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we mobilized the whole of technical staff to complete the Soda plant, With a loan of ¥ 19,000.000 from the Rehabilitation Treasury we completed the plant to be able to produce 100 tons per day of total ash in march, 1948.

For these reasons we repeatedly requested G.H.Q. and Japanese Government for the resumption of soda production, but in vain.

As stated above, the equipment of plant will be completed in accordance with the first program in March. While we have been eagerly hoping to reopen the operation, we received a notice from the Economic Stabilization Board that G.H.Q. had omitted our company from the first quarter(April, May and June)of 1948 coal allocation program; thus our hope of resuming Soda production has completely been shattered.

We understand that the chief reason for the non-allocation of coal for the first quarter for our company was based on a fear of a high production cost.
But we may confidently say that we have superior equipment and excellent technical skill as well as those of other ammonia soda plants.
Also we may be able to mention high yield of our products and low cost of production.

Our labor union to which is composed of our employees belongs to C.I.U. and its behavior was apt to be radical.

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We think it was feared that it would cause hindrances to production owing to the inharmonious relations between capital and labor. However, the relations between capital and labor have become very co-operative since last year. With the total resignation of the leaders of the Union the Union is moving to form a new organization . So we may safely say that there will be no fear about this point.

As we state in the separate paper "Superior Points of our Company, " our cement, potassium fertilizer, calcium chloride and sodium silicate are all made by utilizing soda-waste; so when they are produced together with the production of soda, their costs may become very low, displaying the excellency of a synthetic undertaking.

At the present, unable to utilize the waste from Soda plant, cement and potassium fertilizer are made independently; consequently their costs are comparatively high. Thus the management of our company is very difficult. In case we cannot resume the production of soda in a few months to come we shall be on the brink of bankruptcy.

For the reasons above mentioned, on behalf of our company, our employees and thousands of the citizens directly connected with them, we earnestly beg you that you will please give your kind assistances in giving your recommendation to G.H.Q. to

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allow us to resume the production of soda.

March 22, 1948.

Tokuyama Soda Co.,Ltd.

S. Inagaki

Managing Derector.

To the Commander,

Yamaguchi Military Government Team.

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(1) Name: TOKUYAMA SODA COMPANY LIMITED.

(2) Address: Head Office & Factory

No. 8355 Tokuyama City. Yamaguchi Prefecture.

Tokyo Office

Yamato Building. No.5 Tomizawa Cho.

Nihonbashi, Chuo-ku, Tokyo.

(3) Capital: ¥ 25,000,000,00 fully Paid up.

(4) Established: February 18, 1918.

(5) Executive: President- Yukinobu Kageyama

(6) Area of Factory Compound- 520,000 square metres

Area of Building 73,000 " "

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(7) Organization and Brief of History:

Feb. 1918- Company established with capital of ¥2,000,000,00
Planned Production-50 tons Soda Ash daily
20 tons Caustic Soda daily.

July 1918- Operation of plant started.

1932- Capital increased to ¥5,000,000.00
Equipment of plant expanded to produce
600¥ T.Soda Ash and 300¥ T. Caustic Soda daily.

1933- Capital increased to ¥10,000,000.¤00
Equipment of plant expanded to produce
800 T. Soda Ash and 400 T. Caustic Soda daily.

1937- Completed construction of new facilities i.e.
Cement Factory. Electric Power Generating Plant.
Reservoir etc.

Mar. 1937- Operation of Cement Factory started with a
capacity of 1,000 tons daily.

June 1938- Began construction of by-product plant to
Utilize waste material from soda production.

Sept. 1938- Completed construction of Gypsum Manufacturing
factory to produce 50 tons daily.

Aug. 1939- Completed construction of Magnesium Carbonate
Manufacturing Plant producing 5 tons daily.

Nov. 1939- Completed facilities to produce 35 tons Calcium
Chrolide daily and 18 tons reclaimed salt.

Apr. 1940- Began oparation of Silicate of Soda Manufacturing
Plant producing 10 tons daily.

1941- Capital increased to ¥ 25,000,000,00

1942- Completed Potassium Chrolide Manufacturing plant

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producing 1,000 tons annuary.

July 26,1945- Operation of plant suspended owing to damages recieved in air raid which completely destroyed the fellowing facilities of the plant-
potassium Chroide factory which was under construction at the time to produce 10,000 tons annuary.
Magnesium Carbonste factory,
Store House for material,
Factory Office,
Dormitory.

Oct. 1945- Operation of Cement Factory resumed.

Feb. 1946- Operation of Causticization Plant resumed.

May 1946- Operation of Soda Ash plant resumed.

Apr. 1947- Equipment Completed to recieve 5,500 kw electric power.

(8) Main installations of Soda Manufactaring Plant.

Description	Cap.per Unit	No.of Units	No.Units workable	Capacity per unit	Remarks
a.Power Plant					
Boiler	65 T/H steam 30 kg/cm2	3	3	30 T/H	owing to low grade (4300 cal)
Generator & Turbine 1)	10,000 kw back pressure	1	1		
2)	4,500 kw bleeder	1	1		
b. Installations for manufacturing Soda Ash.					

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Name	Capacity & Dimension	No. of Units	No. units Repaired	Remarks
1. Lime Kiln	4.5 M dia.X 31 M.Ht. 400 T/D Limestone also used as part of causticization equipment.	5 sets	1	300 T/D owing to low grade coal.
2. Brine Purification	200 m^3/H saturated brine	1 series	1	
3. Ammonia Absorber	3.0 M dia. X 17,5 M.Ht. 200 T/D Soda Ash	6 sets	2	
4. Ammonia Distiller	2.4 M dia. X 17.5 M.Ht. 85 T/D Soda Ash	17 sets	4	
5. Solvey Tower	3.0 M dia.X 26.7. M.Ht. 125 T/D Soda Ash	8 Sets	5	
6. Calcinater	1.8 M dia.X 16 sq.M 50 T/D Soda Ash	9 sets	4	
7. Gasproducer	3.2 M dia.X 3.8 M.Ht. 34 T/D coal	4 sets	3	
				100 T/D
c. Causticizing Equipment				
1. Bicarbonate Decomposer	2.4 M dia.X 20.7 M. Ht. 130 T/D caustic Soda	3 sets	3	
2. Dorr Causticizing Equipment	100 T/D Caustic Soda (Present Capacity 70 T/D Owing to lack of milk of lime)	5 sets	2	
3. Pressure Evaporator	1000 sq.m. Heating Surface 100 T/D Caustic Soda	3 sets	2	Density 15%
4. Vaccum Evaporator	(Triple-single system) 240 sq.m.X 4 vessel 50 T/D Caustic Soda	4 sets	4	" 45%
5. Forced Circulation Evaporator	60 square metres 150 T/D Caustic Soda	3 sets	0	" 70%

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6. Caustic pot 11 cubic metres 40 sets 20 " 100%

7 T/D Caustic Soda
(Present Capacity 5 T/D
owing to not using
Forced Circulation
Evaporator)

(9) Transportation Facilities

1. Marine - Dock for accomodating a 10,000 T/Vessel for unloading Salt and Coal.

2. Rail - we have our own spur railway line connected with Tonda Station to facilitate handling of incoming and outgoing finished products, raw material, and other material.

(10) Employees. Male 1373

Female 96

Total 1469

(11) Production Record

a. Soda Ash

Year	Total National Production	Tokuyama Soda Production	Percentage against Nat. Prod.
1935	197,327 Tons	51,500 Tons	26,1
1936	244,500 "	57,500 "	23,6
1937	245,227 "	47,578 "	19,4
1938	242,000 "	39,774 "	16,5

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a. Soda Ash(continued)

Year	Total National Production	Tokuyama Soda Production	percentage Against Nat.Prod.
1939	201,931 Tons	33,278 Tons	16, 5
1940	187,162 "	42,477 "	22,5
1941	151,317 "	32,294 "	21,4
1942	150,744 "	38,709 "	25,7
1943	126,683 "	42,617 "	33,7
1944	100,077 "	22,063 "	22,0
1945	28,912 "	7,242 "	25,1
1946	22,923 "	1,116 "	4,9
Total	1,898,803 "	416,148 "	22,0

b. Caustic Soda(in tons)

Year	Total Nat.Prod. (A)	Solvey Process (B)	Electorolysis	Tokuyama Soda Prod. (C)	C/A%	C/B%
1935	233,288	141,273	92,015	89,400	38,3	63,3
1936	284,999	168,867	116,132	93,615	32,9	55,4
1937	353,031	221,876	131,155	103,311	29,3	46,6
1938	440,316	305,200	135,116	112,214	25,4	36,8
1939	449,460	383,754	166,706	106,731	23,8	27,8
1940	412,860	272,478	140,382	95,782	23,2	35,2
1941	282,363	162,520	119,843	58,423	20,7	30,3
1942	224,097	110,420	113,677	33,421	14,9	30,0
1943	218,258	103,475	114,783	38,097	17,5	56,7
1944	140,590	44,373	95,217	22,815	16,2	51,5
1945	35,759	8,844	26,915	4,724	13,2	53,4
1846	30,076	6,517	23,559	2,332	7,8	35,8
Total	3,105,097	1,828,597	1,276,500	760,947	24,5	41,7

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The superior points of our plant

(1) We are manufacturing various by-products by utilizing the waste products of the exeretion, or the products of our plant.

Kindly refer the attached diagram No1.

a. Portland Cement.

We are manufacturing portland cement by using the waste mud, the product in the process of manufacturing caustic soda from soda ash and the coal ash, the exeretion of the boiler for main raw materials.

b. Potassium and Lime Fertiliser.

We produce fertilizer by treating the waste liquid from the distiller of the Soda plant, the screened waste of lime ore, and potash-feldspar together.

c. Chemicals

We manufacture

1. Calcium chloride from the waste liquor from the destiller of the soda plant.
2. Basic magnesium Carbonate from the waste mud of soda which is produced in the process of refining brine and the gas from the lime kiln.
3. Gypsum from the waste mud of soda and salt cake.
4. Sodium silicate from soda ash and silica sand.

(2.) The devices for saving on coal.

a. In 1942. we were officially commended by the Department of Commerce and Industry for installing the apparatus for double feeding of coal on chain grate stoker for the first time in our country so as to generate steam with needed

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Pressure(30 Kg/cm^2) by using coal bears low calorie (4,000 calorie)

b. Practically and theoretically the consumption of steam per ton of the products is much loss compared with other plants because the pressure evaporator of long vertical tube type is directly connected with the Series of ordinally double or tripple effect evaporator in our plant.

c. As the result of special study on the ammonia distiller, the amount of steam used for distiller per ton of soda ash is by for less compare with other plants.

d. As the gas producer of Mr. Wood's system is used for calcining sodium bicarbonate, the efficiency of heat is much better than that of the stoker system the direct burning system.

3. Completness of the repairing shop.

The fine machinery and electric repairing shops are made in the same compound in order to make remodeling and repairing of the equipment quicker.

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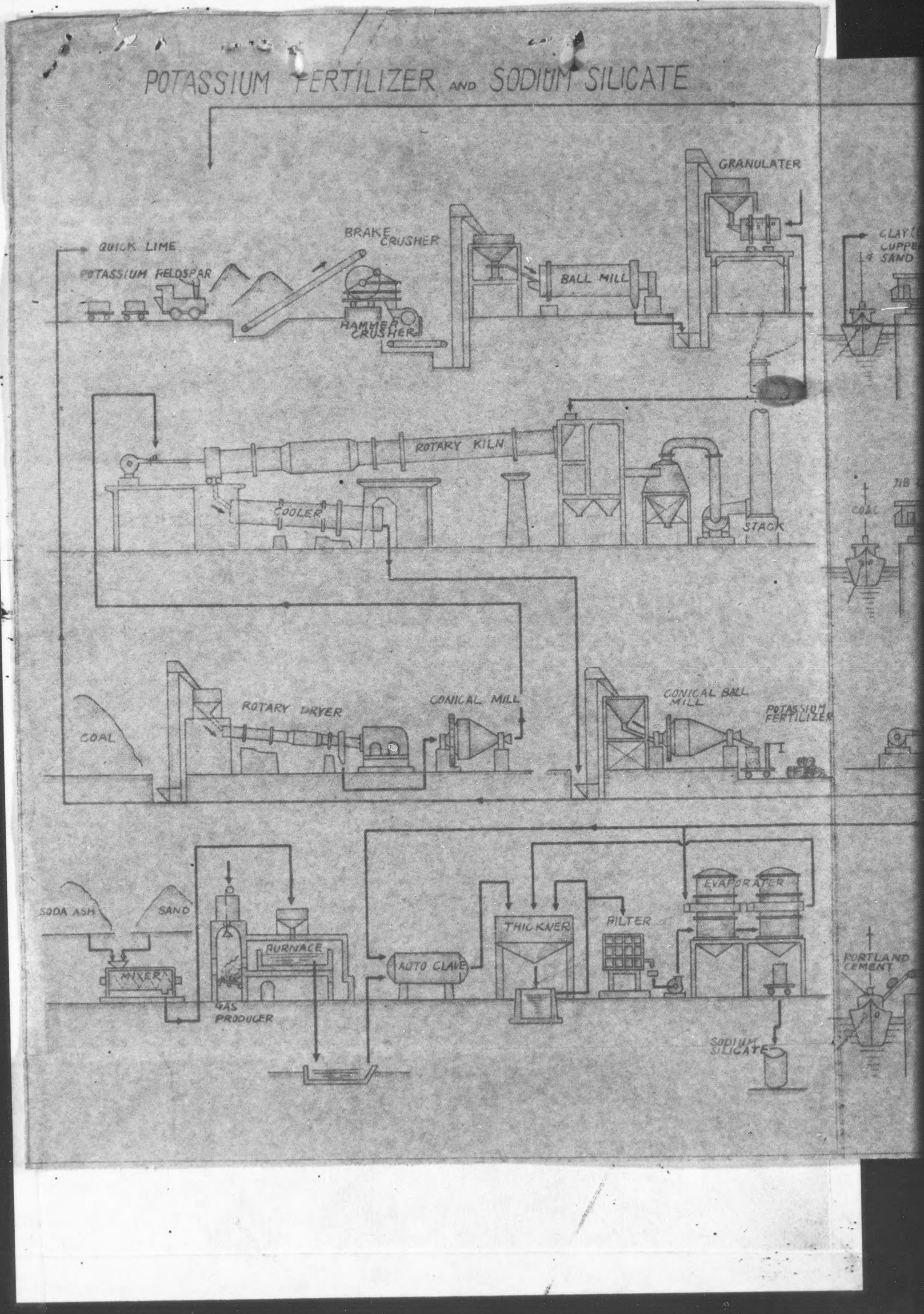
POTASSIUM FERTILIZER AND SODIUM SILICATE



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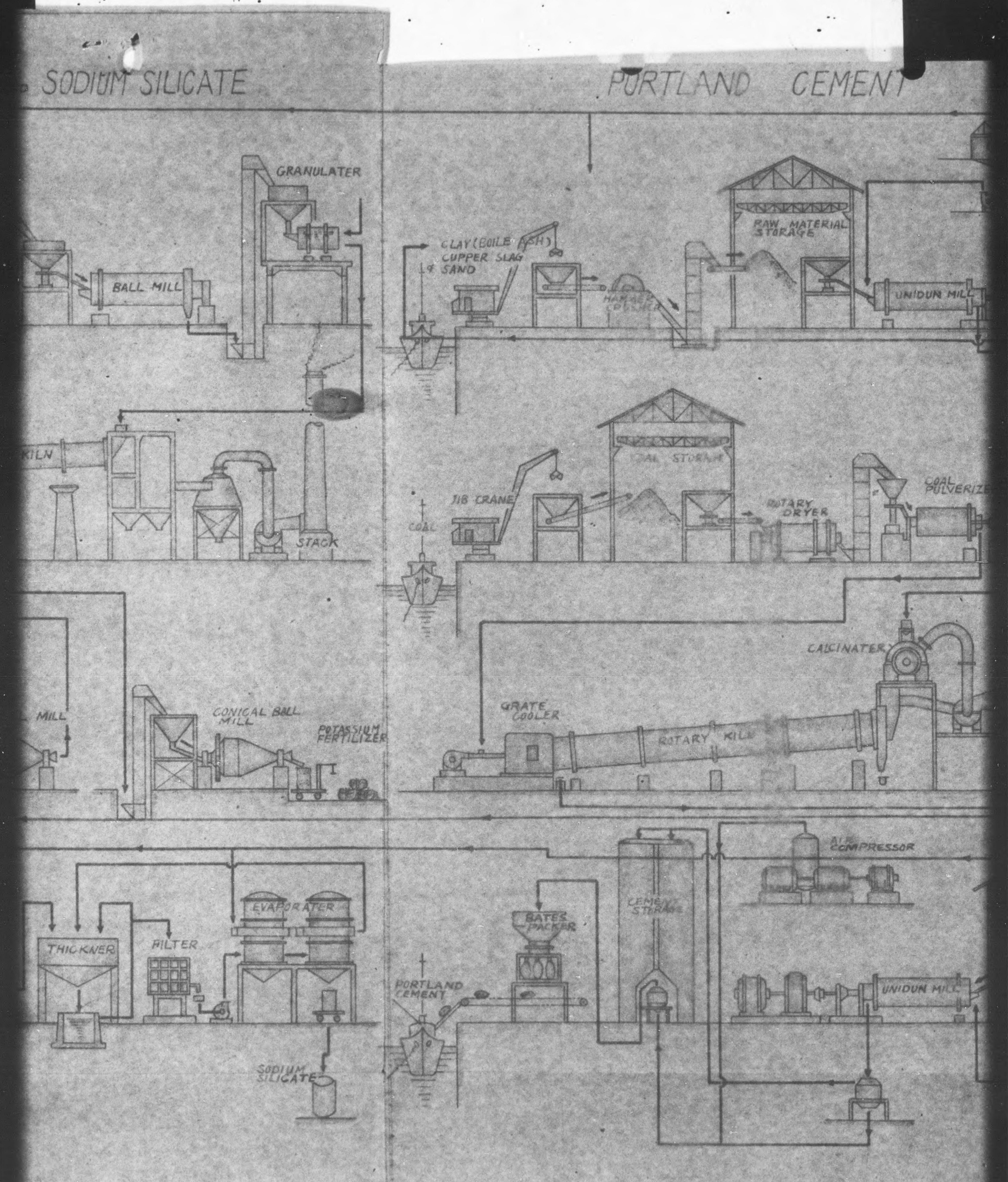

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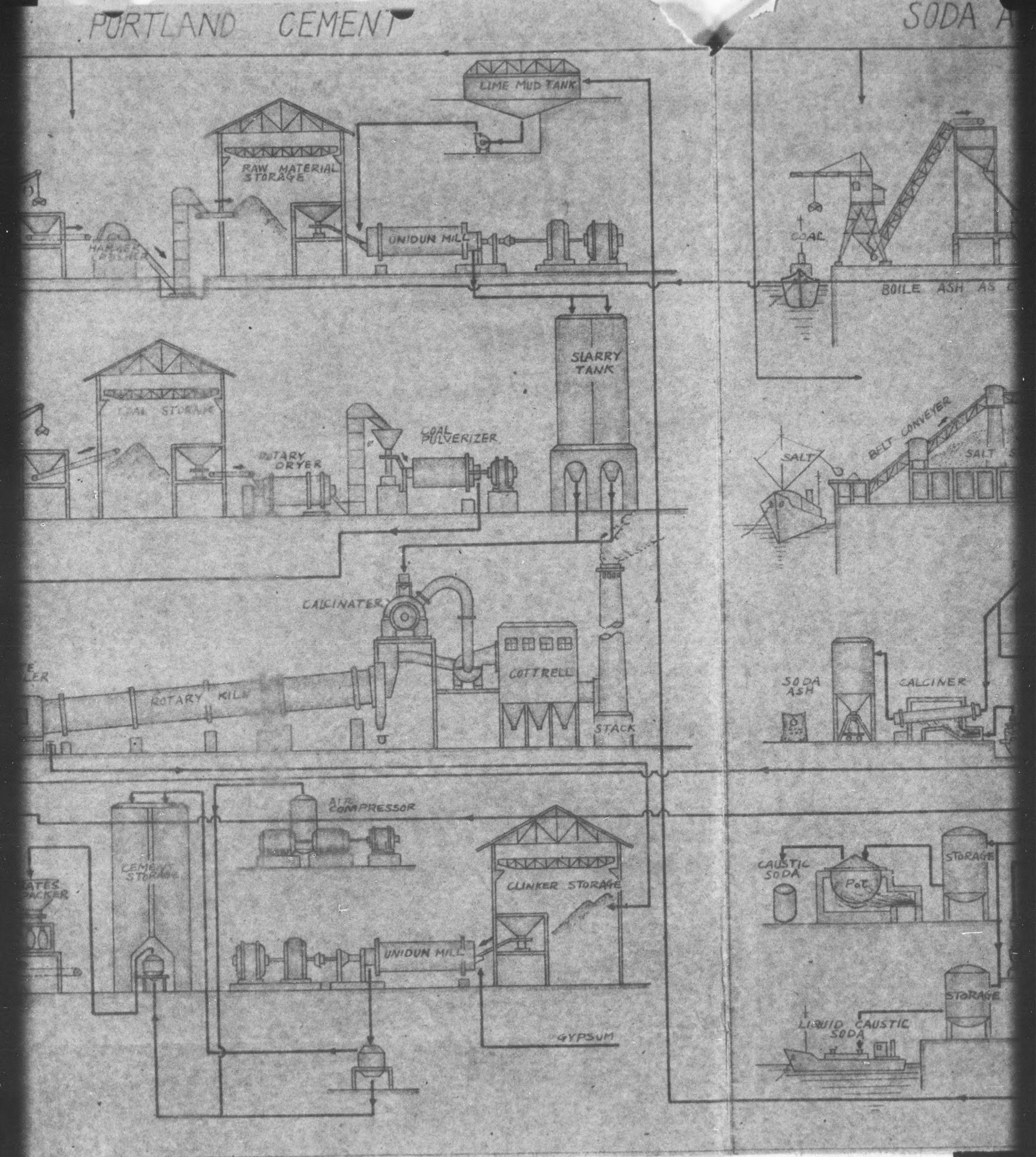

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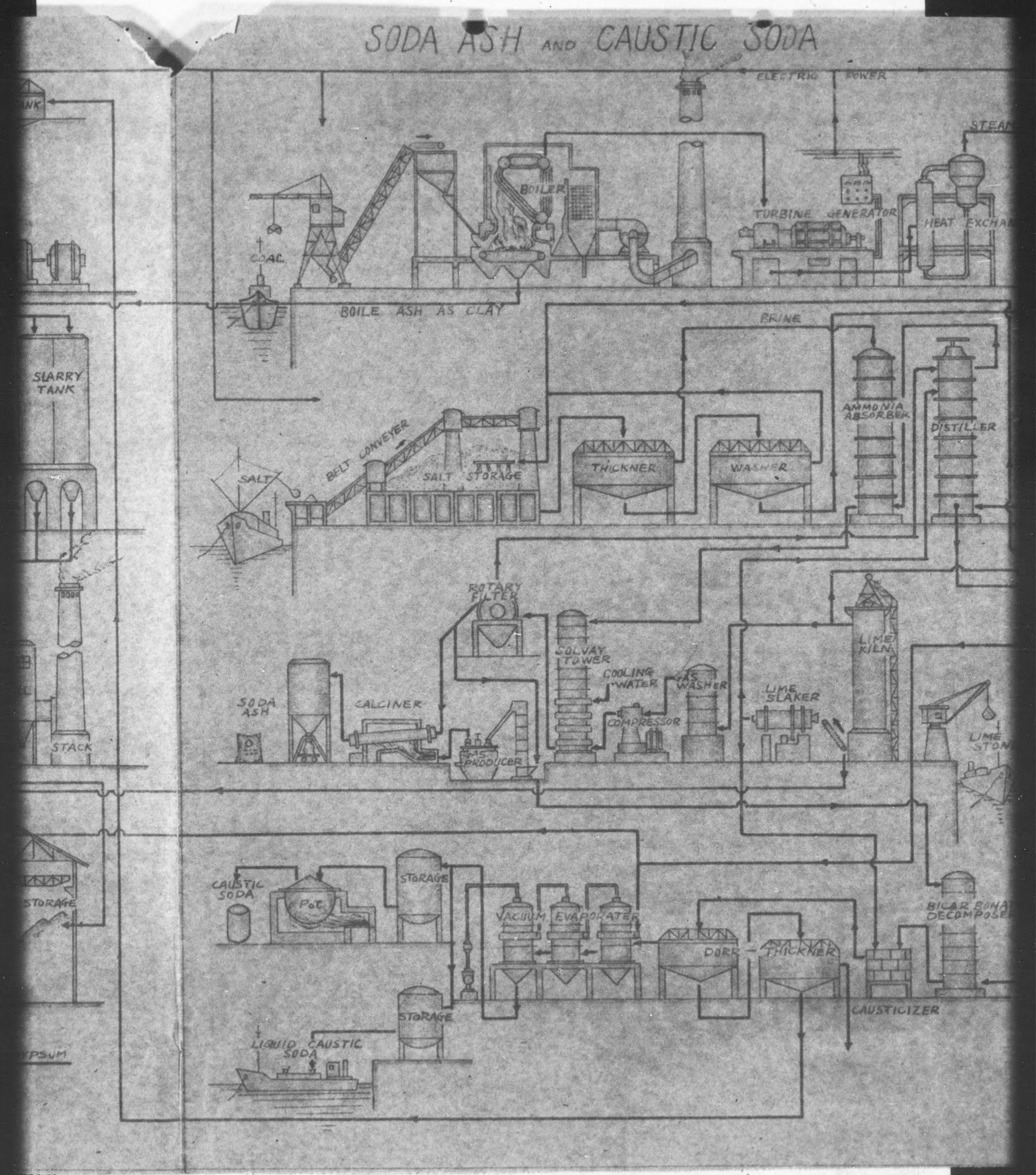
SODA ASH AND CAUSTIC SODA



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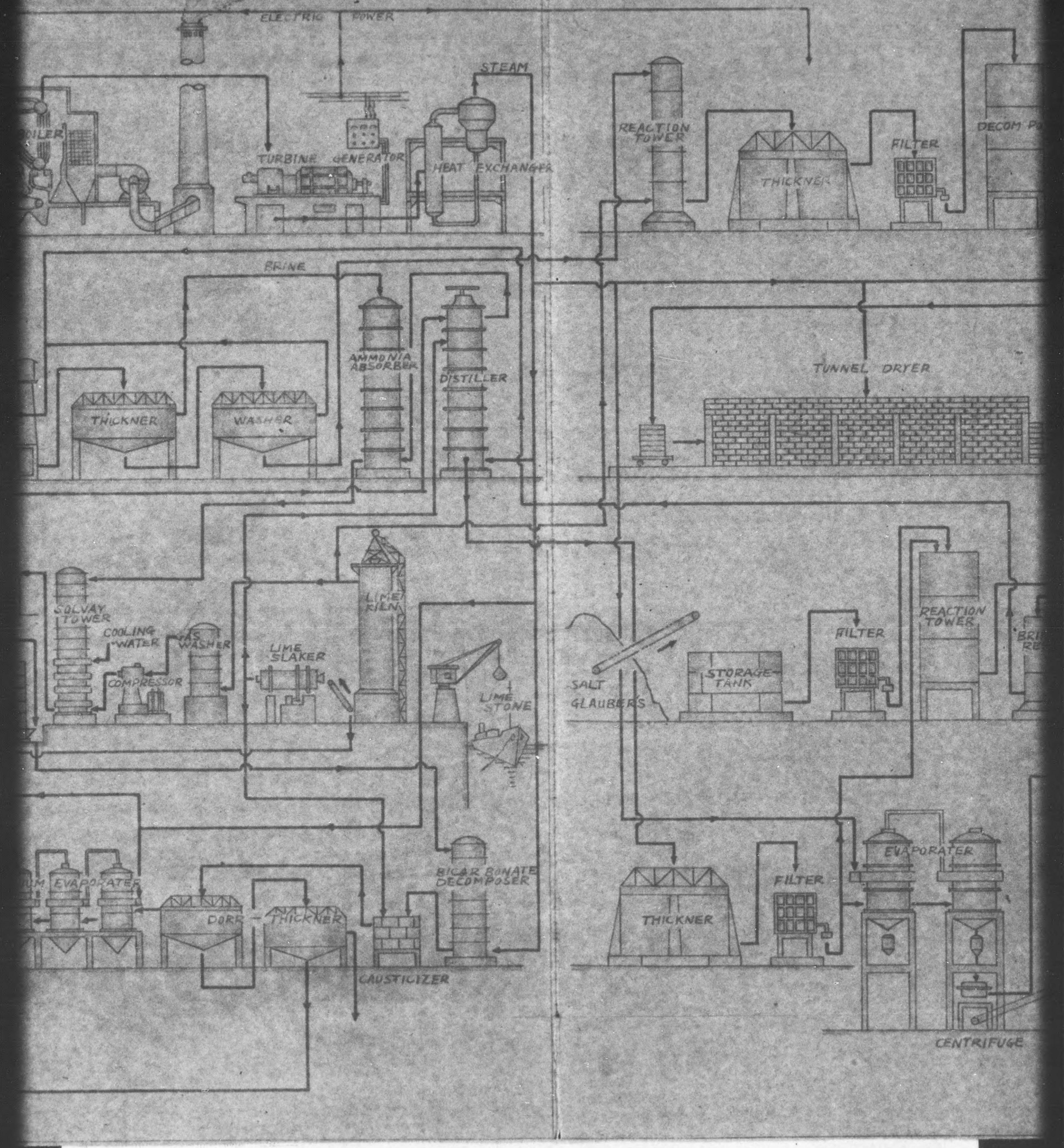
AND CAUSTIC SODA BY—PRODUCTS



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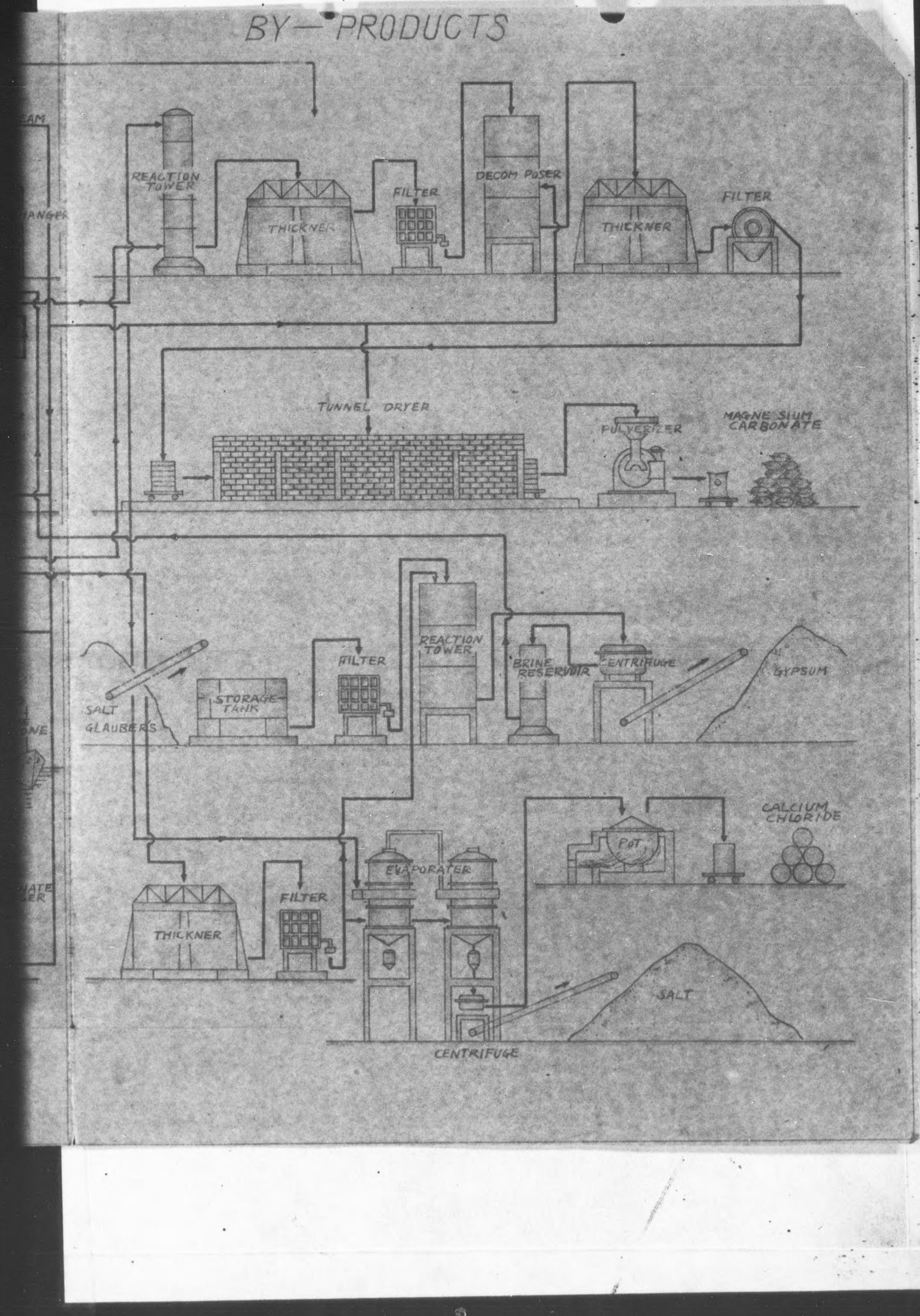
BY—PRODUCTS



DECLASSIFIED E.O. 12065 SECTION 3-402/NNDG NO. [illegible]

The Reports of the Tokuso Experimental Institude

No. 2

On the Accomplishment of Tokuyama Soda Co., Ltd. on Ammonium Chloride Researches

The 2nd Report

On the Studies of Manuring Effect of Ammonium Chloride

by Masao Harada

(Abstract)

Tokuyama Soda Co., Ltd.

published in 1948.

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Chapter I Preface

I have studied on the manuring effect of ammonium chloride since 1938 and reported some of these results in the Report of Agricultural Science Department in the Tokyo Imperial University.

In this report I want to summarize these studies which I have been studying for a long time, but some of these studies were published at the annual meeting of Japanese Agricultural Society.

Chapter II Relation between soil acidity and manuring of ammonium chloride on paddy plant

The 1st experiment This experiment was done at the Tokyo University with wagner pot in the green house. It showed change of soil acidity which are resulted from the various ways of manuring with ammonium chloride on paddy plant.

(1) The divisional manuring of ammonium chloride at much vigorous growth time gave the best harvest.

(2) Good yield is obtained by adding of lime.

(3) Ammonium chloride is superior to ammonium sulphate in the case of much manuring.

(4) Change of PH value in the soil was shown as follow :

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The change of PH in water extraction

Quantity of nitrogen per one pot	Ammonium chloride		Ammonium sulphate	
	Surface soil	Subsoil	Surface soil	Subsoil
0.5 Gm	6.65	6.73	6.36	5.96
1.0	6.36	6.73	5.93	6.56
1.5	5.63	6.86	5.86	6.80
2.0	5.36	6.66	5.86	6.96

The change of PH in Kcl extraction

Quantity of nitrogen per one pot	Ammonium chloride		Ammonium sulphate	
	Surface soil	Subsoil	Surface soil	Subsoil
0.5 Gm	6.06	6.25	5.53	5.96
1.0	5.63	6.70	5.20	6.56
1.5	5.16	6.60	4.95	6.80
2.0	5.53	6.63	5.00	6.96

In this experiment, we can see that ammonium chloride showed a little depressive value of PH in H_2O to ammonium sulphate but the opposite results were given on PH value in KCl extraction.

The 2nd experiment It showed change of soil acidity which are resulted from continuous cultivation of ammonium chloride, ammonium sulphate and these fertilisers mixed with limestone powder on the rice-field cultivation of paddy plant and wheat.

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	Surface soil				Subsoil			
	PHinH_2O	PHinKCl	Total acidity	Cl	PHinH_2O	PHinKCl	Total acidity	Cl
Ammonium sulphate	5.5	4.8	4.32	15.1	5.4	4.8	6.41	135.5
$(NH_4)_2SO_4$ with lime	5.7	4.9	1.51	11.9	5.4	4.8	2.16	119.1
Ammonium chloride	5.5	4.8	3.88	13.0	5.3	4.7	5.81	180.7
NH_4Cl with lime	5.7	5.0	1.15	11.6	5.5	4.9	2.55	181.4
NH_4Cl with small quantity of lime	5.6	4.8	3.57	12.8	5.3	4.8	4.74	89.8
$(NH_4)_2SO_4$ with soy-bean cake	5.5	4.9	2.16	18.4	5.4	4.8	4.42	185.3

(1) Values of PH in H_2O and PH in KCl solution showed no different between ammonium chloride and ammonium sulphate manuring.

(2) Total acidity of soil (Dikubara soil acidity) which was manured ammonium chloride was superior to that of ammonium sulphate.

(3) The Cl quantity in the table was shown mg value of Cl in 100 gr of dry soil. The Cl quantity of surface soils were shown small value but that of subsoil increased fairly quantity. Manuring of ammonium chloride gave a little high value of Cl quantity to ammonium sulphate manufing, and addition of lime stone powder help to leaching of Cl in from the soil.

Chapter III Relation between soil acidity and manuring of ammonium chloride in upland field.

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The 1st experiment This experiment was done at the Tokuyama manuring experimental station, which is attached to Tokuyama Soda Co., Ltd., it was the results of experiment of three nutrimental elements for barley after continuous cultivation of paddy plant and barley alternately.

Change of PH value

Name of plots	Surface soil	Subsoil
1. No manure plot	6.7	6.4
2. No nitrogen plot	6.5	6.4
3. No phophoric acid plot	6.1	6.1
4. No potassium manure plot	6.2	6.1
5. Complete manure	6.0	6.0
6. Complete manure with lime	7.1	6.6

Complete manure plot, employed ammonium sulphate, super phosphate, potassium sulphate showed highest depression of Hydrogen ion value. We must notice that ammonium sulphate give the lower value of hydrogen ion concentration of soil after employing its fertilizer to that of super phosphate and potassium sulphate.

The 2nd experiment It showed the change of soil acidity in the kind of soils when ammonium chloride applied to the cultivation of wheat with heap manure.

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Kind of soil	A - A'		B - B'		C - C'		D - D'	
Yield (gm)	2.8	7.4	0		0	2.1	47.3	50.9
PH value of surface soil	5.2	5.5	5.1	5.4	5.4	5.6	6.2	6.1
PH value of subsoil	5.5	5.5	4.9	4.7	5.1	5.5	6.3	6.2
Total acidity of surface soil	10.5	1.5	4.0	12.0	11.4	24.0	10.9	3.2
Total acidity of subsoil	13.0	1.7	5.3	13.6	22.4	17.2	8.4	1.36

Kind of soil	E - E'		F - F'		G - G'	
Yield (gm)	59.7	61.9	28.0	63.1	17.3	7.6
PH value of surface soil	6.0	6.1	5.6	5.9	5.5	5.4
PH value of subsoil	6.0	6.0	5.5	6.3	5.5	5.6
Total acidity of surface soil	5.7	1.95	21.7	3.7	11.8	4.4
Total acidity of subsoil	3.0	0.45	2.1	2.7	21.0	4.8

A. Komaba light loamy soil, A' Kamaba soil applied with heap manure.

B. Shibukawa gravel soil, B' above same

C. Shibukawa sandy soil, C' "

D. Arakida clayey soil, D' "

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E. Nakagawa clayey soil, E' Kamaba soil applied with heap manure.

F. Nakagawa sandy soil, F' above same

G. Kawaguchi sandy soil, G' "

This experiment showed noticeable results in which the depression of total acidity value (by Daikubara method) of subsoil showed the much inferior results to that of surface soil. Application of heap manure gave a little good results on yield, but gave no bemifitable effect on the depression of soil acidity by application mineral fertilizer only.

The 3rd experiment On the good harvest experiment of wheat at sandy soil, the change of soil acidity in the case of application chiefly ammonium chloride, was studied. Adding of lime stone powder to great quantity of ammonium chloride, very good results gave to yield the crop.

The 4th experiment On the comparative examination of manuring effect of ammonium chloride and ammonium sulphate on kind of wheat and barley, the difference of soil acidity are researched. In this experiment, ammonium chloride is superior to ammonium sulphate on harvest of barley. Next showed the mean value results of these cultivation by the difference between ammonium chloride and ammonium sulphate.

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Change of PH value

	Harvest (gm)	Surface soil acidity		Subsoil acidity	
		PH	Daikuwara	PH	Daikuwara
Ammonium sulphate	49.2	6.0	13.5	6.2	0.9
Ammonium chloride	52.3	6.0	12.7	6.2	1.1

Soil acidity after manuring was not shown any different between ammonium chloride and ammonium sulphate.

The 5th experiment It showed the change of soil acidity when ammonium chloride was employed on wheat cultivation in the case of difference condition of water level elevation.

Change of PH value

	Surface soil		Subsoil	
	PHin H_2O	PHinKCl	PHinH_2O	PHinKCl
8 sun to water level	6.1	5.7	6.1	5.16
5 sun to water level	6.23	5.7	6.23	5.93
Upland field condition	6.06	5.23	6.06	5.36

The soil of upland field condition was slightly more depression of Hydrogen ion concentration than that of the other conditions. It showed more fast the leaching of the base in field condition than others.

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The 6th experiment It showed the change of soil acidity after manuring of ammonium chloride with additional various fertilizers on orange tree cultivation. Adding of limestone powder is not corresponded to fruit harvests, but the soil acidity are regulated by adding of lime. On manuring in exess such as 9 kan of nitrogen per tan area, ammonium chloride which was admixed Organic Manure, such as soy-bean cake, fish meal, rice bran etc, was benefitable to ammonium salt itself.

The 7th experiment It showed the change of soil acidity on the rape-crop in the variation of ammonium chloride and ammonium sulphate manure.

Change of PH value

	Weight of grain	Surface soil		Subsoil	
		PHinH_2O	PHinKCl	PHinH_2O	PHinKCl
1. $(NH_4)_2SO_4$	22.2 gm	5.90	4.77	6.36	5.54
2. Graveled NH_4Cl	19.7	6.14	5.17	6.31	5.86
3. Powdered NH_4Cl	18.4	6.12	5.26	6.31	5.76
4. NH_4Cl with lime	19.8	6.24	5.51	6.51	6.06
5. No nitrogen	9.6	6.32	5.69	6.32	6.09

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These manure gave good results to the harvest of no nitrogen plot, and generally its harvest is greater, the depression of soil acidity is stronger.

The 8th experiment It showed the change of soil acidity on application of various quantity of ammonium chloride on the cultivation of perilla.

(A) On Arakawa sandy soil

	Weight of grain	PHinH_2O	PHinKCl	Total acidity	Cl
No nitrogen	0.45gm	6.2	5.05	0.48	2.1
1g NH_4Cl	1.58	6.13	4.90	0.79	3.03
2g NH_4Cl	3.35	6.3	4.86	1.05	3.26
4g NH_4Cl	8.25	5.93	4.96	3.67	4.36
6g NH_4Cl	15.00	5.4	4.8	4.50	2.8
8g NH_4Cl	16.70	5.8	4.8	3.45	3.36

(B) On Tanashi light loamy soil

	Weight of grain	PHinH_2O	PHinKCl	Total acidity	Cl
No nitrogen	5.60gm	5.9	5.36	0.62	3.83
1g NH_4Cl	6.65	5.86	5.26	0.69	4.40
2g NH_4Cl	5.63	5.73	5.20	0.82	4.56
4g NH_4Cl	9.02	5.60	5.00	1.16	7.13
6g NH_4Cl	7.05	5.63	5.00	1.37	7.10
8g NH_4Cl	8.35	6.73	5.00	1.19	4.90

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On Arakawa sandy soil, application of ammonium chloride was benefitable on cultivation of perilla, but on Tanashi soil was not so evident to Arakawa soil. Change of PH value is less but total acidity (by Daikubara method) of soil was shown a little more increase when the fertilizer was used in exess. In this table Cl was shown on mg value in 100 gm soil and Cl ion run off so fast that very small quantity of Cl was found in the soil to compare application of chloride.

The 9th experiment It showed the change of soil acidity when different feather of nitrogen manure was emplied on the cultivation of perilla.

	Weight of grain	PHinH_2O	PHinKCl	Total acidity	Cl
1. NH_4Cl	248 gm	5.65	5.27	0.55	28.2
2. $(NH_4)_2SO_4$	251	5.50	5.20	0.73	18.0
3. NH_4Cl with $(NH_4)_2SO_4$	244	5.68	5.3	0.62	30.8
4. NH_4Cl with calcium cyanamide	244	5.9	5.6	0.52	23.8

Admixture of calcium cyanamide gave better result of soil acidity than others, and the Cl ion remained in the soil, was not shown in remarkable difference.

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Chapter IV On the effect of ammonium chloride to sugar content.

It was said that there is a close relation between Cl content and sugar in the plant, so that we examined to compare the glucosity of various crops, such as radish, tomato, orange, tanip which are cultivated with ammonium chloride and ammonium sulphate.

Summary of these experiments are as follow :-

(1) Ammonium chloride made the sugar content of these plants greater than ammonium sulphate.

(2) When ammonium chloride was employed on "Root Vegitables" cultivation, these yield was very good and the glucosity of these harvests showed high value to ammonium sulphate.

(3) Adding of phospheric acid manure generally increased the glucosity of harvest, and same relation was befound at potassium manure, but a little.

Chapter V Comparative examination of manuring effects of ammonium chloride and ammonium sulphate when are employed in much excess.

The 1st paddy plant, the 2nd barley, the 3rd wheat and barley, the 4th sweet potato, the 5th potato, the 6th rape crop were used to comparative examination. Generally manuring of ammonium sulphate in excess made on the stalk and leave, wack and feeble but ammonium chloride did not show such defects, and adding of lime to these fertilizers gave the benefitable results, especially in this case application of ammonium chloride showed the better results.

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The 1st experiment It was comparative examination of manuring effects of ammonium chloride and sulphate on the many varieties of apddy plant when these fertilizers were employed in exess. It was shown that ammonium chloride gave more benefitable effect than ammonium sulphate on their application in excess.

Variety of paddy plant	Kind of manure	Total weight of crop	Weight of grain
1. Nowrin 1st	Ammonium chloride	32.8 gm	13.6 gm
	Twice quantity of NH_4Cl	52.8	24.5
	Twice quantity of $(NH_4)_2SO_4$	60.3	29.3
2. Chiba asahi	Ammonium chloride	40.0	16.8
	Twice quantity of NH_4Cl	63.6	28.1
	Twice quantity of $(NH_4)_2SO_4$	53.6	24.2
3. Kyoshin	Ammonium chloride	41.7	16.1
	Twice quantity of NH_4Cl	59.4	24.9
	Twice quantity of $(NH_4)_2SO_4$	60.6	25.1
4. Mubaikoku	Ammonium chloride	20.1	8.0
	Twice quantity of NH_4Cl	53.2	25.3
	Twice quantity of $(NH_4)_2SO_4$	47.5	22.5

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Variety of paddy plant	Kind of manure	Total weight of crop	Weight of grain
5. Nowrin the 8th	Ammonium chloride	44.5	18.8
	Twice quantity of NH_4Cl	68.5	30.7
	Twice quantity of $(NH_4)_2SO_4$	57.2	23.2
6. Miho the 3rd	Ammonium chloride	39.0	15.0
	Twice quantity of NH_4Cl	64.0	27.7
	Twice quantity of $(NH_4)_2SO_4$	62.0	26.7
7. Toyo asahi	Ammonium chloride	39.1	14.2
	Twice quantity of NH_4Cl	69.5	26.7
	Twice quantity of $(NH_4)_2SO_4$	64.0	26.5
8. Toyo akaho	Ammonium chloride	38.7	13.7
	Twice quantity of $(NH_4)Cl$	61.7	23.2
	Twice quantity of $(NH_4)_2SO_4$	56.7	21.2

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The 2nd experiment On barley cultivation the same plant of examination was done at the Tokyo University.

Name of plots	Harvest: Total weight of crop	Weight of grain
1. Ammonium sulphate	81.0 gm	39.8 gm
2. Ammonium chloride	85.4	43.9
3. $(NH_4)_2SO_4$	84.6	41.1
4. NH_4Cl plus lime	90.8	43.7
5. Twice quantity of $(NH_4)_2SO_4$	98.0	49.9
6. Twice quantity of NH_4Cl	101.5	54.4
7. Twice quantity of $(NH_4)_2SO_4$ with lime	112.0	55.2
8. Twice quantity of $(NH_4)Cl$ with lime	121	60.6

In this experiment, ammonium chloride gave the better result to ammonium sulphate, especially when these fertilizers were used in exess, and manuring effects of lime application were shown, when these fertilizers were employed in exess and especially ammonium chloride gave more effective results on that case.

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The 3rd experiment Similar experiment to the 2nd was done at Tokuyama manuring experimental station on wheat and barley cultivation and similar result were given in this experiment.

The 4th experiment Sweet potato experiment at the Tokyo University were given the similar relation between ammonium chloride and ammonium sulphate when these fertilizers are employed in exess. Generally when ammonium sulphate are used in exess on sweet potato cultivation, the leave grow thick and inferior result are given.

The 5th experiment On potato cultivation, similar experiment was done at the Tokyo University.

Soil Type	Kind of manure	the yield in good size	the yield in small size
a. Arakida clayey soil	1. Ammonium chloride	731 gm	110.0 gm
	2. Ammonium sulphate		
	3. Twice quantity of NH_4Cl		
	4. Twice quantity of $(NH_4)_2SO_4$		
b. Tanashi light loamy soil	1. Ammonium chloride	612.0	81.7
	2. Ammonium sulphate	579.5	24.6
	3. Twice quantity of NH_4Cl	825.0	4.8
	4. Twice quantity of $(NH_4)_2SO_4$	519.0	92.8

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Ammonium chloride gave good harvest to ammonium sulphate especially these fertilizers were used in excess.

The 6th experiment Similar plan of rape crop experiment was done at the Tokyo University.

Name of plots \ Harvest	Weight of stlks and leave	Weight of grain
1. Ammonium chloride	764 gm	327 gm
2. Ammonium sulphate	862	336
3. Twice quantity of NH_4Cl	1092	443
4. Twice quantity of $(NH_4)_2SO_4$	934	388

We can say that ammonium chloride is good manure to ammonium sulphate when this fertilizer are emplied in excess.

Chapter VI Effect of ammonium chloride on fibre plants

It had been said that Cl ion to fibre-plants, such as cotton rush, ramie, hemp etc. show the benefitable effect, so we tried to ascertain these facts. The 1st on rush (Hichitoi), the 2nd also rush, the 3rd hemp, the 4th ramie, the 5th rush (Bingoi), the 6th cotton crop were put on practice. Generally, the application of ammonium-chloride gave larger crop to that of ammonium sulphate and increased the flexibility of plant by application of ammonium chloride.

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Chapter VII Effects of Application of Ammonium Chloride on the content of Fat.

We examined to difference of Fat content of crops, such as rape seed, perilla, when ammonium chloride was used on the cultivation of these crops. On the yield of these crops, ammonium chloride was superior to ammonium sulphate in clayey soil and reverse in sandy soil, but fat quantity of these crops can not be recognized any difference between the two fertilizers.

Chapter VIII On manuring effects of Ammonium chloride when phosphoric acid was employed

The 1st experiment Next table showed the comparative results of ammonium chloride and ammonium sulphate in different applied quantity of phosphoric acid manure on paddy plant by Wagnor pot experiment.

Name of plots \ Harvest	Total weight of crop	Weight of grain
1. Ammonium sulphate with no P_2O_5	39.0 gm	12.83 gm
2. Ammonium chloride with no P_2O_5	17.3	6.16
3. Ammonium sulphate with o.25 gm P_2O_5	73.0	28.3
4. Ammonium chloride with 0.25 gm P_2O_5	72.3	31.8
5. Ammonium sulphate with 0.5 gm P_2O_5	94.0	33.9
6. Ammonium chloride with 0.5 gm P_2O_5	100.1	45.8

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7. Ammonium sulphate with 1 gm P_2O_5	113.0 gm	44.1 gm
8. Ammonium chloride with 1 gm P_2O_5	122.3	57.8
9. Ammonium sulphate with 2 gm P_2O_5	123.0	49.4
10. Ammonium chloride with 2 gm P_2O_5	134.6	61.2

The 2nd and 3rd experiments The same experiments was done on many varieties of paddy plants, and was showed the similar results on these experiments.

The 4th experiment It showed the manuring effect of ammonium chloride at the kind of soils when phosphoric acid and lime were used. In the paddy field, we were often recognized many kind of soils which are not shown any benefitable effect on applying phosphoric acid manure. But special kind of soils give very remarkable result on adding phosphoric acid and in these soil in which we can see also the similar results above described, application of lime did not show any benefitable effect when phosphoric acid was not used on the cultivation of apddy plant,

The 5th experiment Next table showed the comparative results of ammonium chloride and ammonium sulphate in different applied quantity of phosphoric acid manure on barley by Wagnor pot experiment.

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Name of plots (Harvest)	Total weight of crop	Weight of grain
1. Ammonium sulphate with no P_2O_5	1.2 gm	0.18 gm
2. Ammonium chloride with no P_2O_5	1.0	0.16
3. Ammonium sulphate with 0.25 g P_2O_5	22.3	11.8
4. Ammonium chloride with 0.25g P_2O_5	14.0	8.2
5. Ammonium sulphate with 0.5g P_2O_5	33.3	18.9
6. Ammonium chloride with 0.5g P_2O_5	33.5	18.6
7. Ammonium sulphate with 1g P_2O_5	53.0	29.5
8. Ammonium chloride with 1g P_2O_5	52.0	29.4
9. Ammonium sulphate with 2g P_2O_5	67.0	17.9
10. Ammonium chloride with 2g P_2O_5	78.0	45.4

On barley cultivation, same relation as above described was shown on application of various quantity of phosphoric acid manure when ammonium chloride and sulphate were used.

The 6th and 7th experiments The same experiments was done on many varieties of barley, and was shown the similar results on these experiments.

We can say that ammonium chloride gave inferior results to ammonium sulphate when the soil are entirely lacked in water soluble phosphate, but when the little quantity of phosphoric acid manure

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applied, the same results between two fertilizers were given and on application of phosphoric acid manure in excess ammonium chloride gave more benefitable results than ammonium sulphate.

Chapter XI Distribution of Cl and N in plants

On the 1st experiment, pea nut cultivation was done by water culture. The water culture solution was made by following attention; the one employed these drugs which has not any sulphure, the other employed the drugs which has not any chloride element.
Next showed the Cl content in plant degree as following order :-

Leave > stalk > root > hull > grain.

When ammonium chloride was applied, the quantity of Cl in the plant increase that of ammonium sulphate, but the difference are very small to compare application of these fertilizers. Next we studied the following crops :-

The 2nd paddy plant, the 3rd various kind of paddy plant, the 4th also paddy plant when phosphoric acid manure employed in various quantity, the 5th sweet potato, the 6th also sweet potato, the 7th potato, the 8th leaf of tea tree, the 9th also leaf of tea tree. On the above experiments we could not see any difference N content of plant which were cultivated with ammonium chloride or ammonium sulphate.

Chapter X On the manuring effects of ammonium chloride and ammonium sulphate in different condition of rice field.

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The 1st experiment This experiment was done on the paddy plant in the Wagnor pot experiment at the Tokyo University, and run out the water from the pot day by day.

Name of plots / Harvest	Total weight of crop	Weight of grain
1. Ammonium chloride 10cc of water (from the pot per day) plot	127.7 gm	63.5 gm
2. Ammonium sulphate 10cc of H_2O plot	112.2	54.7
3. Ammonium chloride 20cc H_2O plot	108.2	53.5
4. Ammonium sulphate 20cc H_2O plot	114.1	58.7
5. Ammonium chloride 50cc H_2O plot	124.7	62.0
6. Ammonium sulphate 50cc H_2O plot	123.5	59.5
7. Ammonium chloride 100cc H_2O plot	125.5	61.5
8. Ammonium sulphate 100cc H_2O plot	135.0	65.5
9. Ammonium chloride 200cc H_2O plot	142.0	68.7
10. Ammonium sulphate 200cc H_2O plot	146.4	64.2
11. Ammonium chloride no run out water	113.2	55.2
12. Ammonium sulphate no run out water	129.0	64.2

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When irrigation water run out from the field, paddy plant gave benefical results, on the paddy field condition. There had been no noticeable difference in the manuring effect of the two fertilizers, and in some instance one was better than the other, and vice versa.

The 2nd and 3rd experiments It showed the comparative manuring effect of ammonium chloride and sulphate on paddy plant, when these fertilizers were leached out by some water after application of these fertilizers. Generally the plot of ammonium chloride which was leached out by some water, gavé the superior results to application of ammonium sulphate.

The 4th experiment It showed the comparative manuring effect of ammonium chloride and sulphate by the difference of water elevation. On the shallow and deep water plots, ammonium chloride gave the superior results to ammonium sulphate.

The 5th experiment It was done on vegitable, this plan of examination was the same as above experiment, and similar results were obtained.

The 6th experiment It showed the comparative manuring effect of ammonium chloride and sulphate on wheat cultivation by the difference of the depth of manuring. On the shallow manuring generally ammonium chloride inferior result to ammonium sulphate but on manuring in the soil usually ammonium chloride was much superior results to ammonium sulphate.

Chapter XI On the manuring effects of different forms of ammonium chloride fertilizer.

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<u>The 1st experiment</u> Symtheric ammonium chloride (prepared by electrolysis Soda Works) and by-product ammonium chloride (prepared by ammonium Soda Works) were emplied on the cultivation of paddy plant, and it showed that by-product ammonium chloride always superior to symthetic products.

<u>The 2-4th experiments</u> Granulating of ammonium chloride, and admixture of lime are examined on cultivation of crops. Granulated ammonium chloride was a little inferior to powdered one on some cultivation. Next, adding of lime gave no benefical effects on paddy plant but gave the good results on wheat and barley cultivation.

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The Experiments of the Manuring Effects of Ammonium Chloride

Part I

1939

(Abstract)

Tokuyama Soda Co., Ltd.

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Notice : This report shows many experimental results comparing ammonium chloride and ammonium sulphate. On the early experimental stage, ammonium chloride was found a little inferior to ammonium sulphate, but the later experiments verify the superiority of ammonium chloride to ammonium sulphate. This is due to the different source of ammonium chloride. Earlier, ammonium chloride that was employed was an industrial chemical, prepared by electrolytic soda factory, while ammonium chloride that was used later, was the by-product of ammonium soda process of Tokuyama Soda Co., Ltd.

Different source of ammonium chloride often gives different fertilizing effects and in this respect you will please refer to Chapter XI of a leaflet, "On the Accomplishment of Tokuyama Soda Co., Ltd. of Ammonium Chloride Researches."

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The Experiments of the manuring effects of Ammonium Chloride

Masao Harada

(abstract)

Preface

The experimental data presented in this report are classified in three parts; First, paddy and upland paddy plant; second, wheat and barley; and third, vegitable and others.

Part I. Paddy and upland plant

(1) Comparative examination of the manuring effect of ammonium chloride and ammonium sulphate.

(2) Experiments of the manuring effect of the mixed fertilizer containing ammonium chloride.

Part II Wheat and barley.

(1) Good harvest experiments of mixed fertilizer containing chiefly ammonium chloride.

(2) Comparative examination of the manuring effects of ammonium chloride and ammonium sulphate.

(3) Experiments of the manuring effect of ammonium chloride admixed various organic fertilizers.

Part III Vegetables and others.

(1) Experiments of the manuring effect of ammonium chloride admixed various fertilizer.

(2) Comparative examination of the manuring effect of ammonium chloride and ammonium sulphate.

Now we show the results of each experiments, briefly:-

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The 1st experiment In the field experiment at Nakagawa-mura in Chiba Prefecture, manuring effects of ammonium chloride was equal to that of ammonium sulphate on the paddy plant, but ammonium chloride was fairly superior to ammonium sulphate when lime was added.

Plots	Husked paddy grain
	Koku/ton
1. Ammonium sulphate	3,921
2. Ammonium sulphate plus lime-stone powder	3,699
3. Ammonium chloride	3,878
4. Ammonium chloride plus lime-stone powder	3,883
5. Ammonium chloride plus a little quantity of lime	3,763
6. Ammonium sulphate plus soybean cake	4,052

The 2nd experiment In the field experiment at Nishina-mura in Shizuoka Prefecture on paddy plant, ammonium chloride, ammonium sulphate and ammonium chloride admixed various fertilizer, such as lime-stone powder, ammonium sulphate, soy-bean cake, fish meal, heap manure, green manure, calcium cyanamid were used. Only mineral fertilizer showed better results on the total weight of yield, but some of ammonium chloride, admixed organic manures were superior to mineral fertilizer in respect of paddy grain. In the yield of the husked grain, the plots of ammonium chloride, admixed ammonium sulphate or fish meal were a little superior to others. Next table show the average yield of these plots per 13 tsubo area.

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Name of Plots	Total weight of crop	Weight of husked paddy grain
	kan/13tsubo	kan/13 tsubo
1. Ammonium sulphate	17,025	5,683
2. Ammonium chloride	17,125	5,580
3. Ammonium chloride plus limo-stone powder	17,325	5,614
4. Ammonium chloride plus ammonium sulphate	17,275	5,828
5. Ammonium chloride plus soy-bean cake	16,625	5,609
6. Ammonium chloride plus fish meal	16,825	5,826
7. Ammonium chloride plus heap manure	16,050	5,574
8. Ammonium chloride plus green manure	16,880	5,611
9. Ammonium chloride plus calcium cyanamid	15,825	5,265

The 3rd experiment In the wagner pot culture experiment on the upland paddy plant at the Tokyo University, ammonium sulphate was superior to ammonium chloride. On addition of lime, each showed less yield.

Name of plots	Total weight of crop	Weight of husked paddy grain
	Gm/pot	Gm/pot
1. Ammonium sulphate	106.4	37.5
2. Ammonium chloride	107.4	36.3
3. Ammonium sulphate plus limo-stone powder	94.0	31.8
4. Ammonium chloride plus lime-stone powder	104	36.3
5. Ammonium chloride plus a little quantity of limo	95.6	31.51

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6. Twice quantity of ammonium sulphate	129.5	46.7
7. Twice quantity of ammonium chloride	119.7	49.66
8. Twice quantity of $(NH_4)_2SO_4$ plus limo-stone powder	120.0	44.6
9. Twice quantity of NH_4Cl plus lime-stone powder	97.6	37.4
10. Twice quantity of NH_4Cl plus a little quantity of lime	118.6	42.5

The 4th experiment In the wagner pot experiment at the Tokyo University on paddy plant, ammonium chloride had a little superior effect to ammonium sulphate. On addition of lime, each showed less yield.

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Name of plots	Total weight of crop	Weight of husked paddy grain
	Gm/pot	Gm/pot
1. Ammonium sulphate	116.8	41.21
2. Ammonium chloride	112	38.88
3. Ammonium sulphate plus lime-stone powder	113	39.46
4. Ammonium chloride plus lime-stone powder	113	38.75
5. Ammonium chloride plus a little quantity of lime	115	40.38
6. Twice quantity of $(NH_4)_2SO_4$	170.5	61.90
7. Twice quantity of NH_4Cl	168.5	59.07
8. Twice quantity of $(NH_4)_2SO_4$ plus lime-stone powder	154	52.70
9. Twice quantity of NH_4Cl plus lime-stone powder	155	53.09
10. Twice quantity of NH_4Cl plus a little quantity of lime	152.3	48.70

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The 5th experiment In the wagner pot experiment at the Tokyo University on paddy plant, addition of green manure to ammonium chloride gave excellent effect on the yield, especially where these green manure were given to the paddy field immediately following the last harvest. The effect of heap manure of straw was not noticeable. Ammonium chloride was superior to ammonium sulphate in all cases in this experiment.

The 6th experiment This experiment was done to compare the manuring effects of ammonium sulphate, ammonium chloride and ammonium chloride admixed various mineral fertilizers, such as ammonium sulphate, calcium cyanamide. The plot of ammonium sulphate was a little superior to others and the plot of ammonium chloride added calcium cyanamide was worst on harvest.

Name of plot	Total weight of crop	Weight of husked paddy grain
	Gm (pot)	Gm (pot)
1. Ammonium sulphate	33.4	12.48
2. Ammonium chloride	30.8	11.84
3. Ammonium chloride plus ammonium sulphate	30.3	11.25
4. NH_4Cl plus a little quantity of $(NH_4)_2SO_4$	31.6	12.26
5. NH_4Cl plus calcium cyanamide	25.3	9.45
6. NH_4Cl plus a little quantity of calcium cyanamide	29.6	11.06

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The 7th experiment Experiment on applying additional ammonium chloride and ammonium sulphate on paddy plant in its early stage showed same yield as on original manuring, but adding in the later stage gave better yield than from original manuring, but the quality of paddy grain was poor. In this experiment of applying additional fertilizers, ammonium chloride was inferior to ammonium sulphate in every respect.

Name of plot	Total weight of crop	Weight of husked paddy grain
	Gm/pot	Gm/pot
1. Basal manuring of $(NH_4)_2SO_4$	33.4	12.48
2. Basal manuring of NH_4Cl	30.8	11.84
3. Basal manuring of $(NH_4)_2SO_4$ additional manuring of $(NH_4)_2SO_4$ in early time.	30.6	11.85
4. Basal manuring of $(NH_4)_2SO_4$ additional manuring of $(NH_4)_2SO_4$ in later time	33.0	13.05
5. Basal manuring of $(NH_4)_2SO_4$ additional manuring of NH_4Cl in early time	33.0	12.81
6. Basal manuring of $(NH_4)_2SO_4$ additional manuring of NH_4Cl in later time	34.0	12.66
7. Basal manuring of $(NH_4)Cl$ additional manuring of NH_4Cl in early time.	32.6	12.65
8. Basal manuring of NH_4Cl additional manuring of NH_4Cl in later time	33.6	12.75

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The 8th experiment The kind soils had much effect on manuring value among ammonium chloride and ammonium sulphate on paddy plant. In the case of "Tamagawa" soil, ammonium sulphate was little superior to ammonium chloride. "Aichi" soil had some harmful element and paddy plant did not naturo. In the case of "Matsumoto" soil, the result was reverse of "Tamagawa" soil.

Name of plot	Total weight of crop	Weight of husked grain
A. Tamagawa soil	Gm/pot	Gm/pot
Ammonium sulphate	33.4	12.48
Ammonium chloride	30.8	11.84
B. Aichi soil		
Ammonium sulphate	18.0	0.55
Ammonium chloride	14.6	0.11
C. Matsumoto soil		
Ammonium sulphate	34.5	11.85
Ammonium chloride	40.3	14.73

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The 9th experiment Many kinds of soils were examined to see the manuring effects of ammonium chloride or ammonium sulphate on upland paddy plant.

(a) Aichi soil :- Ammonium chloride was superior to ammonium sulphate on the yield especially on the addition of lime.

(b) Sandy soil :- Ammonium chloride was inferior to ammonium sulphate especially on addition of lime.

(c) Shizuoka soil :- Ammonium chloride was better than ammonium sulphate, and generally addition of lime decreased the yield.

(d) "Tamagawa" soil :- Ammonium chloride was a little superior to ammonium sulphate.

(e) "Matsumoto" soil :- Ammonium chloride was inferior to ammonium sulphate.

(f) "Kumaba" soil :- The same as above

Name of Plot	Total weight of crop	Weight of husked grain
	Gm/per pot	Gm/per pot
(a) Aichi soil		
(1) $(NH_4)_2SO_4$	17.5	4.83
(2) $(NH_4)SO_4$ plus lime	18.8	5.10
(3) NH_4Cl	19.0	5.17
(4) NH_4Cl plus lime	19.1	5.55

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(b) Sandy soil		
(5) $(NH_4)_2SO_4$	20.8	7.60
(6) $(NH_4)SO_4$ plus lime	14.6	5.34
(7) NH_4Cl	18.0	6.28
(8) NH_4Cl plus lime	12.5	3.68
(c) Shizuoka soil		
(9) $(NH_4)_2SO_4$	25.5	7.97
(10) $(NH_4)_2SO_4$ plus lime	16.7	5.12
(11) NH_4Cl	26.0	6.85
(12) NH_4Cl plus lime	21.2	5.87
(d) Tamagawa soil		
(13) $(NH_4)_2SO_4$	18.1	5.83
(14) $(NH_4)SO_4$ plus lime	13.1	3.48
(15) NH_4Cl	20.2	6.20
(16) NH_4Cl plus lime	15.8	5.06
(e) Matsumoto soil		
(17) $(NH_4)_2SO_4$	29.8	9.39
(18) $(NH_4)SO_4$ plus lime	20.6	6.65
(19) NH_4Cl	18.3	4.43
(20) NH_4Cl plus lime	17.6	5.50
(f) Komaba soil		
(21) $(NH_4)_2SO_4$	25.1	6.51
(22) $(NH_4)_2SO_4$ plus lime	19.3	5.71
(23) NH_4Cl	21.6	4.61
(24) NH_4Cl plus lime	19.6	4.30

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The 10th, 11th and 12th experiments In these experiments, it showed good results at various places when mixed manures principally with ammonium chloride were used on the wheat. At Nakagawa-mura in Chiba Prefecture, mineral fertilizer showed excellent results and ammonium chloride was much superior to ammonium sulphate. At Nishina-mura in Shizuoka Prefecture, ammonium chloride showed good results especially when ammonium chloride alone was used, on the volcanic soil on Kwanto Plain, ammonium chloride is much superior to ammonium chloride with soy bean cake and fish meal added, in respect of grain content. Same results were given on barley.

The 13th experiment In wagner pot culture experiment at the Tokyo University, it showed good results when ammonium chloride with heap manure of straw added, are given on wheat cultivation. The effect of heap manure of straw was excellent when more ammonium chloride was added, and generally ammonium chloride is superior to ammonium sulphate on the crop production when heap manure of straw were used together.

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The 14th experiment This experiment showed the manuring effect on wheat, when ammonium chloride with heap manure of straw added, at wagner pot experiment in the Tokyo University. It was said that the manuring effect of heap manure of straw differed by the kind of soils. The clayey soil, such as Komaba soil and Shibukawa gravel soil showed good effect of heap manure of straw but light soil as Shibukawa sandy soil showed good growth in the early stage but gave opposite results at the ripening time.

The 15th experiment On the comparative experiment of the manuring effect of ammonium chloride and ammonium sulphate at Nakagawa-mura in Chiba Prefecture which has been in progress since last year, no difference could be recognized between the two. Generally ammonium sulphate gave feeble stem to barley plant and weakened the plant but ammonium chloride made it healthy and vigorous.

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Name of plot	Total weight of crop	Weight of grain
	Kan/tan	Kan/tan
1. Ammonium sulphate	218,999	105,788
2. Ammonium sulphate plus lime-stone powder	210,500	102,214
3. Ammonium chloride	217,571	101,000
4. Ammonium chloride plus lime-stone powder	214,785	105,571
5. NH_4Cl plus a little quantity of lime	224,428	108,000
6. NH_4Cl plus soy-bean cake	198,750	94,500

The 16th experiment In the field experiment at Nakagawa-mura in Chiba Prefecture on barley, with ammonium sulphate, ammonium chloride and ammonium chloride, admixed various fertilizer, such as ammonium sulphate, calcium cyanamide, fish meal, soy-bean cake, hoap manure rice bran, generally the plots of mineral fertilizer alone were superior to others. Soy-bean cake and rice bran injured plant roots by fermentation at early stage and calcium cyanamide gave poor yield on the plot, when calcium cyanamide was scattered on the entire surface. On this experiment, ammonium chloride showed better results than ammonium sulphate and ammonium chloride mixed organic manures.

Name of Plots	Total weight of crop	Weight of grain
	Kan/tan	Kan/tan
1. Ammonium sulphate	232,606	117,000
2. Ammonium chloride	269,035	124,714
3. NH_4Cl plus $(NH_4)_2SO_4$	241,071	117,428
4. NH_4Cl plus calcium cyanamide	219,642	106,821
5. NH_4Cl plus fish meal	240,537	113,785

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6. NH_4Cl plus soy-bean cake	220,928	107,142
7. NH_4Cl plus heap manure of straw	242,785	119,142
8. NH_4Cl plus rice bran	221,785	103,542

The 17th experiment This was the comparative experiment of ammonium chloride and ammonium sulphate on barley by wagner pot test in the green house in the Tokyo University. In this experiment lime-stone powder showed excellent manuring effect, with especially remarkable effects recognized when much mineral fertilizers were used, and ammonium chloride was superior to ammonium sulphate in all cases.

Name of plots	Total weight of crop	Weight of grain
	Gm/pot	Gm/pot
1. Ammonium sulphate.	81.0	39.3
2. Ammonium chloride	65.4	43.9
3. $(NH_4)_2SO_4$ plus lime-stone powder	84.6	41.1
4. NH_4Cl plus lime-stone powder	90.3	43.7
5. NH_4Cl plus a little quantity of lime	86.6	43.6
6. Twice quantity of $(NH_4)_2SO_4$	98.0	49.9
7. Twice quantity of NH_4Cl	101.5	54.4
8. Twice quantity of $(NH_4)_2SO_4$ plus lime-stone powder	112.0	55.2
9. Twice quantity of NH_4Cl plus lime-stone powder	117.6	60.6
10. Twice quantity of NH_4Cl plus a little quantity of lime	111.6	62.1

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The 18th experiment This was done by the similar manure as the 15th experiment on wheat. This experiment also showed excellent result when lime-stone powder was added espocially on ammonium fertilizer in large quantity. Wheat showed much more damage than barley when ammonium fertilizers were used in excess, but addmixture of lime-stone powder then gave favorable results and much yield. On plot given a little quantity of lime-stone powder, the result was not good.

Name of plots	Total weight of crop	Weight of grain
	Gm/pot	Gm/pot
1. Ammonium sulphate	69.9	27.4
2. Ammonium chloride	65.3	26.8
3. $(NH_4)_2SO_4$ plus lime-stone powder	86.0	35.0
4. NH_4Cl plus lime-stone powder	82.5	33.5
5. NH_4 plus a little quantity of lime	64.5	26.8
6. Twice quantity of $(NH_4)_2SO_4$	58.5	18.8
7. Twice quantity of NH_4Cl	57.3	18.4
8. Twice quantity $(NH_4)_2SO_4$ plus lime-stone powder	101.6	37.1
9. Twice quantity NH_4Cl plus lime-stone powder	99.3	38.2
10. Twice quantity NH_4Cl plus a little quantity of lime	61.0	21.0

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The 19th experiment Comparative experiments on manuring effect of ammonichloride and ammonium sulphate gave different results by the kinds of soils. Kuga red soil, Aichi red soil, Shizuoka brown soil gave poor growth, and adding lime of 3 particular soils, was not enough to help growth on them. But generally, adding of lime-stone powder gave good results. However, Kuga palaezoic soil, Kuga granite soil, Shizuoka brown soil gave good results when ammonium chloride are employed; and Tokuyama Soil, Tamagawa soil, Matsumoto soil, Komaba soil gave similar results, briefly ammonium chloride was superior to ammonium sulphate in the manuring effects in this examination.

The 20th experiment This was comparative experiment on the manuring effect of ammonium chloride and ammonium sulphate on potato in wagner pot cultivation at the Tokyo University. Ammonium chloride gave much more crop of potato than ammonium sulphate, especially on large quantity of manuring. On hard sticky soil, such as Arakida soil, ammoniuum chloride gave better results than ammonium sulphate in all cases, and on light volcanic soil, such as Tanashi soil, ammonium chloride gave also good results, with the exception of no phosphoric plot, generally ammonium chloride was superior to ammonium sulphate in this experiment.

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Name of plots	Arakida soil		Tanashi soil	
	Weight of good size crop	Weight of small size crop	Weight of good size crop	Weight of small size crop
	Gm/pot	Gm/pot	Gm/pot	Gm/pot
1. Ammonium chloride	243.6	3.6	213.6	27.2
2. Ammonium sulphate	140.0	56.1	193.1	8.2
3. Twice quantity of NH_4Cl	274.3	23.1	275.0	1.6
4. Twice quantity of $(NH_4)_2SO_4$	170.3	43.5	173.0	30.9
5. A little quantity of P_2O_5 with NH_4Cl	180.0	27.9	73.3	0
6. A little quantity of P_2O_5 with $(NH_4)_2SO_4$	134.0	17.4	99.0	7.5
7. A little quantity of K_2O with NH_4Cl	164.5	15.3	114.5	55.1
8. A little quantity of K_2O with $(NH_4)_2SO_4$	164.5	17.1	162.5	18.2

The 21st experiment In the experiment on potato at Chofu-cho, Tokyo Prefecture, ammonium chloride showed better results than ammonium sulphate by much manuring. When a little quantity of phosphoric acid is given, ammonium chloride showed inferior results to ammonium sulphate, but when a little quantity of potassium manure is given opposite result was show.

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Name of plots	Weight of good size crop	Weight of small size crop
	Kan/tsubo	Kan/tsubo
1. Ammonium sulphate	4,050	0.550
2. Ammonium chloride	3,680	0.535
3. Twice quantity of $(NH_4)_2SO_4$	3,450	0.370
4. Twice quantity of NH_4Cl	4,425	0.430
5. A little quantity of P_2O_5 with $(NH_4)_2SO_4$	3,295	0.315
6. A little quantity of P_2O_5 with NH_4Cl	2,890	0.290
7. A little quantity of K_2O with $(NH_4)_2SO_4$	3,020	0.500
8. A little quantity of K_2O with NH_4Cl	3,690	0.345

The 22nd experiment In the experiment of the manuring effects of ammonium chloride, admixed various fertilizers, such as soy-bean cake, ammonium sulphate, rice bran, fish meal, the plot of ammonium chloride, added soy-bean cake, showed best yield and the plot of fish meal admixture gave worst yield on potato caltivation, but its difference was a little in this experiment.

Name of plots	Weight of good size crop	Weight of small size crop
	Kan/1.5tsubo	Kan/1.5 tsubo
1. Ammonium sulphate	2,392	0.370
2. Ammonium chloride	2,367	0.220
3. Ammonium chloride plus ammonium sulphate	2,452	0.270
4. Ammonium chloride plus rice bran	2,355	0.280
5. Ammonium chloride plus fish meal	2,150	0.295
6. Ammonium chloride plus soy-bean cake	2,577	0.445

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The 23rd and 24th experiments In these field experiments at the Tokyo University and at Chofu-cho field, it was shown that the difference in manuring methods gave the different yield on potato cultivation.

The 25th experiment Comparative experiment on the manuring effect of ammonium chloride and ammonium sulphate on sweet potato at the Tokyo University, it was shown similar result on ordinary manuring but ammonium chloride gave good results to ammonium sulphate on much manuring.

Name of plots	Weight of bulks in high class Kg/1tsubo	Weight of bulks in low class Kg/1tsubo
1. Ammonium chloride	3,970	0.755
2. Ammonium sulphate	2,970	0.810
3. Twice quantity of NH_4Cl	3,840	0.652
4. Twice quantity of $(NH_4)_2SO_4$	2,294	0.710
5. No nitrogen	3,170	0.755

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The 26th experiment On the experiment of the manuring effect of ammonium chloride, admixed various fortilizer, such as heap manure, fish meal, ammonium sulphate, rice bran, soy-bean cake, on rape cultivation, the better yields were obtained in these plots which were used ammonium chloride admixed heap manure, and ammonium chloride added fish meal.

Name of plots	Total weight of crop	Weight of grain
	Kan/1tsubo	Kan/1tsubo
1. Ammonium sulphate	3,845	0.274
2. Ammonium chloride	4,750	0.358
3. Ammonium chloride plus ammonium sulphate	3,370	0.212
4. NH_4Cl plus rice bran	3,810	0.260
5. NH_4Cl plus fish meal	4,355	0.330
6. NH_4Cl plus soy-bean cake	3,430	0.241
7. NH_4Cl plus heap manure	4,220	0.321

The 27th experiment On the manuring effects of comparative experiment of ammonium chloride and ammonium sulphate on rape crop at the Tokyo University, it was shown similar yield of rape grain, but ammonium chloride showed good results to ammonium sulphate on much manuring.

Name of plots	Weight of stalk	Weight of grain
	Gm/3tsubo	Gm/3tsubo
1. Ammonium chloride	764	327
2. Ammonium sulphate	862	336
3. Twice quantity of NH_4Cl	1,092	443
4. Twice quantity of $(NH_4)_2SO_4$	934	388

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The 28th experiment On the experiment of the manuring effect of ammonium chloride, admixed various fertilizers, such as soy-bean cake, rice bran, fish meal, ammonium sulphate, on green vegitable "Santo Kakusai" at Chofu-cho field, the best result was obtained in the plot of ammonium chloride admixed soy-bean cake.

Name of plots	Total weight of vegitable
	Kan/2.33tsubo
1. Ammonium sulphate	8,895
2. Ammonium chloride	8,160
3. NH_4Cl plus ammonium sulphate	8,265
4. NH_4Cl plus rice bran	6,640
5. NH_4Cl plus fish meal	8,450
6. NH_4Cl plus soy-bean cake	8,865

The 29th experiment Comparative experiment on the manuring effect of ammonium chloride and ammonium sulphate on radish cultivation at Chofu-cho field, it was not shown any difference in the early stage of growth, but ammonium chloride showed vigorous growth and gave good results to ammonium sulphate in later stage.

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	Total weight	Average weight	Average length
	Kan/1.5	Kan/1.5	Centimeter
1. Ammonium sulphate	5,235 tsubo	0.299 tsubo	39.0
2. Ammonium chloride	5,695	0.325	41.3

The 30th experiment On the experiment of the manuring effect of ammonium chloride, admixed various fertilizer, such as ammonium sulphate, rice bran, fish meal, soy-bean cake, on radish cultivation at Chofucho field, generally ammonium chloride, admixed organic manures are superior to mineral fertilizers alone. We can say that ammonium chloride are good manure to ammonium sulphate in this experiment.

Conclusion From the above experiments, we concluded that the manuring effects of ammonium chloride was similar to that of ammonium sulphate, and it was impossible to decide the superiority of either two. The manuring effect of ammonium chloride, admixed various fertilizers, gave also remarkable results, like admixture of ammonium sulphate. We can say that ammonium chloride are good fertilizer which identical to ammonium sulphate.

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經歷書

德山曹達株式會社

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沿革

大正七年二月　資本金二〇〇萬圓を以て日本曹達工業株式會社を山口縣德山町に設立す其の計畫設備は日產曹達全灰五〇瓲、苛性曹達二〇瓲なり

大正七年十一月　曹達灰の製造設備完成し製造を開始す

昭和四年二月　資本金を三〇〇萬圓に增資す

昭和六年五月　曹達灰の苛性化法による苛性曹達の生產に着手す

昭和七年十二月　資本金を五〇〇萬圓に增資し日產曹達全灰四〇〇瓲、苛性曹達二〇〇瓲の設備をなす

昭和八年十一月　資本金を一、〇〇〇萬圓に增資し日產曹達全灰六〇〇瓲、苛性曹達三〇〇瓲の設備をなす

昭和九年九月　資本金を二、〇〇〇萬圓に增資し日產曹達全灰八〇〇瓲、苛性曹達四〇〇瓲の設備をなす

昭和九年十二月　火力發電設備背壓タービ發電機七、五〇〇KWを完成す（第一發電所）

昭和十一年一月　商號を德山曹達株式會社と改稱す

昭和十一年九月　火力發電設備背壓タービ發電機七、五〇〇KWを增設す（第二發電所）

昭和十二年十二月　曹達製造設備の擴張並に附屬設備の新設工事を完成す

一	曹達全灰	日產	一、〇〇〇瓲
二	曹達灰	〃	四四〇〃
三	苛性曹達	〃	四〇〇〃
四	發電設備	容量	一五、〇〇〇KW
五	貯水池	〃	一、〇〇〇、〇〇〇立方米
六	石灰石採堀設備	日產	一、〇〇〇瓲

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昭和十三年三月　濕式によるポルトランド、セメント日産一、〇〇〇瓲の工場完成し生産を開始す及び火力發電設備背壓タービン發電機一〇、〇〇〇KWを増設す（中央發電所）

昭和十三年九月　化學石膏日産五〇瓲、副産鹹水六〇〇瓲（鹽換算）の工場完成す

昭和十四年八月　日産五瓲の炭酸マグネシヤ工場完成す

昭和十四年十一月　鹽化石灰日産六瓲、回收鹽日産三瓲の工場完成す

昭和十五年四月　日産一五瓲の珪酸曹達工場完成す

昭和十五年十二月　鹽化アンモン日産五瓲、回收鹽日産二五瓲の工場完成す

昭和十六年三月　資本金を二、五〇〇萬圓に增資す

昭和十六年十一月　鹽化石灰日産六〇瓲、回收鹽日産三〇瓲の工場完成し生産を開始す

昭和十七年十二月　年產一、〇〇〇瓲の鑛石加里工場完成す

昭和十八年二月　年產一〇、〇〇〇瓲の鑛石加里工場の建設に着手す

昭和十八年九月　年產二〇、〇〇〇瓲の鹽化マグネシューム工場の建設に着手す

昭和十八年十一月　大嶺採石所採石設備に着手す

昭和十九年二月　鹽化マグネシューム工場完成す

昭和十九年十月　大嶺採石所採石設備完成し採石を始む

昭和二十年七月　空襲により工場事務所、材料倉庫、炭酸マダネシヤ工場、一〇、〇〇〇瓲鑛石加里工場及寄宿舍等燒失し復舊整理のため全工場の運轉を停止す

昭和二十年十月　セメント工場の運轉を再開す

昭和二十一年二月　苛性曹達工場の運轉を再開す

昭和二十一年五月　曹達灰工場の運轉を再開す

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昭和二十一年七月　年産一、〇〇〇瑪鑛石加里工場を肥料用燒成加里工場に轉換し生産を開始す
昭和二十一年九月　苛性曹達工場及曹灰工場の運轉を休止す
昭和二十二年四月　三、五〇〇KW四四、〇〇〇ボルトの特別高壓受電設備を完成す
昭和二十二年九月　月産五〇〇瑪の消石灰工場完成す
昭和二十三年一月　火力發電設備抽氣タービ發電機四、五〇〇KWを增設す（中央發電所）
昭和二十三年六月　苛性曹達工場の運轉を再開す
昭和二十三年十一月　曹達灰工場の運轉を再開す
昭和二十四年一月　セメント發電所第一期工事餘熱汽罐一基完成す（加熱面積一、三〇〇平方米）
昭和二十四年八月　資本金を五、〇〇〇萬圓に增資す

一、本社及工場
德山市大字德山八三五五番地
電話 德山一三七番（代表）

一、東京事務所
東京都港區芝新櫻田町一九番地
電話銀座(57)一七七二、四七九六、六九八二番

一、大阪事務所
大阪市東區瓦町三丁目 三和ビル三階
電話北濱(23)五二一一、五二二二、一五八七番

一、小倉營業所
小倉市鳥町六三小倉商工會議所ビル
電話 小倉（5）二一五一番

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一、津久見營業所
大分縣津久見町セメント町

一、廣島營業所
廣島市石見屋町一三番地

一、宇部營業所
宇部市西區松濱町東陽商會內

一、大嶺採石場
山口縣美禰郡大嶺町大字北分
電話山崎九番

一、資本金
公稱資本金　金五千萬圓也
拂込資本金　金五千萬圓也

一、事業の目的
曹達、セメント、加里肥料及び諸化學工業藥品の製造販賣

一、役員

取締役社長	蔭山信
常務取締役	今津清藏
取締役	內山英麿

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取締役　屋　和　夫
仝　田中秀男
仝　中澤治一
監査役　江口信

二、従業員　四六四名（二十四年三月現在）

一、製品名及生産能力（昭和二十四年三月現在）

曹達灰	月産	九、〇〇〇瓲	
〃	〃	七、五〇〇〃	
苛性曹達	〃	一〇、五〇〇〃	
鹽化石灰	〃	一、〇五〇〃	
セメント	〃	二五、〇〇〇〃	
加里肥料	〃	一、五〇〇〃	
珪酸曹達	〃	五八〇〃	
炭酸マグネシヤ	〃	一五〇〃	復舊計畫中

一、工場設備及附帶事業

一、敷地		工場敷地	一五四、九七四坪
一、規模	曹達工場	建	一〇、六〇〇〃
	セメント工場	〃	二、〇〇〇〃
	藥品工場	〃	一、四〇〇〃

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機械工場	〃		一、三〇〇〃	
動力工場	〃		七〇〇〃	
		(電氣	一四、五〇〇KW	
		蒸汽	一九五瓲	
其他建物	建坪	毎時	三、三〇〇坪	
計	同		一九、三〇〇坪	
繫船設備	一萬噸級大型船接岸壁		一箇所	
	六千噸級 〃		〃	
	三千噸級 〃		〃	
	小型船舶接岸壁	延長	二、〇〇〇米	
貯水池	容量		一、〇〇〇、〇〇〇立方米	
石灰石採堀設備（大嶺）	月産		三〇、〇〇〇瓲	

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TOKUYAMA SODA CO., LTD.,

8355 Tokuyama. City,
Yamaguchi Prefecture

Name of Machinery & Equipment	Total		To be Removed	
	Weight ₸	Depreciated Value (¥)	Weight ₸	Depreciated Value (¥)
Water Gas Plant	679.050	541,045	0	0
Producer Gas Plant	153.007	110,707	127.245	99,481
Carbon Monoxide Conversion Plant	657.757	529,927	509.737	442,583
Carbon Dioxide Removing Plant	264.705	226,349	199.705	192,849
Carbon Monoxide Removing Plant	220.046	676,097	165.124	491,575
Hydro-cracking Plant	2,873.969	6,901,694	1,124.981	2,275,997
Hydrogen Purification Plant	375.390	533,692	0	0
Air Separation Plant	53.358	80,624	0	0
Electric Substation & Distribution Plant	59.870	109,204	0	0
Electric Power Station	3,000.414	3,329,537	0	0
Water Feeding Pump Plant	1,088.470	606,228	0	0
Total	9,426.036	13,645,104	2,126.852	3,502,485
Percentage	100 %	100 %	22.5%	25.6%

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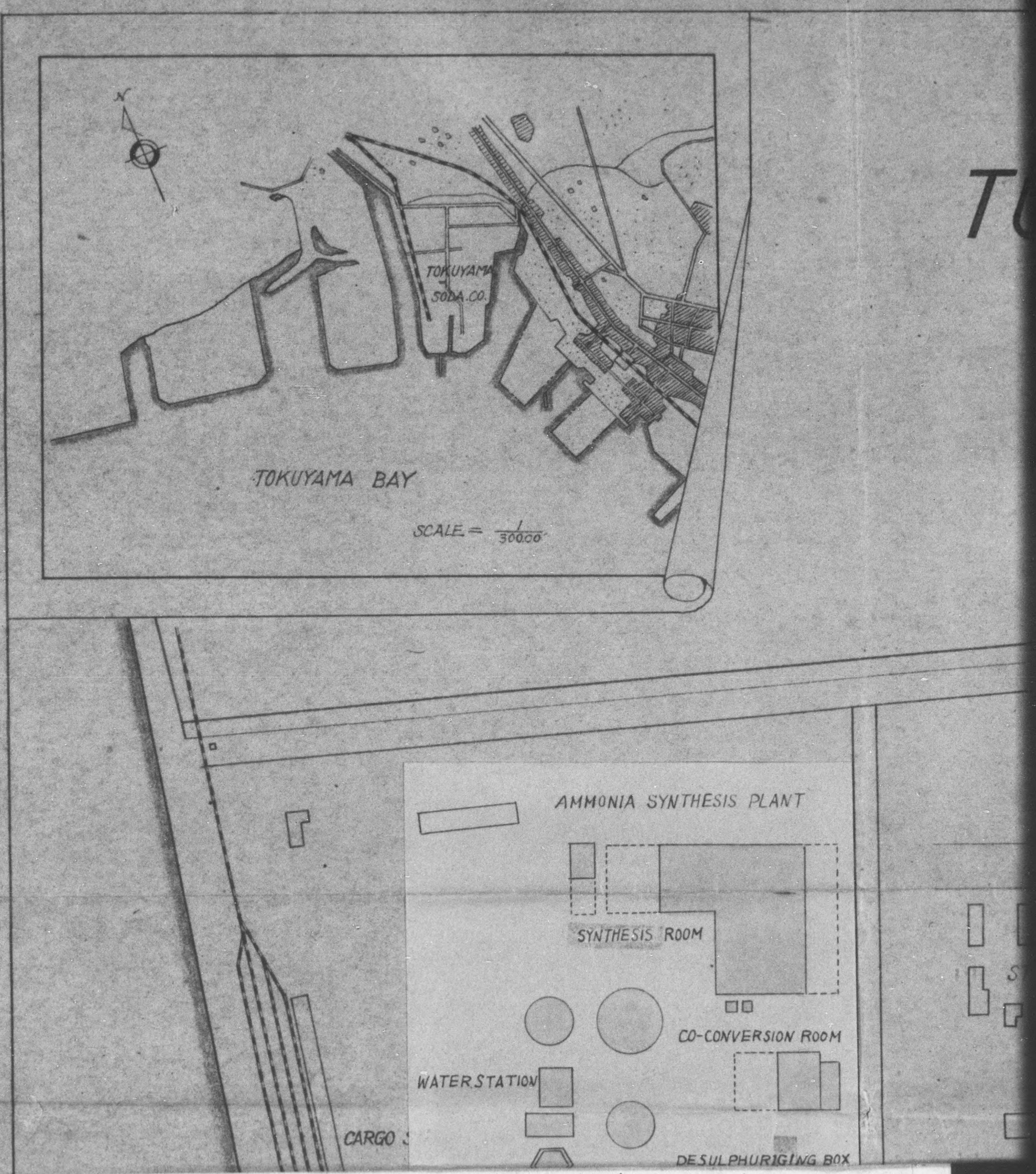

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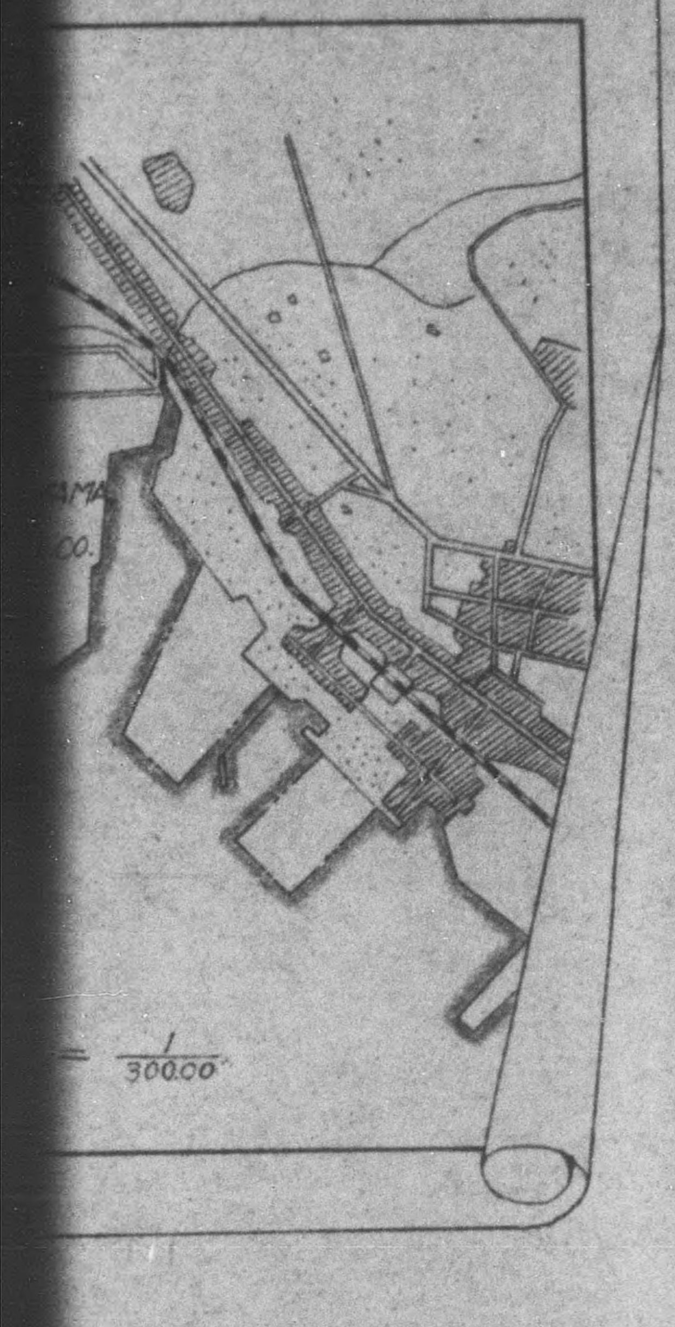
TOKUYAMA SODA
TOKUYAMA C



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AMMONIA SYNTHESIS PLANT

SYNTHESIS ROOM

CO-CONVERSION ROOM

R STATION

DESULPHURIGING BOX

STORE HOUSE

OFFICE

POT

SODA ASH PLANT

DECLASSIFIED E.O. 12065 SECTION 3 102/MDS NR

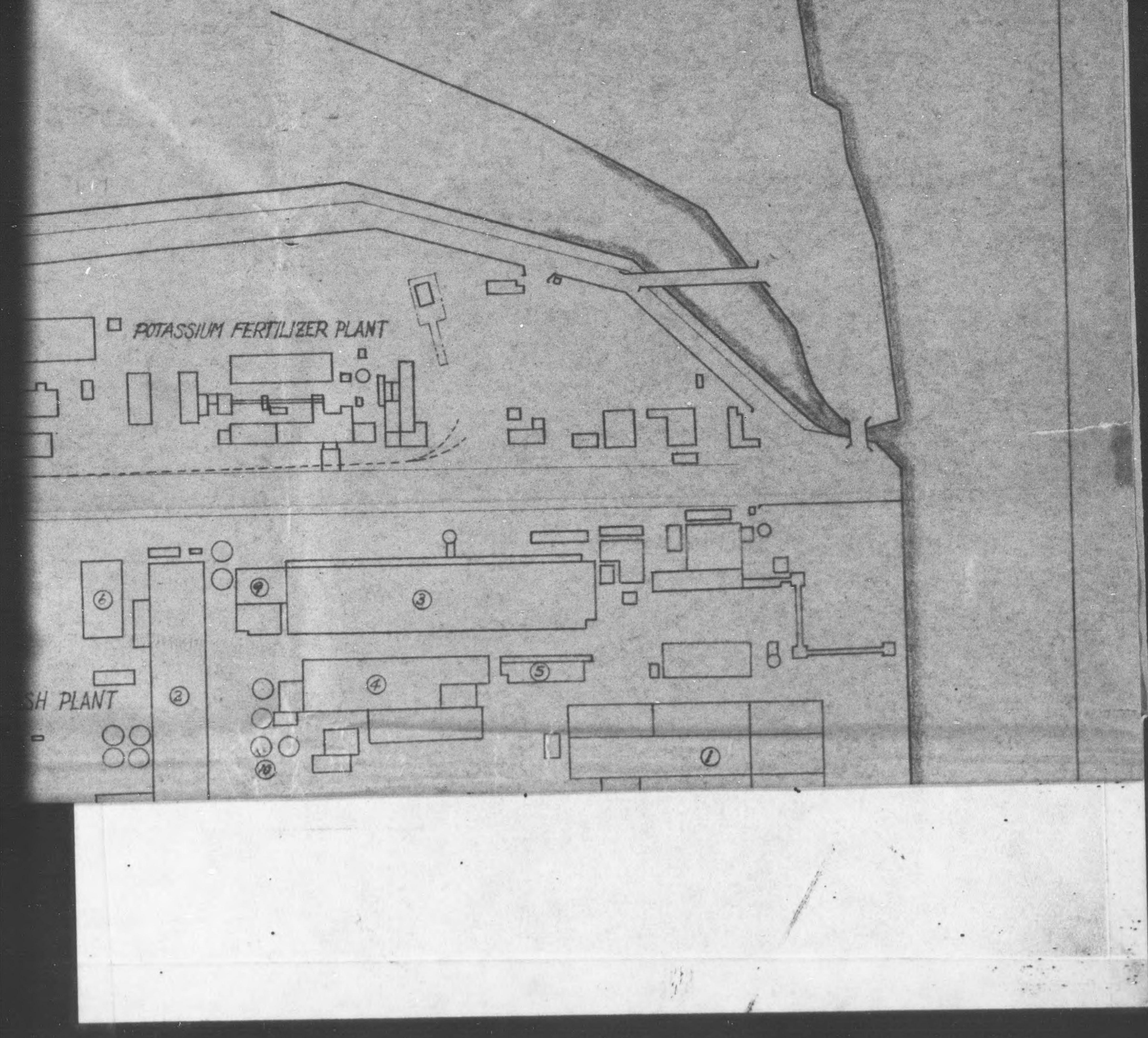
TOKUYAMA SODA CO., LTD.

TOKUYAMA CITY

DECLASSIFIED E.O. 12065 SECTION 3 402/MRS NO.

ODA CO., LTD.

A CITY



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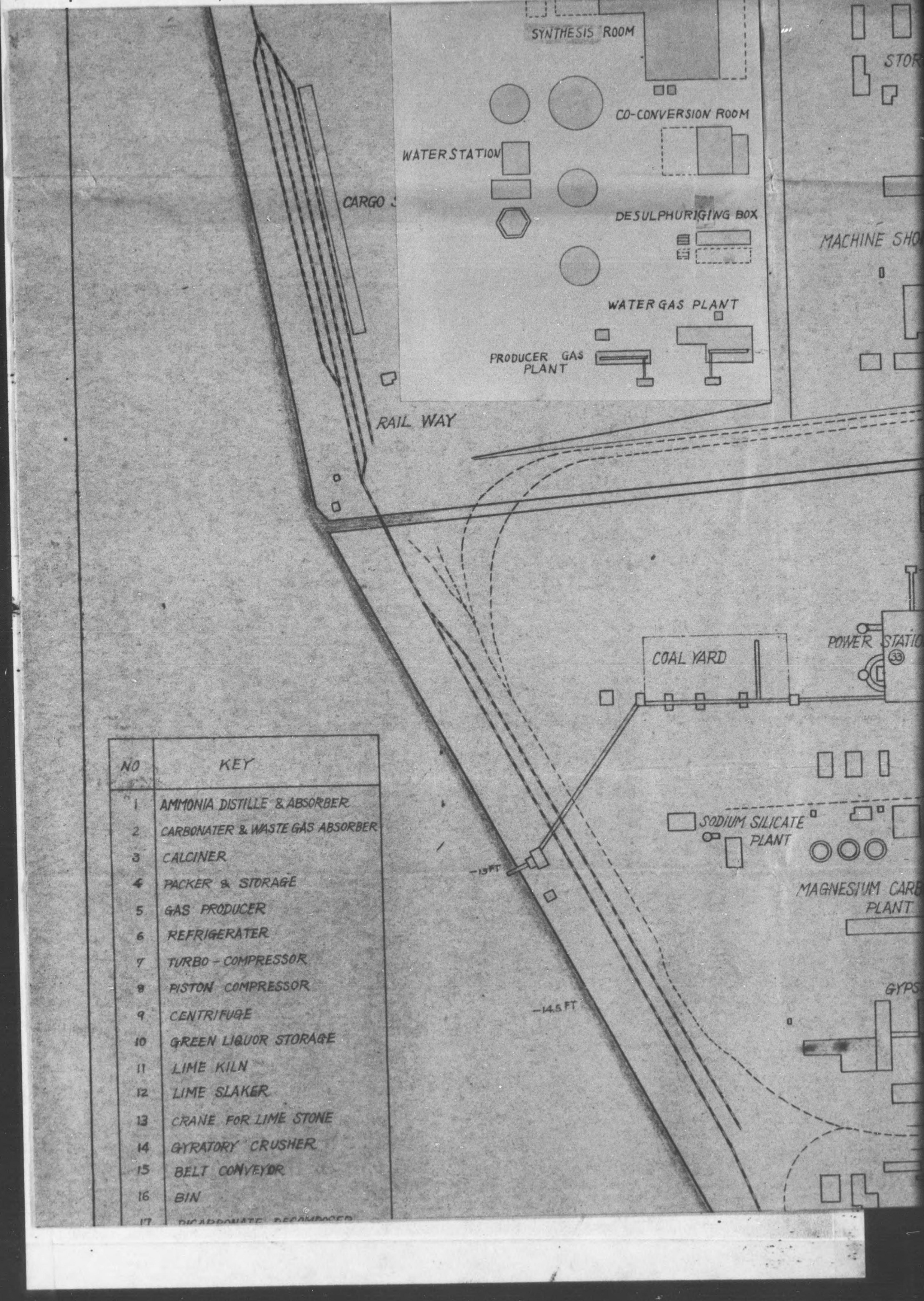
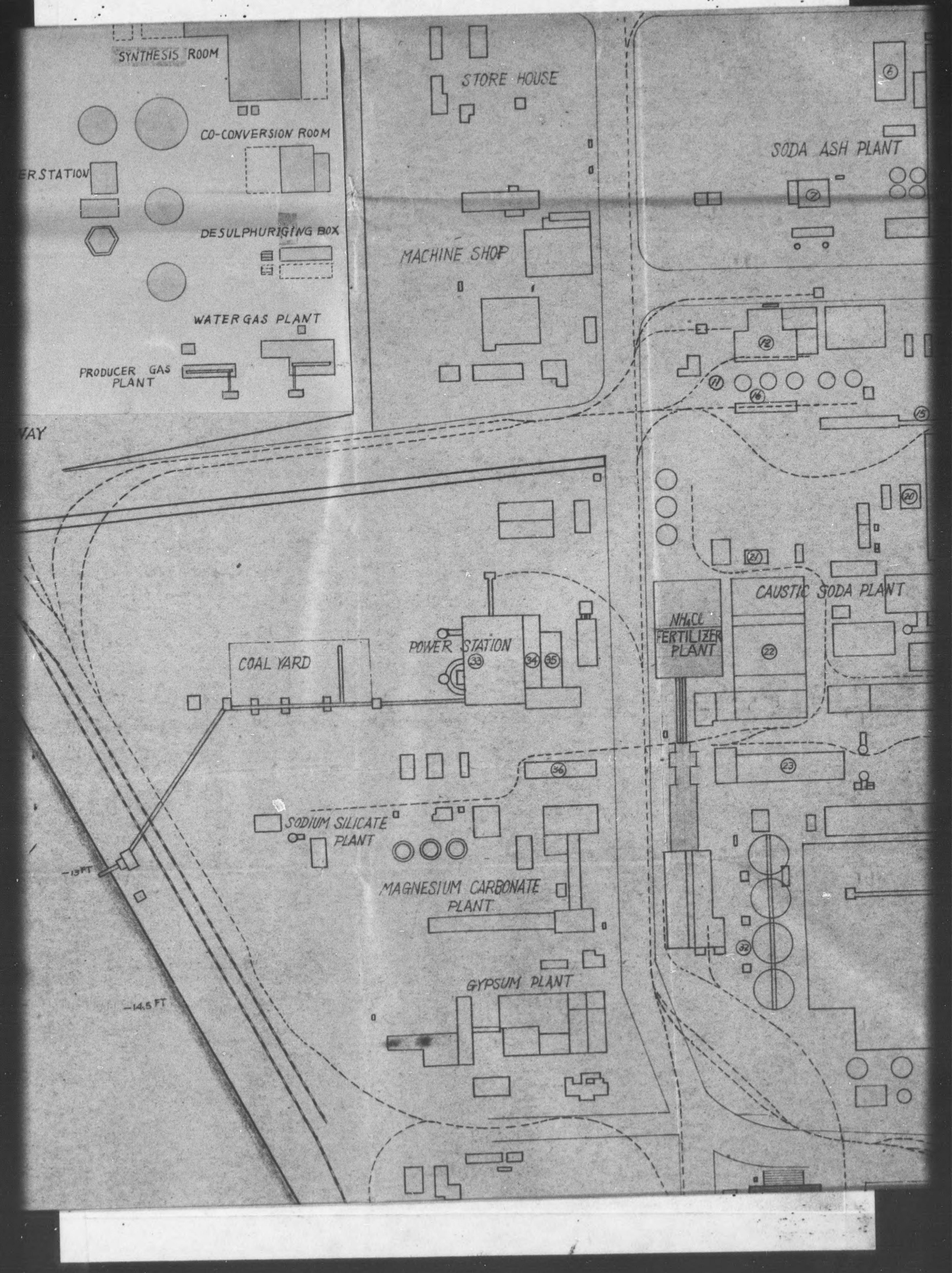


NO	KEY
1	AMMONIA DISTILLE & ABSORBER
2	CARBONATER & WASTE GAS ABSORBER
3	CALCINER
4	PACKER & STORAGE
5	GAS PRODUCER
6	REFRIGERATER
7	TURBO - COMPRESSOR
8	PISTON COMPRESSOR
9	CENTRIFUGE
10	GREEN LIQUOR STORAGE
11	LIME KILN
12	LIME SLAKER
13	CRANE FOR LIME STONE
14	GYRATORY CRUSHER
15	BELT CONVEYOR
16	BIN
17	BICARBONATE DECOMPOSER

DECLASSIFIED E.O. 12065 SECTION 3 402/NNSS NO.



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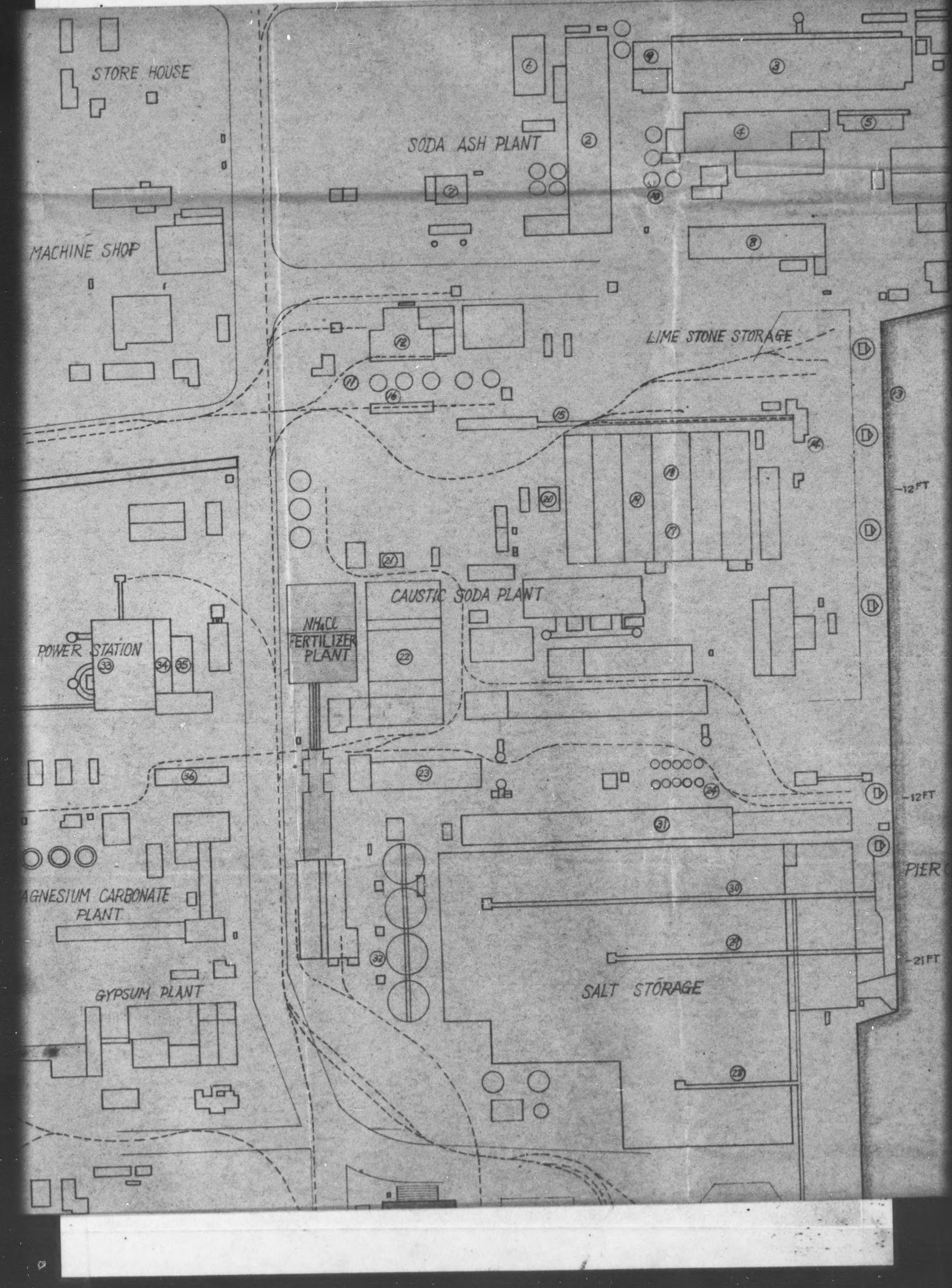

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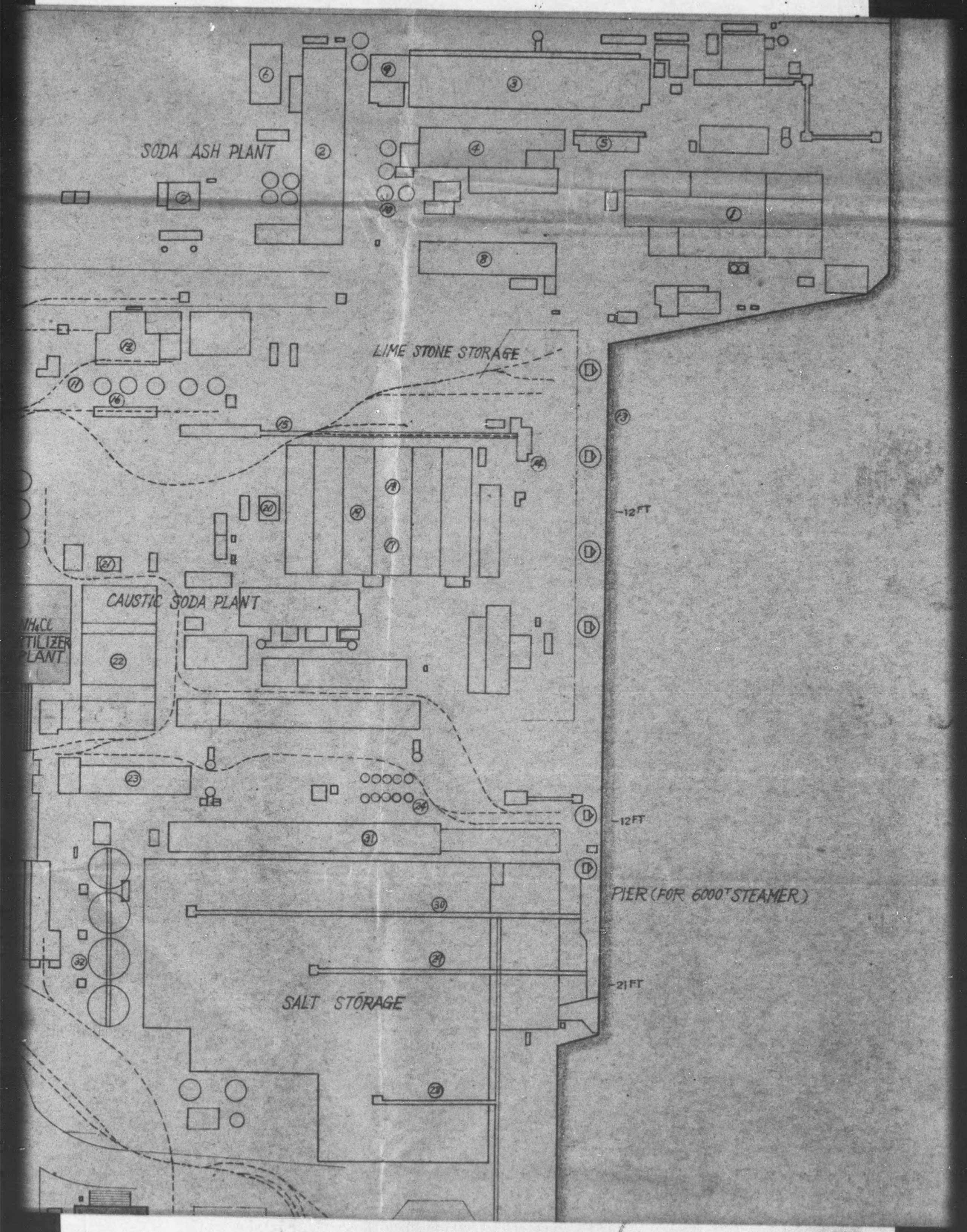

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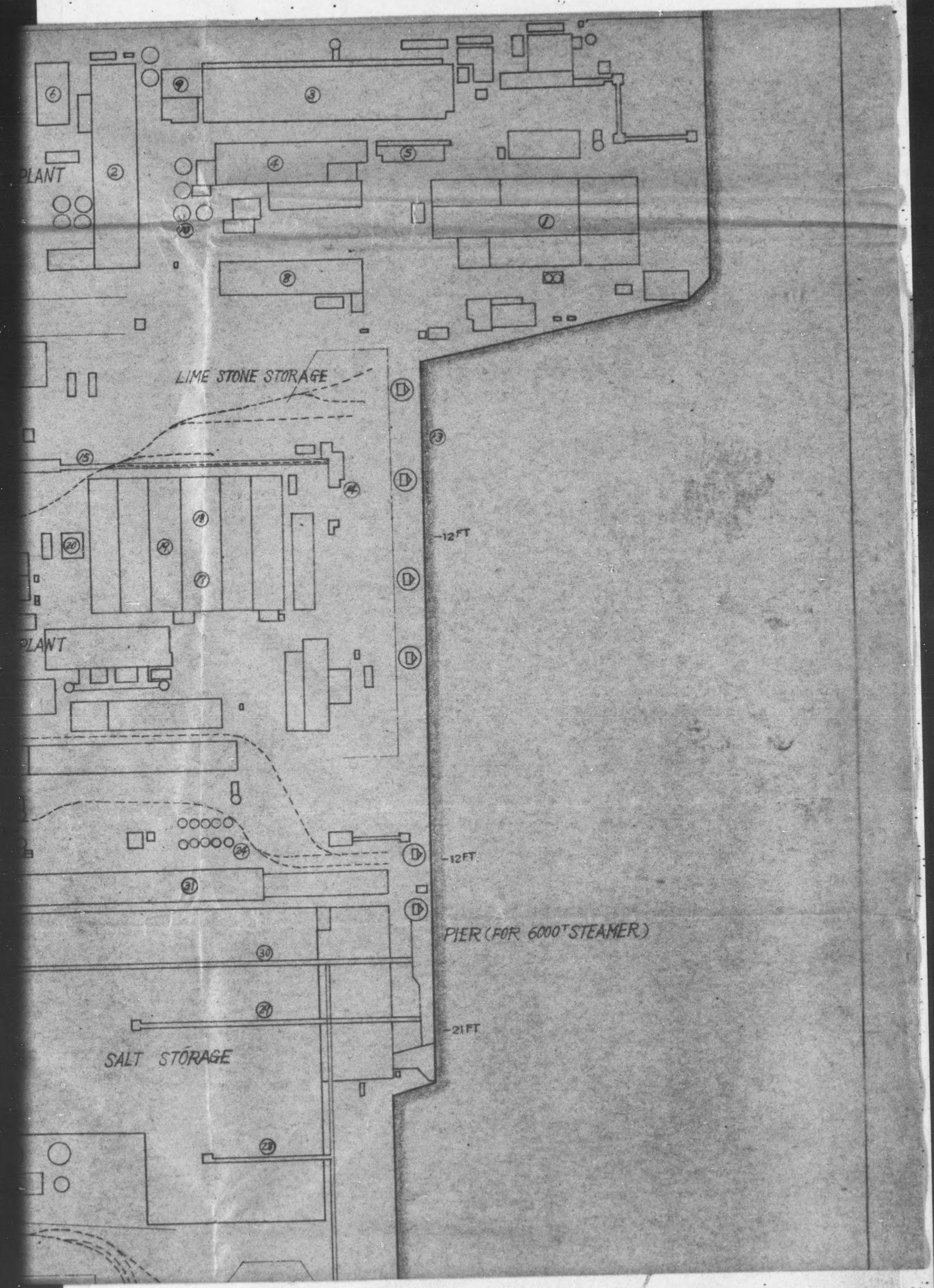

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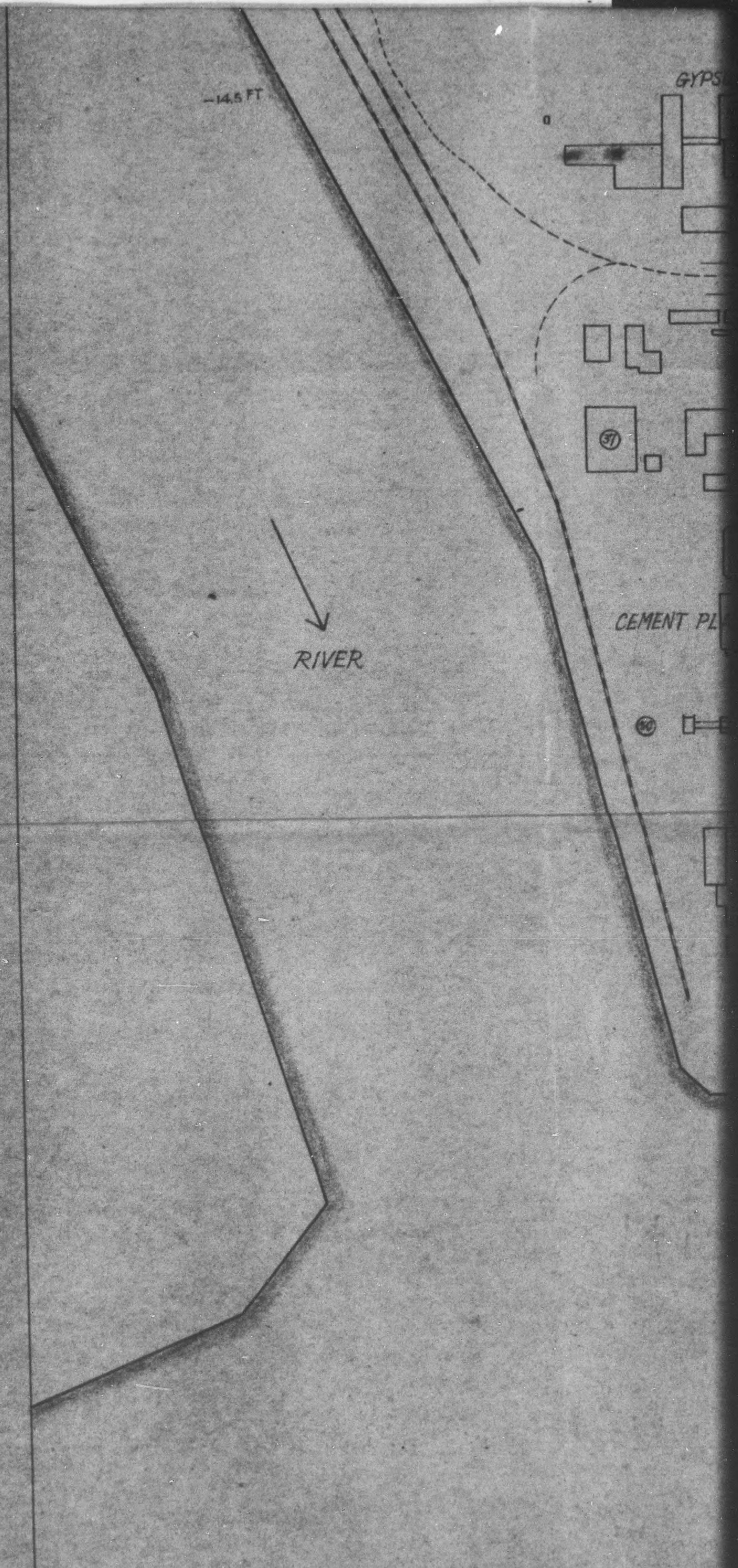
7	TURBO - COMPRESSOR
8	PISTON COMPRESSOR
9	CENTRIFUGE
10	GREEN LIQUOR STORAGE
11	LIME KILN
12	LIME SLAKER
13	CRANE FOR LIME STONE
14	GYRATORY CRUSHER
15	BELT CONVEYOR
16	BIN
17	BICARBONATE DECOMPOSER
18	CAUSTICIZER
19	DORR THICKNER
20	CAUSTIC LIQ. STORAGE
21	VACUUM PUMP
22	EVAPORATER
23	CAUSTIC POT
24	CAUSTIC SODA TANK
25	BELT CONVEYOR FOR SALT
26	
27	
28	
29	
30	
31	BRINE THICKNER
32	MUD DORR WASHER
33	BOILER
34	TURBINE & GENERATOR
35	PRESSURE EVAPORATOR
36	MOTOR REPAIR - SHOP
37	LABORATORY
38	COTTREL DUST CATCHER
39	LIME MUD STORAGE
40	SLURRY TANK
41	RAW MATERIAL HALL
42	CLINKER HALL
43	CEMENT MILL
44	RAW MATERIAL MILL
45	ROTARY KILN
46	PACKER
47	CRANE FOR FUEL
48	CRANE FOR RAW MATERIAL
49	
50	CRANE FOR LIME STONE



DECLASSIFIED E.O. 12065 SECTION 3 402/NNBS NO.

GYPSUM PLANT

-14.5 FT

RIVER

CEMENT PLANT

-12 FT

-20 FT

-20 FT

PIER (FOR 3000 T STEA

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDS NO.

GYPSUM PLANT

SALT STORAGE

CEMENT PLANT

-12FT

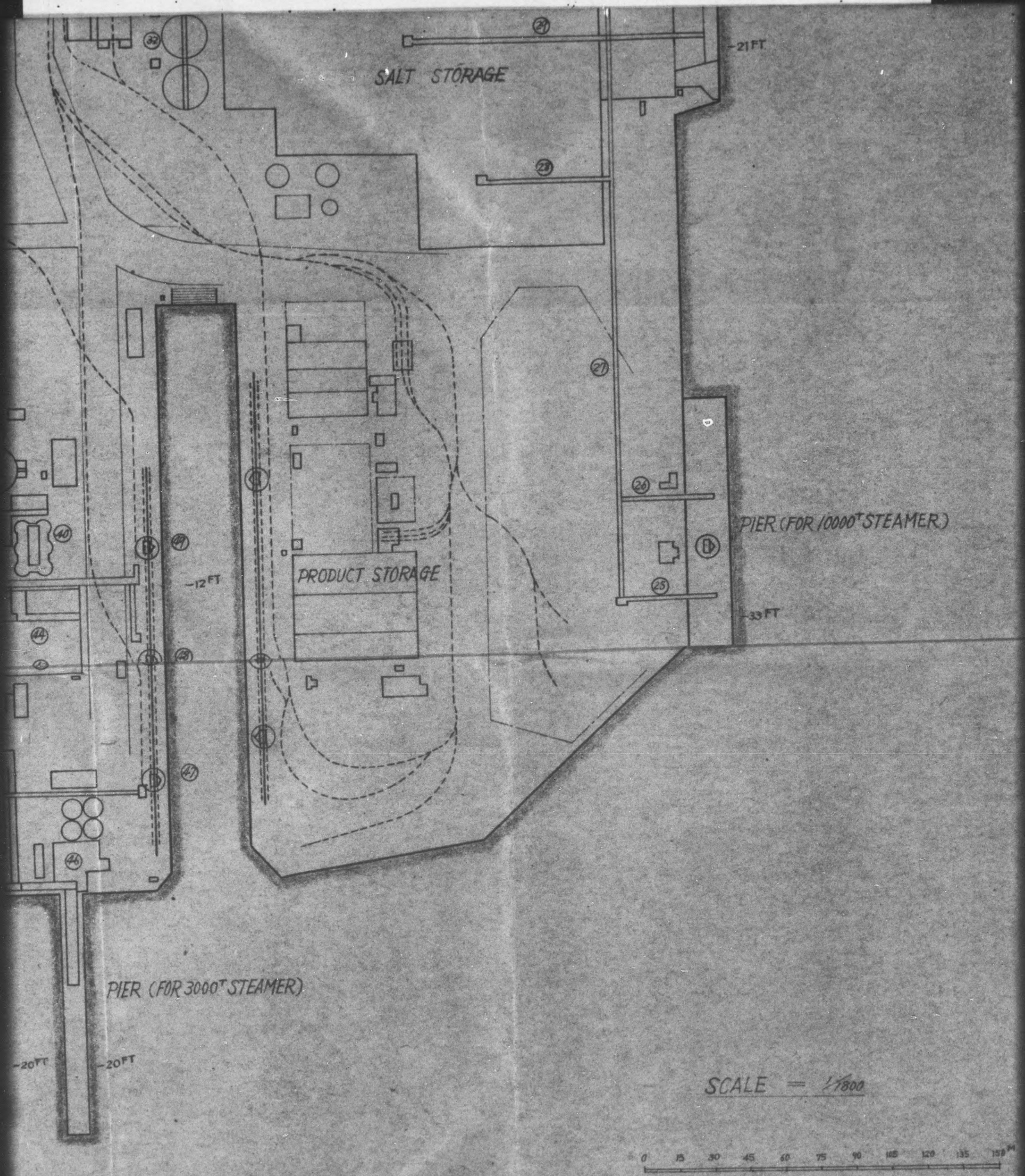
PRODUCT STORAGE

-20FT

-20FT

PIER (FOR 3000T STEAMER)

DECLASSIFIED E.O. 12065 SECTION 3-402/NNDS NO:



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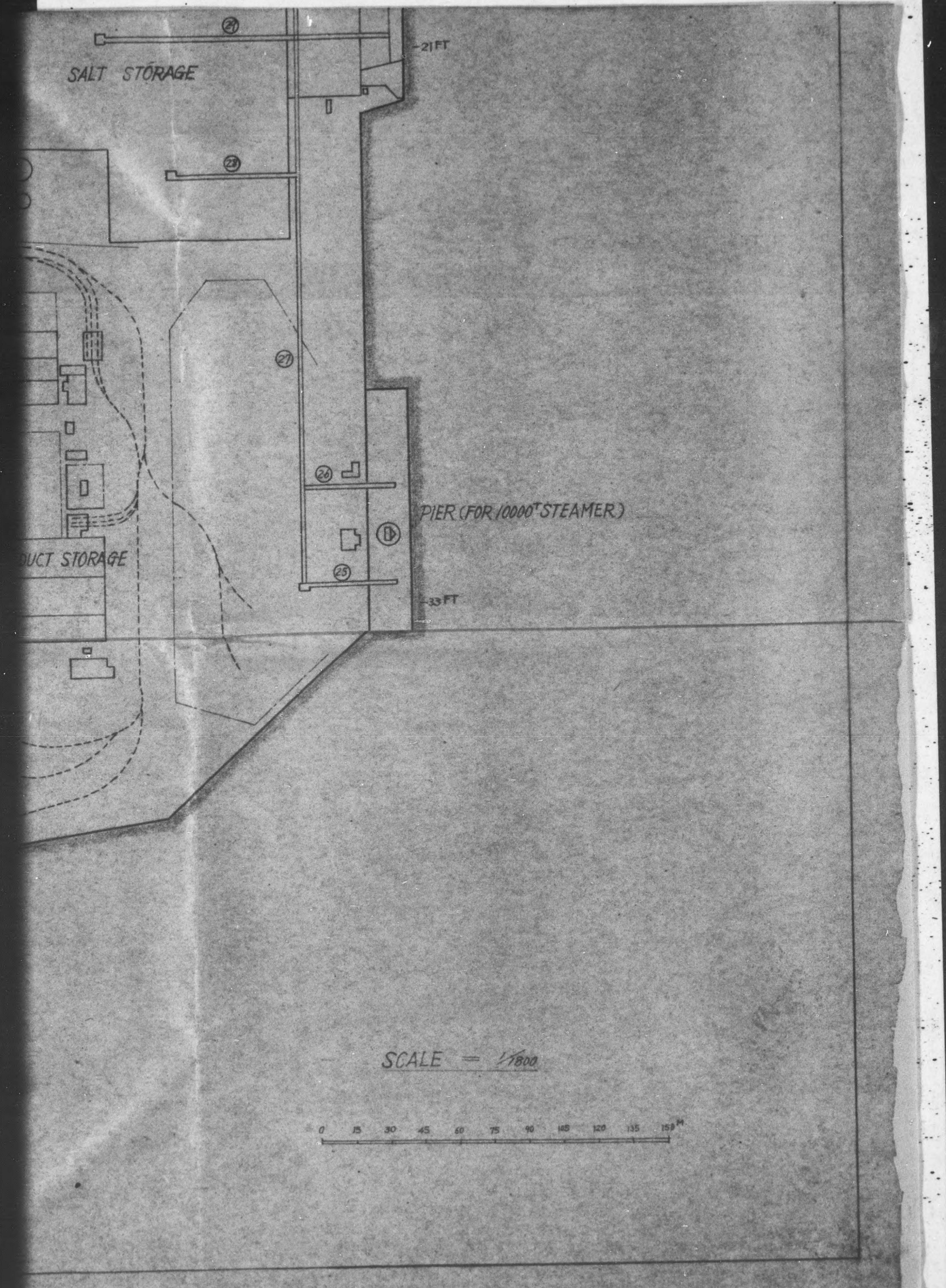

○ To Be Removed (About Half)
△ " "

LIST OF FACILITIES FOR APPLICATION

CODE NO. 45 — 5
NAME OF PLANT IWAKUNI EX_ARMY FUEL DEPOT
ADRESS OF PLANT SHOZOKU, IWAKUNI_SHI, YAMAGUCHI_KEN

1. MACHINERY

WATER GAS PLANT

INV. NO.	NAME OF MACHINERY	BRIEF SPECIFICATIONS	QUANTITY	REMARKS
1F5	OVER HEAD TRAVELLING CRANE	ELECTRIC, SPAN 12M CAP. 1.5T, RAIL LENGTH 100M	1	GIRDER BOMB DAMAGED
2F5 ~ 4F5	MOTOR (FOR 1F5)	INDUCTION 10HP 7.5HP 5HP	3	
5F5	SCREEN	ROLLER TYPE, CAP. 17T/H SEPARATION RANGE 30~50mm	1	MOTOR MISSING
6F5	SKIP HOIST	ELECTRIC, CAP. 15T/H 20HP HEIGHT OF LIFT 30M, BACKET 5T	1	
7F5	MOTOR (FOR 6F5)	INDUCTION 20HP 1170 RPM	1	

DECLASSIFIED E.O. 12065 SECTION 3 4(b)(1)(3) NWD

INV. NO.	NAME OF MACHINERY	BRIEF SPECIFICATIONS	QUANTITY	REMARKS
8F5	CONVEYER	BELT, CAP. 15 T/H 20.6 MH × 400 mmW, SPEED 45 M/MIN	1	BELT MISSING
9F5	MOTOR (FOR 8F5)	INDUCTION 5 HP, 1,150 RPM	1	
10F5	COKE BANKER	HORIZONTAL CAP. 100 M3, LENGTH 18 M	1	
11F5, 12F5	HOPPER	VERTICAL, CAP. 28 T/H 3.45 MH × 2.35 MΦ	2	
13F5, 15F5	COKE CHARGING PART	AUTOMATIC CAP. 1.3 T/H	2	
17F5, 19F5	GAS GENERATOR	P.G.C TYPE, CAP. 2,500 M3/H 2.6 MΦ × 6.5 MH	2	
18F5, 20F5	MOTOR (FOR 17F5, 19F5)	INDUCTION 5 HP, 1150 ~ 150 RPM.	2	
21F5	COMBUSTION CHAMBER	VERTICAL, BRICK LINING 3.07 MΦ × 9.66 MH	1	
22F5	WASTE HEAT BOILER	HORIZONTAL, FIRE TUBE WORKING PRESS. 6.5 KG/CM2	1	
23F5, 24F5	GAS COOLING AND WASHING TOWER	VERTICAL, RIM TYPE 1.5 MΦ × 10 MH	2	
25F5, 27F5	AIR BLOWER	IMPELLER, CAP. 40,000 M3/H PRESS. 1,600 MM/W.G, BORE 530 MM	2	
26F5, 28F5	MOTOR (FOR 25F5, 27F5)	INDUCTION 350 HP 3,510 RPM	2	
29F5, 31F5	PUMP (WATER FEED)	TURBINE, CAP. 8 M3/H SUC. PRESS. 0, DEL. PRESS. 100 M	2	
30F5, 32F5	MOTOR (FOR 29F5, 31F5)	INDUCTION 10 HP 3,490 RPM.	2	

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INV. NO.	NAME OF MACHINERY	BRIEF SPECIFICATIONS	QUANTITY	REMARKS
33F5. 34F5	PUMP (FOR JACKET & BOILER)	TURBINE, 2 STAGES, CAP. $3^{M^3/H}$ SUC. PRESS. 0, DISCH PRESS 25^{M}	2	MOTOR MISSING
35F5. 36F5	PUMP (PRODUCE OF OIL PRESS)	PLANGER. $0.25^{M^3/MIN}$ 80 RPM SUC. PRESS. 0, DISCH PRESS $35^{Kg/cm^2}$	2	MOTOR MISSING
37F5	OIL TANK	VERTICAL $1.7^{M}\phi \times 3^{MH}$	1	
38F5	OIL PRESSUR ACCUMULATER	VERTICAL, $35^{Kg/cm^2}$ $2^{M}\phi \times 2.45^{MH}$	1	
39F5. 40F5	STEAM DRUM (FOR JACKET BOILER)	HORIZONTAL, PRESS $1\sim2^{Kg/cm^2}$ $1.15^{M}\phi \times 2.5^{M.L}$	2	
41F5. 42F5	AUTOMATIC CONTROLLER	ELECTRIC. OIL PRESS. $35^{Kg/cm^2}$	2	ELECTRIC WIRE MISSING
43F5. 44F5	CONTROLLER BOX	HAND CONTROL OIL PRESS. $35^{Kg/cm^2}$	2	
45F5. 46F5	PRIMARY AIR VALVE	AUTOMATIC OPERATE SIZE 600^{mm}, FACE TO FACE 550^{mm}	2	
47F5. 48F5	SECONDARY AIR VALVE	AUTOMATIC OPERATE SIZE 350^{mm}, FACE TO FACE 400^{mm}	2	
49F5 50F5	BLOW GAS VALVE	AUTOMATIC OPERATE SIZE 900^{mm} FACE TO FACE 650^{mm}	2	
51F5. 52F5	TOP GAS VALVE	AUTOMATIC OPERATE SIZE 500^{mm}, FACE TO FACE 550^{mm}	2	
53F5 54F5	BOTTOM GAS VALVE	AUTOMATIC OPERATE SIZE 500^{mm}, FACE TO FACE 550^{mm}	2	
55F5. 56F5	MAIN STEAM VALVE	AUTOMATIC OPERATE SIZE 300^{mm}, FACE TO FACE 360^{mm}	2	
57F5. 58F5	TOP STEAM VALVE	AUTOMATIC OPERATE SIZE 200^{mm} FACE TO FACE 360^{mm}	2	

DECLASSIFIED E.O. 12065 SECTION 3 4(B)(3) NND

INV. NO.	NAME OF MACHINERY	BRIEF SPECIFICATIONS	QUAN-TITY	REMARKS
59F5. 60F5	BOTTOM STEAM VALVE	AUTOMATIC OPERATE SIZE 200^{mm}, FACE TO FACE 360^{mm}	2	
61F5. 62F5	STACK VALVE	AUTOMATIC OPERATE SIZE 600^{mm}	2	
63F5. 64F5	DISK VALVE	AUTOMATIC OPERATE SIZE 500^{mm}	2	
65F5. 66F5	SLIDE VALVE	AUTOMATIC OPERATE SIZE 600^{mm}, FACE TO FACE 320^{mm}	2	
67F5. 68F5	PLATE VALVE	AUTOMATIC OPERATE SIZE 600^{mm}, FACE TO FACE 360^{mm}	2	
69F5. 70F5	INSTRUMENT BOARD	1.25^{ML} x 1^{MW}	2	WITH 12 METERS
71F5	PRESSURE GAUGE	RANGE 0~1.500^{mm}/w.G	1	U TUBE MISSING
72F5	ASH CARRYING EQUIPMENT	STEEL HAND CAR Wt. OF RAIL 8^{Kg} L = 50^{M}	1	
73F5	OVER HEAD TRAVELLING CRAIN	ELECTRIC CAP. 3^{T}, 5^{HP} SPAN 7^{M} RAIL LENGTH 18^{M}	1	
74F5. 75F5	MOTOR (FOR 73F5)	3^{HP} 5^{HP} 1.140$^{R.P.M.}$	2	
76F5	GAS HOLDER	VERTICAL RIVETED CAP. 5,000$^{M^3}$, DIA. 20.1^{M}	1	BOMB DAMAGED
77F5	VOLUME INDICATING ALARM EQUIPMENT	CAP. 0~10.000$^{M^3}$	1	BOMB DAMAGED
78F5. 79F5	CHIMNEY	0.8$^{M\phi}$ x 13^{MH}	2	
80F5	〃	0.8$^{M\phi}$ x 28^{MH}	1	

DECLASSIFIED E.O. 12065 SECTION 3 NND 760033

INV. NO.	NAME OF MACHINERY	BRIEF SPECIFICATIONS	QUAN-TITY	REMARKS
81F5	SWITCH BOARD	3,300 ~ 110V 200A	1	
82F5 . 83F5	ELECTRIC TRANSFORMER	PRIMARY 3,300V 3 PHASE SECONDARY 105/210V	2	METER MISSING
84F5 . 85F5	OIL SWITCH	TO TYPE, 250V. 3 PHASE CYCLE 60, 60A	2	OIL TANK MISSING
86F5 . 87F5	MAGNETIC ATTACHMENT	FL 75A TYPE	2	METER COVER MISSING
88F5 . 89F5	STARTER AND RESISTANCE	C2 TYPE, BB 200 TYPE 350 HP	2	
90F5 . 91F5	SWITCH BOX	LM 102 TYPE, 3000 ~ 3,300V CYCLE 50~60 350 HP	2	METER BOMB DAMAGED
92F5 . 93F5	〃	LM 12X TYPE 220V 200A CYCLE 60	2	
94F5 ~ 96F5	OIL SWITCH	TO TYPE 250V 3 PHASE 60 CYCLE 200A	3	
97F5 ~ 103F5	〃	TO TYPE 250V 3 PHASE 60 CYCLE 30A	7	
104F5 . 105F5	〃	1C TYPE 200 ~ 220V 15A	2	
106F5 ~ 108F5	VALVE	PLATE. SIZE 680mm FACE TO FACE 240mm	3	
109F5 . 110F5	〃	SLUICE ~ 600mm 〃 450mm	2	
111F5 ~ 114F5	〃	〃 〃 350mm 〃 350mm	4	
115F5	〃	〃 〃 450mm 〃 420mm	1	HANDLE MISSING

DECLASSIFIED E.O. 12065 SECTION 3 NND

INV. NO.	NAME OF MACHINERY	BRIEF SPECIFICATIONS	QUAN-TITY	REMARKS
116F5	VALVE	STOP SIZE 150mm FACE TO FACE 400mm	1	
119F5	〃	SLUICE 〃 250mm 〃 〃 400mm	1	
118F5 : 119F5	〃	〃 〃 150mm 〃 〃 270mm	2	
120F5	〃	CHECK 〃 150mm 〃 〃 540mm	1	
121F5 ~123F5	〃	SLUICE 〃 200mm 〃 〃 300mm	3	
124F5	〃	〃 〃 300mm 〃 〃 300mm	1	
125F5	〃	〃 〃 200mm 〃 〃 300mm	1	
126F5	〃	〃 〃 200mm 〃 〃 500mm	1	
127F5	〃	〃 〃 150mm 〃 〃 350mm	1	
NONE NUMBER	1 P.C.S. VALVE	SLUICE SIZE 125mm	1	
〃	2 〃 〃	CHECK 〃 125mm	1	
〃	14 〃 〃	SLUICE 〃 100mm	1	
〃	15 〃 〃	STOP 〃 100mm	1	
〃	4 〃 〃	〃 〃 100mm	1	

DECLASSIFIED E.O. 12065 SECTION 3 4(B)(1)(3)

INV. NO	NAME OF MACHINERY	BRIEF SPECIFICATIONS	QUANTITY	REMARKS
NONE NUMBER	2 PCS VALVE	SLUICE SIZE 100 mm	1	
〃	2 〃 〃	CHECK 〃 65 mm	1	
〃	2 〃 〃	SLUICE 〃 65 mm	1	
〃	2 〃 〃	STOP 〃 50 mm	1	
〃	19 〃 〃	〃 〃 50 mm	1	
〃	19 〃 〃	〃 〃 40 mm	1	
〃	25 〃 〃	〃 〃 25 mm	1	
〃	15 〃 〃	〃 〃 16 mm	1	
〃	10 〃 〃	〃 〃 12 mm	1	
〃	PIPE	WELDING PIPE 690 mmφ × 6.7 ML	1	
〃	〃	610 mmφ × 4.0 ML	1	
〃	〃	560 mmφ × 1.0 ML	1	
〃	〃	460 mmφ × 7.1 ML	1	
〃	〃	360 mmφ × 4.6 ML	1	

DECLASSIFIED E.O. 12065 SECTION 3.4(b)(1) NWS

INV. NO.	NAME OF MACHINERY	BRIEF SPECIFICATIONS	QUAN-TITY	REMARKS
NONE NUMBER	PIPE	WELDING PIPE 310mmϕ x 20ML	1	
〃	〃	GAS PIPE 250mmϕ x 63ML	1	
〃	〃	DRAWN PIPE 270mmϕ x 42ML	1	
〃	〃	〃 216mmϕ x 46ML	1	
〃	〃	〃 165mmϕ x 104ML	1	
〃	〃	GAS PIPE 150mmϕ x 46ML	1	
〃	〃	DRAWN PIPE 150mmϕ x 24ML	1	
〃	〃	GAS PIPE 100mmϕ x 121ML	1	
〃	〃	〃 75mmϕ x 38ML	1	
〃	〃	DRAWN PIPE 900mmϕ x 78ML	1	
〃	〃	GAS PIPE 65mmϕ x 60ML	1	
〃	〃	〃 50mmϕ x 108ML	1	
〃	〃	DRAWN PIPE 64mmϕ x 197ML	1	
〃	〃	〃 51mmϕ x 62ML	1	

DECLASSIFIED E.O. 12065 SECTION 3-402/NNB NO.

INV. NO.	NAME OF MACHINERY	BRIEF SPECIFICATIONS	QUAN-TITY	REMARKS
NONE NUMBER	PIPE	GAS PIPE 40mmφ x 171ML	1	
〃	〃	DRAWN PIPE 38mmφ x 305ML	1	
〃	〃	GAS PIPE 25mmφ x 41ML	1	
〃	〃	DRAWN PIPE 26mmφ x 56ML	1	
〃	〃	GAS PIPE 20mmφ x 90ML	1	
〃	〃	〃 12mmφ x 160ML	1	
TOTAL			164	

DECLASSIFIED E.O. 12065 SECTION 3-402/NND NO.

PRODUCER GAS PLANT

INV. NO.	NAME OF MACHINERY	BRIEF SPECIFICATIONS	QUANTITY	REMARKS
1F11	SKIP HOIST	ELECTRIC DRIVEN. CAP. 15 T/H 10 HP LIFT 30M. BACKET 1T	1	WIRE AND WHEEL MISSING
2F11	MOTOR (FOR 1F11)	INDUCTION 10 HP R.P.M UNKNOWN	1	
3F11	SPEED REDUCING GEAR (FOR 1F11)	REDUCE. STAGE 4. RATIO 1/60 DRUM DIA 800mm, WIDTH 550mm	1	
4F11	CONVEYER	BELT, CAP. 15 T/H WIDTH 400mm, LENGTH 26M	1	BELT MISSING ROLLER AND FRAME DAMAGED
5F11	MOTOR (FOR 4F11)	INDUCTION 7.5 HP R.P.M UNKNOWN	1	
6F11. 7F11	HOPPER	VERTICAL, CAP. 3T WITH COAL ADJUSTOR	2	
8F11 ~ 10F11	GAS GENERATOR	P.G.C, CAP. 4,000 M3/H 3.2 MID x 5 MH	3	WITH COAL DISCHARGE EQUIPMENT
11F11. 13F11	BLOWER	IMPELLER, CAP. 260 M3/MIN PRESS. 400 mm/W.G 1,750 R.P.M.	2	CASING BOMB DAMAGED
12F11. 14F11	MOTOR (FOR 11F11. 13F11)	INDUCTION 40 HP 1,730 R.P.M.	2	FRAM. STATER AND COIL BOMB DAMAGED
15F11 ~ 17F11	GAS COOLING AND WASHING TOWER	RIM TYPE 1.6 MID x 8 MH	3	BOMB DAMAGED
18F11 ~ 20F11	COAL TAR SEPARATOR	VERTICAL 0.85 MID x 1.25 MH	3	BOMB DAMAGED
21F11 ~ 23F11	WATER SEAL TANK	VERTICAL 0.61 MID x 1.7 MH	3	23F11 BOMB DAMAGED
24F11. 26F11	MOTOR (FOR 25F11. 27F11)	INDUCTION 40 HP 1,746 RPM	2	BOMB DAMAGED

DECLASSIFIED E.O. 12065 SECTION 3-402/NND NO.

INV. NO.	NAME OF MACHINERY	BRIEF SPECIFICATIONS	QUAN. TITY	REMERKS
25F11. 27F11	ROTARY WASHER	IMPELLER. CAP. 150M^3/MIN 40HP PRESS. 200mm/w.g BORE 300m.m	2	
28F11. 29F11	PRESSURE CONTROLLER	BOX TYPE, AUTOMATIC WITH PRESSURE GAUGE 0~5Kg/cm^2	2	BOMB DAMAGED
30F11	METER BOARD	STEEL PLATE, VERTICAL WITH 2 PIECES OF PRESSURE GAUGE	1	
31F11	THERMOMETER	INDICATING, RANGE 20~600°C WITH 6 PIECES OF THERMO-COUPLES	1	
32F11	〃	INDICATING, RANGE 0~100°C WITH 6 PIECES OF THERMO-COUPLES	1	
33F11	ASH CARRING EQUIPMENT	RAIL LENGTH 40M, WEIGHT OF RAIL 8Kg, GAUGE OF TRUCK 0.61M	1	
34F11~36F11	MOTOR (FOR 8F11. 9F11. 10F11)	REDUCING SYSTEM 5HP 1150~50 R.P.M.	3	
37F11~39F11	SWITCH	MAGNET 15A 220V 3POLE	3	POLE BROKEN
40F11~43F11	TAR SEPARATOR	VERTICAL, CYLINDER 1Mϕ x 1.15MH	4	
44F11	VALVE	SLUICE, FACE TO FACE 610mm 420mm	1	
45F11	〃	〃 〃 560mm 420mm	1	
46F11~50F11	〃	〃 〃 400m.m 340mm	5	BODY DAMAGED AND HANDLE MISSING
51F11~53F11	〃	〃 〃 250mm 340mm	3	
54F11~56F11	〃	〃 〃 150mm 285mm	3	56F11 BODY DAMAGED

DECLASSIFIED E.O. 12065 SECTION 3-402/NND NO.

INV. NO.	NAME OF MACHINERY	BRIEF SPECIFICATION	QUAN. TITY	REMARKS
57F11	VALVE	SLUICE, SIZE 150mm FACE TO FACE 310mm	1	HANDLE MISSING
58F11. 59F11	〃	〃 〃 500mm 550mm	2	59F11 HANDLE MISSING
60F11 ~ 63F11	〃	〃 150mm 285mm	3	63F11 BODY DAMAGED
64F11	〃	〃 〃 150mm 225mm	1	HANDLE MISSING
65F11	〃	〃 150mm 400mm	1	BODY DAMAGED
66F11 ~ 69F11	〃	〃 〃 400mm 400mm	4	66F11 . 69F11 BOMB DAMAGED
70F11	〃	〃 〃 450mm 430mm	1	
71F11	〃	〃 〃 450mm 330mm	1	
72F11	〃	〃 〃 150mm 270mm	1	
NONE NUMBER	8 PCS VALVE	STOP . SIZE 100mm	1	
〃	10 〃 〃	SLUICE 〃 75mm	1	
〃	2 〃 〃	STOP 〃 50mm	1	
〃	12 〃 〃	〃 〃 25mm	1	
〃	5 〃 〃	〃 〃 12mm	1	

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INV. NO.	NAME OF MACHINERY	BRIEF SPECIFICATIONS	QUAN-TITY	REMARKS
NONE NUMBER	PIPE	WELDING PIPE 800mmOD × 12ML	1	
〃	〃	〃 760mmOD × 20ML	1	10M BOMB DAMAGED
〃	〃	〃 610mmOD × 240ML	1	31M MISSING
〃	〃	〃 560mmOD × 165ML	1	
〃	〃	〃 600mmOD × 80ML	1	
〃	〃	〃 500mmOD × 28ML	1	
〃	〃	〃 300mmOD × 36ML	1	
〃	〃	〃 400mmOD × 18ML	1	
〃	6" PIPE	GAS PIPE 150mmD × 50ML	1	
〃	4" 〃	〃 100mmD × 30ML	1	
〃	3" 〃	〃 75mmD × 68ML	1	
〃	2" 〃	〃 50mmD × 110ML	1	
〃	1½" 〃	〃 38mmD × 37ML	1	
〃	1¼" 〃	〃 32mmD × 22ML	1	