CLEANUP OPERATIONS AT THE OAK RIDGE GASEOUS DIFFUSION PLANT CONTAMINATED METAL SCRAPYARD

L. C. Williams
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831

ABSTRACT

Cleanup operations at the contaminated metal storage yard located at the Oak Ridge, Tennessee, Gaseous Diffusion Plant have been completed. The storage yard, in existence since the early 1970's, contained an estimated 35,000 tons of mixed-type metals spread over an area of roughly 30 acres. The overall cleanup program required removing the metal from the storage yard, sorting by specific metal types, and size reduction of specific types for future processing. This paper explains the methods and procedures used to accomplish this task.

INTRODUCTION

As a result of the diffusion cascade improvement and upgrading programs at the Oak Ridge Gaseous Diffusion Plant (ORGDP), a large quantity of scrap metal contaminated with low-enriched uranium, Tc-99, and trace quantities of transuranics was accumulated. Small amounts of these radioactive materials were deposited on the surface of the metal in the gaseous diffusion process. Although the scrap metal was cleansed of gross deposits, complete removal of the residual contamination was not attempted. Legal restrictions currently prohibit the sale of any material containing enriched uranium; however, this material is considered as a resource with potential economic value as was being stored above ground at the ORGDP in anticipation of reclamation.

An aerial view of the contaminated scrap metal storage area prior to the start of cleanup operations is shown in Fig. 1. A ground-level view is shown in Fig. 2.

PROJECT DESCRIPTION

This project consisted of the cleanup of the ORGDP contaminated scrap metal storage yard. This storage yard, in existence since the early 1970's, contained an estimated 35,000 tons of both ferrous and non-ferrous scrap metal. Carbon steel comprised about 75% of the total weight, with lesser amounts of aluminum plus other ferrous and non-ferrous materials. After removal from the scrapyard, the various metals were segregated as to specific types. The carbon steel was size-reduced by a hydraulic shear to a form and size suitable for feed to an electric induction melting furnace. Other metals not suited for future smelting were size-reduced and stored in manageable configurations until final dispositon is determined. Segregation of the various metal types was maintained throughout the program.

CONTAMINATION LEVELS

Most of the scrap had undergone wet chemical decontamination to remove the major portion of the surface contamination. Estimates of contamination levels remaining on the scrap metal were based on surface smears and readings. As noted earlier, the primary contaminants are uranium and Tc-99. Since the diffusion plant upgrading programs concentrated on the lower-enrichment cascades, the uranium contamination is predominately low-enriched to depleted (<0.711% U-235) uranium. The average enrighment was estimated to be between 1% and 1.5% U-235 and has a specific activity of 0.36 Ci/g and is of biological concern only from the standpoint of ingestion or inhalation. The Tc-99 is a beta emitter with a specific activity of 17 mCi/g.

The concentration levels of these two contaminants varied widely, even on similar components. Uranium concentrations varied from a few parts per million up to several thousand parts per million. Values of Tc-99 ranged from <0.02 ppm to 70 ppm. For most of the scrap, uranium concentrations were estimated to be less than 200 ppm, and Tc-99 was expected to be below 5 ppm for 85% of the scrap metal.

PROCESS DESCRIPTION

A subcontract was awarded to the Quadrex Corporation of Gainesville, Florida, and Southern Metal and Alloys Corporation of Rockwood, Tennessee, in September 1983 to do the scrapyard cleanup. Quadrex had the overall responsibility for the work, including all health physics (HP) aspects. Southern Metals furnishes the equipment and manpower for the acutal metal movement and processing within the yard. Since the scrapyard area is classified as a contamination control area, all subcontractor personnel were required to conform to the same controls and procedures as company personnel. The contractor personnel were given a radiation-contamination training orientation prior to beginning field work, and all site workers underwent monthly urianlysis testing. The scrapyard outer perimeter had sufficient air samplers to detect any unexpected airborne contaminants that could be generated due to moving metal from the piles. All precautions were taken to protect both the scrap workers and company personnel working adjacent to this particular area.

The subcontractor work force includes six health physics personnel and approximately 20 scrap workers. The actual scrap processing started with a HP survey of the specific area of the yard to be cleaned. A survey team first did a beta-gamma scan of the scrap

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and also a visual inspection for large deposits of uranium compounds that will show as yellow, green, or white deposits on the metal. Any metal with beta-gamma reading greater than 100 mR/h or 250,000 disintegrations per minute (dpm) per square centimeter was marked for special handling. All other metals were color coded for removal and further processing. After the HP survey, the metal was removed from the yard by the specific type--steel, aluminum, metals designated as refuse, or other types. The metal was loaded into trucks using both magnetic-crane pickup for ferrous materials and clam-shell pickup for non-magnetic materials. The loaded trucks were weighed and the metal transferred to a specific storage area within the yard. All metals are stored by types. All steel components were transferred to the size-reduction area. Components too large for feed to the metal shear were initially sized by torch cutting as shown in Fig. 3. The metal was then fed to a large hydraulic shear for final size reduction. The metal was cut to a nominal size of 2-ft wide by 4-ft long, which is suitable feed stock for possible future smelting operations. An overall view of the metal shear is shown in Fig. 4. A face-on view of the shear and blade assembly is shown in Fig. 5.

An aerial view of the overall shear and size-reduction area is shown in Fig. 6. The large pile of size-reduced steel in the upper center of the photograph contains approximately 15,000 tons. The aluminum components, left area of Fig. 6, will be processed at a future date.

Table I lists the total materials processed through June 1986, at which time the program terminated. A total of 37,250 tons of metal was removed from the overall area of the scrapyard. The material is currently in a manageable condition and can continue to be stored in this matter until final disposition is determined. A current view of the original area of the scrapyard, after site work was completed, is shown in Fig. 7.

CURRENT PROGRAM

Three commercial firms were recently awarded subcontracts to demonstrate decontamination techniques for cleaning and releasing for reuse, specific metal types from the ORGDP scrap. This project is a small scale effort, but it is expected that processes, procedures, and cost can be developed that will allow all Department of Energy stored scrap metal to be converted to a reusable resource.

TABLE I

Material Processed Through

June 1986

Type	Quantity (Tons)
Steel	18,898
Aluminum	2,275
Stainless Steel	147
Cooper	26
Brass	13
Nickel/Monel	32
Trash and Non-Metals	15,859
TOTAL	37,250

CONCLUSION

All industrial waste streams, particularly those generated by nuclear-related operations, continue to receive tighter public scrutiny as environmental awareness levels increase. What may be perceived as scrapyards has the potential to become an object of public concern now or at some time in the future. This prospect for recycle of this material into a reusable form in years to come is greatly enhanced by transforming the present junkyards into well-characterized, manageable, metallic stockpiles. At the ORGDP, newly generated scrap metal is sorted and size reduced as it is received at the storage yard, then stored by type for future processing.

Fig. 1. Aerial View of Scrapyard Prior to Start of Cleanup Operations.

Fig. 2. Ground View Prior to Start of Cleanup Operations.

Fig. 3. Torch Size Reduction of the Larger Steel Components.

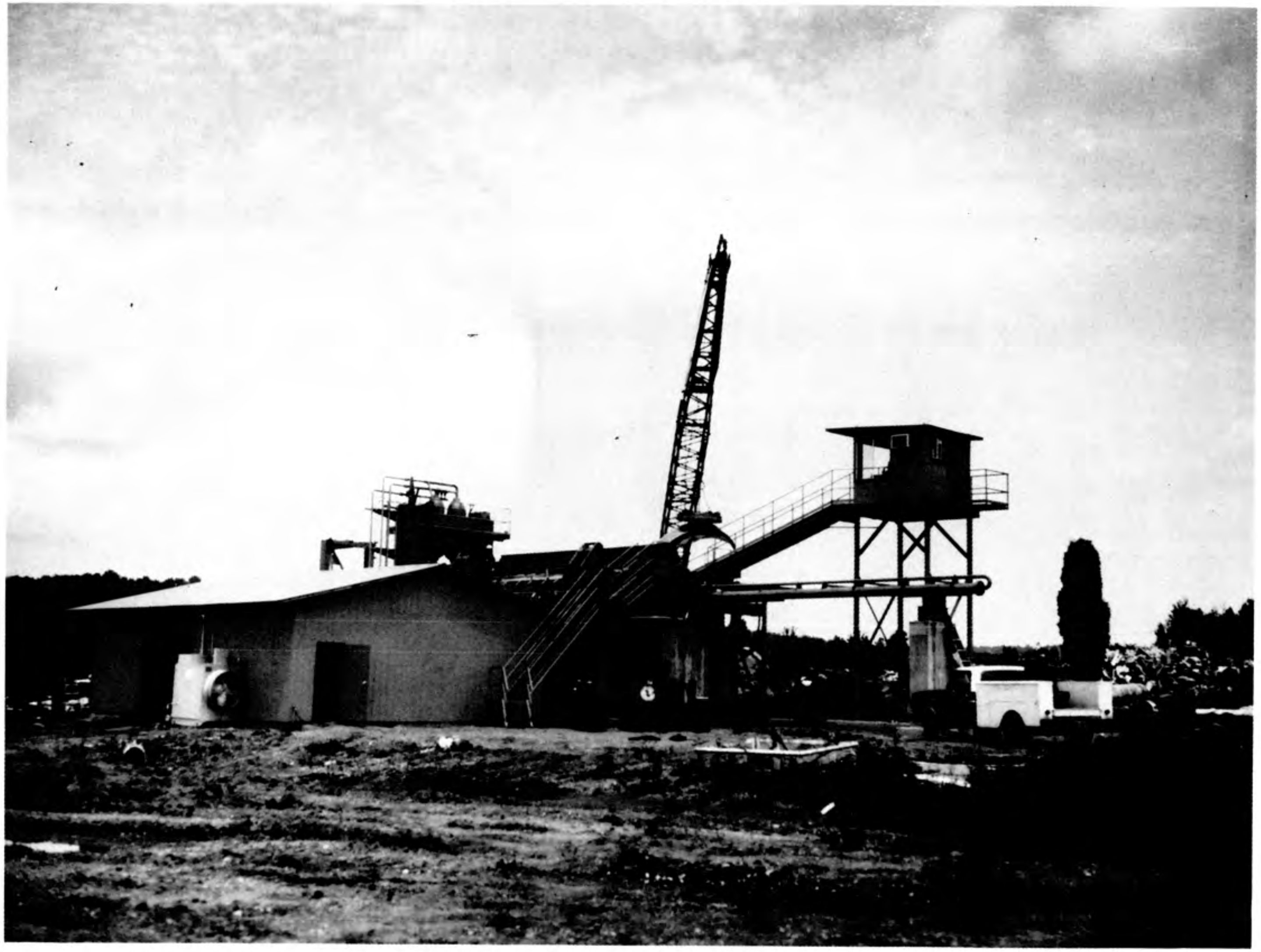

Fig. 4. Hydraulic Shear for Metal Size Reductions.

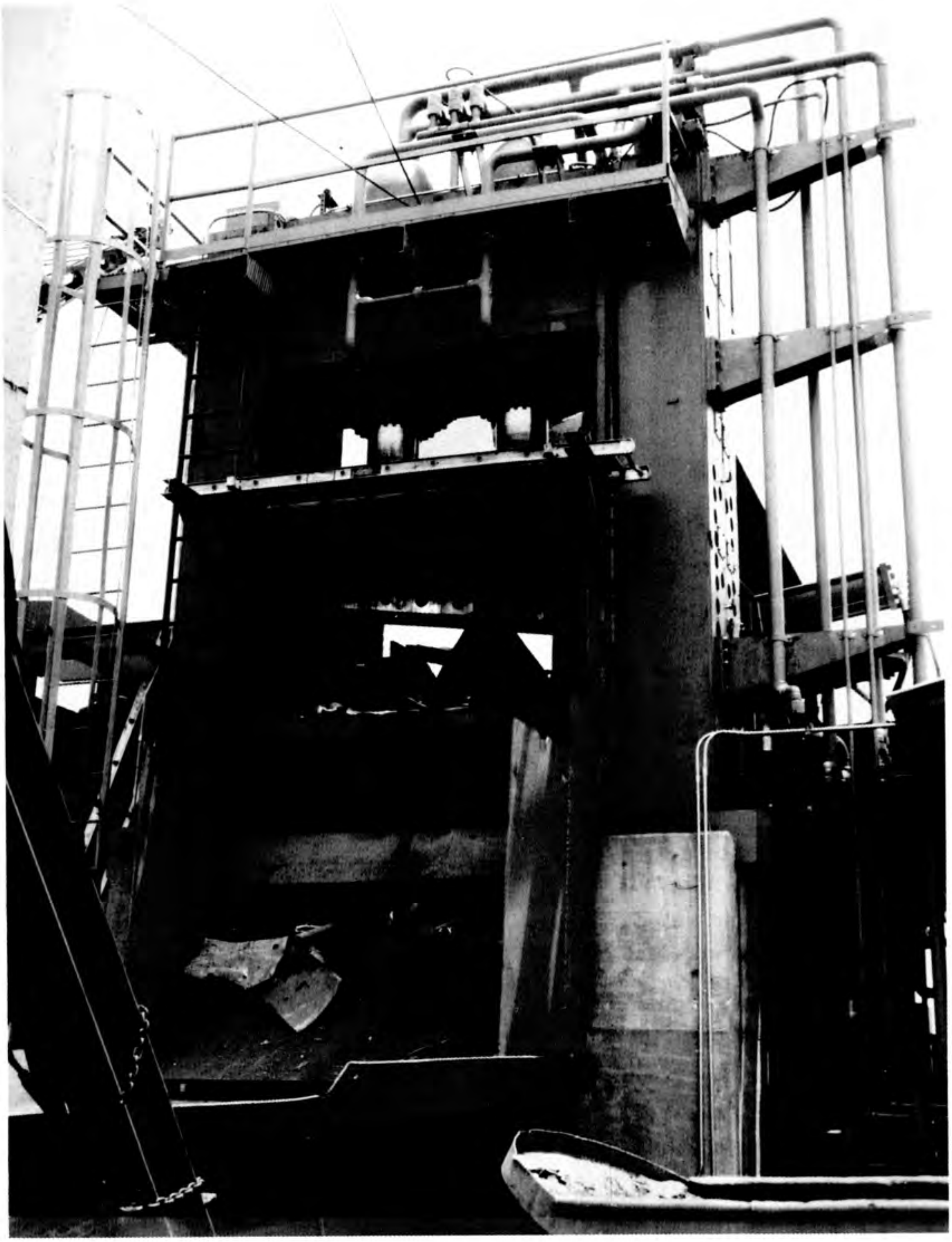

Fig. 5. Face View of Metal Shear and Blade Assembly.

Fig. 6. Aerial View of Size Reduction Area.

Fig. 7. Aerial View of Scrapyard After Cleanup - August 1985.