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CASE STUDY: EVALUATION OF A SCENARIO FOR THE REUSE OF STRUCTURES IN THE PRODUCTION AREA AT FERNALD

Michael J. Davis, Environmental Assessment Division, Argonne National Laboratory, Robert J. Janke, Fernald Area Office, U.S. Department of Energy, Stephen Folga, Decision and Information Sciences Division, Argonne National Laboratory, and David R. Kozlowski, Office of Environmental Restoration, U.S. Department of Energy.

ABSTRACT

The potential for the reuse of uncontaminated structures at federal facilities that are being remediated should be evaluated. Although various factors often limit the viability of such reuse, it may be economically attractive to reuse selected structures. Consideration of a hypothetical reuse scenario for the U.S. Department of Energy's Fernald, Ohio facility shows that the reuse of selected buildings that were not significantly contaminated by production activities at the site may be considerably less expensive than the construction of new ones. The cost of removal of existing buildings is a major factor influencing the relative advantages of these two options. For Fernald, no need for the facility's buildings has been identified; however, the reuse of structures may be a viable option at other facilities.

INTRODUCTION

The U.S. Department of Energy (DOE) and other federal agencies are currently planning the remediation of numerous contaminated facilities. Some of these facilities are quite large and contain many buildings and other structures having varying degrees of contamination. What is the potential for the reuse of such structures? This paper will address issues related to this question by examining the potential for the reuse of structures at one large DOE facility that is in the early stages of remediation. No plan exists for the long-term reuse (i.e., use not associated with remediation) of any structures at the facility; however, development of a scenario for the hypothetical reuse of structures at the facility allows the identification and evaluation of issues associated with the reuse of structures at large, contaminated federal facilities that no longer are carrying out their original missions.

The facility considered in the hypothetical reuse scenario is the Fernald Environmental Management Project (FEMP), located near Cincinnati, Ohio. The FEMP was used by DOE and its predecessor agencies to produce high-purity uranium metal from 1952 until 1989. The former production area of the FEMP contains over 200 structures, including about 100 buildings. Most of the structures at the FEMP date from the 1950's and many of them and portions of nearby soil and groundwater are radiologically contaminated as a result of the production activities at the facility. It is currently planned that all the structures at the FEMP will be removed during remediation. Remediation is being carried out in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended. Decontamination and dismantling of structures from the production area will be managed using an interim remedial action being carried out for Operable Unit 3, which addresses improvements located in the 136-acre former production area. Environmental media are addressed by a different operable unit. Remediation will continue well into the next century.

This paper considers three major topics related to the hypothetical reuse of structures at the FEMP: (1) What are the major factors that would limit the potential for the reuse of structures at a facility such as Fernald? (2) What opportunities are available for the conservative reuse (i.e., reuse that minimizes the potential for any future human exposure

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to contamination) of structures at Fernald? and (3) What are the expected costs of a conservative reuse scenario for the facility?

FACTORS LIMITING THE REUSE OF FEMP STRUCTURES

Is long-term reuse of some of the structures in the Fernald production area a reasonable alternative that should be considered? Although a large number of structures potentially suitable for use as offices, warehouses, or manufacturing facilities are available, their reuse is generally limited by a number of factors:

- The presence of contamination in most structures, particularly those that were actually involved in production activities.
- The presence of transite in the walls and roofs of many structures. Transite is made from cement and asbestos and, although the asbestos is not friable, buildings constructed with this material are not considered suitable for reuse.
- The age of the structures. Most of the structures date from the 1950's.
- The potential for obstructing the remediation of environmental media if the structures are left in place.
- The location of structures in the footprint of any likely on-property disposal cell and the potential for conflicts with the construction of any such facility. Also, structures may be utilized to support remedial activities and may not be available for other uses.
- The potential for future liability if undetected contamination is present in reused structures.
- No identified need for the structures by the federal government. Assuming continued DOE control of the facility, future use is likely to be limited to DOE or other federal activities.

These factors are expected to be relevant to the potential reuse of many structures at other major DOE facilities also.

At the FEMP, many of the factors limiting the potential for the reuse of structures apply primarily to those structures that were used for actual production activities. Various other structures that have been used for administrative activities have fewer constraints on their reuse because of their generally uncontaminated state, the nature of their construction, and their location outside the likely footprint of any on-property disposal cell. The following section considers opportunities for the conservative reuse of structures at the FEMP and develops a reuse scenario for the property. The costs associated with the scenario are then evaluated in the subsequent section.

DEVELOPMENT OF A REUSE SCENARIO FOR THE FEMP

A reuse scenario for the FEMP was developed for the time period following the completion of all remedial action activities, except for the restoration of the Great Miami Aquifer, the major groundwater resource underlying the facility. Following remediation, decontamination and dismantlement activities addressed by the interim remedial action would be complete, contaminated soils and construction debris would be removed, and it is assumed that the majority of these contaminated media and wastes would be placed in an on-property disposal cell.

Structures defining the reuse scenario for the FEMP were selected to provide a refurbished property that would be suitable for future industrial or commercial development, as well as for federal government use. Candidate structures for reuse were selected from the approximately 100 buildings available; buildings are the most valuable structural resources at the FEMP. To be considered for reuse, buildings must:

- Have only limited or no radiological contamination.
- Have no transite used as a construction material.
- Be permanent structures in sound condition.
- Not be connected to non-reusable structures.
- Have a floor area greater than about 900 square meters (about 10,000 square feet) (unless connected to another structure that would result in a total combined area exceeding that amount). Small isolated structures are assumed to have limited value.
- Be currently envisioned to present no conflict with site remediation (i.e., not limit access to contaminated environmental media and not obstruct disposal cell construction or operation.)

Buildings meeting these requirements will require relatively limited effort to make them available for reuse. Since only buildings with little or no contamination are considered for reuse, only minimal soil contamination is expected to be present around or under them, limiting the potential for any conflicts with the remediation of environmental media. The following paragraphs discuss the development of a reuse scenario on the basis of the constraints established by expected post-remediation conditions at the FEMP and the application of the criteria listed above for selecting buildings.

Following remediation, the property is assumed to include an engineered disposal facility, a network of approximately thirty groundwater extraction wells in groups of five to eight wells each, a groundwater treatment facility, and a set of refurbished buildings consistent with a reasonable reuse scenario. The existing parking lot is assumed to be present but greatly reduced in size to be more consistent with the work force required for the reuse scenario.

The engineered disposal facility required to accommodate site-wide needs is anticipated to be approximately 670 m (2,200 ft) by 490 m (1,600 ft) by 12 m (40 ft) high. As presently envisioned, the disposal cell is expected to hold an estimated 1.8 million cubic meters (2.3 million cubic yards) of contaminated soil and construction debris. Due to the large footprint of the disposal cell, which includes land utilized as a lay-down area, a significant portion of the structures in the FEMP production area would have to be removed to accommodate an on-property disposal alternative. The disposal cell is anticipated to be located in the northeast corner of the FEMP. A stormwater control channel around the disposal cell is anticipated to be required to control stormwater runoff.

The groups of groundwater extraction wells are assumed to be located predominantly on the western and southern portions of the FEMP, where there are no current or planned improvements. The groundwater may potentially be treated before being discharged to the nearby Great Miami River. The groundwater treatment facility is scheduled for start-up in early 1995 and is located in building 51.

A reuse scenario was developed using the criteria and constraints discussed above. The approximately 100 existing buildings were first screened to determine those that have only limited or no contamination and that are not constructed of transite. Next, the remaining buildings were evaluated to determine whether they are permanent structures in sound condition, are not connected to non-reusable structures and do not conflict with any anticipated remedial activities, such as the construction and operation of the engineered disposal cell. As noted above, small isolated buildings were assumed to have limited value and were eliminated from consideration.

The structures selected for the reuse scenario are the service building (building 11), administration building (14A), laboratory building (15), security building (28A), human resources building (28B), safety and health building (53A), in-vivo monitoring building (53B), finished products warehouse (77), plant 6 warehouse (79), and the receiving and incoming materials building (82). A simplified perspective view of the FEMP is provided in Fig. 1, with the buildings selected for the reuse scenario highlighted. Assuming that these buildings are refurbished for use as offices and warehouses, the FEMP would potentially have about 32,500 square meters (350,000 square feet) of available floor space. The buildings retained would be the former administration buildings located on the southern portion of the production area and some warehouses located on the eastern edge of the production area but south of the disposal cell footprint. These buildings are readily accessible to the parking lot and main access road. Among the buildings selected, only buildings 11, 15, 77, and 79 would require some decontamination before reuse. A simplified perspective view of the FEMP following remediation is shown in Fig. 2, assuming an on-property disposal cell and a groundwater treatment facility, plus implementation of the hypothetical reuse scenario involving the buildings identified in this paragraph.

PLACE FIG. 1 HERE

PLACE FIG. 2 HERE

EVALUATION OF COSTS FOR THE REUSE SCENARIO

If no actual uses can be identified for the space provided by the buildings included in the reuse scenario, it would be most reasonable to remove them rather than provide maintenance and security for unneeded buildings. No such uses have been identified and current plans call for all buildings at the FEMP to be removed. However, if a potential for reuse actually existed for them, then the major factor determining whether their reuse is reasonable is the relative cost of reuse versus the cost of providing acceptable alternative space. The evaluation of the reuse scenario presented here consists of a consideration of these relative costs. Issues other than those involving costs are considered above in the development of the reuse scenario.

The estimated costs for the reuse of existing buildings and the estimated costs for their replacement with new ones are summarized in Table I. The estimates in the table are provided to allow a rough comparison of the two cases considered and to allow identification of the major factors contributing to differences in their costs. The cost estimates provided were developed to allow these evaluations to be conducted and are not intended to be any more definitive. The cost comparison in Table I does not account for the fact that refurbished buildings would likely be worth less than newly constructed buildings and would have a shorter expected period of use. A more detailed evaluation of the potential for the reuse of structures would account for these factors. No cost is assigned to the land needed for any new construction because it is assumed that any new buildings would be located on uncontaminated areas of the FEMP outside the former production area.

PLACE TABLE I HERE

The unit costs for construction used in Table I are approximate values for new construction in the Cincinnati area (1). The cost of refurbishing the existing buildings is based on industry standards (2), assuming that the labor and material components of the total refurbishment cost are 60% and 40%, respectively. The refurbishment cost is estimated to range between 15% to 50% of the costs of new construction for the building types being considered. Given that many factors (e.g., custom fabrication of components to match existing construction) can significantly increase the costs for refurbishment, it was conservatively assumed that refurbishment costs are 50% of the costs of new construction.

Reuse of an existing building may involve removal of any asbestos that is friable or in poor condition. A small amount of asbestos-containing material is present as piping and ductwork insulation in building 82; however the costs of its removal were determined to be negligible in comparison with the other costs for building reuse.

The cost for surface decontamination was estimated assuming that all interior surfaces in buildings with some contamination present (buildings 11, 15, 77, and 79) were cleaned using a high-pressure power washer and that a fixative coating was then applied to all the surfaces. Recent experience at the FEMP indicates that such surface decontamination can reduce removable contamination levels by a factor of fifteen (3). Application of a fixative coating (acrylic latex paint) is used to "lock down" any remaining loose surface contamination. The costs for surface decontamination were estimated from (4) and exclude treatment costs for the resulting wash water.

The cost of providing a replacement for the existing buildings includes the cost of removing the existing buildings. If not reused, these buildings must be removed. If it were decided to construct new buildings on the FEMP to provide space that could be provided by existing buildings, then the cost of removal of the existing buildings is a cost that must be added to the cost of new construction. If buildings are reused, then the cost of their removal is avoided.

The costs for removing buildings were developed using a "bottoms-up" cost methodology. Contaminated buildings are assumed to be decontaminated before being dismantled. Direct costs associated with decontamination and dismantlement include containment of potential airborne contaminants, surface decontamination by water washing as needed, disassembly and dismantling, wrapping, and transporting waste materials to interim storage areas. A non-productive time allowance for the use of personal protective equipment was included in all applicable activities. Factors for the various indirect cost components (e.g., overhead and profit, contingency) were applied to complete the cost estimate for the individual buildings. The costs were estimated for each building and combined to give the total in Table I. Values presented here should be considered to be conceptual with an estimated overall level of accuracy of +50 percent/-30 percent.

Disposition costs associated with the wastes produced by dismantlement of the buildings were estimated on the basis of a preliminary cost estimate developed for an on-property disposal cell (5). The incremental costs of on-property disposal are about $84 per cubic meter ($64 per cubic yard) and the disposal volume for the wastes generated from the ten buildings is about 33,000 cubic meters (43,000 cubic yards), yielding a cost for on-property disposal of about $3 million.

The costs for decontamination and dismantlement of the buildings were developed for this study and do not represent official estimates for the FEMP. Note that the estimated costs given in the table apply only to the specific buildings considered in the scenario; the costs do not apply to any other structures.

The cost of providing replacement space in new on-property buildings that would be equivalent to that provided by buildings identified in the reuse scenario (Case 1 in Table I) is estimated to be about $47 million or about $1,400 per square meter (about $130 per square foot) of floor space. Reuse of the buildings (Case 2) would cost about $11 million or about $340 per square meter (about $30 per square foot).

The relative cost advantage of reuse of the buildings over replacement is not sensitive to the assumed costs for refurbishment. Even if the refurbishment costs are as high as the costs of new construction, reuse may still be advantageous from a cost perspective because of the high costs of dismantling all the structures compared to the costs of decontaminating only several.

The most critical factor related to evaluating the reuse scenario is the cost of removing existing structures. If uncontaminated structures are dismantled using the same methods as those used for contaminated structures (except for worker protection), then expected costs will be high. The CERCLA Record of Decision for the interim remedial action (6) does not specifically discuss methods that might be used, but always discusses "dismantlement" as opposed to "demolition." Practices at other DOE facilities also appear to favor dismantling as opposed to demolition, even for uncontaminated buildings, if the buildings are located in generally contaminated areas (7). Defining the approach that will be used to remove buildings with little or no contamination is critically important to understanding any cost advantages associated with reuse. If the costs of removing the existing buildings constitute a significant fraction of the cost for the replacement case, then avoiding dismantlement costs by reuse of buildings could potentially result in substantial cost savings, assuming a need for such space is identified.

CONCLUSIONS

In general, the potential for the reuse of buildings and other structures at the FEMP is limited by the lack of an identified mission for them, by the current condition of most structures, and by the possibility for interference with the remediation of environmental media. These conclusions apply in particular to the buildings that were used for production activities.

Opportunities for conservative reuse may exist for some selected buildings at the FEMP that together contain several tens of thousands of square meters (several hundreds of thousands of square feet) of floor space, that are in sound condition, and that have limited or no contamination. These buildings are administrative and warehouse buildings located outside the major areas of contamination and in areas that would not interfere with the construction of an on-property disposal cell. If a need existed for such space, it might be economically preferable to reuse these buildings as opposed to removing them and constructing new ones. However, the attractiveness of reuse is sensitive to dismantling costs. High dismantling costs favor reuse.

The methods to be used for the removal of FEMP structures having little or no contamination need to be better defined. Such information is important both for evaluating any potential reuse of the structures and for evaluating the total costs for the interim remedial action that will remove them.

Arguments favoring the reuse of some buildings on the basis of cost alone are insufficient to justify retaining such structures in the absence of any specific, identified need for the structures. For federal facilities that are planning remedial activities, the viability of reuse of any buildings will depend on the levels of contamination in the buildings, the level of any contamination around and under the buildings, the state of the buildings, and the future land use anticipated for the facility. However, if constraints involving these factors are not present, long-term reuse of the buildings may be economically attractive. Reuse of structures with limited or no contamination should be considered as a serious option at federal facilities if a need for such structures can be identified.

ACKNOWLEDGMENT

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FIGURE CAPTIONS:

Fig. 1 A Simplified Perspective View of the FEMP, with the Buildings Selected for the Reuse Scenario Highlighted.

Fig. 2 A Simplified Perspective View of the FEMP Following Remediation, Assuming an On-Property Disposal Cell, a Groundwater Treatment Facility (51), and Selected Buildings Retained for Reuse.

TABLE I. Cost Estimates (millions of dollars)

Case 1: Replacement of Buildings	
• Decontamination and dismantlement of existing buildings	24
• Disposition of wastes in an on-property cell	3
• Construction of new buildings	
Office buildings (28,500 m^2 @ \$650/m^2) (307,000 ft^2 @ \$60/ft^2)	18
Warehouses (4,370 m^2 @ \$430/m^2) (47,000 ft^2 @ \$40/ft^2)	2
• TOTAL for Case 1	47
Case 2: Reuse of Buildings	
• Decontamination of contaminated buildings	1
• Refurbishment of buildings	
Office buildings (28,500 m^2 @ \$330/m^2) (307,000 ft^2 @ \$30/ft^2)	9
Warehouses (4,370 m^2 @ \$220/m^2) (47,000 ft^2 @ \$20/ft^2)	1
• TOTAL for Case 2	11

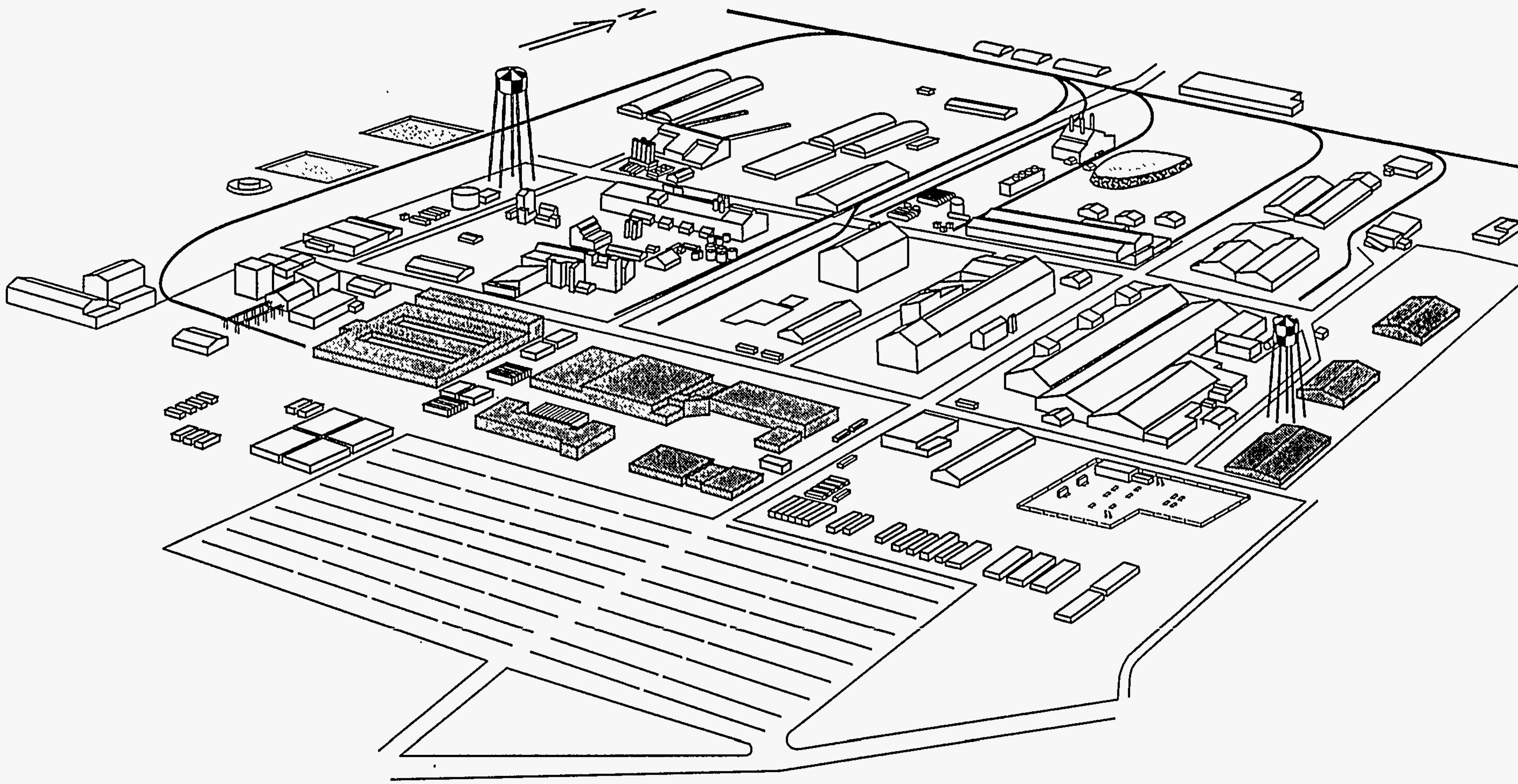

Fig. 1

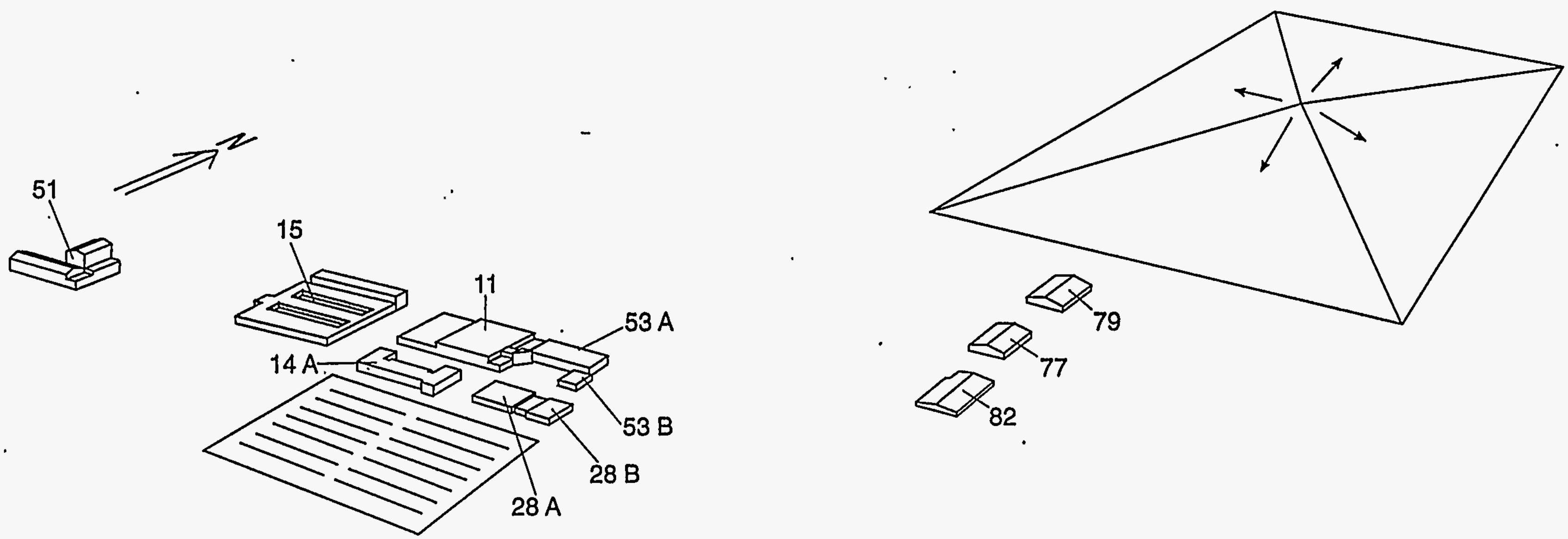

Fig. 2