Geographic Information System: Industrial risks in Bas-Rhin

1rst April 2024

Ecole Centrale de Lyon
Université Lyon 1
Université Lyon 2

Professors: René CHALON, Marie Ramel DELOBEL, Ariane EMMANUELLI, Elodie FAURE

Group 12: Axel BUTTARD, Yupeng CHEN, Chaymae DAHHASSI, Clémence LEROUGE, Xiaowei SHI

Content

Introduction

On the night of 10th to 11th July 1976, a toxic cloud escaped from the ICMESA chemical industry in the village of Seveso, causing an environmental disaster and generating health problems for several decades. Following this accident and its poor management, due to the absence of an emergency plan, the European Union introduced the "Seveso Directive" to oblige EU countries to declare all their industrial sites at risk of major incidents, with low likelihood but high severity, as ‘Seveso sites’. In Bas-Rhin, there are 22 sites classified as Seveso, 18 of which are classified as ‘high risk’ and 4 as ‘low risk’ according to their quantity of substances with properties hazardous to human health and nature. Often the hazards involved in such activities are the toxicity, flammability or high temperatures and pressures, so to avoid this type of event, the authorities (from the local to european level) have implemented several strategies to reduce the likelihood of an accident occurring and the damage it causes on the environment and the population. Which leads us to our problem:

What strategies are implemented to effectively minimise the risks induced by the presence of Seveso-classified sites in the region Bas-Rhin?

In the first part, we are going to study what can be the risks for the population and the social impacts of an industrial accident. Then, we will examine the potential consequences on the environment and consider various accident scenarios. The final part will be dedicated to the solutions implemented by institutions and Industrials.

The aim of this project is to leverage geographic information systems to examine industrial risks within the Bas-Rhin region and to discover solutions to our central question.

Methodology

We used QGIS to make maps. Firstly, we created a global bas-rhin map, and identified the specific locations of SEVESO sites on the map. Secondly, we made specific maps for analysis for each different aspect of impact. Mainly, we analysed the impact of SEVESO sites on human society and the natural environment, as well as the risk management policies currently in place.

Figure 1 presents the global map, while Figure 2.a illustrates the process behind its creation. A critical step in this process involves selecting areas by the postal code prefix "67xxx," enabling us to encompass all communes within Bas-Rhin. After incorporating the SEVESO sites data into Bas-Rhin, we were able to pinpoint the SEVESO sites on the map.

Figure 3 and the Figure 2.cd respectively showcase the map for analysing impact on population and its accompanying illustrative diagram. Initially, we gathered population data from France. A 1 km buffer zone was established around the SEVESO sites, which was then intersected with this data. Utilizing summation, we estimated the population within a 1 km radius of SEVESO sites and represented these figures using graduated symbols. Furthermore, to assess the impact of industrial risks on vulnerable populations, we incorporated data on nursing homes, schools, and hospitals obtained through QUICKQSM.

Figures 4 and Figure 2b depict the map for analysing solutions and its process diagram, respectively. We obtained data on all communes within Bas-Rhin that have Technological Risk Prevention Plans (PPRT) in CSV format, as well as the names of communes with Immediate Protection Perimeters (PPI). By joining the CSV file with the layer representing "all communes in Bas-Rhin," we created the "communes with PPRT" layer. Directly selecting by the names of the communes, we acquired the "communes with PPI" layer. This process allowed us to identify communes hosting SEVESO sites yet lacking any risk mitigation solutions. Additionally, we utilised QUICKOSM to add data of city councils and préfecture which are responsible for implementing the solutions.

Figure 9 identifies the risk zones and vulnerable natural areas in the study's territory. To create this map, we followed 3 steps outlined in the diagram of Figure 8.

1. Description of Terrain Features:

- Layer “Departments_Grand_Est”: Provides the delineations of departments in Grand-Est to position the territory within the region. Obtained by attribute selection (“nom_region” = ‘Grand Est’) from vector layer “Departments_France”.
- Layer “Mapzen Global Terrain”: Provides topographical information of the territory.
- Layer “BD_Forest_Bas_Rhin”.
- Layer “Rivers_Bas_Rhin”: Segments obtained using QuickOSM (Key=”Waterway”; value = “River”), then dissolved based on the “name” attribute of the segments to obtain the rivers. Rivers in Bas-Rhin are selected using selection by location intersecting with the Bas-Rhin layer previously created.

2. Visualisation of Natural Entities in Bas-Rhin:

- Layer “Ramsar_Zones”: designated wetland areas of international importance recognized under the Ramsar Convention, aimed at promoting their conservation and sustainable use. They are characteristic of the region of Bas-Rhin.
  This layer is obtained by attribute selection (“OPERATEUR” = ’DREAL LORRAINE’ or “OPERATEUR” = ’ALSACE’).
- Layers below do not contain the operator of the areas in their attribute table, thus they are obtained using selection by location (Intersects with layer “Bas-Rhin”):
  - “PNR_Bas_Rhin”: Regional natural parks in Grand-Est.
  - “Sensible_Natural_zones_Bas_Rhin”: identified for their ecological sensitivity, requiring specific management strategies to preserve their natural integrity.
  - “National_Natural_Reserves_Bas_Rhin”: areas recognized for their exceptional biodiversity and ecological significance, protected and managed to conserve their unique natural features.
  - “Zico_zones_Bas_Rhin”: identified as Important Bird and Biodiversity Areas (IBAs), crucial for the conservation of bird species and their habitats.
  - “Znieff_I_Bas_Rhin”: classified as Zones Naturelles d'Intérêt Écologique, Faunistique et Floristique, recognized for their ecological, faunal, and floral importance, requiring conservation efforts to maintain their ecological value.

3. Mapping of the Seveso Sites:

Seveso sites are classified by their official danger level (“high threshold” or “low threshold”), and also by their types of activities and pollutants involved to anticipate accident scenarios:

- Attribute table of “Seveso_sites_Bas_Rhin” updated with fields “Activite” (“storage or production” and substances involved) and “Type” (using NAF: French Classification of Activities).
- “Seveso_high_threshold_sites” / “Seveso_low_threshold_sites” selected by attributes (“seuil” = ‘AS’ / ‘SB’).
- Categorized symbolization based on “type” for each layer created.

This map serves as a base layer for other maps for biodiversity risk analysis.

Figure 11 reveals potential natural disasters that could endanger Seveso sites. It’s generated following the steps explained in Figure 10. Three major types of natural disasters prone to Bas-Rhin are identified, we aim to display each of the risk-exposed areas:

1. Floods:

   We used existing PPRNi (Flood Natural Hazards Prevention Plans) of communes in Bas-Rhin to determine different characteristic flood risk zones. (200m from the river : strict prohibition zones, 500m and 1000m : conditional authorisation zones)

   - Buffers (d = 200m, 500m, 1000m) of “Rivers_Bas_Rhin” layer previously reprojected to Lambert 93.

2. Forest Fires:

- Using Layer “BD_Forest_Bas_Rhin”.

3. Geodynamic Hazards:

- Earthquakes: Zones prone to seismic activities identified from past earthquake records.

        - Delimited text layer “Historical_seismic activities sensed in Bas_Rhin” added (Read “X RGF93/L93” as x-field, “Y RGF93/L93” as y-field).
        - Graduated symbolization based on “intensity”.
        - Areas represented based on historical incidents, categorized by preponderant intensity.
- Geomorphological Movements (landslides, subsidences):
    - Layer added from delimited text (Read longitudedoubleprec as x-field, latitudedoubleprec as y-field in WGS 84).
    - Reprojected layer in Lambert 93.
    - Buffer of layers “Seveso_high_threshold” and “Seveso_low_threshold” (R = 5km), dissolved, and merged.
    - Selection by location: Geomorphological movements intersected with the previous merged buffers.

Figure 13 represents accident scenario models, this map is generated following the steps defined in Figure 12. We identified 3 potential types of impacts of an industrial incident:

1. Explosion and Fire:

We estimated severe consequences within a zone of 1km from the center of the site.

- Buffer of layers “Seveso_high_threshold” and “Seveso_low_threshold” (R = 1km), dissolved.

2. Toxic Gas Dispersion:

Contaminable zones represented within 10 minutes and 1 hour of high Seveso sites, with a wind speed of 4m/s, as specified in the reference scenarios defined by the urbanization control guide around high-risk industrial sites from October 1990 [References].

- 10 minutes after the incident: Buffer of “Seveso_high_threshold” (R = 10604 = 2.4km).
- 1 hour after the incident: Buffer of “Seveso_high_threshold” (R = 60604 ~ 15 km).

3. Water Contamination:

- Downstream areas after every Seveso site are manually selected from original disjointed watercourses imported from QuickOSM.

Impacts on biodiversity are studied within zones located within 15km of Seveso sites.

- Sensible natural zones and Ramsar zones are mostly included in Znieff I zones, so we intersected the latter with the previously created 15km buffer to identify layers of exposure-prone zones.
- Zico zones in Bas-Rhin are also intersected with the 15km buffer to identify layers of exposure-prone bird habitats.

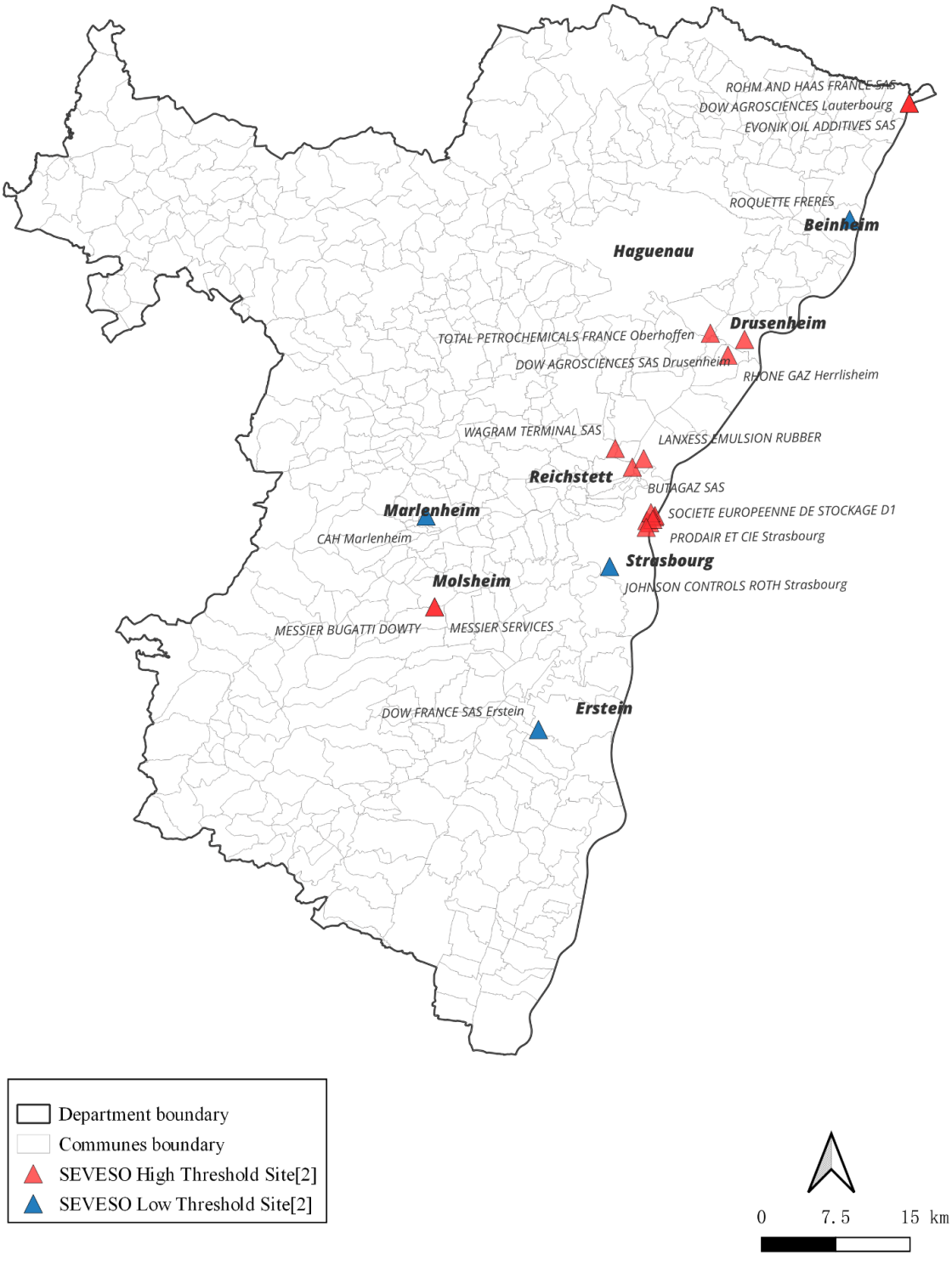


Figure 1：*SEVESO sites in Bas-Rhin (author: Xiaowei SHI)*

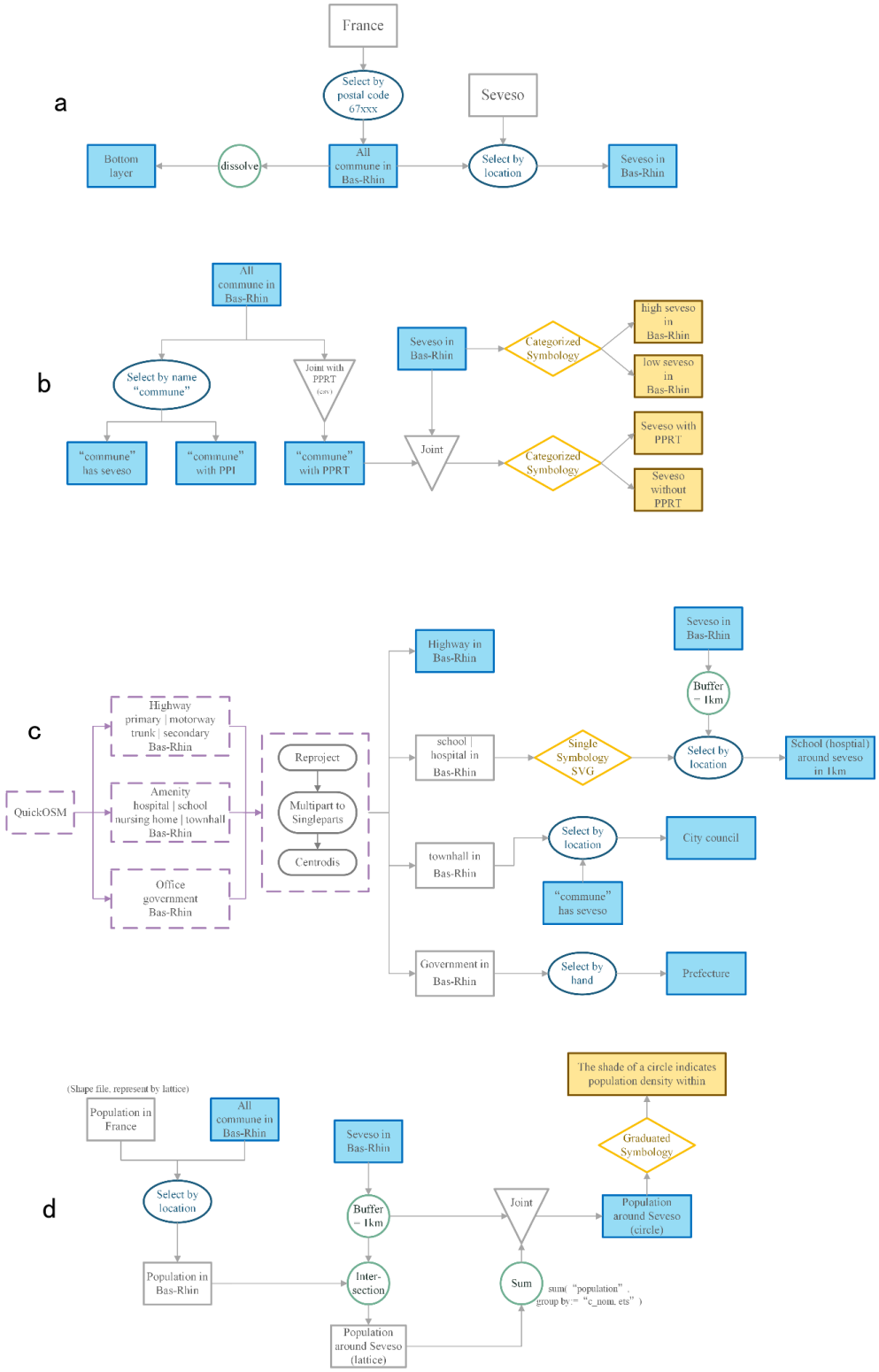


Figure 2: *The different steps followed to generate the maps*
(a.SEVESO sites, b.Strategies implemented c and d: Human and social impacts of SEVESO sites)
(author: Xiaowei SHI)

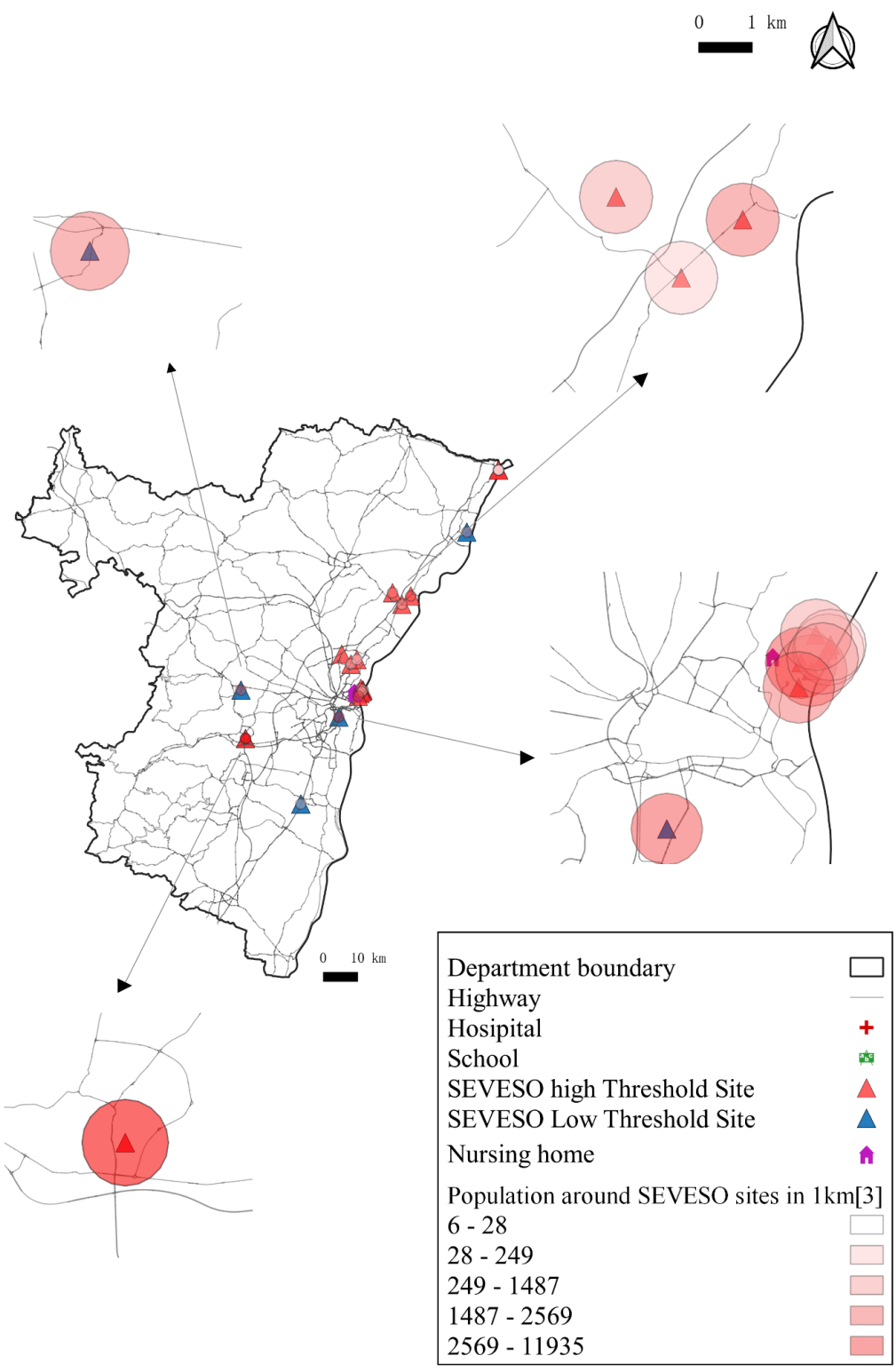


Figure 3: *Human and social impacts of SEVESO sites in Bas-Rhin (authors: Xiaowei SHI, Clémence LEROUGE)*

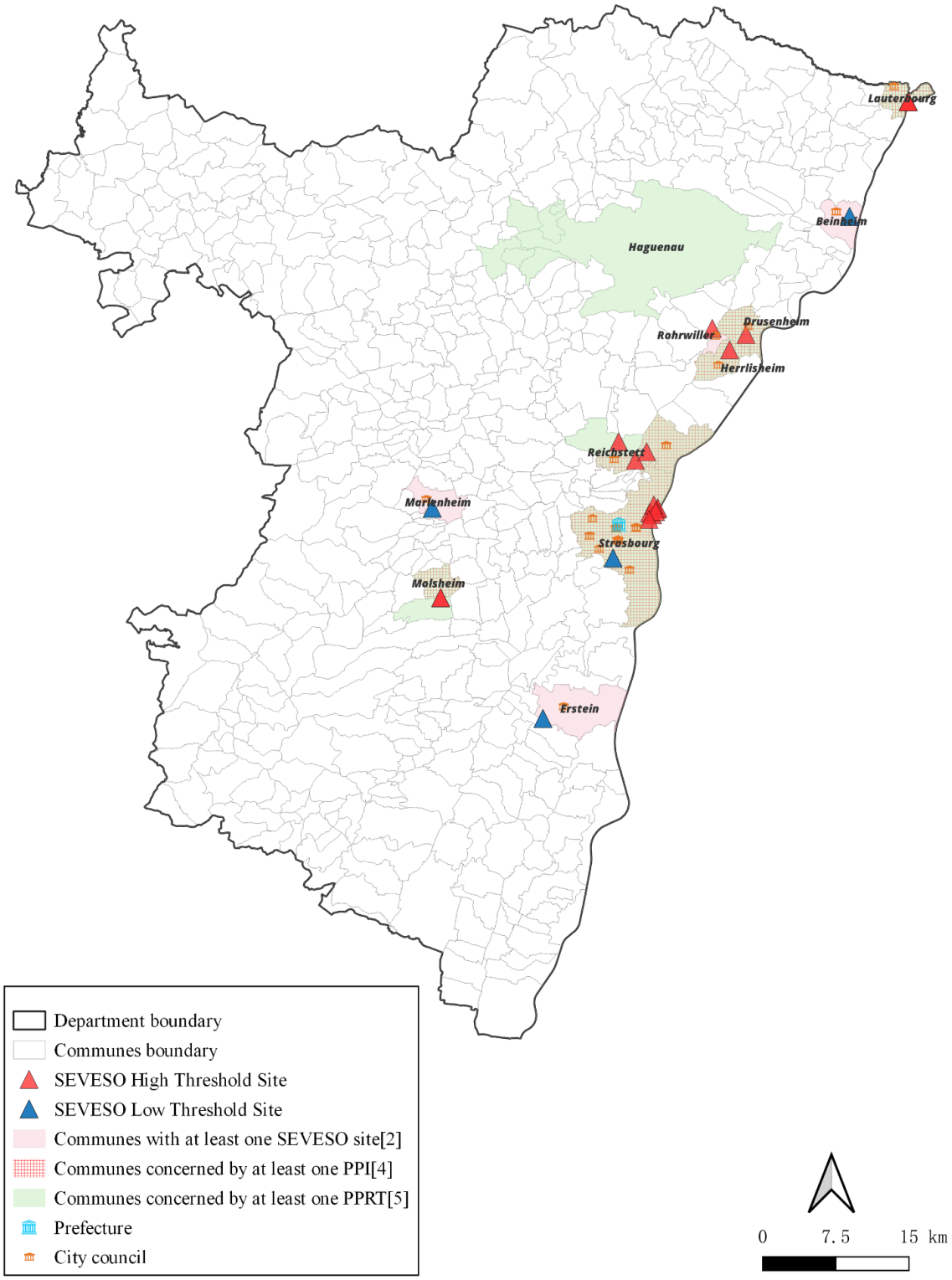
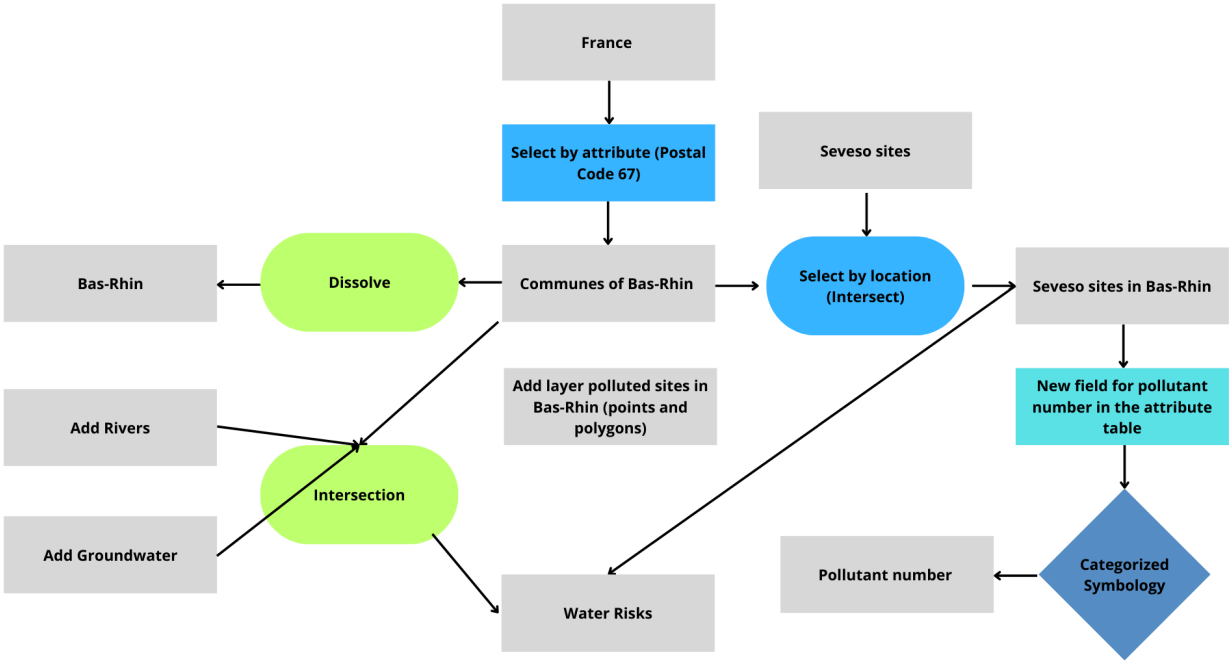


Figure 4: *Strategies implemented to prevent accidents in SEVESO sites or to take action in case of an incident (authors: Xiaowei SHI, Clémence LEROUGE)*



- Field calculator : format_number (“CO2_emiss”, 0) to separate thousands

Figure 5: The steps followed to generate the maps Figure 6. Pollutant risks in Bas-Rhin and Figure 7 : Water risks in Bas-Rhin (author: Axel BUTTARD)

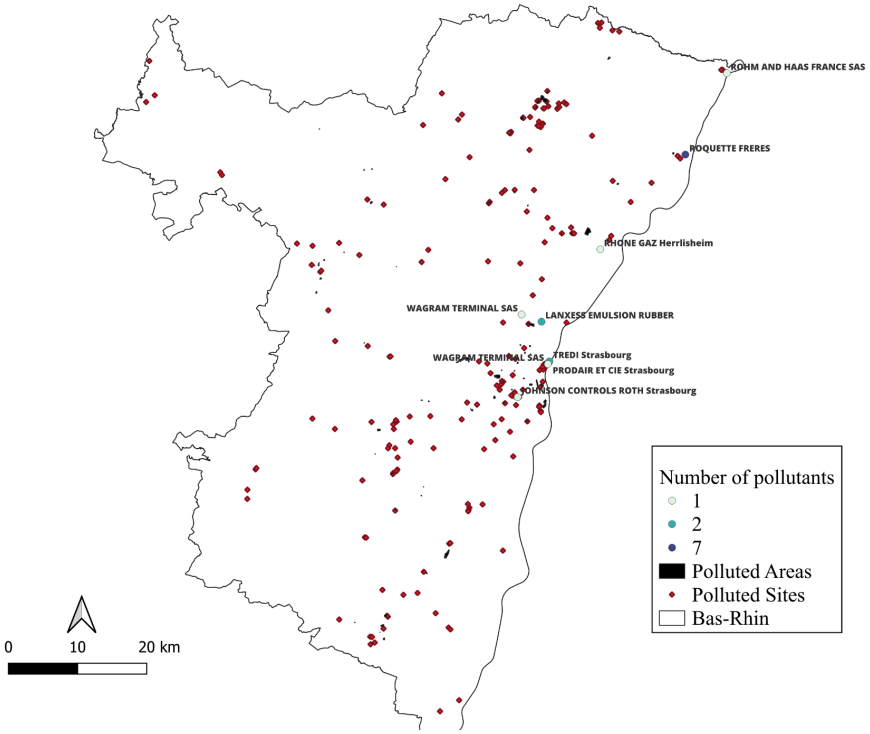


Figure 6 : Pollutant risks in Bas-Rhin (author: Axel BUTTARD)

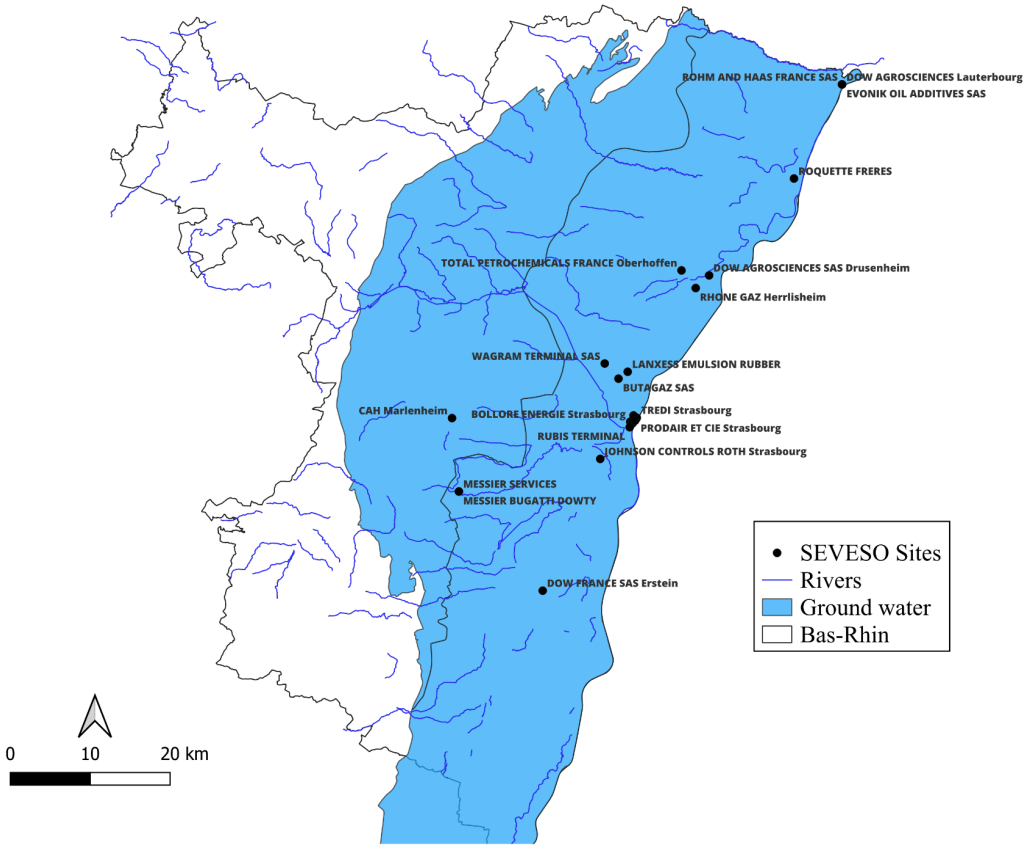


Figure 7 : Water risks in Bas-Rhin (author: Axel BUTTARD)

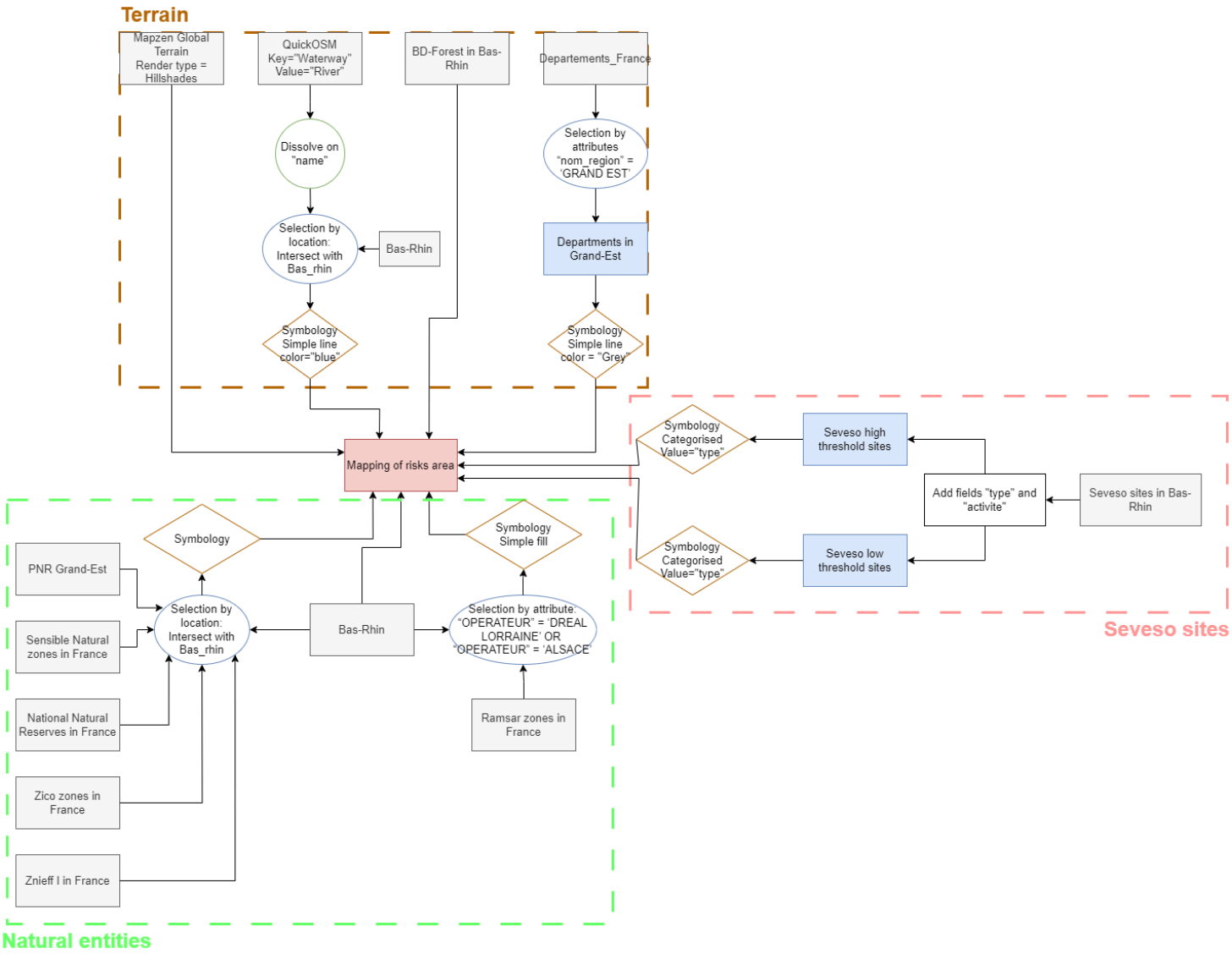


Figure 8: The steps followed to generate Figure 9: Map of risk areas with natural entities and Seveso sites in Bas-Rhin (author: Yupeng CHEN)

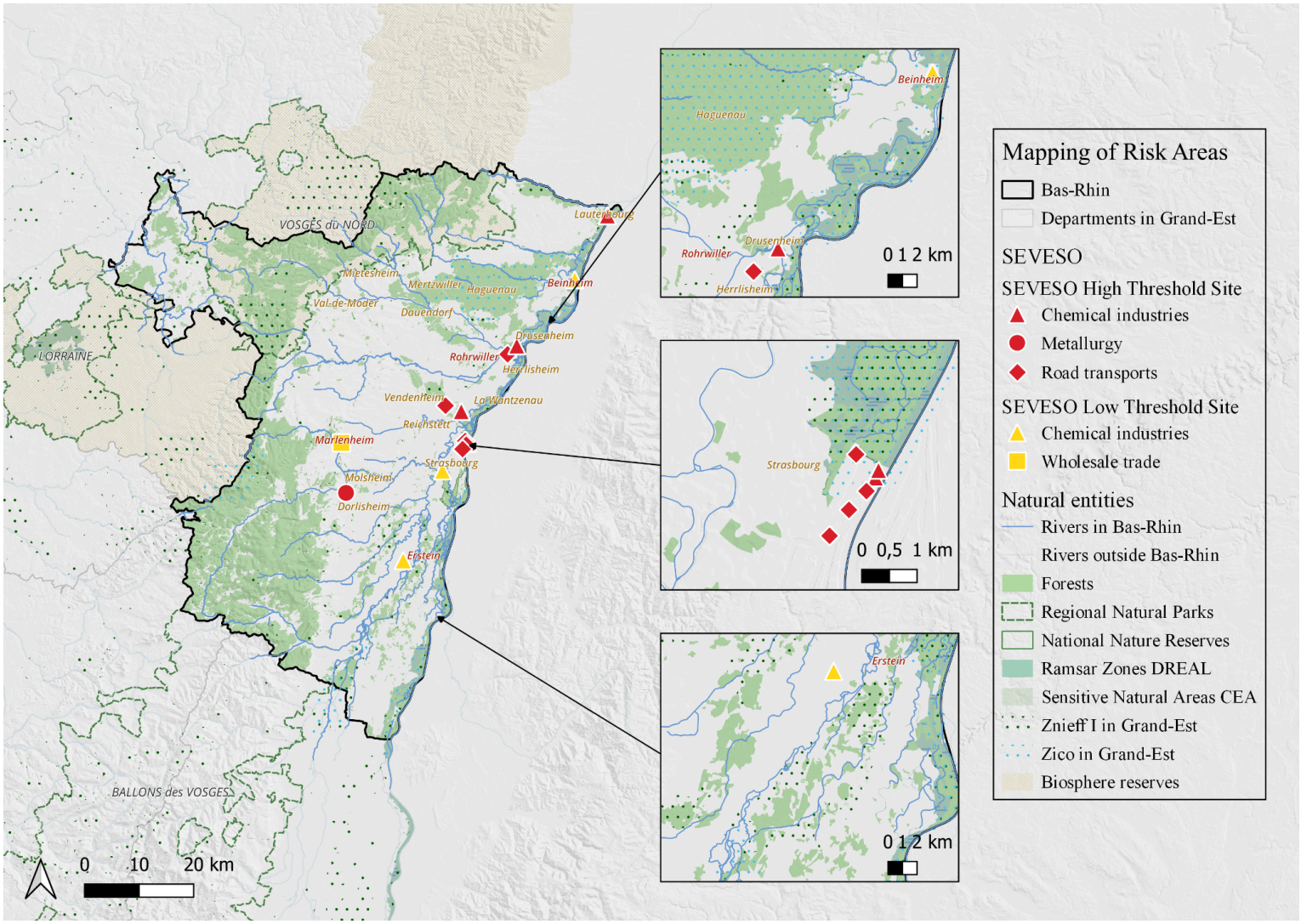


Figure 9: Map of risk areas with natural entities and Seveso sites in Bas-Rhin (author: Yupeng CHEN)

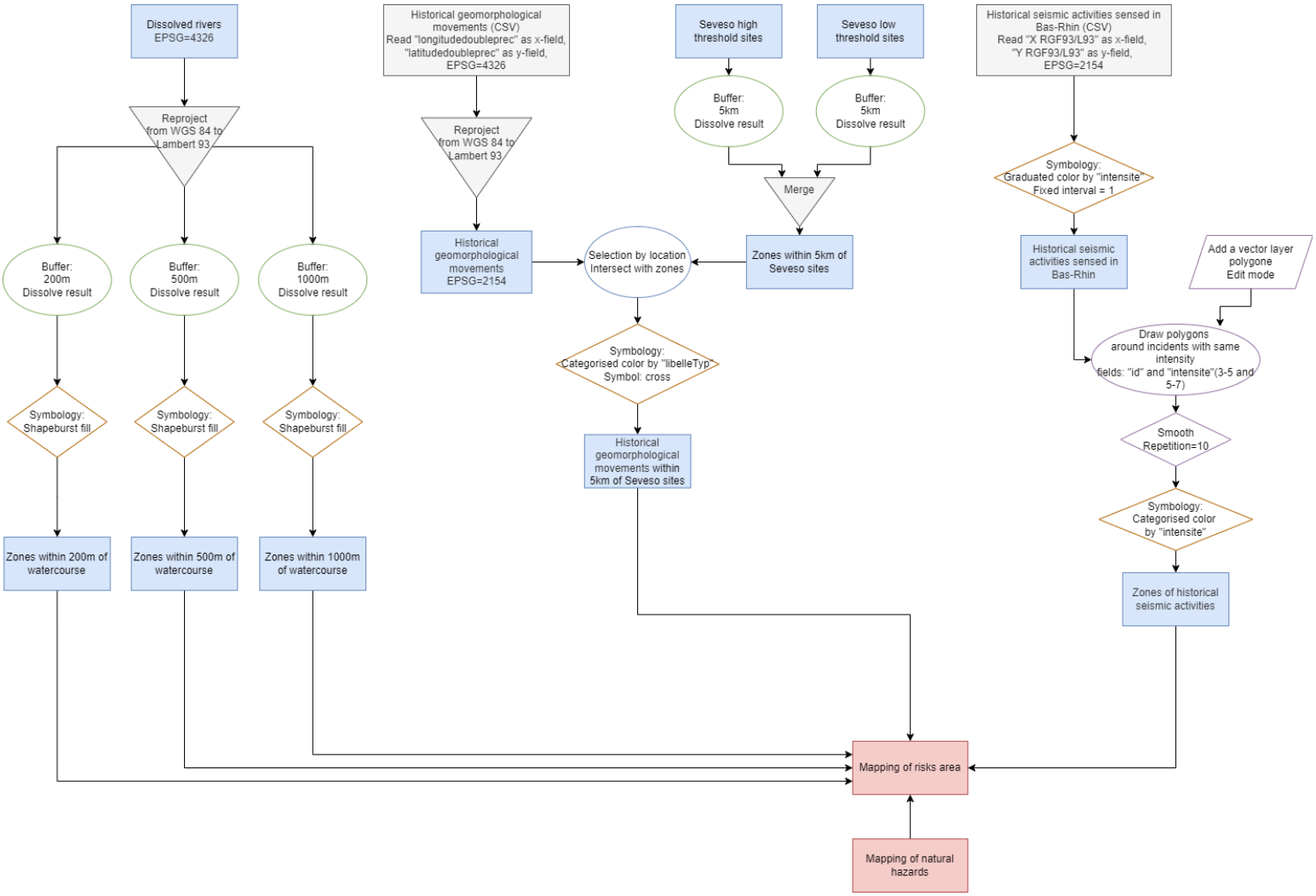


Figure 10: The steps followed to generate Figure 11: Map of natural hazards in Bas-Rhin (author: Yupeng CHEN)

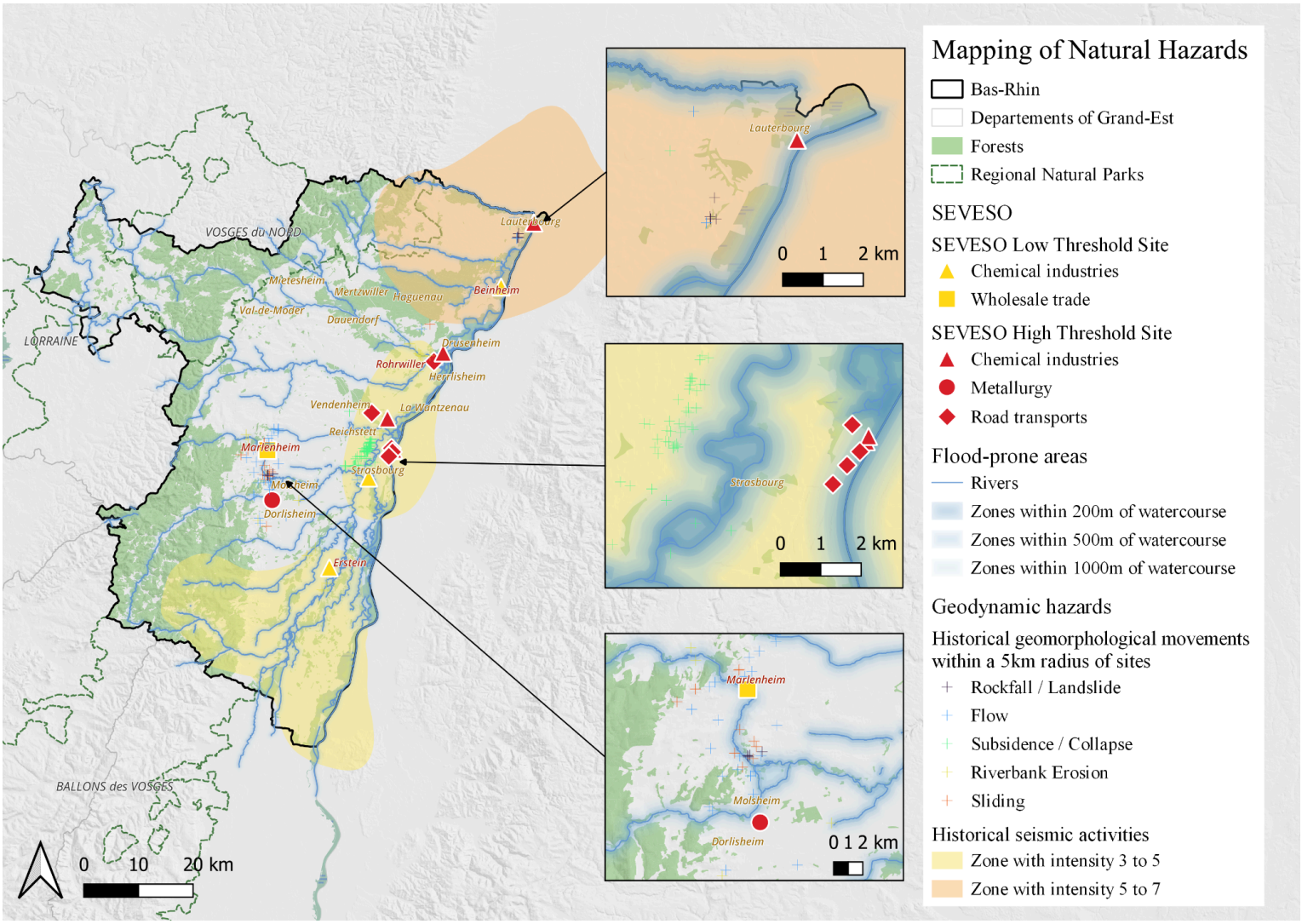


Figure 11: Map of natural hazards in Bas-Rhin (author: Yupeng CHEN)

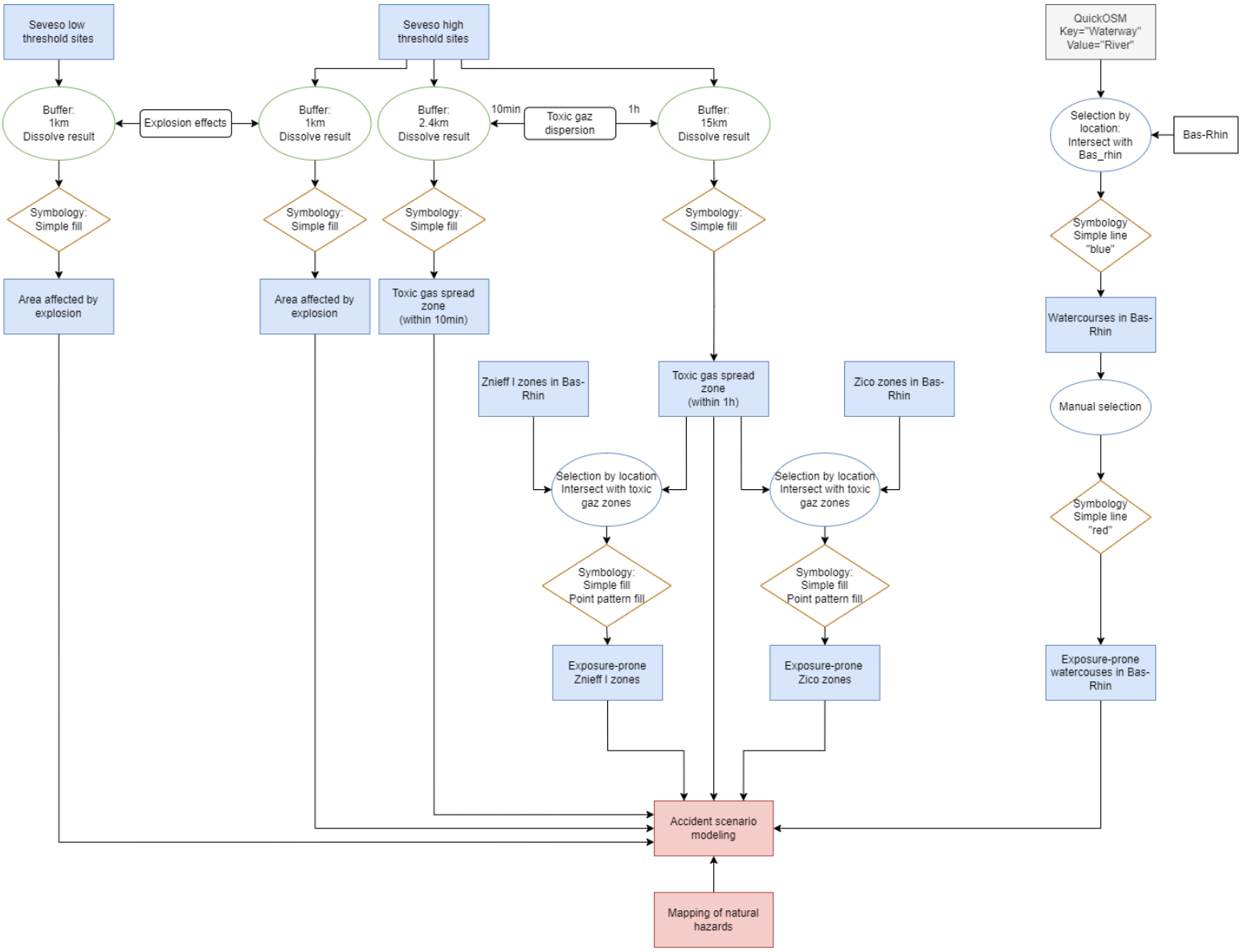


Figure 12: The steps followed to generate Figure 13: Map for accident scenario modeling in Bas-Rhin (author: Yupeng CHEN)

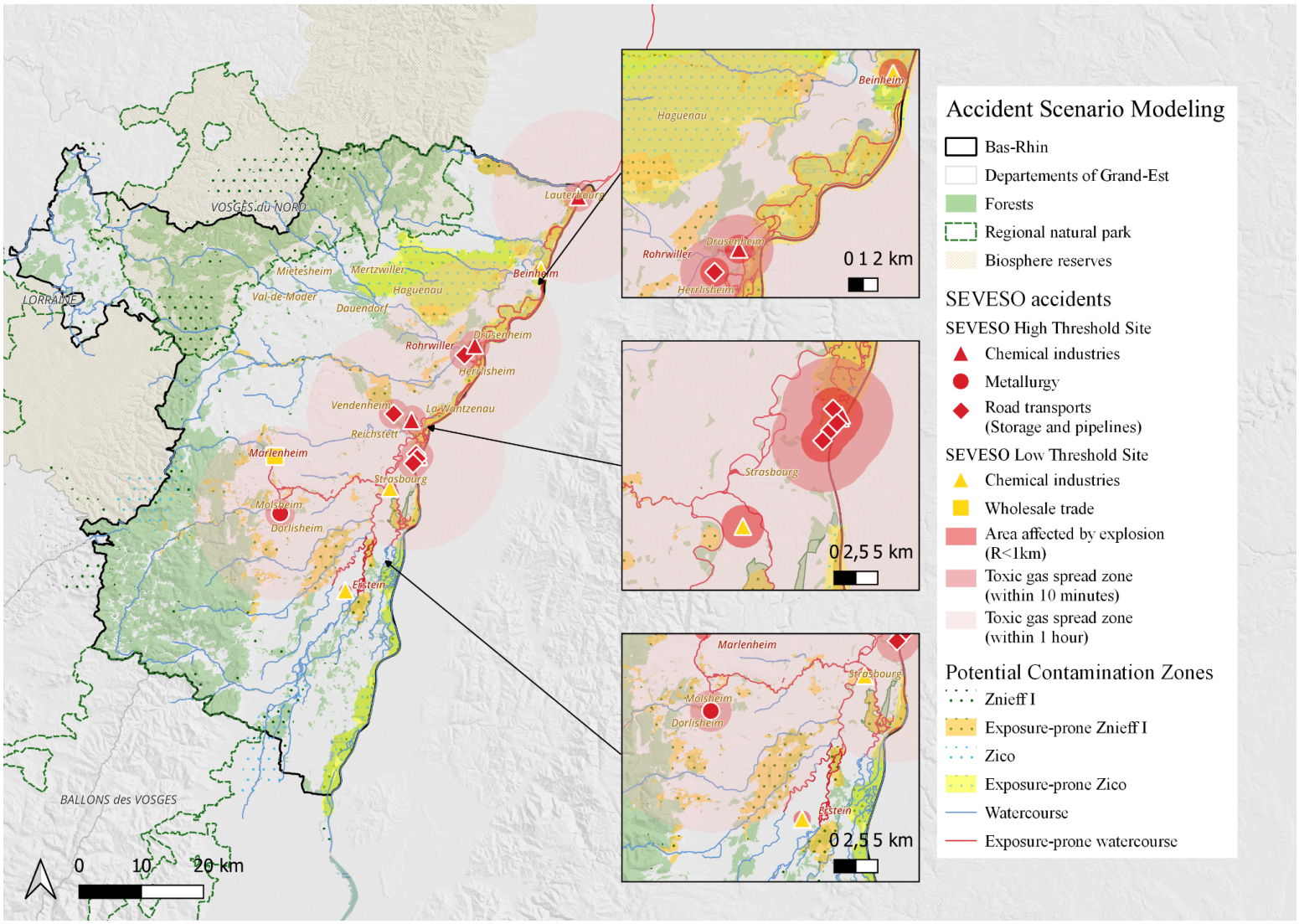


Figure 13: Map for accident scenario modeling in Bas-Rhin (author: Yupeng CHEN)

Analysis

A. Natural risks on Seveso sites

Apart from human error or system failure, natural causes such as flooding, geodynamic activities, or fires could also lead to industrial accidents.

From *Figure 11: Map of natural hazards in Bas-Rhin,* we could identify the most probable natural risks which could affect Seveso sites:

1. **Floods**:
    - We noticed that most of the Seveso sites are situated near rivers for industrial processes or transportation purposes.
        - High-threshold sites are clustered on artificial lands at Strasbourg: namely European Storage Company, Rubis terminal for petrochemical storage, TREDI Strasbourg for waste treatments.
    - Floods can cause damage to buildings, storage tanks, and equipment. Hazardous materials could also be released during flooding, causing environmental contamination on the population and biodiversity, along the river.
    - With the ongoing deregulation of climate, the frequency and intensity of extreme weather events, including heavy rainfall, are expected to increase. This deregulation could lead to more frequent and severe floods, posing heightened risks to industrial sites located in flood-prone areas.
    - On a local scale, a specific PPRT is applied on each site, it's reviewed and renewed frequently.

2. **Geodynamic movements:**
    - Grand-Est is historically prone to seismic activities. We observe distinct zones with seismic activities mainly on the river band of Rhine, this zone constitutes the Rhine Rift Valley.
    - We could identify different types of geodynamic movements specific for the region near each Seveso site:
        - Collapses around Strasbourg.
        - Mudflows and slidings near Molsheim.
        - Soil erosion near all waterways.

      These incidents all have different severity and extent. The prevention measures must be adapted to each of the industrial sites.
    - Heavy precipitation might weaken the stability of the slopes, exacerbating the risks of landslides or mudflows in the region, especially near the stream of rivers, where Seveso sites are situated.

3. **Forest fires:** Most of the Seveso sites are situated in urbanised areas, away from forests. Nevertheless, due to climate deregulation, forest fires might be more frequent in the future years. This risk should not be neglected.

B. Human and social impacts

The presence of Seveso-classified sites in the Bas-Rhin region can have significant social and human impacts, especially among the vulnerable population living nearby these sites, like children, the elderly and people in hospitals (see Figure 3). These impacts may include:

- **Health Effects:** Exposure to hazardous substances released from Seveso sites can have profound impacts on human health. Acute exposure to toxic chemicals during accidents or releases can result in immediate health effects such as respiratory problems, skin irritation, and eye irritation. Long-term exposure may increase the risk of chronic health conditions, including cancer, reproductive disorders, and neurological diseases.
- **Mental Health Issues:** Living in proximity to Seveso sites can contribute to mental health issues such as anxiety, depression, and post-traumatic stress disorder (PTSD). Fear of potential accidents or exposure to toxic substances can cause significant psychological distress, particularly among *vulnerable populations* such as children, elderly individuals, and those with pre-existing mental health conditions.
- **Disruption of Vital Services:** like healthcare, emergency response, critical utilities such as water supply, electricity, telecommunications infrastructure and transportation networks. Disruptions in these utilities, whether due to accidents, natural disasters, or other factors, can impact the ability of Seveso sites to operate safely.
- **Economic Burden:** Health problems resulting from exposure to hazardous substances can impose significant economic burdens on individuals and families, including medical expenses, loss of income due to illness or disability, and reduced productivity.

C. Environmental impacts

I. Pollutant risks

After an accident certain compounds such as nitrogen oxides of sulfur dioxide can react with atmospheric water vapour to form acid species. It can lead to acid rain and can damage vegetation and soils. For most companies, only carbon dioxide emissions are calculated. For the past ten years, industries have been required to quantify their greenhouse gas emissions and report on their carbon footprint. However, beyond this calculation, data on other emitted compounds are very limited. The industry with the most transparent data is Roquette Frères, with no fewer than seven emissions calculated, including heavy metals such as lead, cadmium and nickel. Around these industries, signs of pollution have been measured in the soil.

II. Water pollution risks

Air pollution can also affect water quality. Particles are generally transported over short distances and affect the surrounding area of an industry after an accident. Particles or chemical substances can fall to the ground after an episode of precipitation. These particles are then transported by processes such as leaching or runoff.

There is a large water table under Bas-Rhin. This is France's largest water table with reserves estimated at 35 billion cubic meters just for the Alsace part. In the case of an industrial accident, certain particles deposited on the ground can migrate in the groundwater when they are soluble in water. It has a significant impact on water quality and can contaminate the water table over the long term. Surface waters such as lakes or rivers can also be affected by this pollution which can cause irreversible damage to flora and fauna. Many Seveso sites are located near rivers that may be connected to the water table.

III. Biodiversity risks

The following analysis is made based on *Figure 9: Map of risk areas with natural entities and Seveso sites in Bas-Rhin:*

Natural Entities in Bas-Rhin:

- The region intersects with three regional natural parks: Balloons des Vosges, Vosges du Nord, and Lorraine.
- Wetlands represented by Ramsar zones are mostly located on the riverbank of the Rhine.
- Znieff I zones are predominantly situated in forests or wetlands, so as habitats for birds as defined by Zico zones. We notice that there is a large Zico Zone in Haguenau, which might explain the application of a communal PPRI plan despite the absence of a Seveso site.

- Wetlands, especially near the Rhine, are essential natural habitats containing both Zico and Znieff I zones.

Geographical Situation of Seveso Sites:

- Situated on the frontier of France-Germany, along the riverbank of the Rhine, predominantly in urbanised zones.
- Although they are rather distant from natural reserves and regional natural parks, they are in proximity to forests and wetlands adjacent to the Rhine.
- Therefore, these sites might disrupt ecosystems either through pollution or in the event of an accident.

IV. Accident scenario

According to *Figure 13: Map for accident scenario modeling in Bas-Rhin*, we notice the classification of Seveso is made out of activities and pollutants of each sites:

- Industries classified as high threshold are primarily for petrochemical products fabrication, storage or transportation, involving voluminous tanks of hazardous premiere or transformed petrochemical materials.
- Low threshold sites are mainly for manufacturing from secondary materials like plastic or for wholesome trades.

Based on the types and pollutants of industrial sites, we can anticipate different accident scenarios:

- In the proximity of industrial sites, **explosions** can have detrimental effects, including surpressure or thermal impacts. Notably, wetlands near the Rhine could be directly impacted, particularly those adjacent to the port of Strasbourg, namely Tarpans isles or Robertsau forests. An accident in any of the high-threshold sites on the river bank could lead to irrevocable consequences on these natural entities:
  - Habitat destruction and fragmentation due to physical damage from explosions.
  - Loss of biodiversity as a result of direct impacts on flora and fauna populations.
  - Disruption of ecosystem functioning, such as nutrient cycling and habitat connectivity.

- Away from the sites, **dispersion of toxic gas** may occur, affecting the surrounding and further environment, namely the Haguenau Zico zones.
  - Toxic gas exposure can lead to acute or chronic health effects in wildlife, including respiratory problems, reproductive issues, and decreased survival rates.
  - Disruption of ecological processes, such as pollination and seed dispersal, disturbing the whole ecosystem in the long term.

- **Watercourse Pollution:**

- We noticed that sites are often situated downstream near basins rather than upstream from mountain water sources. The western part of the region is less impacted.
- However, pollutants leaked into watercourses will be transported by rivers and dumped into the Rhine, impacting all downstream areas.
- Immediate impacts include contamination of water bodies, affecting aquatic ecosystems and species.

Furthermore, long-term indirect pollution may occur, such as soil and groundwater pollution, exacerbated by phenomena like acid rain, resulting in sustained environmental degradation over time, on all species.

D. Solutions

Now that we have seen the risks and the impacts of the seveso sites on the population and the natural environment, we are going to look at the strategies that can be implemented in order to protect the individuals and nature.

At the european level:

- **Seveso directive**: It's an european directive aimed at controlling and regulating industrial facilities handling hazardous substances, that we call Seveso sites.
- **Seveso III directive**: It's the most recent seveso directive which has reclassified some hazardous substances and introduced more comprehensive requirement to release basic information about hazardous sites to the general public

At local level:

- **PPRT** (Technological Risk Prevention Plan) focuses on protecting the human life in case of an accident by organising the cohabitation between industrial sites and populated areas. It provides better guidance for future projects of urbanisation and addresses challenging urban planning situations inherited from the past. It is compulsory for all HIGH seveso sites to set up a PPRT, this is why every commune which has a high seveso site is concerned by at least one PPRT.
- **PPI** (Specific Intervention Plans) ensures the protection of the population, material assets, and the environment in case of accidents that may extend beyond the boundaries of the establishment. It defines the emergency resources deployed under the authority of the Prefect of the departement (ex: alert, intervention, civil safety exercises,...). Only the communes of Strasbourg, Molsheim, Drusenheim and Herrlisheim are concerned by a PPI.
- On the maps we wanted to represent the Prefecture (blue building) and the city council (orange building) next to the seveso sites, because these institutions are responsible for implementing the strategies to limit the risk in their area. They are also the ones who have the power of decision in the event of an accident.
- **CLIC** (Local Information and Consultation Committees) can be created by the Prefet to improve the public information about risks and promote local exchange. It can organise meetings between industrial stakeholders and public authorities to present their strategies and results regarding security matters, or they can take part in an information campaign,...

At the firm's level:

- **POI** (Internal Emergency Response Plan) is mandatory for all the seveso sites to facilitate decision-making in the event of a claim and to control a disaster whose effects do not extend beyond the confines of the establishment (≠ from PPI). It defines the

organisational measures, response methods and necessary resources that the operator must put in place to protect personnel, people and the environment.

- **ICPE** (Installations classified as environmental protection) is an installation whose activity leads to possible nuisances or significant risks of pollution covering: The protection of nature and the environment, Public health, The protection of sites and monuments, Agriculture, Neighbourhoords.
- Modelling can help the institutions to create targeted and efficient public policies to protect the population and the environment. For example, in our map (see Figure 3), we aimed to include the roads as they picture the access routes for firefighters and emergency services to use during an industrial incident. Moreover, they depict the potential evacuation routes for the population.

Conclusion

In conclusion, our study delved into the complex dynamics surrounding Seveso-classified sites in the Bas-Rhin region, employing a multifaceted approach that combined mapping techniques with thorough analysis. Throughout our analysis, we delved into the profound human, social, and environmental impacts stemming from the presence of Seveso sites, shedding light on health risks, community stress, and ecological vulnerabilities. We also underscored the importance of regulatory frameworks such as PPRT (Plan de Prévention des Risques Technologiques) and PPI (Plan de Protection des Installations) and other critical strategies for risk management and mitigation. These initiatives play a pivotal role in enhancing emergency preparedness, ensuring regulatory compliance, and safeguarding the well-being of surrounding communities.

However, despite the strides made in our study, we acknowledge certain limitations that warrant consideration. Chief among these limitations was the challenge of accessing comprehensive data sets necessary for a thorough examination of the myriad dimensions associated with Seveso sites. As a result, our analysis predominantly focused on technical and regulatory aspects, potentially overlooking crucial interdisciplinary considerations encompassing economics, sociology, public health, and more.

Moving forward, it is imperative to adopt a more holistic approach to risk management, one that transcends mere regulatory compliance and encompasses a broader spectrum of interdisciplinary perspectives. By integrating diverse expertise and fostering collaboration across various domains, we can better address the multifaceted challenges posed by Seveso sites, ultimately striving towards safer, more resilient communities in the Bas-Rhin region and beyond.

References

Géorisques. (n.d.). *Dossier expert sur les installations classées*. [online] Available at: https://www.georisques.gouv.fr/consulter-les-dossiers-thematiques/installations [Accessed 25 Mar. 2024].

Le risque industriel n 4.2.1. Qu'est-ce que le risque industriel et comment se manifeste-t-il ? (n.d.). Available at: https://www.bas-rhin.gouv.fr/contenu/telechargement/29249/200801/file/Risque+industriel.pdf [Accessed 25 Mar. 2024].

Les services de l'État dans le Bas-Rhin. (n.d.). *Les Plans de Prévention des Risques Technologiques (PPRT)*. [online] Available at: https://www.bas-rhin.gouv.fr/Actions-de-l-Etat/Prevention-des-risques-naturels-et-technologiques/Risques-technologiques/Les-PPRT/Les-Plans-de-Prevention-des-Risques-Technologiques-PPRT [Accessed 25 Mar. 2024].

Les services de l'État dans le Bas-Rhin. (n.d.). *Les Plans Particuliers d'Intervention PPI*. [online] Available at: https://www.bas-rhin.gouv.fr/Actions-de-l-Etat/Securites-et-prevention/Protection-civile/Risques/Risques-technologiques/Les-Plans-Particuliers-d-Intervention-PPI [Accessed 25 Mar. 2024].

Sales, J., Wood, M. and Jelínek, R. (n.d.). *Risk Mapping of Industrial Hazards in New Member States*. [online] Available at: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC38185/jrc38185_saleswoodjelinek.pdf [Accessed 25 Mar. 2024].

Emmanuel Martinais. *Évaluer les risques industriels. Une histoire des analyses de risques, de 1970 à nos jours.* Annales des mines - Série Responsabilité et environnement, 2011. Ffhalshs-03620517ff

Le Dossier Départemental des Risques Majeurs (DDRM) [online] Available at: https://www.bas-rhin.gouv.fr/Actions-de-l-Etat/Securites-et-prevention/Protection-civile/Risques/L-information-preventive

Data Table

No.	Description	Source	Information
1	All the communes in France	https://osm13.openstreetmap.fr/~cquest/openfla/export/communes-20220101-shp.zip	
2	The seveso-classified sites in Bas-Rhin	https://public.opendatasoft.com/explore/dataset/sites-seveso/table/?flg=fr-fr&q=BAS-RHIN	01/04/2019 SHP Ministry of the Environment, Energy, and the Sea"
3	Density of population	https://www.geoportail.gouv.fr/carte?c=	IGN
4	Commune with PPI in Bas-Rhin	https://www.bas-rhin.gouv.fr/Actions-de-l-Etat/Securites-et-prevention/Protection-civile/Risques/Risques-technologiques/Les-sites-PPI-du-Bas-Rhin	12/30/2022 Inventory State services for Bas-Rhin
5	Commune with PPRT in Bas-Rhin	https://www.observatoire-des-territoires.gouv.fr/nombre-de-communes-couvertes-par-un-plan-de-prevention-des-risques-technologiques-pprt	2023 xlsx Base Gaspar
6	Sites and polluted (or potentially polluted) soils in Bas-Rhin	https://www.georisques.gouv.fr/webappReport/ws/infosols/export/shapefile?codeDepartement=67	Daily renewed CSV BRGM
7	Installations industrielles rejetant des polluants - émissions	https://www.georisques.gouv.fr/donnees/bases-de-donnees/installations-industrielles-rejetant-des-polluants	11/2023 CSV INERIS
8	Groundwater	https://data.eaufrance.fr/geosource/srv/fre/catalog.search#/metadata/f9fe2f5e-4d66-4d18-9aad-6dbe8edc0112	2019 SHP BRGM
9	Regional natural parks in Grand-Est	https://www.data.gouv.fr/fr/datasets/fr-200052264-rnr-grand-est-7/	May 2023 WFS
10	Znieff I and II zones Ramsar zones Zico zones in Metropolitan France	https://inpn-inspire.mnhn.fr/catalogue/srv/fre/catalog.search#/metadata/f30dd410-9c72-47f5-a384-96603ddc703e	SHP INPN (National Inventory of

			Natural Heritage)
11	Perimeter of departments in Metropolitan France	https://www.datagrandest.fr/data4citizen/visualisation/export/?id=fr-200052264-a0153-0000&location=7,47.93843,4.38904	June 2020 SHP Région Grand Est / Service Géomatique et Connaissance
12	French classification of activities (NAF)	https://www.insee.fr/fr/metadonnees/nafr2/sousClasse/20.59Z?champRecherche=true	01/01/2008 Reference INSEE
13	Biosphere reserves in Metropolitan France	https://inpn-inspire.mnhn.fr/catalogue/srv/fre/catalog.search#/metadata/016307b9-5d14-4f61-873f-a41691d13a7b	2022-07-30 SHP INPN
14	BD-Forests in Bas-Rhin	https://geoservices.ign.fr/bdforet#telechargementv1	2014-04-01 SHP IGN
15	PPRN Zones of Strasboug	http://catalogue.geo-ide.developpement-durable.gouv.fr/catalogue/srv/fre/catalog.search#/metadata/fr-120066022-jdd-626d4289-3c6b-4f72-a255-02d804d0db6f	2020-03-10 SHP ddt-sig@bas-rhin.gouv.fr
16	PPRN Zones of Zorn Landgraben	http://catalogue.geo-ide.developpement-durable.gouv.fr/catalogue/srv/fre/catalog.search#/metadata/fr-120066022-jdd-3615b6f1-8007-4ae4-98c4-2e35bc013f30	2018-03-08 SHP ddt-sig@bas-rhin.gouv.fr
17	Geomorphological movements in Bas-Rhin	https://www.georisques.gouv.fr/donnees/bases-de-donnees/base-de-donnees-mouvements-de-terrain	Since 1994 CSV BRGM
18	Seismic activities sensed in Bas-Rhin	https://www.sisfrance.net/seismes/result	From 782 to 2004 CSV SISFrance
19	Topography of Grand-Est	Mapzen Global Terrain	
20	Rivers in Grand-Est	OpenStreetMap	