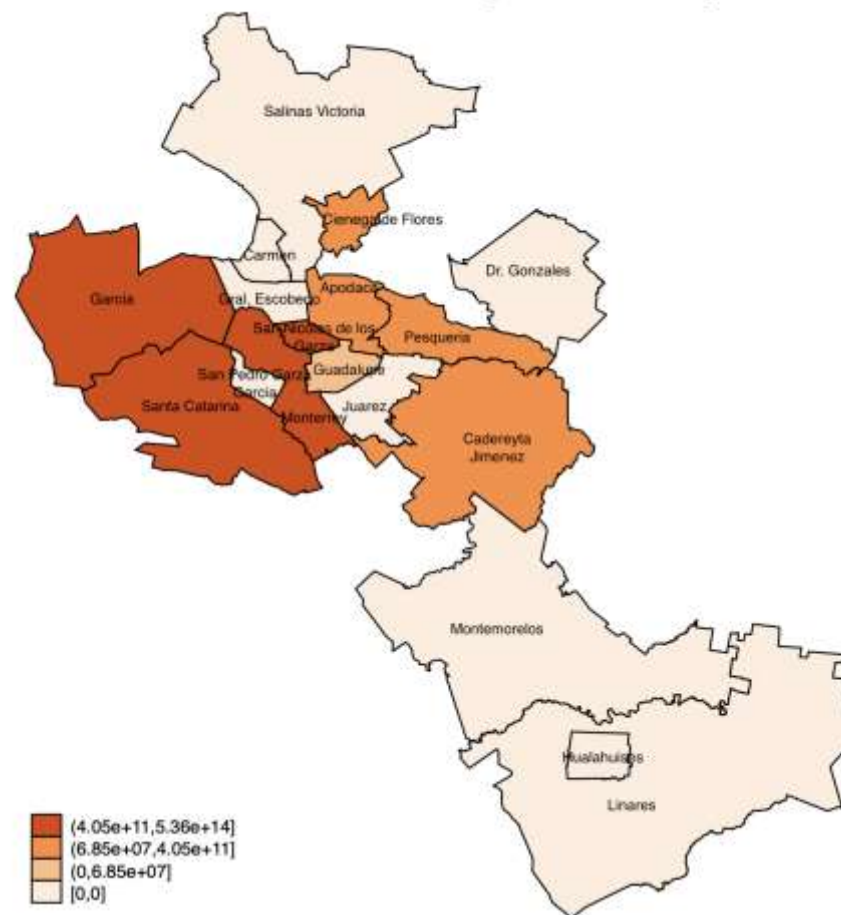
Some methane. Biggest emitter is CFE Generacion Cerra Prieto at 6.4K tonnes.

STATE OF NUEVO LEON: AIR CANCER HAZARD BY MUNICIPALITY

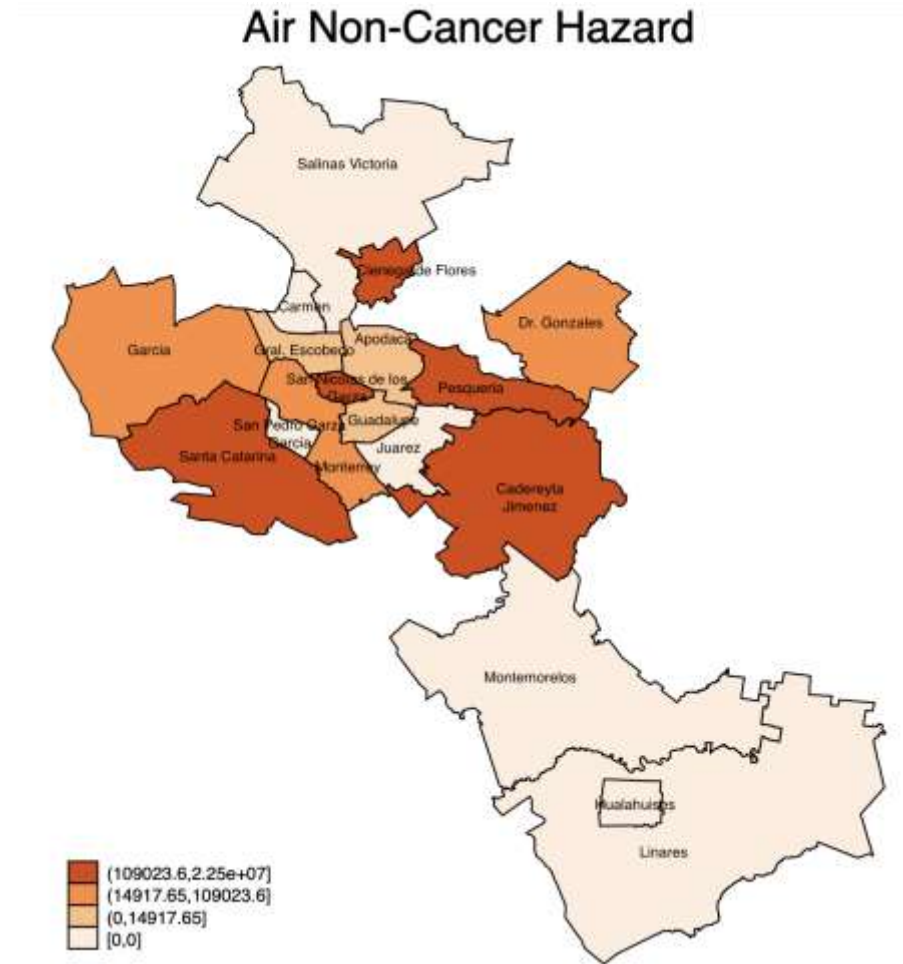


STATE OF NUEVO LEON: AIR CANCER RISK BY MUNICIPALITY

Air Cancer Hazard -Population Adjusted

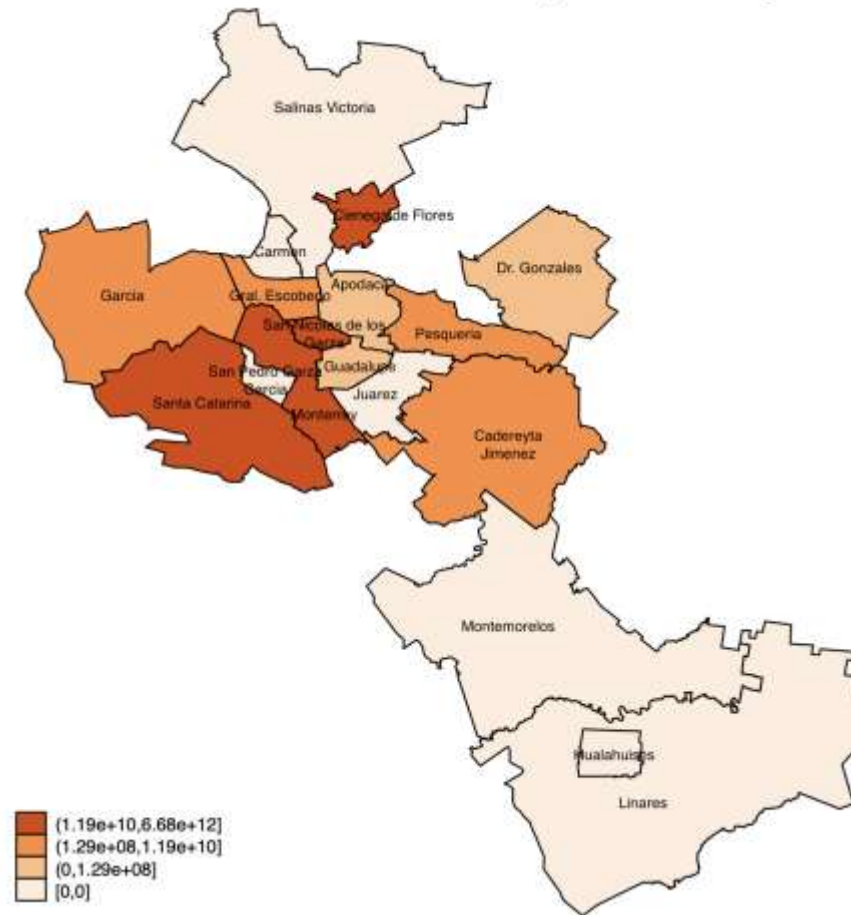


STATE OF NUEVO LEON: AIR NON-CANCER HAZARD BY MUNICIPALITY

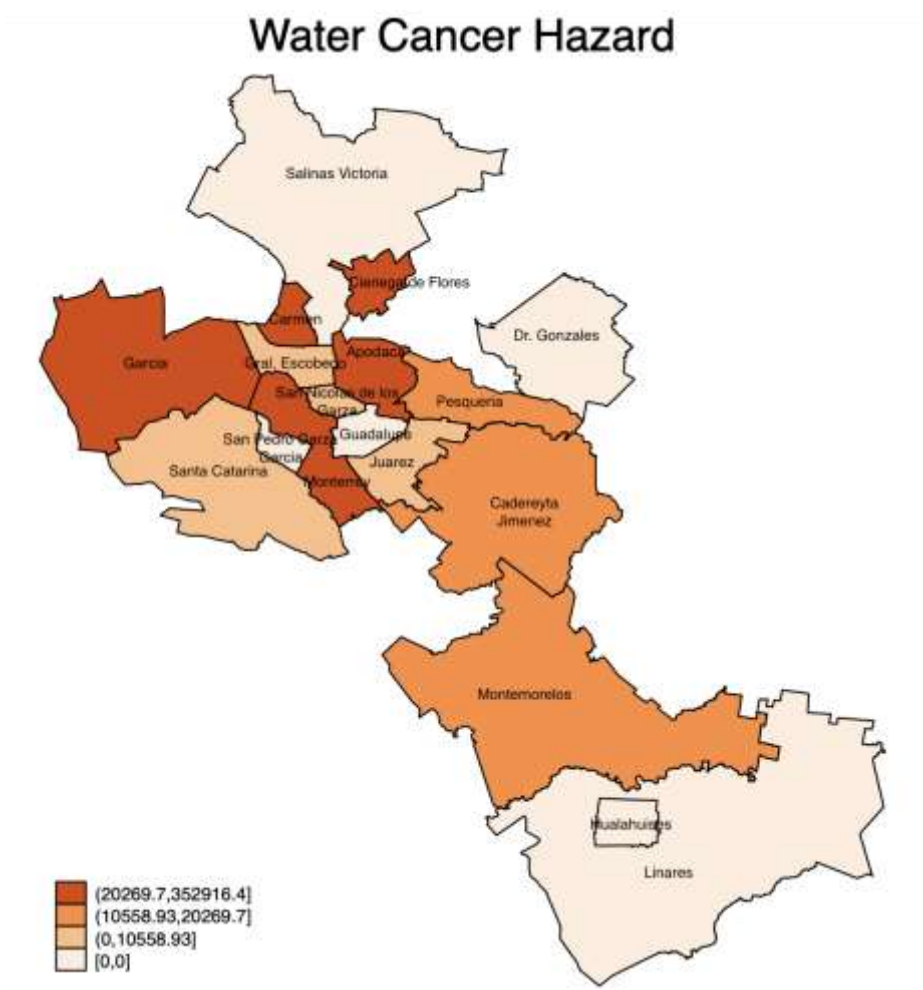


STATE OF NUEVO LEON: AIR NON-CANCER RISK BY MUNICIPALITY

Air Non-Cancer Hazard -Population Adjusted

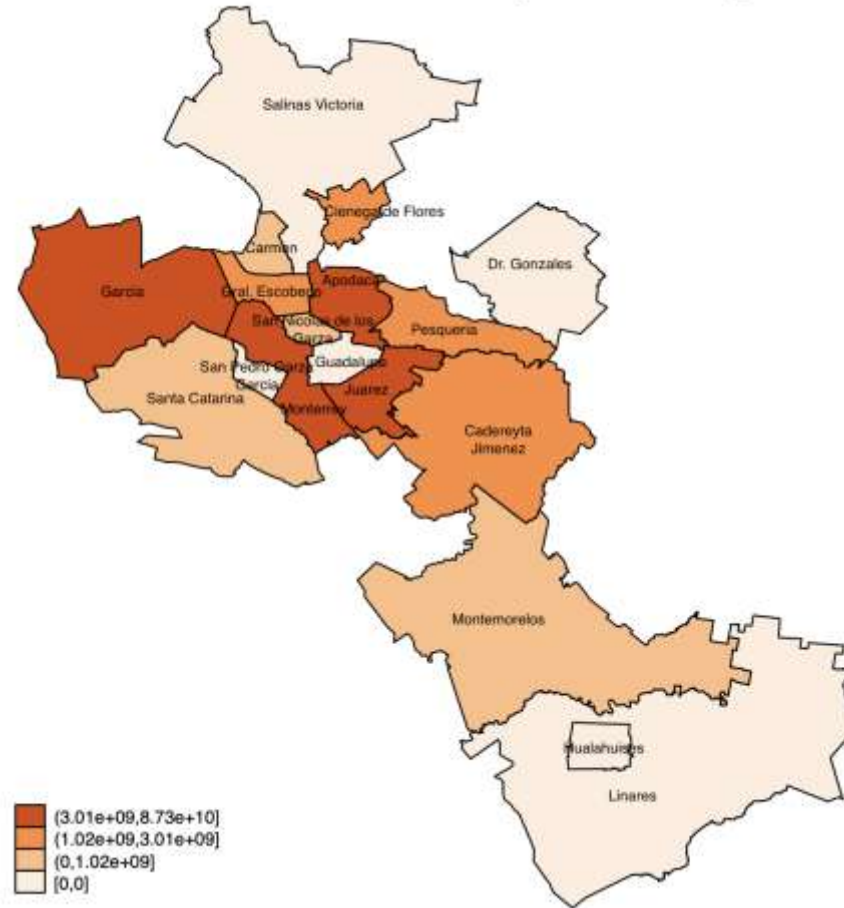


STATE OF NUEVO LEON: WATER CANCER HAZARD BY MUNICIPALITY

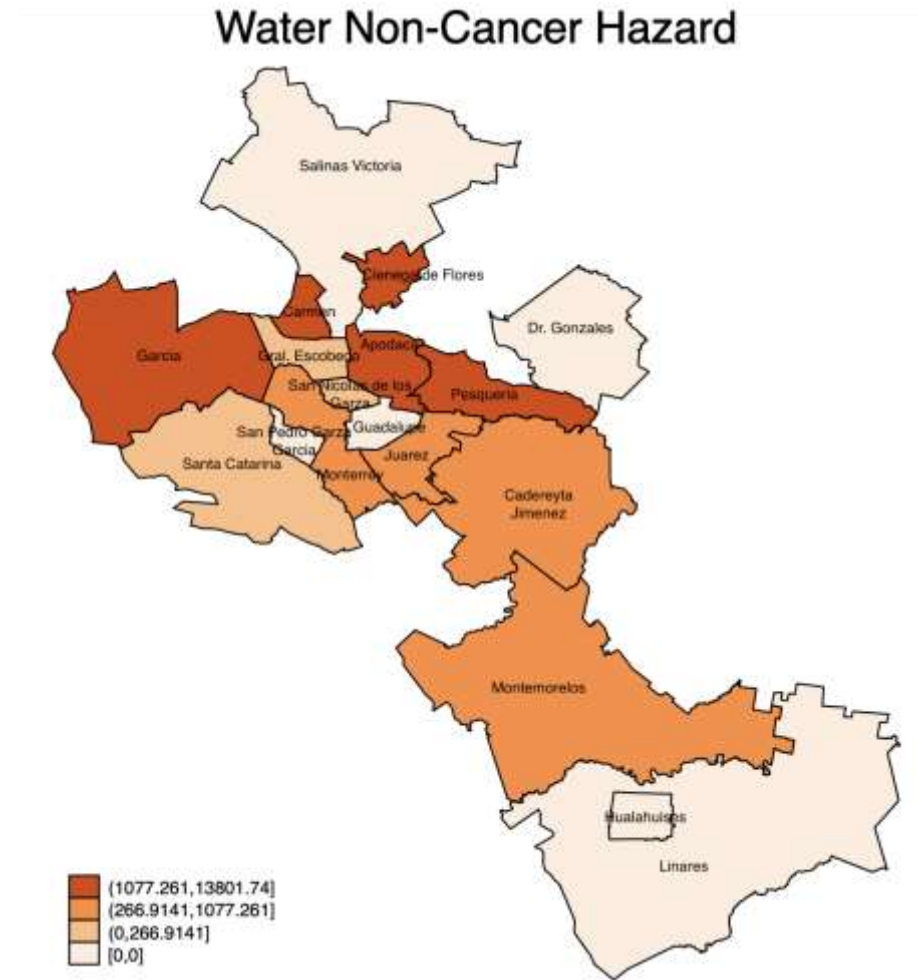


STATE OF NUEVO LEON: WATER CANCER RISK BY MUNICIPALITY

Water Cancer Hazard -Population Adjusted

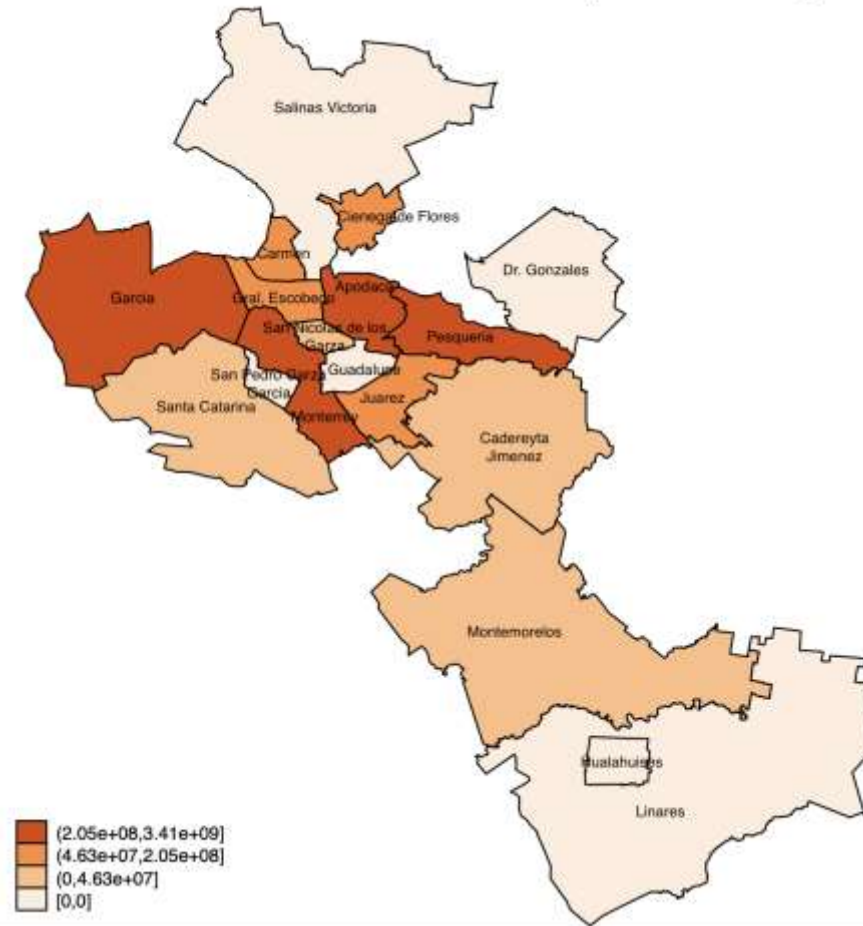


STATE OF NUEVO LEON: WATER NON-CANCER HAZARD BY MUNICIPALITY

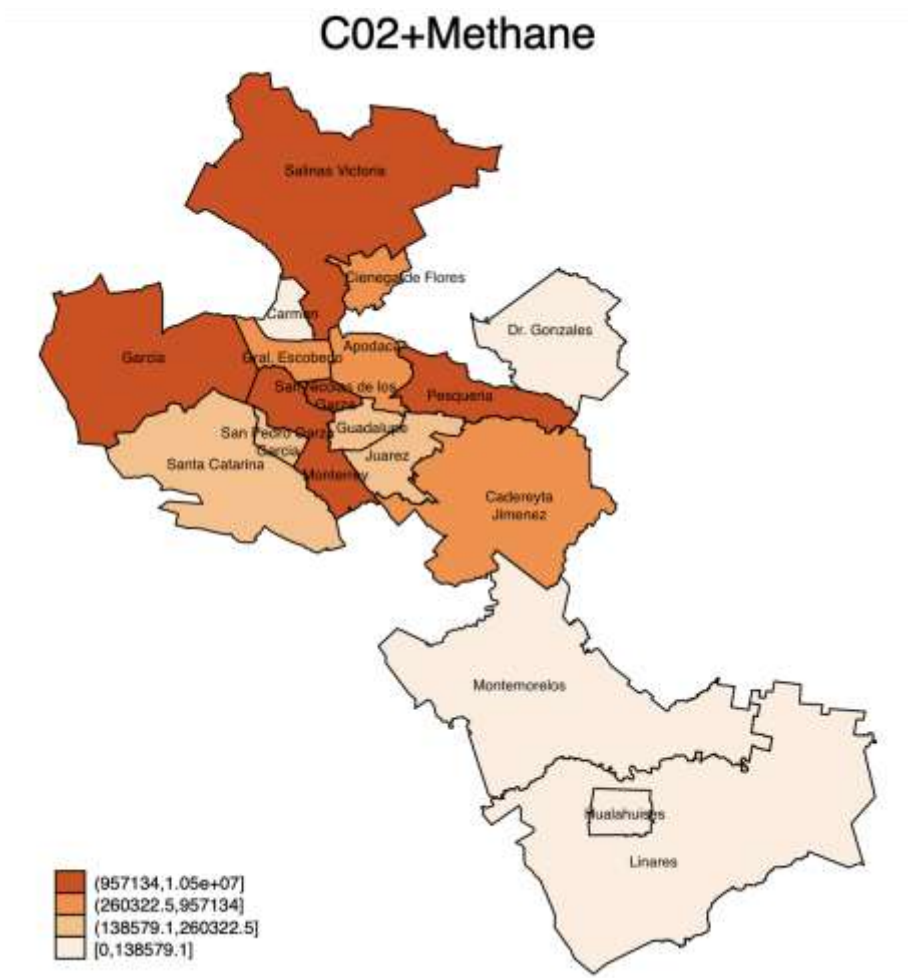


STATE OF NUEVO LEON: WATER NON-CANCER RISK BY MUNICIPALITY

Water Non-Cancer Hazard -Population Adjusted



STATE OF NUEVO LEON: CO2 + METHANE EMISSIONS BY MUNICIPALITY



NEXT STEPS

- Presentation to the Governor of Nuevo Leon.
- Development of hazard/risk maps for the Mexico City metropolitan area and the state of Jalisco (Guadalajara).
- Presentation of the sector-specific and geographic hazard/risk results to SEMARNAT.