FINAL REPORT

FIELD TEST FT-34

ANNEX G

RELATED STUDIES BY THE JAC

JANUARY 1969

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I. INTRODUCTION

This annex reproduces the results of two studies, done by the AEC at ACDA's request, concerning the demonstrated destruction of nuclear weapons.

The first study had to do with the problems of classified information and examined three specific problems: selection of batches, external appearance and weights, and gross gamma measurements. This study is reproduced in section II of this annex.

The second study concerned the facilities for demonstration of destruction. The preliminary results are reproduced in section II and the final results in section IV.

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II. DISCUSSION OF CLASSIFICATION PROBLEMS ASSOCIATED WITH DEMONSTRATION OF WEAPONS DESTRUCTION

Selection of Batches

It is assumed that the weapon retirement schedule that will be used for weapons destruction to obtain the fissionable material for transfer under a cutoff agreement will be developed specifically for this purpose some time prior to reaching an agreement on cutoff. However, for the purposes of this classification study, the weapons listed in the current retirement schedule were used.

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(b)(

Although the cases were examined primarily to facilitate an analysis from the classification standpoint, they provided evidence of the kinds of variables involved which should be considered, in terms of economic considerations, for optimization in the ultimate selection of mixes for the transfer

DoE (b)(3)

[redacted]

Additionally, it was found that certain mixes under certain conditions might result in revealing the exact amount of enriched uranium or plutonium in one or more weapons in the mix [redacted]

DoE (b)(3)

It is evident that among the basic criteria to be developed for the selection of the ultimate weapon mix for this program (presumably an optimization of several of the variables involved) certain criteria should be imposed in order to minimize a later requirement that the mix be adjusted to eliminate information which is not likely to be declassified. These criteria include:

(1) The weapon mix in each batch must be identical with, and in the same proportion to, the weapon mix in the final grand total, or batches must be carefully randomized, in order to minimize the possibility that mathematical relationships could be developed to reveal the exact material content of any individual weapon or all of them;

(2) The number of different weapons in each batch should be sufficiently large so that statistical analyses using known factors such as weights, applications, etc., would not result in the revelation of design characteristics such as the amount of material in each weapon, [redacted]

DoE (b) (5)

etc. This is true particularly in the case of plutonium-bearing weapons. (The fact that a specific weapon contains plutonium is unclassified.) Each batch should consist of several different plutonium-bearing weapons to minimize the possibility of revealing the exact amount of plutonium in any one weapon.

[redacted]

DoE (b)(3)

External Appearance and Weights

With respect to item 1(b) of the October 7 letter, which deals with the question of whether the external appearance and weights for the various weapons to be destroyed reveal classified design information, we have examined the weapons in the current retirement schedule and have concluded that, depending upon the form in which they enter the disassembly building (bare or covered by nose cones, etc.), it may be necessary to cover portions of some and the entire body of others (e.g., the MK 28 warhead) with some sort of opaque covering. Where gas bottles are removed, some sort of opaque covering might have to be used to cover the resultant hole (if externally visible). However, in general, we consider that it is feasible to assure that the visual appearance and weights will be unclassified.

Gross Gamma Measurements

The final point in connection with problems of classified matter raised in the letter of October 7, relates to the question of whether measurements of gross gamma activity at the exterior of the weapons to be destroyed would reveal design characteristics. As a result of discussion with Naval Research Laboratory personnel, it has been concluded that, if gross gamma only is measured, by a fixed instrument collimated to examine the entire weapon simultaneously and used in such a way that, when the entire weapon enters a predetermined area, the instrument is switched on to assure that gammas are emitted and then switched off, classified information would not be revealed.

If, however, the intent of gamma measurements would be to permit extensive access to the weapon with gamma instruments by adverse inspectors, it is possible that extremely sensitive design information would be revealed. It is our understanding that in order to analyze this problem and draw definitive conclusions, a special study would have to be undertaken and considerable laboratory and field testing conducted. It is our understanding that such a study, which might be carried out by AEC or the Naval Research Laboratory (or jointly by both) would take several months to conduct. The desirability and value of such a study should be examined further, along with any further consideration of extensive gamma measurements by adverse inspectors.

Conclusion

Our analysis of these problems clearly demonstrates that final classification evaluation is a function of the weapon mix selected for destruction and that a complete and detailed classification analysis would have to be made after the final weapon mix is selected but prior to the consummation of the demonstration program so that any adjustment necessitated on the basis of classification considerations can be made before the information has been compromised. It also indicates that classification problems can be minimized by judicious management of the destruction operation.

III. PRELIMINARY ANALYSIS OF THE FACILITIES THAT WOULD BE REQUIRED TO CARRY OUT U. S. OBLIGATIONS UNDER A TREATY THAT CALLED FOR DEMONSTRATED DESTRUCTION OF NUCLEAR WEAPONS

Summary

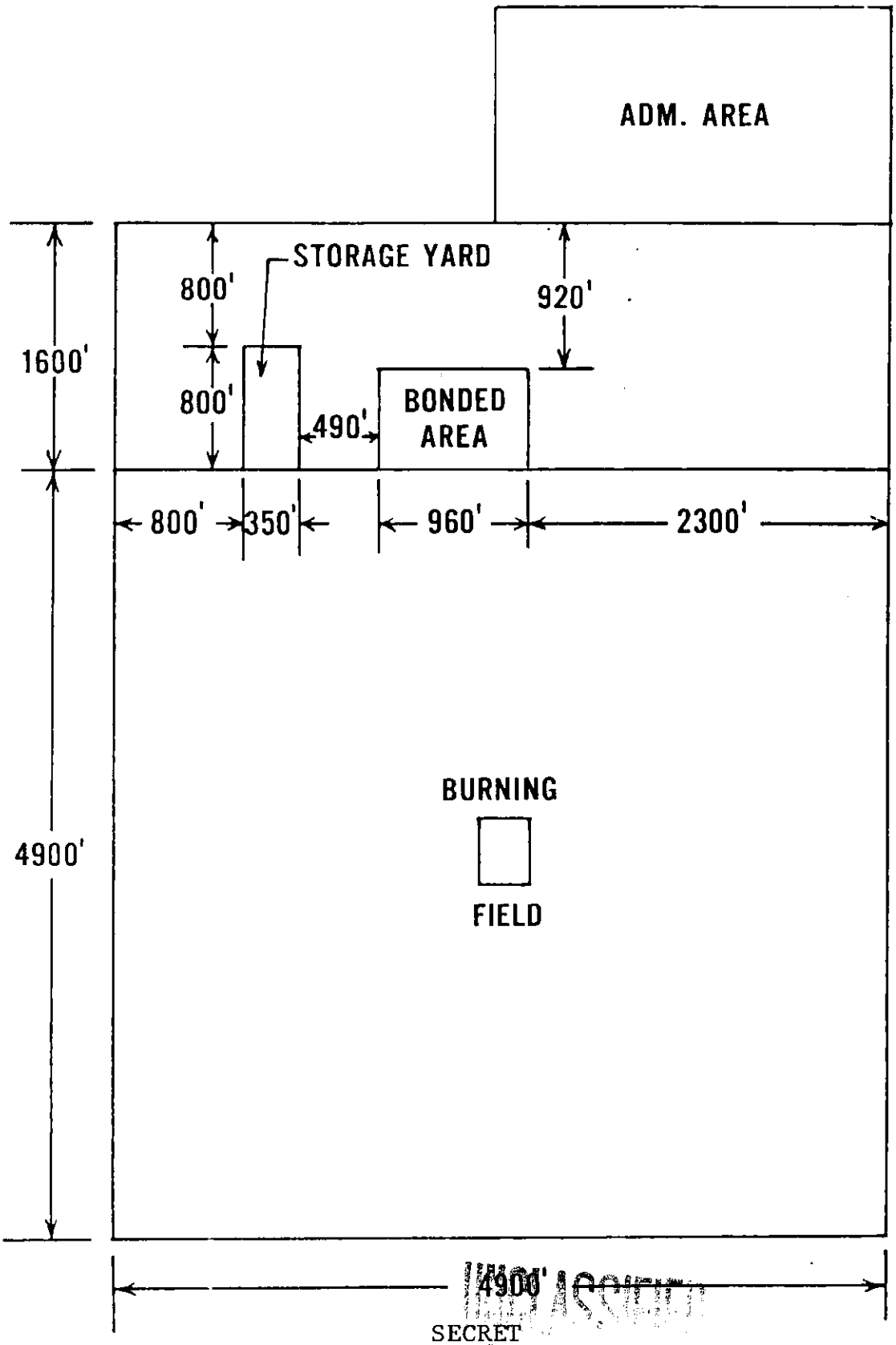
A new permanent facility to demonstrably destroy weapons and provide 60,000 kgs of weapons-grade U-235 and associated plutonium, based on current retirement schedules, is estimated to cost $22.5 million for plant and equipment, but exclusive of land acquisition. Annual operating costs are estimated to be $10 million.

A capability equal to that described above could be established at Medina for an estimated cost of $8.5 million, assuming that use could be made of all presently existing facilities. Annual operating costs are also estimated to be $10 million.

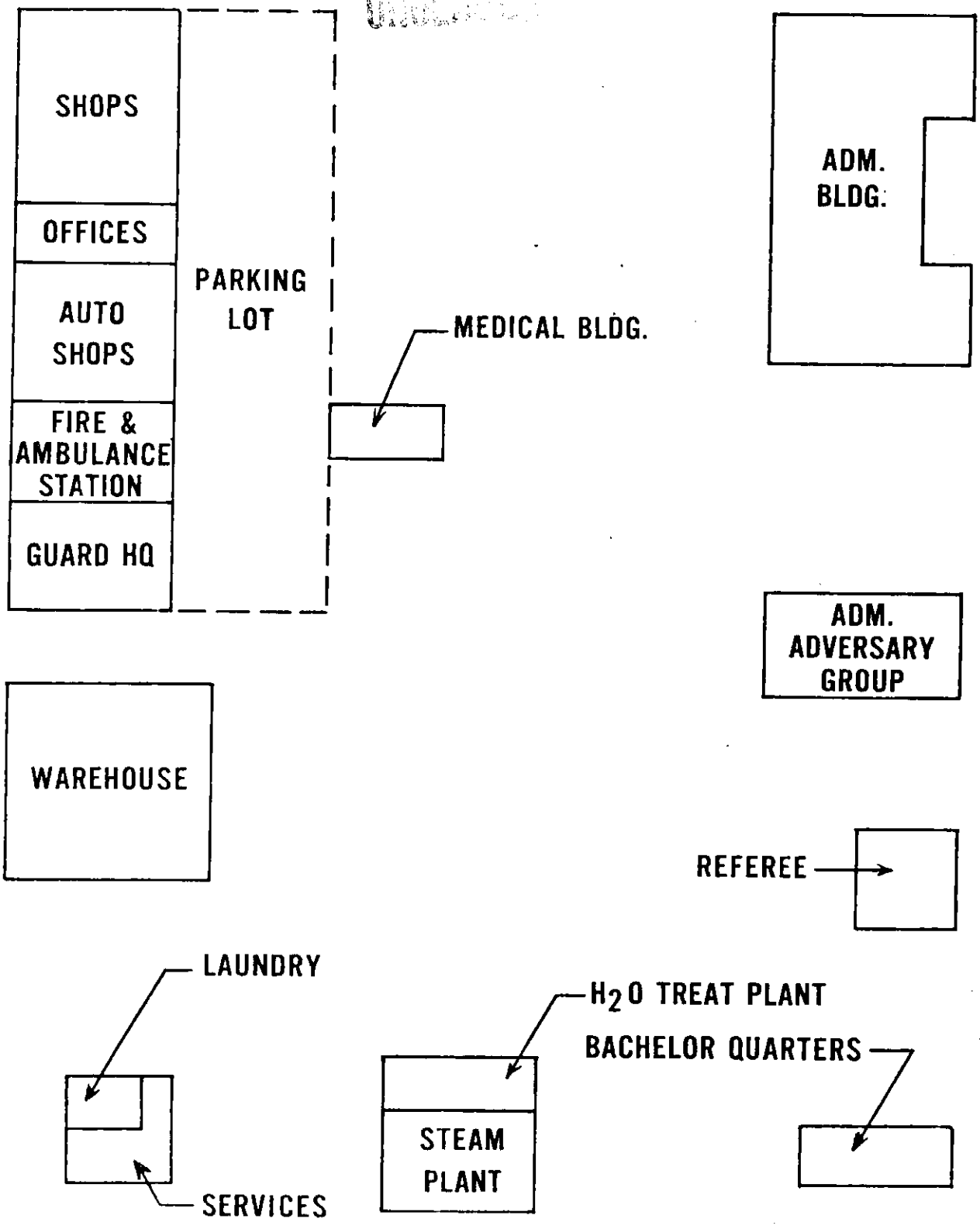
This concept for a new permanent facility has been developed and is illustrated on the following three pages. (The term "bonded area" is used to denote the closed weapons disassembly and destructive processing area.) Construction and equipment costs were tabulated as:

Construction	$13,465,000
15% Engineering	2,019,750
20% Contingency	3,096,950
Construction Total	18,581,700
Equipment	3,198,000
20% Contingency	639,600
Equipment Total	3,837,600
GRAND TOTAL	$22,419,300

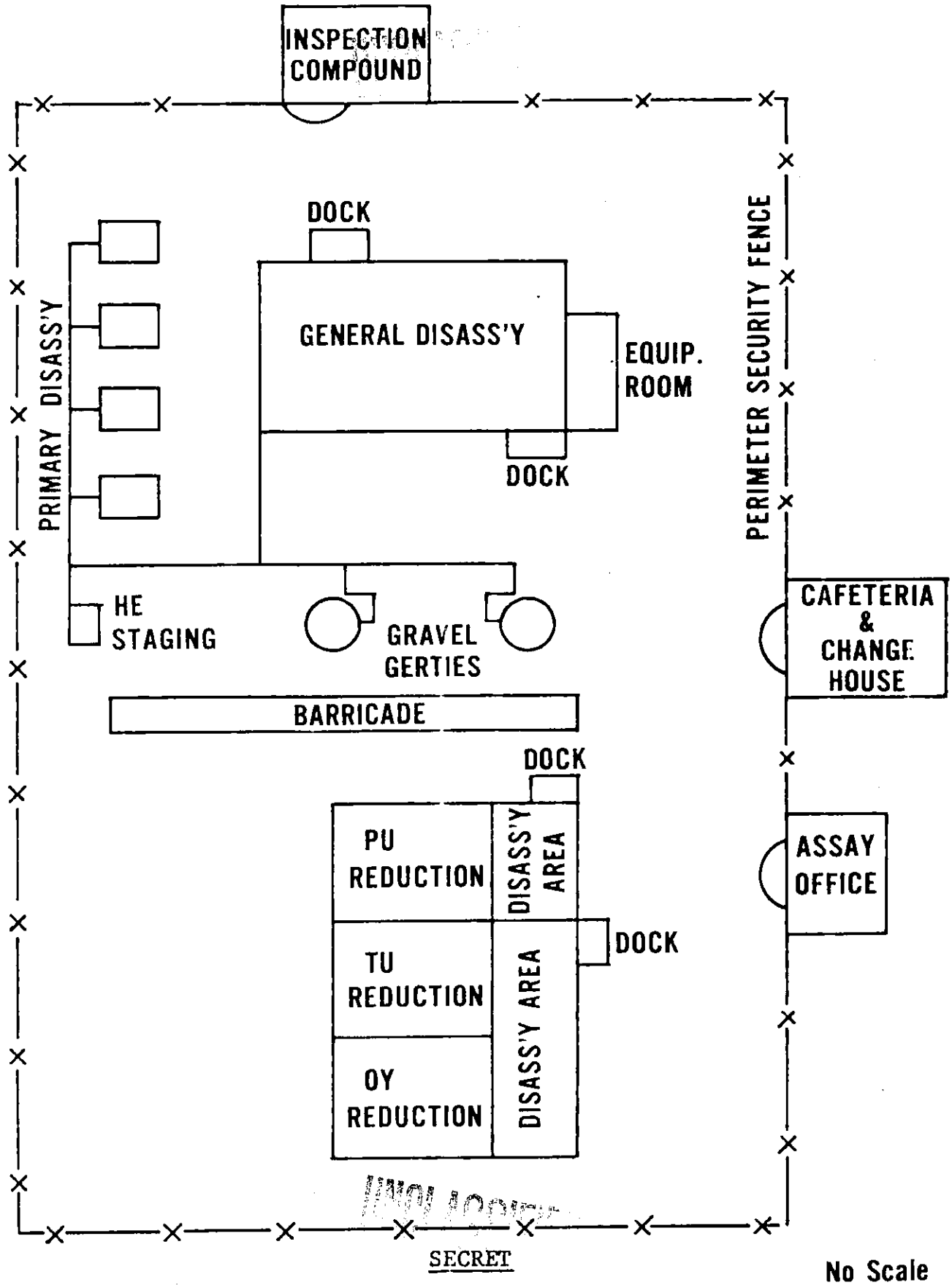
ESTIMATED NEW FACILITY FOR ACDA RELATED WORK



ADMINISTRATION AREA



ESTIMATED BONDED AREA FACILITIES



SECRET

No Scale

Designing and Cost Estimating a Facility at Media

Assumptions used for this case were the same as for designing a new facility. The time to construct would be the same as for a new facility. Construction and equipment costs were estimated as follows:

Construction	$3,360,000
15% Engineering	504,000
20% Contingency	772,200
Construction Total	4,636,200
Equipment	3,837,600
GRAND TOTAL	$8,473,800

Annual Operating Costs at Either a New Facility or at Medina were Estimated as Follows:

General Function	No. People	Cost
Direct Labor:		
U-235	50	$ 500,000
Plutonium	34	340,000
HE and Hardware	60	600,000
Burning Area	6	60,000
Storage Yard	6	60,000
Materials Handling	12	120,000
Inspection Compound	4	40,000
Direct Labor Subtotal	172	$1,720,000
Indirect Labor:		
U-235, Supervisory and Clerical	10	$ 100,000
Plutonium, Supervisory and Clerical	7	70,000
Management, General	7	70,000
Accounting	25	250,000

General Function	No. People	Cost
Indirect Labor (Cont'd):		
Payroll	7	$ 70,000
Timekeeping	9	90,000
Personnel	12	120,000
Medical	6	60,000
Storekeeping	30	300,000
Property	6	60,000
Data Center	15	150,000
Procurement	10	100,000
Transportation	25	250,000
Custodial, Laundry, etc.	35	350,000
Engineering	15	150,000
Maintenance and Utility	211	2,110,000
Fire Protection	30	300,000
Security and Safety	106	1,060,000
Operations Management	20	200,000
Cafeteria (Sub-contract)	0	0
Indirect Labor Subtotal	586	$5,860,000
LABOR GRAND TOTAL	758	$7,580,000
Transportation of Weapons to the Site	-	$ *
Materials and Utilities	-	2,500,000
GRAND TOTAL, ANNUAL OPERATING COST		$10,080,000

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*Estimated transportation from the field to either Burlington Plant (present plan) or to a new facility should be essentially equal and is estimated at $1,200,000. Actually, under present procedures an additional estimated $200,000 will be required to transport pits, secondaries, and other residues from Burlington to other plants for final processing.

IV. A FACILITY TO CARRY OUT THE DEMONSTRATED DESTRUCTION OF NUCLEAR WEAPONS

We now have the final results of our study concerning a facility to carry out the demonstrated destruction of nuclear weapons, and of our study of classification matters relating to that proposal. The preliminary results of those studies were transmitted to Mr. Fisher by our letter of January 6, 1966.

We conclude that it is feasible to design and construct such a facility; that, from the time construction begins, two years will be required to reach initial operation; and that the cost estimates included in the January 6 letter may be used for preliminary planning purposes, subject to the following:

1. It may be found desirable to provide a duplicate assay office for independent use by U.S. personnel prior to the presentation of the enriched uranium and plutonium for international safeguarding. This would add approximately $425,000 to construction and equipment costs, and $60,000 annually to operating costs. It is possible that the single facility provided for in the preliminary results could be used by both the IAEA and the U.S. or that the U.S. would be willing to accept the IAEA assays. This question need not be resolved at this time; it would be prudent, however, to include the duplicate facility as a contingency item.

2. Processing residues, containing enriched uranium and plutonium will be generated in the course of reducing weapons parts to enriched uranium and plutonium metal ingots or buttons. A chemical recovery system to treat such residues to recover pure uranium and plutonium would add about $720,000 in construction costs, $1,950,000 in equipment costs, and $200,000 annually for labor costs. On the other hand, the estimates shown in the preliminary results included provision for burning the crude residues to impure oxides. Those impure oxides could be presented to the international inspectorate who could determine the enriched uranium and plutonium contents of the oxides. We could then substitute equivalent quantities of pure uranium and plutonium metals, from

inventory, for safeguarding, and take back the oxides for treatment in our own (unsafeguarded) recovery facilities. This alternative would (1) save the cost associated with providing an autonomous recovery system (2) be consistent with existing IAEA substitution provisions, but (3) would seem to require explicit provision in an agreement for demonstrated destruction.

3. The tuballoy reduction cell indicated in the sketch of the preliminary study titled "Estimated 'Bonded Area' Facilities," as a part of the facility, is not a necessary item, if the remains of the weapons are not examined by observers. Elimination of the cell would reduce equipment costs by about $200,000, construction costs by about $150,000, and save about $200,000 annually in salaries.

Some of the assumptions used in the facility study are:

1. The work week would be two shifts for five days except that the facility will be empty for three days every month to permit a walk-through inspection.

2. The weapon batch size will always be one month's quantity.

3. Peak rates per month will be [redacted] DoE (b)(3)

4. Materials coming out of the facility will be

a. Enriched uranium metal (at a yet unspecified assay)

b. Plutonium metal

c. Uranium and plutonium oxides (as explained above)

d. Sealed containers of other materials for ocean disposal.

We believe that the facility study has now proceeded as far as possible, in the absence of specific statements of quantities and types of weapons to be submitted for destruction.

Concerning the classification study, we conclude that, by taking due precautions, it will be possible to design procedures which (1) would require a minimum of information to be declassified and (2) would not jeopardize information likely to remain classified.

A possible set of procedures for adversary observations would include:

1. The external appearance of each weapon in a batch would be examined visually by observers.

2. Each weapon in a batch to be weighed by observers.

3. Observers could weigh and sample enriched uranium and plutonium presented to the IAEA inspector from a batch. (More likely, observers would rely upon weights and assays determined by IAEA.)

4. Observers could weigh the remains (with the HE included) from a batch, but could not examine the remains.

5. Observers could watch the burning of HE but not weigh or examine the HE.

6. Observers could oversee disposal of remains (with the HE having been removed) from a batch in the ocean but would not have opportunity for re-weighing or examining those remains.

Such procedures, along with the detailed classification analysis and necessary adjustments of the mix of weapons selected for destruction, as discussed in the preliminary results, provide the basis for our conclusion.

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