

Development, Evaluation, and Long-Term Outcomes of Environmental Health and Land Reuse Training, Part 2—Environmental Health and Land Reuse Trainings for Environmental Health Professionals: Long-Term Follow-Up

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Abstract This article provides a brief overview of participant feedback on the Environmental Health and Land Reuse (EHLR) Classroom Training up to 12 months post-training. The goal was to assess the effectiveness of the EHLR training over time as related to specific outcomes. The outcomes included increasing capacity to engage communities around land reuse concerns, evaluating and communicating environmental and health risks, redesigning communities to improve health, and assessing the ability to measure environmental and health change over the course of community redevelopment. To assess long-term impacts of the training, within 12 months post-training, we repeated initial knowledge assessment questions answered immediately post-training. We also asked participants to specify if there were any aspects of the training that were most useful to them. The survey response rate among participants who completed all five training modules was 22%. The majority of respondents indicated that the training was effective and useful over the long term. While the response rate was low, the clustering of responses to similar prompts from the initial and long-term knowledge assessments indicated that survey respondents found the training effective and useful. Responses indicated that the training provided new knowledge, increased participant confidence to engage in EHLR topics, and motivated participants to learn more.

Keywords: environmental health, environmental health education, community engagement, brownfields, land reuse

Introduction

Environmental health professionals require support and technical assistance to effectively engage communities while reducing exposures to harmful chemicals in the environment. The Agency for Toxic Substances and Disease Registry's (ATSDR) Land Reuse Health Program helps build an environmental health workforce and partnership for the advancement of community engagement capacity and general environmental health skills. ATSDR builds and leverages capacity

from partnerships with the National Environmental Health Association (NEHA) and other federal, state, and local entities to engage communities, train environmental health professionals, and advance community engagement and land reuse knowledge.

Through a partnership with NEHA, ATSDR identified gaps in environmental health professionals' education related to land reuse. In 2016, NEHA conducted a survey of 92 local health department respondents who indicated they worked on land reuse issues.

Despite working on land reuse, 75% of the respondents indicated having no formal education (e.g., college-level classes) or only continuing education courses related to land reuse/brownfields (Berman et al., 2019).

Land reuse sites are properties slated for redevelopment that might have chemical contamination. Such sites are commonly blighted, underused, or vacant properties. These sites can be contaminated from previous industrial uses or hazardous building materials, such as materials containing asbestos or lead-based paint. Brownfields and land reuse sites can negatively affect the overall health of the community. To increase environmental health professionals' capacity to engage in land reuse and fill training gaps, ATSDR and NEHA developed the Environmental Health and Land Reuse (EHLR) Classroom Training. Community engagement, the topic of Module 1, is a binding thread woven throughout the five modules of the EHLR Classroom Training. The EHLR modules are:

1. Engaging With Your Community
2. Evaluating Environmental and Health Risks
3. Communicating Environmental and Health Risks to the Community

TABLE 1

Consolidated Long-Term Follow-Up Survey for the Environmental Health and Land Reuse Classroom Training

Question #	Question	Answer Type and Specific Answers
1	In general, how helpful has the Environmental Health and Land Reuse Training/Certificate Program been to increase your skills for integrating environmental health in land reuse and community revitalization activities?	4-point Likert scale: • Not useful at all • Somewhat useful • Useful • Very useful
2	Considering the certificate training in general, are there any aspects you think were particularly useful? Please select all that apply.	Multiple choice: • Quick reference • Preparation for public meeting • Build skills in environmental health • Increase capacity to engage with communities about land reuse • None of the above
3–7	In reference to the [name of module], please choose all that apply.	Multiple choice: • Specifically useful for my work • Quick refresher • New knowledge about topic • Confidence to increase [module name] skills • Motivated to learn more about land reuse and ways to engage • Not needed for my work • None of the above • Other (please specify)
8	Is there one aspect of the certificate program materials that was most useful to you? If so, please specify here.	Open-ended

4. Redesigning With Health in Mind

5. Measuring Success

ATSDR (2024) maintains the EHLR course materials (www.atsdr.cdc.gov/land-reuse-health-program/php/classroom-training/classroom-training-materials.html) and NEHA maintains an asynchronous online version of the course (<https://www.neha.org/ehlr-certificate>). From 2022 through 2023, ATSDR and NEHA evaluated the EHLR training. Our evaluation included:

- Focus group discussions
- Assessment of training modalities (i.e., live and asynchronous)
- Results of voluntary knowledge assessments
- Pre-test and post-test scores
- Long-term follow-up survey up to 12 months post-training

The voluntary knowledge assessments provided participant feedback on the initial effectiveness and usefulness of each EHLR Classroom Training module immediately after

completion of each module. The long-term survey about the training closely mimicked the initial knowledge assessments. This article examines how effective and useful the EHLR Classroom Training is up to 12 months following training. We discuss the development, launch, initial knowledge assessments, and results of the long-term survey that had questions closely matched to the initial knowledge assessments. Our survey population included asynchronous EHLR participants.

Methods

Long-Term Follow-Up Survey

During May and June 2022, ATSDR conducted a long-term follow-up survey of the first 100 asynchronous EHLR participants who completed all five modules of the training. The participants were environmental health professionals (75%) and students in public health (25%). ATSDR designed

the long-term follow-up survey, shown in a consolidated format in Table 1, to assess the training up to 12 months after completion of the training. The survey focused on effectiveness of the training based on participant feedback. We sent one survey invite and one reminder to potential survey respondents.

General Questions

Questions 1 and 2 of the long-term survey were general questions related to the overall effectiveness of the training. Question 1 asked if the EHLR Classroom Training increased skills for integrating environmental health in land reuse and community revitalization activities. Question 2 asked if there were any aspects of the training that were particularly useful. We excluded the “other” category from Table 1, as no survey respondents selected this option.

Knowledge Assessments

Questions 3–7 pertained to each of the five modules of the EHLR Classroom Training in terms of aggregated knowledge assessments for each module. The survey incorporated similar prompts from the initial knowledge assessment that was completed by participants immediately after completing an EHLR Classroom Training module. The following prompts were used in the initial knowledge assessment for Questions 3–7:

In reference to the [name of the specific module], please choose all that apply:

- Specifically useful for my work. If so, you can describe how here (optional)
- Quick refresher
- Offers me knowledge about a topic I am less familiar with
- Gives me confidence to increase my skills in and understanding of community engagement related to land reuse sites
- Motivates me to learn more about land reuse sites and ways I can be engaged
- Not needed for my work
- None of the above
- Other (please specify)

With the exception of an expansion of prompt D, we incorporated similar prompts from the initial knowledge assessment into the long-term survey. Prompt D in the long-term survey reflected the specific module name and was not limited to “community engagement related to land reuse,” which was the wording used in the initial knowledge assessments.

Prompt D in the long-term survey read: “Gives me confidence to increase my skills in and understanding of [name of specific module topic] related to land reuse sites.”

By including nearly identical knowledge assessment prompts in the long-term survey, ATSDR intended to assess the effectiveness of the training by comparing initial and long-term knowledge assessments. The initial knowledge assessments of the asynchronous EHLR Classroom Training included any participant in any of the five modules at any time. This inclusive structure resulted in a cohort of 129 participants who responded to the initial knowledge assessments in one or more modules.

Question Regarding the Most Useful Aspect of the Classroom Training

Question 8 asked participants to specify if there was one aspect of the EHLR training that was most useful to them. The goal of this question was to gain qualitative feedback about the training over the long term.

Question 9 asked participants to indicate how they took the training (i.e., through the ATSDR website or asynchronously on the NEHA website). Because our analysis was restricted to online asynchronous participants (i.e., via the NEHA website), Question 9 was not relevant to our analysis of the survey results.

Results

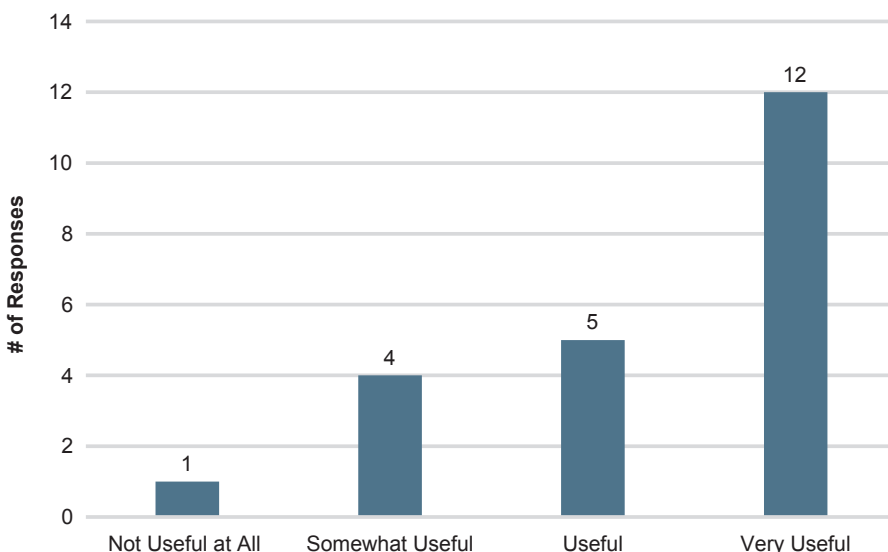
Out of 100 online asynchronous learners who were invited to participate in our survey, 22 completed the follow-up survey (22% response rate).

We compared initial knowledge assessments of asynchronous training participants to the knowledge assessments completed by the long-term survey respondents. The initial knowledge assessments were completed by 129 learners who participated in any training module. The cohort was larger than the first 100 learners who completed all five modules and all learners were invited to complete the follow-up survey. Regardless, we included the 129 knowledge assessment responses from all initial learners in any training module to evaluate all feedback received.

Figures 1 and 2 summarize the results of responses to Questions 1 and 2 of the long-term survey. These questions pertained to the training in general. Within 12 months post-training, 17 of 22 (77%) respondents found the training to be useful ($n = 5$) or very useful

FIGURE 1

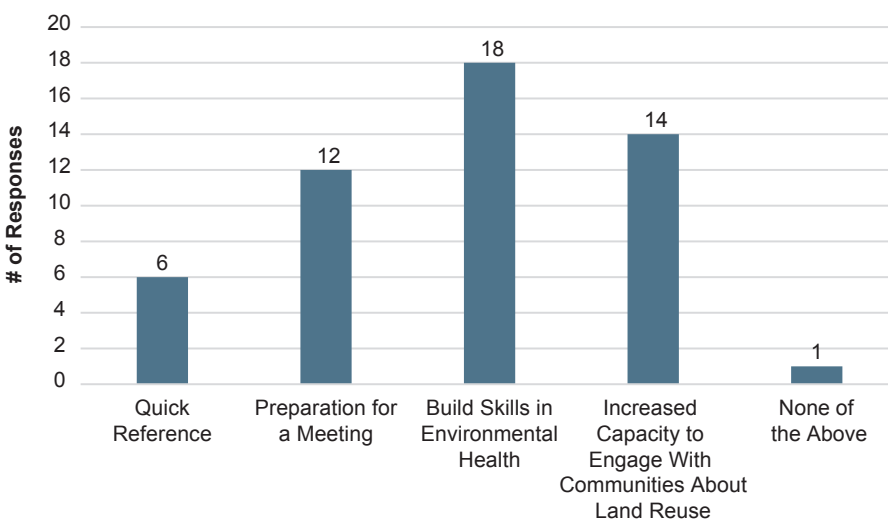
Asynchronous Participant Responses to Question 1 of the Long-Term Follow-Up Survey for the Environmental Health and Land Reuse Training ($n = 22$)



Note. Question 1 asked: “In general, how helpful has the Environmental Health and Land Reuse Training/Certificate Program been to increase your skills for integrating environmental health in land reuse and community revitalization?”

FIGURE 2

Asynchronous Participant Responses to Question 2 of the Long-Term Follow-Up Survey for the Environmental Health and Land Reuse Training ($n = 22$)



Note. Question 2 asked: “Considering the certificate training in general, are there any aspects you think were particularly useful? Select all that apply.”

TABLE 2

Number of Responses to Questions 3–7 From the Long-Term Follow-Up Survey for the Environmental Health and Land Reuse Classroom Training

Question and Module	Specifically Useful for My Work	Quick Refresher	New Knowledge About Topic	Confidence to Increase [Module Name] Skills	Motivated to Learn More About Land Reuse and Ways to Engage	Not Needed for My Work	None of the Above	Other, Please Specify
In reference to the [name of module], please choose all that apply.								
3. Engaging With Your Community	8	3	13	15	17	3	1	0
4. Evaluating Environmental and Health Risks	8	4	16	14	14	3	1	0
5. Communicating Environmental and Health Risks	8	6	11	18	13	2	1	0
6. Redesign With Health in Mind	5	4	16	14	12	3	1	0
7. Measuring Success: Evaluating Environmental and Health Change	7	3	18	13	13	2	1	0

($n = 12$) for increasing their skills to engage in land reuse. Respondents indicated that the following aspects of the training were particularly useful:

- 18 (82%) selected “Build skills in environmental health”
- 14 (64%) selected “Increase capacity to engage with communities about land reuse”
- 12 (55%) selected “Prepare for a public meeting”
- 6 (27%) selected “Quick reference”
- 1 (4.5%) selected “None of the above”

The responses to the knowledge assessment Questions 3–7 are shown in Table 2. The most frequent responses indicated that, across all modules:

- Respondents reported they gained new knowledge about each of the five topics. The responses indicated the following aspects of the training as particularly useful: 18 (82%) respondents selected “Measuring Success: Evaluating Environmental and Health Change” and 11 (50%) respondents selected “Communicating Environmental and Health Risks.”
- Respondents reported they gained confidence to increase their skills in each module topic, with 18 (82%) respondents selecting “Communicating Environmental

and Health Risks” and 13 (59%) respondents selecting “Measuring Success: Evaluating Environmental and Health Change.”

- Respondents reported they were motivated to learn more about land reuse and ways to engage, with 17 (77%) respondents selecting “Engaging With Your Community” and 12 (55%) respondents selecting “Redesign With Health in Mind.”

In all, eight respondents indicated that Modules 1, 2, and 3 were specifically useful for their work; five respondents indicated that Module 4 was specifically useful for their work; and seven respondents indicated that Module 5 was specifically useful for their work. In contrast, three respondents indicated that Modules 1, 2, and 4 were not needed for their work, and two respondents indicated that Modules 3 and 5 were not needed for their work. No respondents selected or completed the “other” category of the survey prompts for these questions.

ATSDR compared results from the initial knowledge assessments and long-term knowledge assessments for each module. ATSDR did not include the “other” category, as there were no responses among the long-term survey participants. The majority of responses for both the initial and long-term knowledge assess-

ments for all five modules clustered around three prompts, summarized here as:

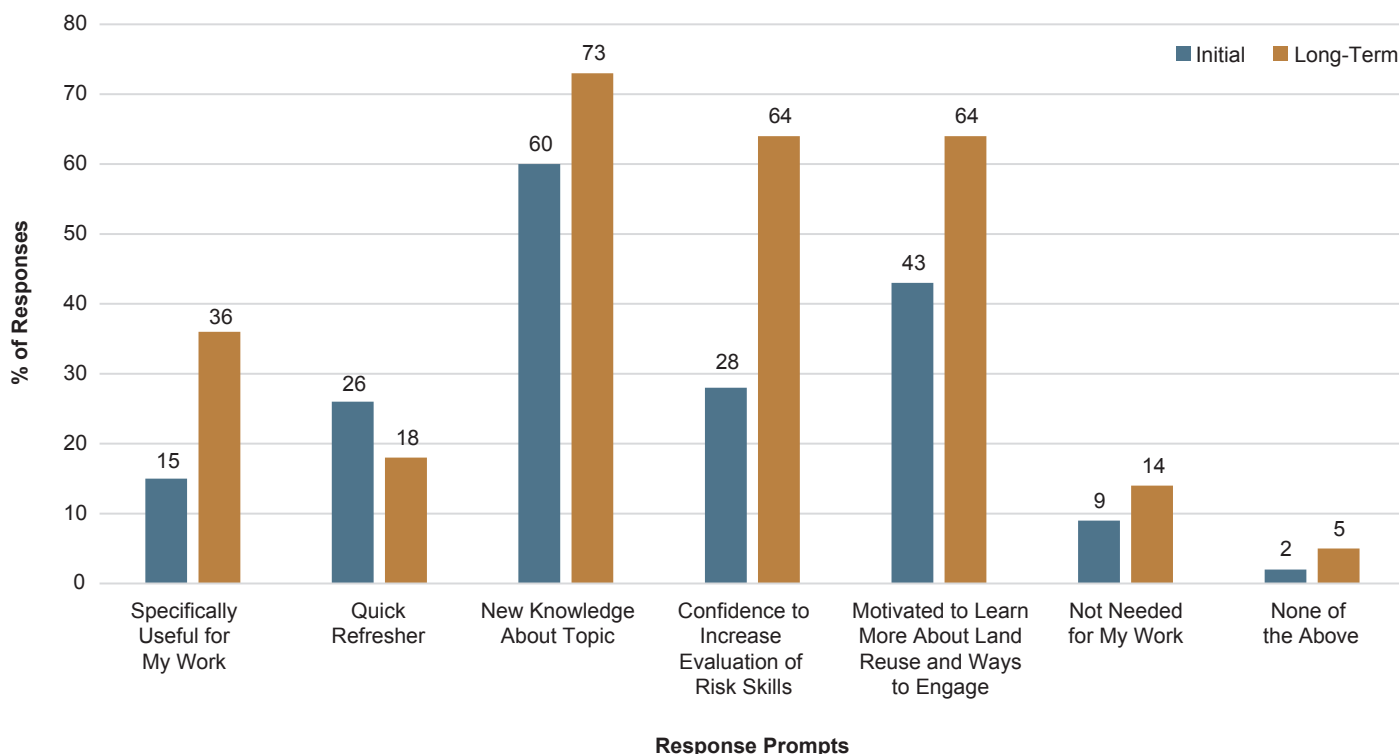
- New knowledge about the topic.
- Confidence to increase skills, either in the specific module topic (long-term knowledge assessments) or in community engagement in general (initial knowledge assessments).
- Motivation to learn more about land reuse sites and ways to be engaged.

Figure 3 provides an example of the compared knowledge assessments from initial to long term, showing the comparison from Module 2, Evaluating Environmental and Health Risks. Moreover, 16 of the 22 (73%) long-term respondents and 78 of the 129 (60%) initial respondents indicated they had learned new knowledge about the topic. Additionally, 14 of the 22 (64%) long-term survey respondents and 36 of the 129 (28%) initial respondents indicated that the training gave them confidence to increase skills in evaluation of risk. And lastly, 14 of the 22 (64%) long-term survey participants and 55 of the 129 (43%) initial survey respondents indicated that the Module 2 training motivated them to learn more about land reuse sites and ways to be engaged.

The clustering of responses around new knowledge, confidence, and motivation was similar for all five modules.

FIGURE 3

Comparison of the Knowledge Assessment of Initial ($n = 129$) and Long-Term Follow-Up ($n = 22$) Survey Participants for the Environmental Health and Land Reuse Training, Module 2 Example



Note. Knowledge assessment questions asked: "In reference to the Evaluating Environmental and Health Risks module, please choose all that apply."

Question 8 asked if there was one aspect of the EHLR training material that was most useful to respondents. Respondents then could opt to fill in an opinion response. All 22 (100%) respondents completed the question. Overall, participants had positive responses to this question and reported finding the training effective and useful. We grouped similar responses (Table 3) to represent the response categories as follows:

- **All useful/good overall:** 7 of 22 respondents indicated that all aspects of the training were useful, the course overall was good, and everything was useful. Two respondents provided detailed comments such as using the materials and recommending the program; they also reported finding the land reuse content to have good subject matter and knowledge skills to advance concepts.
- **Useful in a particular area:** 8 of 22 respondents indicated that specific aspects of the training were useful. Useful aspects include public communication, community engage-

ment, having information about brownfields funding, connecting with resources, evaluating environmental and health risks, and applicability to environmental scenarios.

- **Complete or comprehensive:** 2 of 22 respondents indicated that the training was complete and convenient or complete and comprehensive.
- **Not applicable or no areas were most useful:** 4 of 22 respondents indicated the training was not applicable or did not find a specific area most useful. One respondent elaborated on the latter point: "Not really. All the materials interrelate in my opinion," which could be interpreted as either not applicable or equally applicable.
- **Negative response:** One respondent commented that they did not remember taking the training.

Discussion and Conclusion

Environmental health professionals are uniquely qualified to address community

concerns about contamination and the negative health effects associated with land reuse sites. They may, however, need specialized training to communicate, evaluate, and mitigate risks related to land reuse. We designed the EHLR training specifically for environmental health professionals, who can play a pivotal role in land reuse and reducing adverse health outcomes in communities. We also included urban and community planners and the future environmental health and urban and community planning workforces (i.e., students) as potential participants.

Environmental health professionals often need annual or other regularly scheduled training to maintain their professional credentials. Thus, ATSDR and NEHA developed the EHLR Classroom Training and asynchronous courses to address an observed gap in the education of environmental health professionals. We grounded our work on the results of a 2016 NEHA survey of 92 local health department professionals that detailed

TABLE 3

Asynchronous Learner Responses to Question 8 of the Long-Term Follow-Up Survey for the Environmental Health and Land Reuse Training

Summary Category	Specific Responses
Responses that indicated all or every part of the training was useful ($n = 7$)	• All of it was. • Everything was useful. • Entire program was useful. • All aspects are very useful. • Course overall was good. • I still have saved and use all the reference materials given. I loved this program and recommend it to everyone! • Good subject matter knowledge skills to advance vital land reuse concepts, which I found practical as a trained environmental health specialist (REHS), industrial hygienist, and occupational health specialist and a current USPHS EHO for the various stakeholder communities with whom I interact. Thank you!
Responses that indicated the training was useful in a particular area ($n = 8$)	• Public communication (community engagement; 2 responses) • Evaluating environmental and health risks • Applicability to most environmental health scenarios • Brownfield grant information for redevelopment was highly informative • Awareness of how to approach and how to connect with resources • I work in the food program but am interested in environmental issues • I found the program to be very interesting and the information provided has been helpful in [my] daily routine. It has improved my abilities to discuss community engagement within my community.
Responses that indicated the training was complete and comprehensive ($n = 2$)	• Completeness and convenience • Complete and comprehensive
Responses that indicated the training material was not really useful or was not applicable ($n = 4$)	• Not really. All the materials interrelate, in my opinion. • N/A (3 responses)
Response that was negative ($n = 1$)	• I do not remember taking this training at all. I am only filling this out so that I can stop receiving email requests to take the survey. Please understand that I cannot help you with this unless I took the training again. For which my supervisor said no!
<i>Note.</i> Question 8 asked: "Is there one aspect of the certificate program materials that was most useful to you? If so, please specify here." N/A = not applicable; REHS = Registered Environmental Health Specialist; USPHS EHO = U.S. Public Health Service environmental health officer.	

gaps in education related to environmental health and land reuse.

As the primary EHLR Classroom Training course developers, ATSDR and NEHA were most interested in assessing the effect of the training up to 12 months post-training. We wanted to know if participants would remember or use the training in the long term. We were pleased to learn that participants felt that the training was effective and useful over the long term. For example, responses to Questions 1 and 2 about general training usefulness (Table 2) indicated that participants found the training useful or very useful. They reported that they felt the training built skills and capacity, including preparing for public meetings.

The clustering of responses to similar prompts from the initial and long-term knowledge assessments indicated that the training was most useful in three areas, both

immediately after training and within 12 months post-training:

1. Providing new knowledge.
2. Increasing confidence to engage in each specific module's environmental health aspect related to land reuse (long-term knowledge assessments) or in community engagement related to land reuse (initial knowledge assessments).
3. Motivating participants to learn more about land reuse and ways to be engaged.

The long-term survey results indicated that the EHLR training was useful up to 12 months post-training. Survey Question 8 (Table 3) asked, "Is there one aspect of the certificate program materials that is most useful to you?" Four respondents indicated that "all," "everything," or the "entire program" was useful. Some of the longer, open-ended comments provided more detail about how participants found the course content was

useful in the long term. For example, respondents stated:

"I still have saved and use all the reference materials given. I loved this program and recommend it to everyone!"

"Good subject matter knowledge skills to advance vital land reuse concepts, which I found practical as a trained environmental health specialist (REHS), industrial hygienist, and occupational health specialist ... for the various stakeholder communities with whom I interact. Thank you!"

"I found the program to be very interesting, and the information provided has been helpful in [my] daily routine. It has improved my abilities to discuss community engagement within my community."

We were pleased to see that participants accessed and used the reference materials. They also found the training useful for their

community interactions. In addition, one participant reported incorporating course learnings into their daily routine, including improving their community engagement skills.

One strength of our evaluation of the long-term survey was our use of mixed methods to assess participant responses. Questions 1–7 used quantitative measures, which allowed us to compare the different responses. We compared the percentage of responses of the initial knowledge assessment with the long-term knowledge assessment.

Question 8 used a qualitative approach and asked participants to fill in their opinions on what they found most useful in the EHLR training. This question provided more detailed insights into how participants felt about the EHLR training. Answers were generally positive, with one negative response.

Our long-term follow-up EHLR training survey, which provided some lessons learned, also had some limitations. One lesson learned would be to expand Question 8 or add a separate question to ask, “How have you used knowledge gained from this course in your work?” This question would provide more insight into one goal of the assessment, which was to assess the effect of the training up to 12 months post-training.

One limitation of the evaluation was the low response rate, which could lead to non-response bias. We do not know the views of the people who did not respond. They might not have learned much from the training and therefore chose not to respond. Alternatively, they might not have found the course useful for their profession. Regardless, the initial knowledge assessment responses, which had a much higher response rate, correlated with the long-term survey responses returned by 22 respondents months after the course was completed. This correlation indicates that

the results are likely valid despite the low response rate.

Another limitation is not knowing the professional background of the participants who indicated that the “course was not needed for my work.” Because environmental health professionals and public health students were grouped together as a cohort entity in the long-term survey, we do not know who specifically answered that question. It could be inferred that this response was from a student who may not be working in the field yet. To address this limitation in the future, we might add an assessment question asking why participants took the course and also add a question asking whether the respondent is a student or currently works in environmental health.

An additional limitation is that respondents might already have a high opinion of ATSDR and NEHA, so they completed the survey. For example, they may have received funding or participated in previous trainings or activities sponsored by either ATSDR or NEHA.

Overall, participant responses showed that they had a positive view of the training. These findings are useful to ATSDR and NEHA. The EHLR Classroom Training can build capacity in the environmental health field because our survey results show that professionals are using what they learned from the training up to 1 year later. This finding demonstrates that the training can help strengthen the environmental health workforce. The training is also helpful in teaching individuals about community engagement, environmental health, and land reuse issues. 🌸

Editor’s Note: This article is the second in a series of three that describe the development, launch, and evaluation of the EHLR Certificate Training content. ATSDR and NEHA collabor-

atively developed the EHLR Certificate Training program. The training program consists of 1) the EHLR Basic Training, which is a 5-module short course, and 2) the EHLR Immersion Training, which is an expansion of the first three modules of EHLR Basic.

The first article described the development and delivery of EHLR Classroom Training and the pilot of the EHLR Immersion Training (Berman et al., 2024). The second article describes the long-term effectiveness of the training. The third article will present the evaluation of EHLR Training content, focusing on training effectiveness, training modalities, and participant feedback. ATSDR and NEHA wrote this series of manuscripts related to the EHLR Training to promote the accessibility of free training for environmental health professionals and their partners to build skills and capacity to address concerns related to environmental contamination.

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