

Exponent®
Engineering & Scientific Consulting

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Professional Profile

Dr. Wechsung applies his 17+ years of chemical and mechanical engineering expertise to investigate industrial incidents and analyze issues arising over the life cycle of industrial processes ranging from design, engineering, and construction through operation and maintenance extending after operations ceased. He also investigates product releases, fires and explosions and their origin and cause.

Dr. Wechsung consults for process industry clients such as alternative energy including hydrogen, petrochemical, chemical and industrial processing, oil and gas, pulp and paper, power generation and utilities. His expertise includes process safety, fire and explosions, product releases, risk analysis, historical site operations, greenhouse gas (GHG) emissions inventory accounting and lifecycle assessments (LCAs), and advanced modeling.

Dr. Wechsung has investigated incidents at petroleum refineries, chemical, industrial and waste processing plants and storage facilities and fires and explosions at residential and industrial sites. He has analyzed the flows of contaminants of concerns such as per- and polyfluoroalkyl substances (PFAS) and other hazardous substances through industrial sites from receipt through processing to waste treatment and discharge and testified at deposition. Dr. Wechsung has supported clients in international arbitrations concerning the design, engineering, construction, and commissioning of chemical plants and power generation systems and authored multiple international arbitration reports.

Dr. Wechsung is experienced in modeling, simulating, and optimizing industrial processes and process networks. He leverages his understanding of multi-component thermodynamics, fluid dynamics and reactive systems to analyze process scale-up, upsets, loss of containment, runaway reactions, and product releases from process systems and product storage. He is skillful in using commercial chemical process simulators such as Aspen Plus© and interpreting process historian data.

Dr. Wechsung also advises clients on greenhouse gas (GHG) emissions inventory accounting as it relates to corporate climate change disclosures and voluntary carbon offset markets. He has conducted lifecycle assessment (LCA) to quantify greenhouse gas emissions and understand the benefits of re-used and recycled products.

Dr. Wechsung has evaluated infringement and validity of patents and trade secrets for petroleum technologies. He has performed dust hazard analyses (DHA) for manufacturers handling combustible organic and metal dusts, hazard identification (HAZID) workshops and process hazard analyses (PHA) such as HAZOPs.

Prior to joining Exponent, Dr. Wechsung worked in multiple roles for BASF, one of the world's largest chemical companies. There, he held key roles in multiple industrial process development projects, including methane pyrolysis for sustainable hydrogen production with a reduced carbon footprint. He has successfully supported pilot plant operations for process scale-up and has worked closely with major

multinational engineering companies to bring new technologies to the market. He led research project teams and conducted thorough risk assessments. He advanced digital capabilities of BASF's research and development organization including steady-state and dynamic process modeling and simulation tools. Additionally, he has advised senior management on the impact and mitigation of incidents affecting chemical production at the world's largest integrated chemical complex in Ludwigshafen, Germany, a site with more than one hundred plants. He understands the value contained in industrial data sets and is experienced in analyzing these with state-of-the-art methods to draw actionable conclusions.

Previously, he conducted his Ph.D. research at Massachusetts Institute of Technology (MIT) in the Department of Chemical Engineering. His research focused on developing cutting-edge numerical methods for optimization of nonlinear models and their application in case studies taken from liquefied natural gas (LNG) processing and coal combustion.

Academic Credentials & Professional Honors

Ph.D., Chemical Engineering, Massachusetts Institute of Technology (MIT), 2014

Dipl.-Ing., Mechanical Engineering, RWTH Aachen University, Germany, 2008

Licenses and Certifications

Professional Engineer Chemical, California, #7005

Professional Engineer, Connecticut, #PEN.0039569

Professional Engineer Chemical, Kentucky, #41319

Professional Engineer Chemical, Massachusetts, #60537

Professional Engineer Chemical, New Jersey, #24GE06249300

40-Hour Hazardous Waste Operation and Emergency Response Certification (HAZWOPER)

Certified Fire and Explosion Investigator (CFEI)

Prior Experience

BASF SE, 2013-2019

Professional Affiliations

American Institute of Chemical Engineers (Senior Member, AIChE)

National Association of Fire Investigators (NAFI)

National Fire Protection Association (NFPA)

- Principal Member of the Committee on Hydrogen Technology responsible for NFPA 2 Hydrogen Technologies Code

- Alternate Member of the Committee on Classification and Properties of Hazardous Chemical Data responsible for NFPA 704 Standard System for the Identification of the Hazards of Materials for Emergency Response

International Council on Large Electric Systems (CIGRE)

- Member of Joint Working Group C5/C1.35 Integration of hydrogen in electricity markets and sector regulation

CSA Group

- Member of the Fuel Cell Technical Committee

- Member of the Hydrogen Generators – Fuel Processing Technical Subcommittee

- Member of the Stationary Fuel Cell Power Systems Technical Subcommittee

Verein deutscher Ingenieure (VDI)

Languages

German

Patents

Appel H, Bernnat J, Glenk F, Kolios G, Olbert G, Scheiff F, Zoels B, Kern M, Flick D, Anderlohr CA, Klingler D, Wechsung A. Solids-packed apparatus for performance of endothermic reactions with direct electrical heating. US11,882,629.

Kolios G, Zoels B, Kern M, Bernnat J, Koenig R, Glenk F, Wechsung A. Method and device for carrying out endothermic gas phase-solid or gas-solid reactions. US11,691,115.

Zander HJ, Weikl M, Bode A, Klingler D, Kern K, Kolios G, Wechsung A, Scheiff F, Flick D, Antweiler N, Büker K. Reactor for high temperature endothermic reactions. EP 3,947,261.

Appel H, Bernnat J, Glenk F, Kolios G, Olbert G, Scheiff F, Zoels B, Kern M, Flick D, Anderlohr CA, Klingler D, Wechsung A. Device packed with solid matter for conducting endothermic reactions with direct electric heating. EP 3,744,154.

Publications

Hashad K, Wechsung A, Dimitrakopoulos G, Myers TJ. Promise and potential limitations of power-to-heat technologies. Proceedings, TAPPICon 2025, Minneapolis, MN, 2025.

Filie A, Wechsung A, James J, Morrison AM. Counting your C's: opportunities and risks associated with carbon credits. Proceedings, AIChE Spring Meeting & 21th Global Congress on Process Safety, Dallas, TX, 2025.

Ibarreta AF, Wechsung A, Hart RJ, Morrison DR, Reding N. Blended natural gas/hydrogen fuel gas systems: an evaluation of risk. Process Safety Progress 2025; 44(2):232–238.

Wechsung A, Orella MJ, Kersey KD, Myers, TJ. The energy transition — how will it impact fire investigation. Proceedings, ISFI, Orlando, FL, 2024.

Wechsung A, Barry MT, Dimitrakopoulos G, Spray RL, Colella F, Myers, TJ. Lithium-ion battery fire investigation fundamentals. Proceedings, ISFI, Orlando, FL, 2024.

Kytömaa H, Wechsung A, Dimitrakopoulos G, Cook N, Jaimes D, Hur I, Faraji S. Industry R&D needs in hydrogen safety. Applications in Energy and Combustion Science 2024; 18:100271.

Reding N, Morrison DR, Hart RJ, Wechsung A, Ibarreta AF. Blended natural gas / hydrogen fuel gas systems: an evaluation of risk. Proceedings, 2023 Spring Meeting & 19th Global Congress on Process Safety, Houston, TX, 2023.

Wechsung A, Yen M, Ibarreta AF, Myers TJ, Kytomaa HK. Venting of hydrogen explosions. Proceedings, AIChE Spring Meeting & 19th Global Congress on Process Safety, Houston, TX, 2023.

Wechsung A, Wikramanayake E, Banning M, Stern M, Buehler C, Long R, Kytomaa H. Hydrogen fire safety: an old acquaintance in new roles. Fire Protection Engineering 2022; 94:16–20.

Wechsung A, Buehler CS, James JN, Morrison AM, Stern MC. Carbonomics: introduction to carbon pricing, regulations, and frameworks. Chemical Engineering Progress, 2022, September:23-29.

Stern MC, Orella MJ, Wechsung A, Buehler CS. Carbon capture vs lithium ion batteries – which pairs better with renewable electricity? Proceedings, AIChE Spring Meeting & 18th Global Congress on Process Safety, San Antonio, TX, 2022.

Stern MC, James JN, Morrison AM, Wechsung A, Buehler CS. Carbonomics: introduction to carbon pricing, regulations, and frameworks. Proceedings, AIChE Spring Meeting & 18th Global Congress on Process Safety, San Antonio, TX, 2022.

Stern MC, James J, Morrison AM, Wechsung A, Buehler CS. Life cycle assessments: corporate value or potential risk lies in the details. Proceedings, AIChE Spring Meeting & 18th Global Congress on Process Safety, San Antonio, TX, 2022.

Wechsung A, Buehler CS. What did I actually buy—guarantees of origin for hydrogen. Proceedings, AIChE Spring Meeting & 18th Global Congress on Process Safety, San Antonio, TX, 2022.

Wechsung A, Watson HAJ, Scott JK, Barton PI. Reverse propagation of McCormick relaxations. Journal of Global Optimization 2015; 63:1–36.

Stuber MD, Wechsung A, Sundaramoorthy A, Barton PI. Worst-case design of subsea production facilities using semi-infinite programming. AIChE Journal 2014; 60:2413–2524.

Wechsung A, Barton PI. Global optimization of bounded factorable functions with discontinuities. Journal of Global Optimization 2014; 58:1–30.

Wechsung A, Schaber SD, Barton PI. The cluster problem revisited. Journal of Global Optimization 2013; 58:429–438.

Wechsung A, Aspelund A, Gundersen T, Barton PI. Synthesis of heat exchanger networks at subambient conditions with compression and expansion of process streams. AIChE Journal 2011; 57:2090–2108.

Wechsung A, Oldenburg J, Yu J, Polt A. Supporting chemical process design under uncertainty. Brazilian Journal of Chemical Engineering 2010; 27:451–460.

Presentations

Wechsung A, Dimitrakopoulos G, Modak SV and Kytömaa HK. Customized testing of electrolyzers: lessons learned. Oral presentation, 2025 Center for Hydrogen Safety Americas Conference, Houston, TX, 2025.

Hashad K, Wechsung A, Dimitrakopoulos G, Myers TJ. Promise and Potential Limitations of Power-to-heat Technologies. Poster presentation, TAPPICon 2025, Minneapolis, MN, 2025

Filie A, Wechsung A, James J, Morrison AM. Counting your C's: opportunities and risks associated with carbon credits. Oral presentation, AIChE Spring Meeting & 21th Global Congress on Process Safety, Dallas, TX, 2025.

Wechsung A, Orella MJ, Kersey KD, Myers, TJ. The energy transition — how will it impact fire investigation. Oral presentation, ISFI, Orlando, FL, 2024.

Wechsung A, Barry MT, Dimitrakopoulos G, Spray RL, Colella F, Myers, TJ. Lithium-ion battery fire investigation fundamentals. Oral presentation, ISFI, Orlando, FL, 2024.

Dimitrakopoulos G, Kytömaa H, Wechsung A. Reducing Risk: Safety and Efficiency Considerations for Electrolyzer Integration. World Electrolysis North America, Boston, MA, 2024.

Kytömaa H, Wechsung A, Dimitrakopoulos G, Cook N, Jaimes D, Hur I, Faraji S. Industry R&D needs in hydrogen safety. Industry R&D Needs in Hydrogen Safety. Industry Invited Perspective. Combustion Institute's 40th International Symposium, Milan, Italy, 2024.

Wechsung A, Sulmonetti T, Myers TJ, Kytomaa HK. Safely Implementing an Explosive Hydrogen Market: Applying Lessons Learned to Expanding Hydrogen Usage. 2024 Spring Meeting & 20th Global Congress on Process Safety, New Orleans, LA, 2024.

Wechsung A, Dimitrakopoulos G, Hashad K, Myers TJ. Are Power-to-Heat Technologies Ready to Transition Your Facility? 2024 Spring Meeting & 20th Global Congress on Process Safety, New Orleans, LA, 2024.

Wechsung A, Hart RJ, Morrison, DR, All Aboard: Hydrogen on Rail. Oral presentation, 2024 Center for Hydrogen Safety Americas Conference, Las Vegas, NV, 2024.

Wechsung A, Hietala D. Obviously New or Just a Copy – Engineers Play a Critical Role in Evaluating Patent or Trade Secret Infringement Claims. Oral presentation, AIChE Annual Meeting, Orlando, FL, 2023.

Wechsung A, Reding N, Ibarreta AF, Myers TJ. Navigating Unfamiliar Territory: US Hydrogen Safety Regulations and European Standards. Oral presentation, 2023 Center for Hydrogen Safety Europe Conference, Rotterdam, Netherlands, 2023.

Reding N, Morrison DR, Hart RJ, Wechsung A, Ibarreta AF. Blended Natural Gas / Hydrogen Fuel Gas Systems: An Evaluation of Risk. Oral presentation, 2023 Spring Meeting & 19th Global Congress on Process Safety, Houston, TX, 2023.

Wechsung A, Yen M, Ibarreta AF, Myers TJ, Kytomaa HK. Venting of Hydrogen Explosions. Poster presentation, AIChE Spring Meeting & 19th Global Congress on Process Safety, Houston, TX, 2023.

Stern MC, Orella MJ, Wechsung A, Buehler CS. Carbon capture vs lithium ion batteries – which pairs better with renewable electricity? Oral presentation, AIChE Spring Meeting & 18th Global Congress on Process Safety, San Antonio, TX, 2022.

Stern MC, James J, Morrison AM, Wechsung A, Buehler CS. Carbonomics: introduction to carbon pricing, regulations, and frameworks. Oral presentation, AIChE Spring Meeting & 18th Global Congress on Process Safety, San Antonio, TX, 2022.

Stern MC, James J, Morrison AM, Wechsung A, Buehler CS. Life cycle assessments: corporate value or potential risk lies in the details. Oral presentation, AIChE Spring Meeting & 18th Global Congress on Process Safety, San Antonio, TX, 2022.

Wechsung A, Buehler CS. What did i actually buy—guarantees of origin for hydrogen. Oral presentation,

AIChE Spring Meeting & 18th Global Congress on Process Safety, San Antonio, TX, 2022.

White CC, Streifel BC, Wechsung A, Myers TJ. Understanding the pathways for residual PFAS during fluoropolymer processing. Oral presentation, ACS Spring Meeting, San Diego, CA, 2022.

Wechsung A, Orella MJ, Stern MC, Kytomaa HK, Green hydrogen – removing hurdles and creating the right incentives to make it viable. Oral presentation, AIChE Annual Meeting, 2021.

Orella MJ, Wechsung A, Stern MC, Kytomaa HK, An electrofuel revolution: how direct carbon reduction can electrify the future. Oral presentation, AIChE Annual Meeting, 2021.

Sulmonetti TP, Buehler CS, Wechsung A, Dee SJ. Transitioning from one explosive fuel to the next - safety considerations in the emerging hydrogen economy. Poster presentation, AIChE Spring Meeting & 17th Global Congress on Process Safety, 2021.

Watson HAJ, Wechsung A. Use of nonsmooth models and generalized derivatives to improve the robustness of process simulations. Oral presentation, AIChE Spring Meeting & 16th Global Congress on Process Safety, 2020.

Bode A, Castro-Arce J, Heid B, Henschel C, Wechsung A, Wojcicka J. Process Technology Licensing: An Interface of Engineering and Business. Oral presentation, 12th International Symposium on Process Systems Engineering and 25th European Symposium on Computer Aided Process Engineering, Copenhagen, Denmark, 2015.

Wechsung A, Kellenbenz J, Klingler D, Bode A. R&D at BASF: Developing a more sustainable route to hydrogen and syngas. Invited oral presentation, AVT Kolloqium, Aachen, Germany, 2014.

Wechsung A, Barton PI. On-line modeling of NOx formation in a coal boiler. Poster presentation, European Symposium on Computer Aided Process Engineering, Lappeenranta, Finland, 2013.

Wechsung A, Barton PI. Improving relaxations of implicit functions. Oral presentation. International Symposium on Mathematical Programming, Berlin, Germany, 2012.

Wechsung A, Barton PI. Convex, continuous relaxations of discontinuous factorable functions. Oral presentation, INFORMS Annual Meeting, Charlotte, NC, 2011.

Wechsung A, Barton PI. Design of a self-supporting natural gas liquefaction process for accessing stranded off-shore resources. Oral presentation. AIChE Annual Meeting, Minneapolis, MN, 2011.

Wechsung A, Barton PI. Relaxations of bounded factorable functions with discontinuities. Oral presentation. 2nd World Congress on Global Optimization, Chania, Greece, 2011.

Wechsung A, Barton PI. Global optimization of discontinuous functions. Oral presentation. AIChE Annual Meeting, Salt Lake City, UT, 2010.

Wechsung A, Oldenburg J, Yu J, Polt A. Supporting chemical process design under uncertainty. Poster presentation. 10th International Symposium on Process Systems Engineering, Salvador, Brazil, 2009.

Project Experience

A representative sampling of example project experience across Dr. Wechsung's practice areas is listed below.

Process Safety Incident Investigations

Dr. Wechsung leverages his chemical and mechanical engineering expertise and industrial experience to lead and contribute to process safety incident investigations. He conducts site inspections, evidence collection, interviews, lab exams, and engineering evaluations to determine the sequence of events, contributing factors, and root causes. Frequently, these incidents occurred at facilities that use, process, handle, or store highly hazardous chemicals and are thus subject to OSHA's Process Safety Management (PSM) regulation. Often these incidents lead to investigations by federal, state, and local authorities including (federal or state) OSHA, the Chemical Safety Board (CSB), and the EPA.

Dr. Wechsung has investigated the following:

- Liquid naphtha release and subsequent fire at a petroleum refinery.
- Fuel gas ignition and explosion inside process heater at a natural gas liquids processing site.
- Fire inside process unit at a pulp and paper mill during maintenance activities involving flammable resins.
- Steam explosion in a recovery boiler at a pulp and paper mill.
- Hydrogen explosion of a metal processing reactor during troubleshooting activities.
- Ammonia release from a refrigeration system at a food processing plant.
- Hazardous waste storage tank explosion at a hazardous waste processing facility.
- Hot gas expander failure at a fertilizer plant that resulted in a fire due to the ignition of lubricating oil.
- Propylene explosion at a manufacturing site.
- Release of butadiene from a damaged process pipe as a result of popcorn polymer formation leading to fire and explosion.
- Explosion of an ethylene oxide storage tank at a petrochemical plant.
- Styrene release from a storage tank at a polymer production plant due to self-heating as a result of auto-polymerization.
- Release of hot polymer during equipment maintenance activities.

Construction / Engineering Disputes

Dr. Wechsung applies his expertise and experience as a chemical and mechanical engineer to construction and design disputes between owners, EPC (engineering/procurement/construction) contractors, subcontractors and equipment suppliers. Typical assessments consider the standard of care of parties, scope changes and change orders, design defects, performance shortfalls, and operation or maintenance issues.

Examples of domestic and international disputes where Dr. Wechsung analyzed claims include the following:

- Brownfield chlor-alkali electrolysis plant: Dispute between owner and EPC firm associated with the maturity of the provided basic engineering package, detailed engineering work and construction delays.
- Polysilicon plant: Dispute between owner and piping contractor associated with quantity changes and construction delays.
- Polyethylene plant: Dispute between owner and EPC firms related to design defects of a reactor vent system.

- Paper mill conversion: Dispute between owner and EPC firm related to failure to meet performance guarantees and make-right costs.
- Children's hospital: Dispute between owner and EPC firm associated with lead contamination in the potable water distribution system.
- Coal-fired power plant: Dispute between owner and EPC firm associated with damage to equipment because of plant design and operation.
- LNG (liquefied natural gas) pre-treatment system: Dispute between EPC firm and fabricator associated with prefabricated modules; assessed the standard of care for fabrication and preservation.
- Nuclear power plant: Dispute between EPC firm and equipment supplier associated with delays related to design changes at the conventional island during detailed engineering.
- Natural gas processing facility: Dispute between owner and EPC firm associated with equipment damage due to mercury contamination.
- Non-woven production plant: Dispute between owner and engineering firm associated with design defects, construction delays and performance problems.
- Municipal wastewater treatment plant: Dispute between equipment suppliers associated with performance problems of a biosolids dryer.

Fire and Explosion Investigations

Dr. Wechsung is a Certified Fire and Explosion Investigator (CFEI) and applies his engineering expertise to investigate fires and explosions in residential and commercial buildings, and other settings. His investigations span from batteries in consumer products, to vehicles to industrial equipment. His work includes field inspections and lab exams.

Dr. Wechsung has investigated the following:

- Fire at a residential home involving lithium-ion batteries in laptop.
- Fire at a research facility, and resulting damage, from incident involving an uninterrupted power supply with lead-acid batteries.
- Fires in commercial buildings resulting from the release of flammable refrigerants.
- Combustible dust explosion in biosolids dryer at municipal wastewater treatment facility.
- Flash fire due to reported fuel geysering from a gasoline fuel tank.
- Fire at a hydraulic fracturing site involving diesel-powered fracking pumps.
- Fire at a nuclear waste processing facility resulting from the release of flammable solvents at the waste drum compacting process.

Alternative Energy and Sustainability

Dr. Wechsung actively engages with clients on topics around alternative energy and sustainability. He is a principal member of NFPA 2 Hydrogen Technologies Code and contributes to several CSA technical committees related to hydrogen generators and fuel cells. He holds multiple patents related to methane pyrolysis, a process technology for hydrogen production.

Dr. Wechsung has worked with clients on the following topics:

- Analyzed requirements for hydrogen systems such as fuel cells in hydrogen-powered industrial trucks.
- Investigated hydrogen release and ignition from a hydrogen tube trailer during refilling.
- Prepared a white-paper on behalf of an industry association on advantages and disadvantages of power-to-steam technologies and process electrification for industrial processes operating at very high temperatures.
- Conducted life cycle assessments to estimate metrics such greenhouse gas emissions across the supply chain and during manufacturing, testing, and use.
- Consulted on potential risk associated with voluntary carbon offset schemes such as avoided nitrous oxide (N2O) or sulfur hexafluoride (SF6) emissions from industrial processes.

Industrial Processes and Equipment

Clients approach Dr. Wechsung for guidance on industrial processes and equipment when developing and scaling-up new technologies as well as when facing equipment failures, considering risk mitigating strategies including product recalls or having concerns about industrial safety. His engagement is driven by clients' desire to leverage his subject matter expertise and experience as a mechanical and chemical engineer. He has worked across multiple industries from commodities and energy to industrial goods to foods to pharmaceuticals. In many cases he can leverage his experience working as an engineer for BASF, the world's largest chemical company.

Dr. Wechsung has engaged with clients on the following topics:

- Advised client on scale-up of chemical manufacturing process related to an FDA regulated compound and reviewed technology transfer documentation.
- Advised client on scale-up of process equipment for lipid nanoparticle formation.
- Evaluated food residence time distribution in process equipment and piping systems at a food processing facility.
- Evaluated design and operating behavior of wastewater sludge (biosolids) dryer at municipal wastewater treatment plant.
- Evaluated industrial gas turbine driving rotating equipment at gas processing plant for concerns about vibrations.
- Evaluated failure of check valve in vacuum service for a distillation column leading to subsequent damage to column due to acid attack.
- Investigated steam boiler failure resulting from insufficient water levels in a steam drum due to incorrect level sensor readings.
- Evaluated hazards related to handling, usage, and storage of combustible solids including metal powders at a manufacturing site.
- Performed dust hazard analysis (DHA) for clients across multiple industries.
- Consulted for client concerned about risks associated with flammable liquids and provided guidance on applicable standards such as NFPA 30.
- Consulted for the manufacturer of commercial refrigerators to evaluate if a recall is warranted after a component supplier advised of a quality problem
- Evaluated risks associated with insufficiently odorized propane leveraging field testing results and quantitative risk assessments.

- Evaluated potential hazards associated with a marine fuel storage facility.
- Participated as a subject matter expert in hazard identification workshop on a hydrogen fuel storage solution onboard a railroad tender.

Historical Plant or Process Operation

Dr. Wechsung applies his expertise as a chemical and mechanical engineer to understand historical process operations. His work considers the state-of-the-art at the relevant point in time and is informed by historical records, contemporaneous documentation and literature. In many cases these investigations are driven by concerns about release of contaminants of concern.

Examples of Dr. Wechsung's engagements include the following:

- Analyzed site operations including waste handling and disposal practices at a defunct paper mill decades after the site shut down.
- Analyzed historical operations at a chemical manufacturing site considering received feedstocks, operated processes, wastewater treatment and discharge of contaminants of concern including certain per- and polyfluoroalkyl substances (PFAS).
- Developed a model to evaluate demise of PFAS during polymer processing as a function of residence time and temperatures.