US Army Corps
Of Engineers
Engineering Research and
Development Center

DECONSTRUCTING BUILDINGS AT FORT CAMPBELL KY; A PILOT PROJECT

DRAFT

(Author's note: This Draft represents the complete content of the Fort Campbell Deconstruction Report. It has not been submitted by Editing, and is provided informally for comment.

Per mutual agreement between CERL and FPL PIs, CERL will publish the FPL report on the siding processing, listing the FPL and Penn State writers as the authors. That report is summarized in the Deconstruction report.)

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Foreword

(To be included)

Preface

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DECONSTRUCTING BUILDINGS AT FORT CAMPBELL
A Pilot Project

1. INTRODUCTION

The Army's Environmental Quality Technologies management program has identified Solid Waste Management as the top Research, Development, Testing, and Evaluation (RDT&E) user requirement priority within the Pollution Prevention Pillar (category) of Army Environmental Quality. A major contributor to the solid waste burden is debris generated by construction and demolition (C&D) activities. Nationally, it is estimated that the C&D component of the solid waste stream is roughly 20-25%.

The C&D debris burden within many Army installations, however, is considerably greater. Several factors contribute to generating C&D debris at a higher rate the commercial construction market, including the Facility Reduction Program (i.e. the removal of WWII-era wood buildings), demolition required to clear sites for new construction, waste generated by construction activities, and disposal of obsolete Family Housing through the Residential Construction Initiative (RCI) program, and other rehabilitation and renovation programs. Some Army solid waste managers estimate C&D debris to be as high as 80 percent of the solid waste stream at their installations. Army-wide (during Fiscal Year 1999 data) over 2 million tons of municipal solid waste (MSW) were generated at a disposal cost of roughly $129 million, and roughly 2.9 million tons of C&D debris at a disposal cost of roughly $126 million. To compound this problem, Army policy prohibits siting and permitting new landfills on installations. When on-post C&D landfill capacity is exhausted, debris must be hauled off-post to private or community landfills, increasing transportation and tipping expenses.

The initial expense of landfilling C&D debris is not the only issue of concern. Operating expenses, as well as closure and long-term monitoring must be added to the overall expense of landfilling debris. Army solid waste managers have calculated the life-cycle expense of landfilling C&D debris on-post to be as high as $50/ton, or roughly $1 million/acre.

The adverse effects of landfilling demolition debris extend beyond Army properties as well. Solid waste is also linked to greenhouse gas. The U.S. Environmental Protection Agency (EPA) has identified solid waste reduction as one of many ways to mitigate global climate change. The manufacture, distribution, and use of products – as well as management of the resulting waste, -- all result in greenhouse gas emissions. Waste prevention and recycling (especially wood and organic products) reduce greenhouse gases associated with these activities by reducing methane emissions, saving energy, and increasing forest carbon sequestration.

EPA has developed the WAste Reduction Model (WARM) to analyze greenhouse gas emissions reductions from several different waste management practices. WARM is available in a Web-based calculator format and as a Microsoft Excel spreadsheet. WARM calculates and totals greenhouse gas emissions of baseline and alternative waste management practices—source reduction, recycling, combustion, composting, and landfilling. The model calculates in metric tons of carbon equivalent (MTCE) across a wide range of material types that compose municipal solid waste (MSW).

Reducing both the economic and environmental burdens associated with the C&D debris stream, therefore, will have a significant positive impact on the Army and the community at-large.

2. BUILDING DECONSTRUCTION

Appendix A "Deconstructing Surplus Army Buildings: A White Paper" provides further information on Army demolition practices, the state of deconstruction in the U.S., the potential for deconstruction on Army installations, and obstacles to deconstruction. Major issues are summarized as follows.

The term "deconstruction" has emerged within the last few years to denote disassembling buildings and structures in order to salvage their materials. As with the term "recycling," the fundamental concept of reusing materials is ancient. Only recently (in a broader historical context) has the practice of salvaging otherwise useable materials from obsolete buildings been abandoned.

The conventional method of removing obsolete buildings from Army installations is to mechanically demolish the buildings. Where the installation operates a C&D landfill on-post, it is common practice to allow demolition contractors to dispose of the debris there with no tipping fee. While Directorates of Public Works (DPWs), or Public Works Business Centers (PWBCs), salvage some items prior to demolition, virtually all of the buildings' contents are destined for the landfill.

Deconstruction, by contrast, involves disassembling the building generally in the reverse order of construction, for the purpose of maximizing the reuse and recycling of materials, in a safe and economical fashion. The terms "architectural" and "structural" deconstruction have been applied to different levels of salvage effort. Architectural deconstruction involves removing a building's valuable equipment, components, fixtures, and finishes, then leaving the remainder for demolition. This is also referred to as "cherry picking" or "stripping." Structural deconstruction involves removing framing and other load-bearing members as well as the architectural items. For the purposes of this report, the term "deconstruction" will be used in the "structural" context.

Most examples of deconstruction involve residential-scale wood frame buildings, and deconstruction is typically been performed using manual labor. Materials that cannot be recovered for reuse are removed and separated for recycling or disposal. Materials and components that have a salvage value are removed and processed for reuse. Processing typically involves removing nails, cutting to standard lengths, cleaning, and bundling or stacking for transport.

Framing lumber, sheathing, and millwork (such as finish flooring or decorative trim) are generally the most desirable materials; lumber constitutes the majority of salvageable materials (by mass) in a wood framed building. There is a value associated with salvaged dimensional lumber, which will be reused as lumber for framing and other rough carpentry applications, generally about one-half the prevailing price of new lumber. There is a growing interest in salvaging lumber (timbers and hardwood species especially) as feedstock for architectural millwork. Old buildings were constructed with old-growth lumber. Some species

of old-growth lumber (such as Longleaf Pine and Douglas Fir) have grade and appearance properties that cannot be found in the second- and third-generation wood products now available on the market. Antique (or "vintage") millwork is increasing in popularity as an alternative to new materials. Oddly enough, nail holes and other defects can even increase value as "distressed" materials. Go figure. While still somewhat of a niche market, it is expanding. Cabinets and counter tops, doors and windows, hardware, electrical components and fixtures, plumbing fixtures, furnaces and air conditioning equipment, and other miscellaneous products have value and are commonly marketed through used building materials outlets.

Deconstruction, especially using manual labor, is considerably more labor intensive than mechanical demolition and, therefore, more expensive in initial cost. Removing nails (denaining) is a major labor requirement. The rationale behind deconstruction is that the value of salvaged and recycled materials, and the reduction of debris disposal expenses, offset the increased labor requirement. Several documented case studies suggest that deconstruction can be competitive with demolition if the ***net*** cost is considered, not simply the ***initial*** cost of services. Deconstruction is practiced as an economically viable business throughout the U.S., although the practice in not widespread by any means. The viability of commercial deconstruction depends largely on the cost of landfilling debris. Deconstruction is more common in the Pacific Northwest and the New England region where C&D tipping fees can be $90/ton or more. In regions where C&D landfills are available and relatively inexpensive ($20-30/ton) manual deconstruction may be may be difficult to justify solely on an economic basis.

Research is being conducted to applying combinations of mechanical and manual resources to deconstructing wood buildings. Panelizing buildings and disassembling the components on the ground are being evaluated by the University of Florida Center for Construction and Environment. ERDC/CERL and the California State University, Monterey Bay will develop a Building Materials Recovery Center whereby a more production-based approach to disassembling components and processing materials will be established. The intent is to reduce the labor and time required for deconstruction, while maximizing the recovery rate and value of materials.

The motivation to deconstruct obsolete buildings on an Army installation may be somewhat different than in private demolition market. Installations should be motivated to reduce solid waste burdens for a number of reasons. These include:

Diminishing on-post C&D landfill capacity.

The life-cycle expense of operating, maintaining, closing, and monitoring the landfill.

The Department of Defense (DoD) Measure of Merit to reduce solid waste burden by 40% by FY05.

Objectives and targets established through Installation Sustainability Programs (FORSCOM installations).

Others.

Three installations have developed their own programs for deconstructing WWII-era wood buildings. Briefly, Fort McCoy (through the Corps Omaha District) advertises for bids and sells buildings for salvage. Small contractors, individuals, and other groups interested in the materials deconstruct the buildings, salvage materials, and dispose of the debris as required by their contract. Fort Knox conducts a similar process. Rather than bid buildings for sale, the Fort Knox Recycle Center auctions salvage rights. Fort Campbell, KY, (through Louisville District) has recently bid and sold one building. The winning bidder (i.e. the contractor) lifted the building off the foundation and removed it in-tact from the installation. Fort Campbell will apply this same process to additional buildings in the near future. The processes used by Fort McCoy and Fort Knox to deconstruct buildings are also described in APPENDIX A.

(photograph: church building / Ft. McCoy lumber)
(photograph: residence/Ft. Knox lumber)
(photograph: Fort Campbell building in-tow)

However, deconstruction is still virtually unknown within most Army installations,. DPW or PWBC personnel are reluctant to undertake such a process without previous experience, cost and scheduling data, legal reviews, and other forms of support and assurance that relieve the uncertainty an risk that accompanies departure from the tried-and-true methods.

3. PILOT PROJECT DEVELOPMENT

General Objectives.

A pilot deconstruction project was included in the ERDC/CERL Solid Waste RDT&E Program for FY02. Several deconstruction projects have been performed and documented throughout the U.S. It was felt that another similar demonstration and case study would be of limited usefulness. Two issues were felt to be of importance when developing this project:

> The project should be conducted within the confines of conventional Army building removal practices to the extent possible.
>
> Cost data, labor requirements, logistical and management issues, and other information should be documented in such a way to assist Army installations in planning and implementing deconstruction on an ongoing basis.

Partnerships

ERDC/CERL had collaborated with the University of Florida Center for Construction and Environment (UFCCE), the U.S. Department of Agriculture Forest Products Laboratory (FPL) and the Austin TX Habitat for Humanity affiliate (AHfH) on a cost analysis for removing buildings at Fort Chaffee, AR. This analysis is published as ERDC/CERL Special Report R01-5. UF-CCE performs research in deconstructing buildings in the Gainesville FL area. UF-CCE is also conducting research under an EPA Region 4 Jobs Through Recycling grant. AHfH established the first HfH ReStore for used building materials, and deconstructs buildings in the Austin to supply their ReStore. AHfH has been designated by Habitat International as their Center of Expertise on deconstruction. AHfH is training other HfH affiliates on deconstruction and ReStore operation. FPL was conducting research to develop a grading scheme for salvaged lumber, thus expanding the market for used lumber. FPL had also proposed methods to reprocess salvaged materials, primarily painted materials, into higher value products. These organizations would bring valuable experience, expertise, and resources to the pilot project.

The EPA Office of Solid Waste also expressed an interest in collaborating with ERDC/CERL on a deconstruction project. Under their Global Climate Change Model program, they were seeking data on debris generated by building demolition, and the potential to divert debris from landfilling. The results of this project would be extrapolated to represent the Army-wide potential for debris diversion, and this data would be incorporated into their Global Climate Change model. EPA provided additional funding to perform “value-added” research in addition to the ERDC/CERL RDT&E funds supporting the deconstruction itself.

Site Selection

Several sites were initially considered for the pilot project. They included 4 active Army installations, 2 installations closed under BRAC legislation, and a closed Army Ammunition Plant. Consideration included the numbers and types of buildings available, geographic location, used building materials outlets and other deconstruction services in the area. Of paramount importance, however, was the support of installation personnel to a pilot project.

Fort Campbell was selected as the pilot project site. ERDC/CERL and the Fort Campbell PWBC Environmental Division, Pollution Prevention Branch, have shared a good working relationship in the past, and were collaborating on another project to demonstrate an innovative MSW grinding and reduction technology. ***[[CITE ERDC/CERL TR]]*** Fort Campbell had buildings available, the P2 Branch personnel were receptive to the deconstruction project, and had stimulated interest and support at the PWBC Director's level. Fort Campbell was also conducting their own building bid-for-sale project, and saw this deconstruction project as an opportunity to gain experience in another variation on this approach.

Scope

Funding was available to support the deconstruction of roughly 20,000 square feet (SF) of wood framed building. Fourteen buildings within the 2700 block at Fort Campbell, and one warehouse in the 800 block were available for deconstruction. These included one-story buildings (some built on concrete piers, and some a combination of piers and slab-on-grade), two-story buildings, and large, wide-span warehouse-type building. This selection was presented a good representative sample of the types of WWII-era buildings commonly found on Army installations.

ERDC/CERL entered into a Cooperative Agreement with AHfH for deconstruction services. AHfH selected six buildings: three one-story buildings, each 2,500 SF (one on piers and two combination pier-and-slab foundations), two two-story barracks buildings, each 5,400 SF, and one warehouse, 9,010 SF, or 27,310 SF in total. AHfH was to remove the buildings in total (including foundation), grade, and seed the building sites, leaving them in the same condition as would a contractor working a conventional demolition contract. AHfH would be entitled to keep the materials.

It is important to note that the purpose of this Agreement was not simply to remove buildings from Fort Campbell. Rather, this was a Research and Development exercise to develop a capability in deconstruction and a resource the Army will have at its disposal for future building removal requirements.

ERDC/CERL entered into another Cooperative Agreement with FPL. This tasking was supported with EPA funding. FPL was to evaluate the feasibility of reprocessing salvaged materials into products that could command a higher value than used lumber. The original wood siding was selected as the feedstock for this evaluation. The reasons for evaluating this material are as follows. Siding materials were typically appearance grade, or a higher quality than framing materials. Siding boards would generally be straighter, have fewer knots and defects, and frequently be of a more desirable species than the framing lumber. Furthermore, the siding was coated with lead-based paint (LBP), and would be problematic regarding resale and reuse as siding. It was agreed that AHfH would remove the siding from one barracks building (roughly 4,000 SF) for FPL to reprocess into other products with a potentially higher value. Per agreement with Fort Campbell, AHfH disposed of the painted siding removed from the other buildings.

From the Fort Campbell siding material, FPL was to create one siding profile, and one additional profile of their choosing. In addition to the wood materials processing requirement, FPL was to capture and control the shavings and LBP residue, ensure compliance with occupational safety standards, and monitor and report on airborne lead and worker exposure. FPL was to document the appropriate disposal materials for the shavings, and dispose of them accordingly. FPL would document costs of reprocessing, assess the market and the value of the processed materials, and assess the potential of reprocessing on a commercial basis.

ERDC/CERL entered into a third Cooperative Agreement with UF-CCE. This tasking was also supported by EPA funding. UF-CCE was to support AHfH in deconstruction planning and best deconstruction practices, safety management, and overall on-site support. UF-CCE was also to record and document the labor investment in the deconstruction and generate productivity data for the various deconstruction tasks.

ERDC/CERL was to collaborate with the appropriate Fort Campbell offices to develop requirements and specifications for AHfH's Work, and to participate in other logistical activities. ERDC/CERL would then provide project oversight, monitor and document the project's development and progress, record results relative to deconstruction cost, project management, salvage and debris diversion and debris generation. ERDC/CERL would reflect AHfH's, UF-CCE's, and FPL's results in their report, although each partner would also publish their own technical reports through their own organization's channels.

Project Requirements

Every effort was made to develop the deconstruction project to respect Fort Campbell's interests and preferences, and prevent the conduct of any work that would not be satisfactory to Fort Campbell.

Safety was of paramount importance to Fort Campbell personnel. If volunteers or other non-traditional resources would be applied to this project, there was a concern that they may be more subject to hazards and injury. Training and safety management would be critical issues, and would have to be addressed by AHfH to Fort Campbell's satisfaction.

ERDC/CERL personnel would be on-site throughout the project , but not all day every day. Therefore, Fort Campbell and ERDC/CERL concurred that a Fort Campbell representative would be the Contracting Officer's Representative (COR); the Pollution Prevention Branch Chief was selected. The Contracting Officer's Technical Representative (COTR) would be an ERDC/CERL researcher. AHfH was to maintain contact with the Fort Campbell representative to ensure Fort Campbell's requirements were observed.

Although this was a research project, both Fort Campbell and ERDC/CERL concurred that the deconstruction should be administered in a fashion similar to a conventional contract to the extent possible. Some minor concessions could be made for AHfH's convenience, although the Government would treat AHfH essentially as they would a contractor performing conventional demolition services. In order to conduct an fair comparison with conventional demolition, AHfH would be responsible for all the tasks and expenses ordinarily assumed by a demolition contractor.

The major requirements and conditions developed by ERDC/CERL and Fort Campbell are summarized as follows.

- Buildings would be removed in total.
- Piers, floor slabs, and foundations would be removed to grade. Excavating footings below grade was not required. Walks, driveways, and other pavement flush with the grade may remain in place.
- Underground utilities would be removed above grade only. Removal below grade was not required.
- The building sites would be graded to restore their original contours.
- Upon completion of the building removal activities, sites would be seeded, mulched, and watered.
- AHfH would be responsible for collecting and transporting debris to the Woodlawn Landfill at Fort Campbell, and can tip the debris at no cost.
- AHfH would separate ferrous metals, aluminum, and brass and deliver them to the Defense Reutilization and Marketing Office (DRMO) for

recycling. AHfH would report recycled materials and quantities to the P2 Branch Solid Waste Manager.

- AHfH could deposit recyclable materials, such as beverage containers and cardboard, at any of the Fort Campbell Convenience Centers.
- Fort Campbell would abate all asbestos-containing materials prior to deconstruction. This is Fort Campbell's typical practice in a demolition scenario.
- AHfH would inventory hazardous materials (mercury thermostats and switches, fluorescent tubes, and PCB-containing ballasts) and provide that inventory to Fort Campbell P2 Branch personnel. P2 Branch would provide the appropriate types and numbers of containers. AHfH would remove these items, and place them in the appropriate container, whereupon P2 Branch would pick them up and dispose of them.
- Fort Campbell would terminate water, electrical, sanitary sewer, and gas utilities. AHfH was to provide a 10-day notice prior to the start of deconstruction of each building.
- Fort Campbell would allow AHfH to occupy one vacant building in the 2700 block as a jobsite headquarters, washroom, and tool storage facility. Fort Campbell would leave the utilities active for that building.
- AHfH would be allowed to use the warehouse to process and store materials until it was deconstructed. No additional storage facilities were available.
- Miscellaneous materials had been dumped in the warehouse crawl space. As these materials (mattresses, razor wire, medical containers, other equipment) could not be included in demolition debris, Fort Campbell would remove and dispose of these items.
- AHfH would develop a safety management plan. AHfH and Fort Campbell representatives would conduct a pre-deconstruction meeting to preview the deconstruction plans and safety and environmental management procedures.
- AHfH would be responsible for knowledge of and compliance with all applicable standards and regulations. Fort Campbell would provide AHfH with an environmental compliance manual describing state standards and regulations and Fort Campbell procedures.
- AHfH and all other non-Fort Campbell personnel would be required to wear identification. In the post 9-11 environment, security and access provisions at Fort Campbell were to be established, although details were still being developed.
- AHfH would be allowed to keep all materials. AHfH would be required to provide a disclosure accompanying the resale of any materials containing LBP.
- AHfH could advertise the salvaged materials for sale, and could escort prospective buyers on-site. However, AHfH would have to conduct the actual sales off-site.

The Statement of Work for the Cooperative Agreement is included in this report as Appendix B. This Statement of Work can also serve as a model (or "template") for future deconstruction specifications.

AHfH's interests focused on the buildings themselves. Foundation removal and earthwork were outside their capabilities. Fort Campbell, however, indicated they did not want to perform any independent tasks to restore the site after the buildings' deconstruction. Therefore, AHfH would have to obtain their own excavation service to perform these tasks.

While maximizing the salvage of materials was of primary interest, ERDC/CERL did not want to impose unrealistic requirements on AHfH that would exceed the point of diminishing returns on their salvage efforts. AHfH would determine for themselves what efforts were appropriate for salvaging various materials. The desirability of the materials and value for resale would be left to AHfH's judgment. In other words, ERDC/CERL personnel would not pick materials out of the dumpster and demand "hey, save *this* too!"

Contract Issues

ERDC/CERL initiated a Cooperative Agreement with AHfH for building removal. There are distinctions between a Cooperative Agreement for R&D services and a conventional contract that are worth discussing.

The Cooperative Agreement with AHfH was justified on the basis of HfH's national capabilities in deconstruction. Any carpenter crew could physically dismantle a wood frame building. If simply dismantling the building and stacking the materials was the objective of this project, a competitive bid for these services would have been appropriate. However, providing comprehensive deconstruction services in an economically competitive fashion requires different capabilities.

HfH provides the capability to remove buildings by deconstruction, recover building materials, and market them for resale through their ReStore businesses. Revenues generated by ReStores are used to fund HfH=s new home construction, as well as provide low-cost building materials to the communities they serve. HfH International has designated the Austin Affiliate to be the HfH center of expertise for deconstruction and ReStore business development. AHfH partners with local HfH affiliates for deconstruction and ReStore services. HfH, therefore, provides a national capability to deconstruct buildings, recover building materials, and provide an established network of outlets for their materials= resale and reuse. While simple dismantling of the buildings could have been accomplished by any of a number of parties, a successful demonstration depended on integrating the building removal services with the disposition of the recovered building materials in a timely and economically efficient fashion.

Wage rates and the use of volunteer labor was reviewed during the Agreement's development. It was initially feared that the Davis-Bacon Act would have to apply, requiring that the labor force be paid prevailing construction trade wages. Were this to happen, the demonstration could not continue. It was determined, however, that because removing the buildings was not a part of a construction project; i.e. no new construction was going to take place on the cleared sites, that Davis-Bacon did not apply. The ERDC/CERL contract specialist provided the following:

> Per Department of Labor and our Vicksburg Construction Branch - Deconstruction (no new construction following the deconstruction) is not subject to Davis Bacon Act. It is considered a "service" and therefore the Service Contract Act and applicable wage determinations would apply.

Project Start-up

AHfH had arranged with the National Civilian Community Corps / AmeriCorps to provide crews to perform the deconstruction. AmeriCorps schedules crews to perform various services on a rotating basis, so flexibility in starting and completion dates was somewhat limited. An original starting date of 01 April 2002 was anticipated. However, the subject buildings were still occupied into January and February. The units occupying the 2700 block were to be relocated to a Korean War-era barracks building. However, there was concern whether renovation of this barracks would be completed as anticipated.

Fort Campbell could not guarantee that the subject buildings could be vacated, abated of ACM, and have utilities terminated by 01 April. Therefore, the starting date was rescheduled to 01 May 2002. The effect of this schedule changed is discussed on page _____.

4. BUILDING DESCRIPTIONS

Five of the six buildings selected for deconstruction were located on the 2700 block, which is roughly one mile from the Gate 4, Fort Campbell's main gate. Buildings 2748, 2738, 2736, 2715, and 2717 were selected for deconstruction. Building 2746 was available to use as a office, tool storage, and washroom facility. The other buildings on the 2700 block were vacant as well. There was ample room on this block to deconstruct the buildings and process materials for transport to Building 834 (the warehouse). Building 834 was roughly one mile from the 2700 block, and was immediately adjacent to Gate 3.

(site plan)

All buildings were typical WWII-era wood frame construction. Dimensional lumber was the structural material, and wood sheathing and siding enclosed the buildings. All had been occupied up to the time of this project, and all had been upgraded to accommodate contemporary functions. These upgrades included replacement of the original heating systems, replacement of windows and exterior doors; addition of vinyl siding, re-roofing, and interior re-finishing. While some rooms had been added, the buildings were not extensively partitioned. All of the buildings were in relatively good condition and little deterioration was observed.

Quantity take-offs were performed to estimate the total types and quantities of materials in each building's standing condition. Salvage quantities can then be compared to the standing quantities to determine the diversion rate, in addition to the absolute amount of diverted materials.

An estimate was made of each building's total weight. Lumber, siding, doors, windows, light fixtures, ductwork, piping, and other miscellaneous building components were weighed on-site and unit measures established. Weights of building materials given in standards and tables were also consulted, and used where weighing materials on-site was impractical. Weights of mechanical equipment were approximated, using manufacturers' shipping weights for comparable new equipment. A high level of confidence can be given to the structural and architectural materials' quantities and weights. Mechanical / electrical / plumbing (MEP) components' weights are more approximate. The MEP components, however, constitute a relatively minor portion of the building's total weight, so the overall estimate should be entirely reasonable, if not precise.

Building 2748

Building 2748 was as one-story building, 25' wide, 120'-0 long, and 3,060 Gross SF in floor area. It was originally constructed as a mess facility, and at one time housed a kitchen and food service equipment. It was most recently used as an

administrative / meeting / training building. The basic construction is summarized as follows:

- Foundation: 4 rows of concrete piers
- Floor framing: 2x10 joists spaced at 24" with 1x8 subfloor placed diagonally; beams were built-up 2x10s. At the north end of the building, approximately 12' of floor is constructed as an elevated concrete slab, reinforced with welded-wire fabric (WWF). A 4" concrete topping, also reinforced with WWF is placed on another 25' of framed floor . These areas originally accommodated kitchen and food service functions.
- Exterior walls: 2x6 studs spaced at 24" (balloon-framing) with ½" gypsum wall board (GWB) exterior sheathing, and 8" wood lap siding. Polystyrene insulation board and vinyl siding had been added, as had aluminum soffits and gutters.
- Doors & windows: hollow metal with wood frames; windows were aluminum framed double hung, single glazed.
- Roof: originally trusses field-fabricated from 2x8s with 1x8 sheathing placed perpendicular to the trusses. Contemporary shop-fabricated trusses replaced the original trusses over much of the building. See below.
- Interior finishes: 2' x 4' suspended acoustical tile ceiling system; painted ½" GWB interior wall finish with ¼" paneling wainscot.; 3" tongue-and-groove (T&G) flooring. Multiple layers of vinyl composition tile (VCT) with particleboard underlayment had been added.
- Mechanical / Electrical / Plumbing: air conditioning compressor/condenser unit mounted on a concrete pedestal outside to the west of the building; air handling unit located within the building; ducts running the length of the building above the ceiling. Ceiling hung gas fired units provided heat. 2' x 4' fluorescent light fixtures were installed in the ceiling system. There was no washroom in this building, although some abandoned piping was still present under the floor.

(floor plan)
(exterior photographs)
(interior photographs)

A summary of the major materials' quantities is as follows:

Foundation / Substructure	
Concrete	21 CY
Reinforcing	0.5 T
Floor Construction	
Concrete; slab and topping	12 CY

Framing lumber	7.500 BF
Insulation (fiberglass batt)	2,300 CF

Exterior Wall Construction

Framing lumber	2,800 BF
Sheathing, ½" GWB	2,300 SF
Doors	8 EA
Windows	30 EA
Siding (wood)	2,300 SF
Siding (vinyl)	2,300 SF
Insulation	2,300 SF

Roof Construction

Framing lumber	5,300 BF
Roofing materials	3,400 SF
Insulation	2,300 CF
Soffit & fascia, aluminum	435 SF
Gutters & downspouts, aluminum	288 LF

Interior Construction

Suspended ceiling finish	2,750 SF
Framing lumber (partitions)	450 BF
Wall finish, ½" GWB	3,000 SF
Plywood paneling	1,500 SF
Wood T&G flooring (original)	2,750 SF
Resilient flooring (multilayer)	3,000 SF

Mechanical / Electrical / Plumbing

Air conditioning compressor/condenser	1 EA
Air handling unit	1 EA
Duct	240 LF
Gas fired heaters	2 EA
Piping (est.)	200 LF
Plumbing fixtures	0 EA
Light fixtures	34 EA

The building weight can be summarized as follows (values are rounded):

Foundation & concrete	83,000 LBS @ 41.5 T	3,000 SF =	27.7 LBS/SF
Building			
Superstructure	37,000 LBS		
Exterior closure	23,000 LBS		
Interior construction	30,000 LBS		
M/E/P	3,000 LBS		
	93,000 LBS @ 46.5 T	3,000 SF =	31.0 LBS/SF

Several features of this building effected the types and quantities of materials actually salvaged. Unlike some other Army installations, the exterior sheathing on the buildings at Fort Campbell was ½" gypsum wall board (GWB). GWB is not salvageable, yet is a relatively heavy material. As this material was applied to both interior surfaces and the exterior sheathing, it contributes significantly to the debris stream. While the original 3" pine tongue-and-groove (T&G) flooring was in tact, it was covered by two or more layers of added flooring, each layer consisting of 3/8" particle board plus vinyl tile. These materials, too, were unsalvageable, are relatively heavy, and contribute significantly to the debris stream.

After the vinyl siding was removed it became apparent the original wood siding was unsuitable for resale. Contrary to common perception, the vinyl siding actually does more to deteriorate the wood siding than to protect it. Moisture trapped in the wood accelerates the detachment of the paint. While no regulation exists to prevent the resale of materials containing LBP, the LBP coating must be tightly adhered to the substrate, and not subject to flaking or detachment. The paint was seriously deteriorated on the siding materials and, therefore, could only be landfilled. Where wood siding can be left exposed and protected with a good coating system, this problem is avoidable.

Only after the ceiling was removed was it discovered that a fire had occurred in this building sometime in the recent past. The southern half of the roof had been rebuilt with contemporary shop-fabricated trusses and plywood sheathing. The northern half of the roof structure was original, however it was blackened by smoke and, therefore, not salvageable. Also, the northern end of the building's floor (approximately 12') was constructed of reinforced concrete and a concrete topping was placed over the floor framing another 25' of the building's length. Removing the damaged trusses, then the walls, was an effort that AHfH could not justify to recover the floor framing materials that would have been accessible. AHfH, therefore, elected fully deconstruct the southern half of the building, and mechanically demolish the northern half.

Buildings 2736 & 2738

Building 2736 and 2738 were one-story buildings, 25' wide and 106' long, and 2,650 Gross SF in floor area. They were originally constructed as company administrative and supply buildings. They were most recently used for similar administrative and supply, issue, and storage purposes. These two buildings were virtually identical and were immediately adjacent to each other. They were, built to be mirror-images of each other in plan. While there were minor differences, the following discussion applies to both buildings. The basic construction is summarized as follows:

- Foundation: 3 rows of piers; slab-on-grade and cinder block wall at the boiler room.
- Floor framing: combination framed floor and slab-on-grade. The north portion of the building (approximately 40' is constructed on slab-on-grade. The south portion (approximately 66') is constructed of 2x10 joists spaced at 24" with 1x8 subfloor placed diagonally; beams were built-up 2x10s
- Exterior walls : 2x6 studs spaced at 24" (balloon framing) with ½" GWB exterior sheathing, and 8" wood lap siding. Vinyl siding had been added, as had aluminum soffits and gutters.
- Doors & windows: solid wood, wood five-panel, and hollow metal, with wood frames. Windows were aluminum framed double hung, single glazed.
- Roof: trusses field-fabricated from 2x8s with 1x8 sheathing placed perpendicular to the trusses.
- Interior finishes: ½" painted GWB ceilings with suspended acoustical ceilings in some rooms; painted ½" GWB interior wall finish with ¼" paneling wainscot (a heavily textured paint was applied in Building 2736); 3" tongue-and-groove (T&G) flooring (on the framed floor); multiple layers of VCT with particleboard underlayment had been added; Vinyl Asbestos Tile (VAT) had been removed from the concrete slab floor.
- Mechanical / Electrical / Plumbing: Ceiling hung gas fired units provided heat; one two-fixture washroom; 2' x 4' fluorescent light fixtures were surface mounted on the GWB ceiling.

(floor plans)
(exterior photographs)
(interior photographs)

A summary of the major materials' quantities for each building is as follows:

Foundation / Substructure	
Concrete & block	42 CY
Reinforcing	.8 T
Floor Construction	
Framing lumber	4,500 BF
Insulation (fiberglass batt)	2,200 CF
Exterior Wall Construction	
Framing lumber	2,400 BF
Sheathing, ½" GWB	3,100 SF
Doors	6 EA
Windows	15 EA

Siding (wood)	3,100 SF
Siding (vinyl)	3,100 SF
Roof Construction	
Framing lumber	6,300 BF
Roofing materials	2,900 SF
Insulation	2,200 CF
Soffit & fascia, aluminum	530 SF
Gutters & downspouts, aluminum	250 LF
Interior Construction	
Ceiling finish, ½" GWB	2,700 SF
Suspended ceiling finish	1,000 SF
Framing lumber (partitions)	800 BF
Wall finish, ½" GWB	2,700 SF
Plywood paneling	1,000 SF
Wood T&G flooring (original)	1,400 SF
Resilient flooring (multilayer)	1,400 SF
Mechanical / Electrical / Plumbing	
Gas fired heaters	4 EA
Chimney, brick	81 CF
Piping (est.)	160 LF
Plumbing fixtures	2 EA
Light fixtures	24 EA

The building weight can be summarized as follows (values are rounded):

Foundation & concrete	168,000 LBS @ 84.0 T	2,650 SF =	63.4 LBS/SF
Building			
Superstructure	28,000 LBS		
Exterior closure	25,000 LBS		
Interior construction	30,000 LBS		
M/E/P	7,700 LBS		
	90,700 LBS @ 45.4 T	2,650 SF =	34.2 LBS/SF

The total weight of both Buildings 2736 and 2738 were approximately 260 tons.

A concrete topping was installed at a small washroom in each building. Note also that the brick chimneys and the floor slabs at the north ends of the buildings add considerably to the overall weights of the buildings. The GWB and resilient flooring, too, were unsalvageable, are relatively heavy, and contribute to the debris stream.

AHfH determined only the portions of these buildings constructed with framed floors would be fully deconstructed. Obviously, no floor framing or finish flooring materials are present where the floor was slab-on-grade. Removing the walls from the concrete floor slab at the north portions of the buildings would not yield sufficient resalable material to justify the effort.

Buildings 2715 & 2717

Building 2715 and 2717 were two-story buildings, 30' wide and 90' long, and 5,100 Gross SF in floor area. They were originally constructed as barracks, and were most recently used for housing troops. These two buildings were virtually identical and were immediately adjacent to each other. As with Buildings 2736 and 2738, they were built to be mirror-images of each other in plan. While there were minor differences, the following discussion applies to both buildings. The basic construction is summarized as follows:

- Foundation: 4 rows of piers; slab-on-grade and cinder block walls at the boiler room.
- Floor framing: 2x8 joists spaced at 24" with 1x8 subfloor placed diagonally; 6x6 columns and built-up 2x8 beams supported the second floor. A 3" concrete topping was placed on the framed floor at the latrine.
- Exterior walls : 2x4 studs spaced at 24" (balloon framing) with ½" gypsum wall board (GWB) exterior sheathing, and 8" wood lap siding. Vinyl siding had been added, as had aluminum soffits and gutters.
- Doors & windows: hollow metal, with wood frames. Windows were aluminum framed double hung, single glazed.
- Roof: 2x8 rafters with 1x8 sheathing placed perpendicular to the rafters; 6x6 columns (3-2x6's each) and built-up 2x8 beams supported the rafters.
- Interior finishes: ½" painted GWB ceilings with suspended acoustical ceilings; painted ½" GWB interior wall finish; 3" T&G flooring (on the framed floor); VCT with particleboard underlayment had been added.
- Mechanical / Electrical / Plumbing: Three residential-scale forced air furnaces, distributing heat by ducts running down the middle of both floors; latrine with grouped toilets, lavatories, and shower; gas fired hot water heater and storage tank were located in the boiler room; 2' x 4' fluorescent light fixtures were surface mounted on the GWB ceiling.

(floor plans)
(exterior photographs)
(interior photographs)

A summary of the major materials' quantities is as follows:

Foundation / Substructure	
Concrete & block	18 CY
Reinforcing	0.6 T
Floor Construction	
Framing lumber	13,000 BF
Insulation (fiberglass batt)	3,200 CF
Exterior Wall Construction	
Framing lumber	3,200 BF
Sheathing, ½" GWB	4,000 SF
Doors	7 EA
Windows	36 EA
Siding (wood)	4,000 SF
Siding (vinyl)	4,000 SF
Roof Construction	
Framing lumber	8,600 BF
Roofing materials	3,100 SF
Insulation	3,200 CF
Soffit & fascia, aluminum	300 SF
Gutters & downspouts, aluminum	360 LF
Interior Construction	
Ceiling finish, ½" GWB	5,400 SF
Suspended ceiling finish	4,700 SF
Framing lumber (partitions)	1,300 BF
Wall finish, ½" GWB	7,000 SF
Plywood & laminate paneling	1,000 SF
Wood T&G flooring (original)	4,700 SF
Resilient flooring (multilayer)	4,700 SF
Mechanical / Electrical / Plumbing	
Gas furnaces	3 EA
Ductwork	310 LF
Chimney, brick	225 CF
Piping (est.)	350 LF
Plumbing fixtures	15 EA
Light fixtures	28 EA

The building weights can be summarized as follows (values are rounded):

Foundation & concrete	72,000 LBS @ 36.0 T	5,400 SF =	13.3 LBS/SF
Building			
Superstructure	53,000 LBS		

Exterior closure	30,000 LBS		
Interior construction	55,000 LBS		
M/E/P	23,000 LBS		
	161,000 LBS @	5,400 SF =	LBS/SF
	80.5 T		

The total weight of both Buildings 2715 and 2717 were approximately 197 tons.

Note that the concrete topping at the latrines, the brick chimneys, and the floor slabs at the boiler rooms add considerably to the overall weights of the buildings. The furnaces in these buildings had recently been replaced, although the old furnaces (and miscellaneous piping and hardware) remained in the boiler rooms at the outset of deconstruction. As with the other buildings, the GWB exterior sheathing and added VCT flooring were unsalvageable, are relatively heavy, and contribute to the debris stream.

Building 834

Building 834 was a one-story building, 60' wide, 152' long, and 9,120 Gross SF in floor area. It was originally constructed as a General Purpose Warehouse, and was located along a railroad siding. The original loading docks, however had been removed. This building was vacant several months prior to deconstruction, but was most recently used for storage.

Building 834 was a larger and fundamentally different building than the buildings on the 2700 block. This building was constructed in an open-bay configuration to accommodate the receipt, storage, and issue of a wide variety of materials and commodities. Interior flexibility (and therefore the larger dimensions and open plan) were requirements of the facility type. Construction to accommodate a worse-case loading scenario was also a requirement for flexibility of function.

The basic construction is summarized as follows:

- Foundation: 5 continuous wall foundations running in the building's long dimension.
- Floor framing: Double 2x12 joists spaced at 12" with 2x6 T&G subfloor placed perpendicular to the joists.
- Exterior walls : 2x6 studs spaced at 24" (platform framing) with ½" GWB exterior sheathing 8" wood lap siding. Vinyl siding had been added, as had aluminum soffits.
- Doors & windows: Hollow metal personnel door; built-up sliding wood exterior cargo doors & a steel roll-up interior overhead door; windows were aluminum framed double hung, single glazed replacement type windows.

- Roof: 2x8 rafters with 1x6 sheathing placed perpendicular to the rafters; 8x8 columns (4-2x8's each) and built-up 2x10 beams supported the rafters; 2x6 diagonal framing supported the columns.
- Interior finishes: ¼" fiberboard and ½" painted GWB ceilings; 6" T&G wall surfaces (mostly unpainted) and painted ½" GWB interior wall finish; 3" T&G pine flooring w/ 3" oak flooring placed as runners between material racks; one layer of VCT with particleboard underlayment had been added at the washrooms and office areas.
- Mechanical / Electrical / Plumbing: One forced air furnace; one duct running down the middle of the building; 2 washrooms contained one toilet and one lavatory each.; incandescent single bulb light fixtures were located within each bay of the warehouse area.

(floor plans)
(exterior photographs)
(interior photographs)

A summary of the major materials' quantities is as follows. As the deconstruction scope of work allowed the subsurface concrete to remain in-place, only the above-grade foundation is included in this take-off.

Foundation / Substructure	
Concrete & block	70 CY
Reinforcing	2 T
Floor Construction	
Framing lumber	55,000 BF
Exterior Wall Construction	
Framing lumber	17,000 BF
Sheathing, ½" GWB	3,900 SF
Doors	7 EA
Windows	4 EA
Siding (wood)	3,900 SF
Siding (vinyl)	3,900 SF
Roof Construction	
Framing lumber	37,000 BF
Roofing materials	9,600 SF
Soffit & fascia, aluminum	400 SF
Interior Construction	
Ceiling finish, ½" GWB	340 SF
¼" Fiberboard ceiling finish	9,600 SF
Framing lumber (partitions)	1,300 BF
Wall finish, ½" GWB	7,000 SF

Wood T&G flooring (oak, original)	3,000 SF
Wood T&G flooring (pine, original)	8,800 SF
Resilient flooring	1,000 SF
Mechanical / Electrical / Plumbing	
Gas furnace	1 EA
Ductwork	160 LF
Chimney, brick	xxx CF
Piping (est.)	260 LF
Plumbing fixtures	4 EA
Light fixtures	40 EA

The building weights can be summarized as follows (values are rounded):

Foundation & concrete	288,000 LBS @ 144 T	9,120 SF =	31.5 LBS/SF
Building			
Superstructure	53,000 LBS		
Exterior closure	43,000 LBS		
Interior construction	50,500 LBS		
M/E/P	6,200 LBS		
	152,700 LBS @ 76.4 T	9,120 SF =	16.7 LBS/SF

The foundation construction was considerably more substantial than the buildings on the 2700 block and, therefore, contributed much more to the building's weight. The chimney was also larger in both section and height, contributing more to the building's weight.

5. PROJECT NARRATIVE

The complete description of the project's chronology and progress is given in the University of Florida Center for Construction and Environment report _____. The following narrative provides a summary.

Pre-deconstruction Activities

A number of tasks had to be performed prior to the start of deconstruction. The major issues are summarized as follows.

A "deconstruction team" representing various PWBC offices identified candidate buildings. These were the buildings on the 2700 block. An "alternate list" was also developed. However, there were fewer buildings and therefore fewer options for deconstruction. Furthermore, the alternative buildings were not located in as close proximity to each other, which would complicate the deconstruction process to some extent.

Fort Campbell and ERDC / CERL personnel discussed the utilities and resources that would be made available to AHfH. These discussions took place at various meetings from December '01 through March '02. Issues included each party's responsibilities for trash and debris hauling, handling recyclables, removal of hazardous materials, availability of utilities and use of a building during deconstruction, ACM abatement, and arrangements for terminating utilities. As described above, Fort Campbell and ERDC/CERL intended to treat this project in a similar manner as a conventional demolition project. It was agreed, however, that allowing AHfH to use one of the vacant buildings, with electrical and water service, was the only resource Fort Campbell provided AHfH that they would not ordinarily provide a demolition contractor.

The deconstruction team developed a vacancy schedule. 01 April 2002 was established as the target deconstruction date. However, as discussed above, it appeared as though this schedule may slip. This situation is discussed above.

Surveys for LBP were requested on 18 January, 2002. The surveys were completed within a week-and-a-half.

McKinney Act clearance was initiated by PWBC Master Planning. In summary, vacant Federal properties must be advertised to see if any charitable or housing advocate programs wish to claim the properties. Demolition cannot proceed without this clearance. The subject buildings were advertised and cleared for demolition.

The buildings were vacated by 25 March, 2002. By that time, however, the deconstruction start date was rescheduled to 01 May, 2002. Even though the buildings were vacated before 01 April, there would not have been sufficient time

for securing the buildings, key transfer, abatement, terminating utilities, and other tasks that would have to be completed prior to deconstruction.

Environmental Division notified other agencies within Fort Campbell of the deconstruction project. These included other PWBC branches, Safety Office, Military Police, Fire Marshall, Forces Protection, and Information Technology Business Center (ITBC).

The PWBC transferred the property to the Corps of Engineers Louisville District.

ERDC / CERL requested site and utility plans from the PWBC. The PWBC would terminate utilities, and no further excavation was anticipated. However, AHfH and ERDC / CERL personnel wanted to be aware of utilities locations to prevent accidental damage during deconstruction. PWBC personnel indicated that in order to accurately locate utilities, a dig permit had to be requested. As AHfH was not going to do any digging, the necessity of a dig permit was discussed. There was more of a concern that equipment would run over a line and damage it. PWBC personnel assured AHfH that no piece of equipment they would have on site (hydraulic excavator, tracked end-loader, dump truck, etc.) would damage any underground utilities. Thus, by mutual agreement, dig permits were not pursued any further.

Environmental Division provided guidance on haul routes and local traffic policies. In addition to the designated routes from the sites to the landfill, provisions obtaining passes for AHfH's and AmeriCorps' vehicles were established. Limits to driving on Physical Training (PT) routes were also established.

In order to photograph the deconstruction activities, authority had to be requested from the Director of Public Works. ERDC / CERL provided the required information (name and drivers license number) to PWBC. A single letter was issued identifying all authorized photographers, and copies were carried by each photographer throughout the project.

AHfH developed a deconstruction schedule and submitted it, through ERDC / CERL, to Environmental Division. The schedule indicated the sequence in which AHfH would deconstruct the buildings, and the approximate date deconstruction of each building would begin. This had to be completed prior to abating ACM and disconnecting utilities. Ordinarily, PWBC would disconnect the entire block at once. However, terminating utilities on an as-needed basis was also acceptable to the PWBC. Furthermore, water and electrical power was required to perform the ACM abatement. PWBC requested ten days advanced notice prior to terminating utilities.

The buildings had previously been surveyed for ACM. Environmental Division submitted work orders for ACM abatement on 01 April '02. Three buildings were

abated and cleared for deconstruction prior to 01 May. The remaining buildings were abated and cleared prior to AHfH's scheduled deconstruction dates. It took roughly four weeks to clear all six buildings, each building requiring two to four days. Note that water and electric power is required for the abatement, so utilities cannot be terminated before the abatement is completed.

AHfH requested that Fort Campbell certify or otherwise verify that ACM had been abated from the buildings prior to allowing AHfH or AmeriCorps personnel to begin deconstruction. Fort Campbell could not guarantee, per se, that the buildings were ACM free, as there is always the possibility that undetected ACM may still be present. Environmental Division did provide AHfH with the completed work orders and air sampling data, which were sufficient to verify the buildings had, indeed, been abated. Provisions regarding the discovery and handling of undetected ACM were included in the deconstruction Statement of Work.

AHfH submitted to Environmental Division a roster of the AHfH and AmeriCorps personnel that would comprise the deconstruction workforce. Environmental Division then forwarded the roster to Forces Protection. At the time, post 9/11 security and access measures were still being developed. The roster was developed as a precaution, in the event that it became necessary to verify an individual's presence on Fort Campbell property was appropriate. Environmental Division requested seven days notice prior to any personnel appearing on-site.

AHfH personnel arrived on 24 April '02 to prepare Building 2746 as a tool storage and site office, inventory hazardous materials in the buildings to be deconstructed, make arrangements with local equipment rental services,

Requirements for identification AHfH and AmeriCorps personnel identification were also uncertain immediately prior to the start of deconstruction . The Statement of Work required each individual be issued a photo identification badge with the HfH logo and name. However, as AmeriCorps is a federal agency, and each AmeriCorps worker already had their own badge, this became a non-issue.

On 26 April 02, AHfH and ERDC / CERL personnel performed an inventory hazardous materials in the buildings to be deconstructed. Fluorescent tubes, PCB-containing ballasts, and Hg-containing thermostats and switches were identified. The inventory was then submitted to the Environmental Division, and Environmental Division provided the appropriate containers for disposal. On 27 & 28 April, AHfH and ERDC / CERL personnel removed all fluorescent tubes, ballasts, and mercury (Hg)-containing thermostats and switches. Environmental Division removed the full containers within a day of being notified.

There was some confusion between Environmental Division personnel and AHfH and ERDC / CERL personnel concerning the disposal of ballasts from

fluorescent light fixtures. Initially, AHfH and ERDC / CERL understood Environmental Division to require disposal of only the ballasts containing PCBs. Relatively few of these types of ballasts were identified. AHfH intended to salvage the fluorescent fixtures that had PCB-free ballasts, which appeared to be relatively new. However, Environmental Division personnel indicated that it was standard demolition practice at Fort Campbell to remove *all* ballasts for disposal by Environmental Division. AHfH and ERDC / CERL understood this to be a directive, and commenced to remove all ballasts and place them in the containers provided by Environmental Division. Unfortunately, it was later determined that the newer fluorescent fixtures (with PCB-free ballasts) *could* have been salvaged for re-use. Ballasts had to be removed only if they were to be disposed of in the landfill.

PWBC, Environmental Division, the Contracting Officer's Representative, the Safety Office, AHfH, and ERDC / CERL personnel conducted the pre-deconstruction meeting on 30 April, 02. The deconstruction plan was reviewed, a safety management program was described and discussed, and logistics issues were reviewed. No problems or issues of concern were identified.

Immediately following abatement of each building, PWBC and ITBC salvaged some items. One relatively new furnace and two or three relative new ceiling hung heaters were the only items of consequence that AHfH and ERDC / CERL researchers noticed were removed from the 2700-block buildings. The Fire Marshall retrieved the fire detection and alarm equipment from Building 834.

PWBC captured the freon from the air conditioning equipment at Building 2748 on 01 May '02.

AmeriCorps personnel arrived at their lodgings on 01 May '02.

AHfH and University of Florida personnel began safety and deconstruction training on 02 May. On 03 May, training concluded and the AmeriCorps crews began some preliminary deconstruction activities. The safety program developed by UF-CCE for AHfH is included as Appendix C.

General Deconstruction Sequence

The materials and construction of all buildings was virtually the same. Therefore, the deconstruction process was very similar building to building. A general description of all buildings is given in this section. Descriptions of each buildings' deconstruction individually provides additional information specific to that building's site, condition, or activities.

Prior to beginning deconstruction, the area around each building was cordoned-off to establish a site perimeter for the building and exterior work areas. The intention is to prevent bystanders from inadvertently entering the site. Yellow

safety tape and “danger, hard hat area” signs were satisfactory to Fort Campbell personnel. All personnel within the cordoned-off area were required to wear hardhats and eye protection. All deconstruction personnel were also required to wear long pants, gloves, and steel-toe boots. Long-sleeve shirts were encouraged. Prior to beginning deconstruction on the first building, two days were spent on safety training and recognition of hazardous materials. Each AmeriCorps crew arriving after the start of deconstruction also received safety and deconstruction training.

(photo of ribbon / sign)
(photo of safety training)

Each day’s activities began with a briefing, which include the tasks to be accomplished that day, and remarks about safety and other relevant issues. Tools were then retrieved out of locked storage. Each member of the crew was responsible for their own Personal Protective Equipment (PPE) and hand tools, and all members participated in retrieving and setting up equipment such as compressors, the denailing equipment, and other items used at the jobsite. Each day’s activities ended with final site clean-up, policing the area, collecting tools and equipment, and securing them back in the locked storage. A final brief discussion of the day’s activities was always conducted prior to the crews being dismissed for the day.

Deconstruction of each building was performed in generally the reverse sequence of construction, and progressed from the inside out, and from top down. Most of the work was accomplished by prying nailed members apart with hand tools. Flat bars worked the best for penetrating tight joints without excessive splitting or scarring of wood members. Wrecking bars were also popular. Gorilla bars provided greater leverage for prying. Roofing shovels were used to remove shingles, and also as a tool to perforate GWB so it could be removed in sheets. Common garden rakes were then used to pull sheets of GWB off of ceilings and walls. An electrical reciprocating saw (a “sawsall”) was used to cut members where necessary. In addition to pry bars, claw hammers, and cat’s claw bars, a pneumatic Nail Kicker ® by Reconnex was used to remove nails from wood members.

(photo of prying)
(photo of nail kicker)

The first step to the deconstruction activities was to set up a denailing station. Removing nails, cutting ends, measuring, and stacking materials to be taken to the warehouse (Building 834) was a continuous process throughout each building’s deconstruction.

Windows and doors were the first items removed from the building to provide ventilation for crews working inside. Also, being able to pass materials out of

window openings expedites the materials handling process. The windows were aluminum replacement windows. Rather than being nailed to the rough opening framing from the inside of the opening, they were nailed onto the outside of the opening frame. Therefore, pulling the nails out from the outside of the building and removing the windows was a fairly simple task. Aluminum trim had been wrapped around blocking and nailed around the window as exterior window trim. The aluminum had to be peeled off first, then the blocking pried off, before the window could be removed. Windows were stacked at the site and then hauled to Building 834 once all windows were removed. Doors were removed from their hinges and stacked at the site. No attempt was made to retrieve the frames. AHfH has found there is a better business at the ReStore in doors alone, than trying to handle complete door-in-frame units. Most windows and doors were salvaged for reuse, although some doors were damaged to the extent that they were of no further value, and were discarded.

Prior to removing exterior materials, a polyethylene sheet was laid around the buildings' perimeters as to protect against LBP residue dropping directly onto the ground and contaminating the soil. The sheet was then rolled up, collecting whatever LBP flaked had fallen from the siding.

The exterior vinyl siding was removed, most of which was salvaged for reuse. The vinyl siding was removed in the reverse order of it's installation, that is from the top down. It was easily pulled off of the one-inch roofing nails with which it was fastened to the original wood siding, or pulled the nails out with the siding panels. Where siding panel would not either pull off of the nail, or would not pul the nail out of the siding, the nail was easily removed with a pry bar or claw hammer. Full, 12 ft. long length pieces were salvaged, but the short pieces and trimmed pieces were discarded.

Aluminum gutters, soffit, and downspouts were removed and set aside for recycling. Seamless gutters were pried off of the fascia at one end and pulled off of the eaves for the remainder of their lengths. While they could have been removed in one length, they were more often cut for handling convenience. Fascia and soffit trim was peeled off of the eaves with pry bars and claw hammers.

(photo of window removal)

All interior construction was then removed from the buildings. Interior trim, wall surfaces, ceiling surfaces, finish flooring, plumbing fixtures, and mechanical equipment, were all removed. Most plumbing and electrical equipment was in poor condition or functionally obsolete, and therefore was discarded. The four-tube fluorescent light fixtures were removed and recycled as scrap steel, as the ballasts had already been removed. Heating units were salvaged for reuse. The heaters were either small ceiling hung units, or residential capacity furnaces, and could be handled by one person. Cooling equipment was purged of its

refrigerant and recycled. Most ductwork was surface mounted and was removed by pulling it down from the ceilings. Ducts sections were then separated by uncrimping the seams with pliers for easier handling. Surface mounted piping was removed by pulling it from walls and ceilings, then cutting with the sawzall. Concealed piping was removed as the framing was being disassembled. Metals were recycled if they had no LBP or asbestos contamination.

Most interior surface materials (such as GWB and the added layers of resilient flooring and underlayment) were stripped and discarded. Most of the 1x3 and 1x4 trim was removed. This was appearance grade trim lumber with few defects. While it was painted, it was not identified in the LBP surveys as being lead-based paint. The window trim was removed as a “box” from the window opening, all four sides remaining in tact. The 8 individual pieces were then separated by knocking them outward from the frame.

Virtually all of the original fir T&G flooring was salvaged for reuse. The flooring was removed from the floor platform, sometimes from the interior, and sometimes after the exterior walls were removed. Tongue and groove materials must be removed in the reverse direction, or sequence, in which they were installed. Once the correct starting point and direction of progress was determined, prying the strips individually progressed quickly. The T&G flooring was fastened with cut (flat) nails, and the nails were removed without much difficulty or damage. One AmeriCorps worker became quite proficient at removing flooring and considered this task to be her specialty. Virtually all of the strip flooring was recovered.

(photo of window trim removal)
(photo of interior GWB removal)
(photo of floor removal)

Ceilings were insulated with fiberglass batt. At first, attempts were made to salvage the insulation. However, its bulk made it extremely difficult to handle and store. Furthermore, much of it was extremely dirty, and some of it was water-stained and, therefore, was of questionable value. Most of the fiberglass insulation was discarded.

(photo of insulation pile)

The roof system was removed next. Galvanized sheet metal vents were removed and set aside for recycling. Shingles were stripped off of the sheathing with roofing shovels and discarded. Typically, 6-8 workers would anchor their fall protection harnesses near the ridge of the roof and work their way downwards toward the ridge in a row. Fortunately, only one layer of roofing was in-place on the buildings. Where a dumpster could be located immediately adjacent to the building, the shingle debris could be pushed directly into the dumpster. Otherwise, the shingles fell to the ground and had to be picked up by hand and

deposited in the dumpster. While there is a limited market for recycled shingles in some regions of the U.S., none was found in the Fort Campbell area.

(photo of shingle stripping)

The roof sheathing was then removed. AHfH's original intent was to knock the 1x6 sheathing boards upwards off of the rafters (it was not T&G) from the bottom (i.e. in the attic), then pry it off from the top. Most of this material, however, had become so brittle in the heat that it was extremely difficult to remove without splitting. Therefore, much of the roof sheathing was discarded. After the sheathing was removed, blocking, electrical conductor, and other miscellaneous items were removed from the roof framing members. Roof framing was then removed. Whether the building was constructed using platform or balloon framing technique effected how the roof framing could be removed. After some experimentation, AHfH determined the tails could be cut off the trusses from the interior, and the trusses lowered into the building with ropes. The trusses were then carried out of the building by hand. Rafters were detached at the ridge, intermediate supports, and top of the wall by prying. They were then removed individually and handed down to the ground. Most of the roof framing lumber was salvaged for reuse. There was virtually no deterioration evident in the roof systems.

(photo of sheathing removal)
(photo of truss removal)
(photo of rafter removal)

Once the roof system was removed, the walls were braced, as the roof structure no longer supported them laterally. The original wood siding was removed and discarded. The paint (presumed to be LBP) had deteriorated and become detached from much of the siding. It was concluded between AHfH and the Environmental Division personnel that the siding should not be offered for resale or reuse. The wall was cut vertically into sections 8 – 10 ft wide and dropped, framing and GWB sheathing together, outwards to the ground. The framing materials were then disassembled. As the sheathing was GWB, disassembling the wall frame consisted mostly of knocking the plates and nailers off of the ends of the studs, and knocking apart the window and door opening frames with claw hammers. The GWB sheathing was discarded. How much of the wall framing was salvaged for reuse varied, depended on the building, which is discussed below. Typically, the walls around the boiler room were left in tact, as the floor was concrete slab and there was no floor framing to recover. This space, then, served as a bin for debris

(photo of wall panel)

Once walls were removed, the floor deck was removed. If weather permitted, the original fir T&G flooring was left in-place until the walls were removed. Once the flooring was removed, the 1x8 subfloor was pried from the floor joists. Unlike the

roof sheathing, the subfloor was not subjected to extreme heat, so most of the subfloor was salvageable for reuse. Band joists were knocked off of the floor joists' ends, bridging was knocked out from between the joists, and the joists were removed by prying them off the beams with pry bars. Where joist ends were nailed, typically over a beam, they were pried apart with pry bars. Once the joists were removed, beams were removed. Most beams were nailed horizontally through metal straps embedded in the concrete piers. These straps and nails were pried away from the beams. The beams were built-up members, and the individual 2x10's or 2x12's were pried apart in place and removed. Prying them apart while still mounted on the piers proved much more convenient than trying to hold them on their edges on the ground while prying. Virtually all the floor framing materials were salvaged for reuse. There was relatively little deterioration evident in the floor framing. Roof leakage was evident in only one location of one building. Some other deterioration was found under latrines where plumbing leakage occurred.

(photo of flooring removal)
(photo of subfloor removed)
(photo of floor framing)

A commercial demolition firm completed the buildings' removal. Any remaining sections of wall (see discussions of each building's deconstruction, below) were knocked down with a hydraulic excavator, crushed, and loaded into a dump truck. Concrete piers were pushed over by the excavator, picked up, and loaded into the dump truck. Footings were only located about one foot below grade, and they offered little resistance to tipping. Concrete stairs and floor slabs were broken with the excavator, and the rubble was loaded into a dump truck. Building debris was taken to the Woodlawn Landfill at Fort Campbell. The concrete, however, was set aside at a different location on the landfill property. The Fort Campbell P2 Branch and the Corps Louisville District were in the process of contracting for concrete recycling services. The concrete rubble from the buildings will be crushed and recycled on-post.

Once all material was removed from the buildings' footprints, the sites were graded, seeded, and mulched in a similar fashion to a conventional demolition project ,

(photo of clean site)

Lumber materials recovered from the buildings were processed at the building sites throughout the deconstruction process. A processing location was chosen to be the most convenient to the building, or buildings in close proximity of each other. Individual wood members (trim pieces, sheets of plywood, framing members, and other similar) were carried to the denailing station. Processing consisted of first removing nails with pry bars, claw hammers, cats paw bars, or pneumatic Nailkicker ® denailing guns. AHfH purchased three Nail Kickers ®,

although more than three workers were generally assigned to this task. In addition to removing nails, damaged or non-square ends were cut off. Lumber was sorted, measured, and stacked for transport. Materials were taken to Building 834 for inventory and storage.

(photo of lumber in 834)
(photo of windows in 834)

Building 2748.

Building 2748 was the first to be deconstructed. One AmeriCorps crew was present on-site, and upon their safety and hazardous materials training, they began their first-hand deconstruction experience. While many individuals were somewhat familiar with building and tools, none had any significant construction (or deconstruction) experience.

Deconstruction of Building 2748 followed the general sequence described above. The workforce consisted of 10 AmeriCorps, 2 AHfH, and 1 UF-CCE personnel. Deconstruction began with removing windows and doors, interior trim, interior surface materials (primarily GWB with plywood wainscot paneling) and exterior vinyl siding, essentially as simultaneous activities. Most of this work was completed within five working days. However, removing the layers of flooring that had been added over the building's life slowed progress considerably. Two, and in some places three, layers of resilient flooring and underlayment were in place over the original T&G flooring. To complicate matters, the underlayment was not conventional ¼" underlayment sheet, but ¾" plywood and oriented strand board. Furthermore, this material had been nailed with 16-penny nails and glued to the layers below. An abnormal number of labor hours was invested in this activity.

Unexpected conditions were discovered once the ceiling surface and insulation were removed. The south half of the roof was framed with contemporary factory-fabricated roof trusses, as opposed to the field-fabricated trusses typically found on Army installations. While not necessarily new, the smaller dimensions of the members and presence of galvanized truss plates indicated that repair work hand been done at some time. Furthermore, the roof was sheathed with plywood instead of 1x6 or 1x8 board. The newer roof construction was in place over a more than half of the length of the building; over the south half. The original trusses were in place over the north half of the roof. However, they were charred and smoke damaged. This indicated a fire had damaged the building some time in the not too distant past, and half of the roof was replaced. The half that was not replaced was not suitable for salvage. Even if the structural integrity of the trusses was not compromised, the charring and smoke damage rendered them unsuitable for reuse.

As described above, roughly one third of the floor at the north end of the building was constructed as a concrete slab, or had a concrete topping placed over the wood subfloor and joist framing. Attempts were made to break apart this topping with sledgehammers. It was anticipated that once fractured, the topping could be removed fairly easily. However, the welded wire fabric reinforcing prevented the topping from fracturing to any great extent. Removing the concrete topping was going to be much more difficult than anticipated. AHfH personnel determined that the presence of the concrete topping, combined with the fire damage inflicted on the north half of the roof structure, made it unfeasible to deconstruct the north half of Building 2748. The relatively small amount of recoverable framing material did not justify the labor investment. Further deconstruction efforts were then confined to the south half of that building.

Removal of the roofing began as the interior deconstrution work was progressing. Roofing removal began on the third day, and removal of the roof system (the south half of the roof), was completed five working days later. The ¾" plywood roof sheathing was removed in whole- and half-sheets, as it had been installed. Virtually all the plywood roof sheathing was recovered for reuse. The roof trusses were pried up from the top of the wall and passed down to the ground by hand. All of the shop-fabricated trusses were recovered for reuse.

(photo of trusses on trailer)

Deconstruction of the exterior walls began on the ninth day, and with the exception of one short section of wall, was completed that day. Most of the 2x6 studs were recovered for reuse. Short framing pieces (cripples, headers, sills, fire stops, and miscellaneous blocking) were discarded. Because of the condition of the paint, the 8" exterior wood siding was discarded.

The floor system, 1x8 subfloor and 2x10 joists, was disassembled within three working days. An additional AmeriCorps crew had arrived on-site and contributed to the floor's deconstruction after their safety and hazardous materials training. Virtually all of the primary floor framing (beams, joists, and band joists) was recovered for reuse. Bridging and other miscellaneous

The north half of the building and the concrete piers at the south half of the building remained, and were demolished later. The standing portion of the building was pushed over with a tracked end loader. The tractor then ran over the pile several times to crush the debris. The concrete piers t the north half of the building were knocked over with the end loader, scoped up with the bucket, and deposited them in the dump truck. This demolition took less than two hours. The concrete rubble was separated out at the landfill for future recycling.

Buildings 2738 & 2736.

As noted previously, these two buildings were of identical construction, mirror image in plan, located side by side, and were used for similar purposes when they were vacated. They were deconstructed simultaneously by an average crew size of 24 AmeriCorps volunteers, with the three AHfH and UC-CCE supervisors. As would be expected some differences in team skills, deconstruction technique and team dynamic resulted in somewhat differing approach and pace of work.

Each building had a portion that was erected over an elevated concrete slab and another portion supported by concrete piers; only the elevated portion was completely deconstructed. After the roofing over the slab portion was deconstructed, the walls of that portion were simply demolished because little was salvageable.

The deconstruction of the remainder of the buildings followed the general sequence previously described, beginning with the interior. Salvageable materials such as wood trim, plywood wall paneling, mechanical, electrical, and plumbing components, and undamaged acoustic ceiling tiles came out first. The metal grid for the ceiling was cut into sections using tin snips and wire cutters. Non-salvageable interior materials such as GWB ceiling and wall finishes, insulation, and damaged ceiling tiles were demolished using rakes, shovels, and wheelbarrows. A time saving technique is to have wheelbarrows on hand while workers are pulling the drywall off the walls. If large intact sections can be pulled directly into the wheelbarrows and then wheeled out to the dumpster, time does not need to be spent picking so much debris up off the floor. Non-load bearing walls were demolished and removed by the second day. In building 2736 a metal cage was partially removed and partially thrown away. No extraordinary conditions were found in either building to slow interior deconstruction progress.

Demolition of asphalt shingles from the roof and removal of exterior vinyl siding began on the 2nd day. The roofing was removed from building 2738 with the intent of salvaging the 1x6 roof sheathing. However, the sheathing boards were found to be so brittle that it was extremely difficult to remove intact without splitting. The roof sheathing was removed as debris for the remainder of the buildings. Exterior windows were removed. By the 4th day the removal of roof shingles was complete and structural deconstruction of the roof began.

(photo of sheathing boards' removal)

On Building 2738 was the first building where balloon framing was encountered. The roof trusses were not bearing directly on the walls' top plates, rather were nailed horizontally into the tops of the studs. A horizontal 2x4 nailer also ran the lengths of the walls, both tying the tops of the wall studs together and creating a bearing surface for the trusses. This detail made it difficult to detach the trusses. Furthermore, the original site-fabricated trusses were made of 2x8 members,

doubled in many locations, and were much heavier and difficult to handle than the factory fabricated trusses found in building 2748.

(photo of wall/truss connection)

An experiment was conducted on taking apart the trusses. The trusses were cut in-place with a sawzall, and the individual pieces removed from the roof. The individual pieces were de-nailed for dimensional lumber. It was discovered that this process was very time consuming, and the yield was minimal because of the way the trusses were built. Of the 50 trusses in each building, 15 were cut in this manner.

(photo of truss pieces)

Subsequently, a way was found to remove each truss intact. Each end of the truss was tied up with a rope and was cut from the top of the wall stud, vertically, at the inside edge of the stud. The trusses were then be lowered with the ropes into the building's interior and carried by hand though the door, to a staging area outside the building. The remaining 35 trusses from Building 2738 and all 50 trusses from building 2736 were removed in this manner.

(photo of truss on the floor)
(photo of trusses stacked outside)

The roof structures in Buildings 2738 & 2736 were found to be in excellent condition and were completely recovered, with the exception of the sheathing. There was no damage or deterioration.

The walls were removed by cutting sections vertically and laying the sections onto the floor. The framed portions of the floors in Buildings 2738 & 2736 were constructed at a higher elevation above grade, and therefore it was more convenient to lay the wall sections inward than outward. Most of the 2x6 wall studs were recovered. The GWB sheathing and 8" wood siding were discarded.

By the eighth day the buildings were down to the floor structure. The finish floor, floor sheathing, and floor framing materials were deconstructed using the same general sequence described above. Virtually all of the T&G flooring, sheathing, and flooring lumber were recovered.

After the final cleanup, all that remained were the concrete piers, slab-on-grade, the boiler room slab and walls, precast concrete stairs, and chimney. The boiler room served as a receptacle for debris, which was hauled as the remaining building elements were demolished removed mechanically. The concrete foundation piers were knocked over with a hydraulic excavator. The slabs-on-grade were broken using the excavator. The pieces were then picked up with the

excavator and loaded into the dump truck. The brick chimney was knocked down with the excavator and scooped up as debris.

(photo of 2736 to be demolished)*

Building 2717.

Building 2717 is a two story barracks building which is described in detail above. The AmeriCorps crew averaged 29 people daily, although as many as 45 worked on the building one day. Building 2717 was deconstructed entirely by hand except for the concrete foundation piers, the boiler room floor slab and walls, chimney, and several exterior pre-cast concrete stairs. These were subsequently mechanically demolished and removed from the site.

Work began in the interior with simultaneous exterior work removing doors, windows and vinyl siding, per the general sequence described above.
Most of the plumbing fixtures in the barracks' latrine had been damaged (possibly by Fort Campbell PWBC personnel) while disconnecting the water supply. Therefore, very little in the way of plumbing fixtures could be salvaged. However, four new gas furnaces had recently been installed. PWBC reclaimed one of the furnaces, but left the remaining three. A 60-gallon water heater was also installed in the recent past, although AHfH decided it was too old to resell, as it was probably beginning to fill with mineral deposits.

Acoustic ceiling tiles were removed by hand and the metal grid was cut to lengths with tin snips and wire cutters. Gypsum wall board was removed using rakes and shovels. Unlike the other buildings, AHfH elected to remove the T&G finish floor prior to deconstructing the roof and exterior walls.

Removing some of the latrine partitions was more difficult and time consuming than the typical partitions. At one time, the original interior finishes were replaced with a laminate finish. This laminate, however, was glued to ¾-inch plywood, which offered considerably more resistance than ½-inch GWB.

Austin HfH rented a Genie ® lift to work at the buildings' second-story. The lift proved invaluable for removing windows, vinyl siding, the aluminum gutters and soffit and fascia trim. The lift was also used to piece-mark the individual siding boards for further research, which is described in Chapter 7.

(photo of Genie lift)*

The roofing and sheathing were removed as debris. One dumpster was placed immediately adjacent to the building, so some of the debris was dropped directly into the dumpster. Otherwise, the debris was dropped to the ground, where it had to be picked up by hand for disposal.

Unlike the one-story buildings, the barracks roofs are framed with 2x8 rafters and 2x6 ceiling joists. Rafters were supported mid-span by built-up 2x8 beams, which in turn were supported by 6x6 solid wood columns. There was also substantial 1x6 lateral X-bracing in both lateral and longitudinal directions, as well as horizontally between the framing bays. Rafters were removed individually. Each rafter was pried from the ridge, mid-span beam, and eave, then passed by hand to the exterior of the building and lowered to the ground. The ceiling joists and cross bracing members were detached in a similar manner and passed to the ground.

(photo of 2717 roof framing)*

During the roof's removal, it was noticed that a load bearing partition on the second floor had been removed. This modification was also seen in other barracks buildings in order to convert the two former non-commissioned officers' rooms to one large space. ERDC/CERL and UF-CEE personnel shored this area with wood framing to enable AmeriCorps personnel to stand on the ceiling joists and disassemble the roof structure.

One AmeriCorps member was observed wearing his fall protection harness by the ERDC/CERL researcher, but the tether not anchored. He explained that he was a rock climber, and was comfortable working at heights. When instructed to either tie-up or leave the jobsite, he elected to tie-up. No similar incidents were observed while second-story work was taking place.

The second-floor exterior walls were disassembled. The balloon framing technique utilized wall studs that ran continuously from the first floor deck to the second floor eaves, a length of approximately 20 ft. However, it would have been impractical to remove the wall intact, given that it was also supporting the second floor structure. The walls were cut in sections, as described in the general deconstruction sequence, and also cut horizontally. Each second floor wall section was lowered onto the second floor deck and disassembled. Unlike the other buildings, the original 8" wood siding was recovered from Building 2717. However, as there was no other shear resistance in the wall's construction (the sheathing was GWB, not diagonal boards), the siding was removed only as the wall sections were removed. The 8x8 columns were also continuous from the tops of the foundation piers to the beams in the attic, a length of approximately 24 ft. Because of handling considerations, these too were cut at the second floor and passed or carried to the ground by hand.

(photo of second floor wall deconstruction)*

The second floor deck was removed by first removing the 1x6 floor sheathing. The floor joists were then pried off of the beams and nailers in the first floor walls, passed down, and carried out by hand. Deconstruction of the first floor walls,

columns and floor was accomplished in the same fashion as the second floor. It was noted that deconstruction of the second floor progressed at practically the same rate as measured for previous ground floors.

A 3-inch concrete topping was placed at the latrine floor. An attempt was made to remove the topping and recover the floor framing below. However, the concrete was extremely tough and required three days to remove with an electric jackhammer and three “driven” AmeriCorps personnel. To make things worse, much of the frame below the latrines was found to be deteriorated. While the concrete itself did not leak, leakage occurred around the drains to each plumbing fixture.

When deconstruction was completed, only the boiler room floor slab and walls, chimney, concrete foundation piers, and precast stairs remained. A troop unit picked up the piers to use in their own demolition exercises. The remainder of the standing structure was mechanically demolished.

About 20 windows recovered from Building 2717 were stolen from the jobsite, apparently over night. This was the only incidence of theft experienced during the project.

Building 834.

Building 834 was a single story wood frame warehouse and was the largest building to be deconstructed under this study. Because its only purpose was to store materiel, there were few windows, doors, interior partitions, or interior finishes. The floor framing was designed for much heavier loads than the other buildings in this project. The roof framing system, because of the building’s dimensions, was more complicated. There was virtually no painted lumber in this building.

Interior deconstruction had begun earlier in the project to make a suitable area for processing and storing materials recovered from the other buildings. 2-1/4-inch oak finish flooring was installed, presumably as part of the original design, as a more durable surface for carts running between aisles of materials. This was removed before other materials were brought to Building 834.

Once deconstruction work began on Building 834, it did so as it had for the other buildings using the same methods and tools. There was very little in the way of mechanical or plumbing equipment in the building, and none of it was worth salvaging. One duct ran down the length of the building and was removed in sections. The warehouse had been sprinkled, and the sprinkler system was removed. The piping was mostly by cut apart with a sawzall. PWBC did not want to recover any of the sprinkler heads, valves, or pumps, so all of the sprinkler hardware was recycled as scrap. The Fort Campbell Fire Marshall did, however, retrieve the electronic fire detection and alarm communication

hardware. Industrial style “mariner” light fixtures were removed for resale. Vinyl siding was removed for reuse. Roofing was stripped as debris. The roofing fell to the ground and had to be picked up by hand. The shingles had been removed by the end of the 5th day.

(photo of sprinkler pump)
(photo of pipe scrap)

Unlike the other buildings, Building 834’s interior wall surface was sheathed with 1x6 T&G boards, which were very attractive to AHfH. This was removed in the reverse order of its installation, from the top down. Care had to be taken to not split the tongues or grooves, but this was accomplished without any particular difficulty.

(photo of T&G wall finish)

The roof sheathing was removed as debris, as it had for all buildings other than Building 2748. Unlike the other buildings, however, there was no ceiling joist or truss member on which to stand and pry boards from within the building. Therefore, the crews remained on the top surface of the roof to remove the sheathing.

One feature complicated the rafters’ removal. A fiberboard surface had been attached to the bottoms of the rafters and other roof framing members. Whether this was part of the original construction or was added later is unknown. As this material was not worth salvaging, kicking it down from the rafters while removing the sheathing seemed like the easiest removal method. However, other personnel were working with the salvaged materials below. Therefore, dropping materials could only occur once personnel were cleared below, or had to wait until the personnel could be cleared. This slowed down both the fiberboard’s removal as well as the material processing activities.

Once cleared of the fiberboard surface, the 2x8 rafters were removed individually by detaching them from the ridge, midspan supports, and exterior walls. Each connection was pried apart with little difficulty. Each rafter was passed to the ground and carried away by hand. Much of the primary roof structure consisted of built-up 2x8 framing, and many of the connections were bolted, as opposed to nailed. Fortunately, the nuts could be unscrewed from the bolts and the connections disassembled without cutting. The roof structure provided ample place to stand while detaching connections. All personnel working in the roof structure wore fall protection equipment.

(photo of rafter removal)
(photo of beam removal)
(photo of bolts and plates)

The heavier framing members were more cumbersome to handle. However, a more significant obstacle to the roof system's deconstruction was the competition for space with the personnel and materials inside the building. Moving materials away from work overhead and waiting for areas to be cleared slowed this work considerably. Then, materials were removed from the building and stacked on the ground or loaded into truck trailers for transport to Austin. There was a considerable amount of multiple handling during this stage of the work.

By the 18th day the roof structure had been disassembled and removed. After all exterior and interior wall siding had been removed the remaining walls were simply knocked over and the faming disassembled. All that was left were the ground floor and columns.

The subfloor proved difficult to remove, especially as originally intended. The subfloor was 2x6 T&G boards, as opposed to the 1x6 straight boards found in the other buildings. Furthermore, the subfloor was attached with 20-penny nails. The thickness of the subfloor material, coupled with the large nails, made it difficult and slow to pry without breaking.

The floor joists were double 2x12's spaced at 12 inches. Not only were there more framing members, they were twice as heavy. This did not create any extraordinary deconstruction problem, other than progressing at a slower rate than the other buildings' floor framing. Once the doubled joists were removed, the columns were detached at their bolted base connections and lowered to the ground.

(photo of floor framing)
(photo of column base)

After the floor structure was removed, only the foundation walls, boiler room floor slab and walls, chimney, and miscellaneous debris remained. The foundation walls were knocked down to 6" below grade with a hydraulic excavator, and the remaining structure was demolished. Concrete was separated at the landfill for recycling, and the remainder of the debris was deposited in the landfill.

As the foundation was being removed, a water leak developed between Buildings 834 and 836. As a dig permit had not been pursued, the water line was never located. Whether the leak occurred because of the track hoe running over it, the vibration from knocking down the foundation, or several factors combined, or completely by coincidence is unknown. PWBC repaired it the next day. However, were the exact location of that water line defined, precautions could have been taken to not run over it.

After the AmeriCorps crews departed, the 2 AHfH supervisors spent 3 days loading materials for shipment back to Austin and cleaning the site.

(photo of Mike & lumber in truck)

It must be noted that there was a significant amount of apparently recoverable materials left for demolition at the Building 834 site. It was evident that the pressure of time and the pending departure of the AmeriCorps crews drove AHfH to capitalizing on the more easily removed, higher value materials, and abandoning others.

(photo of boiler room wall framing)
(photo of fallen wall section)

EPA Site Visit.

On June 6, representatives from the U.S. Environmental Protection Agency visited the site. Ms. Thea McManus, Associate Division Director of the Municipal and Industrial Solid Waste Division, and Mr. Ken Sandler, Office of Solid Waste, visited the deconstruction project.

Ms. McManus presented Colonel Thomas Bailey, Director of Public Works, with a letter from Ms. Marianne L. Horinko, EPA Assistant Administrator, to Major General Richard A. Cody, Fort Campbell Commanding General. In her letter, Ms Horinko commended Fort Campbell on taking the initiative to establish the partnerships with other Army offices, academia, and Habitat for Humanity, and to undertake this deconstruction project. A copy of this letter is shown, following.

(.pdf of letter)

Ms. McManus and Mr. Sandler toured the site, and saw the in-progress deconstruction of Building 2717. Unfortunately, June 6th was one of the only days it rained during the project. Ms. McManus also requested to operate a Nail Kicker ®, which she did in the Warehouse.

(photo of letter presentation)
(photo of group in 2717)
(photo of Thea w/ nail kicker)

Service Learning Field Trip.

Part of AfHfH's Agreement with NCCC/AmeriCorps requires that AmeriCorps personnel be given Service Learning opportunities relevant to the type of service the personnel are performing. The P2 Branch arranged a field trip for the AmeriCorps crews to tour the Fort Campbell Recycling Center, the C&D landfill, and the Pollution Prevention Operations Center.

Project Cookout.

The AmeriCorps crews made an extremely favorable impression on Fort Campbell personnel. As a favor, personnel from P2 Branch and Directorate of Contracting personnel frequently visited the site and ensured there was sufficient water and ice on-site. Prior to the first crew's departure, the Director and Deputy Director of Public Works, and P2 Branch Chief, at their own expense, hosted a lunchtime cookout. Each AmeriCorps member was given a Certificate of Appreciation from The Director of Public Works. A good time was had by all.

(photo of crew after cookout)

6. PROJECT RESULTS

Project Evaluation.

The parameters of cost, time (or schedule), quality, and safety are commonly used to evaluate a construction project's results. These parameters can be applied to the Deconstruction Pilot Project as well.

Successful Cost performance in a conventional construction scenario is typically "within budget." While there was a budget for the Deconstruction Pilot Project, the more valid cost metric would be the cost for conventional demolition services at Fort Campbell. However, the deconstruction cost also incorporates the impacts on landfill life cycle cost.

Successful Time or Schedule performance in a conventional construction scenario is typically "on time," or completion within the established date or duration. In this case, there was no pressure on the buildings' sites, and therefore was no established milestone or deadline to complete deconstruction. The pilot project was completed "on time" by definition. However, for information and to assist in planning, activities' durations and productivity were recorded, and can be compared to conventional demolition.

Successful Quality performance in a conventional construction scenario is typically "meets the specs," or more accurately, in conformance with the contract requirements. In the case of building removal, the metric for quality is the end result – an empty and clean site. In a deconstruction context, the amount of debris diverted from the landfill is a critical factor, as is materials' yield from deconstruction.

Successful Safety performance in a conventional construction scenario is typically "no-injuries" or "no lost work hours." This applies equally well to the Pilot Deconstruction Project.

Cost.

Fort Campbell typically assigns demolition tasks to a Contractor who is under an indefinite delivery-type contract. Competitive acquisition had already been performed, and the Contractor is essentially "on-call" to perform tasks within the scope of this contract, and within a maximum dollar ceiling. Demolition costs have been quite favorable, from Fort Campbell's perspective. Environmental Division personnel cited approximately $4/SF as the price they have been paying for WWII-era wood buildings' demolition. This figure includes terminating utilities, removing the buildings and foundations, hauling debris to the landfill, and grading and seeding the building site. It does not include asbestos abatement. Fort Campbell's standard practice is to contract independently to have all asbestos materials, both friable and non-friable, removed from buildings prior to demolition.

Abatement costs vary, but typically range from a few hundred to a thousand dollars-plus per building. Fort Campbell does not charge tipping fees at Woodlawn landfill.

ERDC/CERL contracted with AHfH for deconstruction services. Environmental Division contracted for asbestos abatement, per their typical practice. Fort Campbell PWBC performed the utilities' termination with their own forces. This was done as a favor to AHfH, largely for safety reasons. AHfH subcontracted for foundation removal and debris hauling.

One modification to the contract was made. During the latter stages of the Work, security measures at Fort Campbell were upgraded. These measures prevented the waste hauler from taking the most direct on-post route to Woodlawn Landfill, and required them to leave Fort Campbell and drive around Fort Campbell to the landfill. This tripled the haul-and-return distance and time. The contract was modified to add $2,000 in compensation, as this additional hauling requirement was not within AHfH's control.

The total cost to the Government for deconstructing 22,700 SF of buildings, all tasks and services comparable to conventional demolition, was as follows.

ERDC/CERL contract with AHfH	$120,000
Asbestos abatement	1,507
PWBC utilities termination	1,093
Contract modification	2,000
Total cost	$124,600

At a unit cost of $5.48/SF, this is higher in first cost than Fort Campbell would ordinarily pay for demolition services.

While no tipping fees were charged to either the demolition contractor or to AHfH, landfilling C&D debris on-post is not free of cost. Landfill life-cycle costs include design and construction, operation and management, maintenance, monitoring, and will include closure, capping, and long term monitoring. Fort Campbell Environmental Division personnel have calculated a cost to Fort Campbell of $50/ton of C&D debris over the landfill's life. Cost avoidance through debris diversion must, therefore, be included with the overall cost results. As all other costs represent current values, it is appropriate to represent the $50/ton as a net-present-value as well.

726 tons diverted @ $50/ton =	$ -36,300
Total net cost	$ 88,300

At a unit cost of $3.89, this is *at least* competitive with demolition costs at Fort Campbell when landfill life-cycle cost avoidance is considered.

Unfortunately, this data does not conclusively, indisputably, prove that deconstruction is or is not more economical than demolition and landfilling. Several qualifications were present with this project.

- Fort Campbell has been getting a very good deal on demolition services. Other Army installations, are currently paying $5 – 7/SF or more for building removal (asbestos and ACM removal, utilities termination, demolition, & sitework). If there is no C&D landfill on-post and debris must be hauled off-site, this cost increases. Therefore, a more representative Army-wide benchmark for conventional demolition costs may be somewhat higher.

- Wilmot and Associates, AHfH's subcontractor for demolition and concrete removal, gave AHfH a "very favorable" price for their services – presumably at-cost. An additional markup would have been incorporated into Wilmot's quote under a conventional competitive scenario. Without divulging the exact subcontract cost, the cost of services could be three to four thousand dollars higher under normal project conditions.

- Volunteer labor is not free labor. Two AHfH and one University of Florida personnel were paid professionals, although the labor force consisted of volunteers from NCCC/AmeriCorps. AmeriCorps volunteers were housed in a local motel, and received a stipend for expenses. AHfH paid an equivalent of almost $5/hr per deconstruction labor-hour. A different volunteer labor scenario, one that could utilize local labor resources and not require lodging, will result in a much lower overall cost. However, paying labor prevailing hourly basis will result in a higher overall cost.

- Austin HfH did not include a mark-up factor in their price, although they did achieve a net return of roughly $41,000 in building materials. It is not unreasonable to consider this as a profit of sorts. However, unlike a conventional construction contract, a cash profit is not achieved through the contract's payment, but over time as the materials were sold at the Austin ReStore. In a competitive commercial contract scenario, it is reasonable to expect that the deconstructing entity can reduce their bid or price proposal to some extent, anticipating an economic return from the recovered materials.

It is entirely reasonable, however, to conclude that deconstruction is competitive with conventional demolition when the cost avoidance of diverting debris from the landfill is considered. If debris must be hauled off-post and landfilled at a commercial facility, significant savings should be achievable.

AHfH has estimated that they can perform similar deconstruction services in the future for $5.50/SF.

Time (Schedule), and Productivity.

There is very little data upon which to estimate deconstruction duration, or develop a deconstruction schedule. The data required includes the definition of tasks, labor and equipment resources applied to each task, the time required to complete a task with the assigned resources, and the rate at which the assigned resources perform the tasks – i.e. productivity. Therefore, one of the primary objectives for his project was to generate that could contribute to deconstruction scheduling.

In previous research, UF-CCE has developed a recording methodology to document labor and other resources invested in the various deconstruction tasks. This methodology consists of recording the task each individual is performing at fifteen minute intervals. For example, if an individual is recorded at three consecutive intervals as removing drywall from ceilings, that individual is presumed to be removing drywall from ceilings for forty-five minutes. The location at which each individual is working is also recorded. Over a period of time, the length of time an individual works at each of several tasks can be totaled. The aggregate labor effort for each task can then be totaled. A pre-deconstruction survey is performed to calculate the quantity of Work to be performed within each task. The productivity for performing that task, therefore, is the quotient of the amount of work for the task divided by the total labor hours invested in performing that task.

The University of Florida Center for Construction and Environment recorded and evaluated the Pilot Demonstration Project's productivity performance. They will publish a report under their own cover. The following is a summary of their findings.

Deconstruction tasks were defined as follows. Not all tasks are identical among all buildings, as materials differ.

Remove windows
Remove doors
Remove mechanical / electrical / plumbing (MEP) components
Remove casework (i.e. interior trimwork)
Remove interior plywood paneling
Remove interior GWB, wall
Remove interior GWB, ceiling
Remove interior vinyl floor tile
Remove interior walls, framing, 2x4
Remove interior walls, insulation
Remove roof asphalt shingles
Remove roof sheathing, plywood
Remove roof sheathing, 1x6

Remove roof structure, 2x8
Remove roof structure, truss
Remove exterior walls, vinyl siding
Remove exterior walls, wood siding, 8”
Remove exterior walls, 2x6 studs
Remove exterior walls, 2x4 studs
Remove T&G strip flooring, 4”
Remove subfloor, 1x8
Remove floor structure, 2x8
Remove floor structure, 2x10
Remove floor structure, 2x12
Remove floor structure, 2-2x12
Remove columns, 6x6
Remove columns, 8x8

Labor Hours (LH) were recorded for each task. All deconstruction activities were recorded, including the physical deconstruction, materials handling, denailing, processing (which included trimming, sorting, stacking, and inventory control), supervision, daily start-up and clean-up, safety meetings, site clean-up, and jobsite policing. Time that was clearly unproductive and did not contribute to any of the deconstruction tasks was not counted. Data recording time was not counted.

The deconstruction timeline is summarized as follows.

28-29 Apr	Remove fluorescent tubes, PCB ballasts, & Hg ampules
01 May	First NCCC/AmeriCorps crew arrives
02 May	Conduct deconstruction & safety training
03 May	Begin building 2748 deconstruction,
06 May	Begin building 834 interior deconstruction, (rain prevented work on building 2748)
07 May	Begin building 2748 deconstruction
13 May	Begin building 2736 & 2738 interior deconstruction (rain prevented work on building 2748)
17 May	Second NCCC/AmeriCorps crew arrives; conduct deconstruction & safety training
17 May	Continue building 834 interior deconstruction (rain prevented work on building 2748)
18 May	Complete building 2748 deconstruction
20 May	Continue buildings 2736 & 2738 deconstruction
26 May	Third NCCC/AmeriCorps crew arrives; conduct deconstruction & safety training
01 June	Complete buildings 2736 & 2738 deconstruction
02 June	Fourth NCCC/AmeriCorps crew arrives; conduct deconstruction & safety training
03 June	Begin building 2717 deconstruction
06 June	Begin bulding 824 deconstruction
06 June	Site visit by EPA Administrators (Rain prevented work on building 2717)
07 June	First NCCC/AmeriCorps crew departs
13 June	Complete building 2717 deconstruction

23 June	Second NCCC/AmeriCorps crew departs
09 July	Perform pre-final inspection
11 July	Complete building 834 deconstruction
13 July	Last NCCC/AmeriCorps crews depart
16 July	Complete materials loading, site clean-up, & policing
29 July	Complete final inspection

Note that denailing, materials handling and processing, and jobsite clean-up activities occurred continuously throughout the project. Memorial Day and Fourth of July were taken off as Holidays.

Deconstruction of Building 2748 required 9 working days in total. A crew of 12, including three supervisors, performed the Work. As described previously, only the south two-thirds of the building, or approximately 15,000 SF, was deconstructed for salvage. The remainder was mechanically demolished, which was accomplished in less than an hour.

A summary of the labor hours and productivity rates for deconstructing Building 2748 is as follows.

Building 2748	1530SF		
	Labor Hours	Labor Hour / SF	Percent Labor
Windows & Doors	26	0.02	4%
MEP	19	0.01	3%
Casework	9	0.01	1%
Interior Finishes	144	0.09	22%
Walls & Ceilings	17	0.01	3%
Roof	158	0.10	24%
Exterior Walls	99	0.06	15%
Floor	183	0.12	28%
Columns			
TOTAL	655	0.43	100%

Buildings 2736 & 3738 were deconstructed concurrently in 11 working days. Between 21 and 27 individuals, including three supervisors, performed the Work. The workforce was divided essentially in two crews, although individuals switched back and forth between buildings as necessary. As described previously, roughly half of the exterior walls were left for demolition, as they sat on a slab on grade, and there was no floor framing beneath to salvage. The remaining walls, slab-on-grade, and brick chimney were demolished in approximately one hour. Summaries of the labor hours and productivity rates for deconstructing Buildings 2736 & 2738 are as follows.

Building 2736	2650SF		
	Labor Hours	Labor Hour / SF	Percent Labor
Windows & Doors	21	0.01	3%
MEP	4	<0.01	1%
Casework	1	<0.01	<1%
Interior Finishes	44	0.02	7%
Walls & Ceilings	84	0.03	14%
Roof	243	0.09	41%
Exterior Walls	48	0.02	8%
Floor	154	0.06	26%
Columns			
TOTAL	598	0.23	100%

Building 2738	2650SF		
	Labor Hours	Labor Hour / SF	Percent Labor
Windows & Doors	10	0.01	2%
MEP	3	0.01	1%
Casework	0	<0.01	<1%
Interior Finishes	35	0.01	6%
Walls & Ceilings	73	0.03	12%
Roof	277	0.10	46%
Exterior Walls	25	0.01	4%
Floor	174	0.07	29%
Columns			
TOTAL	597	0.23	100%

Note that unit labor requirement calculated at 0.005 or less are shown as “<0.01” Labor Hours / SF.

Productivity appears relatively high for Buildings 2736 & 2738; i.e. a lower labor hour requirement per square foot of building. Roughly half of the floor was a concrete slab-on-grade, and therefore was not deconstructed. Roughly half of the exterior walls were not deconstructed. If the labor requirement for the floor and walls were extrapolated, to approximate deconstructing the entire building, total labor hour rate would increase to almost 0.30 Labor Hours / SF.

Deconstruction of Building 2717 required 9 working days to deconstruct, plus one day for additional site cleaning. As this was a larger, two story building, more personnel could be applied to deconstruction tasks. As many as 45 individuals were on-site at times, although the typical workforce consisted of 20-24 individuals. Three supervisors were among the crew. The entire building was deconstructed for salvage, with the exception of the brick chimney, boiler room walls, and the foundation piers. A troop unit took the foundation piers. The boiler room walls and slab were mechanically demolished in approximately one hour. A summary of the labor hours and productivity rates for deconstructing Building 2717 is as follows.

Building 2717	5460SF		
	Labor Hours	Labor Hour / SF	Percent Labor
Windows & Doors	39	0.01	2%
MEP	28	0.01	1%
Casework	8	0.01	0%
Interior Finishes	168	0.03	9%
Walls & Ceilings	124	0.02	7%
Roof	306	0.06	16%
Exterior Walls	333	0.06	18%
Floor	880	0.16	47%
Columns	7	<0.01	1%
TOTAL	1891	0.35	100%

Deconstructing Building 834 required 30 working days. The workforce consisted of 20-30 individuals typically, including the 3 supervisors. During Building 834's deconstruction, however, AmeriCorps crews were departing, and the workforce diminished as the project wound down. Only the 2 AHfH supervisors remained onsite for the last three days. The entire building was deconstructed with the exception of the brick chimney, boiler room walls, and foundation walls. Mechanical demolition of the boiler room walls, chimney, and foundation walls took approximately two days.

Building 834	9107SF		
	Labor Hours	Labor Hour / SF	Percent Labor
Windows & Doors	18	0.00	0%
MEP	106	0.01	3%
Casework	26	0.00	1%
Interior Finishes	349	0.04	10%
Walls & Ceilings	61	0.01	2%
Roof	1401	0.15	39%
Exterior Walls	142	0.02	4%
Floor	1475	0.16	41%
Columns			0%
TOTAL	3577	0.39	100%

Based on the Pilot Project data, it is reasonable to expect that a typical wood framed barracks or administrative-type building, 25-30 ft. wide, can be removed in 10-12 working days. This includes manual deconstruction with a crew of 12 (plus or minus), demolition with a hydraulic excavator or tractor and end loader, site grading, and seeding. The warehouse took considerably longer, although it's dimensions and construction were completely different than the typical WWII-era "troop" buildings.

Removing a typical WWII-era wood building by manual deconstruction required roughly twice the time as conventional demolition; approximately two work-weeks

as opposed to one work-week. However, the deconstruction durations were not so protracted as to cause problems at Fort Campbell. Because there was no subsequent construction activity occurring on the buildings' sites, the difference between one week and two weeks duration was inconsequential.

Deconstruction productivity varied from less than 0.3 to 0.4 Labor Hours / SF of building. This rate is reasonably consistent with other published deconstruction case studies. Deconstruction projects conducted by UF-CCE, the Fort Ord Reuse Authority, the National Association of Home Builders (for the US Department of Housing and Urban Development), and others suggests that 0.33 to 0.36 LH/SF is a reasonable rate. *(CITE SOURCES)* A more detailed breakdown of labor effort is provided in Appendix D.

The Project Narrative (Chapter 5) describes issues and conditions affecting deconstruction productivity at each building. Some observations about productivity are as follows.

- The hours invested in handling, denailing, inventorying, stacking and bundling, supervision, and other tasks not directly related to removing materials from the buildings constitute roughly 50% of the total labor invested in many tasks. This data is included as "burdened hours" in the detailed labor effort breakdown.

- Removing interior finishes (including wall and ceiling surfaces) consumed up to 25% of the labor effort for some buildings. As there is relatively little salvageable interior material found in utilitarian Army buildings of this type, this is a time consuming activity with little payback. Note that salvaging the T&G fir strip flooring is recorded under "Floors," not "Interior Finishes" or "Walls and Ceilings."

- Removing the layers of built-up flooring and underlayment dramatically slowed interior deconstruction. In addition to the extra effort required to remove the flooring, it also interfered with other interior deconstruction tasks, primarily mobility and materials handling and disposal. Bad fortune would have it that the most difficult flooring in Building 2748 was located at the exterior doors. In other projects (i.e. not at Fort Campbell), the built-up flooring was cut into squares roughly 2 ft. on a side. The depth of the cut was calculated to not damage the T&G fir flooring below. Prying up smaller sections proved easier than trying to force whole sheets of plywood.

- Uncertainty about what to do with unexpected materials (ceiling insulation, in this case) lead to extra handling, which ultimately did not salvage the materials. Not being prepared to protect this material then resulted in its being lost to water damage. Identifying all materials present and planning for their salvage or disposal and protecting them to preserve value should prevent this type of unproductive labor.

- Balloon framing details are somewhat more difficult to disassemble than platform framing details, especially at the roof / wall connection, and the floor-wall connection of two-story buildings. This detail was unexpected, and resulted in a cumbersome approach to removing the roof structure in building 2738. Considering critical construction details (in addition to the type and condition of the materials) and developing the appropriate deconstruction techniques in advance should improve productivity.

- The availability of manual labor discouraged AHfH from using equipment other than hand tools, which would have incurred rental fees. As a result, some activities were more labor intensive and, therefore, lower in productivity. The roof trusses in Building 2748 were lifted off of the walls and handed down to the ground. The roof trusses in Buildings 2736 & 2738 were considerably heavier than the factory-built trusses in building 2748. They were cut and lowered into the building's interior with ropes, then hand-carried out the door. While effective, these were slow operations. Had a lifting device such as a truck mounted crane been available, removing the roof trusses could have commenced at a much quicker pace. Material handling equipment, such as a bobcat or small fork lift could also have improved materials handling efficiency, especially under the hot weather conditions experienced throughout much of the project.

- A Genie ® construction lift was rented for work on the two-story barracks building. This proved invaluable in maneuvering around the exterior of the building. The Genie ® could position workers at any elevation, at any location around the building's perimeter, move, then return. Working from ladders or scaffolding would have required constant movement and resetting.

- Austin HfH attempted to remove the concrete topping at the latrine in Building 2717. The remainder of the building was being removed around it, and the floor was framed at that location with 2x12's spaced at 12" apart. Therefore, the potential to increase the yield was greater in Building 2717 than it was under the concrete topping at Building 2748. AHfH rented an electric jackhammer. This concrete proved to be exceptionally tough and difficult to fracture. It became evident very quickly that this task would exceed the point of diminishing returns. Despite the amount of lumber under the topping, relatively little lumber was salvageable, as leaks had developed around all the drains at toilets, lavatories, and showers.

- Building 834 was used as a processing area and warehouse for the materials salvaged from the other buildings. However, when deconstruction of that building began, here was conflict in space and activities. For safety purposes, materials had to be moved several times to prevent personnel on the floor from working under other personnel disassembling the roof above.

There was a considerable amount of multiple handling of materials at the later stages of building 834's deconstruction.

- The 2x6 T&G subfloor in Building 834 was an attractive material to recover for reuse. However, it was found to be fastened to the framing with 20d nails. Extracting these nails without breaking either the tongues or grooves was difficult, and slowed this task down significantly. As Building 834 is so large in plan area, and the entire floor was built with this subfloor, the overall productivity of the whole project was effected.

- On a labor hours per square foot basis, deconstruction productivity on Building 834 was not especially high. However, on a linear foot of framing material per labor hour, disassembly of this building progressed on a par with the other buildings.

- Weather conditions were hot and humid throughout much of the Pilot Deconstruction Project, to the point of being oppressive many days. Frequent water breaks were called. It was also clear that personnel movement slowed later in the workday.

- The AmeriCorps crews performed admirably and their work ethic cannot be questioned. However, a relatively large labor force was on-site, and the same number of personnel was present every day. Therefore, the motivation to economize on labor effort was missing to some degree. AHfH could not adjust their personnel according to the task requirements, as would a commercial contractor paying labor by the hour. The total labor invested in deconstructing the 5 buildings was essentially a fixed variable, being the numbers of individuals present multiplied by the number hours spent on the project. Many were of the opinion that the same results could have been accomplished with a smaller workforce, and therefore a lower (better) LH / SF ratio.

Quality.

Each building site was cleared, graded, and seeded. At the conclusion of the Pilot Deconstruction Project, there was no difference between these sites and a site where a building was demolished. From Fort Campbell's perspective, the Work was completely acceptable, and in accordance to their expectations.

A report of no quality problems should be viewed with suspicion. As with any construction project, there were a few minor issues. These did not detract from the overall positive results, but are noted here for the sake of completeness.

- The debris hauler was observed on one occasion to have either left the tarp off the dumpster during a haul, or improperly covered the dumpster. The hauler was notified of this observation, and no further reports were made.

- Fort Campbell and ERDC/CERL originally anticipated the deconstruction would take place in the late spring to early summer timeframe. When ERDC/CERL developed the specifications for the project, they included a requirement to seed, mulch, and water disturbed areas of the building sites. This requirement was appropriate given the anticipated time of performance. As the project did not start when originally anticipated, deconstruction concluding in the heat of mid-summer. Austin HfH's subcontractor seeded, mulched, and watered -- as required -- although it would have been more appropriate to wait until the September to do so. Subsequent visits to Fort Campbell verified that grass is, indeed, growing on these building sites, although the turf cover appeared somewhat parched in places.

- Fort Campbell and ERDC/CERL personnel agreed that AHfH would not be required to remove sidewalks and other paving nominally flush with the ground. This provision was included in the specifications. Grading after removal of Building 2748 included restoring a swale for surface drainage. The grading left a sidewalk partially exposed and somewhat unfinished in appearance. However, Environmental Division personnel considered this to be of no real consequence, and did not require any further action.

The more fundamental objective of deconstructing buildings instead of demolishing them and landfilling the debris is to divert material from the landfill. The Quality evaluation, therefore, also includes an assessment of the materials salvaged from the buildings for recycling and reuse.

Estimates of each building's content are given in Building Descriptions, Chapter 4. The quantity of building materials that would ordinarily be landfilled as debris is expressed in weight (tons). These estimates were based first on quantity take-offs performed on each building. All materials present in the buildings were identified and quantified. The take-offs of structural and architectural elements (i.e. foundations, wood framing, partition construction, finishes and surfaces, doors & windows, etc.) were based on construction drawings and actual measurement, and can be considered to be quite accurate. These components comprised the vast majority of the buildings' mass. Take-offs of mechanical, electrical, and plumbing items can be considered accurate where such items were observable. Concealed MEP items (i.e. pipes, ducts, wiring, etc.) were estimated by indirect measurement or approximation. However, their contribution to the total mass of these subject buildings is minimal.

Weights of materials were taken from several sources. Where weights are considered standard within the construction industry (such as regular weight concrete, half-inch GWB, cast iron pipe, ductwork, eight-inch glass, etc.) these weights were applied to the quantity take-offs.

Weights of some building materials vary. Lumber weight, varies according to species, density, moisture content, and other factors. Lumber experts are sometimes reluctant to provide a single value without qualification. ERDC/CERL personnel physically weighed samples of all lumber products on-site. A common bathroom scale was calibrated with a known weight, and used to weigh the lumber materials. At least 10 loads of each wood material (i.e. 2x12's, 1x8's, plywood sheets, etc.) were weighed, a "load" consisting of as much material as could be held by the research assistant while maintaining his balance on the scale. Weights of lumber materials were calculated on a volumetric basis (cubic foot and board foot). Plywood weights were calculated on an area basis, per thickness of plywood. Other building components that are not standard in weight were weighed in a similar manner. These include doors, windows, plumbing fixtures, pipe, small heaters and furnaces, and other miscellaneous items. While this is method may not be as accurate as using laboratory equipment, it was felt to be entirely reasonable for the purposes.

Weights for large pieces of mechanical equipment and items not accessible for physical weighing were estimated. Manufacturer catalogs were consulted to find comparable pieces of equipment and shipping weights. Again, these items comprise only a small portion of the buildings' mass.

The total potential debris stream was estimated to be as follows.

Building debris	588,100 lbs =	294 tons =	25.6 lbs/SF, avg.
Foundation/masonry rubble	779,000 lbs =	389 tons =	34.0 lbs/SF, avg.
TOTAL	1,367,100 lbs =	684 tons =	63.0 lbs/SF, avg.

Austin HfH did not approach the deconstruction task with the intent of recovering every item that could possibly be removed intact. Several factors were considered. AHfH maintains an inventory of materials at their ReStore, and intended to recover similar materials. Other materials that could possibly be salvaged, but were not typically carried at the ReStore were not especially attractive. AHfH intended to sell as much material locally as they could, but anticipated they would also have to ship material back to Austin. Time was also a constraint. The AmeriCorps crews would only be available until 7 July. Therefore all work had to be completed by that date. The late start to the project shortened the time originally anticipated by one month. Fiberglas batt insulation, as an example, was one of those materials not typically inventoried at the ReStore, was bulky and difficult to ship, and required a lot of handling and care on the deconstruction site. Therefore, this type of material was not high on AHfH's priority list for recovery.

The following describes the materials AHfH recovered from each building for resale and reuse.

Building number:		2748	2738	2736	2717	834	Totals
Personnel doors	EA	4	5	6	4	4	23
Ceiling mounted gas heaters, 50,000 BTUH	EA	2		1			3
Updraft gas furnaces, 125,000 BTUH	EA				4		4
Vinyl Siding, 8"	SF	1,944	960	960	3,180	3,960	11,004
Fire alarm cabinet box	EA					1	1
Mariner-style, industrial light fixtures	EA					15	15
Windows, dbl hung, single glazed, 3.5'x5.5'	EA	15	15	14	15		59
Windows, dbl hung, dbl glazed, 3.5'x5.5'	EA	9					9
Trusses, site- built 2x8 members, 25 ft.	EA		35	50			85
Trusses, manufactured, 25 ft.	EA	31					31
3" Oak T&G flooring , 3"	SF					225	225
Fir T&G flooring .3"	SF	1,550	1,500	1,350	4,100		8,500
OakT&G flooring , 2-1/4"	SF					2,800	2,800
Pine T&G wall sheathing , 6"	SF					3,000	3,000
Plywood, 5/8”	SHT	64					64
	SF	2,084					
1x2	LF			41			41
	BF			7			
1x4	LF	928		211	1,381		2,520
	BF	306		70	456		832
1x6	LF	2,362	192	42	1,331		3,927
	BF	1,181	96	21	666		1,964
1x8 (sub-flooring)	LF		500	2,074	2,663		5,237
	BF		335	1,390	1,784		3,509
1x8 T&G	LF				166		166
	BF				111		111
1x10 subfloor	LF				1,833		1,833
	BF				1,521		1,521
1x12	LF					75	75
	BF					75	75
2x4	LF	213	85	357	4,399	1,724	6,778
	BF	143	57	239	2,947	1,155	4,541
2x6	LF	700	388	514	2,754	6,094	10,450
	BF	700	388	514	2,754	6,094	10,450
2x8	LF	24	39			9,500	9,563
	BF	32	52			12,635	12,719
2x10	LF	1,704	1,618	1,482	828	443	6,075
	BF	2,846	2,702	2,475	1,383	740	10,145
2x6 flooring T&G	LF					5,747	5,747
	BF					5,747	5,747
2x12	LF				828	15,915	16,743
	BF				1,656	31,830	33,486

Altogether, AHfH recovered over 107,000 board feet of lumber materials for resale and reuse.

The Clarksville TN HfH affiliate does not operate a ReStore, so other outlets had to be developed for the materials. At the beginning of the project, AHfH placed advertisements in the Leaf Chronical (local Clarksville newspaper) and the Tennessean (a Nashville newspaper), and called several building contractors in the Clarksville/Hopkinsville area.

The response from the market at large was not as strong as was hoped. One constraint may have been that Fort Campbell personnel were cautious about AHfH issuing public announcements or advertisements describing this project prematurely, then not being able to initiate the project. AHfH, therefore, did not begin any market efforts until mid-April. The events of 9/11 also had their effect on the Fort Campbell community. While Fort Campbell was not closed to the public, enhanced security made it less convenient for the public at large to enter the installation and examine the materials available for sale. Approximately one-third of the materials were sold locally. The remainder were shipped to the Austin ReStore.

Austin HfH has established a price schedule for used building materials sold at the ReStore. Lumber in good condition is sold for nominally half of the retail value. Other components are priced to sell, their prices established according to the estimated market demand. For example, residential windows are extremely popular, and will command the established price ($10-30 each). Other items, such as mechanical equipment of a commercial capacity (a 7-ton compressor/condenser unit, for example), may sell for only a fraction of it's real value, as it is not common to residential do-it-yourself-type projects. It was discovered, however, that local lumber prices were about 20% lower than in Austin. AHfH sold materials locally at roughly 80% of what they would have in Austin. Local sales prices and the Re-Store price list are given in Appendix E.

Additional markets emerged for two unexpected sources. A drive-by market consisted of Fort Campbell personnel, both civilian and military, stopping by the site, inspecting materials, and later removing them off the site. This was an advantage to AHfH, as they would not have to transport these materials to Building 834. Articles in the Leaf Chronical (the Clarksville, TN newspaper) and the Courrier (Fort Campbell newspaper) increased interest. The other unexpected market was troop units. Throughout the deconstruction project, troops inquired about taking materials for various uses in their training exercises. Examples include using scrap lumber to make targets, doors in MOUT exercises, and foundation piers for demolition exercises. In many cases, the units would otherwise have to purchase new building materials from local retail "box stores," only to destroy them in training.

While local sales were not as strong as expected, AHfH considered the Pilot Deconstruction Project to be a success from the material resale perspective. The total value of the recovered building materials, both sold locally and transported to Austin, was approximately $49,000. Transportation cost was $7,200, leaving a net value accrued of $41,800. AHfH reports that the Fort Campbell materials began selling immediately upon their arrival at the Austin ReStore.

From the Fort Campbell Environmental Division's perspective, project success would be judged by the debris diversion rate achieved through deconstruction. Debris diversion was accomplished through several avenues.

- The majority of the building materials, excluding conrete, were recovered for resale and reuse by AHfH. Including concrete to be recycled, the debris stream was reduced by approximately 85%.

- The Pollution Prevention Branch initiated an arrangement with the Defense Reutilization and Marketing Office (DRMO) on Fort Campbell to accept aluminum and ferrous metals directly from demolition contractors. Previously, documentation to verify the appropriate ownership and responsibility for equipment and materiel was required before DRMO could accept items for recycling or marketing. This was a task demolition contractors were generally unable and unwilling to do, especially when they would achieve no return themselves. Although recyclable metals are suppose to be separated during demolition and delivered to DRMO, they typically weren't. Fort Campbell was not unique in this situation. This was a significant accomplishment on the P2 Branch's part to enable a demolition contractor (AHfH in this case) to simply load metals on a trailer, weigh and deposit the scrap at DRMO, and return to the jobsite. The only requirement on AHfH's part were to deposit aluminum and ferrous metals in the appropriate piles in the DRMO yard, and to leave the weight tickets with P2 Branch personnel. P2 Branch then claimed, and will continue to claim, the recycled metals on their Solid Waste Annual Reporting system. Note that not all metals are acceptable to DRMO. Metals with lead-based paint or asbestos, or suspected of having LBP or asbestos, were not acceptable. While the recycled metal was weighed, the contaminated metals were not separated and weighed. Therefore, the diversion rate can only be estimated, and a conservative estimate of 50% is reasonable.

- A troop unit requested a load of concrete piers. Troops loaded the piers from Building 2717, by hand, into trucks and took them for use in demolition exercises.

- Austin HfH intended to take the air conditioning compressor/condenser unit from Building 2748. It was not new, the refrigerant had been purged by PWBC personnel, and as it's capacity was not known, and it was large and

cumbersome. AHfH was then going to recycle it through DRMO. However, another contractor working at Fort Campbell requested it, and AHfH gave it to them.

- Fort Campbell had been requiring demolition contractors to deliver concrete rubble to a specified location at Woodlawn landfill. At the time of the deconstruction, Fort Campbell was planning to initiate a contract action for crushing and recycling concrete on-post. The foundation rubble from the deconstructed buildings was, therefore, deposited in the pile for recycling.

Total debris diversion was is as follows.

TOTAL BUILDING AREA:	21,700	SF				
Materials salvaged by AHfH	254,606	lbs =	127.3	tons =	11.7	lbs/SF avg.
Metals delivered to DRMO	10,900	lbs =	5.5	tons =	0.5	lbs/SF avg.
Concrete piers taken by troops	44,086	lbs =	22.0	tons =	2.0	lbs/SF avg.
Air conditioning unit given away	400	lbs =	0.2	tons =	0.0	lbs/SF avg.
Siding material reprocessed at FPL	2,140	Lbs =	1.1	tons =	0.1	lbs/SF avg.
Concrete rubble	855,068	lbs =	427.5	tons =	39.4	lbs/SF avg.
TOTALS	**1,165,060**	**lbs =**	**583.6**	**tons =**	**53.8**	**lbs/SF avg.**
Total potential debris	1,367,100	lbs =	683.6	tons =	63.0	lbs/SF avg.
TOTAL DIVERSION RATE	**85.4%**					

The most desirable material from AHfH's perspective is lumber, preferably clean, straight 2x6's and deeper. Eight foot lengths are acceptable, although 10 ft and longer is preferred. There is less demand for 2x4's. Virtually all of the lumber material was in excellent condition. There was very little water damage or deterioration in any of the buildings, with the exception of the original wood siding, which is discussed below.

Building 834, the warehouse, provided the best source for lumber. The floor system alone contained over 5 board feet of lumber per square foot of building. This is more than all the framing in the other types of buildings. Altogether, there was over 10 board feet of lumber per square foot of building. Almost none of the framing or sheathing material was painted. The interior wall surfaces of Building 834 were sheathed with 6" T&G board. This material has become popular as antique finish flooring.

Windows and doors are marketable commodities at ReStores. All the windows were aluminum replacement double hung windows, most of the same dimensions. While only single glazed, they were very attractive to AHfH. Unfortunately, they were so attractive to some passers by that about 20 windows were stolen from the jobsite one night.

All the vinyl siding sold locally. This is not surprising. ERDC/CERL had been told in previous years that the vinyl siding disappears from a building as soon as it is vacated for demolition. AHfH kept full length pieces, but disposed of short pieces and trimmed pieces. Had AHfH recovered the short and trimmed pieces, they very likely would have sold also.

All the buildings' original finish floor consisted of 2-1/2" fir T&G strip flooring. There is a strong market in old growth antique flooring, and when refinished it can be quite attractive. Nail holes even add value as "character" marks. Oak flooring was installed in Building 834 as a more durable material for carts running along the warehouse aisles. The finish flooring was attached with flat, cut nails. With a little practice, the AmeriCorps personnel could easily remove flooring without splitting the tongues or grooves. In fact, one member considered this task to be her specialty, and was singularly responsible for removing most of the T&G flooring.

The 1x3 and 1x4 trim around windows had been installed relatively recently, and was also an attractive commodity. As millwork, it was an appearance grade of lumber, straight and with very few defects. While painted, these materials were not identified as lead-containing by the lead-based paint survey.

The heating equipment in buildings 2748 and 2717 had recently been replaced, and consisted of residential-scale gas heaters and furnaces. There were no longer institutional capacity furnaces or boilers.

A total diversion rate of over 85% is noteworthy. In retrospect, however, it is clear that there is a potential for even greater salvage. Some observations on salvage and diversion are as follows.

- As the concrete components of these buildings constitute the majority of the building's debris by weight, the opportunity to recycle concrete adds significantly to the total diversion potential.

- Austin HfH diverted somewhat less than 60% of the building materials, not including the concrete foundations. Gypsum wall board wall surfaces, sheathing, and ceilings contribute to the waste stream, as do several layers of vinyl or linoleum flooring. For example, Building 2748 contained roughly 25,000 lbs. GWB and resilient floor coverings, and Building 2171 contained about 42,000 lbs. of these materials. Roofing adds several tons to the debris stream of each building. While recycling GWB and asphalt roofing is possible, there are relatively few outlets for these materials and none could be found in the Fort Campbell area. Until a more mature and wide-spread market develops for these types of materials, they will remain debris.

- The original wood siding was found to be in very poor condition. The vinyl siding applied as protection actually accelerated the siding's deterioration by

trapping moisture within the wall assembly. While the wood material itself was not deteriorated to the point of failure, the paint was. Paint had detached and flaked off a significant portion of the siding, perhaps up to 50% in some places. Due to the presence and condition of the paint, Environmental Division personnel determined the siding was not suitable for sale. Wood siding from Building 2717 was removed and shipped to Forest Products Laboratory for evaluation. The siding from the other buildings was landfilled.

- An enormous amount of clean wood scrap was generated by the deconstruction. Most common were pieces of bridging, blocking, fire stops, and nailers to support attached items. These were usually 2 ft. pieces of 2x4's or 2x6's fitting between framing members. AHfH did not want to keep members less than 6 ft. in length. There is also clean wood that is damaged by removal, or may have been damaged in the past. The roof sheathing proved to be too brittle to remove easily, and most of it was lost to damage. Fort Campbell has a contracted wood shredding service on post. Pollution Prevention Branch attempted to have the service accept clean wood scrap. However, this service was not operating during the deconstruction, and had not been for some time. There was already an existing backlog of landscape debris and pallets to be shredded, and the contractor would not accept any more wood scrap wood. Unfortunately over 15 tons of clean wood ended up in the landfill.

- A misinterpretation about Fort Campbell's requirements for disposing of fluorescent light fixtures resulted in 74 ceiling fixtures being disposed of as scrap metal as opposed to recovered for reuse. AHfH and ERDC/CERL personnel surveyed the buildings for hazardous materials, which included fluorescent tubes and PCB-containing ballasts. The tubes are recycled, and the PCB-containing ballasts are disposed of as hazardous waste. There were relatively few PCB-containing ballasts. Most of the fluorescent fixtures were contemporary, and were manufactured with "No PCB" clearly evident on the ballast's labels. In a typical demolition scenario, P2 Branch does not want *any* ballasts deposited in the landfill, and requires the demolition contractor to remove them prior to demolition. AHfH understood this to be a requirement to removed *all* ballasts prior to deconstruction. It was later found that AHfH could have kept the "No PCB" fixtures intact for resale. P2 Branch's concern was that they aren't deposited in the landfill, not that they can't be reused. These 74 light fixtures are insignificant relative to the total waste stream, and are of only modest economic value. And they were recycled as scrap metal. However, they still represent an opportunity that in retrospect should not have been lost.

- Some wall framing at Building 834 was observed to have been knocked down, but then disposed of as waste instead of disassembled. The boiler room walls were also left intact; the boiler room was used as a receptacle for debris, and was later demolished and hauled off with the concrete and

masonry. Most of this framing was clean 2x6 studs, not painted and not otherwise damaged. Perhaps the necessity to finish deconstruction before the AmeriCorps crews departed drove AHfH to taking the more easily extracted materials and leaving the more challenging. The amount of this left lumber was not great relative to the overall quantity of lumber available in this building. However, it was lumber that could have been recovered, possibly under a somewhat different set of conditions.

Safety.

Both Fort Campbell and ERDC/CERL were extremely concerned about jobsite safety, especially when AmeriCorps volunteers were involved. The Deconstruction Pilot Project was successful in that no reportable injuries occurred, and no close calls were reported. The AmeriCorps volunteers worked safely, wore their Personal Protection Equipment, and generally seemed serious about protecting themselves and others around them. All seemed to be attentive, especially around dumpsters and drop zones where materials would be dropped out of windows. AHfH and UF-CCE continued to be observant about the safety environment on the jobsite. However, reporting a perfect safety performance would only arouse suspicion. The following items are noted here for the sake of completeness.

- One minor injury was experienced by one of the AHfH supervisors. Although he was wearing steel-shank boots, a splinter penetrated a small nylon mesh area in the instep of his right foot. He was taken to the Gateway Medical Center for examination, although no treatment was rendered.

- ERDC/CERL personnel observed an AmeriCorps volunteer working on the roof of Building 2717, the two-story barracks, wearing his fall protection harness, but with the tether not anchored. When instructed to tie-up, the individual complied. However, this situation should have been detected earlier as part of an ongoing safety observation regimen.

- UF-CCE personnel observed an AmeriCorps volunteer working on the roof of Building 834, wearing her fall protection harness, with her tether anchored at the ridge of the roof. She had worked her way from the ridge toward the eave. Moving toward the eave, she was moving closer to the floor, but lengthening her tether. All workers on the roof were immediately instructed to stop working, reattach closer to the eave, and readjust their tethers to stop them short of the floor if they did fall. This precaution continued to be observed throughout the remainder of the project. No one fell.

- Building 834 was being deconstructed as personnel were working inside processing materials. While there was no immediate hazard, there could have been situations where personnel working inside could be exposed to falling items from deconstruction above. ERDC/CERL, UF-CCE, and AHfH

personnel continued to be observant about locating work both above and below so that no persons were working or passing below activities taking place on the roof or above.

7. EVALUAION OF SIDING MATERIALS

Background

The work described in this section was a research effort conducted in tandem with the R&D on deconstruction of Army WWII era barracks. Much of the wood siding recovered from these buildings was coated with Lead Based Paint (LBP). The presence of LBP creates a challenge in processing this siding without exposing both processors and end users of this wood to lead's harmful effects.

The objective of this piece of the deconstruction R&D is to examine the viability of using conventional and specially designed woodworking equipment to remove LBP coatings from salvaged wood siding while producing a marketable wood product. The U.S. Department of Agriculture (USDA) Forest Products Laboratory (FPL), Madison, WI, was contracted to investigate the processes and requirements for safely milling LBP coated wood siding into saleable products. Siding from the Fort Campbell deconstruction project was originally intended to be the sample upon which this evaluation would be made. However, the opportunity also arose to obtain siding from buildings that were being demolished on the former Fort Ord, CA. The addition of Fort Ord siding afforded an excellent opportunity compare examples from different regions leading to an important conclusion that results will vary according to a number of factors.

This evaluation is documented in full in ERDC/CERL Technical Report _____, authored by Dr. Robert Falk, FPL, and Dr. John Janowiak, Pennsylvania State University. Included in this Chapter is a summary of the key issues of this evaluation.

Summary of Accomplishments & Observations.

A study was conducted to investigate the potential of safely producing value-added wood products from LBP coated wood siding collected from two US Army facilities; Fort Ord, California and Fort Campbell, Kentucky. A summary of accomplishments and observations are listed below:

1. *Siding Materials Tested*: Approximately 13,000 lineal feet of wood siding (Drop pattern #105) were shipped from both Fort Campbell (6580 LF of Southern Pine) and Fort Ord (7152 LF of Douglas Fir) to FPL

2. *Depth of Lead Penetration*: Representative samples of siding were investigated for depth of lead penetration. Mechanical removal of the paint surface (and subsequent layers of wood) was achieved using specially purchased power woodworking equipment. Total lead testing indicated that surface concentrations averaging about 5,500 mg/kg had dropped to an average of about 27 mg/kg at a depth of 0.06". Though results for greater

depths are still being analyzed, this indicates that lead contained in LBP does not penetrate wood, in significant quantities, more than a few hundredths of an inch.

3. *Evaluation of Woodworking Equipment*: Two types of woodworking equipment (and associated dust collection) were extensively evaluated in this project. A conventional 4-head woodworking molder was studied, as well as specialty planing machinery (YieldPro®) specifically developed by the Auburn Machinery Inc. (Auburn, ME.) for LBP removal from wood. A thorough assessment indicated that both pieces of machinery had distinct qualities as well as some limitations. Evaluation of the YieldPro© indicated the practicality of a mobile production system; though in its current configuration, it can only produce a rectangular profile. Though stationary, the 4-head molder evaluated at FPL provided valuable information on the production of several standardized wood product profiles, including flooring, bevel siding, and paneling. It was found that both pieces of machinery could be operated safely, with lead exposures to operators well below existing regulatory standards.

   It was also concluded that the ideal machinery for remanufacturing LBP wood siding would blend the best attributes from both the YieldPro© and the more conventional 4-head molder. That is, a machine with portability, plus the capability of producing a standardized wood product profile in one operation (e.g., flooring, siding, paneling, etc.).

4. *Market Value For Reworked Wood*: A visual quality evaluation followed by remanufacture of the LBP coated siding indicated that valuable wood products can be produced from the salvaged siding, however this value is dependent on several factors, including the original quality (grade) of the wood siding, specie, and extent of damage present (e.g., nail holes, splits, discoloration, decay, etc.). All these factors were found to vary depending on the source of the salvaged siding.

   Because all salvaged wood siding has at least some nail holes present, remanufactured products that can tolerate the presence of these defects are likely to be the most viable. It was determined that flooring is an attractive product choice, primarily because nail holes are accepted in the reclaimed flooring marketplace (often commanding premium prices!). Secondly, flooring can utilize salvaged siding as short as 16”. At the lower end, recycled Douglas fir flooring prices are about $4/sf, translating to about $1/lf market price for the flooring produced from the siding recovered from the Fort Ord buildings (note that this figure is *market price*, not *cost to produce*). Because a typical Fort Ord two-story barrack contains roughly 5,000 lf of siding (after estimated losses), a market value for flooring produced from the siding from a single barrack at this site is calculated to *at least* $5,000. This value could be

much higher, depending on efforts to market the quality aspects of this material.
Costs of *producing* flooring of this value were not evaluated in this study, but depend on raw material (siding) availability and quantity, deconstruction costs, production efficiencies and costs, proximity to markets, and marketing costs.

Description of Collected (Original) Wood.

Wood Collected From Fort Campbell:

The siding was obtained from deconstruction of a single story barrack, a two-story barrack, and a warehouse. This siding material was stacked in banded bundles and shipped to the FPL. For tracking purposes, an identification number was marked on each piece of siding prior to building deconstruction. The siding was visually inspected and photographic records were taken to document outside building conditions.

A visual assessment of the siding indicated that it had been painted several times, however the paint surface was in poor condition. Surface quality varied considerably and paint film separation and flaking was evident in most pieces. This paint failure was problematic in that many siding pieces had lost their ID numbers in the handling and transportation of the material. This limited the ability to accurately account and track for all the siding back to the original building location.

The siding salvaged from Fort Campbell was originally manufactured to a finished 23/32-inch thickness with a dressed width of 7-3/8”. All pieces were confirmed to be Southern Yellow Pine (*Pinus spp*). Southern yellow pine consists of six major commercial species including loblolly, longleaf, short leaf, slash and pitch pine. These wood species are typically grouped together without major differences in market value. Thus no efforts were taken to confirm the exact species composition. Visual observations and handling weight differences did suggest more than one yellow pine species was present within the supply of salvaged siding. Also, old grade stamps were found on the siding indicating that the original siding was of only moderate quality. Interestingly, the grade stamps found were not stamps used for siding, but for lumber board stock (No. 2), which allow much larger knots than siding grades.

(photo of Fort Campbell grade stamp)

The siding profile found at Fort Campbell is a standard siding pattern (No. 105) recognized by the Southern Pine Inspection Bureau (SPIB) wood product grading rules (SPIB 1994). This type of horizontal ‘drop lap’ siding pattern is common, with a long history of U.S. production from a range of commercial species. This pattern was made in several widths, the most common being a nominal 5”.

(photo of Drop 105 pattern)

The Fort Campbell siding was nailed to the building framing using a double nail pattern, spaced 24”on-center. Because the Fort Campbell buildings had the wood siding overlaid with vinyl siding, additional nail holes were evident in all the pieces. Nail holes in salvaged siding are a significant factor that can devalue and/or limit reuse in certain ready-to-finish products.

The siding from Fort Campbell was more deteriorated than the Fort Ord siding. The vinyl siding covering the original wood siding may be a reason for this. Vinyl siding can trap moisture, accelerating paint failure. More importantly, in trapping moisture, the replacement vinyl siding may have maintained favorable conditions (high moisture content) for decay fungi growth. Wood decay and associated discoloration from staining fungi and molds were prevalent on a large number of siding pieces.

Metallic oxide staining (bluish to dark black) was also common in the Fort Campbell siding and discoloration ranged from shallow to complete thickness penetration.

Where paint had peeled from the siding, wood deterioration from weathering was evident. Losses in thickness as great as 1/32” from wind, sun, and rain erosion were found. Graying of the wood fibers and softening of the wood were also evident, indicative of photo-oxidative reactions due to UV exposure.

Many siding pieces also had noticeable surface checking from shallow to deep into the wood fiber. It was anticipated that planing to a depth of 1/16”- to 3/16” would be sufficient to eliminate this defect as well as the photo-oxidative and fungal induced discoloration. Elimination of these defects is critical for end-use applications that may require a clear wood finish.

The effects of decay due to the action of *basidiomycete* or other destructive soft-rot fungi were also evident. A few pieces of salvaged siding were so severely decayed that no usable wood material was left for product recovery.

Another major defect observed that affected the yield of recoverable wood was the end-splitting of the siding. This splitting resulted from either; 1) long-term exposure of repeated cycles in wetting followed by drying or 2) damage from the actual process of deconstruction.

An analysis of the inspection data provided the following summary information:

Total footage of siding shipped to FPL	6580 ft.
Total number of pieces	881
Total footage lost due to damage, decay, or end trimming	1854 ft.

Total number of whole pieces lost due to damage or decay	101
Percentage loss of original length due to damage, decay, or end trimming	28%

Observations were quantified and recorded in the inspection prior to milling. It is apparent that there was slight to heavy surface checking on the siding. Warping, in the form of cup, was present in a significant number of siding pieces, not unexpected with siding of wider widths. Brown rot was present in many pieces, at a much higher incidence than siding sampled from Fort Ord. This would imply either a higher incidence of water intrusion into the Fort Campbell buildings or the vinyl siding applied to the buildings trapped moisture.

(photo of Fort Campbell siding samples)

Wood Collected From Fort Ord:

This siding was salvaged from two single-story barrack buildings (24ft x 82ft) which are very representative of many other one-story wood framed barracks that exist at Fort Ord. The siding was visually inspected and photographic records were taken to document outside building conditions. Each piece of siding on both buildings was given an identification number similar to those used at Ft Campbell. There was a difference in siding width from Fort Campbell siding, otherwise the Fort Ord siding was nailed to the building framing using the same double nail pattern, spaced 24”on-center.

The siding salvaged from Ford Ord was determined to be exclusively Douglas fir (*Pseudotsuga menziesii*). The Fort Ord siding had the same basic profile as the siding salvaged from Fort Campbell, however it was of a narrower 5-1/4” width. The West Coast Lumber Inspection Bureau (WCLIB) standardizes Douglas fir siding profiles. This pattern is designated as WC-105 (WCLIB, 1989). The general SPIB dimensions indicated in are also applicable to this siding pattern.

The siding salvaged from Fort Ord was generally in much better condition than the Fort Campbell siding. In general, the same defects as described for Fort Campbell were found in the Fort Ord siding, however with far less frequency. The paint loss and wood weathering of the Fort Ord siding was more location specific, as a greater degree of weathering and checking were found on pieces from the south sides of the building, where exposure from the sun was greatest.

(photo of Fort Ord grade stamp)

(photo of Fort Ord samples)

Description of Wood Processing Equipment.

Two types of woodworking equipment (and associated dust collection) were evaluated in this project. A conventional 4-head woodworking molder residing at the FPL was evaluated, as well as specialty planing machinery (YieldPro) specifically developed by the Auburn Machinery Inc. (Auburn, ME.) for LBP removal from wood. The 4-head molder at FPL was evaluated over an extended period from April to December 2002, while the Auburn machinery was available for evaluation during a one-week period at Fort Ord in October 2002.

In evaluating the above equipment, a major concern was the abrasive characteristics of paint and metal objects found in the used wood. If the wear to the knife cutting-edge was found be too excessive (and rapid), the costs of resharpening and the losses to wood surface quality could make remanufacturing impractical. This is especially the case for the type of equipment evaluated here. Compared to other woodworking machines, the knife edges in wood planers and moulders are especially sensitive to declines in cutting performance from abrasive wear and damage from foreign objects. In addition to the abrasives found in paint, knives are dulled by the embedded particles of grit and dirt found in weathered wood surfaces and ferrous metal objects. Lumber mills involved with log conversion for lumber recovery are acutely aware of abnormal wear from soil contamination and metal objects and go to great lengths to keep wood free from these materials.

A Diehl moulder Model D-6 located at FPL's mill shop was utilized. This machine is old (1966), however it is very serviceable and a very common style of moulder/planer widely used by millwork producers. It is versatile enough to simultaneously convert feedstock into a many types of surfaced four side (S4S) wood products. In addition, these machines are very prevalent on the used machine market.The unit is equipped with four cutting heads; two for side cutting and two for surface cutting.

(photo of Diehl moulder)

A portable wood processing system developed jointly by the Auburn Machinery Inc. (Auburn, ME.) and Wood Waste Diversion, LLC (Marina, CA.) was also evaluated in this study. Central to this system is a wood planning/sawing machine (YieldPro) capable of machining four surfaces of wooden stock with a variety of configurations possible.

(photo of Yield Pro)
(photo of WWD mobile system)

The machine configuration consisted of three planing heads (top, bottom, and one side head) and a side-ripping blade (hogging blades can also be used for greater material removal). This machine was enclosed in a self contained and mobile unit that includes an electrical generator, air compressor, dust collection and storage system, and a fire suppression system.

Processing of the Douglas fir siding from Fort Ord was conducted using flat and profile high-speed steel (HSS) knifes (M-2 grade) manufactured by Wisconsin Knife Works (Beloit, WI). Four knives were used in each cutterhead. These 35° bevel knives with 16/60 corrugated back blades were matched to the replacement cutterheads. The corrugations on the back of the knives simplify installation and removal as well as mechanical locking of the knife in the cutterhead.

The excessive wear of HSS knives witnessed in early machining trials did suggest that carbide knives might be a logical alternative. In addition to the abrasives in paint, the Southern Pine siding from Fort Campbell had a larger number of knots, which also tends to rapidly dull knives.

Description of Health & Safety Equipment and Procedures.

Because this project involved the machining of wood coated with LBP, there is potential for human exposure to the harmful effects of lead. For this reason, careful thought was given to safety issues, especially worker exposure to LBP. Both in the evaluation of the FPL machinery and Auburn machinery, information was collected on air quality and worker exposure to lead.

A health and safety plan was initiated before any material was processed. In cooperation with FPL's Health and Safety Officer, a monitoring program was developed to assure a safe work environment. Several issues were addressed with the developed program, including: 1) minimization of LBP exposure to woodshop personnel working directly with machining operations, 2) minimization of LBP exposure to the other staff and the general public, 3) evaluation of indoor and outdoor air quality during machining operations per OSHA and EPA regulations, 4) proper handling and disposal of LBP contaminated waste products (shavings, cut-offs, etc.).

As a first step, a new dust collection system was purchased in order to keep LBP from contaminating FPL's existing dust collection system. This would minimize cross contaminating clean wood waste with LBP. To find a dust collection system most suitable for the collection of wood shavings contaminated with LBP, several woodworking dust collection manufacturers were contacted. After reviewing the equipment specifications, it was determined that a 15hp fan blower & cyclone separation system manufactured by Oneida Air Systems, Inc

(Syracuse, NY) would meet the filtration and dust collection needs within the budget available. The Oneida system uses a cyclone for large particle collection and four pleated cartridge filters for fine dust filtration. It is tested and guaranteed by the manufacturer to filter 99.9% of all particles larger than 1 micron at 4200 CFM and 12”static pressure. The dust collection system was located outside the actual FPL mill shop in order to help isolate LBP exposure.

(photo of FPL dust collection system)

Before any machining was performed, a meeting with all woodshop personnel, project Principle Investigator, facilities management, and the safety officer was held. During this meeting, the project was described, health risks of working with LBP were discussed, and proposed safety procedures were reviewed. Shop personnel were only asked to participate in this project *if* they volunteered. After an explanation of objectives, scope, and safety procedures to be used, all personnel volunteered. All volunteers were tested for a baseline blood lead level by a local hospital before machining started. All were fitted with a High Efficiency Particulate Air (HEPA) dust filter mask (the type recommended by OSHA safety regulations for LBP dust exposure) by a local safety company and were given instructions for proper usage. Disposable TYVEK© suits were provided for each worker, in order to minimize the transfer of LBP dust to other parts of the shop or to the employee’s homes. These suits were disposed of after each use.

In order to minimize exposure to other FPL staff and the general public, several measures were taken. As explained earlier, the newly purchased dust collection system served to contain and direct the contaminated waste outdoors. Announcements to staff warning of ongoing operations were made though the local daily bulletin. Work areas directly involved with milling operations were cordoned off, either using signage or visible barriers.

In order to determine if the specific woodworking operations to be used in the remilling of the LBP coated siding produced hazardous levels of airborne lead air sampling was performed. Personnel performing specific milling operations indoors were fitted with a personal air monitoring pump. A general purpose air monitoring pump was used to sample air outside the building, both as a means to establish a background control (clean) sample as well as a means to sample the air around the exhaust of the dust collection system. The air sample collection cartridges were sent to a licensed State of Wisconsin laboratory for analysis.

In their contract with FPL, ERDC/CERL required that all waste material be disposed of according to prevailing state regulations. However, for their own research purposes, ERDC/CERL requested FPL transport the shavings to them for evaluation. This material was containerized for shipping in standard Gaylord corrugated box containers (lined with plastic) for shipment.

Lead Penetration in Wood Siding.

Previous testing (by others) of wood siding at Fort Ord suggested that the lead from LBP might have penetrated into the wood siding to a considerable depth (>1/4”). To determine if this was the case, representative samples of siding from both Fort Ord and Fort Campbell were tested for total lead content. Specially purchased power woodworking equipment was used to plane off the paint surface and subsequent layers of wood to produce specimens of varying thickness. Specimens were sent to ERDC/CERL for analysis.

In order to determine if residual lead was present on the machined wood profiles (either through cross contamination from the molder knifes or from settled dust), lead testing was performed. A standard method provided by the American Society of Testing and Materials (ASTM) was used. ASTM E-1728 specifies the use of a wiping cloth to collect settled dust. The original siding, the manufactured profiles, as well as the machinery used at FPL were sampled using this method.

Results of these lead penetration tests are tabulated in _____. They indicate that the lead contained in LBP does not penetrate the remilled wood siding, in significant quantities, more than a few hundredths of an inch.

Selection of End-Product Profiles Prior to Milling.

Prior to milling each piece of siding was evaluated for its potential to be milled into a saleable profile. Various visual characteristics identified necessary trimming to eliminate unusable length, and helped segregate each piece into a profile classification:

(photo of v-groove profile)
(photo of flooring profile)
(photo of bevel siding profile)

Segregation into the various profile classifications was based mainly on recoverable length; however another overriding constraint on the end-products selected was based on the existing siding thickness (nominal ¾”). Obviously, only products with final dimensions less than this were possible. Because wood-flooring grades will accept short pieces (as short as 16”), pieces up to 7’ in length were classified as T&G flooring. Wood paneling is typically sold in lengths greater than 8’, and often to 10’, to accommodate vertical placement on interior walls. Therefore, siding pieces from 8’ to 10’ were segregated for remanufacture into V-Groove paneling. Lengths longer than 10’ were segregated for remanufacture as Bevel Siding, because longer length siding is preferred in the home building market and commands the highest price.

Besides being suitable for both interior and exterior applications these three profiles were also selected because:

- The T&G Flooring, V-Groove and Beveled Siding profiles are based upon West Coast Lumber Inspection Bureau (WCLIB) and Southern Pine Inspection Rules (SPIB) standard milled lumber profiles.
- The depths of these profiles should eliminate weathering related defects and be of adequate thickness for LBP removal.
- At least one profile should result in a final product that can utilize short lengths of siding without significantly affecting market value.
- These profiles maximize fiber recovery with a minimum of contaminated waste.
- These profiles are well recognized by builders and are common to residential and commercial building construction.

Summary of Conclusions.

The following indicates the estimated product yield for the siding from Fort Campbell. The yield of T&G flooring is lower than for Fort Ord, however the percentage yield of V-Groove paneling is higher. This is due to the fact that the average length of siding from Fort Campbell was greater than for Fort Ord (4.8 ft. vs. 5.7 ft.)

Profile	Average Initial Piece Length (ft)	Piece Count	Estimated Recovery (lf)
T&G Flooring	5.7	507	2108
V-Groove Paneling	9.9	113	902
Bevel Siding	12.5	162	1705

The following shows an example of the T&G flooring produced from the Fort Campbell siding. While there were many knots present in this flooring and a low percentage of vertical grain material, it was deemed attractive, nonetheless.

(photo of Fort Campbell flooring)

It is evident, however, that the Douglas Fir products milled from the Fort Ord siding are a much more valuable material. Obviously, not all siding material is of equal quality or potential.

(photo of Fort Ord Flooring)
(photo of Fort Ord v-groove)
(photo of Fort Ord bevel siding flooring)

The following general conclusions can be made regarding this project:

1. *Salvageable Siding*: Drop pattern wood siding salvaged from military buildings can be successfully remanufactured into value-added products using equipment commonly found in the new and used woodworking machinery market.

2. *Commercial Dust Collection Systems*: When properly sized and specified, commonly available woodworking dust collection systems can be used to safely filter and collect waste LBP shavings and dust from re-machining operations of wood coated with LBP. Lead exposures to workers in the immediate vicinity of remanufacturing operations using the 4-head molder were found to be less than 1/10 that of the OSHA Permissible Exposure Limit (PEL) for indoor lead exposure (50 $\mu g/m^3$).

3. *Three Product Profiles*: An evaluation of three product profiles, including tongue and groove (T&G) flooring, V-groove paneling, and bevel siding indicated that all could successfully remanufactured from the ¾" thick salvaged wood siding. It was concluded that T&G flooring is a promising product, as short pieces of siding can be utilized. Additionally, the nail holes present in the salvaged siding may not significantly affect the market value of the T&G flooring.

4. *Siding Defects*: An evaluation of the Douglas fir siding from Fort Ord and the Southern Pine siding from Fort Campbell indicated that about 1/3 of total length was lost to end trim, splits, and other defects.

5. *Decay & Distress In Wood Samples*: The siding salvaged from Fort Ord contained far less wood decay than the siding salvaged from Fort Campbell. The primary reason is likely the dryer seasonal conditions (wood dryness) associated with the Fort Ord location. Surface checking and end-splits in the Fort Ord siding were less frequent than the siding salvaged from Fort Campbell.

6. *Landfill Diversion by Weight*: As much as 50% of the *weight* of the salvaged Fort Ord siding can be saved from landfill disposal by remanufacturing into T&G flooring (i.e., only 50% of siding ends up as waste). Savings are somewhat lower for other profiles and for the Fort Campbell siding, due to its greater width.

7. *Market Value (Flooring)*: An estimated *market value* for Douglas fir <u>flooring</u> produced from the siding from a typical two-story Fort Ord barrack is calculated to be *at least* $5,000.

8. *Market Value (Millwork)*: It is estimated that the remanufactured Douglas fir <u>millwork</u> (Fort Ord siding) would have a potential *producer* sale value of about

$1.20 bf to $1.90 bf. In contrast, Southern Pine millwork (Fort Campbell siding) would have a significantly lower potential market value estimated at about $0.80 bf.

A Caveat: The results of these trials demonstrate great promise for safely salvaging and remanufacturing LBP coated wood. However, it is an extrapolation to assume that these same results can be achieved everywhere. Differences in climate, maintenance history, exposure to the elements, regional availability of certain woods and other considerations may yield entirely different outcomes. An assessment of the type and quality of siding should be made prior to any significant investment in this type of recycling.

8. A DISCUSSION ABOUT LEAD-BASED PAINT

An Absence of Guidance.

The issue of lead-based paint can be, and frequently is, problematic with regards to deconstruction. Lead-based paint appears on much of the building materials that are recovered through deconstruction, and therefore available for resale and reuse. The lead content of consumer paints and lead-based paint hazard in housing is regulated through a number of federal standards and statutes.

It is observed, however, that Army installations are usually unwilling to allow LBP-containing materials off of the installation, or unwilling to consider deconstruction or recycling of any materials containing LBP. The reason cited is "liability." Installations are reluctant to expose the Army to what is perceived to be an increased risk of litigation, should some future damage be associated with those materials. The difficulty seems to be that this reluctance is based on a *perceived* risk, and standard practice, *not* specific regulation, standard, policy, or other forms of guidance, either allowing or not allowing salvage and reuse of LBP-containing materials. The conservative interpretation will be that if there is no explicit statement allowing some activity, then is by default not allowed.

Promoting deconstruction must not imply an abandonment of health and safety precautions. However, prohibiting reuse of otherwise valuable materials because of a LBP presence may be unnecessary and contrary to other environmental principles relating to the conservation of resources. Demolishing a typical WWII-era barracks will generate over 100 tons of debris (not counting concrete). Yet, the hundred or so pounds of lead contained in the painted siding can "contaminate" the entire debris stream.

Standards governing LBP in consumer products and LBP hazard in homes do not directly apply to a deconstruction scenario. What is needed by the Army, and any potential consumer of deconstruction services, is guidance that explicitly addresses the removal of materials from a building with the purpose of reusing or recycling, the handling of materials containing LBP, any reprocessing or remanufacturing that may be performed, and re-use of the product.

Relevant Federal Regulations and Standards.

The Resource Conservation and Recovery Act (RCRA) applies to waste, not salvaged building materials. Even if it has a lead concentration greater than the 5 mg/l threshold described by RCRA, a salvaged building material is not a RCRA hazardous waste if it is not introduced into the waste stream.

Per the Consumer Product Safety Act, CPSA 15 USC 2057-8, 1978, CPSC limited the lead content of paint (except for industrial coatings such as bridge paint) to be no more than 0.06% (600ppm), dry weight.

Lead-based paint is regulated in housing where children most vulnerable to the hazards of lead are present (children under the age of six years old). This is referred to as "target housing" and "residential dwelling or child-occupied facility." Note that these regulations apply to a very narrow definition of environments. They do not apply to housing or residential facilities in general, nor do they apply to other facilities where children are not present.

> 40 CFR PART 745.61; IDENTIFICATION OF DANGEROUS LEVELS OF LEAD; FINAL RULE: In this regulation, EPA defines "lead-based paint hazard" as 1) any LBP on a friction surface subject to abrasion where dust levels are greater than defined in this Rule, 2) damaged or deteriorated paint on an impact surface, 3) any chewable LBP where there is evidence of teeth marks, or 4) any other deteriorated paint on the interior or exterior of a residential dwelling or child-occupied facility. This document defines deteriorated paint as "any interior or exterior paint or other coating that is peeling, chipping, chalking, or cracking, or any paint or coating located on an interior or exterior surface or fixture that is otherwise damaged or separated from the substrate."
>
> EPA FACT SHEET; IDENTIFYING LEAD HAZARDS IN RESIDENTIAL PROPERTIES: This document describes the same conditions that make LBP a hazard, i.e. it is deteriorating, on a friction or impact surface, or is child-accessible and shows evidence of teeth marks. This document also states that "Lead paint is usually not a hazard if the paint is in good condition and is not on an impact or friction surface (like a window, door, or stair)."
>
> HUD 24 CFR PART 35, EPA 40 CFR PART 745 LEAD; REQUIREMENTS FOR DISCLOSURE OF KNOWN LEAD-BASED PAINT AND/OR LEAD-BASED PAINT HAZARDS IN HOUSING; FINAL RULE. This document describes requirements for disclosing LBP when selling or leasing target housing. A definition of "lead-based paint hazard" is consistent with those given above. To paraphrase, the seller or lessor must disclose to the purchaser or lesee the presence of any knowl LBP and LBP hazard; provide available records and reports, provide the purchaser or lesee with a lead hazard information pamphlet (see below), give the purchaser an opportunity to conduct a risk assessment or inspection, and attach specific disclosure and warning language to the sale or lease contract. The buyer or lessor must then acknowledge they have received the information and have had the opportunity to conduct an inspection. This document provides the specific disclosure language, sample contract provisions, and reference to the EPA pamphlet PROTECT YOUR FAMILY FROM LEAD IN YOUR HOME.

EPA/HUD/CPSC PROTECT YOUR FAMILY FROM LEAD IN YOUR HOME: This document is referenced as the required lead hazard information pamphlet, per the disclosure Rule, above. It describes the harmful effects of lead in body, conditions that constitute lead hazard, and precautionary measures. The description of lead hazard is consistent with the conditions described above. This pamphlet also states that "Lead based paint is usually not a hazard if it is in good condition and is not on an impact or friction surface like a window."

16 CFR PART 1500.230 CONSUMER PRODUCTS SAFETY COMMISSION GUIDANCE; GUIDANCE FOR LEAD (Pb) IN CONSUMER PRODUCTS: Note that this is guidance, not a Rule. It offers the following: Household products that expose children to hazardous quantities of lead under reasonably forseeable conditions of handling or use are "hazardous substances." A toy or other item intended for use by children containing a hazardous amount of lead accessible for children to ingest is banned. A household product that is not intended for children but which may create a risk of injury because it contains lead requires precautionary labeling under 15 U.S.C. 1261 (p). CPSC bans paint and other surface coatings on toys and other articles intended for use by children with lead concentration of over 0.06%.

29 CFR PART 1926 HEALTH AND SAFETY REGULATIONS FOR CONSTRUCTION: These standards regulate safety on a construction jobsite. Of particular interest with regards to deconstruction are Subpart D, Occupational Health and Environmental Controls, Section 62, Lead. These provisions limit worker exposure to lead and blood lead action levels. Subpart T, Demolition provides guidance on demolition safety.

The Department of Defense and US EPA have convened an Interagency Workgroup to develop the Lead-Based Paint Guidelines for Disposal of Department of Defense Residential Real Property – A Field Guide. While not a regulation per se, it is a description of practices the DoD and EPA have determined appropriate when transferring federal property to the private sector. Once again, however, the focus of this document is exposure of children to LBP hazard, and provides guidance consistent with the existing "Title X" regulations.

A Summary of the Applicability of LBP Regulations to Deconstruction.

Salvaged building materials containing LBP are not regulated by RCRA.

Contemporary paints are defined by CPSC to be "lead free" if they contain no more than 0.06% (600 ppm) lead, dry weight of the paint.

There is no explicit regulation or guidance at the federal level that either permits or prohibits the sale or transfer of building materials that are painted with LBP.

Existing regulations defining and governing LBP hazard are developed for a specific set of conditions; "target housing," which is a residence or child-occupied facility. LBP in other facility types are not regulated.

In a "target housing" context, LBP is defined as a hazard if it is deteriorated (i.e. peeling, chipping, chalking, cracking, or otherwise damaged or separated from the substrate), on friction surfaces subject to abrasion, and on impact surfaces (i.e. subject to repeated sudden forces).

In a "target housing" context, LBP hazard must be disclosed prior to a property's sale or lease.

Even in a "target housing" context, LBP is not considered hazardous if it is in good condition and not on a friction or impact surface.

A "hazardous" level of lead on children's toys and other articles used by children is defined by CPSC at 0.06% dry weight; such items exceeding that limit are banned.

Household items not intended for children's use but possibly creating a risk of injury (i.e. exceeding a lead content of 0.06% dry weight) requires precautionary labeling.

Deconstruction and material handling activities are governed by OSHA (29 CFR 1926). Subpart T, Demolition, and Section 62, Lead, are of specific interest to deconstruction.

A Reasonable Approach.

It seems reasonable to conclude the following in the context of deconstructing WWII-era buildings and salvaging building materials:

- Deconstruction activities must observe OSHA construction safety standards.

- Painted materials found in WWII-era buildings should be assumed to be LBP, unless specifically found not to be. However, unless painted materials are introduced into the waste stream, they are not regulated by RCRA.

- Not all painted items will be of sufficient value to salvage for resale and reuse. However, were it not for the paint coating, some items may posses significant value. The value of the material or product may justify acceptance of the LBP coating.

- LBP that is in good condition is not considered hazardous, even in the “target housing” context. Based on a "target housing" model, LBP is hazardous if it is deteriorated, or if it has been applied to a friction or impact surface.

- There are no federal regulations explicitly allowing or prohibiting materials with deteriorated LBP to be sold, donated, or otherwise transferred from one party to another.

- While the HUD/EPA Rules for disclosure and acknowledgement of the presence of LBP, and the CPSC Guidance for labeling a possible lead hazard to children do not directly apply to the transfer of salvaged building materials or products, it is clear that HUD, EPA, and CPSC intend to inform the public about LBP hazards, especially in environments where children are present. Therefore, disclosure / precautionary labeling would be a prudent practice for the Army in a deconstruction and material sale and reuse scenario. The HUD/EPA Rules for disclosure provide specific language, and reference further guidance for controlling lead hazards in homes. This language may provide a reasonable model for disclosing the presence of LBP on salvaged building materials. The precautionary information may include disclosure of the presence of LBP, information on health hazards to children, precautions for preventing exposure of lead-based painted materials to habitable spaces and surfaces, the referenced guidance documents, and acknowledgment of receipt of the disclosure and precautionary information.

Fort Campbell and AHfH followed this model for the Pilot Deconstruction Project. In a previous bid-for-sale of a WWII-era wood-framed building, Fort Campbell included a disclosure of the probable existence of LBP. EDRC/CERL included Fort Campbell's statement in their Agreement with AHfH, which is as follows.

> "LEAD BASED PAINT DISCLOSURE. The Recipient is hereby informed and does acknowledge that lead-based paint was commonly used at the time these buildings were constructed and/or modified and may exist on painted surfaces of the buildings or within the buildings and/or their associated structures. In accordance with the Environmental Protection Agency and the Department of Housing and Urban Development's final rule "Lead; Requirements for Disclosure of Known Lead-Based Paint and/or Lead-Based Paint Hazards in Housing" (61 FR 9064-9088), a federally approved lead hazard information pamphlet and disclosure of any known lead-based paint and/or lead-based paint hazards will be provided to the Recipient upon request."

Forts McCoy and Knox have also included similar language in their solicitations for salvaging and recycling building materials. Contracts for the bid-for-sale, or auction for salvage rights, for these three installations are included in the Corps of Engineers Public Works Technical Bulletin (PWTB) 200-1-23, Guidance for the Reduction of Demolition Waste through Reuse and Recycling, available on the Huntsville Engineering Support Center's TECHINFO website.

Austin HfH applied the definition of LBP hazard when selecting painted materials to salvage or to discard as debris. If paint was “deteriorated,” per the EPA pamphlet PROTECT YOUR FAMILY FROM LEAD IN YOUR HOME, the material was discarded. If paint was in “good condition” per that document’s description, AHfH resold it, but with an accompanying disclosure statement similar to that required by HUD, which is as follows:

[[BILL; PROVIDE STATEMENT]]

The California Integrated Waste Management Board offers the following guidance relative to the reuse of painted building materials in its Military Base Closure Handbook, A Guide To Construction And Demolition Materials Recovery, Revised January 2002.

> "The Department of Toxic Substances Control (DTSC) issued clarifying language regarding lead-based paint in Regulation Guidance: Lead Painted Building Debris dated June 13, 1994. "The Department does not generally expect intact painted building materials to exhibit a characteristic of a hazardous waste pursuant to the criteria contained in Chapter 11, Division 4.5, Title 22, California Code of Regulations (Title 22) and would not require the disposal of intact painted material as a hazardous waste. The waste classification is dependent, in part, upon the physical characteristics of the waste. For example, when the paint is still bonded to the building materials, a generator should consider the ratio of the mass of all the materials in a waste to the lead content of the paint when determining the hazardous waste classification of the intact demolition debris. However, if during the demolition or dismantling of the buildings, the paint is separated from the building material (e.g., chemically or physically removed), then the paint waste should be evaluated independently from the building material to determine its proper management." DTSC also states that it is the generator's responsibility to determine if his waste is hazardous or nonhazardous. (To obtain documents relating to the sampling and classification of wastes, call DTSC's waste evaluation helpline at (916) 322-7676 or consult your telephone directory for regional offices of DTSC and contact the local duty officer.)
>
> There are essentially three options available for reuse of lumber that is coated with lead-based paint. The first option is to remove the paint. This will leave the wood clean, but creates the problem of disposing of the now potentially hazardous residue. This option is usually only cost effective for large dimension lumber or unique timbers or fixtures. The second option is to encapsulate the lead paint by painting over it. This is considered an adequate remediation technique which eliminates the exposure pathway of the lead and allows use of the structure. However, if deconstruction or demolition is planned in the future, the lead-based paint will be exposed again. The third option for remediating lead painted materials for reuse is

to reverse the painted surface to expose the unpainted portion of the lumber. This again eliminates the pathway for human contact, but would lead to re-exposure under demolition of the structure. Any paint removed from the structure has to be evaluated separately to determine if it is a hazardous material. Care must be taken not to contaminate surrounding soil or water."

While the specific regulatory citations are unique to the State of California, the measures to prevent LBP exposure to occupied spaces would seem to be universally applicable.

8. CONCLUSIONS AND LESSONS LEARNED.

A general conclusion can be made that this Pilot Deconstruction Project was a complete success. The following objectives were accomplished.

Both Fort Campbell and ERDC/CERL administered this project within the constraints present with any similar demolition contract. While not without any problems whatsoever, the project progressed according to plan.

Five buildings were deconstructed. The end product was the removal of five buildings (22,700 square feet in total), and five clean building sites were left in their place.

Austin Habitat for Humanity successfully applied National Civilian Community Corps (NCCC) / AmeriCorps personnel to deconstruction services. While not a trained, traditional construction workforce, their performance and accomplishment was impressive.

A process was established by which Fort Campbell was able to deconstruct WWII-era buildings using a non-traditional workforce. This process is described throughout the body of this report. Fort Campbell, and other Army installations, will be able to apply this process in the future. While it must be realized that every location and project will have unique issues, the Fort Campbell project can serve as a fundamentally sound template for the Army.

WWII-era wood framed buildings can be considered a resource, as opposed to a disposal liability. In the right hands, a significant amount of material can successfully and economically be recovered for reuse. Over 85% of the buildings mass was 1) recovered for reuse, and 2) NOT delivered to the landfill.

The Statement of Work developed by ERDC/CERL, and in collaboration with various Fort Campbell offices, proved to be an accurate, workable description of deconstruction requirements. It can be adapted to future deconstruction contracts.

In addition to the amount of materials, the quality of materials (especially lumber) was quite high. Very little deterioration or damage was found.

The cost, time, quality, and safety performance for the Pilot Project were all satisfactory.

> When landfill life-cycle cost avoidance is considered, deconstruction cost the Government less than conventional demolition.

While deconstruction took about twice the time that conventional demolition would, the extra was generally a matter of days, and did not create any adverse consequences.

The end product of the deconstruction project was comparable to conventional demolition; i.e. a clean site. AHfH performed all the Work as would a traditional demolition contractor.

Over 85% of the buildings' mass was recovered for reuse or recycled. AHfH considered both the quantities and qualities of the materials

AHfH, UF-CCE, and the NCCC / AmeriCorps crews all maintained a safe workplace. A minor injury that required no treatment was the only blemish on safety performance, and that was experienced by one of the supervisors. Several observations were made throughout the project that alerted the AHfH supervisors and AmeriCorps personnel to potential hazards. Measures were taken in response, and no incidents occurred.

Siding was removed from one Fort Campbell building and evaluated for the feasibility of reprocessing it to a higher value wood product. The species and grade of material used for siding at Fort Campbell was not any near the quality it is at some installations, such as Fort Ord. However, once the paint is removed, it was found that reasonably attractive wood profiles, conforming to established millwork standards, could be produced. Loss from deterioration and damage did occur, although the vast majority of the siding boards were suitable for reprocessing. Higher quality materials, such as that found at Fort Ord, can be remanufactured into products that can be quite valuable.

An on-post market for the recovered materials existed that was not anticipated. Both civilian and military personnel purchased materials from AHfH largely on a drive-by basis. Military units used scrap material for their own training exercises, which saved them from buying new materials from local building supply stores.

The Fort Campbell Environmental Division and AHfH addressed the handling and resale of materials containing LBP in a fashion that they felt informed and protected the public, while not forcing the disposal of otherwise valuable building materials. Fort Campbell had developed a disclosure statement that they felt informed and protected the public about LBP hazards and protected the Government from extraordinary exposure. AHfH applied the description of "deteriorated" LBP and LBP in "good condition" from the EPA pamphlet on lead hazard in homes. Materials that contained "deteriorated" LBP were deposited in the landfill, such as the siding material. Materials were contained LBP in "good condition" were sold to the public. AHfH then distributed a disclosure statement with the sale of all items containing LBP.

The Fort Campbell Pollution Prevention branch initiated a process by which scrap metals, without LBP or asbestos, could be taken directly to DRMO without the ownership and hand-receipt records and submittal forms previously required. This process removed a major obstacle to recycling metals that should be applicable to all future deconstruction, demolition, and construction projects. These recycled metals were, and will continue to be reported in the SWAR.

The AmeriCorps crews made a positive impression on Fort Campbell personnel. Fort Campbell recognized each individual with a Certificate of Appreciation.

Lessons Learned.

Despite the overall positive results, several issues and events arose that suggest improvements can be made in future deconstruction programs. These are as follows:

Command support was critical. Both the Director and Deputy Director of Public Works were supporting this project. Their presence at planning meetings resulted in the necessary actions being taken. Their absence had the opposite effect.

Pollution Prevention Branch was leading this project. As so many Fort Campbell offices and activities had some involvement in the project, coordination and follow-up became a major requirements. Assignments must be followed-up to ensure the process continues. Lapses in actions or responsibilities will result in major problems later in the process.

As it is now evident that troop units can use construction materials and scrap, an installation should undertake an “outreach” program to providing information about deconstruction projects. In this way, the units can obtain materials without having purchase new materials, and help divert debris from the landfill.

Initiating work orders to terminate utilities building by building proved to be cumbersome. Every effort should be made to schedule deconstruction so that the utilities can be terminated at one time with one work order. Multiple work orders and site visits are cumbersome. Furthermore, submitting work orders for different buildings and different times increases the risk that tasks may not be completed at the time requested. If possible, utilities should remain operational in one of a nearby vacant buildings that will not be deconstructed.

Even if deconstruction will require no excavation, obtaining dig permits, or otherwise marking the exact location of utilities, is recommended. If a utility is located where it may be run over by construction equipment, it can then be determined whether any damage is or is not likely to occur. If it is, the appropriate precautions can be taken.

The pre-job meetings with DRMO was a positive feature of the project, especially in light of the new metals recycling procedures initiated by P2 Branch. On-site assistance by DRMO personnel also helped clarify what was acceptable and not acceptable for recycling.

If possible, the Installation should find securable cover for the contractor to use as processing and storage area. Working in a building as it's being deconstructed was not effective.

Austin HfH was capable of performing all required services. However, it was clear that they were neither familiar, nor comfortable with formal contracting practices. While it is acknowledged that a two- or three-inch thick contract document is intimidating, and every effort should be made to simplify the Agreement, working with contract documents ***will*** be a requirement for other Army, Federal, and public types of deconstruction projects. AHfH and other non-traditional deconstruction services will have to familiarize themselves with the formalities of contracting. Specific issues of interest are as follows.

> The designated Point of Contact is the only person authorized to initiate any actions relative to scope or compensation.
>
> The Statement of Work (and/or drawings and specifications) is the contractually binding description of the Work.
>
> Modifications to the contract are possible, per the conditions described in the contract.
>
> The contractor is still responsible for the Work until all the final inspection and close-out procedures, described in the contract, have been performed.

Army buildings, especially those built at the outset of World War II are consistent in their material content and construction, but rarely are they identical. Furthermore, modifications have taken place throughout their lives. While assuming the typical case will be valid most of the time, a building-by-building survey should be conducted to confirm there are no significant changed conditions, such as fire damage.

The presence of a concrete topping on a framed floor will in all likelihood make deconstruction of that floor impractical. The effort to remove the concrete and reinforcing will usually exceed the point of diminishing returns. Furthermore, if the concrete topping is placed in a wet area (at least in its original configuration), there is likely to be deterioration in the framing due to leakage, if not through the concrete, then around drains and penetrations. A thorough under-floor

examination should be conducted to determine the value of materials under the topping, then an assessment made as to the effort required to remove the slab.

Mobilizing for the final demolition and clean-up is expensive. Where possible, demolition of concrete foundations and other portions of the building not completely deconstructed, should be allowed to take place all at one time, rather than building-by-building, which would require multiple mobilization cycles.

Knowledge of the local marketplace is important to finding outlets for the recovered materials. Marketing in advance of deconstruction is critical if a robust local market does not exist. While AHfH did make some inquiries and did place some advertisements in local newspapers, in retrospect they should have been more aggressive about marketing. It is somewhat surprising that more activity was not forthcoming from the Nashville market, which is only 40 miles to the south. The National Association of Homebuilders Research Center identified Nashville as a market with an active deconstruction industry, one that should continue to be successful in the future.

Safety cannot be overemphasized, especially when volunteers or a non-traditional workforce is on-site. Sever observations were made that, if missed, could have lead to a hazardous situation. While AHfH, UF-CCE, ERDC/CERL, and the AmeriCorps crews were diligent about safety, no amount of attention to safety procedures is too much attention. Developing, and maintaining, a safety program must continue to be a top priority for deconstruction projects.

APPENDIX A.
DECONSTRUCTING SURPLUS ARMY BUILDINGS. A WHITE PAPER

Background.

Army installations are currently removing World War II-era buildings from their real property inventories. These buildings are mostly wood framed structures built in the early 1940s as temporary facilities. Typically, they have remained occupied and have been upgraded several times over the last 60 years. However, they are now functionally obsolete, and further operation and maintenance expenditures cannot be justified. Under the Army's Facility Reduction Program, these surplus buildings are being demolished.

Deleted: '

The U. S. Army Engineer Research and Develop Center (ERDC) Construction Engineering Research Laboratory (CERL) is investigating ways toe reduce solid waste on military installations. This paper discusses deconstruction and recycling as an alternative to landfilling construction and demolition (C&D) waste.

The following represents a summary of current Army practices for disposing of these buildings. Information was gathered from personnel involved in removing WWII-era wood buildings at four major Army installations and three installations closed under the Base Realignment and Closure Program. This White Paper includes the following discussions.

A problem statement.
Current Army demolition practices.
The deconstruction industry.
Potential for deconstruction Army buildings.
Obstacles to deconstructing Army buildings.
Conclusions and recommendations.

Problem Statement.

The Army has over 30 million square feet of surplus buildings to remove by Fiscal Year 2005. This will cost roughly $27 million dollars. Some estimates triple that amount if demolition requirements for Army Family Housing, Military Construction, and other major construction programs are included.

However, the initial expense of demolishing buildings is only part of an installation's problem. Installations estimate the life cycle costs of landfill management to be about $30 – 50 per ton, or roughly $1 Million/acre. Demolishing a typical 2-story WWII barracks will generate close to 400 tons of debris.

The solid waste generated from construction and demolition activities now constitutes roughly 85% of some installations' solid waste burdens. Army landfill

capacities are diminishing. Further landfill expansion will be extremely difficult, if possible at all. When on-post landfills are closed, tipping fees at local landfills will add $30 to $90 per ton of debris, not including transportation costs.

The adverse effects of landfilling demolition debris extend beyond Army properties as well. Solid waste is also linked to greenhouse gas. The U.S. Environmental Protection Agency (EPA) has identified solid waste reduction as one of many ways to mitigate global climate change. The manufacture, distribution, and use of products – as well as management of the resulting waste – all result in greenhouse gas emissions. Waste prevention and recycling reduce greenhouse gases associated with these activities by reducing methane emissions, saving energy, and increasing forest carbon sequestration.

EPA has developed the WAste Reduction Model (WARM) to analyze greenhouse gas emissions reductions from several different waste management practices. WARM is available in a Web-based calculator format and as a Microsoft Excel spreadsheet. WARM calculates and totals greenhouse gas emissions of baseline and alternative waste management practices—source reduction, recycling, combustion, composting, and landfilling. The model calculates in metric tons of carbon equivalent (MTCE) across a wide range of material types that compose municipal solid waste (MSW).

In summary, the solid waste problem attributable to construction and demolition debris is becoming problematic to the Army. Any opportunity to reduce this burden – that is, keep materials out of the landfill -- should be pursued.

Current Demolition Practices.

Typically, WWII-era buildings are demolished under one of two general scenarios, although numerous variations are practiced. Buildings may be demolished to remove them from real property inventory (i.e., Facility Reduction), or to clear a site for new construction. The processes are different for each.

Whether more WWII wood buildings are demolished under the Facility Reduction Program, or as part of a new construction project, depends on the installation. The primary variables are the WWII buildings' location on the installation, new construction programs, and funding availability. Simple observation would suggest most WWII wood buildings are removed under the Facility Reduction Program on most installations.

A third situation, installations under the Base Realignment and Closure (BRAC) procedures, presents a significant requirement for building removal. Under BRAC property transfers, the Army is responsible for removing or remediating an buildings with environmental or physical hazards. Most buildings are eventually transferred. Because the Army does not assume responsibility for removing

these transferred buildings, this is not perceived as an Army problem, but can be a significant barrier to economic development to the receiving organization.

Facility Reduction.

Under a Facility Reduction scenario, buildings are demolished simply to get rid of them and, therefore, avoid further operation and maintenance expenses. Demolition is funded by the installation out of their Operation and Maintenance, Army (OMA) appropriations. The installation's Directorate of Public Works (sometimes organized as the Public Works Business Center) administers this activity. This organization will be referred to as "Public Works" or PW in this paper.

Despite being classified as "surplus," WWII-era buildings are more often than not occupied. The PW Master Planning branch will identify facilities that are ready for demolition once the occupants are relocated, the buildings are vacated, and the appropriate property transfer actions are completed. Typically, this process will vacate buildings in relatively small numbers at any one time. It is unusual that any more than four to six buildings will be vacated at once. The availability of space on the installation, into which occupants can be relocated, dictates the rate at which buildings are vacated. A small group of buildings may be vacated each several weeks, or each five or six months or so. Vacating buildings in large numbers at one time, say 50 to 100, would certainly be the exception.

Once buildings are designated for demolition, PW contracts for demolition services. A common practice is to retain a contractor on a Job Order Contract (JOC), which is an indefinite-delivery type of contract. Awarding a JOC involves a competitive process. But once a JOC has been initiated, PW can assign tasks relatively quickly, as the advertising and bidding requirements have already been satisfied. Demolition tasks can be defined, specified, negotiated, and begun within a couple of weeks. Other types of indefinite-delivery types of contracts are also utilized. As demolition services can be retained quickly and simply under a JOC or similar arrangement, advertising and awarding a contract for demolition services as an independent contract action is generally not done.

Practice among installations varies regarding the removal of asbestos, asbestos-containing materials (ACM), and hazardous materials. In some cases, the PW Environmental Division will contract independently to have these materials removed before demolition. Otherwise, these requirements are included in the demolition contractor's scope of work. The demolition contractor, in turn, will subcontract asbestos, ACM, and hazardous materials removal to qualified firms.

Once buildings are cleared of asbestos, ACM, and hazardous materials, the demolition contractor will terminate utilities at the designated locations, mechanically demolish a building, and crush the debris. The track mounted hydraulic excavator seems to be the equipment of choice at present. Debris is

then loaded into a dump truck and transported to a landfill. Removal of foundations and utilities below grade is typically not required. Concrete foundation walls and floor slabs are broken at grade and loaded into dump trucks. Piers are frequently just extracted intact. Concrete debris is then hauled to a landfill. The site is then graded to drain, seeded, watered, and mulched. A standing building will become a flat, seeded site usually in 3 or 4 days.

To reduce the cost of demolition, the contractor will be allowed to deposit debris in the installation's landfill at no cost. The project specifications frequently go so far as to require ALL debris be deposited in the installation's landfill; removing materials from the installation is prohibited. Asbestos and ACM may or may not be allowed, depending on the installation. Hazardous materials are typically taken to the appropriately classified disposal facility, which is usually located off-site. If, however, an installation no longer operates an active landfill, the contractor must deposit demolition debris in a municipal or commercial landfill at the prevailing tipping fee.

Under a traditional demolition scenario, the cost to demolish a building is roughly $3/SF. Including utilities termination, concrete removal, grading, and seeding, the cost of building removal is typically in the $7-8/SF range, but can vary depending on the location and tipping provisions. Total cost to remove a WWII wood framed building, including asbestos, ACM, and hazardous materials removal is programmed at $9/SF.

In summary, WWII wood buildings can be demolished relative quickly after they are vacated and cleared of asbestos, ACM, and hazardous materials. They are typically demolished in relatively small numbers at any one time, but groups of buildings may be vacated and demolished as frequently as each 2 – 4 weeks. The system of defining demolition tasks under a JOC works well for the purposes, and provides a responsive mechanism for removing surplus buildings.

Salvage or recovering or recycling materials is not considered when demolishing WWII wood buildings. Typically, the PW maintenance shops will be given the opportunity to remove items for future repair or replacement requirements. These items generally include the more expensive mechanical and electrical components that are relatively new and should provide a reasonable service life. However, the ability to maintain extensive stocks is limited. Therefore, only selected items are usually recovered. For all intents and purposes, the building is destined for the landfill.

New Construction.

New construction on Army installations is administered by the Corps of Engineers District serving that installation. WWII buildings may occupy the site on which new facilities will be built. In this case, removal of the buildings typically is included within the construction requirement for the new facility. Construction

is funded through appropriations (not the installation's OMA accounts). Demolition is included within the construction contract amount, and is one activity of the overall construction schedule. Design, contracting, and construction activities are administered by the Corps District, not the installation's PW. It is the installation's responsibility to vacate buildings in time for the construction contractor to demolish them and proceed with construction.

Demolition tasks may be performed by the General Contractor for the new construction project, or subcontracted to a specialty contractor. In either case, the responsibility for performing these services is ultimately the General Contractor's. The physical demolition processes, at least for wood framed buildings, is similar to that described under Facility Reduction, above. Buried utilities and foundations below grade will be removed where they would interfere with the new construction.

Landfilling all debris in the installation's landfill, at no cost to the contractor, is typically specified in the construction contract documents. Again, the rationale is to reduce the cost of construction. Building demolition costs are similar to those described under Facility Reduction, above. However, as demolition is included in the construction contract cost, demolition costs are included as line items in the total project construction estimate. There is no independent funding.

The time taken to demolish a building will be similar to the Facility Reduction scenario. The demolition activities now are not independent but are on the Critical Path of the construction schedule. Any delay in demolition delays the project in total. The General Contractor may add crews or perform activities concurrently to reduce the overall duration of the demolition activity.

Similar to buildings demolished under the Facility Reduction Program, little consideration is given to salvage or materials' recovery. With the exception of some components salvaged by the PW maintenance shops, the building will be demolished and landfilled.

Deconstruction.

A definition for "Deconstruction" should include the following main points:

–Dismantle the building, generally in the reverse order of construction
–Maximize the reuse and recycling of materials
–Ensure a cost-effective and safe process

Thus, deconstruction is a specific approach to remove materials in order to reuse them, in such a way to preserve their integrity and value to the greatest extent possible, in as economical a manner as possible, while not endangering personnel performing the deconstruction. While definitive standard practices have not yet evolved, an overall approach of disassembly in the reverse order of construction applies in the general case. Deconstruction is generally perceived

as manual disassembly of a building, although various combinations of manual and mechanical methods can be applied to improve cost and time performance.

A number of deconstruction projects have been documented and are now recognized as being notable examples. Among them are:

Deconstruction of a house, Portland OR, 1996 *(See http://www.smartgrowth.org/library/waste_mgmt_update_4.html)*

Deconstruction of a WWII-era warehouse building at The Presidio of San Francisco, CA, 1996 *(See http://www.ciwmb.ca.gov/ConDemo/CaseStudies/Presidio/default.htm)*

Deconstruction of Riverdale Village apartments in Baltimore County, MD, 1997 *(See http://www.smartgrowth.org/pdf/deconstruction.pdf)*

Deconstruction of eight WWII-era buildings of various types at Fort Ord, CA, 1997 *(See http://www.fora.org)*

Deconstruction of two WWII-era industrial buildings at Alameda Naval Air Station, CA, 1997 *(See http://www.conversion.org/cec/dsrr.pdf)*

Deconstruction of Stowe Village apartment units in Hartford CT, 1998 *(See http://www.ilsr.org/recycling/deconatwork.html)*

Deconstruction of ten houses in Gainesville FL, 1999-2000 *(See http://www.cce.ufl.edu/past/deconstruction/reuse.html)*

Positive results have been achieved in these and other deconstruction projects. Recovering 50% to over 90% of the building's materials for reuse or recycling has been recorded. It was acknowledged that deconstruction took considerably longer than simple demolition, thereby increasing initial cost. Based on case study data deconstruction progressed at the rate of roughly 3 - 5 square feet of building per labor-hour. The cost to manually deconstruct a wood frame building was in the range $5-$6/SF, compared to roughly $3/SF for conventional demolition. However, higher initial costs were offset by savings in debris disposal and the resale value of the recovered materials. The net cost of deconstruction was documented at anywhere between $0.12 - $2.28/SF lower than conventional demolition, hauling, and landfilling costs. None of these case studies indicated a net income, where the value of the materials exceeded the cost of deconstruction.

From a contractor's perspective, the additional costs involved in deconstructing buildings and processing the materials are offset by the value of the materials and costs avoided by reducing the volume of debris to be disposed of. A rule of thumb is that selling recovered materials to a used building materials outlet will

yield roughly 25% of the retail value of comparable new materials. If a contractor sold these materials directly, a value of roughly 50% of the retail value of comparable new materials would be reasonable. Alternatively, a contractor can donate materials to a non-profit organization. The contractor then incorporates this donation into the company's income tax calculation. The recipient organization may inventory the materials and assign values, per their own selling price or may simply inventory the donated materials and issue a receipt, whereby the contractor would assign a value. Cost avoidance or savings accrue from reduced hauling and tipping expenses due to a reduced debris volume.

It must be noted that some criticism has been leveled at these case studies. Each has been conducted on a pilot or trial basis, several funded from one-time grants, and several utilizing a non-traditional workforce, such as at-risk youth training for construction trades. Their pay was not always comparable to prevailing scale. Furthermore, the estimated value of recovered materials was sometimes used to calculate cost offset, as opposed to actual resale price. Some argue, therefore, that actual costs will be higher and resale values will be lower if deconstruction were conducted on an ongoing commercial basis.

Whether the net cost of deconstruction is actually less than demolition is still somewhat speculative. If deconstruction is performed on a more routine, commercial basis, methods will certainly evolve to improve cost and time performance. The demand for used building materials, and therefore their economic value, have not yet reached the point where landfilling materials as debris is an uneconomical practice. While landfill tipping fees are increasing in some areas of the U.S., it is still an acceptable price for building removal services. The expense is still not great enough to force a dramatic change in practice. However, all indications are that deconstruction can at least be competitive with conventional demolition practices, if all costs and offsets are considered.

There are three noteworthy examples of deconstruction are evident within the Army. Each of these installations have developed methods to remove surplus buildings while at the same time providing resources and opportunities to their communities.

Fort McCoy, WI advertises surplus buildings for public bid and sells them to the highest bidder. Individuals or small contractors deconstruct the buildings to the foundation. Fort McCoy removes the concrete and turns it over to Engineering Battalions, which grind it and use it on-post. Over the last ten years, Fort McCoy has removed over 140 buildings, and estimates that they have saved over $3.5 million.

Fort Knox conducts a similar process, although bids are solicited through live auction. Fort Knox has disposed of 285 buildings over the last three years, which

has generated over $250,000 in income (through their recycle program), and saved roughly $640,000 in demolition cost avoidance.

There are many examples of deconstruction being as a successful commercial venture. However, deconstruction must still be considered an emerging practice within the building industry. Commercial services are available to deconstruct buildings. There are commercial and non-profit outlets through which salvaged building materials can be sold. There are material exchanges (many through public agencies) where salvaged materials can be traded. However, deconstruction is still very much a "cottage industry" with overall limited capabilities and resources, at least compared to the demolition industry. The Used Building Materials Association does provide an industry forum for those engaged in materials' recovery and reuse. *(See http:// www.ubma.com)* The Reuse Development Organization provides a national clearinghouse for marketing and reusing products and materials, used building materials being one of their interests. *(See http://www.redo.org)*

A discussion of "deconstruction" however, must not be confined to the physical activities of disassembling a building. Disposition of the recovered materials – resale, reuse or recycling -- is critical. Without an outlet for the recovered or recycled materials, deconstruction is a pointless endeavor. Therefore, the availability of used building materials' markets, and economic benefit of recovery and marketing, are equally important considerations as the deconstruction process itself.

In summary, "deconstruction" has not yet entered the mainstream of building removal practices. Awareness within the construction industry and public at large is still quite low. The relative economics of deconstructing buildings appears to be favorable, even compared to demolition and landfilling as the default methods of building disposal. However, public and industry awareness of deconstruction as a viable alternative must still improve. Solid waste problems, pressure on landfill capacity, and increasing cost of debris disposal are certain to improve the visibility of deconstruction as a viable method to remove buildings.

Potential for Deconstructing Army Buildings.

In January 2001, the National Association of Homebuilders Research Center authored "A Report on the Feasibility of Deconstruction" for the U.S. Department of Housing and Urban Development. This report describes deconstruction activities taking place in four U.S. metropolitan areas and summarizes conditions and factors that effect the viability of deconstruction as an ongoing commercial practice.

In this report, an opinion is offered that military installations provide a greater potential for structural deconstruction (i.e. removing the whole building) than metropolitan areas in general. To paraphrase, the rational is:

Redevelopment pressures are greater within the metropolitan area, thus reducing the time and opportunity for extensive disassembly and recovery.

The numbers and uniformity of building types on a military installation can provide the consistency and volume of building materials needed to sustain a used building materials market.

Prevailing housing conditions and policy within metropolitan areas will have a lesser impact on military base deconstruction.

When taken in the context of surplus WWII wood buildings, it is evident that military installations provide a greater potential for successful deconstruction than the community at large. While there are pressures on building sites within an Army installation, they are not always as inhibiting to deconstruction as they may be in the commercial building market. To sustain a deconstruction practice in the private market, the deconstructors must conclude arrangements with individual property owners, one at a time, on an ongoing basis. However, there is essentially one property owner on a military installation. Policy or practice can (at least in theory) be implemented in an expedient manner. Securing the endorsement of the Installation or Garrison Commander will help in implementing a deconstruction program involving hundreds of buildings.

Army wide, the potential for deconstruction is enormous. Lumber is the predominant building material in WWII buildings. Observation at several Army installations suggests most WWII buildings are in reasonably good condition, even though they may appear somewhat rundown. Unless a building has been damaged or seriously neglected, and has deteriorated, most lumber and building components should be recoverable.

Buildings that were originally built as barracks, administrative facilities, mess halls, recreation buildings, medical buildings, etc. were generally framed with two-by dimensional lumber framing (i.e. 2” x 4” through 2” x 12” members). Wall and roof sheathing was typically one-inch board. Vehicle maintenance shops and warehouses utilize some heavier lumber (three-by, such as 3”x8” members) in framing, especially with long span roof framing assemblies. Some timber framing (4-inches and heavier) is used in industrial-type buildings.

ERDC / CERL conservatively estimates the quantity of lumber that can be recovered and reused from a typical WWII wood building to be 4 board feet (BF) of lumber per square foot (SF) of building. Given that there are roughly 30 million SF of WWII buildings to be removed, over 120 MILLION BF of lumber could potentially be harvested from Army buildings for reuse. This figure does NOT include the painted wood siding, which is discussed below. Other recoverable materials include the following:

Tongue and groove flooring is found on most installations. It is mostly pine, although oak flooring is sometimes present.

The original windows were predominantly six-over-six double hung style. Original doors are typically five-panel interior doors, and four-panel exterior doors with vision panels. If these remain intact and are in reasonably good condition, they should be marketable. See the discussion below on lead-based paint.

Replacement windows are typically factory finished aluminum, double glazed, double hung windows. Vinyl windows are frequently present. Replacement doors are typically steel exterior doors and solid core interior doors. Replacement hardware is typically commercial grade. These items should be marketable, especially if keys accompany the locksets.

Vinyl siding may be marketable or recyclable. However, outlets will not be available in all locations.

Asphalt shingle roofing can be recycled in some locations. Recycled roofing debris is typically incorporated into new paving materials.

Metals from roof vents, flashings, and other miscellaneous fabrications can be recycled.

Many of these building types were originally heated with their own boilers, which were vented by brick chimneys. Used bricks are marketable in most locations.

Recently installed acoustic ceiling systems are reusable, although these materials may not have much monetary value.

Buildings that have recently been renovated may have furnaces, heat pumps, air handling units, water heaters, plumbing fixtures, electrical distribution equipment (load centers, circuit breaker boxes), and lighting fixtures that can be marketed through used building materials outlets. These buildings are rarely air conditioned, so there would typically be no compressor units or chillers to either resell or dispose.

Piping, ductwork, boilers, hot water tanks, and other metals can be recycled, although scrap values are quite low at present. Copper wiring can also be sold as scrap in many locations.

Generally, WWII-era buildings were built with old-growth lumber, which is denser, with tighter rings, than comparable species harvested from today's second or third generation forests. Siding was generally of a higher grade than framing lumber. Similar lumber is frequently reprocessed into architectural millwork,

commanding a higher price than used framing lumber. The reason for this is that old lumber can provide an appearance when finished that new lumber cannot. Some species, such as old growth long leaf pine, can command much higher prices than similar new lumber.

The effort required to obtain these materials must also be considered. Roofing, exterior finishes, and interior finishes must be removed in order to remove the framing lumber, and must be removed in such a fashion as to not damage the lumber.

The ideal situation for deconstruction would be a building with little or no interior partitioning, exposed framing on the interior, and only the original wood siding on the exterior. However, as these buildings have been occupied since the end of WWII, their occupancy and configuration has evolved according to the requirements of the installation and the buildings' tenants. The most common adaptation of WWII barracks, administrative buildings, dining halls, recreation buildings, and similar lumber-framed buildings was to install partitions to make separate rooms, and finish interior surfaces. Thus, gypsum wall board and/or paneling now cover most interior wall and ceiling surfaces, and multiple layers of flooring and underlayment cover the floor. Asphalt roofing can be recycled in some locations, although shingles are most commonly discarded as debris. Fortunately, multiple layers of roofing have not been observed on WWII-era buildings; the typical practice is to tear-off old shingles prior to installing new paper and shingles. Low-slope roofs on some warehouse designs have been roofed with various types of membrane roofing, which is difficult to remove if it is fully adhered. As these materials have no value, their removal represents all cost with no economic return.

The Army, at least in some quarters, has begun to recognize the potential for disposing of surplus buildings in a more useful manner than landfilling. The Principal Deputy Assistant Secretary of the Army (PDASA) has entered into discussions with Habitat for Humanity and other Federal agencies (including HUD and EPA) to develop less expensive and less wasteful avenues of disposing of surplus buildings by moving them off installations, or deconstructing them to salvage building materials for reuse. The PDASA has committed the Army to supporting initiatives whereby the Army and surrounding communities can benefit from the reuse of excess Army buildings. Furthermore, the PDASA directs ERDC / CERL to work cooperatively with EPA and other organizations to develop deconstruction and reuse technologies.

The Assistant Chief of Staff for Installations and Management (ACSIM) has issued a memorandum providing guidance for management of solid waste generated by construction and demolition (C&D) activities. It describes the objective of C&D waste management "…to ensure that materials removed from demolished structures and waste materials generated during new construction

are either salvaged for resale, reused on site, or recycled in lieu of being disposed of in a landfill or incinerated, when economically feasible. "

Unified Federal Guide Specifications are now being utilized by the Corps of Engineers to replace the Corps of Engineers Guide Specifications. UFGS are mandatory for appropriated Military Construction projects, which are managed by the Corps of Engineers. UFGS are not mandatory for installations' use, although they are frequently edited or adapted and incorporated into installations' contract documents. UFGS 01571, Construction and Demolition Waste Management, and 02220, Demolition, both state that materials and debris shall be salvaged for recycling or reuse to the maximum extent possible. However, no specific criteria for waste diversion is given, and actual jobsite practice may be questionable.

In summary, there is a significant resource available in surplus Army buildings. There is an awareness of the potential benefits of salvaging or recycling materials from surplus buildings, if for nothing else to keep them from consuming diminishing landfill capacity. The challenge is being able to capitalize on this potential in routine practice.

Obstacles to Deconstructing Army Buildings.

Two installations maintain active deconstruction programs for removing surplus WWII buildings currently, and a third is initiating deconstruction on a pilot basis. Thus, deconstruction is possible within the Army environment. There are, however, several factors that make deconstruction more difficult on Army installations, or at least compared to traditional demolition and landfilling practices. The following represent the primary reasons deconstruction is not practiced widely on Army installations.

General Practice.

The institutional paradigm is to *demolish* surplus buildings. While alternatives are possible, demolition with landfilling is the default solution to this requirement. Surplus buildings are perceived as a liability as opposed to a potential resource -- debris as opposed to building materials. Standard practice is the lowest risk course of action. The current system works well given current expectations, and there is little incentive to depart from standard practice.

A DPW or PWBC will include Real Property, Master Planning, Environmental, and Engineering Divisions (or similarly titled units) within its organization. While these Divisions work together in the building removal process, their objectives conflict to a great extent. For example, while free tipping reduces cost of construction and demolition activities, it discourages salvage and debris diversion. What is a desirable result from an engineering perspective creates the problem from an environmental perspective. Conversely, if Environmental

Division places constraints on tipping, the cost of construction and demolition services can increase.

Installation and Corps personnel usually express no fundamental objection to salvaging and re-using building materials. Most are quite receptive to the idea of recovering materials from a resource conservation viewpoint. However, they generally cannot visualize how this can be accomplished within current installation practices.

In summary, the current practice responds to requirements, at least as currently defined, and is the path of least resistance for installation personnel. Any practice outside of the mainstream necessitates greater effort to implement.

Non-familiarity with the Market.

Engineering personnel at the installations and Corps Districts are well attuned to traditional construction services and capabilities in their locale. They are much less familiar with the local capabilities for deconstruction, building materials' recovery and salvage, and materials' resale or reuse.

Deconstruction and salvage contractors are generally quite small firms. They typically do not peruse the media in which Army projects are advertised. They typically do not engage in public projects where an extremely formal contracting environment is in place. Non-traditional services, such as Habitat for Humanity are not organized the same way as commercial contractors. They must typically assemble resources on a job-by-job basis, and may be unable to respond to formal solicitations within the time required.

Installation personnel are also generally not aware of the used building materials marketplace or values. Such information is not represented in any Army guidance media or data. The potential value of a surplus wood frame building, or potential outlets for recovered materials, are essentially unknown.

While deconstruction capabilities may exist in an installation's locale, they are generally unknown to installation personnel. And as demolition is the default method for removing buildings, there is little reason for installations to try to attract these services.

Economic Factors.

Lowest first cost drives building removal practice. Demolition of wood-frame buildings is still relatively inexpensive, especially when contractors are allowed to tip debris into installations' landfills at no cost to themselves. The rationale behind free tipping is to reduce the cost of demolition, or reduce the contract price for construction projects that include demolition activities. This is an appropriate practice from the perspective of managing contract costs. Requiring

a demolition contractor to deconstruct a building could increase first cost from roughly $2 to $3/SF to $4 or $5/SF.

The emphasis of lowest first cost also ignores the other costs to the Government that are outside the initial contract or task scope. Landfill life cycle costs (construction or expansion, permitting, management, closure, and monitoring) are estimated to cost an additional $30-50 / ton of debris.

There are other issues of cost avoidance or cost offset associated with deconstruction that are not reflected in the low-first-cost paradigm. Diverting debris reduces hauling costs. The value of recovered materials offsets the initial cost of extraction. In a competitive environment these factors could, theoretically, result in lower prices for building removal services. However, these factors are not incorporated in the current pricing scheme. In a JOC arrangement, unit prices for demolition are fixed. A contractor will be paid the same per square foot of building regardless of the amount of debris generated or diverted. In a new construction project, demolition activities have a very low sensitivity in the total construction contract cost. Even a dramatic difference in demolition cost will usually alter the total contract cost by a percent or less. Therefore, little emphasis on innovation or economy is justified on the part of the General Contractor. It is unusual that a demolition contract will be advertised as a stand-alone contract (as opposed to a JOC task). Even if this were to happen, other constraints could prevent the contractor from engaging in extensive material recovery (see below).

The applicability of the Davis-Bacon Act to deconstruction has been questioned. Briefly, Davis-Bacon requires that labor for Federal construction projects is paid at the wage scale prevailing in the project's locale. If all labor were to be paid Davis-Bacon wages, deconstruction would be extremely expensive compared to traditional demolition. Application of Davis-Bacon would virtually preclude participation by non-traditional service organizations, such as HfH or National Civilian Conservation Corps. However, per Department of Labor and ERDC's Vicksburg Construction Branch - Deconstruction (no new construction following the deconstruction) is not subject to the Davis-Bacon Act. It is considered a "service" and therefore the Service Contract Act and applicable wage determinations would apply.

Scheduling.

Manual deconstruction takes considerably longer than conventional demolition: "weeks" as opposed to "days" for a typical WWII-era barracks building. Combining mechanical methods with manual deconstruction can reduce deconstruction time. However, deconstruction will almost always take longer than simple demolition.

In a Facility Reduction scenario, a longer deconstruction duration is generally not an obstacle. Schedule problems are due more to the overall processes preceding demolition or deconstruction than the deconstruction activities themselves. There may be no specific deadline by which a given building must be vacated and demolished. However, once a building is cleared for demolition, the installation will generally not let it remain standing vacant for long periods of time.

As described above, an installation can initiate a demolition task on a JOC in a relatively short time. If a deconstruction alternative were considered, it would take considerably longer to advertise and award a contract. Furthermore, it would be difficult for non-traditional services, such as Habitat for Humanity, to coordinate resources within a typical advertisement and bidding timeframe.

In a new construction scenario, building demolition becomes critical to the project schedule. Demolition is one of the first activities on the critical path, and a protracted demolition duration is intolerable. To the General Contractor, the value of time exceeds the monetary value of materials that may be salvaged. Thus, the requirement to clear the site usually prevents any significant salvage or deconstruction efforts.

Contracting.

Public contracting policy and practice are based on maximizing competition and equity among all competitors. However, the practices applied to removing WWII-era buildings de-facto discourages deconstruction. Several factors contribute.

Contracts are typically awarded to the lowest-priced, responsible bidder. The discussion of economic factors, above, describes how this method cannot account for any economic benefits associated with deconstruction. Therefore, deconstruction is seen as being “uneconomical” from a low-first-cost perspective.

The contract mechanism most frequently used in building removal situations is a JOC, as described above. The JOC program typically attracts contractors who perform a variety of services, and who are familiar with JOC processes. Firms that engage in deconstruction as a specialty, or as part of a larger demolition service, typically do not participate in public projects involving more formal, rigorous contract requirements.

Only contractors currently under a JOC perform demolition activities. Therefore, it is difficult to introduce alternative services and resources to demolition requirements. Deconstruction can certainly be performed outside of a JOC. However, initiating independent contract actions is more cumbersome to the installation.

Retaining non-traditional services such as HfH is possible, but would require a contract or agreement that is not typically applied to demolition services. Competitive bidding would be impractical. Sole source selection is possible, but would involve a Justification and Authorization exercise that is not required with competitive bidding.

Under a JOC, unit prices for demolition are established in a Unit Price Book. A JOC contractor will be paid the same per square foot of building whether it is disassembled or crushed it with a track hoe. Therefore, as long as the JOC is in effect, a contractor has no incentive to invest more than the minimum resources required to remove the building.

The greatest obstacle to deconstruction, however, appears to be the prohibition on removing materials from the installation, thus preventing salvage and resale. Clauses frequently appear in Contract Conditions and in Technical Specifications that require ALL building debris to be deposited in the installation's landfill. The rationale appears to be twofold. First, a contractor is being paid to demolish a building and dispose of the debris. Some argue that it somehow improper for contractor to accrue any further benefits by re-selling salvaged materials, i.e. "double dipping." Second, installations are extremely risk adverse, and are reluctant to expose themselves to liability in the event that someone suffers injury or hazard to health because of materials obtained from an Army installation. ERDC / CERL has found no explicit prohibition in statute or regulation on removing materials from an installation. However, this is still widely accepted as standard practice.

Real Property Transfer.

The ownership of a building in a deconstruction scenario is not always clear. If all debris is to be deposited in an installation's landfill, the issue of ownership or salvage rights is a moot point. However, if a party deconstructs a building and remove materials for resale, ownership becomes more clouded. AR 405-90 requires that surplus property that has a value must be sold. Surplus property with no value must be discarded. The question is raised – if a building has value enough for a party to salvage materials, why doesn't the Army sell it, rather than pay for deconstruction services? One interpretation is that the Army (i.e., the using service) has the opportunity to take everything in the building that is of value to them, and what remains has no value to the Army. Another interpretation is that the Installation Commander and Corps District can determine that deconstruction and salvage is an appropriate course of action, and can authorize this approach. Interpretations will differ among installations.

It must be noted, however, that UFGS 02220 includes language that allows salvage to the maximum extent possible, and gives title to materials to the Contractor. Other UFGS for C&D Waste Management and Recycling include similar language.

AR 405-90 gives guidance on the Disposal of Real Estate. The Corps of Engineers has responsibility for disposing of Real Estate from active Army installations, whereas the GSA has that responsibility for "excess" facilities. Any "personal property" associated with a building is removed and recycled or reused by the DPW, or and last tenants. All unwanted personal property should be sold or disposed through the local Defense Reutilization and Marketing Office (DRMO).

Lead-Based Paint.

The presence of lead-based paint (LBP) on WWII-era buildings is the most frequently cited reason for not salvaging the materials. Uncertainty about regulatory constraints and liability concerns are the two primary contributing factors.

Painted materials are considered by many in the Army to be "hazardous" – but in the general definition of the term. Building debris is not classified as hazardous by states' regulations, and used building materials with LBP do not fall under the Resource Conservation and Recovery Act (RCRA) waste regulations. Installations are still reluctant to allow painted exterior siding and other wood materials to leave the installation. The major concern is that the Army will be held liable for any harm suffered as a result of the subsequent use of these materials.

Used building materials' outlets, both commercial and non-profit, commonly sell painted items. Where the presence of LBP is known or suspected, a disclosure statement is issued. Fort McCoy, Fort Knox, and Fort Campbell include LBP disclosures in their deconstruction solicitations. There is still a perception, however, that simply disclosing the presence of LBP does not relieve the Army of liability. There are also concerns about occupational hazards associated with removal and handling of painted items.

There is a great deal of uncertainty about the paint's behavior in buildings. Some within the Army suggest that even unpainted materials become contaminated through lead in dust, foot traffic, and other avenues of contamination.

ERDC/CERL, in coordination with their research partners is currently working to understand how LPB interacts with wood surface, and investigating efficient methods for removing and disposing of LBP residue.

Conclusions and Recommendations.

Deconstruction is emerging as a viable alternative to demolishing buildings and landfilling the debris. The economics of this practice vary considerably depending on the property's owner, project or program objectives, who is

performing the deconstruction services, how the project is financed, local economic conditions, and other factors. However, current practice suggests that deconstruction can be a cost-effective and practical method to remove buildings.

The Army has yet to practice deconstruction routinely. As a “corporate” organization, the Army has established a set of procedures that respond to its building removal requirements. Standard practice works well – at least to remove buildings.

Deconstructing surplus WWII-era buildings is not entirely consistent with the Army’s standard demolition practices. However, deconstruction is not impossible. Examples exist within the Army environment to show how deconstruction can be implemented. While it is the exception rather than the rule, these examples show that obstacles are not insurmountable.

The following measures would have to take place to enable installations to implement deconstruction on a routine basis. While some imply a departure from standard practice, all should achievable within the Army environment. Furthermore, increased emphasis on environmental sustainability by the Army at all levels from Headquarters to installations should provide a justification and the incentive to accommodate deconstruction.

Note that these are described in only general terms and have not been endorsed or adopted as policy at any Army level. However, they do represent avenues that can be pursued within the practical confines of installations’ routine business.

> Identify and promote the value of surplus WWII buildings in terms of salvaged materials, the burdens placed on the installation by the debris stream, and the life-cycle expenses of landfilling debris.
>
> Acknowledge all economic factors effected by demolition and landfilling when assessing the economic feasibility of deconstruction. These include the initial cost of removing the buildings, offsets to initial costs from resale revenues, cost avoidance, and life cycle costs invested in landfill operation and management.
>
> Identify the salvage and deconstruction capabilities within the installation’s locale. These may include commercial deconstruction or salvage companies, demolition contractors that specialize in salvage, used building materials outlets, commercial C&D debris recycling firms, used materials exchanges, trade organizations, and non-traditional services such as Habitat for Humanity. Monitor used building material and scrap markets in the region.

Inform the salvage, deconstruction, and recycling services of the Installation's building removal requirements, and encourage participation in projects.

Adjust demolition schedules to accommodate alternative methods of removing buildings. "Package" buildings into contracts of sufficient scope to attract participants with the required deconstruction, salvage, or recycling services, or non-traditional services to assemble the required resources. This may be 8-12 buildings or more.

Allow sufficient time in the procurement schedule to publicize and encourage participation by capable contractors and services who do not ordinarily participate in Army or Federal contracts.

Allow sufficient time to deconstruct the buildings, salvage and recycle debris, or at least perform extensive salvage prior to demolition. If demolition would be included with a new construction contract, consider removing the building independently of the new construction contract, and far enough in advance to enable the site to be cleared, and not delay construction activities.

Do not require that all non-hazardous demolition debris be deposited in the installation's landfill. Transfer title to the contractors and allow them the opportunity to recover or salvage materials for reuse or recycling. Allow savings to accrue to the contractor as an incentive to divert waste.

Where it is impractical to recover materials such as concrete or reuse, develop uses for recycled products such as rubble, erosion control, or fill on the Installation.

Points of Contact.

Contact any of the following for further information on deconstruction and C&D debris management:

Tom Napier, CEERD-CF-F, 217/373-3497, t-napier@cecer.army.mil
Steve Cosper, CEERD-CN-E, 217/398-5569, s-cosper@cecer.army.mil
Rich Lampo, CEERD-CF-M, 217/373-6765, r-lampo@cecer.army.mil

APPENDIX B.
AGREEMENT WITH HABITAT FOR HUMANITY.

The following is the Agreement between ERDC/CERL and Austin Habitat for Humanity. All personal identification and pricing data has been removed.

The Statement of Work begins on page _____. With the exception of the Research Requirements, this may serve as a model specification for future deconstruction projects.

DEPARTMENT OF THE ARMY
U.S. ARMY CONSTRUCTION ENGINEERING RESEARCH LABORATORIES
2902 NEWMARK DRIVE, P. O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

RESEARCH COOPERATIVE AGREEMENT SCHEDULE

1. Cooperative Agreement Title: Research to Demolish World War II (WWII) Buildings from Army Installations Through Deconstruction and Materials Salvage

2. Cooperative Agreement Number: DACA42-02-2-0051

3. Recipient Name and Address:

Austin Habitat for Humanity Re-Store
310 Comal Street, Suite 101
Attn: *(removed)* Phone: 512/478-2165, Ext. 201
Austin, TX 78702 Email: *(removed)*

Tax ID No: 74-2373217
DUNS No: 603218900
Cage Code: 1XQL3

4. Statement of Work: The research to be accomplished under this agreement is identified in the Statement of Work, Exhibit 1 (16 pages)

5. Grant Officer: *(removed)*, Team Leader, Technology Branch, Vicksburg Consolidated Contracting Office, Champaign Field Office, P. O. Box 9005, Champaign, IL 6l826-9005. Telephone: 217-373-7297.

6. Grant Officer's Technical Representative (GOTR) and CERL Technical Point of Contact (POC): The Primary GOTR for this cooperative agreement will be *(removed)*, Fort Campbell Pollution Prevention Branch Chief, phone: 270/798-3105, mail:

Public Works Business Center
Environmental Division
Pollution Prevention Branch/*(removed)*

Bldg 865, 16th Street & Bastogne
Fort Campbell, KY 42223-5130

The Alternate GOTR is*(removed)*, Telephone: 217/352-6511, extension *(removed)*; Email *(removed)*.
The Technical POC for this agreement will be *(removed)*: 217-352-6511, extension *(removed)*.

7. Performance Period for the First Period/First Funding: from date of award until August 31, 2002.

8. Award Amount and Accounting and Appropriation Data:
Award: *(removed)*
Accounting and Appropriation Data:
21 NA 2002 2040.0000 U4 2002 088140 62272004800 22079 2511 008B9A

9. Administered by: U.S. Army Construction Engineering Research Laboratories and the Office of Naval Research. The ONR office that will perform these duties is identified below:

ONRRO
4520 Executive Drive, Suite 300
San Diego, CA 92121-3019
619/677-6460

10. Terms and Conditions: This Cooperative Agreement is subject to the General Terms and Conditions set forth in Attachment A.

12. Reporting Requirements: Reporting Requirements are pursuant to the requirements in Attachment A.

13. Payments: Payments will be made pursuant to the "Payments" article in Attachment A. Payments will be made by Electronic Funds Transfer (EFT). See EFT instructions and Direct Deposit Authorization Form in Exhibit 6.

Submit invoices to the Alternate GOTR listed in paragraph 6 above, at:

USACERL
Attn: Receiving Clerk
2902 Farber Drive
Champaign, IL 61822-1076

Payments will be made by:

USACERL

%U.S. Army Corp of Engineers Finance Center
5722 Integrity Drive
Millington, TN 38054-5005

14. Government Participation: The Government's technical contribution towards this effort includes the monitoring of the project as a whole. Resource management, safety, quality control, and other project management issues will be documented. Lessons learned will be developed. From these, Best Management Practices will be developed as guidance to Army installations. This guidance will be equally applicable to other institutional building removal requirements.

15. Miscellaneous Provisions

a. Attachment A which contains additional terms and conditions of this Cooperative Agreement is attached hereto and made a part hereof.

b. Attachment B which contains certifications and representations is attached hereto and made a part hereof.

c. Notwithstanding the Awardee's technical and cost proposals, the Government's obligation is restricted to the funding stated in item 8 above.

THIS COOPERATIVE AGREEMENT IS BEING ENTERED INTO PURSUANT 10 U.S.C. 2358.

FOR THE Recipient:

_____ _____
(Signature) (Date)

Name:_____

Title:_____

FOR THE UNITED STATES OF AMERICA:

_____ _____
(signature) (date)

Name: *(removed)*
Title: Supervisory Contract Specialist
Grants Officer

ATTACHMENT A

GENERAL TERMS AND CONDITIONS FOR COOPERATIVE AGREEMENTS WITH EDUCATIONAL INSTITUTIONS AND OTHER NONPROFIT ORGANIZATIONS

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1. RESEARCH RESPONSIBILITY

a. The Recipient will bear primary responsibility for the conduct of the research and will exercise judgement towards attaining the stated objectives within the limits of the agreement's terms and conditions.

b. The program director specified in the agreement document will be continuously responsible for conduct of the research project and will be closely involved with the project. The program director, operating within the policies of the Recipient, is in the best position to determine the means by which the work may be conducted most effectively.

c. The Recipient will advise the Government if the program director will, or plans to, devote substantially less effort to the work than specified in the budgetary portion of the agreement document.

d. The Recipient will obtain the Government's approval to change a program director or to continue the research work during a continuous period in excess of three (3) months without the participation of an approved program director.

e. The Recipient will obtain the Government's approval to change:

(1) The methodology or experiment when such is stated in the agreement as a specific objective;

(2) the stated objectives of the research effort; or

(3) the phenomenon or phenomena under study.

2. ORDER OF PRECEDENCE

Any inconsistency or conflict in the terms or conditions specified in this agreement shall be resolved according to the following order of precedence:

a. Provisions of Public Law applicable to this agreement.

b. The Cooperative Agreement Schedule

c. General Terms and Conditions for Cooperative Agreements with Educational Institutes and Other Nonprofit Organizations (this Attachment A).

d. Recipient's Proposal

3. ADMINISTRATION AND COST PRINCIPLES

The following OMB Circulars and attachments thereto, effective the earlier of (i) the award date of this Cooperative Agreement or (ii) the date on which the Recipient incurs costs to be assessed the agreement, are incorporated as part of this agreement by reference, as applicable:

a. A-110, "Uniform Requirements for Cooperative Agreements and Agreements with Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations."

b. A-122, "Cost Principles for Nonprofit Organizations" (see note below).

c. A-133, "Audits of Institutions of High Education and Other Nonprofit Organizations."

Note: For those nonprofit organizations specifically exempted from the provisions of OMB Circular A-122, Subpart 31.2 of the Federal Acquisition Regulation (FAR) (48-CFR Subpart 31.2) shall apply.

These regulations may be obtained from:
Office of Management and Budget
EOP Publications Office
New Executive Office Building
725 17th Street, N.W., Room 2200
Washington, D.C. 20503
Telephone (202)395-7332

Or they may be downloaded from: http://www.whitehouse.gov/omb/circulars/

4. AMENDMENT OF THE Cooperative Agreement

The only method by which this Cooperative Agreement can be amended is by a formal, written amendment signed by the grants officer. No other communications, whether oral or in writing, are valid.

5. WAIVERS OF OMB CIRCULARS, PRIOR APPROVALS AND OTHER AUTHORIZATIONS

Prior Approvals. All prior approvals required by OMB Circulars A-21 and A-110 are waived except the following:

a. Change in the scope or objectives of the Research Project as required by Article 1 of these terms and conditions entitled "Research Responsibility."

b. Any request for additional funding.

c. Change in key personnel as required by Article 1 of these terms and conditions entitled "Research Responsibility."

d. Exclusive of supplies, material, equipment or general support services, the award of a subcontract or subgrant to accomplish substantial programmatic work required in the agreement to be performed by the prime Recipient.

e. Transfer of funds among all cost elements when the cumulative amount of such transfers exceeds or is expected to exceed 15% of the total budget last approved by the Grants Officer (Exhibit 4).

f. Unless identified in the budget incorporated as part of the agreement (Exhibit 4), expenditures for general purpose equipment and specific purpose equipment costing $1,000 or more.

g. Unless identified in the budget incorporated as part of the agreement, expenditures for foreign travel.

h. Costs for foreign and domestic travel that exceed by more than 25% or $500, whichever is greater, the cost for such effort included in the budget incorporated as part of the agreement.

i. Any purchase of real property using agreement funds shall require approval of Grant Officer.

6. PREAWARD COSTS

The Recipient may incur preaward costs up to ninety (90) days prior to the start date of the agreement. Preaward costs, as incurred by the Recipient, must be necessary for the effective and economical conduct of the project, and the costs must be otherwise allowable in accordance with the appropriate cost principles. Preaward costs are made at the Recipient's risk. The incurring of preaward costs by the Recipient does not impose any obligation on the Government in the absence of appropriations, if an award is not subsequently made, or if an award is made for a lesser amount than the Recipient expected.

7. UNOBLIGATED BALANCES

In absence of any specific notice to the contrary, the Recipient is authorized to carry forward unexpended balances to subsequent funding periods of the agreement.

8. PAYMENTS

Unless specified to the contrary in the Agreement Schedule, payments to the Recipient shall be by the use of predetermined schedule of payments.

Recipients not receiving predetermined schedule of payments shall submit requests for payment using SF 270, Request for Advance or Reimbursement, no more frequently than biweekly. The request shall be submitted to the activity identified in Item 9 of the Agreement Schedule, with an additional copy to the activity in Item 6.

A blank SF 270 is provided for your convenience at Exhibit 3 (2 pages).

9. PUBLICATION AND ACKNOWLEDGMENT

a. Publication. The Recipient is encouraged to publish results of this project, unless classified, in appropriate journals. One copy of each paper planned for publication will be submitted to the Alternate Grant Officer's Technical Representative simultaneously with its submission for publication. Copies of all publications resulting from the research will be forwarded to the Government as they become available even though publication may in fact occur subsequent to the termination date of this agreement.

b. Acknowledgment. The Recipient agrees that in the release of information relating to this agreement, such release shall include a statement to the effect that the project or effort depicted was or is sponsored by the Department of Defense, and that the content of the information does not necessarily reflect the position or the policy of the government, and no official endorsement should be inferred. For purposes of this article, information includes news releases, articles, manuscripts, brochures, advertisements, still and motion pictures, speeches, trade association proceedings, etc.

10. TECHNICAL REPORTING REQUIREMENTS

Technical reports shall be submitted quarterly as well as a final report as required by OMB Circular A-110. In addition, quarterly reports shall summarize accomplishments during the previous quarter, work planned during the coming quarter, and any change in key personnel.

11. FINANCIAL REPORTING REQUIREMENTS

a. All financial reporting required by this agreement shall be as required by Part 52 of OMB Circular A-110 and as detailed below.

b. The following financial reports are required for Recipients receiving funds advanced by Treasury checks:

(1) Report of Federal Cash Transaction (SF 272) (Quarterly); Within 15 working days following the end of each quarter.

(2) Financial Status Report (SF 269) (Final): At completion of agreement.

c. For Recipients receiving funds by advance or reimbursement the following financial reports are required:

(1) Financial Status Report (SF 269) (Final): At completion of agreement.

(2) Report of Federal Cash Transaction (SF 272): Annually.

d. All reports listed above, shall be submitted to the office performing administrative duties.

e. In addition to the reports listed above, a monthly financial report shall be submitted to the Alternate Grant Officer's Technical Representative listed in Paragraph 6 of the agreement schedule.

12. COST-SHARING

Cost-sharing amounts, if any, identified in the agreement documents must meet the allocability test of the appropriate cost principles identified in Article 3 of these Terms and Conditions. If at the end of the agreement period the actual cost of the research project is less than the project cost negotiated, the actual cost will be allocated between the Government and the Recipient in the dollar ratio originally proposed. Excess Government funds will be returned to the government. If the grant officer approves a significant departure from the original research objectives, the Recipient may request that the negotiated cost-sharing agreement be adjusted (Reference Attachment 4 for Cost Sharing Contributions).

13. TITLE TO EXPENDABLE AND NONEXPENDABLE ACQUIRED PROPERTY

Unless specified otherwise in the "Miscellaneous Provisions" paragraph of the agreement, title to all nonexpendable and expendable tangible personal property purchased with agreement funds shall be vested in the Recipient upon acquisition subject to the provisions of Attachment N, OMB Circular A-110.

14. PROGRAM INCOME

The recipient shall account for program income related to this agreement as follows:

a. Interest earned on advances of Federal funds will be remitted to the Federal sponsoring agency.

b. Proceeds from the sale of real and personal property either provided by the federal Government or purchased in whole or in part with Federal funds will be handled in accordance with OMB Circular A-110.

c. Unless this agreement provides otherwise, the recipient will have no obligation to the Federal Government with respect to royalties received as a result of copyrights or patents produced under the agreement.

d. All other program income earned during the project period will be retained by the recipient and, in accordance with the agreement will be--(1) Added to funds committed to the project by the sponsoring agency and recipient organization and be used to further eligible program objectives; or, (2) Used to finance the non-Federal share of the project when approved by the sponsoring agency; or (3) Deducted from the total project costs in determining the net costs on which the Federal share of costs will be based.

15. INTANGIBLE PROPERTY

Intangible property is defined in OMB Circular A-110. The rights of the agreement parties concerning these intangible properties shall be as stated in Part 36 of OMB Circular A-110.

Invention reports shall be filed at least annually and at the end of the period of the Cooperative Agreement. Annual Reports are due 60 days after the anniversary date of the agreement and final reports are due 6 months after the expiration of the final research period. The Recipient shall use DD Form 882, Report of Inventions and Subcontracts, to file the invention reports. Negative reports are required. The agreement shall not be closed out until all invention reporting requirements are met.

16. DISPUTES

a. Disagreements regarding matters of fact between the Recipient and the Government which arise during performance of the agreement shall be resolved by negotiation to the maximum extent practicable. If agreement cannot be reached after a reasonable attempt, the Grant Officer will issue a final decision in writing to the Recipient.

b. The final decision will permit the Recipient to appeal the decision within 30 days after receipt of such notification. Appeals will be resolved at the Headquarters, Department of Army level, who may at their option, resort to non-binding alternative disputes resolution. A decision will be final and not subject to further administrative appeal.

c. If the Recipient refuses to participate in, or does not accept the results of the above procedures, they may bring such formal claims as are authorized by 28 U.S.C. 1491 or other applicable statutes.

17. TERMINATION AND ENFORCEMENT

Section 60 through 62 of OMB Circular A-110 sets forth uniform suspension, termination and enforcement procedures. All matters relating to suspension, termination and enforcement shall conform with these sections of the OMB Circular.

18. CLOSEOUT PROCEDURES

The Recipient shall comply with the closeout procedures included in OMB Circular A-110.

19. SECURITY

The Recipient is not authorized access to classified security information in the conduct of the agreement. Should it appear that access to such information is desirable, the Recipient shall advise the Government and request clearance for the investigator. Should information be developed in the course of work under this agreement that, in the judgement of the program director or the Recipient, should be classified, the Government shall be notified immediately.

20. OFFICIALS NOT TO BENEFIT

No member of or delegate to Congress, or resident Commissioner, shall be admitted to any share or part of this agreement, or to any benefits arising from it, in accordance with 41 U.S.C. 22.

21. NONDISCRIMINATION

a. Employment. In connection with performance of work under this agreement, the Recipient agrees not to discriminate against any employee or applicant for employment because of race, religion, color, sex, or national origin. This provision will include, but not be limited to, the following employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

b. Educational Institutions. If the Recipient is an educational institution, agrees not to discriminate on the basis or race, color, creed, sex, or national origin against any student in selection of personnel for graduate or technical work related to the agreement.

c. The Recipient agrees to permit any person or persons designated by the Government access during normal business hours to such books, records, accounts and other sources of information, and facilities as is reasonably necessary to ascertain compliance with the provisions of this agreement.

22. SITE VISITS

The Government, through authorized representatives, has the right, at all reasonable times, to make site visits to review project accomplishments and to provide such technical assistance as may be required. If any site visit is made by the Government on the premises of the Recipient, a subrecipient, or contractor, the Recipient shall provide, and shall require its subrecipients and contractor to provide all reasonable facilities and assistance for the safety and convenience of the government representatives in the performance of their duties. All site visits and evaluation shall be performed in such a manner as will not unduly interfere with or delay the work.

23. RESEARCH INVOLVING RECOMBINANT DNA MOLECULES

Any Recipient performing research involving recombinant DNA molecules agrees by acceptance of this award to comply with the National Institutes of Health "Guidelines for Research Involving Recombinant DNA Molecules," Nov 1984 (49 CFR 46266-46291), or such later revision of those guidelines as may be published in the Federal Register.

24. PROHIBITION OF USE OF HUMAN SUBJECTS

Notwithstanding any other provisions contained in this agreement or incorporated by reference herein, the Recipient is expressly forbidden to use or subcontract for the use of human subjects in any manner whatsoever. In the performance of this agreement, the Recipient agrees not to come into contact with, use or employ, or subcontract for those or employ of any human subject for research, experimentation, test or other treatment under the scope of works as set out in the agreement without the express written approval from the Cooperative Agreement officer.

25. PROHIBITION OF USE OF LABORATORY ANIMALS

Notwithstanding any other provisions contained in this agreement or incorporated by reference herein, the Recipient is expressly forbidden to use or subcontract or subgrant for the use of laboratory animals in any manner whatsoever without the express written approval of the grant officer.

26. PREFERENCE FOR U.S. FLAG CARRIERS

Travel supported by U.S. Government funds under this agreement shall use U.S.-flag air carriers (carriers holding certificates under 49 U.S.C. 41102) for international air transportation of people and property to the extent that such service is available, in accordance with the International Air Transportation Fair Competitive Practices Act of 1974 (49 U.S.C. 40118) and the interpretative guidelines issued by the Comptroller General of the United States in the March 31, 1981, amendment to Comptroller General Decision B138942.

27. NATIONAL AGENCY CHECK

All Recipient employees (U.S. Citizens and Non-U.S. Citizens) working under this contract or applicable task orders who require access to Automated Information Systems (AIS), (stand-alone computers, networked computers/systems, e-mail) shall, at a minimum, be designated into an ADP-III Position (non-sensitive) in accordance with Army Regulation 380-67, Personal Security, Army Regulation 380-19, Information Systems Security, and DoD 5220-22-R, Industrial Security Regulation. The investigative requirements for an ADP-III Position are a favorable National Agency Check (NAC), SF-85P, Public Trust Position. Each applicable employee shall complete a SF-85P and submit to the CERL Security Office within three (3) working days after award of any contract or task order, and shall be submitted prior to the individual being permitted access to an AIS. (Reference CERL website at http://owww.cecer.army.mil/contracts/formindex.html for a copy of the SF-85P.) Contractors that have a Commercial and Government Entity (CAGE) Code and Facility Security Clearance through the Defense Security Service shall process the NACs and forward visit request/results of NAC to the CERL Security Office. For those contractors that do not have a CAGE Code or Facility Security Clearance, the CERL Security Office will process the investigation in coordination with the Recipient and contract employees.

28. FOREIGN NATIONALS

In accordance with Engineering Regulation (ER) 380-1-18, Section 4, all foreign nationals who work on any Corps of Engineers' contract or task order shall be approved by HQUSACE Foreign Disclosure Officer or higher before beginning work on a contract/task order. This regulation includes subcontractor employees. The Recipient shall submit a letter to the CERL Security Officer containing the following:

a. The Contracting Officer's Representative's Name

b. Solicitation Number and/or Cooperative Agreement Number

c. Narrative Title of the Cooperative Agreement

d. A paragraph explaining what tasks the individual will be performing under the cooperative agreement.

e. A list of names identifying all foreign nationals proposed for performance under the cooperative agreement;

f. documentation to verify that he/she was legally admitted into the United States (US) and has authority to work and/or go to school in the US. Such documentation may include a US Passport, , Alien Registration Card with photograph (INS Form I-151 or I-551), Employment Authorization Card (INS Form I-688A), INS Form 9, INS Form 20, H1B1, etc.

The address for the CERL Security Officer is: ERDC-CERL/SEI, Attn: *(removed)* P.O. Box 9005, Champaign, IL 61826-9005.

ATTACHMENT B

CERTIFICATION AND REPRESENTATIONS FOR COOPERATIVE AGREEMENTS WITH EDUCATIONAL AND OTHER NONPROFIT INSTITUTIONS

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    b. Title IX of the Education Amendments of 1972
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6. Debarment and Suspension
7. Military Recruiting
8. Live Organisms
9. Environmental Impact
10. Subawards/Flow-down Requirements

1. NONDISCRIMINATION

By signing the agreement or accepting funds under the agreement, the Recipient assures that it will comply with applicable provisions of the following National policies prohibiting discrimination:

a. Based on race, color or national origin in Title VI of the Civil Rights Act of 1964, as implemented by 32 CFR 195.

b. Based on sex or blindness in Title IX of the Education Amendments of 1972

c. Based on age in the Age Discrimination Act of 1975

d. Based on handicap in Section 504 of the Rehabilitation Act of 1973

2. CLEAN AIR AND WATER

If the amount of this agreement exceeds $100,000, the Recipient shall comply with the Clean Air Act (42 U.S.C. 1857), as amended; the Federal Water Pollution Control Act (33 U.S.C. 1251), as amended; Executive Order No. 11738; and the related regulations of the Environmental Protection Agency (40 CFR, Part 15).

3. CERTIFICATION REGARDING DRUG-FREE WORKPLACE

Instructions for Certification

1. By signing and/or submitting this application or grant agreement, the grantee is providing the certification set out below.

2. The certification set out below is a material representation of fact upon which reliance is placed when the agency awards the grant. If it is later determined that the grantee knowingly rendered a false certification, or otherwise violates the requirements of the Drug-Free Workplace Act, the agency, in addition to any other remedies available to the Federal Government, may take action authorized under the Drug-Free Workplace Act.

3. For grantees other than individuals, Alternate I applies.

4. For grantees who are individuals, Alternate II applies.

5. Workplaces under grants, for grantees other than individuals, need not be identified on the certification. If known, they may be identified in the grant application. If the grantee does not identify the workplaces at the time of application, or upon award, if there is no application, the grantee must keep the identity of the workplace(s) on file in its office and make the information available for Federal inspection. Failure to identify all known workplaces constitutes a violation of the grantee's drug-free workplace requirements.

6. Workplace identifications must include the actual address of buildings (or parts of buildings) or other sites where work under the grant takes place. Categorical descriptions may be used (e.g., all vehicles of a mass transit authority or State highway department while in operation, State employees in each local unemployment office, performers in concert halls or radio studios).

7. If the workplace identified to the agency changes during the performance of the grant, the grantee shall inform the agency of the change(s), if it previously identified the workplaces in question (see paragraph five).

8. Definitions of terms in the Nonprocurement Suspension and Debarment common rule and Drug-Free Workplace common rule apply to this certification. Grantees' attention is called, in particular, to the following definitions from these rules:

Controlled substance means a controlled substance in schedules I through V of the Controlled Substance Act (21 U.S.C. 812), and as further defined by regulation (21 CFR 1308.11 through 1308.15);

Conviction means a finding of quilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes;

Criminal drug statute means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, use, or possession of any controlled substance;

Employee means the employee of a grantee directly engaged in the performance of work under a grant, including: (i) All "direct charge" employees; (ii) all "indirect charge" employees unless their impact or involvement is insignificant to the performance of the grant; and, (iii) temporary personnel and consultants who are directly engaged in the performance of the work under the grant and who are on the grantee's payroll. This definition does not include workers not on the payroll of the grantee (e.g., volunteers, even if used to meet a matching requirement; consultants or independent contractors not

on the grantee's payroll; or employees of subrecipients or subcontractors in covered workplaces);

Certification Regarding Drug-Free Workplace Requirements

Alternate I. (Grantees Other Than Individuals)

A. The grantee certifies that it will or will continue to provide a drug-free workplace by:

(a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying actions that will be taken against employees for violation of the prohibition:

(b) Establishing ongoing drug-free awareness program to inform employees about--

(1) The dangers of drug abuse in the workplace;

(2) The grantee's policy of maintaining a drug-free workplace;

(3) Any available drug counseling, rehabilitation, and employee assistance programs; and

(4) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;

(c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);

(d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee will--

(1) Abide by the terms of the statement; and

(2) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction;

(e) Notifying the agency in writing, within ten calendar days after receiving notice under paragraph (d)(2) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grants officer or other designee on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification number(s) of each affected grant;

(f) Taking one of the following actions, within 30 calendar days of receiving notice under paragraph (d)(2), with respect to any employee who is so convicted--

(1) Taking appropriate personnel action against such employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or

(2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency;

(g) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (a), (b), (c), (d), (e), and (f).

B. The grantee may insert in the space provided below the site(s) for the performance of the work done in connection with the specific grant:

Place of performance (Street address, city, county, state, zip code)

_____
___
_____
___
_____
___
_____
___

Check [ ] if there are workplaces on file that are not identified here.

Alternate II. (Grantees Who Are Individuals)

(a) The grantee certifies that, as a condition of the grant, he or she will not engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance in conducting any activity with the grant;

(b) If convicted of a criminal drug offense resulting from a violation occurring during the conduct of any grant activity, he or she will report the conviction, in writing, within 10 calendar days of the conviction, to every grants officer or other designee, unless the Federal agency designates a central point for the receipt of such notices. When notice is made to such a central point, it shall include the identification number(s) of each affected grant.

4. CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer of employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a

Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, Disclosure Form to Report Lobbying, in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was place when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31 U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Statement of Loan Guarantees and Loan Insurance

The undersigned states, to the best of his or her knowledge and belief, that:

If any funds have been paid or will be paid to any person for influencing or attempting to influence an officer of employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this commitment providing for the United States to insure or guarantee a loan, the undersigned shall complete and submit Standard Form-LLL, Disclosure Form to Report Lobbying, in accordance with its instructions.

Submission of this statement is a prerequisite for making or entering into this transaction imposed by section 1352, title 31 U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

5. CERTIFICATION OF ACCESSIBILITY TO AND USAGE BY PEOPLE WITH DISABILITIES

By signing the agreement or accepting funds under the agreement, the Recipient certifies that it is complying with the requirements of section 504 of the Rehabilitation Act of 1973, as implemented by 32 CFR 56, concerning access for people with disabilities in recipient programs and activities, including but not limited to those under the agreement.

6. DEBARMENT AND SUSPENSION

Instructions for Certification

1. By signing and submitting this proposal, the prospective primary participant is providing the certification set out below.

2. The inability of a person to provide the certification required below will not necessarily result in denial of participation in this covered transaction. The prospective participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective primary participant to furnish a certification or an explanation shall disqualify such person from participation in this transaction.

3. The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

4. The prospective primary participant shall provide immediate written notice to the department or agency to which this proposal is submitted if at any time the prospective primary participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

5. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause have the meanings set out in the Definitions and Coverage sections of the rules implementing Executive Order 12549. You may contact the department or agency to which this proposal is being submitted for assistance in obtaining a copy of those regulations.

6. The prospective primary participant agrees by submitting this proposal that , should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is proposed for debarment under 48 CFR part 9, subpart 9.4, debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

7. The prospective primary participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-- Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

8. A participant in a covered transaction may relay upon a certification of a prospective participant in a lower tier covered transaction that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the List of Parties Excluded from Federal Procurement and Nonprocurement Programs (http://www.arnet.gov:8000/epls/owa/epls_search.name_srch).

9. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that

which is normally possessed by a prudent person in the ordinary course of business dealings.

10. Except for transactions authorized in paragraph 6 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is proposed for debarment under 48 CFR part 9, subpart 9.4, suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions

(1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency;

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of a Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

7. MILITARY RECRUITING

As a condition for receipt of funds available to the Department of Defense (DOD) under this award, the recipient agrees that it is not an institution of higher education (as defined in 32 CFR part 216) that has a policy of denying, and that it is not an institution of higher education that effectively prevents, the Secretary of Defense from obtaining for military recruiting purposes (a) entry to campuses or access to students on campuses, or (b) access to directory information pertaining to students. If the recipient is determined, using the procedures in 32 CFR part 216, to be such an institution of higher education during the period of performance of this agreement, and therefore to be in breach of this clause, the Government will l cease all payments of DoD funds under this agreement and all other DoD grants and Cooperative Agreements to the Recipient, and it may suspend or

terminate such grants and agreements unilaterally for material failure to comply with the terms and conditions of award.

8. LIVE ORGANISMS

By signing this agreement or accepting funds under this agreement, the Recipient assures that it will comply with applicable provisions of the Rules of the Department of Interior (50 CFR parts 10-24)and Commerce (50 CFR parts 217-227)implementing laws and conventions on the taking, possession, transport, purchase, sale, export, or import of wildlife and plants, including the: Endangered Species Act of 1973(16 U.S.C. 1531-1543); Marine Mammal Protection Act(16 U.S.C. 1361-1384); Lacey Act(18 U.S.C. 42); and Convention on International Trade in Endangered Species of Wild Fauna and Flora.

9. ENVIRONMENTAL IMPACT

The Recipient agrees to identify to the awarding agency any impact the work under this cooperative agreement may have on the quality of the human environment, and provide help the agency may need to comply with the National Environmental Policy Act (NEPA, at 42 U.S.C. 4321, et.seq.) and to prepare Environmental Impact Statements or other required environmental documentation. In such cases, the Recipient agrees to take no action that will have an adverse environmental impact (e.g. physical disturbance of a site such as breaking of ground) until the agency provides written notification of compliance with environmental impact analysis process.

10. SUBAWARDS/FLOW-DOWN REQUIREMENTS

Any legal entity that receives an award from a DoD component shall apply the provisions of part 32 of the DoD Grant and Agreement Regulations, DoD 3210.6-R to subawards with institutions of higher education, hospitals, and other non-profit organizations. Thus, a governmental or for-profit organization, whose prime award from a DoD Component is subject to 32 CFR part 33 or part 34, respectively, applies this part to subawards with institutions of higher education, hospitals, or other non-profit organizations. It should be noted that subwards are for the performance of substantive work under awards, and are distinct from contracts for procuring goods and servcies. It should be further noted that non-profit organizations that implement Federal programs for the States are also subject to State requirements.

All contracts awarded by a Recipient, including those for amounts less than the simplified acquisition threshold, shall contain the following provisions as applicable:

1. <u>Equal Employment Opportunity</u> - All contracts shall contain a provision requiring compliance with E.O. 11246 (3 CFR, 1964-1965 Comp., p.339), Equal Employment Opportunity, as amended by E.O. 11375 (3 CFR, 1966-1970 Comp., p. 684), Amending Executive Order 11246 Relating to Equal Employment Opportunity, and as supplemented by regulations at 41 CFR chapter 60, Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor.

2. Rights to Inventions Made Under a Contract, Grant or Cooperative Agreement - Contracts, grants, or cooperative agreements for the performance of experimental, developmental, or research work shall provide for the rights of the Federal Government and the Recipient ub abt resulting invention in accordance with 37 CFR part 401, Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts, and Cooperative Agreements.

3. Clean Air Act (42 U.S.C. 7401 et seq.) and the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.), as amended - Contracts and subawards of amounts in excess of $100,000 shall contain a provision that requires the recipient to agree to comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act (42 U.S.C. 401 et seq.) And the Federal Water Pollution Control Act as amended (33 U.S.C. 1251 et seq.). Violations shall be reported to the responsible DoD component and the Regional Office of the Environmental Protection Agency (EPA).

4. Byrd Anti-Lobbying Amendment (31 U.S.C. 1352) - Contractors who apply or bid for an award of $100,000 or more shall file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay an person or organization for influencing or attemptin to influence an officer or employee of any agency, a Member of Congress, officer or employee of Congress, or an employee of a Member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 U.S.C. 1352. Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the Recipient.

5. Debarment and Suspension (E.O.s 12549 and 12689) - Contract awards that exceed the simplified acquisition threshold and certain other contract awards shall not be made to parties listed on the General Services Adminstration s Lists of Parties Excluded from Federal Procurement and Nonprocurement Programs in accordance with E.O.s 12549 (3 CFR, 1986 Comp., p.189) and 12689 (3CFR, 1989 Comp., p.235), Debarment and Suspension. This list contains the names of parties debarred, suspended, or otherwise exluded by agencies, and contractors declared ineligible under statutory or regulatory authority other than E.O. 12549. Contractors with awards that exceed the simplified acquisition threshold shall provide the required certifications regarding its exclusion status and that of its principals.

Exhibit 1

STATEMENT OF WORK

Research to Demolish WWII Buildings from Army Installations through Deconstruction & Materials' Salvage

A. Background.

There are over 50-million square feet of surplus World War II-era wood framed buildings that must be removed from Army installations. Typical practice is to mechanically demolish these buildings and deposit the debris in landfills. In addition to the expense of demolition, this practice diminishes already limited landfill space, both on- and off-post, and wastes otherwise useable resources that could be recovered from the buildings. Landfilling demolition debris even contributes to global warming through greenhouse gas generated by landfills and the reduction of forests' carbon dioxide sequestering capacity through lumber harvesting.

The Principal Deputy Assistant Secretary of the Army (PDASA) has entered into discussions with Habitat for Humanity and other Federal agencies (including HUD and EPA) to develop less expensive and less wasteful avenues of disposing of surplus buildings by moving them off installations, or deconstructing them to salvage building materials for reuse. The PDASA has committed the Army to supporting initiatives whereby the Army and surrounding communities can benefit from the reuse of excess Army buildings.

The US Environmental Protection Agency, Office of Solid Waste, is also sponsoring research to identify the potential for demolition debris diversion at military installations, to develop techniques to improve the economic viability of deconstruction as an alternative to mechanical demolition, and to increase the value of recovered materials, thus further encouraging deconstruction.

B. Objective.

The objectives of this research are to 1) develop an Army wide capability and infrastructure for the recovery and reuse of materials from surplus buildings, thereby dramatically reducing the solid waste burden of demolition debris and reducing adverse environmental burdens associated with the extraction and processing requirements of new materials, and 2) develop a method (or "template") for removing surplus wood-frame buildings and salvaging materials. This "template" will include data and processes that are not now available within the industry.

Fort Campbell, KY has made surplus wood framed buildings available for a Pilot Project to develop economical and practical deconstruction techniques, provide

data, evaluate methods of increasing marketability and value of recovered wood materials, and serve as a model for development of a “template” for further demolition by deconstruction and materials salvage.

C. Major Requirements.

SECTION 01, GENERAL.

1. SCOPE.

   1.1. Provide all labor, supplies, materials, equipment, and other resources necessary to perform the following:
      1.1.1. Demolish, by deconstruction and salvage, 20,000 to 25,000 square feet of World War II wood framed buildings at Fort Campbell, KY. Dispose of the remaining demolition debris. Buildings available for demolition are described in APPENDIX A, attached.
      1.1.2. Remove all piers, floor slabs, and foundations to grade.
      1.1.3. Remove underground utilities above grade.
      1.1.4. Remove overhead electrical drops to the pole.
      1.1.5. Fill excavations and grade to drain.
      1.1.6. Seed and mulch exposed soil.

   1.2. The following may remain in place.
      1.2.1. Walks, driveways, hardstands, culverts and drainage structures, and other paving nominally flush with the grade.
      1.2.2. Foundations below grade.
      1.2.3. Underground utilities.

2. RESEARCH PARTNERS. Under independent agreements, the US Forest Products Laboratory (FPL) and the University of Florida, Center for Construction and Environment (UF-CCE) will perform research activities in connection with this Work.

   2.1. Coordinate with the UF-CCE representative to apply selected combinations of manual and mechanical techniques to remove the buildings.

   2.2. Coordinate with the FPL representative to provide a sample of siding material for FPL’s evaluation of paint removal and reprocessing methods.

3. DRAWINGS AND SCHEDULES.
   3.1. Site Plan.
   3.2. Fort Campbell map.

4. REGULATORY COMPLIANCE. The Recipient shall be responsible for knowledge of and compliance with all applicable federal, state, and local

regulations. The Fort Campbell Environmental Manual will be provided to the Recipient in CD ROM format for their reference and information.

5. ASSIGNMENT OF WORK AREAS. Confine deconstruction, materials processing, and associated activities to the areas designated on the Site Plan. These areas include site access, the building sites, parking areas, storage areas, borrow and spoil locations, and haul routes. Use of other Government premises will be permitted only with the written consent of the Fort Campbell representative.

6. SITE ACCESS. Recipient personnel may enter Fort Campbell by automobile through any open gate. Trucks, busses, vans, equipment, and vehicles other than automobiles shall enter through Gate 7 only. Obtain temporary vehicle registration for all vehicles to be entering Fort Campbell throughout the duration of the Work. Site access provisions are subject to change depending on the Alert Status in effect at the time of the Work.

7. IDENTIFICATION. Require all Recipient personnel, including subcontracted services, to display personal identification at all times while on Fort Campbell property.

   7.1. Not later than 5 working days before beginning the Work, submit to the Fort Campbell representative a list of all members of the Recipient's workforce and any Subcontractors the Recipient engages. Notify the Fort Campbell representative of any additional workers no later than 5 working days prior to their appearance on-site.

   7.2. Issue an identification badge to each worker prior to their appearance at Fort Campbell. Display the Recipient's or Subcontractor's name, logo, and telephone number, and worker's photograph and signature on the badge. Cancel the identification for persons no longer working on-site and turn these individuals' badges in to the Fort Campbell representative.

   7.3. Fort Campbell may require Recipient and Subcontractor personnel to wear identification issued by Fort Campbell. If this is the case, identification badges will be made and issued on the first day personnel appear on-site. Provide a copy of this Agreement to the Fort Campbell Office responsible for issuing the badges. ERDC / CERL and/or the Fort Campbell representative will assist in this process.

   7.4. Notify the Fort Campbell representative of any visitors to the site no later than 5 working days prior to their appearance on-site. Photographic identification (such as valid Driver's License) will be required to enter Fort Campbell property. Escort visitors at all times while on Fort Campbell property.

7.5. Identification requirements are subject to change depending on the Alert Status in effect at the time of the Work.

8. MINIMUM AGE. Persons under sixteen years of age are not permitted to perform hazardous work.

9. SAFETY. Develop and implement a Safety Management program throughout the performance of Work.

9.1. Describe the following in the Safety Management plan.
9.1.1. Personnel assigned as the Recipient's Safety Manager, and their oversight and supervision responsibilities.
9.1.2. Hazards present during deconstruction, material processing operations, transportation, methods for communicating hazards, and methods to mitigate or protect against hazards.
9.1.3. Plans for safety training and ongoing safety awareness.
9.1.4. Documentation of safety management activities, including hazard analyses, inspection results, and accident reports.
9.1.5. Accident response plans.

9.2. No explicit acceptance of the Safety Management plan will be issued. The Government reserves the right to require the Recipient to make changes to the Safety Management plan.

9.3. Prior to beginning deconstruction work, meet with the Fort Campbell representatives for a briefing on the BUILDING DECONSTRUCTION SAFETY CHECKLIST, attached as APPENDIX C.

9.4. If personnel are injured performing this Work to an extent requiring emergency medical attention, they may report to Blanchfield Army Community Hospital Emergency Room, or dial 911 for an ambulance.

9.5. Report all injuries requiring emergency medical attention to the Command Safety Office, 956-2621, Building 2170, 13-1/2 Street and Indiana no later than the next work day of the injury.

10. TEMPORARY FACILITIES. Provide and maintain an administrative field office or similar location where the Recipient's Project Manager and project documents shall be located at all times, in-person and by phone, while the Work is being performed. Provide the Fort Campbell representative with the Recipient's phone number during mobilization.

10.1. Provide potable water at each building site during demolition operations.

10.2. All buildings designated for deconstruction are available to the Recipient for their use until they are deconstructed.

10.3. Water, sanitary, and electrical services will be available in at least one building in the 2700 block until these buildings are deconstructed. Coordinate with the Fort Campbell representative relative to the availability and termination of these services. Alternative arrangements may be proposed to the Fort Campbell representative.

10.4. Washroom and toilet facilities in occupied buildings are not available to the Recipient.

10.5. Before final acceptance of the Work, remove all temporary utilities, facilities, and construction from Fort Campbell property.

11. PROTECTION OF LAND AREAS. Preserve land areas outside the limits of the Work in their present condition. The Recipient shall be responsible for the repair and restoration of any property damaged during the performance of the Work.

12. PROTECTION OF TREES AND SHRUBS. Protect trees and shrubs not designated for removal.

12.1. Protect any root structures exposed during excavation activities. Cover exposed roots as quickly as possible with moist backfill, tamped, and watered with a mist spray.

12.2. Restore trees that are scarred or damaged as nearly as possible to its original condition. Coat scars as soon as possible with a tree wound dressing manufactured for that purpose.

12.3. Remove any tree that is damaged beyond saving, and replace it with a nursery-grown tree of the same species and size.

13. PROTECTION OF WATER RESOURCES. Control the disposal of fuels, oils, bitumens, calcium chloride, acids, or other harmful materials, both on and off the Government premises. Comply with all applicable federal, state, county, and municipal laws concerning pollution of rivers and streams.

14. WASTE DISPOSAL. Dispose of demolition debris in the Woodlawn Road Construction Debris Landfill only.

14.1. Separate and collect heavy steel, light steel, aluminum, copper, and brass removed from the buildings during demolition Deposit these materials at the Defense Reutilization and Marketing Office (DRMO), indicated on the Fort Campbell map.

Separate and collect the following office- and household-types of recyclable materials: aluminum cans; steel cans; #1 and #2 plastic beverage containers; office paper; and cardboard. Deposit these materials at the Recycling Convenience Center indicated on the Fort Campbell map.

14.2. The Recipient may, at their option, keep recyclable materials. If the Recipient keeps recyclable materials, they shall provide their own receptacles, weigh each material individually by type, and report the weights to the Fort Campbell representative before materials are removed from the jobsite.

14.3. Dispose of trash and other waste materials other than demolition debris. Deposit these materials at the convenience centers designated on the Fort Campbell map.

14.4. The Recipient shall be responsible for the removal of any waste materials dumped by the Recipient or any Subcontractors in unauthorized areas and remediation of the dump site.

15. DUST CONTROL. Maintain all work areas free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance. Sprinkling with water will be permitted to control dust.

16. EROSION CONTROL. Provide temporary erosion & sedimentation control measures for exposed loose soil in piles of 24 inches or higher which are subject to erosion from rainfall.

17. CLEAN-UP. Unless otherwise authorized by the Contracting Officer, obliterate all debris and signs of operations such as, work areas, temporary structures, or stockpiles of materials prior to final acceptance of the Work. Grade, fill, and seed all disturbed areas.

18. QUALITY CONTROL (QC). Develop and maintain a Quality Control system to ensure the Work is accomplished in compliance with the Agreement requirements.

18.1. Describe the following in the QC plan.

18.1.1. The assigned Recipient's Quality Manager

18.1.2. Plans and schedules for conducting inspections, both on-site and off-site

18.1.3. Documentation of inspection results

18.1.4. Procedures for identifying deficiencies and implementing corrective action.

18.1.5. Procedures for verifying compliance with the prevailing environmental regulations

18.2. No explicit acceptance of the QC plan will be issued. The Grants Officer reserves the right to require the Recipient to make changes to the QC plan and operations to obtain the specified quality of Work.

18.3. Prior to closing out the Work, conduct a Final Inspection with the Fort Campbell representative to verify that all deficiencies have been corrected.

18.4. Maintain current records of inspections, tests performed, and other quality control activities throughout the performance of the Work. When requested, provide current documentation to the Fort Campbell representative.

18.5. The Grants Officer will notify the Recipient of any noncompliance with the Agreement requirements. If the Recipient fails to comply promptly, the Grants Officer may issue an order stopping all or part of the Work until satisfactory corrective measures have been taken.

19. MEETINGS AND REVIEWS.

19.1. Meet with the Fort Campbell representative at the initiation of this project and weekly throughout completion of deconstruction operations. The purpose of these meetings is to review safety, logistical and other site related issues and requirements. These meetings will be scheduled at the mutual convenience of the Recipient and Fort Campbell representative, and may be cancelled by mutual consent.

19.2. Meet with CERL representatives at the initiation of this project at the Fort Campbell Representative's office, and a minimum of once each month throughout completion of deconstruction operations. The purpose of these meetings is to review project administration, progress and results of deconstruction operations to date, and anticipated results upon completion. These meetings will be scheduled at the mutual convenience of the Recipient and CERL personnel.

SECTION 02, UTILITY CLEARANCE AND NOTIFICATION.

1. TERMINATION OF UTILITIES. Fort Campbell will terminate all utilities to the buildings. Provide the Fort Campbell representative with at least 10 working days notice prior to beginning deconstruction on any building, so that utilities can be disconnected. Coordinate with the Fort Campbell representative before beginning work on each building to verify that each utility is inactive.

2. UTILITY SERVICE INTERRUPTIONS. If the Recipient intends to interrupt an active utility, submit to the Fort Campbell representative written notification at

least five working days in advance of each utility and communication service to be interrupted. No single outage shall exceed 4 hours unless approved by the Fort Campbell representative.

3. ROAD CLOSINGS. If the Recipient intends to close or obstruct a street or walk, submit to the Fort Campbell representative written notification at least 48 hours in advance of each closure or obstruction. Closure or obstruction requires approval by the Fort Campbell representative.

4. PROTECTION OF UTILITY LINES. Protect existing buried and underground utility lines from damage. If utility lines are damaged, immediately report damages to the Fort Campbell representative. The Recipient is responsible for repairing such damages.

5. DISCREPANCIES. Notify the Fort Campbell representative of any discrepancies between the utilities described by the Utility Plan and actual in-place conditions.

6. UNDETECTED UTILITIES. Immediately report encounters with any utilities that are not identified on the Utility Plan to the Fort Campbell representative. If the utility is live, stop work until the utility is terminated or otherwise determined by the Fort Campbell representative to be safe to resume work.

SECTION 03, DEMOLITION

1. DISPOSITION OF MATERIALS. All materials generated through the demolition work, unless otherwise specified, shall become the property of the Recipient.

2. PRE-DEMOLITION MEETING. Prior to beginning demolition operations, schedule a meeting with the Fort Campbell Representative, Fort Campbell Safety Office, and CERL representatives. At this meeting, the following will be addressed.
   2.1. Fire protection and Safety Management plans
   2.2. Deconstruction methods, potential hazards, and safety measures.
   2.3. Recipient's Quality Control plan.
   2.4. Environmental management.
   2.5. Security.
   2.6. Logistics and administration of the Work.

3. PROJECT SIGN. The Recipient may furnish and erect a project sign at each building to be deconstructed. Coordinate with the Fort Campbell representative relative to the size of the sign, use of logos, and agencies acknowledged on the sign.

4. FENCING. Cordon off each building site when deconstruction operations are taking place to restrict casual access.

4.1. Four foot high orange plastic snow fencing is an acceptable method.

4.2. The Recipient may lock the buildings to secure tools and materials. Provide the Fort Campbell representative with keys to all locks installed by the Recipient.

5. HAZARDOUS MATERIALS.

5.1. Survey each building to be demolished for fluorescent tubes, PCB-containing ballasts, and mercury (Hg)-containing ampoules. Report the contents of each building to the Fort Campbell Representative and identify the requirements for containers. Fort Campbell will provide and remove the containers.

5.1.1. Assume fluorescent light fixture ballasts are PCB-containing unless labeled by the manufacturer as “NO PCBs” or similar wording. At their option and expense, the Recipient may perform testing on suspected PCB-containing ballasts to determine PCB content.

5.2. Remove fluorescent tubes, PCB-containing ballasts, and mercury (Hg)-containing ampoules prior to beginning any demolition activities on a building. Either removing hazardous materials from all buildings at one time or from each building individually prior to its demolition is acceptable. Contact the Fort Campbell representative when all hazardous materials are removed.

5.2.1. Deposit all hazardous materials directly into the appropriate containers upon their removal.

5.2.2. Do not leave hazardous materials unsecured on the jobsite without supervision. Lock or secure containers in a building at the end of the workday.

5.2.3. In the event that either PCBs or Hg is spilled, leaking, or suspected of spilling or leaking, immediately stop Work in that building and notify the Fort Campbell representative. Do not attempt to clean the leak or spill. Fort Campbell personnel will clean the leak or spill and notify the Recipient when they may resume Work.

5.2.4. Hazardous materials shall not remain on the jobsite for more than three days. Notify the Fort Campbell representative when the containers are ready to be removed.

5. ASBESTOS NOTICE.

5.1. Fort Campbell will remove any asbestos discovered in any of the buildings. All such material is believed to have already been removed by Fort Campbell. The Recipient is hereby informed and does acknowledge that friable asbestos was commonly used at the time this building was constructed and may exist within material or equipment to be removed. Exposure to airborne asbestos has been associated with a number of health problems. If asbestos is suspected or encountered, the Recipient shall immediately stop work in that area and inform the Fort Campbell representative. Federal laws require asbestos removal operations in accordance with the following standards:

5.1.1. National Emission Standards for Hazardous Air Pollution (40 CFR Part 61 as amended)

5.1.2. Standards on Respiratory Protection and Asbestos (29 CFR 1910.134 and 29 CFR 1910.1001).

5.1.3. U.S. Army Corps of Engineers General Safety Requirements (EM 385-1-1).

5.2. If asbestos is confirmed to exist in any building after the Recipient begins work, the Recipient will be provided written notice to stop work. Fort Campbell will promptly remove such material and give the Recipient written notice when to resume salvage and removal work.

5.3. The Recipient specifically agrees to indemnify and hold harmless the Government from liability of any nature or kind arising from asbestos exposure to the Recipient and/or his/her associated personnel.

6. LEAD BASED PAINT DISCLOSURE. The Recipient is hereby informed and does acknowledge that lead-based paint was commonly used at the time these buildings were constructed and/or modified and may exist on painted surfaces of the buildings or within the buildings and/or their associated structures. In accordance with the Environmental Protection Agency and the Department of Housing and Urban Development's final rule "Lead; Requirements for Disclosure of Known Lead-Based Paint and/or Lead-Based Paint Hazards in Housing" (61 FR 9064-9088), a federally approved lead hazard information pamphlet and disclosure of any known lead-based paint and/or lead-based paint hazards will be provided to the Recipient upon request.

7. PERSONNEL PROTECTION. During deconstruction, continuously evaluate the condition of structures being removed and take immediate action to protect all personnel working in and around the buildings being removed. No structural elements will be allowed to remain in-place without sufficient bracing, shoring, or lateral support to prevent collapse or failure while personnel perform work in the immediate area. Ensure no unstable elements

are left unsupported. Support any member made unstable by cutting, removing supporting members, or other deconstruction operations.

8. WASTE CONTROL. Prevent recovered building materials, debris, rubbish, and other waste materials from becoming a nuisance or hazard within designated work areas or adjacent areas.

   8.1. Police the site for rubbish, trash and recyclable materials daily, or more frequently if necessary to prevent their blowing and scattering within the work areas and adjacent areas.

   8.2. Collect demolition debris daily. Remove demolition debris from each building's site no later than 30 days after that building has been deconstructed.

   8.3. Remove and transport debris in a manner to prevent spillage on streets or adjacent areas. Police any material falling from the vehicle at the time of the spillage.

   8.4. Process and store salvaged building materials in a neat and orderly manner.

9. EXPLOSIVES. Use of explosives will not be permitted.

10. BURNING. Burning at the project site will not be permitted.

11. FILLING AND GRADING. Fill and grade all excavated areas at each building site. Meet adjacent elevation and slope to direct runoff to existing drainage patterns. If fill is required, it may be obtained from the borrow area designated on the Fort Campbell map.

   11.1. Remove unsuitable materials from areas to be filled. Existing brick, stone, concrete and other inert rubble may remain, if it will be covered by a minimum of 6-inches of soil. Burying additional rubble is not permitted. Remove sediment, debris, and other obstacles from culverts, swales, and existing drainage courses.

   11.2. Do not place fill when the subsurface is frozen, excessively wet, extremely dry, or otherwise detrimental to proper grading and seeding.

   11.3. Fill holes in lifts of no greater than 3 feet and compact each lift prior to the placement of the next lift.

   11.4. Place fill material in successive horizontal uniformly spread layers of loose material not more than 12-inches deep and compact each layer prior to the placement of the next layer.

11.5. Place a minimum of 6-inches of topsoil over excavated and filled areas to be seeded.

12. SEEDING. Sow Bermuda grass on all exposed topsoil. Do not seed when drought, excessive moisture, or other adverse conditions will prevent germination. Uniformly spread hay or straw mulch over seeded areas on the same day as the seed is applied. Water seeded areas immediately within the workday on which the seed and mulch is spread. Provide a one-year warranty on turf seeded by the Recipient or Subcontractor.

SECTION 04, RESEARCH REQUIREMENTS.

1. UF-CEE RESEARCH. Under an independent agreement, UF-CEE will develop alternative combinations of manual and mechanical techniques for dismantling wood frame buildings. The purpose of this research is to improve the cost, time, and material recovery performance of deconstruction. UF-CCE and the Recipient shall coordinate on the development and application of these methods to this Pilot Project.

2. FPL RESEARCH. Under an independent agreement, FPL will evaluate alternatives for removing paint and reprocessing wood siding material to improve its marketability and increase value. Provide FPL with one (1) semi-trailer load of exterior siding boards. Remove siding boards intact, without cutting. Remove all nails from the boards and band boards into bundles. Protect the siding from rain and moisture, dirt and mud, and physical damage. FPL will pick up and transport this material.

3. ERDC/CERL RERSEARCH. ERDC/CERL personnel will conduct research and development (R&D) activities based on the progress and resources applied to demolishing buildings by deconstruction. This R&D involves monitoring activities, gathering productivity and cost data, modeling project schedules and costs, auditing debris diversion, and providing guidance for future demolition of Army buildings. Provide ERDC/CERL with access to demolition operations and information that will enable this R&D.

4. ACCESS. Allow ERDC/CERL and FPL personnel access to each building site and demolition operations.

5. INFORMATION. Provide CERL personnel with the following information.

   5.1. Description of manual disassembly processes and each experimental disassembly method developed by UF-CCE and applied to the buildings.

   5.2. Work Breakdown Structure or similar description of tasks and activities for each building type and deconstruction method.

5.3. Demolition schedule.

5.4. Resources applied to disassembling each building, including personnel and equipment.

5.5. Codes of Accounts, or similar compilation of labor, equipment, and other resources applied to demolition tasks.

5.6. Recipient's Quality Control and Safety management plans.

5.7. Access to materials salvaged from each building, so ERDC/CERL can model inventories and estimate values of the salvageable materials.

5.8. Access to debris generated from the buildings so ERDC/CERL can characterize debris and model diversion under deconstruction scenarios.

D. Deliverables. At the conclusion of demolition activities, provide three (3) copies of a report that describes the following to the Alternate Grants Officer's Representative:

1. Resources the Recipient utilized to perform the deconstruction activities at Fort Campbell. This includes in-house resources, consulting services, commercial construction services, National Service Programs, non-profit organizations, and other local organizations.

2. Processes taken by the Recipient to provide demolition services to Fort Campbell. These include but are not limited to

    a. Obtaining out-of-house resources.
    b. Obtaining bonding and insurance.
    c. Procedures and requirements to engage NCCC AmeriCorps to provide labor. Include either a summary of the conditions of the agreement between HfH and NCCC Americorps, or a copy of the agreement.
    d. Obtaining housing, food services, and other support for maintaining the workforce on-site.
    e. Arrangements with local organizations, including HfH affiliates, that participated in the deconstruction project.
    f. Other steps necessary to provide a deconstruction capability at Fort Campbell.

3. Outlets for the materials salvaged from the buildings. Describe the types of outlets (i.e. Recipient, broker, re-sales outlet, charitable organization, individuals, recyclers, others) and how these outlets were identified.

Describe the methods by which the materials were transferred (i.e. direct sales, consignment, donation, other).

4. Inventory of the materials salvaged and recycled from the buildings for resale and recycling. Include the weights of all recyclable materials individually.

5. Value of the materials salvaged from the buildings, per each material. Describe sale value of materials that were sold, and estimated value of materials that are not yet sold.

6. A critique, or lessons-learned, from the Fort Campbell project that should be applied to future Army deconstruction projects.

7. Using the Fort Campbell project as point of departure, develop a set of procedures and timeline with which other Army Installations can contract with a non-traditional service (both for-profit and non-profit) to remove WWII-era buildings by deconstruction and salvage.

   a. Describe the steps, activities, tasks, and arrangements to be performed by each the non-traditional service and the Army

   b. Develop a generic timeline that will allow a non-traditional service to deconstruct WWII-era buildings (as opposed to demolishing them). Include tasks and activities described in a, above. Assume the most aggressive schedule reasonable. Describe any opportunities to reduce times, and measures necessary to achieve a reduced scheduled.

   c. Develop a budget-level estimate of cost to the Army to remove WWII-era wood framed buildings. Indicate the major cost variables. Describe opportunities for reducing costs.

E. Insurance:

(a) The Recipient shall, at its own expense, provide and maintain during the entire performance of this cooperative agreement, at least the kinds and minimum amounts of insurance required below.

(b) Before commencing work under this cooperative agreement, the Recipient shall notify the Grants Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective --

(1) For such period as the laws of the State in which this cooperative agreement is to be performed prescribe; or

(2) Until 30 days after the insurer or the Recipient gives written notice to the Contracting Officer, whichever period is longer.

(c) The Recipient shall insert the substance of this clause, including this paragraph (c), in subcontracts under this cooperative agreement that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the cooperative agreement. The Recipient shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Grants Officer upon request.

SCHEDULE OF INSURANCE

TYPE OF INSURANCE	AMOUNT
Workmen's Compensation and Employer's Liability Insurance	$100,000.00
General Liability Insurance per Occurence.....	$500,000.00
Comprehensive Automobile Liability Insurance:	
Minimum Per Person.....	$200,000.00
Per Occurrence for Bodily Injury.....	$500,000.00
Per Occurrence for Property Damage.....	$20,000.00

F. Period of Service. All work to be performed under this cooperative agreement shall be completed no later than August 31, 2002.

APPENDIX A. Building Description.

The following buildings have been identified by Fort Campbell as being available for demolition by deconstruction and salvage. The following descriptions are for general information only, and are not intended to imply a detailed description of construction, contents, or material quantities.

> Buildings 2715, 2717, 2719, 2721, 2723, 2725, 2727, and 2744 are two-story barracks-type buildings approximately 5310 square feet each. The first floors are built on concrete piers, with the exception of a boiler room in one corner, which has a concrete wall foundation and slab-on grade.
>
> Buildings 2736 and 2738, are one story buildings, approximately 3,250 square feet each, and currently used as administrative-type facilities. Roughly half of the floor is built on concrete piers, and the other half is a slab-on-grade.
>
> Building 2748 is a one-story building, approximately 2,950 square feet, and currently used as an administrative-type facility. The floor is built on concrete piers.
>
> Building 834 is a one-story warehouse, approximately 9,000 square feet. A wood framed floor is built on continuous foundation walls running the length of the building.

All buildings are built primarily with dimensional lumber. There is no heavy timber construction.

Interior configurations vary. All buildings have been partitioned to some extent.

All buildings are currently occupied or have recently been occupied, and have been upgraded since their original construction. Upgrades include vinyl siding, replacement windows, interior finishing, and miscellaneous electrical and plumbing upgrades.

APPENDIX B. Safety Checklist.

The following safe work practices must be observed in connection with building demolition.

1. Restrict access to the work site by use of engineer tape or rope to maintain a 15-20 foot buffer around the work area/building. In particular, access must be restricted below areas where overhead demolition is in progress.

2. Children under 16 years of age are not allowed to perform hazardous work.

3. Hard hats should be worn at all times, and are required if you are working below an area where others are working (if prohibited by religion, this requirement can be exempted if overhead hazards are minimized or eliminated using risk management practices). Safety glasses or goggles, gloves and hearing protection are also required when hazards dictate.

4. Demolition of buildings must be performed in a proper manner as to prevent accidental collapse of the structure. A demolition plan should be developed prior to the start of the demolition. Structural or load supporting members shall not be cut or removed until the overlaying structure has been removed. Demolition of exterior wall and floor construction should proceed downward after the roof has been removed. Each story of multi-story structures must be dismantled before commencing with removal of floors and walls in the story below.

5. Electric, gas, and water will be disconnected from the building prior to demolition activities. All utilities <u>must</u> remain shut off.

6. In order to prevent glass fragment hazards glass materials will not be dropped or broken out.

7. If dropping debris through a floor hole, the area around where the material is dropped will be guarded. Floor openings should be covered or guarded with a railing when not in use as material drops.

8. Waste materials and rubbish shall be placed in appropriate containers.

9. Hand and power tools shall be inspected and determined to be in good condition before each use. Throwing tools or materials from one location to another or from one person to another, or dropping them to lower levels is not permitted.

10. Lumber should be stacked level, stable and self-supporting. Lumber piles shall not exceed six feet in height. Reusable lumber shall have nails withdrawn, hammered in, or bent over flush with the wood before stacked for storage.

11. All obstructions or projections into an access way shall be removed or conspicuously marked. Projections that are sharp or pointed shall be covered with protective material. Work areas and means of access shall be maintained free of equipment or material which could obstruct passage or cause a trip hazard.

12. Individuals working on top of a roof or along unguarded edges above six feet must be tied off to a fall protection system. This is a mandatory requirement for all contractors and installation employees. Falling from elevation is one of the most significant hazards faced on demolition/deconstruction projects.

13. Work will be suspended on roofs or on top of walls when weather conditions constitute a hazard (lightning, high winds, wet or icy conditions, etc).

14. Some material(s)s located in the building(s) may contain hazardous substances such as asbestos, and lead based paint. Adequate precautions must be taken when removing this material(s). If unsure whether a type of material within a building contains these hazardous substances, you may check with the Fort Campbell Representative.

15. If there is an employer/employee relationship between a successful bidder and workers on the demolition/deconstruction site, all work is subject to OSHA regulation. Failure to follow OSHA regulations in this situation can result in fines and/or civil/criminal liability.

16. A welding permit must be obtained from the Fort Campbell Fire Department if welding is necessary, such as cutting metal pipes.

17. If personnel are injured performing this demolition to an extent requiring emergency medical attention, they may report to Blanchfield Army Community Hospital Emergency Room, or dial 911 for an ambulance.

18. Contractor will report all injuries requiring emergency medical attention to the Command Safety Office, 956-2621, Bldg 2170, 13 ½ Street and Indiana no later than the next work day of injury.

Building Number of Structure to be demolished: _____

Type of Building (Barracks, Mess Hall, etc): _____

I have been briefed on and understand the above safety procedures.

_____

Name (Please Print)/Signature/Date

_____

Director of Safety (Acting)

Exhibit 2

US ARMY CORPS OF ENGINEERS
ELECTRONIC PAYMENTS/DIRECT DEPOSIT

1. The Debt Collection Improvement Act of 1996 provided that Federal payments shall be made by electronic funds transfer (EFT). The Corps issues electronic corporate payments though the Automated Clearing House (ACH) network using the Cash Concentration or Disbursement Plus Addendum (CCD+) payment format. Instead of receiving checks, you will have payments directly deposited into your checking or savings account.

2. The benefits of receiving payments electronically are no lost or stolen checks, no deposit delays, prompt availability of funds, fully traceable payments, and decrease in fraud.

3. EFT/Direct Deposit payments are available for vendors who have active contracts with the Corps sites within the Continental United States. Corps travelers working for these sites should also sign up for EFT.

4. Attached is Form UFC-DISB-4 with instructions that can be used by both vendors and travelers to sign up for Corps EFT payments.

5. Point of contact for questions is Michael Rye, commercial 901-874-8543, DSN 882-8543, Corps email address; t0rmfmtr@cefc.fc, Internet address; Michael.T.Rye@usace.army.mil.

INSTRUCTIONS FOR COMPLETING FORM UFC-DISB-4

1. Vendors and/or travelers should indicate if this is an add as a new Direct Deposit to be set up or a change or cancellation. USACE employees already on payroll Direct Deposit who have not completed a travel form should mark ADD.
2. Include the Corps of Engineers District name (example: Savannah) or EROC (example: K6) that wrote the contract authorizing payment. If more than one District issued contracts, prepare a separate form for each District.
3. Include the name or Company as it appears on the invoice. If the contract was written to Bill and Betty Smith, the bill and Direct Deposit form should include both names not Bill Smith.
4. This address should be the physical address of the business.
5. The city and state that match the physical address.
6. The mailing address should include any and all Remit to/payment addresses that are different from the physical address. (If more space is needed, include an attachment page with all addresses listed). This is VERY IMPORTANT since we load the routing and bank account number on each payment address.
7. Include daytime phone number in case there are questions concerning the completed form.
8. Check if the bank account number furnished is a checking account.
9. Check if the bank account number furnished is a savings account.
10. Include bank account number, one number in each slot. This number can be found on the front of the check.
11. The full name of the bank for the account.

12/13. An accurate address for the bank.

14. The routing number for the bank. It is located on the face of the check. This is always a nine digit NUMBER. Enter one number in each space.
15. Depositor account title is the name registered with the bank on the bank account.
16. For businesses include the IRS tax ID number. For an individual use the social security number.
17. Businesses should have a signature of an officer of the company. Individuals should sign. If the Direct Deposit form/contract is written in the name of Bill and Betty Smith, both individuals should sign.
18. Date of the authorization.

(removed)

DIRECT DEPOSIT AUTHORIZATION FORM

PRIVACY ACT STATEMENT

The following information is provided to comply with the Privacy Act of 1974 (P.L. 93-579). All information collected on this form is required under the provisions of 31 U.S.C. 3322 and 31 CFR 210. This information will be used by the Treasury Department to transmit data, by electronic means to vendor's financial institution. Failure to provide the requested information may delay or prevent the receipt of payments through the Automated Clearing House Payment System.

I hereby authorized U. S. Army Corps of Engineer, hereinafter called USACE, to initiate direct deposit credit entries to my (our) account indicated below and the financial institution named below, hereinafter called DEPOSITORY, to credit the same to such account.

(1) Check One of the following Statements::

I am not currently participating in the Direct Deposit Program.
( ) **ADD** - Deposit my payment to the account shown.

OR I am currently participating in the Direct Deposit Program.
( ) **CHANGE** – Change financial institutions and/or account number.

(2) Installation EROC _____

Name or (Company as shown on invoice): (3)		
Address: (4)		
City: (5)	State:	Zip:
Mailing Address (if different): (6)		
Daytime Phone: ( ) (7)		

Contract # (Optional):
If more than one contract, please list on a separate sheet.

Please ask your Financial Institution for your Depositor Account Number and Routing Number

(Indicate which type account to credit)

Type of Depositor Account Please check a box.		Checking (8)		Saving (9)
Depositor Account Number (10)				

Name of Financial Institution: (11)									
Address: (12)									
City: (13)			State:				Zip:		
Routing Number: (14)									
Depositor Account Title: (15)									

Tax ID Number (TIN) for Business: (16)	

SIGNATURE:_(17)_____ **DATE:_(18)**_____

Mail To: USACE Finance Center, ATTN: EFT/DISB, 5722 Integrity Drive, Millington, TN 38054-5005
FORM: UFC-DISB-4

Exhibit 3

REQUEST FOR ADVANCE OR REIMBURSEMENT (See instructions on back)	OMB APPROVAL NO. 0348-0004	PAGE OF PAGES
	1. TYPE OF PAYMENT REQUESTED — a. "X" one or both boxes: ☐ ADVANCE ☐ REIMBURSEMENT; b. "X" the applicable box: ☐ FINAL ☐ PARTIAL	2. BASIS OF REQUEST: ☐ CASH ☐ ACCRUAL
3. FEDERAL SPONSORING AGENCY AND ORGANIZATION ELEMENT TO WHICH THIS REPORT IS SUBMITTED	4. FEDERAL GRANT OR OTHER IDENTIFYING NUMBER ASSIGNED BY FEDERAL AGENCY	5. PARTIAL PAYMENT REQUEST NUMBER FOR THIS REQUEST
6. EMPLOYER IDENTIFICATION NUMBER	7. RECIPIENT'S ACCOUNT NUMBER OR IDENTIFYING NUMBER	8. PERIOD COVERED BY THIS REQUEST — FROM *(month, day, year)* / TO *(month, day, year)*
9. RECIPIENT ORGANIZATION *Name* : *Number and Street* : *City, State and ZIP Code:*	10. PAYEE *(Where check is to be sent is different than item 9)* *Name* : *Number and Street* : *City, State and ZIP Code:*	

11. **COMPUTATION OF AMOUNT OF REIMBURSEMENTS/ADVANCES REQUESTED**

PROGRAMS/FUNCTIONS/ACTIVITIES ▶		(a)	(b)	(c)	TOTAL
a. Total program outlays to date *(As of date)*		$	$	$	$
b. *Less:* Cumulative program income					
c. Net program outlays *(Line a minus line b)*					
d. Estimated net cash outlays for advance period					
e. Total *(Sum of lines c & d)*					
f. Non-Federal share of amount on line e					
g. Federal share of amount on line e					
h. Federal payments previously requested					
i. Federal share now requested *(Line g minus line h)*					
j. Advances required by month, when requested by Federal grantor agency for use in making prescheduled advances	1st month				
	2nd month				
	3rd month				

12. **ALTERNATE COMPUTATION FOR ADVANCES ONLY**

a. Estimated Federal cash outlays that will be made during period covered by the advance	$
b. *Less:* Estimated balance of Federal cash on hand as of beginning of advance period	
c. Amount requested *(Line a minus line b)*	$

AUTHORIZED FOR LOCAL REPRODUCTION

(Continued on Reverse)

STANDARD FORM 270 (Rev. 2-92) (EG)
Prescribed by Office of Management and Budget
Cir. No. A-102 and A-110
Designed using Perform Pro, WHS/DIOR, Dec 96

13. CERTIFICATION		
I certify that to the best of my knowledge and belief the data on the reverse are correct and that all outlays were made in accordance with the grant conditions or other agreement and that payment is due and has not been previously requested.	SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL	DATE REQUEST SUBMITTED
	TYPED OR PRINTED NAME AND TITLE	TELEPHONE (AREA CODE, NUMBER, EXTENSION)

This space for agency use

Public reporting burden for this collection of information is estimated to average 60 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0004), Washington, DC 20503.

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET, SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.

INSTRUCTIONS

Please type or print legibly. Items 1, 3, 5, 9, 10, 11c, 11e, 11f, 11g, 11i, 12 and 13 are self-explanatory; specific instructions for other items are as follows:

Item	*Entry*
2	Indicate whether request is prepared on cash or accrued expenditure basis. All requests for advances shall be prepared on a cash basis.
4	Enter the Federal grant number, or other identifying number assigned by the Federal sponsoring agency. If the advance or reimbursement is for more than one grant or other agreement, insert N/A; then, show the aggregate amounts. On a separate sheet, list each grant or agreement number and the Federal share of outlays made against the grant or agreement.
6	Enter the employer identification number assigned by the U.S. Internal Revenue Service, or the FICE (institution) code if requested by the Federal agency.
7	This space is reserved for an account number or other identifying number that may be assigned by the recipient.
8	Enter the month, day, and year for the beginning and ending of the period covered in this request. If the request is for an advance or for both an advance and reimbursement, show the period that the advance will cover. If the request is for reimbursement, show the period for which the reimbursement is requested.
Note:	The Federal sponsoring agencies have the option of requiring recipients to complete items 11 or 12, but not both. Item 12 should be used when only a minimum amount of information is needed to make an advance and outlay information contained in item 11 can be obtained in a timely manner from other reports.
11	The purpose of the vertical columns (a), (b), and (c), is to provide space for separate cost breakdowns when a project has been planned and budgeted by program, function, or activity. If additional columns are needed, use as many additional forms as needed and indicate page number in space provided in upper right; however, the summary totals of all programs, functions, or activities should be shown in the "total" column on the first page.
11a	Enter in "as of date," the month, day, and year of the ending of the accounting period to which this amount applies. Enter program outlays to date (net of refunds, rebates, and discounts), in the appropriate columns. For requests prepared on a cash basis, outlays are the sum of actual cash disbursements for goods and services, the amount of indirect expenses charged, the value of in-kind contributions applied, and the amount of cash advances and payments made to subcontractors and subrecipients. For requests prepared on an accrued expenditure basis, outlays are the sum of the actual cash disbursements, the amount of indirect expenses incurred, and the net increase (or decrease) in the amounts owed by the recipient for goods and other property received and for services performed by employees, contracts, subgrantees and other payees.
11b	Enter the cumulative cash income received to date, if requests are prepared on a cash basis. For requests prepared on an accrued expenditure basis, enter the cumulative income earned to date. Under either basis, enter only the amount applicable to program income that was required to be used for the project or program by the terms of the grant or other agreement.
12	Only when making requests for advance payments, enter the total estimated amount of cash outlays that will be made during the period covered by the advance.
13	Complete the certification before completing this request.

STANDARD FORM 270 BACK (Rev. 2-92)

Exhibit 4

DEPARTMENT OF THE ARMY

CONSTRUCTION ENGINEERING RESEARCH LABORATORIES

Ft. Campbell Deconstruction Research Project

Proposed Budget
Of
Austin Habitat for Humanity

(removed)

APPENDIX C.
UNIVERSITY OF FLORIDA, CENTER FOR CONSTRUCTION AND ENVIRONEMNT AND AUSTIN HABITAT FOR HUMANITY DECONSTRUCTION SAFETY PROGRAM

DECONSTRUCTION CHECKLIST - AMERICORPS*NCCC

Definitions of Terms

.Deconstruction: the act of pulling out materials for reuse by hand labor (this is done carefully)
.Demolition: the act of removing material from the building considered waste or recyclable, usually done to expose something worth saving (this is done as quickly as a worker can)
.Processing: Cleaning up salvaged material for reuse (de-nailing, cutting edges of boards square, cleaning mortar off bricks)

Orientation

In order to carry out deconstruction tasks, Americorps*NCCC (AC) team members will be required to follow a preparatory training and awareness protocol.

There are four elements to the AC training and project tasks:

1. Classroom safety training
2. Field orientation to buildings and deconstruction process
3. Personal protective equipment and tools
4. Daily task and procedures and research data collection

Classroom Training

All Americorps*NCCC (AC) teams will undergo asbestos and lead awareness training

Fit testing for half-mask respirators will be provided to those who request it - Use of half-mask respirators will be required for conditions of dust
Instruction in proper use of power hand tools (reciprocating saw, circular saw, drill)
Proper use of support equipment including HEPA vacuum, compressor, generator, shop lights
Instruction and use of, safety harnesses, scaffolding, and ladders
Instruction in identification of basic building components and materials type~ Instruction in basic building structural concepts

At no times will AC members be asked or authorized to operate heavy equipment Smoking is not permitted on the deconstruction job-site

General Requirements for Project

Steel-toed boots, and head, ear, eye, hand, and arm/leg protection (hardhats, ear plugs, safety glasses, gloves, long sleeve shirts and pants are required to be worn at job site.

All utilities will be disconnected from any building prior to deconstruction and certified by the local utility

All capping or removal of septic tanks, and any other below ground infrastructure will be the responsibility of others. This includes any aboveground utility lines and power poles.

All buildings will be inspected for the presence of asbestos and lead-based paint. Any asbestos abatement will be completed prior to any deconstruction activity. In the event that suspected asbestos is found in the course of deconstruction, work will be halted, additional survey(s) will be conducted, and additional abatement will be completed if necessary, before work recommences.

COMMUNICATION !!!!
Knowing where one is relation to others, walls, roof edges, steps, materials, tools, equipment, changes in level, overhangs, any building element on the ground, OTHER workers and their activities, is EXTREMELY important.

Daily Job Site Rules

- Log-in when arrive and leave
- Contact information sheet
- Hardhat, gloves, safety glasses, boots, toolbelt, long pants, steel-toed boots (PPE)
- Medical and emergency information awareness
- Check all tools for proper function and knowledge of use
- Location of fire extinguisher(s)
- Report any persons seen without hardhat.
- Report any unsafe conditions, possible asbestos containing materials
- Keep passageways clear of debris
- Sufficient lighting and ventilation for areas/tasks
- Report any accidents immediately
- Do not use any equipment that you have not been trained to use
- Use buddy system when lifting heavy objects, using ladders

Personal Hygiene/Respiratory Protection

- Men are shaved to use ½ mask respirator
- No dangling earrings or jewelry
- Hand wash station and break area
- Drinking water station and disposable cups
- Use of open weave protective suits when performing lead environment work
- Proper disposal of suits at lunch and end of day
- Use buddy system and supervisor to check proper fit and use of respiratory and protective clothing before work
- Lead environment air sampling protocol
- Maintenance of *Y2* mask respirators and filter cartridges
- Disposal of protective suits into garbage bags

Electrical Equipment

- Report and remove from operation any broken or malfunctioning equipment
- Assured grounding and use of all electrical tools
- Power equipment instruction will be provided when used
- Proper function, grounding, insulated, guards, PPE
- Use of power cords, GFCI, proper condition, non-wet conditions

Hazard Analysis

- .Building engineering survey and daily update .
- Job site safety analysis
- PPE certification of hazard assessment

- PPE training certification for each worker

Fall Protection and Structural Integrity

- Any openings, unprotected edges covered/protected

- Ladder safety training will be provided when ladders are to be used
- Labeled, no broken pal1s, proper angle, proper use, tie-off
- Do not begin new tasks (except general clean-up) without checking with supervisor .
- Do not remove any wall, roof, floor structural elements without prior instruction
- Fall protection instruction will provided when used and for those using it
- Fall protection required when working 6' or more above grade below
- Monitoring system will be used when any rolling scaffolding or leading edge work is performed

Hazard Communication

- Unknown chemicals, possible hazardous materials will be removed for proper disposal
- MSDS sheet provided *for* use of gasoline
- Measures to lessen possibility of exposure to hazardous materials'

Deconstruction Process

- Clear away any obstacles around building (trees, bushes, yard debris)
- Clear out any furniture, wall hanging items,
- Approach the deconstruction process by working in the opposite direction of the construction process (last thing in is the first thing out)
- Take additions off building first unless it creates a safe working platform for other activities
- Take all doors, windows, out first
- Remove all electrical, plumbing fixtures, cabinetry, and interior trim
- Take out all interior sheet rock or plaster (expose studs & ceiling joists)
- Take *off* roofing and roof structure (shingles, decking, rafters)
- Remove exterior trim & siding
- Remove ceiling and wall structure (ceiling joists & wall studs)
- Pull up finish flooring & sub floor
- Remove Floor structure & Foundation (floor joists carrying beams, concrete slab, chimney)
- Clean up site
- Cap sewer line

Project Flow

- Finish one phase of the project and clean-up before starting the next step
- As materials come out of the building do not let them pile up, send them to the proper locations designated on job-site lay-out plan
- Have one person in charge of the flow of materials Gob-site supervisor)
- Treat any salvage as though it is yours and you are using it in your own house.
- *Do* not throw materials to be salvaged.

- *Do* not throw any materials unless throwing directly into the dumpster
- Always control both ends of the material as *it* is being removed, either by someone holding on to it at the other end or with one end already resting on the ground.
- *Do* not remove structural walls or any walls or materials which are supporting something else. .
- Remove the first layer of materials that you can see before removing anything behind it, for example, remove ALL trim and electrical socket or switch plate covers before removing drywall.

- Always use safety harnesses, lanyards, appropriate strength rope and tie-downs when working on roofs.
- Cleanup debris on all work surfaces CONSTANTLY.
- If you are walking on top of debris and cannot see the ground below, it is time to clean up!!
- Do not leave tools on the ground in the middle of a room or in a door or passageway.
- The only appropriate place to place a tool is against a wall OUT of the WAY.
- Do not place a board or material with nails pointing up and do not place these materials in the middle of a room, near or sticking into a doorway or passageway.
- After materials have been removed either waste or salvage they should be removed in a timely fashion from the work area, either to 1) a dumpster, 2) a de-nailing station, or 3) a storage location for reusable materials,
- When removing components that have parts such as screws or a light fixture with a glass lamp and separate fixture, keep the parts together by taping them, wrapping them in plastic or paper, or placing into a plastic bag, box, to prevent accidental breakage.
- Long sleeves shirts should be worn whenever there is exposure to dust or fibers.
- Do not use your foot as a tool to kick walls, or any other materials in place, do not use a fist as a tool.
- Keep two feet on the ground or on the steps of a ladder at all times.
- Never have two people on the same ladder unless tl1e ladder is approved for this use. .
- Never run in at the job site, never jump onto materials or from a ladder, scaffold, or roof.

Austin Habitat for Humanity

DECONSTRUCTION:

PROCEDURES &
JOB SAFETY PLANS

April 30, 2002

Ft. Campbell Deconstruction Project

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DECONSTRUCTION -GENERAL INJURY AND ILLNESS PREVENTION PROGRAM

Written Plan

Every employer should have a written Injury and Illness Prevention plan. While no plan can guarantee an accident free work place, following the safety procedures set forth in this manual will significantly reduce the risk of danger to you and your co-workers; Thank you for all our safety.

Introduction to Our Program

State and federal law make the safety and health of our employees and volunteers the first consideration in conducting our research. Safety and health in our business must be a part of every operation, and every employee's responsibility at all levels. It is the intent of Austin
Habitat for Humanity to comply with all laws concerning the operation of the business and the health and safety of our employees and the public. To do this, we must constantly be aware of conditions in all work areas that can produce or lead to injuries. No employee/volunteer is required to work at a job known to be unsafe or dangerous to their health. Your cooperation in detecting hazards, reporting dangerous conditions and controlling workplace hazards is a condition of employment. Inform your supervisor immediately *of* any situation beyond your ability or authority to correct. Employees and volunteers will not be disciplined or suffer any retaliation for reporting a safety violation in good faith.

Safety First Priority

The personal safety and health of each employee/volunteer or volunteer is of primary importance. Prevention of occupationally-induced injuries and illnesses is of such consequence that it will be given precedence over operating productivity. To the greatest degree possible, management will provide all mechanical and physical protection required for personal safety and health, but our employees must bear primary responsibility for working safely. A little common sense and caution can prevent most accidents from occurring.

Individual Cooperation Necessary

The Austin Habitat for Humanity maintains a safety and health program conforming to the best practices of our field. To be successful, such a program must embody proper attitudes towards injury and illness prevention on the part of supervisors and employees. It requires the cooperation in all safety and health matters, not only of the employer and employee/volunteer, but between the employee/volunteer and all co-workers. Only through such a cooperative effort can a safety program in the best interest of all be established and preserved. Safety is no accident; think safety and the job will be safer.

Safety Program Goals

The objective of Austin Habitat for Humanity is a safety and health program that will reduce the number of injuries and illnesses to an absolute minimum, not merely in keeping with, but surpassing the best experience of similar operations by others. Our goal is zero accidents and injuries.

Safety Policy Statement

It is the policy of Austin Habitat for Humanity that accident prevention shall be considered of primary importance in all phases of operation and administration. It is the intention of Austin Habitat for Humanity management to provide safe and healthy working conditions and to establish and insist upon safe practices at all times by all employees/volunteers. The prevention of accidents is an objective affecting all levels of our company and its operations. It is

therefore, a basic requirement that each supervisor make the safety of all employees an integral part of his or her regular management function. It is equally the duty of each employee/volunteer to accept and follow established safety regulations and procedures. Every effort will be made to provide adequate training to employees/volunteers. However, if an employee/volunteer is ever in doubt about how to do a job or task safely, it is his or her duty to ask a qualified person for assistance. Employees are expected to assist mal1agement in accident prevention activities. Unsafe conditions must be reported immediately. Fellow employees that need help should be assisted. Everyone is responsible for the housekeeping duties that pertain to their jobs. Every injury that occurs on the job, even a slight cut or strain, must be reported to management and/or the Responsible Safety Officer as soon as possible. Under no circumstances, except emergency trips to the hospital, should an employee/volunteer leave the work site without reporting an injury. When you have an accident, everyone is hurt. Please work safely. Safety is everyone's business.

Safety Rules for All Employees

It is the policy of Austin Habitat for Humanity that everything possible will be done to protect you from accidents, injuries and/or occupational disease while on the job. Safety is a cooperative undertaking requiring an ever-present safety consciousness on the part of every employee. If an employee/volunteer is injured, positive action must be taken promptly to see that the employee/volunteer receives adequate treatment. No one likes to see a fellow employee/volunteer injured by an accident. Therefore, all operations must be planned to prevent accidents. To carry out this policy, the following rules will apply:

1. All employees shall follow the safe practices and rules contained in this ma;1ual and such other rules and practices communicated on the job. All employees shall report all unsafe conditions or practices to the proper authority, including the supervision on the project, and, if corrective action is not taken immediately, a governmental authority with proper jurisdiction over such practices.
2. The job-site supervisor shall be responsible for implementing these policies by insisting that employees observe and obey all rules and regulations necessary to maintain a safe work place and safe work habits and practices.
3. Good housekeeping must be practiced at all times in the work area. Clean up all waste and eliminate any dangers in the work area.
4. Suitable clothing and footwear must be worn at all times. Personal protection equipment (hardhats, respirators, eye protection) will be worn whenever needed.
5. All employees will participate in a safety meeting conducted by their supervisor once every week.
6. Anyone under the influence of intoxicating liquor or drugs, including prescription drugs which might impair motor skills and judgment, shall not be allowed on the job.
7. Horseplay, scuffling, and other acts which tend to have an adverse influence on safety or well-being of other employees are prohibited.
8. Work shall be well planned and supervised to avoid injuries in the handling of heavy materials and while using equipment.
9. No one shall be permitted to work while the employee's ability or alertness is so impaired by fatigue, illness, or other causes that it might expose the employee/volunteer or others to injury.
10. There will be no consumption of liquor or beer on the job.

11. Employees should be alert to see that all guards and other protective devices are in proper places and adjusted, and shall report deficiencies promptly to the job-site supervisor.
12. Employees shall not handle or tamper with any electrical equipment, machinery, or air or waterlines in a manner not within the scope of their duties, unless they have received specific instructions.
13. All injuries should be reported to the job-site supervisor so that arrangements can be made for medical or first aid treatment.
14. When lifting heavy objects, use the large muscles of the leg instead of the smaller muscles of the back.
15. Do not throw things, especially material and equipment. Dispose of all waste properly and carefully. Bend/pull all exposed nails so they do not hurt anyone removing the waste.
16. Do not wear shoes with thin or torn soles.

Employee/volunteer Compliance

This written plan contains incentives designed to promote employee/volunteer pal1icipation in the safety program. These incentives are not part of your regular compensation and are not intended to discourage you from repol1ing accidents.

Agreement to Participate

Every employer is required to provide a safe and healthful workplace. Austin Habitat for Humanity is committed to fulfilling this requirement. A safe and healthful workplace is one of the highest priorities of Austin Habitat for Humanity. The information in this manual constitutes a written injury and illness prevention program. While Austin Habitat for Humanity cannot anticipate every workplace hazard, the following general principals should guide your conduct. To be safe, you must never stop being safety conscious. Study the guidelines contained in this manual. Discuss the workplace situation with the job-site supervisor. Attend all company sponsored training and safety meetings. Read all posters and warnings. Listen to instructions carefully. Follow the Code of Safe Work Place Practices contained herein. Participate in accident investigations as requested. Accept responsibility for the safety of others. Maintain all required documentation. By signing the acknowledgement at the end of this handbook, each employee/volunteer promises to read and implement this injury and illness prevention program. If you don't understand any policy, please ask your supervisor.

Accident Free Workplace

To help us all meet our goal of an accident free workplace, we have instituted a contest: we will offer a prize for each month in which there is not a single time-loss accident at work. The prize will be awarded at random. Each month, the prize will be announced in advance. All employees who worked more than 1 hour in the month are eligible. Failure to report an industrial injury will suspend the prize for two months.

Employee/Volunteer Safety Suggestion Box

From time to time, Austin Habitat for Humanity will award a prize for the best safety suggestion. To be eligible, please give your written safety suggestions to your supervisor during the safety meetings. All these safety suggestions will be discussed at the meeting. The supervisor whose employee/volunteer wins the best safety suggestion will also be given a prize. The group that consistently has the best safety suggestions will also be recognized. Management is the sole judge of the value of safety suggestions, and wilt implement as many of the good suggestions as possible.

Training

Employee/volunteer safety training is another requirement of an effective injury and illness prevention program. While Austin Habitat for Humanity believes in skills training, we also want to emphasize safety training. All employees should start the safety training by reading this manual and discussing any problems or safety concerns with your direct supervisor. You may wish to make notes in the margins of this manual where it applies to your work.

Safety and Health Training

Training is one of the most important elements of any injury and illness prevention program.
Such training is designed to enable employees to learn their jobs properly, bring new ideas to the workplace, reinforce existing safety policies and put the injury and illness prevention program
into action. Training is required for both supervision and employees alike. The content of each training session will vary, but each session will attempt to teach the following: a) the success of Austin Habitat for Humanity's injury and illness prevention program depends on the actions of individual employees as well as a commitment by the Company. b) each employee's immediate supervisor will review the safe work procedures unique to that employee's job, and how these safe work procedures protect against risk and danger. c) each employee/volunteer will learn
when personal protective equipment is required or necessary, and how to use and maintain the equipment in good condition. d) each employee/volunteer will learn what to do in case of emergencies occurring in the workplace. Supervisors are also vested with special duties concerning the safety of employees. The supervisors are key figures in the establishment and success of Austin Habitat for Humanity's injury and illness prevention program. They have primary responsibility for actually implementing the injury and illness prevention program, especially as it relates directly to the workplace. Supervisors are responsible for being familiar with safety and health hazards to which employees are exposed, how to recognize them, the potential effects of these hazards, and rules and procedures for maintaining a safe workplace. Supervisors shall convey this information to tile employees at the workplace, and shall investigate accidents according to the accident investigation policies contained in this manual.

Periodic Safety Training Meetings

Austin Habitat for Humanity has safety meetings every week. The purpose of the meeting is to convey safety information and answer employee/volunteer questions. The format of most meetings will be to review, in language understandable to every employee, the content of the injury prevention program, special work site hazards, serious concealed dangers, and material safety data sheets. Each week, tl1ejob-site supervisor will review a portion of the company's safe work practices contained in this booklet, or other safety related information. Whenever a new practice or procedure is introduced into the workplace, it will be roughly reviewed for safety. A sign-up sheet will be passed around each meeting, and notes of the meeting will be distributed afterwards.

Employee/Volunteer Responsibility for Training

Teaching safety is a two-way street. Austin Habitat for Humanity call preach safety, but only employees can practice safety. Safety education requires employee/volunteer participation. Every week, a meeting of all employees will be conducted for the purpose of safety instruction. The employees will discuss the application of the Company's injury and illness prevention program to actual job assignments. They will also read and discuss a section of the manual and review application of general safety rules to specific situations. Remember, the following general rules apply in all situations:

a) no employee/volunteer should undertake a job that appears to be unsafe.
b) no employee/volunteer is expected to undertake a job until he/she has received adequate safety instructions, and is authorized to perform the task.
c) no employee/volunteer should use chemicals without fully understanding their toxic properties and without the knowledge required to work with these chemicals safely.
d) mechanical safeguards must be kept in place.
e) employees must repoJ1 any unsafe conditions to the job site supervisor and the Responsible Safety Officer.
f) any work-related injury or illness must be reported to management at once.
g) personal protective equipment must be used when and where required. All such equipment must be properly maintained.

Communication

Employers should communicate to employees their commitment to safety and to make sure that employees/volunteers are familiar with the elements of the safety program. Austin Habitat for Humanity communicates with its employees orally, in the form of directions and statements from your supervisor, written, in the form of directives and this manual, and by example. If you see a supervisor or management do something unsafe, please tell that person. We sometimes forget actions speak louder than words.

Accident Prevention Policy Posting

Each employee/volunteer has a personal responsibility to prevent accidents. You have a responsibility to your family, to your fellow workers and to the Company. You will be expected to observe safe practice rules and instructions relating to the efficient handling of your work. .Your responsibilities include the following:
*** Incorporate safety into every job procedure. No job is done efficiently unless it has been done safely.**
*** Know and obey safe practice rules.**
*** Know that disciplinary action may result from a violation of the safety rules.**
*** Report all injuries immediately, no matter ho\v slight the injury may be.**
*** Caution fellow workers when they perform unsafe acts.**
*** Don't take chances.**
*** Ask questions when there is any doubt concerning safety.**
*** Don't tamper with anything you do not understand.**
*** Report all unsafe conditions or equipment to your supervisor immediately.**

Accident Prevention Policy Posting

A copy of this manual will be posted in the work area. It is the policy of Austin Habitat for Humanity to provide a safe and clean workplace and to maintain sound operating practices. Concentrated efforts shall produce safe working conditions and result in efficient, productive operations. Safeguarding the health and welfare of our employees cannot be stressed too strongly. Accident prevention is the responsibility of all of us. Department heads and
supervisors at all levels shall be responsible for continuous efforts directed toward the prevention of accidents. Employees are responsible for performing their jobs in a safe manner. The observance of safe and clean work practices, coupled with ongoing compliance of all established safety standards and codes, will reduce accidents and make our Company a better place to work.

Hazard Identification & Abatement

This writtel1 safety and health plan sets out a system for identifying workplace hazards and correcting them in a timely fashion. Please review *it* carefully with your supervisor. Remember, safety is everyone's responsibility. Since many of the buildings to be demolished/deconstructed have not been cleaned out, many unmarked abandoned jars, cans, bottles and more are still located on site for us to dispose of properly. Any chemicals, solvents and gases must be put to the side for the job site supervisor to review and decide how it should be handled and removed form the job site. All asbestos abatements will be complete before workers will come on the site and work on problem areas. If asbestos is found on the site while work is underway the job will be stopped and a consultant will verify it is safe to proceed.

Safety Audits

The best method to establish a safer workplace is to study past accidents and worker compensation complaints. By focusing on past injuries, Austin Habitat for Humanity hopes to avoid similar problems in the future. Therefore, whenever there is an accident, and in many cases upon review of past accidents, you may be requested to participate in a safety audit interview. During the interview, there will be questions about the nature of the investigation and the workplace safety related to the incident. Please answer these questions honestly and completely. Also, please volunteer any personal observations and/or suggestions for improved workplace safety. Based upon the study of past accidents and industry recommendations, a safety training program has been implemented. In addition to other preventative practices, there 'will be a group discussion of the cause of the accident and methods to avoid the type of accidents and injury situations experienced in the past. Work rules will be reviewed and modified based upon the study of these accidents. In addition to historical information, workplace safety depends on workplace observation. Your supervisor is responsible for inspecting your working area daily before and while you are working, but this does not mean you are no longer responsible for inspecting the workplace also. Each day, before you begin work, inspect the area for any dangerous conditions. Inform your supervisor of anything significant, so other employees and guests are advised. You may also be given written communications regarding unsafe conditions or serious concealed dangers. Review this communication carefully and adjust your workplace behavior to avoid any danger or hazards. If you are unclear or unsure of the significance *of* this written communication, contact your supervisor and review your planned actions before starting to work. It is better to wait and check, then to go ahead and possibly cause an injury to yourself and others. Managers must provide written notice to employees of any serious concealed dangers of which they have actual knowledge. In addition to providing written notice of all serious concealed dangers to employees managers are required to report serious concealed dangers to either OSHA or an appropriate administrative agency within fifteen days, or immediately if such danger would cause imminent harm, unless the danger is abated. Merely identifying the problem is not sufficient. The danger must be reported to the appropriate supervisor and the Responsible Safety Officer, who then will correct the problem. If the danger cannot be corrected, then all employees will be warned to take protective action so that the danger will not result in any Injuries.

Workplace Inspections

In addition to the examination of records, work place safety inspections will occur periodically every week, when conditions change, or when a new process or procedure is implemented. During these inspections, there will be a review of the injury and illness prevention policy and Austin Habitat for Humanity code of safe work practices.

Accident Investigation

A primary tool used by Austin Habitat for Humanity to identify the areas responsible for accidents is a thorough and properly completed accident investigation. The results of each investigation wi11 be reduced to writing and submitted for review by management and Austin Habitat for Humanity's insurance risk management advisors, and, if the accident resulted in serious injury, to Company attorneys. If the accident resulted in serious injury, the procedure will be directed by the attorneys to provide the most reliable evidence or description legally permissible. All investigations pursuant to the directions of legal counsel will be protected by all applicable privileges, if any. The attorney will provide more detail on this topic during the investigation. Every job location will have on site at least one camera, preferably either a video or a sixty-second type, with enough film to take pictures immediately after any occurrence.

Some workplaces will have a video camera. A written report should be prepared from notes and diagrams made at the scene, or a pol1able dictaphone will be used to record direct eyewitness statements as near to the actual time of observation as possible. All statements should include the time and date given, and the town or county where the statement was made. It the statement is intended to be used in court proceedings, a suitable jurat is required, otherwise, a simple statement that the description is sworn to be true under penalty of perjury with the date, place and time should be included. All pictures should be similarly identified. Let people know on tape that they are being recorded. Also, make sure that the names and addresses and day and evening phone numbers of all eye witnesses are noted or recorded. If a formal police report or other official investigation is conducted by any government agency, get the name and badge number of the official, or a business card, and find out when a copy of the official report will be available to the public. If you are requested to make a statement, you have the right to have the Company lawyer attend your statement at no cost to you. A satisfactory accident report will answer tile following questions: 1. What happened? The investigation report should begin by describing the accident, tl1e injury sustained, the eyewitnesses, tl1e date, time and location of the incident and the date and time of the report. Remember: who, what, when, where and how are the questions tl1at the report must answer. 2. Why did the accident occur? The ultimate cause of the accident may not be known for several days after all the data are analyzed. However, if an obvious cause suggests itself, include your conclusions as a hypothesis at the time you give your information to the person in charge of the investigation. 3. What should be done? Once a report determines the cause of the accident, it should suggest a method for avoiding future accidents of a similar character. This is a decision by the Responsible Safety Officer and the supervisor on the project, as well as top management. Once a solution has been adopted, it is everyone's responsibility to implement it. 4. What has been done? A follow up report will be issued after a reasonable amount of time to determine if the suggested solution was implemented, and if so, whether the likelihood of accident has been reduced.

Records

Austin Habitat for Humanity maintains records of employee/volunteer training, hazard identification and abatement, and accident investigation.

OSHA Records Required

Copies of required accident investigations and certification of employee/volunteer safety training shall be maintained by the Responsible Safety Officer. A written report will be maintained on each accident, injury or on-the-job illness requiring medical treatment. A record of each such injury or illness is recorded on OSHA Log and Summary of Occupational Injuries Form 200 according to its instructions. Supplemental records of each injury are maintained on OSHA

Form 10 1, or Employers Report of Injury or Illness Form 5020. Every year, a summary of all reported injuries or illnesses is posted no later than February 1, for one month, until March 1, on OSHA Form 200. These records are maintained for five years from the date of preparation.

General Statement on Safety

Austin Habitat for Humanity strives to maintain a safe place to work and to employ safe workers. It is your responsibility to conduct your work in a safe, responsible manner. Immediately report all accidents occurring on AHfH premises to your supervisor.

General Statement on Safety

Each employee/volunteer has an individual responsibility to prevent accidents. It is to the benefit of all employees and Austin Habitat for Humanity that you report any situation or condition you believe may present a safety hazard, including any known or concealed dangers in your work area. Austin Habitat for Humanity encourages you to report your concern either to your immediate supervisor or to a member of the Safety Committee. The supervisor or Safety Committee will take immediate action to investigate the matter.

Safety Equipment

Proper safety equipment is necessary for your protection. The AHfH provides the best protective equipment it is possible to obtain. Use all safeguards, safety appliances, or devices furnished for your protectiol1 and comply with all regulations that may concern or affect your safety. Wear your gear properly --all snaps and straps fastened, cuffs not cut or rolled. Your supervisor will advise you as to what protective equipment is required for your job. Certain jobs require standard safety appar~1 and appliances for the protection of the employee. Your supervisor is aware of the requirements and will furnish you with the necessary approved protective appliances. These items shall be worn and effectively maintained as a condition of your continued employment and part of our mutual obligation to comply with the Occupational Safety and Health Act. Safety goggles, glasses and face shields shall correspond to the degree of hazard, i.e., chemical splashes, welding flashes, impact hazard, dust, etc. Do not alter or replace an approved appliance without permission from your supervisor. Rubber gloves and rubber aprons shall be worn when working with acids, caustics or other corrosive materials. Specified footwear must be worn. No jewelry shall be worn around power equipment. Hearing protection appliances (approved muffs or plugs) shall be worn by all employees working within any area identified as having excess noise levels. Your supervisor will instruct you in the proper use of the appliance.

Protective Clothing

Proper safety equipment is necessary for your protection. The Company provides the best protective equipment it is possible to obtain. Use all safeguards, safety appliances, or devices furnished for your protection and carry out all regulations that may concern or affect your safety. Wear your gear properly -all snaps and traps fastened, cuffs not cut or rolled. Your supervisor will advise you as to what protective equipment is required for your job.

Smoking & Fire Safety

Fire is one of tl1e worst enemies of any facility. Learn the location of the fire extinguishers. Learn how to use them. You can help prevent fires by observing the smoking rules:
* Smoking is not allowed on the site.
* Smoking is not permitted in toilets.

Reporting

All serious accidents must be reported to OSHA. In cases of hospitalization or death, a full investigation with copies to governmental authorities will be required. In less serious cases, the investigation repol1 must be presented to the company for disclosure to its insurance carrier and for remedial action at the work site.

Asbestos and Lead Safety Protocol

- Buildings will be assessed for both friable and non-friable asbestos by a certified environmental consultant
- If building has friable or non-friable asbestos it will be abated by a licensed asbestos abatement contractor
- After asbestos abatement, the abatement contractor will be required to indicate that all asbestos has been removed. Inspections by appropriate Federal or State agencies will be permitted. Any deficiencies found will be corrected before deconstruction can commence.
- If Safety Officer, Federal or State agent or any other competent or responsible party suspects that asbestos containing material (ACM) is present, or uncovered at any time during the deconstruction all work will be halted. An environmental consultant will be requested to test suspect ACM, and further abatement will be required if ACM is found at regulated levels. Upon completion of additional asbestos abatement, deconstruction work will be allowed to continue Note: Sometimes workers uncover ACM under layers of non-ACM material
- A cel1ified asbestos abatement contractor, will be used for any asbestos abatement required during the project. At no time is any sanding, grinding, abrading; cutting, burning or heating of the LBP wood materials permitted.
- The primary threat of worker exposure to LBP is through ingestion -inhaling, eating, drinking and smoking while in proximity to the LBP. A hand washing station is established on the job-site and personal protective equipment (gloves) and filter masks are required of all workers.

In the event of known LBP in an interior environment, according to OSHA Lead Regulations (29 FCR 1926.26), workers are assumed to be exposed to LBP above acceptable levels until proven otherwise through personal air sampling. Methods to insure the removal of LBP and worker protection are primarily building engineering and mitigation techniques. OSHA and EP A both recognize that deconstruction is a less destructive process than mechanical demolition, but conversely has tile potential for greater worker exposure. Because of the limited exposure and turnover of workers, tI1e following protocol is established:

1) All workers receive ACM and LBP awareness training.
2) AU exterior windows and doors are opened or removed to allow ventilation and prevent accumulation and concentrations of LBP pal1iculate matter during deconstruction activities.
3) All workers in the LBP environment are provided personal fit-tested and approved respirators and protective clotI1ing until personal air samples are analyzed and record lead levels below the acceptable threshold for worker exposure.
4) A HEPA vacuum is utilized tI1roughout the bui1ding interior to remove all dust and particulate matter to the maximum extent feasible.
5) Indoor air quality analysis is completed using approved personal air sampling devices to determine TW A-PEL of lead within the work environment.
6) At such time as air sampling is recorded which shows airborne lead levels below OSHA

thresholds, respirators and protective clothing will be removed.
7) In all cases, workers will be rotated out of LBP environments on a short-cycle and regular basis,
8) Job-site hand washing station will be provided.
9) Smoking is prohibited inside the structure and near any salvaged materials. Workers are required to wash hands before breaks and lunch breaks.
10) Sanding, cutting, grinding, abraded, burning and heat-gun stripping of LBP surfaces is not permitted.
11) Workers are provided with uniform T-shil1S and required to change them at the completion of the work shift and before leaving the job-site.
12) An exception for personal air monitoring is provided through OSHA Lead Regulations (29 FCR 1926.26), through the use of historical data that is less than one year old -provided that the lead-based paint levels are similar, the activities and materials are similar, training and equipment use is duplicated, and similar engineering and administrative controls are duplicated.

Job Safety
A ShOl1 classroom orientation is developed to introduce beginner workers to basic tips such as the appropriate angle of repose for ladders, communication with other workers, and use of tools and techniques for removing and processing materials. The supervisor is also responsible for daily job-safety supervision. Issues related to worker safety training include:

- All workers were required to have their own steel-toed boots, long pants and shirts.
- Safety glasses, hardhats, eye plugs, and gloves are provided.
- Cleanup of debris on all work surfaces will occur after each phase of deconstruction.
- Piles of debris will not be allowed to accumulate in work areas where they could generate a hazard or impediment to the workers,
- One person will be appointed Job Safety Officer and will have overall responsibility for job safety. This does not relieve every person on the site from acting responsibly and overseeing the work of others and communicating any deficiencies that are observed.
- General and Deconstruction-specific construction site safety procedures.
- Roles and duties of Job Safety Officer and each worker.
- Proper use of tools and personal protective equipment.
- Understanding of the Deconstruction process and Goals.
- Stabilizing weakened sections of buildings, and working in such as way as to keep the structures as stable as possible via the order of the deconstruction.
- Routes for materials after they have been removed including placing out a window or dropping from the roof for others to remove to the processing area.
- Handling windows (glass), long items, heavy items, and objects with the nails still in them.
- Understanding how components are connected and the best method and tool to use in
- removing it to minimize force which in turn can result in sudden movements, creating projectiles, slipping, etc.
- Importance of cleaning debris and removing materials from areas where they can be hazards either off or on the ground.
- Understanding load bearing components and stresses produced by gravity, including awareness of damaged components and weak points caused by termite, water damage, etc.
- Use of safety harnesses, scaffolding, ladders, guardrails, and 2x4s nailed horizontally for footholds when working on roofs.
- Using a two-person system for the majority of materials removal so that long wood members, for example, are able to be handled at both ends to protect both workers and materials from any sudden movements.

Basic Job-Site Rules

One person will be the assigned Safety Officer. This does not relieve every individual on the job- site from acting in a safe manner, being responsible for others by their own actions, and by informing other workers and the Safety Officer of any unsafe conditions at any time.

Hard hats are to be worn at all times within 10 feet of the building perimeter and whenever working under or near objects overhead, such as ladders, scaffolding, heavy equipment that may be present at the site.

Eye glasses and safety glasses are to be worn at all times when engaged in deconstruction activities. This includes removal of building materials, processing of any materials including pulling nails or chipping mortar.

Long sleeves shirts are to be worn whenever exposure to dust or fibers may occur.

Half-mask respirators are to be worn in the interior environment, particularly where ventilation may be minimal, there is possible exposure to dust, fibers, particulates, microbial agents, oils, etc. and when engaged in the following activities:

- Removing lead-base painted materials
- Removing any fibrous materials including but mot limited to insulation materials
- Removal of plaster, drywal1, and associated dust-causing debris.

Workers will callout when removing any objects from a height above head height, when others are nearby.

Workers shall callout when releasing materials from a roof area on to the ground. Areas where a larger quantity of materials, over a period of time, are being removed to the ground, should be posted and cordoned off using warning tape and other physical barriers.

It is important to note that every deconstruction site will differ in space allocation. The key points of the site set up include the de-nailing and processing station is located between the "Loading Area", and the dumpsters. If it is not possible to arrange the site in this way the processing station should be located in close proximity to the storage and disposal sites. When materials are removed from the structure, the determination must be made on what to do with the specific material. Most materials fall into three main categories.

- Reuse as is
- Process Further
- Dispose of

For this reason it is important to have the storage space, processing space, and dumpsters close to the structure. Having the processing station between these two stations allows for an easy flow of materials. If processing destroys the material or if it is determined that it is not cost effective to further salvage the material it can be placed into a dumpster/

Set Up Flow of Materials

- Entrance & Exit to Site .
- Worker Parking .
- Tool Location
- Hauling Material from Site .
- Deconstruction Activity .
- Processing Location
- Temporary Storage location .
- Metal Recycling Location
- Concrete Recycling Location .
- Hazardous Material Location

General Site Issues .

- Site security
- .Tree protection
- .Temporary toilet

DECONSTRUCTION ATTITUDE !!

Workers cannot just " go through the motions" they must be alert and invested. .Workers should ask themselves "Am I removing the material in a method that is leaving
the it in a condition that is reusable?"

Tool-Use Techniques

Pull salvageable item off that are nailed,

- F1at bar/Crow bar: Get bar as close to the fastener (nail) as possible before applying leverage, this reduces wood cracking or metal binding of the item being pulled off
- Pry each nail evenly till item is off with several passes, Example, visit each nail four times, loosening at each pass 25% until item is off.

Separate boards that are nailed together

- Scissor technique: Take two pry bars and wiggle them in on the seam on the same side of the boards. Have the pry bars facing opposite directions and pry back and forth simultaneously with both bars.

Materials Handling

Do not throw material that is being saved

Personnel Policy

Minimum responsibilities for each worker are to provide proper personal clothing as stated in this document. The deconstruction site is a drug-free environment. Any presence of illegal or intoxicating substances will be cause for immediate removal from the deconstruction site. Grievance procedure -any issues of concern shall be brought to the Job Supervisor immediately.

Areas of Job Responsibility

Every crew member will be assigned at least one area of responsibility, and over the first few months crew members will be encouraged to cross train each other so there is always at least one

back-up person. A crew of "supervisors in training" is very different from a crew of *"employees."*
The supervisor will review each person's area of responsibility at the morning meetings. Example responsibilities include:

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Site Supervisor Responsibilities

Do pre-work site review and write up list of prerequisite work to give to Owner.
Review work order on-site before a job starts to confirm all special-ordered materials are on hand and all specs are clear.
Set up job site -containment, isolation, dust room, rubbish area, etc.
Assure someone is taking responsibility for all other job assignments.
Establish and maintain production schedule. When a production goal is not met the supervisor will, in consultation with the crew, write up a memo on what needs to be done to improve production or change the schedule.

Supply/Inventory Responsibilities

Review supply list with supervisor to be clear on quantity, specifications, source, order time, etc., of each supply item held in inventory.
Maintain a supply of materials on truck or trailer for at least two days. Make sure storage area has a supply for a month.
Make additions, deletions, changes on inventory form as crew requests. If possible, work with administration to computerize a working system that may include inventory software. Maintain on-site storage areas.

Tool & Equipment Inventory and Maintenance Responsibility

Train people on use of equipment, pal1i.cularly ladders, power tools and electrical cords. If equipment is damaged, tag and have it repaired before use.
Keep an inventory *of* all crew tools and materials. Be sure there is a replacement for critical tools in the warehouse. Check inventory *of* major tools daily.
Keep tools clean and sharp. Keep a full supply of new blades.
Evaluate tools and make recommendations for replacement or additional tools.
This person may also be responsible for vehicle maintenance (checking air, gas, oil, etc.) on a regular basis.

Health and Safety Responsibility

Inspect site for any health and safety problems before and during job. This person may do the pre-work site review rather than the supervisor.

Responsible for implementing weekly safety meetings and maintaining injury/accident reports. Maintaining first aid kit, drinking water supply, a safe, clean, well-lit break area and clean toilets.
Implement respirator maintenance program as required by OSHA. Inspect use of ladders, scaffolding, power equipment, etc.

Site. Data Collection and Salvaged Material Inventory Responsibility Maintain site log.
Record time spent as compared to estimated time. To the degree possible, break work into components such as set-up, windows, clean up, etc. using data collection form provided Record materials used out of inventory or special purchase.

Based on a distribution schedule, what material gets sold on-site, warehoused, processed, etc. Material will be bundled, palletized or placed in racks.
Where materials will be processed on-site (de-nailed, ends cut, mortar removed, etc.), quality control and inventory will be kept.

Worker, Safety, Health & Comfort

Clean up Area -The clean up area is to be located at the entrance/exit area of the job site. It contains:
Wash up supplies -rinse buckets, soap, a pump sprayer for final rinse, paper towels, a 2-bottle eye wash station and a first aid kit.
Worker protection -spare goggles, painter's caps, respirators, tyvac suits and cleaning pads. Clothes rack -a place to leave tyvac suits, dusk masks, respirators, and shoe covers. Work clothing can be vacuumed until it can be changed.
Emergency numbers -local hospital, property owners, utilities, etc.
Workers will leave and enter the job site through the door at the clean up area. Workers must wash their hands before eating, drinking, or smoking and clean up thoroughly before going home.
Break Area -Where this is located depends on the site, the size of tile job and the weather. It could be under a tree or in a heated construction trailer. It should include at least
Good air circulation and shade in hot weather
Safe heat when it's cold
Comfortable places to sit
A place to store food, preferably refrigerated
Easy access to clean toilets
A private area for men and a private area for women to change clothes
A secure place to park -this might include negotiations with neighbors or a contract with a parking facility.
Good lighting, preferably natural light. '

Worker Safety Compliance for Americorps*NCCC

- The first violation of a basic safety rule will result in a verbal warning and instructions for corrective action
- A second violation will result in a verbal warning, instructions for corrective a:ction and a written record of the incident.
- A third violation will result in a written record and removal from the job site for the rest of tile work day.
- A fourth violation will result in a written record and removal from this "spike."

Job Site Technical Issues

- Access to building components and waste roll-offs is critical for deconstruction. Before any work begins, clear and safe areas for working and movement will be established. A work site around the building will be established and also marked with warning tape as the construction zone. Any persons within tile construction site zone will be expected to comply with all provisions of the Safety Procedures for Deconstruction as detailed in this plan.
- Timely removal and drop-off of the roll-offs will be established in order to not impede the removal of components directly into the roll-off, while having them as close as possible to where the major deconstruction effort might be occurring. For example, having a roll-off next to the structure to capture asphalt roofing shingles, but removing it and placing the next roll-off to not impede the removal of exterior siding.

- .Removing both reuseable / recyclable and disposable materials in a timely manner is critical to the safety of the job-site and the efficiency of both the deconstruction and tile processing activities.
- Many nails are placed in such a way as to not be readily accessible to a prying device. Wood is sometimes damaged in the extraction process. In all cases, a material will be removable by use of levering, unscrewing or unbolting, and should not require a sledgehammer or other smashing tool.
- On-site removal of materials as they are processed in order to minimize the effort invested in loading, transporting and storing materials in another location will take place on occasion. If non-deconstruction personnel are allowed onto the site for this purpose, work will be stopped in the immediate area to allow materials to be removed. When materials are store on site, they will be stored in a proper manner as detailed within this document. When materials are to be transported to another location for storage, they will be transferred in a safe and proper manner.
- Good deconstruction sites require sufficient room to work around the building, including de- nailing and stacking areas away from the structure, space for roll-off delivery and pick-ups.
- Coordinating workers and increasing their awareness of how materials must be removed and the importance of balancing efficiency with minimal damage to the materials is critical. Maintaining awareness of the difference between salvage and disposal will require a high degree of supervision. ,
- De-nailing stations will be either inside or under trees for shade and nails will be "caught" and properly disposed of by catching them on the interior floor surface, wheelbarrows, or tarps/carpet scraps. '
- Nails are often more easily removed when the material was still in place in the building such as a along the length of a vertical stud wall member. Damage or multiple nails in the ends of lumber are more readily removed by using a battery-powered saw to simultaneously trim the end and cut off the nails.

Lockout/Blockout Procedures

All machinery or equipment capable of movement must be de-energized or disengaged and blocked or locked out during cleaning, servicing, adjusting or setting up operations, whenever required. The locking out of the col1trol circuits in lieu of locking out main power disconnects is prohibited. All equipment control valve handles must be provided with a means for locking out. The lock-out procedure requires that stored energy (i.e. mechanical, hydraulic, air) be released or blocked before equipment is locked out for repairs. Appropriate employees are provided with individually keyed personal safety locks. Employees are required to keep personal control of their key(s) while they have safety locks in use. Employees/volunteers must check the safety of the lockout by attempting a start up after making sure no one is exposed. Where the power disconnector does not also disconnect the electrical control circuit, the appropriate electrical enclosures must be identified. The control circuit can also be disconnected and locked out.

Confined Spaces

Before entry into a confined space, all impellers, agitators, or other moving equipment contained in the confined space must be locked-out. Ventilation must be either natural or mechanically provided into the confined space. All hazardous or corrosive substances that contain inert, toxic, flammable or corrosive materials must be valved off, blanked, disconnected and separated. Atmospheric tests should be performed to check for oxygen content, toxicity and explosive concentration. Atmospheric tests must be performed on a regular basis in a confined area where entry is required. The area must also be checked for decaying vegetation or animal matter that could produce methane. Adequate lighting must be provided within the space. Iftl1e confined area is located below the ground or near where motor vehicles are operating, care must be taken that vehicle exhaust or carbon monoxide does not enter the space. When personnel enter a confined area, assigned safety standby employees who are alert to the work being done, are able to sound an alarm if necessary and to render assistance, must be in the area. These standby employees must be trained to assist in handling lifelines, respiratory equipment, CPR, first aid, and be able to employ rescue equipment that will remove the individual *from* the confined area. Standby personnel should be in teams of two during such an operation or else within the vicinity if working separately. There must also be an effective communication system utilized while the operation is occurring. When equipment which utilizes oxygen, such as salamanders, torches or furnaces, is used in a confined space, adequate ventilation must be provided to guarantee oxygen content and combustion *for* the equipment. When this equipment is used, adequate measures
must be taken to assure that exhaust gases are vented outside the enclosure. When gas welding or burning is used, hoses must be checked *for* leaks. Compressed bottled gas must be outside the area and torches must be lit outside the area also. The atmosphere must be tested each time before lighting a torch.

Environmental Controls

All emp10yees must be aware of the hazards involved when working with chemicals and the remedies that need to be used when an accident does occur. A training program will give instructions on how to handle the chemical being used and first aid to be applied to victims of chemical exposure. First aid and caution signs will ~')e conspicuously posted so as to alert individuals on a constant basis. Charts identifying the chemicals utilized in the workplace, their symptoms and effects must also be posted. The workers must know what the acceptable level of exposure to a chemical is and what safety systems must be in place when working with a chemical. Staff should also be aware of new chemical products which may be available that are

less harmful, and they must ensure that facilities are adequately ventilated when using chemicals on the premises. Spray painting operations done in spray rooms or booths must be equipped with an appropriate exhaust system. Periodic inspections must be made *of* the booth and noted on an inspection tag posted on the booth. If welding is done, the welder should be certified. In the area of operation where the welding is taking place, tile welder must be aware *of* ventilation available, the type *of* respirator that can be used in the area, and *if* exposure time or other means wi II suffice as a safe and adequate measure when welding as to the fumes that will be emitted. Welders should also be supplied with protective clothing and a flash shield during welding operations. When forklifts and other vehicles are used in buildings or other enclosed areas, carbon monoxide levels must be kept below maximum acceptable concentration. Noise levels also present a potential hazard. Noise levels within a facility must be at acceptable levels and *if* not, steps must be taken to reduce the level using recommended engineering controls. When fibrous materials such as asbestos are being handled, the necessary precautions must be taken to protect the employee/volunteer from the material. The material must be labeled, along with signs conspicuously posted that these materials are being used in the area. Employees should be aware of effective methods used to prevent emission *of* airborne asbestos fibers, silica dust and other similar hazardous materials. Some of tile recommended methods of controlling the emission of these materials are by using water and vacuuming, rather than blowing and sweeping, the
I materials. Machinery such as grinders, saws and other tools that produce a fine airborne dust
i must be vented to an industrial collector or central exhaust system. In any ventilation system the system should be designed and operated at an airflow and volume necessary for proper
application and effectiveness. In the design of the ventilation system the ducts and belts must be free *of* obstructions and slippage. As with all operations, there must be written standards on the procedures for the equipment, description of the job task, usage of the protective equipment provided, such as the selection and use of respirators, and when they are needed. Any water that is provided to an employee/volunteer throughout tile facility should be clearly identified as to whether it is for drinking, washing or cooking. All restrooms must be kept clean and sanitary. Employees should be screened before taking positions that may expose them to hazards they are not physically capable of handling. An employee/volunteer who takes an assignment which requires physical labor must be trained to lift heavy loads properly so as not to damage
themselves physically. If the work assignment involves dealing with equipment that produces ultra-violet radiation, the employee/volunteer must be properly protected or given the correct protective clothing. An employee/volunteer posted to an assignment on a roadway where there is heavy traffic must be given the designated protective clothing (bright colored traffic orange warning vest) and safety training regarding the hazards of this job.

Hazardous Chemical Exposures

In any company that uses chemical substances, a training program on the handling, hazards, storage, exposure risks, symptoms of chemical exposure, and first aid needs to be part of any new employees training. There must also be follow-up training sessions as to any new chemical or processes that may be initiated by the company. Follow-up training sessions act as a reinforcement of safety standards that need to be fol10wed on a daily basis. In a training program, employees will learn acceptable levels of chemical exposure, proper storage and labeling of chemicals, and usage of protective clothing and equipment for handling chemicals. They will also learn about potential fire and toxicity hazards, when not to have a chemical in a confined area, or to store in closed containers, usage of eye wash fountains and safety showers, and the necessary posting of open, and dangerous areas. It is important that an employee/volunteer recognize the Threshold Limit Values or Permissible Exposure Limits of airborne contaminants and physical agents in the workplace. A procedural manual or set of

instructions must be part of the program, with periodic inspections that clearly indicate whether an employee/volunteer may be mishandling a chemical or endangering himself or others. Part of the manual or procedures must establish a standard of when and how to deal with chemical spills, neutralizing, and disposing of spills or overflows. These procedures must also be posted in an area that is easily accessible for reference usage. First Aid training and equipment will be routine in any facility where chemicals are used. Employees must know how to handle equipment in emergency situations, what equipment needs to be used and whether the equipment is adequate for the situation. Respirators may be used either as protective safety equipment or for emergency usage. Therefore, the employee/volunteer should recognize that respirators need to be stored in a clean, sanitary and convenient location and inspected on a regular basis. Also what respirators are approved by NIOSH for their particular applications. With a first aid program an employee/volunteer will recognize when a problem may be occurring by exposure to a chemical ranging from headaches, nausea, dermatitis problems to other factors of discomfort when they use solvents or chemicals. In the design of a facility that transports chemicals from storage to vats, the content of pipes and storage containers must be clearly marked. Within that facility design there must be an emergency shut off system in case of accident. Each employee/volunteer will be trained as to these emergency shut-off systems. Ventilation is another major factor in the design of any facility. Whether by natural means or mechanical, the system must be designed to control dust, fumes, solvents, gases, smoke or vapors which may be generated in the workplace. It is also important that a medical or biological monitoring system be in operation as part of the safety standards. If internal combustion engines are used in the facility, or if there is a chance of leakage or mixture with a chemical that could create a toxic gas, atmospheric gas levels must be monitored. If toxic chemicals are used and stored in the facility they should be located in an isolated area to guarantee safety.

Hazardous Substances Communication

When hazardous substances are used in the workplace, a hazard communication program dealing with Material Safety Data Sheets (MSDS), labeling and employee/volunteer training will be in operation. MSDS materials will be readily available for each hazardous substance used. A training program plus regular question and answer sessions on dealing with hazardous materials will be given to keep employees informed. The program will include an explanation of what an MSDS is and how to use and obtain one; MSDS contents for each hazardous substance or class of substances; explanation of the "Right to Know"; identification of where employees can see the employer's written hazard communication program and where hazardous substances are present in their work area; the health hazards of substances in the work area, how to detect their presence, and specific protective measures to be used; as well as informing them of hazards of non-routine tasks and unlabeled pipes.

Electrical

The workplace will be aware of the OSI-IA Electrical Safety Orders and will comply with the same. Employees will be required to report any hazard to life or property that is observed in connection with a job, electrical equipment or lines. Employees will be expected to make preliminary inspections or appropriate tests to determine conditions before starting work. When equipment or lines are to be serviced, maintained or adjusted, employees must be aware of open switches. Lockouts must be tagged whenever possible. Equipment such as electrical tools or appliance l11ust be grounded or of the double insulated type. Extension cords being used must have a grounding conductor. The workplace supervisor must be aware if multiple plug adaptors are prohibited. If ground-fault circuit interrupters are installed on each temporary 15 or 20 ampere, 120 volt AC circuit at locations where construction, demolition, modifications,

alterations or excavations are being performed, temporary circuits must be protected by suitable disconnecting switches or plug connectors with permanent wiring at the junction. Electricians must be aware of the following: Exposed wiring and cords with frayed or deteriorated insulation must. be repaired or replaced. Flexible cords and cables must be free of splices or taps. Clamps or other securing means must be provided on flexible cords or cables at plugs, receptacles, tools, equipment. The cord jacket must be held securely in' place. All cord, cable and raceway connections must be intact and secure. In wet or damp locations, electrical tools and equipment must be appropriate for the use or location, or otherwise protected. The location of electrical power lines and cables (overhead, underground, under floor, other side of walls) must be determined before digging, drilling or similar work is begun. All metal measuring tapes, ropes, hand lines or similar devices with metallic thread woven into the fabric are prohibited for use where they could come in contact with energized parts of equipment or circuit conductors. The use of metal ladders is prohibited in areas where the ladder or the person using the ladder could come ill contact with energized parts of equipment, fixtures or conductors. All disconnecting switches and circuit breakers must be labeled to indicate their use or equipment served. A means for disconnecting equipment must always be opened before fuses are replaced. All interior wiring systems must include provisions for grounding metal parts or electrical raceways, equipment and enclosures. All electrical raceways and enclosures must be fastened securely in place. All energized parts of electrical circuits and equipment must be guarded against accidental contact by approved cabinets or enclosures. Sufficient access and working space will be provided and maintained around all electrical equipment to permit ready and safe operations and maintenance. All unused openings (including conduit knockouts) in electrical enclosures and fittings must be closed with appropriate covers, plugs or plates. Electrical enclosures such as switches, receptacles, and junction boxes must be provided with tight-fitting covers or plates. Disconnecting switches for electrical motors in excess of two horsepower must. be capable of opening the circuit when the motor is in a stalled condition without exploding. (Switches must be horsepower rated equal to or in excess of the motor hp rating.) Low voltage protection must be provided in the control device of motor driven machines or equipment which could cause injury from inadvertent starting. A motor disconnecting switch or circuit breaker must be located within sight of the motor control device. Motors: a) must be located within sight of their controller; b) must have their controller disconnecting means capable of being locked in the open position; c) or must have separate disconnecting means installed in the circuit within sight of the motor. A controller for a motor in excess of two horsepower must be rated equal to but not in excess of the motor it services. Employees who regularly work on or around energized electrical. equipment or lines will be instructed in cardio-pulmonary resuscitation (CPR) methods. Employees will be trained on how to work on energized lines or equipment over 600 volts.

Noise

Noise levels are measured using a sound level meter or an octave bank analyzer and records kept. Engineering controls will be used to reduce excessive noise levels. When engineering controls are not feasible, administrative contr01s (i.e, worker rotation) will be used to minimize individual employee/volunteer exposure to noise. An ongoing preventive health program will be utilized to educate employees in safe levels of noise, exposure, effects of noise on their health, and use of personal protection. Approved hearing protective equipment (noise attenuating devices) will be available to every employee/volunteer working in areas where continuous noise levels exceed 85 dB. To be effective, ear protectors must be properly fitted and employees will be instructed in their use and care.

Fueling

Where. flammable liquids are used, employees will be trained to deal with spillage during fueling operations, how it is to be cleaned: the types and designs of fueling hoses and the specific types of fuel it can handle, whether fueling is being done with a nozzle that is a gravity flow system or self-cleaning, how to avoid spills and recognition that if a spill does Occur, tile safety of restarting an engine. Employees must be aware that an open flame or light near any fuel is prohibited when fueling or the transfer *of* fuel is occurring. "NO SMOKING" signs will be posted conspicuously.

Material Handling

In the handling *of* materials, employees must know the following: There must be safe clearance for equipment through aisles and doorways. Aisle ways *must* be designated, permanently marked, and kept clear to allow unhindered passage. Motorized vehicles and mechanized

equipment will be inspected daily or prior to use. Vehicles must be shut off and brakes must be set prior to loading or unloading. Containers *of* combustibles 9r flammables, when stacked while being moved, must be separated by dunnage sufficient to provide stability. If dock boards (bridge plates) are used when loading or unloading operations are taking place between vehicles and docks, precautions must be observed. Trucks and trailers will be secured from movement during loading and unloading operations. Dock plates and loading ramps will be constructed and maintained with sufficient strength to support imposed loading. Hand trucks must be maintained in safe operating condition. Chutes must be equipped with sideboards of sufficient height to prevent the handled materials from falling off. At the delivery end of rollers or chutes, provisions must be made to brake the movement of the handled materials. Pallets *must* be inspected before being loaded or moved. Hooks with safety latches or other arrangements will be used when hoisting materials, so that slings or load attachments won’t accidentally slip off the hoist hooks. Securing chains, ropes, chockers or slings must be adequate for the job to be performed. When hoisting material or equipment, provisions must be made to assure no one will be passing under the suspended loads. Material Safety Data Sheets will be available to employees handling hazardous substances. .

Transporting Employees & Materials

When employees are transporting either employees or materials, they must have an operator's license for that classification *of* vehicle and be certified or trained in the operation of that vehicle. For a safety program to be effective, they must also have knowledge *of* First Aid courses and safety equipment, as well as the vehicle and how it operates. As employees are transported by truck, provisions must be provided to prevent their falling from tile vehicle. Vehicles should be in good working condition, inspected on a regular basis and must be equipped with lamps, brakes, horns, mirrors, windshields and turn signals in good working order. If the vehicle transports numerous individuals it must be equipped with handrails, steps, stirrups or similar devices, placed and arranged so that employees can safely mount or dismount.. Safety measures to ensure passenger safety should be observed. When cutting tools with sharp edges are carried in tile passenger compartment, they must be placed in closed boxes or secured containers. Carrying flares and two reflective type flares and a fire extinguisher must be part of the standard emergency equipment carried in tile vehicle at all times.

Ventilation

In the operation *of* any facility ventilation system, there needs to be a design to integrate several systems of control which will expel contaminates and provide clean air. The systems must take into consideration the volume and velocity that will be needed to successfully remove contaminates. The system must not fail in the case *of* an emergency situation where two

contaminates are exposed to each other when a fire or explosion occurs. I n the design of the system, clean-out ports or doors that are provided at intervals will not exceed 12 feet in all horizontal runs of exhaust ducts. The system must be operational so that it will not offset the functions of other operations.

Licenses and Permits

In addition to other postings required by law, Austin Habitat for Humanity maintains a copy of all necessary business licenses, permits, and notices required by the National Labor Relations Board or other governmental bodies, notices of citations during abatement periods, and other required information which are posted during the appropriate times On job sign.

Personal Protective Equipment Clothing

1. Where there is a danger of flying particles or corrosive materials, employees must wear protective goggles and/or face shields provided [or approved] by Austin Habitat for Humanity.

2. Employees are required to wear safety glasses at all times in areas where there is a risk of eye injuries such as punctures, contusions or burns.

3. Employees who need corrective lenses are required to wear only approved safety glasses, protective goggles, or otl1er medically approved precautionary procedures when working in areas with harmful exposures, or risk of eye injury.

4. Employees are required to wear protective gloves, aprons, shields and other means provided in areas where they may be subject to cuts, corrosive liquids and/or harmful chemicals. 5. Hard hats must be worn in areas subject to falling objects, and at all times while at construction sites.

6. Appropriate footwear including steel-toed shoes must be worn in an area where there is any risk of foot injuries from hot, corrosive, poisonous substances, falling objects, crushing or penetrating action.

7. When necessary employees must use the approved respirators which are provided for regular and emergency use.

8. All safety equipment must be maintained in sanitary condition and ready for use. Report any defective equipment immediately.

9. An eye wash facility is located in job-site water container. If any irritant gets into an employee's eyes, call for medical assistance immediately and flush the eye out with clean water.

10. Food may not be eaten in work areas, or in places where there is any danger of exposure to toxic materials or other health hazards. Ask your supervisor to identify safe eating places.

11. In cases where the noise level exceeds certain levels, ear protection is required.

12. In cases of cleaning toxic or hazardous materials, protective clothing provided must be worn.

Hardhats

In Austin Habitat for Humanity, hard hats are required [at all times, in designated areas, when appropriate]. Hardhats are common in our industry. There was a time, about one hundred years ago, when no one wore a hardhat. But, over time, the value of hardhats to save lives was firmly proven, so that the entire industry now accepts this safety device as a natural article of clothing, like a football player wearing a helmet during a game. Sometimes a person fails to wear a' hardhat, either through forgetfulness or through underestimating the risk of head injury W.11ich can be prevented by wearing one. Remember that all it takes is a carelessly dropped tool or piece of material coming down on your head to cause severe injury or even death. There are a number of workers disabled with various type of head injuries and vision problems because they didn't wear a hardhat. When you wear a hardhat, wear it right. Keep it squarely on your head with the inside band properly adjusted. See you supervisor if your having trouble adjusting the hardhat.

Work Environment

Work sites must be clean and orderly. Work surfaces must be kept dry or appropriate means taken to assure the surfaces are slip-resistant. Spills must be cleaned lip immediately. All combustible scrap, debris and waste must be stored safely and removed promptly. Combustible dust must be cleaned up with a vacuum system to prevent the dust from going into suspension.

The accumulated combustible dust must be removed routinely. Metallic or conductive dust must be prevented from entering or accumulating on or around electrical enclosures or equipment. Waste containers must be covered. Oily and paint soaked rags are combustible and should be discarded in sealable metal containers only. Paint spray booths, dip tanks and paint areas must be cleaned reglularly. All oil and gas fired devices should be equipped with flame failure controls that will prevent flow of fuel if pilots or main burners are not working. Ask your supervisor where these controls are located. Make sure all pits and floor openings are either covered or otherwise guarded.

Walkways

All aisles and passageways must be kept clear. Also, aisles and passageways should be clearly marked. Wet surfaces must be covered with non-slip material and all holes properly covered or marked with warning guards. All spills must be cleaned lip immediately, and a caution sign placed on all wet or drying surfaces. In cases of passageways used by forklifts, trucks or other machinery, use a separate aisle for walking, if available. If no separately marked aisle is available, use extreme caution. Remember, walking in a passageway used by machinery is like walking in the middle of a street used by cars: you may have the right of way, but the heavier vehicle can't always see you and can't always stop in time. The key to moving around in such circumstances is to stop, look and listen and then to move when there is no danger. Make eye contact with the drivers of moving vehicles so that you know that they know you are there.

Equipment must be properly stored so that sharp edges do not protrude into walkways. Changes in elevations must be clearly marked, as must passageways near dangerous operations like welding, machinery operation or painting. If there is a low ceiling, a warning sign must be posted. If the walkway or stairway is more than thirty inches above the floor or ground, it must have a guardrail. If an employee/volunteers aware of any breach of these standards, please inform the workplace supervisor.

Floor and Wall Openings

Be careful when working near floor and wall openings. All floor openings (holes) should be guarded by a cover, guardrail or equivalent barrier on all sides except at the entrance to stairways and ladders. Toe boards must be installed around the edges of a permanent floor opening.

Skylights must be able to withstand at least 200 pounds pressure. Glass used in windows, doors, and walls (including glass block) must be able to withstand a human impact, and if required by code, be shatterproof "safety glass." Before beginning work at a new location, inspect it to ensure that all floor openings which must remain open, such as floor drains, are covered with grates or similar covers. In roadways and driveways, covers with capacity to carry a truck rear axle load of at least 20,000 pounds must protect all manholes and trenches. In office buildings, fire resistive construction requires that the doors and hallway closures be properly rated and be equipped with self-closing features. Be sure that there are at least two fire emergency exits accessible from your location at all times.

Work Area

Fire extinguishers must remain accessible at all times. Means of egress should be kept unblocked, well lighted and unlocked during work hours. Excessive combustibles (paper) may be not stored in work areas. Aisles and hallways must kept clear at all times. Designated employees have been trained to respond to a fire or other emergency. Workplaces are to be kept free of debris, floor storage and electrical cords. Adequate aisle space is to be maintained. File cabinet drawers should be opened one at a time and closed when work is finished. Proper lifting techniques are to be used by employees to avoid over exertion and strain when carrying loads. No alcohol or any intoxicating substance may be consumed prior to or during work.

Driving

Drive safely. If vehicles are used during the work day, seat belts and shoulder harnesses are to be worn at all times. Vehicles must be locked when unattended to avoid criminal misconduct. Do not exceed the speed limit. Vehicles must be parked in legal spaces and must not obstruct traffic. Defensive driving must be practiced by all employees. Employees should park their vehicles in well-lighted areas at/or near entrances to avoid criminal misconduct.

Vehicle Maintenance

Work safely when repairing vehicles. Where tires are mounted and/or inflated on drop center wheels, a safe practice procedure must be posted and enforced. Where tires are mounted and/or inflated on wheels with split rims and/or retainer rings, a safe practice procedure must be posted and enforced. Each tire inflation hose must have a clip-on chuck with at least 24 inches of hose between the chuck and an in-line hand valve and gauge. The tire inflation control valve should automatically shut off the air flow when the valve is released. A tire restraining device such as a cage, rack or other effective means must be used while inflating tires mounted on split rims, or rims using retainer rings. Employees are strictly forbidden from taking a position directly over or in front of a tire while it's being inflated. Proper lifting techniques must be used by employees to avoid over-exertion when lifting packages.

Tool Maintenance

Faulty or improperly used hand tools are a safety hazard. All employees shall be responsible for ensuring that tools and equipment (both company and employee-owned) used by them or other employees at their workplace are in good condition. Hand tools such as chisels, punches, etc., which develop mushroom heads during use, must be reconditioned or replaced as necessary. Broken or fractured handles on hammers, axes and similar equipment must be replaced promptly. Worn or bent wrenches should be replaced regularly. Appropriate handles must be used on files and similar tools. Appropriate safety glasses, face shields, etc., must be worn while using hand tools or equipment which might produce flying materials or be subject to breakage.

Eye and face protection must be worn when driving in tempered spuds or nails. Check your tools often for wear or defect. Jacks must be checked periodically to assure they are In good operating condition. Tool handles must be wedged tightly into the heads of tools. Tool cutting edges should be kept sharp enough so the tool will move smoothly without binding or skipping. When not in use, tools should be stored in a dry, secure location.

Ladders

Check ladders each and every time before you climb. Ladders should be maintained in good condition: joints between steps and side rails should be tight; hardware and fittings

securely attached; and movable parts operating freely without binding or undue play. Non-slip safety feet are provided on each ladder. Ladder rungs and steps should be free of grease and oil.

Employees are prohibited from using ladders that are broken, missing steps, rungs, or cleats, or that have broken side rails or other faulty equipment. **It is prohibited to place a ladder in front of doors opening toward the ladder except when the door is blocked open, locked or guarded. It is prohibited to place ladders on boxes, barrels, or other unstable bases to obtain additional height. Face the ladder when ascending or descending. Be careful when you climb a ladder. Do not use the top step of ordinary stepladders as a step. When portable rung ladders are used to gain access to elevated platforms, roofs, etc., the ladder must always extend at least3 feet above the elevated surface.** It is required that when portable rung or cleat type ladders are used, the base must be so placed that slipping will not occur, unless it is lashed or otherwise held in place. All portable 111etalladders must be legibly marked with signs reading "CAUTION" -"Do Not Use Around Electrical Equipment." Employees are prohibited from using ladders as guys, braces, skids, gin poles, or for other than their intended purposes. Only adjust extension ladders while standing at a base (not while standing on the
ladder or from a position above the ladder). Metal ladders should be inspected for tears and signs of corrosion. Rungs of ladders should be uniformly spaced at 12 inches, center to center.

Combustible Materials

All combustible scrap, debris and waste materials (oily rags, etc.) must be stored in covered metal receptacles and removed from the work site promptly. Proper storage to minimize the risk of fire, including spontaneous combustion must be practiced. Only approved contajners and tanks are to be used for the storage and handling of flammable and combustible liquids. All connections on drums and combustible liquid piping, vapor and liquid must be kept tight. All flammable liquids should be kept in closed containers when not in use (e.g., parts-cleaning tanks, pans, etc.). Bulk drums of flammable liquids must be grounded and bonded to containers during dispensing. Storage rooms for flammable and combustible liquids must have explosion-proof lights. Storage rooms for flammable and combustible liquids should have mechanical or gravity ventilation. Liquefied petroleum gas must be stored, handled, and used in accordance with safe practices and standards. No smoking signs must be posted on liquefied petroleum gas tanks. Liquefied petroleum storage tanks should be guarded to prevent damage from vehicles. All solvent wastes and flammable liquids should be kept in fire-resistant, covered containers until they are removed from the work site. Vacuuming should be used whenever possible rather than blowing or sweeping combustible dust. Fire separators should be placed between containers of combustibles or flammables when stacked one upon another to assure their support and stability. Fuel gas cylinders and oxygen cylinders must be separated by distance, fire resistant barriers, etc., while in storage. Fire extinguishers are selected for the types of materials and placed in areas where they are to be used. These fire extinguishers are classified as follows: Class A - Ordinary combustible materials fires. Class B -Flammable liquid, gas or grease fires. Class C- Energized-electrical equipment fires. Appropriate fire extinguishers must be mounted within 75 ft. of outside areas containing flammable liquids, and within 10ft. of any inside storage area for such materials. All extinguishers must be serviced, maintained and tagged at intervals not to exceed one year. Extinguishers should be placed free from obstructions or blockage. All extinguishers must be fully charged and in their designated places unless in use. Where sprinkler systems are permanently installed, are the nozzle heads arranged so that water will not be sprayed into operating electrical switch boards and equipment? Check to see that heads have not I been bent or twisted from their original position. "NO SMOKING" rules will be enforced in areas involving storage and use of hazardous materials. "NO SMOKING" signs have been posted where appropriate in areas where flammable or combustible materials are used and/or stored. Safety cans must be used for dispensing flammable or combustible liquids at point of use. All spills of flammable or combustible liquids must be cleaned up promptly. Storage tanks should be adequately vented to prevent the development of excessive vacuum or pressure as a result of filling, emptying, or atmosphere temperature changes. Storage tanks are equipped with emergency venting that will relieve excessive internal pressure caused by fire exposure.

Mechanical Lockout/Tagout

Point of operation devices shall protect the operator by: Preventing and/or stopping normal stroking of the press if the operator's hands are inadvertently placed in the point of operation; or Preventing the operator from inadvertently reaching into the point of operation or withdrawing his/her hands if they are inadvertently located in the point of operation, as the dies close; or Preventing the operator from inadvertently reaching into the point of operation at all times; or Requiring application of both of the operator's hands to machine operating controls and locating such controls at such a safety distance from the point of operation that the slide completes the downward travel or stops before the operator can reach into tile point of operation with his/her hands; or Enclosing the point of operation before a press stroke can be initiated and maintaining tllis closed condition until the motion of the slide had ceased; or Enclosing the point of operation before a press stroke can be initiated, so as to prevent an operator from reaching into the point of operation prior to die closure or prior to cessation of slide motion during the downward stroke. A gate or movable barrier device shall protect the operator. A presence sensing point of operation device shall protect the operator by interlocking into the control circuit to prevent or stop slide motion if the operator's hand or other part of his/her body is within the sensing field of the device during the down stroke of the press slide. The device may not be used on machines using full revolution clutches. The device may not be used as a tripping means to initiate slide motion. The device shall be constructed so that a failure within the system does not prevent the normal stopping action from being applied to the press when required, but does prevent the initiation of a successive stroke until the failure is corrected. The failure shall be indicated by the system. Muting (bypassing of the protective function) of such device, during the upstroke of the press slide, is permitted for tile purpose of parts ejection, circuit checking, and feeding only. The safety distance from the sensing field to the point of operation shall be greater than the distance determined by the following formula: Os = 63 inches/second x Ts where: Os = minimum safety distance (inches); 63 inches/second = hand speed constant; and Ts = stopping time of the press measured at approximately 90@ position of crankshaft rotation (seconds). Guards shall be used to protect all areas of entry to the point of operation not protected by the presence sensing device. The pull-out device shall protect the operator and shall include attachments for each of the operator's hands. Attachments shall be connected to and operated only by the press slide or upper die. Attachment shall be adjusted to prevent the operator from reaching into the point of operation or to withdraw the operator's hands from the point of operation before the dies close. A separate pull-out device shall be provided for each operator if more than one operator is used on a press. Each pull-out device in use shall be visually inspected and checked for proper adjustment at the start of each operator shift, following a new die set-up, and when operators are changed. Necessary maintenance or repair or both shall be performed and completed before the press is operated. The sweep device, shall protect the operator as specified in this subsection, by removing his/her hands safely to a safe position if they are inadvertently located in the point of operation, as the dies close or prior to tripping the clutch. Devices operating in this manner shall have a barrier, attached to the sweep arm in such a manner as to prevent tile operator from reaching into the point of operation, past the trailing edge of the sweep arm on the downward stroke of the press. This device may not be used for point of operation safeguarding. The sweep device must be activated by the slide or by motion of a foot pedal trip rod. The sweep device must be designed, installed and operated so as to prevent the operator from reaching into the point of operation before the dies close. The sweep device must be installed so that it will not

itself create all impact or shear hazard between the sweep arm and the press tie rods, dies, or any otller part of the press or barrier. Partial enclosure conforming with this subsection, as to tile area of entry which they protect, must be provided on both sides of the point of operation to prevent the operator from reaching around or behind the sweep device and into the point of operation after the dies start to close. Partial enclosures shall not themselves create a pinch point or shear hazard. A holdout or a restraint device shall protect the operator and shall include attachments for each of the operator's hands. Such attachments shall be securely anchored and adjusted in such a way that the operator is restrained from reaching into the point of operation. A separate set of restraints shall be provided for each operator if more than one operator is required on a press. The two hand control device shall protect the operator. When used in press operations requiring more than one operator, separate two hand controls shall be provided for each operator, and shall be designed to require concurrent application of all operators' controls to activate the slide. The removal of a hand from any control button shall cause the slide to stop. The safety distance between each two hand control device and the point of operation shall be greater than the distance determined by the following formula: Os = 63 inches/second x Ts, where: Os = minimum safety distance (inches); 63 inches/second = hand speed constant; and Ts = stopping time of the press measured at approximately 90@ position of crankshaft rotation (seconds).

First Aid Kits

First-aid kits and required contents are maintained in a serviceable condition. Unit-type kits have all items in the first-aid kit individually wrapped, sealed, and packaged in comparable sized packages. The commercial or cabinet-type kits do not require all items to be individually wrapped and sealed, but only those which must be kept sterile. Items such as scissors, tweezers, tubes of ointments with caps, or rolls of adhesive tape, need not be individually wrapped, sealed, or disposed of after a single use or application. Individual packaging and sealing shall be required only for those items which must be kept sterile in a first-aid kit. First-aid kits shall contain at least the following items: 10 Package Kit: I Pkg. Adhesive bandages, 1" (16 per pkg.) I Pkg. Bandage compress, 4" (I per pkg.) I Pkg. Scissors* and tweezers (I each per pkg. 1 Pkg. Triangular bandage, 40" (I per pkg.) I Pkg. Antiseptic soap or pads (3 per pkg.) 5 Pkgs. of consulting physician's choice 16 Package Kit: 1 Pkg. Absorbent gauze, 24" x 72" (1 per pkg.) 1 Pkg. Adhesive bandages, 1" (16 per pkg.) 2 Pkgs. Bandage com presses, 4" (1 per pkg.) 1 Pkg. Eye dressing (I per pkg.) I Pkg. Scissors* and tweezers (1 each per pkg.) 2 Pkgs. Triangular bandages, 40" (1 per pkg.) 1 Pkg. Antiseptic soap or pads (3 per pkg.) 7 Pkgs. of consulting physician's choice 24 Package Kit: 2 Pkgs. Absorbent gauze, 24" x 72" (1 per pkg.) 2 Pkgs. Adhesive bandages, 1" (16 per pkg.) 2 Pkgs. Bandage compresses, 4" (1 per pkg.) 1 Pkg. Eye dressing (I per pkg.) I Pkg. Scissors* and tweezers (1 each per pkg.) 6 Pkgs.Triangular bandages (I per pkg.) 1 Pkg. Antiseptic soap or pads (3 per pkg.) 9 Pkgs. of consulting physician's choice 36 Package Kit: 4 Pkgs. Absorbent gauze, 24" x 72" (I per pkg.) 2 Pkgs. Adhesive bandages, 1" (16 per pkg.) 5 Pkgs. Bandage compresses, 4" (1 per pkg.) 2 Pkgs. Eye dressing (1 per pkg.) 1 Pkg. Scissors* and tweezers (1 each per pkg.) 8 Pkgs. Triangular bandages, 40" (1 per pkg.) I Pkg. Antiseptic soap or pads (3 per pkg.) 13 Pkgs. of consulting physician's choice Scissors shall be capable of cutting 2 layers of 15 oz. cotton cloth or its equivalent. The first-aid kits are maintained at the ten, sixteen, twenty-four or thirty-six package level. Where the eyes or body of any person may be exposed to injurious chemicals and/or materials, suitable facilities for quick drenching or flushing of the eyes and body are provided, within the work area, for immediate emergency use. A poster shall be fastened and maintained either on or in the cover of each first- aid kit and at or near all phones plainly stating, the phone numbers of available doctors, hospitals, and ambulance services within the district of the work site.

First Aid Station

If a fixed establishment employs more than 200 employees at one central location, First-aid stations shall be located as close as practicable to the highest concentration of personnel. First- aid stations shall be well marked and available to personnel during all working hours. One person holding a valid first-aid certificate shall be responsible for the proper use and maintenance of the first-aid station. First-aid stations shall be equipped with a minimum of two first-aid kits, the size of which shall be dependent upon the number of personnel normally employed at tile work site. One first-aid kit may be a permanent wall-mounted kit, but in all cases the station shall be equipped with at least one portable first-aid kit. When required by the circumstances, the station shall be equipped with two wool blankets and a stretcher in addition to first-aid kits. A roster, denoting the telephone numbers and addresses of doctors, hospitals and ambulance services available to the work site, shall be posted at each first-aid station.

Responsible Safety Officer

General Statement

The Responsible Safety Officer is tile person who has been delegated the authority to develop and administer Austin Habitat for Humanity's health and safety program.

Five Functions

The functions of the Responsible Safety Officer are divided into five areas: 1. Operations 2. Health Physics 3. Engineering Services/Occupational Safety 4. Industrial Hygiene 5. Environmental Protection Some of these functions may be delegated in whole or in part to staff and/or outside consultants.

Operations

This area deals with the day-to-day safety operations of the Austin Habitat for Humanity. It includes the following personnel: Field Supervisors or Field Safety Officers help in the planning or preparation of hazardous projects and analysis of difficult safety problems. They provide on- site training; protective equipment and other safety-related equipment for hazardous operations; maintenance of environmental monitoring devices; evaluation of ventilation and air cleaning equipment; and radioactive or chemical source inventory. Decontamination and Waste Disposal Contractors provide services to decontaminate special equipment; assistance with clean-up of radioactive or hazardous chemical spills; collection and disposal of radioactive materials and hazardous chemicals. Special Transportation Contractor provides services for receiving and shipping of radioisotopes and consultation on the regulations concerning transportation of hazardous chemicals.

Engineering Occupational Safety

The primary concern or this area is the general safety of Austin Habitat for Humanity. Its responsibilities include: Occupational Safety: Investigation, statistical analysis, and review of personal injury, property damage, and vehicle accident reports. Recommendation on protective clothing and equipment for eyes, head, feet, and hands to prevent traumatic injury. Evaluation of material-handling and storage facilities, such as manual and mechanical handling devices, slings, ropes, chains, and hooks. Review of design, layout, and code compliance of new or modified facilities and buildings and follow-up inspections of construction sites. Recommendation on proper use and care of ladders, ramps, elevated walks, and work platforms. Review of traffic safety, such as traffic signs and markings, traffic patterns, and layout planning. Determination of qualified operators of special vehicles and equipment. Mechanical Safety: Review/design/inspection of hazardous equipment. Advise on vehicle safety (design, consultation). Recommendation of adherence to mechanical design codes, standards, and procedures. Provision of non-destructive testing services. Reviews of Operational Safety Procedure relating to hazardous equipment. Seismic Safety: Design of anchoring or restraining devices. Inspections and consultations, Interface with building and construction contractors.

Industrial Hygiene

This function must recognize, evaluate, and recommend control for occupational health hazards. Outside consultants are responsible for providing tile following services: Toxicology of occupational chemical hazards Control of non-ionizing electromagnetic spectrum hazards, such as lasers, ultraviolet, infrared, and microwave-radio frequency radiation Evaluation of ventilation for comfort, dilution, and local exhaust Noise and sound analysis Illumination evaluation Environmental sanitation, such as food, water, and vector and pest control.

Measurement of physiological stresses, such as temperature extremes Provision of protective equipment, such as respiratory, hearing, and special eye protection Control of bio-hazards Laser safety,

Environmental Protection

This area is involved with the identification and quantification of environmental quality concerns, development and maintenance of operating permits, assessment of pollution abatement programs, and liaison with environmental protection agencies. It includes the following services: Environmental monitoring, surveillance and analysis of contaminants in air, rain, , surface water, soil, and stack exhaust Air pollution control Water pollution control Polychlorinated biphenyl inventory in transformers and capacitors. Underground tank monitoring and reporting Treatment facilities permitting and sampling for regulatory compliance Environmental remediation of contaminated sites.

Chemical Safety

The objective of this chapter is to provide guidance to all Austin Habitat for Humanity employees and participating volunteers who use hazardous materials so that they may perform their work safely. Many oftl1ese materials are specifically explosive, corrosive, flammable, or toxic; they may have properties that combine these hazards. Many chemicals are relatively non- hazardous by themselves but become dangerous when they interact with other substances, either in planned experiments or by accidental contact. To avoid injury and/or property damage, persons who handle chemicals in any area of the Company must understand the hazardous properties of the chemicals with which they will be working. Before using a specific chemical, safe handling methods must always be reviewed. Supervisors are responsible for ensuring that the equipment needed to work safely with chemicals is provided. The cost of this equipment is borne by the Company.

Hazcom Plan

On May 25, 1986 the Occupational Safety and Health Administration (OSHA) placed in effect the requirements of a new standard called Hazard Communication (29 CFR 1910.1200). This standard establishes requirements to ensure that chemical hazards in the workplace are identified and that this information, along with information on protective measures, is transmitted to all affected employees. This section describes how Austin Habitat for Humanity employees are informed of the potential chemical hazards in their work area so they can avoid harmful exposures and safeguard their health. Components of this program include labeling, preparing a material safety data sheet(MSDS), and training. With regard to MSDS, Austin Habitat for Humanity has limited coverage under the OSHA Hazard Communication Standard. The Company is required to maintain only those sheets that are received with incoming shipments for the following reasons: the Company commonly uses small quantities of many different hazardous materials for short periods of time; that the hazards change, often unpredictably; many materials are of unknown composition and most workers are highly trained. Responsibilities of Supervisors/Management Identify hazards for respective work areas. Ensure hazards are properly labeled. Obtain/maintain copies of material safety data sheets, as required, of each hazardous material used in the work area and make them accessible to employees during each work shift. Have the written Hazard Communication Program available to all employees. Provide hazard. specific training for employees. Identify hazardous materials in the hazard review section of the Austin Habitat for Humanity purchase requisition form. Employees must: Attend safety training meetings. Perform operations in safe manner. Notify management immediately of any safety hazards or injuries. When ordering materials, identify hazardous chemicals in the hazard review

section of tile Austin Habitat for Humanity purchase requisition form; The Responsible Safety Officer must: Develop a written Hazard Communication Program, Maintain a central file of material safety data sheets. Review and update Austin Habitat for Humanity stock safety labels. Provide generic training programs. Assist supervisors in developing hazard-specific training programs, Oversee tile Hazard Communication Standard written policy and implementation plans. Alert on-site contractors to hazardous materials in work areas. Alert on-site contractors that they must provide to their employees information on hazardous materials tlley bring to the work site. The number of hazardous chemicals and the number of reactions between them is so large that prior knowledge of all potential hazards cannot be assumed. Therefore, when the chemical properties of a material are not fully known, it should be assumed hazardous and used in as small quantities as possible to minimize exposure and thus reduce the magnitude of unexpected events. The following general safety precautions should be observed when working with chemicals: Keep the work area clean and orderly. Use the necessary safety equipment. Carefully label every container with the identity of its contents and appropriate hazard warning~. Store incompatible chemicals in separate areas. Substitute less toxic materials whenever possible. Limit the volume of volatile or flammable material to the minimum needed for short operation periods, Provide means of containing the material if equipment or containers should break or spill their contents. Follow the requirements of this manual, if systems tllat can generate pressure or are operated under pressure are involved. Provide a back-up method of shutting off power to a heat source if any hazard is involved. Obtain and read the Material Safety Data Sheets.

Task Evaluation

Each task that requires the use of chemicals must be evaluated to determine the potential hazards associated with the work. This hazard evaluation must include the chemical or combination of chemicals that will be used in the work, as well as other materials that will be used near the work. If a malfunction during the operation has the potential to cause serious injury or property damage, an Operational Safety Procedure (OSP) must be prepared and followed. Operations must be planned to minimize the generation of hazardous wastes. Additionally, unused chemicals should be recycled.

Supervisor Responsibility

Supervisors are responsible for establishing safe procedures and for ensuring that the protective equipment needed to work with tile chemicals is available. Supervisors must instruct their workers about possible hazards, safety precautions that must be observed, possible consequences of an accident, and procedures to follow if an acciden1: does occur. The supervisor is required to enforce the proper use of protective equipment and the established safety practices. It is the responsibility of employees and all who use Austin Habitat for Humanity facilities to understand the properties of the chemicals with which they will work and to follow all precautions that apply to each specific task. When faced with an unexpected threat of malfunction, injury, or damage, employees are expected to choose a course of action that provides the most protection to themselves and to others in the area. Every employee/volunteer is expected to report to the supervisor any unsafe condition seen in the area that would not permit him/her to work safely. The Responsible Safety Officer assists employees and supervisors to work safely by providing information on tile hazardous propel1ies of materials, recommending methods for controlling the hazards of specific operations, and by monitoring the work environment. Supervisors must instruct their personnel about the potential hazards involved in the work, proper safety precautions to follow, and emergency procedures to use if an accident should occur. -To supplement the supervisor's training, the Responsible Safety Officer will conduct training

courses and materials on selected topics. In addition, material safety data sheets and safety information, including hazards, health effects, potential routes of exposure, proper handling precautions, and emergency procedures on specific chemicals, are available through the Responsible Safety Officer's office.

Effects on Reproduction

Both men and women may be exposed to hazardous agents that can cause infertility or result in genetic damage that is passed on to offspring. These agents include ionizing radiation, alcohol, cigarette smoke, pharmaceuticals, and some of the thousands of different chemicals that are used in the home or workplace. Although many of these have been tested to determine whether they cause acute (immediate) effects on the body, few have been studied to see if they cause cancer (carcinogens), birth defects (teratogens), or genetic defects (mutagens). Even fewer have been studied to see if they can cause infertility, menstrual disorders, or other disorders relating to reproduction. The primary path for hazardous substances to reach an unborn child is through the placenta. Scientists now believe that most chemical substances or drugs can cross this barrier with varying degrees of ease and enter the system of the developing fetus. Thus, many chemicals and drugs that enter a pregnant woman's body (through breathing, swallowing, absorption through the skin, etc.) will eventually enter the mother's blood circulation and find their way into tile unborn child. In general, the important questions of exactly how much of the toxic substance that enters the mother's body will reach the fetus or what concentration the fetus can tolerate without harmful effects are not yet answered. The fetus may be most vulnerable in the early weeks of pregnancy, but it is also at risk later in pregnancy. In light of the potential harm of workplace exposures to both a pregnant woman and her developing fetus, it is very impol1ant and required by Austin Habitat for Humanity policy for the woman to inform the Responsible Safety Officer of her pregnancy immediately.

Airborne Contaminants

Exposures by inhalation of airborne contaminants (gases, vapors, fumes, dusts, and mists) must not exceed the levels listed in the latest edition of Threshold Limit Values of Airborne Contaminants (TL V) published by the American Conference of Governmental Industrial Hygienists. These TL V levels refer to airborne concentrations of substances and represent conditions under which it is believed that workers may be repeatedly exposed without adverse effect. In all cases of potentially harmful exposure, feasible engineering or administrative controls must first be established. In cases where respiratory protective equipment, alone or with other control measures, is required to protect the employee, the protective equipment must be approved by the Responsible Safety Officer, for each specific use.

Safety Equipment

Eyewash fountains are required if the substance in use presents an eye hazard. The eyewash fountain must provide a soft stream or spray of aerated water. In areas where a corrosive chemical or rapid fire hazard exists, safety showers must be provided for immediate first aid treatment of chemical splashes and for extinguishing clothing fires. The shower must be capable of drenching the victim immediately in the event of an emergency. Eyewash fountains and safety showers should be located close to each other so that, if necessary, the eyes can be washed while the body is showered. Access to these facilities must always remain open. In case of accident, flush the affected part for at least 15 millutes. Report the accident to the Responsible Safety Officer immediately. A special first aid treatment kit for fluorine and hydrofluoric acid burns is prepared by the Medical Services Department. The kit is obtained by contacting the Responsible Safety Officer. Safety shields must be used for protection against possible explosions or splash

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hazards. Company equipment must be shielded on all sides so that there is no line-of-sight exposure of personnel. The sash on a chemical fume hood is a readily available partial shield. However, a portable shield must also be used, particularly with hoods that have vertical-rising sashes rather than horizontal-sliding sashes.

Labels

All containers (including glassware, safety cans, plastic squeeze bottles) must have labels that identify their chemical contents. Labels should also contain information on the hazards associated with the use of the chemical. Precautionary labels are available from Austin Habitat for Humanity stock room for most of the common chemicals.

Chemical Storage

The separation of chemicals (solids or liquids) during storage is necessary to reduce the possibility of unwanted chemical reactions caused by accidental mixing. Explosives such as, picric acid should be stored separately outdoors. Use either distance or barriers (e.g., trays) to isolate chemicals into the following groups: Flammable liquids (e.g., acetone, benzene, ethers, alcohols). Place in approved fire lockers. Other liquids (e.g., chloroform, trichloroethane). Acids (e.g.., nitric, sulfuric, hydrochloric, perchloric). * ,Treat acetic acid as a flammable liquid. Bases (e.g., sodium hydroxide, ammonium hydroxide). Lips, strips, or bars should be installed across the width of reagent shelves to restrain the chemicals in case of earthquake. Chemicals must not be stored in the same refrigerator used for food storage. Refrigerators used for storing chemicals must be appropriately identified by placing a label on the door (labels may be obtained from Responsible Safety Officer).

Emergencies

In case of an emergency, consider any of the following actions if appropriate: Evacuate people from the area. Isolate the area. If the material is flammable, turn off ignition and heat sources.
Call the Fire Department or 911 for assistance. Wear appropriate personal protective equipment. Pour Sorb-all or appropriate neutralizing agent on spill. Clean up; place waste in plastic bag for disposal. Chemical spill cleanup materials are available from stores as listed below: Flammable solvent spill kit Flammable solvent absorbent Acid spill kit Acid spill absorbent Caustic (base) spill kit Caustic (base) absorbent Safety equipment kit (contains scoops, sponge, safety glasses, disposal bags, etc.) A cabinet to hold kits.

Disposal of Chemicals

All Austin Habitat for Humanity employees, participating guests, and visitors using hazardous chemicals are responsible for disposing of these chemicals safely. Federal and state regulations mandate strict disposal procedures for chemicals. To comply with these regulations all persons using Company facilities must observe these procedures. Routine Disposal of Chemicals In general the disposal of hazardous chemicals to the sanitary sewer is not permitted. The Responsible Safety Officer will advise on the proper disposal of chemical wastes. In using chemical waste storage containers, certain procedures must be observed, as listed below: Incompatible chemicals must not be mixed in the same container (e.g., acids should not be mixed with bases; organic liquids should not be mixed with strong oxidizing agents). Waste oils must be collected in 55-gallon drums. Disposal solids, and explosive materials *must* be stored in separate containers. The following requirements *must* be met as a condition for pickup and disposal of chemicals by the Responsible Safety Officer: Chemicals *must* be separated into compatible groups. Leaking containers of any sort will not be accepted. Dry materials (gloves, wipes, pipettes, etc.) must be securely contained in plastic bags and over packed in a cardboard

box. Packages that are wet or have sharp protruding objects will not be accepted for pick up. Unknown chemicals will require special handling. The responsible department must make every effort to identify the material that is to be disposed. If all the user's attempts to identify the waste chemicals have failed, the Responsible Safety Officer will accept the waste and analyze the material. For more information call the Responsible Safety Officer. Each breakable container must be properly boxed. Place all bottles in plastic bags, then place in a sturdy container and use an absorbent cushioning material that is compatible with the chemicals. Each primary container must be labeled with content, amount, physical state, and the percentage breakdown of a mixture. Each box must have a complete list of contents or description written on an official Responsible Safety Officer hazardous materials packing list. Blank packing lists are available from the Responsible Safety Officer. For safety purposes, boxes must be of a size and weight so that one person can handle them. Boxes that exceed 45 pounds or 18 inches on a side cannot be safely handled by one person and will not be acceptable for pick up. General Housekeeping Rules: Maintain the smallest possible inventory of chemicals to meet your immediate needs.
Periodically review your stock of chemicals on hand, Ensure that storage areas, or equipment containing large quantities of chemicals, are secure from accidental spills. Rinse emptied bottles that contain acids or inflammable solvents before disposal. Recycle unused laboratory chemicals wherever possible. DO NOT: Place hazardous chemicals in salvage or garbage receptacles. Pour chemicals onto the ground. Dispose of chemicals through the storm drain system. Dispose of highly toxic, malodorous, or lachrymatory chemicals down sinks or sewer drains.

Confined Spaces

A confined space is defined as any structure that must be entered and that has or may contain dangerous concentrations of hazardous gases or vapors or an oxygen deficient atmosphere. Entry to these spaces must be rigorously controlled to prevent serious injury or death.

Hazardous Conditions

Hazardous conditions include, but are not limited, to the following: An atmosphere containing less than 19.5% oxygen (normal air contains 20.9% oxygen), This is usually the result of oxygen displacement by inert gases such as nitrogen, argon, helium, or sulfur hexafluoride. Flammable gases and vapors (e.g., methane, ethane, propane, gasoline, methyl-ethyl ketone, alcohol). Toxic gases and vapors (e.g., hydrogen sulfide, nitrogen dioxide, 1,1,1 trichloroethane, perchloroethane, methylene chloride).

Hazard Prevention

The primary objective is to prevent oxygen deficiency or other hazardous condition. This must be accomplished by accepted engineering control measures, such as general and local ventilation and substitution of materials. Only when such controls are not possible should respiratory protection be used. Written operating procedures governing the identification, testing, and entry into a confined space with a potential for oxygen deficiency must be established by the operating personnel and approved by the Responsible Safety Officer. Monitoring devices, audible alarms, warning lights, and instructional signs should be installed where there is a potentially oxygen- deficient atmosphere. These installations must be approved by the Responsible Safety Officer. Before entering a confined space, the steps below must be followed: An entry permit must be issued to the worker by the responsible supervisor and ,reviewed by the Responsible Safety Officer. Air quality must be tested to determine the level of oxygen and toxic or flammable air contaminants. Air purging and ventilation must be provided whenever possible. The confined space must be isolated from supply lines capable of creating hazardous conditions. Lock-out procedures must be used to secure electrical systems, pressure systems, piping, machinery, or

moving equipment. If a person must enter a confined space containing hazardous gases, the procedures below must be followed: Protective equipment must be worn, including air supply respirator plus harness and lifeline. At least one person must be stationed outside the confined space, with suitable respirator. Communication with personnel in the confined space must always be maintained.

Electrical Safety Policy

It is the policy of Austin Habitat for Humanity to take every reasonable precaution in the performance of work to protect the health and safety of employees and the public and to minimize the probability of damage to property. The electrical safety requirements contained in this chapter are regulations set forth by Austin Habitat for Humanity.

Employee/Volunteer Responsibility

All Austin Habitat for Humanity personnel are responsible for all aspe'1ts of safety within their own groups. The Responsible Safety Officer is responsible for providing information, instruction, and assistance, as appropriate, concerning Austin Habitat for Humanity electrical safety requirements and procedures. Individual employees are responsible for their own and their co-workers' safety. This means: Become acquainted with all potential hazards in the area in which they work. Learn and follow the appropriate standards, procedures, and hazard-control methods. Never undertake a potentially hazardous operation without consulting with appropriate supervision. Stop any operation you believe to be hazardous. Notify a supervisor of any condition or behavior that poses a potential hazard. Wear and use appropriate protective equipment. Immediately report any occupational injury or illness to the Responsible Safety Officer, any on site Medical Services Department and the appropriate supervisor. Each employee/volunteer acting in a supervisory capacity has specific safety responsibilities. These include: Developing an attitude and awareness of safety in the people supervised and seeing that individual safety responsibilities are fully carried out. Maintaining a safe work environment and taking corrective action on any potentially hazardous operation or condition. Ensuring that the personnel he/she directs are knowledgeable and trained in the tasks they are asked to perform. Ensuring that safe conditions prevail in the area and that everyone is properly informed of the area's safety regulations and procedures. Ensuring that contract personnel are properly protected by means of instructions, signs, barriers, or other appropriate resources. Ensuring that no employee/volunteer assigned to potentially hazardous work appears to be fatigued, ill, emotionally disturbed, or under the influence of alcohol or drugs (prescription, over the county medicinal or otherwise). Management at every level has the responsibility for maintaining the work environment at a minimal level of risk throughout all areas of control. Each manager: Is responsible for being aware of all potentially hazardous activities within the area of responsibility. May assign responsibility or delegate authority for performance of any function, but -Remains accountable to higher management for any oversight or error that leads to injury, illness, or damage to property.

Procedures

It is the policy of Austin Habitat for Humanity to follow the fundamental princip,les of safety, wliich are described below. A clear understanding of these principles will improve the safety of working with or around electrical equipment. Practice proper housekeeping and cleanliness. Poor housekeeping is a major factor in many accidents. A cluttered area is likely to be both unsafe and inefficient. Every employee/volunteer is responsible for keeping a clean area and every supervisor is responsible for ensuring that his or her areas of responsibility remain clean.

Identify hazards and anticipate problems, Think through what might go wrong and what the consequences would be, Do not hesitate to discuss any situation or question with your supervisor and coworkers. Resist "hurry-up" pressure. Program pressures should not cause you to bypass thoughtful consideration and planned procedures. Design for safety. Consider safety to be an integral part of the design process. Protective devices, warning signs, and administrative procedures are supplements to good design but can never fully compensate for its absence. Completed designs should include provisions for safe maintenance. Maintain for safety. Good maintenance is essential to safe operations. Maintenance procedures and schedules for servicing and maintaining equipment and facilities, including documentation of repairs, removals, replacements, and disposals, should be established. Document your work. An up-to-date set of documentation adequate for operation, maintenance, testing, and safety should be available to anyone working on potentially hazardous equipment. Keep drawings and prints up to date. Dispose of obsolete drawings and be certain that active file drawings have the latest corrections. Have designs reviewed, All systems and modifications to systems performing a safety function or controlling a potentially hazardous operation must be reviewed and approved at the level of project engineer or above. Have designs and operation verified. All systems performing safety functions or controlling a potentially hazardous operation must be periodically validated by actual test procedures at least once a year, and both the procedures and actual tests must be documented. Test equipment safety. Tests should be made when the electrical equipment is de- energized, or, at most, energized with reduced hazard. Know emergency procedures. All persons working in areas of high hazard (with high-voltage power supplies, capacitor banks, etc.) must be trained in emergency response procedures, including cardiopulmonary resuscitation (CPR) certification.

Working with Energized Equipment

This section contains safety requirements that must be met in constructing electrical equipment and in working on energized electrical equipment. Special emphasis is placed on problems associated with personnel working on hazardous electrical equipment in an energized condition. Such work is permissible, but only after extensive effort to perform the necessary tasks with the equipment in a securely de-energized condition has proven unsuccessful, or if the equipment is so enclosed and protected that contact with hazardous voltages is essentially impossible. Definitions: Tile following definitions are used in this discussion of electrical safety. Authorized Person: An individual recognized by management, as having the responsibility for and expertise to perform electrical procedures in the course of normal duties. Such individuals are normally members of electronic or electrical groups. Backup Protection: A secondary, redundant, protective system provided to de-energize a device, system, or facility to permit safe physical contact by assigned personnel. A backup protective system must be totally independent of the first-line protection and must be capable of functioning in the event of total failure of the first- line protective system. Companion: A co-worker who is cognizant of potential danger and occasionally checks the other worker. Electrical Hazard: A potential source of personnel injury involving, either directly or indirectly, the use of e1ectricity. Direct Electrical Hazard: A potential source of personnel injury resulting from the flow of electrical energy through a person (electrical shocks and burns). Indirect Electrical Hazard: A potential source of personnel injury resulting from electrical energy that is transformed into other forms of energy (e.g., radiant energy, such as light, heat, or energetic particles; magnetic fields; chemical reactions, such as fire, explosions, the production of noxious gases and compounds; and involuntary muscular reactions). First Line Protection: The primary protective system and/or operational procedure provided to prevent physical contact with energized equipment. General Supervision: The condition that exists when an individual works under a supervisor's direction but not necessarily

in the continuous presence of the supervisor. Grounding Point: The most direct connection *to* the source of a potential electrical hazard such as the terminals of a capacitor. Such a point must be indicated by a yellow circular marker. Grounds, Electrical: Any designated point with adequate capacity to carry any potential currents *to* earth. Designated points may be building columns or specially designed ground-network cabling, rack, or chassis ground. Cold water pipes, wire ways, and conduits must not be considered electrical grounds. Grounds, Massive: Large areas *of* metal, concrete, or wet ground that make electrical isolation difficult or impossible. Implied Approval: Approval is implied when a supervisor, knowing the qualifications of an individual, assigns that individual a task, or responsibility *for*, a device, system, or project. Qualified Person: An individual recognized by management as having sufficient understanding of a device, system, or facility *to* be able to positively control any hazards it may present. Must, Should, and May: Must indicates a mandatory requirement. Should indicates a recommended action. May indicates an optional or permissive action, not a requirement or recommendation. Safety Watch: An individual whose sole task is to observe the operator and *to* quickly de-energize the equipment, using a crash button or circuit breaker control in case of an emergency, and to alert emergency personnel. This person should have basic CPR training.

Type of Hazards

The degree of hazard associated with electrical shock is a function of the duration, magnitude, and frequency of the current passed by the portion of the body incorporated in the circuit. The current that can flow through the human body with contacts at the extremities, such as between the hand or head and one or both feet, depends largely on the voltage. Body circuit resistance, even with liquid contacts (barring broken skin) will probably be not less than 500 ohms. The current flow at this resistance at 120 volts is 240 milliamperes. Recognition of the hazards associated with various types of electrical equipment is of paramount importance in developing and applying safety guidelines for working on energized equipment. Three classes (in order of increasing severity) *of* electrical hazards have evolved.

Class A Hazard

Class A electrical hazard exists when all the following conditions prevail: The primary AC potential *does* not exceed 130 volts rms. The available primary AC current is limited *to* 30 amperes rms. The stored energy available in a capacitor or inductor is less than 5 joules (J=CV2/2=Ll2/2). The DC or secondary AC potentials are less than 50 volts line-to-line and/or *to* ground or the DC or secondary AC power is 150 volt-amperes (V-A) or less. Although the voltages and currents may be considered nominal, a "Class A" electrical hazard is potentially lethal. This class is particularly dangerous because of everyday familiarity with such sources, an assumed ability to tope with them, and their common occurrence in less guarded exposures.

Class B Hazard

A Class B electrical hazard has the same conditions as a Class A hazard except that the primary AC potential is greater than 130 volts rms, but does not exceed 300 volts rms. Class C Hazard

Class C electrical hazard classifications prevail *for* all situations when one or *more* of tile limitations set in Class B is exceeded.

Employe/Volunteer Attitude

The attitudes and habits of personnel and the precautions they routinely take when working on energized equipment. are extremely important. There are three modes of working on electrical equipment.

Mode 1: Turn Off the Power

All operations are to be conducted with the equipment in a positively de-energized state. All external sources of electrical energy must be disconnected by some positive action (e.g., locked- out breaker) and with all internal energy sources rendered safe. "Mode 1 If is a minimum hazard situation.

Mode 2: Latent Danger

All manipulative operations (such as making connections or alterations t6 or near normally energized components) are to be conducted with the equipment in the positively de-energized state. Measurements and observations of equipment functions may then be conducted with the equipment energized and with normal protective barriers removed. "Mode 2" is a moderate-to- severe hazard situation, depending on the operating voltages and energy capabilities of the equipment.

Mode 3: Hot Wiring

"Mode 3" exists when manipulative, measurement, and observational operations are to be conducted with the equipment fully energized and with the normal protective barriers removed. "Mode 3" is a severe hazard situation that should be permitted only when fully justified and should be conducted under the closest supervision and control. One knowledgeable person should be involved in addition to the worker(s). Written permission may be required. Work on Class B or Class C energized circuitry must only be done when it is absolutely necessary.

Safety Glasses

Either safety glasses or a face shield must be worn when working on electrical equipment.

Personal Protective Devices

For work on any energized circuitry with a Class B or Class C hazard, the use of personal protective devices (e.g., face shields, blast jackets, gloves, and insulated floor mats) is encouraged, even if not required.

Elevated Locations

Any person working on electrical equipment on a crane or other elevated location must take necessary precautions to prevent a fall from reaction to electrical shock or other causes. A
second person, knowledgeable as a safety watch, must assume the best possible position to assist the worker in case of an accident.

Chain of Command

The supervisory chain must be identified for normal operation and development, servicing, or testing of hazardous equipment. An up-to-date set of instructions for operation, maintenance, testing, and safety should be provided and made readily available to anyone working on hazardous equipment. As many tests as practicable should be made on any type of electrical equipment in the unenergized condition, or at most, energized with reduced hazard. All covering, clothing, and jewelry that might cause hazardous involvement must be removed. Adequate and workable lock-out/tag-out procedures must be employed. A person in a hazardous position who appears to be fatigued, ill, emotionally disturbed, or under the influence of alcohol and/or drugs (medicinal, or otherwise) must be replaced by a competent backup person, or the hazardous work must be terminated. Supervisors and workers must be encouraged to make the conservative

choice when they are in doubt about a situation regarding safety. Training sessions and drills must be conducted periodically to help prevent accidents and to train personnel to cope with any accidents that may occur. CPR instruction must be included. An emergency-OFF switch, clearly identified and within easy reach of all high-hazard equipment, should be provided. Also, this switch may be used to initiate a call *for* help. Resetting an Emergency-OFF switch must not be automatic but must require an easily understandable overt act. Automatic safety interlocks must be provided *for* all access to high-hazard equipment. Any bypass of such an interlock should have an automatic reset, display conspicuously the condition of the interlocks, and ensure that barriers cannot be closed without enabling the interlock. All equipment should have convenient, comfortable, and dry access. Communication equipment (e.g., fire alarm box, telephone) should be provided near any hazardous equipment. Its location should be clearly marked to ensure that the person requesting assistance can direct the people responding to a call *for* help to the emergency site quickly. Any component that in its common use is non-hazardous, but in its actual use may be hazardous, must be distinctively colored and/or labeled. (An example might be a copper pipe carrying high voltage or high current.) Periodic tests of interlocks to ensure operability must be performed and documented at least yearly.

Protective Systems

Equipment must be designed and constructed to provide personnel protection. First-line and backup safeguards should be provided to prevent personnel access to energized circuits. Periodic tests must be established to verify that these protective systems are operative.

Safety Practices

Additional safety practices are described below. Cable Clamping: A suitable mechanical-strain- relief device such as a cord grip, cable clamp, or plug must be used for any wire or cable penetrating an enclosure where external movement or force can exert stress on the internal connection. Grommets, adlets, or similar devices must not be used as strain relief. Emergency Lighting: There must be an emergency lighting system that activates when normal power fails in Class C conditions. Flammable and Toxic Material Control: The use of flammable or toxic material must be kept to a minimum. When components with such fluids are used, a catch basin or other approved method must be provided to prevent the spread of these materials should the normal component case fail Isolation: All sources of dangerous voltage and current must be isolated by covers and enclosures. Access to lethal circuits must be either via screw-on panels, each containing no less than four screws or bolts, or by interlocked doors. The frame or chassis of the enclosure must be connected to a good electrical ground with a conductor capable of handling any potential fault current. Lighting: Adequate lighting must be provided for easy visual inspection. Overload Protection: Overload protection and well marked disconnects must be provided. Local *"off"* controls must be provided on remote-controlled equipment. All disconnects and breakers should be clearly labeled as to which loads they control. Power: All ac and dc power cabling to equipment not having a separate external ground but having wire-to- wire or wire-to-ground voltage of 50 volts or more must carry a ground conductor unless cabling is inside an interlocked enclosure, rack, grounded wire way, or conduit, or feeds a commercial double-insulated or UL-approved device. This requirement will ensure that loads such as portable test equipment, temporary or experimental, is grounded. UL-approved devices such as coffeepots, timers, etc., used per the manufacturer's original intent are permissible. Rating: All conductors, switches, resistors, etc., should be operated within their design capabilities. Pulsed equipment must not exceed either the average, the rms, or the peak rating of components. The equipment should be derated as necessary for tile environment and the application of the components. Safety Grounding: Automatic discharge devices must be used on equipn1ent with

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stored energy of 5 joules or more. Suitable and visible manual grounding devices must also be provided to short-to-ground all dangerous equipment while work is being performed.

Safety Practices

The, following check list must be used as a guide for circuits operating at 130 volts or .more or I storing more than 5 joules. An enclosure may be a room, a barricaded area, or an equipment cabinet. Access: Easily opened doors, panels, etc., must be interlocked so that the act *of* opening de-energizes the circuit. Automatic discharge *of* stored-energy devices must be provided. Doors should be key-locked, with the same required key being also used for the locks in the control- circuit-interlock chain. This key must be removable from the door only when the door is closed and locked. Heat: Heat-generating components, such as resistors, must be mounted so that heat is safely dissipated and does not affect adjacent components. Isolation: The enclosure must physically prevent contact-with live circuits. The enclosure can be constructed *of* conductive or non-conductive material. If conductive, the material must be electrically interconnected and connected to a good electrical ground. These connections must be adequate to carryall potential fault currents. Seismic Safety: All racks, cabinets, chassis, and auxiliary equipment must be secured against movement during earthquakes. Strength: Enclosures must be strong enough to contain flying debris due to component failure. Temporary Enclosure: Temporary enclosures (less than 6-month duration) not conforming to the normal requirements must be considered Class C hazards. Ventilation: Ventilation must be adequate to prevent overheating *of* equipment and to purge toxic fumes produced by a fault. Visibility: Enclosures large enough to be occupied by personnel must allow exterior observation of equipment and personnel working inside the enclosure. Warning Indicators: When systems other than conventional facilities represent Class C hazards, the systems should be provided with one of the following two safety measures: (1) A conspicuous visual indicator that is clearly visible from any point where a person might make hazardous contact or entry; and (2) A clearly visible primary circuit breaker or "OFF" control button on the front *of* the enclosure.

Safety Practices

Because a wide range *of* power supplies exist, no one set *of* considerations can be applied to all cases. The following classification scheme may be helpful in assessing power-supply hazards. Power supplies *of* 50 volts or less with high current capability too often are not considered a shock hazard, although these voltages are capable *of* producing fatal shocks. Since they are not "high voltage," such power sources frequently are not treated with proper respect. In addition to the obvious shock and burn hazards, there is also the likelihood *of* injuries incurred in trying to get away from the source *of* a shock. Cuts or bruises, and even serious and sometimes fatal falls have resulted from otherwise insignificant shocks. Power supplies of300 volts or more, with lethal current capability, have the same hazards to an even greater degree. Because supplies in this category are considered Class C hazards, they must be treated accordingly. High-voltage supplies that do not have dangerous current capabilities are not serious shock or burn hazards in themselves and are therefore often treated in a casual manner. However-, they are frequently used adjacent to lower-voltage lethal circuits, and a minor shock could cause a rebound into such a circuit. Also, an involuntary reaction to a minor shock could cause a serious fall (for example, from a ladder or from experimental apparatus). The following are additional safety considerations for power supplies. Primary disconnect. A means *of* positively disconnecting the input must be provided. This disconnect must be clearly marked and located where the workmen can easily lock or tag it out while servicing the power supply. If provided with a lockout device, the key must not be removable unless tile switch or breaker is in the "off' position-. Overload

Protection. Overload protection must be provided on the input and should be provided on the output.

Danger with Large Capacitors

This section describes the hazards associated with capacitors capable of storing more than 5 joules of energy. Capacitors may store hazardous energy even after the equipment has been de- energized and may build up a dangerous residua! charge without an external source; "grounding" capacitors in series, for example, may transfer rather than discharge the stored energy. Another capacitor hazard exists when a capacitor is subjected to high currents that may cause heating and explosion. At one time, capacitors were called condensers and older capacitors may still bear this label in diagrams and notices. Capacitors may be used to store large amounts of energy. An internal failure of one capacitor in a bank frequently results in explosion when all other capacitors in the bank discharge into the fault. Approximately 10 sup 4 joules is the threshold energy for explosive failure of metal cans. Because high-voltage cables have capacitance and thus can store energy, they should be treated as capacitors. The liquid dielectric in many capacitors, or its combustion products, may be toxic. Do not breath tile fumes from the oil in older capacitors. The following are safety practices for capacitors: Automatic Discharge. Permanently connected bleeder resistors should be used when practical. Capacitors in series should have separate bleeders. Automatic shorting devices that operate when the equipment is de-energized or the enclosure is opened should be used, The time required for a capacitor to discharge to safe voltage (50 volts or less) must not be greater than the time needed for personnel to gain access to the voltage terminals --never longer than 5 minutes. In the case of Class C equipment with stored energy in excess of 5 joules, an automatic, mechanical discharging device must be provided that functions when normal access ports are opened. This device must be contained locally within protective barrier to ensure wiring integrity and should be in plain view of the person entering the protective barrier so that the individual can verify its proper functioning. Protection also must be provided against the hazard of the discharge itself. Safety Grounding. Fully visible, manual-grounding devices must be provided to render the capacitors safe while they are being worked on. Grounding points must be clearly marked, and caution must be used to prevent transferring charges to other capacitors. Ground Hooks. All ground hooks must: Have conductors crimped and soldered. Be connected such that impedance is less than 0.1 ohms to ground. Have the cable conductor clearly visible through its insulation. Have a cable conductor size of at least #2 extra flexible, or in special conditions a conductor capable of carrying any potential current. Be in sufficient number to ground conveniently and adequately ALL designated points. Be grounded and located at normal entry way when stored, in such a manner to ensure that they are used. In Class C equipment with stored energy in excess of 5 joules, a discharge point with an impedance capable of limiting the current to 500 amperes or less should be provided. This discharge point must be identified with a yellow circular marker with a red slash and must-be labeled "HI Z PT" in large readable letters. A properly installed grounding hook must first be connected to the current-limiting discharge point and then to a low-

impedance discharge point (less than 0.1 ohm) that is identified by a yellow circular marker.
The grounding hooks must be left on all of these low impedance points during the time of safe access. The low-impedance points must be provided, whether or not the HI-Z current-limiting points are needed. Voltage indicators that are visible from all normal entry points should also be provided. Fusing. Capacitors used in parallel should be individually fused when possible to prevent the stored energy from dumping into a faulted capacitor. Care must be taken in placement of automatic-discharge safety devices with respect to fuses. If the discharge will flow through the fuses, a prominent warning sign must be placed at each entry indicating that each capacitor must be manually grounded before work can begin. Special knowledge is required for

high-voltage and high-energy fusing. Unused Terminal Shorting. Terminals of all unused capacitors representing a Class C hazard or capable of storing 5 joules or more must be visibly shorted.

Danger with Large Magnets

This section describes inductors and magnets that can store more than 5 joules of energy or that operate at 130 volts or more. The following are some hazards peculiar to inductors and magnets: The abi1ity of an inductor to release stored energy at a much higher voltage than that used to charge it. Stray magnetic fields that attract magnetic materials. Time-varying stray fields that induce eddy currents in conductive material thereby causing heating and mechanical stress. Time-varying magnetic fields that may induce unwanted voltages at inductor or magnet terminals. The following are safety practices for inductive circuits: Automatic Discharge. Freewheeling diodes, varistors, thyrites, or other automatic shorting devices must be used to provide a current path when excitation is interrupted. Connections. Particular attention should be given to connections in the current path of inductive circuits. Poor connections may cause destructive arcing. Cooling. Many inductors and magnets are liquid cooled. The unit should be protected by thermal interlocks on the outlet of each parallel coolant path, and a flow interlock should be included for each device. Eddy currents. Units with pulsed or varying fields should have a minimum of eddy-current circuits. If large eddy-current circuits are unavoidable, they. should be mechanically secure and able to safely dissipate any heat produced. Grounding. The frames and cores of magnets, transformers, and inductors should be grounded. Rotating
Electrical Machinery. Beware of the hazard due to residual voltages tllat exists until rotating electrical equipment comes to a full stop.

Safety Design

Proper philosophy is vital to tile safe design of most control applications. The following check list should be used as a guide. Checkout. Interlock chains must be checked for proper operation after installation, after any modification, and during periodic routine testing. Fail-safe design.
All control circuits must be designed to be "fail-safe." Starting with a breaker or fuse, the circuit should go through all the interlocks in series to momentary on-off switches that energize and "seal in" a control relay. Any open circuit or short circuit will de-energize the control circuit and must be reset by overt act. Interlock Bypass Safeguards. A systematic procedure for temporarily bypassing interlocks must be established. Follow-up procedures should be included to ensure removal of the bypass as soon as possible. When many control-circuit points are available at one location, the bypassing should be made through the normally open contacts of relays provided for this purpose. In an emergency, these relays can be opened from a remote control area. Isolation. Control power must be isolated from higher power circuits by transformers, contactors, or other means. Control power should be not more than 120 volts, ac, or dc. All circuits should use the same phase or polarity so that no additive voltages (Class B or Class C hazard) are present between control circuits or in any interconnect system. Control-circuit currents should not exceed 5 amperes. Lock-out. A keyed switch should be used in interlock chains to provide positive control of circuit use. To ensure power removal before anyone enters the enclosure, this same key should also be used to gain access to the controlled equipment. Motor Control Circuits (Class B or Class C Hazards). All Class B or Class C motor circuits must have a positive disconnect within view of the motor or, if this is not practical, a disconnect that can be locked open by the person working on these motor circuits is acceptable. Overvoltage Protection. Control and instrumentation circuits used with high-voltage equipment must have provision for shorting fault-induced high voltages to ground. High-voltage fuses with a high- current, low-voltage spark gap downstream from the high-voltage source are recommended.

This also applies to all circuits penetrating high-voltage enclosures. Voltage Divider Protection. The output of voltage dividers used with high voltages must be protected from overvoltage-to- ground within the high-voltage area by spark gaps, neon bulbs, or other appropriate means. Current Monitors. Currents should be measured with a shunt that has one side grounded or with current transformers that must be either loaded or shorted at all times. Instrument Accuracy. Instrumentation should be checked for function and calibration on a routine basis.

More than 300 Volts

To work on systems with voltages greater than 300 volts (CLASS B OR C HAZARD): Open the feeder breaker, rollout if possible, tag out, and lock if in enclosure. If work is on circuits of600 V or more, positive grounding cables should be attached to all three phases. Tag should contain who, why, and when information, and it is of vital importance because a person's life may depend on it. "Vital" in this case means that the presence and status of the tag are inviolate, and the tag must not be altered or removed except by the person who attached it.

Less than 300 Volts

To work on systems with voltages less than 300 volts (CLASS A HAZARD): Turn-off and tag the feeder breaker. Tag is inviolate except on projects where established circuit checkout procedure allows a qualified person to remove it and energize circuit after checkout is complete.

Motor Generator Systems

For motor or generator work, primary feeder breaker must be opened, tagged, and locked out if possible. For generator-load work, motor-start permissive key must be removed by person doing work and restored when work is complete.

High Voltage

To work on high voltage power supplies and enclosures use Class B or Class C hazard procedure specified in the safety requirements. Access should always be by permissive key that interrupts input power when key is removed from control panel, Grounding of power supply output must occur either automatically when key is removed from control panel or manually before access door can be opened.

High Current

To work on high current power supplies (normally for magnets), treat system as a high voltage power supply, if energy storage is 5 joules or more when system is off. If not, then requirements for working on magnet are as follows: If power supply is equipped with Kirk (trademark) or equivalent interlock, turn key and remove. This locks the input breaker in "off" position until key is reinserted and turned. If power supply is not equipped with a Kirk (trademark) or equivalent interlock, turn off and tag input circuit breaker.

Working on Power Supplies

The minimum requirements for working on any power supply is to turn power off and properly tag feeder circuit breaker external to power supply.

Electrical Lock-out/Tag-out Procedures

When you have to do maintenance work on a machine, take these four steps to protect yourself and your co-workers from injury: 1. De-energize the machine if possible. Positively disconnect the machine from the power source. If there is more than one source of power, then disconnect them all. 2. If possible, lock out all disconnect switches. You must be given a lock and a key for

each disconnect before you begin working on the machine. 3. Tag all disconnect switches. Use the yellow or Red safety tags which state in large letters --"Danger...Do Not Operate," or "Danger...Do Not Energize" and which give the name *of* the individual who locked out the equipment, date and time. The tag must also state "DO *NOT* REMOVE THIS TAG". (The person who placed the tag may remove it only after the machinery maintenance has been completed.) 4. Test the equipment to insure it is de-energized before working on it. First, attempt to operate the equipment by turning it on normally. Next, check all electrical lines and exposed areas with test equipment or a "lamp". Finally, short to ground any exposed connections using insulated grounding sticks. This test must be done even if the electrical connection is physically broken, such as pulling out a plug, because *of* the chance *of* discharg1ng components. A TAG OUT ONLY PROCEDURE MAY BE USED IF THE MACHINE CANNOT BE LOCKED OUT. IF THE MACHINE IS SUPPLIED ELECTRICAL POWER FROM A SINGLE SOURCE, WHICH IS UNDER THE EXCLUSIVE CONTROL OF A TRAINED AND QUALIFIED REPAIR PERSON *AT* ALL TIMES AND THERE ARE *NOT* ANY OTHER PERSONS IN THE REPAIR AREA WHO COULD BE HARMED BY THE ACCIDENTAL ENERGIZING OF THE MACHINERY, THEN TAG *OUT* MAY BE USED INSTEAD OF LOCK-OUT/TAG OUT. Be aware that many accidents occur at the moment of re-energizing. If the machinery is to be re-energized, all persons must be kept at a safe distance away from the machinery. The re-energization can be performed only by a person who either performed the lock-out/tag out, a person acting under the immediate and direct commands *of* the original lock-out/tag out person, or in the event *of* a shift change, or other unavailability *of* the original person, then the original shall, before leaving, appoint a surrogate original person and show him or her all steps taken to lock-out/tag out the equipment.

Emergencies

Organization

Austin Habitat for Humanity requires that during every emergency an organized *effort* be made to protect personnel from further injury and to minimize property damage. All of Austin Habitat for Humanity's resources can be made available to respond *to* an emergency. Each supervisor must know what to do during an emergency in his or her area and must be certain that his or her employees understand their roles.

Master Emergency Response Plan

Austin Habitat for Humanity's Master Emergency Response Plan delineates lines of authority and responsibility for emergency response. During response to such major events, if deemed necessary by management or Austin Habitat for Humanity Fire or Police may be summoned, and a predesignated succession of management personnel would determine who would take charge. The primary responsibility person designated to be in charge is to ensure that priorities are established, that the response is appropriate and adequately implemented, and that the proper notifications are made. In most cases the direct inv01vement of local supervision and remedial action will be necessary. The underlying philosophy of the emergency response plan is the recognition that each employee/volunteer has a vital role and a basic responsibility in the area of safety and emergency action. The only reasonable expectation is that at the onset of an emergency the initial response will be at the individual level. Immediate and knowledgeable action is vital. The emergency plans for specific job sites set forth the responses to be taken by employees following the discovery of an emergency. Following the immediate measures taken by the individual, the responsibility for action will normally proceed upward through normal organizational lines of authority to the job site supervisor and to emergency-response groups. Involvement of individuals at a higher level of responsibility will depend on the particular

situation. To reiterate, levels of responsibility proceed downward from top management while action and response levels proceed upward from the first person involved. Don't be afraid to call outside assistance like police and firefighters. Dial 911. When the police, firefighters or paramedics arrive, surrender command to an qualified emergency specialist. Notify management as soon as practical, which means after all immediate responses have been exercised.

Building Management and Construction Introduction

Austin Habitat for Humanity's buildings and equipment must equal or exceed existing legal standards for safety, fire prevention, sanitation, architectural barriers, health protection, and resistance to seismic forces. Safeguards must provide built-in protection against injury to personnel or damage to property and include methods for limiting the consequences of accidents.

Protection systems must permit the most effective work conditions consistent with effective safeguards. Since physical plant facilities are tile responsibility of the Engineering Department, the following matters related to engineering and construction must be referred to the Engineering Department: New construction or alteration of buildings, building facilities, fixed equipment, outside utilities such as cooling towers, electrical substations, underground pipes, conduits, or vaults, roadways, parking lots, walkways, landscaping, sewers, and drainage systems. Plans under consideration that will affect any structure or physical plant facility because of the size of the project, loads, vibration, temperature requirements, humidity control, radiation background, or ventilation requirements, or any code-related feature of the facility.

General Requirements

The following general requirements apply to all buildings: Construction should be of non-combustible or fire-rated materials as much as possible. Building Manager must ensure that the floors of traffic corridors are unobstructed and meet code requirement. All work areas should have the following: At least two unobstructed exits if total floor area is over 250 sq ft, A smooth wall finish and smooth, impermeable work surfaces. Automatic fire detection and suppression systems. Adequate ventilation. Additional requirements for manufacturing, industrial or production areas are as follows: Safety enclosures or barriers for high-energy systems. Warning signals and safety interlocks for high-energy systems or equipment. Adequate grounding devices for electrical systems as required by the National Electric Code and this manual. Proper design of pressurized gas systems in accordance with this manual. Additional requirements for chemical handling areas are as follows: Process and special ventilation in accordance with the ACGIH standards and recommendations. Safety storage arrangements for chemicals. Emergency eye wash and shower facilities.

Contractors

In addition to tile full- and part-time employees on the Austin Habitat for Humanity payroll, important work is perfonned by personnel through contract arrangements. These non-Austin Habitat for Humanity persons are sometimes referred to as contract or subcontract personnel. Nevertheless, tile safety obl igations of subcontractor personnel are the same as those of the Austin Habitat for Humanity employees. Those Austin Habitat for Humanity supervisors assigned to direct work of contractor and/or subcontractor employees must instruct and otherwise provide safety equipment and conditions equivalent to those provided to payroll employees. This is to ensure that Austin Habitat for Humanity property is protected from damage and that all employees, payroll or non-payroll" are protected from work injury and illness. Austin Habitat for Humanity is required by law to make its facilities as safe as possible for the protection of the employees of its contractors and subcontractors, as well as any other visitor.

Construction Leadership

The following definitions describe personnel referred to in these procedures. Construction Inspector. The person assigned by Austin Habitat for Humanity to monitor subcontractor activities for construction compliance with the subcontract specifications and drawings. Responsible Safety Officer. The person assigned to monitor construction safety. Architect/Engineer (AlE). The person assigned by Austin Habitat for Humanity to ensure tllat a construction project is built according to contract documents and design intent may also be called Project Architect, Project Engineer, or Project Manager. Subcontractor. Firm responsible for actual construction and compliance with all safety regulations.

OSHA Regulations and Building Owner

Responsible Safety Officer has been given the responsibility by Austin Habitat for Humanity and OSHA for monitoring tile safety of construction site activities and enforcing all OSHA regulations. The extent of monitoring will vary depending upon the type of activity the subcontractor is engaged in. The Responsible Safety Officer role after visiting a construction site is to advise the Construction Inspector and the Architect/Engineer wherever the subcontractor is in violation of a safe practice or an unsafe condition exists. After notification by Responsible Safety Officer, the Construction Inspector and the Architect/Engineer are responsible for notifying the Subcontractor to take corrective action. The responsibility for correction of the problems rests with the Subcontractor. The Responsible Safety Officer will follow up to ensure that corrective action is being taken or had been taken by the Subcontractor. A record will be maintained by the Responsible Safety Officer giving the date, discrepancies noted, notifications given, and actions taken by the Subcontractor.

Subcontractor Safety

The Responsible Safety Officer is responsible for monitoring the safety performance of the Subcontractor. He/she will usually coordinate visits with the Construction Inspector, or if the Construction Inspector is not available, will carryon the monitoring activities. The Subcontractor's safety performance must be logged by the Responsible Safety Officer, and if necessary referred in writing to the Construction Inspector and the Architect/Engineer for notification to the Subcontractor and subsequent action as appropriate by the Subcontractor.

Sub-Contractor Employees

Except when responding to an emergency, personnel entering a construction site must: Identify themselves to the Construction Inspector and/or Architect/Engineer upon arrival. State the purpose of their visit and the area to be visited. Obey the on-the-job instructions, wear appropriate protective equipment, and follow any special instructions given by the Construction Inspector. Communicate with the Subcontractor only through the Construction Inspector and tile Architect/Engineer. Notify the Construction Inspector when their visit is terminated. The Responsible Safety Officer visits to construction sites will normally be limited. Instructions and/or recommendations from the Responsible Safety Officer must be directed to the Subcontractor in the presence of the Construction Inspector. Incases of imminent threat to life safety or severe hazard of injury, the Responsible Safety Officer Inspector may contact the Subcontractor witll0ut the presence of the Construction Inspector. Operational problems relating to the safety will be coordinated by the Responsible Safety Officer and discussed directly with the Construction Inspector and/or with the Architect/Engineer. The Construction Inspector and the Architect/Engineer will notify the Subcontractor of the need to fulfill his responsibilities.

Subcontractors Project Safety Program

The Subcontractor must submit a project safety program for review and acceptance before any on-site activities. The Safety Program must be acceptable to the Responsible Safety Officer, with copies of the accepted program going to the Construction Inspector, the Architect/Engineer, and the Contract Administrator. The subcontractor must comply with all rules and the construction industry safety orders by OSHA.

Pre-Job Construction Conferences

The Construction Inspector must notify the Responsible Safety Officer *of* the subcontractor's on- site start date and discuss any unusual safety problems with the Responsible Safety Officer and the Architect/Engineer. In addition, Responsible Safety Officer and the Architect/Engineer will discuss any unusual safety problems at a construction pre-start meeting with the Subcontractor.

Fire Inspections

Construction site fire safety inspections may be made at any time by any authorized representative. All discrepancies or problems observed must be in writing and addressed to the Construction Inspector and the Architect/Engineer.

Stop Work Orders

The Austin Habitat for Humanity stop work procedure applies to all construction subcontractor activities.. It must be used only where life-safety or hazard of severe injury situations exist, or where significant damage to equipment or property could occur if the operation continued. The Construction Inspector or Architect/Engineer of a construction project is responsible for directing the Subcontractor to stop an operation whenever he/she has reason to believe that continuing will lead to injury or damage to Austin Habitat for Humanity or Subcontractor employees or property. The Responsible Safety Officer is authorized to request the Construction Inspector to have the Subcontractor stop any operation they believe will lead to injury of Austin Habitat for Humanity or Subcontractor personnel or damage to Austin Habitat for Humanity or Subcontractor property. All work stoppages must be in writing to the Subcontractor and must reference Safety and Health or the Subcontract's General Conditions, and, if known, the appropriate OSHA regulation. A safety memorandum must be issued by the Responsible Safety Officer after each instance of stopping work, with copies to the Construction Inspector, the Architect/Engineer, and the Contract Administrator. Work must not resume until authorized by Austin Habitat for Humanity management. An example of a work stoppage situation would be having people working next to an upper-level edge not provided with edge barriers. A stop work notice would be issued and work would not resume until Austin Habitat for Humanity management was satisfied that proper barriers were in place. When issuing a stop work order, only those areas of the construction project immediately involved in the hazardous situation are included in the order. Differences of opinion between the Responsible Safety Officer and the Construction Inspector or Architect/Engineer concerning a stop work order must be immediately referred to their supervisors or department heads. The Responsible Safety Officer's recommendations must be followed until the supervisors/department heads make a decision. In the absence of the Construction Inspector, the Responsible Safety Officer must direct the Subcontractor to stop an operation that the Responsible Safety Officer considers perilous to personnel or property. The Responsible Safety Officer must locate the Construction Inspector, the Architect/Engineer, or the department head and notify them of the action taken.

Serious Accidents On Site

In the event of a serious accident on a construction site, the Construction Inspector, Architect/Engineer, or Responsible Safety Officer will determine if all work is to be immediately stopped. Ifwork is stopped, all workmen in the immediate area are to be assembled by the Subcontractor until the Responsible Safety Officer has conducted an initial investigation,
collected applicable information from witnesses, and determined whether work may resume. The person stopping work must initiate notification of Responsible Safety Officer and Austin Habitat for Humanity's legal Counsel.

Excavation and Shoring

Job orders, purchase orders, and subcontracts for excavations that are 5 or more feet deep or are in unstable earth and in which people will work, must specify that shoring is required that is in compliance with 29 CFR 1926, Subpart P, Excavation, which is available from Engineering Department or the Responsible Safety Officer. If it is necessary to deviate from the requirements, a civil engineer registered by the State must submit detailed data to the Responsible Safety Officer for alternative effective shoring and sloping systems. These data shall include soil evaluations, slope stability, and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used. When sheet piling is to be used, full loading due to ground water table must be assumed unless prevented by weep holes and drains or other means. Additional stringers, uprights, and bracing must be provided to allow for any necessary temporary removal of individual supports. Excavated material must be located at least 2 ft back from the edge of excavations of 5- ft or greater depth and 1 ft back from the edge for excavations less than 5-ft deep. Sloping. Instead of a shoring system, the sides or walls of an excavation may be sloped, if this provides equivalent protection. The degree of sloping is dependent on the type of soil and the depth of excavation. Sloping requirements are shown in 29 CFR 1926, Subpart P, Appendix B. Supervision. Excavation work must always be under the immediate supervision of someone with authority and qualifications to modify the shoring system or work methods as necessary to provide greater safety. A ladder projecting 36 in. above ground surface must be provided for access and exit. Travel distance to the ladder must not exceed 25 ft.

Fire Safety Introduction

Policy and planning for fire safety at Austin Habitat for Humanity takes into account the special fire hazards for specific operating areas, the protection of high-value property, and the safety of employees. These ends are met by: * Non-combustible or fire-rated materials and construction practices suitable to the assigned uses of buildings and facilities. * Alarm systems and automatic extinguishing systems. * Availability of suitable hand extinguishers and local hose lines for use before firefighters arrive. * Access to professional fire department, always staffed and trained in the control of emergencies that could occur at the Company. (The Fire Department makes the initial response to all requests for emergency aid received on the emergency telephone number, 911.) This chapter covers the fire safety responsibilities of employees and supervisors and sets forth the fire safety rules and procedures.

Fire Exits

Exit corridors must not be used for storage. The Life Safety Code, NFP A 101, requires that buildings designed for human occupancy must have continuous and unobstructed exits to permit prompt evacuation of the occupants and allow necessary access for responding emergency personnel. The intent of the Cod~ is to keep exits free from obstructions and clear of combustible materials. Attention to housekeeping, therefore, is very important. "Temporary" storage of furniture, equipment, supplies, or anything else is not permitted in exit ways. Combustibles, including recyclable waste paper, are not permitted in exit ways. Metal lockers with ends and tops ferried to the walls and that do not interfere with minimum exit width requirements may be installed in exit corridors when approved by the Fire Department and the Responsible Safety

Officer. The following requirements must be met for storage locker/cabinets: Cabinets will be permitted on one side of the corridor only. Cabinets must end at least 6 ft from the corridor exit i : door. Cabinet ends must be at least 12 in. from the edge of the doorway on the latch side and from the edge of the door leaf when fully opened into the corridor. The cabinets must not be more than 20 in. deep by 37 in. wide by 72-3/4 in. high. The cabinets must be all metal construction with positive latches to prevent spillage of contents in the event of an earthquake. All doors must return automatically to the closed position when not held open manually. A 45 degree-angle fairing must be provided from tile wall to the corridor corner of the cabinet.

Fairing must be provided at both ends of cabinet or bank of cabinets. * A 45 degree-angle fairing must be provided at the top of the cabinets from the outside corridor edge of cabinet to the wall. All cabinets must be anchored to the wall firmly enough to withstand 0.5g of lateral acceleration (or a lateral load equal to 1/2 tile total dead weight of the cabinet and its contents) in the event of an earthquake. Liquids and chemicals are not to be stored in corridor lockers. All cabinets must be kept locked, with one key being retained by the Building Manager. All cabinets must be labeled with the contents and the name, address, and telephone number of the assigned user. Any deviation from the above requirements must be approved by Responsible Safety Officer.

Mechanical Equipment Rooms

Mechanical equipment rooms contain boilers, blowers, compressors, filters, electrical equipment, etc. Such rooms must be separated from other areas of a building by fire-resistant walls and doors. To maintain the integrity of these separations, the fire doors must never be left open. Fan rooms house ventilation equipment which often includes automatic shut down and dampers activated by interlocking with the building smoke and fire detectors. Fire dampers and other automatic shut-down provisions must not be disabled without Fire Department approval (as for temporary maintenance procedures). Mechanical equipment rooms and fan rooms must not be used for storage of any kind.

Construction Areas

Construction areas under control of either Austin Habitat for Humanity or outside contractors must be maintained ill a fire-safe condition and accessible to emergency response forces.

Life Safety Code

The Life Safety Code of the National Fire Protection Association, NFP A 101, requires that emergency lighting be provided for means of egress in certain areas. The Code states emergency lighting is required ill exit corridors ill any office-type building where the building is two or more stories ill height above the level of exit discharge.. In industrial occupancies such as laboratories and shops, the Code requires emergency lighting in all exit aisles, corridors, and passageways. Emergency lighting may be installed in areas where not required by the Code when such areas present all egress hazard during a power failure. Although elevators are not

considered a means of egress within the jurisdiction of the Life Safety Code, they do require emergency lighting. (Titles 8 and 24 require that emergency lighting be maintained in an elevator for a period of at least four hours.) Several types of emergency lights that satisfy the specifications of the Life Safety Code are: Battery Type -Only rechargeable batteries may be used. The rating of the battery must be such that it provides power for illumination for one and one-half hours in the event of a failure of normal lighting. Generator Type -When emergency lighting is provided by an electric generator, a delay of not more than 10 seconds is permitted. Exit sign lights, when burned out, should be reported to Maintenance for service.

Exit Corridors

Exit corridors must not be used for storage. The Life Safety Code, NFP A 101, requires that buildings designed for human occupancy must have continuous and unobstructed exits to permit prompt evacuation of the occupants and allow necessary access for responding emergency personnel. The intent of the Code is to keep exits free from obstructions and clear of combustible materials. Attention to housekeeping, therefore, is very important. "Temporary" storage of furniture, equipment, supplies, or anything else is not permitted in exit ways. Combustibles, including recyclable waste paper, are not permitted in exit ways. Metal lockers with ends and tops ferried to the walls and that do not interfere with minimum exit width requirements may be installed in exit corridors when approved by the Fire Department and the Responsible Safety Officer. The following requirements must be met for storage locker/cabinets: Cabinets will be permitted on one side of the corridor only. Cabinets must end at least 6 ft from the corridor exit door. Cabinet ends must be at least 12 in. from the edge of the doorway on the latch side and from the edge of the door leaf when fully opened into the corridor. The cabinets must not be more than 20 in. deep by 37 in. wide by 72-3/4 in. high. The cabinets must be all metal construction with positive latches to prevent spillage of contents in the event of an earthquake. All doors must return automatically to the closed position when not held open manually. A 45 degree-angle fairing must be provided from the wall to the corridor corner of the cabinet.
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No Smoking

Smoking is forbidden on the job site. Such areas include tile following: Where flammable gases or liquids are stored, handled, or used. Where significant quantities of combustible materials, such as paper, wood, cardboard, or plastics are stored, handled, or used. Where liquid- or gaseous-oxygen is stored, handled, or used. Within 20 ft of a smoke detector. In tape and record storage vaults and computer equipment areas. Areas that are designated "No Smoking" areas for fire safety reasons are indicated by large rectangular signs consisting of white backgrounds with red letters stating "NO SMOKING."

Gases

Introduction

This chapter contains guidelines and requirements for the safe use of flammable and/or compressed gases. It covers the use of flammable-gas piping systems, high-pressure gas cylinders, manifolded cylinders, and compressed air.

Hazards

All gases must be used in a manner that will not endanger personnel or property in routine shop use or experimental operations. Hazards associated with handling and use of flammable and/or high-pressure gases include the following: Injuries caused by flying objects accelerated by an explosion or pressure release; Almost certain death if a flammable mixture is inhaled and then ignited; Asphyxiation; Secondary accidents such as falls or electrical shocks; Fire caused by
ignition of flammable gases;

Relief Valves Required

All systems, system components, and piping subject to over-pressures must be equipped with relief devices.

Operational Safety Procedures

Equipment containing highly toxic gases requires an Operational Safety Procedure (OSP) and must comply with the requirements described in the chapters on chemical safety. If you are in doubt as to the hazards, toxicity, or safe operating practices for any gases, consult the Responsible Safety Officer.

Fire Risk

Fire requires three elements: fuel, oxygen, and ignition. Any experiment or routine operation that places a flammable gas in the presence of an oxidant (air, oxygen) and an ignition source (spark, flame, high temperature) is extremely dangerous. To reduce the risk of fire, eliminate two of these three elements. Thus, when using flammable gases, (I) eliminate ignition sources and (2) prevent mixing of fuel with air or oxygen. Contain or vent fuel. Pyrophoric substances, which are materials that ignite spontaneously when exposed to air, require even more care. Minimize the use of oxygen in high concentration. Materials not normally considered combustible burn violently in high-oxygen atmospheres. Therefore, special precautions must be taken when working with high-oxygen concentrations.

Compressed Air

Compressed air for general shop or laboratory use must be restricted to 30-psig (207-kPa) maximum pressure by restricting nozzles. Compressed air at pressures up to I OO-psig (700-kPa) may be used to operate pneumatic tools, certain control instruments, and research equipment with properly designed over-pressure relief devices. Use of air-pressurized research equipment must be approved by the Responsible Safety Officer. Building compressed air (house air) may be used to dry parts and to help accomplish many other jobs in the shop or laboratory, but always ensure that no one is in line with the air stream and always wear goggles or a face shield. Compressed air must not be used for breathing unless it has been especially installed for this purpose and such use has been approved by Responsible Safety Officer. Never apply air pressure to the body or use compressed air to clean clothing. Compressed air injected into the body openings can be fatal. Compressed air used to clean clothing drives particles into the fabric, where they can cause skin irritation and infections. Use a clothes brush. Compressed air must not be used to transfer liquids from containers of unknown safe working pressure. A pressurized

commercial drum *of* unknown pressure rating is a hazardous device; *for* example, a 55-gal

(200Iiter) drum pressurized to 14.5 psig (100 kPa) has a force on the drum head *of* about 3 tons. To transfer liquids use a pump or a siphon with a bulk aspirator. The transfer pressure *for* commercial-type liquid nitrogen dewars must be less that 14.5 psig. For most laboratory-type liquid nitrogen systems, transfer pressures *of* less than 5 psig are adequate. Compressed air must never be used *for* transferring liquid hydrogen or liquid helium. When an automatic shut-off coupling is not used on air-operated tools, a short metal chain (or its equivalent) should be attached to the hose to prevent it from whipping in case it separates from the tool. When using an air-operated tool, shut *off* the compressed air and vent the hose before changing nozzles or fittings.

Mechanical Guarding

Introduction and Standards

Mechanical guarding must encompass both the power transmission parts *of* all mechanical equipment and the points *of* operation on production machines. Guards must be provided where rotational motion, nip points, and cutting, shearing, punching, and forming mechanisms can cause injury to personnel or damage to too.\s and equipment. Mechanical guards must be designed or otherwise procured to meet the following specifications: The guard must provide positive protection equal to that specified in ANSI B 15. I. The guard must be considered a permanent part *of* the machine or equipment, capable *of* being easily or quickly removed or replaced. The guard must not interfere with efficient operation or maintenance *of* the machine or give discomfort to the operator. The guard must not ,,'eaken the machine structure. The guard must be designed for a specific job and a specific machine. The guard must be durable, resistant to fire and corrosion, and easily repaired. The guard must not present hazards, such as rough edges, splinters, pinch points, shear points, or sharp, corners. Methods *of* guarding that must be considered include the following: Enclosing the operation (preferred) Interlocking devices

Moving barriers Removal devices Remote control Two-handed tripping devices Electronic safety devices Machines designed for fixed locations must be securely anchored to the floor or bench to prevent walking or tipping. Employees may operate machinery only when properly trained and authorized to do so. Proper clothing and protective devices must be worn when specified by the supervisor or shop foreman. ELECTRICAL TAG OUT PROCEDURE When you have to do maintenance work on a machine, take these four steps to protect yourself and your co-workers from injury: 1. De-energize tile machine *if* possible. Positively disconnect the machine from the power source. If there is more than one source *of* power, then disconnect them all. 2. If possible, lock out all disconnect switches. You must be given a lock and a key for each disconnect before you begin working on the machine. 3. Tag all disconnect switches. Use the yellow or Red safety tags which state in large letters --"Danger Do No Operate," or "Danger--Do Not Energize" and gives the name *of* the individual who locked out the equipment, date and time. The tag must also state "DO NOT REMOVE THIS TAG" (except the person who placed the tag may remove it only after the machinery maintenance has been completed. 4. Test the equipment to insure it is de-energized before working on it. First, attempt to operate the equipment by turning on normally. Next check all electrical lines and exposed areas with test equipment or a "lamp".

Finally, short to ground any exposed connections using insulated grounding sticks. This test must be done even *if* the electrical connection is physically broken, such as pulling out a plug, because of the chance *of* discharging components. A TAG OUT ONLY PROCEDURE MAY BE USED IF THE MACHINE CANNOT BE LOCKED OUT. IF THE MACHINE IS SUPPLIED ELECTRICAL POWER FROM A SINGLE SOURCE, WHICH IS UNDER THE EXCLUSIVE CONTRO-L OF A TRAINED AND QUALIFIED REPAIR PERSON AT ALL TIMES AND THERE ARE NOTANY OTHER PERSONS IN THE REPAIR AREA WHO COULD BE HARMED BY THE ACCIDENTAL ENERGIZING OF THE MACHINERY, THEN TAG OUT MAY BE USED INSTEAD OF LOCK OUT/TAG OUT. RE-ENERGIZING Many accidents occur at the moment of re-energizing. If the machinery is to be re-energized, all persons must be kept at a safe distance away from the machinery. The re-energization can be performed only by a person who either performed the lock-out/tag out, a person acting under the immediate and direct commands of the original lock-out/tag out person, or, in the event of a shift change, or other unavailability of the original person, then tile original shall, before leaving, appoint a surrogate original person and show him or her all steps taken to lock-out/tag out the equipment.

Materials Handling Introduction

Austin Habitat for Humanity requires that safety planning and practices for commonplace tasks be as thorough as for operations with unusual hazards. Commonplace tasks make up the greater part of the daily activities of most employees and, not unexpectedly, offer more potential sources of accidents with injuries and property damage. Every operation or work assignment begins and ends with handling of materials. Whether the material is a sheet of paper (paper cuts are painful) or a cylinder of toxic gas, accident risks can be reduced with thorough planning. Identifying obvious and hidden hazards should be the first step in planning work methods and job practices. Thorough planning should include all the steps associated with good management from job conception through crew and equipment decommissioning. Most of the material presented in this chapter is related to the commonplace and obvious. Nevertheless, a majority of the incidents leading to injury, occupational illness, and property damage stem from failure to observe the principles associated with safe materials handling and storage. A less obvious hazard is potential failure of used or excessive motorized handling or lifting equipment. The Responsible Safety Officer must be notified whenever it is desired to acquire a crane, forklift truck, or other motorized handling or lifting equipment from excessed sources.

Lifting and Moving

Lifting and moving of objects must be done by mechanical devices rather than by manual effort whenever this is practical. The equipment used must be appropriate for the lifting or moving task. Lifting and moving devices must be operated only by personnel trained and authorized to operate them. Employees must not be required to lift heavy or bulky objects that overtax their physical condition or capability.

Rigging

Planning for safe rigging and lifting must begin at the design stage, and lifting procedures must be developed for assembly and installation. The lifting procedure should be developed and discussed with the rigging crew fore person. Responsibility for all rigging jobs is shared between the rigging crew and the customer. The customer is responsible for defining and requesting the move, for providing technical information on relevant characteristics of the apparatus, including special lifting fixtures when required, for providing suggestions on rigging and moving, and for assigning someone to represent them both in planning and while the job is being carried out. The riggers are responsible for final rigging and for carrying out whatever moves have been designated. Before any movement takes place, however, each representative must approve tile rigging and other procedures associated with tile intended move. Each must respect the responsibility and authority of the other to prevent or terminate any action he or she judges to be unsafe or otherwise improper. The supervisor must make certain that personnel know how to move objects safely by hand or with mechanical devices in the operations normal to the area and must permit only those employees who are formally qualified by training and certification to

operate a fork truck, crane, or hoist. The supervisor must enforce the use of safe lifting techniques and maintain lifting equipment in good mechanical condition. Employees are required to observe all established safety regulations relating to safe lifting techniques. The Responsible Safety Officer provides training programs followed by certification for employees who have demonstrated the ability to operate fork trucks of up to 4-ton capacity and for incidental crane operations that require no special rigging.

Manual Lifting Rules

Manual lifting and handling of material must be done by methods that ensure the safety of both the employee/volunteer and the material. It is Austin Habitat for Humanity policy that employees whose work assignments require heavy lifting be properly trained and physically qualified, by medical examination if deemed necessary. The following are rules for manual lifting: Inspect the load to be lifted for: sharp edges, slivers, and wet or greasy spots. Wear gloves when lifting or handling objects with sharp or splintered edges. These gloves must be free of oil, grease, or other agents that may cause a poor grip. Inspect the route over which the load is to be carried. It should be in plain view and free of obstructions or spillage that could cause tripping or slipping. Consider the distance the load is to be carried. Recognize the fact your gripping power may weaken over long distances. Size up the load and make a preliminary "heft" to be sure the load is easily within your lifting capacity. If it is not, get help. If team lifting is required, personnel should be similar in size and physique. One person should act as leader and give the commands to lift, lower, etc. Two persons carrying a long piece of pipe or lumber should carry it on the same shoulder and walk in step. Shoulder pads should be used to prevent cutting shoulders and help reduce fatigue. To lift an object off the ground, tlte following are manual lifting steps: Make sure of good footing and set your feet about 10 to 15 inches apart. It may help to set one foot forward of the other. Assume a knee-bend or squatting position, keeping your back straight and upright. Get a firm grip and lift the object by straightening your knees -not your back. Carry the load close to your body (not on extended anns). To turn or change your position, shift your feet -don't twist your back. The steps for setting an object on tlte ground are the same as above, but In reverse.

Mechanical Lifting

Mechanical devices must be used for lifting and moving objects that are too heavy or bulky for safe manual handling by workers. Employees who have not been trained must not operate power-driven mechanical devices to lift or move objects of any weight. Heavy objects that require special handling or rigging must be moved only by riggers or under the guidance of employees specifically trained and certified to move heavy objects.

Load Path Safety

Loads moved with any material handling equipment must not pass over any personnel. The load path must be selected and controlled to eliminate the possibility of injury to employees should the material handling equipment fail. Equipment worked on while supported by material handling equipment must have a redundant supporting system capable of supporting all loads that could be imposed by failure of the mechanical handling equipment. A suspended load must never be left unattended but must be lowered to the working surface and the material handling equipment secured before leaving the load unattended.

Truck Loading

All objects loaded on trucks must be secured to the truck to prevent any shifting of the load in transit. The wheels of trucks being loaded or unloaded at a loading dock must be chocked to prevent movement.

Clean Work Areas

All areas controlled by Austin Habitat for Humanity must be kept in orderly and clean condition and used only for activities or operations for which they have been approved. The following specific rules must also be followed: Keep stairs, corridors, and aisles clear. Traffic lanes and loading areas must be kept c.(ear and marked appropriately. Store materials in work rooms or designated storage areas only. Do not use hallways, fan lofts, or boiler and equipment rooms as storage areas. Do not allow exits, passageways, or access to equipment to become obstructed by either stored materials or materials and equipment that is being used.. Arrange stored materials safely to prevent tipping, falling, collapsing, rolling, or spreading -that is, any undesired and unsafe motion. Do not exceed the rated floor capacity of stored material for the area. The load limit and the maximum height to which material may be stacked must be posted. Place materials such as cartons, boxes, drums, lumber, pipe, and bar stock in racks or in stable piles as appropriate for the type of material. Store materials tl1at are radioactive, fissile, flammable, explosive, oxidizing, corrosive, or pyrophoric only under conditions approved for the specific use by the Responsible Safety Officer. Segregate and store incompatible materials in separate locations. Remove items that will not be required for extended periods from work areas and put them in warehouse storage. Call for assistance. Temporary equipment required for special

projects or support activities must be installed so that it will not constitute a hazard. A minimum clearance of 36 inches must be maintained around electrical power panels. Wiring and cables must be installed in a safe and orderly manner, preferably in cable trays. Machinery and possible contact points with electrical power must have appropriate guarding. The controls for temporary equipment must be located to prevent inadvertent actuation or awkward manipulation. When heat-producing equipment must be installed, avoid accidental ignition of combustible materials or touching of surfaces above 60 degrees C (140 F). Every work location must be provided with illumination that meets OSHA requirements. Evaluation of illumination quality and requirements is made by the Responsible Safety Officer, but the supervisor of an area is responsible for obtaining and maintaining suitable illumination. Areas without natural lighting and areas where hazardous operations are conducted must be provided with enough automatically activated emergency lighting to permit exit or entry of personnel if the primary lighting fails.

Noise

Introduction

This chapter contains information on the effects, evaluation, and control of noise. For assistance in evaluating a noise problem, contact the Responsible Safety Officer.

Danger of Noise

Exposing the ear to high levels of noise may cause hearing loss. This loss can be temporary or permanent. Temporary hearing loss or auditory fatigue occurs after a few minutes exposure to an intense noise but is recoverable following a period of time away from the noise. If the noise exposure is repeated, there may be only a partial hearing recovery and the Joss becomes permanent. Typically, significant hearing losses occur first in the frequency range of 3,000 to 6,000 hertz (Hz). Losses in this frequency range are not critical to speech perception, and the individual usually is completely unaware of this initial symptom. With longer exposures, the hearil1g loss spreads to lower frequencies, which will affect speech perception. Workers'

Compensation laws regard hearing losses in the speech frequency range of *500* to *3,000* Hz as being compensable. The evaluation of hearing loss due to noise is complicated by the fact that hearing acuity normally decreases with increasing age. Further, the losses associated with age are quite similar to those caused by excessive noise since the hearing for high frequency sounds is most affected in both instances. I-hearing impairment may also result from infections, tumors, and degenerative diseases.

Reducing Noise Exposure .

Noise exposure can be reduced by using engineering controls, administrative procedures, or personal protective devices. Engineering Controls Reduction of noise production at the source: Proper design of new machines Modification of present machines Proper repair and upkeep of equipment Use of appropriate mufflers Use of vibration dampeners on machines Reduction of noise transmission: Increase distance between noise and personnel exposed Construction of barriers between noise source and personnel Sound treatment of ceilings and walls Administrative Procedures: Job schedule changes Personnel rotation Personnel Protective Devices: Ear plugs Earmuffs Federal and state occupational safety and health regulations require that whenever employees are exposed to excessive noise levels, feasible engineering or administrative controls must be used to reduce these levels. When these control measures cannot be completely accomplished and/or while such controls are being initiated, personnel must be protected from the effects of excessive noise levels. Such protection can, in most cases, be provided by wearing suitable protective hearing devices. The appropriate Medical Services provider and/or the supervisor of the Department will supply ear plugs for employees upon request or before going into a high noise area. There is a need for medical supervision when ear plugs are used because their effectiveness depends on proper fitting. Only approved plugs should be used. Protection greater than that provided by a single device can be obtained by wearing ear plugs under an earmuff. While the reduction provided by wearing both devices simultaneously is considerably less than the sum of the individual attenuations, it is still greater than when either device is worn separately.

Protective Equipment Introduction

Austin Habitat for Humanity will provide suitable equipment to protect employees from hazards in the workplace. The Responsible Safety Officer will advise on what protective equipment is required for the task, but tile supervisor of the operation must obtain this equipment and see that it is used. Protective clothing is not a substitute for adequate engineering controls.

Protection Issued

Protective clothing will be issued to employees who work with hazardous material for the purpose of protecting their health and safety. The Responsible Safety Officer is available for consultation as needed.

Protective Shoes

Austin Habitat for Humanity encourages the wearing of safety shoes by making them available to any employee/volunteer at cost from a manufacturer. For certain types of work the wearing of safety shoes is required by Company policy or by federal regulations. Examples are when employees are exposed to foot injuries from material handling, or in construction jobs where there is a danger of falling objects or in abnormally wet locations.

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Protective Gloves

Austin Habitat for Humanity provides proper hand protection to employees exposed to known hand hazards, The supervisor must obtain the suitable hand protection and ensure that it is used. The individual department must maintain a supply of special or infrequently used hand ") protection. Assistance in selecting the proper hand protection may be obtained by consulting the Responsible Safety Officer. :

Head Protection

Austin Habitat for Humanity provides appropriate head protection devices for employees to protect them from head or other injuries that could result from their working environment. Some head protection devices are available from stock. The supervisor must also maintain sufficient supply of head protection devices for visitors in the area. Workers in active deconstruction work area need to have hard hat on. Workers in low risk areas such as material processing (denailing) or material stacking areas may not need to wear a hard hat if sufficiently distant from falling objects and over head obstacles;

Eye Protection

Austin Habitat for Humanity provides appropriate eye protection devices for employees assigned to tasks in which an eye-injury hazard exists. The supervisor of the operation is responsible for determining the need for suitable eye-protection devices and for ensuring that the employees use them. The Responsible Safety Officer and appropriate Medical Services agency will assist the supervisor in defining eye-hazard operations and in selecting appropriate eye protection. An optometrist is available to issue, repair, adjust, and fit personal safety glasses and also for consultation regarding occupational eye protection. The standard sign: CAUTION, EYE HAZARD AREA, DO NOT ENTER WITHOUT EYE PROTECTION, must be posted in every area where eye protection is mandatory. All employees who work in such an area must wear the eye protection issued to them. Every visitor to tile area must also be provided with suitable eye protection.

Respiratory Protection

Any operation that generates harmful airborne level~ of dusts, fumes, sprays, mists, fogs, smokes, vapors, or gases or that may involve oxygen-deficient atmospheres requires the use of effective safety controls. This must be accomplished, as much as feasible, by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respiratory protection must be used in accordance with Austin Habitat for Humanity requirements as prescribed by OSHA in ANSI 288.2-1980, Standard Practices for Respiratory Protection.

Responsibilities

To ensure that the respiratory protection program is conducted in accordance with ANSI 288.2-1980, certain responsibilities are required of each employee, supervisor, Responsible Safety Officer, and tile Medical Services Department. Employees are responsible for: Wearing the respirator in accordance with the instructions and training received. Maintaining and storing the respirator in good condition. Returning the respirator at the end of the required use for overhaul, cleaning, and disinfection. Supervisors are responsible for: Identifying those employees who may need to use respiratory protection (Responsible Safety Officer will provide assistance upon request in this determination). Ensuring that their employees have been properly trained and fitted. Ensuring that their employees use the respirators as required.

The Responsible Safety Officer is responsible for:

- Providing respiratory equipment.

- Maintaining the equipment in good condition.
- Fitting employees with proper respirators and providing training for their use.
- Evaluating employee/volunteer exposures and work conditions, including inspection of respirator use.

The Medical Services Department is responsible for: Granting medical approval for each respirator user.

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Ladders and Scaffolds

Ladders

Ladders must be in good condition, made of suitable material, of proper length, and of the correct type for the use intended. Damaged ladders must never be used; they should be repaired or destroyed. Ladders used near electrical equipment must be made of a non-conducting material. Stored ladders must be easily accessible for inspection and service, kept out of the weather and away from excessive heat, and well supported when stored horizontally. A portable ladder must not be used in a horizontal position as a platform or runway or by more than one person at a time. A portable ladder must not be placed in front of doors that open toward the ladder or on boxes, barrels, or other unstable bases. Ladders must not be used as guys, braces, or skids. The height of a stepladder should be sufficient to reach the work station without using the top or next to the top steps. Bracing on the back legs of stepladders must not be used for climbing. The proper angle (75-1/2 degrees) for a portable straight ladder can be obtained by placing the base of the ladder a distance from the vertical wall equal to one quarter of the vertical distance from base to top of ladder's resting point. Ladders must be ascended or descended facing the ladder with both hands free to grasp the ladder. Tools must be carried in a tool belt or raised with a hand line attached to the top of the ladder. Extension ladders should be tied in place to prevent side-slip.

Scaffolds

All scaffolds, whether fabricated on site, purchased, or rented must conform with the specifications found in ANSI A I 0.8, Safety Requirements for Scaffolding. Rolling scaffolds must maintain a 3: 1 height to base ratio (use smaller dimension of base). The footing or anchorage for a scaffold must be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Unstable objects such as barrels, boxes, loose brick, or concrete blocks must not be used to support scaffolds or planks. No scaffold may be erected, moved, dismantled, or altered unless supervised by competent persons. Scaffolds and their components must be capable of supporting at least four times the maximum intended load without failure. Guardrails and toe boards must be installed on all open sides and ends of scaffolds and

platforms more than 10ft above the ground or floor. Scaffolds 4 feet to 10 feet in height having a minimum horizontal dimension in either direction of less than 45 inches must have standard installed on all open sides and ends oftl1e platform. Wire, synthetic, or fiber rope used for suspended scaffolds must be capable of supporting at least 6 times the rated load. No riveting, welding, burning, or open flame work may be performed on any staging suspended by means of fiber or synthetic rope. Treated fiber or approved synthetic ropes must be used for or near any work involving the use of corrosive substances. All scaffolds, bosun's chairs, and other work access platforms must conform with the requirements set forth in the Federal Occupational Safety and Health Regulations for Construction, 29 CFR 1926.451, except where the specifications in ANSI Al 0.8 are more rigorous.

Floors

Workroom floors must be in a clean and, as much as possible, dry condition. Drainage mats, platforms, or false floors should be used where wet processes are performed. Floors must be free from protruding nails, splinters, holes, and loose boards or tiles. Permanent aisles or passageways must be marked. Floor holes must be protected by covers that leave. Floor openings into which persons can accidentally walk must be guarded by standard railings and toe boards. Open-sided floors, platforms, and runways higher than four feet must be guarded by standard railings. Toe boards must be used wherever people can pass below or hazardous equipment or materials are below.

Fall Arrester Systems Required

When workers are required to work from surfaces that are in excess of 6 ft above an adjacent safe work place and are unprotected by railings, the following procedures and guidelines must be applied: Before selecting personnel for work at elevated work stations, supervisors must consider the workers' physical condition, such as medical problems, fear of heights, and coordination. The Medical Services Department should be contacted for information in this regard. Approved fall-arrester systems are required for all work at heights of 0 or more feet. A recommended fall-arrester system consists of a full body-harness, a lanyard consisting of 1/2inch nylon rope or equivalent with a breaking strength of *5400* lb and a maximum length to provide for a fall no greater than 6 feet, Sala-type fall-arrester block (optional), and an anchored hook-up location.

Alternate equipment must be approved by the responsible Safety Officer. Fall-arrester systems are recommended for light work at heights between 7-1/2 and 10 feet. Fall-arrester systems are not required when work is being done while standing on a ladder. Ladders should be tied off. Use of a controlled descent device is not necessary unless it is impossible to reach a stranded person by all other means. The Responsible Safety Officer will advise, on request, regarding usage and procedures. It is the responsibility of the supervisor to plan the intended work sufficiently to ensure that job planning and proper precautions have been taken. The Responsible Safety Officer is available for consultation.

Tools

Company Provided Tools

Austin Habitat for Humanity provides hand and powered portable tools that meet accepted safety standards. A damaged or malfunctioning tool must not be used; it must be turned in for servicing and a tool in good condition obtained to complete the job. Employees must use the correct tool for the work to be performed; if they are unfamiliar with the operation of the tool, they must request instruction from their supervisor before starting the job. Supervisors are responsible for

ensuring that their subordinates are properly trained in the operation of any tool that they are expected to operate.

Grounding

Tools that are not double insulated must be effectively grounded and tested. Testing must be accomplished before initial issue, after repairs, and after any incident that could cause damage, such as dropping or exposure to a wet environment. Grounded tools must always be used with an effectively grounded circuit. Any extension cord used with a grounded tool must be a three-wire, grounded type. Electric-powered hand tools used on construction sites, on temporary wired circuits, or in wet environments will be used in conjunction with an approved ground fault circuit interrupter (GFCI). The responsibility for implementing and maintaining this program rests with tile individual supervisors involved. Tool testing equipment will be maintained by the responsible Safety Officer. Documentation of tool testing will be maintained by the group owning powered hand tools. Tools maintained in a tool crib and tested prior to issue are exempted from this requirement. Repairs of defective tools will only be made by qualified electrical personnel.

APPENDIX D.
LABOR HOUR DETAILS

The following data is extracted from the UF-CCE report on the deconstruction progress and productivity.

For each activity (i.e. removal of a material or component) the following are shown.

Quantity: The quantity or number of items removed from the building. Note that this number may be different than either the total number in the standing building, or the number recovered by AHfH for resale.
Units: Units of measure.
Hours to Deconstruct: The number of Labor Hours (i.e the number of hours to remove the material or component, times the number of individuals performing the task) invested in removing the given quantity.
Hours per Unit: The total Labor Hours per each unit of the material or component removed.
Burdened Hours: The number of Labor Hours invested in material handling, denailing and processing, bundling and stacking, and other tasks not directly involving removing materials from the buildings.
Burdened Hours per Unit: The number of Burdened Hours per unit of the material or component.
Supervisory Hours per Unit: A distribution of the AHfH and UF-CCE supervisors Labor Hours over the removal of the given quantity of material or component.
Total Hours per Unit: The total of Labor Hours, Burdened Hours, and Supervisory Hours on a unit basis.
Total Hours per SF of Building: The total of Labor Hours, Burdened Hours, and Supervisory Hours on a square foot of building basis.

(Author's note: The following tables were simply cut-and-pasted from Excel spreadsheets. The format and appearance will be cleaned up for the Final Report.)

LABOR HOUR DETAILS, Building 2748 1530 SF of building actually deconstructed

Component / Material	Quantity	Units	Hrs. to Deconstruct	Hrs/Unit to Deconstruct	Burdened Hours	Burdened Hrs/Unit	Supervisory Hours/Unit	Total Hrs/Unit	Total Hrs/SF of Bldg
Windows / Doors									
Windows	14	EA	16.75	1.2	8.25	0.6	0.071	1.857	
Total Doors and Windows									**0.017**
MEP	1530	SF	12.00	0.008	5.50	0.004	0.001	0.012	
Total MEP									**0.012**
Casework	1530	SF	5.50	0.004	3.00	0.002	0.000	0.006	
Total Casework									**0.006**
Interior Finishes									
Plywood - Wall	672	SF	2.75	0.004	1.75	0.003	0.000	0.007	
GWB – Wall	1950	SF	17.25	0.009	7.50	0.004	0.001	0.013	
GWB - Ceiling	1530	SF	5.00	0.003	2.00	0.001	0.000	0.005	
Vinyl Tile - Floor	3060	SF	80.05	0.026	22.04	0.007	0.001	0.035	
Total Interior Finishes									**0.099**
Interior Walls and Ceilings									
Framing	255	SF	2.75	0.011	4.60	0.018	0.001	0.030	
Insulation	255	SF	7.13	0.028	2.13	0.008	0.001	0.038	
Total Wall Assembly									**0.011**
Roof									
Asphalt Shingles	1775	SF	20.63	0.012	7.75	0.004	0.001	0.017	
Sheathing - plywood	1775	SF	12.75	0.007	16.25	0.009	0.001	0.017	
Structure	1530	SF	33.25	0.022	61.00	0.040	0.002	0.064	
Structure	1650	SF	33.25	0.020	61.00	0.037	0.002	0.059	
Total Roof Assembly									**0.103**
Exterior Walls									
Vinyl siding	1898	SF	22.25	0.012	12.75	0.007	0.001	0.019	
Wood 1x6	1898	SF	18.75	0.010	5.00	0.003	0.000	0.013	
Framing	1725	SF	12.50	0.007	24.25	0.014	0.001	0.022	
Total Exterior Walls									**0.065**
Floor									
T&G 1x4	1530	SF	16.15	0.011	63.65	0.042	0.002	0.054	
Subfloor	1530	SF	16.91	0.011	35.72	0.023	0.002	0.036	
Joists	1530	SF	7.79	0.005	34.58	0.023	0.001	0.029	

Joists	791	LF	7.79	0.010	34.58	0.044	0.002	0.056	
Total Floor									**0.119**
Total Building	1530	SF							**0.432**

LABOR HOUR				1785	SF of building actually				

DETAILS, Building 2738					deconstructed				
Component / Material	**Quantity**	**Units**	**Hrs. to Deconstruct**	**Hrs / Unit to Deconstruct**	**Burdened Hours**	**Burdened Hrs / Unit**	**Supervisory Hours / Unit**	**Total Hrs / Unit**	**Total Hrs / SF of Bldg**
Windows / Doors									
Doors	4	EA	1.37	0.343	0.53	0.132	0.014	0.489	
Windows	13	EA	10.76	0.827	7.44	0.572	0.039	1.439	
Total Doors and Windows									**0.012**
MEP	1785	SF	2.75	0.002	1.25	0.001	0	0.002	
Total MEP									**0.002**
Interior Finishes									
Plywood - Wall	1048	SF	1.93	0.002	3.5	0.003	0	0.005	
Sheetrock – Wall	3172		14.46	0.005	5.49	0.002	0	0.006	
ACT - Ceiling	1463	SF	6.15	0.004	5.09	0.003	0	0.008	
Sheetrock - Ceiling	1463	SF	4.21	0.003	1.60	0.001	0	0.004	
Total Interior Finishes									**0.024**
Interior Walls and Ceilings									
Framing	1330	SF	22.51	0.017	55.19	0.041	0.002	0.060	
Insulation	1330	SF	2.81	0.002	1.10	0.001	0	0.003	
Total Wall Assembly				0.019					**0.047**
Roof									
Gutter - Aluminum	142	LF	1.72	0.012	2.45	0.017	0.001	0.03	
Asphalt Shingles	1988	SF	24.67	0.012	9.41	0.005	0.001	0.018	
Sheathing – 1x6	1988	SF	28.21	0.014	10.69	0.005	0.001	0.020	
Structure	1785	SF	45.94	0.026	112.75	0.063	0.003	0.092	
Structure	1916	LF	45.94	0.024	112.75	0.059	0.002	0.085	
Total Roof Assembly									**0.136**
Exterior Walls									
Vinyl siding	1682	SF	15.04	0.009	8.95	0.005	0	0.015	
Wood 1x6	1682	SF	16.20	0.01	6.27	0.004	0	0.014	
Total Exterior Walls									**0.027**
Floor									
T&G Oak 1x3	1785	SF	14.82	0.008	36.37	0.020	0.001	0.030	
Joists	1785	SF	27.92	0.016	68.54	0.038	0.002	0.056	
Joists	918	LF	27.92	0.03	68.54	0.075	0.003	0.108	
Total Floor									**0.086**
Total Building	1785	SF							**0.333**

LABOR HOUR DETAILS, Building 2736				1785	SF of building actually deconstructed				
Component / Material	**Quantity**	**Units**	**Hrs. to Deconstruct**	**Hrs / Unit to Deconstruct**	**Burdened Hours**	**Burdened Hrs / Unit**	**Supervisory Hours / Unit**	**Total Hrs / Unit**	**Total Hrs / SF of Bldg**
Windows / Doors									
Doors	4	EA	1.37	0.343	0.53	0.132	0.014	0.489	
Windows	13	EA	10.76	0.827	7.44	0.572	0.039	1.439	
Total Doors and Windows									**0.012**
MEP	1785	SF	2.75	0.002	1.25	0.001	0	0.002	
Total MEP									**0.002**
Interior Finishes									
Plywood - Wall	1048	SF	1.93	0.002	3.50	0.003	0	0.005	
Sheetrock – Wall	3172	SF	14.46	0.005	5.49	0.002	0	0.006	
ACT - Ceiling	1463	SF	6.15	0.004	5.09	0.003	0	0.008	
Sheetrock - Ceiling	1463	SF	4.21	0.003	1.60	0.001	0	0.004	
Total Interior Finishes									**0.024**
Interior Walls and Ceilings									
Framing	1330	SF	22.51	0.017	55.19	0.041	0.002	0.060	
Insulation	1330	SF	2.81	0.002	1.10	0.001	0	0.003	
Total Wall Assembly				0.019					**0.047**
Roof									
Gutter - Aluminum	142	LF	1.72	0.012	2.45	0.017	0.001	0.030	
Asphalt Shingles	1988	SF	24.67	0.012	9.41	0.005	0.001	0.018	
Sheathing – 1x6	1988	SF	28.21	0.014	10.69	0.005	0.001	0.020	
Structure	1785	SF	45.94	0.026	112.75	0.063	0.003	0.092	
Structure	1916	LF	45.94	0.024	112.75	0.059	0.002	0.085	
Total Roof Assembly									**0.136**
Exterior Walls									
Vinyl siding	1682	SF	15.04	0.009	8.95	0.005	0	0.015	
Wood 1x6	1682	SF	16.20	0.01	6.27	0.004	0	0.014	
Total Exterior Walls									**0.027**
Floor									
T&G Oak 1x3	1785	SF	14.82	0.008	36.37	0.02	0.001	0.030	
Joists	1785	SF	27.92	0.016	68.54	0.038	0.002	0.056	
Joists	918	LF	27.92	0.03	68.54	0.075	0.003	0.108	
Total Floor									**0.086**

Total Building	1785	SF							**0.333**

LABOR HOUR DETAILS, Building 2717 5310 SF of building actually deconstructed

Component / Material	Quantity	Units	Hrs. to Deconstruct	Hrs / Unit to Deconstruct	Burdened Hours	Burdened Hrs / Unit	Supervisory Hours / Unit	Total Hrs / Unit	Total Hrs / SF of Bldg
Windows / Doors									
Windows	34 ea	EA	23.50	0.691	14.25	0.419	0.022	1.132	
Total Doors and Windows									**0.007**
MEP	5310 sf	SF	16.75	0.003	10.25	0.002	0	0.005	
Total MEP									**0.005**
Interior Finishes									
Sheetrock – Wall	12276 sf	SF	57.25	0.005	35.00	0.003	0	0.008	
ACT - Ceiling	666 sf	SF	6.50	0.010	4.00	0.006	0	0.016	
Vinyl Tile - Floor	5150 sf	SF	38.25	0.007	23.25	0.005	0	0.012	
Total Interior Finishes									**0.032**
Interior Walls and Ceilings									
Framing	1717	SF	26.25	0.015	76.00	0.044	0.001	0.061	
Insulation	1717	SF	12.00	0.007	7.25	0.004	0	0.011	
Total Wall Assembly									**0.023**
Roof									
Aluminum Gutters	182	LF	2.75	0.015	1.75	0.004	0	0.025	
Asphalt Shingles	3108	SF	40.50	0.013	24.50	0.008	0	0.021	
Sheathing – 1x6	3108	SF	31.25	0.010	21.75	0.007	0	0.017	
Structure	2655	SF	80.75	0.030	219.00	0.083	0.002	0.115	
Structure	3373	LF	80.75	0.024	219.00	0.065	0.002	0.091	
Total Roof Assembly									**0.081**
Exterior Walls									
Framing	4610	SF	14.25	0.003	24.75	0.005	0	0.009	
Fascia and Soffit	246	LF	7.25	0.029	5.75	0.023	0.001	0.054	
Vinyl Siding	4610	SF	32.75	0.007	24.25	0.005	0	0.013	
Wood 1x6	4610	SF	50.00	0.011	168.00	0.037	0.001	0.048	
Total Exterior Walls									**0.063**
Floor									
T&G Oak 1x3	5150	SF	120.75	0.023	398.25	0.076	0.002	0.101	
Subfloor	5150	SF	25.25	0.005	87.50	0.017	0	0.022	
Joists	5150	SF	57.75	0.011	147.75	0.029	0.001	0.041	

Joists	4915	LF	57.75	0.012	147.75	0.030	0.001	0.043	
Concrete Slab	508	SF	22.25	0.044	13.50	0.027	0.002	0.072	
Total Floor									**0.166**
Columns – 6x6	220	LF	3.50	0.016	3.25	0.015	0	0.031	
Total Columns									**0.001**
Total Building									**0.378**

LABOR HOUR DETAILS, Building 834 5310 SF of building actually deconstructed

Component / Material	Quantity	Units	Hrs. to Deconstruct	Hrs / Unit to Deconstruct	Burdened Hours	Burdened Hrs / Unit	Supervisory Hours / Unit	Total Hrs / Unit	Total Hrs / SF of Bldg
Windows / Doors									
Door – Wood 7'x7'	1 ea	EA	2.25	2.25	1.25	1.25	0	3.5	
Door – Large Metal	2 ea	EA	3.5	1.75	2	1	0.125	2.875	
Windows	2 ea	EA	4.75	2.375	3.25	1.625	0.125	4.125	
Total Doors and Windows									**0.001**
MEP	8910 sf	SF	50.25	0.006	52	0.006	0	0.012	
Total MEP									**0.012**
Casework	8910 sf	SF	4.5	0.001	20.75	0.002	0	0.003	
Total Casework									**0.003**
Interior Finishes									
Plywood - Wall	444 sf	SF	2.25	0.005	6	0.014	0.001	0.019	
Sheetrock – Wall	2634 sf	SF	13.75	0.005	8	0.003	0	0.009	
T&G Wood 1x6 - Wall	4664 sf	SF	123	0.026	176.5	0.038	0.002	0.066	
ACT – Ceiling	482 sf	SF	0.25	0.001	0.5	0.001	0	0.002	
Sheetrock - Ceiling	512 sf	SF	2.75	0.005	1.75	0.003	0	0.009	
Vinyl Tile - Floor	482 sf	SF	2	0.004	1.25	0.003	0	0.007	
Total Interior Finishes									**0.039**
Interior Walls and Ceilings									
Framing	1174	SF	25	0.021	33.75	0.029	0.002	0.052	
Total Wall Assembly									**0.007**
Roof									
Asphalt Shingles	9546	SF	130.75	0.014	76.5	0.008	0.001	0.022	
Sheathing – Wood 1x6	9546	SF	121.75	0.013	71.25	0.007	0.001	0.021	
Structure	8910	SF	337	0.038	633.5	0.071	0.002	0.111	
Structure	15032	LF	337	0.022	633.5	0.042	0.001	0.066	
Total Roof Assembly									**0.157**
Exterior Walls									
Vinyl siding	3770	SF	18.75	0.005	32	0.008	0	0.014	

Wood 1x6	3770	SF	11.75	0.003	29.75	0.008	0	0.011	
Framing	3770	SF	12.75	0.003	32.5	0.009	0	0.012	
Total Exterior Walls									**0.016**
Floor									
T&G Oak 1x3	3262	SF	56.75	0.017	147.25	0.045	0.004	0.066	
Subfloor – T&G 2x6	8910	SF	198.5	0.022	502.25	0.056	0.003	0.081	
Joists	8910	SF	148.25	0.017	370	0.042	0.002	0.06	
Joists	13580	LF	148.25	0.011	370	0.027	0.001	0.039	
Total Floor									**0.166**
Total Building									**0.401**

APPENDIX E.
AUSTIN HABITAT FOR HUMANITY PRICE LISTS

MATERIAL	UNIT	SALE PRICE (KY/TN)	RESTORE PRICE (AUSTIN, TX)
Personnel doors	EA		$35.00
Ceiling mounted gas heaters, 50,000 BTUH	EA	$75.00	$110.00
Updraft gas furnaces, 125,000 BTUH	EA		$200.00
Metal window grates	EA		$10.00
Vinyl Siding, 8" (12ft. Sheets)	SHT	$1.00	
Fire alarm cabinet box	EA		
Mariner-style, industrial light fixtures	EA	$10.00	
Windows, dbl hung, single glazed, 3.5'x5.5'	EA		$30.00
Windows, dbl hung, dbl glazed, 3.5'x5.5'	EA		$25.00
Trusses, site- built 2x8 members, 25 ft.	EA	$20.00	
Trusses, manufactured, 25 ft.	EA	$12.50	
3" Oak T&G flooring , 3"	SF	$1.15	
Fir T&G flooring .3"	SF		$1.15
OakT&G flooring , 2-1/4"	SF		$1.25
Pine T&G wall sheathing , 6"	SF		$1.25
Plywood, 5/8”	SHT	$7.00	
Wood paneling	SHT	$2.00	
Ceiling tiles	EA	$0.10	
1x2	LF		
1x4	LF	$0.15	$0.15
1x6	LF	$0.15	$0.18
1x8 (sub-flooring)	LF	$0.18	$0.20
1x8 T&G	LF		
1x10 subfloor	LF	$0.22	
1x12	LF		
2x4	LF	$0.15	
2x6	LF	$0.30	$0.30
2x8	LF	$0.40	$0.41
2x10	LF	$0.70	
2x6 flooring T&G	LF		$0.40
2x12	LF		$0.75
4x4	LF	$0.35	
6x6	LF	$1.00	