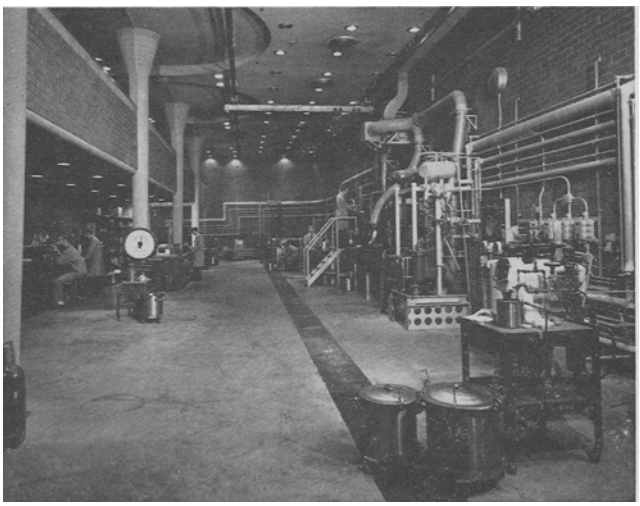

FIG. 3. Above is shown the experimental engineering laboratory at S. C. Johnson and Son Inc.

of an automatic sprinkler system, carbon dioxide fire extinguishers (in some areas these are backed up by powder fire extinguishers), a safety shower, fire blanket, gas mask, rubber and asbestos gloves, goggles, and face shields. The fume hoods have individual exhaust-fans expelling fumes into a center duct, where they are exhausted at the top of the tower by a large exhaust fan. If there is a flash fire or accident in the hood, main valves for turning off steam or gas and an electric switch are located in in front of the hood. As mentioned before, safety shields can be mounted in the front of the hoods. Each floor has a fire-alarm box. When an alarm is turned in, the call immediately goes to the City Fire Department and at the same time an auto-call signal tells everyone in the laboratory and plant the location of the fire.

In the event of a fire the evacuation of the tower could be a problem. Therefore we have a fire brigade, which is divided into two groups. One group, consisting of a man from each pair of floors, has the job of checking the floor to be sure everyone is out of the area. In evacuating the tower, everyone uses the stair-well as the elevator has a capacity of eight people and may not be a safe means of exit. The man on the top floor checks with the men from each pair of floors below, and, if there is no one in the stair-well to report a floor all clear, it is his job to check that floor and make sure it is clear. Upon reaching the ground level, he reports the extent of the fire, whether anyone is injured and how many men are at the scene fighting the fire or aiding any injured person. In surprise practice drills the tower has been evacuated in three to three and one-half minutes.

The second group reports to the scene of an accident or fire with additional fire extinguishers, gas masks, and self-contained, breathing apparatus to help extinguish a fire or render aid if it is needed. If there is any doubt as to their ability to control the fire, they are instructed to leave the building.

The pilot plant is located in the basement adjacent to the tower. It is laid out with a laboratory bench along one wall where new processes can be checked on a laboratory scale before running the larger-size batch. Along the other wall equipment and services are available for running larger-scale batches. In addition to the services, flexible fume ducts are available. The pilot plant is protected by a sprinkler system as well as an automatic carbon dioxide system (Figure 3).

The desk area of the engineers is located on the mezzanine overlooking the working area. Safety glass protects this area from accidents which may occur below.

The chemical and solvent storage-rooms and high-pressure laboratory are located in the basement surrounding the tower and are protected by sprinkler and automatic carbon dioxide systems.

In closing I would like to leave this thought with you. When it comes to safety, "Thou shalt be thy brother's keeper."

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Solvent-Extraction-Plant Operating Safety

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OPERATING an extraction plant safely is much the same experience as driving an automobile in heavy traffic. It is not a severely hazardous thing to handle as long as you are aware of the law, know its mechanical potentials, and are constantly alert in its operation. No one can afford to go to sleep at the wheel.

Like traffic laws, every safety-minded extraction plant has built up a series of rules and regulations according to good basic practice. There are many good printed references that can be used as a guide in establishing these for specific needs. We probably all have some kind of printed rules that are made known and posted to every person concerned or entering the plant areas. These rules usually specify no smoking; the use of non-sparking tools; proper shoes; and general safe-conduct.

Like automobiles, most extraction-plant engineering designs and its equipment are built with full mechanical safety potentials in mind. Various national, local,

and insurance codes and requirements insure that the facilities are built to operate safely. A very fine new national code by the National Fire Protection Association (NFPA) can be used as such a guide. It prescribes the minimum safety standards for new construction as well as operation of existing facilities.

Applying the rules and facilities for safe working conditions is the biggest problem in safety work. In its broad form of usage the word "safety" is meant for protection against personal injuries or accidents as well as against fire and explosions in an extraction plant. Safety starts with a program and an organization to develop the plant rules and safe practices, reviews the mechanical nature of the plant design and equipment, and helps in keeping operators alert to the hazards involved.

The general safety program should include:

1. Prevention against accidents and injuries such as strains, falls, slips, eye injuries, being struck or caught by facilities, allergies, and electrical currents by good layout of facilities, guarding, and maintenance of work areas; proper employee selection, induction, training, and supervision; working with local doctors; interest development and enthusiasm through the use of posters, stunts, publicity, and mass meetings; and review of causes of accidents and application of remedies.
2. Fire and explosion prevention by good engineering according to codes; training in specialized fire fighting techniques (fire brigades); proper maintenance of equipment and lubrication; and coordination with local fire departments.
3. Operating safety by proper checks on the process at regular intervals and counsel on mechanical changes as they affect general safety.

To accomplish this a safety organization is vital. In larger companies this starts with a safety director. At the plant level the manager and superintendent must tie all the safety programs, rules and regulations, facilities, and personnel together with the right perspective to make the plant run safely and at a profit. Some extraction plants have either a safety engineer or a safety committee who make regular periodic inspections and recommendations for safety improvements. They also help promote safety alertness. Company suggestion systems from the operator level also help create interest as well as to correct unsafe practices and equipment. Organized fire brigades and fire drills by departments are a must immediately to combat plant emergencies. Safety of operations is also counselled by regular outside insurance and boiler-inspection experts. The extraction foreman however is the key man in overseeing the whole safety effort. He knows his program, equipment, and men best, and is directly responsible in operator training.

Most extraction plants are in continuous operation and are machine-paced so that the operator spends most of his time maintaining product quality and plant safety. As a portion of over-all safety the following is a review of important "operating-safety" checks being made in an extraction plant and their time intervals.

HOURLY

Water supply, to insure adequate supply and prevent escape of uncondensed solvent vapors to atmosphere; here temperature is the best gauge to safety

Extractor seals, choked feed important to prevent escape of vapors to atmosphere

Final vent, to be sure carbon or refrigeration is minimizing the escape of vapors to the general atmosphere

Waste water tank, to be sure waste water is at least 180°F. and is suitable to leave the plant *via* the separation sump

Building ventilation, to be sure proper drafts are maintained to prevent accumulation of solvent vapors

Leaks, to tighten stuffing boxes to prevent escape of liquid or vapors

Motors and bearings, to prevent over-heating and interlock failures that would upset the flow

Moisture tests, to provide good moisture control and insure that dry material will not become over-heated in cookers or driers

Tramp metal, to insure regular removal from process as a potential source of ignition

Temperatures and pressures, to detect any change that could upset the flow and produce a more hazardous condition

Steam supply, to detect any pressure drop that could upset desolventizing conditions

Sampling, to insure that meal product is solvent-free (odor)

Choke-ups, constantly on watch to prevent flow interruptions.

SHIFTS

Oil flash point, to be sure oil is safe to leave building for storage or loading

Condensate system, to be sure low pressure extraction-building returns are venting to atmosphere

Separation sump, to be sure all plant waste-water is flowing to sewers free of solvent

Housekeeping, a clean plant is a safe plant: elimination of dust, trash, slippery floors, and combustible material from premises.

DAILY

Lubrication, a scheduled program to prevent overheating of all moving parts

Inventories, tank levels checked on all liquids to be sure of normal quantities in building and in process

Bin temperatures, to be sure overheating of stock material is not hazardous

Hexane storage, in winter, above ground tanks are drained to prevent freezing of entrained water and possible bursting

Sniffer, to be sure of operation, cycling, alarm, and detection of vapors at critical points in building and process

Superintendent's inspection, at least once a day to observe general-safety condition.

WEEKLY

Hexane unloading, special precautions observed in safe handling

Safety committee inspection, guards, warning signs, housekeeping, condition of ladders, air masks, hoses, manlifts, flashlights, tools, bin hoists, etc. Conditions reported to superintendent.

MONTHLY

Preventative maintenance shut-down, a primary step to safety

Fire brigade drills, team training, spirit, and enthusiasm

Fire extinguishers, re-charging as is necessary

Shoe inspection, by foreman to insure proper condition

Flame arrestor and vent seal cleaning, to insure proper operation.

SEMI-ANNUAL

Deluge water tests, to insure proper functioning of fire-protective equipment and sensing elements

Boiler inspections, as is necessary for maintenance.

ANNUAL

Yearly overhaul and purge, for major maintenance or to make changes in process; major safety alterations are accomplished at this time

Grounding and bonding checks, of structure and equipment in the extraction building

Personnel medical exams, to insure health protection of operators.

The operations end of safety has been broken down above only to indicate that we must always be alert to keeping things running normally and under control. When choke-ups or other upsetting conditions arise, we then have to rely on the training or experience we have in knowing the rules, the mechanical potentials of the equipment, and general alertness to stay out of hazardous trouble, just like driving a car. If we drive it right, there will be more of us "left."

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