

Continual checking of flake and spent meal seals, together with possible liquid seals, on operating equipment is most important. Sight glasses on operating equipment should be of the enclosed high-pressure type to avoid accidental breakage and resultant discharge of solvent or oil. Adequate low-level mechanical ventilation for enclosed buildings is necessary to maintain an atmosphere free of solvent vapors. Class I, Group-D hazardous location electrical controls are required throughout the extraction-processing area and in the general vicinity of activity because of the possible presence of vapor; ordinary hazard type of major electrical controls may be employed when installed distant from and elevated above vapor range on grade or housed in a solvent-free, air-pressurized structure. Direct motor drives are recommended for operating equipment to eliminate static-producing belts. Good positive continuous grounding should be provided for building all processing equipment, transfer lines, conveyors, etc. Reliable condenser water-supply is essential together with an auxiliary gravity supply of sufficient capacity safely to shut down all operating equipment; normally this would call for water volume to supply all condenser requirements for at least a 30-min. interval. Installation of an approved type of constant sampling and registering type of flammable-vapor indicator is recommended at all points from which solvent vapors may be discharged under abnormal operation of the extractor, at auxiliary units, and at pumps subject to leakage on account of normal wear. Provision of visual and audible alarms for indicating loss of condenser water pressure and excess steam to operating equipment are valuable aids for the operating personnel. Complete interlocking of process flow is essential automatically to shut down all flow of materials and processing on the upstream side of any impaired operating unit.

**FIRE PROTECTION** for the Preparation Building and auxiliary structures normally consists of a conventional fixed-temperature automatic sprinkler system.

Protection of the Extraction Building requires a special hydraulically designed open-head sprinkler system together with additional directional spray sprinklers for some processing units, all under control of a deluge valve operating through a rate-of-rise release system. When properly designed and supported from principal structural members, such a system will withstand explosions and provide excellent fire control. Since all sprinklers on an open-head sprinkler system discharge water simultaneously, the problem of water supply is of paramount importance, particularly when volumes in the range of 2,000 to 5,000 G.P.M. may be needed at pressures varying from 50 to 100 lbs. In addition to the water supply for this protective equipment, substantial volumes are also

necessary for hose streams. Where available, fire-protection-system water supplies may be obtained from the city water works system after all factors of the city system are analyzed and necessary tests are conducted at the plant site. Where the city water system has adequate volume but at low pressures, the latter deficiency could be improved by the installation of automatic booster pumps in the city line serving the plant. When the city supply is not available, private supplies are necessary. These would consist of a minimum 100,000-gal. gravity tank on not less than 100-ft. tower together with adequate automatic fire-pump capacity taking suction from ample-size reservoirs. The fire pump and reservoir capacities are determined by the total demand established by the hydraulically calculated system in the Extraction Building with additional allowance for hose streams. Specifically the water supply for solvent-extraction plants is based on an individual review of each property. Adequate drainage is of particular importance for the Extraction Building to dispose of the low-flash solvent and water from the fire protection system. Such drainage must include a properly trapped interceptor sump for separating solvents and oils prior to passage of water to discharge source.

Provision of approved type of hand extinguishers, small hose connections inside of buildings, and standard watchman service at nights and inoperative day periods are needed to supplement the major fixed protection in the property.

Notwithstanding all the protective features incorporated into the solvent-extraction plant, the safe operation of such a unit is still in the hands of the management and operating personnel. Good house-keeping and control of all ignition sources require constant attention. Repairs and alterations require purging and inerting prior to any cutting or welding operations. Emergency conditions require a well-trained operating force to bring the processes to a safe stand-still condition. Extreme care is required on start-up or shut-down of extraction units.

Attention is again directed to the continuous conveyor connections between the Extraction Building and other structures even though building separations are provided by explosion-resisting fire walls or some intervening space. These connections provide a direct path for vapor travel from the extraction units to the other areas. It is imperative that positive, solid meal seals be established in these conveyor connections together with the provision of means for detecting possible vapor passage.

The general good over-all fire and explosion experience in solvent-extraction plants is an indication of the present high caliber operating and management supervision. This must continue to maintain a safe operation of these plants.

## Safety as We Look at It

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**T**HE HUMAN SIDE OF SAFETY is something that we call "safety consciousness" and is considered equal to if not more important than technical safety. The work done by the A.O.C.S. and the N.S.P.A. in conjunction with the committee on flam-

mable-liquid plants is very commendable. Solvent extraction of vegetable oils is a new industry in this country, and it is a rapidly expanding one. Safety pioneering is badly needed, and the tentative standards for solvent-extraction plants represents a sizeable

step in the right direction. The industry is having its growing pains, and there is a great deal more to be learned.

We operate a Blaw-Knox Rotocel extraction plant at Mankato, Minn., and a DeLaval refinery combined with a Blaw-Knox deodorizer. Our plant is devoted totally to soybean and soybean oil processing. Actually we have grown quite a little in the last 10 years along with the Minnesota soybean crop. This is our third extraction plant. In 1948 we were crushing 40 tons of soybeans a day in expellers. Our first solvent plant was a V. D. Anderson 150-ton unit. We replaced this in 1952 with a 500-ton Rotocel and installed our present 1,200-ton Rotocel in 1955. We are presently processing about 1,400 tons of beans per day.

Our continual expansion and construction program complicates safety and makes it all the more necessary for personnel to be on their toes. We try to bring safety into the picture to the fullest extent when we install new equipment. We take into consideration the latest safety practices and devices and put them into effect. This is done after consulting with engineers, our insurance company, and our technical staff. Once the installation is completed, the operational phase of safety takes over, and this is where the human factors present themselves. On the drawing board it is possible to set up a machine under the safest of conditions. However this does not mean that the operator will not create unsafe conditions by poor operation or by allowing safety devices to become inoperative. In order to prevent this from happening we do our best to instill safety consciousness in the minds of our personnel. Those of you who operate plants probably know that this is easier said than done.

We have set up the following procedure, which amounts to a continual educational process. From supervision we have nominated a permanent safety chairman, who is directly in charge of the safety program. Each month he designates a safety committee comprised of a plant foreman and four men from different departments. This committee rotates monthly so that everyone has an opportunity to serve. Once a month the committee makes a complete inspection of the plant and notes all safety infractions, unsafe conditions, and unsafe practices. Shortly after that the committee meets with management to discuss safety, and by that I mean safety alone. We try not to let production matters come into the meeting. Each man's suggestions are discussed in an open-minded fashion whether management finds his ideas acceptable or not. This is an important point because if you reject a man's ideas without thoroughly hearing him out, he soon loses interest in the program. If a man's suggestion is good and is accepted, we make it a policy to put it into practice as soon as possible. On the other hand, if we decide not to use a man's suggestion, there is a valid reason for it and he is given a thorough explanation. On the average, the suggestions of the safety committee have been sound and serious. The results have been gratifying. Suggestions have been numerous, and the interest of personnel has been good.

We also use the safety meetings to discuss any accidents that may have occurred during the month, review what has happened, and decide what steps should be taken to prevent another occurrence.

Aside from the ideas that we learn in these meetings, the important point is that they stimulate

"safety consciousness" and keep our personnel thinking "safety," which we all agree is one of the most important phases of operating a safe plant.

NOW SOME PEOPLE might feel that plant tours which always cost over-time are superfluous inasmuch as plant personnel and supervisors should be on the lookout for hazards at all times. This is theoretically true; however many times because of the stresses of day-to-day production, safety problems are side-tracked to a later day. In order to minimize this we have given safety a place of its own and felt it well worth the money to have our employees devote a certain amount of time each month to safety alone.

Safe maintenance and operating procedures require continual propagandizing. Everyone involved with machinery in a hexane or a nonhexane area must be conscious of the hazards. Accidents can happen to both the solvent-plant operator and to the man unloading grain doors in a box car. There is no job in a plant like ours that could be classified as completely safety-free.

Housekeeping is another major safety factor. The safety committee is instructed to inspect housekeeping and note infractions. Dust constitutes a serious hazard as well as materials and tools left in the wrong places. Machinery should be kept as dust-free as possible, and wherever necessary we install dust-collection equipment and keep it in top operating condition. Spillage points have to be continually checked in an expanding operation such as ours and eliminated as soon as possible. When they do occur because of an equipment breakdown, they have to be immediately cleaned up.

We found that it helps a great deal to keep the plant well painted in bright colors. This gives the operator pride in his working areas and makes it easier for him to fulfill the dull task of housekeeping. In our solvent area hexane hazards are kept at a minimum. We are constantly on the lookout for hexane leaks, and they are corrected. We believe it well worth the money to have more than adequate condensing capacity to keep vapor equipment operating at zero pressure or in a slight vacuum.

In the case of solvent-plant breakdowns, personnel must be especially instructed on maintenance procedures in a hazardous area. Most safety practices are plain common sense, but they involve knowing and understanding the hazards. To achieve this end is a selling job, and management has to sell safety all the time. Our system is far from perfect, and I know we are not dealing in a perfect science. What we are trying to do, by our safety meetings and our safety inspections, is to instill safety consciousness in the minds of our men so that they are constantly on the lookout for potential danger spots and know how to deal with them when they occur. Of course it cannot stop with this alone. We have to put the latest safety procedures and techniques into practice and keep the plant easy to clean and well painted. This all costs money, but it is worth every penny of it.

In the intense competitive strife of day-to-day business it is too easy to set safety aside for a later day. Plant personnel are under continual pressure to achieve maximum production. We believe that management has to take positive action to keep safety a high priority item.