ELEVATE
Equity through climate action

SUSTAIN DANE

CITY OF MADISON WISCONSIN

Coupling Lead and Mold Remediation with Efficiency Programs in Madison

SEPTEMBER 2022

Program Partners

This report was funded by a grant from Healthy Babies Bright Future (HBBF), an organization working to create and support initiatives that measurably reduce babies' exposures to neurotoxic chemicals. The project team includes a partnership between Elevate, Sustain Dane, and the City of Madison.

Background and Goals

This grant aims to improve housing quality, health, and resilience in Madison, WI by designing a program that mitigates lead and mold exposures alongside energy efficiency retrofits. Housing quality is a social determinant of health in children. Lead-based paint and mold exposures are known health risks for children and are particularly problematic in low-income housing that is not regularly upgraded. Housing quality can also deter energy efficiency upgrades – homes with existing mold or lead issues are turned away from efficiency programs until health risks can be addressed. Offering a program that integrates energy efficiency and health assessments broadens the impact of efficiency programs while improving health conditions for occupants.

This grant builds upon an existing multifamily affordable housing initiative – the Efficiency Navigator, currently run by Elevate and Sustain Dane with funding from City of Madison. The Efficiency Navigator program currently helps unsubsidized affordable multifamily housing remain affordable by reducing utility bills and making housing more comfortable for residents. In partnership with the City of Madison, we created a program design that combines assessments and mitigation for lead and mold with the Efficiency Navigator program as mold and lead exposures are primary health concerns in Madison. Heavy rainfall events in 2018 and 2008 caused flooding across Madison's housing infrastructure and highlighted the region's vulnerability to heavy rainfall and storms. While the City of Madison water utility was the first major city in the US to launch a full Lead Service Replacement Program for water lines in 2000, paint-based lead exposure is still a pressing issue as a significant portion of the housing stock is built before 1978.

The development of our program design consists of two deliverables: (1) a high-level flow chart and detailed descriptions of additions to the program, and (2) an interactive map with relevant Madison-specific data on lead and mold risks. We engaged stakeholders including City and State agencies and community organizations to better understand opportunities and feedback on integrating healthy home assessments into the Efficiency Navigator design. In the following sections, our approach, deliverables, and lessons learned are described.

Approach

Integrating lead and mold assessments into the Efficiency Navigator process was an iterative process between holding stakeholder interviews and collecting/analyzing lead and mold data, resulting in the program design and interactive map. The goal of the program design was to specify necessary program changes and additions to incorporate lead and mold assessments and mitigation pathways into the Efficiency Navigator. The goal of the interactive map was to understand the landscape for opportunity in Madison for this program. The following stakeholders were engaged throughout the process:

- John Hausbeck – Public Health Supervisor, Public Health Madison & Dane County (interview)
- Jose Maria Donoso – Housing Inspection Supervisor, City of Madison Building Inspection Department (interview)
- Tariq Saqqaf – City of Madison Racial Equity and Neighborhood Resource Team Coordinator (interview)

- Jessica LeClair – Clinical Faculty Member at UW School of Nursing, PhD Candidate, University of WI-Madison (interview)
- Agi Redei – 211 Project manager at 211 United Way of Dane County (email correspondence)
- Sean Rhee and Liz Truslow Evans – Lead Safe Homes Program, WI Department of Health (interview, and email correspondence regarding feedback on process map)
- Caroline Burger, Sarah Lerner, and Janet Schmidt – Watershed Study Program, City of Madison Engineering (interview)

Lead issues are handled at the county level by Public Health Madison & Dane County and mold issues are handled by the City of Madison in the Building Inspection Department. We began our stakeholder interviews with these departments to gather information on the existing city and county processes for both lead and mold, and ideas for data related to these health issues. Following this, Tariq Saqqaf and Jessica LeClaire were interviewed to gather perspectives from community groups on how lead and mold issues are raised (or not raised) by residents. To assess opportunities for lead remediation from the building owner perspective, we spoke with the Lead Safe Homes Program, which is a state-run program funding lead abatement for qualified housing. Finally, we conversed with engineers working on the Watershed Study with the City of Madison to brainstorm potential data proxies for presence of mold or moisture issues in housing.

The program design development began after our initial interviews, describing how lead and mold could be integrated across each phase of the Efficiency Navigator based on the City's existing processes. Upon speaking with different stakeholders and iterating the program design, it became apparent a high-level flow chart would be immensely helpful in visualizing the process impacts, particularly for lead as its integration was more complex. The flow chart was developed across several internal brainstorming sessions, and finally sent to Public Health Madison & Dane County, City of Madison Building Inspection, and WI Department of Health for review. The interactive map was developed in tandem, as we learned about additional data sources through interviews. Reflections and lessons learned about this approach can be found in the Conclusions and Recommendations section of the report.

Deliverables

INTERACTIVE MAPPING

A screenshot of the map is shown in Figure 1 and the interactive version can be found online.[1] The map consists of six data tabs, which relate to either lead risk, mold risk, or demographic information. In each tab, a heat map displays the prevalence of a metric across Madison by census tract. Of note, none of the data points are direct indicators of lead or mold risk – they are proxies which are assumed to be correlated based on research and stakeholder interviews. Reflections on the data collection process can be found in the lessons learned section. A description of each data point, its relation to this study, and source is as follows:

- Housing Pre-1950[2]: Shows the percent of housing units built prior to 1950. Housing built before 1950 has the highest risk for paint-based lead exposure.
- Housing 1950-1979[2]: Shows the percent of housing units built between 1950 and 1979. Housing built between 1950 and 1978 has an elevated risk for paint-based lead exposure.

[1] https://elevate.maps.arcgis.com/apps/MapSeries/index.html?appid=7fb61d5555054b85ae07cc3cc95960b1
[2] 2010-2014 American Community Survey 5-year estimates

- Adults with Asthma[3]: Shows percent of adults currently with asthma. Mold exposure is a potential trigger of asthma symptoms. The data is from the CDC's PLACES database.
- Population Under Age 18[2]: Shows the percent of the census tract's population that is younger than 18. This is a demographic indicator for children who may be more at risk for lead or mold exposure.
- Child Poverty[2]: Shows the percent of children whose income over the past 12 months is below the poverty level. This is a demographic indicator for populations who may be more at risk for lead or mold exposure.
- Income Distribution[1]: Shows the percent of households whose annual income is below $40,000. This is a demographic indicator for households who may be more at risk for lead or mold exposure.

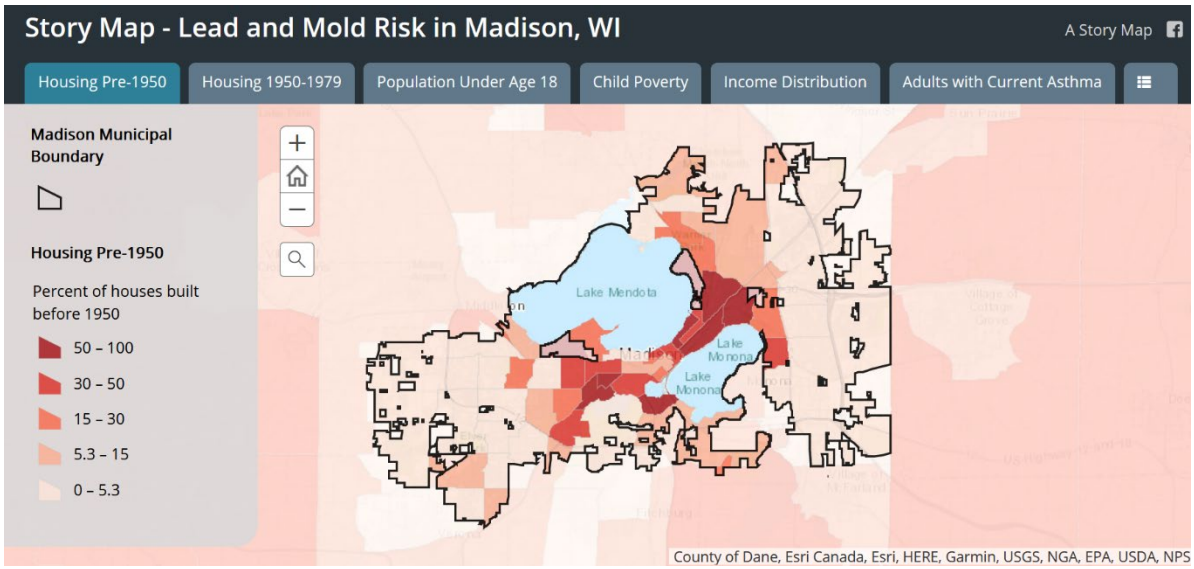

FIGURE 1: SCREENSHOT OF INTERACTIVE MAP

Users can navigate between tabs, zoom in and out of neighborhoods, and enter specific addresses to interact with the data. The goal of the map is to use available data to understand lead and mold risk across Madison and target program outreach. Users can view areas that potentially have higher concentrations of paint-based lead exposures and mold issues. The program can also be tailored to target and set program goals to specific areas using the map.

[3] CDC PLACES database: https://www.cdc.gov/places/index.html

PROGRAM DESIGN

A program design was created to describe how health assessments for lead and mold can be integrated into the existing Efficiency Navigator program. The program design consists of a flow chat map to show the high-level process and highlight dependencies between the efficiency and health programs. Following the flow chart is a more detailed description of each step in the flow chart.

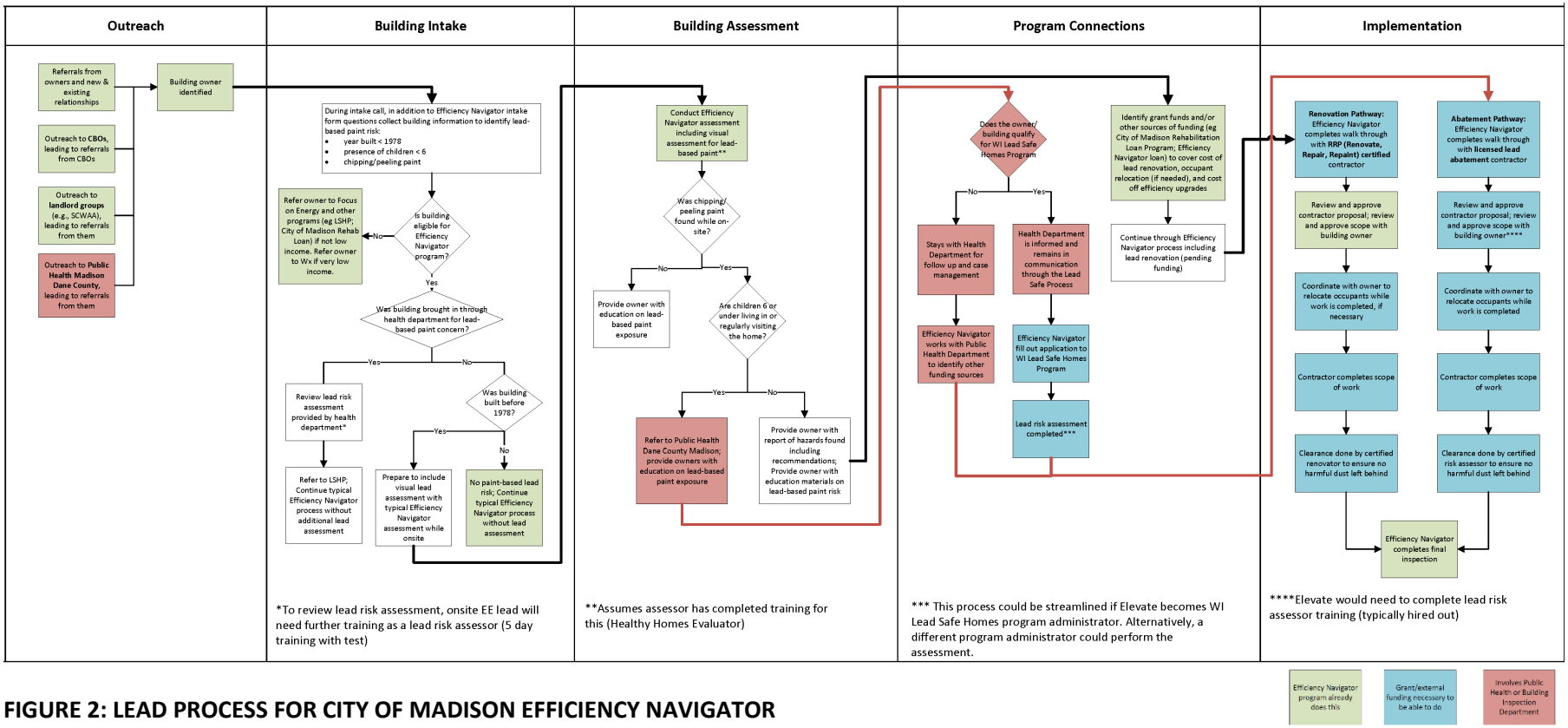

FIGURE 2: LEAD PROCESS FOR CITY OF MADISON EFFICIENCY NAVIGATOR

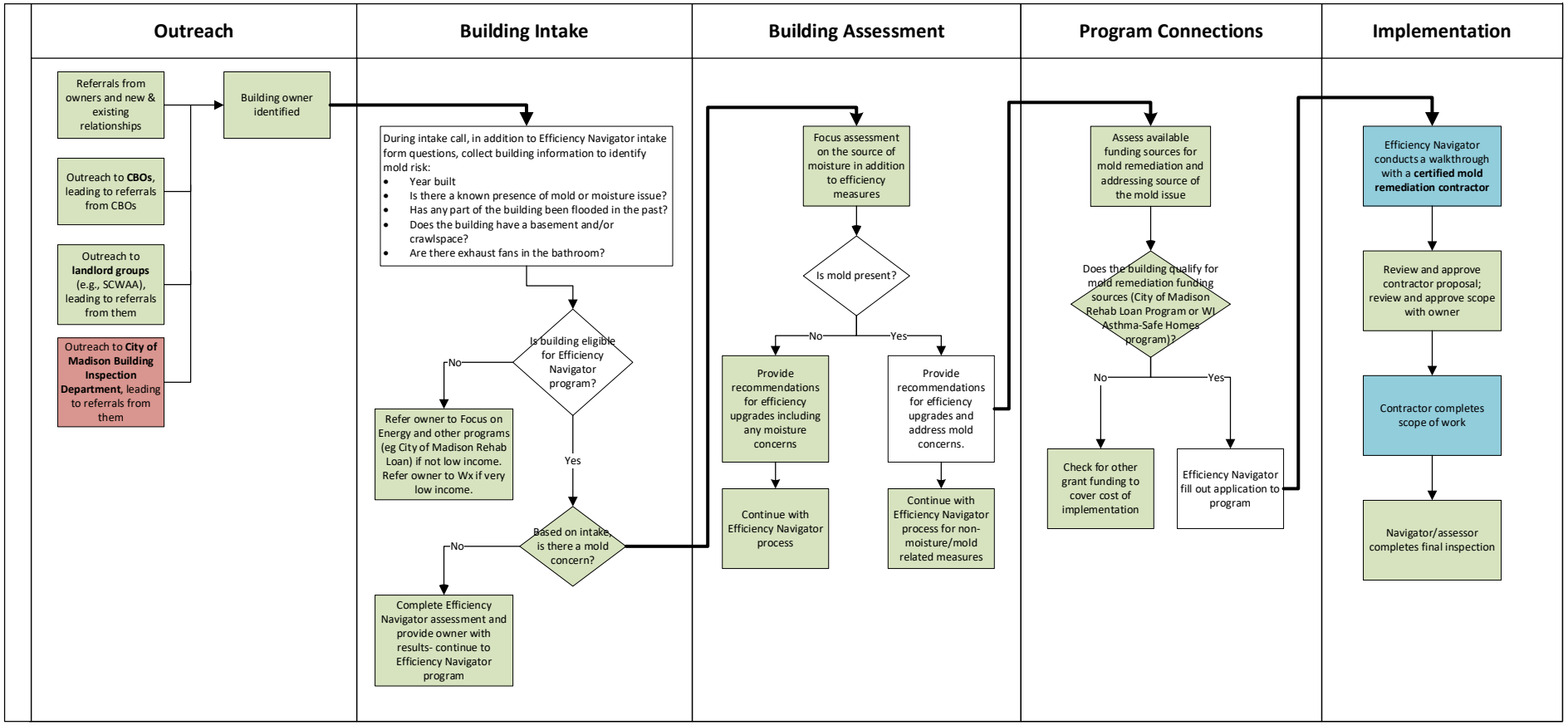

FIGURE 3: MOLD PROCESS FOR CITY OF MADISON EFFICIENCY NAVIGATOR

Outreach: Currently, the Efficiency Navigator relies on both leveraging existing networks and fostering new strategic relationships among the multi-family owner sector for outreach to new owners. They have an outreach content bank including one-pagers and presentations.

Initially, we explored potential collaboration opportunities between the Efficiency Navigator and local community-based organizations doing work with healthy housing. Increasing local organizations' awareness of the Efficiency Navigator offerings, including health-based assessments, can help expand the program's reach and help learn about areas experiencing significant lead and mold issues. From 211 United Way of Dane County, we learned they reported only 34 calls about mold issues in 2021, and their typical process when a tenant reports a mold issue is to refer them to the City's Building Inspection department or Public Health Madison & Dane County.

In further conversations with community groups, they emphasized tenants are often hesitant to reach out to the City, or even tenant organizations, with housing quality issues such as mold because of the risk of lease non-renewal from landlords, and lack of alternative affordable housing options. We highlight this finding because energy efficiency programs such as the Efficiency Navigator may have more success with scaling their program to include health impacts by focusing on engagement with organizations that reach building owners and landlords. This also places the burden of action on the owner, versus the tenant who has less capacity and scale in reach. With that in mind, we recommend the following:

1. **Referrals from owners and new and existing relationships**
    a. Continue to build relationships with owners who participate in the Navigator program to connect with other interested owners.

2. **Outreach to community-based organizations (CBOs) leading to referrals from CBOs.**
    a. Engage with local tenant organizations (211 United Way, Tenant Resource Center) to identify building owners to focus on.

3. **Outreach to landlord groups leading to referrals from such groups.**
    a. Collaborate with landlord and building owner organizations such as the Apartment Association of Wisconsin. Building a relationship with this organization or other groups that work closely with owners/landlords can help recruit owners to join the program beyond the existing networks typically relied upon, which self-selects owners.

4. **Outreach to local and state health or buildings departments.**
    a. Lead outreach
        i. Provide Public Health Madison Dane County with Efficiency Navigator program information. For cases that do not require enforcement (low lead levels and no child under 6) and could benefit from home assessment and funding for upgrades, the city could refer owners to the Navigator program.
        ii. Become a partner or program administrator for the Department of Wisconsin Lead-Safe Homes Program (LSHP). This newer program (started early 2020) has funding through CHIP (Children's Health Insurance Program) to abate lead hazards in eligible residences. The program has primarily worked in single-family homes but has the potential to fund

lead abatement for eligible units in multi-family. Eligible homes include properties built before 1978 and occupied by children with Medicaid health insurance. They are actively seeking local organizations in Wisconsin to partner with to expand the reach of the program. There is potential to marry these funds with other funding sources to holistically respond to home issues. The LSHP has also funded energy efficiency measures that address lead issues concurrently (e.g., triple-pane windows).

b. Mold outreach
    i. Provide City of Madison's Building Inspection Department with Efficiency Navigator program information. For cases that do not require enforcement and could benefit from home assessment and funding for upgrades, the city could refer owners to Navigator program. In addition, engage with Building Inspections to identify potential owners where the majority of issues are reported and who more likely need building upgrades. Pursuing these owners has the potential to have the highest impact to those who join the program, and learnings from conducting outreach to this market can inform gaps in the program for those who do not want to take part in the program.
    ii. Reach out to the Wisconsin Asthma-Safe Homes Program for possible collaboration opportunities. This is an emerging program under the Wisconsin Department of Health, similar to LSHP.

5. **Update content bank to include language on how energy efficiency and health can be addressed together and the benefits to the building owner of doing so.**
    a. Consider language such as:
        - This program aims to address energy efficiency and lead & mold health issues
        - Improve health outcomes of residents by reducing and preventing health issues such as asthma, allergies, and lead poisoning
        - Reduce likelihood of property being deferred for programs and services due to hazardous conditions and health & safety issues
        - Increase property's value
        - Improve building's performance (e.g., air sealing, efficient ventilation)

Building Intake: Currently, the Efficiency Navigator conducts a phone call with the owner to ask questions about the property and eligibility, collecting utility bills.

We recommend incorporating the following lead and mold questions into the Efficiency Navigator's current intake form. These questions will help inform the assessor of potential lead or mold issues prior to going onsite and inform whether the owner meets prerequisites for Wisconsin's Lead-Safe Homes Program. If it is determined the owner will receive a building assessment, incorporate the answers to these questions into the building assessment form for the assessor's reference.

Lead Questions:

1. What year was your property built? What year did it undergo any major renovations?
    1.a. If property built prior to 1978, is there the presence of chipping or peeling paint?
    1.b. Do children under the age of 6 live at the property?

Mold Questions:

1. Is there a known presence of mold or moisture issue?
2. Has any part of the building been flooded in the past?
3. Does the building have a basement and/or crawlspace?
4. Do the bathrooms have exhaust fans that exhaust to the outside?

Building Assessment: During the site visit, the Navigator performs a visual inspection of the equipment conditions and completes a site visit form with field data. Data is primarily collected with notes by hand. A report is delivered to the owner, and a week or so after Efficiency Navigator has a call with building owner to answer any questions.

The following outlines recommendations for the assessor to incorporate lead and mold assessments into their existing assessment process.

1. **Collect the following data while onsite.** Table 1 outlines the data points that are currently collected and recommends additional data points as well as revisions to current ones.

TABLE 1. LEAD AND MOLD DATA COLLECTION RECOMMENDATIONS

Category	Data Point	Currently collected?	Recommendation
Mold	Did building owner indicate a past or present moisture concern?	Yes	NA
	Exhaust fan in Kitchen? Is it vented to the outside?	Yes	NA
	Is there an exhaust fan in Bathroom? Is it vented to the outside? Measure and record airflow.	Yes	Add: If no exhaust fan in the bathroom, is there a window?
	Are gutters in place and functioning?	Yes	NA
	Is grade around the building sloped away from foundation? If not, where?	Yes	NA
	Is dampness in the basement? If so, what is the source?	Yes	NA
	Is humidity at a level that would support mold growth?	Yes	Record where measurements taken.
	Is there visible mold? If so, where/how much? List possible moisture sources.	Yes	Add: Is mold > 10ft^2?
	Are there musty or mildew odors? If so, where? List possible moisture sources.	Yes	NA
	Are any leaks, mold, or condensations present on the walls or windows?	No	Add to data collection form.
	Is a dehumidifier used in the home? If not, is one needed?	No	Add to data collection form.
	Are dryer(s) vented to outside?	No	Add to data collection form.
Lead	Is building older than 1978?	Yes	NA
	Is there chipping/deteriorating paint (both inside or outside)? If yes, where?	Yes	NA
	Is water main pipe made of lead?	Yes	NA

2. **Have assessors obtain a Building Performance Institute (BPI) Healthy Home Evaluator certification**
    a. The Healthy Homes Evaluator (HHE) course trains assessors to identify environmental health and safety hazards and provide recommendations to address hazards including the risk of mold and lead poisoning in homes.
    b. An active BPI Building Analyst Professional, BPI Energy Auditor, BPI Quality Control Inspector, or BPI Multifamily Building Analyst certification is a pre-requisite to the Healthy Homes Evaluator certification. A handbook for the HHE is available for assessors to self-pace training online before scheduling an exam at a BPI testing center. Some BPI testing centers offer in-person trainings to prepare for the exam with an approximate cost of $800 per person. The exam consists of 50 multiple-choice questions available online and exam prices are set by testing centers. After passing the exam, a certification is mailed. HHE's must re-certify every 3 years. For more information visit http://www.bpi.org/certified-professionals/healthy-home-evaluator.

3. **Provide owner with education.** After an assessment report is created, meet with building owners to review health hazard remediation recommendations and opportunities for upgrades and available resources. Consider providing the owner with the following factsheets, depending on the issues identified during the site visit:
    a. Department of Energy's one-pager on healthy homes: Do you have a healthy home?
    b. **Lead:** Information on basics and health effects of exposure to lead based paint: EPA's Protect Your Family from Lead in the Home
    c. **Mold:** Basics and health effects of mold in your home: EPA's Mold and Moisture in the Home

4. **Consider the following recommendations, with increasing levels of effort, to implement as part of the program evaluation**[4]
    a. Document lead and mold issues when encountered onsite. Report findings annually such as number of units with mold issues and number of units with lead issues.
    b. As the program expands, consider including indoor air quality monitoring as part of the evaluation process. This could include monitoring metrics such as PM2.5, PM10, VOC, temperature, humidity, or other indoor pollutants before and after upgrades are implemented to better measure the impact of the program. This is recommended as a later stage part of the program because of the time and expense that it may take to set up monitoring evaluation programs. CLEAResult's Healthier Homes Program partnered with PNNL (Pacific Northwest National Laboratory) on a similar monitoring effort as part of the program evaluation.

[4] Of note, we considered recommending a health survey distributed to tenants before and after upgrades to track health metrics (emergency medication uses; missed school days), however did not include this recommendation due to the lack of feasibility to go through owner to gather personal data for each tenant. Also, gathering such data can get complex with HIPPA requirements.

Program Connections: Currently, the Efficiency Navigator helps process all owner incentive applications, including to: (1) Focus on Energy, (2) Water utilities, (3) Sewerage authority, and (4) other programs.

Lead: For lead-based paint exposures, there are two process pathways for program connections, depending on the lead-based paint risk exposure found during the building assessment phase. The two pathways are described below.

1. **If building is built before 1978, peeling and/or chipping paint identified on site, and children are living at the property who are under 6:**

   Because children are living at the property who are under 6 and there is a risk of lead-based paint exposure, the Public Health Dane County Madison will need to be notified. If the property qualifies for funding through the WI LSHP[5], then Public Health Dane County Madison should be kept informed as the Efficiency Navigator Program fills out the property's LSHP interest form. Next, the LSHP will conduct a lead risk assessment. After the lead risk assessment is completed, the property will move on to the *abatement* pathway detailed in the Implementation section. If the property does not qualify for WI LSHP, the property should stay with Public Health Dane County Madison for follow up and case management. Meanwhile, the Efficiency Navigator should work with Public Health Dane County Madison to identify additional funding sources. The main difference between this process and the process below is that Public Health Madison Dane County is updated throughout the process.

2. **If building is built before 1978, peeling and/or chipping paint identified on site, but NO children are living at the property who are under 6:**

   The Efficiency Navigator Program will seek other grant funds or funding sources to cover the cost of lead renovation. Once funding is identified, the property will move on to the *renovation* pathway detailed in the Implementation section.

Mold: For mold issues identified, the Efficiency Navigator Program will assess whether the mold issue qualifies for mold remediation funding sources (such as the City of Madison Rehab Loan Program or WI Asthma-Safe Homes Program[6]). If it does not, the Navigator Program will look for other grant funding to cover the cost of implementation. Once funding is identified, the process moves to Implementation.

Financing Health Upgrades: Existing programs integrating health into energy efficiency assessments have stressed the variety of sources where funding for health measures may come from. For example, ClearResult's Healthier Homes Program has been funded through innovation/pilot funds, rural funds, and health & safety funds, depending on the type of funding available in the state they were operating in. Mold and health mitigation measures have the potential to apply to many different sources of funding that are not tied to cost-

[5] See Financing Health Upgrades section for more details on the LSHP.
[6] See Financing Health Upgrades section for more details on the City of Madison Rehab Loan Program or WI Asthma-Safe Homes Program.

effectiveness. Below are existing or expected programs with funding in Madison or Wisconsin for mold and/or lead mitigation. We recommend keeping up-to-date with grants/programs that mold or lead mitigation could qualify for, and importantly funding for management of the grant application process and contractor coordination may need to come from additional sources.

1. Wisconsin Department of Health Services Lead-Safe Homes Program: this is a relatively new program (started early 2020) that provides funding for lead assessments and abatement in owner-occupied and rental housing. The requirements for eligibility are listed on their website, and summarized below:
    - Owner-occupied home or tenant-occupied rental home; (*note: for tenant-occupied, only units that meet all these requirements are eligible for remediation*)
    - Home built before 1978;
    - At minimum, one (1) Medicaid or BadgerCare Plus eligible child or pregnant woman living or visiting occupant of home (visiting example: visiting home of a family member or relative, or participant of family child care provider, where the child spends three (3) hours a day on two (2) separate days a week, and a total of sixty (60) hours per year);
    - Current on all property taxes or have a tax payment plan in place;
    - Covered under a current homeowner's insurance policy for complete loss.

    Of note, if this funding is used, *all* lead hazards must be removed from the property. As mentioned in the outreach section, the LSHP is actively seeking local program administrators or partners with this program. We recommend continued collaboration with LSHP to ease and/or expedite program applications for eligible properties.

2. City of Madison's Rehabilitation Loan Program: this program provides zero and low-interest loans for specific home repairs. Eligible properties are as follows:
    - Total debt secured by the property, including the new City loan, cannot exceed 100% of the after rehabilitation value of the property.
    - Existing owner-occupied properties and rental units containing no more than sixteen dwelling units.
    - Property must be located within the City of Madison

3. Wisconsin Department of Health Services Asthma-Safe Homes Program: this is an emerging program to keep an eye on in the coming year. Once it is developed, it may offer funds to mitigate hazards associated with asthma, in a similar structure as the Lead-Safe Homes Program.

4. For additional details on strategies and ideas for pursuing health-related funding, review ACEEE's How to identify and pursue health-related funding and resources.

Implementation: Currently, the Efficiency Navigator also works with the contractor to implement energy efficiency upgrades. The Efficiency Navigator finances energy efficiency retrofits through foundation and grant support.

Lead: Depending on whether a building came in through the health department or the type of funding it receives for mitigation, it will need either lead *abatement* or lead *renovation* (see previous section for descriptions of when each would be necessary). For both lead abatement and lead renovation, lead mitigation would need to be completed before implementation other efficiency measures.

1. **Abatement Pathway:** If a building came in through Public Health Dane County Madison or was connected with this department after the assessment process, then the property will need to undergo lead abatement. Lead abatement is the process of eliminating lead paint hazards, guided by a lead risk assessment report detailing the presence and severity of lead-based paint hazards and options for abatement. Public Health Dane County Madison may provide a copy of the lead risk assessment report. The Efficiency Navigator completes a walk through with a *licensed lead abatement contractor* guided by the lead risk assessment report. After the contractor creates the scope of work, the scope is reviewed by the Efficiency Navigator and approved by the building owner. Importantly, during abatement the current tenants will need to be relocated until the work is complete. Once the work is complete, clearance is conducted by a certified risk assessor to ensure no harmful dust is left behind. Finally, the Navigator conducts a final inspection. Typical costs for the lead abatement process are in Table 2.

TABLE 2. COSTS ASSOCIATED WITH LEAD ABATEMENT PER UNIT

Item	Cost per Unit
Lead risk assessment	$600
Relocation	$1,000
Abatement	$20,000
Clearance	$2,000
Total	$23,600

2. **Renovation Pathway:** If a building was never connected with Public Health Dane County Madison (due to not having children under the age of 6), then it is acceptable for the lead to be renovated. Lead renovation entails removing chipping and peeling suspected lead-based paint following EPA's Renovation, Repair and Painting (RRP) Rule by a certified renovator. Renovation does not permanently remove lead hazards but serves as an interim control to minimize the risk of exposure to the harmful effects of lead-based paint. Individuals performing renovation must be trained and certified in the RRP's lead safe work practices. Under renovation, the Efficiency Navigator completes a walk through with a *RRP certified contractor*. After the contractor creates the scope of work, the scope is reviewed by the Efficiency Navigator and approved by the building owner. During renovation relocation is not required but occupants should not be present in the work area to minimize exposure to lead and lead dust. Once the work is complete, clearance is conducted by a certified renovator to ensure no harmful dust is left behind. Finally, the Navigator conducts a final inspection.

Mold: After mold or moisture issues are identified and funding secured, the Efficiency Navigator conducts a walk through with a *certified mold remediation contractor*. After the contractor creates the scope of work, the scope is reviewed by the Efficiency Navigator and approved by the building owner. After the scope of work is complete, the Efficiency Navigator conducts the final inspection. Depending on the severity of the mold and the source of the issue, it may make sense for energy efficiency upgrades to take place concurrently with mold remediation. We recommend the Navigator assess what sequencing makes sense on a case-by-case basis.

Conclusions and Recommendations

Overall, integrating health as a central component of the Efficiency Navigator process makes this program more holistic and comprehensive in our goals for resident comfort and resilience in their homes. Successful integration will require assessor certifications, at a minimum, BPI's Healthy Home Evaluator certification. For more advanced knowledge, assessors should consider lead risk assessor training. This training can prepare efficiency programs for partnering with health funding organizations, such as the Lead Safe Homes Program (LSHP) in Wisconsin. Partnering with the LSHP can expand program reach in Wisconsin and help streamline application processes. Implementation funding is essential to address lead or mold issues when they are identified to improve home health as well as ready homes to access funding for energy efficiency upgrades. While there are some existing grants and loan programs through the City and State agencies in Wisconsin, more availability of flexible funding to address health issues is needed – especially in situations where remediation is not mandated by law. The following outlines some specific recommendations related to integrating lead and mold into the Efficiency Navigator program.

1. **Integrating lead assessments vs mold assessments:** Importantly, the process of adding lead assessments to energy efficiency assessments was significantly more complex than adding mold assessments. Lead-based paint exposure has more regulations during the assessment (Lead Risk Assessor training), testing (Elevated Blood Lead Level measurements), and mitigation (lead abatement requirements) phases. On the other hand, in our interviews with public health departments, mold had fewer prescriptive regulations and treatment requirements. This impacted our process development. **Adding lead to the program will take additional internal staff training and time to properly integrate lead into assessments. Meanwhile, mold can more seamlessly integrate as it already has overlap with existing efficiency assessments.**

2. **Navigating building owner relationship and maintaining involvement:** Building owner enforcement with health departments arose as a potential issue as this could be a deterrent for building owners signing up for the program. Through the research process it became apparent that integrating health assessments into the existing program would inevitably require reporting building owners to health departments in specific situations (e.g., lead-based paint exposure with children under 6 living in the building). Our interviews enlightened which specific circumstances in which enforcement would be required. To this end, **implementation funding is critical for enforcement to not deter program reach**; **if funding is available for mold and/or lead-based paint exposure, this will give building owners the ability to make health improvements and as a result continue to improve housing through efficiency measures.**

3. **Data map limitations**: A variety of proxies for lead and mold were considered but not included in the final map due to either lack of established associations with lead or mold events, biases in the dataset, or time limitations due to data complexity. We considered incorporating data from the City of Madison's Watershed Studies which displays modeled impacts of a 100-year flooding event; however, we could not find documented associations between this type of flood event and mold growth in homes. In conversations with Building Inspections, reported mold events were not concentrated in specific areas of the city or with certain housing types. **The city also collects self-reported flood data; however, this data is biased towards areas where people have the time and confidence to report issues. As noted in conversations with community groups, renters are more often hesitant to report moisture and mold issues due to risk of losing housing; building owners of these properties is who our program would ideally like to reach.** Madison's building permits database was also considered but ultimately would

have been too time intensive to parse through individual permit records for moisture-related projects. In the end, asthma was included as a mold risk indicator, as asthma has a documented association with mold events (although asthma can be triggered by other events as well), and is consistently collected across the city by the CDC. Lead-based paint exposure was more straightforward to map as housing year built is a known indicator of lead-based paint and this data is readily available across all areas in the US.

4. **Data map use**: The data mapping showed the oldest homes being most prevalent along the isthmus in Madison, where 7 census tracts have at least 50% of housing built prior to 1950. This housing stock has the highest risk of lead-based paint exposure. On the other hand, homes built between 1950 and 1979 are concentrated census tracts outside of the isthmus area. These homes still have lead-based paint exposure risk, although at a lower risk than the homes built prior to 1950. Homes on the outlying census tracts on the edges of the city had very low concentrations of homes built before 1979 and should be less of a focus for the program to address lead. For asthma, an indicator of mold risk, areas on the western isthmus and northeast neighborhoods have the highest risk. **The map can be used to identify particular census tracts with the highest lead and/or mold risk, and target areas that overlay with specific demographic information (e.g., high number of children). The map should be updated regularly as data sources become updated or new data becomes available.**