

INTRODUCTION

The purpose of this manual is to provide the auxiliary operator with information and training materials that will enable him/her to work in an efficient and safe manner.

This is not a detailed guide to all procedures. The format is general and can be easily revised. If you have comments or would like to change the manual, please feel free to contact supervision.

This is a highly skilled job. This unit is optimized and operated based on information supplied by you. Do not take short cuts. There is a reason for everything you do. If you have any questions about why you do a particular task, ask your lead operator.

Try to learn as much as possible about the other jobs in the control room. It will make you appreciate your job.

THINK SAFETY

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CHEMICALS



INDUSTRIES

INTEROFFICE / LAKE CHARLES

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TO Distribution DATE June 30, 1980
FROM R. G. Corley SUBJECT Emergency Squad Response

The response of the plant Emergency Squad into Plant "B" has been reviewed and discussed with Operations personnel and the Fire Chief. A revised plan for response has been developed and outlined below.

General Points:

1. The Squad will respond to every call, no matter who initiates it. (This is often not known anyway.)
2. Strobe lights will be respected at all times. Not even the ambulance will drive through one--except by specific permission from the Shift Supervisor or the Shift Superintendent.

Specific Procedure:

1. Emergency Squad members will respond to the scene of an emergency in the plant as in the past. In all areas except Plant "B", Squad members will assemble at the Fire Department pickup truck, if possible. Otherwise, they will respond directly to the injury or fire by getting directions from personnel in the area.
2. In Plant "B", Emergency Squad will respond only to one of four designated assembly points, depending on the location of the emergency. Assembly points are:
 - a) west end of Organics Road at the strobe light
 - b) east end of Organics Road at the strobe light
 - c) Tri-Ethane II Control Room
 - d) VCM II Shop
3. For emergencies located in Plant "B", the Fire Chief/Shift Coordinator will respond to one of the four designated locations. The Fire Department pickup will be parked at the location with engine off, but radio and emergency lights on.
4. Squad members will congregate at the truck and monitor the radio for instructions.
5. Fire Chief/Shift Coordinator will have proceeded into the operational area on foot to size up the situation by visual inspection and contact with an Operations representative. Fire Chief/Shift Coordinator will contact the assembly point by walkie-talkie and direct Squad members where to respond,

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6. Fire Trucks or any other engine powered vehicles will cross a flashing strobe light only on specific directions from the Fire Chief/Shift Coordinator. He will not issue these instructions without agreement from the production representative. This representative will be the ranking person at the scene who represents operations.

In the absence of any operations representatives (such as might occur in a large-scale disaster), the Fire Chief will make the decision based on the information available to him.

7. Ambulances will not cross strobe lights without specific directions from the Fire Chief/Shift Coordinator. Again, Shift Supervisor approval is required. Pending that permission, ambulance attendants will respond into the unit on foot to render preliminary first aid. The driver will remain in the unit and monitor the radio.
8. As a tactical philosophy, the foam pumper will be committed into the unit only on direction from the Fire Chief/Shift Coordinator after the situation is sized up.

The dry chemical truck is not a first strike unit. It will normally be moved into position and operated after water streams have been placed to cool structures and a coordinated water-chemical attack can be set up.

9. For vehicle response, the order of preference is as follows:
 - a) Fire Department pickup
 - b) Dry Chemical unit
 - c) Foam pumper

The foam pumper will be cranked, pulled out of the garage, and held on standby until dispatched by the Fire Chief/Shift Coordinator.

10. Due to the congested nature of some plant areas, and the potential for personnel injury, emergency response vehicles will observe a 35 mph speed limit.

In addition to training Emergency Squad and Safety Department personnel on this procedure, medical and security personnel will also require briefing.

Also, the Plant "B" Operations Superintendent group must be briefed on the importance of providing a representative to meet the emergency response group at battery limits to provide information and assistance. In the absence of such a person, emergency response personnel must act as their judgment dictates.

SAFETY

The following is not meant to be a general discussion of safety in the Lake Charles Plant, but is meant to present a more defined discussion of safety in the Per-Tri Plant.

Personal Protective Equipment:

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The personal protective equipment that will be required in your routine duties at Per-Tri will be a hard hat, safety shoes, respirator, safety goggles, and gloves. The hard hat is to be worn at all times in Plant B except inside the control room or in any office. Safety shoes, with steel toes, are to be worn by any person who works in the process areas of the plant. The respirator, which is an activated carbon filter used to filter out low levels of chlorine and many of the organics found in Plant B, is to be on the person at all times. Safety goggles are to be worn whenever outside in the unit or in the plant lab. Gloves are to be worn when catching samples. The laboratory exhaust fan should be left running whenever you are working in the lab.

Canister Masks:

In low level concentrations of contaminating gases where the oxygen level is at least 19.5 percent, canister-type gas masks are to be used. These gas masks are kept on the ~~north~~ ^{WEST} wall in the control room. These masks offer full face protection, but, as with the pocket respirator, they merely filter the air, they do not provide oxygen.

Scott Air Packs:

In cases where there is less than 19.5 percent oxygen present or if there are impurities present which are not filtered out by activated carbon,

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Scott air packs are to be used. These air packs are stored on the north wall in the control room. Scott air packs are 30-minute self-contained units offering full face protection. An alarm is present on the pack which goes off when there is approximately 5 minutes of air left. These air packs are not filters but are self-contained units which do provide a source of air.

Air-Line Masks:

In cases of emergency, there is a station in the control room equipped with six self-contained escape units connected to compressed air cylinders. The purpose of this station is to provide air to those persons who are required to remain in the control room once it has been contaminated and provide them with enough air to allow them to escape. These units are connected to four air cylinders by 50 ft. of tubing. This length of tubing is to allow the person to maneuver throughout the control room while drawing air from four large cylinders of compressed air. Each unit has a small 5-minute bottle that is strapped around the waist. For escape, the 50-ft. tubing is to be removed from the unit and the person begins breathing out of his 5-minute escape bottle.

Only one of the four air cylinders is open to the manifold. In case of emergency, open the other three cylinders.

Safety Showers:

There are thirty safety showers scattered throughout the Per-Tri area. These showers are placed in strategic places so that a shower is easily accessible from almost any area within the plant. It is a very good idea whenever performing a duty in the plant, such as catching a sample, to

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locate the nearest shower. This way, if something happens, you will know exactly where to go. If you have material splashed on your clothing, don't hesitate to remove them. Paper coveralls are in the orange tubes attached to each shower. Do not put back on your chemical laden clothes. Also, under each shower is a short piece of hose. This can act as an eyewash should you splash something in your eye.

Fire Extinguishers:

Scattered throughout the plant are dry-chemical fire extinguishers. These dry-chemical fire extinguishers are recommended for electrical and chemical fires. Again, you should look for and know the position of these fire extinguishers.

Red Phone System:

Per-Tri's red phone is located on the north end of the center table in the control room. The red phone system is part of the regular phone system and is used in situations where different control rooms must communicate closely and also during emergency situations.

The various stations in the Red Telephone System have been assigned to three different groups with some locations being in more than one group. The system is to be used for alerting various stations as a group in an emergency. In order for a station to make a group alerting call, he can either pick up the handset or push the on button on the speaker phone and then dial the group master number. The groups and their master numbers are as follows:

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Group 1
Master Number: 3101

Liquefaction
Cell Bridge
Caustic "A":
PH "A" Switchboard
PH "A: Boiler Board
Riverside
Powerhouse "C"
Shift Supervisor "A"
Shift Superintendent
Mercury Cell

Group 2
Master Number: 3102

EDC
Per-Tri
EC-VC-HCl
Shift Supervisor "B"
Liquefaction
Cell Bridge
Shift Superintendent
OHC
Powerhouse A Switchboard
Powerhouse A Boiler Board
Riverside
Powerhouse "C"
Silica Pigments Furnace

Group 3
Master Number: 3103

Chlorine Control Room
Caustic Control Room "C"
Powerhouse "C"
Powerhouse A Switchboard
Powerhouse A Boiler Board
Riverside
EDC
Liquefaction
Shift Supervisor "C"
Shift Superintendent
Silica Pigments Furnace

Master number for all stations: 3100

Reporting an Emergency:

In case of a fire or first aid emergency, go to any phone, dial 2700, state what kind of emergency exists, and your location (Per-Tri is in Zone 17). This phone number should be glued to every phone throughout the plant. Once notified, the guards will send the plant's fire fighting equipment or the ambulance, as is required, along with members of the emergency squad.

Plant B Evacuation:

There are four different warning devices that you will be concerned with: the Per-Tri siren, the reactor startup light, the roadway lights, and the Plant B horn.

The Per-Tri siren can be activated by a switch located on the south face of the center pillar in the control room. This siren is activated when a dangerous situation occurs. When it is on, all non-Operations personnel are to evacuate the area. All Operations personnel are to return to their control room where they may be needed.

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The reactor startup light is located just north of the acid pit. This light is activated by a switch located on an I-beam north of the old OHC control room. This light will be activated by OHC or Per-Tri operators whenever a reactor is being started. When this light is on, a potentially dangerous situation exists and all Operations personnel should remain in their control rooms.

The roadway lights are located at the entrance to Plant B. These lights are on to indicate that a dangerous situation exists and all non-Operations personnel should evacuate and remain outside Plant B. If you are in a vehicle, you should pull over to the side of the road, shut it off, and proceed to the control room where you may be needed.

The Plant B evacuation horn can be activated by a switch located on the east face of the center pillar in the control room. The horn it activates is the shift-change horn. This horn is activated only under potentially dangerous situations and calls for the evacuation of Plant B for all non-essential persons.

Emergency Flashlight:

Although the lighting system in the control room can be powered from two sources; the normal bus and an auxiliary bus, there may be cases where lighting is lost to the control room. In these cases, light will be supplied by a battery-operated light located on the north wall in the control room.

Sprinkler System:

In the Per-Tri process area, the reactors, cooling towers, and stabilizer building have been equipped with their own automatic water deluge systems

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for fire protection. An automatic deluge valve is installed at each of these locations throughout each area, heat activated devices (HAD) have been strategically placed and will trip the deluge valve in the event of fire, causing the area to be sprayed with water through a system of sprinklers. The automatic deluge valve can be manually activated in each of the red fire water houses and also from behind the control board.

Dowtherm Furnace Shutdown Switch: -

The Dowtherm furnace is equipped with a shutdown switch located in the control room. The furnace also has an organic vapor detector which will shut down the furnace should it detect any organic vapors. This shutdown system is installed so that in cases where there may be a dangerous level of vapors near the furnace, the furnace will not ignite.

Air-N₂ Alarm Light:

The process control instruments used in the control room are normally run on instrument air from VC, but are capable of being run on nitrogen. The O₂-N₂ light, located on the south face of the center pillar in the control room, indicates whether we are using instrument air (O₂ light is on) or nitrogen (N₂ light is on). When nitrogen is being used, the doors of the control room are left open to ensure an adequate supply of breathing oxygen. As a precaution, an O₂ sensor and alarm is located behind the control room board. If the O₂ level falls below 19.5 percent, the alarm is sounded as a warning of low level O₂.

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Permit Procedures:

There are three types of permits used in the plant. A vehicle entry permit, a burning or welding permit, and a tank-entry permit. A sample of each of these permits is at the end of this section.

A vehicle entry permit must be issued for all vehicles brought into the unit's area. The vehicle entry permit is given by either an Operations supervisor or the lead operator. This permit is good for eight hours or less.

The ^{PINK}~~red~~ permit is the burning or welding permit. A burning or welding permit must be obtained for any burning, welding, or sandblasting in the area. These permits must be signed by an Operations supervisor and a Maintenance or Construction foreman. Prior to the permit's issuance, an inspection of the area must be made to make sure that all valves are closed and tagged, all bleed valves are opened and tagged, all connections have been blinded, all circuits are pulled and tagged, and that the process materials and area in general are free of explosive gases. This permit is good for a maximum of four hours.

The orange permit is the tank entry permit. This permit must be signed by an Operations supervisor and a Maintenance or Construction foreman. The tank must be cleaned and have all process lines to and from the tank removed or blinded. The tank should be tested for flammable vapors and for oxygen. A life line is to be worn inside the tank, unless the line would not contribute to the safety of the job (i.e., a vessel with manways on the bottom). A fresh air mask is to be used in a vessel where there is a chance of being suddenly surrounded by gas. A manway watch is required at all times that someone is in the tank.

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Housekeeping:

Housekeeping is a very important part of safety. The following are the main areas of responsibility:

1. The lab. It should be kept clean and orderly at all times.
2. You and the "C" operator should frequently clean the stabilizer building.
3. Wash down organics after catching samples. This is a potential fire and health hazard.
4. Wash down catalyst after adding to reactors.
5. Always roll up hoses and put away tools after using them.

Tank Farm:

Per-Tri's tank farm is located northwest of the control room and consists of twenty-three tanks. Of these twenty-three tanks, six are Tri stabilizing tanks, six are Per stabilizing tanks, ten are auxiliary still line feed tanks, and one is a Tri rework tank. Figure 1 shows the location of these tanks and the use of each tank.

Figure 2 is a sketch showing the Per-Tri dock tanks located at the docks. After a certain batch of regular grade Per or Tri has been stabilized and cleared by the main lab, it will normally be transferred to these tanks. It is from these tanks that barges or ships are loaded. After a dock tank has been filled, ~~or if material is needed before a tank is filled~~, the main lab must run another set of analyses on the dock tank before the material is cleared for shipment **BY WATER**.

Table III shows what each of the tanks in Per-Tri's tank farm is used for.

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A PERMIT MUST BE ISSUED BEFORE ANY WELDING OR BURNING CAN BE DONE IN THE PLANT. PERMITS ARE ISSUED BY A SUPERVISOR.

E & L ASSOCIATES

59-572-0060

WELDING, BURNING, OR OPEN FLAME PERMIT

Date _____ Area _____

Job Description _____

Checklist

(This portion to be filled in by Operations)		Yes	Does Not Apply
1. Valves closed/tagged			
2. Bleed valves open/tagged			
3. Connections blanked or blinded & tagged			
4. Electric circuit breakers pulled/tagged			
5. Sufficient O ₂ for test. Meter in calibration. Free of process materials & gases. % explosive. _____			
(This portion to be filled in by Maint/Constr)			
1. Fresh air masks & air needed			
2. Life line (wristlets, belt-harness) required			
3. Sewer line opening sealed			
4. Control points checked and tagged			
5. JSI given			

Permit Start Time _____

Expiration Time _____
Maximum Duration: Four Hours

New Permit required after job interruptions such as lunch break, evacuation, safety meeting, or process upset. For other situations requiring revalidation, the Operations Foreman's signature is required on reverse side of field copy.

Operations

Maint/Constr

Foreman

Foreman

When job is complete, Maintenance Foreman/Field Engineer returns Permit to Operations Foreman who will then forward both copies to the Senior Safety Supervisor/Engineer.

Job Completed _____
Maintenance Foreman/Field Engineer

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CONTROL ROOM COPY

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LAKE CHARLES
VEHICLE ENTRY PERMIT

DATE: _____ AVAILABLE: _____
NAME: _____
ADDRESS: _____
DESCRIPTION OF BUSINESS: _____
SIGNATURE: _____
OFFICIAL SUPERVISOR: _____

IF A FLANK OR AREA EVACUATION SIGNAL IS
TURNED ON, ALL VEHICLES MUST IMMEDIATELY
SHUT OFF ENGINE AND LEAVE THE AREA

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IGNITION SOURCE PERMITS MUST BE GIVEN ON POSSIBLE SPARK OR HEAT IGNITION SOURCES SUCH AS TOWMOTORS, WELDING MACHINES, AIR COMPRESSORS, MANLIFTS, OR SUBSTATIONS IN THE PLANT.

E & L

58-572-0165
Rev. 9-15-88

IGNITION SOURCE PERMIT

Date _____ Unit _____

Location in Unit _____

Job Description _____

Description of Tools or Equipment Covered by Permit _____

Checklist (to be filled in by Issuing Operations Supervisor)

Yes

1. Sewer openings sealed _____
2. Fire extinguisher accessible _____
3. Job area free of process materials and gases _____
4. JSI given _____
5. Shutdown point (switch, etc.) of ignition source noted by Issuing Supervisor _____

Permit Start Time _____

Expiration Time _____

Maximum Duration: Eight Hours

New permit required after job interruptions such as process upset, area siren, or plant evacuation. Permit must be revalidated by Operations following lunch break or shift change. (See Reverse Side)

Permit Requested by: _____

Permit Issued by: _____

Maintenance Foreman/Field Engineer

Operations Supervisor/Lead Operator

Job Completed _____

Maintenance Foreman/Field Engineer

When job is complete, Maintenance Foreman/Field Engineer returns Permit to Operations Foreman who will then forward both copies to the Senior Safety Supervisor/Engineer.

CONTROL ROOM COPY

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Form 43A-SD-25
PPG ID # 59-572-0030
Rev. 6/82

TANK ENTRY PERMIT

Date_____Time of Issue_____AM
PM Permit Duration_____Hrs. (8 Hrs. Max.)

Tank Description_____Prior Contents_____

Job Description_____

Tank Cleaned_____ / Previously Purged with: Air ☐ No ☐

Burning or Welding Required: Yes ☐ No ☐

Process Lines to Tank Tagged and Blinded (or Removed)_____

Power Sources Locked and Tagged_____

Breathing Air Required: Yes ☐ No ☐ / Mask Required: Yes ☐ No ☐

External Ventilation Required: Yes ☐ No ☐ / Air Horn ☐ Electric ☐

Life Line Required_____ Wristlets ☐ Safety Belts ☐

Electrical Equipment Required: Yes ☐ No ☐ / Low Voltage Lights ☐
110 Volt Lights with Ground Fault Breaker ☐ 110 Volt Tools or Inspection
Devices with Ground Fault Breakers ☐

Ladder Required: Yes ☐ No ☐

Manway Watch Assigned_____ Communication Device Provided_____

Checked for Toxic Material (See Back of Card): Yes ☐ No ☐

Comments_____

Type Protective Clothing To Be Used_____

Tank Atmosphere Checked

% O₂: _____ % Flammable _____
(19.5% Minimum) (10% of Lower Flammable Limit Max)

Supervisor Approvals

Operations _____

Maintenance Construction _____

Job Completed_____

(Maintenance Construction Supervisor)

Definition of Tanks

The term "tank" includes tanks, mixers, sewer manholes, heaters, boilers, electric manholes, fume tunnels, large pipelines, small vaults, cooling tower basins (in special cases) and similar confined areas with restricted access difficult rescue where any of the following hazards may be encountered: toxic or flammable gases or vapors; mechanical hazards such as moving agitator blades, acids or caustics; plant inert gas; or oxygen deficiency.

This Permit Form Must Be Hung Near the Tank Manway or Entry Point.

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This drawings shows the location and identification of critical block valves on leaders to Ber/Tri. In cases of emergency it may be desirable to close these valves. Make sure you know the location of these valves.

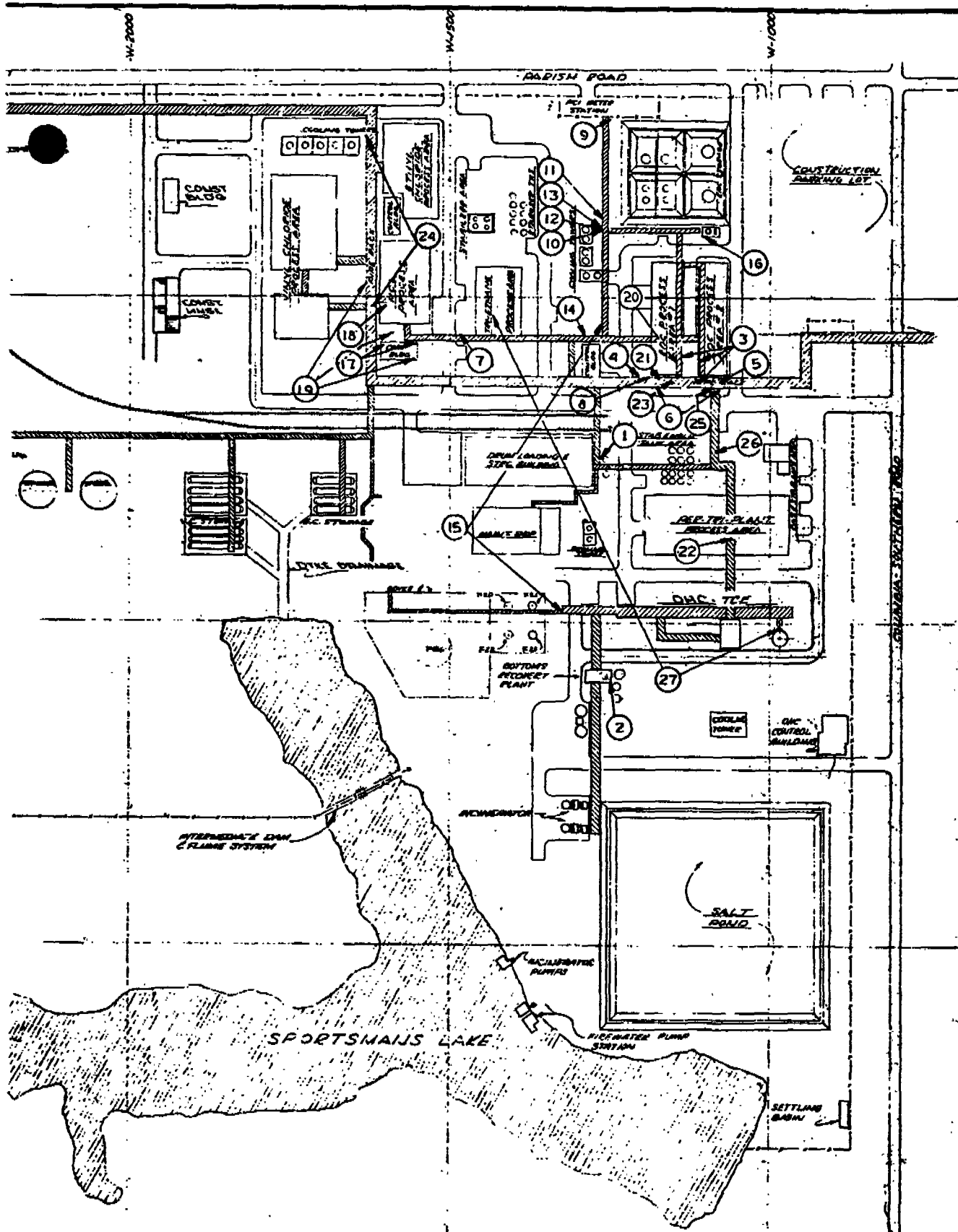
UNIT COLOR	UNIT	PRODUCT	IDENT MARK	VALVES REQ'D CLOSED
BROWN	EC	C ₂ H ₄ ETHYLENE	9	1
	EC	HCL HYDROGEN CHLORIDE	17	2
LT. GREEN	EDC #1	CL ₂ CHLORINE	9	2
	EDC #2	CL ₂ CHLORINE	8	4
	EDC #3	C ₂ H ₄ ETHYLENE	10	3
	EDC #1	C ₂ H ₆ METHANE	20	1
LT. GREEN	EDC #2	CL ₂ CHLORINE	9	2
	EDC #2	C ₂ H ₄ ETHYLENE	11	2
WHITE	NCL APPROX	NCL HYDROGEN CHLORIDE	18	2
GOLD	MC	C ₂ H ₆ METHANE	21	1
RED	MC	CL ₂ CHLORINE	4	2
	MC	C ₂ H ₄ ETHYLENE	12	1
	MC	EDC ETHYLENE DICHLORIDE	14	2
DK GREEN	DMC	C ₂ H ₄ ETHYLENE	13	1
	DMC	EDC ETHYLENE DICHLORIDE	15	8
	DMC	NCL HYDROGEN CHLORIDE	19	2
	DMC	C ₂ OXYGEN	25	1
	DMC	C ₂ H ₆ METHANE	22	1
BEIGE	DMC	C ₂ H ₆ METHANE	23	1
	PER-TRI	AN ₃ AMMONIA	1	1
	PER-TRI	BTMS BOTTOMS	2	1
	PER-TRI	CL ₂ CHLORINE	5	1
	PER-TRI	NCL HYDROGEN CHLORIDE	17	2
	PER-TRI	C ₂ H ₆ METHANE	23	1
DK GREEN	PER-TRI	C ₂ OXYGEN	26	1
	PER-TRI	TCE TRICHLOROETHANE	27	1
GRAY	TETRA	BTMS BOTTOMS	2	1
	TETRA	CL ₂ CHLORINE	6	2
	TETRA	C ₂ H ₄ ETHYLENE	13	1
	TETRA	EDC ETHYLENE DICHLORIDE	15	8
GRAY	VC	CL ₂ CHLORINE	7	1
	VC	EDC ETHYLENE DICHLORIDE	16	2
	VC	C ₂ H ₆ METHANE	24	1

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RIGHT OF WAY

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FUTURE TRAILS

SL 020668



REVISIONS

UNIT 001011
 ADDED
 7-22-77 - DE
 W-048806

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PITTSBURGH PLATE GLASS COMPANY	
LAKE CHARLES, LOUISIANA	PLANT AREA B
CRITICAL BLOCK VALVE LOCATIONS	
DRAWN BY: [Signature]	
CHECKED BY: [Signature]	
APPROVED BY: [Signature]	
DATE OF MATERIAL: 5/24/82 - DWG. NC59A-80001	

INTRODUCTION TO MAJOR RESPONSIBILITIES

What you will read in the following pages may sound complicated to you, but do not worry about it. After you complete your training, you will have a better understanding of what your part is. Basically what is happening; we put some chemicals into a vessel and mix them or heat them to form another chemical. This mixing does not turn out a pure product, so we then put the chemicals through a series of clean up steps. The end result is a saleable or usable product. You will be involved in this manufacturing of chemical products.

The name Per-Tri is a shortened form for this unit's products, Perchloroethylene (Per) and Trichloroethylene (Tri). As you can see, it is much easier to use the term Per-Tri. These liquid products are used as either liquid or vapor degreasers.

Per-Tri is divided into two major operating areas. These areas are the Reactors and Still Line. The Reactors make the product and the Still Line purifies it.

Feeds for the Per-Tri reactors are gaseous oxygen (O_2), gaseous chlorine (Cl_2) and liquid organics. These organics are of varying composition and must be vaporized before being fed to the Per-Tri reactors. The O_2 comes from an out of plant supplier. Chlorine comes to the Per-Tri unit from the Liquefaction Area in Plant "A". Organics for the reactors come from the Tetra Unit and some is liquid impurities recycled from the Still line.

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These feeds are fed to the Per-Tri reactors. They react in the reactor tubes in the presence of a copper chloride and potassium chloride catalyst. The catalyst is fluidized in the tubes. This fluidization causes the catalyst to boil like water in a pot. Fluidization in the reactor tubes is caused by the feeds coming into the bottom of the tubes. By being fluidized, the catalyst can serve its two major functions. They are to promote the reaction and to transfer the heat from the reaction. Since the Per-Tri reaction is heat producing (exothermic), a means is provided to cool the reactor. Dowtherm, a heat transfer liquid, surrounds the reactor tubes and serves as a coolant.

The crude Per and Tri leave the reactor as a gaseous mixture through the vapor line. This gaseous crude goes into a condensing system where it is liquified. After being cooled and condensed, the crude is put into a tank. The Per-Tri reactors make water as a waste. The following word equation shows, in a simplified form, the reaction in the Per-Tri reactors. Oxygen + Chlorine + Organics catalyst Perchloroethylene + Trichloroethylene + water. This water is removed from the crude with a Dehydration Still (DH). Moisture in excess of 50 ppm should not be allowed beyond the DH Still. This moisture could result in corrosion damage to the Still Line.

The dried liquid crude is then fed to a series of distillation columns called stills. Separation of the Per and Tri occur first in the Per-Tri Still. Tri and lighter material leave the top of the Per-Tri Still as a

gas. The Per and heavier material leave the bottom of the Per-Tri Still as a liquid. It will now be necessary to follow one stream to completion and then take the other. Please keep in mind that in the Still Line there are two major streams. One is the Tri stream and the other is the Per stream. In addition to these will be impurity streams such as recycle and bottoms.

The Tri leaves the top of the Per-Tri Still, is condensed to a liquid and goes to the Tri Stills. Here the impurities lighter than Tri are removed, as a gas, at the top of the Tri Stills. Sometimes the Tri must go through the Topping Still. In this still, heavier than Tri impurities are removed at the bottom as a liquid while the Tri leaves the top as a gas. The gaseous Tri is condensed to a liquid. After the distillation process is completed in the Tri Stills and Topping Still, the Tri passes through a neutralizer to remove other impurities. The final purification step for the Tri is a set of driers to remove moisture. Dried Tri is then stored for sales.

Coming off the bottom of the Per-Tri Still is the Perchloroethylene and heavier material. This stream goes to a Heavies Still where the heavier than Per impurities are removed in a liquid state at the bottom. The gaseous Per and lighter material exits through the vapor line of the Heavies Still. The Per and lighter material is condensed, liquified and fed to the Per Stills. In the Per Stills, the Per is separated from the lighter materials. Per leaves the bottom of the Per Stills as a liquid. The lighter than Per material leaves the top as a gas. The Per is neutralized to remove other impurities. Driers then remove moisture from the purified Per product before it is stored for sales.

This is a brief explanation of what happens in the Per-Tri Unit. There are other flows and equipment not mentioned. This general idea will be useful in understanding what is happening around you on the Per-Tri "D" job.

A safe and efficient operation of the Per-Tri Unit will depend a great deal on your performance. You will be responsible for process analyses and assisting when needed in the units. The Per-Tri Unit will be operated largely on your sample analyses.

To a great extent, the operation of the unit is dependent upon your job performance. Your job is important. This is a big responsibility. Your training and ability will enable you to fulfill this important responsibility. As you gain experience, your job will become easier.

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PER-TRI PLANT DESCRIPTION

The Per-Tri Plant is designed to produce high purity Perchloroethylene (Per) and Trichloroethylene (Tri) simultaneously from a feed stock of chlorine, oxygen, 1,1,2-Trichloroethane (TCE), 1,1,2,2-Tetrachloroethane (Sym), 1,1,1,2-Tetrachloroethane (Unsym), and other chlorinated hydrocarbons. Per and Tri are formed by a series of successive chlorination and cracking reactions in which HCl is cracked off of the chlorinated organic molecules at high temperatures. These reactions are carried out, under low pressure, in a tubular reactor containing catalyst. The chlorinated hydrocarbons (hereafter referred to as TCE), chlorine, and oxygen, all in the vapor state, are fed into the bottom of the reactor and flow up through the fluidized bed of solid catalyst particles where the gases are reacted into Per, Tri, water, HCl, and other chlorinated hydrocarbons. Most of the reactions involved are exothermic and the excess heat must be removed. The heat is removed from the reactor by the boiling of liquid Dowtherm which surrounds the outer walls of the reactor tubes. The boiling rate of the liquid Dowtherm is controlled so as to keep the reactor tubes at a constant temperature.

Basically, the Per-Tri Plant consists of reactors, a system to remove water and HCl, and a purification system for removal of unwanted chlorinated organics from both end products. Associated with each of the five reactors is a vaporizer and two reactor condensers. The water and HCl removal system consists of three phase separator tanks and two drying stills, and the organics purification system, called the distillation train, consists of seven distillation columns and their associated condensers and tanks. Following the distillation train, there is a product neutralizer and dryers for both Per and Tri. The Per-Tri storage consists of twenty-three tanks in a tank farm adjacent to the process area and six dock area storage tanks. Of the twenty-three tanks in the tank farm, ~~six~~ ^{three} are Tri stabilizing tanks, ~~six~~ ^{three} are Per stabilizing tanks, ten are auxiliary still line feed tanks, and one is a Tri rework tank. In the dock area, three tanks are Tri and three are Per storage *plus one sphere for Per 232.*

The Per-Tri reactors are large shell and tube type exchangers with the reactants in the tubes and the heat transfer medium on the shell side. The reactor tubes are actually fluidized beds filled with catalyst. The TCE and chlorine are first vaporized, then mixed together and fed into the bottom of the reactor tubes. The oxygen is fed into the tubes through a separate line. These gases, as they travel up the catalyst-filled tubes, react and give off a large amount of heat. This heat is absorbed by the liquid Dowtherm on the shell side. The Dowtherm is vaporized, leaves the top of the reactor as a vapor, is condensed, and is returned to the reactor shell as a liquid. The Per and Tri leave the top of the reactor as a vapor along with HCl, water, and other undesirable by-products. The vapor stream from the reactor flows first to a water-cooled condenser and then to a chilled brine condenser where the organics and the water are condensed. From these condensers, the condensed organics and water flow to a degasser tank which removes some of the

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dissolved gases and seals the reactor pressure. The organics and water is then fed to the drying still feed tanks. These feed tanks also serve as a phase separator, sending the acidic aqueous phase to the acid pit and pumping the heavier organic phase to the drying stills for the removal of the dissolved water and HCl. The water and the HCl leave the top of the drying still as a vapor, flow through two condensers where the vapors are condensed, and fall into the drying still reflux drum. In the reflux drum, the water, which has absorbed the HCl, separates from the organic phase and is discarded to the acid pit. The organic phase left in the drum is refluxed to the drying still. Dry organics leave the bottom of the drying still and are pumped to the still line feed tank.

From the still line feed tank, the crude process stream is pumped to the still line, consisting of seven stills, where the unwanted organic compounds are separated from the Per and Tri. The first still in the chain, called the Per-Tri still, makes the split between Per and Tri, the remaining six stills remove the light and heavy impurities from each of the two products. The light impurities are removed in the overhead of two Tri stills and are sent to the Tetra Plant. The heavy impurities are removed in the bottoms from the heavies still and are sent to the Bottoms Plant.

In the first still, the Per-Tri still, the Tri is separated from the Per with the Tri and other light impurities going overhead and the Per and heavier compounds leaving the bottom. The overhead stream is condensed and sent to two Tri stills where the Tri is separated from the lighter components. Part of these lights is recycled to the still, and the remainder goes to the Tetra Plant or to the recycle tank. The Tri still bottoms are pumped to the Tri topping still where heavies are removed at the bottom and recycled to the reactor and pure Tri is taken off the top and condensed. The Per stream is taken off of the bottom of the Per-Tri still, pumped to the heavies still feed tank, and then to the heavies still. The Per leaves the top of the heavies still, is condensed, and is pumped to the two Per stills. The heavies still bottoms are sent to the Bottoms Plant. The lights leaving the Per stills are condensed, part is sent back to the still as reflux, and the remainder is sent to the reactor recycle tank. The pure Per product is drawn off the bottom of the Per still.

After distillation, the pure Per and Tri streams are fed to the neutralizers, where they are first treated with ammonia, then washed with water, and from here flow to alumina dryers where the water is removed. After drying, they are pumped to stabilizing tanks where stabilizing chemicals are added, after analysis, are transferred to storage.

In the Per-Tri process area, the reactors, cooling towers, and stabilizer building have been equipped with their own automatic water deluge systems for fire protection. An automatic deluge valve is installed at each of these locations and throughout each of these areas, heat activated devices have

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been strategically placed such that they will detect fire and activate the deluge system. These heat activated devices (HAD) will trip the deluge valve in the event of fire and the area will be sprayed with water through a system of sprinklers.

For each of the three deluge valves in the process area, there is a set of sprinklers that cover its particular area. In addition to the automatic sprinklers, there are carbon dioxide and dry chemical fire extinguishers, and five hose houses located throughout the plant. For protection against over-pressurization in the process, vessels are equipped with rupture discs.

In the Per-Tri Plant, flammable materials are present in some areas, and, for this reason, special precautions are taken regarding electrical equipment and grounding. In the control building area, the still area, and the product storage area, all motors are TEFC, and lighting is vapor tight. The control building is pressurized to prevent any vapors from entering. In the reactor and Dowtherm areas, and in the stabilizer building, all motors are TEFC, lighting is vapor tight, and all arcing devices are explosion-proof and sealed. All motors and other electrical devices in the plant are grounded and the ground is contained in the conduit supplying the device. Due to the static charges produced in the handling of hydrocarbons, all vessels and pumps are grounded, and flanges are equipped with jumpers and as a result, any static charge buildup is eliminated.

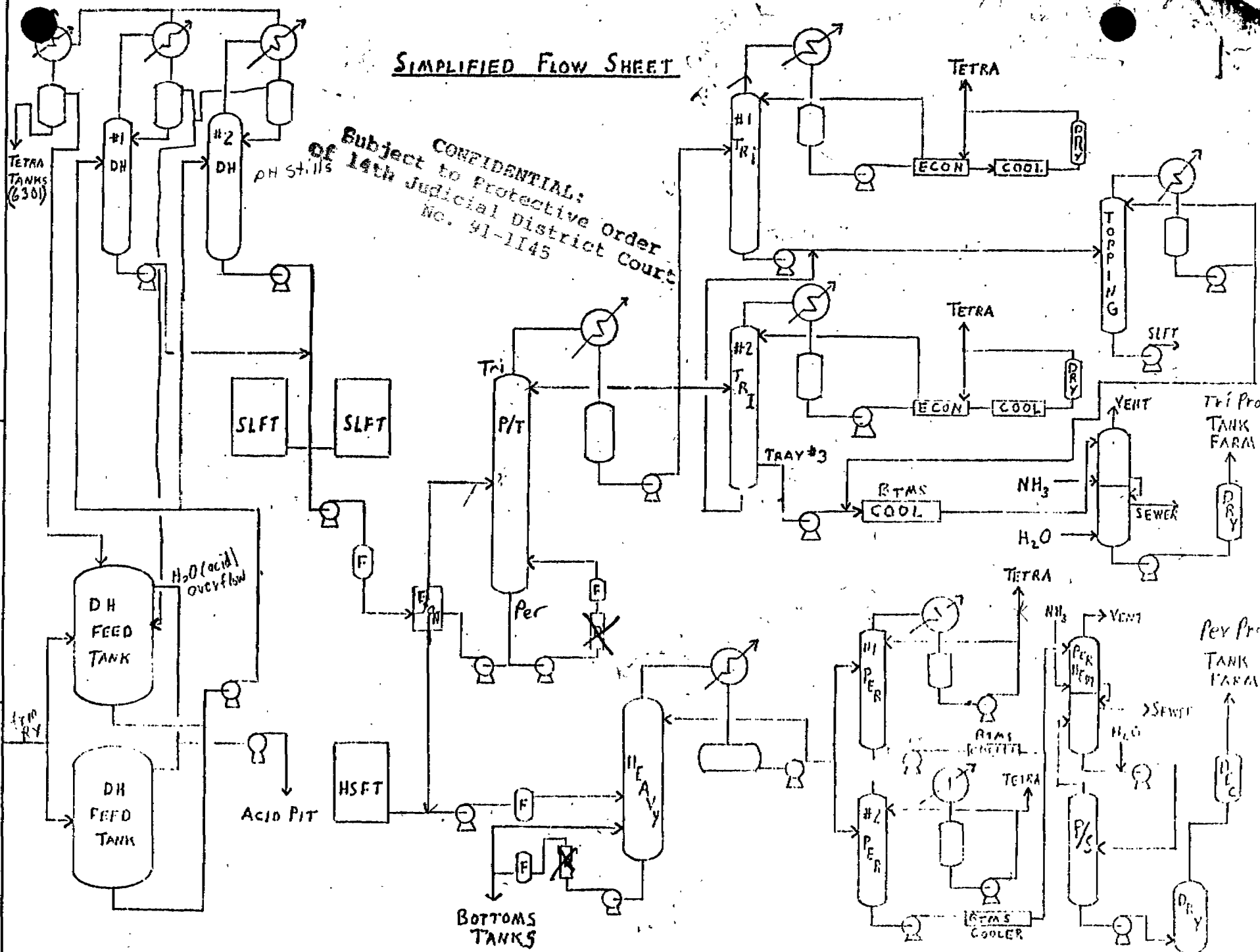
The plant is equipped with an alarm system that warns operating personnel of any abnormality in the plant, telling them where the abnormal condition is located and whether it is above or below the normal operating condition. All variables in the plant that can cause serious trouble or operating difficulties, such as levels, flows, temperatures, pressures, pH's etc., are equipped with alarms. When an abnormal condition occurs, alarm horns will sound in the control building and a light will flash on the graphic panel board showing the exact location of the trouble. The lights on the panel board are green under normal conditions, but if a high flow, pressure, temperature, level, etc., occurs, the alarm horns will sound and the light will flash red; if a low condition occurs, the horns will sound and the light will flash yellow. The horns will continue to sound and the lights flash until the acknowledgment button is pushed. Pumps and other electric motors ^{are} also connected to the alarm system. When a motor is running, a green light shows on the panel board, but if the motor should stop for any reason, the horn will sound and a red light flashes on the board.

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SIMPLIFIED FLOW SHEET

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PER/TRI GROUND FLOOR SHT. 3 OF 3



MATCHLINE, SEE SHTS. 1 OF 3 & 2 OF 3

CONCRETE RD. & WALK WAY

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71-1349

60-488

60-404

71-1344

71-1343

71-1345

60-1398

LINE OF PUMPS



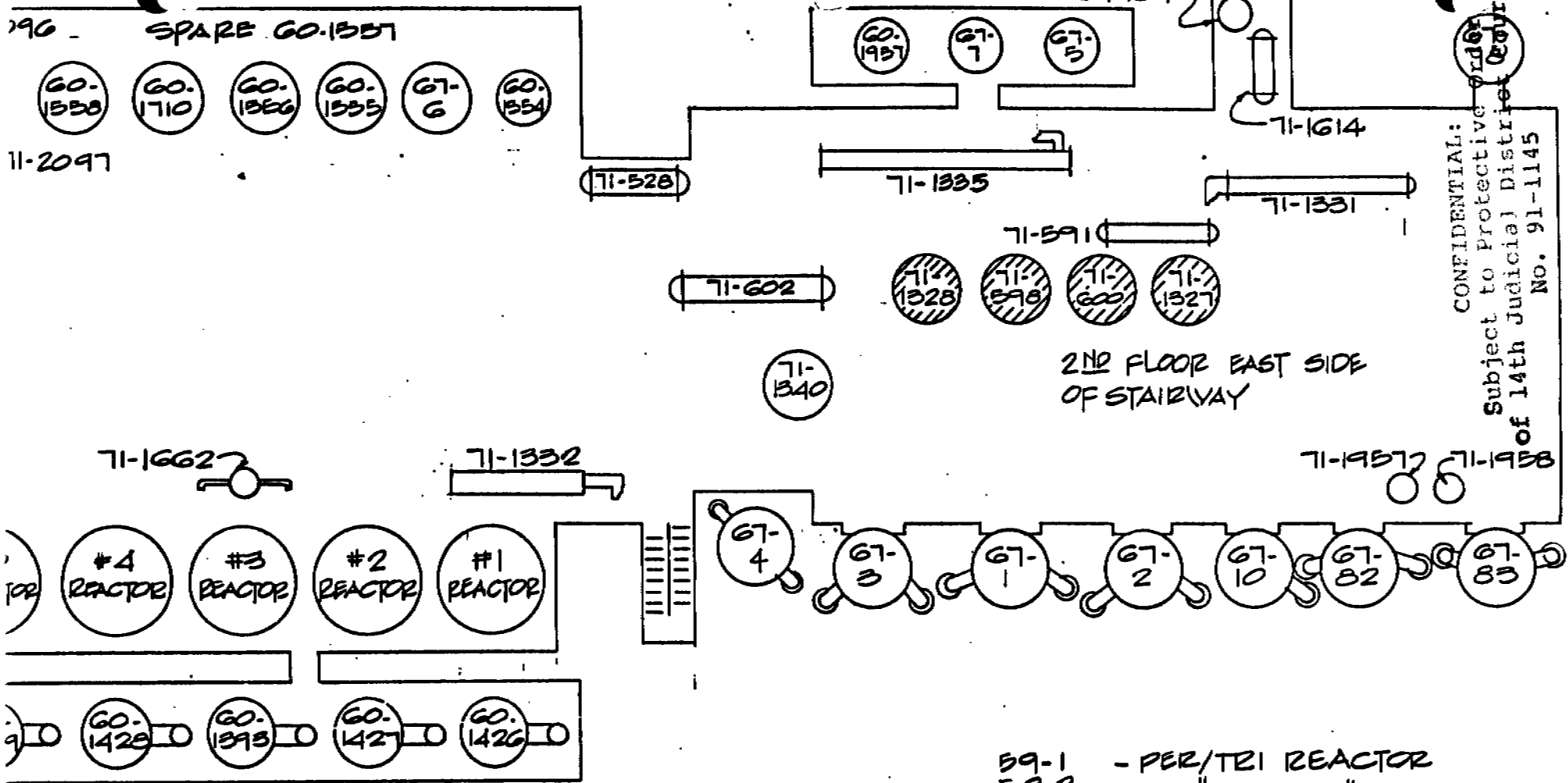
- 2-404 - COND. FLASHER
- 2-463 - TRI TOPPING STILL REFLUX DRUM
- 2-469 - #2 PER STILL REFLUX DRUM
- 0-470 - TRI STILL REFLUX DRUM
- 0-471 - P/T " " "
- 2-488 - CONDENSATE STORAGE
- 2-1135 - #2 TRI STILL REFLUX DRUM
- 2-1136 - H.S. REFLUX DRUM
- 2-1390 - VENT HEADER ENT. SER
- 2-1398 - LEWIS OIL SEPARATOR (BTM. MIDDLE)
- 2-1958 - #1 PER STILL REFLUX DRUM
- 7-1 - #2 PER STILL
- 7-2 - #1 TRI " "
- 7-3 - P/T STILL
- 7-4 - #1 PER STILL
- 7-10 - TRI TOPPING STILL

- 67-64 - HCL ABSORBER
- 67-82 - #2 TRI STILL
- 67-83 - HEAVIES STILL
- 71-596 - #2 PER STILL REBOILER #2
- 71-599 - " " " " #1
- 71-601 - #1 TRI STILL REBOILER #1
- 71-603 - PER TRI STILL REBOILER #1
- 71-605 - #1 PER STILL REBOILER
- 71-619 - #1 TRI " " #2
- 71-620 - PER TRI " " #2
- 71-1343 - SOUTH EVAPORATOR
- 71-1344 - NORTH OIL COOLER
- 71-1345 - NH3 COND. (TOP MIDDLE)
- 71-1349 - CONDENSATE FLASH COND.
- 71-1350 - HEAVIES STILL REBOILER #2
- 71-1351 - " " " " #1
- 71-1353 - #2 TRI " " " "

PER/TRI

2ND FLOOR

CONFIDENTIAL



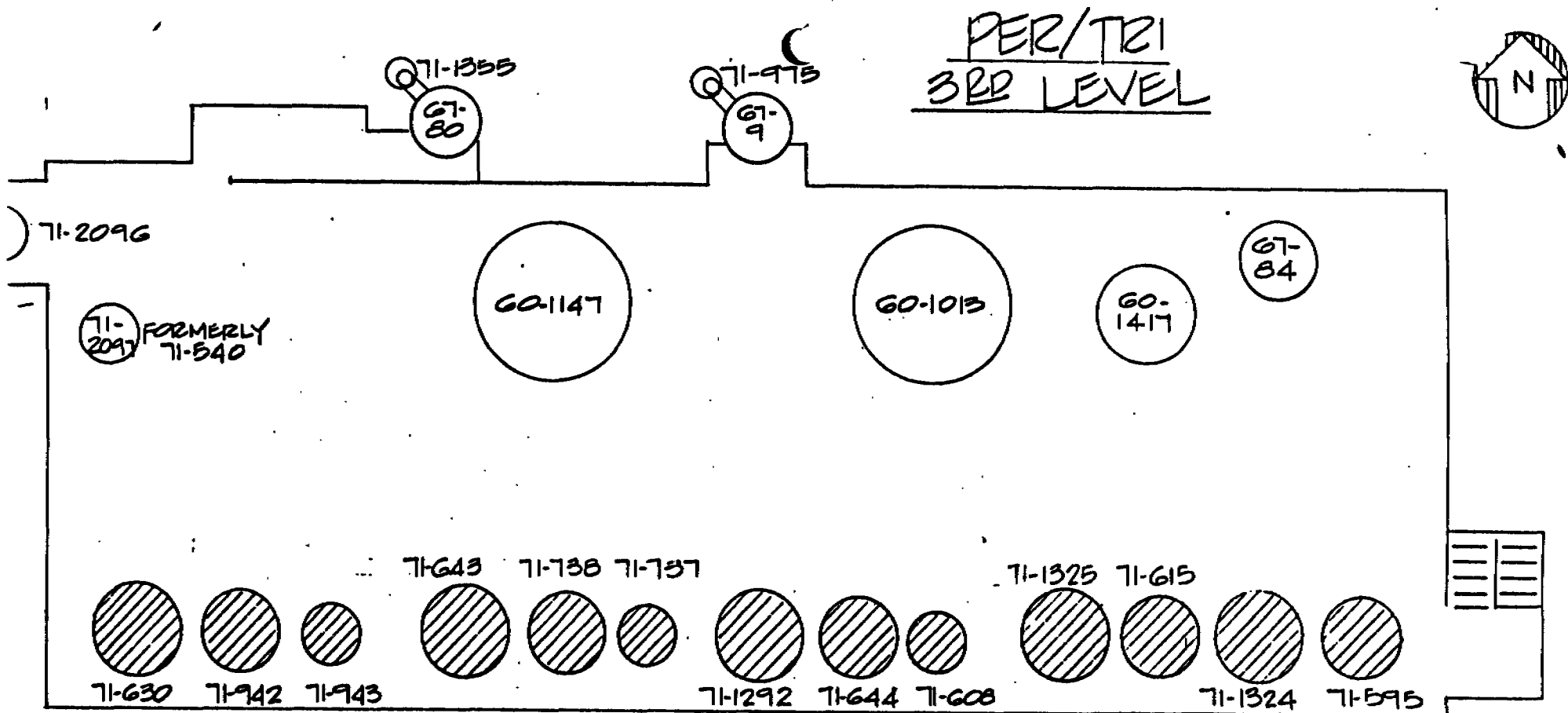
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2ND FLOOR EAST SIDE
OF STAIRWAY

- 13 - #5 RX ORG. VAPOR DRUM
- 26 - #1 " " " "
- 27 - #2 " " " "
- 28 - #4 " " " "
- 29 - #5 " " " "
- 34 - #1 RX DEGASSER
- 35 - #2 " " " "
- 36 - #3 " " " "
- 58 - #5 " " " "
- 10 - #4 " " " "
- 57 - PER WASH SEPARATOR #2
- #2 PER STILL
- #1 TRI " "
- PER/T " "
- #1 PER " "

- 67-5 - #1 PER NEUT.
- 67-6 - DH SCRUBBER
- 67-7 - #2 PER NEUT.
- 67-10 - TRI TOPPING STILL
- 67-78 - TRI-NEUT.
- 67-82 - #2 TRI, STILL
- 67-83 - HEAVIES STILL
- 67-107 - DRYER REGENERATION CONTACT SCRUBBER
- 70-2096 - HCL PRIM. COND.
- 71-528 - #1 PER PRODUCT COOLER
- 71-591 - TRI TOPPING STILL COND.
- 71-598 - #2 PER STILL COND.
- 71-600 - #1 TRI " "
- 71-602 - #1 PER " "
- 71-1327 - #2 TRI " "

- 59-1 - PER/TRI REACTOR
- 59-2 - " " "
- 71-1328 - PER/TRI STILL COND.
- 71-1331 - TRI BOTTOMS COOLER
- 71-1332 - OXYGEN PREHEATER
- 71-1340 - P/T STILL BOTTOMS ECON.
- 71-1614 - CONTACT CONDENSER
- 71-1662 - N₂ PREHEATER
- 71-1957 - H.S. CARBATE COND.
- 71-1958 - " " "
- 71-2097 - HCL ABS SECONDARY COND. REPLACED 71-540
- 71-1335 - #2 PER BOTTOMS COOLER
- 59-3 - PER/TRI REACTOR
- 59-6 - " " "
- 59-10 - " " "
- 59-23 - " " "



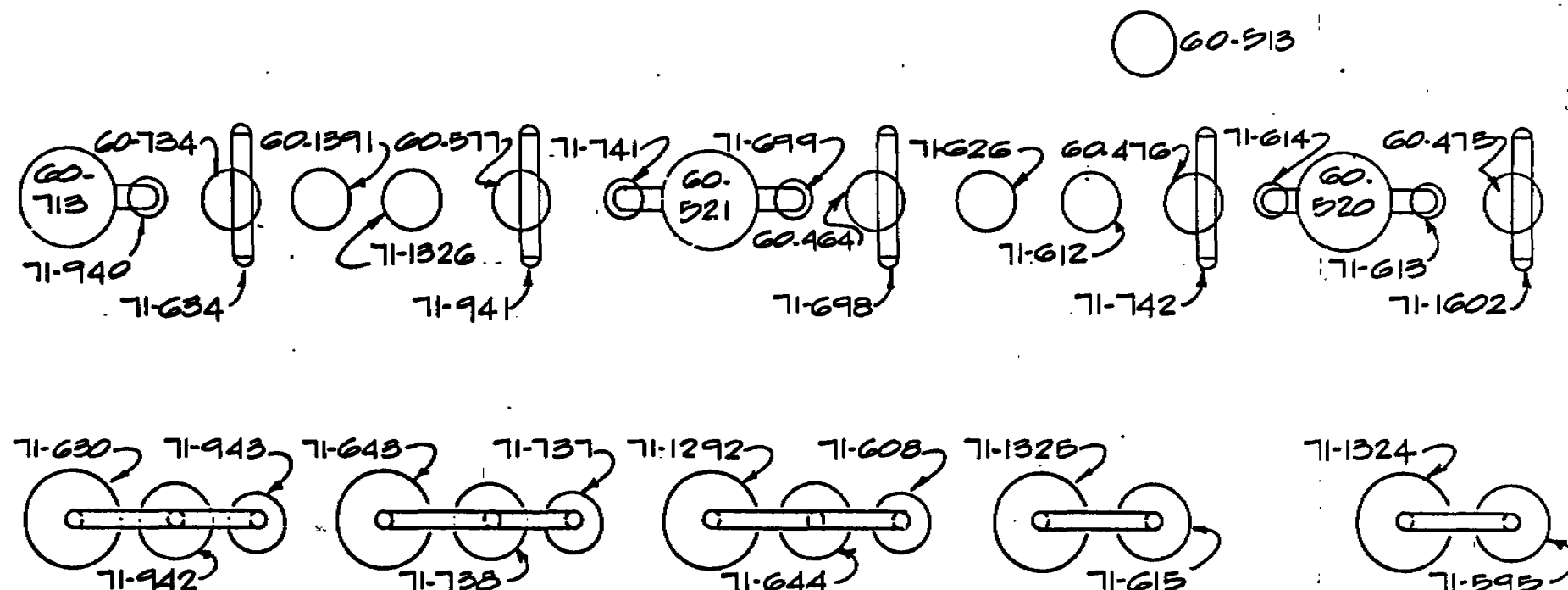
60-1013 - #1 D.H. STILL REFLUX DRUM
 60-1147 - #2 " " "
 60-1417 - D.H. PHASE SEP.
 67-9 - #1 D.H. STILL
 67-80 - #2 " "
 67-84 - D.H. VENT SCRUBBER KNOCK-OUT POT
 71-975 - #1 D.H. STILL REBOILER
 71-1355 - #2 " "
 71-2096 - HCL PRIMARY COND.
 71-2097 - HCL ABS. SEC. COND.

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PER/TRI

4TH FLOOR (TOP LEVEL)



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60-464 - #3 RX DANTHERM VENT COND. REC.
60-475 - #1 " " " "
60-476 - #2 " " " "
60-513 - BRINE HEAD TANK
60-520 - #1 STEAM DRUM
60-521 - #2 " "
60-577 - #4 RX DANTHERM VENT COND. REC.
60-731 - #3 STEAM DRUM
60-734 - #5 RX DANTHERM VENT COND. REC.
60-1391 - ABS. COND. ENT. SEP.
71-595 - #1 RX SEC. COND.
71-608 - #3 " "
71-612 - D.H. STILL SEC. VENT COND.
71-613 - #1 RX DANTHERM COND.
71-614 - #2 " "
71-615 - #2 RX. SECONDARY COND.
71-626 - #1 STILL PRIMARY "
71-730 - #5 RX PRIMARY COND. #1

71-634 - #5 RX DANTHERM VENT COND
71-643 - #4 RX PRIMARY COND. #1
71-644 - #3 " " " #2
71-698 - #3 RX DANTHERM VENT COND.
71-699 - #3 " " COND.
71-737 - #4 " SECONDARY "
71-738 - #4 RX PRIMARY COND. #2
71-741 - #4 " DANTHERM COND.
71-742 - #2 " " VENT COND.
71-940 - #5 RX " " COND.
71-941 - #4 " " VENT COND.
71-942 - #5 " PRIMARY COND. #2
71-943 - #5 " SECONDARY " "
71-1292 - #3 " PRIMARY " #1
71-1324 - #1 " " " "
71-1325 - #2 " " " "
71-1326 - #2 D.H. STILL PRIMARY COND.
71-1602 - #1 RX DANTHERM VENT COND

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<u>Sac No.</u> <u>60-</u>	<u>Service</u>	<u>Normal</u> <u>Max. Cap.</u>	<u>Dia.</u>	<u>Side</u> <u>Height</u>	<u>Roof Type</u>	<u>Bottoms</u> <u>Type</u>	<u>Gallons</u> <u>Ft.</u>
427	Per Shipping Tank	24,500	12'	30'	Umbrella	Flat	840.10
523, 823, 1142	Per Dock Tanks Nos. 1, 2, 3	430,000	48'	32'	Umbrella	6" Crown	13,506.13
1137, 1138	Per Stab. Tanks Nos. 1, 2	65,000	20'	30'	Umbrella	Flat	2,345.18
1139, 1140, 1216	Tri Stab. Tanks Nos. 1, 2, 3	65,000	20'	30'	Umbrella	Flat	2,345.18
649, 650, 652	Tri H.P. Stab. Tanks, Nos. 1, 2, 3	13,500	12'	17'6"	Umbrella	Flat	840.10
428	Tri Shipping Tank	24,500	12'	30'	Umbrella	Flat	840.10
522, 824, 1141	Tri Dock Tanks Nos. 1, 2, 3	430,000	48'	32'	Umbrella	Flat	13,506.13
1143	TCE Storage Tank	102,060	24'	30'	Umbrella	Flat	3,372.13
528	NH ₃ Storage Tank	13,000	9'	33'2"	Dished/ 700 gal.	Dished/ 700 gal.	471.46
505	BLM Storage Tank	6,000	9'	13'	Umbrella	Flat	471.46
647	EPN Storage Tank	4,100	9'	9'	Umbrella	Flat	471.46
506	NPL Storage Tank	6,000	9'	13'	Umbrella	Flat	471.46
486	Dowtherm Storage Tank	8,700	10'	13'	Horizontal	Dished Heads	-
488	Condensate Storage Tank	10,500	10'	18'	Horizontal	Dished Heads	-

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PER-TRI AREA TANKAGE

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<u>Sac No.</u> 60-	<u>Service</u>	<u>Normal</u> <u>Max. Cap.</u>	<u>Dia.</u>	<u>Side</u> <u>Height</u>	<u>Roof Type</u>	<u>Bottoms</u> <u>Type</u>	<u>Gallons</u> <u>Ft.</u>
477	Recycle Tank	20,000	12'	24'	Umbrella	Flat	840.10
1424, 1425	DH Feed Tanks Nos. 1, 2	7,500	8'	Horiz.	Dished Heads	-	-
	DH Feed Tank No. 3	12,100	12'	15'	Dished Heads	Flat	840.10
468, 472	Still Line Feed Tanks Nos. 1, 2	20,000	12'	24'	Umbrella	Flat	840.10
490, 491, 492, 493, 494, 495, 496, 499, 500, 651	ASLFT No. 1 - No. 10	13,500	12'	17'6"	Umbrella	Flat	840.10
497	Wash Tank	13,500	12'	17'6"	Umbrella	Flat	840.10
859	P/T Feed Tank No. 1 at OHC	39,660	15'	30'	Umbrella	Flat	1,314.49
503	Heavies Still Feed Tank	20,000	12'	24'	Umbrella	Flat	840.10
586	Bottoms Plant Feed Tank No. 1	20,000	12'	24'	Umbrella	Flat	840.10
630	Bottoms Plant Feed Tank No. 2	11,250	12'	14'	Umbrella	Flat	840.10
483, 484, 498, 501	Per Deg. Stab. Tank Nos. 1, 2, 3, 4	13,500	12'	17'6"	Umbrella	Flat	840.10

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