CASE STUDY

LAC MÉGANTIC

TUTOR INSTRUCTIONS

Environmental Risk Assessment

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Lac Mégantic PBL

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General aim of the case study

- To assess the environmental impact of a massive release of pollutants after an accident

- **Based of the tragic accident of Lac Mégantic (Québec, Canada)**

Source: https://www.lexpress.fr/monde/accident-du-lac-megantic-la-societe-ferroviaire-americaine-en-cause-fait-faillite_1272095.html

Source: https://twitter.com/sureteduquebec/status/353519189769732096/photo/1

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Lac Mégantic case study

- **The Lac-Mégantic rail disaster**

How the rail disaster happened

Lac Mégantic case study

- **The Lac-Mégantic rail disaster**

- **Some videos to understand the accident and its consequences:**
  - **Train accident**
  - **Accident and fire control (in French, use English subtitles if needed)**
  - **After the accident**
  - **Impact on the river**

Terminaphos case study: students

- Students will work in group of 4 to 6 people (ideally)

- Students will work as scientists working for a research laboratory investigating the impact of the accident, 7 days after the train derailment.

- Alternatively, they can act as scientists working for a consulting company, especially if you want to include a financial aspect in the case study (cf PBL Potential evolution)

- Students will need to provide an investigation report (min. 25 pages) and/or an oral defense (20 min + 20 min questions)

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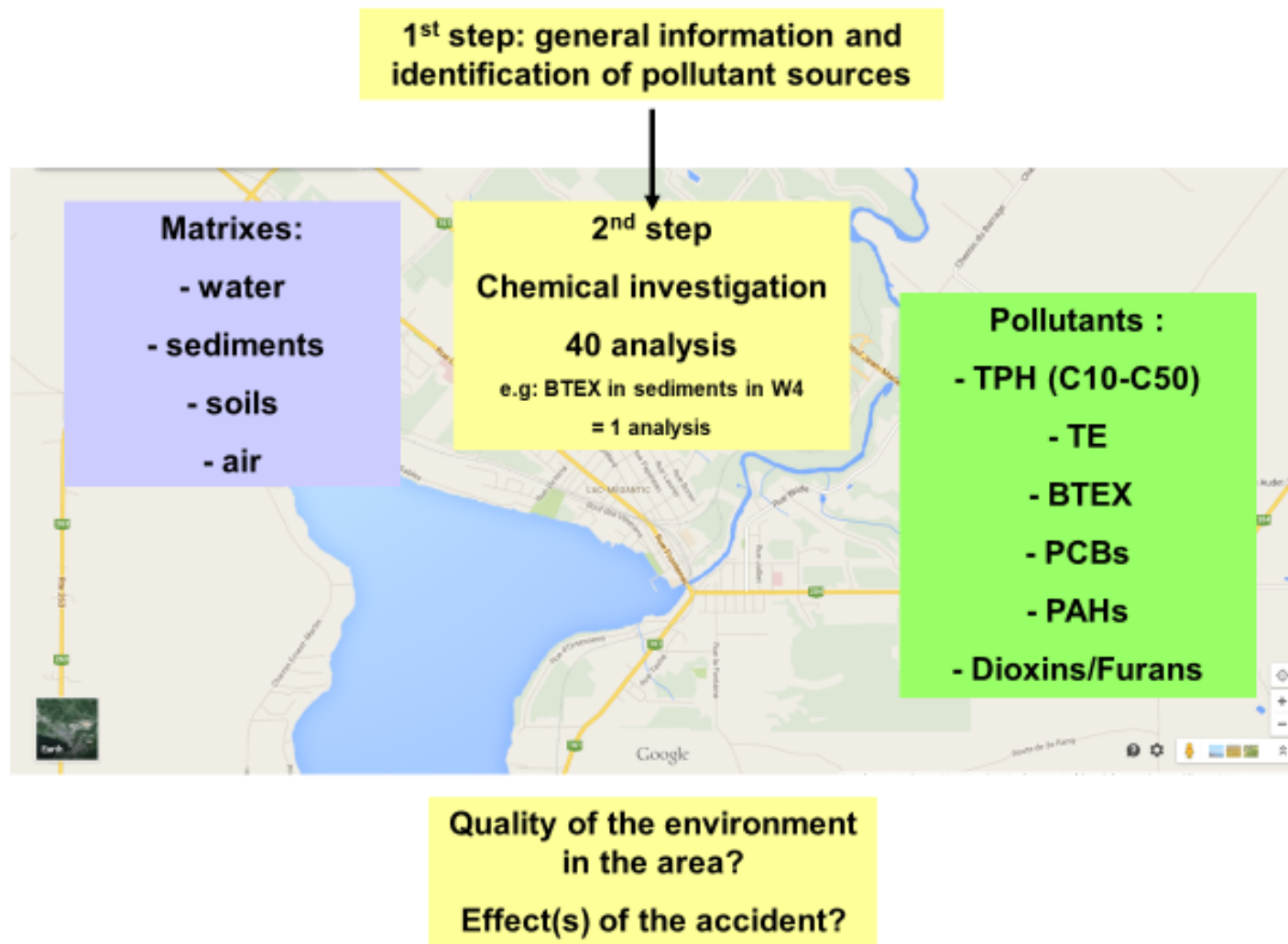
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Learning outcomes

- Know the major pollutants in the environment and their main characteristics;

- Understand the fate of pollutants in abiotic (soil, water, air, sediments) and biotic matrixes (bacteria, plants, animals);

- Get the basis on toxicology and ecotoxicology;

- Understand and use results from ecotoxicological approaches with non-standard test species;

- Understand and use results on the effects of chemicals on food-webs;

- Perform an advanced data analysis on chemical and biological monitoring data;

- Practice collaborative group work: work, oral presentation, debate.
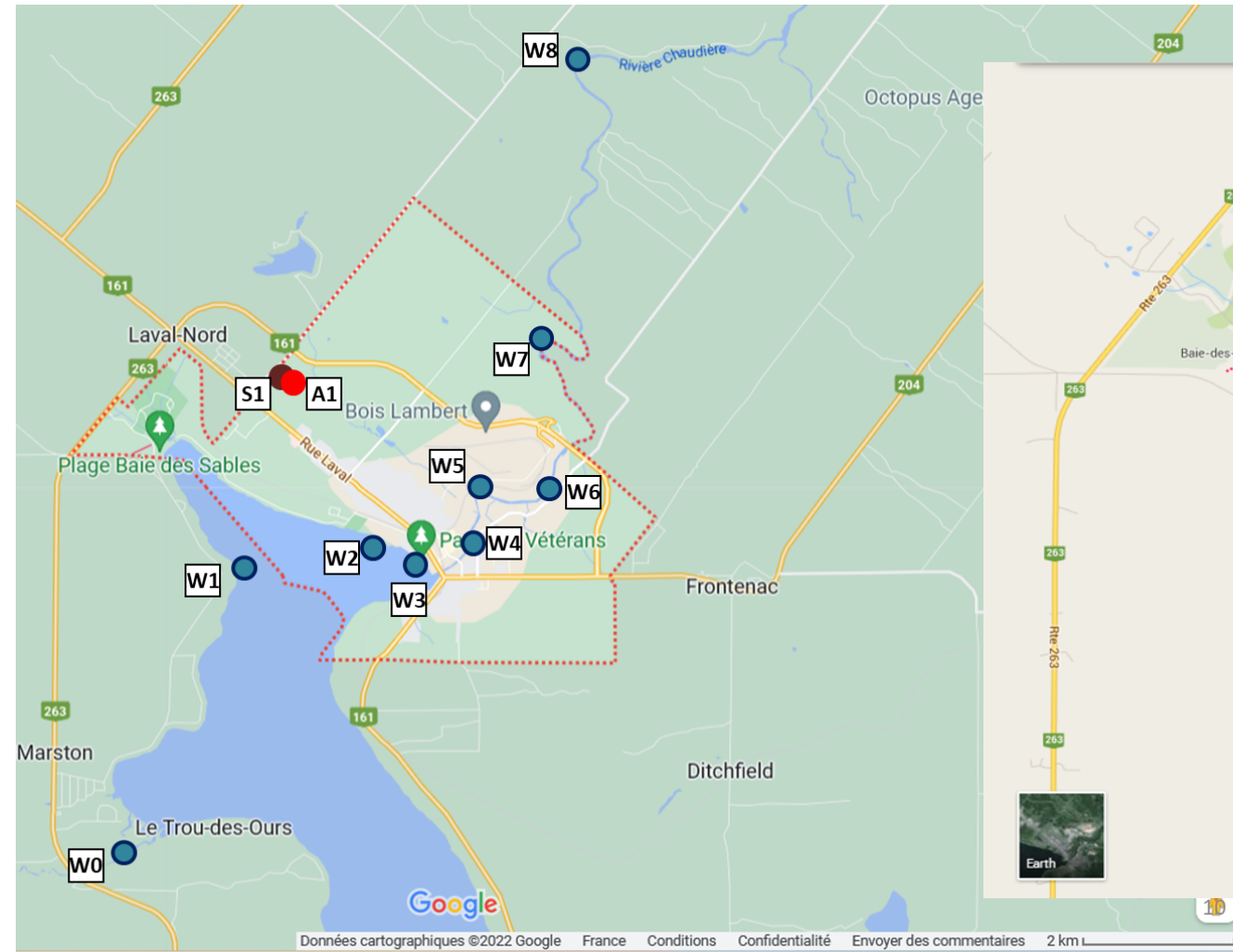
Lac Mégantic case study: 1st step

- Students need to collect to investigate by themselves the main sources of pollution:

  ▪ Oil spill: precise composition of the oil (especially TPH, BTEX and PAHs), and oil spill extent

  ▪ Smoke: smoke potential pollutants (PAHs, Dioxins/Furans, BTEX)

  ▪ (less obvious: contaminated dust released after the accident by trucks and caterpillars on site)

  ▪ (less obvious: historical and current sources of pollution on the site; e.g. Tafisa wood company)

- Students need to collect to collect the maximum information about the site:

  ▪ Weather conditions during and after the accident: wind direction, temperature, rain…

  ▪ Site topography

  ▪ Soil type and river/lake information

  ▪ Information about the wildlife

  ▪ …

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Lac Mégantic case study: 2nd step

1st step: general information and identification of pollutant sources

Matrixes:
- water
- sediments
- soils
- air

2nd step

Chemical investigation

40 analysis

e.g: BTEX in sediments in W4 = 1 analysis

Pollutants :
- TPH (C10-C50)
- TE
- BTEX
- PCBs
- PAHs
- Dioxins/Furans

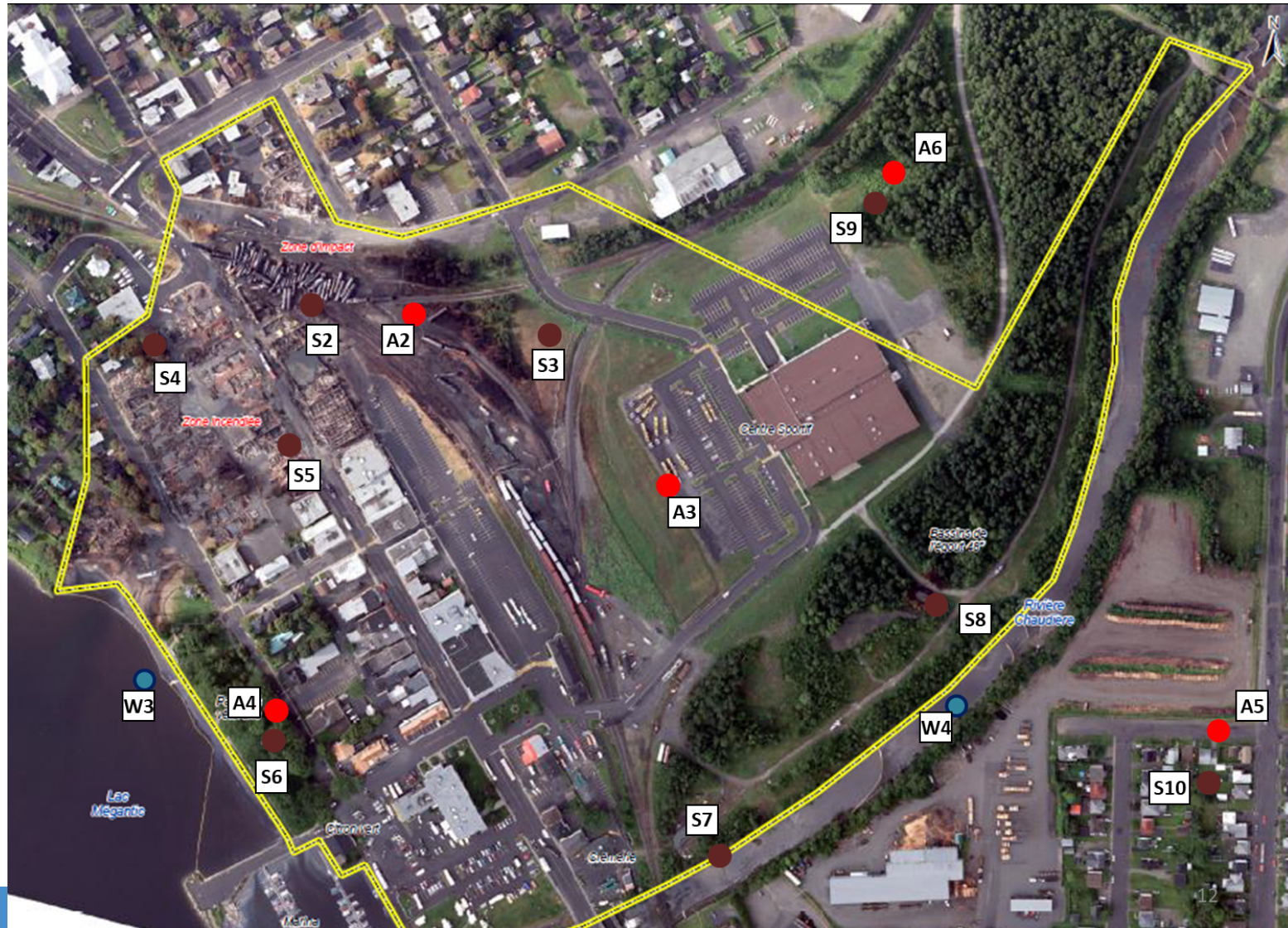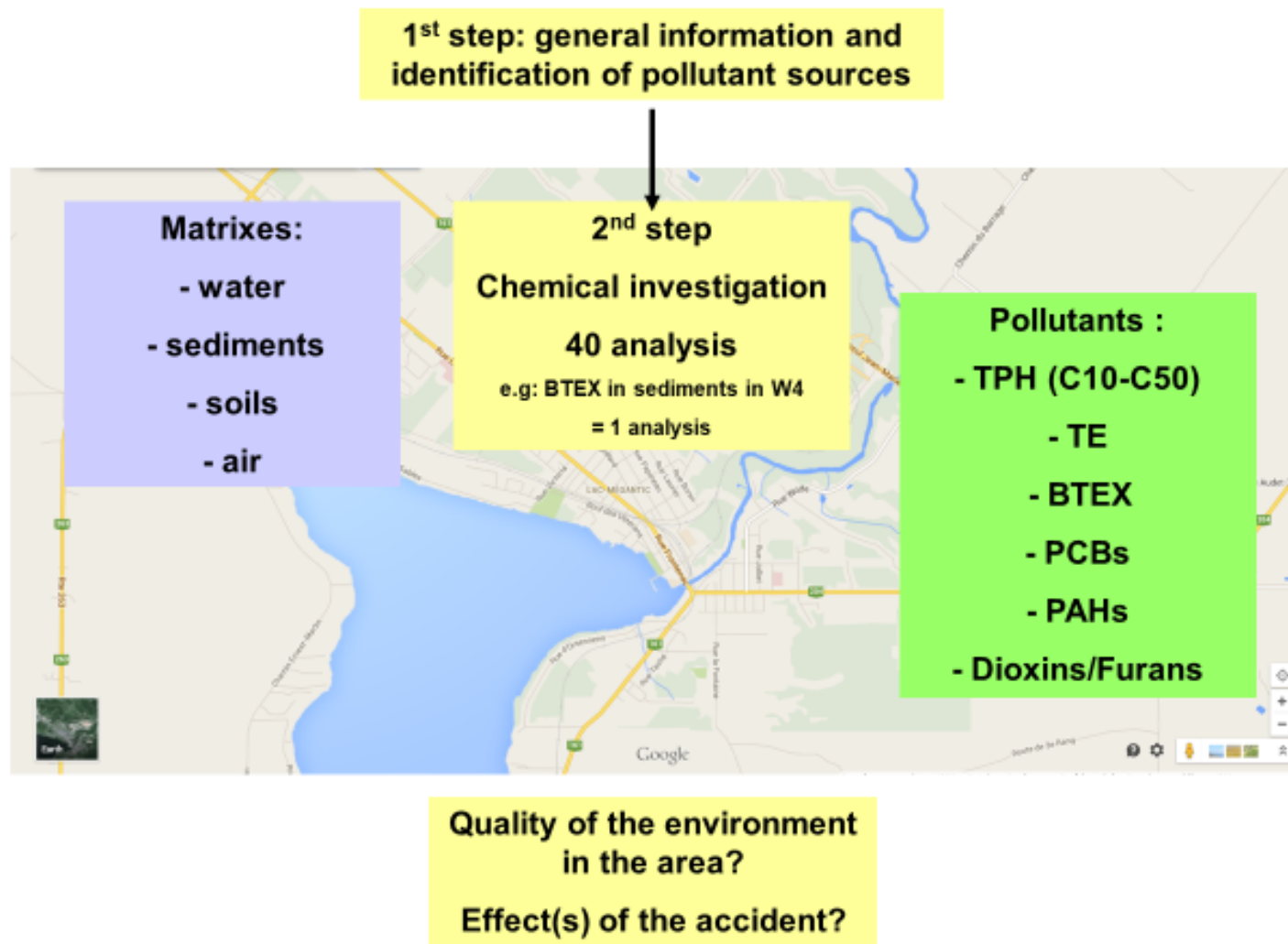Quality of the environment in the area?

Effect(s) of the accident?

Lac Mégantic case study: 2nd step

Lac Mégantic case study: 2ⁿᵈ step

Lac Mégantic case study: 2nd step

Lac Mégantic case study: 2nd step

1st step: general information and identification of pollutant sources

Matrixes:
- water
- sediments
- soils
- air

Ecotoxicological tools:
- Bioindicators
- Biomarkers
- Bioaccumulation

2nd step
Chemical investigation
40 analysis
e.g: BTEX in sediments in W4
= 1 analysis

2nde investigation
Biological investigation
50 analysis

Pollutants :
- TPH (C10-C50)
- TE
- BTEX
- PCBs
- PAHs
- Dioxins/Furans

Quality of the environment in the area?

Effect(s) of the accident?

PBL Documents

- Chemical analysis request form (for students)

- Lac Megantic chemical data (for teachers)

- Biological analysis request form (for students)

- Lac megantic biological data (for teachers)

- Sampling maps

PBL Suggested organisation

- Global organization 40h of student work + extra student work: 2 ECTS
- Evaluation: written report and/or oral defense: +1 ECTS

	Monday	Tuesday	Wednesday	Thursday	Friday
Morning	Case study: presentation - Research of information about the accident and site	Strategy for pollution investigation	Analysis of chemical data - Risk assessment	Strategy for environmental impact investigation debriefing	Analysis of biological data - Impact assessment
Lunch		**Deadline for chemical analysis request**		**Deadline for biological analysis request**	
Afternoon	Strategy for pollution investigation	Analysis of chemical data - Risk assessment	Strategy for environmental impact investigation	Analysis of biological data - Impact assessment	Synthesis of chemical and biological data

PBL Potential evolution

- Use the same principle on a different type of pollution or accident (Note: complete sets of data are needed)

- Include a financial aspect in the case study by:
  - Limiting the analysis request with a maximum budget (instead of a number of analysis): you need to provide a pricing list for chemical and biological analysis
  - Evaluating the investigation proposal by its relevance and its budget (no maximum budget) and cost/efficiency ratio: you also need to provide a pricing list for chemical and biological analysis

- Perform Human Risk Assessment based on the chemical data on the different matrixes (soil, air, water…)

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Enjoy!!!!!

For any questions regarding the case study: bertrand.pourrut@ensat.fr

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