Dudley Services Inc.

BEST Process Overview

Vermiculite Attic Insulation Removal

Three Generations of Know-How. Decades of Service.

Designed based on experience, industry leadership, and listening to our customers' needs.

"Placing the safety of everyone involved at the forefront of everything we do."



Experience | Innovation | Safety

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The Problem and the Solution

Vermiculite insulation originating from the Zonolite mine in Libby, Montana, was widely distributed and installed in homes throughout North America. Much of this material was contaminated with Libby Amphibole Asbestos. Published scientific research estimates that approximately **5.8 million tons of vermiculite ore** were mined and distributed between 1924 and 1990.

Vermiculite from the Libby mine was used in numerous products, including attic insulation, where it was commonly poured over existing insulation to reduce heating costs and help prevent ice damming. The U.S. Environmental Protection Agency has indicated that vermiculite insulation originating from Libby could potentially be present in millions of American homes.

As the nation moves toward higher energy-efficiency standards and long-term carbon reduction goals, millions of homes will require weatherization improvements, including upgrades to attic insulation R-values.

Unfortunately, the discovery of vermiculite during a home energy assessment often presents what the industry refers to as a **"pre-weatherization barrier,"** preventing or delaying important energy-efficiency improvements until the insulation can be properly addressed.

With modern heating and cooling technologies increasingly dependent upon comprehensive weatherization for optimal performance, the need for a safe, effective, and practical solution to this barrier has become more important than ever.

Further complicating the challenge is the remarkable diversity of American residential construction. Homes built over several centuries incorporate countless architectural styles, structural configurations, and construction methods, making vermiculite removal particularly demanding.

Dudley Services Incorporated recognized this bottleneck and set its course toward developing a solution capable of adapting to the challenges presented by different homes, seasons, and working conditions.

Through years of innovation, field experience, and continuous refinement, Dudley Services developed its proprietary **Bulk Extraction System Technology (BEST)**, an integrated extraction process designed to overcome the many challenges associated with removing vermiculite and other loose-fill attic insulation, including material contaminated with Libby Amphibole Asbestos.

The result is a technology born from practical experience, refined through real-world applications, and developed to address one of the most persistent obstacles to residential weatherization.

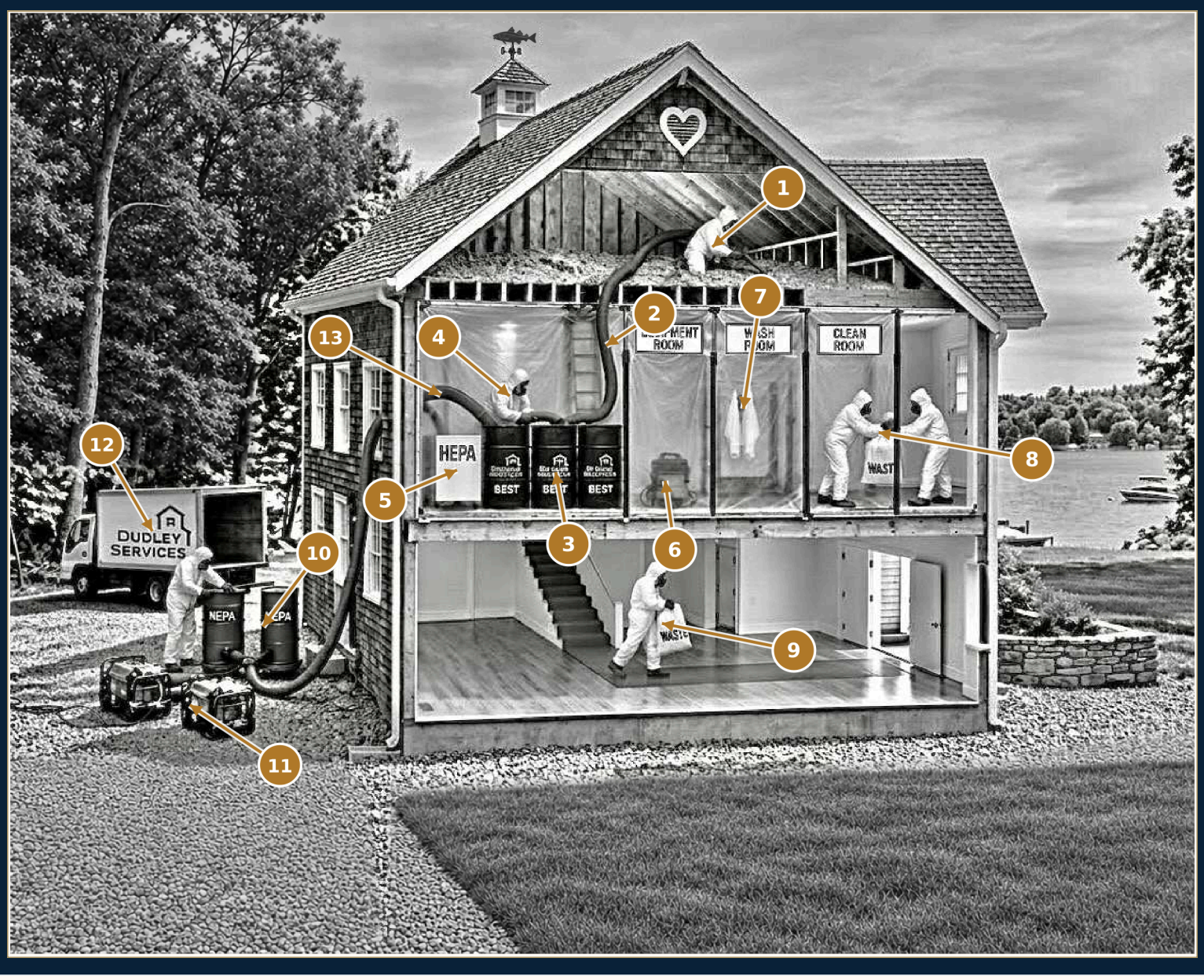
This presentation introduces the BEST process, a technology developed and refined through the successful remediation of thousands of attics throughout the Greater Boston area.

Source: Environmental Health Perspectives (2010), doi:10.1289/ehp.0901680. The 5.8 million tons refers to ore, not finished attic insulation.

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BEST Process Explained



1 Attic Extraction

Worker uses the incredible amount of HEPA filtered suction from the BEST system to extract vermiculite and all mixed loose-fill insulation from crevices and hard to reach areas leaving the substrate thoroughly cleaned.

2 Attic Suction Hose

The attic extraction hose carries material from the attic to the BEST processing drums. This hose can clog; however, servicing a clog within the regulated workspace helps reduce the risk of contamination outside the work area.

3 BEST Drum System

It took years of development to refine the interconnected drum system. Our main goal of this design was to prevent loose fill insulation from clogging up the HEPA filtered vacuums which would halt the extraction process. We succeeded with the BEST design which is a HUGE leap forward when vacuuming dissimilar materials. The crux of our technology lies within these drums and unfortunately, we cannot disclose exactly what that looks like without an NDA.

4 Drum Processing Worker

This is where things really happen. It is a fast paced insulation processing factory setting. Workers monitor the level of insulation in the drums and move bags in and out of the drums to allow the process to flow continuously. The workers vacuum seal up the bags and place them in the properly labeled Asbestos disposal bags.

5 Negative-Air Machine

The HEPA-filtered Negative Air Machine maintains a negative pressure within the regulated work area throughout the project duration. The HEPA filtered air exits through the opening leading to the outside of the structure.

6 Equipment Room

This area is where tools and equipment are stored safely out of the BEST processing area.

7 Wash Room

Equipment and personnel decontamination area is designed for cleanliness and has plastic flaps on each entryway to help maintain negative pressure within the work area.

8 Clean Room Bag Handoff

After filled bags are removed from the BEST drums, securely tied off, and vacuum-sealed, they are transferred through the clean room to a worker outside the containment. The receiving worker carries the sealed bags along the protected route directly to the truck for transport to an offsite dumpster.

9 Protected First-Floor Transport

Worker carries sealed waste bags along the protected floor and toward the exit.

10 Exterior HEPA Vacuums

Two exterior vacuum units provide suction for the BEST extraction system. Knowing how to service these vacuums and keep them "sucking right along" is what we do.

11 Generators

Supply power to the HEPA filtered vacuum equipment. The BEST process requires serious amounts of suction and having a dedicated generator for each vacuum is a must.

12 Dudley Services Truck

Receives properly packaged waste for controlled transportation and disposal.

13 BEST Suction Hose — Clog Prevention

The BEST system captures vermiculite, cellulose, and any other loose-fill insulation within collection bags inside the specially designed drums. By cyclonically separating the bulk material before it reaches the downstream suction hose, the system is preventing "show stopping" clogging of the hose leading from the drums inside to the HEPA filtered vacuums outside. This significantly reduces the need for workers to disconnect, open, or investigate clogged suction hoses, thereby reducing potential exposure to asbestos-containing dust and fibers.

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Protecting the Home

Preparation Before Extraction

Protecting the customer's home is where every BEST project begins.



Preparing and securing the protected access route.

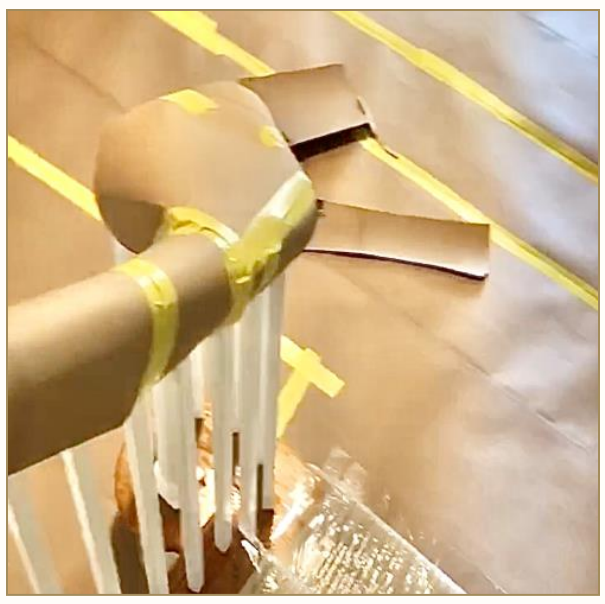
Before extraction begins, Dudley Services carefully prepares the work area and establishes a protected route to the attic entrance.

Temporary protective coverings, including Ram Board and appropriate surface-protection materials, are installed over flooring, stairs, carpets, and other vulnerable finishes. Seams and edges are secured to help prevent accidental damage during the movement of workers, equipment, and materials.

Additional site-specific preparations are made to protect surrounding areas and prepare the home for the installation of the regulated containment system.



Handling Ram Board for floor protection.



Protecting railings and vulnerable finishes.



Installing protection along the staircase.

The objective is simple: protect the home, protect its occupants, and prepare a controlled environment for the work ahead.

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Establishing Containment

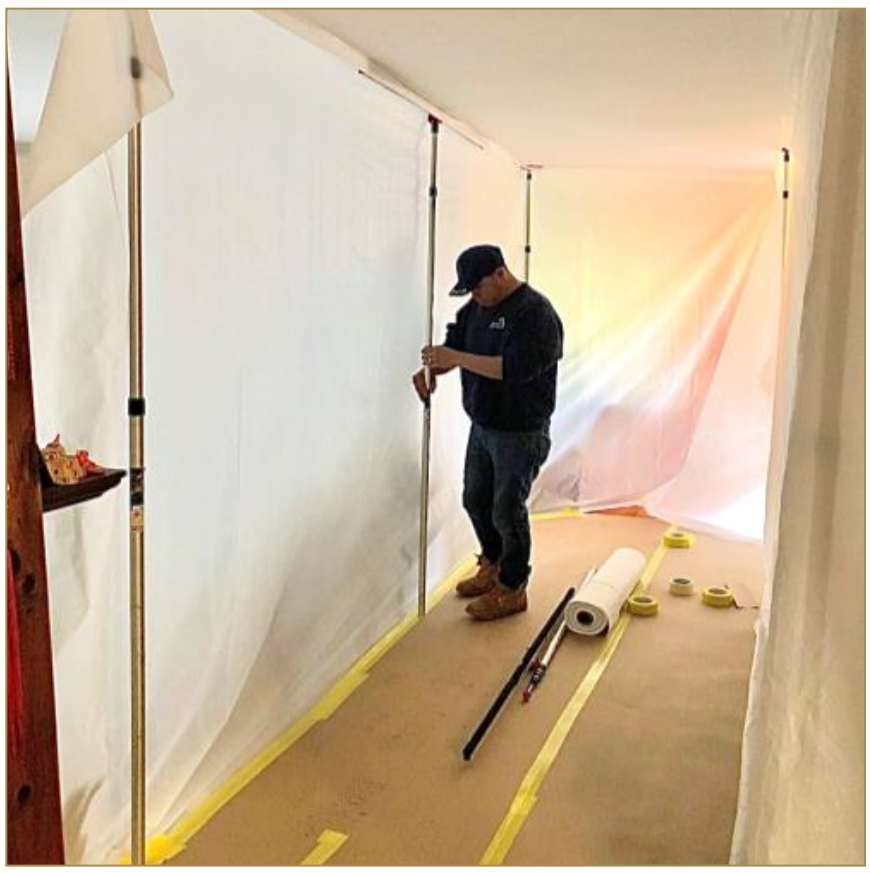
Creating a Controlled Work Environment

Before extraction begins, Dudley Services establishes a controlled, regulated work area designed to contain asbestos-contaminated insulation and protect the surrounding environment.

Using the ZipWall support system and heavy-duty six-mil polyethylene sheeting, workers construct a temporary enclosure beneath the attic entrance. Walls, ceiling, seams, and perimeter connections are carefully sealed to establish the containment boundaries.

A three-stage decontamination unit is incorporated into the work area, providing designated equipment, wash, and clean rooms for personnel entering and leaving containment.

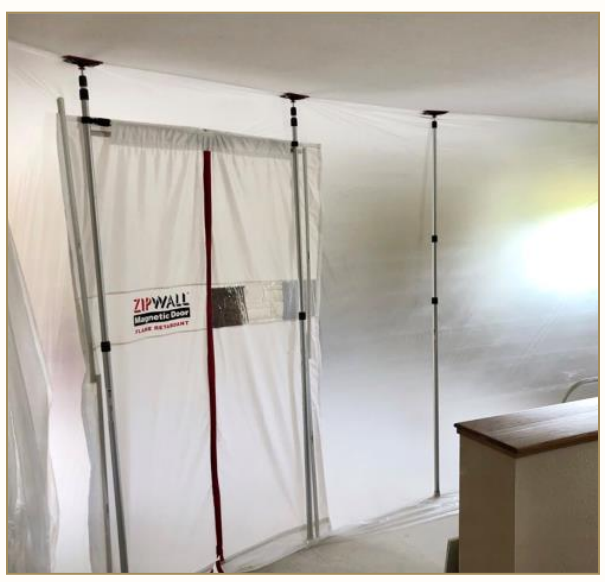
A dedicated HEPA-filtered negative-air machine is installed to maintain negative pressure within the regulated workspace. Filtered exhaust air is directed outdoors through a properly sealed opening, helping control the migration of airborne contaminants.



Installing support poles and polyethylene walls.



Sealing the polyethylene ceiling and wall seams.



Completed enclosure with a defined access opening.



Dedicated HEPA-filtered negative-air machine inside containment.

Together, these measures establish the controlled work environment necessary for the BEST extraction process.

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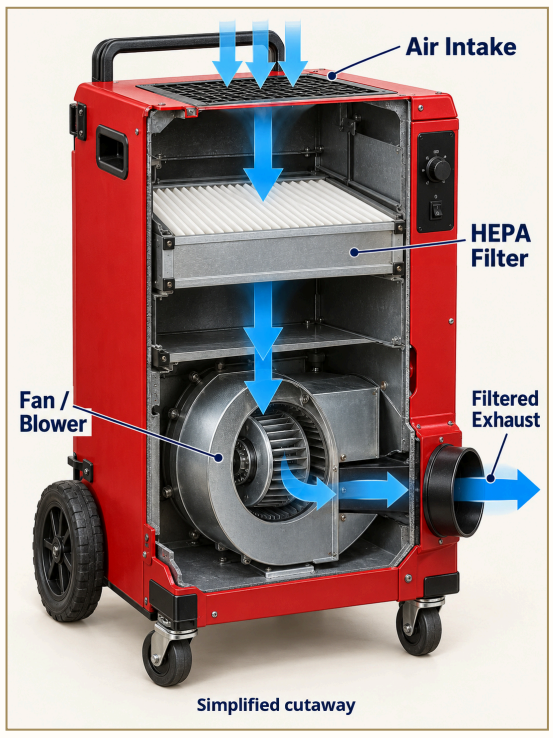
Establishing Negative Air Pressure

Maintaining Airflow Control Within Containment

Once the containment area has been established, Dudley Services installs a HEPA-filtered negative-air machine to help maintain negative pressure within the regulated workspace.

Negative pressure helps direct airflow into the containment system and toward the filtration unit, reducing the potential for airborne contaminants to migrate outside the controlled work area.

Air is drawn through the decontamination path and containment enclosure toward the negative-air machine. After passing through HEPA filtration, the filtered exhaust air is directed out of the work area through a properly sealed discharge path.



Negative-air machine cutaway showing fan, HEPA filter, and airflow path.

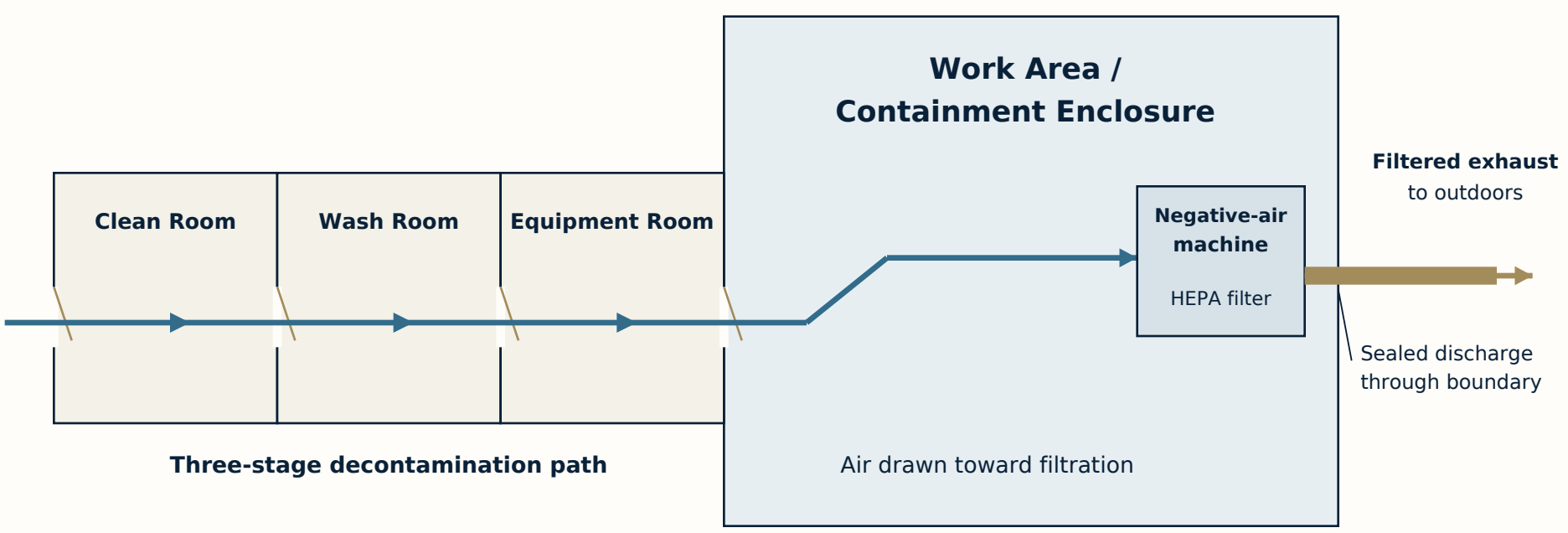


HEPA-filtered exhaust directed outdoors through a sealed window connection.

A separate system for airflow control

The negative-air machine controls containment airflow. It is separate from the exterior BEST bulk-extraction vacuums and processing drums.

CONTAINMENT AIRFLOW — TOP VIEW



Simplified airflow concept • Not to scale

This controlled airflow pattern is an important part of maintaining the integrity of the containment system and supporting the BEST extraction process.

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Installing the BEST System

Preparing the Equipment for Bulk Extraction

Once the regulated containment area and negative-air system are established, Dudley Services installs its proprietary Bulk Extraction System Technology (BEST).

The interconnected BEST processing drums are positioned within the containment area and connected to the attic extraction hose and exterior HEPA-filtered vacuum equipment.

Designed and refined through years of field experience, the BEST system provides operators with control over the extraction process while separating bulk insulation material from the downstream vacuum airflow.

An important design advantage is that the powerful, noisy HEPA-filtered extraction vacuums are positioned outside the home. This reduces equipment noise within the regulated workspace, allowing workers to communicate more easily with the team operating in the attic.

Keeping the vacuums outdoors also prevents the heat generated by their motors from adding to the already demanding temperatures frequently encountered during attic remediation. This helps improve working conditions and reduce unnecessary heat-related stress on personnel.

This innovative design helps prevent material from clogging the suction hoses leading to the exterior HEPA vacuums, reducing interruptions and the need to service clogged hoses outside the regulated workspace.

Extracted insulation is collected and securely packaged within the controlled processing area, then transferred through the designated decontamination and waste-handling route for transportation and disposal.



Dudley Services crew with the original BEST equipment.



BEST Processing System

BEST combines powerful extraction, controlled material handling, and practical engineering into one integrated system.

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Preparing the Attic for Extraction

Clearing Access and Protecting HVAC Components

Once the negative-air containment area has been fully established beneath the attic entrance, workers proceed to prepare the attic for extraction.

Floorboards are lifted, vacuumed, and stacked or removed as needed to provide access to all loose-fill insulation. Fiberglass batts and miscellaneous debris or “junk” items that may interfere with the extraction hose are bagged and removed from the work area.

Flexible HVAC ducting may be disconnected and removed where necessary, while metal ductwork and other HVAC components within the attic are prepared and protected as conditions require.



Floorboards and insulation access



Attic preparation in progress

When an HVAC system is present in the attic, Dudley Services takes additional precautions to help protect it during the extraction process. Registers, supplies, and returns associated with the system are sealed, and one selected register located outside the containment area is fitted with an inline fan and flexible duct connection.

The fan operates continuously throughout the project, creating positive air pressure within the HVAC system. This helps reduce the potential for airborne particulates generated during attic work to enter the duct system while remediation is underway.



Flexible attic ductwork



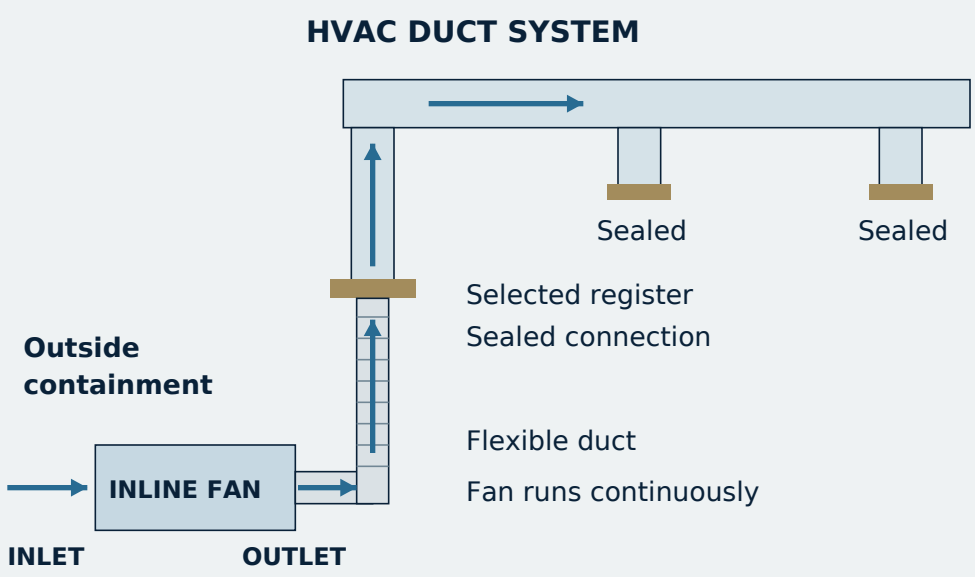
Protected duct openings

Dudley Services HVAC Positive-Pressure Protection System



Inline fan and sealed duct connection used to maintain positive pressure within the HVAC system during attic remediation.

Illustration based on an actual Dudley Services field installation.



HVAC Positive-Pressure Protection — Airflow Diagram

Simplified diagram; not to scale.

These preparation steps help create a safer, more efficient work environment and support a controlled extraction process.

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Power Up High Powered Vacuums

Continuous Exterior Suction for Safe, Efficient Extraction

Dudley Services positions two high-powered HEPA-filtered extraction vacuums outside the home and manifolds them together to support the BEST removal process.

The vacuum assembly is connected to the Bulk Extraction System through a heavy-duty 3-inch hose routed through a sealed window or other properly protected building opening. Dedicated generators provide the electrical power required to operate the extraction equipment, with each vacuum supplied independently.

By locating the extraction vacuums outdoors, Dudley Services reduces equipment noise and motor-generated heat within the regulated work area while maintaining the strong suction needed at the point of extraction.

A key advantage of the BEST process is that it helps prevent large particulates from reaching and clogging the exterior vacuums. By separating bulk material before it reaches the vacuum equipment, the system helps maintain continuous airflow and reduces the need to open or disassemble vacuum components outside the regulated process.

This is an important safety and efficiency benefit, because a clogged vacuum requiring outside disassembly could create an unnecessary contamination hazard.

Inside the Extraction System

The proprietary BEST processing drums separate and collect bulk insulation while filtering the outgoing airflow through an internal filtration system.

Filtered air from BEST then travels to the exterior HEPA-filtered extraction vacuums, where additional filtration takes place before the air is discharged.

Each exterior vacuum contains three motors that generate powerful suction. The lower shaker filter captures additional dust, while the HEPA filter provides the final filtration stage.

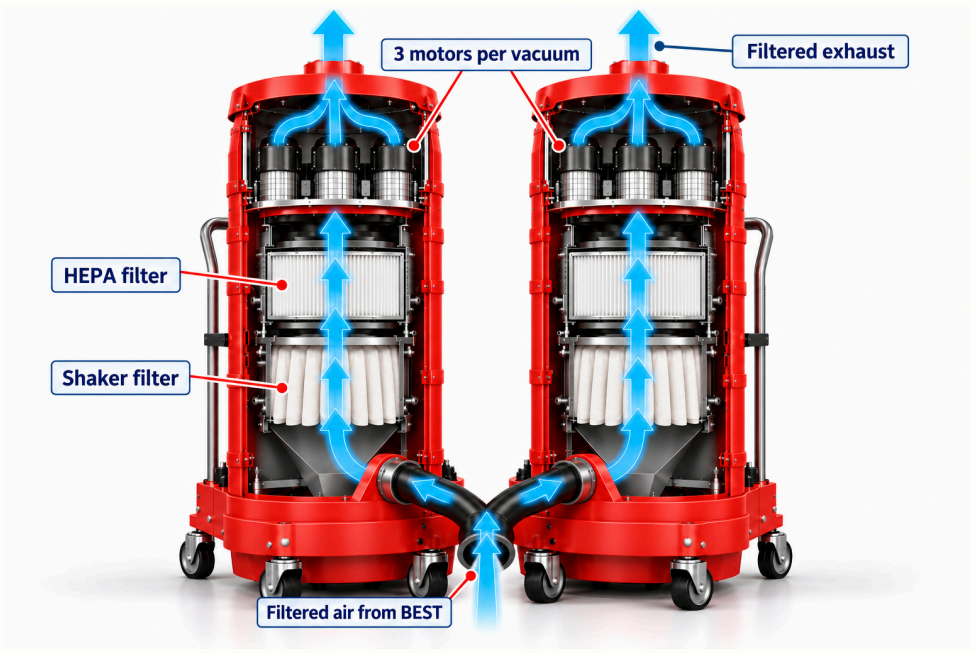
By separating and filtering material before it reaches the exterior vacuums, BEST helps reduce clogging, maintain continuous suction, and minimize interruptions during extraction.

This integrated approach provides the operator with strong, dependable suction while allowing the extraction process to be started and stopped as needed.



Exterior extraction setup — presentation illustration based on reference equipment.

VACUUM FILTRATION & AIRFLOW



Simplified overview illustration - three motors in each vacuum.



Dedicated generators — one power supply per vacuum.

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Insulation Extraction Underway

Continuous Suction, Thorough Removal, and Worker Safety

The Extraction Process

Attics can present extremely demanding working conditions, with temperatures during warm weather sometimes exceeding 110°F.

The combination of confined spaces, difficult access, protective equipment, and elevated temperatures places considerable physical demands on the abatement workers.

The BEST process provides strong, continuous HEPA-filtered extraction suction, helping workers remove large quantities of loose-fill insulation efficiently while reducing unnecessary time spent performing physically demanding work in these conditions.

Using a flexible extraction hose, trained workers remove vermiculite and associated insulation from between attic floor joists, around framing members, and within accessible cavities.

Maintaining continuous airflow is essential to the extraction process. The proprietary BEST bulk-processing system separates and collects insulation before the downstream airflow reaches the exterior HEPA-filtered vacuums. This helps reduce interruptions caused by equipment and hose clogging.



Bulk extraction of vermiculite insulation between attic framing members.



Controlled extraction of loose-fill insulation within a confined attic workspace.

Detailed Final Cleaning

Following removal of the bulk insulation, workers perform detailed cleaning of accessible attic surfaces, framing, and cavities.

This secondary cleaning phase addresses residual loose insulation, dust, and debris that may remain following initial extraction.

Where asbestos-containing or presumed asbestos-containing material cannot be safely accessed and removed, its location must be documented and the remaining material appropriately controlled in accordance with applicable requirements. Where appropriate and permitted, remaining material may be securely covered or encapsulated and conspicuously identified for future contractors.

Watch BEST in Action

Actual attic insulation extraction demonstration

youtu.be/YETdH3DWJ8U

BEFORE & AFTER

BEST Attic Insulation Extraction

BEFORE



Attic conditions before completion of insulation removal.

AFTER



Exposed attic floor cavities following BEST extraction and detailed cleaning.

The objective is a thorough, controlled extraction process that protects workers, building occupants, and the surrounding environment while preparing the attic for inspection and clearance.

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Project Completion with Final Clearance Inspection





Final air-clearance testing performed by an independent third-party project monitor.

Independent Final Clearance Inspection

Following insulation removal and detailed cleaning, an independent third-party project monitor inspects the regulated work area and performs the required air-clearance testing to verify that applicable clearance criteria have been met.

The inspection and clearance process is completed before the regulated containment system is dismantled.





Cleaned attic conditions following BEST extraction and detailed cleaning.

Containment Removal and Waste Disposal

Once final clearance has been achieved, the interior containment plastic sheeting is carefully removed, sealed, and disposed of as asbestos-containing waste.

The temporary containment structure is then dismantled under controlled conditions, with remaining protective materials removed appropriately.

Final Cleaning and Property Inspection

Following dismantling, the work area and surrounding protected surfaces receive a final cleaning and inspection for residual dust, debris, and any damage to the home's surfaces or finishes.

Any identified damage is documented and addressed before the project is considered complete.

Our goal is to leave the customer's home clean, protected, and ready for the next stage of home improvements.

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