



REVIVE 2024

Good for the planet
Good for your buildings
Quality assured results

Overview

Outcome goals, process goals

Updates to the standard in response to public comments

Tiers

Certification Guidebook updates

QA Workbooks

Software Tool & Resources

REVIVE 2024

A retrofit standard for all kinds of existing buildings



Outcome goals

- Resilience
- Health
- Decarbonization

Process goals

- Quality assurance
- Openness

Thanks to all who commented on the public review draft



~ 15 unique commenters

~ 550 comments

Responded to individually

Response Options

Accepted

A: Accepted comment as submitted

Amin: Accepted, with minor changes
(same approach to the issue)

Abut: Accepted, in principle (a different
response to the issue is proposed)

Rejected

R: Rejected

Rbut: Rejected, except as noted
(majority of comment is not accepted)

Deferred

More: More information is needed

Doos: Deferred, Out-of-Scope

DL: Deferred, Late

Outcome Goals

Resilience | Air sealing, insulation, seismic, PV, batteries...

+

Health | Radon, Carbon monoxide, mold...

+

Decarbonization | Electrification, community solar, low-carbon choices...





Resilience Performance Protocol & Criteria

- Simulate seven-day outages, in extreme weather.
- Whole building remains habitable, not just a protected zone.
- On-site PV and batteries provide limited power.
- Assume full design occupancy for residential.
- Reduced ventilation rate 5 cfm/person.

Winter Resilience Criteria

- Zero hours below 35°F
- Limited degree-hours
≤ 216 SET-hours*, below 54°F
(*similar to LEED pilot credit)
- Critical electrical loads covered

Summer Resilience Criteria

- Zero hours of Heat Index in Danger
- Zero “deadly days”
- Critical electrical loads covered



Health and Hazards

EPA

1. Asbestos
2. Belowground contaminants (except radon)
3. Building products/material emissions
4. Carbon monoxide and other combustion appliance emissions (nitrogen oxides, VOCs and particulates)
5. Environmental tobacco smoke
6. Garage air pollutants (CO, benzene and other VOCs)
7. Lead
8. Moisture (mold and other biologicals)
9. Pests
10. Polychlorinated biphenyls
11. Radon
12. Wood smoke and other solid fuel emissions
13. Heating, ventilating and air conditioning (HVAC) equipment
14. Combustion safety, vented combustion appliances
15. Combustion safety, unvented combustion appliances
16. Source or local exhaust ventilation
17. Whole-dwelling ventilation for distributed contaminant sources
18. Home safety
19. Protecting IAQ during construction
20. Jobsite safety

Infectious aerosols

FEMA, IBHS

SEISMIC

FLOOD, TSUNAMI

HAIL

WIND

ICE DAMS, SNOW LOAD

WILDFIRE / smoke

Decarbonization

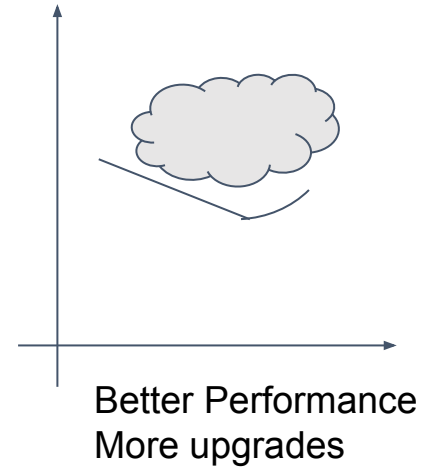
Cost Metric = Sum of these annualized costs:

- Direct energy cost. E.g. site kWh * \$/kWh = \$
- Direct building retrofit measures cost (material & labor)
including building-level electrification cost. E.g. ft3 of stuff * \$/ft3 = \$
- **Cost of carbon -- upfront/embodied. CO₂e kg * \$0.25/kg = \$**
- **Cost of carbon – operating. CO₂e kg * \$0.25/kg = \$**
- **Energy system transition cost. E.g. new solar + storage. \$/W * W = \$**

Plus additional decarbonization effort

- Electrification, renewable sources
- Embodied carbon

Life cycle cost



- Design as if there's a cost of carbon.
- Minimize total life cycle cost.



Process Goal – Quality Assurance

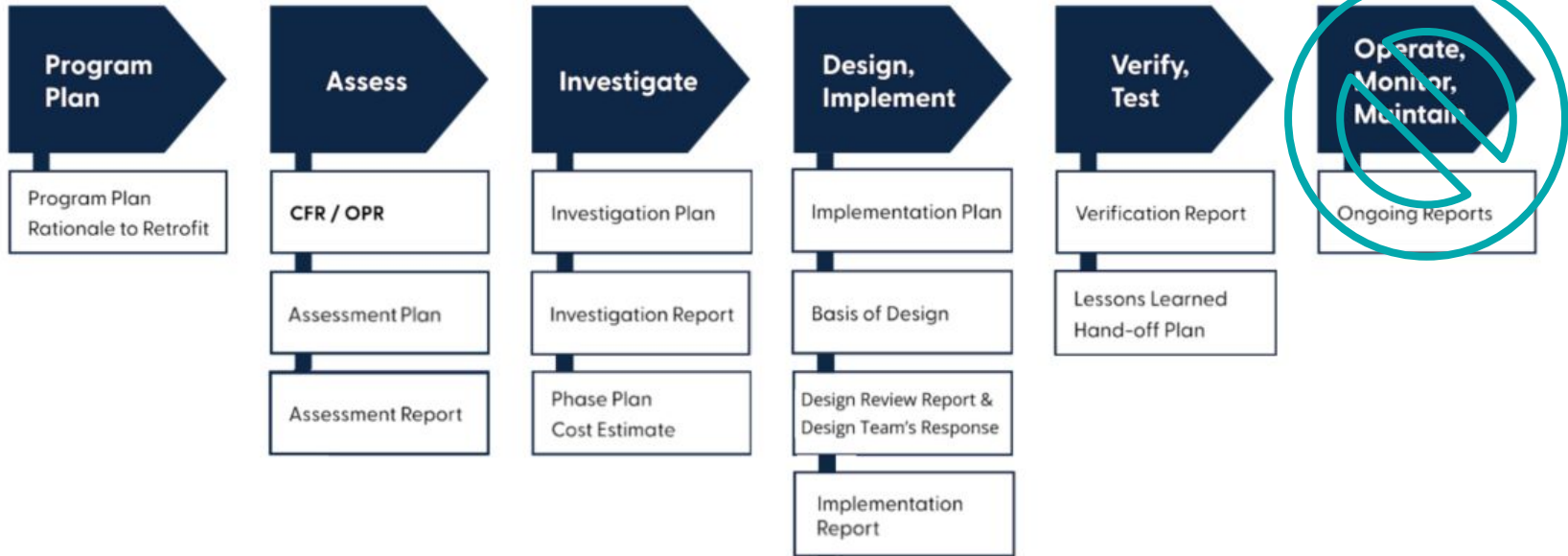
Compliance is documented

Zoning

Permit

C.O.

BPS







Process goal – Openness for Scalability

The Standard Document

- Written in code-mandatory language.
- All calculation protocol spelled out, for requirements on modeled performance.

Roles:

- Owner 
- Authority 
- Commissioning Provider 
- Verification & Testing Providers 

The Certification Program

- Our certification to the standard.
- Maintain open-source calculation engine.

Corresponding Roles for our certification to the standard:

- Owner
- Phius
- CPHC®
- Phius Raters & Verifiers

Owner is responsible for
Review & Approval of reports
on Elective Requirements



Top changes in response to comments

- Consistently distinguished requirements for residential versus nonresidential.
- Reimposed a specific post-retrofit air-tightness requirement.
- Batteries not strictly required – a tier is added where electrical operation during an outage does not have to be carbon-free.
- Electrification required by the final retrofit phase rather than the initial phase.
- No monitoring required for residential buildings.



New construction

Retrofit

H/C performance

S/E performance

IAQ, moisture mgmt

EPA/DOE QA process

————

————

————

————

Existing condition investigation

Resilience performance

Life cycle cost performance

IAQ, moisture mgmt

Site hazard fortification

ASHRAE Cx process

Monitoring / OCx



Guidebook Updates & QA Workbooks

- The REVIVE Program will be detailed in Section 3 of the Phius Certification Guidebook v24
- The intent of the *Guidebook* is to support the requirements outlined in the *Standard*
- The Guidebook will address:
 - Phius' Certification Process
 - Certification requirements (per the Standard)
 - Modeling protocol (per the Standard)
 - Documentation requirements for each phase (for Phius Certification)

Phius REVIVE 2024 Certification Requirements

| Table 3.3.0 Phius REVIVE 2024: Building Certification Requirements by Project Type | | | |
|--|---|---|---|
| Project Type | Single-Family, Duplexes & Townhouses | Multifamily | Non-Residential |
| Program Version | CORE & ZERO (for differences refer to Table 3.3.1) | | |
| Co-requisite Requirements | | | |
| Personnel | Phius Certified Rater or Verifier with Multifamily Designation | Phius Certified Verifier with Multifamily Designation | Phius Certified Verifier |
| EPA Indoor airPLUS ³⁷ | Construction Specifications Version 1 (Rev. 04) | | |
| | Refer to Section 1.4.1.1 | Refer to Section 1.4.1.2 | |
| EPA ENERGY STAR ³⁸ | Single-Family New Homes Version 3.2 Refer to Section 1.4.1.1 & Section 1.5.3.1 | Multifamily New Construction (MFNC) Version 1.2 Refer to Section 1.4.1.2 & Section 1.5.3.1 | |
| EPA Energy Savings Plus Health Guidelines | Publication No. EPA 402K21001 | Publication No. EPA 402K21002 | |
| ASHRAE Standard 227P | Section 7.5.5 | | |
| Energy Star Portfolio Manager | Monitoring recommend, but not required | | Monitoring required per Section 3.3.4 |
| Hazard Mitigation³⁹ | | | |
| Earthquake | Refer to Section 3.3.2 | | |
| Flood / Tsunami | IBHS FORTIFIED Commercial (Sec 3.2.4-3.2.5) | | |
| Hail, Snow Loads & Ice Dams | Refer to Section 3.3.2 | | |
| Structural / High Wind | Refer to Section 3.3.2 | | |
| Wildfire | FEMA Risk "Relatively Moderate" or higher: Defensible Space & Home Hardening Self-Inspection Checklist | | |



Phius REVIVE 2024 Certification Requirements

Table 3.3.0 Phius REVIVE 2024: Building Certification Requirements by Project Type (continued)

| Project Type | Single-Family, Duplexes & Townhouses | Multifamily | Non-Residential |
|---|--|-------------|-----------------|
| Program Version | CORE & ZERO (for differences refer to Table 1.3.1) | | |
| <u>Phius Passive Conservation Requirements</u> | | | |
| Resilience | Winter and Summer requirements outlined in Section 3.3.3.3 | | |
| Airtightness | Blower door testing is required to show compliance with limits outlines in Section 3.3.3.2 | | |
| Moisture Risk Mitigation & Comfort | Opaque assembly, detailing and fenestration requirements are outlined in Section 1.3.3.3 | | |
| <u>Phius Active Conservation Requirements</u> | | | |
| Life Cycle Cost Limit | The ADORB cost for all projects must not exceed that of a baseline case* | | |



Phius REVIVE 2024 Certification Requirements

| Table 3.3.1 Phius REVIVE 2024: Building Certification Requirements by Program Version | | |
|---|--|--|
| Project Type | Single-Family, Duplexes, Townhouses, Multifamily and Non-Residential | |
| Program Version | CORE | ZERO |
| Renewable Energy | | |
| On-Site Renewables | Credited with utilization factors applied as outlined in Appendix _. | Credited |
| Off-Site Renewables | Not credited. | Credited with utilization factors applied as outlined in Appendix _. |
| Battery Storage | Battery readiness required. | Required. |
| Combustion Equipment, Fireplaces and Appliances | | |
| Space Heating (natural gas furnace, boiler etc...) | Allowed with electrification readiness criteria per Appendix _. | Not Allowed. |
| Domestic Hot Water (natural gas water heaters) | | |
| Other Fossil-Fuel based Equipment | | |
| Appliances (natural gas cooking, natural gas dryer etc...) | | |
| Fireplace (Natural Gas) | Allowed if vented to the outside, with an airtight stove or fireplace box and electrification readiness criteria per Appendix _. | |
| Fireplace Insert or Wood Stove (Biomass-burning) | Allowed if vented to the outside, with an airtight stove or fireplace box. | |
| Fireplace (Open / Unvented / Ethanol) | Not Allowed. | |



Phius REVIVE 2024 Certification Process - Part 1

Table 3.1.1 Phius REVIVE 2024 Process Matrix

| AIA Project Phases | Phius Benchmarks | Guidebook | Phase Summary |
|-----------------------|---|-----------------------|--|
| Pre-Design (PD) | Phase 0 Programming | 3.1.1 | Rationale for Retrofit -A free online tool used to conduct a preliminary assessment for retrofit buildings Multi-Facility Planning -Project team makes an initial Program Plan and establishes the general scope of work to be completed |
| | Phase 1 Paperwork | 3.1.2 | Inquiry -Submitter requests a quote, invoice, & contract per building. |
| | Milestone 1 Project Registered | 3.1.3 | Registration -Initial registration fee is paid & contract is signed. -The project is now publicly visible on the Phius Certified Project Database. A Dropbox folder is shared by Phius with the Submitter. |
| Schematic Design (SD) | Phase 2 Assessment, Investigation & Review | 3.1.4 | Assessment & Investigation -Commissioning Provider (CxP) conducts existing building assessment and investigation, including creating and running the performance model Assessment & Investigation Review -CxP submits Assessment & Investigation deliverables to Phius -Phius Review & Feedback -CxP Revisions & Response -Repeat (as needed) |
| | Milestone 2 Assessment & Investigation Approval | 3.1.5 | Assessment & Investigation Approval -Phius approves the Assessment & Investigation deliverables. An official letter of approval is sent to the design team. -Phius creates and sends a Design Review Invoice which shall be paid before Phase 3 can begin. |



Phius REVIVE 2024 Certification Process - Part 1

Corresponds with Standard section:

- 4.5: Programming

| | | |
|-----------------------------------|-------|---|
| Phase 0 Programming | 3.1.1 | Rationale for Retrofit -A free online tool used to conduct a preliminary assessment for retrofit buildings Multi-Facility Planning -Project team makes an initial Program Plan and establishes the general scope of work to be completed |
| Phase 1 Paperwork | 3.1.2 | Inquiry -Submitter requests a quote, invoice, & contract per building. |
| Milestone 1 Project Registered | 3.1.3 | Registration -Initial registration fee is paid & contract is signed. -The project is now publicly visible on the Phius Certified Project Database. A Dropbox folder is shared by Phius with the Submitter. |

| | | | | |
|--|---------------------------------|---|---------------|--|
| Rationale for Retrofit | 4.5.1.1 Intended Building Life: | Indefinite / Permanent | | |
| | 4.5.1.2 Building Functionality: | Existing function will be maintained | | |
| | Existing Function | Residential: Multifamily Non-Residential: N/A | | |
| | New Function | Residential: [Select from dropdown] Non-Residential: [Select from dropdown] | | |
| | 4.5.1.3 Site and Land Use: | Climate migration risk values will automatically populate based on the Climate Migration Map published by PROPUBLICA based on the County defined in the 'Program Plan' tab below. | Cx Team Notes | |
| | 4.5.1.3.1 Climate Migration | Project County: | Centre County | |
| | | Heat Risk: | 3 | |
| | | WB Risk: | 4 | |
| | | Farm Crop Risk: | 3 | |
| | | Sea Level Rise Risk: | 1 | |
| 4.5.1.3.2 Zoning | Wildfire Risk: | 2 | | |
| | Economic Risk: | 4 | | |
| | Typical Zoning Designation: | Residential | | |
| | Specific Zoning Code: | [Enter Zoning Code (i.e. R-1)] | | |
| | Variance Needed: | No | | |
| Final Considerations & Cx Team Acceptance: | | This building may be an ideal candidate for retrofit. Please confirm acceptance of this determination by typing "X" in the box to the right. | | |

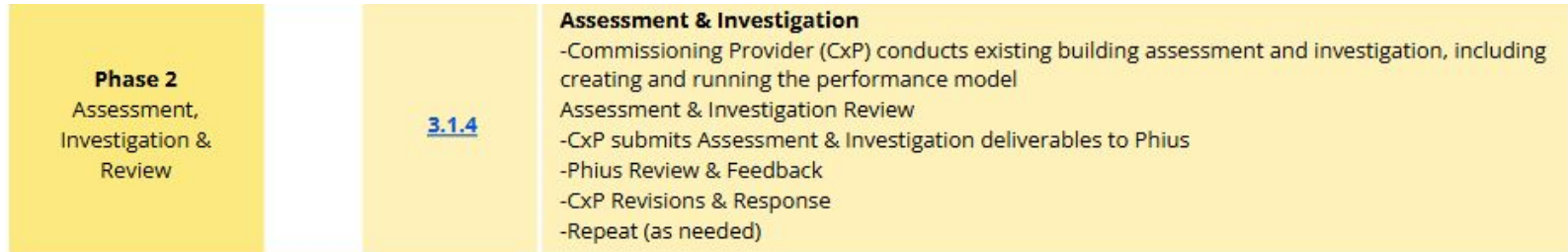
Snip from the Phius REVIVE 2024 Assessment & Investigation Workbook

| Phius REVIVE 2024 Programming Worksheet | | | | | EBCx Program Scope & Objectives | | | | |
|---|-------------------------|---------------|-------------------|-----------------------|---------------------------------|----------------------------|----------------------------|-------------------------|-------------------|
| Building Triage and Ranking | General | | | Owner Name: | Super Cool Owner | Program Mission Statement: | [Purpose for Retrofitting] | | |
| | | | | Submitter Name: | Super Cool Submitter | | | | |
| | | | | CPHC CxP Name: | Really Good CxP | Additional Notes: | | | |
| | | | | CPHC CxP #: | 12345 | | | | |
| | | | | City: | Boalsburg | | | | |
| | | | | State: | Pennsylvania | | | | |
| | | | | County: | Centre County | | | | |
| | | | | Facility Quantity: | 1 | | | | |
| | Facility Identification | | | | | Ranking Metrics | | | |
| | Facility Rank | Building Name | Existing Function | Approximate ICFA (sf) | Intended Function | Intended Building Life | Building Function | Climate Migration Score | Maintenance Needs |
| 1 | Building 1 | Residential | 10,000 | Residential | >30 yrs | No change | 3 4 | Moderate | |
| 2 | Building 5 | Residential | 15,000 | Mixed-Use | >30 yrs | Moderate change | 3 4 | Minimal | |
| 3 | Building 3 | Mixed-Use | 15,000 | Mixed-Use | >30 yrs | Slight change | 3 4 | Moderate | |
| 4 | Building 4 | Vacant / None | 10,000 | Residential | >30 yrs | Complete change | 3 4 | Considerable | |
| 5 | Building 2 | Industrial | 13,000 | Commercial | >30 yrs | Complete change | 3 4 | Considerable | |

Snip from the Phius REVIVE 2024 Multi-Facility Planning Tool



Phius REVIVE 2024 Certification Process - Part 1



Corresponds with Standard sections:

- 5.1 IAQ & Moisture Risk Mitigation
- 5.2 Hazard Mitigation
- 8.6: Assessment Phase
- 8.7 Investigation Phase

General Note:

- This phase is anticipated to be the 'heaviest lift' in terms of CPHC (aka CxP) involvement, planning, and time commitment

Major Documentation Requirements

- Compliance Tool & supporting documentation
- MBEST Workbook (Multifamily projects only)
- Phius REVIVE 2024 Assessment & Investigation Workbook



Phius REVIVE 2024 Certification Process - Part 1

| Table 3.4.2.0 Required Documentation for Phius REVIVE 2024: Phase 2 - Assessment & Investigation | | | | |
|--|--|--|---|--|
| | | Compliance Tool | Phius 2024 REVIVEcalc Results & Supporting Documentation | |
| | | Additional Documentation | DOE Multifamily Building Efficiency Screening Tool (MBEST) Workbook | |
| Phius REVIVE 2024 Assessment & Investigation Workbook | Issues & Resolutions Log | | Feedback channel between Cx team members | |
| | Updated Program Plan | | Completed for each individual building | |
| | Rationale for Retrofit | | Must be conducted for every building | |
| | Site Hazard Mitigation Worksheet | | Automatically generates project-specific requirements based on hazard zones | |
| | Owner Worksheet | | Basic facility information, documentation, & occupant survey | |
| | <i>Begin development of the CFR Document</i> | | | |
| | Existing Buildings Commissioning (Cx) Plan - Part 1 | Assessment Planning | IAQ Assessment site visit plan | |
| | | Investigation Planning | IAQ Investigation site visit plan | |
| | Existing Buildings Commissioning (Cx) Report - Part 1 | Current Facility Requirements (CFR) | Regulatory, financial, & functional requirements | |
| | | | On-going commissioning (OCx) | |
| | | | Facility Summary | |
| | | Additional Reports | IAQ Assessment & Investigation Reports | |
| Initial Performance Modeling Report | | | | |
| Initial phase plan report | | | | |
| | | Site hazard risk report | | |
| *For Multifamily residential projects only | | | | |



Phius REVIVE 2024 Certification Process - Part 1

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| | | | On-going commissioning (OCx) | |
| | | Additional Reports | Facility Summary | |
| | | Additional Reports | IAQ Assessment & Investigation Reports | |
| | | | Initial Performance Modeling Report | |
| | | | Initial phase plan report | |
| | | | Site hazard risk report | |
| *For Multifamily residential projects only | | | | |

These items correspond with the tabs included in the Assessment & Investigation Workbook

All sections should be complete before submitting to Phius for review



Phius REVIVE 2024 Certification Process - Part 1

| Table 3.4.2.0 Required Documentation for Phius REVIVE 2024: Phase 2 - Assessment & Investigation | | | |
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| | Updated Program Plan | Completed for each individual building | |
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| | | | On-going commissioning (OCx) |
| Facility Summary | | | |
| Additional Reports | | IAQ Assessment & Investigation Reports | |
| | | Initial Performance Modeling Report | |
| | Initial phase plan report | | |
| | Site hazard risk report | | |

*For Multifamily residential projects only

Reports will be auto-generated in the background as the CPHC completes the Assessment & Investigation Workbook

The Phius reviewer will use these reports to verify that the Workbook has been fully completed



Phius REVIVE 2024 Assessment & Investigation Workbook

Phius REVIVE 2024 Programming Worksheet

Cx Program Scope & Objectives

Building Triage and Ranking

General

| | |
|-----------------|-------------------|
| Owner Name: | |
| Submitter Name: | |
| CPHC CxP Name: | |
| CPHC CxP #: | |
| Street Address: | |
| City: | |
| State: | [Select Dropdown] |
| Zip Code: | |
| County: | |

Facility Identification

| Facility Rank | Building Name | Existing Function | Approximate iCFA (sf) | Intended Function |
|---------------|---------------|-------------------|-----------------------|-------------------|
| 1 | | [Select Dropdown] | | [Select Dropdown] |

Ranking Metrics

| Intended Building Life | Building Function | Climate Migration Score | Maintenance Needs |
|------------------------|-------------------|-------------------------|-------------------|
| [Select Dropdown] | [Select Dropdown] | - | [Select Dropdown] |

Start with the 'Program Plan' and complete tabs in order: left to right, top bottom

Program Plan | **Rationale for Retrofit** | **Hazard Mitigation** | **Owner Worksheet** | **Current Facility Requirements** | **Phase 2 IAQ Assessment** | **Phase 2 IAQ Investigation** | **Phase 2 Performance Modelling** | **Issues & Resolutions Log**



Phius REVIVE 2024 Assessment & Investigation Workbook

| Phius REVIVE 2024 Workbook: | | Site Hazard Mitigation Worksheet | | |
|---|--|----------------------------------|-----------------------|-------------------|
| 5.2 Hazard Mitigation | | Single Family Duplexes Townhomes | Multifamily Mixed-Use | Non-Residential |
| <i>Use the resources for each hazard category below to determine which hazard mitigation requirements will be needed for certification. Use the '+' to the left to expand each section.</i> | | | | |
| Type 'X' to indicate project type (select ONE) | | X | | |
| EARTHQUAKE | | | | |
| 5.2.1 Earthquake | Seismic Design Category (SDC): IRC 2021 R301.2.2 | [Select Dropdown] | [Select Dropdown] | [Select Dropdown] |
| | w/i scope of FEMA P-50? (SF detached, wood frame) | [Select Dropdown] | n/a | n/a |
| | Seismic Performance Grade: Simplified Seismic Assessment Form | [Select Dropdown] | n/a | n/a |
| | Certification Requirement: | - | - | - |
| | Compliance Resources: | FEMA P-50-1 | - | - |

Site Hazard Mitigation

- Use the resources in the worksheet for each hazard category to determine the applicable hazard zones (seismic design category, flood zone, etc.)
- Standard Section 5.2

- Automations are built-in to quickly establish project-specific site hazard mitigation requirements

| Phius REVIVE 2024 Workbook: | | Site Hazard Mitigation Requirements | | |
|---|--|---|-----------------------|-------------------|
| 5.2 Hazard Mitigation | | Single Family Duplexes Townhomes | Multifamily Mixed-Use | Non-Residential |
| <i>Use the resources for each hazard category below to determine which hazard mitigation requirements will be needed for certification. Use the '+' to the left to expand each section.</i> | | | | |
| Type 'X' to indicate project type (select ONE) | | X | | |
| EARTHQUAKE | | | | |
| 5.2.1 Earthquake | Seismic Design Category (SDC): IRC 2021 R301.2.2 | D | [Select Dropdown] | [Select Dropdown] |
| | w/i scope of FEMA P-50? (SF detached, wood frame) | Yes | n/a | n/a |
| | Seismic Performance Grade: Simplified Seismic Assessment Form | C+ | n/a | n/a |
| | Certification Requirement: | Design to improve to Grade B- or higher | - | - |
| | Compliance Resources: | FEMA P-50-1 | - | - |
| FLOOD | | | | |
| HAIL | | | | |
| STRUCTURAL / HIGH WIND | | | | |
| SNOW LOAD & ICE DAMS | | | | |
| WILDFIRE | | | | |



Phius REVIVE 2024 Assessment & Investigation Workbook

| Phius REVIVE 2024 Workbook: Owner Worksheet | | 8.6.1 Facility Information | Additional Notes |
|---|---|---|------------------|
| Facility Summary | Project Name: | Please enter building name in 'Program Plan' tab below | |
| | Year Constructed: | [Select Dropdown] | |
| | Known Prior Renovations? | [Select Dropdown] | |
| | Existing ICFA (sf): | Please enter approximate ICFA in 'Program Plan' tab below | |
| | Number Bedrooms: | [Select Dropdown] | |
| | Number Bathrooms: | [Select Dropdown] | |
| | Existing Occupants: | [Select Dropdown] | |
| | Roof / Ceiling Insulation: | [Select Dropdown] | |
| | Wall Construction: | [Select Dropdown] | |
| | Foundation Type: | [Select Dropdown] | |
| | Cooling System: | [Select Dropdown] | |
| | Heating System: | [Select Dropdown] | |
| | Hot Water System: | [Select Dropdown] | |
| | Ventilation System: | [Select Dropdown] | |
| Available Facility Documents | Construction Documents: | [Select Dropdown] | |
| | Systems / Facility Manuals: | [Select Dropdown] | |
| | Existing consultant reports: | [Select Dropdown] | |
| | Utility rates / supplier info: | [Select Dropdown] | |
| | Utility meter / submeter location: | [Select Dropdown] | |
| | Operations / maintenance report: | [Select Dropdown] | |
| | Annual maintenance cost breakdown: | [Select Dropdown] | |
| | Onsite energy production: | [Select Dropdown] | |
| Low-cost repair budget: | [Select Dropdown] | | |
| | | 8.6.2 Occupant Survey | Additional Notes |
| General | Age Range of Occupants: | [Select Dropdown] | |
| Noise | Acoustical Privacy: | [Select Dropdown] | |
| | Ambient noise negatively impacting concentration: | [Select Dropdown] | |
| Thermal | Perception of Summer comfort: | [Select Dropdown] | |
| | Perception of Winter comfort: | [Select Dropdown] | |
| Visual | Adequate lighting for tasks / activities: | [Select Dropdown] | |
| | Light quality: | [Select Dropdown] | |
| | Lighting color discrimination: | [Select Dropdown] | |
| | Problematic light flicker: | [Select Dropdown] | |
| | Glare: | [Select Dropdown] | |
| | Difficulty seeing computer screen: | [Select Dropdown] | |
| Indoor air quality | Adequacy of light levels: | [Select Dropdown] | |
| | Air Quality (general): | [Select Dropdown] | |
| | Unpleasant odors: | [Select Dropdown] | |

Facility Information & Occupant Survey

- CPHC to work through this section with the owner to establish basic what is known about the existing building
- Aims to capture high-level building information
- No 'Select Dropdowns' should be left. Each should have a selection (n/a is an option)
- Standard Sections 8.6.1 & 8.6.2



Phius REVIVE 2024 Assessment & Investigation Workbook



Phius REVIVE 2024 Workbook: Current Facility Requirements (CFR)

Facility Summary

The Cx team should interpret and synthesize the information provided by the Owner up to this point. Create a comprehensive project narrative in the space to the right.

[Complete the facility summary once facility requirements are determined below]

General Requirement:

The retrofitted building shall meet the requirements of Phius REVIVE 2024. The retrofitted building shall also meet the owner-directed and owner-elected requirements listed below.

Owner-Elected Facility Requirements

Each owner-elected deliverable must be completed, proven, and accepted by Phius in order to become Final Certified. The Cx Team will be expected to address deliverables during Phase 2: Design

Requirement ID

Work with the Owner to define specific facility requirements. Create a unique name for each owner-elected deliverable below

Description

Briefly describe each owner-elected requirement

Date Added

8.6.4.1 Facility Requirements

FR1 Regulatory

FR1.1
FR1.2
FR1.3
FR1.4
FR1.5
FR2.1
FR2.2
FR2.3
FR2.4
FR2.5
FR3.1
FR3.2
FR3.3
FR3.4
FR3.5

FR2 Financial

FR3 Functional

8.6.4.1.1 *Critical Loads & Occupancy

Use the 'Critical Loads & Occ' tab below to define information on critical process loads and occupancy schedules during outage periods

Current Facility Requirements

- CPHC to work through this section with the owner to establish regulatory, financial, and functional general requirements
- Aims to capture high-level building needs
- Teams limited to 15 CFR items to limit potential scope-creep
- Encouraged, but not required
- All elected deliverables must be met to earn final certification
- When all requirements are determined, the CPHC should summarize them in the 'Facility Summary' field of the worksheet
- Standard Sections 8.6.4



Phius REVIVE 2024 Assessment & Investigation Workbook

Phius REVIVE 2024 Workbook: Assessment

| Instructions | Site Visit Log | | | |
|---|---|----------------------|---|---------|
| Phase 2 (part 1): Assessment | Team Members | Assessment Complete? | Date | Notes |
| <p>8.6.5.1 IAQ Assessment Site Visit Planning</p> <p><i>With respect to the EPA energy savings plus health documents, list the assessment protocol items that can be accomplished in a walkthrough in columns 'E' and 'F'. Expand each section using the '+' to the left. Complete the initial assessment site visit once each Assessment Protocol item is addressed. Then, complete columns 'G' and 'H' to indicate the findings of the site visit. The EBCx team should use the site visit log to the right to record the overall status of the Assessment phase, the date of each visit, and any valuable site visit notes. During these site visits, the Cx Team should also collect measurements and begin compiling existing building documentation.</i></p> | | [Select Dropdown] | | |
| | | [Select Dropdown] | | |
| | | [Select Dropdown] | | |
| | | [Select Dropdown] | | |
| <p><u>EPA Energy Savings Plus Health IAQ Guidelines</u></p> | | [Select Dropdown] | | |
| <p>Priority Issue 1: Asbestos</p> | <p>CxP Assessment Planning Notes <i>Complete pre-assessment</i></p> | Assess or Defer | <p>CxP Assessment Reporting Notes <i>Complete post-assessment</i></p> | Status? |
| <p>Priority Issue 2: Below Ground Contaminants (Except Radon)</p> | <p>CxP Assessment Planning Notes <i>Complete pre-assessment</i></p> | Assess or Defer | <p>CxP Assessment Reporting Notes <i>Complete post-assessment</i></p> | Status? |
| <p>Priority Issue 3: Building Products & Material Emissions</p> | <p>CxP Assessment Planning Notes <i>Complete pre-assessment</i></p> | Assess or Defer | <p>CxP Assessment Reporting Notes <i>Complete post-assessment</i></p> | Status? |

On-site Assessment & Investigation

- CPHC to first complete the assessment **PLANNING** (columns D & E)
- Following the initial site visit, CPHC should complete the assessment **REPORTING** notes & update the issue status (columns F & G)
- Log all site visits
- Repeat for Investigation
- Standard Sections 8.6.7.2 & 8.7.6.1

Phase 2 IAQ Assessment

Phase 2 IAQ Investigation



Cells in the 'IAQ Investigation tab' are HIGHLY dependent on the assessment tab. Make sure to choose ALL 'Select Dropdown' options in column G before moving to the next section



Phius REVIVE 2024 Assessment & Investigation Workbook

Phius REVIVE 2024 Workbook: Assessment

| <i>Instructions</i> | | Site Visit Log | | | |
|----------------------------|--|---|------------------------|---|-----------------------------------|
| Priority Issue 1: Asbestos | | CxP Assessment Planning Notes <i>Complete pre-assessment</i> | Assess or Defer | CxP Assessment Reporting Notes <i>Complete post-assessment</i> | Status? |
| Asbestos | AP1.1 Determine Potential Asbestos Hazard | Find out when house was built | Walkthrough assessment | House built post-1980, no concern | No further investigation required |

Phius REVIVE 2024 Workbook: Investigation

| <i>Instructions</i> | | Site Visit Log | | | |
|----------------------------|--|---|-----------------------------------|---|-------------------|
| Priority Issue 1: Asbestos | | CxP Investigation Planning Notes <i>Complete pre-investigation</i> | Current status? | CxP Investigation Reporting Notes <i>Complete post-investigation</i> | Final status? |
| Asbestos | AP1.1 Determine Potential Asbestos Hazard | | No further investigation required | | [Select Dropdown] |



Phius REVIVE 2024 Assessment & Investigation Workbook

Phius REVIVE 2024 Workbook: Assessment

Instructions

Site Visit Log

Priority Issue 1: Asbestos

CxP Assessment Planning Notes *Complete pre-assessment*

Assess or Defer

CxP Assessment Reporting Notes *Complete post-assessment*

Status?

| | | | | | |
|----------|--|-------------------------------|------------------------|--|-----------------------------|
| Asbestos | AP1.1 Determine Potential Asbestos Hazard | Find out when house was built | Walkthrough assessment | House built ~1940s. May contain asbestos | Needs further investigation |
|----------|--|-------------------------------|------------------------|--|-----------------------------|

Phius REVIVE 2024 Workbook: Investigation

Instructions

Site Visit Log

Priority Issue 1: Asbestos

CxP Investigation Planning Notes *Complete pre-investigation*

Current status?


CxP Investigation Reporting Notes *Complete post-investigation*

Final status?

| | | | | | |
|----------|--|--|-----------------------------|---------------------|----------------------|
| Asbestos | AP1.1 Determine Potential Asbestos Hazard | Review list of potential asbestos-containing building components | Needs further investigation | Asbestos suspected. | Remediation required |
|----------|--|--|-----------------------------|---------------------|----------------------|



Phius REVIVE 2024 Assessment & Investigation Workbook

|  Phius REVIVE 2024 Workbook: Performance Modeling | |
|--|---|
| 8.6.5.2 Initial Performance Modeling <i>Refer to section 3.4.2 of the Phius 2024 Certification Guidebook for certification modeling protocol and REVIVEcalc instructions. Use the following checklist to confirm that all modeling documentation has been collected and uploaded to the project Dropbox.</i> | 8.6.5.2 Initial Performance Modeling Documentation Checklist |
| Runlist *.csv* File | Uploaded to Dropbox? ("X" = Yes) |
| Geometry *.idf* File | Uploaded to Dropbox? ("X" = Yes) |
| Existing Building Drawings Schematic Plans ICFA Takeoff (est.) Schematic Elevations Assembly Assumptions Equipment Assumptions / Specs | Uploaded to Dropbox? ("X" = Yes) |
| Databases Carbon Correction Construction (Assemblies) Materials Windows | Uploaded to Dropbox? ("X" = Yes) |
| Weather Files *.ddy* File *.epw* File | Uploaded to Dropbox? ("X" = Yes) |
| Results Table *.csv* File | Uploaded to Dropbox? ("X" = Yes) |

Initial Performance Modeling

- CPHC should have gathered all information needed for initial performance modeling by the time all assessment & investigation items are complete
- The CPHC should use the initial performance modeling checklist in the workbook to make sure that they have compiled all of the documentation needed to run the REVIVEcalc analysis
- Standard Section 6



Phius REVIVE 2024 Assessment & Investigation Workbook

| | | |
|---|---------------------|--|
| <p>Milestone 2 Assessment & Investigation Approval</p> | <p><u>3.1.5</u></p> | <p>Assessment & Investigation Approval -Phius approves the Assessment & Investigation deliverables. An official letter of approval is sent to the design team. -Phius creates and sends a Design Review Invoice which shall be paid before Phase 3 can begin.</p> |
|---|---------------------|--|

- Assessment & Investigation Workbook submitted to Phius with:
 - REVIVECalc supporting documentation
- Phius will review and give feedback on the submission until all deliverables have been met
- Phius will award Assessment & Investigation Approval
- Project will then begin **Phase 3: Design**



Phius REVIVE 2024 Certification Process - Part 2

Table 3.1.1 Phius REVIVE 2024 Process Matrix (continued)

| AIA Project Phases | Phius Benchmarks | Guidebook | Phase Summary |
|--|-------------------------------------|-----------------------|---|
| Design Development (DD) / Construction Drawings (CD) | Phase 3 Design & Review | 3.1.6 | Design -Selection of design approach based on performance modeling completed during the investigation phase Design Review -CxP document upload -Phius Review & Feedback -CxP Revisions & Response -Repeat (as needed) |
| Bidding & Procurement | Milestone 3 Design Certification | 3.1.7 | Design Certification -The design is certified by Phius. An official letter of design certification will be sent to the design team |



- Standard Section 8.8
- Compliance workbook still in development
- Design approach selected from options determined during initial performance modeling



Phius REVIVE 2024: Required Design Documentation

Table 3.5.1.0 Required Documentation for Phius REVIVE 2024: Phase 3 - Design

| | | | |
|--|--|---|---|
| Phius REVIVE 2024 Design Workbook | Issues & Resolutions Log | | Feedback channel between Cx team members |
| | Approach Declaration | | Define the selected retrofit approach |
| | Existing Buildings Commissioning (Cx) Plan - Part 2 | CFR Deliverables Plan | Complete the workbook sections relating to the CFR deliverables solutions |
| | | Passive Systems Plan | Complete the workbook sections relating to passive design strategies |
| | | IAQ Remediation Plan | Complete the workbook sections relating to IAQ remediation strategies |
| | | Active Systems Plan | Complete the workbook sections relating to active building systems |
| | | Site Hazards Mitigation Plan | Complete the workbook sections relating to site hazard mitigation strategies |
| | Existing Buildings Commissioning (Cx) Report - Part 2 | Design Review Report | Automatically updated based on acceptance, rejection and/or feedback on established design deliverables |
| Construction Documents | | Refer to Section 1.4.4 for all possible required CDs* Refer to Section 3.5.4 for possible retrofit-specific required documentation | |
| *Required documentation for retrofit projects is based on the specific selected approach. Not all projects will have the same documentation requirements | | | |



Phius REVIVE 2024 Certification Process - Part 2

| | | | |
|--|---|-----------------------|--|
| Construction Administration (CA) / Commissioning (Cx) | Phase 4.1 Implementation, Observation & Testing | 3.1.8 | Onsite Review -Rater/Verifier performs site visits and communicates all changes to the Submitter/CxP -All changes should be recorded in the Phius REVIVE Workbook Multi-Phase Projects -When all phases are complete, the project will be eligible to submit documentation for final certification |
| Post-Construction (PC) | Phase 4.2 Final Review | 3.1.8 | Final Review -Rater/Verifier Provider document upload -Phius Review & Feedback -Rater/Verifier Provider Response -Repeat (as needed) |
| | Milestone 4 Final Certification | 3.1.9 | Final Certification -The as-built project is Final Certified by Phius when all project phases are complete. A digital certificate and physical plaque will be sent to the project team. -Building resumes typical or new intended operation |



- Standard Section 8.9
- Compliance workbook still in development



Phius REVIVE 2024: Required Final Documentation

Table 3.6.1.1 Required Documentation for Phius REVIVE 2024: Phase 4 - Implementation

| | | | |
|--|--|--|--|
| Phius REVIVE 2024 Implementation Workbook | Issues & Resolutions Log | | Feedback channel between Cx team members |
| | Existing Buildings Commissioning (Cx) Plan - Part 3 | Final CFR | Add additional CFR deliverables to the Implementation Workbook as needed |
| | | Final Phase Plan | If doing a phased retrofit, use the Phase Planner to track phase deliverables, construction schedules, etc. |
| | | Final M&V Plan* | Use the M&V Planner to schedule and track the completion of M&V requirements |
| | | Final Maintenance Plan | Record strategy for maintaining implemented measures (i.e. filter replacement schedule) |
| | Existing Buildings Commissioning (Cx) Report - Part 3 | Executive Summary | Summarize the implemented measures, and indicate possible future improvements. |
| | | Final Findings & Recommendations | Update the performance analysis based on findings during the implementation process |
| | | New Discovery Report | Record any new discoveries made during Implementation that may impact the project's ability to meet the certification requirements. Describe method of resolution. |
| | | Final Testing & Verification Report | Complete the required checklists to verify that all tests have been performed and that all documentation has been collected and provided to Phius for Final Review |
| | | Final Training Report** | Schedule and track any training sessions for ongoing maintenance and operation of building systems |

*For non-residential projects only

**Only for projects which include property/building managers or operators other than the building Owner



Phius REVIVE 2024 Certification Process - Part 3

| AIA Project Phases | Phius Benchmarks | Guidebook | Phase Summary |
|-------------------------------------|---|---------------------------------|---|
| On-going Commissioning (OCx) | Phase 5.1 Monitoring | <u>3.1.10</u> | Monitoring -Non-residential projects are required to register with and allow Phius access to the Energy Star Portfolio Manager |
| | Phase 5.2 Ongoing Commissioning (Optional) | <u>3.1.10.2</u> | Ongoing Commissioning (OCx) & Monitoring Electives -Additional monitoring and commissioning electives are encouraged for all projects, but not required |

- Monitoring may become required in future versions, but for now is optional for all residential projects
- Non-residential projects required to register and provide Phius access to ENERGY STAR Portfolio Manager



Performance calculation tool and resources

REVIVEcalc v24.2.0

Synopsis:

- Better tools yield better buildings
- Provide a tool that is designed to support specific calculations
- Enable parametric design
- Automate menial tasks
- Current version made in house for quick updates
- Database options for quick use



REVIVEcalc v24.2.0

FAQ:

- Why can't we just use WUFI Passive?
 - WUFI Passive is a static calculation engine, not hourly. WUFI Plus cannot model equipment.
- I hear E+ is difficult, I don't like coding?
 - The tool is a GUI interface that automates a lot of the E+ modeling, and we have distilled this to a geometry file and 50 inputs.
- How do I learn how to do this?
 - Training videos, email support, and guidebook / standard documentation are resources.



REVIVEcalc v24.2.0

Inputs

User Input IDF
(Geometry)

User Input CSV
(Run List)

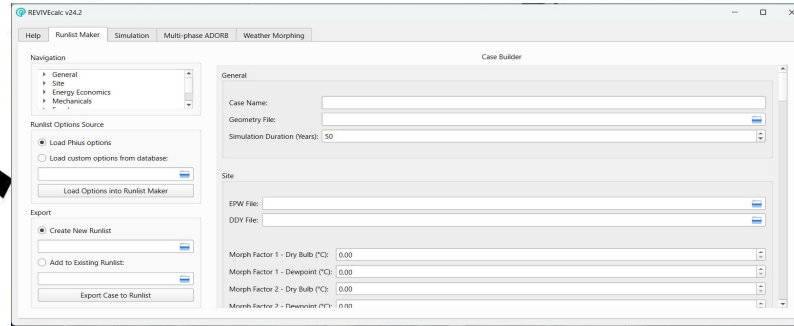
Static Databases

Cambium Database
Country Emissions Database

User Editable Databases

Carbon Correction Database
Construction Database
Material Database
Window Database

Analysis



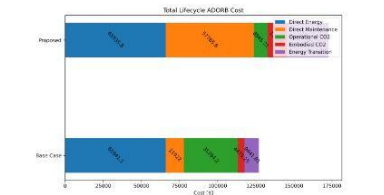
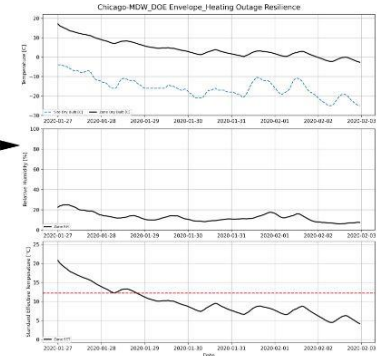
Resilience Simulation
IDF

Annual Simulation IDF

ADORB



Results



Geometry Input

The screenshot shows the SketchUp Make 2017 interface. A 3D model of a yellow house with a brown roof is centered in the workspace, enclosed within a blue wireframe bounding box. The Object Info dialog box is open, displaying the following information:

Object Info

Object Inputs

Class: **Zone**

Name: WholeHouse|UNIT|SB|2R

Rotation: 0.0 deg

Multiplier: 1

Include In Total Building Floor Area

Object Summary

| | |
|--|--|
| Surfaces: 24 | Sub Surfaces: 16 |
| Unit Floor Area: 1766.5 ft ² | Total Floor Area: 1766.5 ft ² |
| Total Exterior Surface Area: 3922.92 ft ² | Percent Exterior Glazing: 5.3 % |

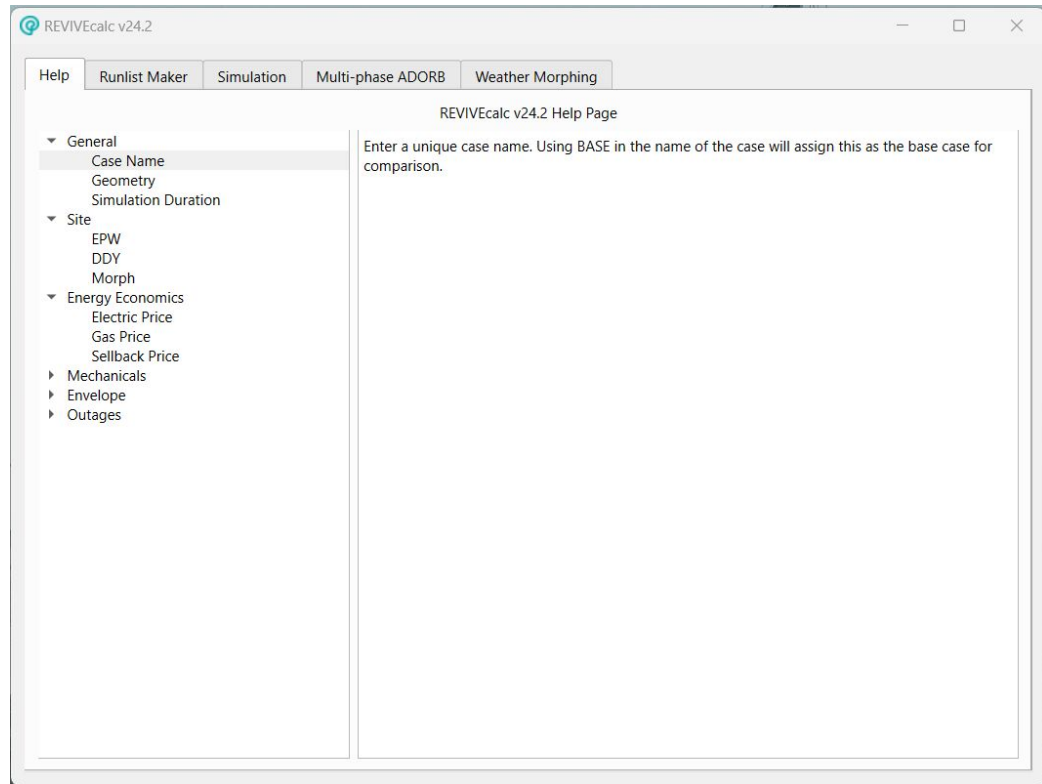
Object Text

```
Zone,
WholeHouse|UNIT|SB|2R,    !- Name
0.0,                      !- Direction of Relative North (deg)
0.0,                      !- X Origin {m}
0.0,                      !- Y Origin {m}
0.0,                      !- Z Origin {m}
,                          !- Type
1,                        !- Multiplier
,                          !- Ceiling Height {m}
,                          !- Volume {m3}
164.11;                   !- Floor Area {m2}
```



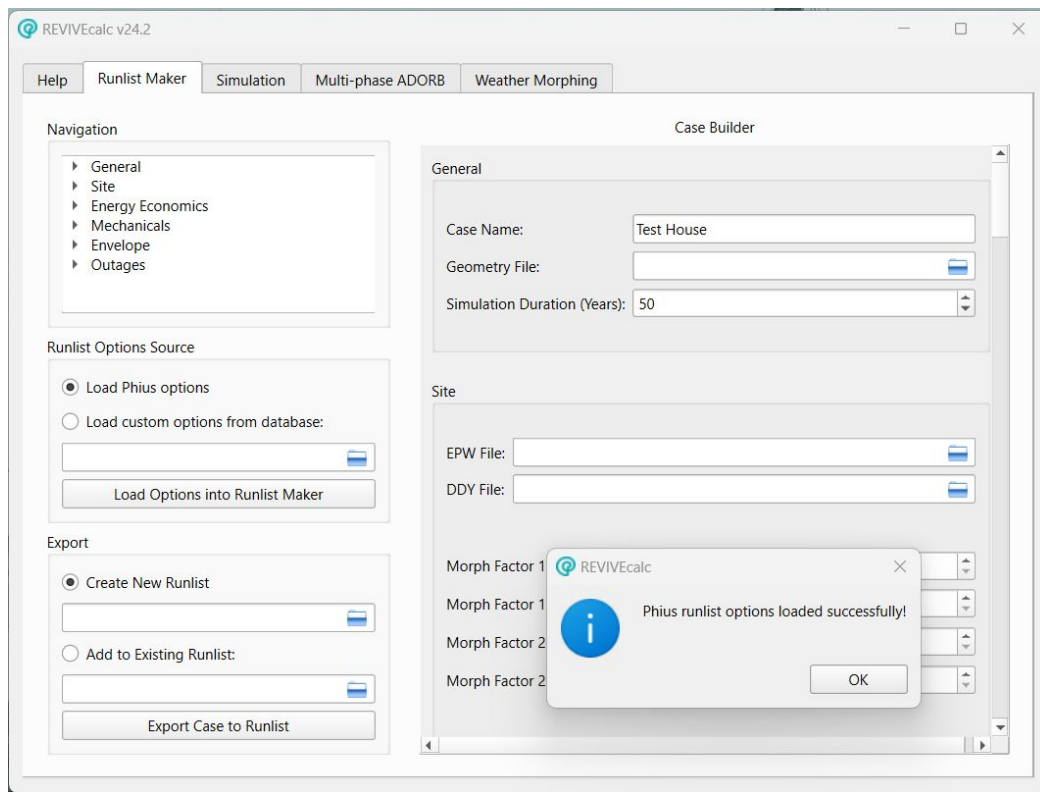
Help Screen

- Mirrors the guidebook
- Data tree aligns with runlist maker



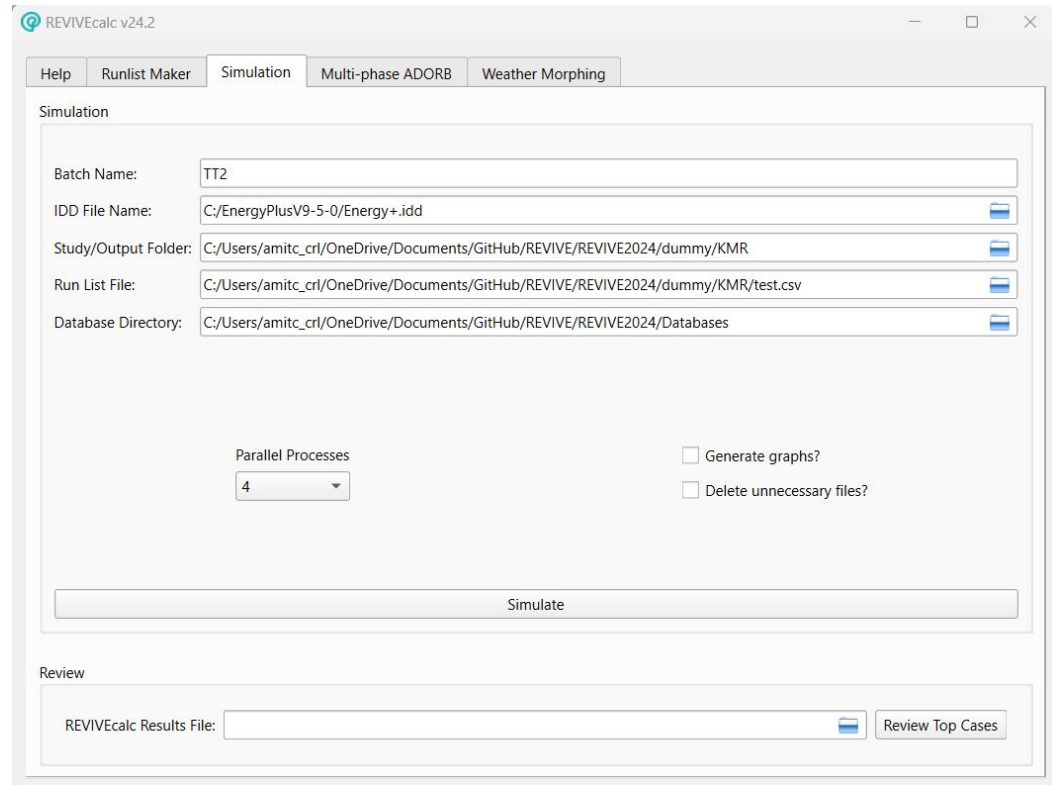
Runlist Maker

- Data tree aligns with help screen
- GUI input for making runlists
- Select most options from databases or dropdowns
- Can append cases to other run list



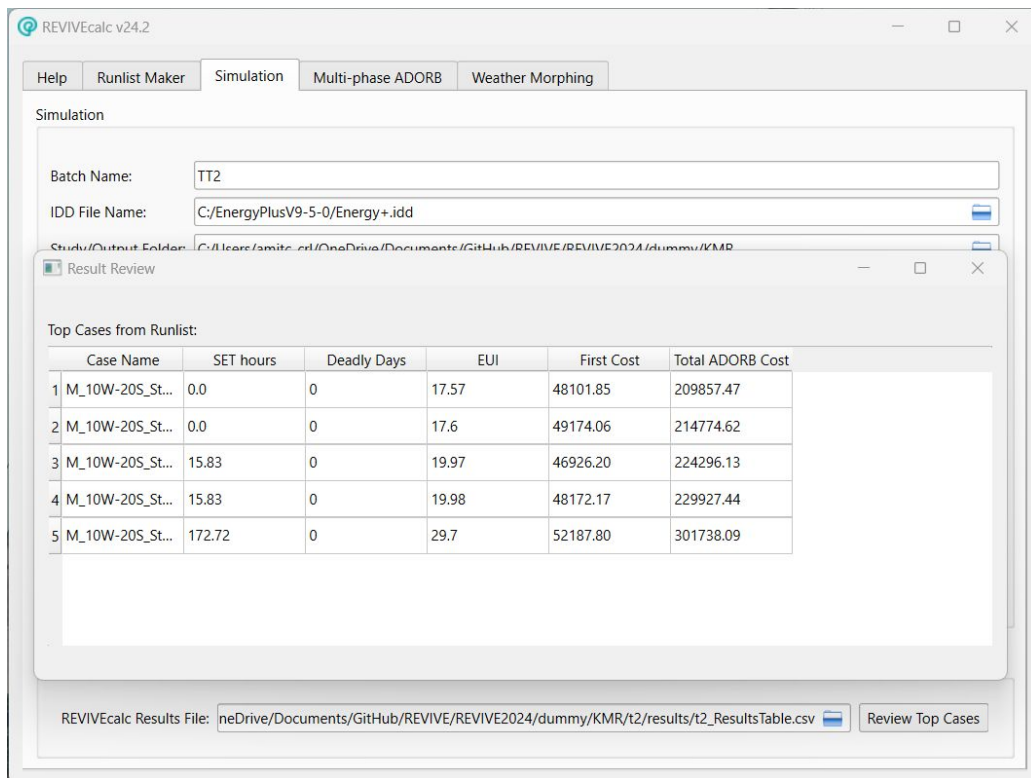
Simulation

- Calls run list to make models and simulate
- Saved results in folders
- Can do parallel processing



Simulation

- Quick results viewer sorts 5 lowest ADORB cost cases that meet resilience



The screenshot displays the REVIVEcalc v24.2 application window. The 'Simulation' tab is active, showing the following settings:

- Batch Name: TT2
- IDD File Name: C:/EnergyPlusV9-5-0/Energy+.idd
- Study/Output Folder: C:/Users/ajmitc.../OneDrive/Documents/GitHub/REVIVE/REVIVE2024/dummy/KMR

A 'Result Review' dialog box is open, displaying the 'Top Cases from Runlist' table:

| | Case Name | SET hours | Deadly Days | EUI | First Cost | Total ADORB Cost |
|---|-----------------|-----------|-------------|-------|------------|------------------|
| 1 | M_10W-20S_St... | 0.0 | 0 | 17.57 | 48101.85 | 209857.47 |
| 2 | M_10W-20S_St... | 0.0 | 0 | 17.6 | 49174.06 | 214774.62 |
| 3 | M_10W-20S_St... | 15.83 | 0 | 19.97 | 46926.20 | 224296.13 |
| 4 | M_10W-20S_St... | 15.83 | 0 | 19.98 | 48172.17 | 229927.44 |
| 5 | M_10W-20S_St... | 172.72 | 0 | 29.7 | 52187.80 | 301738.09 |

At the bottom of the dialog, the 'REVIVEcalc Results File' is set to 'neDrive/Documents/GitHub/REVIVE/REVIVE2024/dummy/KMR/t2/results/t2_ResultsTable.csv', with a 'Review Top Cases' button next to it.



Multiphase ADORB

- Combine 2-5 phases of ADORB costs to evaluate a multiphase retrofit.

The screenshot shows the REVIVEcalc v24.2 application window. The 'Multi-phase ADORB' tab is active. The interface includes a menu bar with 'Help', 'Runlist Maker', 'Simulation', 'Multi-phase ADORB', and 'Weather Morphing'. Below the menu, there are three phase configuration sections: 'Phase 1', 'Phase 2', and 'Phase 3'. Each section contains an 'ADORB Results File' input field with a file selection icon, a 'Year' dropdown menu set to '0', and a trash icon. A button labeled 'Add additional phase' is located below the phase sections. At the bottom of the window, there is a large button labeled 'Compute Multiphase ADORB'.



Weather Morphing

- Calculate morphing factors for weather files

The screenshot shows the 'Weather Morphing' tab in the REVIVEcalc v24.2 software. The interface includes a menu bar with 'Help', 'Runlist Maker', 'Simulation', 'Multi-phase ADORB', and 'Weather Morphing'. Below the menu is the 'Site Weather Settings' section, which contains an 'EPW CSV file:' label and an empty text input field with a file selection icon. There are two rows of dropdown menus for 'Winter Outage Start' and 'Summer Outage Start', both currently set to 'January' and '1'. Below these are four numerical input fields for 'Winter Return Extreme Dew Point', 'Winter Return Extreme Dry Bulb', 'Summer Return Extreme Dew Point', and 'Summer Return Extreme Dry Bulb', all set to '0.0'. At the bottom of the form is a 'Compute Weather Morph Factors' button.



Questions

And answers



Attend the Pro Forum: October 21-23 2024

