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-1-

MATERIALS TESTING REACTOR PROJECT
ARGONNE NATIONAL LABORATORY
DESIGN REPORT NO. 36

Site Plan

by R.F. Guszik and L.E. Link

Date May 3, 1950

Distribution:

Classification cancelled, or changed to UNCLASSIFIED
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-2-

TABLE OF CONTENTS

- 1.0 Statement of Problem
- 2.0 Proposed Design
- 3.0 Recommendations
- 4.0 Detailed Disclosure of Problem
- 5.0 Design Data
- 6.0 Detailed Disclosure of Design Proposal

APPENDICES

- I Bibliography of Design and Development Reports
- II Reference Drawing List
- III Reference Personnel

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740-2

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-3-

1.0 Statement of Problem

Since the site plan for the MTR is already established, the main purpose of this design report will be to record the premises upon which it was designed.

A reactor of the size and having the purposes of the MTR has a number of auxiliary functions which must be provided for. In addition to the building housing the reactor these include four separate types of water systems, a canal for storage and disposal of spent fuel assemblies, a steam plant, an air cooling and exhaust system, laboratory facilities, quarters for administrative personnel, quarters for maintenance and protection staffs, and waste disposal facilities. For various reasons it is not practical to consolidate all these functions into one building, or a few buildings, hence they are divided, and in some cases combined, into various "areas" and/or buildings. In addition there are two gate houses, perimeter fences and lights, patrol and service roads, sidewalks, and the usual utilities such as electricity, sewers, telephones etc.

With the reactor and its building as a nucleus, these areas are arranged into a "site plan" wherein the best possible locations are made for all functions, subject to a number of important governing factors as outlined in detail in section 4.0.

2.0 Proposed Design

From the data available and a preliminary site plan layout mentioned in Appendix II, an area was selected to fulfill in the best possible manner the requirements of the MTR. The area was selected where the overburden was sufficiently deep to avoid blasting of rock and which provided a level stretch for the quarter-mile beam. The prevailing winds influenced the location of the air system and stack, the deep water flow and subterranean drainage fixed the location of the wells as related to waste disposal, the surface drainage controlled the sewage system, and the geographical location influenced the railroad spur and electrical sub-station.

The plot is divided into fenced-in areas: a "limited" or "clean" area in which most of the general and service functions are located, and an "exclusion" or "hot" area where the reactor, its most closely related auxiliaries and the waste disposal facilities are placed. The limited area includes such functions as gate house, automotive building, fire protection, security, steam plant, water supply, fuel oil storage, and electric sub-station. The exclusion area includes the reactor building and laboratory wing, reactor service building, fan house and stack, process water building, working reservoir, retention basin, effluent control and burial ground, and critical materials storage. In both

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740-3

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-4-

areas careful consideration has been given to provision of adequate space for future expansion of various facilities and addition of others not considered necessary in the initial program.

Area security is adequately provided for by locating the perimeter fence 150 feet beyond all buildings and facilities, by patrol roads placed 15 feet inside of all fences, by regulation perimeter lighting, suitable gate houses and gates, and space for security personnel and equipment.

The site plan as outlined is shown on drawing BKC-3150-91-5, Rev. 1. Later this was cut to the plan shown on BKC-3150-91-5, Rev. 3 which is described in Section 6.

3.0 Recommendations

The site plan as shown on BKC-3150-91-5, Rev. 3 is dictated by strict economy measures and is barely adequate for start-up requirements. As soon as the initial operation indicates the reactor is a success the facilities deleted from Rev. 1 should be reinstated. It is recommended that as the design progresses it be assumed that these facilities will be reinstated at an early date and the details be worked out accordingly.

4.0 Detailed Disclosure of Problem

Important factors governing the layout of the site area are as follows:

- (a) Building or facility function and its relationship to the reactor and other facilities.
- (b) Accessibility to and from not only function-wise but also security-wise.
- (c) Contamination and pollution as it may affect other facilities.
 - 1. Wind direction
 - 2. Deep water direction
 - 3. Subterranean drainage
 - 4. Surface drainage
- (d) Power, railroad and highway connections.
- (e) Topography of MTR Plot.
 - 1. Flat terrain for the quarter-mile beam.
 - 2. Natural drainage for the retention basin.
 - 3. Overburden.
- (f) Security.
 - 1. Fire fighting
 - 2. Patrolling
- (g) Future expansion of initial facilities.
- (h) Future buildings and facilities.
- (i) Most feasible and shortest piping, air ducts, wiring, fencing, roads and walks.

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-5-

Probably the most important problem in establishing a plot plan is the satisfactory location of the reactor building and the reactor itself. In studying the topography of the site the first problem is to find a spot on the plot that extends out relatively level in the direction of the quarter-mile beam. This is necessary for a possible future use of the quarter-mile beam of the reactor. The overburden at the reactor building location is also important. The excavation for the reactor building, canal, reactor building wing and the reactor itself is quite extensive in area as well as depth. It can readily be seen that a plot with scanty overburden over a sizeable area would not be too satisfactory since this would necessitate rock blasting which is time consuming and costly. The location of the reactor must also be in a vicinity where suitable wells may be drilled with little difficulty. These wells should be relatively close by and should produce sufficient gallonage for the MTR Project. It would also be desirable to have the plot sloping in one direction away from the reactor to get natural drainage to the retention basin which holds up the bulk of the contaminated water.

Having located the reactor building and the adjoining wing satisfactorily and in the proper orientation as to deep water flow, subterranean drainage, surface drainage, and prevailing wind direction, the problem now is to locate the other buildings in the most suitable locations. The process water building should be as close to the reactor as practical so that piping may be minimized, however not closer than fifty feet to the reactor building so that a roadway may run between the buildings. The cooling tower and the demineralizing building should be close to the water process building leaving again fifty feet between buildings. Although the working reservoir should also be in as close as possible to save on piping yet sufficient space must be left to allow for the valve pit, strainers, and venturi. Locations should also be so selected to allow for future expansion. The air stack should be approximately 300 feet away from the reactor building and so located that the contaminated air will be blown off the site boundary in a path covering the least amount of site area.

All buildings and facilities should not be closer than fifty feet from each other. This is established so that sufficient roadways can be laid not only for accessibility but also in case of fire emergencies. The function of any particular facility and its relationship to other facilities is to be taken into consideration. In locating effluent storage the deep water flow, the subterranean and surface drain direction should be such that any contamination that may get out of the tanks would tend to flow away rather than towards other buildings. Hot material burial and sewage disposal is to be located as far away from all buildings as possible and so located that water flow will not carry contamination into the rest of the area.

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-6-

The plot is to be sub-divided into two areas, a limited area and an exclusion area. The limited area is to consist of facilities and activities which are vital and restrictive but which can be controlled by effective security or administrative measures. The facilities in this area are essentially non-radioactive. The area occupied by the reactor building, reactor building wing, process water building, working reservoir, filter and fan house, stack and any other facility containing radioactive activities is to be treated as an exclusion area.

The perimeter of the plot is to be fenced-off with an 8'-0" high chain link fence topped with three strands of barbed wire angling inward. The limited area is to be separated from the exclusion area by a similar fence. The hot material burial, effluent control and spent fuel assembly storage will be fenced separately within their respective areas.

All buildings and facilities are to be a minimum of 150 feet within the perimeter fence. A patrol road is to encircle the plot within 15 feet of the perimeter fence. A stationary lighting system is to be provided consisting of lighting fixtures which provide continuous light during hours of darkness. Pendant luminaries with a refractory lens, designed so as to direct most of the light in the direction needed, should be used. All normally used pedestrian and vehicle entrances to the area where guards or other personnel are engaged in checking identifications, shall be effectively lighted. The emergency power system for the areas is to be located within the exclusion area. All areas within a separated fencing of their own shall be past and effectively lighted.

A control house shall be located at the entrance to the plot or limited area. A smaller control house is to be located at the entrance to the exclusion area. A truck trap is to be installed at the limited area entrance. All other entrances to the plot shall be such that they offer difficult egress or ingress when not in use.

The facilities requiring rail service shall be so located as to dictate the shortest and straightest run rail sidings within the plot. Suitable parking and bus terminal is to be provided near the plot entrance.

The entire plot is to be graded and grassed in order to minimize the dust problem. Wind breaks should be considered if found to be necessary for the area.

Sufficient area should be left for future buildings. This vacant area should preferably be near the entrance end of the plot plan. Enough area must be left on either side of the canal for future hot laboratory buildings. No building should be so located to prevent future canal extension.

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740-6

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-7-

Roadways and walks should be planned so that a minimum of underground piping and wiring pass underneath. Access to pipe tunnels and underground lines should be planned so that roadways do not suffer destruction when repairs, changes, or additions to existing systems are carried out in the future.

5.0 Design Data

Design data applicable to the layout of the site plan will be found in some of the references given in Appendix I wherein general features of the Reactor Testing Station area are described. Of particular interest are the following: Nos. 1, 2, 7, 8, 10, 12, 14 and 15.

6.0 Detailed Disclosure of Design Proposal

The final approved design is given on Drawing 3150-91-5, Rev. 3. This includes only the facilities needed for start-up operations. After the reactor startup procedure proves the design to be a success it is expected that installation of the balance of the facilities shown on BKC-3150-91-5, Rev. 1 will be initiated.

After BKC-3150-91-5, Rev. 1 was agreed upon a critical economic study of the Materials Testing Reactor was made during which it was decided to cut the initial construction costs to the bare minimum needed to prove that the reactor will perform satisfactorily. From this standpoint it was necessary to restudy the site plan and the various facilities. The automotive building, reactor service building, warehouse, and hot materials burial were eliminated from the initial construction plans. The cafeteria building was reduced in area from approximately 3,500 square feet to 800 square feet and will merely serve as a canteen. The electric sub-station was moved closer to the water reservoirs. With this change it was possible to reduce the site area from approximately an area 2,900 feet x 1,900 feet to an area 1,100 feet x 1,700 feet. The reduced site plan is shown on drawing BKC-3150-91-5, Rev. 3.

Although initially, construction will be as outlined in the reduced site plan, it is planned to construct some of the eliminated facilities in the future. The first expansion which could be expected would be to replace the tips on the reactor wing, installation of the reactor service building, and the installation of a warehouse. The reactor wing tips would be expected within a year after the reactor starts. The service building and warehouse would be added at the same time or slightly later depending somewhat on the volume of experimentation and the efficacy of usage of central machine shops and storage facilities. Service facilities to these future additions will be provided at the respective positions in the initial construction period if not too costly. Main header lines and service lines will be so sized that these additions can take place without difficulty in piping and future construction.

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740-7

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-8-

The steam plant will be made large enough initially to handle all facilities shown on drawing BKC-3150-91-5, Rev. 3 plus the capacity to take care of the future tips on the reactor wing, the service building, and the warehouse. Space will be allowed in the plot for possible future addition of filters to the fan house for the reactor exhaust air which have been eliminated from the present fan house.

Additional future expansion will probably consist of the following: administration building, second laboratory wing, cafeteria, maintenance building, expansion to demineralizer building, expansion to cooling tower, hot laboratories, and expansion to the boiler house. These future expansions are to be kept in mind in laying out the site plan. With these expansions the site plan area will undoubtedly increase to somewhat the area as shown on drawing BKC-3150-91-5, Rev. 1. In the initial construction period, no provisions are to be made for these additions.

The design will not be discussed in detail as it follows the general philosophy outlined in section 4.0.

R. F. Guzik
R.F. Guzik

L. E. Link
L.E. Link

RFG:LEL:rw

Approved by:

John R. Huffman
John R. Huffman

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740-8

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-9-

APPENDIX I

Bibliography of Design and Development Reports

No.

- 1 AI-(49-1)-311 Survey Report on Fort Peck, Montana and Pocatello, Idaho Sites, dated March, 1949 by Smith, Hinchman and Grylls, Inc.
- 2 Meteorology of the Reactor Test Site, Arco, Idaho
by R.C. Wanta and F.D. White of the Scientific Services Division - U.S. Weather Bureau, Washington D.C.
dated September 16, 1949
- 3 Earthquake Information of Possible Application at Arco, Idaho
by J. Stewart Williams
- 4 ANL-4263 Quarterly Report for Period Ending March 1, 1949
by J.R. Huffman - Secret
- 5 ANL-4304 Quarterly Report for Period Ending June 1, 1949
by J.R. Huffman - Secret
- 6 ANL-4351 Quarterly Report for Period Ending September 1, 1949, by J.R. Huffman - Secret
- 7 MonN-262 Process Design Information
by M.C. Leverett and J.R. Huffman
dated March 4, 1947 - Secret
- 8 MonT-433 Feasibility Report on Clinton High Flux Pile
by J.R. Huffman, M.C. Leverett, H.W. Newson and A.M. Weinberg
dated December 1, 1947 - Secret
- 9 ANL-SI-27 Preliminary Estimate for Cost of Materials Testing Reactor
by Smith, Hinchman and Grylls - Secret
- 10 JRH File Proposed Site Plan and Building List of
No. 4114 Materials Testing Reactor and its Immediate
(7-518) Facilities
by J.R. Huffman, dated April 19, 1949
Restricted
- 11 JRH File Site Plan (1100 Area Site Plan at ORNL)
No. 4114
(7002)

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740-9

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-10-

No.		
12	JRH File No. 4114 (B-202)	The Kellex Corporation Engineering Study No. 2 Site Plan Restricted
13	JRH File No. 4114.1	Contacts with Kellex Corporation May to September, 1947 - Secret
14	ANL-SM-20	Site Survey Study dated April 25, 1949 - Confidential
15	Study Req. No. 2	The Kellex Corporation Status of Work Report Plot Plan - 1100 Area (Doc. No. 48-3-89) by Kellex Corporation dated January 12, 1948 - Restricted

APPENDIX II
Reference Drawing List

Several studies of the site plan have been made by ANL. The data available along with ANL drawings of the site plan have been forwarded to the design contractor from which the present site plan has been developed. ANL drawings of the site plan are the following:

MTR-3007-E	Preliminary Study No. 1 - Plot Plan dated April 12, 1949 - Restricted
MTR-3014-E	Proposal Plot Plan Study No. 2 - Restricted dated May 15, 1949

The site plan as developed by the design contractor and approved by ANL is shown on Drawing BKC-3150-91-5, Rev. 1. Since the time of this drawing there has been a revision due to the decision of keeping the cost of construction and development of the MTR at a minimum. Drawing BKC-3150-91-5, Rev. 3 shows the site plan to date.

APPENDIX III
Reference Personnel

J.R. Huffman	ANL	P.O. Box 5207	Chicago (80), Illinois
A.B. Schultz	ANL	P.O. Box 5207	Chicago (80), Illinois
R.F. Guzik	ANL	P.O. Box 5207	Chicago (80), Illinois
L.E. Link	ANL	P.O. Box 5207	Chicago (80), Illinois

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740-10

- LIST OF AREAS**
SYMBOL	DESCRIPTION
YARD (OUTSIDE FENCE)	
YARD (INSIDE FENCE)	
REACTOR BUILDING	
REACTOR BLDG WING	
PROCESS WATER BLDG	
WORKING RESERVOIR	
COOLING TOWER (DUMP HOUSE)	
CONDENSING BLDG	
STEAM PLANT	
RAILROAD & STACK	
PLUG STORAGE	
RETENTION BASIN	
EFFLUENT CONTROL	
SECURITY BLDG	
CANTEEN	
EMERGENCY C.H. WATER TANK	
RESERVOIR (WATER PUMP HOUSE)	
CONTROL HOUSE - LIMITED AREA	
CONTROL HOUSE - EXCLUSION AREA	
ELECTRIC SUB-STATION	
SANITARY SEWAGE TREATMENT PLANT	

- LEGEND**
SYMBOL	DESCRIPTION
1	BLOCK NUMBER
2	AREA NUMBER
3	SANITARY SEWERS
4	WATER MAINS
5	WATER DRAINAGE
6	WATER DRAINAGE - PROCESS
7	WATER DRAINAGE - PROCESS
8	WATER DRAINAGE - PROCESS
9	WATER DRAINAGE - PROCESS
10	WATER DRAINAGE - PROCESS

GENERAL NOTES

ELEVATIONS ON BLOCK PLANS SHOWN THUS
ADD 4000 TO CONVERT ELEVATIONS TO
SEA LEVEL DATUM.

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PITTSBURGH, PA.		PITTSBURGH, PA.	
UNITED STATES ATOMIC ENERGY COMMISSION		RESEARCH & DEVELOPMENT	
MATERIALS TESTING REACTOR		YARD AREA 18	
PLOT PLAN		3180-915	
3180-915		3180-915	

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- LIST OF AREAS**
AREAS	DESCRIPTION
1	YARD - OUTSIDE FENCE
2	YARD - INSIDE FENCE
3	REACTOR BUILDING
4	REACTOR BUILDING WING
5	PROCESS WATER BUILDING
6	WATERING RESERVOIR
7	COOLING TOWER & PUMP HOUSE
8	DEMINERALIZER BUILDING
9	STEAM PLANT
10	AIR FILTER BUILDING, FAN HOUSE, & STACK
11	REACTOR SERVICE BUILDING
12	RETENTION BASIN
13	EFFLUENT CONTROL
14	SECURITY BUILDING
15	AUTOMOTIVE BUILDING
16	CAFETERIA BUILDING
17	HOT MATERIAL BURIAL
18	EMERGENCY OVERHEAD WATER TANK
19	RESERVOIR & WATER PUMP HOUSE
20	CONTROL HOUSE - LIMITED AREA
21	CONTROL HOUSE - EXCLUSION AREA
22	WAREHOUSE
23	ELECTRIC BUS STATION
24	SIXTAY SEWAGE TREATMENT PLANT
25	AIR SUPPLY BUILDING

NOTES

1. THE ADDITIONAL WATER WELLS TO BE LOCATED - FUTURE
2. THE WELLS TO BE LOCATED - FUTURE
3. THE WELLS TO BE LOCATED - FUTURE
4. THE WELLS TO BE LOCATED - FUTURE

1. SYMBOL (A) INDICATES STRUCTURE HEIGHTS (FT)

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CHEMICAL PLANTS DIVISION BLAW KNOX CONSTRUCTION COMPANY PITTSBURGH, PA.	
UNITED STATES ATOMIC ENERGY COMMISSION ISRD OPERATIONS MATERIALS TESTING REACTOR	
YARD - MTR PLANT AREA #1	
PLOT PLAN	
DATE: 11-1-58	BY: J. H. 3180

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740-12

700 600 500 400 300 200 100 0

END

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