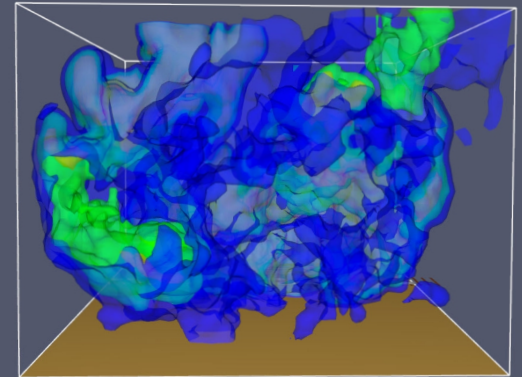
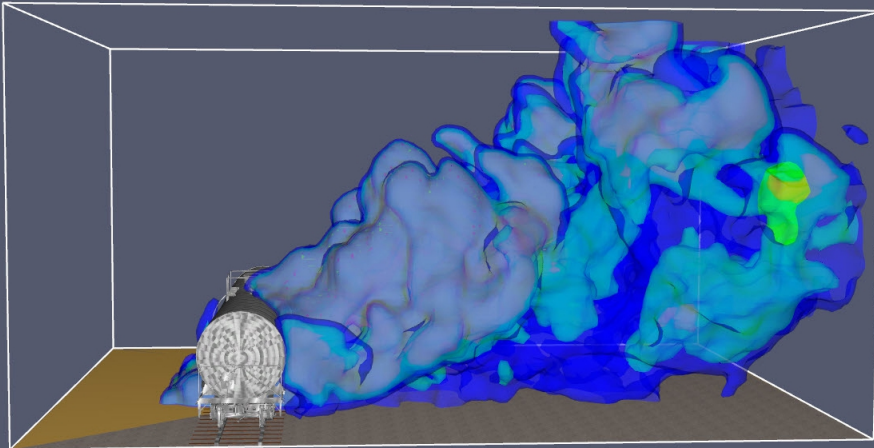
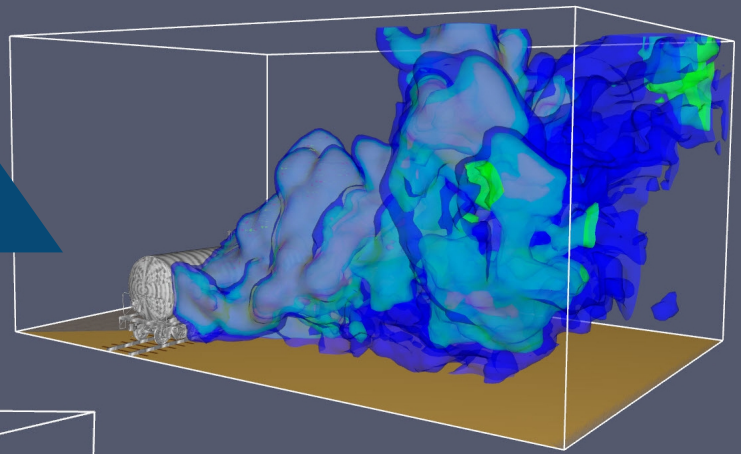
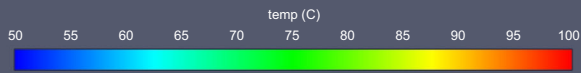




THERMAL AND FLUID MODELING



EXPERIENCE & EXPERTISE

Thermal and fluid dynamics modeling can be critically important to solving industrial problems such as incident root cause investigation, hazard identification and mitigation, and engineering design and troubleshooting. ESI's Thermal-Fluid Analysis Team has extensive experience in development, application, and interpretation of models for such problems involving flows of gases, liquids, and heat at both small and large scales.

ESI maintains a toolkit of industry-standard and custom-built models that it uses to tailor a fit-for-purpose analysis to every problem. This rightsizing of modeling efforts helps get maximum value from these services. ESI's team leverages real-world experience and multidisciplinary capabilities in the fields of Fire and Explosion Investigation, Mechanical Systems, Transportation, Materials Science, and more to ensure that results are grounded in engineering fundamentals and recommendations are actionable.

KEY CAPABILITIES

- Fire and Smoke Modeling
- Blast Damage Assessment
- Chemical and Petrochemical Processes
- Environmental
- Facility Siting
- Fire and Smoke Dynamics
- Fire Protection Systems
- Flammable, Chemical, and Toxic Chemical Dispersion Analysis
- Hazard Assessment
- Heat Transfer
- Computational Fluid Dynamics (CFD)
- Multiphase Flows
- Product Analysis
- Reactors
- Underground Gas Migration



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THERMAL AND FLUID MODELING

Project Examples

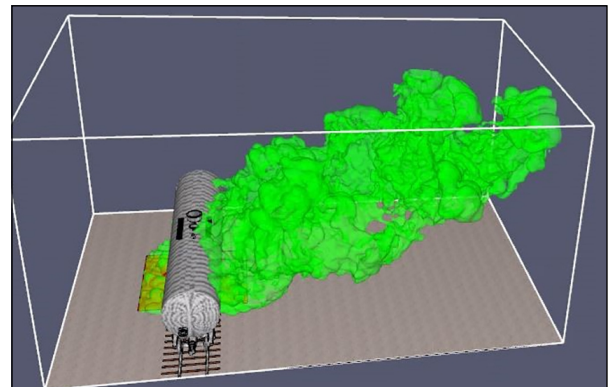
Clearing of Settled Particles in a Pipeline

A chemical plant experienced severe corrosion of a pipeline that was suspected to be due in part to the accumulation of solid particles in the line. ESi conducted a CFD study to assess the adequacy of flushing procedures to remove such particles. ESi's model predicted that the plant's original flushing procedure would likely leave residual solids in the pipe, while a remedial procedure would succeed in eliminating all solids.



Rail Car Fire Protection Assessment

A client asked ESi to study the efficacy of insulation on tanker cars from a fire protection perspective. ESi broke down this complex problem into three parts, tackling each with a separate modeling approach: CFD to describe a pool fire underneath a rail car and predict the peak temperature outside the car; a conduction model to estimate the heat flux through the insulation; and a simple thermodynamic model to estimate the impacts of temperature rise on car pressure. ESi demonstrated that the insulation provides over an hour of fire protection, most likely giving emergency responders time to arrive and apply cooling water before the car could rupture and escalate the incident.



Pharmaceutical Plant Deflagration Investigation

ESi was retained to assist in an investigation at a pharmaceutical facility that had a small vapor cloud explosion in an area not expected to contain flammable vapors. In addition to bringing expertise in investigating deflagration damage patterns and estimating the quantity of flammable vapor involved, ESi also performed hydrodynamic modeling to inform the investigation. This work included ducting and piping hydraulic modeling to quantify fuel ingress to the incident area as well as computational fluid dynamics of air-fuel mixing and dispersion. With the help of this modeling, ESi was able to identify the most likely fuel source and recommend changes to the facility equipment and operations to prevent a future reoccurrence.



ABOUT ESi

Engineering Systems Inc. (ESi) is an engineering and scientific investigation and analysis firm committed to providing clear answers to the most challenging technical problems. Our technical expertise, practical experience, technological resources, and extensive diagnostic, analytical, and physical testing capabilities empower us to provide our clients with the most comprehensive and efficient solutions across dozens of industries.



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