WATER OPERATION AND MAINTENANCE

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UNITED STATES DEPARTMENT OF THE INTERIOR
Water and Power Resources Service

The Water Operation and Maintenance Bulletin is published quarterly for the benefit of those operating water supply systems. Its principal purpose is to serve as a medium of exchanging operation and maintenance information. It is hoped that the reports herein concerning laborsaving devices and less costly equipment and procedures will result in improved efficiency and reduced costs of the systems for those operators adapting these ideas to their needs.

To assure proper recognition of those individuals whose suggestions are published in the bulletins, the suggestion number as well as the person's name is given. All Service offices are reminded to notify their Suggestions Award Committee when a suggestion is adopted.

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Division of Operation
and Maintenance Technical Services
Engineering and Research Center
Denver, Colorado 80225

Cover Photograph

Navajo Dam and Reservoir, Colorado River Storage Project. Navajo Dam is located on the San Juan River approximately 48 km (30 mi) northeast of Farmington, New Mexico. Water is withdrawn from the reservoir to supply the Navajo Indian Irrigation Project for lands on and adjacent to the Navajo Indian Reservation.

On November 6, 1979, the Bureau of Reclamation was renamed the Water and Power Resources Service in the U.S. Department of the Interior.

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WATER OPERATION AND MAINTENANCE
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INTRODUCTION

The article on page 1 describes the use of several design variations of rock gabions in the sandy areas of the Navajo Indian Irrigation Project.

Keeping the heavy, steel stud bolts tight on the main couplings of the Hyatt pump/generator units was quite a chore. Design of adjustable locking plates described in the article on page 6 was the solution to those hard head bumps and bruised fingers.

On page 9 is an article on the successful use of modified World War II land vehicles to break up ice fields before the spring runoff.

Start preventive maintenance with plan review. It's the key for a smooth and efficiently run operation for years to come. See page 12.

Plenty of water is a must when using anhydrous ammonia. See article on page 16.

What's a "red head" to you? The use of the same word for the same meaning, leads to successful communication, as pointed out on page 18.

USE OF ROCK GABIONS IN DRAINS ON THE NAVAJO INDIAN IRRIGATION PROJECT[1]

Drains on a project serve as protection for project features; e.g., canals, roads, and pumping plants, from storm water runoff. In addition, they provide for diversion of wastewater.

There are about 80 to 97 km (50 to 60 mi) of drains completed on the NIIP (Navajo Indian Irrigation Project). More are expected to be constructed as they are required when new blocks come under irrigation. Rock gabions are used in many of the drains.

Three general types of rock gabions are in use on the drains. They are in-line drops, inlet structures, and curve structures. The in-line drops serve as energy dissipating devices and are installed at elevation drops. The inlets prevent erosion of the drain where water is diverted into the drain. Curve structures protect the outer slopes of drains at angles and bends.

Rock gabions were selected for the NIIP because they are generally considered by design engineers to be suited for unstable and shifting earth, typical in sandy areas. This type is common on the project. The theory is that rock baskets within the structure can shift and settle with the ground. In contrast, a solid-type structure like concrete is not flexible and cannot conform to ground deviation.

Figure 1.–Completed gabion drop with gabion control notches.

[1] Provided especially for this publication by Frank Tazawa, Chief, Land Division, Navajo Indian Irrigation Project, Farmington, New Mexico.

Installation initially is costly because wire baskets that are specially hand fabricated are incorporated. This is compounded with the cost of securing and hand placing rocks in the baskets. It is anticipated that maintenance will be relatively low. Theoretically, when settling has occurred and sediment has filled the crevices between the rocks, the structure should be stable.

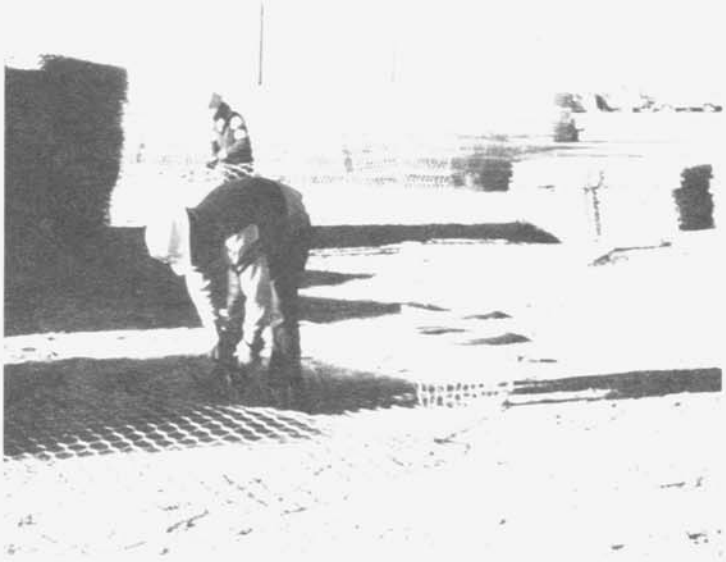


Figure 2.–Fabricating gabions which were then hauled to the construction site.

Figure 3.–Placing preselected and sorted rocks in gabions.

Several design variations for gabion drops have been used on the project to determine the most stable and functional energy dissipating structure.

In the laterals and collector drains in block 1, these drops are designed with a 229-mm or 305-mm (9-in or 12-in) gabion mat on a longitudinal slope of 8:1 with a 458-mm (18-in) deep cutoff under the invert only at each end and underlain with filter cloth. These structures were installed in 1975 and none have failed to date.

Figure 4.–Gabion drops installed in block 1.

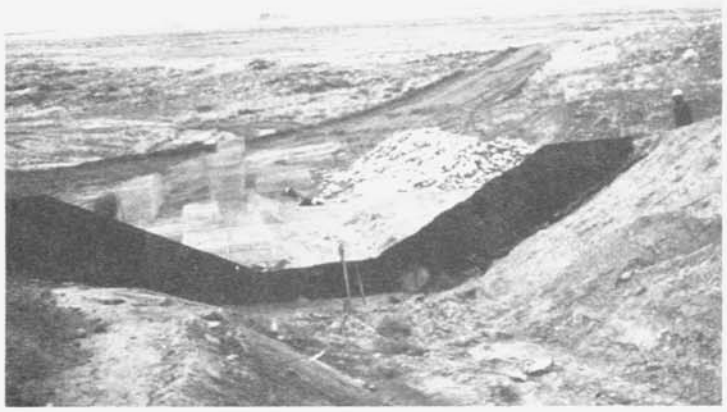
Figure 5.–Gabion riprapped inlet structure on collector drains underlain with filter cloth.

In the Gravity Main Canal and tunnel No. 5, a control notch formed of gabion baskets was added to raise the upstream water surface and prevent erosion of the channel above the drop, and the longitudinal slope was steepened to 4:1. These structures have been in service since 1976 with only minor damage observed to date.

In the collector drains in block 2, these drops have sheet piling at the upstream end of the structure, gabion control notches, and a 5:1 longitudinal slope with gabion baffles. They were installed in the spring of 1980 and have been subjected to storm runoff.

Figure 6.–Gabion drops installed in block 2.

Figure 7.–Gabion drops currently under construction in block 3.



In the collector drains in block 3, these drops are currently under construction and have control notches formed from sheet piles and vertical drop at the piling with 1-m (3-ft) high gabion baskets placed in stairstep fashion on the downstream side.

Performance of all these designs is being monitored by project personnel on a continuing basis.

* * * * *

A NEW WAY TO KEEP STUD BOLTS TIGHT IN HYATT PUMP/GENERATING PLANT[2]

The main couplings for the pump/generator units at Oroville's Hyatt plant consist of a number of heavy, steel stud bolts with large nuts at either end. The stud bolts are several feet long, extending all the way through the coupling. Each nut is 200 mm (8 in) or more across and weighs-out as rather heavy. This stud and nut configuration is also the way the lower generator is coupled together. Only the lower generator studs are smaller in diameter, with correspondingly smaller nuts. Both types of studs have one thing in common. The nuts are secured (to keep them from backing off) by turnup locking plates. It is basically the same locking-plate system used for nuts and bolts on an automobile engine except that the Hyatt locks are somewhat thicker. Even then, they are only made of sheet steel approximately 3-mm (1/8-in) thick. The locking plate has to be thin enough to be bent up against a flat of the nut without too much pounding, and to be bent down again when necessary. The type of plate used originally at Oroville is shown in figure 8. There is a plate for the large stud bolts of the unit coupling and for the smaller studs of the generator. A slot cut in the plate between the two stud holes allowed an edge of the plate to be bent up against the nut.

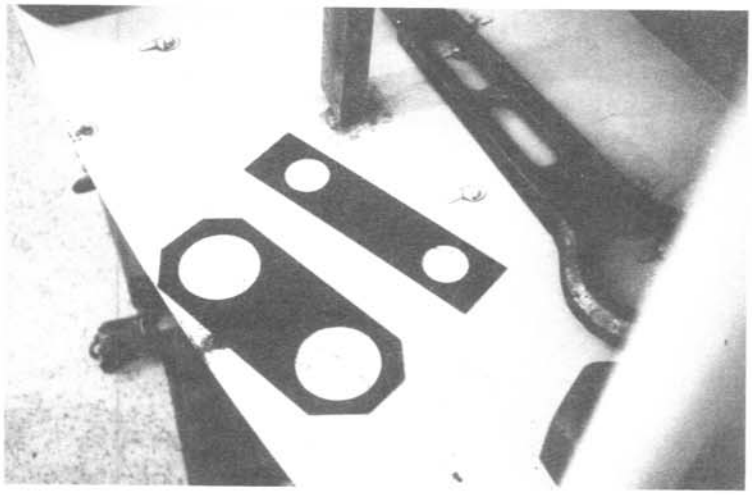


Figure 8.–Locking plates formerly used at Oroville.

The locking system of thin plates and bent-up corners works pretty well on the small nuts in an automobile. It works basically the same for the larger examples at Oroville, but there are some peculiar problems. Sometimes as the nuts are being tightened (particularly on the main coupling studs which torque down to 1588 kg (3500 lbs)), the thin locking plate can distort or tear. If this happens, the nuts have to be backed off and the plate replaced. Then the whole torquing process has to start over again, since the nuts must go down in a

[2] Reprinted with special permission of the Editor of Technical Bulletin No. 46, State of California Department of Water Resources.

prescribed pattern. This process must be gone through if any locking plate is replaced. With a little bad luck, the nut tightening job can run into quite a lot of time. Then there is the exertion and discomfort involved. The physical conditions are not the greatest when working on either of the stud bolts. The maintenance workers end up lying down at full length under the unit with no more than 0.76-m (2-1/2 ft) of head room. They have to use big, heavy wrenches (like the one just visible in figure 8). Even though these wrenches are helped along by pneumatic rams, just handling the heavy things in such restricted quarters is hard work. No one wants to do it any more than is absolutely necessary. There are additional discomforts. The metal of the unit is nearly always hot from use and there is generally dust present from the brake shoes. In addition, the turned-up corners of the locking plates have to be straightened out with a special tool. It resembles a wood splitting wedge fastened by a length of chain to a block of steel; in fact, that is what it is. Getting this wedge into position and then bashing it with the steel block is even more fun when lying down. After a typical session of bumped heads and bruised fingers, Jim Marquez, a mechanic at Hyatt, worked out another means of locking the nuts in place.

To eliminate the problem of the locking plates tearing under pressure, Jim made his new plates out of 12-mm (1/2-in) thick steel. He arranged the plates so that they would fit around two or more stud bolts, just like the old plates had done. But there the similarity ends. The new one used adjustable toggles to fit against the flats of the nuts. The toggle was held securely in place by a 12-mm (1/2-in) bolt and an ordinary lock washer. Since the flat of the nut could stop randomly, there were several tapped holes available to position the toggle.

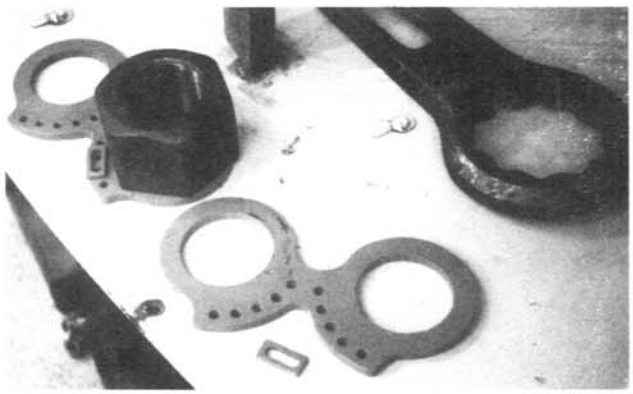


Figure 9.–New locking plates.

With this plate, there is no banging or bending required. If by chance a toggle bolt should strip, the big coupling nut would not have to be touched. A bolt or toggle hole could be changed with no trouble at all. This same advantage is shared by the plate for the smaller studs of the generator. However, there are one or two differences. The generator nut locking plates fit over three studs instead of two. Instead of having tapped holes to secure them, the locking toggles are slotted and move back and forth on small bolts welded to the locking plate.

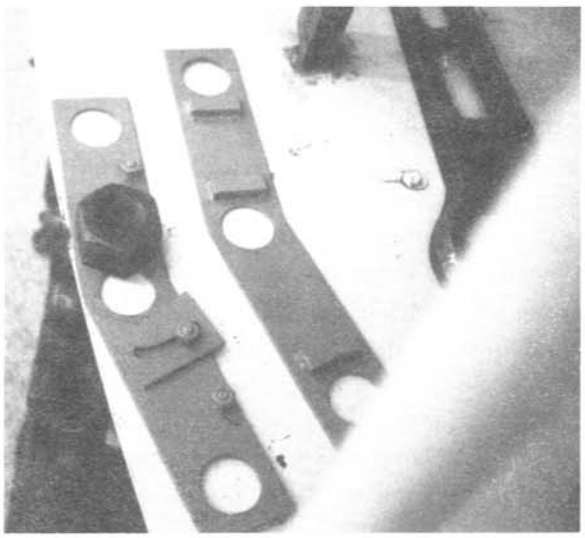


Figure 10.–Locking toggles are slotted and move back and forth.

These three-hole plates produced an added advantage, almost as a bonus. The generator studs pass all the way through and have a nut at each end. Because of this, to keep the bolt from turning, a wrench had to be held on both nuts when they were being tightened. A bent-up lock plate was also required for both ends. Jim decided to eliminate this need for two workers. When he made the three-hole locking plate arrangement, he welded a permanent toggle by each hole on part of the plates. The flat of the nut rests against this lock. All of the nuts on one end can be prepositioned. Then the final tightening can be done from the other end only by one worker. The adjustable locking plate can be used on that end, so that the toggles can be fitted against the randomly placed flats of the nuts. One of the welded toggle plates is shown on the right in figure 10.

Now the job of tightening the nuts on both items of equipment can be done quicker and with less labor expended.

* * * * *

A SOLUTION TO SPRING ICE-JAM FLOODING [3]

John C. Loffredo, P.E.

Each spring, the City of Buffalo is faced with the possibility of ice-jam floods from heavy rains. Cazenovia Creek, located in the southern part of the city is covered with a sheet of ice at that time of year, substantially reducing its discharge capacity. To alleviate this condition, the city employs three World War II landing vehicles (LVT's) to act as small ice breakers. Even small tugboats would require too much draft to operate in very shallow streams.

Many communities which are adjacent to nonnavigable streams are faced with the same problem. Often, the only immediate recourse is to use dynamite on the ice field or, for the long range, look to the Federal Government for relief. In 1963, Buffalo was not successful with either solution, so we developed an ice breaker that could operate in nonnavigable waterways.

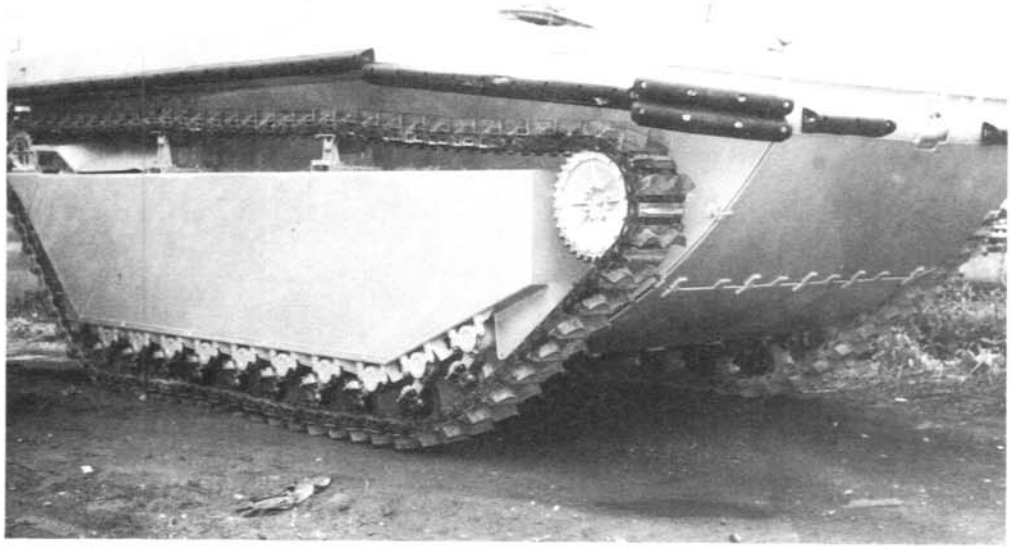


Figure 11.–Side view of modified landing craft. Note perimeter impact bumpers and armor plate.

[3] Reprinted by special permission of the Editor, Public Works, from March 1980 issue. Mr. Loffredo is Acting City Engineer, Buffalo, New York.

The LVT's are track powered and amphibious. They have been extensively modified for ice breaking activities by adding the following: A front end, below waterline, armor plating; perimeter impact rubber bumpers; and a diesel powerplant, heavy duty clutch, and fluid couplings.

These modified vehicles are approximately 8 m long by 3 m wide (27 ft long by 10 ft wide) and weigh 16 330 kg (36 000 lbs). They can operate in 1.5 m (5 ft) of water and can break ice up to 0.6 m (2 ft) thick. By using dynamite in conjunction with our vehicles, we have broken ice up to 1.5 m (5 ft) thick.

Theory

There is quite a difference between open flow channel capacity and "closed conduit" capacity. The former occurs when we have a moving, broken ice field, and the latter occurs when an ice field is solid and stationary. For example, the free-flow capacity of Cazenovia Creek is 311 000 L/s (11 000 cfs). However, the city has experienced flooding with a flow as little as 153 000 L/s (5400 cfs) when there was a large, solid, stationary ice field. There does not have to be a complete ice blockage of the channel cross section in order to have flooding. Under certain conditions, a large stationary ice field will do the job just as well.

Therefore, in order to increase Cazenovia Creek's capacity, Buffalo uses the LVT's to break up the ice field before the heavy spring runoff. In this way, we try to prevent a problem from occurring, rather than reacting to one after it happens.

Figure 12.–LVT's break ice to increase winter flow of Cazenovia Creek and prevent ice jams that might cause extensive flooding in early spring.

Last spring, two LVT's were transported to Port Byron, New York, approximately 209 km (130 mi) east of Buffalo, on flat bed tractor-trailers. This community is adjacent to a nonnavigable stream, Owasco Outlet, and downstream from a dam which was at that time in danger of topping. Under normal conditions, the elevation of the reservoir is controlled by passing water into the Owasco Outlet. However, its capacity was drastically reduced by an ice cover which resulted in rising reservoir water levels. If conditions continued uninterrupted, the dam would be topped with the spring rains causing the flooding of Port Byron.

An emergency was declared by the State of New York and Mayor Griffin of Buffalo was asked to transport the LVT's and operators to Port Byron. The vehicles were successful in breaking up critical sections of the ice field and were instrumental in sufficiently increasing Owasco Outlet's capacity to avert flooding conditions.

Figure 13.–In 1959, the creek developed an ice jam that threatened the residential areas along banks. Experience led to present concern.

Future Development

One major drawback experienced with the LVT's in the Port Byron operation was their lack of power and speed in reverse. Our normal method of operation is to wait for a small streamflow to develop. Then the LVT's break ice from the open water edge of the ice field. This allows the broken pieces of ice to flow downstream, beyond the LVT's area of ice breaking activity. If these conditions do not exist, the LVT's will be surrounded by large pieces of ice, and because of their lack of power in reverse, will become stuck in the ice field. We are looking into the possibility of obtaining a Federal grant to modify the LVT's transmissions which will overcome this problem.

I believe that the LVT operation is a very cost-efficient solution to a not uncommon problem.

* * * * *

PLAN PREVENTIVE MAINTENANCE OF PLANTS AT THE RIGHT TIME [4]

Richard R. Metcalf

Effective preventive maintenance starts with design. You will be hampered in your efforts to start developing a preventive maintenance schedule at the design stage for two reasons. The biggest villain is cost. Your community is concerned only with initial costs; the costs of design and construction. Who gives a thought to the operation and maintenance costs for the next 10, 20, or 30 years ? You will also be faced with reluctance of designers to heed your suggestions. Their reaction is often: What do you know about design? Perhaps you could counter with "What do you know about plant operation and maintenance?" Remember it will become your plant and there is nothing more permanent than a design error cast in concrete and steel.

Start your preventive maintenance with plan review. Go over those plans with a fine-tooth comb and fight for every change you can get that will make your job easier now and in the future. Ask yourself, "How do I change the light bulbs in ceilings over stairwells? How many flush connections do I have on the sludge lines and can I get water and steam to them? Why isn't the roof extended over the loading dock to keep ice and snow from accumulating in winter? Do I need all that grass? Where do I put the snow in the winter?" The time spent on plan review, the discussions and arguments and even the compromises will be worth the effort. Don't shirk the time nor the hassle.

Are you contemplating new equipment and new processes? What do you know about them? It's time to go see them in action somewhere else. Don't depend on the field representative entirely–his job is to sell–that's where the money is and that's where his commissions are. Visit several plants where the equipment and processes are being used on the job you want them to do. Don't limit your visit to a guided tour and the top brass. Sometimes it's amazing how little you can learn from supervised tours. Spend some time alone with the operator and mechanic on the job. They are the ones who will tell you about the problems of operation and repair, how much downtime they have had, and what spare parts are needed.

This is the time to think about operation and maintenance manuals and how they are to be prepared. Shouldn't they really be ready by startup time and in language you and your mechanic can understand? It's not too early to think about your identification system for plant equipment, color coding, and even your equipment card file. All of this should be in the design and preconstruction phase.

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[4] Reprinted with special permission from Editor, Public Works, from September 1980 issue. Mr. Richard R. Metcalf is Training Officer, Department of Drainage and Sanitation, North Syracuse, New York.

On to construction. You, the chief operator, must be on the site at least by the 50-percent construction stage. Why? So for the first time in your life you can get paid for being a sidewalk engineer? Fascinating isn't it? Yes, but there's preventive maintenance to be done. Here's your chance to catch those things that you missed on plan review. Can't that valve be turned around so it doesn't have to be operated in the corner? And that clam shell carrying grit clear across the grit room floor to the truck outside–shouldn't we have some way of draining the drippings and spills back to the grit chamber? Modifications cost money but they're worth it. What will they save you in time, labor, and safety later on?

Isn't is amazing how pipes and valves move around under a few feet of dirt? Do you know exactly where they are? See for yourself! This brings us to the subject of "as builts." Insist that you are furnished with as-built plans for all changes in the original drawings, especially those of underground structures, lines, etc. It's your plant, you are the customer and you are entitled to an accurate set of plans upon completion of the project. Don't trust your memory.

Figure 14.–General view of maintenance foreman's office showing files for service manuals and index file for parts, service history, etc.

As equipment arrives and is put in place, check for proper installation, alinement, and accessibility. Ask questions about safety and the guarding of moving equipment. When equipment arrives, you take possession of operating, maintenance, and service manuals. If they don't arrive with the equipment, start your campaign to get them immediately and when they arrive, guard them with your life. Service manuals have a habit of winding up in the

possession of the contractor or consultant and are often forever lost to the operator or mechanic.

This is the time to record all pertinent data on your equipment cards. You may wish to add comments of parts needs which you obtained on your plant visits at this time. Set up your service cards and schedule. It is much easier to set up a service schedule piecemeal than waiting until everything is installed and operations get underway. Prepare your operations and maintenance checklists for your personnel now.

A big job? It'll be the busiest time in your career. There won't be enough time in the day. But if you do it, you will look back on that time with satisfaction and start your plant with a great deal of confidence.

It's startup time. Hydraulic testing and equipment startup is done under the supervision of the consultant and sometimes the equipment manufacturer. You should be present with your mechanic. This is learning time for both of you. Get all the information you can on proper startup, operation, and shutdown procedures. Make notes and prepare cook book procedures for use by your personnel in the future.

Make that manufacturer's representative earn his money. Check your equipment cards to make certain you can identify the equipment and parts for future reference and ordering. Determine what lubricants you should use and what, if any, are the alternates. Ask about proper servicing procedures and the recommended frequency of servicing. Inquire about wear parts, inventory needs and availability and delivery times.

In closing out the construction phase, make every effort to resolve problems before accepting the plant equipment. Remember, like your car, equipment warranties run out all too soon.

If you have made it this far, you have an efficient and workable preventive maintenance system which just needs a little refining. You have equipment cards identifying each piece of equipment, a service schedule for maintenance, servicing and lubrication, a service card system to record service and repair, parts used including frequency and cost, labor time, cost, and downtime. The equipment and service cards will enable you to have an intimate knowledge of each piece of equipment for future reference and startup, operation, and shutdown procedures for easier operation.

The service schedules and inspection checklists will enable you to detect problems and make adjustments that will minimize major repairs and downtime. Undoubtedly you will miss a few things which you will catch as you go along. Have you a schedule for filing and testing the batteries in your plant? This is one of our most neglected routine maintenance jobs.

Two areas of routine daily maintenance deserve our constant attention; i.e., records and inventory. Records are essential–without them there can be no effective preventive maintenance.

Parts and equipment inventories must be well organized and retrievable. Let's face it, you have to know what you need, how often you need it, if you have it, and where it is. It is usually best to have one man, hopefully with a competent substitute, in charge of records and inventory. Inventories should be stored in areas free of dirt, moisture, and corrosive materials.

Effective preventive maintenance requires planning, scheduling, inspecting, adjusting, repairing, ordering, recording, and work. Timing just makes it easier.

* * * * *

ANHYDROUS ACCIDENT CAN CAUSE BLINDNESS, BURNS [5]

Like gasoline, propane, insecticides, and many other products used on farms, anhydrous ammonia must be handled with care to prevent serious injury.

Anhydrous ammonia can cause painful skin burns by freezing, caustic action, and dehydration. While these skin burns can be serious, eye exposure can be even more critical because it can result in blindness.

Most accidents happen when ammonia is being moved from one tank to another. A major cause of accidents is the accidental opening of hose-end valves and quick-couplers. Defective hoses also allow ammonia to escape without warning.

Because of these reasons, during the transfer of anhydrous ammonia from one tank to another, the connecting and disconnecting of nurse tanks from the applicator, and any maintenance of applicators or tank, always wear rubber gloves and chemical goggles and/or face shield to prevent injury to the hands and eyes.

If you receive a blast of anhydrous ammonia, liquid or vapor, remember that flushing with water for at least 15 minutes is the only first aid. Then get professional help.

A plentiful water supply must always be available when handling anhydrous ammonia.

A small pocket squeeze bottle container, containing at least 0.12 L (4 oz) of water, should be carried on your person, preferably in your shirt or jacket pocket. In addition to the small personal water supply, carry at least 19 L (5 gal) of water on the nurse tank or tractor. Water from the small squeeze bottle should be used to flush excess ammonia out of the eyes in the first few seconds so that you can find and use the large water supply.

Eyes doused with ammonia will close involuntarily. They must be forced open so that the water can flush the entire eye surface and inner lining of the eyelids.

If you are wearing contact lenses while working with ammonia, remove them immediately before you begin the flushing process.

Do not apply salves, ointments, or oils to ammonia burns for at least 24 hours. Applying such medications can result in a more severe burn. Let a doctor decide on the medical treatment to use.

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[5] Reprinted with special permission from the Editor, Nebraska Farmer, from March 15, 1980 issue.

The safe use of anhydrous ammonia depends on the individual. Remember these safety rules:

1. Know your equipment and keep it in good condition.

2. Train your employees in anhydrous ammonia safety.

3. Wear rubber gloves and goggles and/or face shield.

4. Carry plenty of water–small squeeze bottle plus at least 19 L (5 gal) on nurse tank or tractor–and immediately flush body area exposed to anhydrous ammonia liquid or vapor for at least 15 minutes. Then seek medical attention.

* * * * *

HOW WELL DO YOU COMMUNICATE?[6]

Harry Hatcher

Communication is the most vital aspect of safety training, as training is almost the magic ingredient in any accident prevention program.

How many accidents in your area can be traced to poor communications?

Successful communication occurs when the listener and the speaker or writer use the same words for the same meanings. "A red head" means one thing to the drugstore cowboy and something different to the maintenance man who knows it as an expansion bolt.

We have to be sure we are understood, and the burden is on the speaker or writer, more than on the listener.

A person's mind is a private domain, and you'll be admitted only when you present an understandable, interesting idea.

Even then, that person has a lot of other things to think about and does not have the time or perhaps the ability to interpret what you might mean–but will accept what that mind thinks you mean. And that may be a lot different than what you really had in mind.

Education deals primarily with broadening knowledge and understanding, and training deals primarily with the development of skill in performance. It is this latter training that you are most concerned with and in which you must be good at being understood–else your employees will not be able to properly do the job–and will likely have accidents.

But while you are concentrating on training, don't forget you are also educating–broadening knowledge and understanding while you are teaching skills on the job.

Only if the employee understands you, only if you communicate, will this happen.

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[6] Reprinted from the Industrial Supervisor. Mr. Hatcher is Corporate Safety Specialist, Abbott Laboratories, North Chicago, Illinois.

How do you go about that?

First, you have to have a grasp of the subject and its special language. So to prepare to communicate, know your job and be specific. Second, know your listener.

Don't skip details of the job. If you are teaching someone to tie a shoe and you skip a step, the shoe will fall off. So cover each detail.

There's a good method of training used successfully in World War II when the Government had to train thousands of men in a hurry, called Job Instruction Training. Basically it went like this.

Tell them how to do the job.
Show them how to do the job.
Have them do the job (while you observe and correct).
Let them do the job themselves.

That's the best way, but now we are talking about just talking, giving instructions. Will you be understood?

A safety shutdown box, an electrical relay switch, and a line control panel are all the same thing, but the terms are used by safety inspectors, electrical engineers, and production managers in that order. What does it mean to you?

There is a lot of talk among safety pros and supervisors about "motivating" people to work safely. The problem really is communicating properly so the job is done as it should be done, then safety is the wanted byproduct. In other words, if the job is done right, it will be done safely.

A highly educated person, who knows all the words and why they mean what they mean and why they are spelled that way, should be able to communicate, but too often can't think in simple thought patterns that the rest of us can visualize, and that's what each of you has to do! Visualize. See the words and their meanings.

Sometimes we use language in the hope it will be impressive. You no doubt talk differently to your children than you do to your employees or to your boss. We couch our communications in terms that will suit the subject and the "receiver." This is proper. But you have to know the receiver. And often, when attempting to train an employee, you must assume he does not know. Communication is accomplished only when the receiver (an employee or a supervisor) gets a clear picture of the message you are trying to convey.

Your job is not only to make your message clear, but to make sure your message cannot be misunderstood. Your communication is aimed at getting out production, in getting your employees to use the equipment and materials, in the most effective manner to accomplish

the goals established by management, to produce. But you don't make a profit if you have injury costs, damaged equipment, and repair costs, and material-loss costs. Those costs are created by accidents.

If you are to have low-cost production that will create a profit, you have to cut costs–accident costs.

So you have to communicate.

The Occupational Safety and Health Act of 1970 states: "Each employee shall comply with occupational safety and health standards and all rules, regulations, and orders issued pursuant to this Act which are applicable to his own actions and conduct."

If the employee is to "comply with * * * all rules, regulations and orders * * *" then he must understand them. And that is your job–to make them understandable.

* * * * *

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