



TO: Massachusetts Program Administrators (PAs), Massachusetts Energy Efficiency Advisory Council (EEAC) Consultants

FROM: Jared Powell and Betty Tolkin, NMR Group

SUBJECT: Process Assessment of CCSI Residential Classroom Trainings

CC: Pam Rathbun, Tetra Tech; Lynn Hoefgen, NMR Group; Joanne O'Donnell, NMR Group; Lauren Abraham, NMR Group; Allen Lee, Cadmus Group; Holly Farah, Cadmus Group; Sara Wist, Cadmus Group; Althea Koburger, Cadmus Group

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NMR attended three residential classroom trainings sponsored by the Code Compliance Support Initiative (CCSI) in 2015:

- HVAC and Indoor Air Quality held in Waltham on May 29th (5/29 HVAC-IAQ)
- Envelope and Building Science held in Palmer on June 5th (6/5 EBS)
- HVAC and Indoor Air Quality held in Boston on September 29th (9/29 HVAC-IAQ).

CLEARResult conducted the HVAC-IAQ trainings and the Center for EcoTechnology (CET) conducted the EBS training. The 5/29 HVAC-IAQ training had technical difficulties, which delayed its start by about an hour and decreased its duration from three hours to two hours. This was the longest any training had been delayed, and NMR elected to attend the training again on 9/29 to get a more accurate perspective for the process assessment.

The process assessment focused on both the presentations and the audiences. For the presentations, NMR assessed the overall quality, usefulness, comprehensiveness and level of detail provided, quality of materials, structure, and pace. NMR also assessed the composition of the audiences, the types of questions and issues brought up, and how well questions and issues were addressed. The process assessment relied on observation of the three trainings, informed by the expertise of the NMR staff member who attended, a certified HERS rater experienced in the use of various code compliance software.

The process assessment of the CCSI residential classroom trainings is part of the overall evaluation of the CCSI in 2015. The evaluation has several other components including:

- Analyses of immediate surveys collected at the end of the trainings with the attendees' ratings of the areas covered in terms of quality, usefulness, and new material presented
- Analyses of follow-up interviews with the attendees conducted approximately six months after the trainings exploring how they are using what they learned in the field
- Analyses of the types of information collected by various municipalities on energy code compliance.

NMR found all three residential classroom trainings attended to be very good overall. As noted in the body of this report, both presenters did a fine job of conveying the information to the attendees. Both types of trainings should be very useful for people in the field who need to be



brought up to speed on how to meet the new 2012 IECC requirements. Based on the trainings attended, NMR offers the following points for consideration:

- Consider making the slides, or a tailored version of the slides designed for future reference, available to all attendees—preferably, when they sign in at the beginning of the sessions.¹
- Consider having the trainings focus more on providing reference materials that attendees can use to answer questions in the future, such as websites and support phone numbers.
- Consider continuation of the trainings well into the future—attendees often go into the sessions with limited knowledge of the code requirements. Indeed, current plans call for approximately the same number of trainings in 2016, though the details have not been worked out. The trainings in 2016 will need to be revamped and will become more critical if Massachusetts adopts an energy code based on 2015 IECC in July.

Overall Presentation Quality

NMR found the overall quality of all three presentations to be quite good. The CLEARResult presenter for HVAC-IAQ was quiet but engaging, authoritative, knowledgeable, and incorporated humor appropriately. She did a good job of going through the key requirements of the new code, comparing it to the old code, pointing out the differences, and explaining the rationale behind why the changes were made, what kind of impact the changes will have, and the consequences of not incorporating them correctly.

The CET presenter for EBS was clearly a technical expert who was able to describe the code requirements and practical ways to meet them. He facilitated a lively interaction with attendees, at the cost of some time, causing some rushing at the end of the presentation. It was not, however, always clear whether the topics being presented were based on meeting code requirements or just following best practices for energy-efficient construction. The outline presentation categories listed did not always feel like clearly distinct presentation sections, and some of the topics carried across presentation categories.

Comprehensiveness and Usefulness—HVAC-IAQ Presentations

The HVAC-IAQ presentations should be very useful for people in the field who need to be brought up to speed on how to meet the new requirements. These presentations provided excellent detail, both on the requirements and the consequences of doing things improperly. The presentations used multiple photos of examples of good and bad work while talking through the problems represented (such as insufficient insulation, unsealed ductwork, poorly routed ducts, consequences of abrupt directional changes, and consequences of using flex duct vs. straight duct).

The presentations spent the most time covering ducts and ventilation issues. The stretch code was a very minor focus of the presentations, discussed for a couple of minutes while introducing the new code. The stretch code was also discussed at the beginning of these presentations

¹ Since this memo was originally issued on October 18, 2015, an enhanced handout package has been provided to training attendees starting on November 9, 2015. The handouts include about two-thirds of the slides used in the trainings (picture slides are excluded) and other information. NMR believes these handouts should address most of the related concerns raised in this process assessment.



along with descriptions of the IECC 2012 updates, with a brief comparison and explanation of how the stretch code that is in force in some towns is still based on the 2009 IECC code rather than the updated 2012 IECC code. The presenter added that the stretch code can still be quite stringent compared to the 2012 IECC code due to the stricter inspection requirements, even if it does not match 2012 IECC on every measure.² Table 1 lists the approximate time durations of each topic for both HVAC-IAQ trainings.

² NMR paid particular attention to the handling of the stretch code since many code officials and some builders who attend the trainings work in stretch code communities. More information on how attendees from stretch code communities use what they learn at the trainings will be provided in the analysis of the follow-up interviews.



Table 1. Topics Covered and Duration for HVAC-IAQ Trainings

Topic	May 29 th Training		September 29 th Training	
	Duration (minutes)	Percent of total training time	Duration (minutes)	Percent of total training time
Ventilation	34	28%	31	22%
System/duct sizing	21	18%	21	15%
Ducts	19	16%	37	26%
Indoor air quality	17	14%	25	18%
Code updates/stretch code	9	8%	6	4%
Introduction	7	6%	8	6%
Real world problems	4	3%	4	3%
Mechanical systems	3	2%	2	1%
Resources/wrap-up	3	2%	1	1%
Lighting	2	2%	<1	<1%
Incentives	1	1%	5	4%

Materials—HVAC-IAQ Presentations

The slides used in the HVAC-IAQ presentations were quite good, with limited text, encouraging the audience to listen to the presenter rather than focus on trying to read wordy slides. However, there were a large number of slides, and they were not made available to the attendees, limiting their use as a reference source for attendees. The presenter addressed this issue after someone asked for the slides, saying that their organization’s policy was to encourage people to attend the trainings and be engaged rather than looking at slides/handouts. She also said they were concerned that people would just rely on PowerPoint slides if they were made available and would not attend trainings, which would result in them missing the richer material that was conveyed verbally. However, NMR believes that having access to the slide deck and the many links that are provided in it is a valuable resource. At a minimum, at least a handout that contains some of the key takeaways would be very useful to the attendees.³ The handouts provided at the presentations were barely discussed, other than noting that they were there, and participants could look at them for more information. While the agenda and REScheck checklist provided in the handouts are very helpful as a summary of the key things inspectors look for, more attention could have been called to that document.

The minimal materials provided mean that the training itself does not serve as a resource for future reference. It does serve as a good starting point, and the attendees are encouraged to look to other sources, though those sources were only summarily addressed. The HVAC-IAQ presenter did mention early in the session that CLEARresult can do visits to offer help on specific projects, but there was no discussion of what would be involved or how this would be arranged.

³ As noted above, the trainings have recently addressed this issue.



Structure and Pace—HVAC-IAQ Presentations

The HVAC-IAQ presenter (the same individual presented both sessions) was very good overall—she was quite knowledgeable and clearly an expert in this field. She also appeared friendly, calm, and humorous, keeping the audience engaged through what can be a dry topic. She maintained a steady pace throughout the trainings and did not appear rushed, even at the 5/29 HVAC-IAQ, which had a delayed start due to technical difficulties (she did not take a break herself at that training but encouraged the attendees to do so if needed). In order to stay on schedule, she declined to provide detailed answers to attendee questions that were off topic or would be addressed later in the presentation, asking them to either look up the answers in the reference materials provided or wait to see if their question would be addressed later in the relevant section of the presentation. Audience members may not always have appreciated these moments of the presenter exercising control over the pace of the presentation, but they did seem to respect her explanation and the need to stick to the presentation schedule.

The HVAC-IAQ presenter was particularly helpful in explaining the real-world difficulties that may lead to some projects failing to meet certain provisions of the code. She also explained how following code practices is important and leads to better outcomes despite the difficulties some builders and contractors might face—that is, she provided the rationale for compliance. The trainings delved into specific situations, using numerous real-world examples of good and bad practices. The presenter emphasized important issues, such as putting ducts in conditioned space. She also provided the code officials with tips for enforcement—for example, checking Manual J calculations to ensure there is no gaming of the system.

Comprehensiveness and Usefulness—Envelope and Building Science Presentation

The EBS presentations should also be very useful for people in the field who need to be brought up to speed on how to meet the new 2012 IECC requirements, with a significant focus on issues of building science. The trainings would be less useful to true novices in this field who might benefit from an even more basic introduction to building science. The focus of the presentation included real-world examples of how to follow advanced building science principles as well as the new code requirements. As with the HVAC-IAQ presentations, the EBS presentation provided excellent detail both on the new code requirements and the consequences of not following best practices for energy-efficient construction. The presentation used multiple photos of examples of good and bad work while talking through the problems represented (such as ice dams, water infiltration problems, and poor insulation quality).

The presentation spent the most time on discussions of sealing and testing the building envelope, but topics related to building science generally overlapped, with similar topics covered in the various sections of the presentation. Principles discussed in the general building science section were reinforced in the component-specific sections and discussions of real-world problems. As with the HVAC-IAQ trainings, there was little focus on stretch code. The presenter talked about the stretch code at the beginning of the presentation for less than four minutes, explicitly noting that the presentation was designed to focus on 2012 IECC code because it was the new code, and most attendees would have already been exposed to stretch code



requirements.⁴ Similar to the HVAC-IAQ presentations, he provided a brief comparison of 2012 IECC to stretch code and talked about how the overall level of energy efficiency is similar, but the stretch code might be stricter at times due to the verification requirements. Table 2 lists the approximate time durations of each topic for the EBS training.

Table 2. Topics Covered and Duration for the EBS Training

Topic	Duration (minutes)	Percent of total training time
Envelope sealing/testing	29	17%
Basements/slabs	22	12%
General building science	18	10%
Ceilings/roofs	14	8%
Code updates	13	8%
Intro	13	8%
Real-world problems	13	8%
Windows/walls	12	7%
Stretch code	10	6%
Insulation	10	6%
REScheck	6	3%
Resources/wrap-up	5	3%
Ducts	4	2%
Incentives	3	2%
Lighting	0.5	<1%

Materials—EBS Presentation

Similar to the HVAC-IAQ trainings, the slides were very good, but there were a large number of them and they were not made available to the attendees. One attendee specifically complained about not being given a handout with the slides on it and wanted to have a handout to follow along with the presentation and take notes. He also noted that the insulation requirements that had just been described in the presentation were not listed in the handouts available. The presenter responded that he was just doing what he had been told to do and that they had decided not to provide the slides. Again, this issue appears to have been addressed since NMR attended the trainings.

⁴ Many towns in central Massachusetts, where this training was held, have not adopted the stretch code and thus come under 2012 IECC. However, the larger cities, such as Springfield and Worcester, are under the stretch code.



The presenter briefly listed the contents of the handouts at the beginning of the presentation, and did call some attention to the REScheck checklist provided, but did not rely on or refer to these materials much through the presentation. As in the case of the HVAC-IAQ trainings, NMR believes that having access to the slide deck—or an abbreviated version designed to focus on key takeaways—and the many links that are mentioned in the trainings as resources would be very useful to the attendees.

Structure and Pace—EBS Presentation

The EBS presenter was very good overall; he spoke clearly and knowledgeably and demonstrated an excellent understanding of the material. He appeared to be an expert in the field with a technical focus and was also humorous with good eye contact. He also responded well when the attendees disagreed with him, making a good case for the material he presented.

The pace of the EBS training was somewhat uneven due to a high level of audience involvement. This caused the presenter to rush at the end to cover the final topics; the training was thus more heavily weighted to the topics at the beginning of the agenda.

The EBS training topics overlapped quite a bit; there was much useful, related, technical information, but the presentation categories were not very distinct from one another. It did seem that the presentation jumped around a bit; for example, slab insulation was discussed for about ten minutes at the beginning of the presentation; then there was a basement/slab section that took another ten minutes later in the presentation. Other topics were also treated this way.

Training Attendees

The participants at the training sessions NMR attended were mostly code officials and energy efficiency specialists. The 5/29 HVAC-IAQ training had 22 attendees; about one-half were code officials and most of the remainder were energy efficiency specialists including HERS raters, based on a show of hands. There appeared to be only one or two builders at this training. The 9/29 HVAC-IAQ training had 14 attendees; again, about one-half were code officials, and the remainder were mostly HERS raters, with two architects and two HVAC technicians. The 6/5 EBS training had 16 attendees, mostly code officials and energy specialists, with a few architects and developers. Different questions were brought up at the trainings and the presenters' interactions with the attendees also varied.

Questions and Issues Raised—HVAC-IAQ Trainings

Several attendees asked questions and expressed opinions during the HVAC-IAQ presentations and received responses covering the following topics:

- Belief that homes are built too tight (presenter acknowledged this concern and explained why she disagreed).
- Code official claimed that builders do not know how to use Manual J or even what it is (presenter stressed its importance).
- What are the available rebates for construction or equipment (presenter pointed to MassSave.com).
- Always-on ventilation equipment requires maintenance, and when installed in low-income housing, it does not get maintained, which is harmful to the occupants (presenter



acknowledged importance of maintenance, and said that is not just a low-income problem; developers and builders should express these concerns to manufacturers).

- Belief that builders do not know that they are supposed to be insulating foundation walls (presenter addressed this briefly and said that was unfortunate, but she wanted to move on to cover the bigger picture and key topics).
- When HERS ratings are required (presenter clarified).
- Which code is used in Massachusetts (presenter clarified the stretch code based on the 2009 IECC code is used in some cities and towns and the 2012 IECC code is used in the rest of the state).
- Do bathroom fan ducts need to be insulated? (presenter replied yes, to avoid condensation).
- Do any gas dryers provide fresh combustion air? (presenter replied no, and gas dryers are bad for indoor air quality).
- What inputs go into a load calculation? (presenter gave clear, helpful description)
- Multiple comments on code officials' experience in the field with below-code work.

Overall Handling of Attendee Issues—HVAC-IAQ Trainings

The presenter's handling of questions and other attendee issues was excellent—she acknowledged people who had already spoken and remembered their previous comments. She was very polite in dealing with opinionated questioners—disagreeing with them while acknowledging their concerns and making a good case for her perspective. She also handled a disruptive pair of attendees who were whispering between themselves rather than listening or asking questions by good-naturedly scolding them. In the future, it may be advisable to ask the attendees up front not to have side conversations—they are very distracting in a classroom setting.

There was no formal Q&A at the end of the presentations, but the presenter went up to attendees who wanted to ask questions at the end of the session and talked with them directly; this is a good strategy for getting those not wanting to speak up during the presentation to participate.

The presenter also engaged the trainees by asking several questions on the material presented. The attendees voted anonymously on these quiz questions, both before and after receiving the information (with some attendees still providing the wrong answers). Unfortunately, the Audience Response System (ARS) using hand-held clickers did not work at all at the 5/29 HVAC-IAQ session due to the technical difficulties experienced on that day. At the 9/29 HVAC-IAQ session, the ARS clickers had not been properly calibrated, showing an incorrect number of clickers in use.

The ARS at the 9/29 HVAC-IAQ training did provide some interesting information on how much the attendees knew going in. For example:

- One-half of the attendees incorrectly answered whether or not ventilation was a new requirement under 2012 IECC, prior to the presenter explaining it.
- Two-thirds were incorrect about whether or not code required stoves to be vented outside, prior to presenter explaining the requirement.
- Three-quarters were correct about duct leakage testing not being a new requirement for 2012 IECC code, prior to the presenter explaining it.



- Only slightly more than one-quarter of attendees answered correctly as to what type of bathroom ventilation fans were required by code, even after the presenter had covered the area.

Questions and Issues Raised—EBS Training

Most attendees (11 out of 16) asked questions and expressed opinions during the EBS presentation and received responses covering the following topics:

- Is the stretch code more flexible or more stringent than IECC 2012 (presenter believes the stretch code is more flexible since it uses the performance path, but probably more stringent in terms of energy efficiency, while he had heard that it is more difficult to comply with the 2012 IECC code due to less flexibility in meeting the code's requirements).
- Does the stretch code checklist have to be verified by someone other than builder; a HERS rater will not sign off on something he has not seen (presenter replied that this varies across jurisdictions; they cannot see everything, so they have to make a call on what they will allow without having seen it).
- What kind of ventilation can be used to meet new requirements? (presenter provided a clear example of different options).
- Does the code require a dedicated fresh air intake channel? (presenter replied “No,” but that it is a good idea to use a balanced system if the house is really tight to avoid problematic negative pressures).
- What to do about homeowners (particularly low-income) shutting off ventilation systems to avoid wasting heat, as this practice causes moisture problems and condensation on bathroom walls (presenter replied that this is a challenge and needs to be addressed with consumer education).
- How to insulate and air seal properly when the builder uses ceiling strapping (presenter replied that dead air space is a problem if not sealed really well; attendee and presenter argued a bit, but they accepted that there are different situations; presenter reaffirmed his final point).
- Belief that long-term water condensation issues will arise from the code requirements and the energy code is not taking that into account (presenter replied that they will find out over time what the consequences are; there was a bit of back and forth discussion among the attendees; the issue was not fully resolved).
- How to label blown-in wall insulation and test for its R-value (presenter replied that it is a judgment call and depends on rater or code official).
- What does unconditioned volume mean? (presenter provided official code definition and acknowledged that some code officials look at it differently).
- How to seal fireplaces (presenter provided a clear example).
- Are there fire-rated spray-on insulation materials? (presenter did not know).
- Builders object to some of the new code requirements due to cost (presenter affirmed comment).
- Multiple attendees discussed rotting assemblies due to improper water barriers (presenter provided a technical example; there was some back and forth about assemblies rotting because they cannot dry out; some attendees did not seem totally satisfied with the presenter's response, but eventually agreed that they did not want two vapor barriers).



Overall Handling of Attendee Issues—EBS Training

The EBS training included much more questioning and discussions about building science and code upgrades than the HVAC-IAQ trainings. The attendees asked a lot of questions about what exactly the code requires and how to meet those requirements. They also spoke at length about the issues they face in the field when builders and contractors do not know the requirements or how to meet them. As noted in the listing of the questions asked, attendees did express their disagreement with code requirements and what they perceived as the negative impacts of these practices.

The presenter encouraged lively audience participation and the attendees seemed to appreciate the discussions. When there were disagreements, the presenter did a good job of acknowledging the attendees' opinions and pointing out where their understanding did not match his. He typically reaffirmed his own point of view after some back and forth, most of the time to close out the issue. The drawback to all the discussions, as noted above, was that they took a fair amount of time, resulting in the presenter rushing at the very end of the presentation and giving less time to the areas at the end of the agenda. Providing copies of the presentation slides to the attendees would have been particularly useful in this case where there was not enough time to cover everything in the classroom.

The ARS worked well at the EBS training; the presenter asked about ten questions, which appeared to engage the attendees.

Conclusions

NMR found all three residential classroom trainings attended to be very good overall. Both presenters did a fine job in conveying the information to the attendees and also in dealing with unexpected technical glitches and attendees fostering long discussions on the code and conditions in the field. After attending three presentations, NMR believes the trainers should consider making the slides, or a tailored version designed for future reference, available to all attendees—preferably, when they sign in at the beginning of the sessions. This issue appears to have been addressed recently. Additional focus should be given to the reference materials that attendees can use to answer questions in the future; these (websites, support phone numbers, etc.) were typically mentioned quite briefly, when they should be emphasized to the attendees. While the trainings are quite good, they can only be seen as an entry point to the topics discussed, and the attendees will undoubtedly have questions in the future that need to be answered.

Finally, it is important to continue to offer the trainings. As noted through the ARS use at the 9/29 HVAC-IAQ training, a large number of attendees go into these trainings with limited knowledge of the code requirements. The trainings also provide a venue for code officials, builders, HERS raters, and other market actors to discuss conditions in the field affecting code compliance.

