

## ► DIRECT FROM ATSDR

Stacey Konkle,  
MPH, PhDD. Kevin Horton,  
MSPH, DrPHMaureen Orr,  
MS

## Assessment of Chemical Exposures (ACE) Program: Toolkit Advances and Recent Investigations

**Editor's Note:** As part of our continued effort to highlight innovative approaches to improve the health and environment of communities, the *Journal* is pleased to publish regular columns from the Agency for Toxic Substances and Disease Registry (ATSDR) at the Centers for Disease Control and Prevention (CDC). ATSDR serves the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. The purpose of this column is to inform readers of ATSDR's activities and initiatives to better understand the relationship between exposure to hazardous substances in the environment, its impact on human health, and how to protect public health.

The findings and conclusions of this column are those of the author(s) and do not necessarily reflect the views of CDC or ATSDR.

Dr. Stacey Konkle is an epidemiologist for the Registries and Surveillance Section within the Office of Innovation and Analytics at ATSDR. Dr. D. Kevin Horton is chief of the Registries and Surveillance Section. Maureen Orr is an epidemiologist and the Surveillance Team lead for the Registries and Surveillance Section.

### Introduction

In 2010, the Agency for Toxic Substances and Disease Registry (ATSDR) developed the Assessment of Chemical Exposures (ACE) Toolkit to assist state and local health departments with performing epidemiologic assessments after acute chemical releases (Duncan, 2014). The ACE Toolkit has been enhanced and adapted over the years for use in various types of acute environmental incidents, including the ability to conduct rapid epidemiological assessments after radiological and nuclear incidents, explosions, natural disasters, and other environmental incidents (Duncan & Orr, 2016).

The ACE Toolkit contains easily modifiable surveys, corresponding consent forms,

training modules, and interoperable software tools that public health authorities can use to conduct rapid epidemiological assessments of exposed individuals (Agency for Toxic Substances and Disease Registry [ATSDR], 2022).

### Toolkit Advances

The ACE team at ATSDR strives to incorporate innovative techniques and implement key takeaways from each investigation into its toolkits. The addition of the Epi CASE (Epidemiologic Contact Assessment Symptom Exposure) Toolkit allows for rapid person-level data collection (e.g., demographics, exposure data, clinical information) during an ongoing disaster investigation (ATSDR, 2020). The Epi CASE Toolkit contains ready-

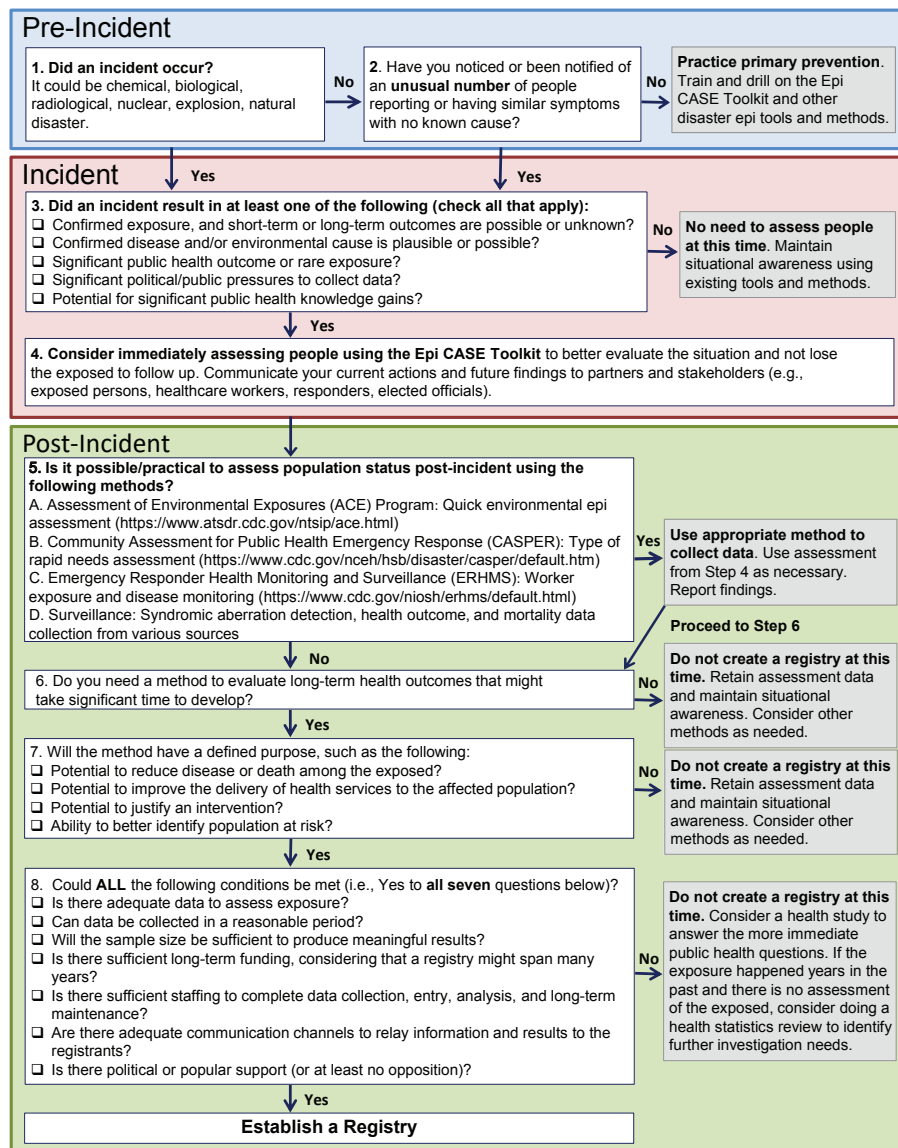
made surveys targeted for populations of interest (e.g., adults, children, first responders), household-level surveys, medical chart abstractions, and preapproved consent forms. The toolkit also includes a decision support tool (Figure 1) designed to help health authorities determine whether a postdisaster registry is a valid public health action.

In addition to the traditional door-to-door and phone interviews conducted during disaster responses, recent modifications to the ACE and Epi CASE Toolkits allow for the rapid distribution of online surveys. The ability to reach large numbers of people quickly with limited staffing requirements, via online survey distribution and data collection, has increased the utility and reach of ACE investigations.

Qualitative questionnaires have been added to ACE investigations and will be incorporated into future toolkit enhancements. Qualitative questionnaires help gather feedback on community concerns and broader effects on community resources that might not have initially been identified. A more comprehensive understanding of community perceptions regarding the success of the response and any lingering concerns or needs can help authorities tailor future recommendations and appropriately allocate resources.

The ACE team has worked with the National Institute for Occupational Safety and Health and Federal Emergency Management Agency to develop the Disaster Related Exposures Assessment and Monitoring (DREAM) course, which is offered through the Center for Domestic Preparedness and provides free, hands-on training for public health responders on how to implement ACE and Epi CASE (Center for Domestic Preparedness, 2023).

FIGURE 1

**Epi CASE Decision Support Tool**

Note. Epi CASE = Epidemiologic Contact Assessment Symptom Exposure.

**Recent Investigations**

The ACE program has completed 16 investigations in 10 states since 2010 (Figure 2). From 2010 to 2014, the program developed the original ACE Toolkit and completed five investigations (Duncan & Orr, 2016). Since 2015, 11 ACE investigations have been completed and acute chemical exposure-related data have been collected on more than 8,200 participants (Table 1). Each ACE investiga-

tion is unique—the exposure, the response, the community, and the needs. Most investigations begin with the ACE general survey. Investigators can easily modify the ACE and Epi CASE Toolkit features to produce final survey tool(s) specific to the exposure event. The ready-made tools make it easy to modify survey questions, distribute surveys, and manage databases in the field in real time. This feature allows investigators to rapidly

address the exposed population size, type of exposure, severity of health outcomes, and special populations of interest.

Investigators have modified medical chart abstraction forms, key informant interviews, responder-specific questionnaires, survey sections focused on mental health, and qualitative questionnaires. ACE investigations frequently use mapping and analysis capacities from the Geospatial Research, Analysis, and Services Program (GRASP) within ATSDR for planning, evaluation, and presentation of the findings (ATSDR, 2023).

In 2021, the ACE team conducted the first community-level, post-acute-disaster follow-up investigation at the request of the Winnebago County Health Department and Illinois Department of Public Health (Sekkarie et al., 2023). Since the initial request, the ACE team has conducted two additional follow-up investigations at the community level. These follow-up investigations included the collection of qualitative data from residents and key informants, which resulted in data about lingering concerns and broad effects on community resources that were not available elsewhere. ACE follow-up investigations after an acute disaster have given public health authorities a distinct opportunity to gauge recommendation implementation and identify any continuing needs in the community.

**Discussion**

ATSDR created the ACE Toolkit in 2010 to help public health authorities conduct epidemiologic public health responses after chemical incidents. Since the development of the original toolkit, the ACE team has diligently incorporated innovative techniques and implemented key takeaways from investigations into the ACE tools. These modifications have enhanced user experience and enabled rapid initiation of acute chemical exposure investigations. The ACE Toolkit facilitates both rapid needs assessments and long-term health monitoring that capture the experiences of participating respondents and help guide public health action in a timely manner.

The ACE and Epi CASE Toolkits are designed to be easily modified. They are well suited for various exposure scenarios and for assessing health impacts to both first responders and the general public. Recent improvements to the toolkits provide the

ability to conduct follow-up impact and wellness assessments of an affected community, which can help public health authorities stay engaged with the affected community and guide additional public health needs.

The ACE and Epi CASE Toolkits are available to all public health agencies. Many investigations have used the methodology, which has proven to be an intuitive set of tools that provide data for timely public health action. The ACE team can provide technical assistance over the phone (404-567-3256) and via e-mail (ATSDRACE@cdc.gov), as well as deploy on-site when needed.

## Limitations

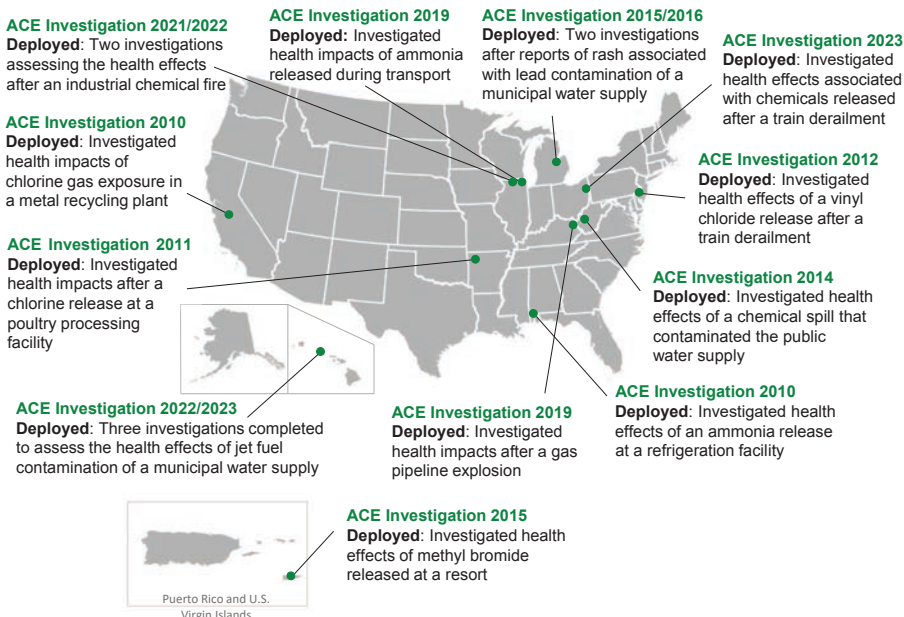
ACE investigations are designed as rapid public health responses intended to facilitate rapid needs assessments that capture the experiences of participating respondents and rapidly guide public health action. ACE investigations are not rigorous epidemiological investigations and their results are not generalizable. ACE investigation teams often work with other government agencies that provide vital response capacity (e.g., environmental testing) and regulatory authority. ATSDR is not a regulatory agency, however, and ACE investigation recommendations are not enforceable.

## Conclusion

Acute chemical releases in the U.S. frequently result in exposure to the public and first responders, with the potential to cause both short- and long-term physical and mental health issues. Such health effects raise a need for a rapid epidemiological assessment of affected, or potentially affected, populations. Many investigations have used the ACE Toolkit and methodology, and public health authorities continue to request them for critical investigations. The dedication of the ACE team to continuous improvements of the ACE and Epi CASE Toolkits has made ACE investigations a critical support tool for communities experiencing chemical incidents and other large-scale environmental emergencies. ACE investigations can now more rapidly collect data from more people in more varied situations to guide response and recovery efforts. Affected communities can also be revisited by investigators to ensure that their needs have been met. 🌸

FIGURE 2

### Map of Investigations Conducted Through the Assessment of Chemical Exposures (ACE) Program, 2010–2023



**Corresponding Author:** Stacey Konkle, Epidemiologist, Agency for Toxic Substances and Disease Registry, Atlanta, GA.  
Email: qdv8@cdc.gov.

## References

- Agency for Toxic Substances and Disease Registry. (2020). *Epi CASE Toolkit*. <https://www.atsdr.cdc.gov/epitoolkit/index.html>
- Agency for Toxic Substances and Disease Registry. (2022). *Assessment of Chemical Exposures (ACE) Program*. <https://www.atsdr.cdc.gov/ace/index.html>
- Agency for Toxic Substances and Disease Registry. (2023). *About GRASP*. [https://www.atsdr.cdc.gov/placeandhealth/about\\_grasp.html](https://www.atsdr.cdc.gov/placeandhealth/about_grasp.html)
- Bui, D.P., Kukiellka, E.A., Blau, E.F., Tompkins, L.K., Bing, K.L., Edge, C., Hardin, R., Miller, D., House, J., Boehmer, T., Winquist, A., Orr, M., Funk, R., & Thoroughman, D. (2022). The occupational health effects of responding to a natural gas pipeline explosion among emergency first responders—Lincoln County, Kentucky, 2019. *Disaster Medicine and Public Health Preparedness*, 16(5), 1997–2004. <https://doi.org/10.1017/dmp.2021.266>
- Center for Domestic Preparedness. (2023). *Disaster Related Exposure Assessment and Monitoring*. Federal Emergency Management Agency. <https://cdp.dhs.gov/training/course/MGT%20908>
- Duncan, M.A. (2014). Assessment of chemical exposures: Epidemiologic investigations after large-scale chemical releases. *Journal of Environmental Health*, 77(2), 36–38.
- Duncan, M.A., & Orr, M.F. (2016). Toolkit for epidemiologic response to an acute chemical release. *Disaster Medicine and Public Health Preparedness*, 10(4), 631–632. <https://doi.org/10.1017/dmp.2015.187>
- Kulkarni, P.A., Duncan, M.A., Watters, M.T., Graziano, L.T., Vaouli, E., Cseh, L.F., Risher, J.F., Orr, M.F., Hunte-Cesar, T.C., & Ellis, E.M. (2015). Severe illness from methyl bromide exposure at a condominium resort—U.S. Virgin Islands, March 2015. *Morbidity and Mortality Weekly Report*, 64(28), 763–766. <https://doi.org/10.15585/mmwr.mm6428a4>
- Miko, S., Poniatowski, A.R., Troeschel, A.N., Felton, D.J., Banerji, S., Bolduc, M.L.F., Bronstein, A.C., Cavanaugh, A.M., Edge, C., Gates, A.L., Jarvis, M., Mintz, N.A.,

TABLE 1

**Assessment of Chemical Exposures (ACE) Investigations After Acute Chemical Releases, 2015–2023**

Incident	Year	Location	Chemical Agent	# of Participants	Surveillance Instrument
Exposure to indoor use of a prohibited pesticide (Kulkarni et al., 2015)	2015	U.S. Virgin Islands	Methyl bromide used as an indoor pesticide	16 participants	ACE general survey by phone
Skin rash after lead contamination in a municipal water system (Unified Coordination Group—Flint, Michigan, 2016)	2015	Flint, Michigan	Lead in a municipal water system	390 participants	ACE general survey by phone, dermatologist exam, and water quality testing done in conjunction with U.S. EPA
Clinical care follow-up of skin rashes after lead contamination in a municipal water system (Unified Coordination Group—Flint, Michigan, 2016)	2016	Flint, Michigan	Lead in a municipal water system	40 participants	ACE general survey by phone, dermatologist exam, and water quality testing done in conjunction with U.S. EPA
Explosion of a gas pipeline (Bui et al., 2022)	2019	Lincoln County, Kentucky	Natural gas pipeline fire and explosion	120 residents 105 first responders	ACE general survey conducted door-to-door, review of medical records, and first responder survey
Chemical release onto a roadway during transportation (Rispen et al., 2020)	2019	Lake County, Illinois	Anhydrous ammonia released onto a roadway during transportation	48 residents 38 first responders	ACE general survey conducted door-to-door, review of medical records, and first responder survey
Fire at an industrial chemical facility (Surasi et al., 2021)	2021	Winnebago County, Illinois	PM <sub>2.5</sub> and PM <sub>5</sub> caused by an industrial fluid and grease fire	2,030 participants	ACE general and Epi CASE survey modified into a <b>single, electronic, self-administered online survey</b>
Contamination of a municipal water source by jet propellant (Miko et al., 2023; Troeschel et al., 2022)	2021	Oahu, Hawaii	Jet propellant (JP-5) in a municipal water system	2,289 participants	ACE general and Epi CASE survey modified into a single, electronic, self-administered online survey, as well as <b>in-person, key informant interviews</b>
Community-level follow up 1 year after an industrial chemical facility fire (Sekkarie et al., 2023)	2022	Winnebago County, Illinois	PM <sub>2.5</sub> and PM <sub>5</sub> caused by an industrial fluid and grease fire	676 participants	ACE general and Epi CASE survey modified into an electronic, self-administered online follow-up survey, as well as <b>qualitative interviews with residents conducted door-to-door and by phone</b>
Community-level follow up 6 months after jet fuel contamination of a municipal water source *	2022	Oahu, Hawaii	Jet propellant (JP-5) in a municipal water system	986 participants	ACE general and Epi CASE survey modified into a single, electronic, self-administered online survey, <b>as well as use of the Registry Decision Support Tool</b>
Review of medical charts after jet fuel contamination of a municipal water source *	2023	Oahu, Hawaii	Jet propellant (JP-5) in a municipal water system	653 participants	<b>Comprehensive review of medical charts</b>
Train derailment *	2023	East Palestine, Ohio	Release of vinyl chloride and n-butyl acrylate after a train derailment	704 residents 339 first responders	ACE general and Epi CASE survey modified into electronic surveys available online, <b>administered in a health clinic</b> , and conducted door-to-door, as well as an online survey for first responders

\* Publication pending.

Note. Bold text indicates the first use of that particular surveillance technique during an ACE investigation. Epi CASE = Epidemiologic Contact Assessment Symptom Exposure; PM = particulate matter; U.S. EPA = U.S. Environmental Protection Agency.

continued on page 44



bias or slanted viewpoint. Words such as very, extremely, exceedingly, and seriously fit into this category. Do not report minor imperfections found during the inspection if there is no added value to public health. Avoid reporting names of individuals unless it is germane to the problem encountered. And never make recommendations. Recommendations confer ownership. On the other hand, suggestions provide guidance.

We always found it quite useful to provide the inspected with the names and contact information (with their kind consent, of course) of at least three businesses and individuals who successfully dealt with similar conditions and situations cited in an

inspection report. This practice is particularly important for those violations deemed serious or that require significant modifications or additional services to correct physical plant deficiencies or operations.

As a final note, the information on the art and science of inspection started about 10 years ago in preparation for a lawsuit against an environmental health specialist at a health department. The errors made during this individual's inspections were significant and extreme, costing the restaurant owner loss of income and unwarranted damage to the restaurant's good reputation. One of the authors of this column served as an expert for the plaintiff and prepared a

report detailing the errors and shortcomings of the inspection process and subsequent actions taken against the operator based on those errors. The case settled out of court with considerable compensation paid to the restaurant owner and the health department issued a public letter of apology. Significant to the settlement was an agreement by the health department that its inspectors receive training on conducting inspections and issuing reports. This situation could have been prevented by persistent instruction on the art and science of inspection and professional deportment. ✨

Contact: powitz@sanitarian.com.

# ► DIRECT FROM ATSDR continued from page 39

Parasram, V., Rayman, J., Smith, A.R., Wagner, J.C., Gerhardstein, B.G., & Orr, M.F. (2023). Community health impacts after a jet fuel leak contaminated a drinking water system: Oahu, Hawaii, November 2021. *Journal of Water & Health*, 21(7), 956–971. <https://doi.org/10.2166/wh.2023.109>

Rispens, J.R., Jones, S.A., Clemmons, N.S., Ahmed, S., Harduar-Morano, L., Johnson, M.D., Edge, C., III, Vyas, A., Bourgikis, E., & Orr, M.F. (2020). Anhydrous ammonia chemical release—Lake County, Illinois, April 2019. *Morbidity and Mortality Weekly Report*, 69(4), 109–113. <https://doi.org/10.15585/mmwr.mm6904a4>

Sekkarie, A., DeJonge, P., Martell, S., Patrick, S., Caudill, M., Horton, D.K., Orr, M., & Konkle, S. (2023). Notes from the field:

Follow-up assessment 1 year after a chemical exposure investigation—Winnebago County, Illinois, July–August 2022. *Morbidity and Mortality Weekly Report*, 72(3), 80–81. <https://doi.org/10.15585/mmwr.mm7203a6>

Surasi, K., Nakayama, J.Y., Johnson, M., Martell, S., Patrick, S., Owen, L.R., Horton, D.K., & Orr, M. (2021). Notes from the field: Deployment of an electronic self-administered survey to assess human health effects of an industrial chemical facility fire—Winnebago County, Illinois, June–July 2021. *Morbidity and Mortality Weekly Report*, 70(49), 1715–1716. <https://doi.org/10.15585/mmwr.mm7049a4>

Troeschel, A.N., Gerhardstein, B., Poniatowski, A., Felton, D., Smith, A., Surasi,

K., Cavanaugh, A.M., Miko, S., Bolduc, M., Parasram, V., Edge, C., Funk, R., & Orr, M. (2022). Notes from the field: Self-reported health symptoms following petroleum contamination of a drinking water system—Oahu, Hawaii, November 2021–February 2022. *Morbidity and Mortality Weekly Report*, 71(21), 718–719. <https://doi.org/10.15585/mmwr.mm7121a4>

Unified Coordination Group—Flint, Michigan. (2016). *Flint rash investigation: A report on findings from case interviews, water testing, and dermatologic screenings for rashes that developed or worsened after October 16, 2015*. <https://www.phe.gov/emergency/events/Flint/Documents/rash-report.pdf>

## Show them you are an expert.

You are dedicated to environmental health. Earn the **Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS)** credential to let your community and employer know just how much. **The REHS/RS credential is the gold standard in environmental health.**

Learn the requirements:  
[neha.org/rehs-rs-credential](https://neha.org/rehs-rs-credential)

