NORTHERN CIRCLE INDIAN HOUSING AUTHORITY TRIP REPORT
Assessment of Mold and Moisture Conditions

Final Report

Date:
July 21-25, 2004

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U.S. Department of Housing & Urban Development
Office of Native American Programs

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BACKGROUND INFORMATION

The NCHA is located in Ukiah in Mendocino County, California. The Berry Creek Rancheria is located in Oroville in Butte County and the Manchester Point Arena Rancheria is located in Point Arena in Mendocino County in the state of California. Mendocino County is on the Pacific Coast, and greatly influenced by the large body of relatively cool water. Oroville is nestled next to the Sierra Nevada foothills and neighboring Lake Oroville. There are 111 American Indian/Alaskan Native (AIAN) Persons residing on the Berry Creek Rancheria and 173 AIAN persons residing on the Manchester Point Arena Rancheria. Berry Creek has 17 Mutual Help units and 23 Low Rent units for a total of 40 units. Manchester Point Arena Rancheria has 11 Mutual Help units and 29 Low Rent units for a total of 40 units. The average annual precipitation is 26.87 inches in Oroville and 40.50 inches in Point Arena. The average annual maximum temperature is 75.5 degrees F in Oroville and 61.8 degrees F in Point Arena and the average annual minimum temperature is 48.8 degrees F in Oroville and 40.88 degrees F in Point Arena.

The assessment team responded to a request from the NCHA to assess site and housing conditions contributing to mold and moisture problems. Darlene Tooley, NCHA Executive Director, requested technical assistance to address mold and moisture conditions. The assessment team visited 14 homes, seven at Berry Creek Rancheria and seven at Manchester Point Arena Rancheria. Exterior and interior inspections were conducted at 15 homes. At one home the occupants were not present, so only an exterior inspection was done. All the homes were slab-on-grade and ranch style. The homes at Berry Creek Rancheria were heated with natural gas. The homes at Manchester Point Arena Rancheria were heated with propane.
PART I

NORTHERN CIRCLE INDIAN HOUSING AUTHORITY TRIP REPORT

INTRODUCTION

Kate Brown from the Building Research Council (BRC) at the University of Illinois Urbana-Champaign and Paul Knight from Magna Systems conducted a site visit at the Northern Circle Indian Housing Authority (NCIHA). The NCIHA administers the housing program for the Tyme Maidu Tribe of Berry Creek Rancheria and the Manchester Band of Pomo Indians of the Manchester Point Arena Rancheria. The assessment team provided technical assistance to the Housing Authority in assessing mold and moisture conditions in housing units. This report summarizes activities and issues addressed while on site. A detailed analysis of findings and recommendations is found in PART II: Northern Circle Indian Housing Authority Technical Housing Assessment Report: Examining Mold and Moisture Conditions of Homes on the Berry Creek, Manchester Point Arena Rancherias.

BACKGROUND INFORMATION

The NCIHA is located in Ukiah in Mendocino County, California. The Berry Creek Rancheria is located in Oroville in Butte County and the Manchester Point Arena Rancheria is located in Point Arena in Mendocino County in the State of California. Mendocino County is on the Pacific Coast, and greatly influenced by the large body of relatively cool water. Oroville is nestled next to the Sierra Nevada foothills and neighboring Lake Oroville. There are 111 American Indian/Alaskan Native (AIAN) Persons residing on the Berry Creek Rancheria and 178 AIAN persons residing on the Manchester Point Arena Rancheria. Berry Creek has 17 Mutual Help units and 23 Low Rent units for a total of 40 units. Manchester Point Arena Rancheria has 11 Mutual Help units and 29 Low Rent units for a total of 40 units. The average annual precipitation is 28.57 inches in Oroville and 40.88 inches in Point Arena. The average annual maximum temperature is 75.5 degrees F at Oroville and 61.8 degrees F in Point Arena and the average annual minimum temperature is 48.8 degrees F in Oroville and 40.88 degrees F in Point Arena.

The assessment team responded to a request from the NCIHA to assess site and housing conditions contributing to mold and moisture problems. Darlene Tooley, NCIHA Executive Director, requested technical assistance to address mold and moisture conditions. The assessment team visited 14 homes, seven at Berry Creek Rancheria and seven at Manchester Point Arena Rancheria. Exterior and interior inspections were conducted at 13 homes. At one home the occupants were not present, so only an exterior inspection was done. All the homes were slab-on-grade and ranch style. The homes at Berry Creek Rancheria were heated with natural gas. The homes at Manchester Point Arena Rancheria were heated with propane.
Day 1: Monday, June 21, 2004

Monday was a travel day.

Day 2: Tuesday, June 22, 2004

The assessment team arrived at the Berry Creek Rancheria Tribal Office in Oroville, CA on Tuesday morning to meet with Dwayne Brown, Environmental Coordinator for the Tyme Maidu Tribe, Don Casillas, NCIHA Maintenance Manager and Robert Long, NCIHA Housing Inspector. The group discussed the day’s activities, outlined the team’s role while on the Rancheria, and addressed the housing authority’s issues. The NCIHA housing staff discussed the specific mold and moisture issues that the Housing Authority had been handling at this site.

The NCIHA selected the properties to be inspected and Don Casillas coordinated the logistics for the site visit. The assessment team, guided by Don Casillas, inspected seven homes on the rancheria.

In the late afternoon, the assessment team traveled to the administrative office of the NCIHA in Ukiah, CA.

Day 3: Wednesday, June 23, 2004

In the morning, the assessment team met with Darlene Tooley, Executive Director of NCIHA and her staff. Half day training was conducted for the NCIHA staff. Digital photos from Berry Creek Rancheria were presented during the training session. Darlene Tooley extended an invitation to Mary Weber from the local area Indian Health Services. She attended the training session.

In the afternoon, the assessment team traveled to the Manchester Point Arena area.

Day 4: Thursday, June 24, 2004

In the morning, the assessment team met with Don Casillas and Robert Long at the Manchester Point Arena Rancheria in Point Arena, CA, to discuss the day’s activities. The NCIHA housing staff reviewed the specific mold and moisture issues that the Housing Authority had been handling at this coastal site.

The NCIHA selected the properties to be inspected and Don Casillas coordinated the logistics for the site visit. The assessment team, guided by Don Casillas, inspected exterior and interior conditions in six homes and exterior conditions only at one home.

Day 5: Friday, June 25, 2004

Friday was a travel day.
FINDINGS

An overview of the findings and recommendations from the site visit follows. PART II: Northern Circle Indian Housing Authority Technical Assessment Report provides a more detailed discussion and analysis of the findings.

Northern Circle Indian Housing Authority

Three sets of findings are presented. The first set of findings relate to both Rancherias. The second set of findings relate only to the Berry Creek Rancheria. The third of findings relate only to the Manchester Point Arena Rancheria.

A. Findings for both Rancherias:

1. All the bathroom fans were the originally installed ones, functioned poorly, vented to the outside, as did the kitchen exhaust fans.

2. The metal framed double-glazed windows units had been installed improperly allowing for rain water entry.

3. Site drainage was generally good at all the inspected homes, especially for the Berry Creek Rancheria homes. Although the development was built into the side of a hill where site drainage could be a serious issue, sites were well designed to direct rain water away from the homes. It was clear that a significant amount of time, money, and effort were expended to ensure good site drainage. All the homes had intact gutter systems, which blended very well with the home designs and color schemes.

B. Berry Creek Rancheria Findings

1. Metal supply air plenums, or ducting, for the evaporative cooling systems were not insulated in the attics allowing condensation to occur on the inside of the plenums during the heating season.

2. Furnaces were sealed combustion; that is, no indoor air was used for combustion. This helped maintain good indoor air quality during the heating season.

3. The water heaters were natural draft. Combustion air inlets were clogged with lint and appeared too small for the water heaters.

C. Manchester Point Arena Rancheria Findings

1. Exterior siding is T-1-11. Fungal growth was found in the routed sections of the siding as well as in joints between pieces. Sections of the siding were soft indicating rot. The window trim was rotting.
2. The exterior bandjoists at the base of the homes were not properly designed to shed water. Water was getting behind the bandjoist and is also being absorbed by the wood T-1-11 siding contributing to fungal growth and rot in the siding.

3. Metal supply air registers in the attic were not insulated creating potential condensation and rust issues.

FUTURE HOUSING AUTHORITY ACTIONS

The following are recommendations the Housing Authority may consider in the existing and future housing projects:

1. Install ventilation fans with high CFM ratings for the bathroom conditions.

2. Develop policies and procedures for handling mold and moisture problems in tribal homes.

3. Work with the Tribal Attorney to develop an Addendum to the standard lease agreement that requires the tenant to take steps to reduce the potential for mold growth in their unit. *Attachment 1* is a copy of the Addendum under development by another Tribe. This document not only provides some level of protection for the occupants, but also an excellent educational tool that lists tenant actions or steps to discourage mold growth and promote a healthy environment.

4. Include a ‘Notice, Disclosure and Disclaimer’ statement addressing mold conditions in current tenants lease agreement packet. With minor editing by the Housing Director and Tribal Attorney, this document can provide valuable information to potential tenants. *See Attachment 2*.

The Housing Authority (HA) is taking positive action to develop a team effort between the HA and the tenants to prevent mold. Both the Addendum and Notice, Disclosure and Disclaimer documents in Tenant Lease Agreements could provide valuable information on mold background, tenant responsibilities, and practices that contribute to a healthy indoor environment. Preventing mold requires a team effort among the HA, building maintenance, and occupants. These documents, if included, reinforce the important role occupants play in maintaining healthy, safe home environments.

PROGRAMMATIC RECOMMENDATIONS

Addressing mold and moisture problems presents a two-phase challenge to all housing authorities to develop a prompt and effective delivery system:

- Develop a partnership between the HA and residents.
- Develop a two-part training program to:
Train maintenance staff to implement technical recommendations.
- Train residents on their roles and responsibilities as homeowners and tenants.

The HA has already taken excellent steps to create a partnership with the residents. Additional steps to supplement their program could include the following formalized methods for addressing mold problems and maintenance issues as they occur:

1. Mandatory attendance at annual homeowner/tenant clinics as part of the annual recertification process. At these clinics, provide instruction on home maintenance issues, such as identifying and repairing leaks, using exhaust fans and maintaining gutters.

2. During the annual recertification process, ask occupants to complete a survey based on Housing Quality Standards (HQS) with additional questions on mold and moisture conditions in their homes. Completing the survey further engages residents in home maintenance. Furthermore, the survey responses provide additional information to the housing authority on unreported problems, especially leaks and inoperable fans that might contribute to an unsafe, unhealthy home environment.

The following web sites and references provide further information on mold remediation and testing:

**Indoor Air Quality:**

**Ball State University Indoor Environment Notebook** - General resource on a number of topics related to indoor air quality.
http://publish.bsu.edu/ien/archives/archive_list.htm  
(will open a new browser window)

**Mold:**

**EPA** - Mold Remediation in Schools and Commercial Buildings
http://www.epa.gov/iaq/molds/index.html  
(will open a new browser window)

**New York City Department of Health Bureau of Environmental & Occupational Disease Epidemiology** - Guidelines on Assessment and Remediation of Fungi in Indoor Environments
( will open a new browser window)

**References:**

*Guidelines on Assessment and Remediation of Fungi in Indoor Environments* attachment, Bemidji Area Indian Health Service Office of Environmental Health and Engineering, Environmental Health Services Section.

Exhibit "A" to Lease Agreement

Joseph E. Quinault

This Addendum to Lease Agreement dated the 7th day of July, 1970, is attached to and made part of the Lease Agreement dated 7th day of November, 1970, by and between ("Landlord") and ("Tenant") and relates to Unit #.

WHEREAS, it is acknowledged between Landlord and Tenant that apartments in areas that experience high humidity and wet weather may under certain circumstances experience mold growth and,

WHEREAS, Landlord and Tenant agree that the Tenant should use due diligence in attempting to minimize the possible environment for mold growth by preventing excess moisture inside the unit area, and,

WHEREAS, the Tenant agrees to contribute to these efforts and the goal of preventing mold growth in the unit by alternatively accepting the following obligation:

NOW, THEREFORE, Landlord and Tenant agree as follows:

1. Tenant agrees to open windows, as temperature and weather conditions permit, to allow an exchange of air and permit the introduction of sunlight throughout the unit.

2. Tenant agrees to regularly maintain the air conditioning system but not exclusive of, vacuuming, cleaning, dusting, and using typical household cleaners.

3. Tenant agrees to maintain general temperatures within the unit between 65°F and 75°F, as well as maintain general relative humidity between 30% and 50% within the unit at all times. Further, Tenant agrees that if Tenant is having trouble maintaining these indoor comfort conditions that Tenant will promptly notify Landlord so that repairs can be made to maintain these indoor air quality standards.

4. Tenant agrees to air out as reasonably possible, mine down and dry areas that accumulate visible moisture like counter tops, windows, window sills, bathroom walls, shower areas, etc.

5. Tenant agrees to use pre-installed bathroom fans when showering or bathing in such a way that excess moisture is vented from the bathroom.

6. Tenant agrees to leave bathroom doors open until all moisture on mirrors and bathroom wall surfaces has dissipated.

7. Tenant agrees to clean laundry and other wet upholstered items as soon as possible after they have become wet.

8. Tenant agrees to use exhaust fans in kitchens when cooking or while dishwashers are on dry cycles to vent excess moisture from kitchens.

9. Tenant agrees to limit house plants to a reasonable number, do not over water house plants and clean up spills from over watering.

10. The Institute of Continuing Legal Education

Attachment 1
Exhibit B
Exhibit “A” to Lease Agreement

Joseph E. Quandt

This Addendum to Lease Agreement dated this _______ of ________________,
20____ is attached to and made part of the Lease Agreement dated ________________
20____ by and between (“Landlord”) of and ______________________________________
("Tenant") and relates to Unit #_____.

WHEREAS, it is acknowledged between Landlord and Tenant that apartments in
areas that experience high humidity and wet weather may, under certain circumstances,
experience mold growth; and,

WHEREAS, Landlord and Tenant agree that the Tenant should use due diligence in
attempting to ameliorate the possible environment for mold growth by preventing excessive
humidity inside the unit area; and,

WHEREAS, the Tenant agrees to contribute to these efforts and the goal of preventing
mold growth in the unit by affirmatively accepting the following obligation:

NOW THEREFORE, Landlord and Tenant agree as follows:

1. Tenant agrees to open windows, as temperature and weather conditions permit, to
allow an exchange of air and permit the introduction of sunlight throughout the unit.

2. Tenant agrees to regularly maintain the unit including but not exclusive of, vacuuming,
mopping, dusting, and using typical household cleaners.

3. Tenant agrees to maintain general temperatures within the unit between 65°F and
78°F as well as maintain general relative humidity between 30 and 50% within the
unit at all times. Further, Tenant agrees that if Tenant is having trouble maintaining
these indoor ambient conditions that Tenant will promptly notify Landlord so that
repairs can be made to maintain these indoor air quality standards.

4. Tenant agrees to as soon as reasonably possible, wipe down and dry areas that
accumulate visible moisture like counter tops, windows, window sills, bathroom
walls, shower areas, etc.

5. Tenant agrees to use pre-installed bathroom fans when showering or bathing in
such a way that excess moisture is vented from the bathroom.

6. Tenant agrees to leave bathroom doors open until all moisture on mirrors and bath-
room walls/tile surfaces has dissipated.

7. Tenant agrees to clean laundry and other wet upholstered items as soon as possi-
ble after they have become wet.

8. Tenant agrees to use exhaust fans in kitchens when cooking or while dishwashers
are on dry cycles to vent excess moisture from kitchens.

9. Tenant agrees to limit house plants to a reasonable number, do not over water
house plants and clean up spills from over watering.

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1. Mr. Quandt gratefully acknowledges the assistance of Julie A. Harrison in the compi-
lation of written materials for this program.
10. Tenant agrees to ensure that any clothes dryer vent is properly connected and clear of obstructions. Also, clean the lint screen after every use. When washing clothes in warm or hot water, watch to make sure that condensation is not built up within the washer and dryer closet. If condensation does gather, leave the closet door open after every use.

11. Tenant agrees to when showering, be sure to keep the shower curtain inside the tub or fully close the shower doors.

12. Tenant agrees to periodically clean and dry the walls around the bathtub and shower using a common reliable household cleaner.

13. Tenant agrees to not allow damp or moist stacks of clothes or other cloth material to lay in piles.

14. Tenant agrees to immediately report to the management office, any evidence of a water leak or excess moisture in the unit, storage room, garage or any common area.

15. Tenant agrees to immediately report to management any evidence of mold or mildew like growth that cannot be removed by simply applying a common reliable household cleaner.

16. Tenant agrees to look for leaks in washing machine hoses and discharge lines especially if the leak is large enough for water to saturate trim or drywall.

17. Tenant agrees to immediately report to management, any failure or malfunction with the heating ventilation or your air conditioning system.

18. Tenant agrees to immediately report to management any inoperable windows.

19. Tenant agrees to not block or cover any heating ventilation or air conditioning supply, diffusers and/or return grills in the unit.

20. Tenant agrees to follow the house pet policy and immediately clean up any pet accidents.

21. Tenant agrees to recognize that unreasonable and/or humidifier use can contribute to conditions favorable for mold growth.

22. Tenant agrees to recognize that personal air cleaners have been linked to unacceptable amounts of ozone in indoor environments and that the use of personal air cleaners is discouraged as ozone can enhance the condition and environment for excess mold growth.

Tenant agrees that Tenant shall be responsible for damage to the unit and the Tenant’s property as well as any injury to the Tenant or anyone residing in the unit with Tenant for any period of time which results from the Tenant’s failure to comply with this exhibit/addendum. A default under the terms of this Addendum/Exhibit shall be deemed a material default under the terms of the lease and Landlord shall be entitled to exercise all rights and remedies at law or in equity.

Except as specifically stated herein, all other terms and conditions of the lease shall remain unchanged. In the event of any conflict between the terms of this Addendum/Exhibit and the terms of the lease, the terms of this Addendum/Exhibit shall control. Any term that is capitalized but not defined in this Addendum/Exhibit that is capitalized and
defined in the Lease shall have the same meaning for the purposes of this Addendum/Exhibit as it has for purposes of the Lease. Tenant understands that if mold is detected in Tenant's unit under certain circumstances, Landlord may, at its discretion, temporarily relocate Tenant to a comparable furnished apartment while the problem is evaluated. This may include Landlord's option to terminate Tenant's Lease. Your signature below indicates your agreement that Landlord may temporarily relocate Tenant to a comparable furnished unit under such circumstances.

Agreed to this ____ day of __________________, 20__.

Landlord: Tenant:
NOTICE, DISCLOSURE and DISCLAIMER

What Homeowners Should Expect About Mold

Mold: Molds are filamentous fungi that grow over surfaces in damp, humid conditions. They can grow on any building material, including hard surfaces and wood building materials. They can grow in dry environments and thrive in locations with high relative humidity. Mold growth can occur in both indoor and outdoor environments, and it is a common occurrence in most homes. Mold growth can be prevented by maintaining proper ventilation and moisture control. Homeowners should be aware of the potential health effects of mold exposure and take appropriate measures to prevent mold growth.

Attachment 2

What the Homeowner Can Do: The homeowner can take positive steps to reduce or eliminate the concentration of mold growth in the home, and thereby minimize any possible adverse effects. The following steps can be taken by mold growth prevention, mold growth prevention, and mold growth prevention, mold growth prevention.

1. Before bringing items into the home, check for signs of mold. Fungal plants (roots and stem), fruiting bodies or even juices, and conditions that promote mold growth, such as high humidity and poor ventilation, can be identified. Benches and furniture, as well as any other household items, should be checked. Remove any mold growth that is present.

2. Keep the humidity in the home low. Vent clothes dryers to the outdoors. Ventilate kitchens and bathrooms by opening the window, by using exhaust fans, or by running the condenser exhaust system. The Institute of Contemporary Legal Education
Mold Matters: Everything You Should Know: March 25, 2003

NOTICE, DISCLOSURE and DISCLAIMER

What Homeowners Should Know about Mold

Mold. Lately, mold has been in the news. Mold is a type of fungus. It occurs naturally in the environment, and it is necessary for the natural decomposition of plant and other organic material. It spreads by means of microscopic spores borne on the wind, and is found everywhere life can be supported. Residential home construction is not, and cannot be, designed to exclude mold spores. If the growing conditions are right, mold can grow in your home. Most homeowners are familiar with mold growth in the form of bread mold, and mold that may grow on bathroom tile.

In order to grow, mold requires a food source. This might be supplied by items found in the home, such as fabric, carpet or even wallpaper, or by building materials, such as drywall, wood and insulation, to name a few. Also, mold growth requires a temperate climate. The best growth occurs at temperatures between 40 degrees F and 100 degrees F. Finally, mold growth requires moisture. Moisture is the only mold growth factor that can be controlled in a residential setting. By minimizing moisture, a homeowner can reduce or eliminate mold growth.

Moisture in the home can have many causes. Spills, leaks, overflows, condensation, and high humidity are common sources of home moisture. Good housekeeping and home maintenance practices are essential in the effort to prevent or eliminate mold growth. If moisture is allowed to remain on the growth medium, mold can develop within 24 to 48 hours.

Consequences of Mold: All mold is not necessarily harmful, but certain strains of mold have been shown to have adverse health effects in susceptible persons. The most common effects are allergic reactions, including skin irritation, watery eyes, runny nose, coughing, sneezing, congestion, sore throat and headache. Individuals with suppressed immune systems may risk infections. Some experts contend that mold causes serious symptoms and diseases which may even be life threatening. However, experts disagree about the level of mold exposure that may cause health problems, and about the exact nature and extent of the health problems that may be caused by mold. The Center for Disease Control state that a causal link between the presence of toxic mold and serious health conditions has not been proven.

What the Homeowner Can Do. The homeowner can take positive steps to reduce or eliminate the occurrence of mold growth in the home, and thereby minimize any possible adverse effects that may be caused by mold. These steps include the following:

1. Before bringing items into the home, check for signs of mold. Potted plants (roots and soil), furnishing or stored clothing and bedding material, as well as many other household goods, could already contain mold growth.

2. Regular vacuuming and cleaning will help reduce mold levels. Mild bleach solutions and most tile cleaners are effective in eliminating or preventing mold growth.

3. Keep the humidity in the home low. Vent clothes dryers to the outdoors. Ventilate kitchens and bathrooms by opening the window, by using exhaust fans, or by running the
air conditioning to remove excess moisture in the air, and to facilitate evaporation of water from wet surfaces.

4. Promptly clean up spills, condensation and other sources of moisture. Thoroughly dry any wet surfaces or material. Do not let water pool or stand in your home. Promptly replace any materials that cannot be thoroughly dried, such as drywall or insulation.

5. Inspect for leaks on a regular basis. Look for discolorations or wet spots. Repair any leaks promptly. Inspect condensation pans (refrigerators and air conditioners) for mold growth. Take notice of musty odors, and any visible signs of mold.

6. Should mold develop, thoroughly clean the affected area with a mild solution of bleach. First, test to see if the affected material or surface is color safe. Porous materials, such as fabric, upholstery or carpet should be discarded. Should the mold growth be severe, call on the services of a qualified professional cleaner.

Disclaimer and Waiver

Whether or not you as a homeowner experience mold growth depends on how you manage and maintain your home. Our responsibility as a homebuilder must be limited to things that we can control. As explained in our written warranty, provided by separate instrument, we will repair or replace defects in our construction (defects defined as a failure to comply with reasonable standards of residential construction) for a period of ____ years. We, the builder, will not be responsible for any damages caused by mold, or by some other agent that may be associated with defects in our construction, to include but not limited to property damage, personal injury, loss of income, emotional distress, death, loss of use, loss of value, and adverse heath effects, or any other effects. Any implied warranties, including an implied warranty of workmanlike construction, an implied warranty of habitability, or an implied warranty of fitness for a particular use, are hereby waived and disclaimed.

This notice, disclosure and disclaimer agreement is hereby appended to and made apart of the contract of sale. The consideration for this agreement shall be the same consideration as state in the contract of sale. Should any term or provision of this agreement be ruled invalid or unenforceable by a court of competent jurisdiction, the remainder of this agreement shall nonetheless stand in full force and effect.

I acknowledge receipt of the notice, disclosure and disclaimer agreement. I have carefully read and reviewed its terms, and I agree to its provisions.

BUYER DATE SELLER DATE

BUYER DATE SELLER DATE

10-5 The Institute of Continuing Legal Education
PART II
NORTHERN CIRCLE INDIAN HOUSING AUTHORITY

TECHNICAL HOUSING ASSESSMENT REPORT

EXAMINING MOLD AND MOISTURE CONDITIONS IN HOMES ON THE TYME MAIDU TRIBE OF BERRY CREEK AND THE MANCHESTER BAND OF POMO INDIAN OF THE MANCHESTER POINT ARENA RANCHERIA

Executive Summary

Introduction

Section 1: Methodology

Section 2: House Descriptions

Section 3: Findings

Section 4: Technical Discussion and Recommendations

Section 5: Discussion of Common Problems

Appendix A: Housing Survey Summary Site Visit Report

Appendix B: Housing Assessment Results
EXECUTIVE SUMMARY

Fourteen units were inspected for mold and moisture problems for the Northern Circle Indian Housing Authority (NCIHA). Seven homes were inspected at the Berry Creek Rancheria in Oroville, CA, and seven were inspected at the Manchester Point Arena Rancheria. The investigation was conducted between June 21st and June 25th by Kate Brown (Building Research Council) and Paul Knight (Magna Systems). The team conducted a mold training session for the NCIHA staff on the morning of June 23rd.

Thirteen home inspections were conducted. Occupants were not present at one home, so only an exterior inspection was made. The inspection process involved visual assessment of both interior and exterior conditions, air flow measurement of bathroom exhaust fans and resident interviews where possible.

NCIHA reported the following moisture problems in their homes:

- Window condensation during the winter.
- Rotting wood siding and window trim.
- Occasional mold in bathrooms and in bedrooms.

Minor amounts of mold were found in 13 of the 14 homes, usually limited to window stools, under sinks, and on ceilings. Rotted siding and window trim was found on 8 homes (all seven at Manchester Point Arena and one at Berry Creek).

Window condensation and leakage was an issue at both Rancherias. All the measured bathroom exhaust fans performed below their rated capacities. All inspected homes at Berry Creek Rancheria had condensation issues related to the distribution system for the evaporative coolers. All the inspected homes at Manchester Point Arena had exterior water problems related to the siding.

Most of the inspected buildings were constructed in 1992 and 1993. All the homes were site built with 2” x 6” framing built over slabs-on-grade.

FINDINGS

Three sets of findings; first those related to both Rancherias, second those related to the Berry Creek Rancheria, and third those related to the Manchester Point Arena Rancheria, follow:

A. Findings for both Rancherias:

1. All the bathroom fans were the originals, functioned poorly, and vented to the outside, as did the kitchen exhaust fans.

2. The metal framed double-glazed windows units were not installed properly allowing for rain water entry.
Northern Circle Indian Housing Authority
Technical Housing Assessment Report

June 21-25, 2004

3. Site drainage was generally good at all of the inspected homes, especially for those homes at the Berry Creek Rancheria. Although the development was built into the side of a hill where site drainage could have been a serious issue, the sites were well designed to direct rain water away from the homes. It was clear that a significant amount of time, money, and effort were expended to ensure good site drainage. All the homes had intact gutter systems which blended very well with the design and color schemes of the homes.

B. Berry Creek Rancheria Findings

1. Metal supply air plenums for the evaporative cooling systems were not insulated in the attics allowing condensation to occur on the inside of the plenums during the heating season.

2. Furnaces are sealed combustion; that is, no indoor air is used for combustion. This helps maintain good indoor air quality during the heating season.

3. Water heaters are natural draft. Combustion air inlets were clogged with lint and appeared to be too small for the water heaters.

C. Manchester Point Arena Rancheria Findings

1. Exterior siding is T-1-11. Fungal growth was found in the routed sections of the siding as well as in joints between pieces. Sections of the siding were soft indicating rot. The window trim was rotting.

2. The exterior bandjoists at the base of the homes were not properly designed to shed water. Water is getting behind the bandjoist and is also being absorbed by the wood T-1-11 siding contributing to fungal growth and rot in the siding.

3. Metal supply air registers in the attic are not insulated creating potential condensation and rust issues.

The report provides technical recommendations and discussions focusing on these items. Appendix A includes a summary of findings at each inspected unit. Appendix B provides observations and recommendations for each unit.
INTRODUCTION

The Building Research Council (BRC) responded to a request from the Eastern/Woodlands Office of Native American Programs to assess site and structural conditions contributing to mold and moisture problems in homes managed by the Northern Circle Indian Housing Authority (NCIHA) in northern California. The investigation was conducted between June 21st and June 25th by Kate Brown (Building Research Council) and Paul Knight (Magna Systems). The team conducted a mold training session for NCIHA staff on the morning of June 23rd. Inspected units were pre-selected by NCIHA which included homes in the Berry Creek and Manchester Point Arena Rancherias.

NCIHA has reported the following moisture problems in their homes:

- Window condensation during the winter.
- Rotting wood siding and window trim.
- Occasional mold in bathrooms and in bedrooms.

Fourteen homes were inspected (an exterior inspection only was done at one unit, since the occupants were not home). Minor amounts of mold were found in 13 homes, usually limited to window stools, under sinks, and bathroom ceilings.

All the homes had good, well-designed site drainage and intact gutter systems.

All the windows were double glazed with metal frames. However, the windows were not flashed properly, causing rain water to drain behind the trim and exterior siding. Interior window condensation also occurred during the heating season.

All but one bathroom fan appeared to be original. All exhaust fans vented to the outside, but functioned below their rated capacity. The kitchen fans vented to the exterior.

Homes at the Berry Creek Rancheria had evaporative cooling systems, or swamp coolers. Metal supply air plenums were not insulated and condensation could occur inside the plenums during the heating season. Seal the plenums from the interior during the heating season to prevent this occurrence. However, it was clear that this could not be done in many instances. Condensation could also occur on the metal pressure activated dampers related to the operation of the evaporative cooling system.

Swamp coolers were not used at the Manchester Point Arena Rancheria. However, some metal supply air registers located in the ceilings were not insulated creating potential condensation and rust issues.
Exterior siding at Manchester Point Arena is T-1-11. Fungal growth was on the siding (Figure 1). The poor design of the wood bandjoist at the base of the homes also contributed to siding mold and rot.

SECTION 1 – METHODOLOGY

Visual inspection was used to assess mold and moisture conditions in the homes.

The results of the mold and moisture assessments were compiled on a spreadsheet, with broad categories of common moisture problems noted. This data is presented in Appendix A of this report. Findings and recommendations for individually inspected homes are presented in Appendix B.

Visual Inspection

Housing inspections consisted of visual assessment of mold and moisture conditions. Assessment forms developed for the Chicago Mold and Moisture Project (a HUD Healthy Homes Program) were used to record information. The assessment forms are organized for a room-by-room inspection. All rooms were examined for water damage and evidence of mold. Assessment of kitchens, bathrooms, utility rooms and attics included additional inspection relating to plumbing, localized ventilation, water entry and other moisture source issues.

The exterior of the homes were inspected for rain water management, including site grading, roof condition and gutter system.

Whenever possible, residents were interviewed to gather history on moisture problems, plumbing leaks, winter condensation, health issues, number of occupants and other useful information that could be offered.

Digital photographs were taken at each home to visually record notable conditions.

Measurements

Actual ventilation rates of bathroom fans were measured with an exhaust fan flow meter. The flow meter consists of a gasketed pan that is placed tightly over an operating exhaust fan. The pan has a variable orifice and a connection for a digital manometer. The manometer measures the pressure difference between the pan and the house during fan operation. Based on the setting of the variable orifice and the measured pressure difference at the fan, the cubic feet of air per minute (CFM) exhaust by the fan is calculated.
SECTION 2 – HOUSE DESCRIPTIONS

NCIHA manages 40 homes at the Berry Creek Rancheria (111 residents) and 40 homes at the Manchester Point Arena Rancheria (178 residents). All the homes were constructed in the late 1980’s and early 1990’s.

All homes are 2” x 6” stick-built construction. Sidewall insulation could not be inspected and is assumed to be R19 fiberglass batts. Inspected attics were insulated with R38 fiberglass batt insulation. Soffit and ridge vents were the common attic ventilation strategy.

*Masonite* siding was used as the exterior siding material at Berry Creek. T-1-11 siding was used as exterior siding for homes at Manchester Point Arena. *Masonite* is oriented strand board (OSB) textured to look like wood lap siding and was produced by the Masonite Corporation (Masonite discontinued the production of its OSB siding in 1996; Louisiana-Pacific currently produces an OSB siding called (*Omniwood*). Over time the, OSB siding was plagued with widespread failures. In a May 1995 class-action lawsuit, filed in the U.S. District Court in Portland, Oregon, plaintiffs claimed that the siding was swelling, warping, disintegrating, and even growing mushrooms\(^1\).

T-1-11 siding was used at Manchester Point Arena. T-1-11 siding is textured plywood panels, usually 4’ x 8’ sheets and ½” thick. Fungal growth was common on this siding, particularly on walls oriented south. Failures of T-1-11 siding have also been reported, but not to the extent of OSB siding.

A horizontal band joist (2” x 10”) was installed at the base of the homes. The joint between the T-1-11 siding and band joist was caulked, however, much of the caulk had failed over time. The band joist was not cambered, or curved, to shed rain water (Figure 2). Consequently, wood rot at this joint was commonly found.

All the homes were built on slab-on-grade. Slab perimeters at Manchester Point Arena were insulated with 2” of extruded polystyrene insulation (R10).

Gas-fired forced air heating systems are used in the Berry Creek homes. All but one of the furnaces was direct vent sealed combustion (90% efficient). Propane-fired furnaces (80% efficient) are used in the Manchester Point Arena homes. Insulated flex is used as the supply air ducts and are located in the attics. Central returns are utilized with grilles in the furnace closet doors. Homes at Manchester Point Arena also utilized wood stoves for heating (Figure 3). Most of these stoves had supply air ducted to them.

\(^1\) Environmental Building News, Vol.4, Number 6
Evaporative cooling systems are used at Berry Creek. No cooling systems are used at Manchester Point Arena. Cooling units are hung on a side wall and utilized separate supply ducts to the house (Figure 4). Drain lines from the units are located in the exterior walls and have caused leakage problems in the past.

Cool air is supplied to the home through three supply air registers. The ducts are insulated as was the first metal plenum over the supply air register nearest to the evaporative cooling unit. The remaining two metal plenums were not insulated. Pressure activated dampers located in the living and dining room ceilings are used in the homes to relieve pressure when the system is operating.

All the water heaters are gas or propane-fired natural draft units. Combustion air inlets are used to supply air to the water heaters in the Berry Creek homes. Combustion air is drawn from the attic and ducted to the water heater closets. It appeared that the inlets were under-sized. Many of the inlets were blocked with dust and lint restricting the flow of air to the water heaters. The water heaters at the Manchester Point Arena Rancheria are located outside the living space in storage closets attached to the homes.

SECTION 3 – FINDINGS

3.1 Bathroom & Kitchen Exhaust Fans; Clothes Dryers

Properly operating and vented exhaust fans and clothes dryers remove moisture from bathrooms and homes. Bathroom exhaust fans were found in all of the homes. An exhaust fan flow meter (Figure 5) was used to measure actual CFM exhausted by the bathroom fans (the fan flow meter doesn't fit over kitchen exhaust fans). The measured exhaust ranged between 0 CFM and 100 CFM (see Table 1). The rated exhaust flow of the fans was 80 CFM.

Figure 4 - Typical evaporative cooling unit

Figure 5 - Exhaust fan flow hood and digital manometer
Table 1: Measured Bathroom Fan CFM

<table>
<thead>
<tr>
<th>House Address</th>
<th>Main Bath Fan CFM</th>
<th>Bedroom Bath Exhaust Fan</th>
</tr>
</thead>
<tbody>
<tr>
<td>86 Tyme Way</td>
<td>36 CFM</td>
<td>n/a</td>
</tr>
<tr>
<td>97 Tyme Way</td>
<td>59 CFM</td>
<td>36 CFM</td>
</tr>
<tr>
<td>98 Tyme Way</td>
<td>46 CFM</td>
<td>n/a</td>
</tr>
<tr>
<td>115 Tyme Way</td>
<td>36 CFM</td>
<td>29 CFM</td>
</tr>
<tr>
<td>6 Yellow Hammer</td>
<td>41 CFM</td>
<td>n/a</td>
</tr>
<tr>
<td>11 Yellow Hammer</td>
<td>53 CFM</td>
<td>50 CFM</td>
</tr>
<tr>
<td>85 Yellow Hammer</td>
<td>100 CFM*</td>
<td>65 CFM</td>
</tr>
<tr>
<td>407 Sea Lion Crt.</td>
<td>41 CFM</td>
<td>50 CFM</td>
</tr>
<tr>
<td>409 Sea Lion Crt.</td>
<td>54 CFM</td>
<td>n/a</td>
</tr>
<tr>
<td>406 Sea Lion Crt.</td>
<td>32 CFM</td>
<td>21 CFM</td>
</tr>
<tr>
<td>408 Sea Lion Crt.</td>
<td>0 CFM</td>
<td>46 CFM</td>
</tr>
<tr>
<td>403 Sea Lion Crt.</td>
<td>32 CFM</td>
<td>n/a</td>
</tr>
<tr>
<td>509 Garcia Crt</td>
<td>43 CFM</td>
<td>n/a</td>
</tr>
</tbody>
</table>

* - Replacement fan

All bathroom fans vented to the outside. Flexible metallic duct was used at Berry Creek (Figure 6). A combination of flexible metallic duct and rigid metal duct were found at Manchester Point Arena. Most fans were controlled by an “on/off” switch that also controlled the bathroom light.

A few fans were controlled by a separate on/off switch. All but one bathroom fan was quite noisy. Occupants tend not to use fans that are loud.

The fan at 85 Yellow Hammer appeared to have been a replacement and was very quiet. This fan had the greatest CFM exhaust at 100 CFM.

At a minimum, bathroom exhaust fans should provide a ventilation rate of 70 CFM. None of the original bathroom exhaust fans measured greater than this. It is not unique to the housing stock at NCIHA to have bathroom fans measuring below their rated exhaust capacity. This is commonly seen in all housing types, regardless of economic strata.
All the kitchen fans vented to the outside which is imperative in controlling moisture levels while cooking.

Clothes dryers vented to the outside. Flexible metallic vents connecting the dryers to the outside ducts were compressed with multiple bends (Figure 7). Two of the flexible vents were cracked or disconnected.

### 3.2 Window Condensation and Rain Water Leakage

Winter condensation on windows was a common complaint. Existing windows were metal framed double glazed units with poor thermal breaks that exacerbate the condensation problem. Rainwater leakage behind the exterior trim has led to wood decay and rotted siding (Figure 8).

Reducing interior humidity levels through improved bathroom exhaust ventilation will reduce window condensation potential. Houses with wall furnaces have no airflow into bedrooms when doors are closed which acts to keep the room and surface temperatures cooler, thus increasing the potential for both window and wall/ceiling surface condensation.

Replacing existing windows with higher quality double pane windows will elevate the interior surface temperature and raise the dew point temperature\(^2\), decreasing the condensation potential. Include proper flashing with the window installation to allow proper rainwater drainage.

### 3.3 Site Drainage

Site drainage was very good around all inspected homes. Although the homes at the Berry Creek Rancheria were built into the side of a hill where site drainage could be a serious issue, the sites were well designed to direct rainwater away from the homes (Figure 9). It was clear that a significant amount of time, money, and effort were expended to ensure good site drainage.

\(^2\) Dew point temperature is the warmest temperature of a surface where water condensation from the surrounding air would form on that surface. If the surface temperature is increased, the dew point temperature also increases which decreases the potential for condensation to occur.
All the homes had intact gutter systems, except for a few incidents of disconnected downspouts and splash-blocks pitched toward the homes rather than away from them. The gutter systems were also well designed with color selection matching those used on the homes. It was difficult determining if gutters were present from the street due to the accurate color matching.

Overall site planning was done very well, with street lighting, fire hydrants and storm drains common. Plantings around the homes were plentiful and colorful (Figure 10).

3.4 Metal Supply Air Plenums (Berry Creek)

Cool air from evaporative coolers is distributed through one insulated flexible supply duct to three supply air plenums, or metal boxes with registers on the interior ceiling surface. The plenum nearest the evaporative cooler was insulated whereas the remaining two plenums were not (Figure 11). Also, the joints of the cooling ductwork were not well-sealed to the plenums.

Seal the registers during the heating season to prevent warm air from escaping from the house to the outside. Some the registers were designed with clips to accept a cover (Figure 12).

As swamp coolers pressurize a home, occupants are encouraged to open a window to relieve the pressure when the system is operating. However, two pressure activated dampers were used in these homes, designed to open automatically under pressure and located in the ceilings of the living and dining rooms and open to the attic. A metal box is used to enclose the dampers in the attic to keep insulation away (Figure 13).

The non-insulated supply plenums and unsealed registers allow warm moist air to move up into the evaporative cooling system. Condensation on the inside of the supply air plenums is a possibility. In addition, warm moist air moving-
up past the pressure activated dampers may condense on the interior side of the metal box enclosure.

### 3.5 Furnaces (Berry Creek)

All but one inspected furnace at Berry Creek was direct vent sealed combustion. These furnaces were high efficiency models with ratings of at least 90%. In addition, the furnaces utilized outdoor air for combustion and ventilation (Figure 14). Consequently, homes could be tighter, resulting in energy savings and occupants being more comfortable because of fewer drafts. Furthermore, there was no need to provide combustion air inlets from the attic that were commonly seen in these homes. The combustion air inlets were required, however, for the natural draft water heaters.

Supply air ducts were located in the attic. The ducts were insulated flex and appeared to be in good condition. Air was centrally returned to the furnaces through grilles in the furnace closet doors. Some inspected filters were dirty. In other cases, occupants tend to store items in the furnace closet that could be a fire hazard and also restrict return air flow to the furnace.

### 3.6 Water Heaters (Berry Creek)

Water heaters were natural draft and located in closets near the center of the homes. Two combustion air registers open to a duct providing combustion air to the closets. Many of the inlets were clogged with lint and dirt restricting the supply of combustion air (Figure 15).

Inadequate combustion air supply could cause backdrafting of the water heater. Products of combustion of a backdrafting water heater are carbon dioxide and moisture. Under the worse case scenario, carbon monoxide could be produced creating a serious indoor air quality issue to the occupants.

### 3.7 Exterior Bandjoist (Manchester Point Arena)

The house at 85 Yellow Hammer Drive was power vented and 80% efficient. Power vented furnaces use indoor air for combustion and ventilation.
A common architectural feature on the homes at Manchester Point Arena is a horizontal 2" x 10" bandjoist at the base of the building. The joint between the bandjoist and T-1-11 siding is caulked, but was failing in many locations (Figures 16 & 17). The bandjoist is not cambered to shed water. Water is pooling on top of the bandjoist and also draining between it and the T-1-11 siding.

3.8 Exterior Siding (Manchester Point Arena)

T-1-11 siding is textured plywood that may be installed directly to wood studs or over non-structural sheathing. Fungal growth was common on this siding, particularly on the southern walls (Figure 18).

A number of reasons may be contributing to the fungal growth.

1. Manufacturing/Installation Defects

A defect in the manufacturing process may allow water absorption by the siding material. Edges of the siding may not have been sealed prior to installation allowing for water absorption.

2. Exterior Bandjoist/Window Leakage

Poor detailing of the bandjoist may cause water pooling at the joint between the siding and bandjoist. Capillary action of the siding may be pulling water up from the bandjoist as a result. Poor drainage around windows has led to rotted window trim (Figure 19) and may be draining behind the siding material.

3. Thermally Driven Moisture

Solar radiation striking a vapor permeable surface has the capability of driving moisture through it. Plywood is semi-vapor permeable with a unique characteristic. When dry,
plywood has a perm rating\(^4\) of .75. That is, it is impermeable to moisture and is technically classified as a vapor barrier. However, the perm rating increases to 3.5 when it gets wet and as high as 20 when saturated. Thus, plywood moves from being a vapor barrier to a material that readily allows a significant amount of vapor movement through it.

The siding is subject to repeated wetting as a result of the homes being located in a coastal climate. As the siding gets wet, it becomes more permeable to moisture. As the sun’s surface temperature increases driving moisture through the siding. As the exterior surface of the siding dries, its perm rating drops and is no longer permeable to moisture. Water driven through the material or leaking from the windows is trapped within or behind it.

3.9 Uninsulated Supply Air Registers (Manchester Point Arena)

Metal supply boots are used to connect insulated flex duct to supply air registers. Some metal boots are not insulated (Figure 20). Winter time condensation has occurred on the registers as a result, especially in bathrooms with high moisture loads and inadequate ventilation (Figure 21).

SECTION 4 – TECHNICAL RECOMMENDATIONS

The following recommendations are based on the site visit findings.

4.1 Bathroom & Kitchen Exhaust Fans; Clothes Dryers

Large amounts of moisture can be generated in bathrooms and kitchens given their function. Properly operating exhaust fans are key to removing moisture from these spaces.

1. Replace all bathroom exhaust fans with ones rated for a minimum 70 CFM at 0.25" of static pressure (the rating provided on the box is generally at 0.10" of static pressure).

\(^4\) Perm rating measure is a measurement of how much water vapor will move through a material over a given period of time. A material with a perm rating less than 1.0 is vapor impermeable. Materials with perm ratings greater than 10 are vapor permeable.
2. Ensure new bathroom fans have a sone ratings no higher than 1.5. Sone is a rating for sound – the lower the sone rating, the quieter the fan. Occupants tend not to use loud fans because of the noise. Low-sone fans include Broan Solitaire and Panasonic WhisperCeiling and WhisperLite series. Low-sone fans generally cost between $75 and $100.

3. Replace flexible ribbed vent with round, smooth sheet metal vent. Minimize duct length, turns and bends in the ductwork. Smooth ducts provide less resistance and improved flow over ribbed ductwork. Recommend that occupants clean dust and lint from intake grilles on an as-needed basis.

4. Replace fan on/off switches with 60 minute timer switches. Recommend to occupants that fans operate for at least 15 minutes following showering or bathing. Timer switches cost between $15 and $50.

5. Replace any existing combination bathroom light/fan switches with fan delay timers. A fan delay timer is a two function switch that is typically wired to a fan and a light. When the switch is turned-on, both the light and exhaust fan are turned-on. When the switch is turned-off, the light is turned-off but the fan continues to operate for an extended period of time. The extended period of time can be adjusted from 1 to 60 minutes. Fan delay timers are about $35.

6. Periodically inspect all bathroom and kitchen exhaust fan ducts. Ensure that exhaust ducts are vented outside, properly attached and sealed to the exhaust fan housing and to roof or wall vent caps.

7. As rehab work is done in laundry areas, re-install flex duct to minimize bends and elbows. Install a “dryerbox” to help make the transition (Figure 22). Cost is about $20 (www.drybox.com).

8. Periodically inspect dryer vents and correct the following conditions when found:
   - Install missing or damaged dryer vent.
   - Replace crimped or cracked dryer vents.
   - Reconnect disconnected dryer vents.
   - Replace plastic ribbed dryer vents with smooth metal vents as space permits.

4.2 Window Replacement

Existing windows are metal frame double pane windows. The conductivity, or U-value\(^5\), of the existing windows is about 0.64. This corresponds to an R-value of 1.56, or equivalent to \(\frac{1}{2}\)" of fiberglass insulation.

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\(5\) - U-value is a measure of how well a material conducts heat. The higher the U-value, the greater the conductivity. For comparison purposes, R49 of fiberglass insulation has a U-value of 0.02.
Benefits resulting from window replacement include:

- Energy savings.
- Reduced interior surface condensation.
- Elimination of water leakage by properly flashing new windows.

Recommendations regarding window replacement include:

1. Window unit U-value should be no higher than 0.40 as recommended by the US Department of Energy for the climate of northern California. Generally, windows achieving a U-value of 0.40 will be double glazed with a low-E coating. Window frames will be wood, vinyl, wood clad or hybrid/composite. The best U-value for metal framed windows with a thermal break and double glazed with a low-E coating is approximately 0.48.

2. Window U-value should be rated by the National Fenestration Rating Council (NFRC). The NFRC is an independent rating organization verifying the thermal performance of a window. Windows rated by the NFRC will bear a label indicating the window U-value (Figure 23).

See additional information relating to reduced condensation potential and flashing problems in Sections 5.2 and 5.3.

4.3 Evaporative Cooling Systems – Berry Creek

The following recommendations are made with respect to the evaporative cooling systems in homes at the Berry Creek Rancheria.

1. Seal all duct joints between flex duct and supply air plenums with residential grade duct mastic. Duct mastics include RCD Corp. #6, Seal-n-Save by United-McGill and Permitite 777. Do not use duct tape, since it is not durable and will fail over time. An acceptable tape is SF-686 by Shurtape Technologies.

2. Insulate supply air plenums with minimum R6 duct insulation with vapor barrier facing out to the attic.
3. Alternately, insulate and air seal supply air plenums with two-part spray polyurethane foam (Figures 24 & 25). Spray foam will provide an R-value of 6 per inch. Two-part spray foams are available in sizes from 15 board feet ($28.00) to 600 board feet ($650).

4. Modify supply air registers and pressure activated dampers to accept air tight closures. Closures would be installed from the inside of the house by the occupants during the winter to prevent warm moist air from moving up into the evaporative cooling ducts and the attic.

5. Encourage occupants to open windows by 1” to 2” in rooms they wish to cool when evaporative cooler is operating to avoid cool air from bypassing rooms and escaping through the pressure activated dampers.

4.4 Combustion Air Inlets

Combustion air inlets are used at Berry Creek to provide combustion air to the water heaters. Furnaces are sealed combustion and take their combustion air from the outside through PVC pipe.

Combustion air inlets are provided for the furnaces at Manchester Point Arena (Figure 26). Water heaters are located outside the living space in storage closets and have their own source of combustion air.

Grille openings on combustion air inlets at both Rancherias were covered with lint and dirt restricting combustion air flow to the appliances. Secondly, especially at Berry Creek, the openings appeared to be too small.

1. Clean all grilles of lint and dirt.
2. Inspect the size of the combustion air openings. Two combustion air openings are required. Each opening must meet the following criteria. For every 4,000 Btu input to the appliance, 1 in\(^2\) of free ventilation area is required. Water heaters at Berry Creek have a rated input of 38,000 Btu/hours. Thus, 9.5 square inches of free ventilation area is required for each combustion air inlet. Duct opening to the attic must be at least 19 square inches. Cross sectional area of the duct must be equal to or greater than the free ventilation area of the combustion openings\(^6\).

3. When calculating the free ventilation area of openings, assume 50% of the gross area of the vent. This includes louvered openings found at Manchester Point Arena and the wire mesh openings found at Berry Creek.

4.5 Exterior Siding – Manchester Point Arena

Current recommendations for the plans for replacement of the T-1-11 siding include:

1. Remove the T-1-11 siding to install new siding.

2. Properly flash windows as part of the siding replacement program.

3. Use an exterior siding material that is impermeable to moisture, such as fiber cement siding, OSB siding or vinyl.

4. Ensure the sheathing is impermeable to moisture, such as OSB or thin profile sheathing such as Thermo-Ply. Cover OSB sheathing with a house wrap.

5. Use spacer mesh to provide a ventilated air space between the siding and sheathing. Use vertical furring strips (3/16" or 1/4") to create the air space, ventilated to dry the wall.

6. Install new bandjoists to shed water. Two recommendations are provided:

   - After replacing siding, install bandjoist over spacer mesh or furring strips (3/16" or 1/4") to allow drainage between the bandjoist and siding.
   - Alternately, install bandjoist first. Install siding down to top of bandjoist with flashing behind siding to shed water onto bandjoist that has been cambered to drain water.

Additional information may be found in Section 5.4.

4.6 Supply Air Registers – Manchester Point Arena

Inspect supply air boots. Exposed metal boots should be insulated with two-part foam. Two-part foam will air seal the enclosure and provide an R-value of 6 per inch.

\(^{6}\) - NFPA 54, Section 5.3.3
4.7 Occupant Lifestyle

Occupant lifestyles may also contribute to moisture and other indoor air quality issues. Educate occupants in the following areas to assist in solving and eliminating mold and moisture problems:

1. Instruct occupants to open windows slightly when using evaporative coolers. Instruct occupants on sealing cooling supply registers and pressure activated dampers during the winter.

2. Instruct occupants to change furnace filters on a monthly basis.

3. Instruct occupants not to store items adjacent to furnaces and water heaters as a safety precaution.

4. Line drying of clothes in homes should be discouraged.

5. Instruct occupants on the importance of using bathroom and kitchen exhaust fans when showering or cooking. Bathroom exhaust fans should operate for a minimum of 15 minutes following showering or bathing.

6. Encourage occupants to report plumbing leaks to management as soon as possible.
SECTION 5 – DISCUSSION OF COMMON PROBLEMS

5.1 Bathroom & Kitchen Exhaust Fans; Clothes Dryers

Several rooms in a home are natural moisture sources simply by the nature of their function. Showers result in 100% humidity in bathrooms. Kitchens are used for cooking and cleaning. In laundries, clothes dryers must remove large quantities of water from wet clothes. By removing moisture at the source in these areas, exhaust ventilation serves as a source control strategy. Exhaust ventilation dilutes the moisture and places the room in a negative pressure, thus limiting the spread of moisture to the rest of the home until most of the moisture has been removed to the outside.

Bathroom exhaust fans, kitchen exhaust fans and clothes dryers should always vent to the outside rather than into the living space. Venting to the basement, crawl space, or attic can lead to moisture problems in these areas. For this reason, localized exhaust ventilation requires ductwork.

The effectiveness of exhaust fans is based on the power of the exhaust fan, length and type of exhaust duct, and cleanliness of the fan grille. When there is excessive resistance in the ductwork, the exhaust fan motor may not be powerful enough to vent sufficient airflow through the duct. The longer the duct length, the greater the static pressure in the duct and the less air flow through the duct. Turns and bends in the ductwork also increase the static pressure and reduce flow. Similarly, a smooth duct provides less resistance and improved flow over ribbed ductwork. For all types of exhaust ventilation, using round, smooth sheet metal ductwork is recommended. A dirty intake grille will also greatly increase resistance and reduce airflow.

Fan capacity is typically listed at 0.10” and 0.25” of static pressure. Bathroom exhaust fans should provide a minimum ventilation rate of 70 CFM at 0.25” of static pressure. Selecting a fan capacity at 0.10” static pressure is appropriate only if the exhaust duct is smooth, straight (no more than one elbow), and less than 15’ in length. For example, a bathroom fan with an exhaust ventilation rate of 90 CFM or 100 CFM (at 0.10”) may be required to obtain 70 CFM at 0.25” of static pressure if there are numerous elbows, the exhaust duct is ribbed, and the length is over 15’. Fan performance curves should be reviewed to determine ventilation rates at 0.25”.

Replace non-operable and recirculating kitchen exhaust fans whenever possible with ones vented to the outside. The fans should have a minimum exhaust capacity of 150 CFM. Under no circumstances should recirculating fans be installed in place of the kitchen exhaust fans.

Ensure dryer vents are smooth-surfaced rigid duct or use non-combustible flexible metal duct approved for dryer venting. Make duct joints in the direction of the air flow. Fasten ducts with screws or fasteners that extend into the duct. Minimize the length of the duct run, especially with flexible metal duct. Install flexible metal duct without dips or sags. Insulate dryer vents extending through non-conditioned spaces.
Minimum the duct diameter to 4” and the length to less than 25’ from the dryer outlet to the termination point. Use 5” diameter duct if the length is greater than 25’.

Dryer vent caps should have a backdraft damper that closes when the dryer is not being used. Insect screens or small wire cages should not be installed over the vent cap.

5.2 Window Replacement

The graph in Figure 27 shows condensation potential on the center of glass area (the area at least 2.5" from the frame/glass edge) at various outdoor temperature and indoor relative humidity conditions. Condensation can occur on all points that fall on or above the curves. As the U-factor of windows improves, there is a much smaller range of conditions where condensation will occur.

For example, the U-value of the existing windows is near 0.64, near that of a double glazed window. If condensation is occurring at 20°F outside temperature, indoor relative humidity is 50% (typical indoor relative humidity should be around 35%). If replacement units are double glazed, low-E, argon gas windows (a very common window type), condensation wouldn’t occur until the relative humidity reached 70% at 20°F outside temperature. Or, condensation wouldn’t occur until the outside temperature dropped to 0°F and the indoor relative humidity was 60%. In other words, chances for condensation on the glass are minimal, especially if effective bathroom ventilation is installed.

5.3 Window Flashing

Proper flashing of replacement windows is necessary to allow rainwater to drain behind siding and trim. An example of a window flashing procedure is shown next. The procedure has been taken from “Read This Before You Design, Build or Renovate”, US Department of Energy and the Asthma Regional Council of New England.
Step 1 – OSB on wood frame wall

Step 2 – Install wood backdam

Step 3 – Mechanically attach strip of building paper; attach at top only, leave sides and bottom loose

Step 4 – Apply first piece of adhesive backed sill flashing; apply second piece of adhesive backed sill flashing
Step 5 – Install corner flashing patches at sill

Step 6 – Install building paper at jambs

Step 7 – Apply sealant at jambs and head; alternately, sealant can be placed on the back side of the nailing flange (back-caulked)

Step 8 – Install window; install jamb flashing then head flashing
Step 9 – Install first course of building paper under sill flashing

Step 10 – Install second course of building paper at jambs

Step 11 – Install third course of building paper at jambs

Step 12 – Install fourth course of building paper at head

Building Research Council
5.4 Exterior Wall Construction

The US Department of Energy has developed specific building guidelines for residential construction given various climatic regions of the country. Homes in the Manchester Point Arena are located in a "Mixed Humid Climate". The following guidelines and typical wall section are for exterior wall construction in this climatic zone (Figure 28). Additional information is found at http://www.buildingscience.com/.

- ventilated rain screen between siding and sheathing
- vapor impermeable siding
- vapor impermeable sheathing

![Figure 28: Typical wall section](image)
## SUMMARY SITE VISIT REPORT

**DATE:** June 21-25, 2004

### Appendix B: SITE Northern Circle Housing Authority

#### Northern Circle Housing Authority

#### Gutter Exterior Visible Inspection
- **HUD Building Model and Site Drainage System**
  - Leaks from Exterior
  - Rotted Siding
  - Plumbing Problems
  - Bathroom Problems
  - Exhaust Ventilation
  - Exterior wall/ceiling problems

#### Problems
- **Exterior Number Address Program Age Occupancy Foundation Type Framing Type Heat Type**
  - **Problems Problems (Column #)**
  - **CFM**

#### Berry Creek

1. **1.1 86 Tyme Way LR 12 years 5 Slab on Grade Ranch Natural Gas No No No No Yes No No Yes 11 36**
2. **1.2 97 Tyme Way LR 12 years 1 Slab on Grade Ranch Natural Gas No No Yes No No No Yes No Yes 11 59/36**
3. **1.3 98 Tyme Way LR 12 years 1 Slab on Grade Ranch Natural Gas No No No No No No No Yes No Yes ** 46**
4. **1.4 115 Tyme Way LR 12 Years 6 Slab on Grade Ranch Natural Gas No No Yes No No Yes No Yes 11 36/29**
5. **1.5 6 Yellow Hammer Drive LR 12 Years 5 Slab on Grade Ranch Natural Gas No No No No No Yes No No Yes Yes 11 41**
6. **1.6 11 Yellow Hammer Drive LR 12 Years 7 Slab on Grade Ranch Natural Gas No No Yes Yes No No Yes No Yes 11 53/50**
7. **1.7 85 Yellow Hammer Drive MH 9 Years 3 Slab on Grade Ranch Natural Gas No No No No No Yes No Yes 11 100/65**

#### Point Arena/Manchester

8. **2.1 407 Sea Lion Court MH 11 Years 3 Slab on Grade Ranch Propane/Wood No No Yes Yes No No No Yes No Yes 11 41/50**
9. **2.2 409 Sea Lion Court LR 11 Years 3 Slab on Grade Ranch Propane/Wood Yes Yes Yes Yes No No Yes Yes Yes Yes 15 54**
10. **2.3 406 Sea Lion Court LR 11 Years 6 Slab on Grade Ranch Propane/Wood Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes 12 32/21**
11. **2.4 404 Seal Lion Court MH 11 Years not home Slab on Grade Ranch Propane/Wood No No No No No No No Yes Yes 11 0/40**
12. **2.5 408 Sea Lion Court LR 11 Years 5 Slab on Grade Ranch Propane/Wood No No No No Yes No Yes Yes No Yes 11 0/40**
13. **2.6 403 Sea Lion Court LR 11 Years 4 Slab on Grade Ranch Propane/Wood No No Yes Yes Yes Yes Yes Yes Yes Yes 11, 12, 13 32/NA**
14. **2.7 509 Garcia Court LR 18 Years 1 Slab on Grade Ranch Propane/Wood No No No No Yes Yes Yes Yes No Yes 12, 13 43**

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4 = mutual help  
TK = Turnkey/Rent to Own  
LR = Low Rent  
1. = includes window condensation problems  
** = Mold in entry closet.
Appendix B: Northern Circle Indian Housing Authority

Inspection Number: 1-1
Address: 86 Tyme Way
Age: 12
House Type: Low rent
Bedrooms: 3
Foundation: Slab-on-grade
Heat Type: FA furnace (natural gas)
Construction: Stick-built, 2” x 6”
Occupancy: 2 adults, 3 children (ages 5, 12, 17)

Mold and Moisture Conditions: Mold was found around some windows. The back wall had been replaced due to a leaking evaporative cooler. Two of the three supply air plenums for the evaporative cooler were uninsulated.

Rainwater Management: The site drainage was good. The gutter system was intact.

Bathroom/Kitchen: The bathroom exhaust fan measured 36 CFM - 41 CFM with the grille removed (Figure 2). The fan vented through the roof with metal flex duct. The kitchen exhaust fan also vented to the outside.

Attic: The attic was insulated to about R38 with fiberglass batt insulation. The roof sheathing was in good shape with no signs of mold. The attic hatch was not insulated with 4” of Thermax insulation (Figure 3).

Heating System: The furnace was a sealed combustion gas-fired model with a central return. The water heater was a natural draft gas-fired model (Figure 4). Combustion air was ducted to the furnace closet from the attic through rigid metal ductwork. Because the original combustion air intake was not large enough to provide an adequate amount of combustion air, another duct was added (Figure 5).
Cooling was provided by an evaporative cooler (Figure 6). Supply air was provided through an insulated duct to three supply air registers located in the ceiling. A metal plenum was located above each supply register. Two of three plenums were uninsulated (Figure 7). In addition, the holes were visible in the duct connections to the plenums.

Two pressure activated registers, located in the living and dining room ceilings, open to a metal box within the attic cavity (Figures 8 and 9).

**Occupant Notes:**
Five people lived in the home. The three children had allergies.

**Recommendations:**
- Replace existing bathroom fan with low-sone exhaust fan with mechanical timer in place of “on/off” switch; replace metallic flex duct with smooth metal.
- Seal duct joints in attic with duct mastic.
- Insulate supply air plenums for evaporative cooler.
- Remove or air seal pressure activated dampers in living room and dining room ceilings.
- Replace water heater with sealed combustion model as needed.
- Replace windows with windows that have a U-value no higher than 0.40 as needed.
Inspection Number: 1-2
Address: 97 Tyme Way
Age: 12
House Type: Low rent
Bedrooms: 4
Foundation: Slab-on-grade
Heat Type: FA furnace (natural gas)
Construction: Stick-built, 2" x 6"
Occupancy: 1 adult

Figure 1 - 97 Tyme Way

Figure 2 - Splash block directs rain water away from slab

Figure 3 - Both bathroom exhaust fans vented through roof

Figure 4 - Dryer vent with sharp elbows

Figure 5 - Natural draft water heater located just off the kitchen.

Mold and Moisture Conditions: Mold was reported on some bedroom and bathroom window sills.

Rainwater Management: Despite the relatively flat site drainage in front of the home, there were no reports of site drainage causing problems in the home. The gutter system was intact with good drainage away from the slab (Figure 2).

Bathroom/Kitchen: The main bathroom exhaust fan measured 59. The exhaust fan in the master bedroom bath measured 36 CFM. Both fans vented through the roof with metal flex duct (Figure 3). The kitchen exhaust fan also vented to the outside. The dryer vented to the outside through flexible metallic duct work that had very sharp elbows (Figure 4).

Attic: The attic was insulated to about R38 with fiberglass batt insulation. The roof sheathing was in good shape with no signs of mold. The attic hatch was insulated with 4" of Thermax insulation.

Heating System: The furnace and water heater were located in separate spaces. The furnace was a sealed combustion gas-fired model with a central return. The filter was very dirty. The water heater was a natural draft gas-fired model and located just off the kitchen (Figure 5). Combustion air was ducted to the furnace.
closet from the attic through rigid metal ductwork. Both combustion air inlets were covered with lint.

Cooling was provided by an evaporative cooler. Supply air was provided through an insulated duct to three supply air registers located in the ceiling. A metal plenum was located above each supply register. Two of three plenums were uninsulated (Figure 6). Two pressure activated registers were located in the living and dining room ceilings.

**Occupant Notes:** One person lived in the home and reported having allergies.

**Recommendations:**

- Replace the existing bathroom fans with low-sone exhaust fans with mechanical timers in place of “on/off” switch; replace metallic flex duct with smooth metal.
- Seal duct joints in attic with duct mastic.
- Insulate supply air plenums for evaporative cooler.
- Remove or air seal pressure activated dampers in living room and dining room ceilings.
- Clean combustion air inlets for water heater; increase size of openings if necessary.
- When needed, replace water heater with sealed combustion model.
- Install new windows that have a U-value no higher than 0.40.
Appendix B: Northern Circle Indian Housing Authority

### Inspection Number: 1-3

**Address:** 98 Tyme Way  
**Age:** 12  
**House Type:** Low rent  
**Bedrooms:** 3  
**Foundation:** Slab-on-grade  
**Heat Type:** FA furnace (natural gas)  
**Construction:** Stick-built, 2" x 6"  
**Occupancy:** 1 adult

#### Mold and Moisture Conditions:
The evaporative cooler had leaked into the back bedrooms. Some minor water damage was found on the floor next to the bathtub. Mold was also reported in the front entry closet caused by a leaking water line to the hose bib.

#### Rainwater Management:
Site drainage was good. Water was directed away from the slab with splash blocks. A planter on the corner of the home had trapped rain water next to the slab (Figure 2).

#### Bathroom/Kitchen:
The bathroom exhaust fan measured 46 CFM. The fan vented through the roof with metal flex duct. The kitchen exhaust fan also vented to the outside. Some minor water damage was found on the floor next to the bathtub.

#### Attic:
The attic was not inspected and was assumed to be similar to other inspected homes with respect to insulation level, uninsulated plenums for the evaporative cooler, and pressure-activated dampers.

#### Heating System:
The furnace was a sealed combustion gas-fired model with a central return. The water heater was a natural draft gas-fired model. Combustion air was ducted to the furnace closet from the attic through rigid metal ductwork. Cooling was provided by an evaporative cooler. Supply air was provided through an insulated duct to three supply air registers located in the ceiling. A metal plenum was located above each supply register. Two pressure activated registers were located in the living and dining room ceilings.

#### Occupant Notes:
One person lived in the home.

#### Recommendations:
- Replace the existing bathroom fan with low-sone exhaust fan with a mechanical timer in place of “on/off” switch; replace metallic flex duct with smooth metal.
• Seal duct joints in attic with duct mastic.

• Insulate supply air plenums for evaporative cooler.

• Remove or air seal pressure activated dampers in living room and dining room ceilings.

• Check size for combustion air inlets for water heater; increase size of openings if necessary.

• When appropriate, replace water heater with sealed combustion model.

• When appropriate, replace windows with windows that have a U-value no higher than 0.40.

• Install a drain in the planter ensuring the drainage flows away from the foundation.
Appendix B: Northern Circle Indian Housing Authority

Inspection Number: 1-4
Address: 115 Tyme Way
Age: 12
House Type: Low rent
Bedrooms: 4
Foundation: Slab-on-grade
Heat Type: FA furnace (natural gas)
Construction: Stick-built, 2” x 6”
Occupancy: 2 adults, 4 children (ages 13, 10, 5, and 3

Mold and Moisture Conditions: Mold was found on many window sills (Figure 2) and on the bedroom wall near the evaporative cooler (Figure 3). The drain line was located within the wall cavity (typical of these homes). If a leak occurred, it could go undetected until mold appeared on the wall. The home had a large aquarium. The toilet in the master bedroom bath had a leaky base.

Rainwater Management: Site drainage was good. The gutter system was intact.

Bathroom/Kitchen: The main bathroom exhaust fan measured 36 CFM and was controlled by a combination light/fan switch. The master bedroom bathroom exhaust fan measured 29 CFM and was controlled by a separate switch. Both fans vented through the roof. The kitchen fan vented to the outside.

Attic: The attic was insulated to about R38 with fiberglass batt insulation. The roof sheathing was in good shape with no signs of mold. The attic hatch was insulated with 4” of Thermax insulation. Two of three plenums for the evaporative cooler were uninsulated.

Heating System: The furnace and water heater were located in separate spaces. The furnace was a sealed combustion gas-fired model with a central return. The water heater was a natural draft gas-fired model located just off the kitchen. Combustion air was ducted to the furnace closet from the attic through rigid metal ductwork. The combustion air inlets were covered with lint.

Cooling was provided by an evaporative cooler. Supply air was provided through an insulated duct to three supply air registers located in the ceiling. A metal plenum was
located above each supply register. Two of three plenums were uninsulated. Two pressure activated registers were located in the living and dining room ceilings.

**Occupant Notes:** Six people lived in the home. The son had repeated allergies.

**Recommendations:**

- Install low-sone bathroom exhaust fan with a fan delay timer (main bathroom) and mechanical timer in master bedroom bathroom; replace metallic flex duct with smooth metal.
- Seal duct joints in attic with duct mastic.
- Insulate supply air plenums for evaporative cooler.
- Remove or air seal pressure activated dampers in living room and dining room ceilings.
- Check size for combustion air inlets for water heater; increase size of openings if necessary.
- When appropriate, replace water heater with sealed combustion model.
- When appropriate, replace windows with windows that have a U-value no higher than 0.40.
Appendix B: Northern Circle Indian Housing Authority

Inspection Number: 1-5
Address: 6 Yellow Hammer Drive
Age: 12
House Type: Low rent
Bedrooms: 4
Foundation: Slab-on-grade
Heat Type: FA furnace (natural gas)
Construction: Stick-built, 2” x 6”
Occupancy: 2 adults, 3 children (ages 5, 8, 16)

Mold and Moisture Conditions: Some exterior siding on one side of the home was replaced due to water leakage from the evaporative cooler. Some mold was found on the bathroom ceiling (Figure 2). Clothes were hang-drying in the laundry area (Figure 3). The dryer vent was disconnected. Mold was reported on some bedroom window sills.

Rainwater Management: The site drained toward the house in front, but did not appear to have caused any moisture problems. The gutter system was intact.

Bathroom/Kitchen: The bathroom exhaust fan measured 41 CFM. The kitchen fan vented to the outside.

Attic: No mold was found on the attic sheathing. No wall sheathing was found on one gable end – just house wrap.

Heating System: The furnace and water heater were located in separate spaces. The furnace was a sealed combustion gas-fired model with a central return. The occupant stored items around the furnace that may restrict return air to the grill (Figure 4). The water heater was a natural draft gas-fired model and was located just off the kitchen. Combustion air was ducted to the furnace closet from the attic.

Cooling was provided by an evaporative cooler. Supply air was provided through an insulated duct to three supply air registers located in the ceiling. A metal plenum was located above each supply register. Two of the three plenums were uninsulated. Two pressure activated registers were located in the living and dining room ceilings.

Figure 1 – 6 Yellow Hammer Drive
Figure 2 – Mold on bathroom ceiling
Figure 3 – Clothes hang-drying in laundry area
Figure 4 – Items stored in furnace closet that may restrict air flow to furnace (note return air grille on the left)
Appendix B: Northern Circle Indian Housing Authority

Occupant Notes: Five people lived in the home. The husband and two children suffered from allergies.

Recommendations:

- Replace the existing bathroom fan with a low-sone exhaust fan with a mechanical timer in place of an "on/off" switch; replace the metallic flex duct with a smooth metal.

- Re-connect the dryer vent.

- Seal duct joints in the attic with duct mastic.

- Insulate the supply air plenums for the evaporative cooler.

- Remove or air-seal the pressure-activated dampers in the living room and the dining room ceilings.

- If necessary, increase the size of the combustion air inlets for the water heater.

- When necessary, replace water heater with sealed combustion model.

- When necessary, install new windows that have a U-value no higher than 0.40.
Appendix B: Northern Circle Indian Housing Authority

Inspection Number: 1-6
Address: 11 Yellow Hammer Drive
Age: 12
House Type: Low rent
Bedrooms: 4
Foundation: Slab-on-grade
Heat Type: FA furnace (natural gas)
Construction: Stick-built, 2" x 6"
Occupancy: 2 adults, 5 children

Mold and Moisture Conditions: The exterior siding had rotted near the evaporative cooler. Poor water drainage around the window may have caused the damage (Figure 2). Water draining along one side of the house may have also contributed to the problem. Minor mold growth was above some of the baseboards (Figure 3) and on the master bedroom bathroom ceiling.

Rainwater Management: The site drainage was good, despite a large hill behind the home. A swale directed water away from the back of the home and along the sides of the home. The gutter system was intact.

Bathroom/Kitchen: The main bathroom exhaust fan measured 53 CFM. The master bedroom exhaust fan measured 50 CFM. The kitchen fan vented to the outside.

Attic: The attic was not inspected and appeared similar to the previously inspected attics.

Heating System: The furnace was a sealed combustion type. The water heater was a natural draft system.

Occupant Notes: Seven people lived in the home.

Recommendations:

- Replace the existing bathroom fan with a low-sone exhaust fan with a mechanical timer in place of an "on/off" switch; replace metallic flex duct with smooth metal.
- Seal duct the joints in the attic with duct mastic.
- Insulate the supply air plenums for evaporative cooler.
• Remove or air seal pressure activated dampers in living room and dining room ceilings.

• If necessary, increase the size for combustion air inlets for water heater.

• When appropriate, replace water heater with sealed combustion model.

• When appropriate, install new windows that have a U-value no higher than 0.40.
Appendix B: Northern Circle Indian Housing Authority

Inspection Number: 2-1
Address: 407 Sea Lion Court
Age: 11
House Type: Mutual help
Bedrooms: 4
Foundation: Slab-on-grade
Heat Type: FA furnace (propane/wood)
Construction: Stick-built, 2” x 6”
Occupancy: 3 adults

Mold and Moisture
Conditions: Fungal growths occurred at the joints of the T-1-11 siding on the south side of the home (Figure 2). Some mold was found at the base of the living room wall.

Rainwater Management: The site drainage was good. The gutter system was intact. Mold growth was found in the joints of the T-1-11 siding on the south side of the home. The exterior bandjoist showed signs of deterioration (Figure 3).

Bathroom/Kitchen: The main bathroom exhaust fan measured 41 CFM. The exhaust fan in the master bedroom bath measured 50 CFM. Both fans vented through the roof through a common rigid metal duct (Figure 4). An exhaust fan was also present in the laundry closet. The kitchen exhaust fan vented to the outside. The dryer vented to the outside.

Attic: The attic was insulated to about R38 with fiberglass batt insulation. There were numerous gaps and voids between the batts with exposed ceiling area (Figure 5). Some metal supply air registers were not insulated (Figure 6). The roof sheathing

Figure 1 – 407 Sea Lion Court
Figure 2 – Fungal growth in joint of T-1-11 siding
Figure 3 – Bandjoist deterioration
Figure 4 – Common metal duct used to exhaust both bathroom fans
Figure 5 – Gaps in batt insulation exposing top surface of gypsum board
Figure 6 – Exposed metal supply air register
was in good shape with no signs of mold. The attic hatch was not insulated with 4” of Thermax insulation.

**Heating System:** The furnace was an 80% propane-fired model with a central return. Combustion air was ducted to the furnace closet from the attic through rigid metal ductwork (Figure 8). A wood stove located in the living room provided supplemental heat (Figure 7). Outside combustion air was provided to the stove. The water heater was a natural draft propane-fired model located in a non-conditioned space on the back of the home. There was no cooling system in the home.

**Occupant Notes:** Three people lived in the home.

**Recommendations:**

- Replace the wooden bandjoist so that water drains from it.

- When appropriate, replace windows with ones with a U-value no higher than 0.40; flash so that the trim cannot trap water behind it.

- Replace existing bathroom fans with low-sone exhaust fans with mechanical timers in place of “on/off” switches.

- Inspect the attic insulation; insulate exposed gypsum board surfaces.

- Insulate exposed metal registers in the attic.

- When appropriate, replace the furnace with a sealed combustion model.
Appendix B: Northern Circle Indian Housing Authority

Inspection Number: 2-2

Address: 409 Sea Lion Court
Age: 11
House Type: Low rent
Bedrooms: 3
Foundation: Slab-on-grade
Heat Type: Wall furnace (propane/wood)
Construction: Stick-built, 2” x 6”
Occupancy: 3 adults

Figure 1 – 409 Sea Lion Court

Figure 2 – Disconnected downspout
Figure 3 – Splash block allows water to drain back towards the slab
Figure 4 – Mold at the wall/ceiling joint in back bedroom
Figure 5 – Gap was found between trim and siding where mold was growing

Mold and Moisture
Conditions: Mold was found at the exterior wall/ceiling joint in the back bedroom.

Rainwater Management: Site drainage was flat. A downspout was disconnected (Figure 2). Rain water is direct back towards the slab in some locations (Figure 3).

Bathroom/Kitchen: The bathroom exhaust fan measured 54 CFM. The fan vented through the roof with metal flex duct. The kitchen exhaust fan vented to the outside. Dryer was vented outside through flexible metal ductwork that was constricted.

Attic: Mold was found on the back bedroom ceiling at the exterior wall (Figure 4). Attic insulation appeared to be adequate over the top plate. However, daylight was visible over the insulation to the outside. Gaps were visible between the trim and the siding that allowed cold air to move through the insulation, cooling the ceiling surface temperature (Figure 5). The problem was further compounded by the fact that there was no warm-air distribution system in the home.

The attic was insulated to about R38 with fiberglass batt insulation. There were numerous gaps and voids between the batts with exposed ceiling area. A large bypass
was found around the kitchen exhaust fan (Figure 6). The roof sheathing was in good shape with no signs of mold.

Heating System: A propane-fired wall furnace was used for heating with no supply or return air ductwork (Figure 7). A wood stove located in the living room provided supplemental heat. The water heater was a natural draft propane-fired model. There was no cooling system in the home.

Occupant Notes: Three people lived in the home.

Recommendations:

- Re-insulate and air seal over the top plate in the back bedroom.

- Seal all attic bypasses, especially around the kitchen exhaust fan.

- Install a transfer grille between the back bedroom and main body of the house to improve the air circulation.

- Repair the downspouts/ correct the pitch of the splash blocks.

- Replace wood band joist so that water can drain from it.

- When appropriate, install new windows with a U-value no higher than 0.40; flash appropriately to not trap water behind the trim.

- Replace the existing bathroom fans with low-sone exhaust fans with mechanical timers in place of “on/off” switches.
Appendix B: Northern Circle Indian Housing Authority

**Inspection Number:** 2-3

**Address:** 406 Sea Lion Court

**Age:** 11

**House Type:** Low rent

**Bedrooms:** 4

**Foundation:** Slab-on-grade

**Heat Type:** FA furnace (propane/wood)

**Construction:** Stick-built, 2” x 6”

**Occupancy:** 1 adult, 5 children

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**Mold and Moisture Conditions:** The exterior bandjoist was rotting (Figure 2) as was T-1-11 siding beneath the window trim (Figure 3). Water leaked through the exterior wall from a kitchen plumbing leak. The supply air register in the bathroom ceiling was rusty.

**Rainwater Management:** Site drainage was flat. The gutter system allowed water to drain next to home (Figure 4).

**Bathroom/Kitchen:**

The main bathroom exhaust fan measured 32 CFM. The exhaust fan in the master bedroom bath measured 50 CFM. Both fans vented to the outside. The kitchen exhaust fan vented to the outside. The dryer vented to the outside.

The metal supply air register in the bathroom was rusty, indicating that the register was not insulated in the attic.

The kitchen sink was leaking and water was draining through the exterior wall onto the back patio. Some mold was under the cabinet.

**Attic:** The attic was not accessed. It was assumed that the conditions were similar to other homes, especially in regards to uninsulated metal supply air registers given the rust stains found in the interior.
**Heating System:** The furnace was an 80% propane-fired model with a central return. Combustion air was ducted to the furnace closet from the attic through rigid metal ductwork. A wood stove located in the living room provided supplemental heat. Outside combustion air was provided to the stove. The water heater was a natural draft propane-fired model located in a non-conditioned space behind the home. The occupant stored items around the water heater creating a fire hazard. There was no cooling system in the home.

**Occupant Notes:** Six people, one adult and five children—ages 5 years to 14 years—lived in the home. Allergies and asthma had been reported by the occupants.

**Recommendations:**

- Correct the kitchen plumbing leak.
- Re-connect downspouts to direct water away from the home.
- Replace the wood bandjoist so that water could drain from it.
- When appropriate, install new windows with a U-value no higher than 0.40; flash to avoid trapping water behind the trim.
- Replace the existing bathroom fans with low-sone exhaust fans with mechanical timers in place of “on/off” switches.
- Inspect the attic insulation; insulate the exposed gypsum board surfaces.
- Insulate the exposed metal registers in the attic.
- When appropriate, replace the furnace with a sealed combustion model.
- Advise the occupant not to store items near the water heater.
Appendix B: Northern Circle Indian Housing Authority

Inspection Number: 2-4

Address: 404 Sea Lion Court

Age: 11

House Type: Mutual help

Bedrooms: 4

Foundation: Slab-on-grade

Heat Type: FA furnace (propane/wood)

Construction: Stick-built, 2" x 6"

Occupancy: Unknown

Occupants were not at home. Only an inspection of the siding on the front of the home was done.

Mold and Moisture Conditions: Exterior band joist was rotting. T-1-11 siding was very soft, especially around the window trim (Figure 2).
Appendix B: Northern Circle Indian Housing Authority

Inspection Number: 2-5
Address: 408 Sea Lion Court
Age: 11
House Type: Low rent
Bedrooms: 4
Foundation: Slab-on-grade
Heat Type: FA furnace (propane/wood)
Construction: Stick-built, 2" x 6"
Occupancy: 2 adults, 3 children

Mold and Moisture Conditions: The exterior bandjoist was rotting (Figure 2). Fungal growth was found in the joints of the T-1-11 siding. Mold was found in the corner of the back bedroom and in the master bedroom bathroom.

Rainwater Management: The site drainage was flat. Some holes and depressions were adjacent to the slab (Figure 3). The gutter system was intact. The exterior bandjoist was rotting. A poor design of the bandjoist was likely the cause of water entry into the sidewalls (Figure 4).

Bathroom/Kitchen: The main bathroom exhaust fan measured 0 CFM. The exhaust fan in the master bedroom bath measured 46 CFM. Both fans vented to the outside. The kitchen exhaust fan vented to the outside. The dryer vented to the outside.

Attic: The attic was not accessed. It was assumed that the conditions were similar to those found in other homes, especially in regards to uninsulated metal supply air registers.

Heating System: The furnace was an 80% propane-fired model with a central return. Combustion air was ducted to the furnace closet from the attic through rigid metal ductwork. A wood stove located in the living room provided supplemental heat. Outside combustion air was provided to the stove. The water heater was a natural draft propane-fired model located in a non-conditioned space behind the home. There was no cooling system in the home.

Occupant Notes: Five people, 2 adults and 3 children, ages 3-5 years, lived in the home. The son had allergies.
Appendix B: Northern Circle Indian Housing Authority
June 21-25, 2004

Recommendations:

- Replace the wood bandjoist so that water can drain from it.

- When appropriate, install new windows with a U-value no higher than 0.40; flash so water is not trapped behind the trim.

- Replace the existing bathroom fans with low-sone exhaust fans with mechanical timers in place of "on/off" switches.

- Inspect the attic insulation; insulate the exposed gypsum board surfaces.

- Insulate the exposed metal registers in the attic.

- When appropriate, replace the furnace with a sealed combustion model.
Appendix B: Northern Circle Indian Housing Authority

Inspection Number: 2-6
Address: 403 Sea Lion Court
Age: 11
House Type: Low rent
Bedrooms: 5
Foundation: Slab-on-grade
Heat Type: FA furnace (propane/wood)
Construction: Stick-built, 2” x 6”
Occupancy: 2 adults, 2 children

Mold and Moisture Conditions: The exterior bandjoist and window trim was rotting (Figures 2 & 3). Mold was found in the main bathroom on the wall and ceiling.

Rainwater Management: The site drainage was flat. The gutter system was intact. The exterior bandjoist and window trim were rotting.

Bathroom/Kitchen: The main bathroom exhaust fan measured 32 CFM. Mold was growing on the wall and ceiling (Figure 4). Mold was also found under the bathroom sink (Figure 5). The exhaust fan in the master bedroom bath was inaccessible. Both fans vented to the outside. The kitchen exhaust fan and dryer vented to the outside.

Attic: The attic was insulated to R38. Conditions were similar to those found in the houses 2-1 and 2-2. Gaps between the batt insulation were found exposing the gypsum ceiling and metal supply air registers were not insulated. In addition, uninsulated copper plumbing lines were found (Figure 6).
Heating System: The furnace was an 80% propane-fired model with a central return. Combustion air was ducted to the furnace closet from the attic through rigid metal ductwork. A wood stove located in the living room provided supplemental heat. However, unlike previous wood stove, combustion air for the stove was drawn from the house (Figure 7). The water heater was a natural draft propane-fired model located in a non-conditioned space behind the home. There was no cooling system in the home.

Occupant Notes: Four people lived in the home. The children have allergies.

Recommendations:

- Replace the wood bandjoist so that water can drain from it.
- When appropriate, install new windows with a U-value no higher than 0.40; flash so that no water is trapped behind the trim.
- Replace the existing bathroom fans with low-sone exhaust fans with mechanical timers in place of “on/off” switches; replace the flexible metal duct with rigid metal.
- Inspect the attic insulation; insulate the exposed gypsum board surfaces.
- Insulate the exposed metal registers in the attic.
- Insulated the copper plumbing pipes.
- When appropriate, replace the furnace with a sealed combustion model.
Appendix B: Northern Circle Indian Housing Authority

Inspection Number: 2-7  
Address: 509 Garcia Court  
Age: 16  
House Type: Low rent  
Bedrooms: 2  
Foundation: Slab-on-grade  
Heat Type: Wall furnace (propane/wood)  
Construction: Stick-built, 2" x 6"  
Occupancy: 1 adult

Figure 1 – 509 Garcia Court

Figure 2 – Rotted bandjoist

Figure 3 – Rotted window trim; note fungal growth at base of trim

Figure 4 – Fungal growth on siding

Mold and Moisture
Conditions: The exterior bandjoist and window trim was rotted (Figures 2 & 3). Mold was found on the bathtub surround. Some water damage to the wall adjacent to the bathtub was noted.

Rainwater Management: The site drainage was flat. The gutter system was intact. The exterior bandjoist and window trim were rotting. Fungal growth on the T-1-11 siding was prevalent (Figure 4).

Bathroom/Kitchen: The bathroom exhaust fan measured 43 CFM. Mold was growing on the tub surround (Figure 5). Gypsum board adjacent to tub was water damaged. The floor was damp under a throw-rug. The kitchen exhaust fan vented to the outside. The dryer vented to the outside through a properly installed flexible metal duct (Figure 6). Some mold was found under the kitchen sink.
Attic: The attic was not inspected. Conditions were assumed to be similar to those found in other homes with R38 fiberglass batt insulation, gaps between batts exposing gypsum ceiling surfaces and a bypass around the kitchen exhaust vent.

Heating System: A propane-fired wall furnace was used for heating – there was no supply or return air ductwork (Figure 7). A wood stove located in the living room provided supplemental heat. Some wood was stored near the stove. The water heater was a natural draft propane-fired model located in an unconditioned space outside the house. No items were stored near the heater (Figure 8). There was no cooling system in the home.

Occupant Notes: One person lived in the home.

Recommendations:

- Replace wood bandjoist such that water can drain from it.

- When appropriate, install new windows with a U-value no higher than 0.40; flash so water is not trapped behind the trim.

- Replace the existing bathroom fans with low-sone exhaust fans with mechanical timers in place of "on/off" switches; replace the flexible metal duct with rigid metal, if necessary.

- Inspect the attic insulation; insulate the exposed gypsum board surfaces.

- Inspect the plumbing in the attic; insulate uninsulated pipes.

- Install a transfer grille between the back bedroom and main body of the house to improve the air circulation.