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The following material quantities were used in this building:

Material	Quantity
Structural Steel	390 Tons
Reinforced Concrete	17,400 Cu. Yds.
Concrete Blocks	50,000 Blocks
Concrete Bricks	71,000 Bricks
Roofing	250 Squares

The material quantities required in the construction of the Piles has already been given in this section.

In addition to the Piles and the rod mechanisms, the 105 Buildings contain the following pieces of major equipment:

Number	Type	Size - Capacity - Power
2	Recirculating Pumps	125 GPM
2	Oxalic Acid Feed Tanks	8' diameter x 7' in height
1	Oxalic Acid Rubber-lined Constant Level Tank	
2	Injection Pumps	125 GPM
1	Sulphuric Acid Constant Level Tank	8' diameter x 7' in height
1	Final Feed Tank	
1	Sodium Dichromate Storage Tank	1,000 Gallon
1	Sodium Dichromate Constant Level Tank	1,000 Gallon
2	Gas Pumps	15 c.f.m.
1	Gas Pump	2 c.f.m.
1	Air Compressor	116 c.f.m.
1	Electric Strip Heater	250 W - 750° F.
1	Gasoline Electric Generator Tank	10 KVA - 220/110 V.
1	Water Heater	150 GPH
4	Exhaust Fans	75,000 c.f.m.
4	Supply Fans	50,000 c.f.m.
1	Air Supply Unit	4,400 c.f.m.
2	Glass-lined Tanks	30 Gallon
2	Stainless Steel Tanks	30 Gallon
1	Air Compressor	114 c.f.m.

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116 STACK

There is one Ventilation Exhaust Stack in each of the three 100-Areas. It is located between the 105 and 115 Buildings and is connected to both of these buildings by concrete ventilation ducts.

Each stack is of reinforced concrete set on a reinforced concrete octangular base. The Stack varies in outside diameter from 16'-7" at the bottom to 9'-6" at the top. The Stack itself is 200' high while the foundation extends 17'-6" below the bottom of the Stack. In the side of the Stack facing the 105 Building, is a breech opening 18' high by 8' wide.

This structure required a total of approximately 595 cubic yards of concrete.

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d 200 Process Areas

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(1) Description of Sites

As previously outlined in Part 1, Section E, "Preliminary Description of the Plant", the scope of the work included the construction of three 200 Process Areas, designated as 200 North, 200 East and 200 West according to their respective geographic locations. The nature of the Plant, plus certain hazards involved in its operation, made it undesirable to concentrate these buildings in one area. Certain storage buildings were segregated (200-N) and the productive capacity divided (200-E & 200-W). The distances required between areas made a large tract necessary. The sites selected lay in the intervening valley between the Rattlesnake Hills, Gable Mountain, and Gable Butte with the latter two providing a natural barricade between the 100 and 200 Process Areas.

(a) Locations

Sites for the 200 East and West Process Areas are located at the east and west extremities of a well defined gradual sloping flat topped ridge forming a water shed between Cold Creek Valley and the Flats. The southerly slope of the ridge was not nearly so pronounced as the northern, which breaks sharply just north of the Hanford-Cold Creek Road. This ridge parallels Gable Mountain and Gable Butte, and is approximately seven miles in length. The flat top section is above the 700' contour and varies from two to two and one-half miles in width.

Process Area 200 East occupies Sections 2, 3, 10, and 11 in Township T12N-R26E and part of Sections 34 & 35 in Township T13N-R26E. Process Area 200 West is located at the intersection of four townships with portions of the Area in the following: Section 36 in Township T13N-R25E, Section 31 in Township T13N-R26E, Sections 1 & 12 in Township T12N-R25E, and Sections 6 & 7 in Township T12N-R26E. The northern boundaries for these areas are approximately six-tenths of a mile south of the Hanford-Cold Creek Road.

Two separate sites were selected for the 200 North Process Area, one containing the three Lag Storage Areas, the other the Magazine Storage Area. Both sites lay approximately one mile north of the Hanford-Cold Creek Road. The larger, or main portion of the 200 North Area, lays in the Flats, south and directly opposite the narrow gap between Gable Mountain and Gable Butte. This area occupies portions of Sections 20, 21, 28 & 29 in Township T13N-R26E. The east section of the 200 North Area lies at the foot of the south slope of Gable Mountain approximately one and one-half miles west from the east end of the mountain. The area is located in Sections 29 & 30 in Township T13N-R27E.

(b) Fenced Areas

All 200 Areas were rectangular in shape and permanently fenced, with fence lines paralleling Section and Coordinate Lines, with the exception of the east section of the 200 North Area, which is octangular in shape.

The 200 West Area extends 10,900' north and south, and 7,600' east and west, containing approximately 1,901.7 acres with corner coordinates as follows: N46600.0-W70600.0; N46600.0-W78200.0; N35700.0-W78200.0; N35700.0-W70600.0.

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The 200 East Area, almost square in shape, extends 9,620' north and south, and 9,580' east and west, containing approximately 2,115.7 acres with corner coordinates as follows: N46880.0-W47240.0; N46880.0-W56820.0; N37260.0-W56820.0; N37260.0-W47240.0.

The 200 North Area is composed of four separate fenced areas, totaling approximately 58.6 acres; three of which, having the same dimensions, comprise the western section of the area and the fourth the eastern section of the area. Fenced areas N, P, and R measure 845' north and south, and 620' east and west, with each containing approximately 9.7 acres. These areas lay equidistant in a single row, separated by a distance of 2,020' with corner coordinates as follows:

N Area - N55565.0-W65280.0; N55565.0-W65900.0; N54720.0-W65900.0; N54720.0-W65280.0.

P Area - N55565.0-W62640.0; N55565.0-W63260.0; N54720.0-W68260.0; N54720.0-W62640.0.

R Area - N55565.0-W60000.0; N55565.0-W60620.0; N54720.0-W60620.0; N54720.0-W60000.0;

The eastern section of the 200 North Area, containing approximately 29.5 acres, extends 1,510' north and south, and 1,080' east and west, with corner coordinates as follows: N55040.0-W34260.0; N55540.0-W34620.0; N55540.0-W34980.0; N55040.0-W35340.0; N54530.0-W35340.0; N54030.0-W34980.0; N54030.0-W34620; N54530.0-W34260.

Ground elevation within the 200 West Area varies from 748.5' to 640.0' above mean sea level datum. The major portion of the fenced area slopes westward to a well-defined draw which runs along the inside of the west fence and saddles midway with run-off in both directions, southward to Cold Creek Valley and northward to the Flats.

Terrain within the 200 East Areas varies from 748.0 to 585.0 with most of the fenced area gradually sloping southward toward Cold Creek Valley and the north and northeastern portion of the area sloping in the direction with the run-off in the direction of the Flats and Hanford.

(e) Soil Conditions

The top soil in the 200 Area is mainly medium light brown sand, containing some silt, varying in depth from one foot to twenty feet, partially stabilized by sagebrush, greasebush, and clumps of cheat grass. Immediately beneath this layer is a stratum of coarse gravel, cobbles, and sand, followed by intermittent layers of sand, cemented sand and pea gravel. Available weather records indicated a maximum frost depth of eighteen inches.

Four general methods were employed to determine the type of soil and foundation bearing capacity; namely, core borings, test pits, test tables, and test poles.

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1 Preliminary Investigations

Three core borings were made for the "Gable Project", now known as the Hanford Engineer Works, by the Portland Office of the United States Geological Survey to determine the nature of overburden on the Project Area. These borings, varying in depth from 95' to 540', were made at the following locations: Station L-3 located in the southwest corner of Section 30, Township T12N-R26E; Station L-6, located in the southwest corner of Section 28, Township T13N-R25E; and Station L-1, located in the southwest corner of Section 15, Township T13N-R27E. The results obtained by these sub-soil investigations are outlined in the letter dated April 7, 1943, to the Chief of the Engineering Division, quote: "All holes penetrated sand and gravel of excellent bearing capacity with some silt and clay layers, also of excellent bearing capacity. Foundation conditions in the entire area are good for loads up to eight tons per square foot at a depth of four to five feet below the ground surface."

The boring made at Station L-6 falls northwest of the 200 Process Areas but is typical of those areas with the strata varying directly in elevation as to differences in terrain within the areas. A copy of the Driller's Log, made at this location, is as follows:

Boring at Station L-6

Strata	Depth
Sandy Loam	0'-5'
Sand and Gravel Boulders at 15'-20'	5'-20'
Impervious Cemented Gravel with Sand and Silt	20'-87'
Gravel, Sand, Silt & Clay Impervious Dry	87'-125'
Loose Dry Sand	125'-220'
Gravel, Sand & Clay	220'-288'
Cemented Gravel, Impervious	288'-342'
Sand & Pea Gravel, Some Clay, Impervious	342'-365'
Firm Cemented Sand, Impervious	365'-395'
* Pea Gravel & Sand	395'-402'
Compacted Sand, very little water	402'-430'
Sand & Gravel	430'-462'
Compacted Sand	462'-480'

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Boring at Station L-6 (Con't.)

Strata	Depth
Sand & Pea Gravel	480'-492'
Brown Sandy Clay	492'-513'
Sand & Gravel	513'-518'
Pea Gravel & Sand with Clay	518'-540'

* Water table rose to 365'

2 Core Borings

On June 25, 1943, prior to the major excavation work in the 200 West Area, two 6" diameter core borings were started to determine the exact soil strata underlying the 221-U Building Site. These borings were completed on July 2, 1943, at a depth of 90', and were the only core borings made in the 200 Process Areas. This work was done by the Ranny Water Collector Corporation, of Louisville, Kentucky, and was covered by an alteration to their contract, RPG 57½. The logs from the five Durand Test Wells drilled in the 200 North Area were used, thus avoiding duplication of labor in determining soil bearing conditions.

Tabulated below are the logs for the core drill holes made at Building 221-U:

Hole #1 at Coordinates W37500-N38160

Strata	Depth	Elevation
Grade		700.7'
Loose yellow sand	5'	695.7'
Sand, coarse & medium gravel and cobbles	30'	665.7'
Partially cemented sand, medium gravel and cobbles	23'	642.7'
Cemented sand and gravel	32'	610.7'

Hole #2 at Coordinates W73285-N38410

Strata	Depth	Elevation
Grade		703.4'
Loose yellow sand	5'	698.4'
Coarse sand, gravel and cobbles	65'	633.4'
Cemented sand, pea gravel & some mud streaks	20'	613.4'

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3 Test Pits

Five area test pits numbering 1, 2, 3, 1A, and 3A were dug with a clamshell crane in the 200 West Area prior to the establishment of the coordinate system in order to locate aggregate barrow pits, and as a general soil reconnaissance of that area. Two such pits were dug in the north portion, two in the middle portion, and one in the south portion of the West Area. Three other test pits were also dug, employing the same method for similar reasons, in the 200 East Area. These last pits numbered 6, 7, and 8, and were made in the north, south, and middle portions of that area.

At the completion of general excavation for the 221-T and U Buildings, it was decided to dig two six-foot square test shafts in the excavated area in each building in order to visually inspect the undisturbed soil to a depth of thirty feet below the building footing pads.

One test shaft was dug in the deep sewer section located in the northern part of each building, requiring only an additional fifteen feet of excavation to obtain the desired depth. The other pit was dug in the southern part of each building, starting approximately at the bottom grade of the foundation pad in that portion of the building.

Pit Number 1, starting at elevation 679.0' and located at coordinates N44065-W73134, is typical of both buildings. The first five feet consisted of coarse gravel and dry sand, the next three feet of fine dry yellow sand, (hard packed) and the next seven feet of very coarse black sand (loose packed) and a small amount of pea gravel.

A preliminary foundation slab pour was made by representatives of the Design Division at the 221-T Building, on July 27, 1943, to check the capillary reaction of concrete poured on loose gravel and sand. Very little moisture was lost during this pour. However, to insure against losses which might occur during future pours, it was recommended that all loose subsoil be vetted down thoroughly beforehand.

4 Test Tables and Test Poles

Test tables were set up within the site area of all major structures to determine accurately the load-bearing capacity of the soil in order to prepare adequate foundation designs to meet field conditions. A minimum bearing load of 8,000 pounds per square foot, having less than 10/32 of an inch of settlement, was required for all process buildings and large service structures, such as: 212, 213, 221, 224, 231, 241, 251, 272, 282, 283, 284, and 291 Buildings.

Wooden test tables, having bearing plates twelve inches square and platforms six feet square, were set at a minimum of four to five feet below ground level in undisturbed soil. Additional test tables were set up in the deep excavations of buildings such as 221 and 241. Weight was added at regular twenty-four hour intervals in 2,000 pound increments over a period of ten days. From the settlement readings made daily, settlement diagrams were plotted for each test to ascertain the actual soil-bearing capacity.

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Up to June 10, 1944, when these tests were approximately 100 per cent complete, a total of seventy-two had been made, averaging from 10,000 to 12,000 pounds per square foot. Twenty-eight of the total tests were made in the 200 West Area, averaging two per building; thirty-four were made in the 200 East Area, twelve of these at the 221-C Building Site; and ten were made in the 200 North Area. Of this group, only one failure was recorded in the 200 West Area at the 231-W Building, and two in the 200-North Area, at the 213-J and 213-K Buildings. The foundation walls for the 231-W Building were extended to provide a more stable foundation. The original footing design for the 213-J and 213-K Buildings had to be changed to obtain the required bearing capacity. In the 200 East Area, soil failures, (load bearings less than 5,000 pounds per square foot) were found at the 221-C, 224-C, 282-E, and 284-E Building Sites. The standard foundation designed for the 221-C Building had to be changed to correct this condition. A layer of volcanic ash, varying from two to three feet thick, was encountered in the excavation of the 282-F and 284-F Buildings which had to be removed, increasing the original foundation depth. Foundations for the 224-C Building were likewise deepened for similar reasons.

A series of pole foundation tests were conducted to determine the maximum deflection of overhead lines due to the varying top soils found in the Plant Area. Additional tests were made by applying unbalanced loads to supports set in different types of soil and by encasing butts of pole supports in concrete to determine the maximum anchoring effect.

(d) Existing Facilities

Prior to the start of construction, the 200 Process Areas were completely barren of facilities and man-made improvements with the exception of roads as follows: a twenty-foot loose gravel-surfaced road known as the Hanford-Cold Creek Road, State Highway 11A, which ran east and west between the 200 East and West and 200 North Areas; a second sixteen-foot loose gravel-surfaced road ran southwest from White Bluffs connecting with the Hanford-Cold Creek Road and passed through the northwest corner of the 200 North Area; a third single lane ranch road ran southwest from the White Bluffs Road to Benton's Ranch and passed through the northwest corner of the 200 West Area.

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(2) Preliminary Work

(a) Layout

Layout began March 27, 1943, at which time horizontal and vertical controls were established in order to prepare a topographic map of the 200 North, West, and East Areas. This was required by Design for the location of permanent buildings and facilities. These Areas were mapped in the following sequence:

Area	Started Preliminary Controls	Completed Topographic Map
200 West	3-27-43	5-6-43
200 East	4-3-43	6-3-43
200 North	6-11-43	6-23-43

From time to time additional inter-area topography was requested by Design for locating facilities. Outlying portions of these areas were mapped which had not been included in the original survey.

Process Areas 200 North, West, and East were coordinated from the established base line N-50,000 previously described in the same location for the 100 Areas.

200 West Area

W-76,000 from N-50,000 to N-22,000 was a corrected base line which was turned 90° off of N-50,000. North lines were turned off of W-76,000 at 1000 foot intervals and chained East to W-70,000 and West to W-82,000.

200 East Area

N-48,000 was turned 90° off of W-76,000 and chained East to 50,000 through both areas. All layout on N-48,000 was chained West or East of W-56,000. Other North lines were turned off W-56,000 and chained East to W-50,000 and West to W-62,000.

200 North Area

N-50,400 was an offset base line established from N-50,000 for both 212 and 213 Areas. In the 212 Areas W-45,000 and W-75,800 was turned 90° off of N-50,400 with the East and West coordinate lines being turned off of these lines at 1000 foot intervals. The 213 Area was likewise coordinated by turning W-33,600 and W-36,800 - 90° off N-50,400 and from these lines established East and West lines at 1000 foot intervals.

Hub-tacked wooden stakes (2" x 2" x 16") protected by 4' x 4' wooden barricades were used as temporary coordinate points. Later, brass caps bearing coordinates and elevations were set in concrete monuments at undisturbed points for future reference.

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Temporary bench marks were set in all areas, with elevations established from corrected level circuits tied to the United States Coast and Geological Survey Bench Mark, based on Mean Sea Level Datum located in the 100-B Area.

During the week ending June 5, 1943, the permanent fence line for the 200-West Area was staked-out; however, there was a lapse of about three weeks before starting of the layout for the TC Area and Facilities. Layout for site clearing and excavation of the first permanent building (221-T) was made June 22, 1943, and similar layout for the last permanent building (231-W) was completed on June 13, 1944.

In the construction of the 200-East Area the layout for the 221 and 241 Buildings preceded layout for temporary construction as in the 200-West Area. The objective was an early completion of major excavation work by the subcontractor. The same was true for the 200-East Area.

On July 27, 1943, Building 221-B was laid out for site clearing and general grading with the last building layout lagging as late as June 24, 1944, due to required sequence of construction in the congested area about the 221-B Building and the receipt of additional building design. Layout for the TC Building and Facilities in the 200 East Area began November 30, 1943, and was completed during the latter part of December of that year.

Layout for the 212-P, 212-N, and 212-R Buildings in the 200 North Area was started December 5, 1943. Building layout for 213-J and 213-K did not begin until April 10, 1944. No layout was made for temporary buildings and facilities due to the limited amount of TC work in those areas.

(b) Organization

The initial step in organizing the 200 Process Areas for construction began July 1, 1943, when a Division Engineer was assigned to handle all construction work in these areas and the 300 Process Area. Later, as additional key engineering personnel arrived on the job and as work in the Process Areas got under way, Division Engineers were set up for individual areas as follows: Division Engineer 200 West and North Areas, Division Engineer 200 East Area, Division Engineer 272 Areas, and Division Engineer 300 Area.

Up to November 19, 1943, the work in the 200 North, East, and West Areas progressed under the original Division Engineers assigned for those areas. At that time a second Division Engineer was set up to supervise the construction of temporary buildings and facilities for the 200 East Area and to expedite the construction of the 272 and 273 Buildings in that Area. On January 8, 1944, the Division Engineer for this area was assigned to other work having completed most of the larger temporary buildings and facilities. The construction responsibilities for this area were reassumed by the Division Engineer, 200 West Area.

A Division Engineer was permanently assigned to the 200 East Area Construction on February 22, 1944, at which time permanent construction work was scheduled to begin. A third Division Engineer's Office was established on March 13, 1944, which was responsible for the completion of the 200 Area

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Shop Buildings 272-E and 272-W and the special field fabrication work performed there by construction forces.

(e) Establishment of Temporary Construction Facilities

The 200 Process Area Sites lacked all necessary temporary construction facilities; therefore, before permanent construction work could be accomplished, the following had to be provided: Construction Offices, Shops, Storage Buildings and Yards, Electric Power, Water, Steam, Telephones, Roads, Railroads, Walks, Fences, Commuting Facilities, etc. The time required for the establishment of the above facilities in each area directly affected the progress of permanent construction. Plot Plans showing the layout of Temporary Construction Buildings and Facilities in the 200 West and 200 East Areas are included in the preceding Section, subheading a Temporary Construction Facilities (7) (e).

Definite locations were set aside in the 200 East and West Areas at the beginning of construction as Temporary Construction Areas, in order to avoid interference with the erection of permanent plant structures. In the West Area, the section lying within the boundaries of "C" and "D" Avenues and First and Eighth Streets and two plots, one north and one south of the Power Area Extending to the 221 Buildings, were reserved for construction needs. An area 1,200' x 3,200', lying south of "C" Street in the central portion of the 200 East Area, as indicated by the dotted line on the included plot plan, was designated as the TC Area.

1 Construction Offices and Shops

On June 22, 1943, construction was officially opened in the 200 West Area at which time ground was broken at the 221-T Building Site. The first temporary construction work in this area, by du Pont, was the erection of a 24' x 40' wood frame building located in the vicinity of the 221-T Building, started on July 12, 1943. This housed the early offices of the Division Engineer's personnel. Later as the personnel expanded in proportion with growth of construction, a larger office building providing more adequate facilities was erected on the West side of "C" Avenue midway between 200-T & U Process Areas. This office was not ready for occupancy until October 23, 1943. A shortage of carpenters existed at this time as a temporary "hold" had been placed on all work in this area in order to speed up the completion of vital Hanford Camp Buildings. This condition was also responsible for the lag in the completion of the Carpenter Shop, Millwright Shop, Pipe Shop, Reinforcing Steel Shop, Electrical Shop, Miscellaneous Offices, Warehouses, etc.

A total of 97 buildings and 8 facilities, as listed under subheading a Temporary Construction Facilities (7) (e) (200 West Area) and as shown on the included plot plan of that area, were constructed in the 200 West Area.

Facilities included the construction of roads and walks, storage and parking lots, railroads, sanitary water lines and fire protection system, sewers and septic tanks, electric power and lighting, temporary boilers and steam lines, air lines, and telephones.

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Temporary construction work was essentially complete in this area by February 1, 1944. Other pertinent work, temporary in nature, needed for certain field fabrications and special experiments were charged directly to the buildings and are not included in Cost Codes TC-34, 35, or 36. Examples of such construction are the fabrication yard for pre-cast concrete cell block covers located in the 200-West Area, meteorological studies at the 291-T Building, and preassemblies at the 272-E and 272-W Buildings. These and several other expedients will be discussed later in this section under Subheading (b) "Special Construction Methods".

The erection and establishment of similar buildings and the same facilities were required for the construction of the 200-East Area, totaling 58 buildings and 8 facilities, as listed under Subheading a, Area Temporary Construction (7) (c) (200-East Area) and as shown on the included Plot Plan of that area. The extent of TC work performed in the 200-East Area up to December 6, 1943, was negligible due to the shortage of carpenters and laborers. Up to that time a few small wood frame skidded craft buildings and one Butler Nisson Type Hutment were erected in the vicinity of the 272-E Building on which permanent construction work was under way. The hutment served as offices for the Division Engineer's personnel throughout the temporary construction period. On February 29, 1944, these offices were moved into the Division Engineer's Office located on "G" Avenue halfway between the 221-B and 221-C Buildings. A second Division Engineer's Office was built within the 272-E restricted area fence upon the establishment of a separate organization. Temporary work was essentially complete in the 200-West Area by June 1, 1944.

The extent of temporary work in the 200-North Area was held to a half dozen movable craft buildings and two facilities (lighting and water). These small structures were moved from one building to another as construction progressed.

2 Electric Power

Temporary lighting and electric power for construction needs were first obtained in the 200-East and West Areas from portable gasoline-driven generator sets, varying in size from 3 KW to 50 KW, which were suitably located in the field to serve shops and construction areas dependent upon this facility. These units were used entirely in the construction of the 200 North Areas and other isolated sections of the plant where the installation of temporary lighting and power would have required considerable expenditure of labor and critical materials.

The Pacific Power and Light Company provided the Hanford Engineer Works with construction electric power. Service for the 200 East and West Areas was obtained by tapping the existing 66 KV transmission line of the Pacific Power and Light Company approximately 3.5 miles East of Allard Substation, later co-ordinated as N65853.0-W56363.03 and by building a temporary three wire 66 KV transmission line due south of N45600-W56405 just inside the NE corner of the 200-East Area, then West to N45600-W74200, then again South, terminating at N40585 - W74200. At this point a temporary substation was constructed. It consisted of a single auto-transformer having a capacity

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of 5,000 KVA with 66,000 volts primary and 6,900 volts secondary, 3 phase, 60 cycle, power. The substation was open-type framing with the transformer set on a concrete foundation enclosed by a wooden fence and contained necessary switching and metering equipment. It was energized on September 3, 1943.

Eleven temporary transformer banks (ground installation) were constructed in the West Area, furnishing 440/220 volt secondary power and 110 volt lighting power. A 6,900 volt transmission line was built North from the 200 West Area Substation to the Cold Creek Road, thence East and West paralleling it, serving the Central Shops Area and the McGee Well and Booster Station.

A substation was also erected in the 200 East Area, similar to the one in the West Area, having the same primary and secondary voltages and capacity. It was not energized until April 4, 1944, due to the late delivery of the 5,000 KV auto-transformer. Power to 200-East Substation was supplied by extending the 55 KV transmission from N45600-456405 to N42000-456405, thence East to N42000-452600. Up to September 1, 1944, five transformer banks were constructed, four of which furnished 440/220 volt secondary power and 110 volt lighting power. The bank located at the booster station supplied 2,300 volts secondary power for the booster pump driven by a 250 HP electric motor.

The temporary 66 KV transmission lines in both areas were left in place after the close of construction for stand-by purposes. Their locations are shown on the Plot Plan of "A" Area, showing Power Lines, Telephone Lines, Roads and Railroads, which is included in Part II, Construction by Areas, Section "f", 500 Area. The setting of temporary power poles was minimized wherever possible by the installation of permanent pole lines, most of which were erected prior to the energizing of the area substations. See "Temporary Construction Lists" for the 200 E & W Areas included in Section II, subheading (c) "Area Temporary Construction" for a tabulation of substations installed in those areas.

3 Telephones

Temporary telephone service was inaugurated in the 200 West Area on December 12, 1943, to provide the field construction offices with communication services. In both the East and West Areas temporary service was obtained by tapping the permanent cable system and using the two-position manually operated switchboard permanently installed in each area, thus minimizing the expenditure of materials and labor.

A single open-wire telephone line was run from the 200 West Area, Spruce Exchange, to the Division Engineer's Office located just northeast of the 272-E Building in the 200 East Area, and was the only means of communicating with the outside areas until March 27, 1944, when service was established through the 200 East, Birch Exchange. No temporary telephones were installed in the 200 North Areas. Prior to the installation of telephone service in the 200 West Area, construction relied upon a short wave radio set located in the field patrol office for emergency communications. Inter-area telephone service was limited during the major part of construction due to the small capacity of the connecting trunk lines installed for permanent service. All telephone installations were made by the Signal Corps of the United States Army.

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Approximately seventy telephones were installed in the 200 East Area serving twenty-six temporary construction buildings and approximately seventy-five telephones were installed in the 200 West Area Serving twenty-seven TC Buildings.

4 Water

Water for construction purposes in the 200 East, West, and North Areas, was obtained from three sources, McGee Artesian Well, Allard Coyote Pump Station, and the Hanford Irrigation Ditch. Prior to the completion of temporary water system from the McGee well drinking water for construction forces was hauled by tank trucks from this well and Central Shops. This well is located on the north side of the Cold Creek-Hanford Road, approximately five miles west of the 200 West Area. Water for early concrete mixing, road and area stabilization was transported by the same means from the nearest section of the Hanford Irrigation Ditch.

Myer Bros. - N. M. Ball Sons, Road & Excavating Contractor, as an alteration to their contract, HPG 407, hauled water for du Pont construction work, from the first of September to the latter part of October, 1943.

Water in any appreciable quantity was not obtained in the 200 West Area from the McGee Well System until November 8, 1943, at which time water was supplied at 200 GPM, having 20# per square inch line pressure. The line pressure was raised to 65# per square inch, on November 22, 1943, upon the installation of a booster station and a 100,000 gallon ground storage tank.

Water service was not obtained in the 200 East Area until February 8, 1944. A similar booster station and ground water storage tank was installed in order to have a sufficient water supply and line pressure in all parts of the area. Due to the delay in starting permanent building construction in this area, permanent lines were installed in advance, thus eliminating the laying of temporary water mains in certain portions of the area.

Later on, an additional water line was run from the Allard Coyote Pump Station, located on the bank of the Columbia River, approximately five miles due north of the 200 West Area, and tied to the McGee Water Line just east of the 200 West Booster Station to insure an adequate water supply. A three inch screwed steel line tied to the latter line was run lengthwise through the 212-N, 212-P, and 212-R portion of the 200 North Area for reservoir testing purposes.

All water obtained from the McGee Well and Allard Coyote Pumping Station was chlorinated regardless of final usage. The temporary water mains in the 200 West Area were looped, having risers at frequent intervals for building usage and fire protection. A majority of the temporary water lines were run underground and varied in size from 1" to 8". Wooden slip joint pipe was principally used for water mains 4" and larger, with some welded and screwed schedule 40 steel pipe being installed.

5 Roads

At the opening of construction the only access to the 200-West Area was

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by means of a single lane ranch road which ran southwest from Cold Creek Road to Benton's Ranch, passing through the northeast corner of the area. During the first few weeks surplus drifted sand was removed by road patrols and scrapers to permit vehicular travel and eventually the road was widened to twenty feet. Water stabilization and reshaping was required daily until other temporary gravel base roads could be built.

Temporary roads of increased widths were constructed to alleviate congested traffic conditions. These roads were laid out having approximate center line locations of proposed permanent area and plant-wide roads enabling them to be used later as bases for permanent roads. Myer-Ball & Sons, Excavation Contractor, constructed the majority of temporary roads in 200 East and West Areas while completing major excavation work.

Temporary roads were constructed eight to twelve inches thick, of water-bound sand and gravel, and were sprinkled with water to eliminate dust. A tabulation of TC roads by lengths and widths for each area is included in Area Building Lists of Temporary Construction. The balance of the roads were built by the Company's Earthworks Department, using material excavated from the 221-T and U Building sites, eliminating the opening of additional barrow pits.

The stabilization of entire working areas reduced the number of lineal feet of temporary road and greatly eased congested transportation problems.

6 Railroads

In order to facilitate the handling of construction materials and equipment, railroad spurs, passing tracks, turn-outs, and ladder tracks were built in the 200-East and West Areas in addition to using the permanent rail systems within those areas. An inter-area rail line, part of the permanent plant system, connecting the 200-East and 200-West Areas with an existing branch of the Chicago, Milwaukee, St. Paul and Pacific Railroad at Riverland, Washington, was one of the first lines to be laid. This provided rail service to the areas.

Temporary standard broad gauge railroad lines totaling approximately 25,078 lineal feet were laid in the 200-West Area and 28,902 lineal feet in the 200-East Area. Of these total lengths approximately three-quarters were required in order to supply the temporary concrete mixing plants with aggregate and cement; the balance was used for miscellaneous unloading. At each concrete plant temporary railroads were installed capable of handling five loaded cement cars and sufficient storage for the disposal of empties and facilities for the handling of thirty carloads of aggregate and sand. In the 200-West Area a special yard was constructed for the fabrication of precast concrete cell block covers. Used rail (varying from 65# to 85#), #8 frogs, and hand throw switches were obtained for this work.

Rail service to the 200-West Area was established on September 15, 1943 by the way of #1 track, but service to the 200-East Area was not obtained until November 21, 1943. The permanent tracks serving the 212-N, P, & R, Areas were completed in advance of major construction work in these areas, making possible the delivery and unloading of structural steel and equipment at each building site without the laying of temporary rail.

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All railroads, both temporary and permanent in the 200 Areas, were laid by the Guy F. Atkinson Company, Railroad Subcontractor, under contract RPG 403. Railroad material, with the exception of ballast, was furnished by du Pont in order to expedite the procurement. Tract maintenance work was performed by du Pont forces under the supervision of the Division Engineer, 600 Area. Special wide gauge railroad tracks were laid on both sides of the 221-T, U, & B Buildings running lengthwise on which steam whirleys traveled during the construction of these buildings. Portions of the temporary rail lines in each area were left in place at the request of the Operating Department.

I Aggregate Barrow Pits

The only natural resources usable for construction found in the Plant Area were sand and gravel deposits immediately underlying the surface, indigenous to the region. This pit-run material was of excellent quality for road building and stabilization work in Process Areas. It was also suitable as concrete aggregate wherever washing facilities could be provided.

Concrete aggregate used in the construction of the 200 Process Area was shipped by rail, and truck, from the Haven Pit, located approximately one-half mile west of the 100-B Area, and from the Hanford Pit, located approximately one-half mile west of Hanford. The Hanford Pit had a capacity of 14,800 tons of concrete aggregate daily, and the Haven Pit was capable of producing 9,600 tons daily. The combined total was sufficient for approximately 16,120 cubic yards of concrete daily.

To insure an adequate supply of concrete aggregate during the winter months when washing operations would be hindered, aggregate was stock piled at both pits with an immediate supply in the 200-West Area.

Five barrow pits, approximately 500 feet square, averaging from twelve to sixteen feet in depth, and having northwest corners at coordinates N45250-W48000, N42450-W48000, N46450-W52800, N57500-W44250, and N43400-W49650, were opened in the 200 East Area for temporary and permanent road construction and stabilization work. Only one barrow pit was opened in the 200-West Area as the waste material from the 221-T and 221-U Building excavations was suitable. This pit is irregular in slope having an average length of 800 feet, width of 500 feet, and depth of 10 feet with the northwest corner located at coordinate W72400-N40400. It was used later as an Ash Disposal Basin, Building 288-W.

Upon clearing the sage and greasebushes from the working areas, it was imperative that these sites be immediately stabilized in order to proceed with temporary construction work. The top soil in the 200 Process Areas was mainly loose sand which seriously impeded the movement of trucks, equipment, and material. Wind movement readily produced an undesirable dust condition. Working areas around permanent and temporary buildings, storage yards, fabrication yards, and parking lots were covered with gravel and sand, using excavated material from Building 221-T and U and from local barrow pits. The use of irrigation and the sowing of grass for permanent stabilization in Process Areas was impractical. The majority of this work was charged directly to permanent construction under General Grading as the elimination of dust was desirable in all Process Areas.

8 Concrete Plants

Three concrete mixing plants were erected by Hanford Concrete Contractors

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in furnishing ready-mix concrete, on RPG 410, for Construction in the 200 Area. These plants were erected in the immediate vicinity of the 221-T, U, & B Buildings where the bulk of concrete yardage was concentrated. This enabled concrete for these buildings to be placed by the pumpcrete method from a central pumping plant. After 90 per cent of the concrete had been poured at that location the 200-T Mixing Plant was moved to the 221-C Building in the 200 East Area. It was only partially set up when the 211-C, 221-C, 222-C, 224-C, 271-C, 291-C, and 292-C Buildings were cancelled on June 23, 1944, eliminating the need for this plant. The balance of the concrete in the Process "T" Area was obtained from the 200-U Mixing Plant and hauled by transit mixer trucks to the "T" Pumpcrete Building. Concrete mixing plants complete with mixers, bins, scales, aggregate and water heating units, conveyers, hoppers, and equipment housing facilities were furnished complete and erected by the subcontractor with the exception of special cement bins which were purchased by du Pont, and erected by the subcontractor. Erection of the first plant at the 221-T Building was started on July 16, 1943, with the first concrete batch being mixed at this unit on October 2, 1943. Concrete pours were made in the 200-West Area prior to this time by hauling mixed concrete from the Hanford Batch Plant.

Listed below are the dates when the first and last batches were mixed at each plant and the total number of cubic yards of concrete mixed by each unit.

Plant	Date Start	Date Complete	Total Mixed, Cu.Yds.
200-T	10-12-43	5-13-44	100,122
200-U	1-27-44	10-11-44	124,512
200-B	5-12-44	12-18-44	97,017
		Grand Total	321,651 cu. yds.

Two of the mixing plants, 200-T and 200-B, were each equipped with two 2-cubic yard drum mixers having a combined maximum capacity of 160 cubic yards per hour based upon one and one-half minute mixing time for each batch. The 200-U Mixing Plant was equipped with two 3-cubic yard Ransome Drum Mixers having a combined maximum capacity of 240 cubic yards per hour based upon the mixing time. An aggregate storage bin was erected underneath the unload track capable of holding 160 tons of gravel and 100 tons of sand.

Du Pont erected a 2-story wood frame Pumpcrete Building adjoining each mixing plant. These housed three Rex Pumpcrete Machines having a capacity of 50 cubic yards each per hour. Portable single pumpcrete machines were used in the 200-North Area where the pours were on a much smaller scale and at widely separated sites. Ready-mix concrete was delivered to the 200-N Area machines in transit mix trucks from the 200-U and 200-B Mixing Plants. The pumpcrete system, in conjunction with other methods, proved an economical method of placing concrete in the 200 Areas. Approximately 50 per cent of the total yardage was pumped directly into forms.

Listed below is type and size of equipment composing the mixing plants used in the 200 Process Areas:

200-T Plant

1 - 120 ton Aggregate bin (2-1/2" gravel)
1 - 140 ton Aggregate bin (1-1/2" gravel)

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200-T Plant (Con't.)

1 - 100 ton Aggregate bin (3/4" gravel)
1 - 110 ton Sand bin
1 - 420 bbl. Cement bin
2 - 2 cu. yd. Rex Mixers

200-U Plant

4 - 75 ton capacity Aggregate bins
1 - 750 bbl. & 75 tons, two compartment Sand and Cement bin
1 - 3,000 bbl. Cement bin (du Pont purchase)
1 - 470 bbl. High-Early Cement bin (du Pont purchase)
2 - 3 cu. yd. Ransome Mixers

200-B Plant

4 - 75 ton capacity bins for Aggregate
2 - 2 cu. yd. Smith Mixers
2 - 300 bbl. Cement bins

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(3) Permanent Area Works

The construction of three separate 200 Process Areas (West, East, and North) were included in the scope of work covered by Prime Contract W-7412-Eng-1 for the construction of the Hanford Engineer Works. Areas West and East are Process Finishing areas containing the same Process Buildings, Service Buildings, and Facilities, with the exception of a few minor changes in each area. The 200-North Area is primarily a storage Area, part of which serves for Lag Storage between the 100-B, D, & F and the 200-E & W Process Areas, with the balance of the area being used as a storage place for the final end product.

Five general types of permanent building construction were used for these areas; reinforced mass concrete construction, structural steel frames and concrete block construction, reinforced concrete frame and concrete block construction, structural steel frame and wood construction, and wood frame construction.

The 200-E, 200-W, and 200-N Areas are composed of a total of 62, 50, and 16, permanent building structures and 33, 29, and 14 service facilities respectively. These buildings and facilities are divided into seven groups as follows:

Process Buildings

Building No.	200-E	200-W	200-N	Building Name
211	1	2	0	Tank Farm
212	0	0	3	Lag Storage
213	0	0	1	Magazine Storage
216	1	0	0	Process Waste Disposal Trench
221	1	2	0	Cell Building
222	1	2	0	Sample Preparation Lab.
222	1	2	0	Solvent Storage Shelter
224	1	2	0	Bulk Reduction Building
224	1	2	0	Testing Unit
231	0	1	0	Concentration Building
241	2	2	0	Process Waste Disposal System
271	1	2	0	Chemical Preparation & Service Building
291	1	2	0	Exhaust Bldg. & Stack
292	1	2	0	Exhaust Gas Lab.
	12	21	4	

Power, Water Treatment & Storage Buildings

Building No.	200-E	200-W	200-N	Building Name
282	1	1	0	Reservoir & Pump House
283	1	1	0	Filter Plant
284	1	1	0	Power House
288	1	1	0	Ash Disposal Basin
	4	4	0	

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2500 - Outside Electrical Facilities

Building No.	200-E	200-W	200-N	Name
251	-	-	1	Primary Substation (230 KV/13.8 KV)
252	1	1	1	Secondary Substation (13.8 KV/2300 V)
253	13	21	3	Distribution Substation (2300 V/440-220-110 V)
2501	x	x	x	Fence & Road Lighting
2503	x	x	x	Outside Transmission Lines (including poles and hardware)
2505	x	x	-	Fire Alarm System
2506	x	x	x	Telephones & Telephone Cable

2600 - General Facilities

Building No.	200-E	200-W	200-N	Name
2601	x	x	x	Standard Gauge Railroad Track
2603	x	x	x	Roads and Walks
2605	x (18)	x (16)	x (3)	Fences (including Guard Towers)
2607	4	7	3	Septic Tanks
2612	x	x	x	Open Drainage Ditches
2613	x	x	x	Permanent Parking Lot
2614	4	6	1	General Monitoring Stations
2621	3	3	-	Emergency Gas Generator Shelters

2700 - Service Buildings

Building No.	200-E	200-W	200-N	Name
272	1	1	-	Area Shop
273	1	-	-	Heat Treating
274	1	1	-	Machinery Storehouse
275	1	1	-	Chemical Storehouse
2701	1	1	-	Gate House & Clock Alley
2701-A	-	1	-	Gate House
2704	1	1	-	Supervisors' Office Bldg.
2707	1	1	-	Change House (Service Area)
2707-A	1	1	-	Change House (Power Area)
2709	1	1	-	Fire Headquarters
2713	1	1	-	Storeroom
2713-A	1	1	-	Essential Material Storehouse
2713-B	1	1	-	Miscellaneous Storehouse
2715	1	1	-	Oil & Pain Storage
2716	1	1	-	Automotive Repair Garage
2719	1	1	-	First Aid Building
2720	1	1	-	Patrol Headquarters

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2700 - Service Buildings (cont'd)

Building No.	200-E	200-W	200-N	Name
2722	1	1	-	Paint & Riggers' Shop
2723	-	1	-	Laundry
2729	-	1	-	Extra Machinery Storehouse
2730	-	1	-	Salvage Yard
2731	-	1	-	Burning Pit
2734	1	1	-	Cylinder Storage
2743	-	-	4	Gate House & Guard Tower Bldg.
	18	22	4	

2800 - Outside Overhead Pipe Lines

Building No.	200-E	200-W	200-N	Name
2801	x	x	-	Pipe Supports
2802	x	x	-	Steam Lines
2803	x	x	-	Air Lines
2805	x	x	-	Process Lines

2900 - Outside Underground Lines

Building No.	200-E	200-W	200-N	Name
2901	x	x	x	Water Lines (including Elevated Storage Tanks)
2902	x	x	-	Fire Lines (including Elevated Storage Tanks)
2903	x	x	x	Sanitary Sewers
2904	x	x	x	Process Sewers
2905	-	-	x (2)	Wells & Pump Houses

Some of the above buildings and facilities were originally constructed as temporary, or TC items to be used for construction purposes only, and were then to be dismantled or removed. From time to time the Operating Department requested that certain items be left in the 200-E & W Areas to become permanent parts of those areas. Such buildings and facilities were then assigned permanent building, or code, numbers by the Design Division in the same manner as the other permanent units.

Below is a list of the temporary buildings and facilities in the 200 Areas which were taken over as permanent units. This list shows the permanent numbers and names as well as TC numbers and names:

200-E Area

Permanent Construction		Temporary Construction	
Number	Name	Number	Name
2709	Fire Headquarters	TC-34	Barrack Section Only
2713-A	Essential Material Whse.	TC-34	Div. Warehouse

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200-E Area (Con't.)

Permanent Construction		Temporary Construction	
Number	Name	Number	Name
2713-B	Miscellaneous Storehouse	TC-34	Pipe Warehouse
2716	Automotive Repair Garage	TC-34	Transportation Garage
2601	Standard Gauge Railroad Track (4200' only)	TC-6	Temporary Railroad Track

200-W Area

Permanent Construction		Temporary Construction	
Number	Name	Number	Name
2709	Fire Headquarters	TC-34	Barracks Section Only
2713-A	Essential Material Storehouse	TC-35	Div. Warehouse
2713-B	Miscellaneous Storehouse	TC-35	Igloo Warehouse
2716	Automotive Repair Garage	TC-35	Transportation Garage
2729	Extra Machinery Storehouse	TC-35	MS Stores & Pipe Warehouse
2730	Salvage Yard	TC-35	Slab Yard
2731	Burning Pit	TC-35	Burning Pit
2601	Standard Gauge Railroad Track (5000' only)	TC-6	Temporary Railroad Track

(a) 200-W Area

Process Building Groups 200-T & U are independant Process Finishing Lines; each containing the same type, number, and size buildings and facilities. The 221-T Building, however, is sixty-five feet longer than the 221-U Building, owing to the erection of a Head End Addition. This addition, released for construction on December 27, 1943, houses test laboratory equipment, which is to be used in conjunction with the 221 Cell Building Equipment. The essential difference between the test laboratory section and a standard section of Building 221 is that each test laboratory cell contains smaller-capacity equipment corresponding to two standard sections.

Process Group 200-T is confined to the north central portion of the area and the 200-U Group to the south central portion, as shown on the included Plot Plan of the 200-West Area. Each Process Group is symmetrically laid out paralleling the221-Cell Buildings which run northeast and southwest with the head end of the building facing northeast. Starting according to operating sequence, the 221-Building is serviced by the following buildings; 211-Acid Tank Farm, located on the west side, south of the head end tunnel; 271-Chemical Preparation and Service Building attached to the middle of the west side of Building 221; 222-Sample Preparation Laboratory and Solvent Storage Shelter, located on the east side, midway of the building; 224-Bulk Reduction Building and Testing Unit Buildings situated on the same side, south of Building 222; 291-Exhauster Building and Stack erected on the same side, north of Building 222; 292-Exhaust Gas Laboratory constructed near the Exhaust Stack; and 241 Waste Storage & Disposal System more distantly located west of the Building 221. Process Units T & U are served

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by 17 facilities; namely, Electric Lines, Distribution Substations, Fire Alarm System, Telephones, Railroads, Roads & Walks, Fences, Septic Tanks, Drainage Ditches, Pipe Supports, Steam Lines, Air Lines, Process Lines, Sanitary Water Lines, Fire Lines, Sanitary Sewers, and Process Sewers.

A third Process Area is located in the west central portion of the area and consists of a single structure, the 231-W Concentration Building, which is surrounded by a second enclosure fence 592' x 547' that further restricts the movement of unauthorized personnel into this area. For Security, as well as for Safety purposes, similar Type No. 1 fences were permanently constructed about the east entrances to the 224 Buildings and the railroad tunnel entrance to the 221 Buildings.

The Power Area and its associated buildings are centrally located in the area, halfway between the T & U Process Groups. A construction barrow pit approximately 500' southeast of the Boiler House was used for the 288-W Ash Disposal Basin. Building 284-W also includes an inclined Coal Conveyor, Crusher House, Coal Storage Pit, Salt Dissolving Pit, and Brine Pump House.

The 2700 Buildings and the Service Group are more or less concentrated to the east of the Power Area. This group directly serves the groups previously mentioned in an administrative and maintenance capacity.

In both the 200-E & W Areas a 50,000-gallon elevated soft water storage tank is provided at the Power House, a 50,000-gallon elevated fire water storage tank at each of the 200 Process Groups, and a 100,000-gallon elevated fire water storage tank at the Service Area.

(b) 200-E Area

The design of this Area originally specified two separate Process Finishing Groups - B & C. On June 23, 1944, Field Letter No. 53 was issued cancelling 211-C, 221-C, 224-C, 271-C, 291-C, 282-C; the Settling Tank, Eq. No. 241-C-361; and Retention Basins, Eq. No. 241-C-351 and 352; all of which comprised the Process C Group. Technical research during several previous months had revealed that these buildings would not be required. At the time of cancellation major excavation work had been completed for the 221-C Building. The Exhaust Stack 291-C for the 221-C Building had been completed by the Rust Engineering Company. The 50,000-gallon elevated fire water storage tank for these buildings had likewise been completed by the subcontractor.

Where work had been started in the buildings affected the areas were cleaned up and placed in stand-by unfinished status. This included the painting of reinforcing rod stubs, heavy greasing of anchor bolts, the removal of batter boards, the erection of permanent barricades, and the dismantling of the wooden elevated water storage tank. A diversion box at 221-B was added and the diversion box at 241-C was retained. Piping between these boxes was omitted for the time being.

Process Group 200-B is confined to the west central portion of the area and the 200-C Group was to be constructed in the east central portion as indicated on the enclosed Plot Plan of the 200-West Area. The layout for Plant B Building is identical to Plant U in the West Area, containing the same type, size, and number

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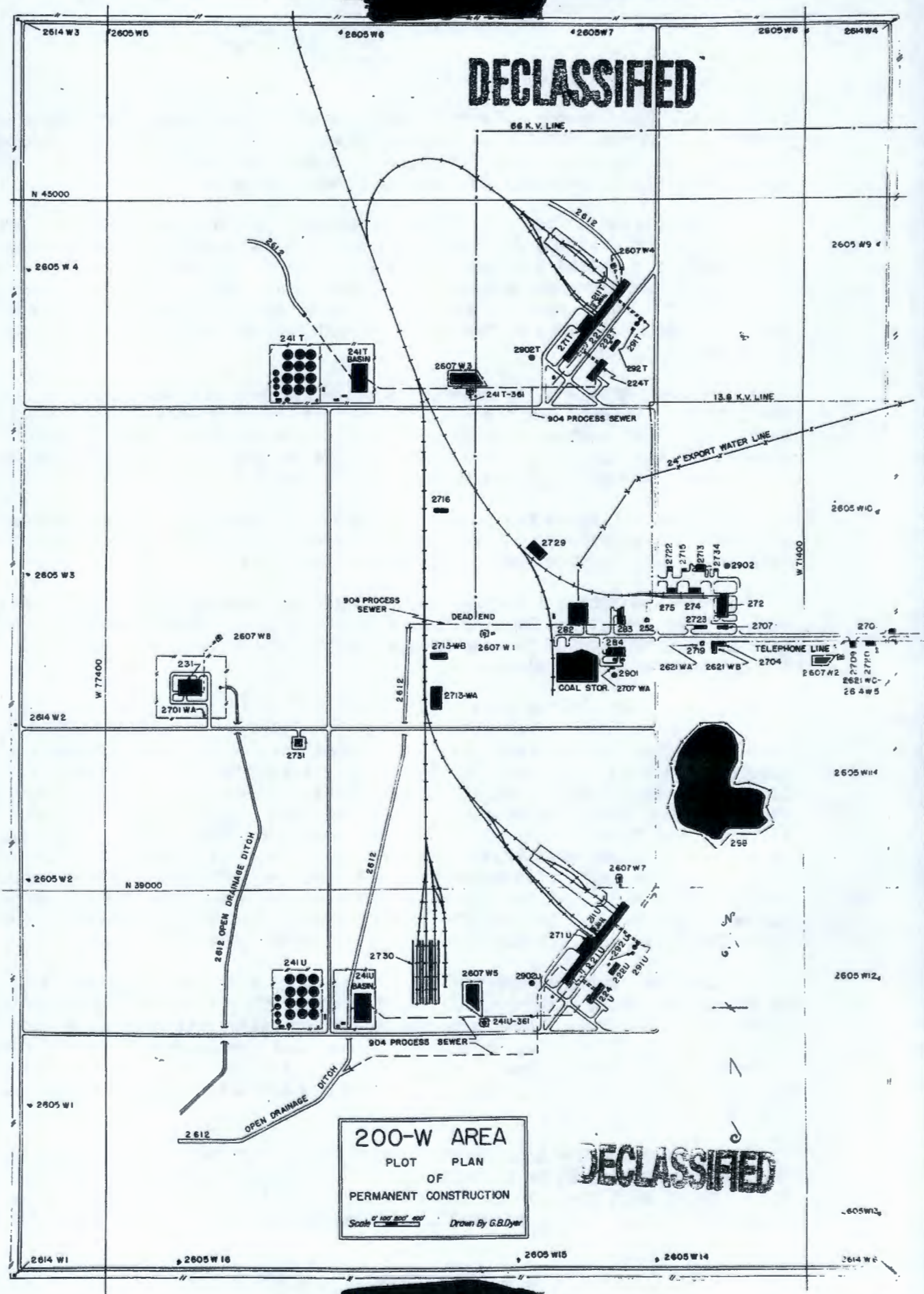

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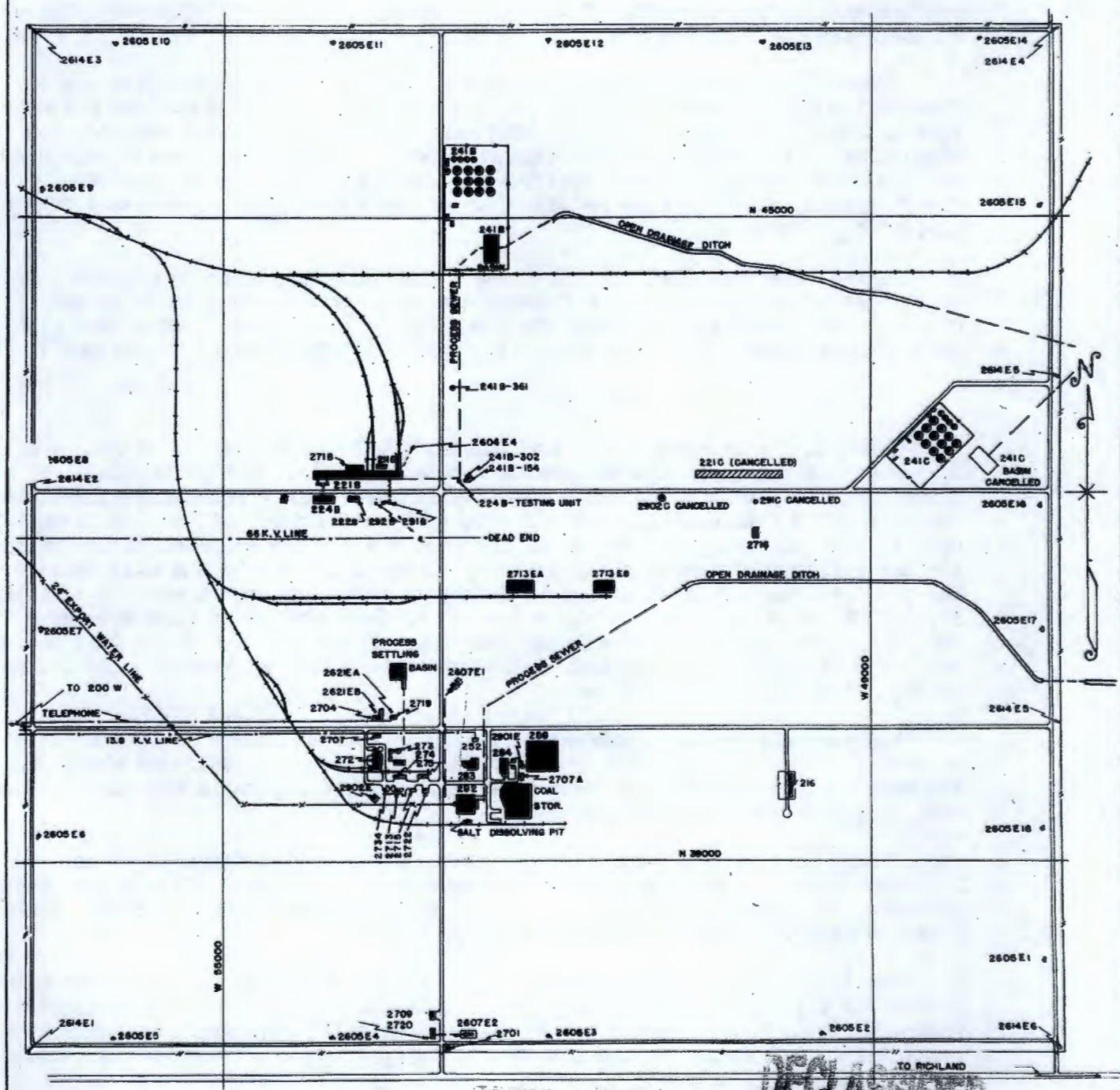

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200-E AREA
PLOT PLAN
OF
PERMANENT CONSTRUCTION

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of buildings and facilities. Building 221-B runs East and West paralleling the local coordinate system with the head end of the building facing east.

The East Power Area is a duplicate of the West Area with the East Group oriented 90° from the West Group, facing south. It is centrally located south of the Process Area adjacent to the 2700 Service Group. Each Power Area was located to facilitate expansion within the areas. An Ash Disposal Basin was constructed on the east side of the Boiler House as no barrow pits were located in the immediate vicinity.

The only essential differences between the East and West Services and the 2700 Buildings are as follows: 1. 2701-A Gate House and 2723 Laundry Building were omitted in the East Area. 2. Building 273-E Heat Treating Furnace, including an Acid Pickling Trough, Chemical and Fuel Storage Tank Farms, was added to the East Group, and was constructed just east of the 272-E Area Shop. 3. 272-E Building is of uniform height, whereas the 272-W Building contains only a partial high section.

It was essential that the 272-E and W Area Shop Buildings be completed well in advance of the 221-T, U, and B Buildings in order that they could be used by Construction to fit and assemble the operating cell equipment. This work will be discussed later in this section under Part (6) "Construction Expedients".

(c) 200-N Area

Three of the Process Groups are identical and are designated as Plants N, P, and R. Within each fenced area is located a 212-Lag Storage Building, a Guard Tower, Building 2605; and a combination Gate House - Guard Tower, Building 2743. Plant P also contains one 614 - General Monitoring Station, and Plant R contains two Well Pump Houses, Buildings 2905 P & R. The original design called for the drilling of one of these wells at Plant N, but due to the well failure there and in Plant P, both had to be drilled in their present locations. Buildings 212-N, P, & R are located in the north central portion of each area with the Guard Tower inside the northeast fence corner and the Gate House just inside the south fence, between the vehicle and railroad gates, as shown on the included Plot Plan of the 200-West Area.

The partially-refined product is placed in special "casks" and transported by means of special well-bottom railroad cars to the above-mentioned areas where the product is transferred to deep water-filled storage pits in the 212 Building until required for further processing.

Plants N, P, & R are served by 14 Facilities; namely, Fence Lighting, Electric Lines, Primary Substation, 1 Secondary Substation, 3 Distributing Substations, Telephones, Railroads, Roads and Walks, Fences, 3 Septic Tanks, Water Lines, Sanitary Sewers, Process Sewers, and Wells.

The fourth Process Group, Plant J & K, is enclosed in a single fenced area having the 213 J & K combined Magazine Building centrally located with a Guard Tower, Building 2605, constructed on the side of Cable Mountain over-looking the area; and a Gate House and Guard Tower, Building 2743, stationed at the vehicle gate entrance. Plant J & K is served by 5 facilities; namely, Fence Lighting, Electric Power, Telephones, Roads and Walks, and Fences.

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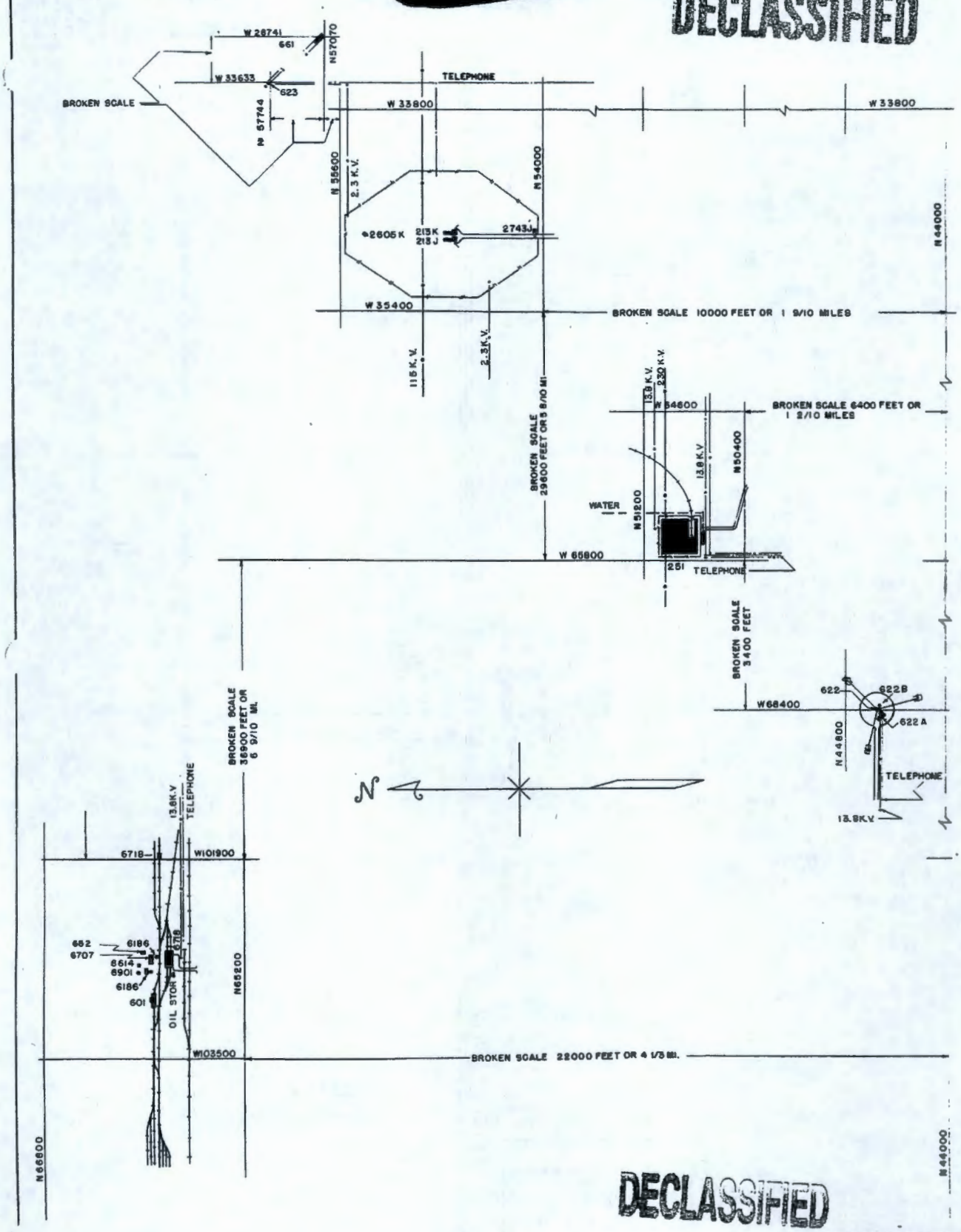

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200-N & 600 AREAS
PLOT PLAN
OF
PERMANENT CONSTRUCTION

Scale 0 100' 200' 400'

Drawn By J.R.Dyer

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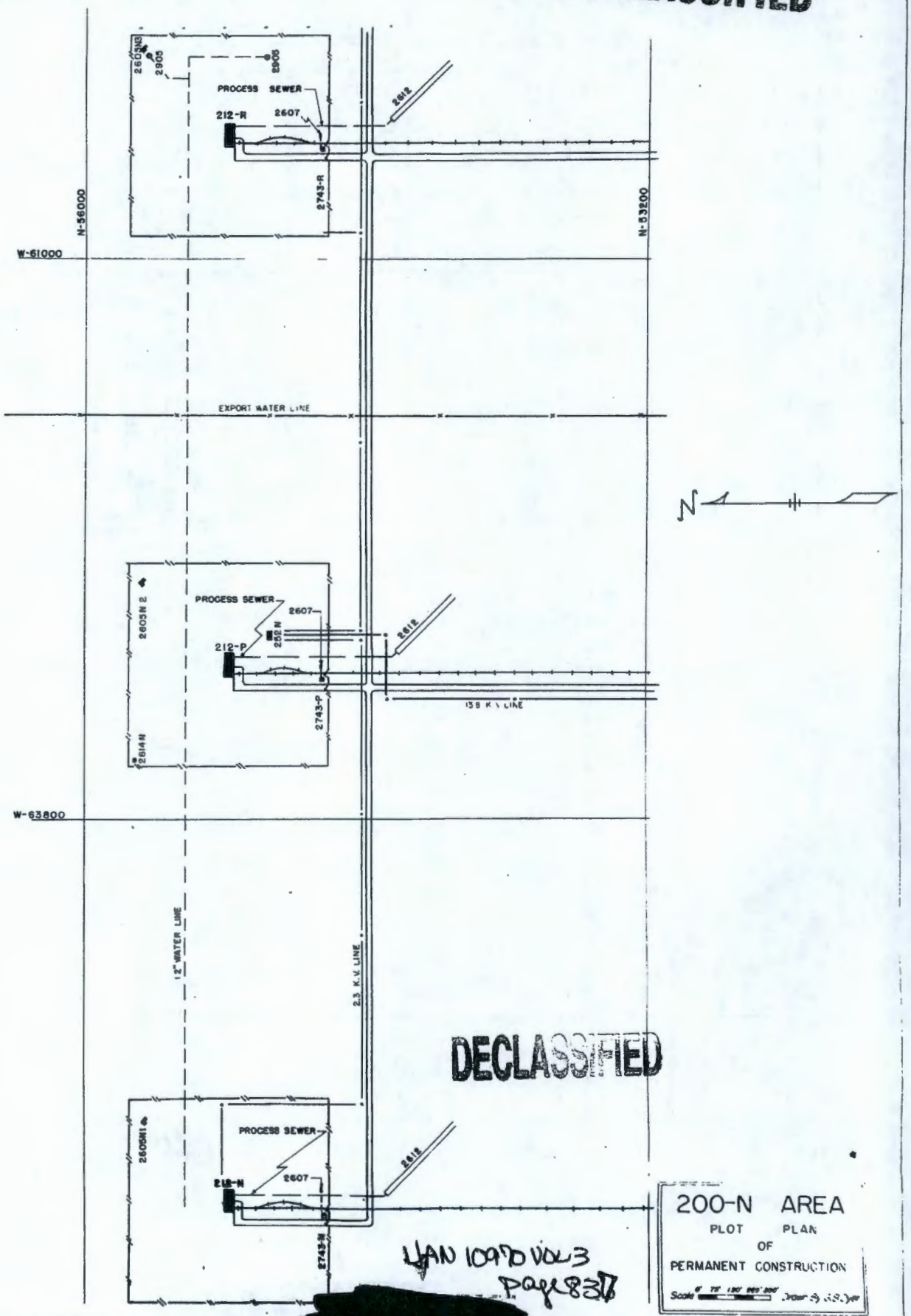

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200-N AREA
PLOT PLAN
OF
PERMANENT CONSTRUCTION

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A Primary Substation and Switch House Building 251-N, furnishing the 200-West, East and North Areas with 13.8 KV permanent Electric Power, lies in the North Area just north of Central Shops. Services to this Substation include an Access Road, Railroad Spur, Raw Water, Sanitary Sewers, and Septic Tank, Telephone, Fences, and Electric Transmission Lines. This substation, with a designed capacity of 15,000 KVA, steps the purchased power down from 220,000 volts to 13,800 volts.

(d) Availability of Facilities

Tabulated below is the availability of facilities for the 200-West, East, and North Areas, based upon actual design.

Services & Facilities	200-West	200-East	200-North
	Design	Design	Design
Raw Water	9,000 G.P.M.	9,000 G.P.M.	1,600 G.P.M.
Filtered Water	800 G.P.M.	800 G.P.M.	---
Chlorinated Water	800 G.P.M.	800 G.P.M.	---
Softened Water	516 G.P.M.	516 G.P.M.	---
Electric Power	6,250 K.V.A.	6,250 K.V.A.	2,000 K.V.A.
Steam	240,000 # Per Hr.	240,000 # Per Hr.	---
Process Sewerage	2,000,000 G.P.D.	1,000,000 G.P.D.	---
Sanitary Sewerage	43,000 G.P.D.	29,000 G.P.D.	600 G.P.D.
Compressed Air	2,576 C.F.M.	1,426 C.F.M.	---

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(4) Progress of Construction

(a) Schedules

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At the inception of the formal contract, a start-up and completion date other than "earliest possible" date was not established for the Project, or any portion; as at that time it was impossible to ascertain or to estimate accurately these dates. There were too many indeterminate factors; such as, availability of manpower, uncertain delivery dates for special equipment and critical material, and length of time required for experimental design. However, despite these unknown factors, Completion Forecast Schedules for the 200 West, East, and North Areas were drawn up on September 30, 1943, and are included under Part II, Section 7, "Planning and Scheduling". The original forecasts were based upon a combination of the preliminary design schedule, meager procurement information, and an estimate of time required for building construction and equipment installation, predicated on the fact that only 18% of the total drawings had been issued for the 200 Areas. These over-all schedules were revised on March 15, 1944, and that for the 200 East Area again on August 23, 1944, with revisions based primarily on available force and the intention of bringing the design and procurement schedules into line.

Shortly after construction was under way, the TNX Manufacturing Division furnished the Construction Division with a desired sequence of Process Area Start-ups, giving the time lag for each succeeding area after the initial area start-up. They also advised the length of time that certain buildings would be required in each area prior to start-up. In the construction of the 200 Process Areas the start-up and completion dates set for each Process Plant were the same, as the method of manufacturing and plant security would not permit simultaneous construction and operation. Using this information, together with the previous Area Forecast and Bar Charts, the Field prepared on February 10, 1944, a "Preliminary Sequence of Start-up Chart" for the 100 and 200 Areas, which was used thereafter as the base for all Building and Area Construction Schedules. This chart was revised several times, as it was contingent upon the availability of labor and the receipt of critical materials. On August 8, 1944, due to changes in production requirements at Hanford, Operations requested that new emphasis be placed on the early completion of 100-D, prior to and at the expense of, Plant 200-U.

According to the date schedule the maximum time for completion of the 200 Areas was as follows: 200-T, 30 days after the completion of 100-B; 231-W, 212-N, P, & R, and 213 J and K, 60 days after the completion of 100-B; 200-U, 110 days after the completion of 100-B, or 50 days after the completion of 100-D; and 200-B, 180 days after the completion of 100-B or the same as the completion date for the 100-F Area. A copy of the revised "Sequence of Start-ups", dated September 30, 1944, is likewise included in Section 7, "Planning & Scheduling" for future reference.

Single bar-type Construction Schedules & Progress Charts, prepared by the field for individual buildings, major facilities, and overall areas; were based upon start-up dates requested by the Operating Department as indicated by the "Sequence of Start-up Chart". A copy of the schedules for the 200-E, 200-W, and 200-N Areas whereby the actual rate of construction can be compared with the estimated building and area schedules are included in this section. The upper solid bar indicates estimated construction schedule, the lower solid bar

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the actual construction schedule, and the hatched portion of the line indicating the number of weeks that construction was behind schedule.

Daily Construction Schedules and Progress Charts were also prepared for the Major Process Buildings 221, 224, 231, and 241 respectively. The schedules for the 221, 224, and 231 Buildings are primarily a detailed sequence of equipment installations in order for the work to progress in an orderly manner with a minimum amount of over-lapping. The schedules for the 241 Buildings (for the erection of the Composite Storage Tanks), included the sequence for the erection of the steel linings, X-raying, water testing, membraning, guniting, forming and pouring of walls and domes, stripping, water-proofing, painting, and backfilling.

(b) Rate of Construction

Permanent construction work progressed very slowly in the 200 Areas for a period of four to six months after ground had been broken, as only a limited amount of manpower was available. The work performed during that time consisted mainly of mass excavation work for permanent buildings and temporary construction work in order to provide these areas with necessary construction facilities.

200-W: Work was officially started in the 200-W Area on June 26, 1943, and at the end of December, 1943, the West Area as a whole was only 3% complete. From that time on, a sharp increase in the rate of construction was noted and continued with an increasing rate to the end of July, 1944. During the latter month approximately 15% of the physical work was accomplished. At this point the rate of construction began to diminish, but failed to follow a smooth curve due to the fluctuation in the labor supply for this area. The area was essentially complete by the end of November, 1944, at which time 98% of the work had been completed.

200-E: Ground was officially broken in the East Area on August 2, 1943. Permanent construction work in this area was likewise slow in getting under way for the same reason as listed above for the West Area. At the end of April, 1944, the area as a whole was only 6% complete. From this time on, the tempo of construction increased and continued with an increasing rate through August, 1944. During this month alone, 16% of the total physical work was accomplished. For the next 4 months, the rate of construction diminished with an occasional increase for a short period of time. This was brought about by the fluctuation in manpower available for allocation to the East Area. The area was essentially complete by the end of January, 1945, at which time 97% of the work had been completed.

200-N: Ground was officially broken in the North Area on November 17, 1943, but progress was limited until sufficient manpower could be obtained. This shortage was overcome during the latter part of March, 1944, and a sharp increase was noted in the rate of construction for this area. During the month of June, 28% of the physical work was accomplished. From that time on, the rate of construction diminished in a smooth curve as shortages and critical crafts thereafter did not effect the balance of the work to be completed in the 200-N Area. By the end of September, 1944, the area was essentially complete, having reached 97%.

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At the end of this section is a tabular list showing the progress of construction for all buildings and facilities in the 200 East, West, and North Areas. The following data have been incorporated for each building and facility:

1 Date design received in the field authorizing the start of construction.

2 Dates when mass or major excavation work was started and completed for building sites or building foundations.

3 Dates when forming was started for building or major equipment foundation and when the stripping of these foundations was complete.

4 Dates when the erection of building structural steel was started and completed.

5 Dates when concrete or wooden frame building superstructure was started and completed.

6 Dates when the setting of process equipment was started and completed or when the installation of process piping and power wiring was started and completed.

7 Dates when the test runs were started and completed for major process equipment.

8 Date of actual start-up of process manufacturing.

9 Official completion date for construction work.

10 Final acceptance dates for building or facility by the Operating Department and the Area Engineer for the United States Government.

(c) Start-ups

Construction forces, including stand-by men, were removed from the 200-T Plant at 12:00 midnight on October 8, 1944, at which time the Operating Department started preparations for a preliminary start-up. Starting approximately one month prior to this time, portions of the building and process equipment were turned over to the Operating Department upon completion. This allowed the plant operators to check the operation of the equipment and to run in the cell equipment with water. From these test runs, final corrections, calibrating of instruments, and last minute changes in design were made by Construction at the request of Operations. Actual process manufacturing was not started until December 6, 1944. The balance of the construction forces in the 200 West Area were removed at 12:00 midnight on December 17, 1944, having concluded construction responsibilities for the 200-U Plant and the 231-W Concentration Building. The latter building was started up for process manufacturing on January 14, 1945, but the 200-U Plant was not actually started until several months later when sufficient process material was available. The 200 West Power and Service Areas were completed well in advance of the operating

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requirements. Occupation of the 2704-W Supervisor's Office Building by Operating Personnel began in the first part of May, 1944. The 282-W Pump House & Reservoir was placed in operation on July 10, 1944 with the 283-W Filter Plant and 284-W Power House following on July 13, 1944.

At 12:00 midnight on February 11, 1945, all construction forces were removed from the 200 East Area, having concluded construction responsibilities for the remaining 200-B Plant. The 200 East Power Area was likewise started up and completed well in advance of area process requirements. However, in both the East and West Areas steam, water, and air were needed by construction for testing, cleaning, and blowing-out pipe lines in all process buildings. The 282-E Reservoir & Pump House Building was placed in operation on November 6, 1944, with the 283-E Filter Plant Building following on the 15th day of the same month. The first boiler in the 284-E Boiler House was started up on November 4, 1944, with water being supplied from the temporary area system. The 200 East Service Area was turned over to Operations on February 11, 1945, Construction having completed the pre-assembly of cell equipment for Building 221-B. Prior to assuming operational responsibilities for the 200 East Power and Service Areas on May 15, 1944, the Operating Department began the initial occupation of the 2704-E Supervisor's Office Building.

Because of the division arrangement, each portion of the 200 North Area could be turned over to the Operating Department and restricted as soon as construction was complete. The 251-Primary Substation was put into service on June 17, 1944, but was not taken over by Operations until December 26, 1944. Building 212-N was turned over to the plant operators on September 12, 1944, in order to test transfer equipment. This was done for all three buildings with minor corrections and adjustments being made by construction. All portions of the North Area were completed well in advance of their needs for process use. The portion of the North Areas were restricted in the following order; 212-N, 212-P, 212-R, and 213-J and K. Their completion and start-up dates are shown on "Progress of Construction Facility List" for the 200-North Area.

(d) Conclusion

Construction work in the 200 Areas progressed in an orderly, scheduled manner despite many delaying factors which were encountered during construction, such as; lack of labor, lack of mechanics for precision work, unfamiliar design, close tolerance for mass concrete, isolated location lacking man-made facilities, late delivery dates for special material and equipment, major design changes, classified construction, late design, failure, absenteeism, turnover, and items of similar nature. Every effort and expedient were employed to counteract these delays and will be taken up later in Section (6), "Construction Expedients". It might have been possible to better the start-up and completion dates for the 200 Process Areas, but to do so would have required the re-allocation of manpower at the expense of the 100 Areas, which would have upset the required sequence of area start-ups.

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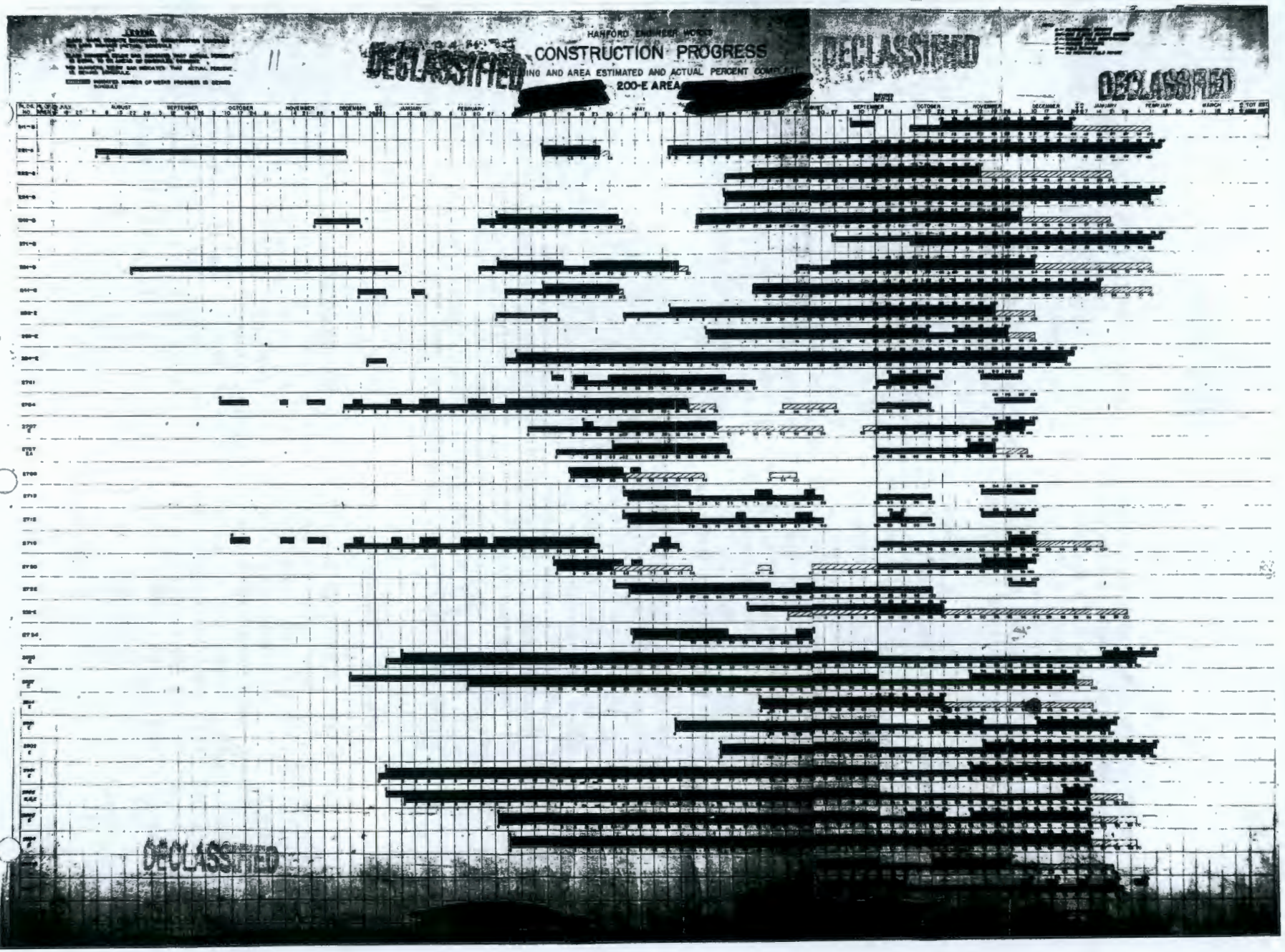
HANFORD ENGINEER WORKS
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200-E AREA
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HANFORD ENGINEER WORKS

CONSTRUCTION PROGRESS

BUILDING AND AREA ESTIMATED AND ACTUAL PERCENT COMPLETE

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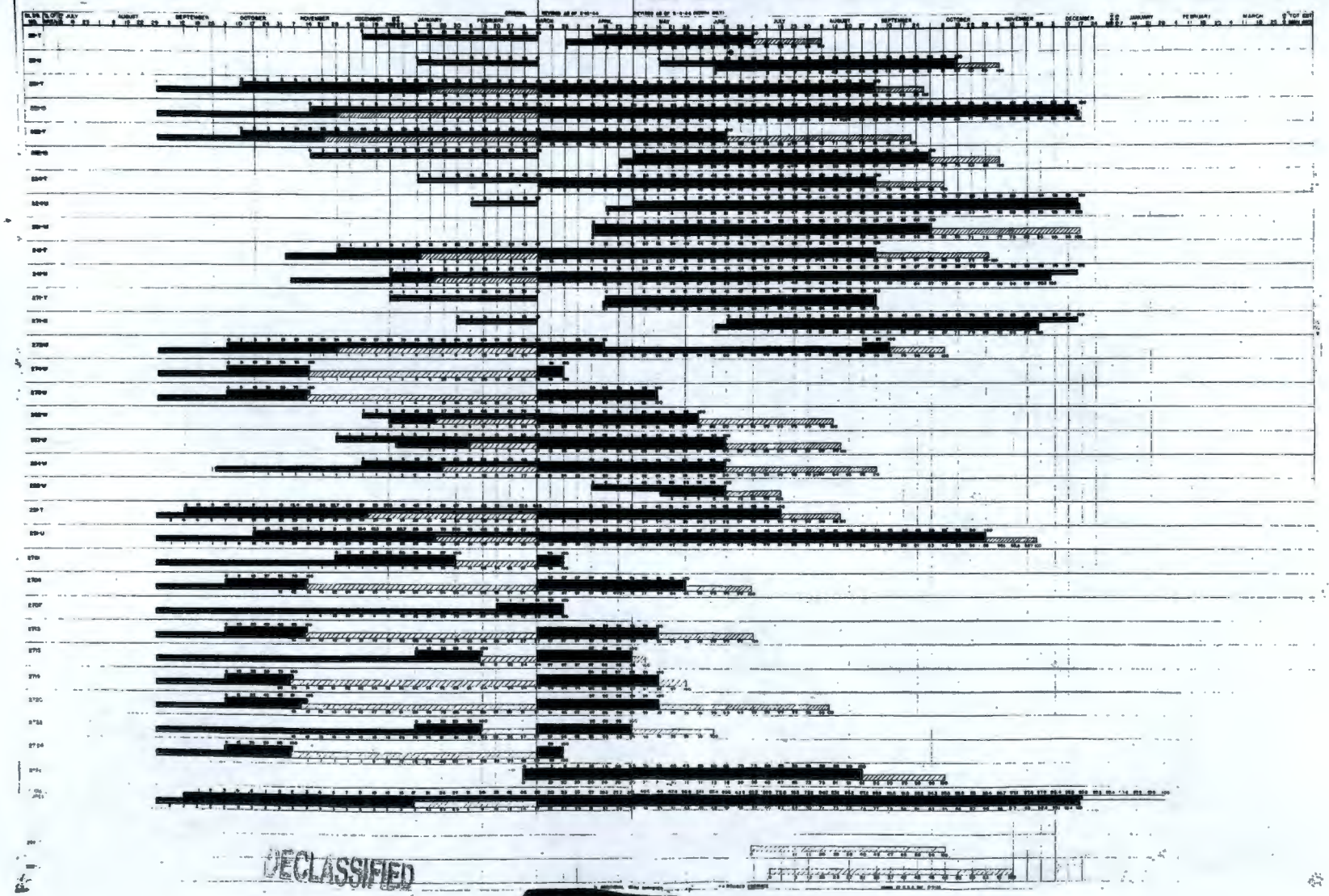

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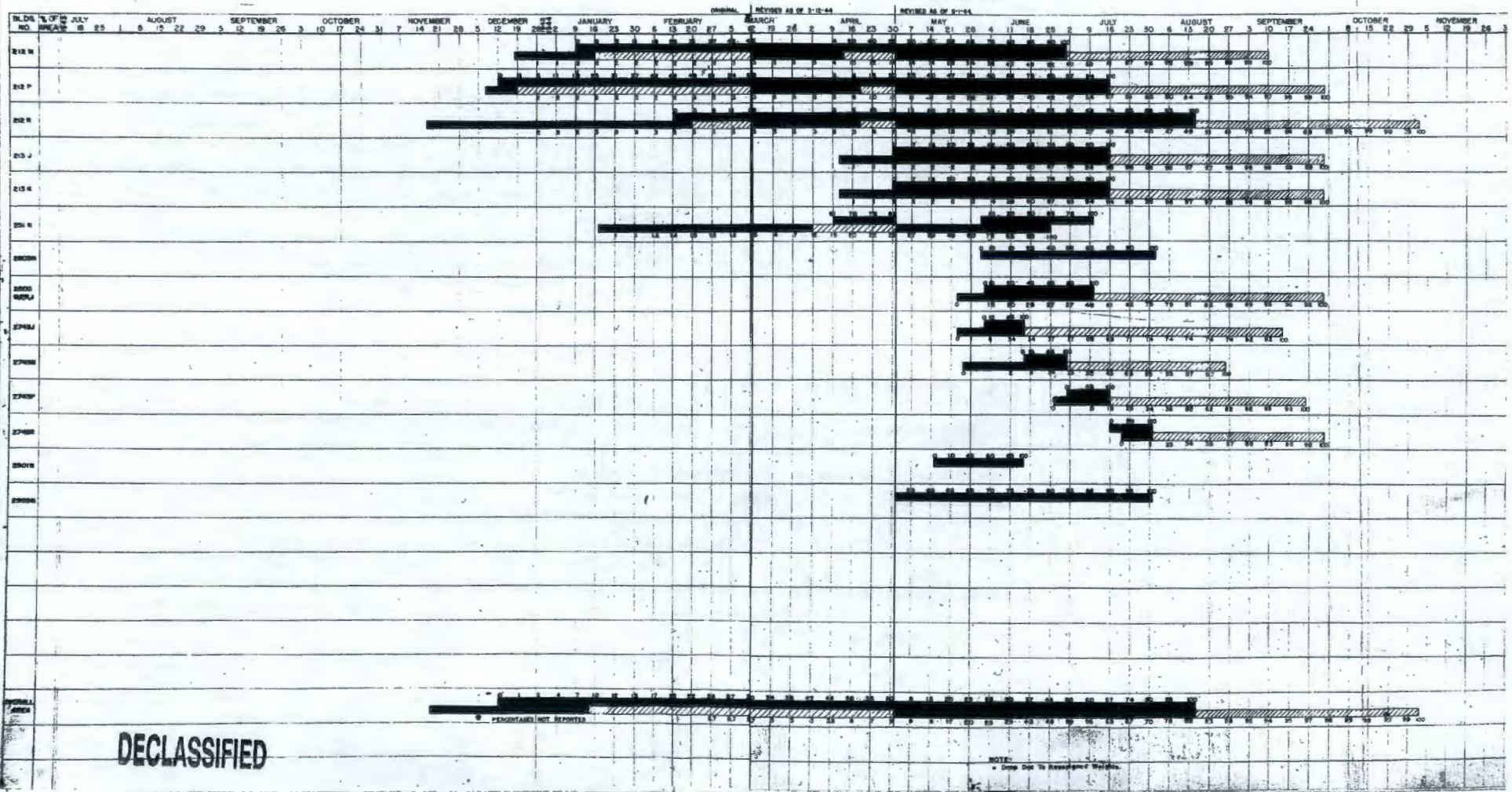
HANFORD ENGINEER WORKS

CONSTRUCTION PROGRESS

BUILDING AND AREA ESTIMATED AND ACTUAL PERCENT COMPLETE

200-N



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CONSTRUCTION PROGRESS

BUILDING AND AREA ESTIMATED AND ACTUAL PERCENT COMPLETE

200-N

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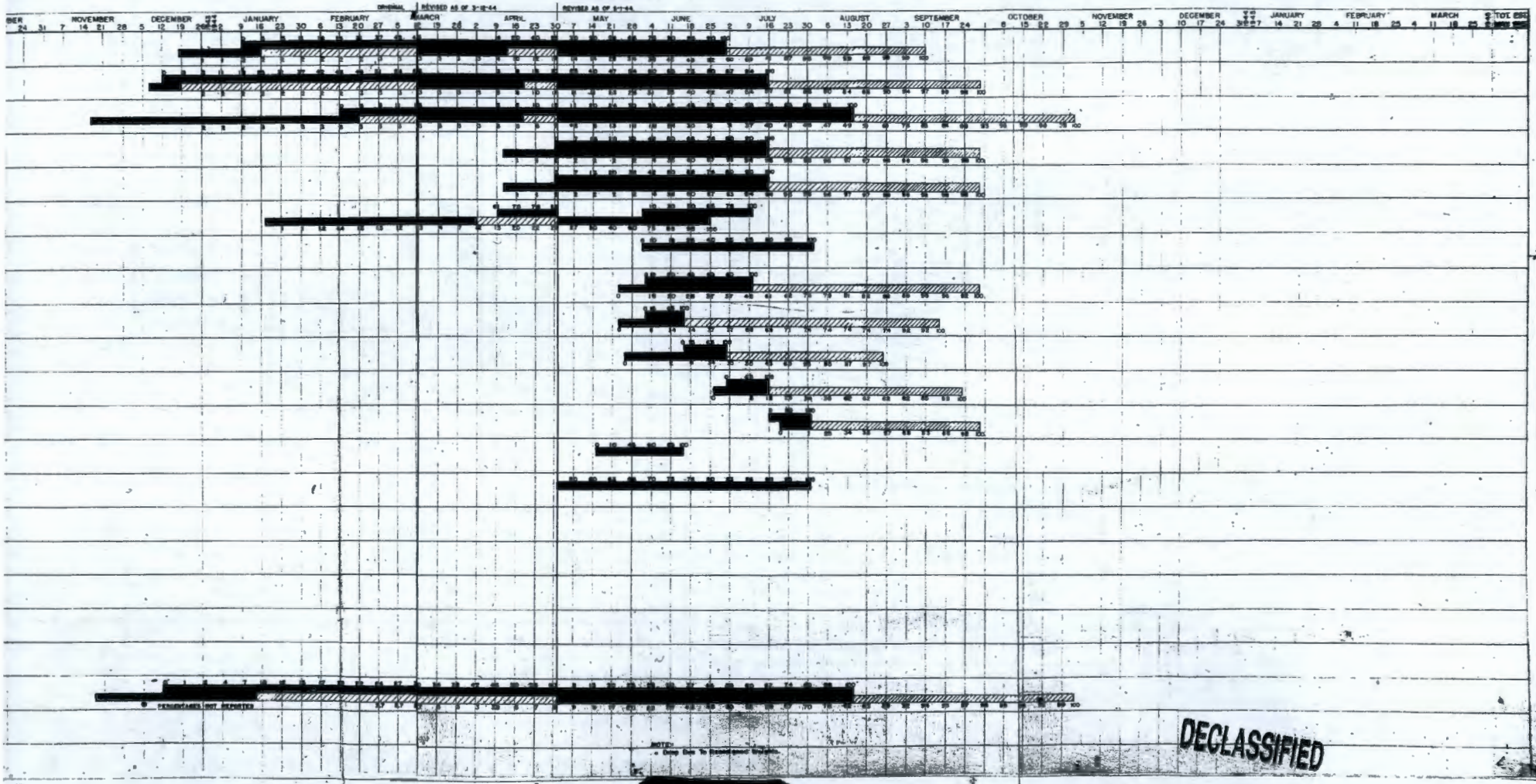

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BUILDINGS & FACILITIES
200 EAST AREA
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BUILDING NUMBER	NAME	DESIGN RELEASED	EXCAVATION		FOUNDATIONS		STRUCTURAL STEEL		SUPERSTRUCTURE		EQUIPMENT INSTALLATION		TEST RUNS MAJOR EQUIPMENT		START-UP DATE	COMPLETION DATE	DATE ACCEPTED BY	
			STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE			OPERATION	GOV'T.
213-B	Tank Farm	9-2-43	10-6-44	10-16-44	10-11-44	12-30-44	—	—	—	—	10-20-44	2-7-45	—	—	—	2-10-45	2-13-45	2-13-45
	Waste Disposal Trench	1-15-45	2-1-45	2-5-45														
216-E	Process Sewers	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2-10-45	2-5-45	2-2-45
221-B	Cell Building	7-12-43	8-2-43	8-19-43	4-17-44	6-23-44	—	—	6-18-43	12-24-44	8-1-44	2-7-45	—	—	—	2-10-45	2-13-45	2-13-45
222-B	Sample Preparation Laboratory	7-22-43	7-1-44	7-16-44	7-16-44	8-25-44	—	—	7-23-44	1-7-45	8-11-44	1-24-45	—	—	—	1-20-45	2-13-45	2-13-45
224-B	Bulk Reduction Building	1-3-44	7-1-44	7-21-44	7-20-44	8-11-44	—	—	8-4-44	1-7-45	8-21-44	2-10-45	—	—	—	2-10-45	2-13-45	2-13-45
241-B	Process Waste Disposal System	10-22-43	11-24-43	12-13-43	2-15-44	12-10-44	—	—	—	—	6-27-44	1-14-45	—	—	—	1-19-45	2-13-45	2-13-45
241-C	Process Waste Disposal System	10-22-43	12-18-43	12-30-43	2-20-44	1-15-45	—	—	—	—	7-9-44	1-26-45	—	—	—	1-26-45	2-13-45	2-13-45
252-E	Secondary Sub-Station	1-18-44	8-1-44	—	—	—	—	—	—	—	—	—	—	—	—	1-26-45	2-16-45	2-12-45
253-E	Distribution Sub-Stations	12-12-43	10-23-43	—	—	—	—	—	—	—	—	—	—	—	8-31-44	1-26-45	2-16-45	2-12-45
271-B	Chemical Preparation & Service Building	8-25-43	9-5-44	10-12-44	10-13-44	11-17-44	—	—	11-1-44	1-20-45	10-27-44	2-10-45	—	—	8-31-44	2-10-45	2-13-45	2-13-45
272-E	Area Shop	7-20-43	11-16-43	12-17-43	12-15-43	1-14-44	1-29-44	2-23-44	1-24-44	5-5-44	3-1-44	2-10-45	—	—	5-3-44	5-31-44	2-20-45	2-17-45
273-E	Heat Treating Furnace	8-28-43	9-15-43	11-26-43	10-17-43	12-17-43	11-15-43	1-25-44	11-15-43	3-17-43	10-25-43	5-21-44	1-29-44	2-4-44	5-3-44	5-31-44	2-20-45	2-17-45
274-E	Machinery Store House	6-10-43	12-29-43	1-7-44	1-5-44	1-14-44	—	—	3-13-44	4-14-44	—	—	—	—	—	4-14-44	2-9-45	2-7-45
275-E	Chemical Store House	6-10-43	12-28-43	1-14-44	1-12-44	1-23-44	—	—	3-13-44	4-14-44	—	—	—	—	—	4-14-44	2-9-45	2-7-45
282-E	Reservoir & Pump House	1-5-44	2-29-44	5-26-44	7-3-44	9-10-44	9-14-44	9-15-44	7-22-44	12-1-44	8-20-44	12-7-44	—	—	11-16-44	12-9-44	12-20-44	12-20-44
283-E	Filter Plant	9-1-43	6-28-44	7-28-44	7-26-44	9-15-44	9-18-44	9-28-44	7-28-44	12-1-44	8-20-44	12-7-44	—	—	11-13-44	12-9-44	12-20-44	12-20-44
284-E	Power House	8-17-43	12-23-43	3-21-44	3-15-44	5-26-44	4-26-44	7-4-44	4-26-44	12-15-44	7-21-44	12-27-44	6-13-44	7-1-44	11-4-44	12-29-44	1-20-45	1-25-45
288-E	Sewage Disposal Basin	10-6-43	2-28-44	3-17-44	—	—	—	—	—	—	—	—	—	—	11-4-44	11-22-44	1-24-45	1-25-45
291-E	Exhaust Gas Building & Stack	7-12-43	8-20-43	10-13-44	8-24-43	11-4-44	—	—	8-18-44	12-9-44	2-27-44	12-30-44	—	—	—	2-10-45	2-9-45	2-7-45
292-E	Exhaust Gas Laboratory	6-27-44	8-14-44	8-16-44	8-16-44	8-18-44	—	—	8-20-44	11-17-44	10-1-44	1-15-44	—	—	—	1-19-45	2-9-45	2-7-45
2501-E	Fence & Road Lighting	12-12-43	10-1-44	—	—	—	—	—	—	—	—	—	—	—	11-15-44	2-10-45	2-14-45	2-12-45
2503-E	Electric Lines	10-12-43	10-15-43	—	—	—	—	—	—	—	—	—	—	—	8-31-44	2-10-45	2-16-45	2-12-45
2505-E	Fire Alarm System	12-15-43	1-15-44	—	—	—	—	—	—	—	—	—	—	—	—	2-2-45	2-15-45	2-12-45
2506-E	Telephone Cable & Inst.	12-7-43	—	—	—	—	—	—	—	—	—	—	—	—	3-27-44	2-10-45	—	—
2601-E	Stand. Gauge R.R. Tracks	7-5-43	—	—	—	—	—	—	—	—	—	—	—	—	—	2-10-45	2-13-45	2-13-45
2603-E	Roads & Walks	7-5-43	—	—	—	—	—	—	—	—	—	—	—	—	—	2-10-45	2-9-45	2-10-45
2605-E	Fences (incl. Guard Towers)	10-12-43	1-1-44	—	—	—	—	—	—	—	—	—	—	—	—	2-2-45	2-9-45	2-8-45
2606	Settling Basin	1-24-44	3-6-44	—	—	—	—	—	—	—	—	—	—	—	—	4-15-44	2-5-45	2-3-45
2607-E	Septic Tanks	1-24-44	2-13-44	—	—	—	—	—	—	—	—	—	—	—	—	1-8-45	2-5-45	2-3-45
2612-E	Open Drainage Ditches	1-24-44	8-29-44	—	—	—	—	—	—	—	—	—	—	—	—	1-8-45	2-5-45	2-3-45
2613-E	Permanent Parking Lot	1-14-44	1-15-45	—	—	—	—	—	—	—	—	—	—	—	—	2-17-45	2-9-45	2-9-45
2614-E	General Monitoring Station	2-13-44	7-17-44	—	—	—	—	—	—	—	—	—	—	—	—	1-8-45	1-24-45	1-25-45
2621-E	Emergency Gas Generator Shelters	5-22-44	—	—	—	—	—	—	—	—	—	—	—	—	—	9-1-44	2-13-45	2-13-45
2701-E	Gate House & Clock Alley	8-27-43	4-10-44	4-16-44	4-17-44	5-5-44	—	—	5-1-44	9-7-44	5-25-44	10-15-44	—	—	—	10-16-44	2-5-45	2-2-45

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BUILDING NUMBER	NAME	DESIGN RELEASED	EXCAVATION		FOUNDATIONS		STRUCTURAL STEEL		SUPERSTRUCTURE		EQUIPMENT INSTALLATION		TEST RUNS MAJOR EQUIPMENT		STARTUP DATE	COMPLETION DATE	DATE ACCEPTED BY	
			STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE			OPERATION	GOV'T.
2704-E	Supervisor's Office Building	8-16-43	12-11-43	12-16-43	12-16-43	1-14-44	—	—	1-11-44	9-1-44	5-5-44	8-25-44	—	—	—	10-16-44	12-8-44	12-5-44
2707-E	Change House	6-30-43	1-17-44	1-7-44	3-23-44	4-26-44	—	—	5-3-44	7-27-44	7-14-44	9-29-44	—	—	—	12-4-44	12-8-44	12-5-44
2707-E1	Change House (Power Area)	12-16-43	4-10-44	4-14-44	4-16-44	4-25-44	—	—	4-20-44	12-3-44	7-14-44	11-17-44	—	—	—	12-5-44	12-8-44	12-8-44
2709-E	Fire Headquarters	1-21-44	4-1-44	4-7-44	4-5-44	4-27-44	—	—	4-13-44	6-9-44	7-5-44	7-29-44	—	—	—	7-31-44	12-21-44	12-13-44
2713-E	Storeroom	8-21-43	4-8-44	4-12-44	4-14-44	4-21-44	—	—	6-12-44	8-21-44	—	—	—	—	—	10-16-44	12-8-44	12-5-44
2713-E1	Remedial Material Storeroom	5-15-43	12-20-43	—	—	—	—	—	—	—	—	—	—	—	—	6-3-44	2-5-45	2-7-45
2714-E	Oil & Paint Storage Building	7-25-43	5-8-44	6-1-44	6-2-44	6-9-44	—	—	6-9-44	9-1-44	—	—	—	—	—	10-16-44	12-8-44	12-5-44
2716-E	Automotive Repair Garage		12-22-43	—	—	—	—	—	—	—	—	—	—	—	—	5-27-44	2-9-45	2-7-45
2718-E	Minor Aid Building	7-30-43	12-10-43	12-16-43	12-20-43	1-14-44	—	—	1-9-44	3-17-44	4-10-44	11-17-44	—	—	—	1-15-45	2-9-45	2-8-45
2720-E	Patrol Headquarters	7-6-43	4-1-44	4-7-44	4-5-44	4-28-44	—	—	4-12-44	5-12-44	5-1-44	12-3-44	—	—	—	12-4-44	12-8-44	12-5-44
2722-E	Paint & Sign Shop	6-30-43	5-8-44	5-27-44	5-28-44	6-3-44	—	—	6-7-44	9-1-44	—	—	—	—	—	10-16-44	12-8-44	12-5-44
2724-E	Cylinder Storage Building	4-13-43	5-10-44	5-27-44	5-28-44	6-3-44	—	—	6-7-44	8-7-44	—	—	—	—	—	8-9-44	12-8-44	12-5-44
2801-E	Pipe Supports	2-15-44	6-2-44	—	—	—	—	—	—	—	—	—	—	—	—	1-17-45	2-5-45	2-2-45
2802-E	Steam Lines	2-15-44	6-26-44	—	—	—	—	—	—	—	—	—	—	—	—	2-10-45	2-13-45	2-13-45
2803-E	Air Lines	2-15-44	3-29-44	—	—	—	—	—	—	—	—	—	—	—	—	2-10-45	2-5-45	2-2-45
2805-E	Process Lines	3-17-44	10-15-44	—	—	—	—	—	—	—	—	—	—	—	—	1-15-45	2-13-45	2-13-45
2901-E	Water Lines & Elev. Tanks	9-29-43	12-27-43	—	—	—	—	—	—	—	—	—	—	—	—	1-8-45	2-5-45	2-2-45
2902-E	Fire Lines & Elev. Tanks	9-29-43	1-31-44	—	—	—	—	—	—	—	—	—	—	—	—	1-8-45	2-13-45	2-13-45
2903-E	Sanitary Sewers	1-24-44	2-28-44	—	—	—	—	—	—	—	—	—	—	—	—	1-31-45	2-5-45	2-2-45
2904-E	Process Sewers	1-24-44	3-6-44	—	—	—	—	—	—	—	—	—	—	—	—	1-31-45	2-5-45	2-2-45
*2713-E2	Pipe Warehouse	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2-9-45	2-3-45

* T. C. Building transferred to operations and assigned permanent building numbers.
** Excavation started on Preliminary Drawings.

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PROJECT 9536

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BUILDING NUMBER	NAME	DESIGN REFERENCE	EXCAVATION		FOUNDATIONS		STRUCTURAL STEEL		SUPERSTRUCTURE		EQUIPMENT INSTALLATION		TEST RUNS MAJOR EQUIPMENT		START-UP DATE	COMPLETION DATE	DATE ACCEPTED BY	
			STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE			OPERATION	GOV'T.
211-T	TANK FARM	9-2-43	3-27-44	4-9-44	3-29-44	7-21-44	—	—	5-7-44	7-28-44	4-21-44	7-28-44	7-29-44	8-1-44	12-6-44	8-5-44	8-[illegible]-44	8-5-[illegible]
211-T	TANK FARM	9-2-43	6-10-44	6-22-44	6-26-44	8-4-44	—	—	7-17-44	11-3-44	7-1-44	11-3-44				11-3-44	12-20-44	12-[illegible]-44
221-T	CELL BUILDING	7-12-43	6-22-43	7-17-43	12-30-43	1-23-44	—	—	1-17-44	9-8-44	4-22-44	9-15-44			12-6-44	9-27-44	10-13-44	10-9-[illegible]
222-C	CELL BUILDING	7-12-43	7-5-43	8-1-43	1-11-44	4-30-44	—	—	3-21-44	11-3-44	6-13-44	12-1-44			12-6-44	12-16-44	12-20-44	12-16-44
224-C	SAMPLE PREPARATION LABORATORY	7-22-43	8-31-43	2-6-44	3-7-44	9-1-44	—	—	2-22-44	9-22-44	4-18-44	9-22-44	—	—	—	9-21-44	10-13-44	10-[illegible]-44
222-U	SAMPLE PREPARATION LABORATORY	7-22-43	4-21-44	4-29-44	4-30-44	10-6-44	—	—	5-12-44	11-3-44	7-17-44	11-3-44	—	—	—	11-3-44	11-15-55	11-15-44
22[illegible]-U	MILK REDUCTION BUILDING	1-3-44	2-21-44	2-23-44	3-7-44	7-21-44	—	—	3-14-44	9-29-44	6-12-44	10-6-44			12-6-44	10-8-44	12-20-44	12-15-44
226-C	MILK REDUCTION BUILDING	1-3-44	4-17-44	4-28-44	4-30-44	3-11-44	—	—	5-12-44	8-11-44	7-19-44	12-1-44				12-16-44	12-20-44	12-16-44
231-U	CONCENTRATION BUILDING	6-15-44	4-8-44	4-21-44	6-18-44	7-21-44	—	—	7-19-44	12-8-44	9-22-44				1-14-45	12-16-44	12-20-44	12-16-44
241-T	PROCESS WASTE DISPOSAL SYSTEM	10-22-43	11-6-43	12-1-43	12-7-43	7-25-44	—	—	—	—	2-8-44	9-29-44	—	—	12-6-44	10-30-44	12-5-44	12-7-44
241-C	PROCESS WASTE DISPOSAL SYSTEM	10-22-43	11-19-43	1-3-44	12-12-43	10-13-44	—	—	—	—	2-15-44	11-10-44	—	—		12-1-44	12-20-44	12-13-44
2[illegible]-U	SECONDARY SUB-STATION	1-18-44	2-1-44	2-8-44	2-10-44	4-30-44	—	—	2-15-44	6-16-44	4-25-44	6-16-44	—	—	6-29-44	10-15-44	12-26-44	12-13-44
2[illegible]-U	DISTRIBUTION SUB-STATION	11-30-43	2-1-44	—	—	—	—	—	—	—	—	—	—	—	6-29-44	12-9-44	12-26-44	12-1-44
272-T	CHEMICAL PREPARATION & SERVICE BL	8-25-43	4-1-44	4-8-44	4-10-44	5-31-44	—	—	4-28-44	8-11-44	5-18-44	9-1-44			12-6-44	9-2-44	10-1[illegible]-44	10-[illegible]
272-C	CHEMICAL PREPARATION & SERVICE BL	8-25-43	6-12-44	6-28-44	6-26-44	10-6-44	—	—	7-1-44	11-10-44	7-28-44	11-21-44				12-1-44	12-20-44	12-15-44
272-U	AREA SHOP	7-20-43	8-2-43	12-15-43	12-11-43	3-13-44	2-10-44	3-2-44	2-3-44	4-30-44	1-21-44	9-25-44	—	—	—	9-30-44	10-7-44	11-9-44
274-U	MACHINERY STORE HOUSE	6-10-43	8-21-43	12-23-43	12-30-43	2-27-44	—	—	2-12-44	3-26-44	—	—	—	—	—	5-13-44	6-1-44	6-1-[illegible]
282-U	RESERVOIR & PUMP HOUSE	1-5-44	12-24-43	1-28-44	1-28-44	4-9-44	—	—	3-1-44	7-28-44	2-27-44	6-16-44	7-10-44	7-11-44	7-10-44	8-12-44	10-11-44	10-1[illegible]-44
283-U	FILTER PLANT	9-1-43	12-30-43	1-21-44	1-28-44	4-22-44	1-24-44	4-25-44	3-3-44	7-28-44	2-27-44	6-16-44	7-10-44	7-11-44	7-13-44	8-15-44	9-18-44	9-18-44
284-U	POWER HOUSE	8-27-43	9-27-43	12-30-44	10-13-44	3-12-44	2-17-44	3-29-44	2-18-44	7-14-44	2-6-44	9-1-44	5-25-44	7-25-44	7-13-44	9-2-44	12-7-44	12-7-44
288-U	ASH DISPOSAL BASIN	10-6-43	5-25-44	—	—	—	—	—	—	—	—	—	—	—	7-15-44	7-14-44	12-7-44	12-7-44
291-T	EXHAUST GAS BLDG. & STACK	7-12-43	6-26-43	5-15-44	8-31-43	7-14-44	—	—	8-11-44	8-10-44	9-21-43	8-12-44			12-6-44	8-13-44	10-13-44	10-9-44
291-U	EXHAUST GAS BLDG. & STACK	7-12-43	8-09-43	7-21-44	9-7-44	10-6-44	—	—	6-28-44	10-6-44	9-25-43	10-27-44				11-21-44	12-20-44	12-13-44
292-T	EXHAUST GAS LABORATORY	6-27-44	7-3-44	7-3-44	7-6-44	7-21-44	—	—	7-27-44	9-15-44	8-12-44	9-27-44	—	—	12-6-44	10-1-44	9-30-44	9-30-[illegible]
292-U	EXHAUST GAS LABORATORY	6-27-44	7-10-44	7-28-44	7-15-44	7-28-44	—	—	7-18-44	11-3-44	8-26-44	11-10-44	—	—	—	11-16-44	12-30-44	12-13-44
2501-U	FENCE & ROAD LIGHTING	11-22-43	2-15-44	—	—	—	—	—	—	—	—	—	—	—	—	10-15-44	12-26-44	12-14-44
2503-U	ELECTRIC LINES	11-16-43	2-1-43	—	—	—	—	—	—	—	—	—	—	—	6-29-44	12-9-44	12-26-44	12-14-44
2505-U	FIRE ALARM SYSTEM	12-14-43	1-15-44	—	—	—	—	—	—	—	—	—	—	—	—	12-1-44	12-26-44	12-11-44
2506-U	TELEPHONE CABLE & LINES	12-1-43	12-1-43	—	—	—	—	—	—	—	—	—	—	—	12-12-43	12-9-44	—	—
2601-U	STANDARD GAGE R.R. TRACKS	7-5-43	7-20-43	—	—	—	—	—	—	—	—	—	—	—	9-15-43	11-8-44	12-11-44	12-6-44
2603-U	ROADS & WALKS	7-5-43	7-20-43	—	—	—	—	—	—	—	—	—	—	—	—	12-8-44	12-20-44	12-16-44
2605-U	FENCES (INCL. BARBED WIRE)	10-12-43	12-9-43	—	—	—	—	—	—	—	—	—	—	—	—	12-1-44	10-13-44	10-16-44
2607-U	SEPTIC TANK	1-6-44	2-8-44	—	—	—	—	—	—	—	—	—	—	—	—	9-15-44	12-30-44	12-16-44
2612-U	OPEN DRAINAGE DITCHES	3-16-44	6-15-44	—	—	—	—	—	—	—	—	—	—	—	—	11-29-44	12-20-44	12-20-44
2613-U	PERMANENT PARKING LOT	7-5-43	9-5-44	—	—	—	—	—	—	—	—	—	—	—	—	12-15-44	12-20-44	12-20-44
2614-U	GENERAL MAINTENANCE SHOPS	2-12-44	12-9-43	—	—	—	—	—	—	—	—	—	—	—	—	9-1-44	8-28-44	8-28-44

[redacted]

DECLASSIFIED

• PROGRESS OF CONSTRUCTION •
BUILDINGS & FACILITIES
200 WEST AREA
PROJECT 9536

DECLASSIFIED

BUILDING NUMBER	NAME	DESIGN RELEASED	EXCAVATION		FOUNDATIONS		STRUCTURAL STEEL		SUPERSTRUCTURE		EQUIPMENT INSTALLATION		TEST RUNS MAJOR EQUIPMENT		START-UP DATE	COMPLETION DATE	DATE ACCEPTED BY	
			STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE			OPERATION	GOV'T.
2[illegible]-W	EMERGENCY GAS GENERATOR SHELTERS	5-22-44	6-6-44	—	—	—	—	—	—	—	—	—	—	—	—	[illegible]	[illegible]	[illegible]
2701-W	GATE HOUSE & CLOCK ALLEY	7-27-43	8-27-43	12-12-43	12-19-44	1-8-44	—	—	1-6-44	3-26-44	2-15-44	5-26-44	—	—	—	[illegible]	[illegible]	[illegible]
2701-WA	GATE HOUSE & CLOCK ALLEY	4-13-44	7-1-44	—	—	—	—	—	—	—	—	—	—	—	—	[illegible]	[illegible]	[illegible]
2703-W	SUPERVISOR'S OFFICE BUILDING	8-16-43	8-21-43	9-19-43	10-3-43	11-28-43	—	—	10-26-43	2-27-44	1-25-44	5-[illegible]-44	—	—	—	[illegible]	10-1[illegible]-44	[illegible]
2707-W	CHANGE HOUSE	6-30-43	8-20-43	10-3-43	10-5-43	11-28-43	—	—	10-27-43	2-10-43	4-8-43	5-28-44	—	—	—	7-1[illegible]-44	[illegible]	[illegible]
2707-WA	CHANGE HOUSE (POWER AREA)	12-16-43	2-1-44	2-2-44	2-2-44	3-27-44	—	—	2-6-44	6-16-44	3-7-44	3-12-44	—	—	—	[illegible]	[illegible]	[illegible]
2709-W	FIRE HEADQUARTERS	1-21-44	2-3-44	2-12-44	2-12-44	3-26-44	—	—	2-28-44	5-19-44	4-18-44	7-21-44	—	—	—	7-28-44	[illegible]	[illegible]
2714-W	STOREROOM	8-21-43	8-26-43	10-10-43	10-11-44	1-3-44	—	—	11-4-43	5-12-44	5-7-44	6-30-44	—	—	—	7-1[illegible]-44	[illegible]	[illegible]
*2714-WA	ESSENTIAL MATERIAL STOREROOM	5-15-43	7-1-43	—	—	—	—	—	—	—	—	—	—	—	—	11-24-44	[illegible]	[illegible]
*2714-WB	MISCELLANEOUS STOREHOUSE	—	8-15-43	—	—	—	—	—	—	—	—	—	—	—	—	[illegible]-2-43	[illegible]	[illegible]
2715-W	OIL & PAINT STORAGE BLDG.	7-25-43	8-26-43	10-3-43	10-4-43	12-19-43	—	—	11-4-43	3-19-43	2-27-44	5-12-44	—	—	—	5-5-44	[illegible]	[illegible]
*2716-W	AUTOMOTIVE REPAIR GARAGE	—	7-1-43	—	—	—	—	—	—	—	—	—	—	—	—	12-20-43	[illegible]	[illegible]
2719-W	FIRST AID BUILDING	7-30-43	8-26-43	8-28-43	8-30-43	9-19-43	—	—	10-5-43	2-27-44	1-25-44	5-26-44	—	—	—	6-1-44	[illegible]	[illegible]
2720-W	PATROL HEADQUARTERS	7-6-43	8-27-43	10-6-43	10-7-43	12-19-43	—	—	11-5-43	5-12-44	1-25-44	4-28-44	—	—	—	8-10-44	[illegible]	[illegible]
2722-W	PAINT & RIGGER SHOP	6-30-43	8-20-43	10-3-43	10-5-43	12-19-43	—	—	11-5-43	5-12-44	2-16-44	6-9-44	—	—	—	8-10-44	[illegible]	[illegible]
2723-W	LAUNDRY	2-25-44	3-6-44	3-10-44	3-9-44	3-26-44	—	—	6-13-44	7-28-44	6-30-44	9-8-44	—	—	—	[illegible]	[illegible]	[illegible]
*2729-W	EXTRA MACHINERY STOREHOUSE	10-30-43	11-1-43	—	—	—	—	—	—	—	—	—	—	—	—	1-20-44	[illegible]	[illegible]
*2730-W	SLAB YARD	3-29-44	4-1-44	—	—	—	—	—	—	—	—	—	—	—	—	[illegible]	[illegible]	[illegible]
*2731-W	BURNING PIT	—	8-1-43	—	—	—	—	—	—	—	—	—	—	—	—	8-10-[illegible]	[illegible]	[illegible]
2734-W	CYLINDER STORAGE BLDG.	6-12-43	8-26-43	10-3-43	10-5-43	12-20-43	—	—	1-23-44	3-26-44	—	—	—	—	—	3-28-44	[illegible]	[illegible]
2801-W	PIPE SUPPORTS	11-25-43	2-2-44	—	—	—	—	—	—	—	—	—	—	—	7-31-44	[illegible]	[illegible]	[illegible]
2802-W	STEAM LINES	11-25-43	2-2-44	—	—	—	—	—	—	—	—	—	—	—	7-31-44	12-8-44	[illegible]	[illegible]
2803-W	AIR LINES	11-25-43	2-2-44	—	—	—	—	—	—	—	—	—	—	—	7-31-44	7-21-44	[illegible]	[illegible]
2805-W	PROCESS LINES	3-17-44	7-15-44	—	—	—	—	—	—	—	—	—	—	—	—	[illegible]	[illegible]	[illegible]
2901-W	WATER LINES & ELEV. TANKS	9-29-43	10-18-43	10-25-43	—	—	—	—	—	—	—	—	—	—	7-24-44	11-1-44	[illegible]	[illegible]
2902-W	FIRE LINES & ELEV. TANKS	12-20-43	12-21-43	12-23-44	—	—	—	—	—	—	—	—	—	—	[illegible]	[illegible]	[illegible]	[illegible]
2903-W	SANITARY SEWERS	12-15-43	1/3/44	—	—	—	—	—	—	—	—	—	—	—	—	[illegible]	[illegible]	[illegible]
2904-W	PROCESS SEWERS	1-14-44	2-7-44	—	—	—	—	—	—	—	—	—	—	—	—	11-1-44	[illegible]	[illegible]

* T.C. Building Transferred to Operations and Assigned Permanent Building Nos.
** Excavation Started on Preliminary Drawings.

DECLASSIFIED

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• PROGRESS OF CONSTRUCTION •

BUILDINGS & FACILITIES

200 NORTH AREA

PROJECT 9536

DECLASSIFIED

BUILDING NUMBER	NAME	DESIGN RELEASED	EXCAVATION		FOUNDATIONS		STRUCTURAL STEEL		SUPERSTRUCTURE		EQUIPMENT INSTALLATION		TEST RUNS MAJOR EQUIPMENT		START-UP DATE	COMPLETION DATE	DATE ACCEPTED BY	
			STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE	STARTED	COMPLETE			OPERATION	GOV'T.
212-H	Log Storage Bldg.	10-29-43	12-18-43	1-1-44	2-21-44	7-14-44	6-13-44	6-31-44	6-6-44	8-11-44	6-16-44	8-25-44	9-12-44	9-26-44	12-4-44	9-10-44	9-26-44	10-11-44
212-P	Log Storage Bldg.	10-29-43	12-8-43	12-17-43	1-5-44	7-28-44	7-10-44	7-29-44	6-23-44	9-29-44	7-5-44	9-29-44	10-2-44	10-4-44	1-3-45	9-29-44	12-20-44	12-20-44
212-R	Log Storage Bldg.	10-29-43	11-17-43	12-5-43	1-4-44	8-11-44	8-8-44	8-23-44	7-21-44	10-13-44	8-27-44	10-20-44	10-27-44	10-29-44	1-3-45	11-3-44	12-30-44	12-30-44
213-BRK	Magazine Bldg.	4-1-44	4-11-44	5-15-44	5-17-44	6-16-44	———	———	6-8-44	6-30-44	7-21-44	9-29-44	———	———	———	9-29-44	9-29-44	10-11-44
251	Primary Substation	1-5-44	1-17-44	1-30-44	1-25-44	5-12-44	4-29-44	4-30-44	3-5-44	6-10-44	2-6-44	6-21-44	———	———	6-17-44	10-15-44	1-17-45	12-14-44
252-H	Secondary Substation	1-31-44	4-29-44	———	———	———	———	———	———	———	———	———	———	———	8-27-44	9-1-44	*11-2-44	*10-28-44
253-H	Distribution Substation	2-1-44	8-1-44	———	———	———	———	———	———	———	———	———	———	———	8-27-44	11-3-44	*11-2-44	*10-28-44
2501-H	Fence & Road Lighting	2-1-44	8-1-44	———	———	———	———	———	———	———	———	———	———	———	11-20-44	9-29-44	*11-2-44	*10-28-44
2503-H	Electric Lines	2-1-44	8-1-44	———	———	———	———	———	———	———	———	———	———	———	8-27-44	11-3-44	*11-2-44	*10-28-44
2506-H	Telephone Cable & Instruments	1-25-44	8-15-44	———	———	———	———	———	———	———	———	———	———	———	11-20-44	11-20-44	———	———
2601-H	Standard Gauge Track	9-17-43	9-20-43	———	———	———	———	———	———	———	———	———	———	———	9-12-44	9-29-44	12-30-44	12-20-44
2603-H	Roads & Walks	9-17-43	6-14-44	———	———	———	———	———	———	———	———	———	———	———	———	9-15-44	12-30-44	12-20-44
2602-H	Fence (Incl. Guard Tower)	10-15-43	5-25-44	5-26-44	5-27-44	6-16-44	———	———	6-16-44	7-28-44	7-16-44	8-11-44	———	———	9-27-44	8-25-44	9-26-44	10-11-44
2605-1	Fence (Incl. Guard Tower)	10-15-43	6-26-44	6-29-44	6-30-44	7-7-44	———	———	7-6-44	8-11-44	7-24-44	8-11-44	———	———	———	9-15-44	12-20-44	10-3-44
2605-2	Fence (Incl. Guard Tower)	10-15-43	7-20-44	7-20-44	7-21-44	7-28-44	———	———	7-24-44	9-29-44	7-28-44	9-29-44	———	———	———	9-29-44	12-30-44	12-20-44
2605-3RK	Fence (Incl. Guard Tower)	4-1-44	5-18-44	5-19-44	5-20-44	6-2-44	———	———	5-22-44	7-7-44	6-20-44	9-29-44	———	———	———	9-29-44	12-5-44	12-5-44
2606-H	Septic Tank	1-29-44	6-14-44	———	———	———	———	———	———	———	———	———	———	———	———	7-28-44	10-9-44	10-18-44
2607-P	Septic Tank	1-29-44	6-14-44	———	———	———	———	———	———	———	———	———	———	———	———	7-28-44	10-9-44	10-18-44
2608-R	Septic Tank	1-29-44	6-14-44	———	———	———	———	———	———	———	———	———	———	———	———	7-28-44	12-28-44	12-16-44
2612-H	Open Drainage Ditches	2-8-44	7-1-44	———	———	———	———	———	———	———	———	———	———	———	———	7-28-44	12-30-44	12-20-44
2613-H	General Landscaping Machine	7-5-44	8-15-44	———	———	———	———	———	———	———	———	———	———	———	———	9-1-44	9-28-44	9-6-44
2743-H	Gate House & Guard Tower	1-19-44	5-25-44	5-27-44	5-27-44	6-16-44	———	———	6-19-44	7-28-44	7-16-44	8-11-44	———	———	———	8-25-44	9-26-44	10-11-44
2743-P	Gate House & Guard Tower	1-19-44	6-26-44	6-28-44	6-29-44	7-7-44	———	———	7-5-44	9-15-44	7-16-44	9-28-44	———	———	———	9-28-44	12-30-44	12-20-44
2743-R	Gate House & Guard Tower	1-19-44	7-20-44	7-23-44	7-23-44	7-28-44	———	———	7-30-44	9-29-44	8-20-44	9-29-44	———	———	———	9-29-44	12-30-44	12-20-44
2743-J	Gate House & Guard Tower	1-19-44	5-25-44	5-25-44	5-25-44	5-30-44	———	———	5-30-44	7-28-44	6-09-44	9-15-44	———	———	———	9-28-44	12-5-44	12-5-44
2901-H	Water Lines	3-15-44	4-23-44	———	———	———	———	———	———	———	———	———	———	———	9-12-44	9-29-44	12-30-44	12-16-44
2903-H	Sanitary Sewers	2-8-44	6-14-44	———	———	———	———	———	———	———	———	———	———	———	———	7-28-44	12-30-44	12-20-44
2904-H	Process Sewers	2-8-44	6-14-44	———	———	———	———	———	———	———	———	———	———	———	———	9-28-44	12-30-44	12-20-44
2905-PR	Wells & Pumps	5-2-44	6-1-44	6-3-44	———	———	———	———	———	———	———	———				9-29-44	12-30-44	12-14-44

NOTE: The dates shown on this sheet reflect the time at which the various interim stages of construction were essentially complete. In some cases, these dates will vary slightly from the final dates carried in the weekly progress report.

* Indicate acceptance.

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Listed below is the Physical Percentage complete by months for 200 Areas, as well as the Rate of Construction.

MONTH ENDING	PHYSICAL COMPLETE (PERCENTAGE) 200 East	200 West	200 North	RATE OF CONSTRUCTION (PERCENTAGE) 200 East	200 West	200 North
July, 1943	--	01	--	--	00	--
August	--	01	--	--	01	--
September	--	02	--	--	01	--
October	--	03	--	--	00	00
November	--	03	--	--	00	01
December	01	03	01	00	04	00
Jan. 1944	01	07	01	01	05	02
February	02	12	03	02	15	00
March	04	27	03	02	11	06
April	06	38	09	03	05	11
May	09	43	20	03	12	28
June	12	55	48	13	15	22
July	25	70	70	16	05	18
August	41	75	88	12	08	09
September	53	83	97	09	07	02
October	62	90	99	12	08	01
November	74	98	100	10	02	--
December	84	100	--	13	--	--
Jan. 1945	97	--	--	03	--	--
Feb. 10	100	--	--	--	--	--

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(5) Construction Delays

In the construction of the 200 Areas, a number of tangible and intangible general delaying factors were encountered. Part of these were actual factors due to the project location, nature of the work, type of construction, and "War Time" conditions. Others developed from time to time during the course of the work. The exact amount of time lost cannot be evaluated, but is reasonable to assume that the start-up and completion dates for these areas could have been improved greatly if many of the factors had been non-existant.

Listed below in sequence of importance are ten of the more important General Delaying Factors:

1. Lack of labor
2. Lack of mechanics for precision work
3. Unfamiliar design, close tolerances for mass concrete
4. Isolated location lacking man-made facilities
5. Material
6. Major design changes
7. Design
8. Classified Construction
9. Failures
10. Absenteeism, Turnover, etc.
11. Miscellaneous Delays

(a) Lack of Labor

The shortage of both skilled and unskilled labor was the largest contributing factor in the delay of construction for the 200 Areas. This shortage was more prevalent for Common Labor than in the Skilled Crafts, as shortages in Common Labor prevailed throughout the entire construction period, while the scarcities in the Skilled Crafts were intermittent. From time to time, scarcities were encountered in nearly all crafts with initial shortages at the beginning of the job in Labor, Carpenters, and Reinforcing Steel Workers. Later, this list was enlarged to include Pipefitters and Plumbers, Electricians, Welders, Millwrights, and Sheetmetal Workers. Allocation of labor became necessary in order to perform area work in sequence of Area start-ups, as the Company was unable to secure sufficient workers to man all the areas simultaneously. For this reason, work could not be started in some areas immediately upon receipt of design, and after starting, work had to be stopped for a period of time in order to perform more critical work. Critical craftsmen were shifted continually from one area to another to meet start-up dates.

It was early realized that the number of workers available for allocation to the East & West Areas would be the controlling factor in the speed of construction as Procurement and Design could be brought into line. Therefore, machine excavation work for the major building structures and necessary facilities was started at the earliest possible date so that work could be begun in force when the manpower was available.

Original Area Force Curves were prepared for the 200 East and West Areas on September 30, 1943, with the manpower for the 200 North Area included in the

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West Area Force Curve. These curves were based purely on available manpower forecast, not upon estimated field demand, and are included on the following page for further reference.

200-W Area

The "hold" placed on permanent construction work in the 200-W Area during the latter part of September was greatly responsible for the small amount of progress made during 1943, as work was held up approximately two months. Labor previously scheduled and allocated for work in this area had to be shifted to Hanford Camp Construction to meet the increased demand for living quarters. The principal craft shortages at that time were Carpenters and Laborers. During this period, work was practically at a standstill; urgent work only being carried on with a skeleton force. This included the preparation of foundations for stacks and elevated water tanks, as the subcontractors were scheduled to start work during that period.

A sharp increase was made in the Area Force on November 28, 1943 when normal work was resumed. Prior to this time, the average number of workers available for this area was less than 300. The Area Force Curve was revised on March 15, 1944, to meet the existing rate of allocation, thereby extending the estimated peak to the middle of July, 1944. A sharp influx in employment after this time enabled a peak force of approximately 4960 employees to be reached during the middle of May, 1944. Employment was maintained at 90% of the peak for approximately three months, from April 14, 1944, to July 19, 1944. This occasioned a second revision to the overall Area Force Curve August 23, 1944.

By the aid of the tabulated sheet on the following page, we have endeavored to show statistically the principal Craft shortages and the period over which they were critical. Eight categories are included; namely, Laborers, Carpenters, Reinforcing Steel Workers, Riggers, Pipe Fitters and Pipe Welders, Electricians, and Millwrights. During the period from approximately December 12, 1943, to April 1, 1944, only 43% Laborers, 67% Carpenters, 64% Reinforcing Steelworkers, and 80% Riggers were available for work in the 200 West Area. The initial delay caused by the shortage in these crafts affected all future craft work in main process building. Apparent shortages in the Pipe Fitter, Pipe Welder, Electrical and Millwright Crafts appeared about the latter part of January, 1944, and carried through for the first two crafts until the middle of September, 1944.

Pipe work was seriously affected by the shortage of welders, especially in the fabrication of stainless steel pipe. At one time it was felt that pipe fabrication could be carried out by the piping subcontractor at the rate of 100 pieces per day. On this basis, the piping work in the 200-T Area was originally guaranteed for completion by July 15, 1944. Due to the shortage of welders, this work on a single 10-hour shift averaged about 40 pieces per day, not accounting for the fact that a very sizeable quantity of stainless steel pipe for the 105-B Building took precedence to the extent of shutting down fabrication for the 200 Area.

Practically all pipe work was stopped on the "U" Process Building Group from July 5, 1944, to August 25, 1944, in order to meet the completion dates set

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200-W AREA

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WEEK ENDING	LABORERS			CARPENTERS			REINF. RODSETTERS			RIGGERS			PIPEFITTERS			PIPE WELDERS			ELECTRICIANS			MILLWRIGHTS		
	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO. REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT
12/19/43	450	51	399	415	297	118	25	10	15	45	45	—	25	10	15	2	2	—	20	5	15	20	16	4
12/25/43	450	462	+ 12	415	415	—	25	20	5	45	45	—	25	8	17	3	3	—	22	7	15	20	16	4
1/2/44	450	450	—	500	500	—	40	40	—	55	55	—	26	26	—	3	3	—	40	12	28	20	16	4
1/9/44	450	405	45	850	700	150	60	40	20	60	60	—	50	50	—	5	5	—	50	17	33	25	25	—
1/16/44	500	405	95	1050	700	350	70	40	30	58	51	7	68	49	19	6	3	3	58	25	33	16	16	—
1/23/44	550	250	300	1300	700	600	100	35	65	75	70	5	95	66	29	8	0	8	70	25	45	50	30	20
1/30/44	600	225	375	1500	700	800	125	40	85	95	76	19	140	64	76	10	5	5	70	45	25	50	30	20
2/6/44	650	200	450	1600	1000	600	150	40	110	110	76	34	150	86	64	15	6	9	90	63	27	60	30	30
2/13/44	650	200	450	1700	1000	700	160	100	60	125	76	49	175	92	83	20	9	11	90	63	27	60	25	35
2/20/44	800	250	550	1750	1000	750	175	100	75	125	76	49	150	117	33	20	9	11	90	63	27	70	25	45
2/27/44	800	250	550	1800	1014	786	150	100	50	150	82	58	180	145	35	25	12	13	100	83	17	80	25	55
3/5/44	800	250	580	1700	1014	686	160	100	60	150	109	41	180	139	41	25	16	9	100	75	25	90	25	65
3/12/44		200	600	1700	1096	604	150	146	4	150	106	44	180	148	32	30	14	16	115	65	50	90	40	50
3/19/44	800	290	510	1650	1200	450	160	160	—	160	130	30	210	207	3	30	22	8	125	70	55	100	70	30
3/26/44	800	300	500	1600	1375	225	170	170	—	160	130	30	230	180	50	30	25	5	135	64	71	110	90	20
4/1/44	800	374	426	1600	1500	100	120	120	—	175	144	31	240	240	—	30	30	—	170	64	106	120	90	30
4/8/44	800	305	495	1550	1500	50	180	180	—	190	154	36	280	260	20	30	28	2	190	70	120	135	90	45
4/15/44	800	300	500	1550	1500	50	180	180	—	210	157	53	310	310	—	30	30	—	180	75	105	150	113	37
4/22/44	800	300	500	1550	1550	—	180	180	—	210	190	20	320	247	73	30	28	2	190	103	87	160	97	63
4/29/44	800	330	470	1700	1662	38	180	180	—	200	190	10	340	300	40	30	17	13	200	103	97	170	109	61
5/6/44	800	300	500	1700	1662	38	180	180	—	210	190	20	350	343	7	30	17	13	225	103	122	190	109	81
5/13/44	800	400	400	1700	1546	154	180	180	—	220	220	—	370	350	20	35	20	15	240	110	130	210	109	101
5/20/44	725	400	325	1600	1500	100	180	180	—	220	211	9	400	389	11	35	24	11	250	110	140	220	109	111
5/27/44	700	500	200	1500	1500	—	180	180	—	200	200	—	420	389	31	35	31	4	260	131	129	230	184	46
6/3/44	650	550	100	1400	1400	—	160	145	15	180	180	—	440	440	—	35	32	3	260	137	123	235	199	36
6/10/44	650	750	+ 100	1100	1000	100	115	112	3	180	180	—	480	480	—	40	36	4	270	160	110	240	180	60
6/17/44	800	850	+ 50	950	900	50	115	115	—	180	180	—	700	500	200	50	42	8	330	220	110	225	204	110
6/24/44	800	700	+100	900	900	—	90	90	—	180	175	5	825	591	234	60	57	3	340	240	100	250	240	10
7/1/44	800	800	—	800	800	—	100	90	10	150	150	—	750	590	160	65	60	5	350	256	94	300	231	69
7/8/44	750	750	—	800	800	—	75	65	10	150	150	—	750	408	342	70	32	38	350	247	103	300	300	—
7/15/44	650	650	—	750	750	—	75	75	—	150	150	—	750	430	320	70	58	12	350	230	120	300	300	—
7/22/44	650	600	50	800	800	—	75	75	—	150	140	10	750	396	354	70	35	35	350	256	94	300	300	—
7/29/44	600	500	100	800	800	—	70	70	—	150	150	—	750	440	310	70	40	30	350	300	50	300	300	—
8/5/44	600	485	115	700	700	—	65	65	—	139	139	[redacted]	750	470	280	70	53	17	350	350	—	300	300	—
8/12/44	600	425	175	600	600	—	65	65	—	150	[redacted]		[redacted]	[redacted]	262	70	65	5	350	300	50	300	275	25

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200-W AREA

PROJECT 9536

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WEEK ENDING	LABORERS			CARPENTERS			REINF. RODSETTERS			RIGGERS			PIPEFITTERS			PIPE WELDERS			ELECTRICIANS			MILLWRIGHTS		
	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT
8/19/44	500	425	75	500	500	---	40	40	---	125	125	---	550	550	---	75	65	10	350	350	---	300	288	12
8/26/44	500	450	50	500	500	---	50	50	---	125	125	---	550	450	100	75	53	22	350	350	---	300	288	12
9/2/44	500	450	50	450	450	---	25	25	---	125	125	---	550	400	150	70	53	17	350	350	---	180	180	---
9/9/44	500	450	50	300	300	---	50	34	16	125	125	---	575	400	175	85	53	32	300	300	---	180	164	16
9/16/44	500	450	50	300	300	---	50	50	---	125	125	---	550	416	134	70	65	5	300	300	---	200	194	10
9/23/44	350	350	---	250	200	50	20	20	---	75	75	---	500	500	---	50	50	---	200	200	---	175	175	---
9/30/44	275	275	---	150	150	---	20	20	---	55	55	---	400	419	+ 19	50	50	---	150	150	---	175	150	25
10/8/44	350	350	---	185	185	---	15	15	---	75	75	---	400	426	+ 26	40	45	+ 5	175	150	25	175	150	25
10/14/44	350	385	+ 35	160	160	---	15	10	5	75	65	10	375	430	+ 55	40	41	+ 1	160	150	10	140	140	---
10/21/44	280	325	+ 45	130	130	---	2	2	---	80	75	5	400	375	25	32	41	+ 9	240	200	40	120	120	---
10/28/44	290	385	+ 95	150	150	---	12	12	---	70	65	15	375	415	+ 40	35	39	+ 4	200	200	---	140	140	---
11/4/44	200	200	---	115	105	10	0	0	---	50	45	5	395	320	75	40	30	10	200	180	20	110	110	---
11/11/44	200	180	20	100	100	---	0	0	---	50	49	1	315	360	+ 45	33	33	---	220	163	57	96	96	---
11/18/44	180	160	20	80	75	5	0	0	---	50	48	2	315	344	29	30	41	+ 11	200	155	45	90	90	---
11/25/44	160	108	52	70	65	5	0	0	---	50	45	5	300	300	---	30	32	+ 2	200	155	45	75	75	---
12/2/44	140	120	20	30	25	5	0	0	---	40	40	---	200	200	---	20	19	1	150	150	---	60	60	---
12/9/44	120	120	---	75	75	---	0	0	---	30	30	---	160	160	---	16	16	---	90	90	---	50	50	---
		19,790			39,351			3956			5809			15503			1595			7737			6697	

100 318

101

LEGEND:

REQ. Number of men requested by the Division Engineer for work in the above area.

ALLOC. Number of men allocated by the Planning & Scheduling Department to work in the above area.

SHORT Number of men short daily not including absenteeism.

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for the 105-B Building and the "T" Process Group. After the completion of the 100-B Area sufficient manpower was made available for work in the West Area, eliminating shortages thereafter except for Sheet Metal Workers over a short period.

200-E Area

Due to the lack of sufficient manpower to carry on simultaneous plantwide construction, and because of the position of the 200-E Area in the "Sequence of Area Start-ups", it became necessary to place a "Hold" on permanent construction work in that area until forces could be made available. This was responsible for the small amount of permanent work accomplished in the 200-E Area up to March 5, 1944. Prior to that time the work in the East Area had been limited to the preparation of foundations for Process Stacks, Power House Stacks, and the 273-E Heat Treating Furnace, as the subcontractors were scheduled to begin work during that period. The construction of the 272-E Area Shop and supporting Service Buildings 274, 275, 2704, 2719 were also allowed to progress as these buildings were required for the pre-assembly of cell equipment.

Up to March 5, 1944, the average number of workers available for this area was less than 200, not including the additional force that was brought in during the month of December, 1943 and the first part of January, 1944 for the construction of main TC Buildings and Facilities. The original area Force Curve was revised on March 15, 1944 to meet the existing rate of allocation, thereby extending the estimated peak to about the first of September, 1944. This curve was again revised on August 23, 1944 and was based upon the decrease in area manpower requirements brought about by the cancellation of plant "C" and the rate of allocation existing at that time. A peak force of approximately 2450 employees was reached during the middle of August, 1944 and was maintained at 90% of the peak force over a period of two months, from July 20th to September 20th. After this peak had been reached, work was curtailed in the East Area until the completion of the 100-B & D and 200-W & N Areas. This occasioned a second peak in forces during the month of December, 1944.

By the aid of the tabulation sheet on the following page, we have endeavored to show statistically the principal craft shortages and the period over which they were critical. Eight categories are included; namely, Labor, Carpenter, Reinforcing Steel Workers, Rigger, Pipe Fitter and Pipe Welder, Electrical and Millwright. The shortage of Common Labor was apparent throughout the entire construction period with shortages running as high as 75%. During the period roughly from January 1 to August 1, 1944, only 66% of the number of Carpenters requested were available. Shortages in the Reinforcing Iron Worker and Rigger Crafts appeared for approximately six weeks from the first of July to the middle of August, 1944. The above shortages greatly affected all future craft work in the Plant "B" Process Buildings.

The installation of piping and electrical equipment was seriously affected by the shortage of Pipe Fitters, Pipe Welders, and Electricians which first appeared about the middle of May, 1944 and carried through until the latter part of January, 1945. Shortages appeared now and then in the Millwright craft for four and five week periods. This condition was brought about by the shifting of men to other Process Areas to meet start-up dates.

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200-E AREA
PROJECT 9536

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WEEK ENDING	LABORERS			CARPENTERS			REINF RODSETTERS			RIGGERS			PIPEFITTERS			PIPE WELDERS			ELECTRICIANS			MILLWRIGHTS		
	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT	NO REQ	NO ALLOC	NO SHORT
12/19/43	80	16	64	48	48	---	2	0	2	6	6	---	8	0	8	1	1	---	4	0	4	2	2	—
12/25/43	144	200	≠ 56	80	180	≠ 100	2	0	2	6	6	—	3	0	3	1	1	---	6	4	2	4	2	2
1/2/4	250	75	175	192	186	6	2	2	---	6	6	—	12	0	12	1	1	—	6	4	2	2	0	2
1/9/44	300	75	225	192	60	132	4	2	2	10	10	---	12	12	---	0	2	≠ 2	8	0	8	2	0	2
1/16/44	100	16	84	80	32	58	2	0	2	10	10	---	12	4	8	0	0	---	8	0	8	2	2	—
1/23/44	85	16	69	48	16	32	4	0	4	10	10	—	21	0	21	1	0	1	18	0	18	2	2	—
1/30/44	100	16	84	100	16	84	4	0	4	10	18	≠ 8	25	10	15	0	0	---	24	0	24	2	2	—
2/6/44	100	16	84	100	16	84	4	0	4	18	9	9	10	9	1	1	1	—	24	0	24	2	2	—
2/13/44	100	16	84	100	20	80	4	0	4	18	10	8	25	9	16	1	1	—	24	0	24	5	0	5
2/20/44	100	32	68	100	48	52	4	0	4	18	16	2	25	20	5	1	5	≠ 4	24	15	9	5	0	5
2/27/44	100	32	68	100	48	52	4	4	—	18	16	2	25	14	11	1	4	≠ 3	24	15	9	5	5	—
3/5/44	56	32	24	108	80	28	3	2	1	18	18	—	17	16	1	1	7	≠ 6	7	6	1	8	5	3
3/12/44	36	32	4	148	148	—	2	2	---	18	18	—	18	14	4	1	3	≠ 2	7	7	—	8	5	3
3/19/44	46	46	—	146	146	—	4	4	—	24	24	—	24	24	—	2	2	—	12	11	1	16	16	—
3/26/44	90	50	40	164	160	4	7	7	—	32	29	3	50	34	16	3	1	2	13	10	3	13	13	—
4/1/44	159	100	59	200	200	—	24	24	—	20	20	—	48	48	—	2	2	—	30	16	14	16	16	—
4/8/44	215	100	115	200	200	—	35	35	—	30	25	5	55	50	5	2	2	—	28	27	1	20	16	4
4/15/44	215	50	165	220	200	20	36	36	—	36	25	11	62	62	—	4	4	—	30	27	3	32	18	14
4/22/44	215	50	165	286	200	86	40	40	—	38	30	8	83	89	≠ 6	4	4	—	45	16	29	32	20	12
4/29/44	250	50	200	328	200	128	44	44	—	45	16	29	83	83	—	4	4	—	45	16	29	56	20	36
5/6/44	250	60	190	256	200	56	44	44	—	44	16	28	86	85	1	5	4	1	50	16	34	45	20	25
5/13/44	250	82	168	280	184	96	54	54	—	44	44	—	86	82	4	5	4	1	50	16	34	45	20	25
5/20/44	250	82	168	320	184	136	56	54	2	50	36	14	86	59	27	5	2	3	50	16	34	45	24	21
5/27/44	260	82	178	356	184	172	78	54	24	50	36	14	103	70	30	6	2	4	45	16	29	20	20	—
6/3/44	180	180	—	320	210	110	82	80	2	58	50	8	86	85	1	6	4	2	40	16	24	24	20	4
6/10/44	238	260	≠ 22	500	336	164	133	133	—	70	70	—	75	75	—	9	4	5	40	16	24	45	20	25
6/17/44	342	360	≠ 18	672	336	336	148	146	2	78	78	—	129	70	59	13	4	9	46	16	30	51	35	16
6/24/44	352	452	≠100	676	350	326	128	128	—	83	78	5	139	65	74	6	6	—	44	8	36	46	40	6
7/1/44	396	396	—	752	454	298	114	110	4	125	70	55	147	55	92	10	6	4	44	8	36	60	35	25
7/8/44	432	396	36	856	609	247	130	68	62	123	70	53	183	70	113	12	4	8	50	8	42	60	60	—
7/15/44	392	329	63	943	600	343	133	83	50	132	68	64	175	65	110	15	4	11	73	12	61	73	60	13
7/22/44	406	329	97	927	600	327	131	68	63	136	68	68	203	64	139	19	7	8	68	12	56	64	50	14
7/29/44	430	310	120	901	619	282	129	77	52	128	73	55	183	50	133	19	10	9	65	77	≠ 12	74	54	20
8/5/44	414	285	129	811	779	32	103	95	8	125	98	27	198	67	131	20	10	10	81	50	31	96	93	3
8/12/44	428	305	123	790	790	—	103	90	13	134	108	[redacted]	212	72	140	20	20	—	81	50	31	100	85	15

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CRITICAL CRAFTS

200-E AREA
PROJECT 9536

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WEEK ENDING	LABORERS			CARPENTERS			REINF. RODSETTERS			RIGGERS			PIPEFITTERS			PIPE WELDERS			ELECTRICIANS			MILLWRIGHTS		
	NO. REQ.	NO. ALLOC.	NO. SHORT	NO. REQ.	NO. ALLOC.	NO. SHORT	NO. REQ.	NO. ALLOC.	NO. SHORT	NO. REQ.	NO. ALLOC.	NO. SHORT	NO. REQ.	NO. ALLOC.	NO. SHORT	NO. REQ.	NO. ALLOC.	NO. SHORT	NO. REQ.	NO. ALLOC.	NO. SHORT	NO. REQ.	NO. ALLOC.	NO. SHORT
8/19/44	379	285	94	856	856	—	103	90	13	134	128	6	217	80	139	20	20	—	81	81	—	92	85	7
8/26/44	353	285	68	647	647	—	103	90	13	140	129	11	217	50	167	20	20	—	86	86	—	107	107	—
9/2/44	353	265	88	636	636	—	77	77	—	83	83	—	217	30	187	20	6	14	95	75	20	130	130	—
9/9/44	330	265	65	541	541	—	75	75	—	80	80	—	238	57	181	27	6	21	100	81	19	128	120	8
9/16/44	280	265	15	432	432	—	57	51	6	80	80	—	245	57	188	20	12	8	92	90	2	30	30	—
9/23/44	280	280	—	390	380	10	44	44	—	80	80	—	245	57	188	12	6	6	92	92	—	25	25	—
9/30/44	300	280	20	350	350	—	44	44	—	80	80	—	245	160	85	21	6	15	80	80	—	50	25	25
10/7/44	293	293	—	340	332	8	34	34	—	75	75	—	239	162	77	19	14	5	78	68	10	50	25	25
10/14/44	288	325	+ 37	380	380	—	28	20	8	65	65	—	229	153	76	19	18	1	98	58	40	70	25	45
10/21/44	240	310	+ 70	350	300	50	33	30	3	60	55	5	225	221	4	22	26	+ 4	100	55	45	70	50	20
10/28/44	268	325	+ 57	350	350	—	26	26	—	65	65	—	227	222	5	21	29	+ 8	98	55	43	60	25	35
11/4/44	275	275	—	350	217	133	22	22	—	60	45	15	250	100	150	25	10	15	100	50	50	70	50	20
11/11/44	300	180	120	400	331	69	16	22	+ 6	60	45	15	250	105	145	25	25	—	150	50	100	100	50	50
11/18/44	330	150	180	440	325	115	18	20	+ 2	65	45	20	300	167	167	30	22	8	165	43	122	100	100	—
11/25/44	330	100	230	400	340	60	30	30	—	65	40	15	300	153	147	30	14	16	200	43	157	100	85	15
12/2/44	300	145	155	350	346	4	30	32	+ 2	65	45	20	300	191	109	30	20	10	220	60	140	100	85	15
12/9/44	275	150	125	300	300	—	30	27	3	65	55	10	300	279	21	30	30	—	220	127	93	150	122	28
12/16/44	275	175	100	225	225	—	32	29	3	75	71	4	300	260	40	30	26	4	200	138	62	150	146	4
12/23/44	300	220	80	275	275	—	44	27	+ 3	75	72	3	275	260	15	28	28	—	200	170	30	150	150	—
12/30/44	300	200	100	275	257	18	20	22	+ 2	75	65	10	350	260	90	35	28	7	210	150	60	130	130	—
1/6/45	300	156	144	225	225	—	12	16	+ 4	70	62	8	350	225	125	35	26	9	210	125	85	120	120	—
1/13/45	300	250	50	150	150	—	10	13	+ 3	65	61	4	450	382	68	40	30	10	225	146	79	110	100	10

LEGEND:

REQ. Number of men requested by the Division Engineer for work in the above area.

ALLOC. Number of men allocated by the Planning & Scheduling Department to work in the above area.

SHORT Number of men short daily not including absenteeism.

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200-W Area

The "Progress of Construction Building and Facility Tabulation", included in the preceding Section indicates an approximate two-months' delay between the completion of the machine excavation work for the 212-W, T & U Buildings, and the start of foundation work for those buildings. Upon completion of mass excavation work, a crew of carpenters and laborers was sent in to start foundation work, but after a couple days' work were transferred to the 100-B Area to complete more urgent work. It was not until late February, 1944, that forces were available to resume work. At no time were there sufficient laborers, carpenters, and reinforcing rodsetters available to carry on this work properly. In spite of this handicap, the work was completed well in advance of the Operating requirements.

(b) Lack of Mechanics for Precision Work

Prior to the start of construction at the Hanford Engineer Works, there existed "Nation Wide" a definite shortage of highly-skilled mechanics capable of performing precision work. This shortage was felt especially along the West Coast, where an increased demand had been created by the activity in the aircraft and ship building industries. Skilled mechanics in other parts of the country were likewise engaged in essential "War Work", allowing little possibility of obtaining this type of help by recruitment. Shortages were most apparent in Millwright, Pipefitter, Electrical, Machinist, and Welder trades. In order to attain the precision workmanship required in the Process Buildings, less-skilled workers had to be hired and trained, resulting in a loss of both efficiency and production. Trained personnel and specialized craftsmen were transferred from maintenance groups in du Pont Commercial Plants, and from Government Defense Plants operated by the Company, to fill key positions in handling this work.

(c) Unfamiliar Design - Close Tolerance for Mass Concrete

The design of 200-Area Process Plants was a radical departure from normal industrial construction as it was based upon laboratory experiments magnified a thousand-fold. The background experience of foremen and workmen could not be fully utilized due to the completely new and different type of construction and to the classified nature of the work involved.

Design for the 221, 224, and 241 Building specified massive concrete construction, which required that the work progress in pyramidal order. In spite of the massiveness of the work, concrete in many places had to be poured to plus or minus 1/8" tolerances. The placement of hundreds of inserts, sleeves, piping and conduit embedments within the concrete required setting to even closer tolerances. The electrical and mechanical control systems in most of the Process Buildings likewise required expert workmanship and high caliber supervision, as the process equipment is operated by remote control.

(d) Isolated Location - Lacking Man-made Facilities

As mentioned earlier in Sections (1) Selection of Sites and (2) Preliminary Work, the 200 Areas lie in an isolated section completely barren of man-made

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facilities, with the exception of an unimproved state highway (No. 11-A). Before permanent construction work could be accomplished in any degree, construction facilities had to be established as follows: Offices, Shops, Storage Buildings and Yards, Electric Power, Water, Telephones, Roads and Railroads. The time required for the establishment of these facilities directly affected the speed of permanent construction work. Work was officially started in the 200-W Area on June 22, 1943, and in the 200-E Area on August 3, 1943, when ground was broken for the 221-Buildings. However, adequate facilities were not essentially complete in the West Area until the latter part of January, 1944, and in the East Area until the latter part of May, 1944.

The lack of early water and electric power supply, and railroad and telephone service, in both areas particularly hampered work in these areas and influenced the volume of work that could be accomplished with the available force. Water was probably the controlling facility, as concrete could be poured only on a small scale and the amount of stabilization and road work was often dependent upon an adequate local supply of water. Even after service had been established to the West Area, the quantity had to be limited to 200 GPM due to the early large line losses and to the large demand by Central Shops for central distribution.

Listed below by areas are the dates when services were established for the major facilities:

Facility	200-West Area	200-East Area
Water	11- 8-43	2- 8-44
Electric Power	9- 3-43	4- 4-44
Railroads	9-15-43	11-21-43
Telephones	12-12-43	3-27-43

(e) Material

1. 200-W Area

The completion of four buildings (221-T, 222-T, 224-T and 231-W) in the 200-W Area was affected by the late delivery of critical limiting material and equipment.

The principal material delay in the completion of the 221-T Building was the late delivery of stainless steel thru-concrete cell piping. This condition was greatly improved for the "U" and "R" Buildings by changing the vendor's shop fabrication sequence schedules to meet field requirements. Late deliveries of cell piping, cell equipment and the 10-ton crane for the head-end addition to the 221-T Building delayed the final completion of this building by approximately two weeks. Cast-iron cell and trench forms were received approximately two weeks too late in order for 100% use in the 221-T Building, thereby requiring the construction of some wooden forms to prevent further loss of time. The completion of the 222-T Buildings could have been improved considerably had it not been for the late receipt of laboratory and furniture equipment. However, this did not affect the start-up of the "T" Plant. Approximately two months' delay was encountered in the installation of cell and gallery equipment in the 224-T

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Building due to the delay in obtaining stainless steel tanks and piping for this building.

On October 12, 1944, there were 56 outstanding orders for the 231-W Building, late receipt of material would limit start-up. The more important were as follows: 5 - 26' S/S hoods; 11 - 12' S/S hoods; 8 - 8' S/S hoods; 10 - S/S vacuum receivers; miscellaneous S/S tanks and accessories, laboratory furniture and sinks; stainless steel bolts, nuts, fittings, filters, bodies, and nozzles, brasses, etc.

2 200-E Area

The delivery of material and equipment for the 200-E Area was favorable in view of the limited manpower available for allocation. However, on several occasions special expediting and handling was required in order to bring in line the plant delivery dates for process equipment.

(f) Major Design Changes

During the course of construction, revisions were made to the original drawings, some in the form of additions and changes, others covering deletions. Some of these required major changes or came late in the job, causing the construction schedule for the 200-T Process Group to be extended. The principal design change in the 200 Areas was the cancellation of Plant "C" in the East Area, making possible the early completion of that area. Buildings 2716 East and West Transportation Garage were also deleted.

Building Additions

221-T - A 65' Head End Addition containing cells 1A and 2A was added to this building on December 21, 1943, causing late orders to be placed for this portion of the building.

222-T, U, B - These buildings were extended approximately 56'. These additions, containing shower and locker rooms, required the changing of equipment and furniture previously installed.

224-T, U, & B - Concrete wall added in Cell "F".

231-W - One 150' deep test-hole or dry well added.

241-T, U, B, & C - Seven test-holes or dry wells approximately 150' deep, and one approximately 400' deep were added to each tank farm area. Gunite columns and pre-cast concrete beams were added to support underground stainless steel piping in this area. An Instrument Storage Building was added for each Composite Storage Group.

251 - A three-inch galvanized screwed water line was run from the 212-N Plant to the Switch House after work had been initially completed.

272-E & W - Sand Blast Room added.

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284 - E & W - Laboratory Room added in each Boiler House.

291 - T, U, & B - Steam Engine House added for each Process Plant.

292 - T, U, & B - Exhaust Gas Test Laboratory added for each Process Plant.

2701 - E & W - An additional room was added to the plant side of each Gate House and Clock Alley. Work was done on a Field Change Request issued by Operations.

2719 - E & W - A 12' extension was added to the Office end of the building and a 23' addition was built to the Laboratory, to provide a Waiting Room, Office, Recovery Ward, Rest Room, and Storage Room. These additions were covered by a Field Change Request after the completion of Plant "T".

Changes

212 - N, P, & R - Corrections to transfer pit concrete walls, steel plate, and rail guides.

221 - T, U, & B - Changed building ventilation systems from dry unfiltered to wet filtered systems in order to eliminate dust. These changes necessitated late placing of orders for this equipment. Changed hook-up piping to weight tanks using diaphrams and sight glasses, and changed the capacity of stainless steel siphons from 20 gpm to 10 gpm. Lubrication and hydraulic control piping on centrifuges and gear reducers had to be changed prior to start-up of the "T" Building. Also, changes were made in special electrical instruments, locations of space microphones, and miscellaneous adjustments to the 75 ton crane. A last-minute change in the gasket specifications from GK to G-9 required hundreds of made joints to be recoupled.

224 - T, U, & B - Changes to lubrication and hydraulic control piping similar to those made in the 221-Building were made for the cell equipment.

241 - W - Two changes were made to the stainless steel drain lines, one to the piping from Section 9 and 10 and between Division Boxes 151 and 143. The changes in the 221-Buildings were made to provide means for discharging material to Tank 201 from the precipitators in Cell 17 and 19. The changes at the diversion boxes provided means for discharging material from the precipitators to Tank 112.

(g) Design

Design work for the 200 Areas was started on December 1, 1942, and was estimated in the Monthly Field Progress Report, dated May 15, 1943, to be complete by January 1, 1944. Preliminary working drawings or "S" Drawings were issued to the Field for study purposes prior to the release of final "W" Drawings. From a total of 1626 drawings issued for the 200 Areas, 856 pertained only to the 221 Buildings. The first permanent building drawings were issued on June 4, 1943. Design was not essentially complete until August 17, 1944. Included on the following page is the Design Status Chart for the 200-Areas. This shows the sequence in which Process Drawings, Building Drawings, including Architectural,

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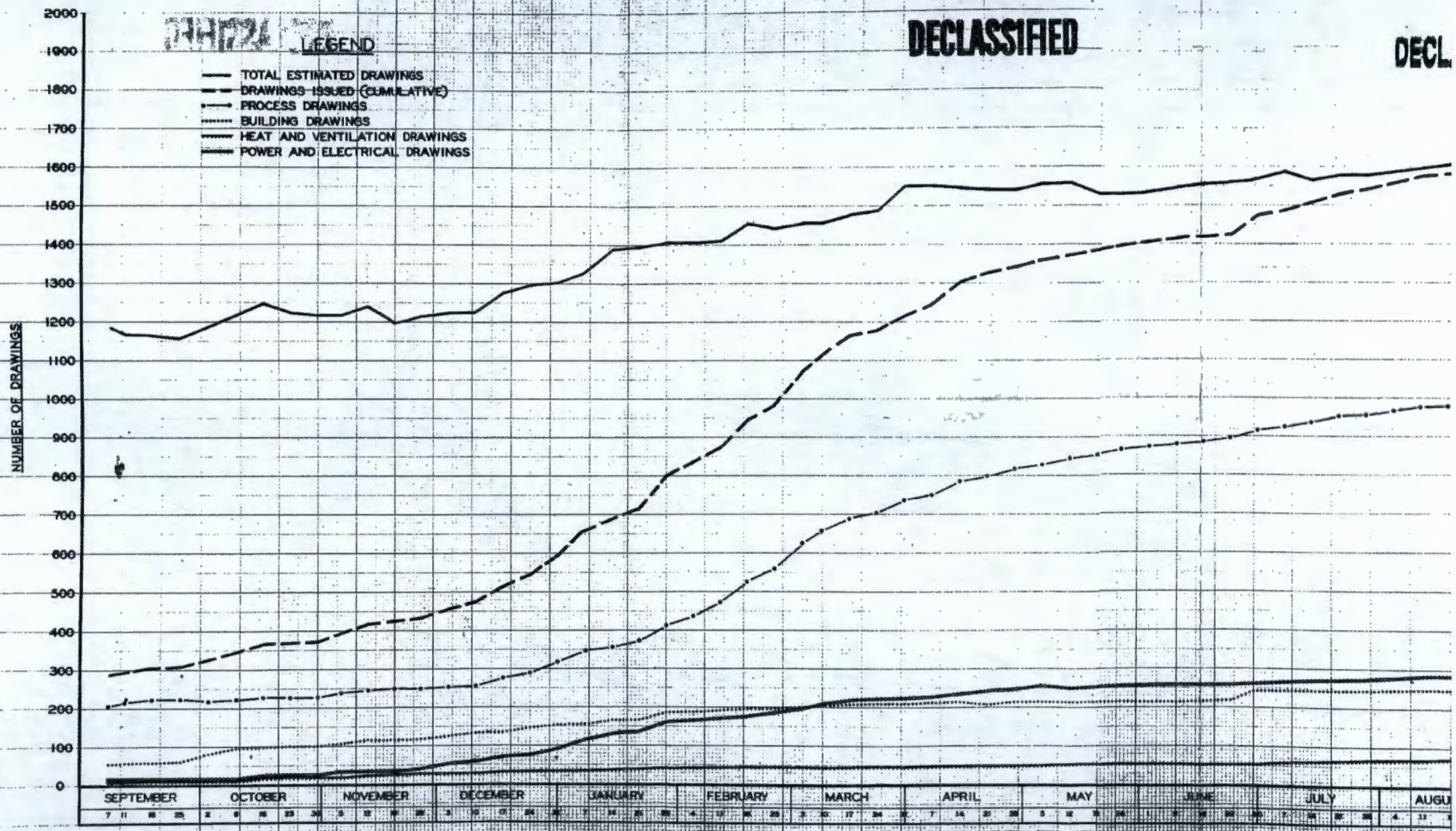

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• DESIGN STATUS •
200 AREAS
PROJECT 1934

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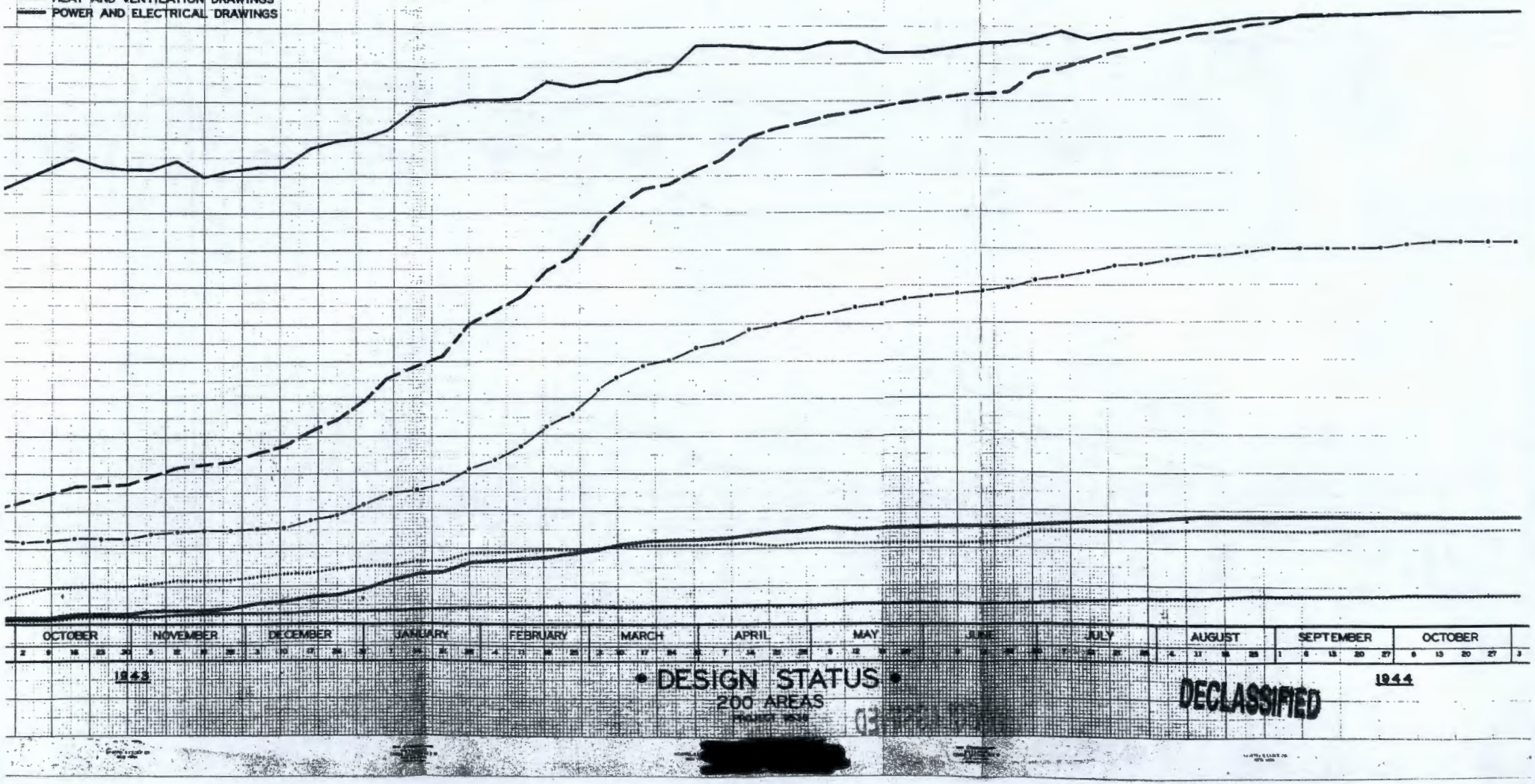
LEGEND

- TOTAL ESTIMATED DRAWINGS
- DRAWINGS ISSUED (CUMULATIVE)
- PROCESS DRAWINGS
- BUILDING DRAWINGS
- HEAT AND VENTILATION DRAWINGS
- POWER AND ELECTRICAL DRAWINGS



• DESIGN STATUS •
200 AREAS

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Steel Concrete and Plumbing, Heating and Ventilation Drawings, Electrical and Power Drawings were issued. The dates on which design was received in the field, authorizing the start of work for building and facility construction are shown on the tabular form included in the preceding Section (4) "Progress of Construction".

1 Late Design

Process Area design was based primarily on experimental results obtained at other locations. This accounted for part of the delay in releasing some final building and equipment design and also was responsible for the late placing of orders for special equipment, as the preparation of final drawings could not be started and equipment requisitioned until pertinent experimental work had been completed. The construction of the 224-T Bulk Reduction Building, the 231-W Final Preparation Laboratory and the 221-T Head End addition to the Separation Building was delayed because of this condition. According to the original Design Schedule, foundation and building design for Building 231 was scheduled for issue on December 19, 1943. After considerable design work had been accomplished, the original building design had to be revamped, and the equipment contemplated for this building required changing as the result of laboratory experiments. Foundation drawings were finally issued to the Field on June 15, 1944, but Process Piping and Equipment drawings were not essentially complete until September 1, 1944.

There was an approximate three months' lag in the issuance of Process Piping and Equipment Design for the 224-T Building because a considerable number of building alterations were required. Foundation and Building Design was issued on January 16, 1944. Equipment Drawings were issued from May 19, 1944 to August 20, 1944. However, the late release of the latter did not affect the start-up of the "T" Plant.

(h) Classified Construction

The Government required a great portion of the work in Process Areas to be "classified" for security purposes. In other words, the movement of personnel, equipment and materials in these areas had to be controlled. During the preassembly period, the 272-E & W Area Shops and adjoining facilities were further restricted. As the Process Plants T, U, & B and the 231-W Building neared completion, they similarly were restricted to the extent that only authorized personnel were permitted to work in or enter those areas.

The necessary procedures hampered and delayed construction to the following extent:

a All available manpower could not be used for restricted area work.

b Time was lost in the movement of personnel, material, and equipment in and out of restricted areas.

c Foremen and direct supervision did not have immediate access to restricted drawings. Therefore, not knowing the overall scope of the work, they could not foresee conditions to a normal extent, and thus were unable to use to the greatest advantage their past construction experience.

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(i) Delaying Factors

The delaying factors encountered in the construction of the 200 Area were relatively small in number in comparison to the amount of work involved and the conditions under which it was performed. Only five delaying factors were recorded as directly or indirectly affecting the speed of construction; namely, failure of a vendor to meet fabrication schedule, failure of a subcontractor to meet field schedules, failure of a special point to meet field conditions and two failures due to local conditions.

The Quality Porcelain Enamel Products Company was awarded purchase order number 4575½ for the casting and fabrication of five stainless steel hoods to be installed in the 231-W Concentratiin Building. When it was determined that the vendor would be unable to meet the delivery dates set for the last three hoods, du Pont requested them to ship the rough castings and assemblies via air express. Necessary tools were procured for grinding, polishing and assembly; and the balance of the work was done in the field Central Machine Shop, thereby avoiding considerable delay.

It was anticipated that the Wm. Vail Company, roofing subcontractor, would be unable to meet the roofing schedules set for the 200 Areas, due to the subcontractor's inability to obtain sufficient labor and special crafts required to perform the increased volume of plant work at the time required. Therefore, the 212 P & R, 221, 222, 224, 231, 282, 283 and 284 Buildings were deleted from this contract and the work performed by du Pont labor, using materials previously purchased by the subcontractor for this work. By doing so, a definite delay was avoided.

"Ucilon", a plastic base paint, was originally specified for cell painting. While applying the first coats to the 221 Cells, it was found that this type of paint would not adhere properly to large metal or concrete surfaces. "Amercoat", a similar plastic base paint, having better adhesive properties for concrete surfaces, was substituted wherever "Ucilon" paint had been specified in the 212, 221, 224, 231, 241 and 272-Buildings. This paint was readily obtainable on the West Coast and thereby eliminated further delay.

Three dry holes were encountered in the 200 North Area, two in the vicinity of 212-N Building and one near the 212-P Building before producing water wells could be obtained. For soil failures in the 200-East Area, see Part (1) Selection of Site.

(j) Absenteeism, Turn-over, Etc.

The high rate of absenteeism that prevailed among the du Pont and Cost-Plus-A-Fixed-Fee Subcontractors' manual employees, as well as the excessive rate of Labor Turnover on this job, were additional factors contributing to the delay in construction. Individual area absenteeism and turn-over percentages are not available, but the overall Project figures shown in Section 2, "Employment" are representative of the critical crafts employed in the construction of the 200 Areas.

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(k) Miscellaneous Delays

No units of the pre-assembled cell equipment could be set until all concrete work had been completed in the gallery portion of the 221 Building, as cleanliness of equipment and piping during installation was of paramount importance. Sand or dirt in the piping would have damaged the equipment or contaminated the process units.

The galleries and canyon portion of the 221-Buildings contained no windows, therby requiring all inside work and equipment installation to be performed under artificial light. A number of condensers, furnished by the Graver Tank and Mfg. Company for the 241-Buildings, were damaged in shipment and required field repairs by the vendor. The balance of the condensers were shipped unassembled and assembled in the field to prevent further damage. In drilling the 241-T-361 observation or dry well, a water table was struck 281' below the top of the well, requiring additional drilling to provide a dry well for testing purposes.

Bearing failures were encountered in the draft fans for the 284-W Power House. The boiler tubes received for installation in the 200-W Power House arrived in unsatisfactory condition with the finishing on the ends of the tubes pitted and rough to the extent that they did not meet specifications. Additional polishing with hand equipment was required in the field, delaying somewhat their installation.

Approximately three months' delay occurred in the fabrication and erection of the steel linings for the 241 Composite Storage Tanks. This work was performed by Morrison-Bechtel-McCone Company under subcontract RPG #1451½. Due to the hazardous properties of the process material to be stored in these tanks, they could not be entered safely for repair and maintenance work after they had been placed in service. Consequently, to insure leak-proof vessels, special fabrication procedures and welding techniques were developed in the field during a three-months' period of experimentation.

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(6) Construction Expedients

Whenever and wherever feasible, construction expedients were employed to alleviate, or to overcome, the delaying factors mentioned in the previous section. These expedients are more or less divided into two groups: General Area Expedients, and Special Construction Methods pertaining to a specific building or job.

Listed below, in sequence of importance, are the more widely-known expedients used on this Project:

(a) General Area Expedients

1 Shift Work, Extended Working Hours, and Sunday Work
2 Subcontracts
3 Premium Payments
4 Specification Changes to Suit Conditions
5 Procurement
6 Air and Express Shipments
7 Design Representation in the Field
8 Miscellaneous Expedients

(b) Special Construction Methods

1 Pre-Assemblies
2 Field Fabrications
3 Special Equipment and Material
4 Sequence

(a) General Area Expedients

1 Shift Work, Extended Working Hours, and Sunday Work

Due to the lack of adequate manpower, close construction sequence for some process buildings, late deliveries of materials, and the need for 24-hour facilities, the Field had to resort to shift work, Sunday work, and extended working hours in order to meet the required completion schedules set for the 200 East and West Areas.

Shift Work

Shift work was carried out on a two-shift, 9 and 10-hour, basis for certain buildings in the 200-West Area throughout the major part of their construction. Prior approval in detail for shift work was obtained from the Area Engineer for the Project. Highly specialized work, such as gallery piping, instrument installation, and pre-assembly work, could not be successfully accomplished even on a two-shift basis. This work had to be done on a single 9 and 10-hour shift basis.

Shift Work 200-West Area Buildings

Building	Time Requested	Shift	Reason
211-T & U	3-15-44 *5-1-44	2	To meet schedule

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Shift Work 200-West Area Buildings

Building (Con't.)	Time Requested	Shift	Reason
211-T & U	12-30-43 * 3-15-44	2	Amount of concrete
222-T & U	3-15-44 *5-1-44	2	To meet schedule
224-T & U	12-30-43 * 5-1-44	2	Amount of concrete
231-W	7-7-44	2	To meet schedule
241-T & U	6-3-44	2	Tie in with Subcontractor
271-T & U	3-15-44 * 5-1-44	2	To meet schedule
291-T & U	3-15-44 5-1-44	2	To meet schedule

Note: On September 9, 1944, additional approval was requested to install cell piping and equipment on two 9-hour shift basis.

* Dates for U Buildings.

200-E Area

The use of shift work in the construction of the 200-E Area was limited because at no time was sufficient manpower available for more than one shift. However, during the last two months of construction, certain specialized jobs were placed on a two-shift basis, these include; installation of cell floor templates, concrete work to deck level, installation of cell equipment, painting, and the flushing and testing of lines. Shift work was started on December 4, 1944 and was carried on intermittently by the required crafts until completion of work for Plant "B".

Shift Work 200-East Area Buildings

Building	Time Requested	Shift	Reason
221-B	11-24-44	2	Install Cell Floor Templates
224-B	12-20-44	* 3	Spray Painting
"B" Group	1-11-45	2	Flushing & Testing Lines

Note: On January 10, 1945, additional approval was requested to install cell piping and equipment on two 9-hour shift basis.

* Third Shift only.

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Other miscellaneous general facility work, as listed below, was performed on a two-shift basis to support construction work in the 200-Areas.

1 Water supply pump house operation - all Areas.

2 Temporary light plant operation - all Areas.

3 Stand-by or emergency work (including electricians, steamfitters, and millwrights) - all Areas.

4 Road grading and sprinkling - all Areas.

5 Pumpcrete repair and maintenance - all Areas.

6 Steel stock yards for Machine Shops - 200-East and West Areas.

7 Millwright, Machine, and Sheet Metal Shops - 200-East and West Areas.

8 Heavy equipment and crane repair - all Areas.

9 Operation of Heat Treating Furnace 273-E - 200-East Area.

10 Filing Saws, Carpenter Shop - 200-West Area.

11 Excavation underground lines - 200-East Area.

12 Concrete Finishing and Curing - all Areas.

13 Form Fabrication, Carpenter Shop - 200-West Area.

14 Boiler Firing and Maintenance - all Areas.

15 Automotive equipment repair - 200-East and West Areas.

16 Bus and truck driving - all Areas.

17 Unloading coal - 200-East Area.

Extended Working Hours

To make the greatest possible use of limited manpower, working hours were extended from the regular 48-hour week to a maximum 60-hour week. Tabulated below, in chronological order, are the work weeks established during construction:

Date	Days	Total Hours	Crafts
3-22-43	Six 8-hour days	48	All
Start 5-31-43	Six 10-hour days	60	All
5-31-43 9-2-43	Five 10-hour days and one 8-hour day	58	All

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Date (Con't.)		Days	Total Hours	Crafts
9-2-43	9-20-43	Six 8-hour days	48	* All except
9-20-43	10-23-44	Six 9-hour days	54	** All except
10-23-44	End	Six 9-hour days	54	All

* Steamfitters, Six 10-hour days; Carpenters, Laborers, and Truck Drivers - five 9½-hour and one 8-hour days.

** Steamfitters, Plumbers, Electricians, Laborers, Automotive Mechanics, Heavy Duty Mechanics, Boiler Firemen, and Groundmen.

Sunday Work

Routine maintenance, sanitation, concrete finishing and protection, and similar work were required on a seven-day basis throughout the life of construction in these areas. Each Friday a list, by crafts, enumerating the types of work to be performed on the coming Sunday, was submitted to the Area Engineer for approval. Work which conflicted with the seventh consecutive day ruling, for non-manual, non-exempt employees, required prior approval by the Wilmington Office of the Company. As permanent work progressed in the 200-East and West Areas, other urgent jobs required Sunday work in order to meet construction schedules.

From the latter part of May, 1944, to October 14, 1944, Sunday work was carried on to some extent in the pre-assembly of equipment for the 221-Buildings. Starting August 20, 1943, the full force worked six consecutive Sundays.

Listed below, by Areas, are buildings which required Sunday work:

200-West Area	200-East Area
211 - T & U	
221 - T & U	221 - B
224 - T & U	224 - B
231 - W	
241 - T	241 - B
272 - W	272 - E
Outside and Underground Lines	273 - E

2 Subcontracts

A total of twenty-seven subcontracts were awarded to twenty-three separate subcontractors for certain phases of construction work in the 200-East, West, and North Areas. These awards were made for the following reasons; to speed up construction, to obtain specialized labor and supervision, to eliminate delays in the procurement of special construction equipment, to make use of extensive

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organization and personnel of specialized contractors, and to complete each phase of work in the shortest possible time. Included on the next two pages is a tabulation of subcontracts, giving name of subcontractor, scope of work, and buildings in which the work was performed.

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LIST OF SUBCONTRACTORS
200-West, East & North Areas

RPG NO.	SUBCONTRACTOR	SCOPE OF WORK	BUILDING
54½ & 1678½	Haughton Elevator Company	Elevators	224-T, U, B, & 271-T, U, B
170½	Tate-Jones & Company	Heat Treating Furnaces	273-E
173½ & 587½	Rust Engineering Company	Concrete Chimney	291-T, U, B, & C & 284-E & W
241½	Clinton Bridge Works	Structural Steel	272-E & W, 283 E & W 284-E & W, 212-N, P, & R
305½	Erie City Iron Works	Boiler Erection	284-E & W
416	A. A. Durand & Son	Wells, Dry Wells	212-R, 241-T, U, B, & C
403 & 4339	Guy F. Atkinson Company	Railroads	All Areas
407	Myers Bros., & N. M. Ball Sons	Excavation & Road Construction	221-T, U, B, & C 241-T, U, B, & C
408	Newberry-Chandler-Lord	C.P.F.F. - Electrical Work	All Areas
410	Hanford Concrete Contractors	Furnishing Ready-Mix Concrete	All Areas
411	Hankee-James-Zahniser-Warren	C.P.F.F. - Piping Work	All Areas
567½ & 1938½	W. E. Caldwell Company	Elevated Water Storage Tanks	2901-E & W, 2902-E & W
658½	Link Belt Company	Coal Handling Systems	284-E & W
808½	Philadelphia Iron Works	Boiler Breechings	284-E & W
1180½	Connery Construction Company	Forced Draft Ducts	284-E & W

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LIST OF SUBCONTRACTORS - Cont'd.
200-West, East & North Areas

RPG NO.	SUBCONTRACTOR	SCOPE OF WORK	BUILDING
1451½	Morrison-Bechtel-McCone	Composite Storage Tanks	241-T, U, B, & C
1473½	Asbestos Supply Company	Thermal Insulation	200-E, W, & N Areas
2115½	Triplett Barton Company, Inc.	X-Ray Inspection	241-T, B, & C
3564½	National Gunite Construction Company	Catch Basin & Settling Tanks	241-T, U, B, & C
3778½	E. F. Hauserman Company	S/S Enclosures	224-T, U, & B
3589½	Graver Tank Company	Furnishing & Installing Condensers	241-T, B, & C
4332	William Vail	Built-up Roofing Subcontractor No. 2	200-E, W, & N Areas
4335	National Gunite Construction Company	Gunite Reservoirs	282-E & W
4354	H. R. Parsons Tile Company	Asphalt Tile & Linoleum	222-T, U, & B; 271-T, U, & B 292-T, U, & B; 2704-E & W 2719-E & W

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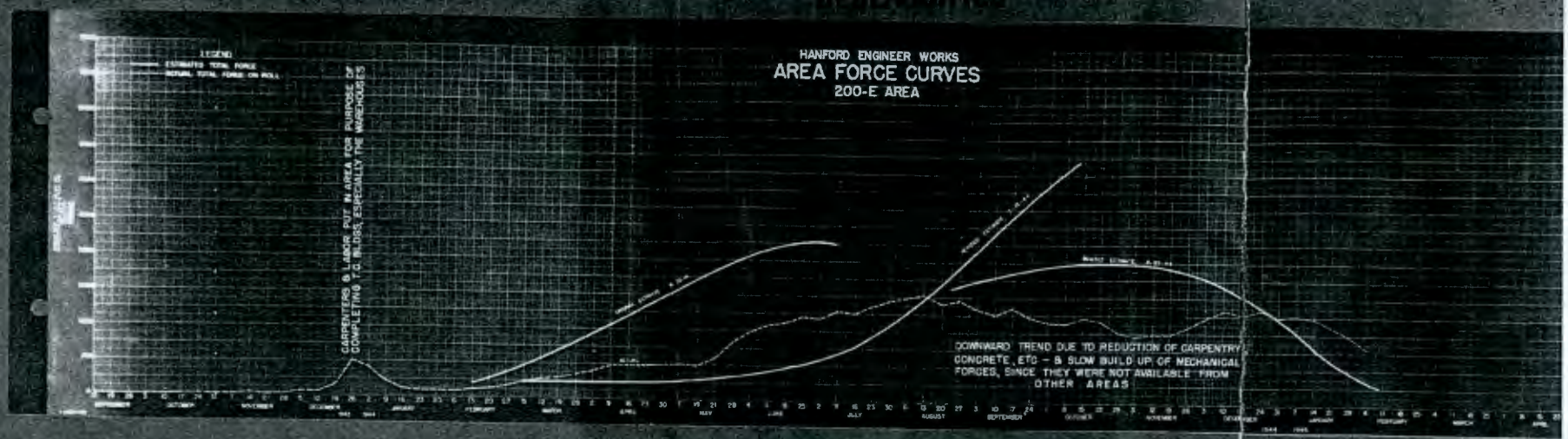

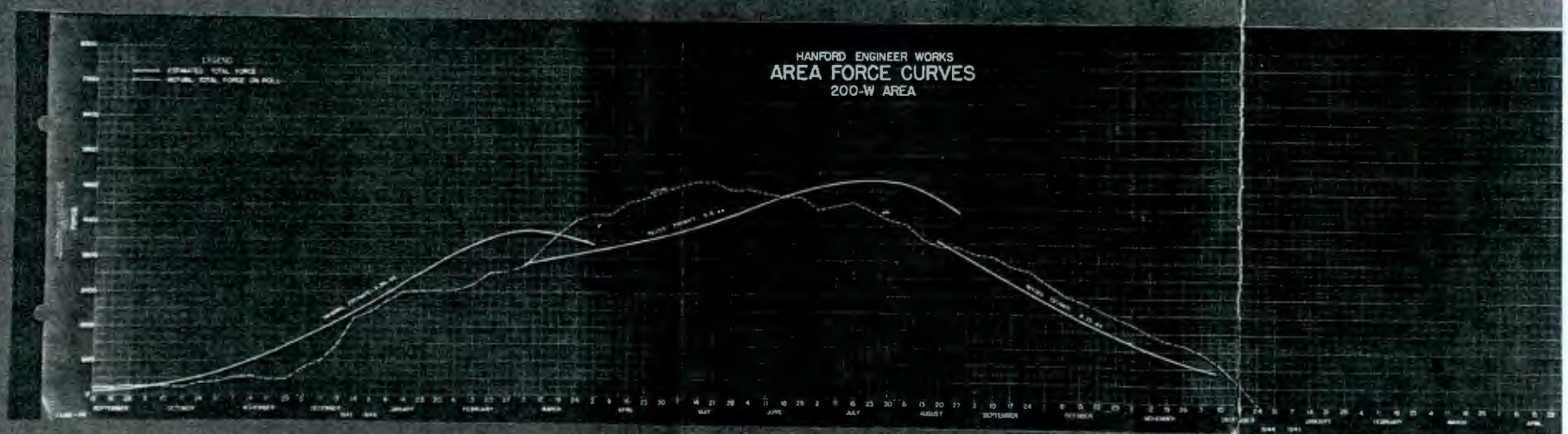

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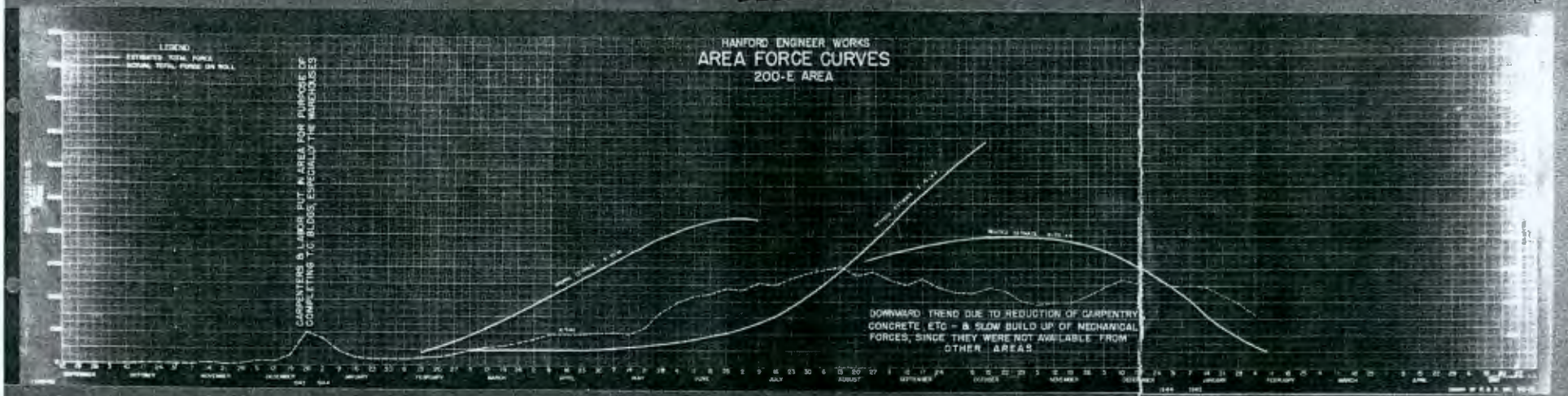

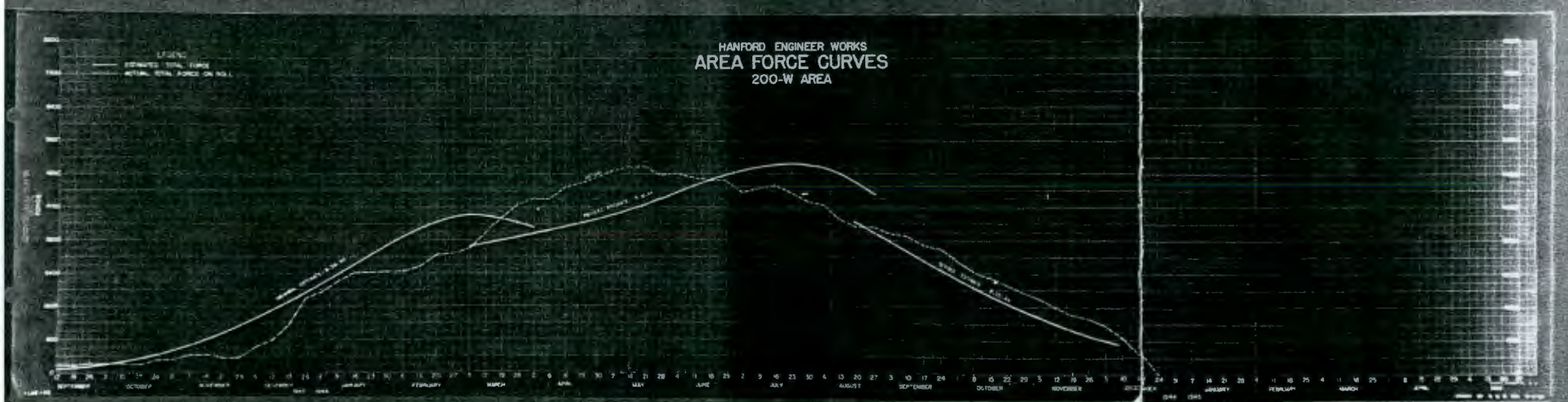

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3 Premium Payments

A number of premium payments were awarded vendors in order to expedite the delivery of critical materials and equipment under fabrication in their shops. The largest and most important, amounting to approximately $100,000.00, was made jointly to Waldrip Engineering Company, Hollidate, California and to the Associated Piping Engineering Company, Los Angeles, California, vendors for the fabrication of cell and through-wall piping. This premium was allowed these companies for Sunday and overtime work and for changing their shop fabrication sequence to meet field requirements. The vendor's bids had been figured based on the fabrication of all similar piping details with a single setting of jigs and bending machines. This schedule could not be followed, as the sequence of construction and start-ups for Plants T, U, & B would not permit delivery on this basis.

Listed below are the principal vendors which were allowed premium payments for Sunday and overtime work:

Vendor	Material
Pittsburgh Piping Company	Cell Piping
Pennsylvania Furnace & Iron Co.	Cell Piping
S. Blickmon Company	Centrifuges
Bird Machine Company	Centrifuges
Alloy Fabricators	Tanks
Joyce Machine Company	Connectors

4 Specification Changes

When materials specified by Design were found unobtainable, or deliveries promised beyond required dates, substitutions were made, with Design Division approval, of more easily procured materials meeting practically the same specifications. Early in the job it was necessary to change the specifications of stainless steel tubing from seamless to welded steel tubing because the delivery of seamless tubing was unfavorable.

Another worthwhile substitution was that of earthenware pipe for chemical stoneware pipe. Vendors for the latter type advised in their quotations that they would be unable to make deliveries anywhere near the required dates. An acid-resisting pipe of this type, most of which was to be encased in the mass concrete foundations for the 221-Buildings, was required for process drains. This factor alone limited the pouring of process building foundations. After considerable investigation by the Field, a local plant - the Washington Brick and Lime Company, located at Spokane, Washington - was found to possess suitable clays for the manufacture of acid-resisting earthenware pipe very similar to chemical stoneware pipe. This Company secured the business on a competitive bid basis and changed over a portion of their plant for the manufacture of the above specified pipe.

The water-jacketed portion of tank equipment in the 224 and 271 Building was changed from stainless steel to standard steel plate in order to speed up the erection of steel for these buildings and to allow other work to progress safely while steel plumbing and permanent bolting up work was being done.

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5 Procurement

One of the major contributing factors responsible for the early completion of the Process Plants was brought about by the early placing of blanket orders for 25-12 Cb and 18-8 stainless steel plate, tubing and bars with G. O. Carlson, Allegheny-Ludlum Steel Company, and the Carpenter Steel Company. Up to that time only a small amount of 25-12 Cb special stainless alloy had been rolled, with none available on the open market for immediate purchase. These orders were placed several months prior to the release of design for process equipment.

Knowing that vendors normally wait until drawings have been received and material take-off has been made before placing sub-vendor orders for material required for fabrication, the Company acted as a procurement agency and furnished necessary stainless steel stocks to vendors in order to expedite fabrication. This material was used in the fabrication of centrifuges, precipitators, condensers, agitators, tanks, piping, siphons, valves, and miscellaneous assemblies. Approximately 700,000 feet of stainless steel piping from 1/4" to 3-1/2" in nominal diameter, and 150,000 stainless steel bolts and nuts, were required for the 200 Areas. Purchase orders were issued to Porcelain Metal Products Company of Carnegie, Pennsylvania, for the cutting, warehousing, handling, and issuing of stainless steel stock to the various vendors. At least three to four months' time was gained in delivery of this material.

6 Air and Express Shipments

Air, express, and truck shipments were used for the more-urgently required materials. Express and truck shipments were made from vendors east of the Mississippi River to the nearest Air Transport Command for consignment to the Hanford Engineer Works. During the latter part of the job, the Army Transport Command delivered air shipments directly to the Plant, using the Hanford Airport.

Practically 50% of the smaller items for the 231-Building, including material and special tools for the stainless steel hoods, was brought in by air express. Express and air shipments for the 221-Buildings included instrument panels, instruments, gang valves, electrical equipment, ejectors, connectors, some piping assemblies, and other items.

7 Design Representation in the Field

A representative of the Wilmington Design Division was present in the field during the major part of the construction period to serve as an immediate contact between the Field Forces and the Design Group, and to act as a consultant in handling local design problems. This help was invaluable at the start of construction, as the Field was unfamiliar with this type of design, and a sufficient number of drawings had not then been issued to indicate the full scope of the work. This service was especially beneficial in planning construction, and in working out last-minute design details for minor changes normally found necessary prior to, and at the time of, start-up.

8 Miscellaneous Expedients

The recruitment of labor, erection of the Hanford Camp to provide suitable living quarters, inauguration of an adequate transportation system, and the establishing of other commercial facilities; all directly or indirectly expedited

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the construction of the Plant. The first mentioned helped to overcome the lack of manpower that existed in most crafts during the first half of construction; while the latter three reduced the high rate of turn-over and absenteeism, and improved the morale of the workers.

(b) Special Construction Methods

It was early recognized that special construction methods and sequences of operation would have to be adopted and followed in the construction of the 221-Cell Buildings in order for both precision workmanship and speed to be attained. Many conferences of Field and Design Engineers resulted in the preparation of a complete concrete pouring schedule, production line pre-assembly of cell equipment, specifying of certain field fabrication, and design of special tools and equipment for the expeditious handling of this work. The field forces from time to time added to the above methods, taking advantage of latest devised construction methods, tools, and equipment.

1 Pre-Assemblies

The method of installation of Process Equipment in Building 221 cells differed from any normal job in several respects. The equipment and piping was assembled into units in Building 272 shop cells and was moved as units into Building 221 cells. Each cell contained from one to three pieces of equipment and 25 to 35 piping assemblies. These were assembled as complete units in the 272-E Area Shop, then placed in racks and crates on flat cars and moved into the 221-Building for placing by building cranes.

For this reason, the 272-Area Shops, in the 200-West and East Areas, were rushed to an early completion. These buildings are located adjacent to other maintenance facilities and were completely fitted for maintenance work. The shop in the 200-East Area was principally used for this work, as it is the larger of the two, and could be used by construction after the start-up of Plants T & U. The 272-E Shop is also adjacent to the 273-Heat Treating Furnace.

In addition to the shop facilities, each building is fitted with three sets of steel framework simulating the arrangement of piping connections within the cells of the 221 Buildings. These dummy cells are oriented with respect to the crane and cab in a manner identical to the actual cells in the 221-Buildings. Independent two-level wood platforms were built encompassing each dummy cell in order to facilitate fitting-up work. The dummy cells are designed with the same slope of floor, height of wall connections from floor, spacing and dimension of connectors, and of equipment guides. Five additional dummy cells were installed in the 272-E Area Shop by Construction to expedite fitting-up work. All dummy cells were provided with air, steam, water, and electrical facilities for testing assembled equipment.

It was of paramount importance to keep these buildings dust-proof; therefore, all windows and doors were sealed and vestibules were installed at pedestrian entrances. A ventilating system, using filtered and washed air, and having a capacity of 33,000 cfm., was installed. This system also built up a slight positive pressure inside the building to reduce the infiltration of dust to a minimum.

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A concrete and steel plate base, with equipment guides set to a tolerance of .005" and having the same slope as the cell floors, was designed by the Field to check the location of flanges on all vessels. The results were recorded on a separate "record sheet" for each vessel. This was required so that when piping repairs or changes are made later, dummy equipment flanges can be set up to which the piping assemblies can be fitted.

As the piping, connectors, and conduit in the cells were being fabricated to detail by various vendors, all of these parts had to be assembled by the field into piping assemblies. The connectors were assembled and painted in an assembly line manner inside the 274 Building, which was temporarily equipped with an overhead monorail system. Building 275 was used to assemble conduits and electrical connectors.

All equipment was installed in the 272 Shop dummy cells and piping fitted before transfer to the 221-Building Cells. This piping fit-up required the rebending of some pipe sections, and whenever possible this was done cold without excessive bending. Piping assemblies were bent so the flanges would fit perfectly without any strain. The 25-12-S Cb piping that required refabrication or excessive bending was reheat-treated in the 273-Heat Treating Furnace. This furnace was also used by Construction to anneal all the cast-iron cell and trench cover forms. All piping was fitted to a tolerance of plus or minus .010".

Centrifuges and agitators were operated over a test run period at high and low speeds. All equipment, including even these piping assemblies which were fabricated, balanced, and installed by the field before removal from the 272 Area Shops, was fitted with lifting lugs. An additional 10-ton bridge crane was purchased and installed in the 272-E Building as the permanent building crane was inadequate for this volume of work.

After fit-up and testing, the piping and equipment as set up in Building 272 shop cells were dismantled by loosening only the connectors with a power impact wrench and removing the assemblies by the overhead building crane. They were then set up, in the same angular position as in the cell, in steel racks on flat cars for transportation to the 221-Buildings. Sixteen of these racks, with sheet metal box covers, were fabricated. Their purpose was to eliminate damage to piping and equipment, possible errors in identification, and the future contamination of cell piping and equipment by the collection of dirt or foreign matter while enroute from the 272-Area Shops to the 221-Buildings. For further protection, all piping connectors, nozzles, and flanges were thoroughly cleaned in the 272 Buildings after fabrication, and sealed with cellophane. Special precautions were taken in packaging and shipping of mechanical equipment to prevent dirt or water entering the equipment and damage from any other source.

Centrifuges were shipped to the 221-Buildings assembled, covered completely by a waterproof crating with only the lifting eyes protruding. Motorized gear reducers for the vessel agitators were completely assembled and protected in a similar fashion.

Listed below is the date work was started on the cell units for each 221-building, as well as the date the last unit was loaded out of the 272-Area Shop.

Building	Date Started	Date Completed
221-T	5-10-44	9-1-44

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Building (Con't.)	Date Started	Date Completed
221-U	8-24-44	11-22-44
221-B	10-30-44	1-24-45

2 Field Fabrications

Concrete Forms

Carpenter shops were constructed in both the 200 East and West Areas primarily for the building of concrete forms and panels. Complete cell forms were fabricated outside the building limits and set in a single operation by the steam whirleys. Many of these forms were reused for all three 221-Buildings, thereby saving lumber and labor and enabling the carpenters to work outside congested areas.

Cell & Trench Cover Blocks

The design of the canyon portion of the 221-Building called for each cell, and the main connecting pipe trench, to be covered with removable reinforced concrete blocks. Four standard cover units, C1, C2, C3, & C4 were cast for this purpose, using quantities of the first two to cover cells and the last two to cover the main pipe trench. All cover blocks are tapered on four sides with three 6" steps protected by an angle iron curbing. Each block contains four inserts, two on each side, for installation of shim plates so that when blocks are pushed to one end of the cell opening, the maximum gap between concrete faces will not exceed 1". Concrete surfaces were poured to a tolerance of plus 1/16" and minus 3/16". One balanced cover bail, or lifting eye, was encased in each block.

Type C1 Cover Blocks - These blocks are 6' 4-3/4" wide, 15' 11½" long, and 6' 0" thick with overlapping step sides and tapered step ends containing approximately 15.5 yds. of concrete and weighing 31.5 tons.

Type C2 Cover Blocks - These blocks are key blocks with tapered step ends and sides, overall dimensions of 5' 10½" wide, 15' 11½" long and 6' 0" thick, containing approximately 14.0 cu. yds. of concrete and weighing 28.2 tons. One was used with three C1 blocks to cover a typical cell and one with five C1 blocks for cell openings 1 to 4.

Type C3 and C4 Cover Blocks - Covers C4 are the invert type of C3 with overall dimensions of 11' 4½" wide, 10' 8½" long, and 4' 6" thick containing approximately 16 cu. yds. of concrete and weighing 32 tons.

Because of the large number required, and difficulty of handling, it was decided to cast the blocks in mass production. An area was set aside, in the 200 West Area, west of the 221-U Building for this work. Six reinforced concrete aprons, 8" thick, 20' wide, and from 540' to 645' long were constructed, separated by three parallel standard gauge railroad tracks running between each pair of aprons. Here special cast-iron forms were set up and the inserts, angles, reinforcing steel and lifting eyes were installed. Then they were poured, stripped, rubbed, and cured. Each block was carefully checked for maximum and minimum clearances and then painted completely before delivery to the 221-Building. A concrete dummy cell was constructed in this area for checking a typical four

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block multiple installation.

When checking was completed three coats of "Amercoat" was applied by spraying and brushing. The blocks were then placed on special field-fabricated cars and moved inside one of two special covered pits which were built by the field to facilitate painting the cover bottoms.

Listed below, by building, are the types and numbers of cover blocks fabricated for each building.

Building	Type of Covers			
	C1	C2	C3	C4
221-T	136	44	74	74
221-U	126	42	74	74
221-B	126	42	74	74
Total	388	128	222	222

Concrete cover blocks were also fabricated by the field in each 200 Area for the 241 Diversion Boxes. Nine types of blocks, of variable lengths and width of standard thickness, (some having tapered ends and sides) were cast for this purpose. These were laid three deep with an overlapping joint. The first two layers have recessed lifting eyes. A total of 88 separate blocks was required for each building.

Centrifuge Bases

Removable reinforced concrete centrifuge bases specified by design were fabricated by the field at the 272-E Building. A concrete and steel plate base, similar to the one used in the area shop for measuring vessels, was built southeast of the building. The plane enabled construction to maintain the plus 1/16" or minus 1/8" tolerance required for centrifuge bases. Each base contained four embedded anchor bolts and a considerable amount of steel framework to accommodate centering guides and lifting lugs.

Eleven bases, each measuring 6' 0" x 7' 6" x 9' 3-7/8" high overall, containing 15.5 cu. yds. of concrete and weighing 31.5 tons, were cast for each 221-Building. All exposed surfaces were painted with three coats of "Amercoat".

Crane Cab

The field chose to assemble the three 75-ton Whiting Cranes and to fabricate the cab for each outdoors on a trestle prior to moving them into the 221-Buildings because of the cramped conditions in the cab runway, thus saving considerable time and labor.

Reinforcing Steel Fabrication

Two shops, one located in the 200 East and the other in the 200 West Areas, fabricated approximately 7,234 tons of reinforcing steel used in the construction of the 200 Areas. The establishing of more than one central fabrication shop contributed directly to speed of building construction.

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Pipe Fabrication

A central pipe fabrication and blacksmith shop was erected at White Bluffs, in addition to the Area Shops in both the 200 East and West Areas, in order to expedite pipe fabrication. Only that portion of cell piping assemblies and thru-wall piping in the 221-Buildings was fabricated by outside vendors.

3 Special Equipment & Material

Specialized time and labor-saving equipment was procured by direct purchase, rentals, through Government transfers, and by the awarding of contracts. Some of this equipment was acquired solely for the construction of the 221 and 241 Buildings, due to the intricate and unusual building and equipment designs peculiar to those buildings.

a Four American Revolver Cranes, each having a capacity of 25 tons at a 12' radius with a 100' to 125' boom, were rented from the United Construction Company of Winona, Minnesota. These cranes were erected adjacent to both sides of the 221 Buildings and traveled the entire length by means of a broad gauge track. They were principally used for handling pre-fabricated forms, reinforcing steel, steel roof trusses, concrete, and lumber.

b Five 50-ton steam-driven railroad cranes were obtained by Government transfer for the pouring and handling of mass concrete cell and trench cover blocks.

c A number of special railroad cars were also constructed by the field for the transfer of cover blocks from the fabrication yard to each of the 221-Buildings.

d Cast-iron cell and trench cover forms were purchased to secure the tolerance required for these blocks and to enable production line assembly. Similar forms were also procured for the pouring of pipe trenches and tops of cells. Structural steel frames were fabricated by the field to support the cast-iron forms in making the top portion of the cell pours.

e Structural steel roof trusses, totaling 569 tons, were purchased solely for construction purposes in the 221-Buildings. These trusses supported the forms for sectional roof slab pours, and were mounted on wheels running on the permanent building crane rails. This eliminated elaborate shoring and made possible the early completion of building roof slabs.

f Three separate concrete mixing plants for each process group T, U, & B were specified in the contract for ready-mix concrete, in order to provide an adequate supply of concrete near the bulk point of placing. Stationary and portable pumpcrete machines were purchased and used in placing a majority of the concrete in 200 Areas to effect a saving in both time and labor. High Early Strength Cement and special concrete mixes enabled early form stripping, in portions of the building where concrete was holding up other work. Sheets of 7/16" corrugated asbestos were used as forms to make construction joints for monolithic concrete in the 221-Buildings.

g Steel plate welds in the construction of the 241-Tank Farm were inspected by means of X-ray equipment to guard against failures and leaks.

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h Cast-iron templates, steel H-beam supports and special jigs were used to support through-wall cell piping and nozzles in 221 and 224 Buildings, and to prevent misalignment during cell wall pours. Wooden templates were improvised to assist in the installation of gallery piping.

i A temporary monorail was installed on top of the gallery-canyon barricade wall inside the 221-Buildings. This allowed temporary overhead hand, electric, and air-operated cranes, in addition to the permanent crane equipment, to be used in handling materials and equipment in the canyon section.

j A suspended wood frame working level was built the entire length of each canyon in order to eliminate congestion to a great extent, and to provide a barricade over working areas. This platform carried a push car rail system for further ease of handling incoming and outgoing materials.

k In both the 200-East and West Areas complete machine and sheet metal shops were provided capable of handling all types of work. This was necessary as the Plant Site is in an isolated area and the commercial job shops in this section of the country were not equipped to handle an additional volume of work.

4 Sequences

Prior to the placing of concrete, a definite Forming and Concrete Pouring Schedule was prepared for the 221-Buildings to eliminate congestion of crafts and to make use of standard forms. Drawings, issued to designate both horizontal section and elevation pours, simplified the construction of the buildings. Other detailed construction schedules for main process buildings were made and equipment installation procedures were prepared for similar assemblies.

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(7) Building Descriptions

On the pages following are included descriptions of the major buildings and facilities in the 200-E, W, & N Areas. These descriptions attempt to portray, in a brief and concise manner, the type of construction of each permanent building in the 200 Areas. Included with each description is a representative photograph of the structure showing it at its completed stage after all revisions and changes have been made.

The data used in the building descriptions were secured by direct knowledge obtained from various field inspections of the building during the course of construction, followed by a study of the prints and necessary take-offs. The overall dimensions of the building show the longest lengths and widths, of the building regardless of its shape, while the height is taken from the bottom of the foundation to the highest point of the roof. The area figure shown is the greatest cross sectional area while the volume figure is a displacement in cubic feet from the bottom of the foundation to the average height of the roof, or the top of the roof in the case of a flat building.

Quantities of construction materials have been given for the more common building materials, such as lumber, structural steel, reinforcing steel (both rod and mesh), concrete, masonry (concrete blocks and bricks), roofing, building insulation, special siding, lining and ceiling material. A tabular list of the major process and building equipment is also included in the building description giving number, name, size, capacity, and power.

On the two pages immediately following is an index of the building descriptions for the 200 Areas.

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BUILDING & FACILITY LIST
200 EAST - WEST & NORTH AREAS
PROJECT 9536

Bldg. No.	Building Name	East 200 Area Plant B	East 200 Area Area E	East 200 Area Plant C	West 200 Area Plant T	West 200 Area Area W	West 200 Area Plant U	North 200 Area Plant N	North 200 Area Plant P	North 200 Area Plant R	North 200 Area Plant J & K
211	Tank Farm	B			T		U				
212	Lag Storage Bldg.							N	P	R	
213	Magazine Storage Bldg.										J & K
216	Process Waste Disposal Trench		E								
221	Cell Building	B			T		U				
222	Sample Preparation Laboratory	B			T		U				
224	Bulk Reduction Bldg.	B			T		U				
231	Concentration Bldg.					W					
241	Process Waste Storage & Disp. System	B		C	T		U				
251	Primary Substation							Between Plants N & P			
252	Secondary Substation		E			W			N		
253	Distribution Substation		E			W		X	X	X	
271	Chemical Preparation & Service Bldg.		B		T		U				
272	Area Shop		E			W					
273	Heat Treating Furnace		E								
274	Machinery Storehouse		E			W					
275	Chemical Storehouse		E			W					
282	Reservoir & Pump House		E			W					
283	Filter Plant		E			W					
284	Power House		E			W					
288	Ash Disposal Basin		E			W					
291	Exhauster Bldg. & Stack	B			T		U				
292	Exhaust Gas Laboratory	B			T		U				
*2501	Fence and Road Lighting		E			W		X	X	X	X
*2503	Electric Lines		E			W		X	X	X	X
*2505	Fire Alarm System		E			W					
*2506	Telephone Cable & Inst.		E			W		X	X	X	X
*2601	Standard Gauge Railroad Tracks		E			W		X	X	X	
*2603	Roads and Walks		E			W		X	X	X	X
*2605	Fences (Including Guard Towers)		E			W		X	X	X	X
*2606	Settling Basin		E								
*2607	Septic Tanks		E			W		X	X	X	
*2612	Open Drainage Ditches		E			W					

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Bldg. No.		East 200 Area Plant B	East 200 Area Area E	East 200 Area Plant C	West 200 Area Plant T	West 200 Area Area W	West 200 Area Plant U	North 200 Area Plant N	North 200 Area Plant P	North 200 Area Plant R	North 200 Area Plant J & K
*2613	Permanent Parking Area		E			W					
*2614	General Monitoring Station		E			W			X		
*2621	Emergency Gas Gen. Shelter		E			W					
**2701	Gate House and Clock Alley		E			W					
2701-A	Gate House					WA					
2704	Supervisors' Office Bldg.		E			W					
2707	Change House		E			W					
2707-A	Change House		EA			WA					
**2709	Fire Headquarters		E			W					
**2713	Storeroom		E			W					
2713-A	Essential Material Storehouse		EA			WA					
2713-B	Miscellaneous Storehouse		EB			WB					
**2715	Oil & Paint Storage Bldg.		E			W					
2716	Automotive Repair Garage		E			W					
**2719	First Aid Building		E			W					
**2720	Patrol Headquarters		E			W					
**2722	Paint & Riggers' Shop		E			W					
2723	Laundry					W					
2729	Extra Machinery Warehouse					W					
2730	Slab Yard					W					
2731	Burning Pit					W					
**2734	Cylinder Storage Bldg.		E			W					
2743	Gate House & Guard Tower Bldg.							N	P	R	J
*2801	Pipe Supports		E			W					
*2802	Steam Lines		E			W					
*2803	Air Lines		E			W					
*2805	Process Lines		E			W					
*2901	Water Lines and Elevated Tanks		E			W		X	X	X	
*2902	Fire Lines and Elevated Tanks		E			W					
*2903	Sanitary Sewers		E			W		X	X	X	
*2904	Process Sewers		E			W		X	X	X	
*2905	Wells and Pump Houses										P & R

* Building descriptions are included in group descriptions for 500 - 600 - 800 and 900 Areas.
** Building descriptions are included with similar 100 Area Buildings.
X Facilities installed in the 200 North Area Plants.

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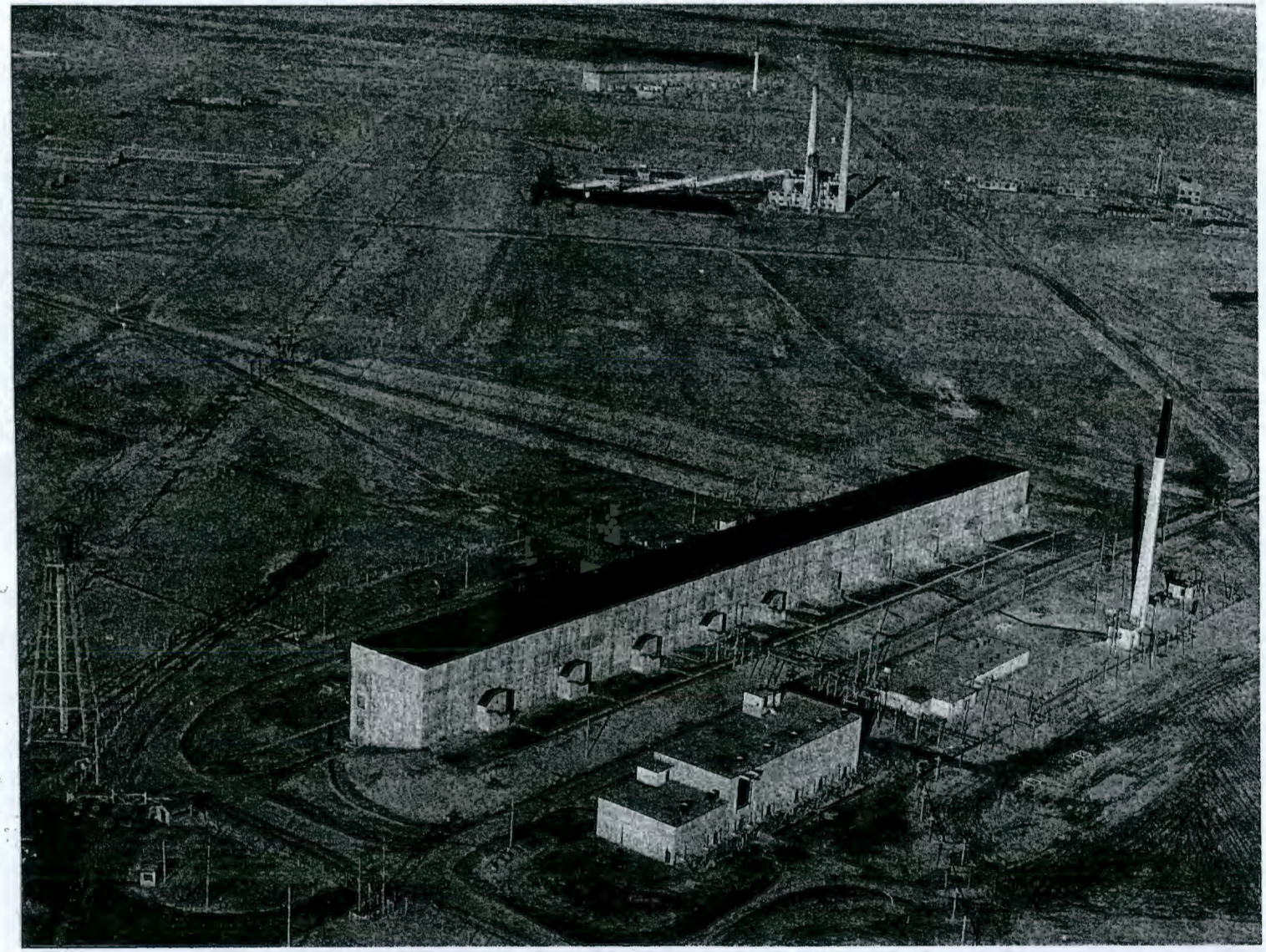

200 - WEST AREA
Aerial View
Looking North

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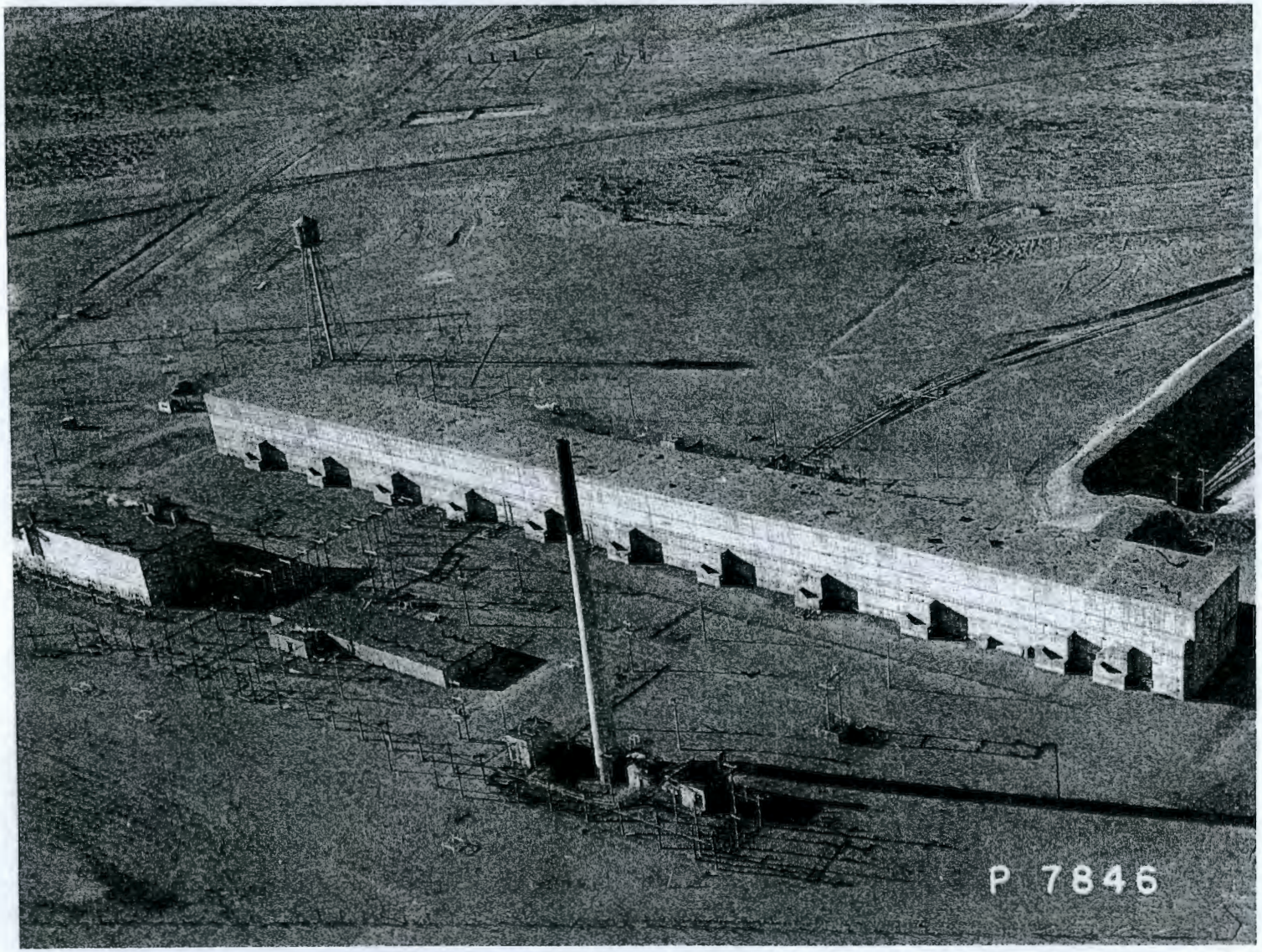

200-T PROCESS GROUP
Aerial View
Looking Southwest

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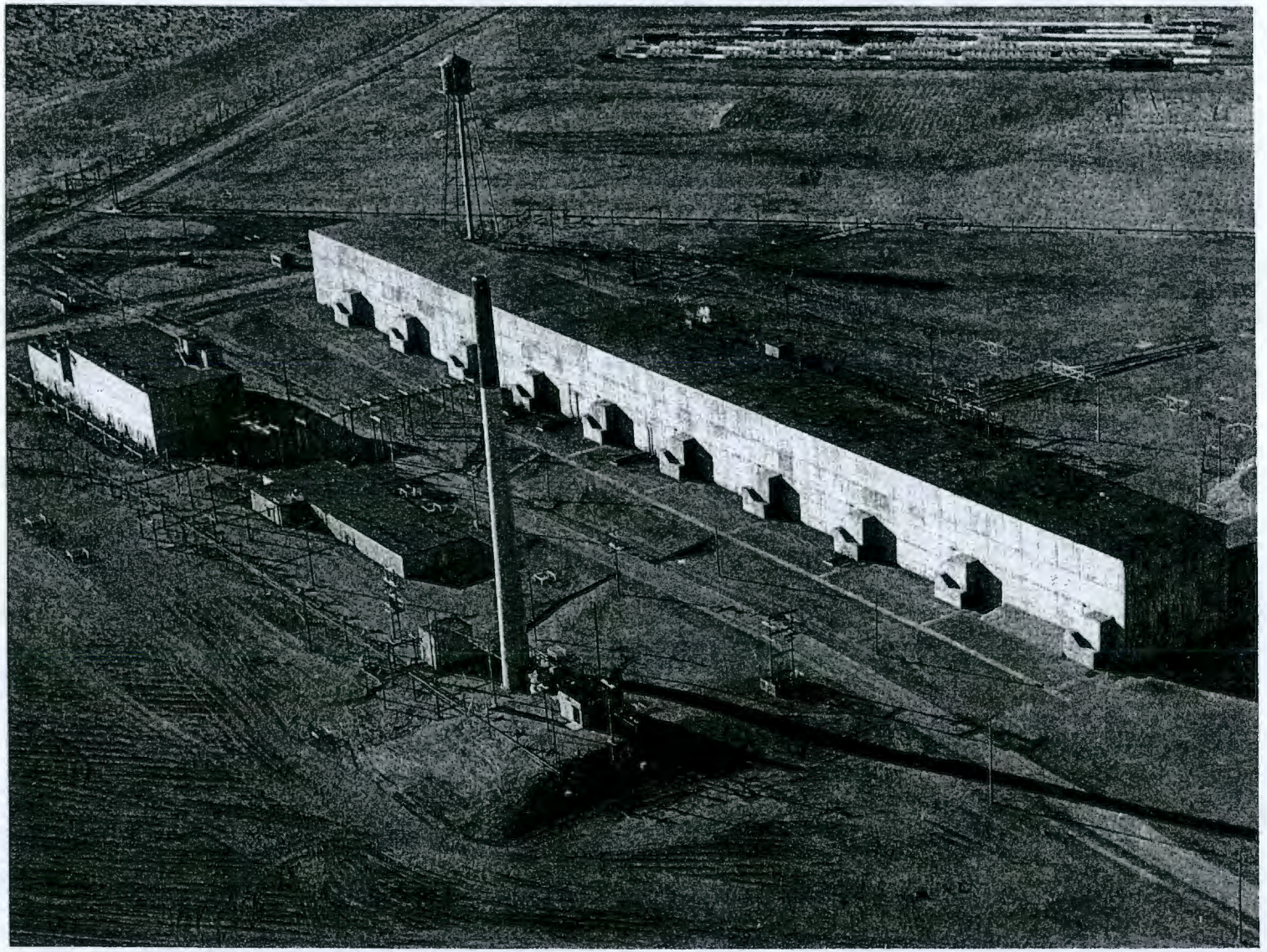

200-U PROCESS GROUP
Aerial View
Looking Southwest

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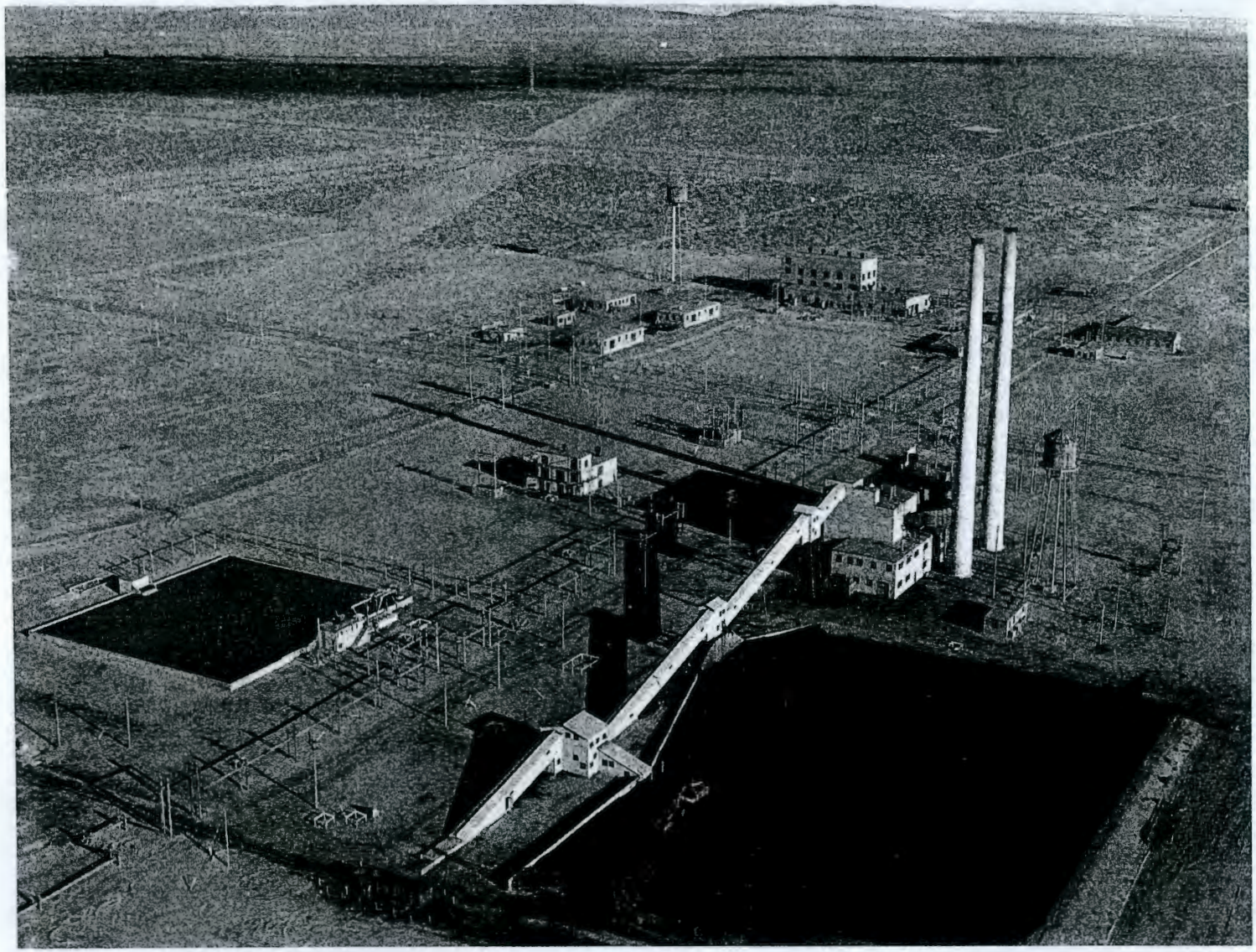

200-WEST POWER & SERVICE AREAS
Aerial View Looking Northwest

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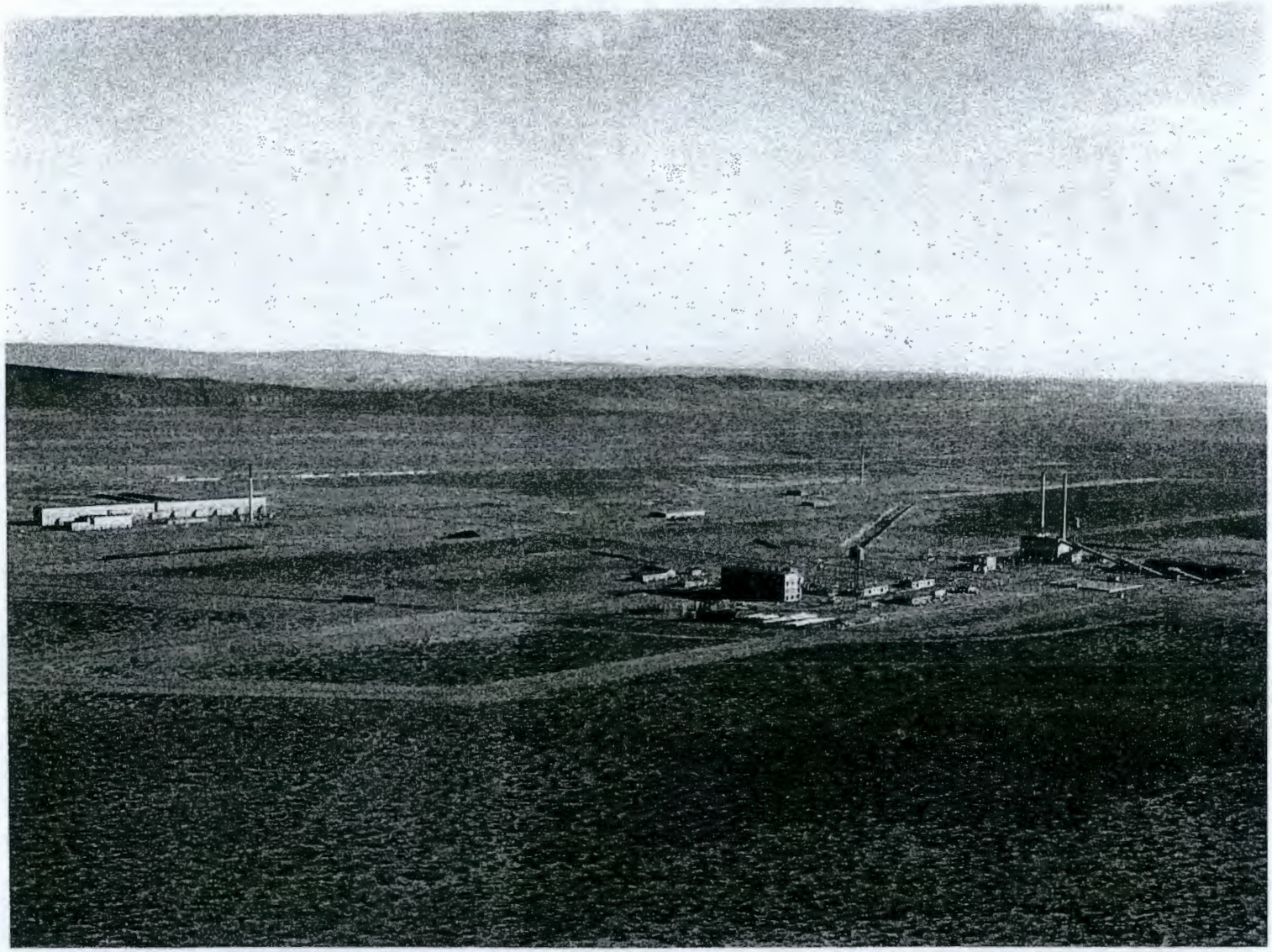

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200-E AREA
Aerial View Looking Northwest

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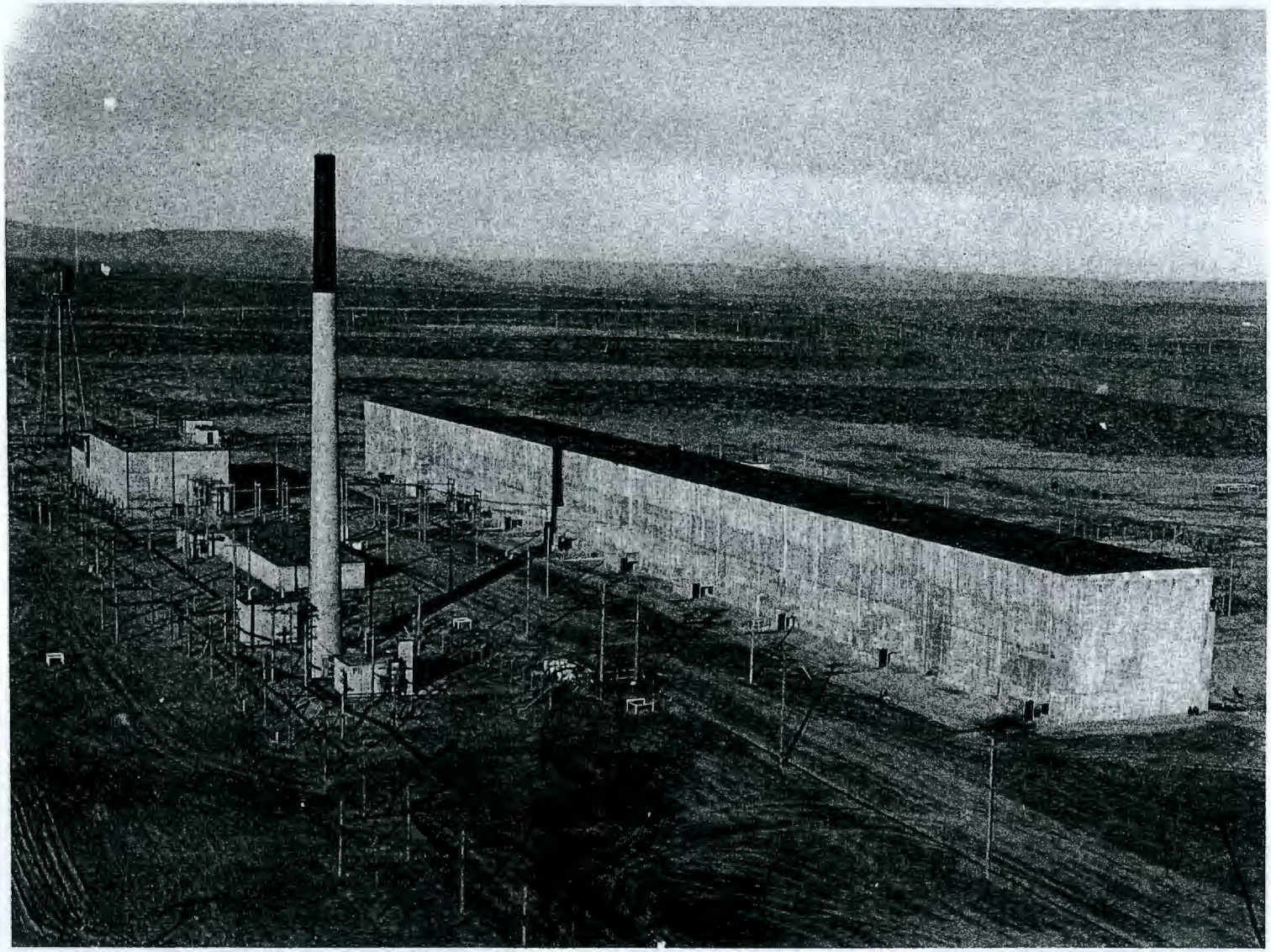

200-B PROCESS GROUP
Aerial View Looking Northwest

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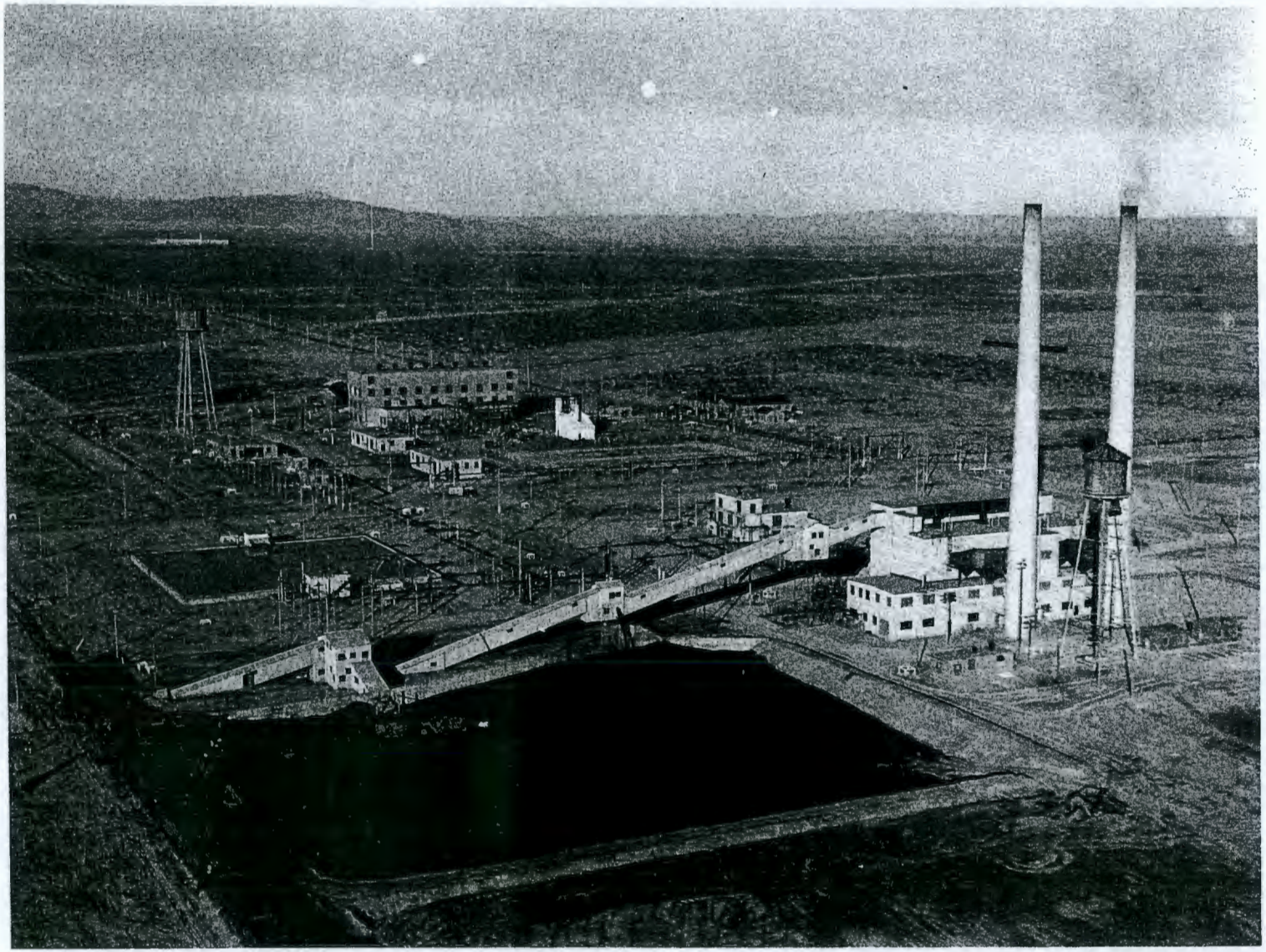

200-E POWER AND SERVICE AREAS
Aerial View Looking Northwest

892

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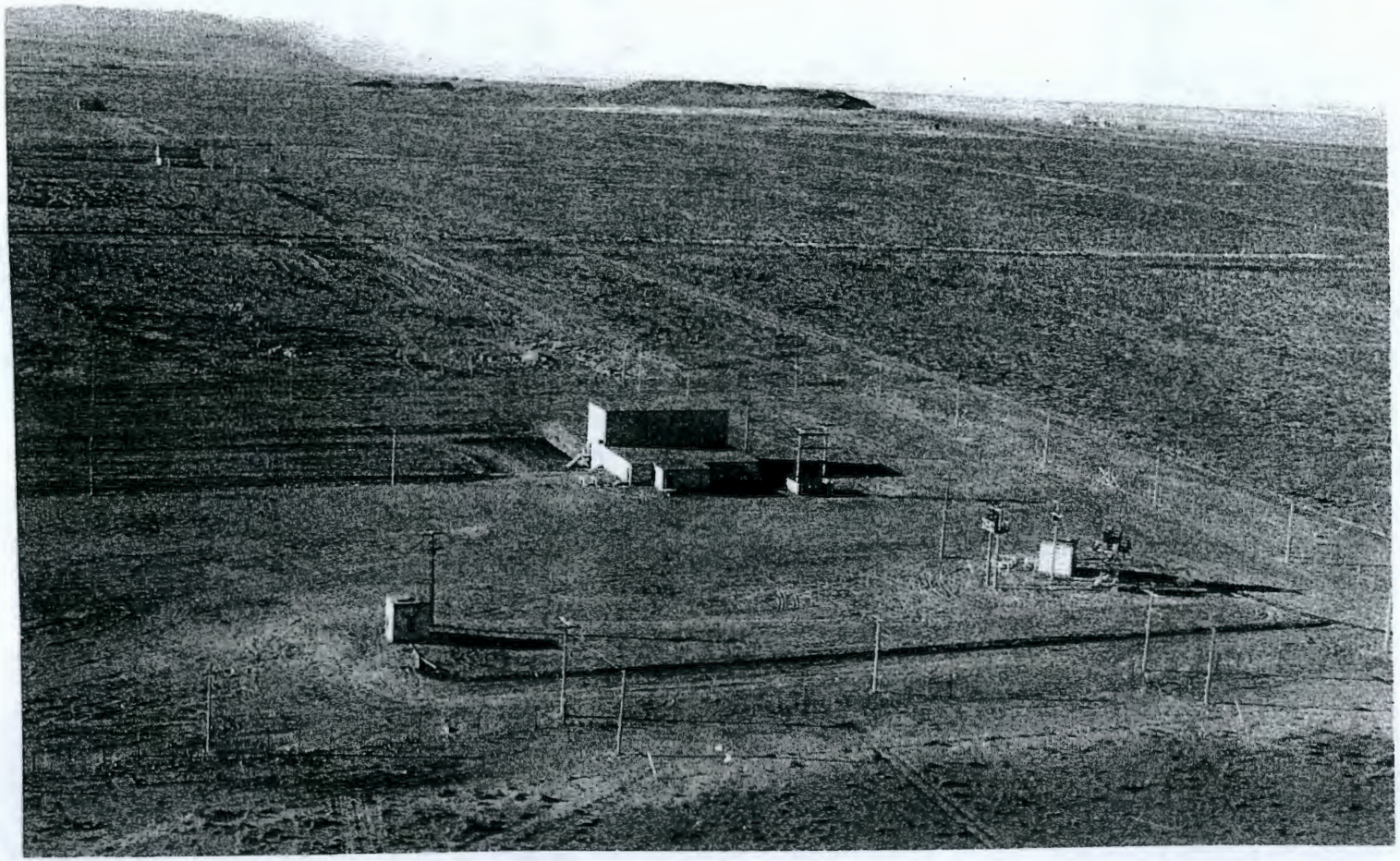

AERIAL VIEW 200 NORTH AREA
Looking Northwest

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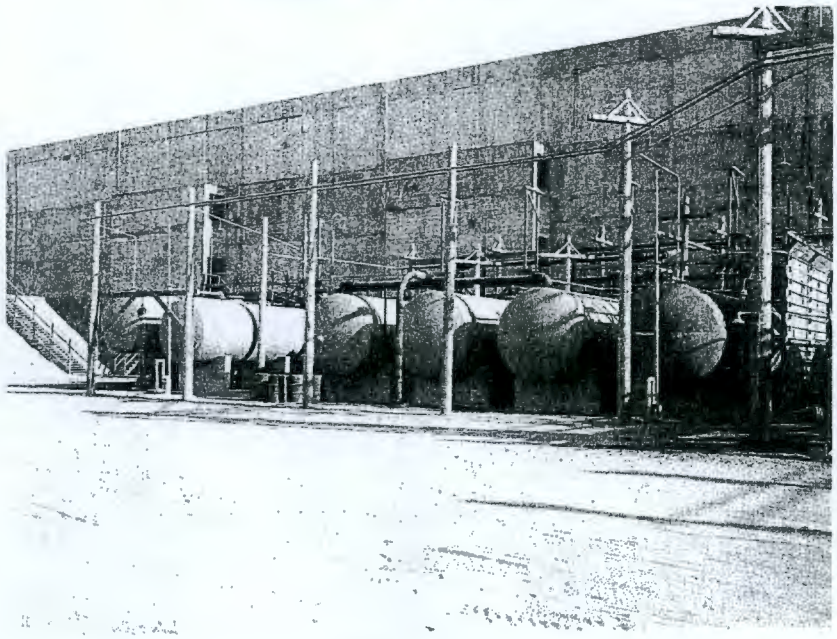
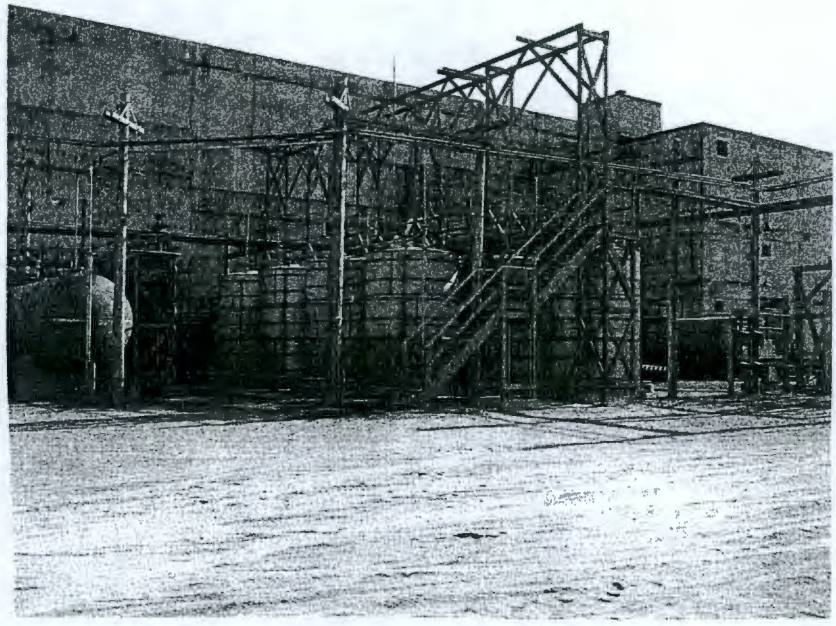


211 - HORIZONTAL ACID STORAGE TANKS
WEIGHT TANK AND COOLER
Locking East



211 - VERTICAL ACID STORAGE TANKS AND CAR SPOTS
Looking Southeast

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211 TANK FARMS

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T, U, and B

Tank Farms were constructed for each 200 Process Group - T, U, and B, for the handling and storage of liquid chemicals and are located at the rear of the 221 Buildings in the angle between the 271 Building and the railroad tunnel to Building 221. Two car spots are provided along one of the railroad spurs adjacent to the 271 Building. One car unloading pump for each kind of chemical is provided at one or the other of these car spots. The Tank Farm is more or less divided into two parts; vertical storage tanks and horizontal storage tanks.

Vertical Storage Tanks: Nine 18-8-S-Cb vertical storage tanks 10 ft. diameter by 14 ft. high are arranged adjacent to the car spots in two rows on concrete octagon-shaped foundations with wood frame access stairways and platforms. Tanks #211-101 to #211-105 are for 70% nitric acid, and tanks #211-121 to #211-123 are for 75% phosphoric acid. A pump is located adjacent to these tanks for transferring acids to Building 271. Tank #211-201 is for formic acid. A pump is located near this tank for transfers to Building 221.

Horizontal Storage Tanks: Six horizontal storage tanks adjoin the vertical storage tanks on reinforced concrete cradles and are provided with wood frame access stairways and platforms. These tanks are used as follows: #211-108 is a 9' x 36' of 18-8-S-Cb for the storage of concentrated nitric acid directly from the tank cars. Adjacent to this tank is an 18-8-S-Cb trombone cooler and pump for circulating the acid during the process of water dilution. After dilution to 70%, the acid is discharged into one of the five tanks previously mentioned and then is distributed to the 221 and 271 Buildings by two transfer pumps.

Three 9' x 36' steel tanks #211-141 to #211-143 are provided for the storage of 50% caustic acid which is pumped directly into Building 221. Steam coils are provided in these tanks to keep the caustic in liquid form during cold weather. An 8' x 30' steel tank #211-161 provides storage for concentrated sulphuric acid and a pump is located adjacent to it for transferring acid to Building 221. A second tank #211-181 of similar size is suspended on scales for the storage of anhydrous hydroflouric acid. A small expansion tank with necessary safety head gauges, pop valves, etc. is provided to prevent rupturing of the main tank. A pump is installed nearby for transferring acid to #221.

Building 211-T only is equipped with drum filling facilities for handling sulphuric, formic, nitric, and phosphoric acids.

	Dimensions	Volume	Area
Overall	120' x 188' x 35'	534,024 Cu.Ft.	19,832 Sq.Ft.

Material	Quantity
Lumber (Framing)	12,000 f.b.m.
Reinforcing Steel	1.0 Tons
Concrete	210 Cu. Yds.

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This building houses the following equipment:

Number	Type	Size - Capacity - Power
5	18-8 S/S Vertical Storage Tanks	10' Diam. x 14' - 41,250 Gals. - 70% HNO_3
3	18-8 S/S Vertical Storage Tanks	10' Diam. x 14' - 24,750 Gals. - 75% H_3PO_4
1	18-8 S/S Vertical Storage Tanks	10' Diam. x 14' - 8,250 Gals. - HCOOH
1	18-8 S/S Horizontal Storage Tank	9' Diam. x 36' - 17,200 Gals. - 95% HNO_3
3	Horizontal Storage Tanks	9' Diam. x 36' - 51,600 Gals. - 50% N_2OH
1	Horizontal Storage Tank	8' Diam. x 30' - 11,300 Gals. - 93% H_2SO_4
1	Horizontal Storage and Weigh Tank	8' Diam. x 30' - 11,300 Gals. - HF
1	Weight Tank Scale	60 Ton - Toledo
1	Expansion Tank	3' x 5'
1	HNO_3 Acid Cooler (Water Evap.)	12½' x 19½' - 1635 Sq. Ft.
9	Transfer Pumps	50 GPM - 7½ HP - 440/220 V.
4	Transfer Pumps	100 GPM - 10 HP - 440/220 V.
1	Circulating Pump	20 GPM - 1 HP - 440/220 V.

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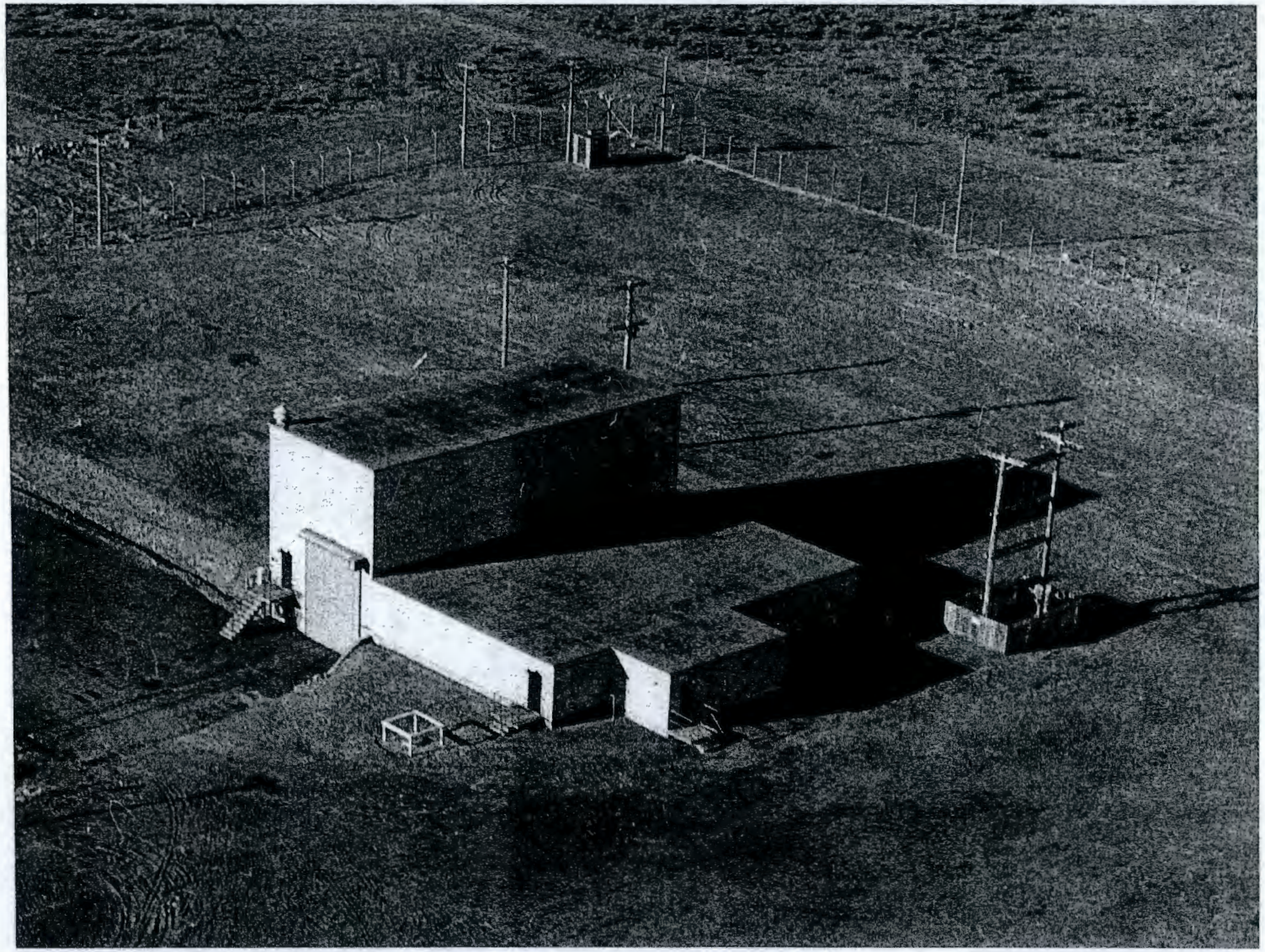

212-P LAG STORAGE BUILDING
200 North Area
Aerial View Looking Northwest

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212 LAG STORAGE BUILDINGS

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Three identical buildings, known as Plants N, P, and R, were built in the 200 North Area for storage of partially processed material enroute from the 100 Process Areas to the 200 East and West Process Areas. All buildings are oriented north and south. These buildings are essentially one-story, steel frame with 8" concrete block walls and pre-cast tile roof covered with built-up felt, graveled surface roofing. Each building is divided into three parts: Transfer Room, Storage Room, and Fan Room.

Transfer Room: This is the high east portion of the building containing two transfer pits, and accommodations for one special railroad car. An electrically operated overhead steel roller door covers the railroad entrance. This room is served by a 30-ton overhead bridge crane operated with a pendant cord control to handle casks from the car to the transfer pit and vice-versa. The transfer pits are equipped with manually-operated hydraulic systems for the handling of storage buckets. Inside surfaces of the transfer pit were painted with "Amercoat" to provide a non-porous surface.

Storage Room: This west portion of the building houses a sub-level 20'-9" deep, water-filled concrete pool. A monorail system runs from the transfer pits to the Storage Room from the trolleys of which are suspended 180 galvanized dipped yokes and buckets. Buckets are weighed and counted by an automatic, printing, monorail scale located near the doorway leading to the Storage Room. The operating floor is made up of movable wooden sections supported by T-shaped concrete piers and are slotted to allow yokes to pass.

Fan Room: This room is attached to the east side of the building, housing a selective forced draft heating and ventilating system. Air is discharged by wall ducts into the Storage Room after having been filtered and pre-heated by an electric unit heater. A separate unit heater is located in the Transfer Room.

Two types of foundations were used - reinforced concrete slab with a 4 ft. spread footing for the Storage and Transfer Pit Sections; and reinforced concrete piers with spread footing for the west and south walls of the Transfer Pit Section, and east wall of the Fan Room. Storage Pit walls are tapered inside from 2'-3" to 1' at the top, and the balance of the building walls are 16" and 8" reinforced concrete curtain walls. Concrete floors vary in thickness from 4" to 18" with the Fan Room floor being supported by reinforced concrete beams.

These buildings contain no windows; three louvres and five pedestrian doors with outside concrete platforms and steps, one at each corner of the building and one for access to the Fan Room.

	Dimensions	Volume	Area
Overall	74' x 89'-8" x 37'-6"	169,090 Cu. Ft.	6,150 Sq.Ft.

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These buildings house the following equipment:

Number	Type	Size - Capacity - Power
1	Overhead Bridge Crane	30-ton "Whiting" - 3 Motors 440 V.
1	Monorail System	883' including Switches and Weigh Scale

Material	Quantity
Lumber (Flooring)	8,000 f.b.m.
Structural Steel	67.32 Tons
Reinforcing Steel	94 Tons
Concrete	1,336 Cu. Yds.
Roofing (Built-up)	61.5 Squares
Concrete Block (8" x 8" x 16")	9,000 Blocks
Concrete Brick (2" x 4" x 8")	20,000 Bricks

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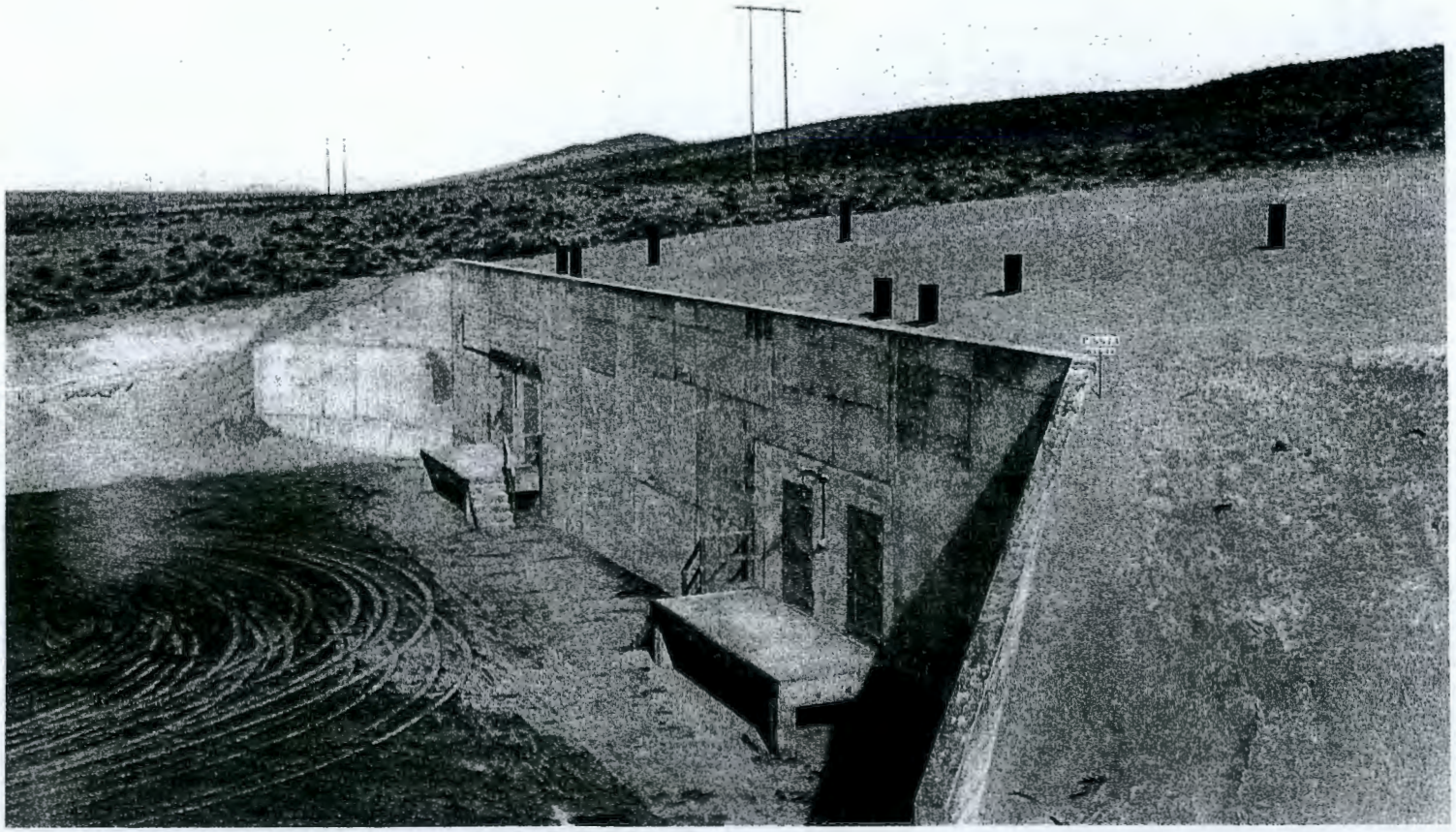

213 - J & K MAGAZINE STORAGE BUILDING
Looking Northwest

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213 J & K MAGAZINE STORAGE BUILDINGS

A reinforced concrete, earth-covered, magazine building, containing two parallel vaults, was constructed in the easternmost portion of the 200 North Area for the storage of the product. The south end of each vault forms a continuous reinforced concrete wing-shaped retaining wall which has an attached reinforced concrete loading platform for each vault section. The structure is oriented north and south, having its center line identical with the center line of its access road. Distance between vault sections is 44'-6" face to face. Each section contains three rooms, namely, Magazine, Vestibule, and Instrument. The latter two have outside, steel-hinged doors opening out onto the loading platform.

The type of foundations used are as follows: Vault Section - reinforced concrete slab 1' thick with 4" spread footing; Loading Platform - 12" square reinforced concrete piers with 6" spread footings; Retaining Wall - 10'-6" reinforced concrete spread footing, 1'-8" thick. Side walls, end walls, and roof slabs are reinforced concrete 1' thick with the bulkhead wall between the Vestibule Room and the Magazine Room being 2' thick. An 8' ceiling is maintained in all rooms. The Retaining Wall is reinforced concrete extending 2' above backfill and tapers from 1'-8" to 1' at the top. Roofs have membrane waterproofing, 2-ply, with 1" Celotex protective covering. Exterior surface of the rear and side walls is treated with "Carbozite" waterproofing.

Ventilation is provided by four 12" diameter A.C.M. ventilators in each unit, equipped with dampers and bird screens. These extend approximately 4 ft. above the backfill which averages 6' to 10' above the roof slab. Six-hour fire-resistive, double combination lock, steel doors are installed in the bulkhead wall. Reinforced concrete shelving with concrete brick partitions line each side of the Magazine Sections. The floor is built-up an additional 6" under the shelving portion.

	Dimensions	Volume	Area
Overall	47' x 147' x 21'	14,477 Cu. Ft.	1,155 Sq. Ft.

Material	Quantity
Reinforcing Steel	345 Tons
Concrete	463 Cu. Yds.
Concrete Brick	1,500
Waterproofing	6.5 Squares
Painting (Carbozite)	1,750 Sq. Ft.

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216-E PROCESS WASTE BURIAL TRENCH
Looking South

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216 & 316 PROCESS WASTE DISPOSAL TRENCHES

Two identical, open trench, fence enclosed, process waste burial grounds were constructed, one each in the 200 East and 300 Areas. Unit 216 in the 200 East Area is located on the south side of "E" Street approximately 2600 feet east of the Power House. Unit 316 is located at the northeast inside corner of the 300 Area.

Each burial ground is enclosed by Type #1 fencing, 150' x 250', having a 20' vehicle gate at both ends and contains a 16' V-bottom ditch 8' deep and 200' long. Ditches were dug parallel to the 20' area service road with space provided along the other side for a similar size future trench.

Fifteen feet from each end of the trench is located a concrete bench mark containing a stainless steel plate stamped "DANGER - Do not dig between markers".

	Dimensions	Volume	Area
Overall	150' x 250'	--	37,500 Sq. Ft.

Material	Quantity
Lumber	2,000 f.b.m.
Woven Wire - 6'	1,600 Ft.
Barb Wire	2,400 Ft.
Excavation	475 Cu. Yds.

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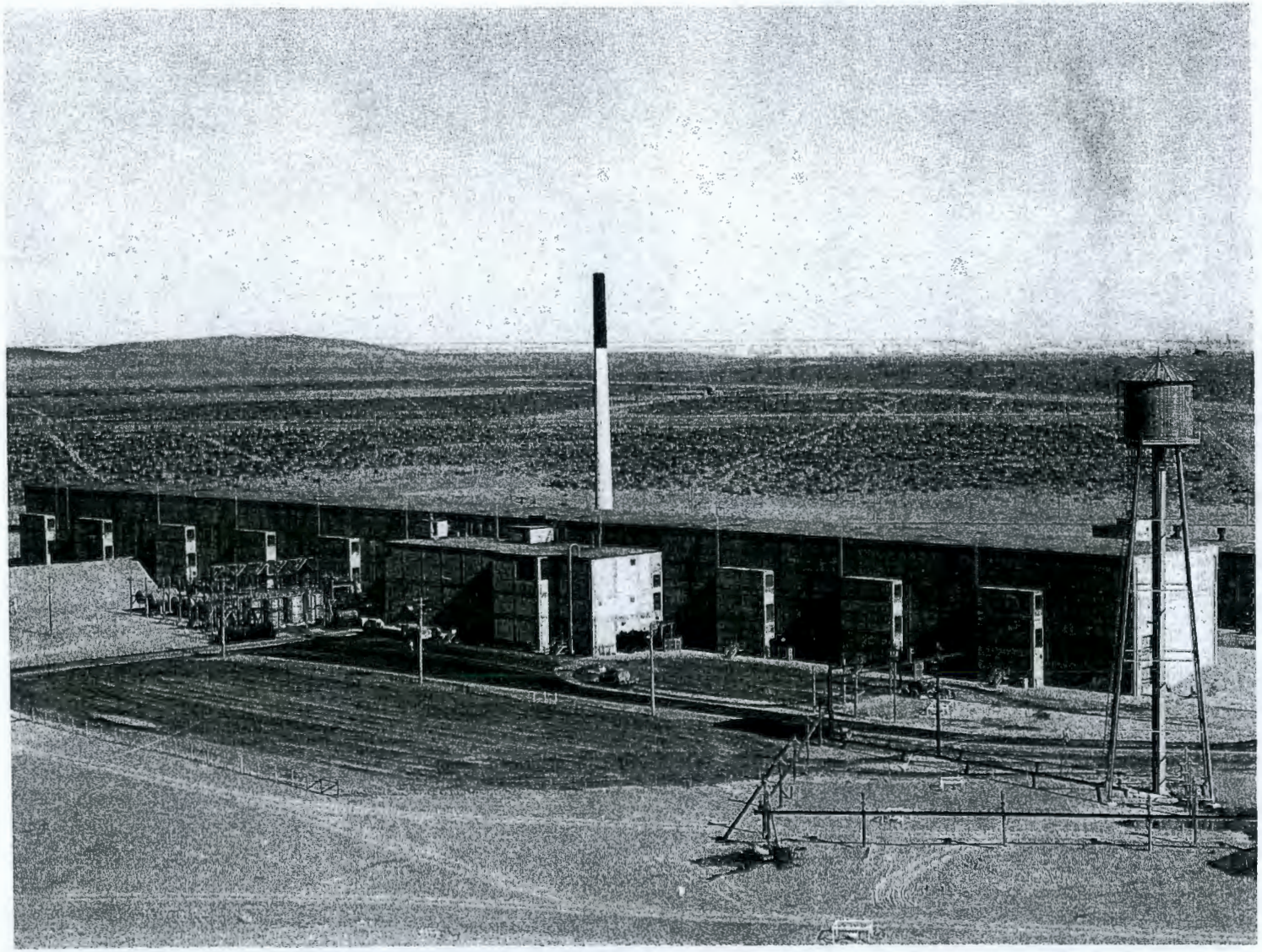

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221-T - SEPARATION BUILDING
Aerial View - Looking East

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221 CELL BUILDINGS

T, U, & B

In each Process Plant, T, U, & B, is a long, flat, rectangular-shaped mass concrete structure of which approximately one-quarter is below finished grade. These buildings are designated as Cell Buildings due to their design, and are identical in all respects except Building 221-T, which is 65' longer, containing a Head-End Addition. These buildings are of extremely unusual design due to process requirements. In other words, once the equipment in any of the cells is placed in operation, it will not be possible to approach it for maintenance or to manually remove or fit up piping. Each process group is symmetrically laid out, paralleling and supporting the 221 Building. In addition to it, the group is composed of the following: 211 Tank Farm, Building 222 - Sample Preparation Laboratory, 224 - Bulk Reduction Building, 241 - Process Waste Storage and Disposal System, 271 - Chemical Preparation and Service, 291 - Exhauster Building and Stack, and 292 - Exhaust Gas Laboratory.

The 221 Building structure is separated into two main portions - Galleries and Canyon, with the inside of the building being divided into twenty sections, each encompassing two cells. Sections are 40' long with the exception of Sections 1, 2, and 20 which are 44', 43', and 43½' respectively.

Galleries: Building 221 is so designed that the control panel boards, chemical and service distribution, are located in three galleries, one above the other along the front side of the building. The first gallery is called the basement gallery and is used principally for electrical distribution and control cabinets. The first floor gallery consists principally of a piping loft containing steam, water, air, and chemical headers as well as piping connections between the panel boards and weigh tanks on the second floor and through-wall cell piping. The second floor gallery is the control center for the cell equipment. Each 40' building section constitutes a separate unit and the gauge board and weigh tank arrangements are designed accordingly. The gauge board panels are installed in a row along the barricade wall between the canyon and the galleries with weigh tanks along both front and back walls of the gallery.

Canyon: The lower portion of the canyon below the deck level contains 40 individual concrete cells having removable concrete cell-block covers. A 10'-6" x 10'-6" exhaust duct runs along the back wall of the building paralleling the bottom of the cells and is connected by an underground concrete duct to the 291 Exhauster Building and Stack for the removal of cell fumes. Immediately above this duct is a pipe trench which also parallels the cells containing inter-connecting cell piping. The pipe trench is likewise covered with removable, sectional concrete block covers. The construction of the cells has been standardized as much as possible. The standard design section numbers are 4 to 6 through 19. Section 3 differs in that the pipe trench ends opposite cell #5. Section 5 differs in that cell #10 is much deeper affording drainage to the sewer section. Section 20 differs in that the pipe trench terminates opposite Cell #40 in a manner that will allow for future extension of the building. Section 1 constitutes a large

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cell with two long openings for the immediate storage of partially processed material. Section 2 contains two long openings of the same size, one of which centers over the railroad track and the other houses initial cell equipment. A reinforced concrete railroad tunnel, extending 150' from the front side of the building, provides rail service to this section.

The equipment installed in the cells consists mainly of centrifuges and vessels with and without agitators, and connecting piping between cell walls and equipment. Around the periphery of each cell are 42 flanged piping connections serving the cell equipment. Special piping connectors were used allowing pipes, conduits, and instrument leads to be connected by tightening a single nut. Vertical connectors are used for electrical connections only and horizontal connectors for piping, instruments, etc.

The Canyon portion is principally served by an overhead bridge crane equipped with 75 and 10-ton hooks as well as four independent monorail hoists of 1 and 1/2-ton capacities. The crane cab is of special design and contains special controls, observation and communication facilities in order to remove cell blocks, cell equipment and cell piping by remote control. Each building also contains a second overhead bridge crane, 10-ton capacity for maintenance use only, when the building is completely shut down.

Head-End Addition: A testing laboratory is attached to the Head-End of Building 221-T having the same general characteristics as the rest of the 221 Buildings. The addition consists essentially of two equipment cells, A nd B, having the same length as cells 1, 2, 3, and 4. The essential difference between the testing laboratory and a standard section of Building 221 is that each testing laboratory cell contains the equipment corresponding to that in two standard cell sections. The 75-ton crane rails are extended to permit the crane to travel to the extreme end of Building 221. The addition also includes a continuation of the basement, first and second floor galleries. These galleries turn at the head-end and continue across to the rear wall of the building.

Stair Towers: Seven four-story reinforced concrete stair towers were constructed along the front side of the 221 Building to provide access to the three gallery levels and the crane-cab runway. These stair towers also house heating and ventilating equipment and toilet rooms for the galleries. Nine reinforced concrete labyrinthed stair towers are built along the rear side of Building 221 which provide access to the Canyon portion of the building at the deck level. Building 221-T contains an additional rear and front stair tower for the Head-End Addition.

General Type of Construction: The foundation for the main building structure is a reinforced concrete pad varying from 6' to 8' in thickness with a spread footing. Outside building walls are likewise reinforced concrete 3' and 5' thick. The barricade wall between the cells and canyon and the galleries is 7' thick. The building has a suspended flat concrete roof varying from 3' to 4' in thickness. Construction joints are provided between each section and expansion joints at required intervals. The inside surfaces of the cells and pipe trench, removable cover blocks, the deck floor level in the canyon, and the second floor control gallery are painted

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with "Amercoat" to obtain non-porous surfaces. For any additional information in regard to the installation of cell equipment, See: Section 6 - Expediences, sub-heading (b) "Special Construction Methods".

	Dimensions	Volume	Area
221-T Overall	85'-2" x 875'-6" x 102'	5,485,220 Cu.Ft.	66,319 Sq.Ft.
221-U & B Overall	85'-2" x 810'-6" x 102'	5,098,464 Cu.Ft.	61,582 Sq.Ft.

These buildings house the following equipment:

Number	Type	Size - Capacity - Power
3	Dissolver Tanks and Columns	7' diam. x 7' x 24" O.D. x 10'-8"
4	Tanks (25-12-S-Cb)	8' diam. x 14'
1	Tank (25-12-S-Cb)	11' x 18' x 27'
4	Tanks (25-12-S-Cb)	6'-6" diam. x 14'
11	Tanks (25-12-S-Cb)	9' diam. x 9'
9	Tanks (25-12-S-Cb) Agitators and Motoreducers	9' diam. x 9' - 15 HP - 440 V. Electric Motors
4	Tanks (25-12-S-Cb) Agitators and Motoreducers	9'-6" diam. x 10' - 15 HP - 440 V. Electric Motors
13	Tanks (25-12-S-Cb) Agitators and Motoreducers	4'-6" diam. x 7' - 5 HP - 440 V. Electric Motors
11	Centrifuges	48" - 20/10 HP - 440 V.
150	Steam Jet Syphons	20 GPM
456	Steam Jet Syphons	75 GPM
66	Steam Jet Syphons	10 GPM
1	Overhead Bridge Crane	75-ton, 10-ton aux. hoists & two 1-ton hoists - 40, 30, 25, 3 HP - 440 V. Electric Motors
1	Overhead Bridge Crane	10-ton - 2 - 3000# monorail hoists - 25, 15, 3, 1 HP - 440 V. Motors
6	Impact Wrenches	2.4 HP - 440 V.
130	Gauge Boards	Type A to Z
12	Weigh Tanks (18-8-Cb) & Scales	400 Gals. - 6000#
12	Weigh Tanks (25-12-S-Cb) and Scales	400 Gals. - 6000#
30	Weigh Tanks (25-12-S-Cb) and Scales	75 Gals. - 1200#
8	Unit Agitators	1/2 HP - 440 V.
2	S/S Pumps	5 GPM - 1/2 HP - 440 V.
2	Tanks (25-12-S-Cb)	18" diam. x 2'-4"
4	Water Measuring Tanks	500 Gals.
2	Steel Tanks and Scales	400 Gals. - 6000#
11	Pump (25-12-S-Cb)	20 GPM - 15 HP - 440 V.
11	Pumps	30 GPM - 7½ HP - 440 V.
11	Measuring Tanks	18" diam. x 2'-6"
10	Wet Cell Units	5000 CFM - 30 GPM - 1/2 & 2 HP - 440 V.

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EQUIPMENT LIST (Continued)

Number	Type	Size - Capacity - Power
10	Unit Heaters	540,000 BTU - 5000 CFM - 1/2 & 2 HP - 440 V.
1	Multiblade Fan	860 CFM - 1/6 HP - 110 V.
12	Exhaust Fans	3600 CFM - 1/2 HP - 440 V.

* The above equipment list is for one building only.

221-T Head-End Addition

1	Dissolver and Column (25-12-S-Cb)	30" diam. x 48" - 24" O.D. x 6'
3	Tanks (25-12-S-Cb) Agitators and Motoreducers	24" diam. x 32" - 1 HP - 440 V.
3	Tanks (25-12-S-Cb) Agitators and Motoreducers	42" diam. x 48" - 1 HP - 440 V.
3	Tanks (25-12-S-Cb)	4'-6" diam. x 7'
3	Tanks (25-12-S-Cb)	42" diam. x 48"
1	Measuring Tank	18" diam. x 24"
5	Weigh Tanks (25-12-S-Cb) and Scales	18" diam. x 28" - 300#
8	Weigh Tanks (25-12-S-Cb) and Scales	11" diam. x 16" - 300#
2	Unit Agitators	1/4 HP - 440 V.
20	Steam Jet Syphons	200 GPH
1	Heating Unit	500,000 BTU - 500 CFM - 2-1/2 HP - 440 V.
1	Wet Cell Unit	5,000 CFM - 50 GPM - 1/2 & 2 HP - 440 V.
1	Exhaust Fan	3600 CFM - 1/2 HP - 440 V.
53	Gauge Boards	

Material	221-T	221-U	221-B
* Structural Steel	189,688 Tons	189,688 Tons	189,688 Tons
Reinforcing Steel	1,880 Tons	1,678 Tons	1,678 Tons
Reinforcing Mesh	27,000 Sq.Ft.	23,000 Sq.Ft.	23,000 Sq.Ft.
Concrete	90,473 Cu.Yds.	81,903 Cu.Yds.	79,865 Cu.Yds.
Concrete Blocks (4" x 8" x 16")	500	500	500
Roofing (Waterproofing)	595 Sqs.	556 Sqs.	556 Sqs.

* Roof trusses for temporary construction use only.

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222-T - SAMPLE PREPARATION LABORATORY BLDG.
Looking Southwest

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SAMPLE PREPARATION LABORATORIES

222 T, U, & B

Three one-story, reinforced concrete frame structures, with concrete block exterior and interior walls, were constructed - one for each of the 200 Process Groups. These buildings are located between Building 224 and 292 paralleling Building 221. Each building contains a total of 22 rooms, two outside and two inside vestibules, and an L-shaped corridor. The rooms are used for the following purposes:

No. 1	Receiving Room
No. 2 & 3	Offices
No. 6	Chemical Preparation Laboratory
No. 7	Sample Preparation Laboratory
No. 8	Balance Room
No. 9	Sample Measuring Room
No. 10	Instrument Repair Room
No. 11 & 19	Equipment and Machinery Rooms
No. 12	Conference Room
No. 13	Storeroom
No. 14, 16, 17, 18, 20, 21, 22, 23, 24	Shower, Toilet, Locker and Lounge Rooms
No. 15	Janitor's Closet

The Main Equipment Room is attached to the rear of the building and houses mechanical equipment such as is required for air conditioning, ventilation, water distillation, water heating and steam vacuum jet. A separate hot water heater and ventilation system is housed in rooms No. 19 and 24 which are in the end of the building opposite Building 292. A separate fume exhaust system is provided for the hoods in the Laboratory Rooms. The Sample Measuring Room and Instrument Repair Room are in the end of the building adjacent to Building 224 and are of explosion-proof construction having walls and roof of reinforced concrete 2' thick with a 4" concrete block wall between rooms. An emergency exit is provided for the Sample Measuring Room. The floors in rooms No. 9 and 10 are covered with 1/8" linoleum and have a 2" layer of cork insulation between 4" layers of concrete. Ceilings and walls above 6'-6" in these rooms are covered with 1" fibracoustic tile board.

Floors in rooms No. 1, 3, 2, 6, 7, 8 and 12 are covered with 3/16" tile, including a 6" base. Rooms No. 6, 7 and 8 are plastered, having a white finish coat. Inside partition walls are 4" concrete block. Roofs are reinforced concrete 4" thick, supported by reinforced concrete beams, and covered with 1" insulation board built-up, gravel surfaced roofing. The building contains four outside door entrances, no windows, and louvres for air circulation.

Solvent Storage Shelter: Each 222 Building is provided with an open side, steel frame lean-to, which houses a sheet metal box for the storage of solvents. These are located approximately 25' from the front side of the buildings between the two outside vestibule entrances.

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These buildings house the following equipment:

Number	Type	Size - Capacity - Power
4	Aerofin Heaters	#71 - 24 Tube - 3'-6" Tube Length
2	Humidifiers	5' x 3'-3" x 3'-6" - #13 Buffalo Forge
2	Humidifier Pumps	46 GPM - 1/2 HP - 440/220 V.
1	Condensing Unit and Compressor	48,000 B.T.U. per hr. - 5 HP - 440 V.
1	Pump	46 GPM - 1/4 HP - 110 V.
4	Shell & Tube Coolers	(2 - 15" x 4'-0" x 8 GPM (2 - 14" x 4'-0" - 8 GPM
1	Air Conditioning Unit (Pump for above)	2,500 c.f.m. - 1 HP - 440/220 V. 46 GPM - 3/4 HP - 440/220 V.

	Dimensions	Volume	Area
Building Overall	64' x 160'-6" x 15'-2"	111,562 Cu.Ft.	7,336 Sq. Ft.

Material	Quantity
Lumber (Trim)	1,000 f.b.m.
Structural Steel	0.25 Tons
Reinforcing Steel	17.5 Tons
Reinforcing Mesh	7,000 Sq. Ft.
Concrete	659 Cu. Yds.
Roofing (Built-up)	76.71 Squares
(Sheet Metal)	.80 Squares
Concrete Block (8" x 8" x 16")	5,320 Blocks
(4" x 8" x 16")	6,000 Blocks
Plaster (1/2" thick)	355 Sq. Yds.
Linoleum (1/8" thick)	855 Sq. Ft.
Asphalt Tile Floor Covering (3/16" thick)	2,760 Sq. Ft.
Cork Floor Insulation (2" thick)	786 Sq. Ft.
Roof Insulation (1" thick)	67.41 Squares
Fibracoustic Board (1" thick)	1,250 Sq. Ft.

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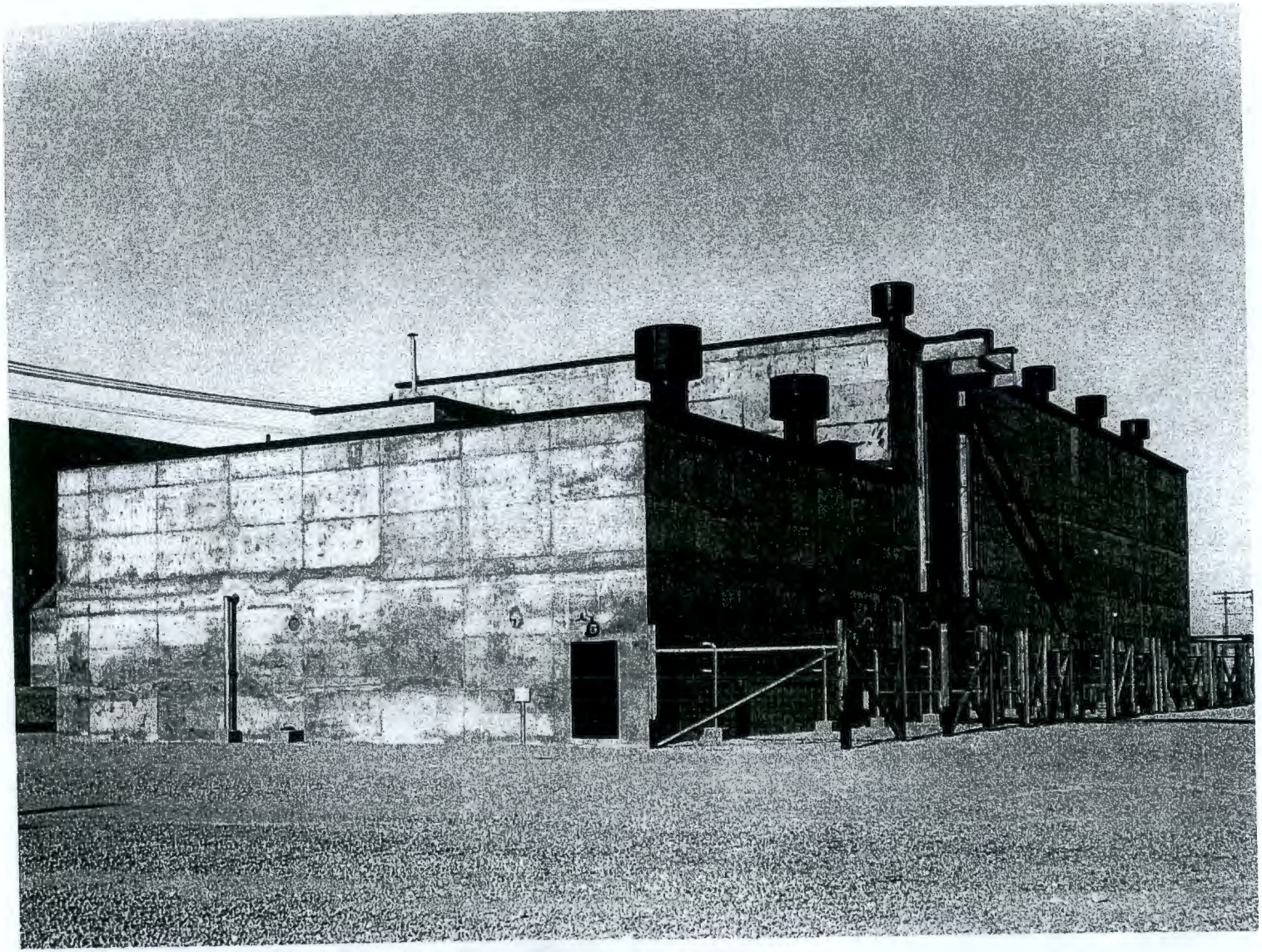

224-T - BULK REDUCTION BUILDING
Looking Northwest

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224 BULK REDUCTION BUILDINGS

T, U, & B

Three reinforced concrete, three-story frame structures with concrete and concrete block exterior and interior walls were constructed - one for each of the 200 Process Groups, T, U, and B. The front of these buildings is 150' from the back of Building 221, and is in line with the front of Building 222. Each building contains a total of 21 rooms not including two stair towers, one closet, one janitor's closet, and an elevator penthouse.

The back side of the main structure has 1' thick concrete walls with a balcony running around three sides. This portion of the building is separated into Cells A to E inclusive, with Cells A, B, D, and E having a walled platform for supporting 40" centrifuges. These cells are served by a hand-operated overhead crane. In Cell C, the right-hand portion is a pit which connects with an underground pipe tunnel that runs from the center line of Sections 13 and 14 in Building 221 to the 224 Building. The floors in the cells are sloped to a trench along the wall in a manner similar to cell bottoms in Building 221. The equipment is designed to rest upon the floor. Bolted flange connections were used for cell vessels and equipment instead of the special piping connectors used in Building 221.

The front side of the main structure is reinforced concrete frame with 8" concrete block panels and 8" and 4" concrete block partitions. An elevator identical in all respects to Building 271 is installed adjacent to the No. 1 stair tower and is provided with an outside concrete loading platform to facilitate the movement of chemicals to and from trucks. The first floor contains two Offices, Chemical Storage Room, a central Ventilation Room, which provides filtered and tempered air with humidification, Lunch Room, Wash Room, Shower Room, two Toilet Rooms, and two Locker Rooms. The second floor is principally a Pipe Loft containing five concrete vestibules opposite each centrifuge platform. All chemical and service lines enter the building on this level at the end of the building facing Building 222. The third floor is the Operating Gallery containing gauge boards and weigh tanks, etc. The bare panel boards are identical in size with those in Building 221 and in most instances, the arrangement of instruments and piping is the same.

The right-hand portion of the building is two stories high, having outside concrete walls 1' thick. This section of the building contains Cell F which is ell-shaped due to the inclusion of an office in one corner. A mezzanine floor extends across the side facing Building 221 upon which are mounted gauge boards and weigh tanks used in connection with Cell F. A glass enclosure is located in Cell F against the office wall where the partially finished product is collected for transfer to the 231-W Concentration Building.

Building foundations are comprised on reinforced concrete walls with spread footings, reinforced concrete piers and beams, and concrete pads. Floor slabs are reinforced concrete 4" to 12" thick. Roofs are flat reinforced concrete 5" to 12" thick, covered with built-up felt, gravel surfaced roofing, and containing 8 wood frame ventilators with motors. Each

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building contains 11 single and one double-swing pedestrian doors, 2 freight doors, and no windows. The walls and floors in Cells A through E, and walls, floors, and ceilings in the Cell and Office are painted with "Amercoat" to produce a smooth, impervious surface.

	Dimensions	Volume	Area
Overall	60'-1" x 197' x 60'-5"	507,445 Cu. Ft.	11,982 Sq. Ft.

This building houses the following equipment:

Number	Type	Size - Capacity - Power
6	Tanks & Agitators (25-12-S-Cb)	9' diam. x 9' - Motoreducer - 15 HP - 440 V.
4	Tanks (25-12-S-Cb)	9' diam. x 9'
1	Tank (25-12-S-Cb)	4' diam. x 5'-10½"
3	Tanks & Agitators (25-12-S-Cb)	4' diam. x 5' - Motoreducer - 1 HP - 440 V.
6	Tanks & Agitators (25-12-S-Cb)	4'-6" diam. x 7' 5 HP - 440 V.
4	Tanks & Scales (25-12-S-Cb)	25 Gals. - 300# Toledo
3	Steam Jet Syphons	10 GPM
48	Steam Jet Syphons	20 GPM
32	Steam Jet Syphons	75 GPM
7	Steam Jet Syphons	200 GPH
7	Tanks (25-12-S-Cb)	15" diam. x 20"
4	Tanks & Agitators (25-12-S-Cb)	55 Gals. - Motoreducer - 3 HP - 440 V.
4	Steel Oil Drums (25-12-S-Cb)	55 Gals.
16	Tanks (25-12-S-Cb)	12" diam. x 12"
4	Tanks (25-12-S-Cb)	8" diam. x 12"
5	Weight Tanks & Scales (18-8-Cb)	3'-6" diam. x 6' - 6000# Toledo
5	Unit Agitators	1/2 HP - 440 V.
10	Weigh Tanks - 5 (18-8-Cb) and 5 (25-12-S-Cb)	2'-6" diam. x 2'-8"
10	Unit Agitators	1/2 HP - 440 V.
10	Tank Scales	1000# Toledo
1	Weigh Tank (Steel) & Scale	3'-6" diam. x 5' - 1000# Toledo
1	C.I. Pump	30 GPM - 3 HP - 440 V.
5	Pumps	30 GPM - 7½ HP - 440 V.
5	Pumps	30 GPM - 7½ HP - 440 V.
3	Platform Scales	200# Toledo
4	Centrifuges	40" - 40/10 HP - 440 V.
1	Centrifuge	26" - 15/3.7 HP - 440 V.
1	Centrifuge	10" - 1½/1 HP - 440 V.
1	Tank (25-12-S-Cb)	10' I.D. x 14½"
1	Freight Elevator	8000# Houghton
1	Crane & Trolley	8-tons - Whiting - Hand-operated
24	Containers (25-12-S-Cb & 18-8-Cb)	

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EQUIPMENT LIST (Continued)

Number	Type	Size - Capacity - Power
1	Supply Fan	38,000 CFM - 25 HP - 440 V.
8 Sec.	Pre-heaters & Re-heaters	24-Tube - 7' Tube Length
1	Humidifier & Pump	44,000 CFM - 100 GPM - 2 HP - 440 V.
5	Booster Fans	3,000 CFM - 1/2 HP - 440 V.

Material	Quantity
Lumber (Framing & Finish)	4,000 f.b.m.
Reinforcing Steel	136 Tons
Reinforcing Mesh	8,000 Sq. Ft.
Concrete	2,832 Cu. Yds.
Concrete Blocks (8" x 8" x 16")	6,700 Blocks
(4" x 8" x 16")	5,500 Blocks
Concrete Bricks (2" x 4" x 8")	3,500 Bricks
Roofing (Built-up)	121.4 Squares

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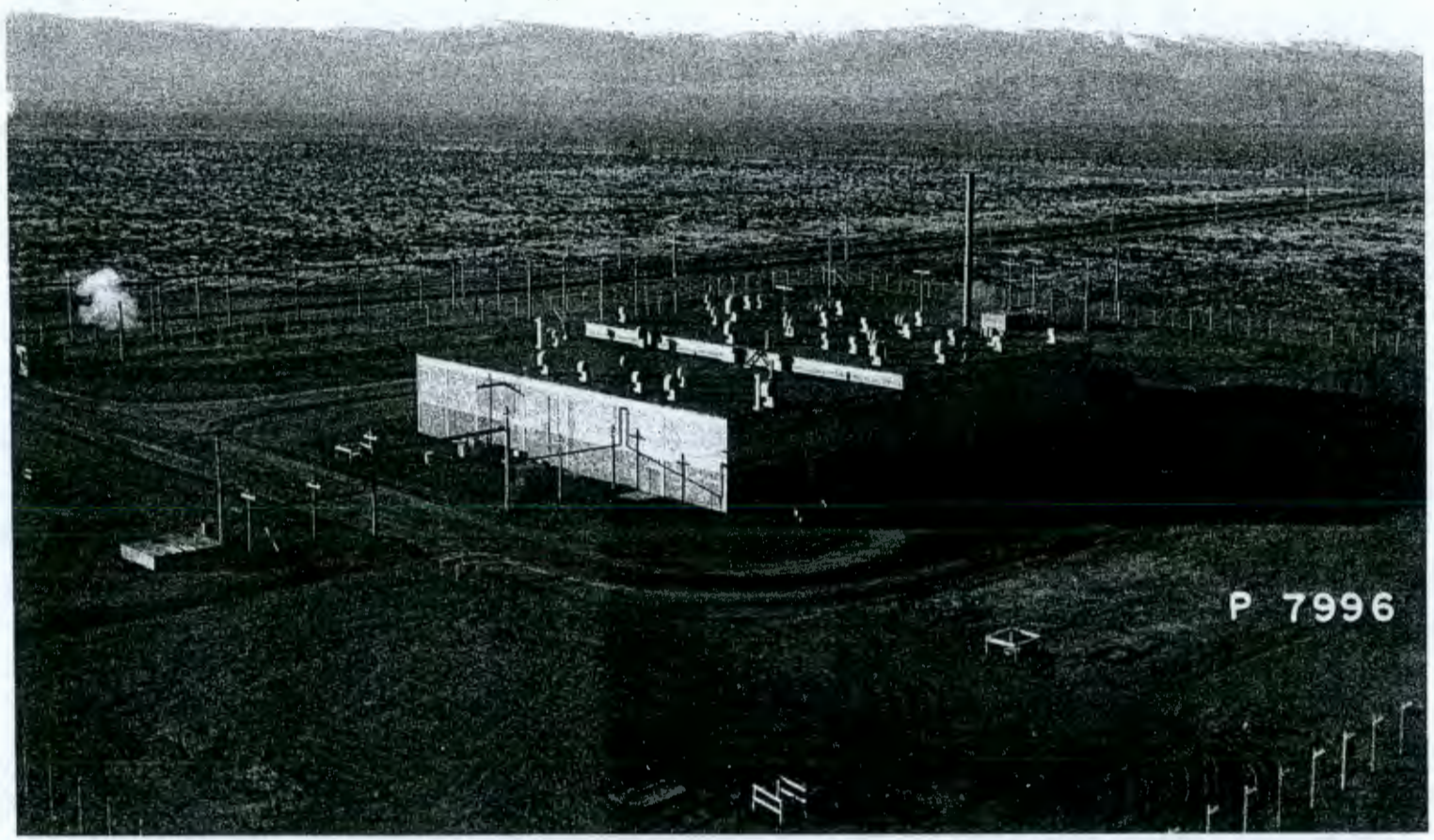

231-W CONCENTRATION BUILDING
Aerial View Looking Southwest

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231-W CONCENTRATION BUILDING

In the western portion of the 200-W Area, midway between Building 241-T and Building 241-U, is located a two-story, flat roof, reinforced concrete, frame building with 8" concrete block panels and 4" and 8" concrete block partitions. In this building the plant and product reaches its final process stage. The structure is of fireproof construction throughout having most of the rooms completely air conditioned. For the latter reason, windows have been omitted.

The building contains a total of 57 rooms including approximately twenty Laboratories for various purposes, several Process and Chemical Receiving and Storage Rooms, Offices, Change Room facilities for 190 employees, air conditioning equipment, distilled water system, ventilation and exhaust systems, and a compressed air system. All of these facilities except one toilet room are located on the first floor with the second floor serving as a pipe and service loft containing duct work and filters for the ventilation and exhaust systems. For further reference, a list of all rooms giving names and room numbers is included at the end of this section.

The central roof portion of the building is 4'-10" higher than the east end of the building and 17'-2" above the one-story Ventilation and Equipment Room which runs along the west end of the building. The west side of the Ventilation and Equipment Room contains fixed louvres which are protected by an 8" concrete barricade wall that is approximately 4' from the face of the louvres and extends 4' above the roof. Two 8' north and south corridors, A and B, are provided, one on each side of the Cell Laboratories with emergency exits to the outside of the building. Corridors C and D run east and west connecting with corridor B and have emergency exits on the east end of the building. Corridors E and F run north and south separating laboratories and intersect corridors C and D. Two concrete stairways are provided for access to the second floor, one at the inside northeast corner of the building, and the other at the south end of the Ventilation and Equipment Room.

Building foundations are composed of reinforced concrete piers with spread footings and concrete walls with spread footings. Floors are reinforced concrete varying from 4" to 12" in thickness. The walls and ceilings of the Cell Laboratories and Vaults A and B are reinforced concrete 1' thick. Roofs are likewise reinforced concrete 4" thick and are covered with built-up felt, gravel surface roofing containing numerous openings for intake and exhaust ducts. The interior surface of all exterior concrete block walls on the first floor, except in the Ventilation and Equipment Room, is plastered having a white finish coat. All interior partitions are likewise plastered except the Sample Test Room, Instrument Room, and one Office which are lined and ceiled with 1" Acoustic tile board. The Lunch Room is also ceiled with tile board. The walls, floors, ceilings, and equipment in rooms 1 to 6, 8, 27, 31 to 45, Vaults A and B, and corridors A, B, C, D, E, and F are painted with "Amercoat" to obtain non-porous surfaces. Rooms 7 and 18 to 26 are painted with standard inside wall paint. The building contains 12 single swing, outside pedestrian doors and five double-swing freight doors, three of which are on the second floor and provided with extended monorails for the removal of equipment.

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A reinforced concrete sump pit 17' x 17' x 17-6" deep is located approximately 115' east of Building 231-W. This pit extends approximately 4' above grade and contains a 9' x 9' (25-12-S-Cb) sump tank with agitator. The top of the sump pit is covered with removable slabs of cement tile supported by structural steel I beams. Process waste water from Building 231-W is collected in this tank prior to discharge into an open drainage ditch.

Number	Name	Room Number
6	Cell Laboratories	1, 2, 3, 4, 5, 6
2	Control Laboratories	34, 35
13	Laboratories	6-A, 6-B, 6-C, 31, 32, 33, 38, 40, 41, 42, 43, 44, 45
1	Process Receiving Room	8
2	Vaults	A, B
1	Solution Preparation Room	46
1	Instrument Room	27
1	Balance Room	37
1	Sample Test Room	36
8	Offices	9, 10, 15, 16, 17, 29, 30, 39
1	Receiving Room	49
1	Receiving Office	48
1	Store Room	47
1	Shop	50
3	Locker Rooms	13, 23, 26
2	Shower Rooms	14, 24
3	Toilet Rooms	12, 22, 51
1	Clean Linen Storage Room	25
1	Women's Rest Room	11
1	Lunch Room	20
1	Lunch Box Storage Room	19
1	Entry Room	18
3	Janitor's Closets	13-A, 21, 28
1	Ventilation Equipment Room	7

	Dimensions	Volume	Area
Overall	147' x 189'-10" x 34'	803,240 Cu. Ft.	27,964 Sq. Ft.

This building houses the following equipment:

Number	Type	Size - Capacity - Power
5	Stainless Steel Hoods	6' x 26' x 7'-6"
10	25-12-S-Cb Precipitators and Catch Tanks	18" x 22-3/4"
5	25-12-S-Cb Tanks & Agitators	22" x 25-1/2"
10	25-12-S-Cb Catch Tanks	18" x 22-3/4"
40	Agitators and Air Motors	60 to 180 RPM
15	25-12-S-Cb Solution Tanks and Receivers	12" x 16"
10	25-12-S-Cb Waste Receiver Tanks	20" x 2'-6"

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EQUIPMENT LIST (Continued)

Number	Type	Size - Capacity - Power
5	25-12-S-Cb Stills	12" x 12"
10	Filter Assemblies	
5	Scale Tanks	6" x 10-3/8" Toledo Platter Scales
5	Head Tanks	6" x 16"
10	Centrifuge Head Tanks	10" x 14"
5	25-12-S-Cb Adjustment Tanks and Agitators	
1	25-12-S-Cb Sump Tank & Agitator	9' x 9' - 15 HP - 440 V.
4	Centrifuges	12" - 1-1/2 HP - 440 V.
6	Centrifuges	12" - 2-1/2 HP - 440 V.
6	Air Pumps	5 CFM - 1/4 HP - 110 V.
1	Air Compressor	102 CFM - 20 HP - 440 V.
1	Air Compressor & After Cooler	304 CFM - 40 HP - 440 V.
1	Air Receiver	42' x 10' - 125#
2	Centrifuges	#3 - 2 HP - 440 V.
11	Centrifuges	#2 - 3450 RPM - 110 V.
11	Clinical Centrifuges	3450 RPM - 110 V.
9	Stainless Steel Lab. Hoods	8' long
1	Head Tank	5' x 4'-6" - 500 Gals.
1	Chilled Water Unit	
2	Vacuum Pumps and Receivers	114 CFM - 15 HP - 440 V.
4	Fans	17,647 CFM - 10 HP - 440 V.
12	Preheaters and Reheaters	5'-6" Tube Lengths - 24 Tube Face
4	Humidifiers and Pumps	5850 CFM - 8'-5" x 6' x 6'-6" - 50 GPM - 1-1/2 HP - 440 V.
3	Booster Heaters	2' Tube Length - 12 Tube Face
1	Booster Heater	2'-6" Tube Length - 12 Tube Face
3	Booster Heaters	3'-6" Tube Length - 12 Tube Face
1	Fan	3500 CFM - 3 HP - 440 V.
1	Dehumidifier	3440 CFM - 1/6 HP - 110 V.
1	Water Cooler and Surge Tank	31 GPM
1	Circulating Pump	31 GPM - 1 HP - 440 V.
1	Refrigeration Unit	112,000 BTU at 45° - 10 HP - 440 V.
1	Exhaust Fan	80" - 16,000 CFM - 40 HP - 440 V.
2	Exhaust Fans	5850 CFM - 1600 CFM - 1½ HP - 440 V.
2	Air Compressors	#5 - 8½ CFM - 1-1/2 HP - 440 V.
54	Filter Arrangements	
1728	Filter Medical Pads - Office and Laboratory Furniture - Shop Tools - Grinders - Pedestal Drills, etc.	

Material	Quantity
Lumber (Trim)	3,000 f.b.m.
Reinforcing Steel	142 Tons
Reinforcing Mesh - #9 and #11	30,352 Sq. Ft.
Concrete	3,083 Cu. Yds.
Concrete Blocks (4" x 8" x 16") (8" x 8" x 16")	12,200
Acoustic Tile Board (12" x 12")	10,895 Sq. Ft.
Plaster	1,950 Sq. Yds.
Roofing (Built-up)	268.26 Squares

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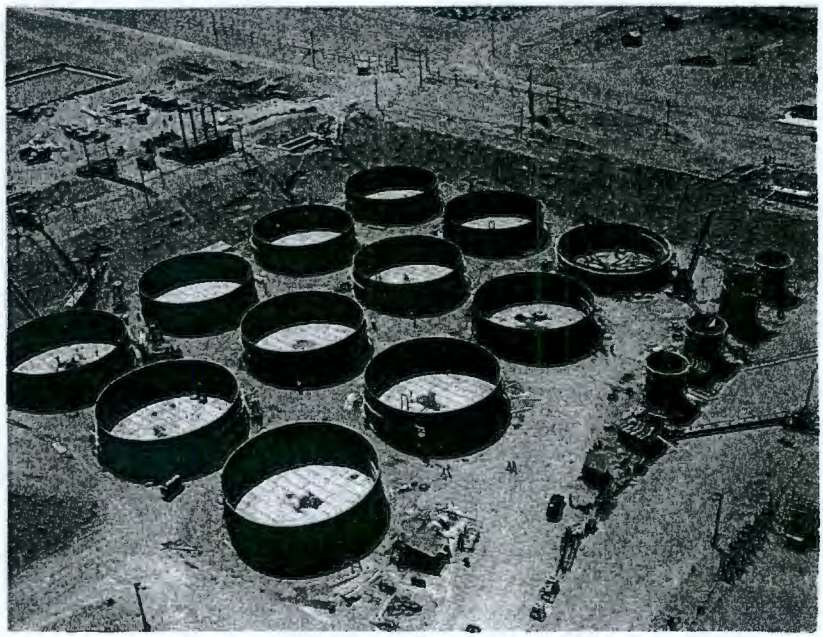
241 - TYPICAL FOUNDATIONS FOR WASTE PROCESS DISPOSAL TANKS



241 - TYPICAL CONSTRUCTION OF WASTE PROCESS DISPOSAL TANKS

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241-T PROCESS WASTE STORAGE & DISPOSAL SYSTEM
Aerial View Looking Southwest

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241 PROCESS WASTE STORAGE AND DISPOSAL SYSTEMS

T, U, B, & C

A separate Process Waste Storage and Disposal System was constructed for each 200 Operating Plant, T, U, and B, whereby the process and cooling water waste originating in Buildings 221, 222, 224, 271, 291, and 292 is either stored in underground storage tanks or held up in reservoirs until it can be disposed of into the ground. Upon cancellation of Plant C, it was necessary to provide an additional diversion box at 241-B, Eq.Pc. #241-B-145 as 241-C was retained with the exception of settling tank Eq.Pc. #241-C-361, and retention basins Eq.Pc. #241-C-351, and 352.

These systems require a considerable area with the ground elevation below the invert elevation of the cooling and process waste water lines at the process buildings. These systems were located approximately 2000' to the rear of the 221-Buildings.

Process Waste Storage System -

Each disposal system is comprised of twelve 75' diameter and four 20' diameter underground composite storage tanks, designed and constructed by Morrison-Bechtel-McCone Company under sub-contract RPG 1451½; one 20' diameter underground catch tank, designed and constructed by National Gunite Contracting Company, under subcontract RPG 3564½; and four diversion boxes of varying dimensions.

1. Composite Storage Tanks - The twelve 75' tanks are spaced 100' on centers, four to a row and are numbered 241-101 to 241-112. The four 20' tanks are spaced 50' on centers in a single row 100' from the center line of the last row of the 75' tanks and are numbered 241-201 to 241-204. The bottom of the large and small tanks are 40' to 42' below the backfill level with a minimum coverage of 9' above the dome of the 75' tanks.

These tanks are reinforced concrete, having a 1/4" welded steel plate lining with spherical bottom to reduce the possibility of leakage. The steel shell is 18' high in the 75' tanks and 25' high in the 20' tanks. The liquid storage level is 2' below the top of the rim in the 75' tanks and 1' below the rim in the 20' tanks. The outside surface of the steel lining is covered with a 3/4" layer of 3-ply waterproofing membrane and "Gunite" protection. Foundations for both size tanks are reinforced concrete having a minimum thickness of 8" with a 3-ply asphaltic membrane waterproofing between the 2" grout surface directly supporting the tank bottoms and the concrete foundation pad. The larger tanks have an enlarged section 2' x 4'-3", including a 2' spread footing around the entire circumference in order to support the tank walls. The smaller tanks are of the same construction, having a 1'-6" x 3'-3" pad which includes a 1' spread footing.

Tank walls for both size tanks are 1'-1" thick, including the steel lining and waterproofing. The 75' tanks have arched domes 15" thick, not including a 3/4" top layer of 3-ply membrane waterproofing. Six of the larger tanks have single trunk concrete hatchways extending from the dome

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to 1' above the top of backfill. Each of the smaller tanks have double trunk concrete hatchways that extend from the top of the flat roof slab covering these tanks. Air-cooled, finned tube condensers are installed over each hatchway opening to condense fumes and keep them from escaping to the atmosphere.

All exposed interior surfaces of the steel tank linings were sandblasted and given two coats of "Du Lux Seacrome Primer". The ceilings of the 20' tanks and the underside of the domes for the 75' tanks were given three or more applications of magnesium zinc-fluosilicate in order to saturate all exposed concrete surfaces.

2. Catch Tank - On the same center line as the last row of the 75' composite storage tanks offset approximately 112' from tank 241-112 is a 20' diameter "Gunite" Sump Tank Eq.Pc. #241 - #301, to receive drainage from the diversion boxes. This tank is 20'-3" from the bottom of the floor slab to the top of the dome and has a 6' minimum backfill covering. A 6" thick reinforced concrete foundation was furnished by du Pont, having an additional 1' x 2'-6" section with 6" spread footing around the circumference. Tank walls are 6" thick, supporting a suspended dome of the same thickness. The interior surface is painted with two coats of "Amercoat" to obtain a nonporous surface.

3. Diversion Boxes - Four reinforced concrete diversion boxes are located in the immediate vicinity of the composite storage tanks in order to divert the process wastes from certain buildings to especially assigned storage tanks and to provide future flexibility in storage. Foundations and end walls are 2' thick and side walls are 18" thick. Each box is equipped with water spray nozzles for flushing and has removable overlapping concrete covers three layers deep. Cover blocks and the inside surfaces of the diversion boxes are painted two coats with "Amercoat".

Within the diversion boxes, the pipe connectors and piping arrangement is similar to those in Building 221, including steel supports, kick plates, templates, impact wrench assembly, etc. Piping from the diversion boxes to the underground tanks and overflow piping between tanks is carried on concrete pads and supported by concrete piers and beams in the backfill area.

Cooling Water Disposal System -

Uphill from the process waste storage facilities is a cooling water disposal system consisting principally of two retention basins of 500,000 gallon capacity each, #241-352 and 353. The 24" cooling water drain installed on haunches along the rear of Building 221 discharges into either retention basin by means of shut-off valves installed to permit change-over from basin to basin and for discharge into open earthen drainage ditches. The cooling water and third floor wastes from Building 271 are connected into this 24" drain mentioned above for Building 221. The process waste from Building 224 is connected into the same 24" drain. The cooling water drain from Building 224 is also connected into the 24" drain. A process drain from Building 224 is connected to a "Gunite" settling tank Eq.Pc. #241-351, buried uphill from the retention basins.

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1. Settling Tank - This tank is the same size and identical to the Catch Tank previously mentioned. The discharge from the settling tank is by means of a manhole into the 24" main cooling water line. Cooling water drains from Buildings 221, 222, 224, 271, and 291 are earthenware to points varying from 5' to 30' away from the building, and are terra cotta pipe thereafter.

2. Retention Basins - These basins are reinforced concrete dyke-shaped, having 10" outside walls supported by 1' x 3'-10" floor pads with 6" spread footings. The remainder of the retention basin bottom is 6" thick.

Observation Wells -

Seven observation wells within a 500' radius, approximately 150' deep, and 8" to 12" in diameter were drilled in each Composite Storage Tank Area and one approximately 300' deep and 8" to 12" in diameter was drilled adjacent to the Settling Tanks in order to detect leakage from the Composite Storage Tanks. These wells were cased with Sch. 40 steel pipe and perforated near the bottom of the wells. Drilling was done by the cable-tool percussion method.

	Dimensions	Volume	Area
Composite Storage Area (Fenced Area)	500' x 500'		
Composite Storage Tank Area (Overall)	300' x 400' x 37')	4,440,000	120,000
	75' x 190' x 37')	527,250	14,250
** Cooling & Retention Area (Fenced Area)	350' x 400'		
Retention Basins (2)	@ 123'-6" x 124'-8" x 7'-1"	227,930	30,138
** Settling Tank Area (Fenced Area)	100' x 100'		
Settling Tank (Overall)	21' O.D. x 28'	9,688	315
	TOTAL	5,204,868 Cubic Ft.	164,703 Sq. Ft.

** Omitted for 241-C

EQUIPMENT

Number	Type	Size - Capacity - Power
12	Composite Storage Tanks	75' I.D. x 16' - 6,300,000 Gals.
4	Composite Storage Tanks	20' I.D. x 24' - 225,000 Gals.
1	Settling Tank	20' I.D. x 15'-3" - 36,000 Gals.
1	Catch Tank	20' I.D. x 14'-10" - 35,000 Gals.
* 1	Catch Tank	9' I.D. x 36' - 17,200 Gals.
2	Retention Basins	@ 118' x 118' x 6'-1" - 500,000 Gals.
4	Diversion Boxes	(See Dimensions)
11	Condensers (Air-Cooled)	3' x 5'-6" - 19'-6" - 50 Finned Tubes

* 241-B Tank Farm only.

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Material	Quantity
Lumber (Framing)	2,500 f.b.m.
Poles (Class 2WRC)	8 - 70 Ft. Long
Steel Tank Linings 1/4" Plate (Subcontractor)	1,405 Tons
Reinforcing Steel (Subcontractor)	62.0 Tons
Reinforcing Mesh (6" x 6" - #8)	41,400 Sq. Ft.
Concrete	2,195 Cu. Yds.
Concrete (Subcontractor)	8,875 Cu. Yds.
*Gunite (Subcontractor)	395 Cu. Yds.
Membrane Waterproofing (Subcontractor)	6,580 Sq. Yds.
Membrane Mesh (Subcontractor)	124,910 Sq. Ft.
Painting	800 Sq. Yds.
Painting (Subcontractor)	6,190 Sq. Yds.
Excavation (Subcontractor)	260,000 Cu. Yds.
Backfill (Subcontractor)	208,250 Cu. Yds.

NOTE: Above quantities are for typical units T, U, & B only.

*Includes Gunite for Membrane Protection, Settling Tanks and Catch Tanks.

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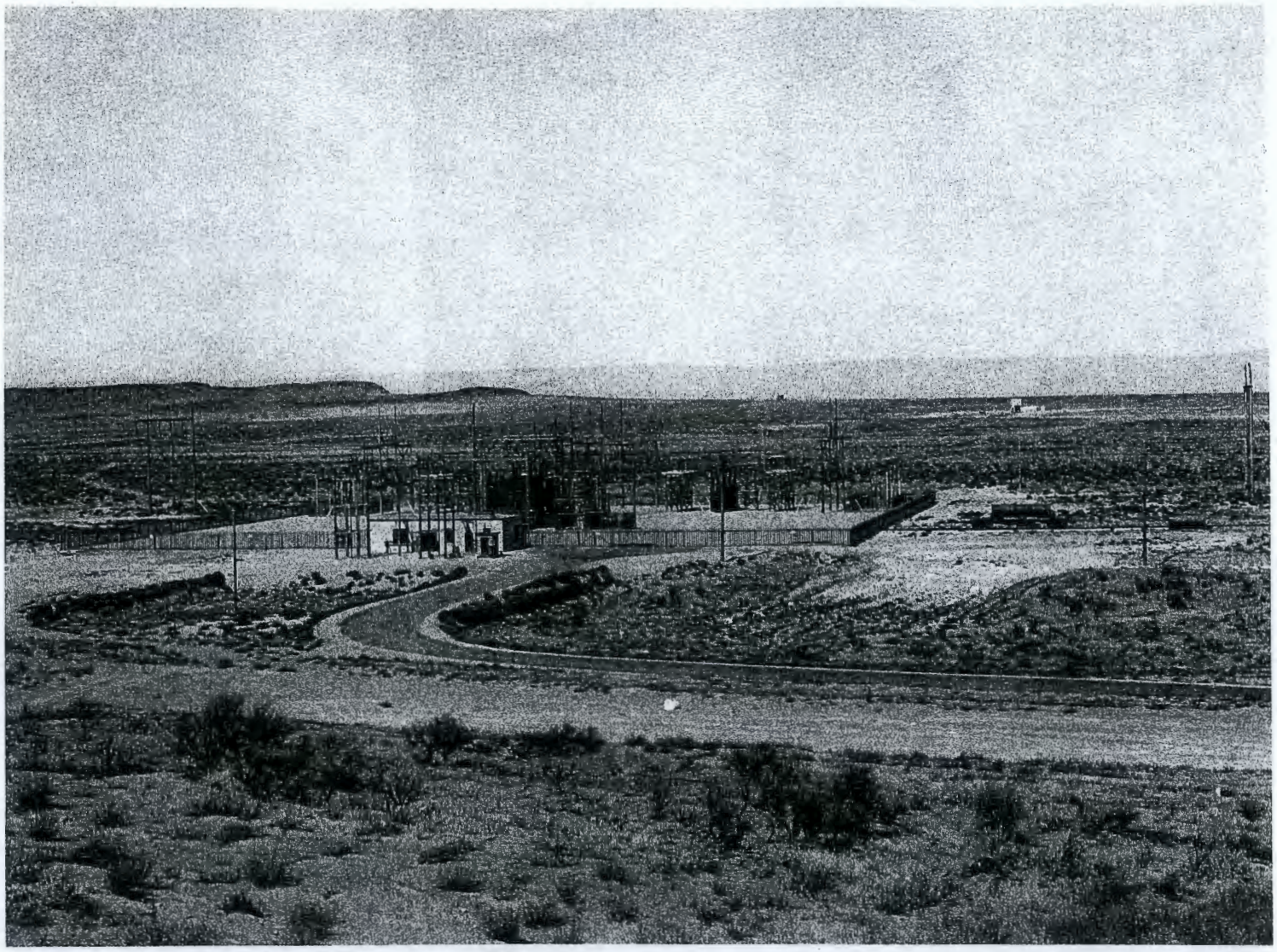

251 - PRIMARY SUBSTATION
Aerial View Looking North

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251 PRIMARY SUBSTATION

One open frame Primary Substation was constructed at a central location in the 200 North Area to provide the 200 East, West, and North Areas with 13.8 KV power. This station is composed of a wood fenced, gravel surfaced area 301' x 330'. A reinforced concrete and concrete block Switch House is located midway on the south fence line.

Fenced Area - This area contains two wood frame bus structures, 230 KV and 13.8 KV, forming a T, with the latter structure running north and south having a 220,000/13,800 Volt main transformer located at the bottom of the T opposite the Switch House. A railroad spur directly serves this area to provide for changing the main transformer in case of an emergency. Underground concrete encased "Kordduct" ducts connect the Switch House with the 230/196 KV Oil Circuit Breakers, the 15 KV Oil Circuit Breakers, Main Transformer and the 13.8 KV north and south Terminal Structures. Two types of foundations were used for all outside equipment - reinforced concrete slab, and reinforced concrete piers with spread footings.

Switch House - The Switch House is essentially a one-story building having a sub-level Cable Pit equipped with a sump pump. All duct lines terminate here. The main floor is comprised of a Switch House with a Fan and Battery Room at the east end. A reinforced concrete slab floor, 1' to 18" thick, served as a foundation for the cable pit and the pit walls 1' thick likewise support the north and west building walls. The east and south building walls are supported by reinforced concrete beams and piers with spread footings. Concrete block walls and concrete brick pilasters support structural steel roof framing overlaid with pre-cast concrete tile covered with built-up felt, gravel surfaced roofing. Floors are reinforced concrete 1' thick over the cable pit, and 6" thick over the backfill section. Partitions are concrete block, 4" thick. Air is discharged into the Switch Room by a wall louvre after having been filtered and pre-heated by an electric unit heater.

	Dimensions	Volume	Area
Switch House (Overall)	24'-4" x 55'-2" x 25'-8"	21,085	1,338
Fenced Area	301' x 330'	--	99,330
	TOTAL	21,085 Cu.Ft.	100,668 Sq.Ft.

This Substation is equipped as follows:

Number	Type	Size - Capacity - Power
1	Transformer	15,000 KVA - 220,000/13,800 V - 60 Cycle - 3 Phase
1	Transformer	20,000 KVA - 220,000/13,800 V - 60 Cycle - 3 Phase
1	Transformer Grounding	13,800 V - 60 Cycle - 3 Phase
1	Oil Circuit Breaker	1,200 AMP - 15 KV - 250,000 KVA
2	Oil Circuit Breakers	800 AMP - 230/196 KV

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EQUIPMENT LIST (Continued)

Number	Type	Size - Capacity - Power
2	Air Break Switches Grounding	196 KV - 1200 AMP.
1	Air Break Switch	196 KV - 1200 AMP.

Switch House

1 Set	Switch Gear

Material	Quantity
Fence Lumber	16,000 f.b.m.
Structural Steel	5.32 Tons
Reinforcing Steel	13.25 Tons
Concrete	648 Cu. Yds.
Roofing (Built-up)	14.2 Squares
Concrete Blocks (8" x 8" x 16")	1,885 Blocks
Concrete Blocks (4" x 8" x 16")	775 Blocks
Concrete Bricks	2,000 Bricks
Kerduct - 2" Diameter	2,400 Feet
Kerduct - 3" Diameter	1,350 Feet
Kerduct - 4" Diameter	1,000 Feet
Kerduct - 5" Diameter	1,300 Feet

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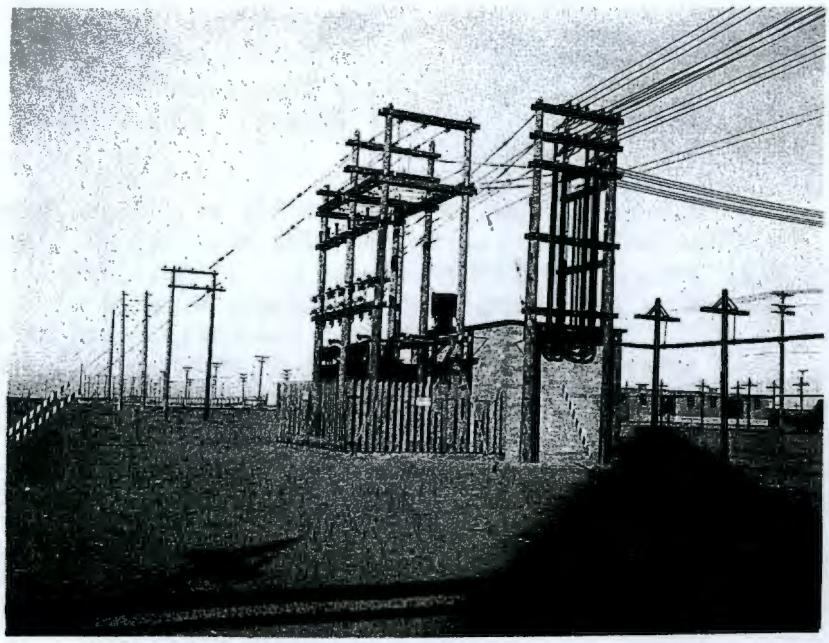
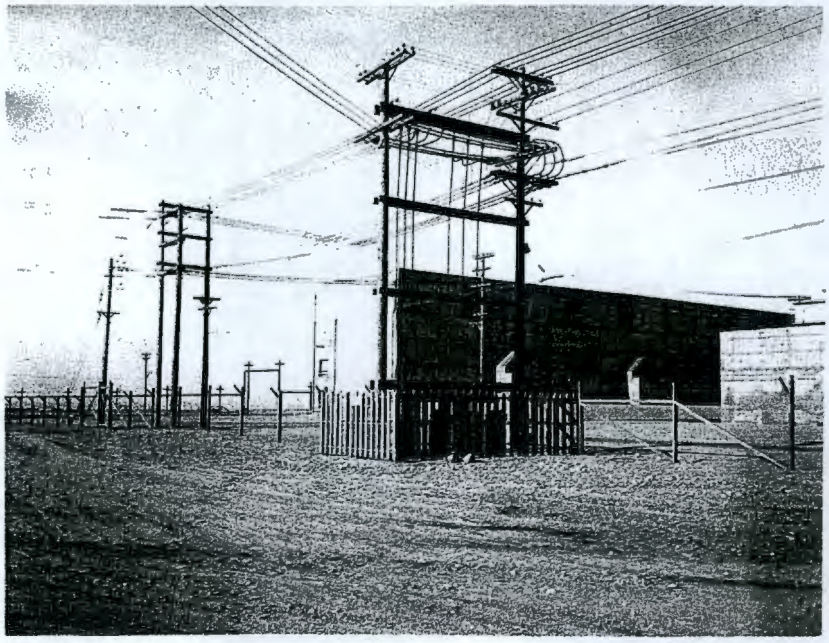


252-W - SECONDARY SUBSTATION
Looking Northeast



353-W - TYPICAL DISTRIBUTION SUBSTATION

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252 SECONDARY SUBSTATION

One open frame Secondary Substation was erected just east of the 212-R Building in the North Area, to supply Plants N, P, R, and J & K with 2300 Volt power.

The Substation is a four-pole, wood frame structure with the lower portion supporting a bus over the 13.8/2.3 KV transformer with the upper half supporting four pole-type oil circuit breaks, disconnect switches, lightning arrestors, fuse mountings, etc. A 5' x 24' wood frame elevated catwalk provides access to the oil circuit breakers. A 3'-6" x 6'-4" x 2'-0" concrete pad supports the transformer. The entire structure is surrounded by a 20' x 23' x 7' wood picket fence.

	Dimensions	Volume	Area
Overall	20'-0" x 23'-0" x 38'-6"	17,710 Cu.Ft.	460 Sq.Ft.

EQUIPMENT LIST

Number	Type	Size - Capacity - Power
1	Transformer	2,000 KVA - 13.8/2.3 KV - 3 Phase

Material	Quantity
Lumber	1,000 f.b.m.
Concrete	1.7 Cu.Yds.

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252 SECONDARY SUBSTATION

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Two frame, partially open Secondary Substations with attached concrete and concrete block switch houses were constructed. One provides the 200 East Area and the other the 200 West Area with 2300 volt power. Both are located in respective Power Areas as follows: 252-E is north of the 283-E Filter Plant, and 252-W is east of the 283-W Filter Plant.

Fenced Area: The outside area is enclosed by a 7' picket fence and contains a six-pole, wood frame, bus structure over the two main 13.8/2.3 KV transformers supported by separate 4' x 7' x 3' concrete pads. This structure also supports two small, low-voltage transformers providing 240/120 V power for the transformer fans.

Switch House: This building houses 2300 V switchgear and test rack equipment. The walls are supported by a 1' thick concrete floor slab haunched around the perimeter for additional strength. Walls are concrete block 8" thick. Roof consists of pre-cast concrete tile, supported by steel roof framing, and covered with built-up felt, gravel surfaced roofing. A 24" A.C.M. roof ventilator provides ventilation. This building has one single and one double door, but no windows.

	Dimensions	Volume	Area
Overall	27'-4" x 34'-0" x 35'-7"	24,600 Cu. Ft.	930 Sq. Ft.

Equipment

Number	Type	Size - Capacity - Power
2	Transformers	3125 KVA - 13.8/2.3 KV - 3 P
1 Set	Switchgear	2300 V

Material	Quantity
Lumber	1,000 f.b.m.
Structural Steel	.62 Tons
Concrete	40 Cu. Yds.
Roofing (Built-up)	4.63 Squares
Concrete Block (8" x 8" x 16")	1,175 Blocks

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253 & 653 DISTRIBUTING SUBSTATIONS

A total of 40 Distributing Substations have been provided in the 200 and 600 Areas - thirteen in 200-E, twenty-one in 200-W, four in 200-N, one at Riverland Yards, and one in the vicinity of the Meteorological Tower. These Substations are of similar design and construction differing only in the number and size of transformers in each bank. The 253 Substations all have primary voltages of 2.4 KV with secondary voltages ranging from 120 V to 140 V for lighting and 240 V to 280 V for heating and power. All lighting transformers are single phase and most of the power transformers are likewise single phase except the transformer installations at the 221, 622, and the 6707, which are three phase.

These Substations are of open frame construction using wooden pole structures surrounded by picket fences. Two types of installations were used; ground installation with transformers resting on a concrete pad, and elevated installations with the transformers resting on an elevated wooden platform suspended between two poles. Installations of the latter type were made at the 213, 241, 291, and 622 Buildings.

On the following page is a tabulation of the 253 and 653 Distributing Substations giving their locations, the primary - secondary voltages, phase, number of transformers, and the KVA capacity of each transformer. All other transformer installations in the 200 and 600 Areas for lighting, heating, and power are either charged directly to the building it serves or to 2503 & 6503 Outside Overhead Electric Lines.

Material	Quantity
Concrete	53 Cu. Yds.

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253 & 653 DISTRIBUTING SUBSTATIONS

Number of Substations	Adjacent to Bldg. No.	AREA 200-E	200-W	200-N	600	Voltage Primary	Secondary	Phase	No. of Trans.	KVA Capacity Each Trans.
3	212 M, P, R			x		(2400 V	120/240 V	1	1	10
						(2400 V	240/480 V	1	3	150
1	213 J & K			x		2400 V	120/240 V	1	1	25
15	221 T, U, & B	x	x			(2400 V	120/240 V	1	1	100
						(2400 V	240/480 V	3	3	300
						(2400 V	120/240 V	1	1	37½
						(2400 V	240/480 V	3	1	300
						2400 V	240/480 V	3	1	300
						(2400 V	120/240 V	1	1	15
						(2400 V	120/240 V	1	1	37½
						(2400 V	120/240 V	1	1	15
						(2400 V	120/240 V	1	1	37½
3	224 T, U, & B	x	x			(2400 V	120/240 V	1	1	75
						(2400 V	240/480 V	1	1	100
1	231-W		x			(2400 V	120/240 V	1	1	100
						(2400 V	240/480 V	1	3	100
4	241 T, U, B, & C	x	x			2400 V	240/480 V	1	2	5
2	272 E & W	x	x			(2400 V	120/240 V	1	1	75
						(2400 V	240/480 V	1	3	100
2	272 E & W	x	x			(2400 V	120/240 V		1	37½
						(2400 V	240/480 V	1	3	100
2	285 E & W	x	x			(2400 V	240/480 V	1	3	25
						(2400 V	120/240 V	1	2	37½
3	291 T, U, & B	x	x			(2400 V	120/240 V	1	1	50
						(2400 V	240/480 V	1	3	37½
2	2720 E & W	x	x			(2400 V	120/240 V	1	1	25
						(2400 V	120/240 V	1	3	75
1	622				x	2400 V	*120/240 V	3	1	50
1	6707				x	2400 V	220 V	3	3	100

* Lighting and Power

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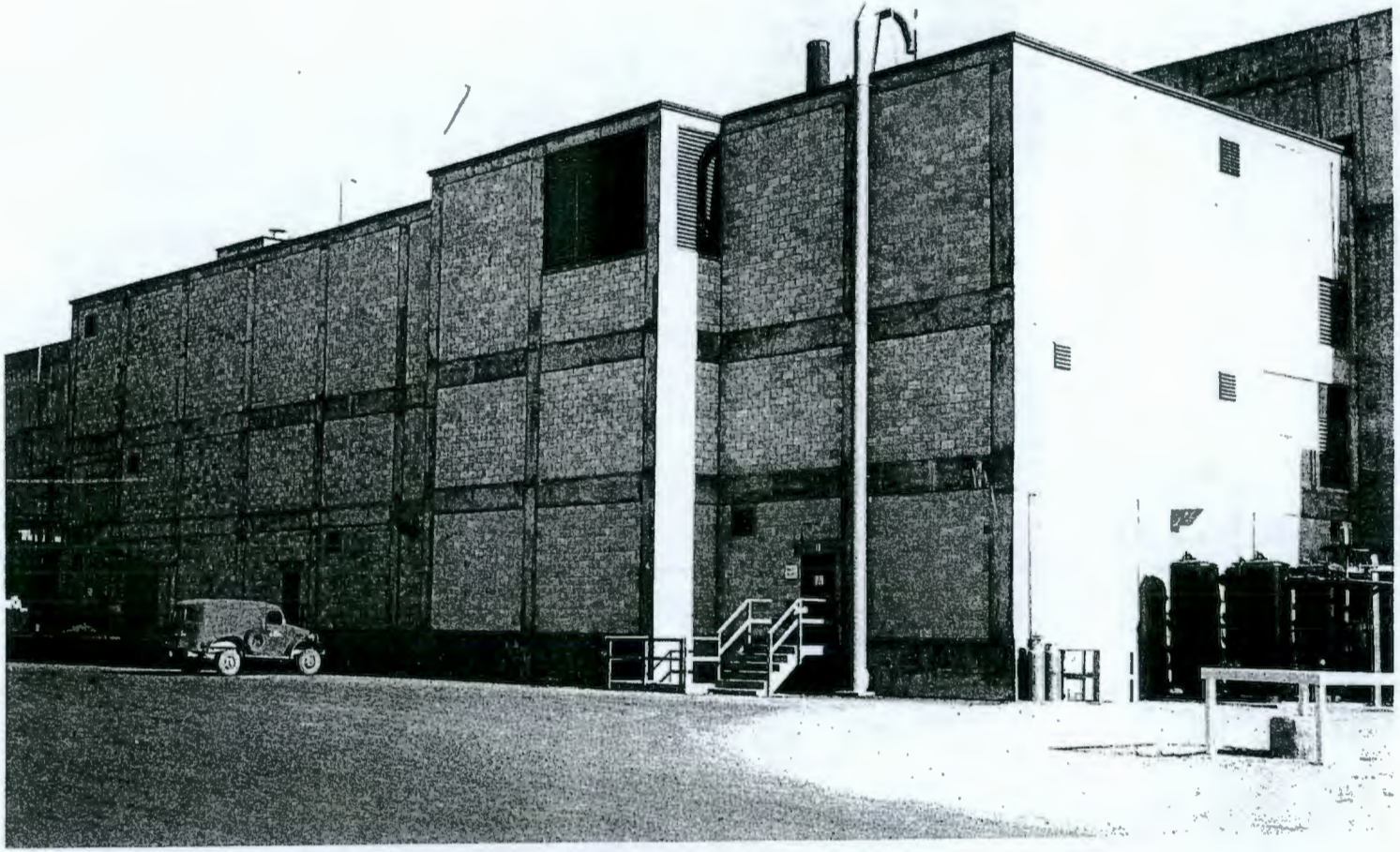

271-T - CHEMICAL PREPARATION & SERVICE BLDG.
Looking Northeast

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271 CHEMICAL PREPARATION AND SERVICE BUILDINGS

T, U, & B

A four-story reinforced concrete frame structure with concrete block exterior and interior walls is attached approximately midway to the back side of each 221 Cell Building, and houses such service items as Chemical Preparation with Laboratory, Offices, Communication Center, Change Room Facilities, Medical Examination Laboratory, Small Shops, Air Treatment, and Compressed Air Supply. Each building contains a total of 44 rooms, not including two stair towers, two pipe shafts, two air shafts, one elevator shaft, three vestibules, two janitor's closets, and seven corridors, in order to accommodate these services.

The buildings are constructed independently of Buildings 221, but they abut the side of the building adjacent to Sections 10, 11, 12, and 13. The first floor is 4' above grade with two concrete loading platforms, one adjacent to the railroad spur and the other at right angles for handling Chemicals to and from railroad cars and trucks. A freight elevator, 8000# capacity, is located at the end of the building adjacent to the railroad spur and serves all four floors and permits passage of small items of equipment to Building 221.

An air intake and air supply shaft, four-stories high, is attached to the front side of each building adjacent to the Fan Room. The air supply shaft is lined with 2" cork insulation and the air intake shaft is equipped with louvres at the top of the shaft.

Building foundation and basement walls are a combination of reinforced concrete piers and walls with spread footings. Floor slabs are reinforced concrete varying from 4" to 12" in thickness and are covered with Mastic Tile only in the Toilet Rooms, Chemical Laboratory, Battery Room and Mezzanine floor. Roofs are reinforced concrete slab varying from 4" to 6" in thickness and are covered with built-up felt, gravel surfaced roofing. The penthouse section for the elevator shaft and No. 1 stair tower extends above the main roof section.

<u>Basement Floor</u> - At the left hand end of the basement floor is a large storage room for supplies in addition to two large solution tanks which are supported from the floor and project upward to an opening in the first floor. Two pumps are located nearby for distributing solution from these tanks. The back and middle front side of the basement contains an Instrument Repair Room, Shop, Tool Crib, and Office. At the right-hand outside corner of the basement is located a Compressor Room which supplies compressed air, both process and instrument, to the 211, 221, 222, 224, 271, and 291 Buildings. Four air receivers are located just outside the right-hand end of the building. On the front side of the building, a pit is arranged to permit movement of large pieces of equipment into or out of the basement. A Fan Room is located between the Compressor Room and the Shop which, in addition to supplying air for this building, also directs an air supply to the basement gallery of Building 221. A small Electrical Control Room is located back of the #2 stair tower and houses controls for the Fan and Compressor Rooms.

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First Floor - At the left-hand end of the first floor is a large room for storage of solid and liquid chemicals in crates and dissolving facilities previously mentioned in connection with the basement. A pipe shaft is located to the rear of the two dissolving tanks to permit ready access to all piping between floors and Building 221. A second pipe shaft starts 7' above the first floor at the right end of the building and extends likewise through the third floor. The central portion of the first floor contains two Locker and Wash Rooms, a Shower Room, Toilet Room, Water Heater Room, and Clean Laundry Room. The right-hand end of this same floor contains a Doctor's Office, Medical Laboratory, Waiting Room, two Toilet Rooms and a Battery Room.

Second Floor - This floor contains eight offices, a File Room and Fire Resistant Vault, a Dispatcher Room with two small adjacent communication rooms, a Lunch Room, two Toilet Rooms, and two Heater Rooms located between the stair towers and Building 221. The Heater Rooms supply filtered and tempered air to the second floor gallery of Building 221. In one of the small communication rooms is installed a 100-circuit switchboard and equipment for handling an independent inter-communication system serving Buildings 211, 221, 22, and 224. The second room contains communication, signal and control equipment for door inter-locks.

Third Floor - The top floor consists mainly of a chemical preparation room containing a number of 25-12-S-Cb weighing, mixing, storage tanks, and distributing pumps several of which are located on a concrete mezzanine floor 10' above the third floor level. For this work a Chemical Control Laboratory is provided. Two Heater Rooms are also provided behind the stair towers similar to the second floor arrangement. Two labyrinthed access ways to the crane-cab runways of Building 221 are provided. The #1 stair tower provides access to the roof. A portion of the roof has been designed to support a 10,000-gallon tank for demineralized water in the event that it becomes necessary to use it for process.

	Dimensions	Volume	Area
Building Overall	58' x 170' x 67'-10"	496,792 Cu.Ft.	9,280 Sq.Ft.

These buildings house the following equipment:

Number	Type	Size - Capacity - Power
1	Tank (18-8-S-Cb)	2'-3" x 5'
1	Tank Scale - Dial Type	2000# Toledo
2	Tanks (25-12-S-Cb)	5'-6" x 5'
1	Tank (18-8-S-Cb)	5'-6" x 5'
1	Tank (18-8-S-Cb)	2'-3" x 5'
1	Tank Scale - Dial Type	2000# Toledo
1	Steel Tank and Lead Lined Pan	400 Gals.
1	Tank Scale	6000# Toledo
6	Tanks (18-8-S-Cb)	5' x 4'-6" - 500 Gals.
2	Tanks (25-12-S-Cb)	5' x 4'-6" - 500 Gals.
2	Tanks (18-8-S-Cb)	2'-9" x 3' - 100 Gals.

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EQUIPMENT LIST (Continued)

Number	Type	Size - Capacity - Power
2	Mix Tanks (25-12-S-Cb), Agitators and Motoreducers	500 Gals. - 1/2 HP - 440 V.
1	Mix Tank (18-8-S-Cb), Agitator and Motoreducers	500 Gals. - 1/2 HP - 440 V.
1	Mix Tank (18-8-S-Cb), Agitator	100 Gals. - 1/3 HP - 110 V.
1	Carbon Steel Mix Tank, Agitator and Motoreducers	2500 Gals. - 2 HP - 440 V.
1	Distributing Pump (for above tank)	50 GPM - 7½ HP - 440 V.
1	Mix Tank (18-8-S-Cb), Agitator and Motoreducer	1000 Gals. - 1 HP - 440 V.
1	Distributing Pump (for above tank)	50 GPM - 7½ HP - 440 V.
2	Air Compressors & After Cooler	300 CFM - 110# - 60 HP - 440 V.
1	Air Compressor & After Cooler	650 CFM - 125 HP - 440 V.
4	Air Receivers	3'-6" x 9" - 110#
1	Elevator	7' x 7' Car - 40'-6" Travel - 8000# - 440 V.
1	Supply Fan	8000 CFM - 60 HP - 440 V.
4 Sec.	Pre-heater	4' x 9' x 1' - 24 Tube Face
4 Sec.	Re-heater	4' x 9' x 1' - 24 Tube Face
1	Washer (Humidifier)	84,000 CFM
1	Pump (for above equipment)	183 GPM - 7½ HP - 440 V.

Material	Quantity
Lumber (trim, platform & finish)	3,000 f.b.m.
Reinforcing Steel	111 Tons
Reinforcing Mesh - #9	4,200 Sq. Ft.
Concrete	1,910 Cu.Yds.
Concrete Blocks (8" x 8" x 16")	18,256 Blocks
(4" x 8" x 16")	13, 837 Blocks
Concrete Bricks (2" x 4" x 8")	3,000 Bricks
Roofing (Built-up)	81.34 Squares
Flooring (Asphalt Tile)	1,076 Sq. Ft.

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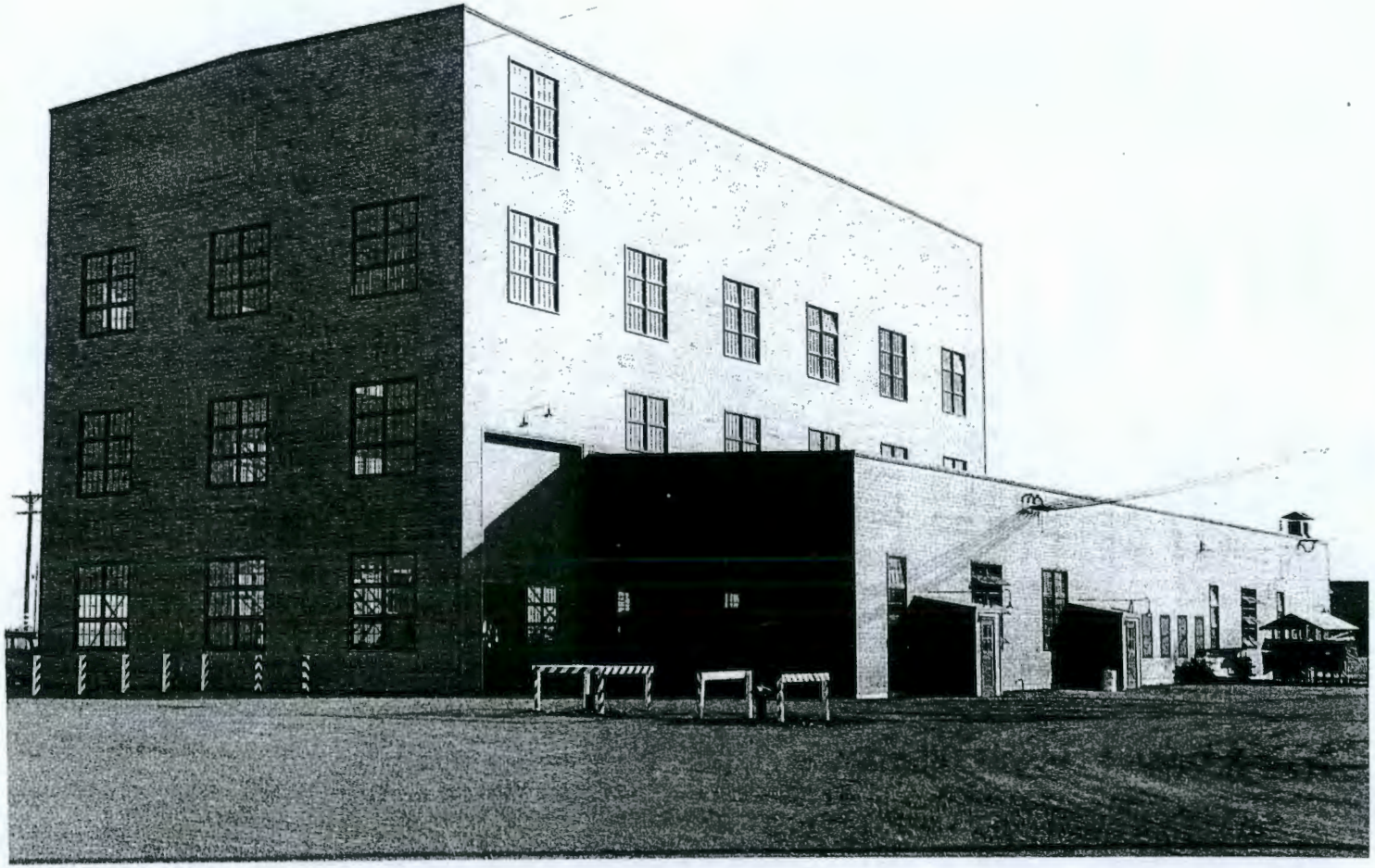

272-W - A R E A S H O P
Looking Southeast

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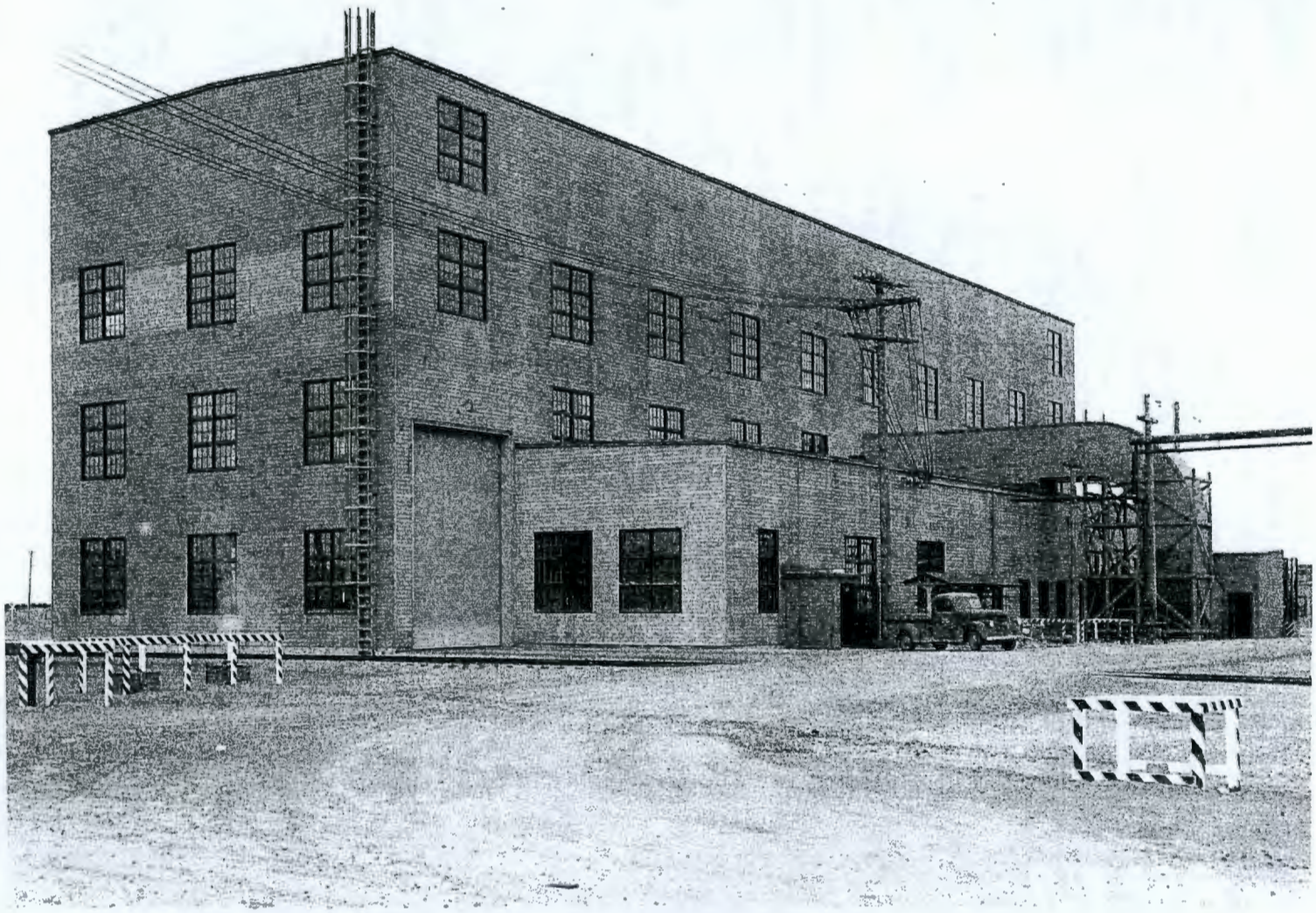

272-E AREA SHOP
Looking Northwest

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272 AREA SHOPS

An Area Shop was constructed in each of the 200 East and West Service Areas adjacent to the other maintenance buildings and facilities, and was especially equipped for assembling and fitting-up the operating equipment for the Cells in Building 221. The architectural features of these buildings and facilities are similar. Building 272-E houses a Machine Shop with lathes, milling machines, shapers, shears, punches, drills, grinders, etc.; Electrical Shop with a special drying oven; Pipe Shop with pipe cutting and threading equipment and special facing machine for truing-up flanges after heat treating; Forge and Welding Shop; Carpenter Shop with saws, band saw, jointer, etc.; Tool Room with Crib; six Offices; and a Toilet Room. Building 272-W contains in addition a Sheet Metal Shop with shear rolls, crimper, break, etc.; and a Sand Blasting Room.

The main structure of both buildings consists of a four-story structural steel frame. A one-story frame truss supported lean-to is attached to one side. Building 272-E contains ten bays with the high structural steel frame portion extending the full length of the structure. In Building 272-W, the high portion extends only six bays with the balance of the building a one-story wood frame lean-to of typical post and girder construction. Building foundations are reinforced concrete piers with spread footing and a combination of reinforced concrete piers with spread footing having 9" concrete curtain walls between piers. Both buildings are covered with 1" T & G sheathing and 1", pattern 105, drop-siding with building paper insulation between, fastened to the structural steel frame portion by wood purlins bolted to clips extending from the framework. Roofs are decked with 2" T & G sheathing covered with built-up felt roofing. Each building contains eight 42" and two 18" A.C.M. ventilators with motors. Partitions for the Tool Room, Offices, Electrical Shop, and Toilet Room are 1/4" "Masonite" and the Forge Shop and San Blasting Room are lined with 1/4" "Transite" board. The Tool Room, Offices, Sand Blasting Room, and Electrical Shop are ceiled with 3/8" "Gypsum" board. Building 272-E contains 83 single and double frame, double and triple hung windows; 5 outside pedestrian single and double doors; 3 overhead roller railroad doors and 1 sliding freight door. Building 272-E contains 69 single and double frame, double and triple hung windows; 5 outside pedestrian single and double doors; 2 overhead roller railroad doors; and 3 freight doors, sliding and double swing.

The south end of Building 272-E and the north end of Building 272-W is served by a railroad spur extending through the building in order to facilitate the handling of large tanks and heavy equipment to and from railroad cars. A furnace car track also runs from the north end of Building 272-E to the 273-E Heat Treating Furnace.

The high portion of Building 272-E is equipped with two 10-ton overhead bridge cranes 49' above the ground floor level, and Building 272-W is equipped with one such crane. The space underneath the cranes is fitted with three sets of steel framework simulating the arrangement of piping connections within the Cells of Building 221. These dummy cells are oriented with respect to the crane and cab in a manner identical to the actual cells in Building 221. Platform space has been arranged on two levels above the

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floor to facilitate fitting-up work. The dummy cells are consequently designed with the same slope of floor, height of wall connections from the floor, and spacing dimensions of connectors and of equipment guides. Air, Steam, Water and Electrical facilities are arranged at each cell for the purpose of testing equipment.

	Dimensions	Volume	Area
272-E Building (Overall)	85'-5" x 201'-9" x 68'-6"	907,509 Cu.Ft.	16,111 Sq.Ft.
272-W Building (Overall)	85'-5" x 201'-9" x 68'-6"	718,276 Cu.Ft.	16,651 Sq.Ft.

EQUIPMENT LIST

272-E Bldg. Number	272-W Bldg. Number	Type	Size - Capacity - Power
2	1	Overhead Bridge Crane	10-ton - 50' Span - 30, 10, 1, 3/4, and 1/2 HP - 440 V.
2	2	Hoist Overhead Traveling (for the above Crane)	1000# - 3/4 & 1/2 HP - 440 V.
-	2	Engine Lathes	16" - 12" Centers - 7½ HP - 440 V.
1	1	Threading Machine	4" - 1-1/2 HP - 440 V.
-	-	Shaper	10" - 3 HP - 440 V.
1	2	Shaper	20" - 5 HP - 440 V.
1	-	Flange Facing Unit	2 & 5 HP - 440 V.
1	1	Forge	5' x 5' x 4' - 1/15 HP - 110 V.
-	1	Grindstone	30" - 1/2 HP - 110 V.
-	1	Hand Planer & Joiner	12" Yates - 5 HP - 440 V.
1	1	Air Compressor	230 C.F.M. - 50 HP - 440 V.
1	1	Air Receiver	30" x 7' - 125#
1	1	Bench Lathe	12" - 1/2 HP - 440 V.
4	2	Drill Presses	20" - 2 HP - 440 V.
2	4	Bench Drills	12" - 1/3 HP - 110 V.
2	2	Double Pedestal Grinders	2 - 12" Wheels - 2 & 1 HP - 440 V.
-	2	Lathes	1 - 12" and 1 - 14" - 3 HP - 440 V.
1	1	Power Hack Saw	9" x 9" - 1 HP - 440 V.
1	1	Arbor Press	Hand-operated
1	1	Milling Machine	#2-A Universal - 5 HP - 440 V.
-	1	Miller	#4-H Universal - 10 HP - 440 V.
-	1	Squaring Shear	8' - 3 HP - 440 V.
-	1	Precision Grinder	28" - 3 HP - 440 V.
-	1	Bar Folder	Hand-operated
-	1	Hand Roll	Hand-operated
-	1	Bending Brake	Hand-operated
-	1	Engine Lathe	25/50" - 15 HP - 440 V.
1	1	Radial Drill	4' - 2 HP - 440 V.

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EQUIPMENT LIST (Continued)

272-E Bldg. Number	272-W Bldg. Number	Type	Size - Capacity - Power
1	1	Pipe Machine	8" - 3 HP - 440 V.
1	1	Pipe Machine	1/4" to 2" - 1/2 HP - 110 V.
-	1	Bending Table	5' x 5'
-	1	Hydraulic Press	150 Ton - 3 HP - 440 V.
-	1	Band Saw	36" - 3 HP - 440 V.
-	1	Cut-Off Saw	16" - 5 HP - 440 V.
1	-	Drying Oven and Truck	3 HP - 440 V.
-	1	Baking Oven	6' x 6' x 6' - 400°F. - 35 KVA
1	1	Punch and Shear	#1/2 Buffalo - 2 & 3 HP - 440 V.
1	1	Test Pump, Tank & Benches	2 HP - 440 V.
-	1	Beader and Crimper	1/3 HP - 110 V.
-	1	Rip Saw	16" - 5 HP - 440 V.
-	1	Roll Forming Machine	Hand-operated
-	1	Metalizing Spray Facilities	
-	1	Sand Blasting Cabinet & Fan	24" x 14" - 15 HP - 440 V.
1	-	Lathe	18" - 3 HP - 440 V.
1	-	Pump Coolant	1/4 HP - 110 V
-	1	Centrifuge	42" - 40 HP - 440 V.
-	1	Do-All Saw	12" - 2 HP - 440 V.
1	1	Tool Grinder - Pedestal	12" - 2 HP - 440 V.
-	1	Heat Treating Furnace	110 V.
-	1	Power Hammer	250# - 7½ HP - 440 V.
-	1	Contour Machine	1/2 & 1/4 HP - 200 V.
-	1	Lathe	27" x 96" - 15 HP - 440 V.
-	2	Lathes	14" x 18" - 3 HP - 440 V.
-	1	Engine Lathe	10" - 3/4 HP - 440 V.

Material	272-E Building	272-W Building
Lumber (Framing)	68,000 f.b.m.	80,000 f.b.m.
Lumber (Sheathing & Decking)	71,700 f.b.m.	82,100 f.b.m.
Lumber (Siding)	28,000 f.b.m.	24,000 f.b.m.
*Lumber (Flooring)	8,000 f.b.m.	5,000 f.b.m.
**Structural Steel	229 Tons	139 Tons
Reinforcing Steel	14.3 Tons	14.3 Tons
Reinforcing Mesh (6 x 6 - #9)	15,028 Sq. Ft.	15,028 Sq. Ft.
Reinforcing Mesh (6 x 6 - #8)	5,680 Sq. Ft.	5,680 Sq. Ft.
Concrete	761 Cu. Yds.	739 Cu. Yds.
Roofing (Built-up)	225.53 Squares	230.93 Squares
Transite Board - 1/4"	770 Sq. Ft.	770 Sq. Ft.
Gypsum Board - 3/8"	1,300 Sq. Ft.	2,050 Sq. Ft.
Masonite - 1/4"	3,200 Sq. Ft.	3,700 Sq. Ft.

* Walkways around Cells.
** Does not include Structural Steel for dummy Cells.

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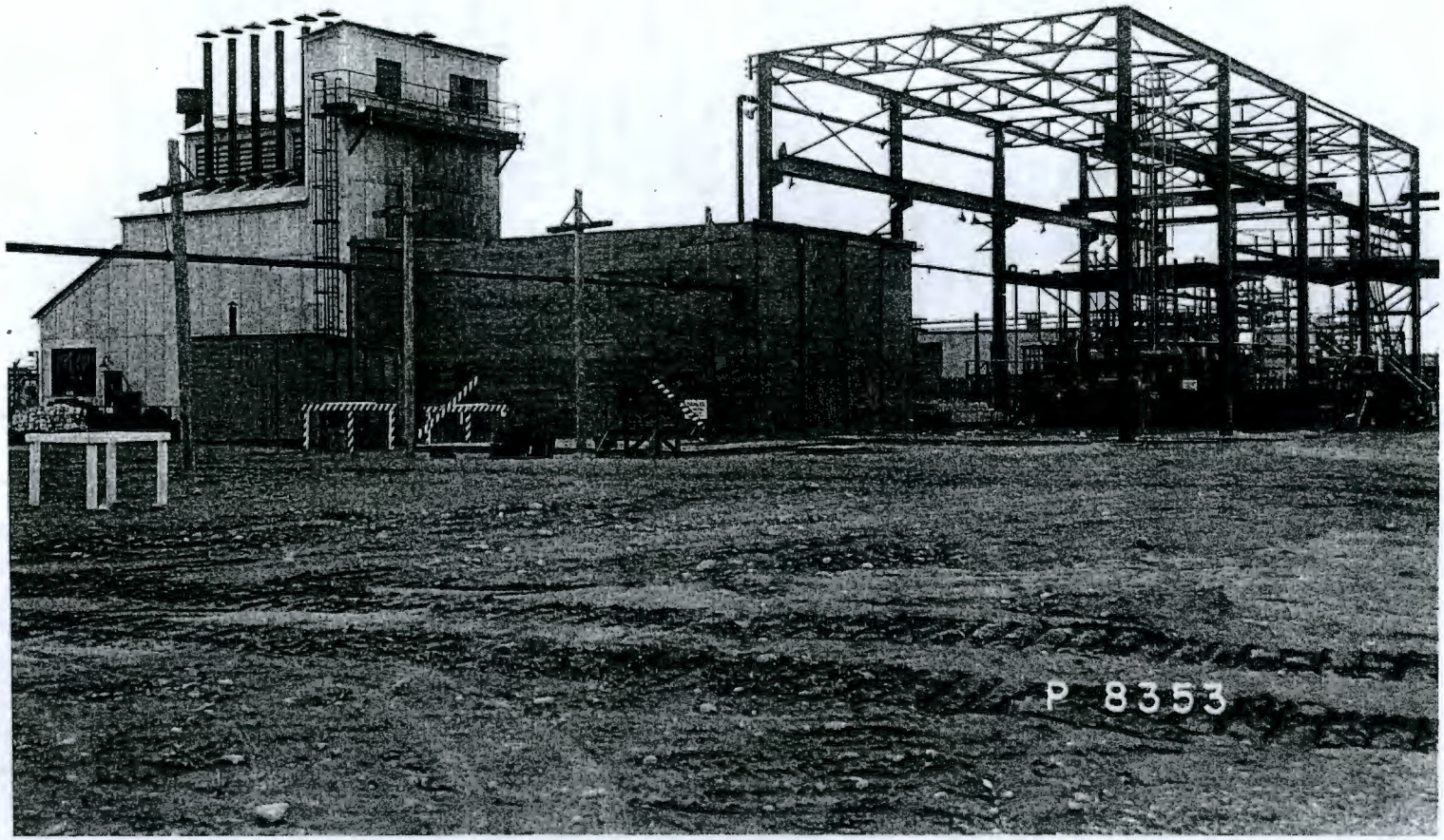

273-E HEAT TREATING FURNACE
Looking West

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273 HEAT TREATING FURNACE

One Heat Treating Furnace with necessary facilities was constructed in the 200 East Area adjacent to Building 272-E, the Area Shop, for the purpose of heat treating and pickling 25-12-S-Cb piping and equipment. The excessive corrosion met with in the process requires all items of process equipment to be fabricated of 25-12-S-Cb, which in turn must be heat treated in accordance with Specifications 819-R-1. Since a considerable amount of fit-up work and some fabrication would be required in the field by both maintenance and construction, it was considered advisable to provide adequate heat treating facilities at the plant site.

Heat Treating Furnace - This furnace was purchased from and erected by the Tate-Jones Company under purchase order RPG 170½ on foundations furnished by du Pont. The maximum inside dimensions of the furnace are 13'-1" x 25'-1½" x 15'-10" high which handles a 12 x 24' wide gauge rail car. It has a single overhead sliding door facing Building 272. Some of the features of this furnace are: three zone control, eight pound recorders with thermocouple heads in the furnace walls and others extending up through the bottom of the car, dual oil pumps, constant pressure blower with a safety oil cut-off switch, 24 dual fuel oil burners, and a car-puller to the rear of the furnace door.

The furnace and heat control equipment is housed in a structural steel frame building covered with corrugated asbestos siding and roofing. This building is oriented east and west with a transfer track running directly from the furnace building to Building 272-E. The Furnace Building has a gabled roof with louvred ventilator running the entire length of the ridge and has a lean-to Control and Equipment Room attached to the east end of the building. An enclosed door shaft section is attached to the opposite end of the structure housing the overhead sliding furnace door. Six sheet metal furnace stacks extend 2' above the high point of the roof in the furnace section for draft purposes and the Control and Equipment Room is provided with a 24" A.C.M. roof ventilator. Access catwalks run along the sides of the furnace and across the upper face of the door shaft section. This building contains two windows in the control room and four doors for pedestrians.

Building foundations are a combination of reinforced concrete piers with spread footings and concrete curtain walls. The ground floor is a reinforced concrete slab varying from 4" to 18" in thickness.

Quenching Station - Water spray quenching facilities supported by an overhead steel framework are located approximately 15' from the door of the Furnace Room. This spray utilizes 1,200 GPM and can be turned on prior to the removal of the car from the furnace house or after the car is in place.

Transfer, Pickling and Wash Area - A transfer track is located southwest of the Quenching Station to permit switching of cars to and from the Spray Quench, Building 272-E, and the Pickling Tank.

Pickling facilities consist of a reinforced concrete tank, carbon and acidproof brick lined, 13'-10" wide by 23'-11" long with an average depth

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of 13'-9". The top of the tank is 4'-5" above grade. This tank is equipped with two 25-12-S-Cb steam heating coils and a steam jet syphon for emptying and for adding heated water, HNO_3, HF, and NaOH. Beside the Pickling Tank is a concrete paved surface provided with hose connections and drains for cleaning equipment after pickling. An overhead hand-operated bridge crane supported by a steel framework serves the Wash Area, Pickling Tank, Transfer Truck, and a portion of the track which runs from the Heat Treating Furnace and Spray Quench area to Building 272-E.

Chemical and Oil Storage Tank Farm - South and east of the Wash Area is a car unloading spot and chemical storage tanks as follows: One 10' x 14' 18-8-S-Cb vertical storage tank for HNO_3 with a distributing pump and line to the Pickling Tank; one 8' x 30' horizontal steel storage tank equipped with an expansion tank for HF set on a 60-ton scale and a distributing pump and line to the Pickling Tank; one 9' x 36' horizontal steel storage tank for NaOH, including a heating coil and distributing pump to the Pickling Tank for neutralizing purposes; and one 9' x 36' horizontal steel storage tank for fuel oil with a gravity feed line to the fuel pumps in the furnace building. The latter tank is surrounded by an earth dyke. Wood frame access stairs and walkways are provided for the other storage tanks. The stationary horizontal storage tanks rest on reinforced concrete cradles with spread footings. A separate car unloading pump is provided for each chemical tank adjacent to the car spot.

	Dimensions	Volume	Area
Overall	162' x 225' x 13'-8" to 52'-9"	368,334 Cu.Ft.	13,015 Sq.Ft.

This building houses the following equipment:

Number	Type	Size - Capacity - Power
1	Heat Treating Furnace Car, Pumps, Blowers, etc.	12' x 24' x 12' - 1950° to 2050° F.
1	Overhead Box Crane	6-ton - Hand-operated
1	Transfer Truck	40-ton
1	Pickling Tank	13'-10¼" x 23'-11" x 13'-6½" to 14' (Inside Dimensions)
2	25-12-S-Cb Steam Coils (For the above Tank)	
1	Vertical Storage Tank (18-8-S/S)	10' x 14' - 8,250 Gal. HNO_3
1	Horizontal Storage Tank	9' x 36' - 17,200 Gal. NaOH
2	Heating Coils (For the above Tank)	
1	Horizontal Storage Tank (18-8 S/S)	8' x 30' - 11,300 Gal. HF
1	Expansion Tank (18-8 S/S	3' x 5' - HF
1	Tank Scale	60-ton - Toledo
1	Horizontal Storage Tank	9' x 36' - 17,200 Gal. Fuel Oil
1	Oil Unloading Pump	50 GPM - 2 HP - 440 V.
1	SandBlast Cabinet	30" x 48" - 1 HP - 440 V.
1	Car Unloading Pump	NaOH - 100 GPM - 10 HP - 440 V.
1	Distributing Pump	NaOH - 35 GPM - 7½ HP - 440 V.

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EQUIPMENT LIST (Continued)

Number	Type	Size - Capacity - Power
1	Car Unloading Pump	HNO_3 - 50# - 15' Head - 5 HP - 440 V.
1	Car Unloading Pump	HF - 20 GPM - 1 HP - 440 V.
1	Distributing Pump	HNO_3 - 50# - 15' Head - 5 HP - 440 V.
1	Distributing Pump	HF - 20 GPM - 1 HP - 440 V.

Material	Quantity
Lumber (Framing)	2,500 f.b.m.
*Structural Steel	71.18 Tons
Reinforcing Steel	15.0 Tons
Reinforcing Mesh	1,596 Sq. Ft.
Concrete	451 Cu. Yds.
Roofing (Corr. Asbestos 5/16" Thick)	1,750 Sq. Ft.
Siding (Corr. Asbestos 5/16" Thick)	4,200 Sq. Ft.
Carbon Brick (2½" x 4½" x 8")	10,000 Bricks
Acid-proof Brick (2½" x 4½" x 8")	8,500 Bricks

* Does not include structural steel furnished by Subcontractor.

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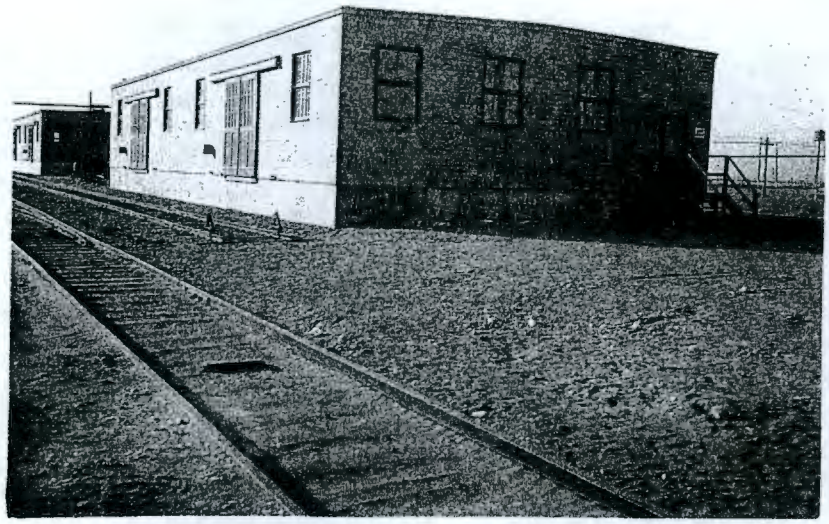

274-W - MACHINERY STOREHOUSE
Looking Northeast

275 - CHEMICAL STOREHOUSE
Looking Southeast

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MACHINERY STOREHOUSES & CHEMICAL STOREHOUSES

274-E & W; 275-E & W

In the service plants for the 200 East and 200 West Areas are located two identical wood frame, shed roof buildings for the storage of extra machinery and chemicals. These buildings are approximately 100' feet apart and lay alongside the same railroad spur. Building foundations are 8" thick reinforced concrete curtain walls with tapered concrete piers supporting the center columns. Floor slabs are reinforced concrete 6" thick and built 4' above grade to facilitate the movement of equipment and supplies to and from railroad cars and trucks.

From the floor upward, the buildings are of wood frame, post and girder construction having 1" T & G sheathing and decking thoughout. Side walls are covered with 1" drop siding with building paper insulation between the siding and sheathing. Roofs containing two 30" x 30" wooden roof ventilators, are sloped two ways and are covered with built-up felt, gravel surfaced roofing. Each building has four 10' x 10' double sliding doors, two single swing pedestrian doors with outside wooden steps and platform, and fourteen single frame, double hung windows.

	Dimensions	Volume	Area
Building Overall	39'-6" x 96' x 20'-7"	78,141 Cu.Ft.	3,792 Sq.Ft.

Material	Quantity
Lumber (Framing)	7,000 f.b.m.
Lumber (Siding)	3,025 f.b.m.
Lumber (Decking)	3,825 f.b.m.
Reinforcing Steel	2.0 Tons
Reinforcing Mesh - #9 & #11	4,400 Sq. Ft.
Concrete	228 Cu. Yds.
Roofing (Built-up)	39.48 Squares

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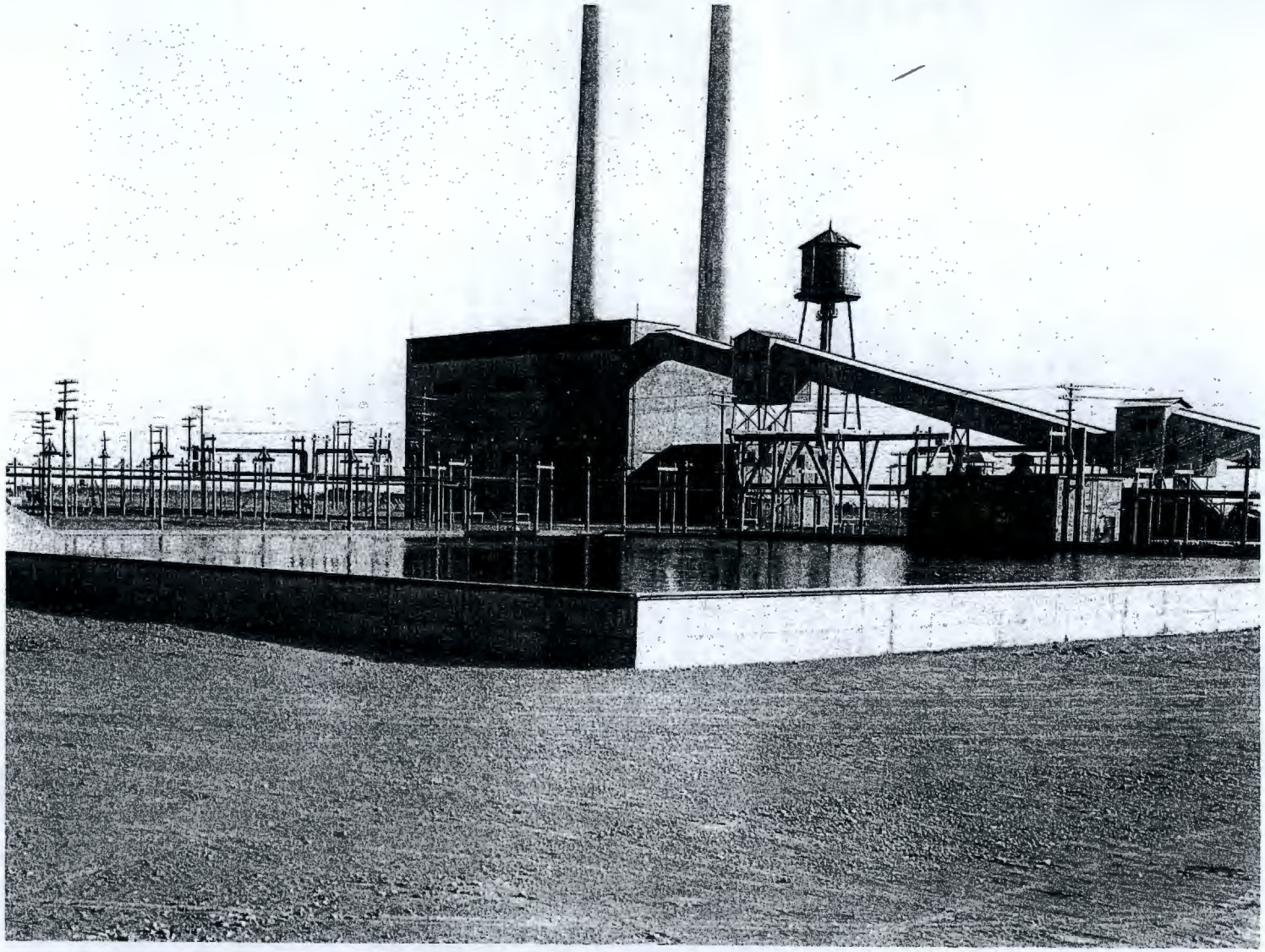

282-W - RESERVOIR AND PUMP HOUSE
Looking Southeast

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282 RESERVOIR & PUMP HOUSE BUILDINGS

In the 200-E and 200-W Power Areas, a Reservoir and Pump House Building is located which furnishes raw water to the Filter Plant Building #283, having a branch line to the Power House Building #284 for an emergency supply, and cooling water supply lines to the Process Areas. Each system consists of an open reservoir with an Inlet Water structure on one side and a Pump House building and a Chlorine Storage structure on the other. The layout of the 282 Building in the 200-E and W Areas is identical except for a 90° difference in orientation between the respective Power Areas. That is, in the East Area, the Inlet House is on the west side of the reservoir and in the West Area it is on the north side of the reservoir.

Inlet House: Water is supplied to the reservoir by the 24" concrete export line which is changed to a 24" steel pipe just outside of the water Inlet House. This building houses a 12" level controlled cone valve which automatically controls the flow from the export line and allows the water to be discharged into a small concrete weir chamber. The construction of the Inlet House is as follows: one-story concrete and concrete block building one-half below grade, 9" reinforced concrete foundation walls with spread footings, flat concrete tile roof covered with built-up felt, gravel surfaced roofing supported by structural steel framing.

Reservoir: The concrete reservoir has inside dimensions of 172' x 172' with a maximum storage depth of 16'-6", capacity 3,000,000 gallons, and is provided with an overflow weir designed for 7,000 GPM. Outside reservoir walls are tapered one side 10" to 12" thick, 6'-9" high and extend 4'-6" above grade. A spread footing pad 4'-6" wide and 1' thick supports the outside walls. From the footing pad to the bottom of the reservoir, the side slopes are 6 on 12 and are of Gunite construction 6" thick. This portion of the work was performed by the National Gunite Contracting Company under subcontract HPG 4335. The side of the reservoir adjacent to the Pump House contains a single compartment pump suction well 5' deep and 5' wide.

Pump House: The Pump House building is a two-story structure having a basement or pump section built entirely below grade adjacent to the reservoir pump section pit previously mentioned. An outside concrete covered basement stairway is provided alongside the building for access to the Pump Room. This section contains three 3,000 GPM, 250' head, raw water pumps, one of which has a steam turbine drive in case of power failures. The concrete block superstructure portion is divided into two rooms - one housing electrical control equipment and the other chlorination equipment. This portion of the structure has a sloped concrete tile roof covered with built-up felt, gravel-surfaced roofing supported by structural steel roof framing. The roof section of the Pump Room opposite the entrance to the Control and Chlorinator Rooms, contains a hatch-covered opening for the removal of pumping equipment, and is served by an overhead wood frame monorail system which extends from the Chlorine Storage structure to the top of the Pump House.

Chlorine Storage Structure: As previously mentioned, a covered pit is provided adjacent to the Pump House for the storage of chlorine cylinders. The pit section is built entirely above grade having a concrete slab floor

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and 8" concrete block walls approximately 3'-6" high with removable asbestos board and wood frame covers. Each pit is capable of storing four 30" x 72" chlorine cylinders.

	Dimensions	Volume	Area
Overall	174' x 205' x 35'-2"	299,286 Cu. Ft.	32,469 Sq.Ft.

This building houses the following equipment:

Number	Type	Size - Capacity - Power
2	Centrifugal Pumps	3000 GPM - 250 HP - 2300 V.
1	Centrifugal Pump	3000 GPM - 225# Steam Turbine
1 Set	2 Cubicle Starters & Switch	250 HP - 2300 V.
1	Air Receiver & Float Chamber	42" x 10' - 105# Air
1	Hyd. Cone Valve	12"
1	Chlorinator & Heater	Wallace Tiernan

Material	Quantity
Lumber (Framing)	1,000 f.b.m.
Structural Steel	5.6 Tons
Reinforcing Steel	47 Tons
Reinforcing Mesh - #9	1,200 Sq. Ft.
Reinforcing Mesh (6 x 6 - #8)	34,600 Sq. Ft.
Concrete	1,715 Cu. Yds.
Concrete Blocks (8" x 8" x 16")	1,450 Blocks
Roofing (Built-up) - SG-1C	4.40 Squares
SM-2GX	2.85 Squares
SG-1T	7.43 Squares
Concrete Roof Tile	664 Sq. Ft.

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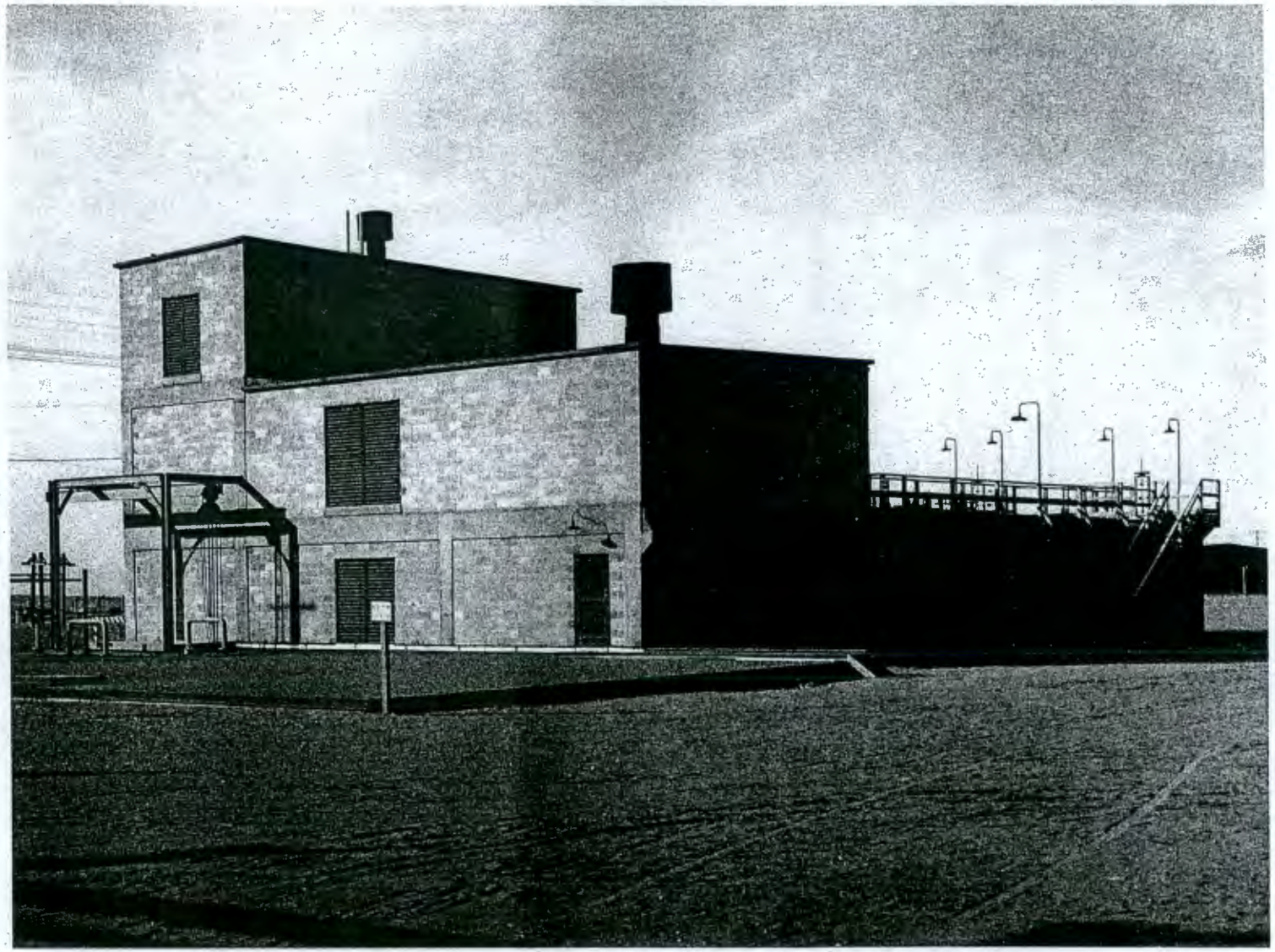

283-W - FILTER PLANT
Looking Northwest

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283 FILTER PLANT BUILDINGS

The 200 East and the 200 West Power Areas each have an identical four-story concrete and structural steel frame building in which all water is filtered except for Process Cooling and raw water for the Power House. Each plant consists of a Head House for Chemical Feeding, Chemical Mixing and Contact Chambers, two Sedimentation Basins, one Clearwell Reservoir and Filtered Water Pump Room. The filter plants are designed so that they can be expanded to three basins and filters if necessary. Building 283-E is oriented east and west and lays due west of Building 284-E. Building 283-W is oriented north and south and lays due north of Building 284-W.

Sedimentation Basins - Contact Chambers - On the front side of the Head House are located two open, reinforced concrete, Settling Basins each having inside dimensions of 17' x 51' with an average storage depth of 12', each totaling 80,000 gallons. Raw water entering the filter plant is controlled by a Bailey Meter Company, filter level recorder-controller, air-operated, connected through a standardizing relay to the 8" diaphragm-operated, double-seated, V-port valve in the 8" raw water line. Each subsidence basin can be drained and flushed out by admitting settled water at the discharge end of the empty basin which will flush out the sludge to the sewer. On the right side of No. 1 Settling Basin and across the front of both basins are constructed Baffle Mixing and Contact Chambers. The Mixing Chamber is designed for a retention period of 20 minutes with a rate of flow of 800 GPM and a Baffle Contact Chamber for each subsidence basin is designed for a retention period of 15 minutes with a rate of flow of 400 GPM. A chlorine solution is applied to the raw water inlet at the rate of 4 ppm by means of two automatic solution feed, visible vacuum Wallace & Tiernan chlorinators which are located adjacently in the Chlorination Room. The foundation for the above structures is a reinforced concrete pad 18" thick having a spread footing. Basin and Chamber walls are likewise reinforced concrete averaging 1' in thickness.

Head House - This portion of the plant is an L-shaped building with the main portion three-stories high and the short section two-stories high. The first story is reinforced concrete frame; the second story is likewise reinforced concrete frame for the Chemical Mixing Room but structural steel frame for the Filter portion; and the third floor is structural steel frame throughout. Roofs for the structural steel portion are concrete tile sloped one way, covered with built-up felt, gravel surfaced roofing. Roofs for the concrete frame portion are flat covered with built-up felt, gravel surfaced roofing and contain one 30" and one 20" A.C.M. roof ventilator with motor. Outside building walls are 8" concrete block and partitions are 4" concrete block. The third floor is used for dry chemical storage and will accommodate a 60-day supply of Alum, Lime and Carbon. Bags and barrels of chemicals are raised from the ground level to the storage floor and transported to the respective bins by means of a 1-ton electric and a 1-ton manually-operated monorail hoist. Steel extension hoppers are provided for each of the two Alum and the two Lime feeders, each hopper having a capacity of 900# sufficient for 24-hour operation. Hoppers are serviced by a gravimetric feeder on the floor below. These feeders are automatically controlled by the raw

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water influent meter. In addition to the Alum and Mixing Feeders, the second floor contains a manually-controlled Carbon Feeder. The first and second floors adjacent to the Settling Basins house two 14' and 16' Roberts Filters rated at 400 GPM each which corresponds to 1.8 GPM per square foot. Each filter can be back-washed at the rate of 4200 GPM by means of a back-wash pump installed below in the ground floor. The filter beds are supported on "Wheeler Bottoms" covered with gravel, sand, and "Anthafilt". The ground floor level contains a sub-level pipe gallery adjacent to the base of the filters and an Office and Laboratory and Chlorine Room at right angles to the filters. This floor is also provided with Toilet and Wash Room.

Clearwell and Pump Room - Along the back side of the Head House is located a sub-level reinforced concrete covered Clearwell Reservoir and Filtered Water Pump Room built entirely below grade. The Clearwell Reservoir has a storage capacity of 200,000 gallons; the Pump Room contains three 600 GPM filtered water pumps and one 600 GPM sanitary and fire pump. The latter pump and one of the filtered water pumps are driven by 55 HP non-condensing steam turbine as insurance against power failures. The Pump Room has been provided with force ventilation and a hatched opening with an overhead monorail for the removal of pumping equipment. The walls for this section of the plant are reinforced concrete 1' thick with spread footings having an 18" wall between the Pump Room and the Clearwell. The floor in the Clearwell is sloped on three sides similar to Building 282 and contains a 5' x 5' suction well adjacent to the Pump Room. The roof is reinforced concrete 4" thick covered with built-up felt, gravel surfaced roofing extending approximately 6" above grade.

	Dimensions	Volume	Area
Overall	75'-3" x 138' x 55'	205,892 Cu. Ft.	8,670 Sq. Ft.

EQUIPMENT LIST

Number	Type	Size - Capacity - Power
2	Filters and Controls (gravity type)	400 GPM
1	Carbon Feeder	1/4 HP - 110 V.
2	Lime Feeders	Ejector Feed
2	Alum Feeders	Ejector Feed
2	Chlorinators	Wallace Tiernan
3	Filtered Water Pumps	600 GPM - (2) 50 HP - 2300 V. (1) 30 HP - 440 V.
1	Filtered Water Pump	600 GPM - Turbine 225# Steam
1	Fire Pump	600 GPM - Turbine 225# Steam
1	Back Wash Pump	4,200 GPM - 75 HP - 2300 V.
1	Air Receiver	12" x 48" - 105#

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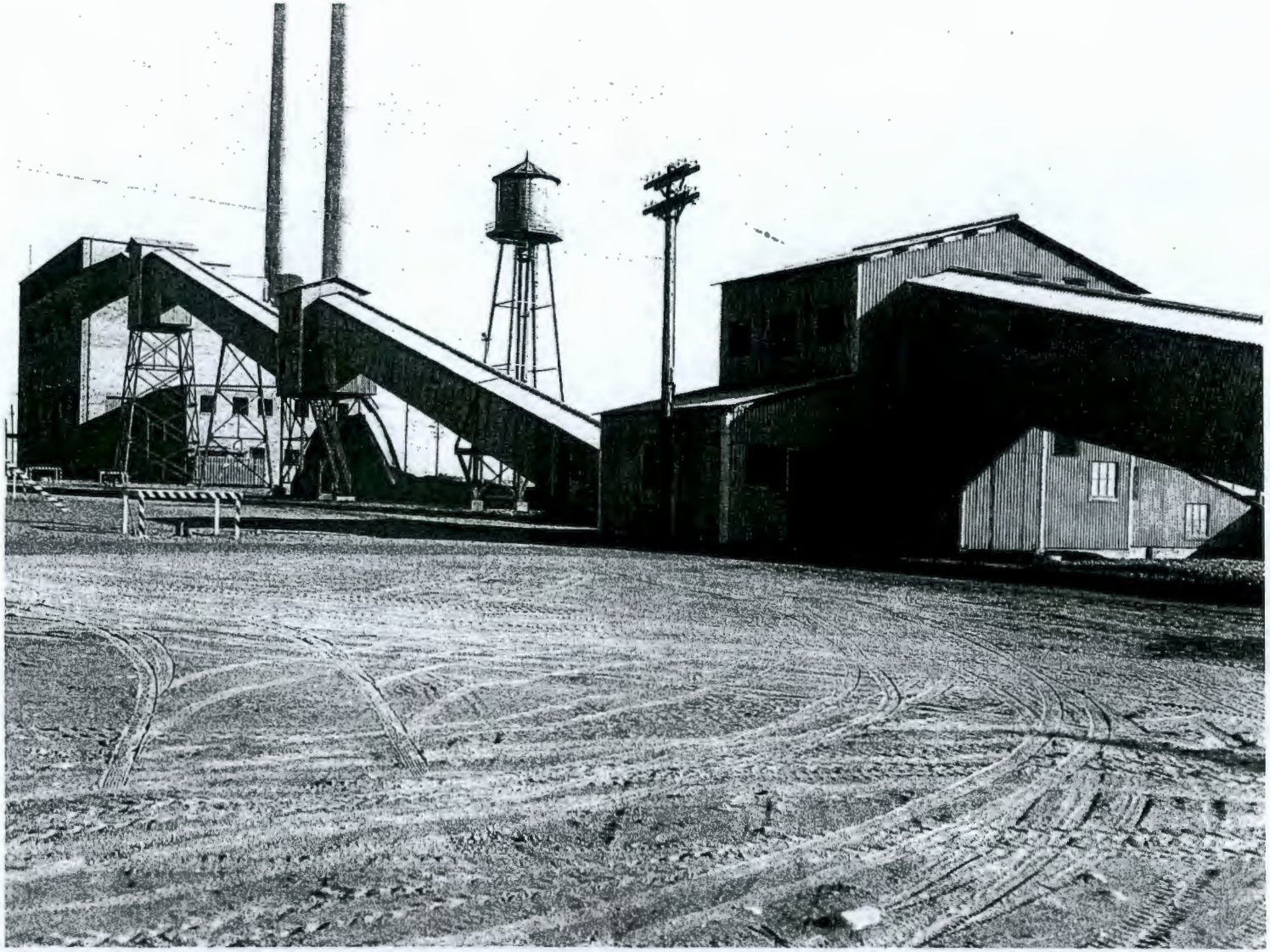
Material	Quantity
Lumber (Framing and Finish)	2,000 f.b.m.
Structural Steel	9.6 Tons
Reinforcing Steel	103 Tons
Reinforcing Mesh - #9	170 Sq. Ft.
Reinforcing Mesh - 6 x 6 - #8	3,000 Sq. Ft.
Concrete	1,917 Cu. Yds.
Concrete Blocks (4" x 8" x 16")	380 Blocks
Concrete Blocks (8" x 8" x 16")	4,000 Blocks
Concrete Bricks (4" x 4" x 8")	3,000 Bricks
Roofing - (SG-1C)	44.57 Squares
Roofing - (SG-1T)	21.87 Squares
Concrete Tile	2,870 Sq. Ft.



284-W - POWER HOUSE & COAL CONVEYOR
Looking Southeast

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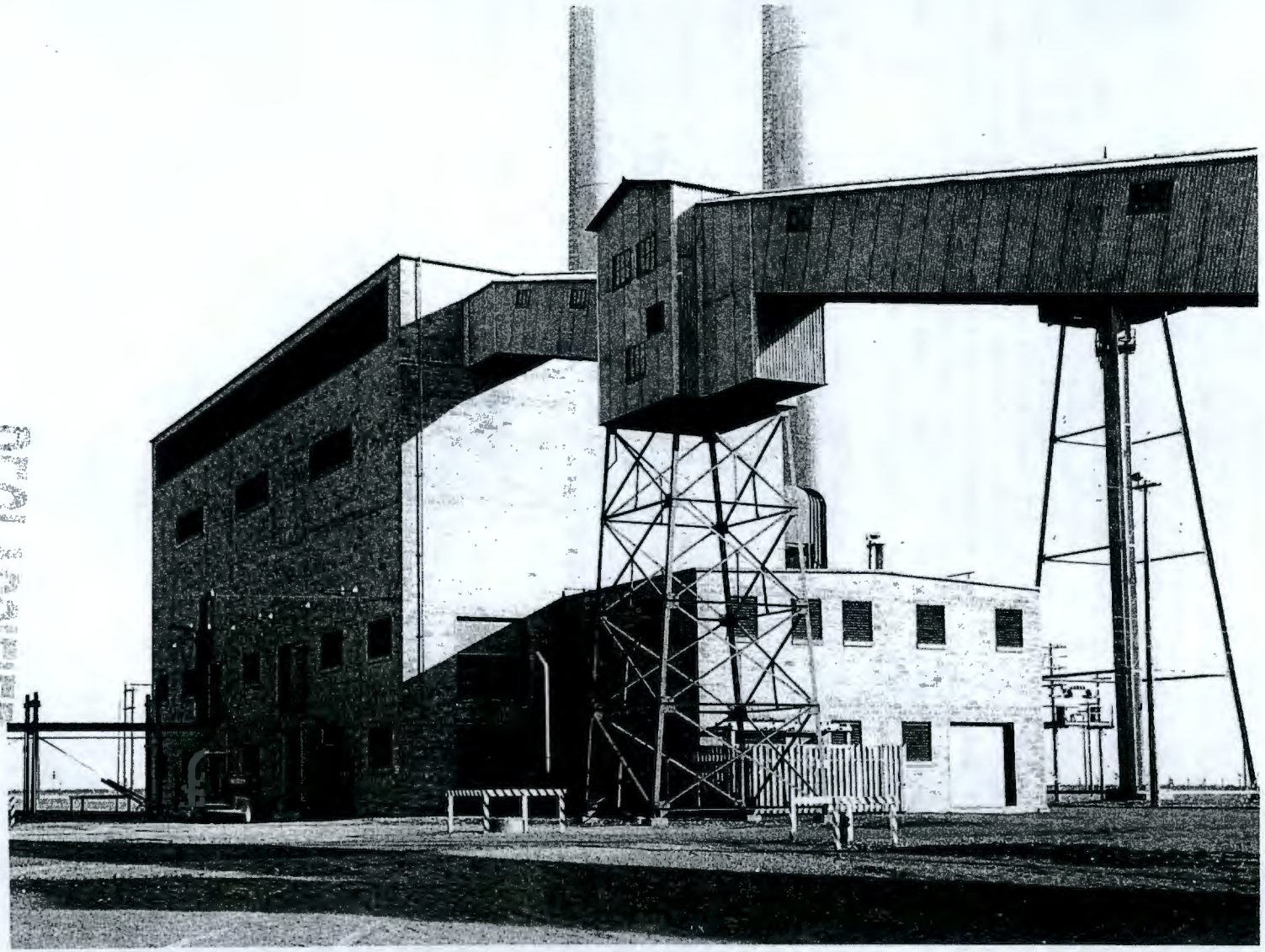

284-W - POWER HOUSE BUILDING
Close-up View Looking Southeast

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284 POWER HOUSES

There is one 284 Power House in each of the 200 East and West Power Areas. Both of these buildings are identical in design, size, and equipment except for a few minor changes. These buildings are designated as Power Houses but are primarily Boiler Houses with each containing only a 750 KW Turbo-Generator for emergency service such as building lights and motors that must be maintained in case of power failures.

Each Power Plant consists of the following structures: Main Power House Building; two reinforced concrete Stacks partically lined; Coal Handling Conveyor System, including two Track Hoppers, Crusher House, and two Transfer Houses; an Open Coal Storage Pit; and Salt Dissolving Pit, including a Brine Pump House. The layout of the 284 Buildings in the 200 East and West Areas is identical except for a 90° difference in orientation between the respective Power Areas; that is, in the East Area the Power House is oriented north and south, east of the Reservoir and Filter Plant Buildings, and in the West Area it is oriented east and west, south of these Buildings.

The type of construction and floor plan arrangement of these buildings is the same as for the 184 Power Houses with the exception that Buildings 184 are 5' wider and 56' longer, housing an additional 100,000# per hour boiler. The Stacks for the 184 and 284 Buildings are of similar design and were built by the Rust Engineering Company with the Stacks for the 284 Building being constructed under subcontract RPG 587½. The latter Stacks are 9' I.D. at the top and 250' high which is 2' less in diameter at the top and 50' lower than the Stacks for the 184 Building. Coal Handling Conveyor Systems for all buildings are of the same design and capacity with variable length conveyors and variable size Coal Storage Pits. For further details in the construction of Building 284, see "Building Description 184 B, D, & F - Power Houses".

	Dimensions	Volume	Area
Power House (Overall)	73' x 156' x 80'	639,542	21,144
Coal Handling System (284-E - Overall)	71' x 513' x 88'	90,000	5,780
Coal Handling System (284-W - Overall)	71' x 483' x 88'	86,500	6,090
Coal Storage Pit (284-E - Overall)	310' x 350' x 11'	1,138,500	103,500
Coal Storage Pit (284-W - Overall)	280' x 390' x 11'	1,138,500	103,500
Salt Storage Pit (Overall)	18' x 32' x 12'	4,704	416
	TOTAL - 284-E	1,869,246	130,840
	Total - 284-W	1,872,746	131,150

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EQUIPMENT LIST

Number	Type	Size - Capacity - Power
2	Reinforced Concrete Stacks	23' to 9' I.D. x 250' high - (partially lined)
1	Combustion Control System	
3	Steam Boilers	100,000# per hr./225# Steam
3	Boiler Feed Pumps	300 GPM - Back Pressure Steam Turbines
3	Coal Bunkers	180 Tons
3	Forced Draft Fans	45,000 CFM - Steam Turbine Drive
3	Zeo-lite Water Softeners	10' diam. x 9' - 51 GPM
1	Steam Turbine Generator	750 KW - 2300 V - Non-Condensing
1 Set	Switchgear	2300 V
1	Deaerator	9' diam. x 16' - 350,000# per hr.
2	Air Receivers	4' diam. x 12' - 125#
1	Air Compressor	111 CFM - 100# - 25 HP - 440 V.
1	Air Compressor	75 CFM - 100# - Steam Driven
3	Tri-Sodium Phosphate Pumps	4 GPH - 300# - 1/4 HP - 110 V.
2	Sodium Sulphite Pumps	10 GPH - 100# - 1/4 HP - 110 V.
2	Soot Blowers	3600 CFM at 14.5# (75 HP
2	Ash Pumps	(75 HP - 440 V - (284-W) (50 HP - 440 V - (284-E)
2	Sluice Water Pumps	1400 GPM - 75 HP - 2300 V.
1	Coal Flight Conveyor	15-tons/hr.
1	Coal Handling System	150-tons/hr. - 15 HP - 440 V.
1	Coal Belt Tripper	24" Belt - 30'/min. - 150-ton/hr.
2	Coal Crushers	75-tons/hr. - 50 HP - 440 V.
2	Brine Pumps	25 GPM - 1 HP - 440 V.
3	Transformers	100 KVA - 2300/440 V.
1	Transformer	50 KVA - 2300/220/110 V.

Material

Lumber (Framing, Walkways, etc.)	5,000 f.b.m.
*Structural Steel	402 Tons
Grating	3,000 Sq. Ft.
Reinforcing Steel	84 Tons
Reinforcing Mesh - #9	6,290 Sq. Ft.
Reinforcing Mesh (6 x 6 - #8)	1,680 Sq. Ft.
Concrete	2,382 Cu. Yds.
Concrete Blocks (8" x 8" x 16")	22,000 Blocks
Concrete Blocks (4" x 8" x 16")	8,500 Blocks
Concrete Bricks (2" x 4" x 8")	35,000 Bricks
Concrete Roof Tile	11,000 Sq. Ft.
Roofing (Built-up)	115 Squares
Transite Roofing	45.5 Squares
Transite Siding	96.0 Squares

* NOTE: Does not include structural steel for Coal Handling System.

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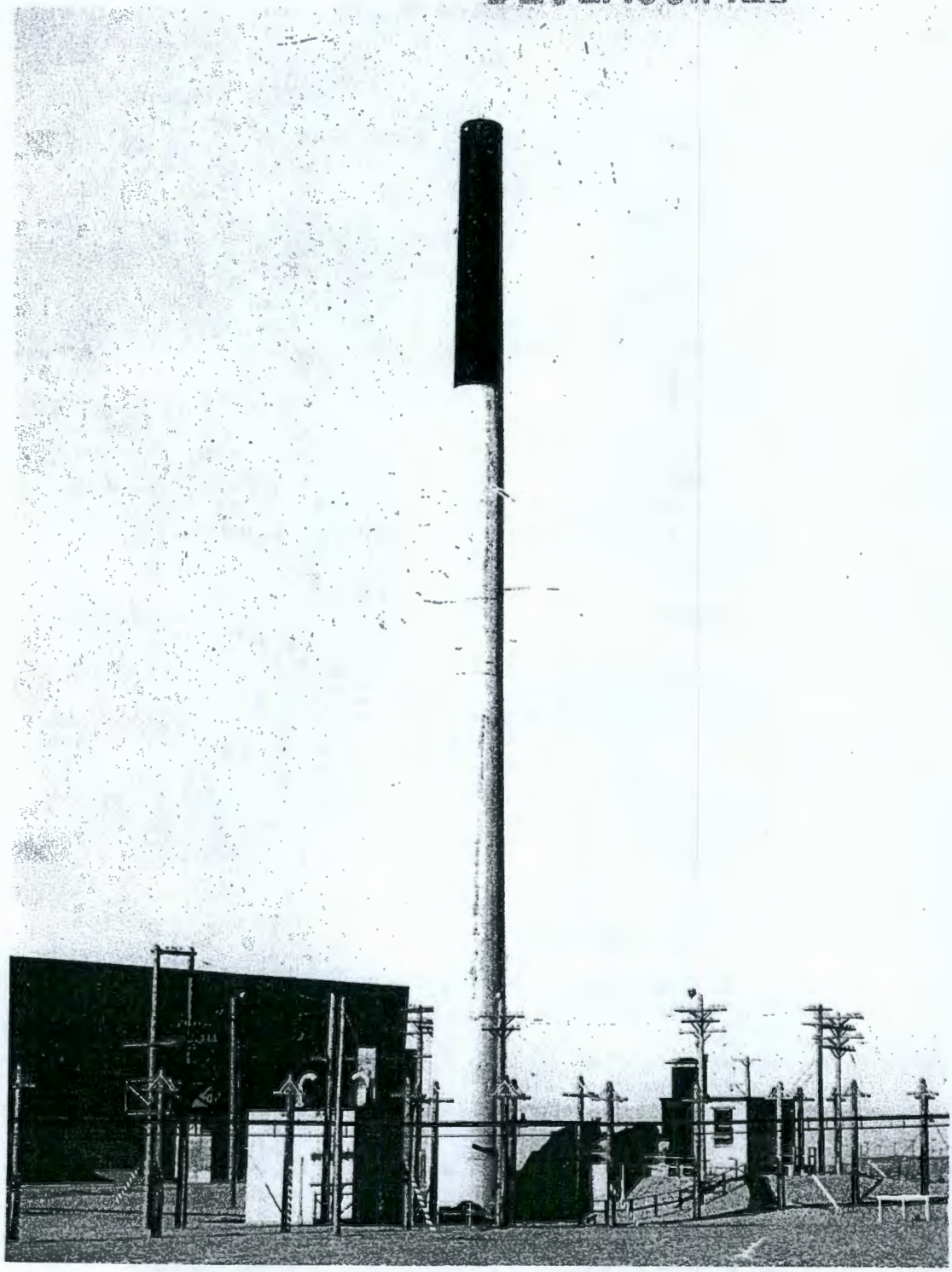

291-T - EXHAUSTER BUILDING AND STACK
Lookins Northwest

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291 EXHAUSTER BUILDINGS AND STACKS

T, U, & B

Three exhaust systems were constructed, one for each of the 221 Buildings, to provide adequate ventilation for the "canyon" portions of these buildings. Building 291 consists of a stack, three blowers, control house, and an underground inlet and exhaust duct system.

Stack: The stacks are reinforced concrete shells, 200' tall, having an independent acid-proof brick lining 5' inside diameter at the top, and were erected by the Rust Engineering Company on purchase order RPG 173½. Stack foundations are reinforced concrete, octagon-shaped, 7' thick, and were built having the top of the stack foundations, in all cases, 19' below the deck level of the 221 Building and 187' from the head face of these buildings, with the exception of the 221-T, in which case the stack was located 252' from the head face. The stack foundation is so oriented that the breeching opening is on the axis parallel to the 221 Building, with the opening facing in the head end direction. An access door was provided opposite the breech opening, as well as ladder rungs, lightning protection, and stainless steel breeching. A stainless steel pan was installed in the bottom of the stack and connected to a 4" chemical-ware drain encased in the stack base to carry off condensate or flushing water. The top 50' exterior surface of the stack is painted with an acid-resisting paint. Three 3" 18-8 Sb lines run underground from a point outside Building 221 (opposite Cells 5, 6 and 7) to a pit adjacent to the stack, in which area is located an arrangement of three stainless steel steam-jet syphons which discharge to the stack breeching by special nozzles. This area is partially enclosed by reinforced concrete curtain walls and roof slab to protect the piping in this section.

Exhaust Fans: Three stainless steel fans are mounted on concrete foundations which are adjacent to the inlet and outlet air ducts, with the latter fan being steam-powered and enclosed in the control house. These fans are in line with the stack breeching parallel to the 221 Building. Exhaust gas is removed from the inlet duct by means of metal duct work between the Concrete inlet duct and the fan and from the fan to the outlet concrete duct, then it is exhausted to the stack.

Control House: This building houses the third fan farthermost from the stack, steam engine, and controls. The structure is reinforced concrete and concrete block having a 9" curtain wall foundation, 8" thick floor slab, 8" thick concrete block walls, and a 6" thick concrete flat roof slab covered with built-up felt, gravel surfaced roofing. It contains two doors, one double and one single door, and one window. The building is steam heated.

Inlet and Outlet Ducts: The inlet duct consists of an L-shaped underground concrete passageway with the main part 4' wide by 7' high, which runs at right angles to the line of the fans and the 221 Building and directly connects with the center line of Section 3, that is, between Cells 5 and 6 of Building 221. The latter section of the inlet duct parallels the outlet duct and is separated only by a concrete wall. Walls are, in most cases, 12" thick reinforced concrete, having the inside surfaces painted with bitumastic.

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Dimensions		Volume	Area
Control House (Overall)	17'-6" x 18'-10" x 17'-8"	5,830	330
Fan Bases (2)	7'-3" x 10'-8" x 6'-9"	976	145
Stack Base (1)	23'-0" x 23'-0" x 7'-0"	2,580	529
Stack (1)	I.D. 11'-10-3/8" I.D. 6'-6" 200' High O.D. 13'-10-3/8" O.D. 7'-6"		
Pit Section (1)	13'-10" x 13'-10" x 8'-0"	1,520	190
	TOTAL	10,906 Cu.Ft.	1,089 Sq.Ft.

INLET DUCT

Height O.D.	Height I.D.	Width O.D.	Width I.D.	Length	Volume
9'-0"	7'-0"	6'-0"	4'-0"	204'-6"	70,330
9'-0" to 6'-6"	7'-0" to 4'-6"	7'-10"	6'-6"	49'-0"	2,156

OUTLET DUCT

6'-0" to 10'-9"	4'-0" to 8'-9"	5'-0"	3'-0"	47'-0"	1,551

Each building houses the following equipment:

Number	Type	Size - Capacity - Power
3	Exhaust Fans	Class 2 - Size 7 - Buffalo Forge
2	Electric Motors	40 HP - 440 V. - 3 Phase - 60 Cycle
1	Steam Engine	40 BHP - Troy Engberg - 225# Steam

Material	Quantity
Reinforcing Steel	14.1 Tons
Concrete	457 Cu. Yds.
Roofing (Built-up)	3.7 Squares
Concrete Blocks (8" x 8" x 16")	725 Blocks

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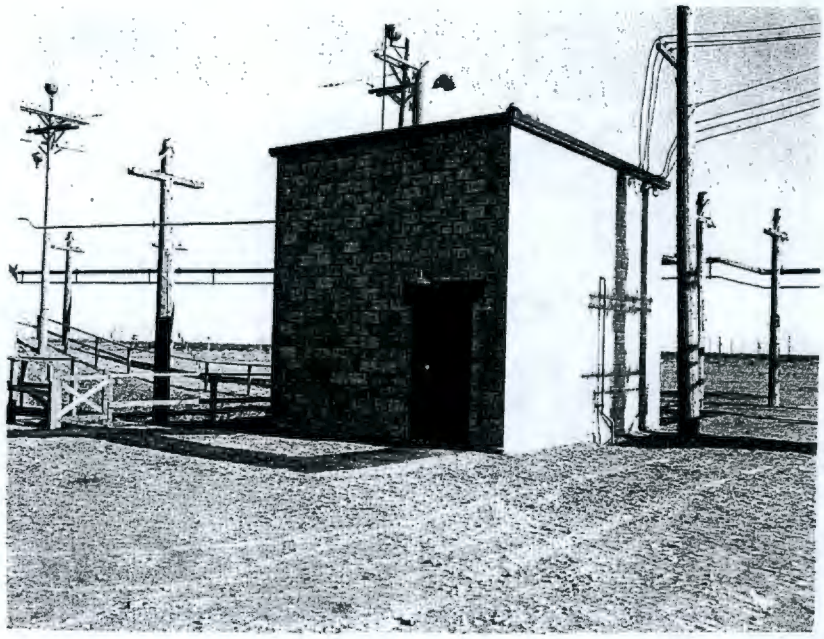
291-T - EXHAUSTER BUILDING
Close-up View Looking Southeast



292-T - EXHAUST GAS LABORATORY BUILDING
Looking Northeast

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292 EXHAUST GAS LABORATORIES

T, U, & B

Three reinforced concrete and concrete block, one-story buildings were constructed, one adjacent to each 291 Exhauster Building and Stack for the purpose of testing exhaust gases for toxic fumes. These buildings lie approximately 40' from the center line of the exhaust stack in the direction of the 222 Buildings. A two-inch 18-8 Cb overhead sampling line runs from the stack to each building.

The type of construction used was as follows: 9" reinforced concrete curtain wall foundation; 4" reinforced concrete floor; 8" concrete block walls; and 4" reinforced concrete flat roof slab, supported by concrete beams, and covered with built-up felt, gravel surfaced roofing. Each building contains two outside doors, no windows, and two roof ventilators. An overhead wooden catwalk along one side of the building provides access to the upper building equipment.

	Dimensions	Volume	Area
Building (Overall)	16' x 21' x 19'-7"	6,621 Cu.Ft.	336 Sq.Ft.

Each of these buildings houses the following equipment:

Number	Type	Size - Capacity - Power
1	Refrigeration System	
1	Gas Blower	15 CFM - 1/3 HP - 220/110 V.
1	Water Pump	15 CFM - 1/20 HP - 220/110 V.
1	Scrubber	
1	Water Chamber	
1	Air Chamber	
1	Flow Chamber	
1	Cooler	

Material	Quantity
Lumber (Flooring and Finish)	300 f.b.m.
Reinforcing Steel	.40 Tons
Concrete	21 Cu. Yds.
Roofing (Built-up)	3.74 Squares
Concrete Blocks (8" x 8" x 16")	1,150 Blocks

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2701 - WA - GATE HOUSE AND CLOCK ALLEY
Looking Southwest

2704 - TYPICAL SUPERVISORS' OFFICE BUILDING

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2701-WA GATE HOUSE BUILDING

One wood frame, one-story, flat-roof, gate house building was constructed adjacent to the access gate serving the 231 enclosure. Building foundations are plain concrete curtain walls 8" thick supporting a 4" floor slab. The structure is covered on the outside with 1" drop siding and is lined and ceiled with 3/16" asbestos board. Roofing is built-up felt over 1" T & G sheathing. The building contains seven single frame, double hung windows and one single door.

	Dimensions	Volume	Area
Overall	9'-2" x 10'-6" x 13'-7"	1,304 Cu.Ft.	97 Sq. Ft.

Material	Quantity
Lumber (Framing)	550 f.b.m.
Lumber (Siding)	250 f.b.m.
Lumber (Sheathing and Decking)	100 f.b.m.
Reinforcing Mesh - 6 x 6 - #4	100 Sq. Ft.
Concrete	2.8 Cu.Yds.
Roofing (Built-up)	1.35 Squares
Asbestos Board - 3/16"	300 Sq. Ft.

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2704 SUPERVISORS' OFFICE BUILDINGS

An identical, one-story, L-shaped, wood frame, gable roof, office building was constructed in each Service Area to house the Supervisors' Offices for the 200 East and West Areas. Building 2704-E lays north of the Area Shop and west of the First Aid Building, and Building 2704-W lays south of the Area Shop and east of the First Aid Building in the respective areas. Each building contains a total of 27 rooms including two Toilet Rooms and a Telephone Exchange Room which houses the telephone switchboard.

Outside building foundation walls are 8" concrete block laid on plain concrete spread footings and intermediate supports are reinforced concrete piers with spread footing covering the center girders and columns. Buildings are floored throughout with 1" T & G end-matched flooring laid 3' above finished grade except the Toilet and Janitor's Closet which is also covered with 1/8" "Jaspe" linoleum. Outside building walls are covered with 1" T & G sheathing and drop siding with building paper insulation between. Exterior walls, room sides of corridors and one side of cross partitions are lined with 3/16" asbestos board except for the walls of the Toilet Room which are lined with 1/4" tempered Presdwood. Buildings are ceiled throughout with 3/8" Gypsum board. Roofs are gabled and hipped with a 6 on 12 pitch and are covered with built-up felt roofing over 1" T & G sheathing. Each building contains a 6' L-shaped corridor connecting with four single outside pedestrian doors; and 33 single frame, double hung windows. Wooden louvres are provided in the gable end of each building for attic ventilation. The hot water heater for each building is mounted in the attic over the Toilet Room.

	Dimensions	Volume	Area
Overall	95'-3" x 119'-4" x 25'	165,866 Cu.Ft.	6,518 Sq.Ft.

Each building houses the following equipment:

Number	Type	Size - Capacity - Power
1	Telephone Switchboard	2-Position - 120 Circuit
1	Auxiliary Power Unit	110 V.

Material	Quantity
Lumber (Framing)	37,500 f.b.m.
Lumber (Flooring)	6,600 f.b.m.
Lumber (Siding)	5,400 f.b.m.
Lumber (Sheathing and Decking)	13,600 f.b.m.
Reinforcing Steel	.3 Tons
Concrete	30 Cu. Yds.
Concrete Blocks (8" x 8" x 16")	2,300 Blocks
Roofing (Built-up)	85.32 Squares
Asbestos Board - 3/16"	11,650 Sq. Ft.
Gypsum Board - 3/8"	6,600 Sq. Ft.
Presdwood - 1/4"	960 Sq. Ft.
Celotex - 5/8"	300 Sq. Ft.

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2707-A - TYPICAL CHANGE HOUSE

2707-B - TYPICAL CHANGE HOUSE

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CHANGE HOUSES

2707 EA, WA & 3707 B

Three identical, one-story, wood frame, Change House Buildings were constructed adjacent to the Power House in the 200-E, 200-W, and 300 Areas to serve the personnel working in the power areas. Each building contains five rooms; namely, Locker Room having a capacity of 22 individual lockers, Lunch Room, Toilet Room with lavatory, Heater Room and Vestibule.

Building foundations are comprised of 8" concrete block walls laid on plain concrete spread footings. Floor slabs are 4" plain concrete haunched under partitions. The outside of the building is covered with 1" T & G sheathing and 1" drop siding with building paper insulation between. The inside of all rooms, except the Heater Room, is lined with 3/16" asbestos wall board. Roofs are sloped one way and are covered with built-up felt, gravel surfaced roofing over 1" T & G sheathing, and contain one 12" and one 18" A.C.M. roof ventilators. Each structure contains one outside pedestrian door and nine single frame, double hung windows.

	Dimensions	Volume	Area
Overall Building	16' x 43'-10" x 15'	10,515 Cu.Ft.	701 Sq.Ft.

Material	Quantity
Lumber (Framing)	1,800 f.b.m.
Lumber (Siding)	1,450 f.b.m.
Lumber (Sheathing and Decking)	2,150 f.b.m.
Concrete	13 Cu. Yds.
Concrete Block	240 Blocks
Roofing (Built-up)	7.44 Squares
Asbestos Board - 3/16"	1,810 Sq. Ft.

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2707 CHANGE HOUSES

Two identical, wood frame, one-story Change House Buildings were constructed in the 200 East and 200 West Areas adjacent to the 272 Area Shop in order to serve the personnel working in the Service Areas. These buildings are rectangular in shape with a lean-to Heater Room attached to the side of the building opposite the Shower Room, and have an outside vestibule at each of the three pedestrian doorways. Each building contains a total of six rooms; namely, Locker Room having a capacity of 209 individual lockers, Lunch Room, Wash Room, Shower Room, Toilet Room and Heater Room.

Building foundations are comprised of 8" concrete block walls laid on plain concrete spread footings. Floors are 4" plain concrete haunched under partitions with the exception of the Heater Room which has a cinder floor. The outside of each building is covered with 1" T & G sheathing and 1" drop siding with building paper insulation between. The inside of the exterior walls of the Locker Room are lined with 1/4" presdwood to the ceiling. All walls of the Lunch Room are lined with the same 8' high, having a drop ceiling of 3/8" Gypsum board. Wash Rooms and Toilet Rooms are lined with 1/4" tempered presdwood to the ceiling. The Shower Room walls are lined with 1/4" asbestos board. Roofs are sloped one way and covered with built-up felt, gravel surfaced roofing over 1" T & G sheathing and are provided with two 18" and three 24" square wood frame roof ventilators. Each building contains three outside pedestrian doors; a double outside door to the Heater Room; sixteen single frame, double hung windows; one double frame pivot window; and two double frame, double hung windows.

	Dimensions	Volume	Area
Overall	37'-6" x 88'-2" x 15'-10"	38,810 Cu.Ft.	2,551 Sq.Ft.

Material	Quantity
Lumber (Framing)	6,000 f.b.m.
Lumber (Siding)	3,200 f.b.m.
Lumber (Sheathing & Decking)	6,000 f.b.m.
Concrete	44.5 Cu. Yds.
Concrete Blocks (8" x 8" x 16")	800 Blocks
Roofing (Built-up)	26.75 Squares
Presdwood - 1/4"	3,000 Sq. Ft.
Asbestos Board - 1/4"	506 Sq. Ft.
Gypsum Board - 3/8"	300 Sq. Ft.

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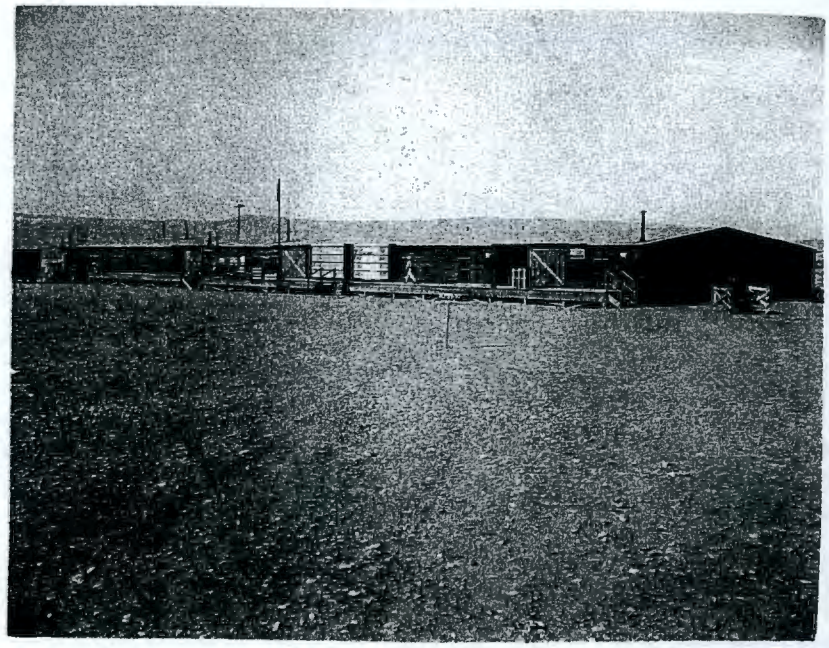

2713-A - TYPICAL STOREHOUSE - ESSENTIAL MATERIALS

2713-WB - STOREHOUSE - MISCELLANEOUS STORES
Looking Northwest

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ESSENTIAL MATERIAL STOREHOUSES

1713 BA, DA, FA, & 2713 EA, WA

The one-story, wood frame, shed roof Division Warehouses built in the 100-B, D, F and 200-E and W TC Areas formerly used for construction purposes were taken over by Operations at the close of construction and assigned permanent building numbers - 1713-BA, DA, FA and 2713-EA, WA. Building 1713-BA and 1713-DA are both oriented east and west, north and west of Buildings 184 and 188; Building 1713-FA is oriented east and west, south of Building 190-F; Building 2713-EA is oriented east and west at the southwest corner of "D" and 5th Streets, and Building 2713-WA is oriented north and south on 3rd Street between "C" and "D" Avenues. A railroad spur runs along one side of each building and wooden unloading platforms 4' high have been provided along each side of the warehouses to facilitate the movement of material and equipment to and from railroad cars and trucks. Inclined ramps extend inside the warehouses as the floor level of these buildings is set on natural grade.

Each building is sixteen bays long, five bays wide, set on 16' centers and is divided as follows: Bays 1 and 2 Tool Room; Bays 3, 4, 5 and 6 Miscellaneous Storage, including a Cash Sales Office; Bays 7, 8 and 9 Receiving Portion, including four Offices; Bays 10, 11, 12 and 13 Equipment Storage.

The type of construction used for these buildings is as follows: Post and girder construction with column posts set on wood mats; 2" plank floor laid on 2 x 6 sleepers; 4' on centers; outside building walls covered with 1/2" exterior Gypsum board except for Building 2713-WA which has 1" T & G sheathing covered with roll roofing; shed roof sloped two ways and covered with roll roofing over 1" T & G sheathing; inside partitions are 1" T & G sheathing. Each building is provided with one single outside pedestrian door, five 7' x 8' sliding doors, and 33 single frame, double hung windows.

	Dimensions	Volume	Area
Overall	92' x 208' x 16'	228, 616 Cu.Ft.	19,714 Sq.Ft.

Material	Buildings 2713-EA	1713-BA, DA, FA	2713-WA
Lumber (Framing	58,000	58,000	68,000 f.b.m.
Lumber (Sheathing)	21,000	21,000	28,500 f.b.m.
Lumber (Flooring)	40,000	40,000	40,000 f.b.m.
Exterior Gypsum Board	7,200	7,200	7,200 Sq. Ft.
Roofing (Roll 65#)	169	169	241 Squares

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2713-WB MISCELLANEOUS STOREHOUSE

The "Butler" sheet metal, igloo-type hut erected in the 200-W TC Area and formerly used for the storage of process equipment was taken over by Operations at the close of Construction and assigned permanent building number 2713-WB.

Building 2713-WB is oriented east and west on "G" Avenue between 3rd and 4th Streets. This building is semi-cylindrical having a 2" plank floor laid on 4" x 4" sleepers, 6" channel bow-truss framing covered with No. 12 gauge corrugated sheet iron. Each end contains a double-hinged vehicle door and two six-light barn sash windows.

	Dimensions	Volume	Area
Overall	41' x 150' x 20'-6"	99,000 Cu. Ft.	6,350 Sq. Ft.

Material	Quantity
Lumber (Flooring)	14,500 f.b.m.

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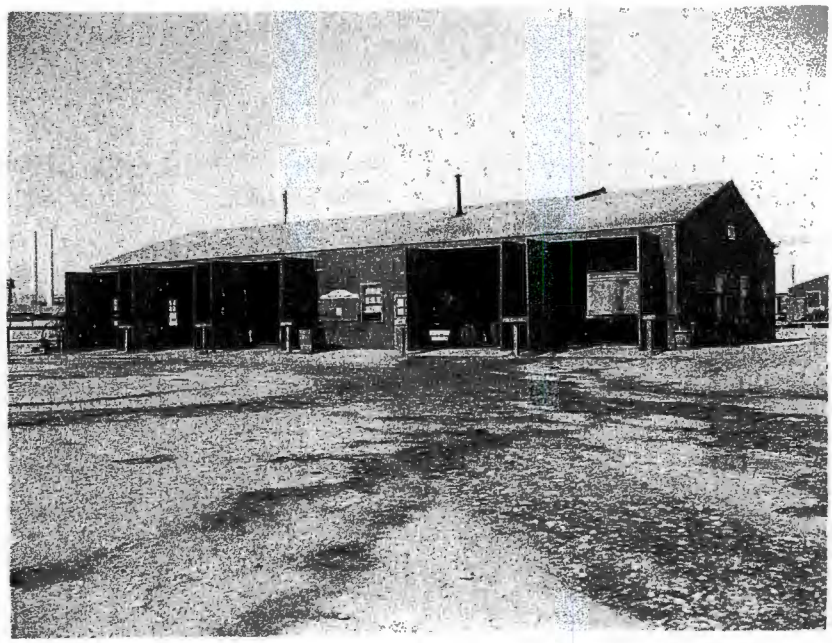
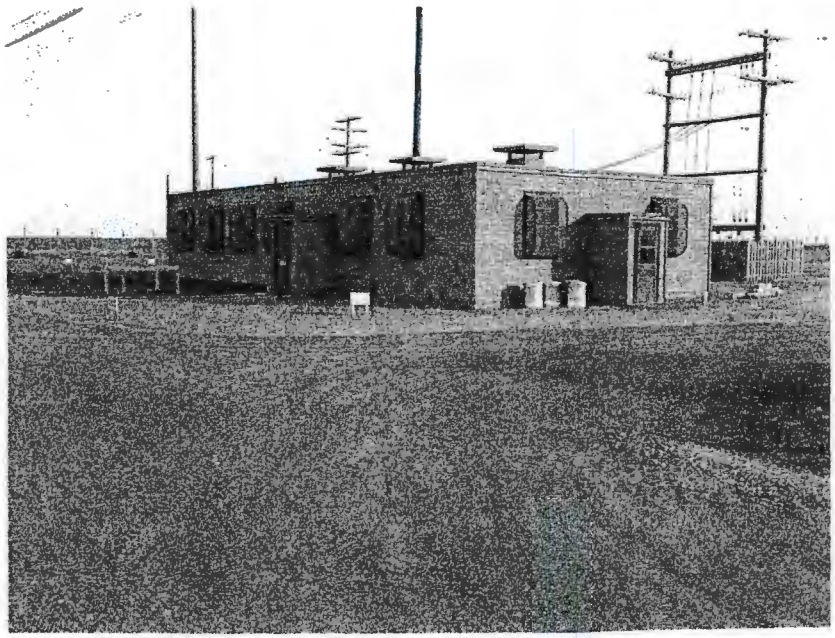


2716 - TYPICAL AUTOMOTIVE REPAIR SHOP



2720 - TYPICAL PATROL HEADQUARTERS

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2716 AUTOMOTIVE REPAIR GARAGES

The wood frame, one-story, gable roof Transportation Repair Shops built in the 200 East and 200 West TC Areas for construction purposes were taken over by Operations at the close of Construction and assigned permanent building numbers - 2716-E and 2716-W. Building 2716-E is oriented north and south at the southwest corner of "C" and 7th Streets. Building 2716-W is oriented north and south at the northwest corner of "C" and 6th Streets. Adjacent to each building are located two electrically driven gasoline pumps and two underground fuel oil storage tanks.

These buildings are of the following construction: 6" plain concrete floor slab foundation haunched around the perimeter and under intermediate column supports; post and girder construction; outside walls covered with 1/2" exterior Gypsum board; inside partitions and ceilings for office, Spare Parts Storage and Tire Storage Rooms, 1" T & G sheathing; gabled roof 4 on 12 pitch-covered with rolled roofing over 1" T & G sheathing.

Each building contains 6 bays, 5 of which are provided with 12' x 12' double-swing, hinged doors. Bay No. 1 contains a 3' x 32' x 5' deep concrete grease pit. Bay No. 2 is equipped for tire repair. Bay No. 3 is divided into 3 rooms; an Office, Small Parts Storage Room, and Tire Storage Room. Bays No. 4, 5 and 6 are for Automotive Repair. A concrete apron 6' wide extends along the front side of each building. In addition to the vehicle doors, each building is provided with two single outside pedestrian doors and 15 single frame, double hung windows.

	Dimensions	Volume	Area
Overall	46' x 90' x 24'-6"	72,800 Cu. Ft.	3,600 Sq. Ft.

EQUIPMENT LIST

Number	Type	Size - Capacity - Power
2	Gasoline Pumps	Electric-Driven - 1/3 HP - 110 V.
2	Gasoline Storage Tanks	2,000 Gallons
1	Air Compressor & Receiver	15 CFM - 1 HP - 220 V.

Material	Quantity
Lumber (Framing)	10,500 f.b.m.
Lumber (Sheathing)	6,000 f.b.m.
Concrete	110 Cu. Yds.
Exterior Gypsum Board	4,600 Sq. Ft.
Roofing (Roll 65#)	39.13 Squares

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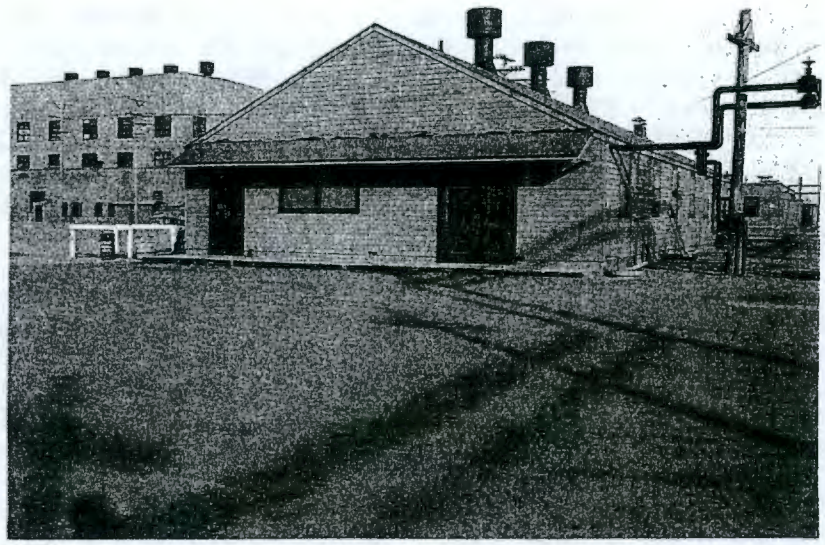
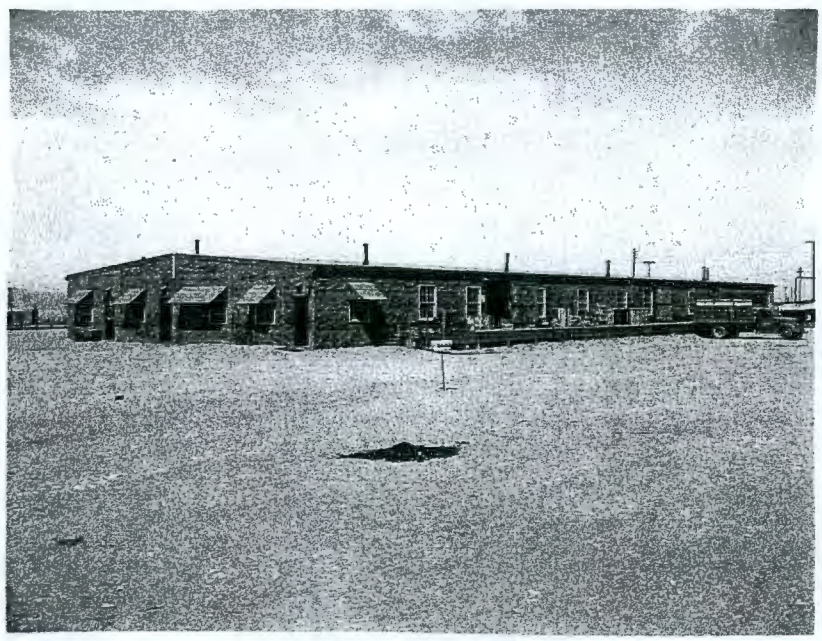


2723 - LAUNDRY



2729-W - EXTRA MACHINERY STOREHOUSE

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2723-W LAUNDRY

In the 200-W Service Area, southwest of the 272-W Area Shop, is located a one-story, wood frame, gabled roof building. This building houses Laundry and Shoe Repair Equipment serving both the 100 and 200 Areas, and contains a total of 12 rooms; namely, Wash Room, Pressing Room, Laundry Storage and Receiving Room, Sorting Room, two Testing Rooms, Glove Washing Room, Shoe Repair Room, Store Room, Office, Toilet, Shower and Locker Room, and Rest Room. The Locker Room has a capacity of 20 individual lockers.

The type of construction used for this building is as follows: 8" plain concrete curtain walls and concrete piers with spread footings for intermediate column supports; 4" concrete floor slab throughout, outside walls 1" T & G sheathing and drop siding with building paper insulation between; gable roof 6 on 12 pitch covered with built-up felt roofing over 1" T & G sheathing. The inside face of all exterior walls, all partitions, low partitions and ceilings over the Office, Testing Rooms, Glove Washing Room, Women's Toilet-Locker Room and Rest Room are lined and ceiled with 3/16" asbestos board. Low partitions are used between the Wash Room, Pressing Room, and Sorting Room. Across the west end of the building is a 4' pent roof extension 8'-4" above the high point of the floor protecting the Receiving and Delivery Room doors. A hot water heater is suspended in the attic above the Testing Room and Office. Three 24" A.G.M. motor-driven ventilators are provided in the ridge for ventilation. This building contains: four single outside pedestrian doors, one sliding outside door, and 24 single frame, double hung windows.

	Dimensions	Volume	Area
Overall	40'-2" x 110'-8" x 23'-3"	78,183 Cu.Ft.	4,283 Sq.Ft.

This building houses the following equipment:

Number	Type	Size - Capacity - Power
2	Washers (wooden)	36" x 54" - 2 HP - 220 V.
2	Extractors	30" Diameter - 3 HP - 220 V.
1	Glove Washer (wooden)	36" x 36" - 1 HP - 220 V.
2	Tumblers	36" x 30" - (2) 1/3 HP - 220 V.
2	Uniform Presses	100# Steam
3	Ironing Board and Irons	110 V.
1	Sewing Machine	1/3 HP - 220 V.
1	Marking Machine	110 V.
1	Darning Machine	110 V.
1	Button Stitcher	110 V.
1	Air Compressor & Receiver	23 CFM - 1 HP - 220 V.
1	Solvent Tank (Fireproof)	4'-6" diam. x 3'-6" - 350 Gals.
1	Solvent Tank (wooden)	3'-0" diam. x 2'-6" - 100 Gals.
2	Soaking Tanks (wooden)	4'-6" diam. x 3'-6" - 350 Gals.

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Material	Quantity
Lumber (Framing)	14,500 f.b.m.
Lumber (Siding)	3,250 f.b.m.
Lumber (Sheathing and Decking)	9,600 f.b.m.
Concrete	79 Cu. Yds.
Roofing (Built-up)	49.68 Squares
Asbestos Board - 3/16"	8,500 Sq. Ft.

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EXTRA MACHINERY STOREHOUSES

1729-B, D, 2713-EB & 2729-W

The one story-wood frame, shed roof MS Pipe Warehouses - Tool Rooms built in the 100-B, D, and 200 E & W TC Areas and formerly used for construction purposes were taken over by Operations at the close of Construction and assigned permanent building numbers - 1729-B, 1729-D, 2713-EB, and 2729-W. Buildings 1729-B and D are oriented north and south and both are located west of Building 182. Building 2713-EB is oriented east and west along the same railroad spur as the 2713-KA Storehouse. Building 2729-W is oriented southeast and northwest and is located north of Building 282-W. A railroad spur runs along one side of each building. Wooden unloading platforms 4' high are provided alongside each warehouse to facilitate the movement of material and equipment to and from railroad cars and trucks. Inclined ramps extend from the platforms to the floor of the warehouse as they are set at natural grade.

Each building is eleven bays long and four bays wide set on 16' centers and is partitioned as follows: Bay #1 contains four Offices; Bays 2, 3, 4 and 5 are for Area Pipe Storage; Bays 6, 7 and 8 are for Valves and Special Piping Equipment, including a Receiving Office; Bays 9 and 10 are for MS stock; and Bay 11 is a Tool Room, likewise containing a Receiving Room.

The type of construction used for these buildings is similar to that for Buildings 1713 BA, DA, FA, and 2713 EA, WA. Each building is provided with seven single outside pedestrian doors, four sliding freight doors, and 27 single frame, double-hung windows.

	Dimensions	Volume	Area
Overall	100' x 176' x 17'	174,200 Cu. Ft.	15,392 Sq. Ft.

Material	1729 B & D	2713-EB & 2729-W
Lumber (Framing)	43,500 f.b.m.	43,500 f.b.m.
Lumber (Flooring)	31,000 f.b.m.	31,000 f.b.m.
Lumber (Sheathing & Decking)	12,000 f.b.m.	18,000 f.b.m.
Ext. Gypsum - 1/2"	5,000 Sq. Ft.	
Roll Roofing	115.04 Squares	177.44 Squares
Celotex - 1/2"	4,680 Sq. Ft.	4,680 Sq. Ft.

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2730 SLAB YARD

In the 200 West Area between Building 221-U and 241-U are located six reinforced concrete paved aprons, 8" thick, 20' wide, and varying from 540' to 645' in length. These were formerly used by construction for the fabrication of concrete cell cover blocks. The concrete was poured in 15' sections with mastic joints between sections and these strips were separated by three parallel standard gauge railroad tracks serving these areas. There are also two open end, wood frame, gable roof buildings over the passing tracks east of the slab area and two concrete pits adjacent to these buildings which were used by construction for painting cell cover blocks.

The paint spray buildings have 8" concrete block foundation walls and contain a concrete paved pit section 4' below the top of the rail. These buildings are covered overall with 1" T & G sheathing and roll roofing. The outside pits are reinforced concrete throughout with structural steel framework supporting the rail over the pit sections. The above facilities were taken over by Operations at the close of Construction and are to be used for the storage of salvage material and equipment in the 200 West Area.

		Dimensions	Volume	Area
Overall		300' x 1,200'		
Slabs - (6)		(2) 20' x 540' x 8"	14,400	21,600
		(2) 20' x 600' x 8"	16,000	24,000
		(2) 20' x 645' x 8"	17,200	25,800
Paint Building	(2)	62' x 16' x 18'	35,712	1,680
Pits	(2)	82' x 12' x 4'	7,872	1,640
		TOTAL	91,184 Cu.Ft.	74,720 Sq.Ft.

Material	Quantity
Lumber (Framing)	10,000 f.b.m.
Lumber (Sheathing and Decking)	6,000 f.b.m.
Concrete	1,860 Cu. Yds.
Reinforcing Steel	2.8 Tons
Reinforcing Mesh	80,000 Sq. Ft.
Roofing - Roll	17.36 Squares
Siding Tar Paper	27.0 Squares
Concrete Blocks (8" x 8" x 16")	1,400 Blocks

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2731 BURNING PIT

An open pit approximately 90' x 90' x 10' deep having 1 on 1 side slopes and a 10' wide ramped access road was dug and formerly used by construction for burning scrap lumber and waste materials. This pit is located at the southwest corner of the intersection of Third and "B" Streets in the 200-W Area.

It was originally constructed on Cost Code TC-35, and was taken over by Operations at the close of Construction for similar usage. It has been assigned permanent building number 2731.

	Dimensions	Volume	Area
Overall	90' x 90' x 10'	837,000 Cu. Ft.	8,100 Sq. Ft.

Material

Excavation	Approx. 3,100 Cu. Yds.

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2743 GATE HOUSE & GUARD TOWER BUILDING

Four wood frame, two-story, flat roof, penthouse-type buildings were built in the 200 North Area; one each at the vehicle and pedestrian gate entrance to Plants N, P, R, and J & K. These buildings served as combination Gate House and Guard Tower Buildings and are located 20' north of the fence line and 33' east of the center line of the main entrance road. The ground floor room contains a 4' x 5' toilet room in the northwest corner except in Building 2743-J, where it is omitted. Access to the second floor tower room is by an outside wooden stairway attached to the north side of the building.

Building foundations are 8" concrete curtain walls supporting a 4" reinforced concrete floor at ground level. The structure is covered on the outside with a 1" drop siding and lined and ceiled on the inside with 1/4" asbestos board. These buildings are covered with built-up type roofing having a gravel finish.

	Dimensions	Volume	Area
Overall	13'-9" x 19'-2" x 21'	3,170 Cu.Ft.	264 Sq.Ft.

Material	Quantity
Lumber (Framing)	3,200 f.b.m.
Lumber (Siding)	500 f.b.m.
Lumber (Flooring)	60 f.b.m.
Lumber (Sheathing and Decking)	300 f.b.m.
Concrete	9.0 Cu. Yds.
Roofing (Built-up)	2.4 Squares
Asbestos Board - 1/4"	850 Sq. Ft.

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2905 DEEP WELL PUMP HOUSES

Two reinforced concrete and concrete block, one-story, flat roof buildings are built in the 212-R fenced portion in the 200 North Area to house deep well pumping equipment. Both buildings are constructed at an angle of 90° to the well water mains, one structure covering No. 1 Well and the other the No. 2 Well.

Building walls are 9" reinforced concrete with 4" spread footings with the wall adjacent to the 12" discharge header forming a kicker block. The floor is reinforced concrete 6" thick with a floor trench from the pump base to the east wall carrying a 6" blow-off pipe. Walls are 8" concrete block supporting a reinforced concrete beam and slab roof 14" thick covered with waterproofing. The roof contains a 4' 0" x 3' 4" hatch opening for the removal of pump equipment. Each building contains one door and window.

	Dimensions	Volume	Area
Pump Room	12' 6" x 15' x 17'	3,179 Cu. Ft.	187 Sq. Ft.

Each building houses the following equipment:

Number	Type	Size - Capacity - Power
1	Pump - Deep Well	1,000 GPM - 335' Head - 1770 RPM 125 HP
1	Motor Starter	125 HP - Cubicle - 2300 V.

NOTE: A 600 GPM - 335' Head - 1765 RPM - 100 HP Pump - Vertical - was installed in the 2905-R Building.

Material	Quantity
Reinforcing Steel	1.3 Tons
Concrete	17 Cu. Yds.
Roofing (Built-up)	2.16 Squares
Concrete Blocks (8" x 8" x 16")	700 Blocks

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