VACUUM TRANSPORT OF HIGH-BULK ASBESTOS-CONTAMINATED MATERIALS

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Abstract

The labor-saving, time-saving and safety-enhancing benefits of vacuum transport of asbestos and asbestos-contaminated materials (ACM) are becoming well documented and well understood. However, most experience with vacuum transport involves removal of sprayed material or contaminated dirt, which tend to be loose, fluffy and easily vacuumed using normal means (Figure 1). Specially designed shredders, placed in the abatement area and discharged directly into the vacumm hose, are changing this -- allowing vacuum transport of many types of high-bulk materials, including large pieces of pipe insulation, floor tiles, ceiling tiles and wallboard. The paper explains the types of shredders available, their strengths and limitations, correct operating procedures -- and how to determine whether shredding and vacuuming are actually preferable to conventional transport methods on a given project.

Figure 1
Vaccums have traditionally been used on loose, fluffy materials.

Introduction

Potentially, anything can be vacuumed. Even the Empire State Building, if it were broken into small-enough pieces, could be a candidate for pneumatic transport by a high-powered vacuum machine.

Realistically, of course, there would be more efficient ways to dispose of the rubble. But the concept remains valid: What is transportable by vacuum is not only a function of the vacuum itself; it is also a function of the ability to reduce bulk. In the specific case of asbestos or ACM removal, vacuum transportability is a matter of ensuring that pieces will pass through the 5-inch hose connected to a HEPA filtered vacuum machine (Figure 2).

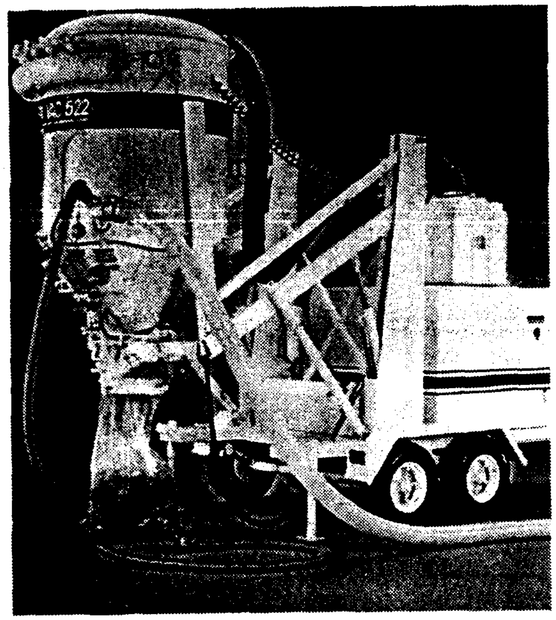

Figure 2
HEPA VAC 522A asbestos vacuum.

Sprayed-on fireproofing or chunks of asbestos block, for example, can usually be handled with a vacuum hose alone, or with simple bulk-reduction techniques often overlooked. So can contaminated dirt. There is no need to break down pieces that already fit in a hose. Even those that are somewhat bulky may be sufficiently broken down by the action of a vacuum hose or the force of transport to allow easy bagging when discharged from the vacuum machine.

The Bulk Handling Problem

Seldom, however, are abatement jobs so simple, or ACM so homogeneous. Removal and disposal of ceiling tiles and floor tiles, or large pieces of pipe insulation and wallboard, are routine in abatement jobs, and are becoming more so. Clearly, the trend in abatement today is complete removal of all asbestos and ACM, not just that which is currently friable. So the need for safer and more efficient transport of bulk materials is continually growing.

Mechanical shredding systems are one tool that, properly applied, can help meet this need by expanding the benefits of high-powered vacuum transport even to bulky materials not otherwise suited to vacuuming (Figure 3). On the face of it, shredding asbestos may seem dangerous, an invitation to contamination through fiber discharge. But when the shredder is set up in the containment area and discharges directly to a vacuum line, the process is not only safe, but may be the safest way of all to handle bulk ACM, depending on the application. The safety results from the fact that bag and material handling and passage into and out of the containment are greatly reduced. The material flows out of the containment area directly through the shredder and vacuum hose, then is deposited in approved asbestos bags at the vacuum machine. There, the bags are tied off and disposed of without additional handling (Figure 4). According to field studies by Vacuum Engineering Corporation, a manually filled asbestos bag is typically handled eight times

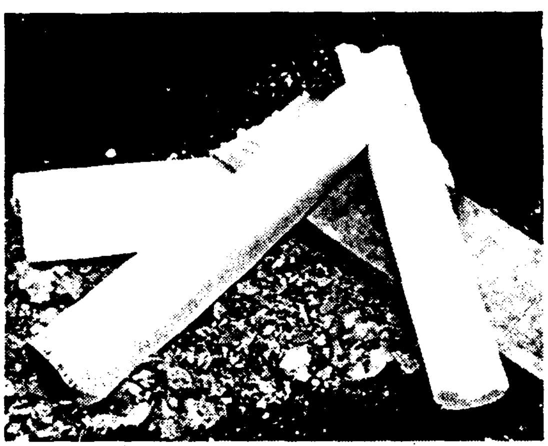

Figure 3
A shredder allows even bulky materials to be vacuumed.

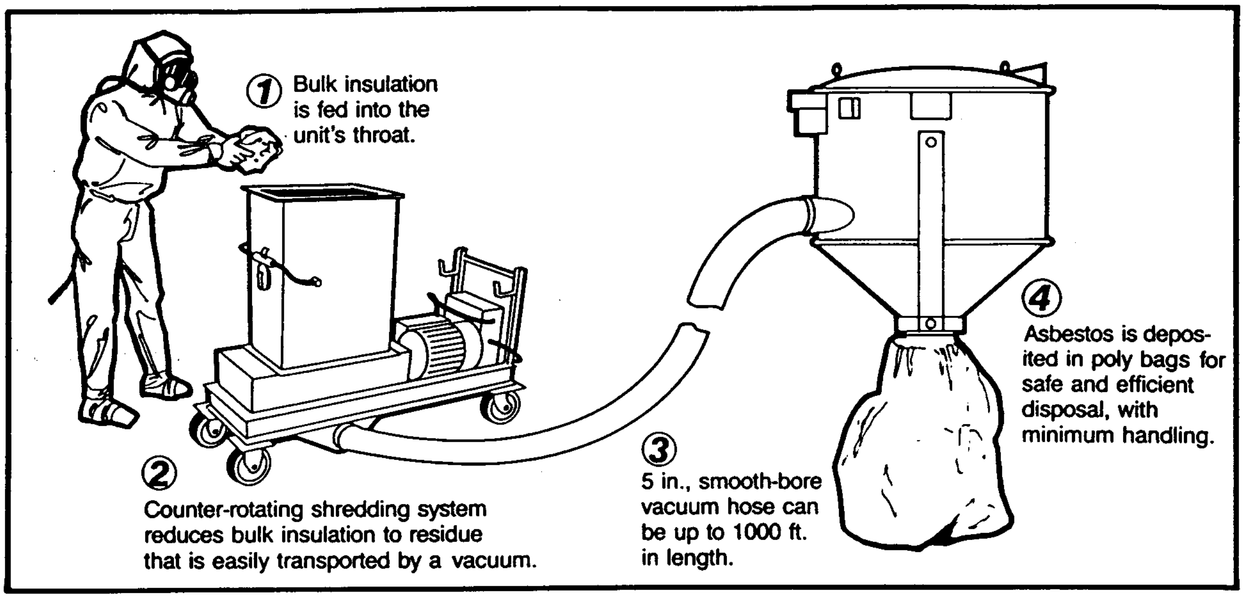

Figure 4

Diagram shows key elements of asbestos shredding system.

within the containment area, then another three to four times as it is transported to the disposal area, for a total of 11 or 12 times. With a vacuum machine, the bag needs to be handled only once -- a much safer and far more efficient alternative.

While greater safety and higher, more efficient production are two of the most important benefits of shredding and vacuuming, they are not the only ones. Another is the potential for substantial savings -- up to 75 percent -- in waste hauling costs and landfill tipping fees. This is the result of the inherent compaction and bulk reduction that comes through shredding and vacuuming. How all these benefits add up will determine whether shredding of bulk material is appropriate on a given project.

When to Consider a Shredder

Let us state from the outset that shredders, while of great benefit in many applications, are by no means a fool-proof solution to every bulk handling problem. In fact, in many cases where a shredder at first glance seems to be the answer, it actually may be unnecessary. Like any other other tool, a shredder must be properly applied. Here are three key questions to analyze before determining whether to use a shredder and vacuum on a given job: One, how accessible is the containment area? Two, is the ACM shreddable? And three, once shredded, is the ACM flowable?

We will examine accessibility to the containment area first. The question to ask here is: How time-consuming or labor-intensive would it be to use conventional "bag and drag" techniques? On jobs involving easily accessible, little-used sites (like a school building vacant during summer), it may well make sense to use the vacuum machine without a shredder on smaller, looser material and to palletize, wrap and manually transport tiles, wallboard and higher bulk materials.

On other jobs, the transport distance may be so short, or the relative volume of debris so small, that "bagging and dragging" alone is the best answer. The point is, just because a technology exists doesn't mean it's always appropriate to use it. No one needs the space shuttle to travel to the store for a loaf of bread.

Still, most successful contractors and consultants do not limit themselves to projects where the containment is close or convenient to the lugger box. Power plants, high-rise office buildings, crawl spaces, tunnels, ships -- these high-ticket abatement venues are seldom, if ever, easily accessible.

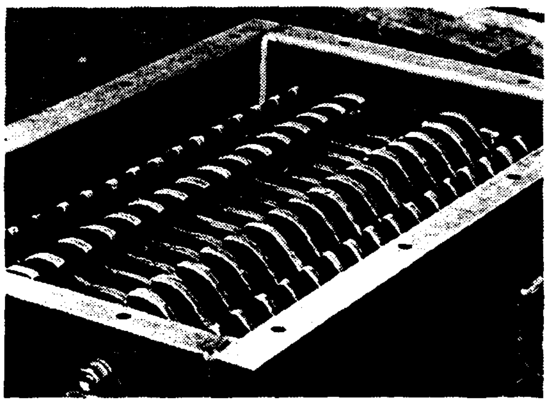

Figure 5
Internal mechanism of ACM shredding machine.

Entrance and exit routes in power plants are notoriously few and indirect, often involving cramped elevators. Transporting palletized bulk material from the top-floor containment area in a busy office building to a ground-level disposal site has its own problems. These can involve numerous corridors, corners, severe resitrctions on elevator access and curious onlookers -- among other concerns. Here, the benefits possible by combining a shredder and vacuum are usually great enough to justify the investment. It is not at all unreasonable to expect a shredder to pay for itself in just one such project. That is, of course, provided the material to be shredded meets certain requirements.

That leads to the other two critical issues that must be analyzed before determining whether a shredder is applicable to a given job: Is the material shreddable? And, just as important, is it flowable? Put another way, once shredded, can the material be readily sucked out of the shredder and down the vacuum hose?

To help determine whether the material is sufficiently shreddable, ask yourself whether it can be torn ... not cut, not ground, but torn. That is the action of an ACM shredder, a fact that's easily discernible when one studies the counter-rotating shredding mechanism of an ACM shredder (Figure 5). To help determine whether the shredded material is sufficiently flowable, think what would happen if you squeezed a handful of it. Would it remain relatively loose and free flowing? If so, excellent. If, however, it would form a tight, uniform ball, you may experience flowability problems.

Based on their shreddability and flowability, groups of bulk materials can be classified as good shredder applications, possible shredder applications, or poor shredder applications. Figure 6 makes some of these comparisons. These classifications are, of course, to be used only as a guide. Let experience, hands-on knowledge of the materials and common sense be the final determining factors.

Good Shredder Application
- Ceiling tiles
- Air cell pipe insulation
- Wound-paper pipe insulation
- Rag-wrapped pipe insulation
- Plaster-coated pipe insulation
- Plaster board
- Brittle, old floor tiles
- Cooling tower media
- Old, brittle asbestos roof tiles
- Old, brittle asbestos siding
- Transite siding
- Flourescent tubes

Possible Shredder Application
- Asbestos pipe, block or sheet
- Chicken-wire-reinforced pipe insulation
- Cementitious elbows
- Newer asphaltic tiles, roofing and siding
- Soft fire brick
- Caked fly ash
- Fiberglass

Poor Shredder Application
- Aluminum strips
- Metal ceiling-tile supports
- Wood
- Heavy-wire-reinforced pipe insulation
- Wire and wood lath
- Plastic sheeting
- Tyvek uniforms
- Built-up roofing
- Rubber roofing
- Carpeting
- Vinyl flooring
- Light fixtures
- Ductwork
- Hard fire brick
- Unsorted general debris

Figure 6
Classification of bulk materials.

How to Choose a Shredder

Figure 7 shows five types of elementary, but very effective, shredding devices for many kinds of bulk ACM. Before rushing headlong into use of a mechanical shredder, seriously ask yourself whether a hammer, hatchet, ice scraper, rake, or the end of the vacuum hose might really be all you need to break large chunks into smaller pieces that will fit through a vacuum hose. You may be surprised at what "low-tech" can do, particularly if the structure of the material to be broken down is relatively weak. Don't force a technical solution on the problem when a simple solution will do.

Of course, there still will be plenty of jobs where, based on material volume, material type and transport concerns, a mechanical shredder will be the choice. Fortunately, there are machines specifically engineered and manufactured to be ACM bulk handling devices. The best of these incorporate operational and safety features appropriate to the containment environment, are precisely matched to a full-featured asbestos vacuum machine, and have been thoroughly field-proven.

Figure 8 shows the two basic types, both powered by electric motors. One type of shredder is designed for pipe insulation. This has a wide throat to accept insulation up to a 16-inch half shell. Its angular chute makes the machine easily maneuverable for positioning in cramped areas. The second type is designed for high-bulk materials up to 1 foot by 2 feet. Physically, this is the largest production-model shredder of all and therefore

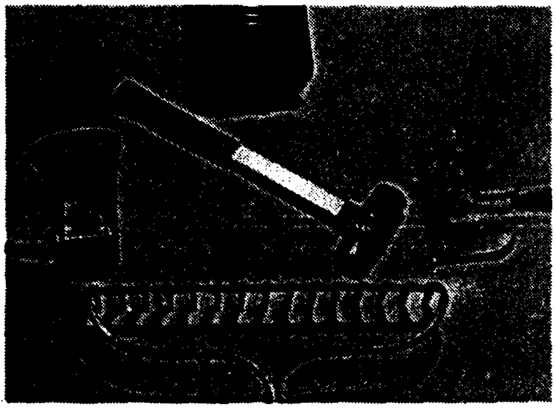

Figure 7
Elementary, but effective, shredding devices.

will handle the greatest variety of materials. Other types of shredders may be available by special order.

Shredders can be made for metal, such as wire lath. However, this has not been generally successful in abatement work since metal shredding and insulation shredding are seldom compatible. Insulation shredding, because of the relative shreddability of the material and the typically large volume to be processed, is best accomplished by a high-speed, high-output device. Metal shredding, on the other hand, demands greater torque and therefore correspondingly lower cutting speeds -- too slow for the kind of bulk generated at a typical abatement site. Plus, metal shredders are typically very heavy, hard to maneuver and expensive to own and operate. Any system that shreds both heavy metal and insulation is a compromise and is probably best avoided. In almost all instances, then, it is advisable to strip thick metal from the bulk material -- sending the insulation through the shredder or directly through the vacuum hose, and setting the expanded mesh or other metal aside for staging into a barrel compactor or other handling means.

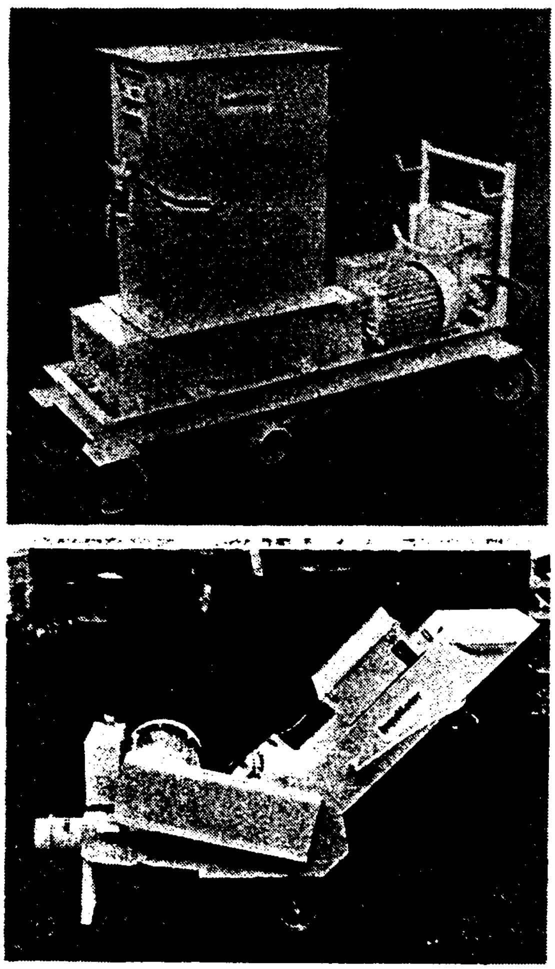

Figure 8
High-bulk shredder (top); pipe-insulation shredder (bottom).

And a final warning about shredding metal: Vacuuming shredded metal can be like vacuuming razor blades. While it's probably not going to be tough on the vacuum hose or vacuum itself, it will almost be disaster for the asbestos bag. Any shredded metal in the vacuum stream will require the added expense and trouble of placing the poly bags in 55-gallon drums or other "needleproof" containers.

Some Real-Life Examples

There is no question that an ACM shredder, properly applied, is a machine of great value. Dozens of contractors can attest to this.

Yet there remains the tendency among many to apply the shredder where it is not always necessary, or to apply it incorrectly and on inappropriate materials. For one reason or another, the shredder has become viewed as a fantasy solution to all difficult-to-handle materials. As the following examples show, that often is not the case.

Case No. 1: "Too close for comfort."

A field technician from Vacuum Engineering, on a routine customer visit, discovered workers gathered around a pile of damp ACM set outside a steel mill building. Less than 100 feet from the debris, across open level ground, was a secure dumpster. But instead of manually bagging up the debris and carrying it to the dumpster, which would have been the easiest and most efficient thing to do, the crew had gone to the trouble and expense of setting up a shredder and vacuum machine. *The lesson: Don't close your eyes to the simple solution.*

Case No. 2: "Watch your diet."

A large collection of assorted debris, from asbestos pipe insulation to hammer heads, angle irons and pipe elbows was ready for disposal at a demolition site. This is the ultimate shredder fantasy. The crew assumed all that was necessary was to simply dump the material in the shredder, and it would disappear neatly down the vacuum hose. But the shredder kept jamming on the metal, which it was not designed to handle. *The lesson: Fantasy and reality don't mix, and neither do heavy metal and ACM. Sort before you shred.*

Case No. 3: "An asphyxiation situation."

A veteran vacuum operator, when sucking up low bulk material, knew from experience that he couldn't just plunge the hose deep into a pile of material. That would choke the hose -- not allowing it sufficient air to convey the material. But he failed to realize that the same thing would happen if he dumped wheelbarrow loads of material into a shredder. *The lesson: Don't over-feed a shredder. Give the vacuum hose enough air to breathe.*

Case No. 4: "A gooey problem."

Soaking wet pieces of soft insulation were being loaded into the shredder at an appropriate feed rate. But instead of exiting the machine cleanly, much of the shredded material became caked to the machine's walls, eventually halting production. Clearly, the material became too sticky to be flowable in its shredded form. Our technician suggested breaking the pieces up with a hatchet or the end of the vacuum hose rather than shredding. The small "chunks" of wet material that resulted from the simple bulk-reduction method vacuumed just fine, even though the shredded material had turned into glue. *The lesson: Flowable in bulk doesn't necessarily mean flowable when shredded.*

Again, these examples are in no way meant to deter anyone from considering a shredder. The purpose is merely to forewarn about potentially troublesome situations so that the shredder is correctly applied to jobs where its high productivity is best utilized.

Conclusion

Shredding systems can extend the labor-saving, time-saving and safety-enhancing benefits of vacuum transport to abatement projects involving bulk material. On traditionally vacuumed materials, contractors have documented a 60% or greater reduction in time, labor costs, bagging materials and disposal fees compared with manual transport. With shredding, similar savings can extend to ceiling tiles, pipe insulation, plasterboard and other high-bulk materials.

Typically, the greatest benefits will be achieved on sites where material quantities are large, transport distances substantial, access routes inconvenient, and material predictably shreddable and flowable. It is important first to analyze all possibilities. Then, if mechanical shredding is deemed to be the best solution, choose a shredder matched to the vacuum system and the application, and one specifically engineered for and proven in asbestos abatement work.