PROCESS FOR REDUCTION OF VOLUME OF CONTAMINATED SOIL BY COMPACTION

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ABSTRACT

Burial costs for low-level radioactive waste are assessed by the volume of the waste. These costs are presently at $10 per cubic foot and will continue to increase with time. A reduction in waste volume can be directly converted to a reduction in burial costs.

A large amount of low-level contaminated soil exists throughout the DOE complex. The Nuclear Complex Modernization Task Force has identified over 5 million cubic feet of contaminated soil for eventual clean-up at the Mound site ($50,000,000 to bury at FY1991 costs).

By using a combination of a clay soil compactor, automatic loading system, specially designed dust enclosures, and specifically designed containers for both on-site haulage and shipment to the Nevada Test Site (NTS), the total waste volume, and burial cost, can be reduced by up to 30% by compacting the soil into high-density "bricks" (depending upon the compaction quality of the soil). Several tests have been performed on Mound's cold on-site soils, with resulting densities of 131 pounds per cubic foot. When this is compared to normal LSA metal box filling of 80-90 pounds per cubic foot, one can readily see the savings.

INTRODUCTION

This paper addresses the problem of processing large volumes of LSA-clayey-type soils which exists throughout the DOE complex. In particular, those problems are three fold; high shipping costs to DOE, high burial costs to DOE, and millions of cubic feet of contaminated soil.

The conventional method has been, as always, to dig up the soil very carefully so as not to exceed ALARA limits with a backhoe and dump the soil very carefully into an LSA box. The soils are removed-in-situ-at desities from 100 to 115 pounds per cubic feet and dumped (loosely)in the awaiting box (uncompacted) where their desities range from 80-95 pounds per cubic feet. The production has averaged, at our site for the past 10 years, about 8 boxes (100 cubic feet each box) per day at an average box weight of 8000 pounds (gross weight).

NEW APPROACH AND SOLUTION

Mound wanted to overcome the high costs and time of the conventional old methods by evaluating end needs, examining options, and designing a process introduced as the "Contaminated Soil Compaction System" (see Fig. 1) which this author has been working on for the last five (5) years.

This process utilized proven brick making technologies; it adapted proven (same as used for containing industrial high dust producing material) dust enclosures to standard brick making equipment; and specially designed automatic box loader (or a "brick setter" as commonly called).

This paper addresses only the "heart" of the process, "Brickmaking System" and "Automatic Box/Pallet Loader" at this time as we are concentrating on working out the "bugs" and making necessary equipment adjustments toward a more efficient operation. We are now also in the process of writing necessary H.P. and sampling plans and of obtaining permits to go into a "hot" operation this spring. When we have successfully demonstrated feasibility for a "hot" operation and have finalized "Digging Operation", (including a rock separation operation), "Haulage", and "Stockpiling" procedures/processes, this author will issue a second paper. This second paper will include the Sampling Plan utilized and the Environmental Analysis and Results associated with this new approach which for clayey-type soils, will revolutionize volume reduction methods for LSA clayey soils.

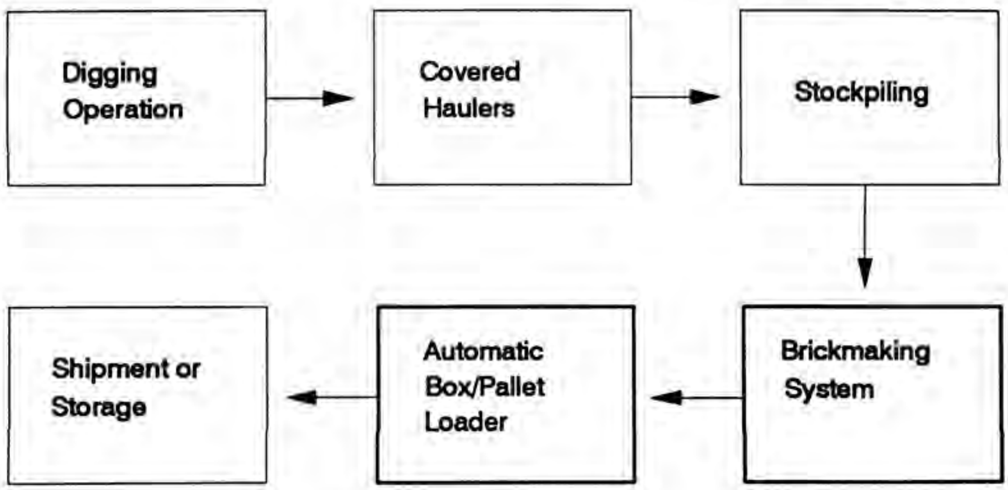

Fig. 1. Contaminated soil compaction system.

The unique feature of this newly developed contaminated soil volume reduction systems include (see Fig. 2): a soil compaction "Brick Making System", which is essentially a "portable" brick manufacturing plant (without the kiln) including an infeed hopper 1), disintegrator/grinder/even feeder 2), extruding/pug mill 3), and an automatic box and/or pallet loader 4) which takes the brick columns and loads them automatically onto pallets or into LSA boxes.

This equipment is skid mounted with quick connections for detachment and is housed in an open ended portable cloth-covered, three-sided shelter. The equipment has a 30-40 year life span when the material (clayey soil with (-)4 inch rock) throughput is limited to 10 tons per hour. All machines can be broken down and loaded onto three semitrailers and transported from site to site.

As indicated by the next series of figures, the sequence of operations for the soil compaction system is as follows: The contaminated soil is dug up at its source and loaded via dedicated (hot) end loader bucket into the feed hopper (Fig. 3). Having been fed through the disintegrator via a series of conveyors and into the compactor, a nominal 8" x 8" brick is extruded from this point (Fig. 4) onto the box loader operation where it is cut, indexed, and picked up (Fig. 5). From here it is automatically transferred to an awaiting box where it is off loaded (Fig. 6). The columns of clay are neatly stacked automatically into the metal LSA box (Fig. 7) which results in a 25-30% volume reduction due to the highly compacted soils (120-131 lbs. per cubic feet densities), as seen in Fig. 8.

RESULTS

On October 15, 1992, we successfully filled, automatically, a newly designed "smaller" brick box (figure 8) for a net volume reduction savings of 26.2%.

Based on a survey of pertinent information and discussions with people who are knowledgeable in the field, we believe that this system is unique based on the following criteria: utilization of time tested clay working machinery (from the brick making industry) and specially designed box loading equipment, coupled with special dust controls, resulting in 25-30% savings on contaminated soil burial volumes, and subsequent costs; installation of the above equipment onto skids, allowing the system to be loaded up and moved (or pulled) from site to site (or "hot" spot to "hot" spot); and the housing of the system in a portable rubberized (commercially available) shelter. These operation criteria make this a true prototype system in the contaminated soil waste minimization effort.

Potential applications of this technology are not limited to the DOE and DOD communities, but may extend to the public sector as well.

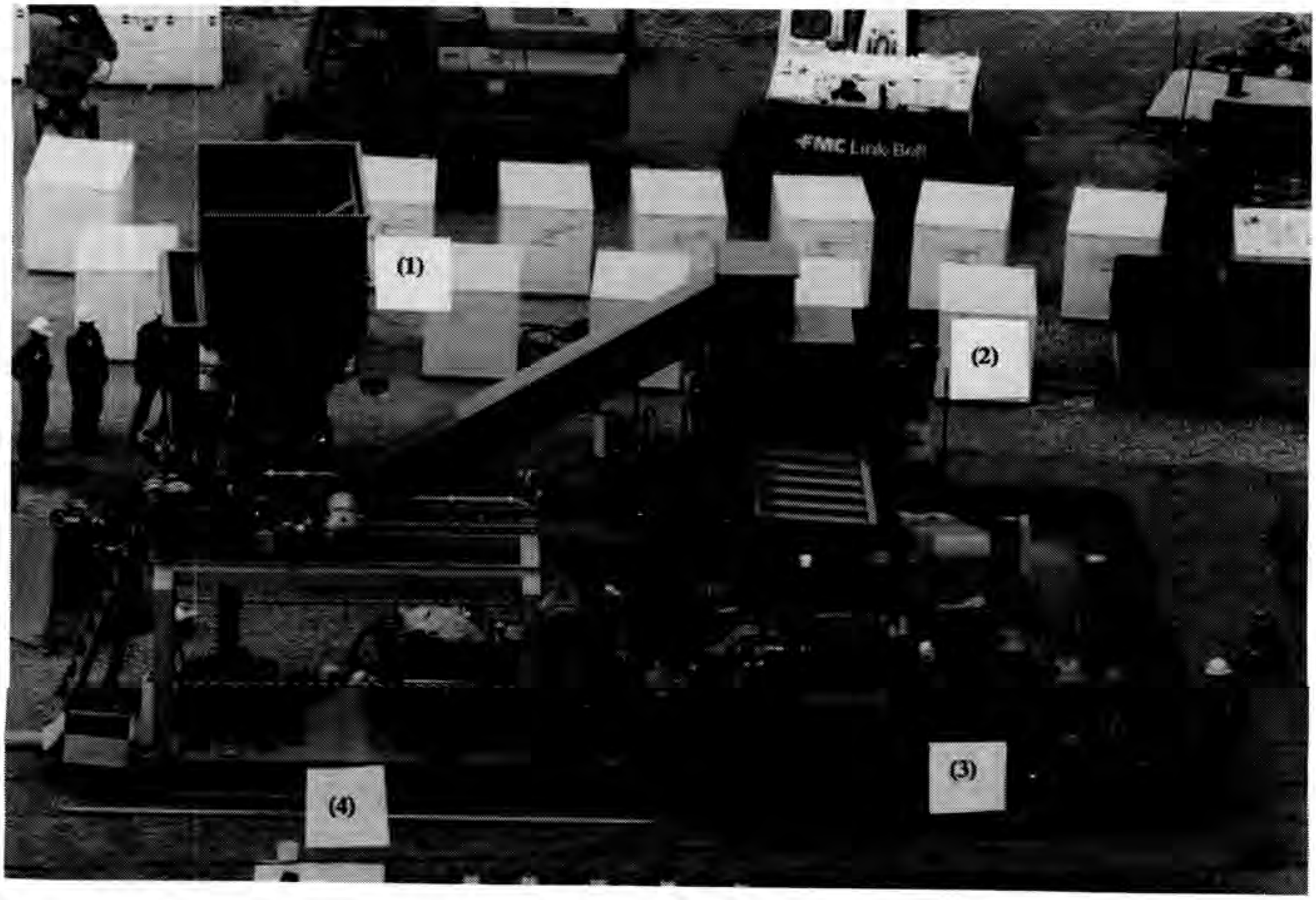

Fig. 2. Brick making system.

Fig. 3. Infeed hopper.

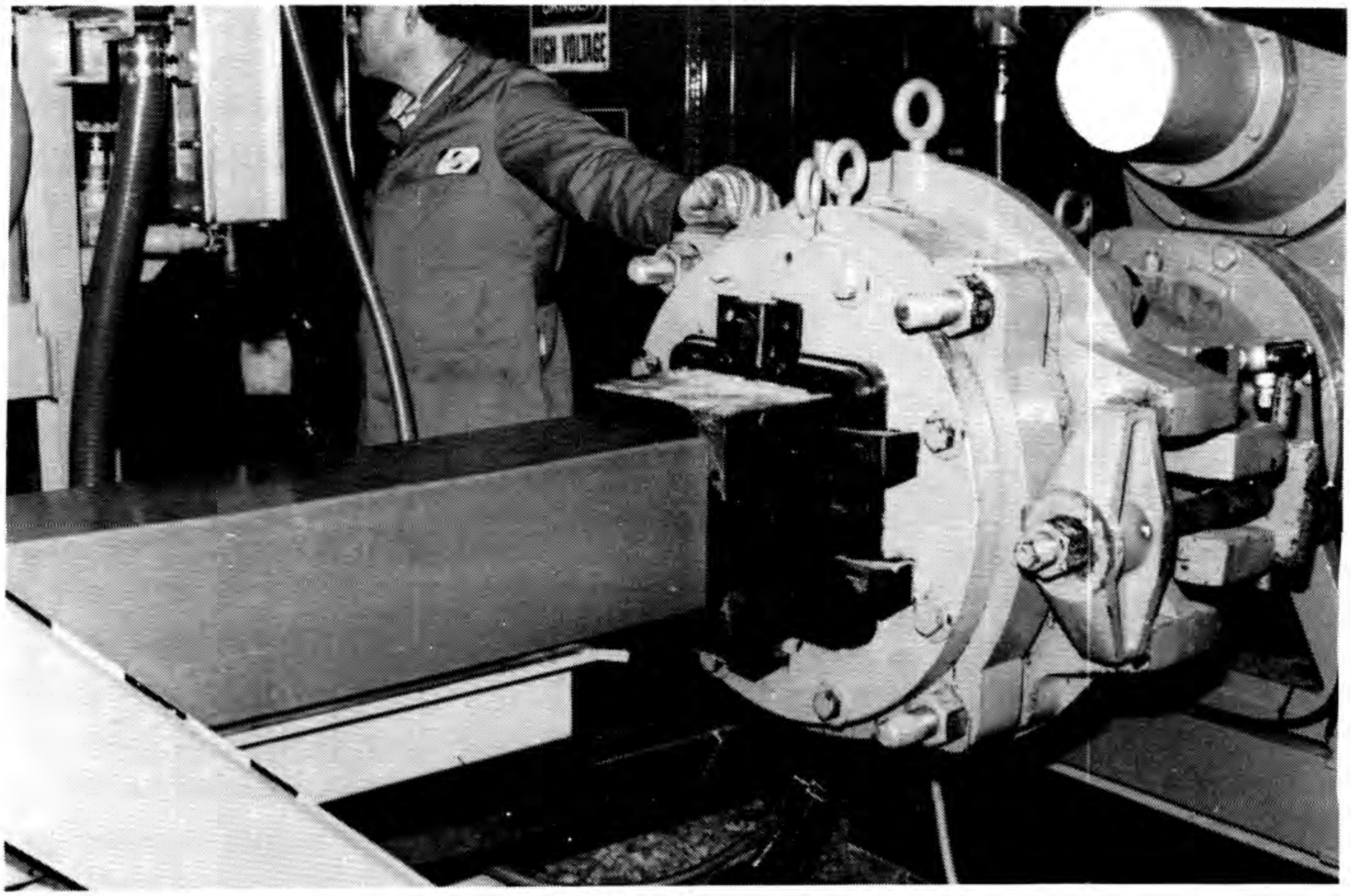

Fig. 4. Extruder/compactor.

Fig. 5. Brick setter (cut, indexed, and pick-up).

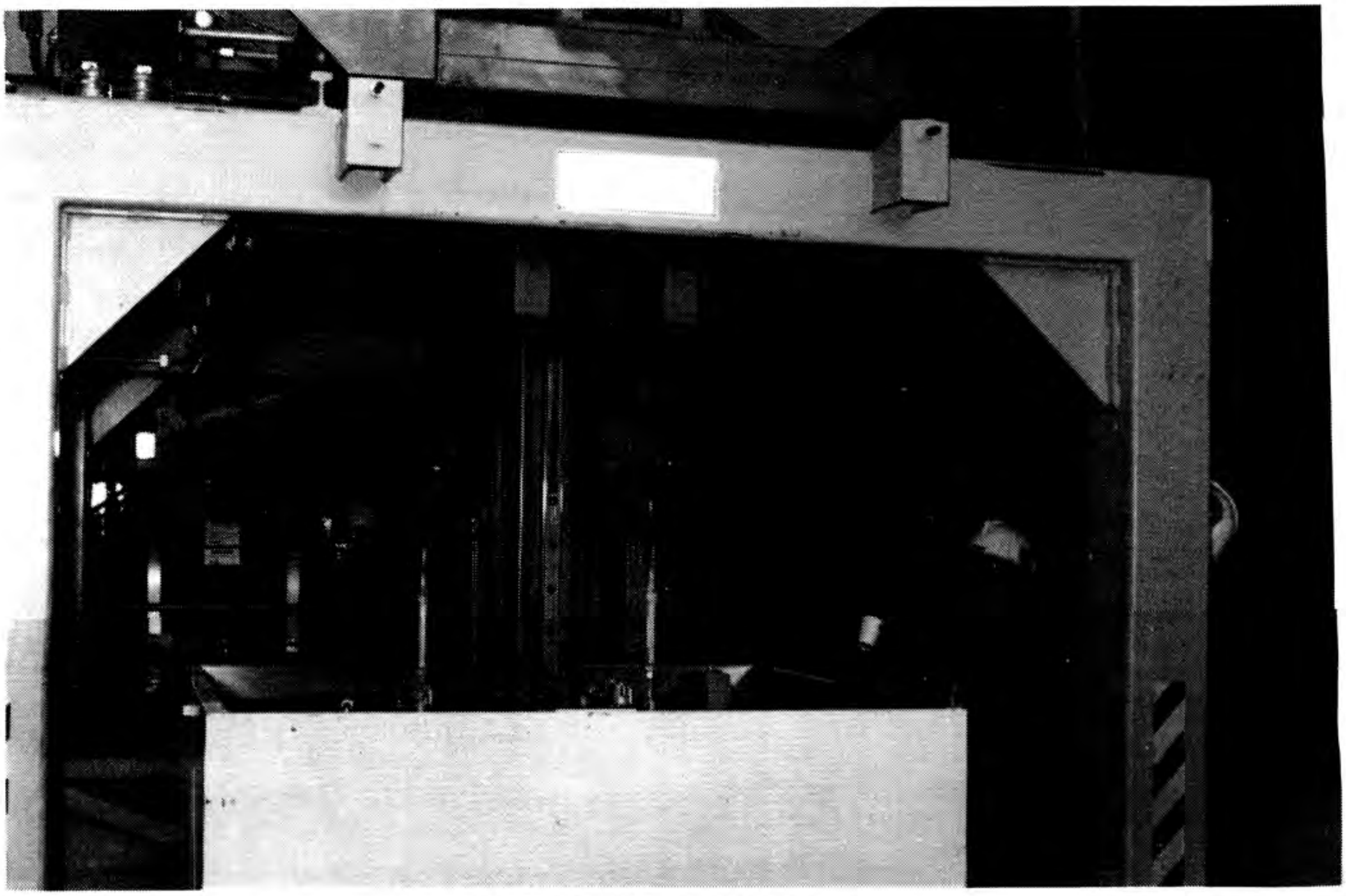

Fig. 6. Brick being loaded into box.

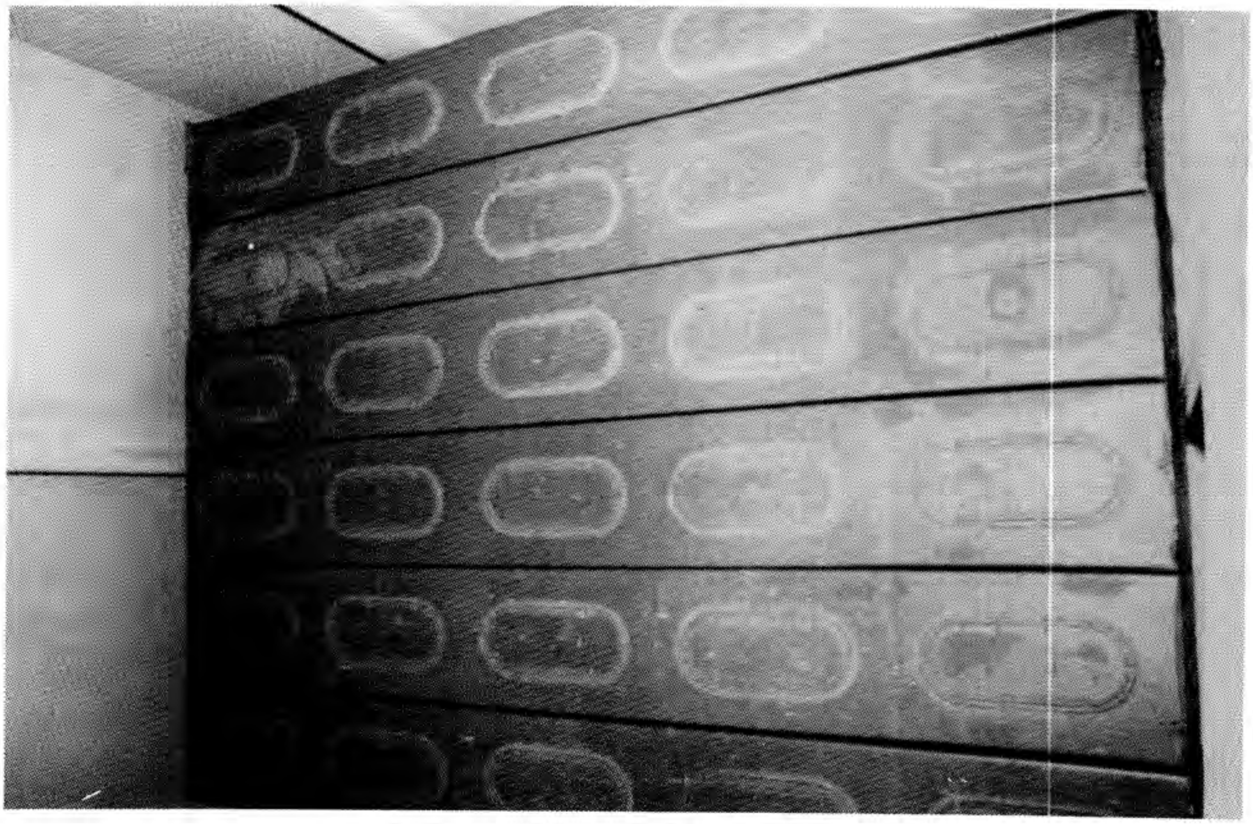

Fig. 7. 1st stack (row) of bricks set inside box.

Fig. 8. A savings in volume reduction.