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“How To Handle a Lean Collecting Main”

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## HOW TO HANDLE A LEAN COLLECTING MAIN

When the battery has not pushed in a long time (approximately 8+ hours) the collecting main will go lean; that means the gas which is generated is mostly hydrogen, and very little gas is generated.

It is imperative that the back pressure on Acme's batteries remain above 6.5 inches of water. This back pressure is a function of the height of the top of the collecting main over the floor of the oven; it is simply a function of the head pressure in the gas being sufficient to prevent air being drawn into the ovens at the end of the coking cycle. An approximation of the minimum pressure is given by the equation:

$$\text{Minimum Back Pressure (mm H}_2\text{O)} = 0.35 \text{ Height (feet).}$$

The proper amount of minimum back pressure must be determined experimentally by drilling a hole in the bottom of the door furthest away from the crossover.

Anything less than this minimum back pressure will draw air into the ovens. This will cause the refractory in the jams to burn out, thus shortening the life of the ovens. In the event the main is lean, the low back pressure will create an explosive condition which could manifest itself dramatically.

Collecting main explosions usually relieve themselves through the lids of the ovens still on the main, through the spooning holes, or through opened standpipe caps. They can and have caused damage to oven brickwork, butterfly control valves, the gas main, and people.

Coke Oven gas can explode when it is between 5.0% and 28.4% of a gas mixture with air. The explosive limits of Methane are between 4.8 and 14.0% of a mixture with air. The explosive limits of Hydrogen are between 4.1 and 74.0% of a mixture with air. The composition of Coke Oven gas changes with the time in the coking cycle, until it finally becomes a mixture of Hydrogen and Carbon Monoxide.

The following table gives the amount of hydrogen and methane in the Coke oven gas that is being generated at a particular point in the coking cycle:

| Hours | %CH <sub>4</sub> | %H <sub>2</sub> |
|-------|------------------|-----------------|
| 2     | 42               | 38              |
| 4     | 40               | 41              |
| 6     | 38               | 43              |
| 8     | 37               | 45              |
| 10    | 34               | 50              |
| 12    | 28               | 56              |
| 14    | 15               | 67              |



These test results show that the methane is driven off earlier in the coking cycle and that at the end of the coking cycle, the gas being generated is virtually all hydrogen. A mixture of 74% Hydrogen and 26% Air can explode.

Long periods of time without charging will occur, the question becomes how to survive these periods without damaging the plant or one's self.

#### LEAN MAIN STRATEGIES

The following list is a description of the strategies one may use with a lean collector main to safely preserve the plant.

1. Lower exhauster suction.
2. Lower the throttle valve at the end of the crossover.
3. Reduce the amount of flushing liquor to the collecting main.
4. Turn on the recycle coke oven gas.
5. Turn steam on the sides of the collector main.
6. Reduce the size of the collecting main by dampering off ovens.

#### 1. LOWER EXHAUSTER SUCTION

Have the By-Products reduce the Exhauster suction as the time of the delay continues to increase. Ideally, two holes should be showing on the Askania Butterfly quadrant; practically, anything that produces the proper back pressure is okay.

In order to get the Steam Exhauster below 8 cm. of suction, it must be adjusted so it will control. There will be more on this at a later date.

The lowest controllable limit that has been attained by the Steam Exhauster is 4 cm. of suction before the Primary Coolers.

#### 2. LOWER THE THROTTLE VALVE

The throttle valve at the end of the crossover can be lowered to increase the pressure drop between the Collecting Main and the Exhauster.

When lowering the throttle valve, check the collecting main to be sure the valve hasn't been lowered to the point it cuts off the flow of flushing liquor to the by-products. The collecting main will fill up with liquor when this happens, and liquor will eventually run in the ovens and destroy them. The quickest place to check this is through one of the spooning holes on the crossover. There are flushing liquor runaround lines around the throttle valve, but they have been unreliable at times.

#### 3. REDUCE FLUSHING LIQUOR TO THE COLLECTING MAIN

Do NOT reduce flushing liquor to the gooseneck sprays. The liquor going to the sprays provides a quenching effect to sparks that may come from the oven and provide a source of ignition to a lean collector main.

Cut off half of the Collecting Main liquor sprays to maintain a main temperature of 180 °F. When the temperature drops to 175



°F, cut off more collecting main sprays so that one in four collecting main sprays are on. A certain amount of flushing liquor is necessary in the collecting main to ensure the flow of tar to the By-Products plant, so if it is desirable to cut off any more sprays, make certain the sprays at the ends of the main are on, and the rest of the sprays are the same the distance from the crossover; it will be necessary to check the main for buildup when this condition is reached.

4. TURN ON RECYCLE COKE OVEN GAS

The recycle coke oven gas comes off the fuel gas main along the East side of the Quench Track by the end of the crossovers. On #1 Battery the valve is underneath the Throttle valve. On #2 Battery, the valve is located under the crossover platform by the steam makeup station.

The other valves are located on the North and South sides of both Collecting Mains.

Do not bleed gas while the recycle gas is on-just straight economics; there are cheaper ways to light up the plant.

If the Fuel Gas main has been purged from the By-Products plant, this option is not available.

5. TURN ON STEAM TO THE SIDES OF THE MAIN

This is a last resort step, to be used when recycle gas is not available to maintain back pressure.

When this option is used, use the flushing liquor on the collecting main to control the main temperature and keep the main from warping; if the pressure is too low, try cutting off liquor sprays.

6. DAMPER OFF OVENS

To cut down on the amount of gas or steam necessary to maintain back pressure, damper off the ovens that are coked out. Just pull the damper down; LEAVE THE STANDPIPE CAP CLOSED-this will maintain pressure in the oven that is dampered off.

When returning to pushing and charging after an extended outage with a lean collector, the ovens will be charged off the main until the gas in the main is sufficiently rich in Btu and is evolving sufficient amounts to allow the ovens to be charged on the main.