Environments for the Chemically Sensitive as Models for Healthy Building Construction: Issues of Architectural Space Planning

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INTRODUCTION

Multiple Chemical Sensitivity Syndrome (MCS, also known as Environmental Hypersensitivity, 20th Century Disease, and Environmental Illness or EI) is a controversial and little understood medical condition. It's appearance is circumstantially linked to the post-war chemical revolution and in more specific ways to the widespread construction of tightly sealed environments following the 1973 energy crisis. As these various names suggest, MCS involves a heightened sensitivity to chemicals now commonly found in the environment such as pesticides and formaldehyde. Such hypersensitivity also often extends to naturally occurring irritants such as wood resins, molds and pollens. Symptoms such as headaches, nausea, disorientation, and lack of muscle control are similar to those of the more familiar Sick Building Syndrome. Unlike Sick Building Syndrome, however, the symptoms tend to be persistent and not specific to any single immune response.'

At the current time there is no clearly established etiology and no known cure for MCS, which leaves isolation from potential irritants as the strongest course of action and the provision of a 'healthy house' or safe haven environment the best therapy. This fact makes the MCS community's work at securing shelter an intriguing case study in the architectural issues of health and the indoor environment. Without resolving the status of MCS in the medical arena it is quite plausible to grant these individuals a heightened ability to perceive the presence of suspected irritants and hence to respect the commitment with which they pursue the task of creating 'safe haven' environments for themselves.

This paper reports on an ongoing project of documenting such refuge environments, focusing on the issue of architectural programming and space planning. After briefly introducing the project and some of the larger issues addressed by these dwellings I will call out the specific MCS driven features that have a distinctive impact in plan and/or section. Where previous papers have examined the overall aesthetic questions posed by both the architecture and the outlooks of the inhabitants[2] and specifically on the crucial and highly visible issue of materials selection[3], the question of space planning is interesting for the paradoxical reason that it has so little visibility in the rhetoric of the MCS community.

This is not to say that the case study dwellings aren't full of interesting and occasionally novel spatial solutions to the problems of creating healthy living environments. They are. But to see these myriad small physical adjustments as a part of an overall architectural strategy is an architect's way of thinking, and few of these houses involved architects' services. My contention is that this is one aspect of 'healthy housing' where traditional architectural skills are pointedly absent and can add significantly to the discussion. Because of it's direct spatial implications, it is also one of the few introductions to the topic of healthy housing that is immediately engaging to design students.

BACKGROUND

The research has involved both the documentation of physical structures and interviews with the clients, builders, and the occasional architects involved in their creation. To date, eleven projects have been documented. Of these, five houses and two apartment buildings are discussed here, representing several different climates across the United States and Canada. This climatic range was intentional and, as expected, the differences between climates show up strongly in the issue of space planning.

Two houses are located in Wimberley, Texas, a resort community in the hill country outside of Austin. The climate of the hill country is mild and allows virtually year round outdoor living in a beautiful but barren setting consequently free of agricultural pesticides. The similarly mild climates of Aptos and Sausalito, California are the respective sites for an affluent private residence and a low income housing project. The documented work of the Healthy House Institute is in central Indiana, where a temperate climate requires a more guarded relationship between inside and out than the Texas or California examples. The remainder of the work is found in the vicinity of Ottawa, Ontario, where bitter winters demand compact plans and only seasonal use of unheated or exterior space.

CASE STUDY DWELLINGS

1) The Pitman House, Wimberley, Texas[4]

This house is characterized by outdoor living, a radically simplified materials palette, and integrated pest management. The owner is seemingly atypical in her preference for wood as an interior finish material. She in fact expressed a negative reaction to both concrete and plaster; the more common choices of the MCS community.

This house is probably the most dramatic example documented of spatial relationships being manipulated to control the indoor air quality of the house. The plan is a free interpretation on the traditional dog run log cabin that is vernacular to this part of Texas. Two log cabins sit within an immense screened porch enclosure; one cube houses only the sleeping rooms and the other the living dining and study areas as well as the kitchen and bath. The entire structure is raised approx. eight feet off grade to catch the breeze and expose the posts for easy termite inspection. The special treatment of the bedroom as an isolated space will appear again and again in other houses; in this case, Sue Pitman described the plan more specifically in terms of consolidating and isolating the 'wet' rooms (kitchen and bath) to minimize and contain potential mold problems.

The life of the house happens on the porch, where most of the house's storage space is found. In one isolated and breezy comer is a cabinet with Sue's teenage son's model airplane supplies, along with extra kitchen and cleaning supplies. A garment closet is metal lined to prevent insect infestation and is equipped with it's own portable dehumidifier during particularly humid times. Shaker pegs decorate much of the remaining wall space in this area, allowing for cloths and other items to be stored before entering the inner houses. The Pitmans now rent out a similar, smaller cabin that they first constructed and lived in. Their current house is larger in every respect, but interestingly from a planning point of view, Sue commented most pointedly about the dimensions of the porch. The first house has an eight foot wide gallery and even one additional foot would have make it function more effectively.

A television is also housed on the porch; set up on wheels within casework that allows it to be rolled out of sight when not in use. (Televisions in particular can be offensive to a person with MCS, both because of the amount of plastic and the high temperatures inside the case: The heat produces off-gassing from the plastic and fried dust.) On a larger scale, the master bed is on wheels and is rolled onto the porch nightly duringgood weather. Rolling it back into the bedroomallows a dehumidifier to dry the comforter during the day. Sue spoke of the house in terms of being able to move around from place to place within it to avoid being constantly exposed to the same irritants.

The final key to the lifestyle that the house suggests is a detached garage and laundry with a large storage room above, isolated from the automobiles through its construction and venting. Again, the principle of isolating the garage is common both among these case studies and more mainstream recommendations for insuring indoor air quality. The detached storage room was especially important to Sue in that it allowed her to remove herself from most of her belongings without throwing them away, making the process of seeking a safe haven less emotionally draining. Over the years that the family has lived in the house and both Sue's and her children's health has improved, family items have one by one been brought inside.

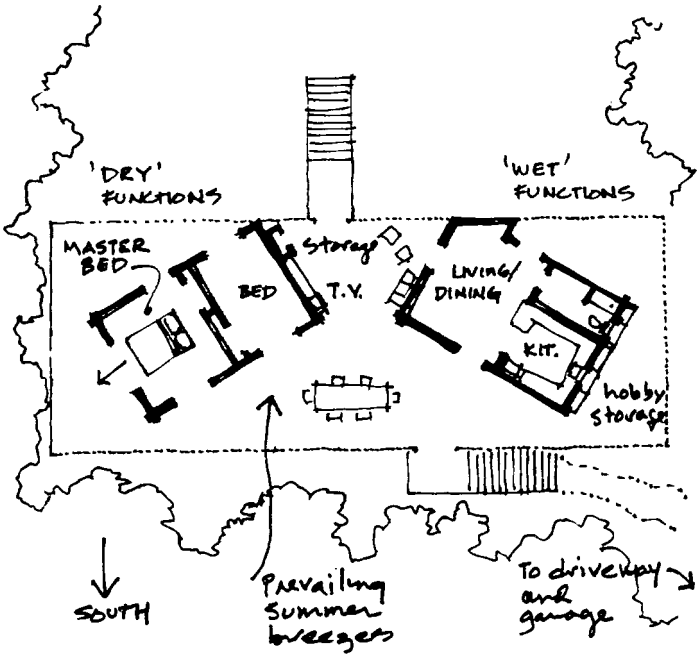

Fig. 1. The Pitman House, main living floor.

2) The Brausieck House, Wimberley, Texas"

Annabell Brausieck suffers from a degree of sensitivity that is rare even among the MCS community. Her house is similar in many respects to other examples, but to date it has failed to provide an acceptable environment. Behind the house and it's screened sleeping porch is a freestanding cold weather sleeping room that is to date her most effective refuge.

The house is a conventional tract house for the most part, sited on the ridge of a hill for maximum air circulation. The bathroom area has been enlarged to accommodate a sauna, which is a therapy often associated with MCS. The television is awkwardly placed in the hall adjoining the living room, allowing it to be viewed from behind the glass door that separates the two spaces. The enclosed rear patio of the house is used as a sleeping porch. In retrospect, Annabell felt that the laundry room would be better removed from the main body of the house in order to isolate it as a source of mold and other odors.

The porcelain lined shed that serves as Annabell's cold weather sleeping room is an extreme statement of the principle of making the bedroom a final refuge environment. The small size of the room kept the cost down and does make it easy to keep clean. The bed is the only furnishing, with a television mounted in a box outside of one of the windows

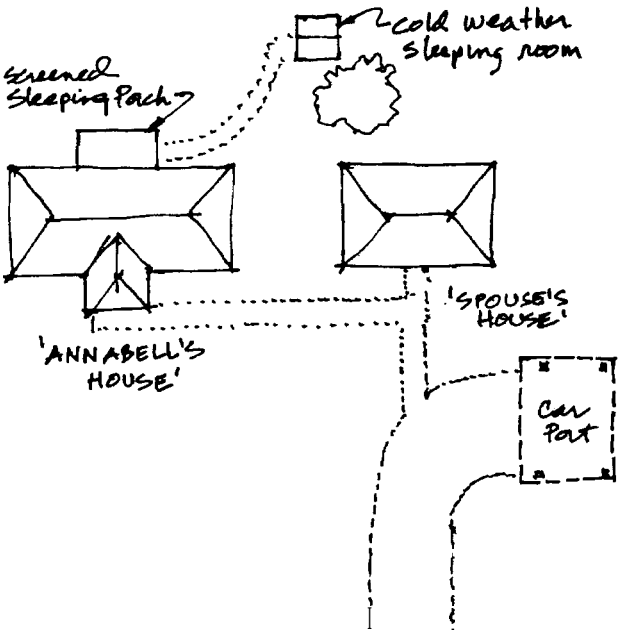

Fig. 2. The Brausieck House, partial site plan.

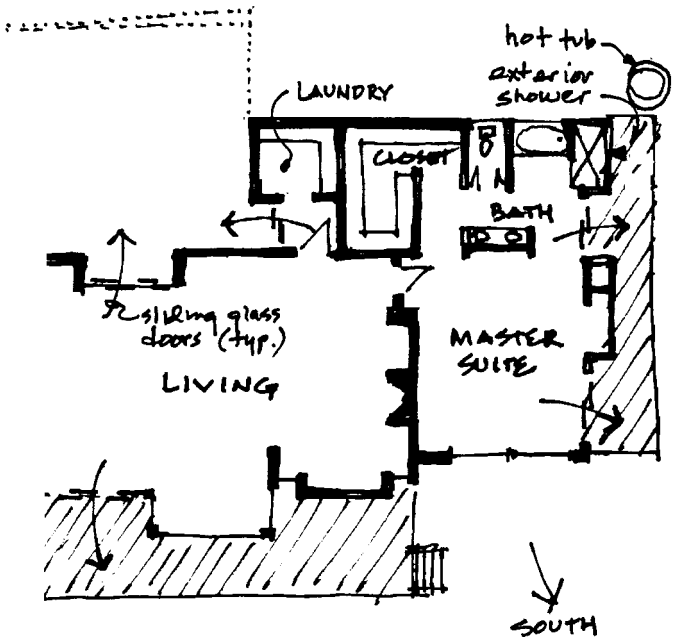

Fig. 3. The Robson House, partial plan.

and controlled remotely. A small vestibule contains an oxygen tank and a bed pan, which speaks volumes about the difficulty of Annabell's situation.

As with Sue Pitman's house, the garage is credited with saving Annabell's marriage. Rather than let the difficulties of coping with such forced austerity come between her and her husband, the two of them converted the garage into an apartment where he can live as he pleases.

3) The Robson House, Aptos, California[6]

The Robson house, designed by architect George Foy, displays a comfortable congruence between an open architectural style characteristic of the location and Dalia Robson's expressed needs. The airiness of the volumes and their direct connection to habitable exterior space are notable, with sliding doors leading out of every room. This architectural sensibility is extended by the requirement that the walk-in closet have an open air connection to other rooms to avoid stuffiness, by the use of sliding glass patio doors in the laundry room so that those chores can be done either outside or bathed in sunlight, and by Dalia's insistence on a handicap accessible bathroom in the eventuality that she would need to use a wheelchair.

The architect has provided a master bath that is essentially a large tiled wet-room, connecting without doors to the rest of the house. This bath is also linked to the exterior through a sliding glass door leading to an outdoor hot tub. A second shower head on the exterior of the house allows the family to wash off after returning from the beach or tub and before entering the house. Again, this is perhaps standard for the neighborhood. From Dalia's point of view it serves to keep the interior clean and odor free. Dalia exploits this openness in a final way through the use of a rolling cloths rack, allowing cloths to be moved outside through the sliding doors to air out.

4) Ecology House, San Rafael, California[7]

Ecology house stands as the first attempt in the United States to provide for the MCS community under the federal housing provisions for people with disabilities. The program represents the problem of designing for MCS at it's thorniest, in that it was bound by the HUD framework for low income housing on the one hand and had no specific client to test materials for compatibility with on the other. Ecology house has been plagued with problems since its opening (after my site visit). As a consequence the verdict on the success of the strategies represented remains out. As one might expect, the spatial strategies are less implicated in the building's current problems than the materials selections, given the initial risk laden decision to create an apartment building with all of the attendant potential conflicts between tenants idiosyncratic needs and the constraints of the funding and site selection processes for HUD sponsored housing.

As a architectural planning exercise, Ecology house is notable for its single loaded courtyard circulation and use of balconies, justified in the face of HUD restrictions on such amenities on the basis of air circulation and the need for personal open air space. An additional and novel addition to the program is a communal open air storage room on the upper floor, intended to give residents a place to air out large personal belongings before bringing them into their individual apartments.

All of the apartments are designed for handicap accessibility. One notable feature in this regard is that the storage

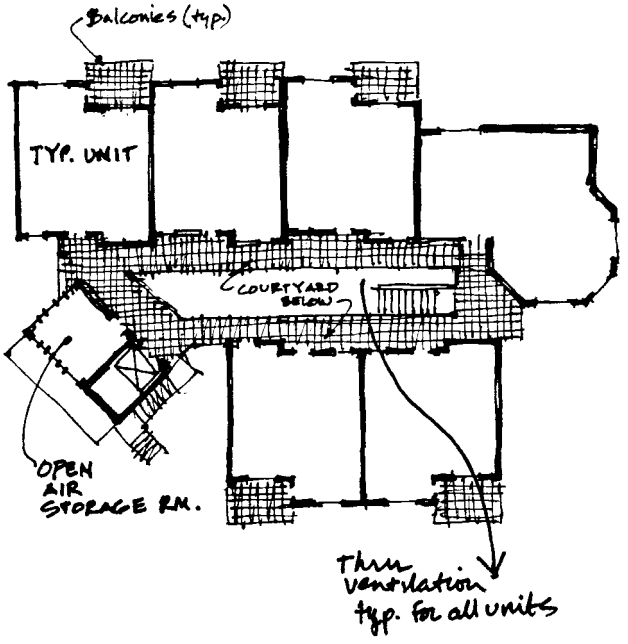

Fig. 4. Ecology House, second floor (schematic).

closet at the entry to each apartment is a freestanding metal unit that can be removed to create the required space for wheelchair access.

5) The Bower House, Lyle House, and Haltom House/ Healthy House Institute Model Home, Unionville, Indiana[8]

These three projects here presented as one are the work of John Bower. Bower began building 'healthy houses' when his wife became chemically sensitive and is now recognized as an authority on the subject. His houses are customizations of standard plans, characterized by strategies of careful site selection, isolation of the interior from the envelope assembly through air-tight drywall construction, careful selection of interior finish materials and purposefully controlled mechanical and natural ventilation.

All three houses have independent garages. The Bower house is also supported by a freestanding office structure. As in other cases, the garages prove important not only to isolate the automobile from the house but to provide a shelter and staging ground for airing out furniture, construction materials, etc...

Both Bower and Lyle discussed the necessity of having a place where the non-sensitive spouse returning from business trips etc., can shower and even sleep occasionally, rather than contaminating the house proper. For John, the office serves this function, also allowing him to use equipment such as a photocopier, printer and fax that would be unacceptable in the primary living space.

This segregation of functions is also seen in the use of glass pocket doors that shut the kitchen off from the remainder of the house to control cooking odors.

In all cases the utility room is adjacent to the bath in the center of the house. A typical concern in such cases is the potential for mold or mildew contamination, and John's philosophy is to prevent this through adequate detailing and space provisions. This approach seems in these houses to be successful. Katy Haltom discussed the potential of removing the laundry from the house, but feared for the loss of convenience. The central vacuum system bag for each of these houses is also located in the utility room, but no one noted any problems with contamination associated with emptying it.

Finally, Melany Lyle noted that since becoming chemically sensitive she has changed her cooking habits and now prepares her own food from scratch. For this reason she appreciated the ample kitchen and would even make it larger in relation to the rest of the house.

6) Barhaven Community Housing for the Environmentally Hypersensitive, Ottawa, Ontario[9]

This recently completed low income housing is by far the most architecturally radical of these examples in its reconsideration of issues of design. It is characterized by the simplification of all construction assemblies to offset higher material costs, the elimination of all possible construction cavities and a design that allows complete access behind all major appliances and dismountability of the duct system for cleaning.

To a much greater degree than at Ecology House, the climate and the budget conspired to produce a compact plan that is not necessarily ideal in terms of air circulation or space planning. Still, the apartments are remarkable for solving the accommodation of one, two and three bedroom units, each on two floors, with a consistent mechanical room layout that organizes all of the utilities, the appliances of the abutting laundry rooms and kitchens, and the fixtures of the abutting baths. As mentioned, all of these appliances and fixtures protrude through the walls of the utility closets to allow for complete access from behind. This solution also eliminates the need for a common basement, which was seen as a potentially dirty, wet and therefore problematic environment.

As you would expect in a cold climate, the apartments each have vestibules that act as a place to disrobe before entering. The specific usefulness of such a space was mentioned in several interviews as a way to control contamination of the house by having people remove their shoes, etc.. The bedroom closet is treated as a walk-in storage room opening onto the hall rather than the bedroom itself.

One expressed criticism of Barhaven is that the two story apartments, and especially the single bath on the second floor, are potentially difficult to use for a person with severe MCS. One of the common symptoms of MCS is dizziness and loss of both strength and muscle control, which could argue for designing for handicap accessibility as a general rule. This has not yet proven to be an actual problem in the field at Barhaven.

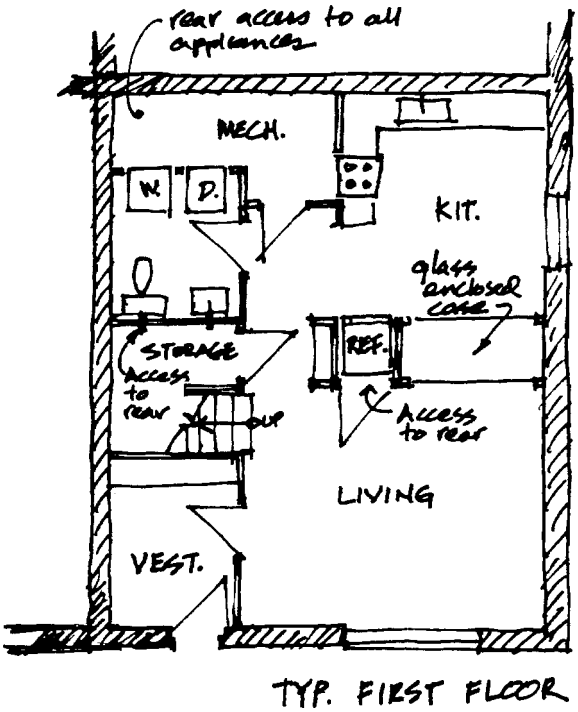

Fig. 5. Barhaven Community Housing, typical unit plan, first floor.

7) The Nelms House, near Carp, **Ontario**[10]

This super-insulated house is characterized by its hard surfaces and natural interior finishes, careful zoning and elaborate mechanical ventilation. The use of color and the capture of daylight in this harsh climate were central to Catherine Nelms' successful recovery.

The garage and storage loft are a separate building. The vestibule is ample. The house is a tri-level, with the master bed on the main floor so that at her most ill, Katy Nelms wasn't forced to use either the upper level where her husband's office is located, or the lower level, which houses the service rooms. The master bedroom, master bath, family room and kitchen share the southern exposure. Concern for daylight penetration led the Nelms to construct a freestanding screened pavilion rather than enclosing the south facing patio when they decided to expand several years after the completion of the original house.

As with several other examples, the kitchen can be closed off from the rest of the house with glass doors. The house has slowly been furnished as Katy has recovered her health and as the Nelms could afford to have furniture rebuilt with organic batting, which gives the house a conventional warmth. This fact calls all the more attention to the master bedroom, which like other examples is treated as a final refuge housing the fewest possible articles. As with the Pitman house and Barhaven, the closets do not open directly into the bedroom, isolating the bedroom from possible contamination from either clothing or mold and mildew.

CONCLUSION

I have previously examined these projects in terms of what I have called their opposing tendencies towards either conventionalism or experimentalism." In light of the issues of architectural space planing the philosophies of Mary Oetzel and to some degree John Bower represent the conventional pole; their houses explicitly rely on careful materials selection and detailing to create clean interiors, and self-consciously attempt to maintain as much of a semblance of conventionality as they can in plan. The Pitman house and Barhaven stand at the other extreme, one in a warm climate and one in a cold, both taking on as many issues as possible in the plan, expressing the rethinking of various functions equally as self-consciously as the others repress it. John Bower would argue that given the appropriate detailing of both wall construction and ventilation, a garage could just as easily be attached to a MCS house as not. Sue Pitman has had to do just this to prevent the garage from contaminating the storage area above it, but to connect the car to the house for convenience sake would still be , I surmise, unthinkable. These differences of approach are driven by many factors, not the least of which is the uniqueness of the sensitivities of each individual. This basic fact makes generalized solutions and judgments difficult.

In either case, the general concerns that drive these planning issues are familiar both in the larger literature of handling household hazards at the residential scale and guaranteeing office air quality at a larger scale. On the one hand there is a desire to avoid stuffiness which favors thinking in terms of interconnected open spaces, and on the other the desire to zone activities by their noxiousness and isolate incompatible activities from one another, which favors thinking of rooms as discreet. On the one hand there is a desire to put physical distance between these discreet functions and on the other there are compelling reasons, especially with an enfeebled inhabitant, to gather things together for ease of use.

Several themes are both common and distinctive to this MCS housing. The idea of zoning space from dirty to clean is not unique to these houses but is strongly expressed in them. The idea that the bedroom be treated as a final refuge is common within the MCS community; it is often either all that an individual can afford or the logical first step in renovating an existing house. The advice is always to close the room off as completely as possible from the rest of the living space, including closets and baths. This is demonstrated here in a cold climate in the Nelms house and contradicted by the airiness of the Robson house in mild California.

Similarly, the emphasis in several houses on zoning to cluster the service spaces takes on a different meaning when the motivation is to isolate sources of moisture. This again is seen clearly in the Pitman house and Barhaven. Similarly, the kitchen is designed to be isolated in several but not all of the examples.

These houses all take storage space very seriously, whether isolated or integrated (in which case they are often served by a dedicated exhaust). In particular, the desirability of long term storage where a person's belongings could be warehoused during the recovery process is worth noting.

The fact that this medical condition can be extremely hard on couples was discussed again and again, and in this light the imperative of providing a separate space for the non-chemically sensitive spouse, parent or children is also worth noting. The objective is to allow others to preserve aspects of their own lifestyle that may be in conflict with the needs of the person with MCS.

Finally, the small and probably exceedingly personal reinterpretations of functional areas are interesting; the idea that the kitchen should grow to accommodate a required cooking regimen, or that the laundry room should similarly grow to allow for careful sorting and the elimination of potentially offensive dryers (as was found to be necessary in two houses not discussed here. In one, the Canadian Mortgage and Housing Co. Demonstration House for the Environmentally Hypersensitive in Ottawa, a radiant drying closet was provided in the place of the dryer).

These are all issues that architects and architectural students can bring design expertise to in a way that might foreword the goals of all involved. As a closing example of this potential for architectural dialog, I would point to the design specialty of 'universal design,' or design accommodating multiple generations and multiple states of physical ability and disability over time. MCS victims share many of these concerns. Their dwellings by could easily be conceived of as 'universal' designs, but to the best of my knowledge such a conversation has vet to take place.

NOTES

1 Interview with Claudia Miller, Univ. of Texas Health Science Center, San Antonio. See Ashford, Nicholas and Claudia Miller, *Chemical Exposures: Low Levels and High Stakes*. New York; Van Nostrand Reinhold. 1991.

2 Wasley, J. "Multiple Chemical Sensitivity Syndrome and 'Traditional Concepts of Architecture.'" *Proceedings of the 83rd American Collegiate Schools of Architecture Annual Meeting*. Seattle, Washington. (1995) [Selected for presentation at the national conference. This paper can also be found in the *Proceedings of the 1994 American Collegiate Schools of Architecture West Central Regional Conference.]*

3 Wasley, J. "Environments for the Chemically Sensitive as Models of Healthy Building Construction: Eight Case Studies from an Architectural Perspective." *Proceedings of Healthy Buildings '95: an International Conference on Healthy Buildings in Mild Climates*. Milan, Italy. (1995)

4 Interview with Susan Pitman. Pending interview with Tony Patch, contractor. No architect involved.

5 Interview with Annabelle Brausieck and with Don Wiley, the metal fabricator who built a porcelain enamel room. General contractor out of business. No architect involved.

6 Interviews with Dalia Robson and with George Foy, architect. General contractor out of business.

7 Interviews with Matt Anderson and Steve Kodama of Kodama Associates, Architects, and Susan Molloy and Bruce McCreary, activists behind the project. Pending interview with the contractor.

8 Interviews with John and Lynn Bower, Healthy House Institute. interviews also with Ron Halton and with Melany Lyle, MCS victims and 'healthy house' owners. See Bower, John. *Healthy House Building: A Design and Construction Guide*. Bloomington; The Healthy House Institute. 1993.

9 Interviews with Philip Sharp, architect, and Oliver Drerup, contractor. The CMHC has funded a sociological report on the project, now underway.

10 Interviews with Catherine and John Nelms, clients, and Oliver Drerup, designer and builder.

11 Wasley, J. "Multiple Chemical Sensitivity Syndrome and 'Traditional Concepts of Architecture.'" ibid.