III. OPERATING PROCEDURES

A. Reactor Evacuation

General Information

Evacuation of the reactor is required prior to charging in order to remove as much of the air (inerts) as possible. Air is introduced into the reactor during previous phases of the reactor batch cycle since dump, rinse, and chem wash require that the reactor be vented to the atmosphere.

Proper reactor evacuation is extremely important. Some of the problems that can occur if too much air is left in the reactor prior to charge include:

1. A buildup of excess pressure in the reactor during charge.
2. An explosive mixture can be created when VCM is put into the reactor that already contains ~~oxygen from the air.~~ air (oxygen). Any spark source, such as static, could then create a catastrophic situation.
3. Poor temperature control during polymerization because of inerts blanketing the condenser and impairing proper heat transfer.
4. The production of off-grade PVC or a coarse batch.
5. A buildup of excess pressure and/or an explosive mixture in the recovery system as the inerts are vented into that system.

III. OPERATING PROCEDURES (Continued)

A. Reactor Evacuation (Continued)

General Information (Continued)

Evacuation is accomplished using one of the two available two-stage steam jet ejector systems. Evacuation is controlled by the lead operator from the control panel. The "A" operator must check on the evacuation jets and valves, if needed, and confirm that the reactor is evacuated to the correct vacuum during evacuation.

Procedure

1. Prior to evacuating, the lead operator should start filling out the Large Reactor Batch Sheet (Figure 2) for the reactor to be evacuated. The following items should be completed:

   Reactor: Write the reactor number on the sheet. The "batch number" may also be recorded which increases by one every time that particular reactor is to be charged (e.g., if reactor ~~743~~ 400 had batch number 522 the last time it was charged, the next time that ~~743~~ 400 is charged if would be batch number 523).

   Type: Write the resin type to be charged (e.g., 5385).

   Date: Write the current date. Note that the period from midnight to 7 A.M. is considered to have the previous day's date because the vinyl department "day" is from 7 A.M. one morning to 7 A.M. the following morning (e.g., at 5:00 A.M. on 2/23/82, the date recorded on the batch sheet should be 2/22/82).

talking about old unit, aren't we?

III. OPERATING PROCEDURES (Continued)

A. Reactor Evacuation (Continued)

Procedure (Continued)

Water Counts: Record the formula amount of water counts to be charged and the charge water temperature.

Methocel, gallons and inches: Record the formula amount of Methocel and inches of Methocel to be charged.

VCM, Counts: Record the formula amount of total VCM to be charged into the reactor.

RVCM, % and Counts: Write the % of the recovered VCM charge tank(s) and counts of RVCM to be charged.

Catalyst, gallons and type: Record the amount and type of catalyst(s) to be used.

NOTE: Several things should be considered before the amount of catalyst to be charged is decided upon. The lead operator has the responsibility of seeing that the reactors are turned around as efficiently as possible and that catalyst loadings are decided upon which will give needed production with minimum downtime. The following should be taken into account:

a. Run time and catalyst loading of the previous batch.

b. Reactor spacing - i.e., if catalyst is increased will the shorter poly time be negated by waiting on recovery?

c. Outside weather conditions and projected conditions during the batch - i.e., will the sun probably be coming up to warm the weather up after the batch is charged?

d. Resin particle size.

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III. OPERATING PROCEDURES (Continued)

A. Reactor Evacuation (Continued)

Procedure (Continued)

NOTE: (Continued)

d. (Continued)

Shorter poly times usually cause slightly finer resin and longer poly times usually cause slightly coarser resin. If the particle size is close to out of specificaiton, a change in catalyst loading may not be advisable.

If the lead operator thinks that a change in catalyst loading should be made, he is responsible for contacting and consulting with the shift supervisor and then making the change if the supervisor approves it.

Run Temp.: Set the temperature setpoint on the reactor temperature controller to the specified temperature for the product to be produced ~~changed~~ in that reactor. Record that temperature on the batch sheet.

Run Pressure: Record the pressure that the reactor should run (according to previous batches).

Typical run temperatures and pressures are as follows:

Product	Run Temp., °F	Run Pressure, psig
5265	150-152	~150
5305	143-145	~135
5385	130-135	~120
5425	123-127	~100
5465	116-120	90-95

It unbelievable that 5385 type is 5°. Each will only have 2-3° spread. to ten

III. OPERATING PROCEDURES (Continued)

A. Reactor Evacuation (Continued)

Procedure (Continued)

2. When the reactor is okay for charge and there are no major problems known on raw materials to be charged, the lead operator will record the time and his initial in the appropriate blank on the large reactor batch sheet. One important consideration is to make sure the reactor is empty by re-checking for flow through the bullseye with the reactor sewer valve open and checking the reactor agitator amps. The lead operator will then record the precharge amps on the large reactor batch sheet. If there is any question about whether the reactor is empty, the lead operator will contact the "A" operator and have him check the bullseye in the field.

3. The lead operator puts the interlock mode selector on "evacuation" for the reactor to be evacuated. The only valves on the reactor that should be able to open in this mode are the condenser valve, the evacuation valve, and the jacket steam valve. All valve lights should be showing either open or closed with no double indications. The lead operator will put any light that does not work on the panel light list or contact the shift supervisor if an "E" work order is required.

4. The lead operator tells the reactor "A" operator via radio that the reactor is ready to put under evacuation and specifies the reactor, product, and catalyst loading to be charged- e.g., "D-300 is ready for evacuation, 5385, five gallons of L-223 catalyst".

III. OPERATING PROCEDURES (Continued)

A. Reactor Evacuation (Continued)

Procedure (Continued)

5. The "A" operator responds and tells the lead which evacuation system (big or little "jet") to use, depending on what he is doing and how long it will take him to get to the top of the reactors.

What does this mean?

Energy conservation is very important for the "A" operator to consider here because steam will be wasted if the big jet is used and the reactor is pulled down to a vacuum several minutes before the "A" operator gets there to check vacuum. Also, note that reactor evacuation and charge takes priority over most other "A" operator jobs. The big evacuation system will pull the reactor to a vacuum in about half the time that the little evacuation system will.

Should not start till ready

If D-700 is being charged, the big evacuation system will automatically be used.

6. The lead operator opens the condenser valve and evacuation valve on the reactor to be evacuated.

7. The lead operator opens the valves on the appropriate evacuation system which has been chosen for that reactor in step (5), as follows:

Little Evacuation System:

a. Open CV-151 which is between the reactor evacuation header and the two primary evacuation jets for the system.

b. Open CV-152 which opens the steam for the two primary evacuation jets and the two secondary evacuation jets in the system (one actuated valve).

III. OPERATING PROCEDURES (Continued)

A. Reactor Evacuation (Continued)

Procedure (Continued)

Big Evacuation System:

a. Open CV-133 which is between the reactor evacuation header and the primary evacuation jet for the system.

b. Open CV-131 which opens a steam valve going into each of the two jets (primary and secondary).

8. When the valves in step 7 are opened, the lead will check on the camera to see that the jets came on.

9. The lead operator will open the emergency cooling water valve which supplies cooling water to the reactor condenser.

NOTE: In cold weather, cooling water on the condenser will lower the reactor temperature significantly, causing long heat-up times. Under these conditions, the emergency cooling water should be shut off as soon as the reactor temperature starts falling (this takes about 30 seconds to a minute). However, the emergency cooling must always be turned on initially during evacuation.

10. The lead operator will open the steam to the jacket valve on the reactor being evacuated. This begins heating-up the reactor shell and helps reduce polymerization heat-up time.

11. The lead operator will record the time the evacuation started on the batch sheet.

12. The reactor "A" operator will proceed to the top of the reactors and will check the reactor vacuum on the reactor mercury monometer using the following procedures:

III. OPERATING PROCEDURES (Continued)

A. Reactor Evacuation (Continued)

Procedure (Continued)

a. Check the pressure gauge on the reactor and make sure it is showing a vacuum. If pressure is on the reactor and the valve to the manometer is opened, the mercury in the manometer can be blown out and will have to be refilled.

b. Open the valve at the manometer for the reactor that is being evacuated.

c. Watch the mercury level and when it reaches 28.5 inches of mercury notify the lead operator - e.g., "28.5 on D-300".

d. Close the valve at the manometer once the proper vacuum has been reached.

13. The lead operator checks the vacuum on the reactor from the control room reactor pressure indicator when notified by the "A" operator that a 28.5 inch vacuum has been obtained. If the pressure indicator shows the incorrect pressure, the lead op will have the "A" op recheck the vacuum and notify the shift supervisor if there is a further problem.

14. When a 28.5 inch vacuum has been obtained per both the reactor mercury manometer and the control room reactor pressure indicator, the lead will shut the condenser and evacuation valves on the reactor (this can be done by going to the charge mode on the reactor).

are you sure you want to do this. Does this step also shut off steam to the jets. If it does, can suck air back into rx if steam shuts off quicker than other valves.

III. OPERATING PROCEDURES (Continued)

A. Reactor Evacuation (Continued)

Procedure (Continued)

15. The lead operator must then close the reactor emergency cooling water valve. He will then scan the reactor control panel and make sure all valves show closed except the steam to the jacket valve.
16. The lead operator then closes the evacuation system off that was started in step 7, by closing either CV-133 and CV-131 or CV-151 and CV-152.
17. Evacuation is now complete and the reactor is ready for breaking vacuum.
18. The lead will record the time the evacuation is completed on the batch sheet and record the vacuum attained.

Troubleshooting

1. One problem that commonly occurs is that one or more of the actuated valves will not open. This is evidenced by the jets not coming on or by the pressure on the reactor not falling after the jets are on. If either of these conditions occur, the following procedure will be followed:
   a. The lead operator will have the "A" or check the valves in the field by specifying which valve is the problem (if he can tell from the control panel).
   b. The "A" operator will then check the valve in the field and if it is working improperly will follow the steps given in the "Actuated and Automatic Valves" section (Section Q) of this manual and try to get the valve to open.

III. OPERATING PROCEDURES (Continued)

A. Reactor Evacuation (Continued)

Troubleshooting

2. If all the valves are working and the reactor will not evacuate, check the plant steam pressure. It should run between 140-145 psig. If it is low, there may not be enough pressure to evacuate a reactor. If steam pressure is low, contact the supervisor for priorities on what to use steam for. If the steam pressure is below 125 psig, the lead operator should start cutting back on steam usage immediately because of the possibility of rupturing boiler tubes, and the supervisor should then be contacted and made aware of the situation.

3. If the reactor will not evacuate at all and all the evacuation system valves are open, a valve on the reactor may be open that should not be open. This may include the vent valves, the evacuation valve on another reactor, or the recovery valve on the selected reactor. The lead operator should have the "A" operator check for open valves and if none can be found, contact the supervisor or chief ~~lead~~ operator. The lead op may be able to narrow down the cause of the problem by closing the selected evacuation and condenser valves and having the evacuation header pressure checked in the field. This will tell whether the problem is on the selected reactor or if it is in the evacuation header and jets. Another possibility is that the reactor could be evacuating but the indicator in the control room may have malfunctioned. This can be checked by pressure gauges in the field. the field manometer, not press gages!

III. OPERATING PROCEDURES (Continued)

A. Reactor Evacuation (Continued)

Troubleshooting

4. If the reactor will evacuate partially but not reach a 28.5 inch vacuum, the problem could again be that there are valves open or partially open to the atmosphere on either the selected reactor or another reactor. Another possibility is that water may have been left in the reactor and as a vacuum is pulled, the water will evaporate, filling the reactor vapor space and preventing complete evacuation. This can be checked by redraining the reactor.

Other problem areas to check if the reactor will not evacuate to 28.5 inches of mercury are the catalyst injection valve and the Christmas tree valves on top of the reactor. If these are cracked or left open, a 28.5 inch evacuation may not be attainable.

should be a separate item - if the rx won't pull all the way down, or it is erratic, need to start over by redraining & then going thru the drain checkout procedure again.
Very important item

III. OPERATING PROCEDURES (CONTINUED)

S. Power Failure Procedures

When a power failure occurs, the first consideration is the in-plant personnel and secondly, to secure the plant. When power is lost, the reactor agitators stop and cooling tower water pumps and fans are lost. This makes each reactor in the polymerization mode a potential runaway reactor, where the pressure and temperature may rise significantly and uncontrollably. The panel operator will get alarms on all the reactor agitator amp alarm annunciators. Most power failures are of short duration (just a few seconds to a minute) but occasionally an extended power outage will occur. All shift personnel must know what action to take in either ~~other~~ situations. These procedures will be outlined in this section along with steps to take once power is regained.

During a power failure the instrument air compressors are also lost which supply air to the control valves in the reactor unit. A rented liquid nitrogen storage and supply system is tied into the vinyl air system to provide instrument air to the reactor areas during a power failure. It will supply 500 SCFM of nitrogen at 100 psig, allowing instrument operation for one hour to the reactor areas.

Emergency cooling water can be supplied to each reactor area from the plant firewater system during a power failure. The emergency cooling water system is designed to supply 2000 gpm (gallons per

III. OPERATING PROCEDURES (CONTINUED)

S. Power Failure Procedures (Continued)

minute) of firewater to the condensers in each reactor unit. The lead operator must put the system into operation as needed and select which reactor will utilize the cooling water. Full cooling on the condenser should be used to supplement Emergency AMS killing. The full cooling provides maximum refluxing (vaporizing and condensing) in the reactor vapor space and more effectively kills the reaction. The emergency cooling water will fill and overflow the cooling tower sumps because there is no cooling water blowdown when the pumps are off.

1. When power is lost, the lead operator will acknowledge the reactor amp alarms and check which reactors are in the polymerization mode. Reactors in pressure drop that have not yet been killed will not usually overpressure, but the pressure should be monitored to make sure. Reactors which have been in polymerization the longest but have not pressure dropped will usually need to be killed first if the power outage is prolonged.

2. If the power has not come on within 15-20 seconds, the lead operators must take the following steps:

   a. The old unit lead operator will open the sphere deluge valve on the old unit charge panel. This will drop the process water pressure enough to bring on the firewater diesel operated pumps. When you hear the pumps come on, close the deluge valve.

III. OPERATING PROCEDURES (CONTINUED)

S. Power Failure Procedures (Continued)

b. Emergency instrument air will be turned on by the new unit lead operator using the nitrogen supply switch on the new unit recovery panel.

c. The new unit panel operator will also actuate the following valves which have switches located on the new unit recovery panel:

(1) OPEN the cooling water supply to D-300/D-400

(2) OPEN the old unit cooling water supply valve

(3) OPEN the new unit cooling water supply valve

(4) CLOSE the new unit recovery cooling water supply valve.

d. The old unit panel operator, meanwhile, will turn on the toggle switch in the supply room for the emergency lighting generator, and will place the battery pack operation in emergency by throwing the switch into the emergency position.

e. Both panel operators should obtain a portable radio. The base station will be off due to the power failure.

3. The panel operators will continue to monitor reactor pressures and temperatures. The cooling water controllers will still be operational and will divide the 2000 gpm according to which valves are open. 2000 gpm is enough water for any one reactor to have full cooling (10 roots of flow). The cooling water valves for any reactor not in polymerization should be placed

III. OPERATING PROCEDURES (CONTINUED)

S. Power Failure Procedures (Continued)

in the manual mode and be manually closed by the lead operator.

4. Depending upon how many reactors are in polymerization, the lead should start killing reactors with the Emergency AMS system. Reactor swirling will be maintained for about four minutes after a power failure and AMS injection during this period is much more effective. It takes about 30 seconds to put the entire Emergency AMS kill pot into a reactor. If the power failure lasts over two minutes, AMS should be added per the procedures given in the Emergency AMS Kill Procedure of the polymerization section in this manual (Section C). Full emergency cooling water to the reactor to be killed should be turned on while killing with AMS.

5. The reactor temperatures and pressures will continue to be monitored throughout the power failure. If the pressure on any of the reactors starts to runaway, AMS will continue to be added or other steps taken per the procedures outlined in the Emergency AMS Kill Procedure of the polymerization section of this manual (Section C), including use of NO_3 or equalizing "live" reactors with reactors that are killed.

6. In a prolonged power failure, switches for major equipment should be put in the off position if the equipment was running when power was lost. An example is the recovery compressors. This will minimize a power surge when power is regained.

III. OPERATING PROCEDURES (CONTINUED)

S. POWER FAILURE PROCEDURES (Continued)

Not all steps

7. If all the reactors are killed and power is still not regained, close the emergency cooling water supply valves and nitrogen supply valve opened in 2b and 2c (above). The new unit recovery cooling water supply valve must be re-opened.

NOTE: During extended power outages, the "A" operator should make sure the catalyst freezer is closed and ~~stray~~ stays closed to keep the catalyst cold as long as possible. Use of dry ice in the catalyst freezers may also become necessary.

8. When power is restored, it is important to start up large pieces of equipment individually. The amperage should be allowed to drop to normal before starting the next piece of equipment. The following must be done for the rector units:

a. The lead operator will start the reactor agitators, beginning with the one the longest in polymerization that has not pressure dropped or been killed.

b. The reactor "A" operator will check the HPSW and MSPW pumps to make sure they are on and are operating, and check the agitator seal flush sytems. Notify the lead operator of any abnormalities and correct the situation ~~as soon as possible.~~ immediately. Reactor seal flush water is required to run the agitators.

III. OPERATING PROCEDURES (CONTINUED)

S. Power Failure Procedures (Continued)

c. The chief operator and shift supervisor will reset the cooling tower ~~tanks~~ fans and pumps. The lead operator will work with them to make sure flow is re-established to the reactors.

d. The new unit panel operator will operate the following valve switches, if needed;

(1) CLOSE the cooling water supply valve to D-300/D-400

(2) CLOSE the old unit cooling water supply valve

(3) CLOSE the new unit cooling water supply valve

(4) CLOSE the nitrogen supply valve for the emergency instrument air system

(5) OPEN the new unit recovery cooling water supply valve

e. The old unit panel operator will turn off the emergency lighting generator and will reset the battery pack power supply by taking the switch out of the emergency position.

f. After steam pressure is regained, the recovery steam valve for each reactor that contains resin should be opened momentarily then closed. This will help resin agitation if the slurry settled out, and will also blow any slurry out of the steam lines that may have leaked through a valve.