HHS Public Access

Author manuscript

J Environ Health. Author manuscript; available in PMC 2024 August 02.

Published in final edited form as:

J Environ Health. 2023 November ; 86(4): 36–44.

THE ASSESSMENT OF CHEMICAL EXPOSURES (ACE) PROGRAM: TOOLKIT ADVANCES AND RECENT INVESTIGATIONS

Stacey Konkle, MPH, PhD[1], **D. Kevin Horton, MSPH, DrPH**[1], **Maureen Orr, MS**[1]

[1]Agency for Toxic Substances and Disease Registry, Atlanta GA

Keywords

toolkit; epidemiologic response; chemical spills; preparedness

ASSESSMENT OF CHEMICAL EXPOSURES (ACE) PROGRAM

In 2010, the U.S. 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 (ATSDR, 2022).

TOOLKIT ADVANCES

The ATSDR ACE team 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 (e.g., demographics, exposure data, clinical information) collection during an ongoing disaster investigation (Epi CASE Toolkit, 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 pre-approved consent forms. The Toolkit also includes a Decision Support Tool (Figure 1) designed to help health authorities determine whether a post-disaster registry is a valid public health action.

In addition to the traditional door-to-door and phone interviews generally conducted during disaster responses, recent modifications to the ACE and Epi CASE Toolkits allow for rapid

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

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 greatly 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 may not have initially been identified. A more comprehensive understanding of the communities' perceptions of the successes of the response and lingering concerns or needs can help authorities tailor future recommendations and appropriate allocate resources.

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

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 has been collected on more than 8,200 participants (Table 1). Each ACE investigation is unique—the exposure, the response, the community, and the needs. Most investigations begin with the ACE general survey. Investigators can easily modify 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 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 abstractions forms, key informant interviews, responder specific questionnaires, mental health focused survey sections, and qualitative questionnaires. ACE investigations frequently use mapping and analysis capacities from ATSDR's Geospatial Research, Analysis and Services Program (GRASP) for planning, evaluation, and presentation of findings. (GRASP, 2023).

In 2021, the ACE team conducted the first community-level post-acute-disaster follow-up investigation at the request of the Winnebago County, Illinois Health Department (Sekkarie et al., 2023). Since then, the ACE team has conducted two additional community-level follow-up investigations. These follow-up investigations included collection of qualitative data from residents and key informants, resulting in rich data about lingering concerns and broad effects on community resources that were not available elsewhere. Post-acute-disaster ACE follow-up investigations 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 original toolkit's development, the ACE team has diligently incorporated innovative techniques and implemented key takeaways from investigations into the ACE tools. These modifications have enhanced the user experience and enabled rapid initiation of acute chemical exposure investigations. ACE Toolkits facilitate both rapid needs assessments and long-term health monitoring that capture the experience 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 both first responders and the general public's health impacts. Recent improvements to the ACE Toolkits provide the ability to conduct follow-up impact and wellness assessments of an affected community. This 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 e-mail (ATSDRACE@cdc.gov) and can deploy on-site when needed.

LIMITATIONS

ACE investigations are designed as rapid public health responses—intended to facilitate rapid needs assessments that capture 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, who provide vital response capacity (e.g., environmental testing) with regulatory authority. However, ATSDR is not a regulatory agency, and ACE investigation recommendations are not enforceable.

CONCLUSIONS

Acute chemical releases in the United States frequently result in exposures 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 ATSDR ACE Toolkits and methodology, and public health authorities continue to request them for critical investigations. The ACE team's dedication 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. They can also revisit affected communities to ensure their needs have been met.

REFERENCES

Agency for Toxic Substances and Disease Registry. (2022). Assessment of Chemical Exposures (ACE) Program. Retrieved from https://www.atsdr.cdc.gov/ace/index.html?CDC_AA_refVal=https%3A%2F%2Fwww.atsdr.cdc.gov%2Fntsip%2Face.html

Agency for Toxic Substances and Disease Registry, National Institute for Occupational Safety and Health, Federal Emergency Management Agency. (2023). Disaster Related Exposure Assessment and Monitoring Course. Retrieved from https://cdp.dhs.gov/training/course/MGT%20908

Bui DP, Kukielka EA, Blau EF, Tompkins LK, Bing KL, 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. 10.1017/dmp.2021.266 [PubMed: 34544524]

Duncan MA (2014). Assessment of chemical exposures: epidemiologic investigations after large-scale chemical releases. Journal of Environmental Health, 77(2), 36–38. https://www.ncbi.nlm.nih.gov/pubmed/25226784

Duncan MA, & Orr MF (2016). Toolkit for Epidemiologic Response to an Acute Chemical Release. Disaster Medicine and Public Health Preparedness, 10(4), 631–632. 10.1017/dmp.2015.187 [PubMed: 27417212]

Epi CASE Toolkit. (2020). ATSDR Agency for Toxic Substances and Disease Registry (ATSDR). Retrieved 07/31/2023 from https://www.atsdr.cdc.gov/epitoolkit/index.html

Agency for Toxic Substances and Disease Registry. (2023). About GRASP. Retrieved from https://www.atsdr.cdc.gov/placeandhealth/about_grasp.html

Kulkarni PA, Duncan MA, Watters MT, Graziano LT, Vaouli E, Cseh LF, Risher JF, Orr MF, Hunte-Ceasar TC, & Ellis EM (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. 10.15585/mmwr.mm6428a4 [PubMed: 26203630]

Miko S, Poniatowski AR, Troeschel AN, Felton DJ, Banerji S, Bolduc MLF, Bronstein AC, Cavanaugh AM, Edge C, Gates AL, Jarvis M, Mintz NA, Parasram V, Rayman J, Smith AR, Wagner JC, Gerhardstein BG, & Orr MF (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. 10.2166/wh.2023.109 [PubMed: 37515565]

Rispens JR, Jones SA, Clemmons NS, Ahmed S, Harduar-Morano L, Johnson MD, Edge C 3rd, Vyas A, Bourgikos E, & Orr MF (2020). Anhydrous Ammonia Chemical Release — Lake County, Illinois, April 2019. Morbidity and Mortality Weekly Report, 69(4), 109–113. 10.15585/mmwr.mm6904a4 [PubMed: 31999683]

Sekkarie A, DeJonge P, Martell S, Patrick S, Caudill M, Horton DK, 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. 10.15585/mmwr.mm7203a6 [PubMed: 36656791]

Surasi K, Nakayama JY, Johnson M, Martell S, Patrick S, Owen LR, Horton DK, & 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. 10.15585/mmwr.mm7049a4 [PubMed: 34882658]

Troeschel AN, Gerhardstein B, Poniatowski A, Felton D, Smith A, Surasi K, Cavanaugh AM, 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. 10.15585/mmwr.mm7121a4 [PubMed: 35617135]

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

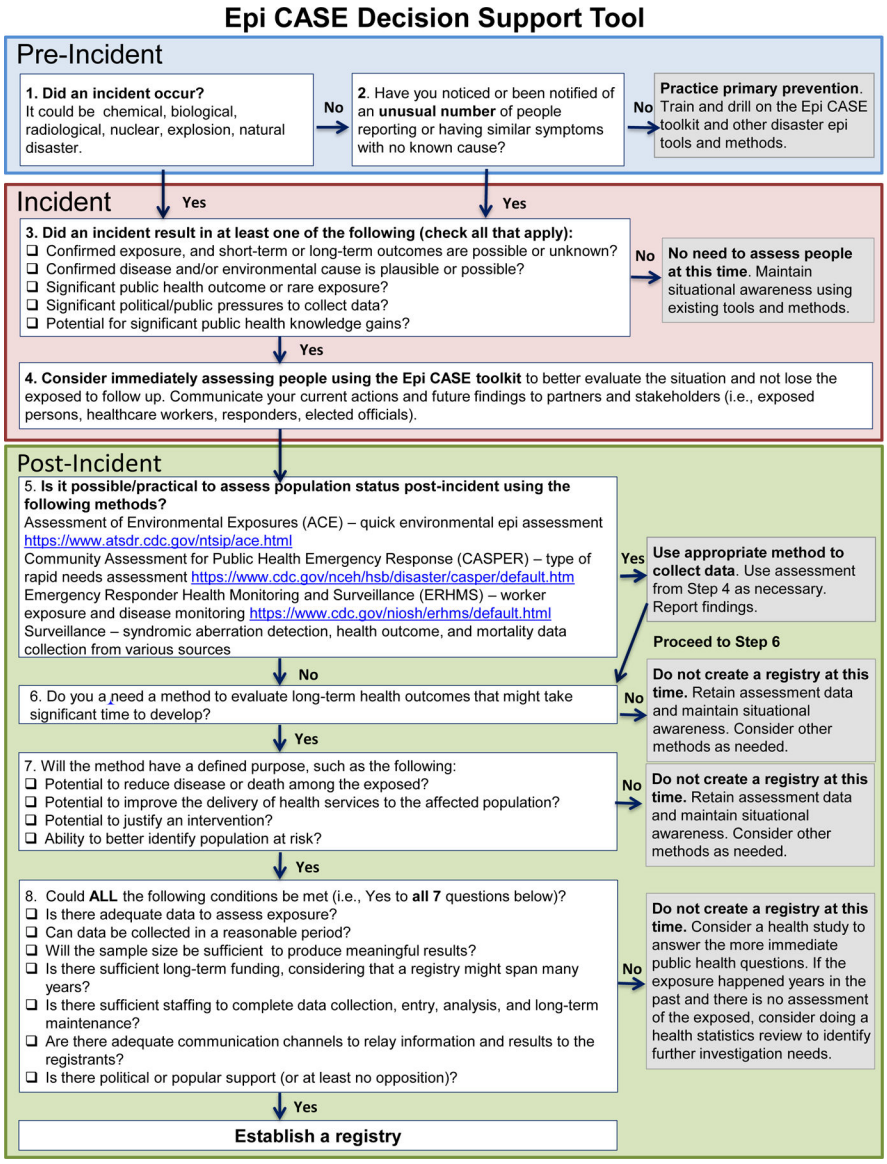

Figure 1. Epi CASE Decision Support Tool

Epi CASE Decision Support Tool designed to help health authorities decide whether a post-disaster registry is a valid public health action after a chemical disaster.

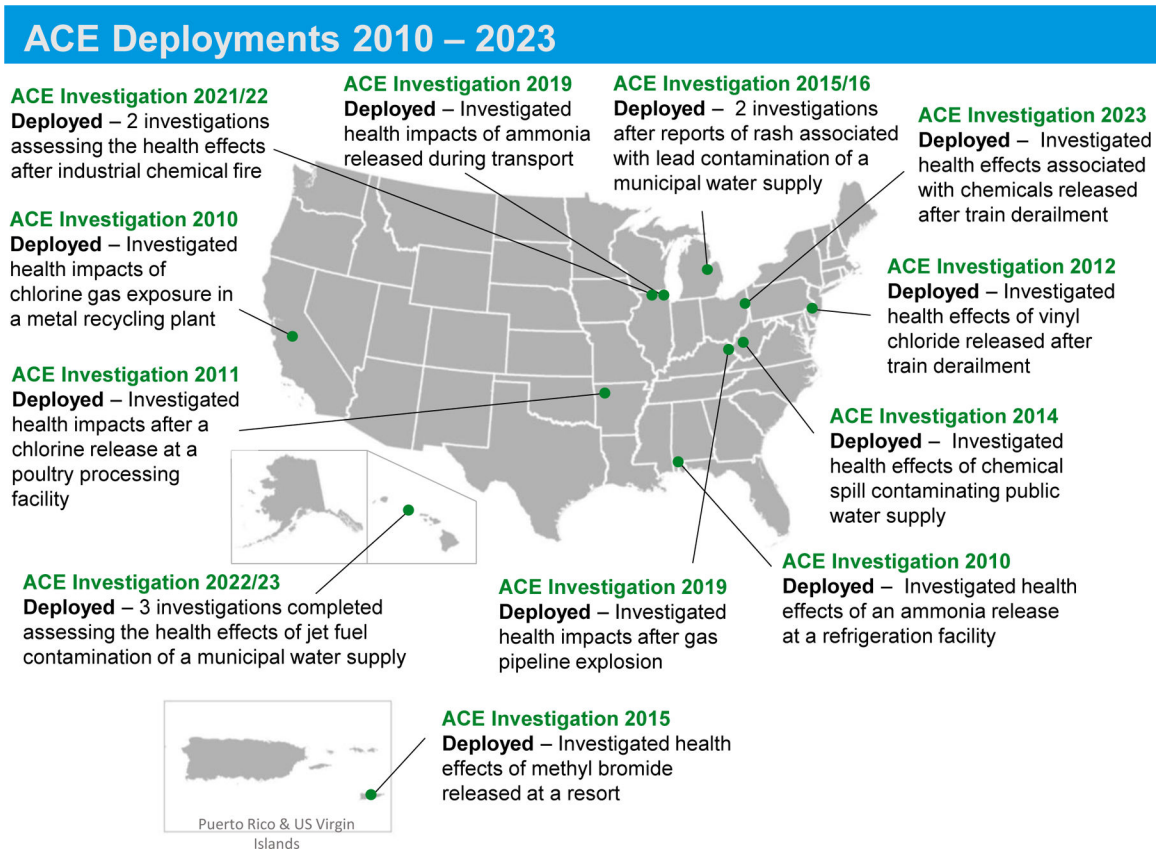

Figure 2. Map of ACE Investigations Conducted 2010 – 2023

The ACE program has completed 16 investigations since 2010 in 10 states. Each ACE investigation is unique—the exposure, the response, the community, and the needs.

TABLE 1.

ACE Investigations After Acute Chemical Releases, 2015–2023

Incident	Year	Location	Chemical Agent	Number of Participants	Surveillance Instruments
Prohibited indoor pesticide use exposure (Kulkarni et al., 2015)	2015	U.S. Virgin Islands	Methyl bromide used as indoor pesticide	16 participants	ACE general survey by phone
Skin rash after lead contamination in municipal water (Unified Coordination Group—Flint, 2016)	2015	Flint, Michigan	Lead in municipal water system	390 participants	ACE general survey by phone, dermatologist exam, water quality testing (in conjunction with EPA)
Skin rash clinical care follow-up after lead contamination in municipal water (Unified Coordination Group—Flint, 2016)	2016	Flint, Michigan	Lead in municipal water system	40 participants	ACE general survey by phone, dermatologist exam, water quality testing (in conjunction with EPA)
Gas pipeline explosion (Bui et al., 2022)	2019	Lincoln County, Kentucky	Natural gas pipeline fire and explosion	120 residents, 105 first responders	ACE general survey door to door, medical records review, first responder survey
Chemical release onto roadway during transportation (Rispens et al., 2020)	2019	Lake County, Illinois	Anhydrous ammonia released onto roadway during transportation	48 residents, 38 first responders	ACE general survey door to door, medical records review, first responder survey
Industrial chemical facility fire (Surasi et al., 2021)	2021	Winnebago County, Illinois	Industrial fluid and grease fire-caused PM 2.5 and PM 5	2,030 participants	ACE general and Epi CASE survey modified into a **single, electronic, self-administered online survey**
Jet fuel contamination of municipal water source at Red Hill (Miko et al., 2023; Troeschel et al., 2022)	2021	Oahu, Hawaii	Jet fuel, petroleum- (JP-5) in municipal water	2,289 participants	ACE general and Epi CASE survey modified into a single, electronic, self-administered online survey, **in-person key-informant interviews**
One-year community-level follow-up after an industrial chemical facility fire (Sekkarie et al., 2023)	2022	Winnebago County, Illinois	Industrial fluid and grease fire-caused PM 2.5 and PM 5	676 participants	ACE general and Epi CASE survey modified into an electronic, self-administered online follow-up survey, as well as **door-to-door and phone qualitative interviews with residents**
Six-month community-level follow-up after jet fuel contamination of municipal water source at Red Hill *	2022	Oahu, Hawaii	Jet fuel, petroleum- (JP-5) in municipal water	986 participants	ACE general and Epi CASE survey modified into a single, electronic, self-administered online survey, **Registry Decision Support Tool**
Medical chart review after jet fuel contamination of municipal water source at Red Hill *	2023	Oahu, Hawaii	Jet fuel, petroleum- (JP-5) in municipal water	653 participants	**Comprehensive medical chart review**
East Palestine, Ohio Train Derailment *	2023	East Palestine, Ohio	Vinyl chloride, n-butyl acrylate	704 residents, 339 first responders	ACE general and Epi CASE survey modified into electronic surveys available online, **administered in a health clinic**, and door to door, online first responder survey

* Publication/s pending, **Bold text** indicates first use of particular surveillance technique during an ACE investigation