Building Science Institute, Ltd. Co. Process 005-2024 Quality Control Conformity Assessments for Verification Organizations

This process applies to Building Science Institute, Ltd. Co. True North Quality Management Services Quality Assessors and Building Science Institute-credentialed Verification Organization Quality Assessment Designees, Verifiers, and Software Analysts.

Related policies:
- Building Science Institute, Ltd. Co. Policy 05-2022 Secondary Interests
- Building Science Institute, Ltd. Co. Policy 08-2022 Terminology
- Building Science Institute, Ltd. Co. Policy 09-2022 General Requirements for Verification Organizations
- Building Science Institute, Ltd. Co. Policy 10-2022 Structural Requirements for Verification Organizations
- Building Science Institute, Ltd. Co. Policy 11-2022 Resource Requirements for Verification Organizations
- Building Science Institute, Ltd. Co. Policy 12-2022 Process Requirements for Verification Organizations

Reference Documents

Building Science Institute Policy 05 Secondary Interests

Building Science Institute Policy 09 General Requirements for Verification Organizations

Building Science Institute Policy 10 Structural Requirements for Verification Organizations

Building Science Institute Policy 11 Resource Requirements for Verification Organizations

Building Science Institute Policy 12 Process Requirements for Verification Organizations

Building Science Institute Policy 14 Referenced Standards, Codes, and Programs

Building Science Institute Process 001 Ethics Compliance & Homeowner Inquiry Resolution

Building Science Institute Process 002 Training & Certification System

Building Science Institute Process 003 Conformance Assessment Program Management

Building Science Institute Process 004 Prepare & Plan a Conformity Assessment

Building Science Institute Process 006 Assessment Report

Building Science Institute Process 007 Conformity Assessment Follow-up & Closure

Building Science Institute Process 009 Root Cause Analysis

Building Science Institute Procedure A Field Conformity Assessment

Building Science Institute Procedure B File Conformity Assessment

Building Science Institute, Ltd. Co. Procedure C Organizational Conformity Assessment
ENERGY STAR Certification Protocols
ENERGY STAR Checklists
Indoor airPLUS Certification Protocols
Indoor airPLUS Specifications
Zero Energy Ready Home Certification Protocols
Zero Energy Ready Home Checklists

Level One: Is the Work Done?
Level One is the structured workflow process embedded in HouseRater. For each verification visit (airsealing, pre-drywall, final, etc), each element to be verified at that visit is identified in HouseRater. If the Verifier attempts to close the visit without verifying a required element, HouseRater prompts them to verify the element or manually override the prompt.

The manual override may be necessary in cases where the element is not present at the time of the verification visit, and will be added to the list of elements to be verified on the next visit or a re-verification visit scheduled when the element is present.

HouseRater flags the missing data.

Level Two: Is the Work Complete?
Level Two is the review by a Software Analyst of the data collected in HouseRater by a Verifier. The Software Analyst checks for flags created by missing data, based on program participation requirements.

If the Verifier work is not complete and required data is missing, a Field Verifier must collect and document the missing data in HouseRater.

Level Three: Does the Verifier Know What Data to Collect & Document?
When HouseRater flags missing data, it notifies the Quality Assessor or Quality Assessment Designee. The Quality Assessor or Quality Assessment Designee contacts the Verifier to discuss why the data was not collected and records the reasons given. These responses are tracked to identify if a systemic problem exists that needs correction. If the missing data causes a change in the ERI of more than 3 points or results in 1 non-conformance item on ENERGY STAR, Indoor airPLUS, Zero Energy Ready Home QA Checklists, the Quality Assessor or Quality Assessment Designee must perform an observation of the Verifier in conformance with Building Science Institute Procedure A Field Conformity Assessment.

This assessment identifies gaps between Verifier performance and conformance with ANSI/RESNET/ICC Std 301, ANSI/RESNET/ICC Std 380, ANSI/RESNET/ICC Std 310, and ENERGY STAR, Indoor airPLUS, and Zero Energy Ready Home Certification Protocols.The following non-conformances must trigger that additional review, either remotely or in-person:

- Differences between field data collected and documentation that create more than 3 points difference on ERI
- Differences between field data & documentation collected and file data that create more than 3 points difference on ERI
- More than 5 non-conformance items on Building Science Institute Procedure A Field Conformity Assessment Checklist (data collected does not align with documentation collected)
- 1 non-conformance item on ENERGY STAR, Indoor airPLUS, Zero Energy Ready Home QA checklist
- Non-conformances that trigger additional reviews must undergo a root cause analysis in conformance with Building Science Institute Process 009 Root Cause Analysis

Level Four: Is the Data Reasonable?
As data is collected and entered into HouseRater, validation checks are made on over 300 elements depending on as-built features. These validations checks are for reasonability. If entered data is outside the reasonability boundaries, that element is red-flagged which prevents certification.

The Software Analyst may manually override a red-flagged item in cases where the reasonability boundary does not represent the as-built element.

Level Five: Is the Data Unreasonable?
If a Software Analyst manually overrides a red-flagged item from Level Four, HouseRater notifies the Quality Assessor. The Quality Assessor must perform an observation of the Software Analyst in conformance with Building Science Institute Procedure B-2023 File Conformity Assessment. This is the Software Analyst equivalent of the Verifier field observation.

This assessment identifies gaps between Software Analyst performance and conformance with ANSI/RESNET/ICC 301 and ENERGY STAR, Indoor airPLUS, Zero Energy Ready Home Certification Protocols.The following non-conformances must trigger that additional review, either remotely or in-person:

- Differences between field data collected and documentation that create more than 3 points difference on ERI
- Differences between field data & documentation collected and file data that create more than 3 points difference on ERI

- More than 5 non-conformance items on Building Science Institute Procedure B File Conformity Assessment Checklists (data collected does not align with documentation collected)
- 1 non-conformance item on ENERGY STAR, Indoor airPLUS, Zero Energy Ready Home QA checklist
- Non-conformances that trigger additional reviews must undergo a root cause analysis in conformance with Building Science Institute Process 009 Root Cause Analysis

Level Six: Can the Home be Certified as an ENERGY STAR, Indoor airPLUS, Zero Energy Ready Home New Home?

Prior to certification as a Certified ENERGY STAR, Indoor airPLUS, Zero Energy Ready Home, the Quality Assessor or Quality Assessment Designee reviews the HouseRater quality control dashboard to ensure the project does not have any outstanding issues, is under the correct program version based on permit date, and is eligible for the label and certificate.

Level Seven: Does the Process Work?

The Quality Assessor reviews a randomly selected sample of files through HouseRater. The population size for file reviews must not exceed 3,460 rating files per Software Analyst or Verifier per Metropolitan Statistical Area (MSA as defined by the Bureau of Economic Analysis for the Office of Management & Budget) per calendar year.

The sample size must be chosen to provide a 95% confidence level, a population proportion of 0.5, with a 5% margin of error to be considered statistically significant.

Population proportion of failures is the number of failures divided by the population size. In the context of certifying homes, it is the fraction of homes that get certified as compliant when they do not comply. This parameter is generally unknown, but needed in order to calculate an appropriate sample size for a binomial distribution. As a consequence, the conservative choice of 0.5 is generally used, because it yields the largest sample size.

Z-score is a standardized value that represents the standard deviations of a member of population from the mean. The equation to calculate z-score is: z = (population - mean of population)/standard deviation of population. 95% of an evenly distributed population will have a z-score of 1.96.

Margin of error is how much error is allowed.

Confidence is the proportion of times the answer will be right.

For an online calculator for this equation, visit calculator.net/sample-size-calculator.html and enter the required data (confidence level, margin of error, population proportion, and population size) to calculate the required sample size.

Necessary sample size from a finite population that provides 95% confidence (+ 5% margin of error) that a randomly selected home from that population earned certification is calculated with this equation:

Sample size for finite population = (Z-score2 * PopProp * (1-PopProp) / margin of error2) / (1 + (((Z-score2 * PopProp * (1-PopProp) / margin of error2) -1) / population))

For example, if a Software Analyst or Verifier performed 4,000 certifications in a MSA in a calendar year:

Population cap is = 3,460

Confidence Level = 1.96, the corresponding Z-score constant for 95%

Population proportion = 0.5

Margin of Error = 0.05, 5%

Sample Size n = (1.962 * 0.5 * (1-0.5) / 0.052) / (1 + (((1.962 * 0.5 * (1-0.5) / 0.052) -1) / 3460))

n = (3.8416 * 0.5 * 0.5 / 0.0025) / (1 + (((3.8416 * 0.5 * 0.5 / 0.0025) -1) / 3460))

n = (3.8416 * 0.25 / 0.0025) / (1 + (((3.8416 * 0.25 / 0.0025) -1) / 3460))

n = (0.9604 / 0.0025) / (1 + (((0.9604 / 0.0025) - 1) / 3460))

n = 384.16 / (1 + ((384.16 -1) / 3460))

n = 384.16 / (1 + (383.16 / 3460))

n = 384.16 / (1 + 0.11073)

n = 384.16 / 1.11073

n = 345.86

The number of file reviews required must be rounded to nearest whole number, e.g., 101.4 is rounded to 101 and 67.6 is rounded to 68. A number ending in $\geq$ 0.5 is rounded up and <0.5 is rounded down.

A sample size of 346 files reviewed for conformance is required for a population of 3,460 energy ratings.The remaining 540 files (4,000 -3.460) form a new population requires a file review sample size of 225 files, in addition to the 346 files reviewed in the first population group.The total file reviews required is, at a minimum, 571 files for that Software Analyst or Verifier.

Non-conformances discovered through routine Quality Management work conducted by the Quality Assessor or Quality Assessment Designee may trigger an additional review of the responsible party's verification activities. The following non-conformances **must** trigger that additional review, either remotely or in-person:

- Differences between field data collected and documentation that create more than 3 points difference on ERI
- Differences between field data & documentation collected and file data that create more than 3 points difference on ERI
- More than 5 non-conformance items on Building Science Institute Procedure A Field Conformity Assessment and Procedure B File Conformity Assessment Checklists (data collected does not align with documentation collected)
- 1 non-conformance item on ENERGY STAR, Indoor airPLUS, Zero Energy Ready Home QA checklist
- Non-conformances that trigger additional reviews must undergo a root cause analysis in conformance with Building Science Institute Process 009 Root Cause Analysis

This assessment identifies gaps between performance and conformance with ANSI/RESNET/ICC Std 301, ANSI/RESNET/ICC Std 380, ANSI/RESNET/ICC Std 310, and ENERGY STAR, Indoor airPLUS, Zero Energy Ready Home Certification Protocols.

Level Eight: Are the Verifiers & Software Analysts Performing the Correct Procedures?

Annually (or more frequently if errors are discovered during the course of normal QA/QC Level 1 - 7 activities), each Verifier & Software Analyst must be observed performing field verification / software analysis on a dwelling unit by a Quality Assessor or Quality Assessment Designee.

Field Verifiers are observed for conformance in accordance with Building Science Institute Procedure A Field Conformity Assessment and Software Analysts are observed for conformance in accordance with Building Science Institute Procedure B File Conformity Assessment.

Verifiers are observed for both Building Science Institute procedures.

This assessment identifies gaps between performance and conformance with ANSI/RESNET/ICC Std 301, ANSI/RESNET/ICC Std 380, ANSI/RESNET/ICC Std 310, ENERGY STAR, Indoor airPLUS, Zero Energy Ready Home Certification Protocols.

Level Nine: Does the Verification Organization's Quality Management System Conform with Building Science Institute Policies, Processes, & Procedures?

Annually (or more frequently if errors are discovered during the course of normal QA/QC activities warrant), the Building Science Institute's True North Quality Management Services Quality Assessors must perform an assessment of the verification organization's Quality Management System in accordance with Building Science Institute Procedure C Organizational Annual Conformity Assessment.

This conformity assessment includes a review of conformance with Building Science Institute Policies 09 General Requirements for Verification Organizations; 10 Structural Requirements for Verification

Organizations; 11 Resource Requirements for Verification Organizations; 12 Process Requirements for Verification Organizations; and ENERGY STAR®, Indoor airPLUS, Zero Energy Ready Home Certification Protocols and referenced standards.

Assessment Data Collection and Analysis

Energy simulation files for every Certified ENERGY STAR®, Indoor airPLUS, Zero Energy Ready Home shall be collected by the Building Science Institute through HouseRater.

HouseRater quality control checks include, but are not limited to, more than 300 checks for validity and reasonability on inspection requirements, program-level validations, project reasonability, climate, building, utilities, garages, floors, foundations, roofs, ceilings, doors, windows, walls, cooling systems, heating systems, duct systems, thermostats, infiltration, mechanical ventilation, water heating, rim joists, slabs, skylights, solar thermal systems, PV systems, clothes washers, clothes dryers, dishwashers, refrigerators, dehumidifiers, ranges, and lighting.

Documentation reviews are to identify gaps between site data and documentation collected, between site data & documentation collected and energy simulation files, for completion of referenced program checklists (ENERGY STAR, Indoor airPLUS, Zero Energy Ready Home), and to ensure the verifier reviewed the National HVAC Design Report.

- For verification organizations with internal Quality Assessment Designees, the internal quality function must review the flagged items from the HouseRater quality control reports in conformance with Levels 3 & 5 QC.
    - True North QMS assessors assigned to the verification organization review the HouseRater quality control reports with the verification organization's internal quality function monthly.
- For verification organizations without internal Quality Assessment Designees, True North QMS assessors must review the flagged items from the HouseRater quality control reports on an on-going basis.

Verifiers must have their work observed either in real-time or through HouseRater on an on-going basis in conformance with Level 3 & 5 QC. A gap assessment between the verifier or software analyst's original work and file reviews / field observations by the Quality Assessor / Quality Assessment Designee shall be performed by the Quality Assessor / Quality Assessment Designee.

- For verification organizations with internal Quality Assessment Designees, the internal quality function must perform the observations in real-time or through HouseRater on an on-going basis.
    - File reviews are performed after all verification activities (site data collection and software analysis) have been performed and prior to certification of home, in conformance with Level 7 QC.
    - Each Verifier and Software Analyst must have 1 annual review of their verification activities, either remotely or in-person, in conformance with Level 8 QC.
- For verification organizations without internal Quality Assessment Designees, the assigned True North QMS Quality Assessor must perform the file reviews in real-time or through HouseRater on an on-going basis.
    - File reviews are performed after all verification activities (site and software analysis) have been performed and prior to certification of home, in conformance with Level 7 QC.
    - Each Verifier and Software Analyst must have 1 annual review of their verification activities, either remotely or in-person, in conformance with Level 8 QC.
- For multi-family projects, the dwelling units selected should be 1st floor units adjacent to garages or elevator shafts; upper floor units adjacent to stairwells or elevators; top floor units on corners of the building.

The assessment criteria are:

- Differences between field data collected and documentation that create more than 3 points difference on ERI
- Differences between field data & documentation collected and file data that create more than 3 points difference on ERI

- More than 5 non-conformance items on Building Science Institute Procedure A Field Conformity Assessment and Procedure B File Conformity Assessment Checklists (data collected does not align with documentation collected)
- 1 non-conformance item on ENERGY STAR, Indoor airPLUS, Zero Energy Ready Home QA checklist

If a Verifier or Software Analyst has more than 2 projects that are non-conforming in a 12 month period, that individual must be placed on suspension in conformance with Building Science Institute Process 001 Ethics Compliance & Homeowner Inquiry Resolution.

If a Verifier or Software Analyst has more than 3 projects that are non-conforming in an 18 month period, that individual must have their credential revoked per Building Science Institute Process 001 Ethics Compliance & Homeowner Inquiry Resolution.

If objective evidence shows conclusively that a Verifier or Software Analyst has deliberately conducted their verification activities to permit a home that does NOT meet the ENERGY STAR New Homes program requirements to become certified, that individual must have their credential revoked by the Building Science Institute.

On an annual basis, the Building Science Institute's True North Quality Management Services must assess (Level 9 QC) the verification organization's conformity, using Building Science Institute Procedure C Organizational Annual Conformity Assessment, against the following criteria:

- ENERGY STAR New Homes Certification Process requirements
- Indoor airPLUS Certification Process requirements
- Zero Energy Ready Home Certification Process requirements
- ANSI/RESNET/ICC 301
- ANSI/RESNET/ICC 380
- ANSI/RESNET/ACCA 310
- ANSI/ACCA Standard 12 QH
- Building Science Institute Referenced Policies
- Building Science Institute Referenced *Processes*
- Building Science Institute Referenced Procedures

This is a document and record examination that includes, but is not limited to:

- Software files used to generate ERI for ENERGY STAR or Zero Energy Ready Home certification
- Verifier credentials
  - only verifiers/software analysts who have been credentialed to perform verifications in conformance with ENERGY STAR, Indoor airPLUS, Zero Energy Ready Home Certification Protocols are permitted to do verification work, including energy simulation files
  - rating organization must report list of verifiers/software analysts employed or contracted by them for inclusion in Building Science Institute database
- Training records
- Employee interviews
- Physical examination of Certified ENERGY STAR, Indoor airPLUS, Zero Energy Ready Home program homes
- Data analysis
- Performance reports by internal Quality Assessment Designees or True North QMS Assessors
- Customer feedback
- Observation of verification activities (on-site observations, performance testing, energy software analysis)
- Impartiality and independence of verification activities
- Confidentiality
- Administrative requirements
- Organization and management requirements
- Personnel
- Facilities and equipment
- Verification methods and procedures
- Handling verification items
- Verification records
- Certification reports and certificates
- Complaints and appeals

- General management system documentation
- Control of documents
- Control of records
- Management review
- Corrective actions
- Preventive actions

Remote observation of verification activities is permitted; a visual recording of the remote observation (with audio) is required to be kept for at least 3 years and made available to the Building Science Institute's True North QMS Quality Assessors.

Homes selected for file review and field observation should be as representative as possible across builders and communities.

For verification organizations with internal Quality Assessment Designees, during the annual conformity assessment the True North QMS Quality Assessors must observe and review documentation that the internal Quality Assessment Designees performed quality control per the Building Science Institute's quality assessment process.

Approved by Building Science Institute Quality Council on June 21, 2024.

Approve: Brian Christensen, Erik Straite, Kirsten Shaw, Tabetha Johnson

Reject: NoneNot Voting: Brett Dillon, Chair; Wes Davis