

Advances in Air Pollution Science: Meteorological Modeling, Cost-Benefit Optimization, Litigation Support

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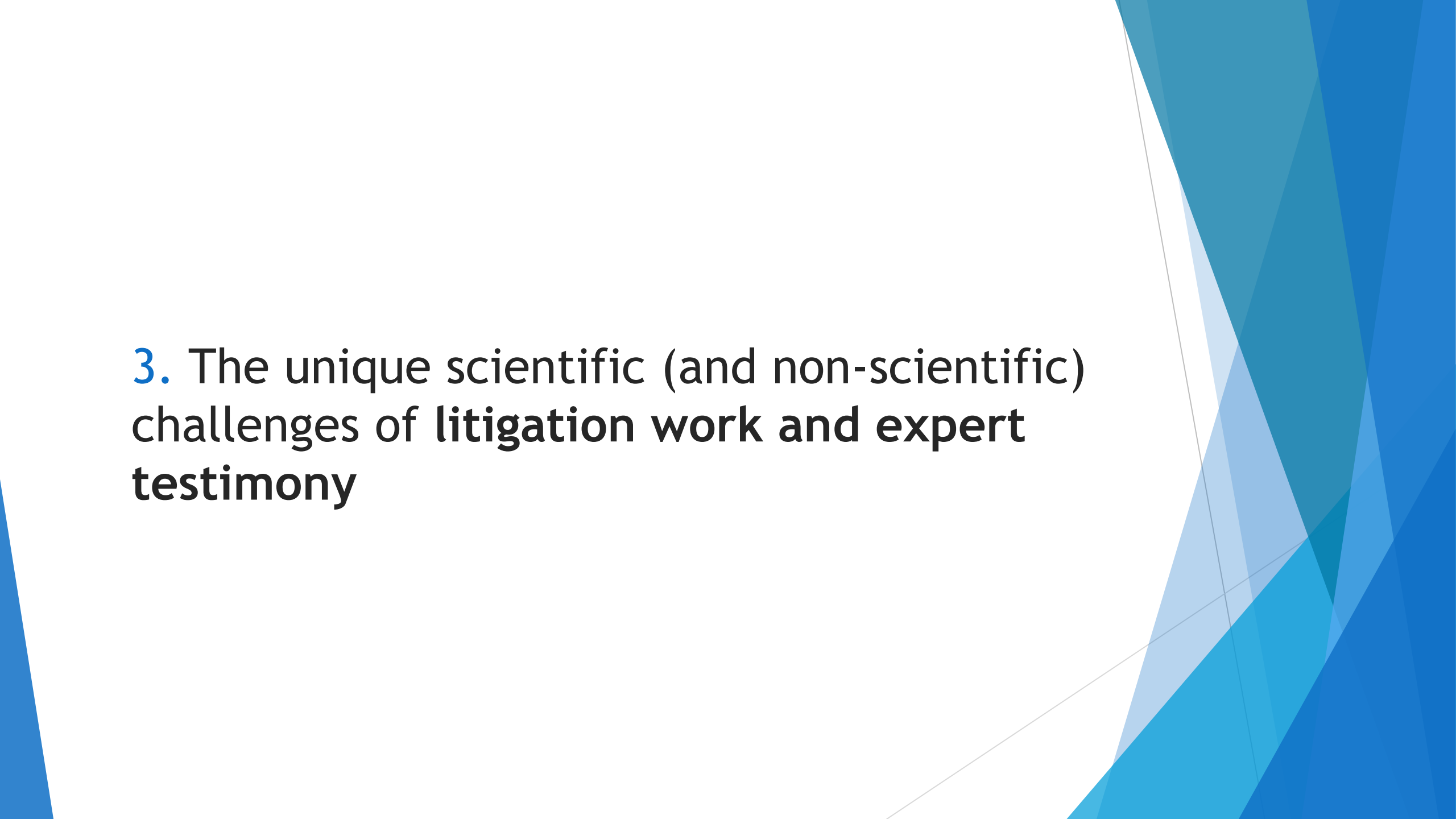
June 24, 2019

An Introduction

- ▶ Worked on Air Pollution Modeling since 1971
- ▶ First half-life: R&D; second half-life: R&D and consulting
- ▶ Italy, Los Angeles, Kuwait, Norway, San Francisco
- ▶ Books:
 - ▶ Air Pollution Modeling (1990)
<http://www.amazon.ca/Pollution-Modeling-Theories-Computational-Available/dp/0442308051>
 - ▶ Air Quality Modeling series (4 books; 2003-2010)
<http://www.envirocomp.org/aqm>
- ▶ Intensive litigation work

Three Topics Today

- ~~1. The increasing role of full 3D meteorological modeling in air pollution studies~~
- ~~2. The development and possible future use of Cost-Benefit Optimization techniques in managing industrial/urban development~~
- 3. The unique scientific (and non-scientific) challenges of litigation work and expert testimony**

The background features abstract, overlapping geometric shapes in various shades of blue, ranging from light sky blue to deep navy blue. These shapes are primarily located on the right side of the slide, creating a modern, layered effect.

3. The unique scientific (and non-scientific) challenges of **litigation work and expert testimony**

What is “Litigation” Work?

- ▶ In litigation, one party (the plaintiff) files a legal case - a dispute - against another party (the defendant)
- ▶ Both parties, typically, hire attorneys to represent them
- ▶ The legal case goes to court in front of a judge and, sometimes, a jury
- ▶ In special cases, attorneys hire experts to investigate the matters of the case and provide expert opinions
- ▶ Experts may be medical doctors, scientists/engineers, crime investigators, financial specialists, etc.
- ▶ Experts often prepare reports and sometimes testify under oath
- ▶ Litigation, and the use of experts, is very common in the United States. Why?

Litigation in the US

- ▶ Very common
 - ▶ Plaintiff attorneys can work on “contingency” fees, i.e., for a fraction of the final settlement (e.g., 30%), and require no payments from individual plaintiffs
 - ▶ Class actions in which hundreds/thousands of plaintiffs are represented in a single case
- ▶ Of course, 30% of \$0 is \$0 ...
- ▶ Final settlement amounts can be very high, especially in class actions, and therefore, there is an incentive, on both sides, to hire capable experts to help understand the technical/scientific/medical aspect of a case
- ▶ Litigation is increasing outside the US, even though the legal systems of other countries are different and US-style litigation is not always possible

Environmental Litigation

- ▶ Environmental litigation mostly deals with
 - ▶ Air/water/soil/groundwater pollution
 - ▶ Claims of toxic impacts of pollutants
 - ▶ Acute human exposure, for short times (e.g., a few hours)
 - ▶ Chronic human exposure, for long times (e.g., several years)
 - ▶ Remediation/clean up costs
 - ▶ Regulatory compliance
 - ▶ Accidental releases from fires, explosions, leaks, unplanned events
- ▶ Computer modeling plays an important role!

Computer Modeling

- ▶ Environmental cases are so complex that, often, a valid scientific opinion can be given only with the use of computer models
- ▶ For example, in air pollution cases, models are used for:
 - ▶ Estimating the amount of chemicals released into the atmosphere
 - ▶ Simulating the turbulent transport and diffusion of these chemicals in the atmosphere
 - ▶ Including special issues, such as complex terrain, ground deposition, chemical reactions, decay
 - ▶ Calculating the chemical exposure at different locations and times (e.g., plaintiffs' locations)

A Typical Air Pollution Litigation Case: Accidental Release

The Accident







Technical Tasks

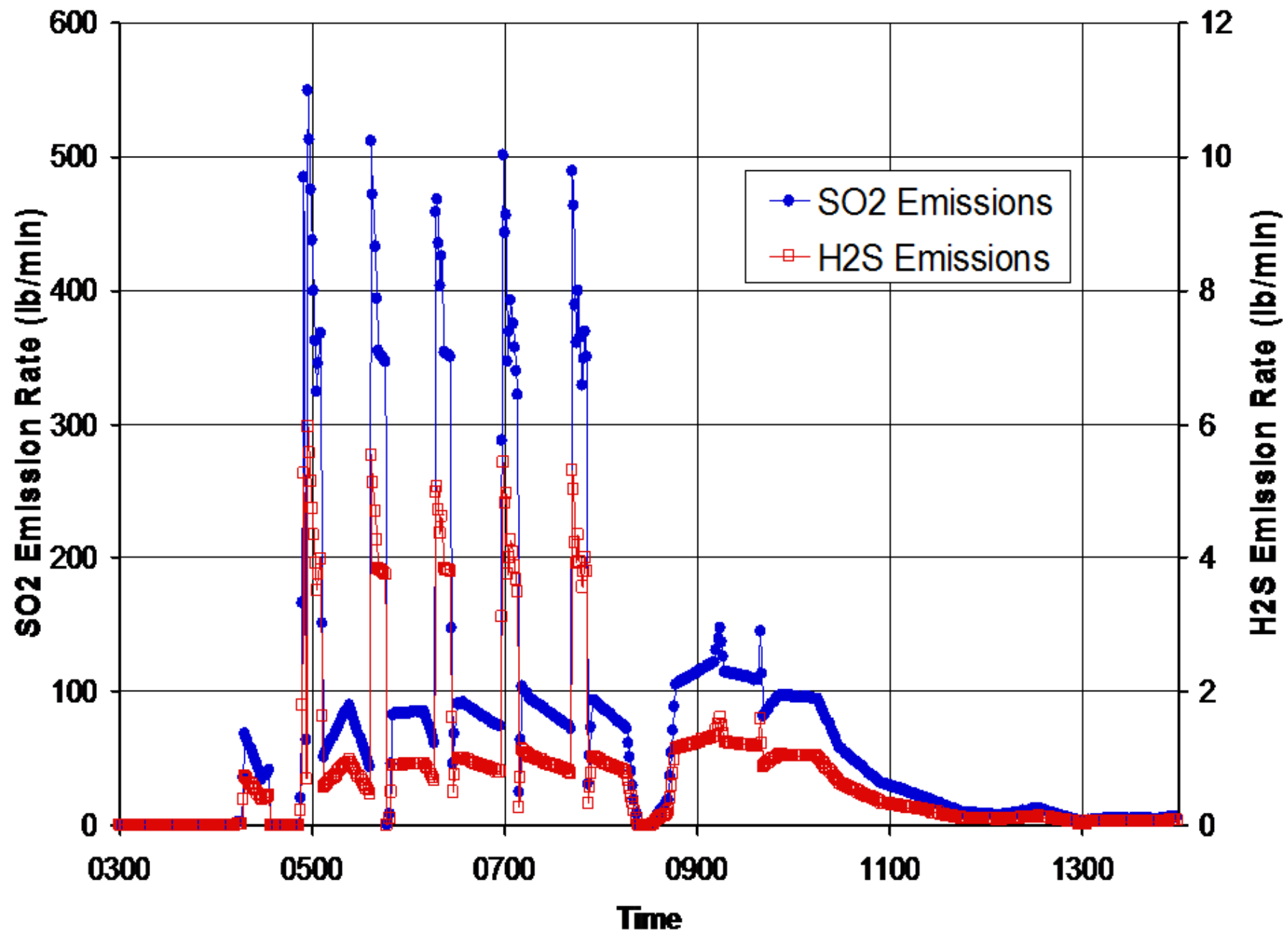
1. Accident Reconstruction
2. Emission Characterization (→)
3. Meteorological Characterization
4. Plume/Puff Modeling (→)
5. GIS Visualization
6. Adverse Effects

Example of Emission Characterization

- Average release rate and parameters
- Minute-by-minute estimates
- E.g., a flaring incident (1990s)



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Some Available Simulation Models

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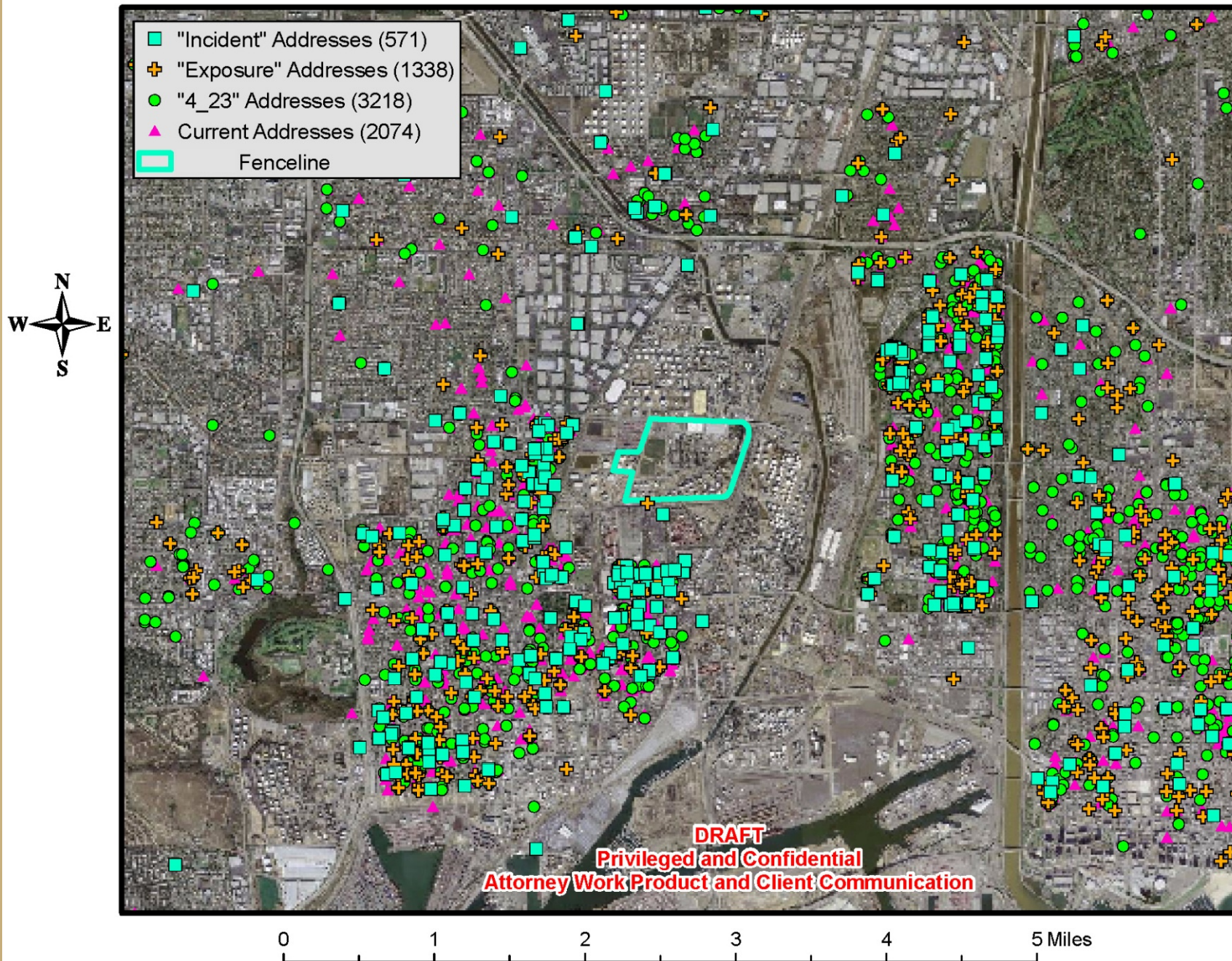
- ▶ Dispersion Models developed/recommended by government agencies <https://www.epa.gov/scram>
 - ▶ AERMOD
 - ▶ CALPUFF
 - ▶ Photochemical models, e.g., CAMx
- ▶ Models developed at National Laboratories and Universities
- ▶ Models developed by private industrial groups and consulting companies
- ▶ Models/Methodologies to calculate adverse health effects, e.g., risk assessment:
<https://www.epa.gov/fera/risk-assessment-and-modeling-epa-risk-assessment-policy-guidelines-and-related-materials>)
- ▶ Our Lagrangian particle simulation model LAPMOD:
<https://www.enviroware.com/lapmod/>

Results from: Accident Reconstruction, Modeling, and Visualization

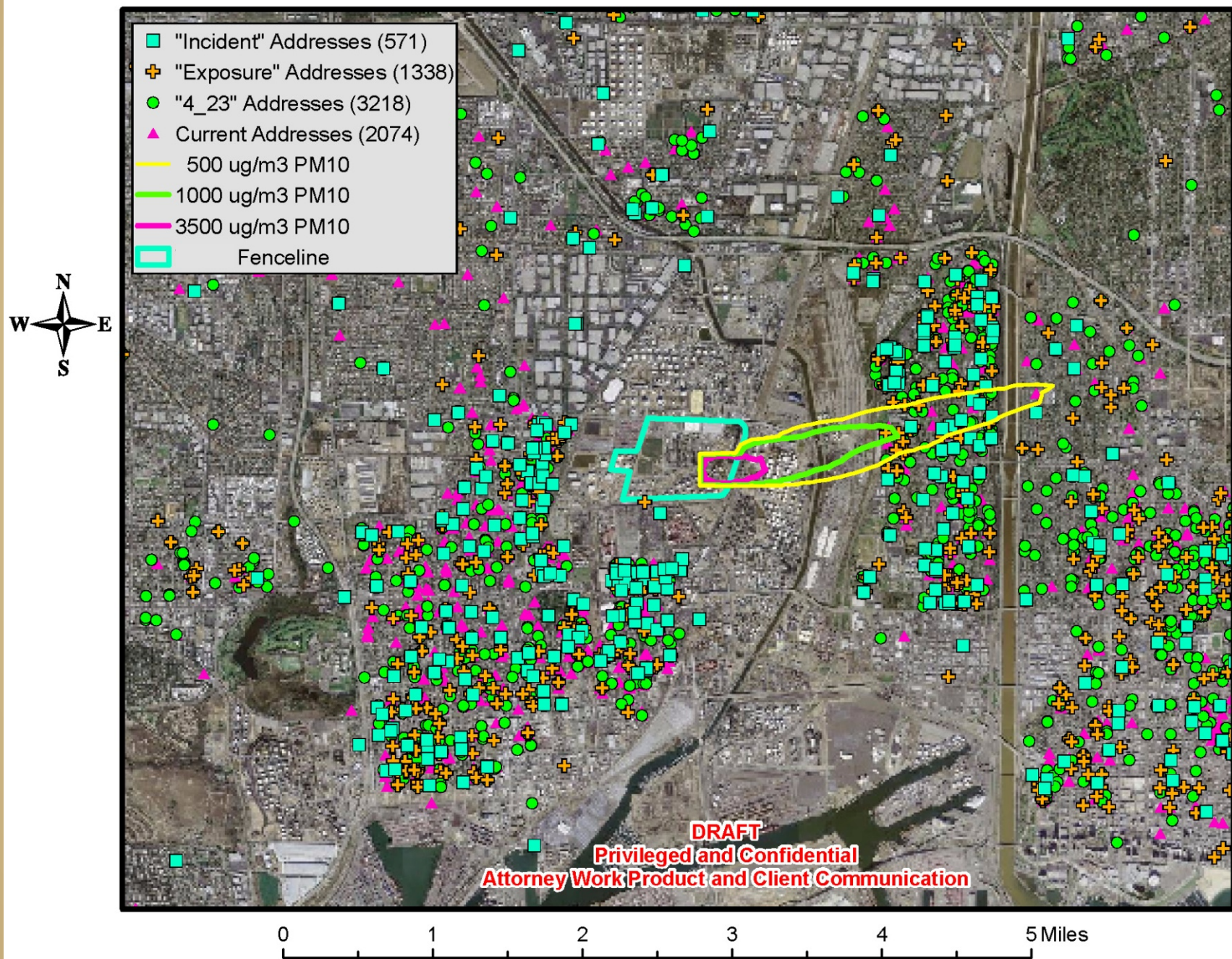
→ Animations

The Use of GIS is Crucial

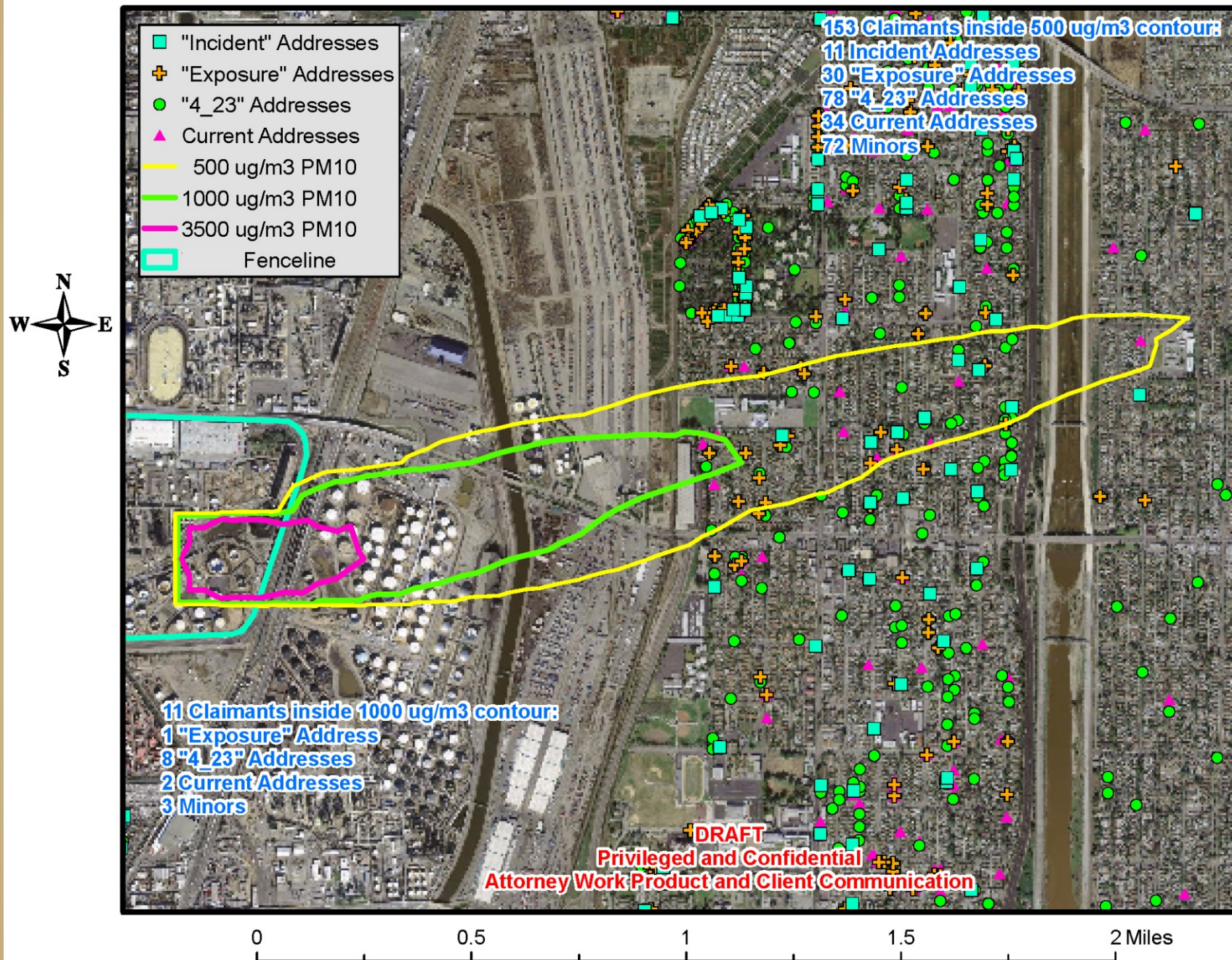
Geocoded Addresses



1-Hour Maximum Pointwise PM10 Concentrations and Geocoded Addresses



1-Hour Maximum Pointwise PM10 Concentrations and Geocoded Addresses



Conclusions

- ▶ Environmental litigation work will probably increase in Europe in the next few years
 - ▶ Opportunity for interesting scientific work and extra income
- ▶ Many scientists may be asked to work as experts
 - ▶ Litigation work is not for everybody
 - ▶ Very demanding, often with “impossible” deadlines; work under pressure
 - ▶ Interactions with attorneys may present challenges
 - ▶ Language, goals, culture are different

More reading on this topic

- ▶ My article “Environmental litigation - air pollution models and modelers in court”
<http://www.envirocomp.com/zcv/P.49.pdf>
- ▶ Material under “Selected Projects” at
<http://www.envirocomp.com/>

Thank you!

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