WATER OPERATION AND MAINTENANCE

BULLETIN NO. 105

SEPTEMBER 1978

IN THIS ISSUE

UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Reclamation

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 bulletin, the suggestion number as well as the person's name is given. All Bureau offices are reminded to notify their Suggestions Award Committee when a suggestion is adopted.

Any information contained in this bulletin regarding commercial products may not be used for advertisement or promotional purposes and is not to be construed as an endorsement of any product by the Bureau of Reclamation.

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

Tehama-Colusa Canal, Sacramento Canals Unit, Central Valley Project, California. The "paver" is laying a 88.9-mm (3-1/2-in) coating of concrete on the slope of reach 4. The Tehama-Canal will service an area of about 89 964 irrigable hectares (205 000 acres) that requires a supplemental water supply of 493×10^6 m^3 (400 000 acre-feet) per year. At present, the land is used primarily for dry farming. Under full development, it is expected that the land will be used for forage crops, field crops, fruit and nut orchards.

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INTRODUCTION

Of specific interest to farmers, ranchers, and water managers, and to the public as well, is an informative article on the Bureau's weather modification program entitled "Project Skywater," beginning on page 1.

Use of rubberized asphalt is proving to be very effective for sealing lining cracks on the Tehama-Colusa Canal, as described in the article on page 5.

"The irrigation well is the heart of any irrigation system when the water source is ground water." The article starting on page 8 helps the irrigator solve problems that may cause reduction in well yield.

The "Happy Hooker" on page 13, is quite a handy tool. It was invented and put in use at the Solano Irrigation District and has saved many a smashed finger.

Feeling tipsy? The skid-steer loader operator, described on page 15, can right the machine if it should tip forward with a full load.

Accidents can be prevented when working with gas chlorination systems, see page 16.

The article on page 17 shows how to store your pesticide equipment and pesticides safely.

WEATHER MODIFICATION–PROJECT SKYWATER[1]

A research program developing a technology of weather modification that some believe holds great promise for the Nation, especially the West, is the Bureau of Reclamation's Project Skywater.

In Project Skywater, the Bureau's mission is to develop effective, socially acceptable technologies to manage rainfall and snowfall. Skywater's research deals not only with the multitude of problems in cloud physics, but also is probing the environmental, social, and economic implications. The results of this work are encouraging, particularly in the last several years. The goal of Skywater is to be able to turn over to water managers, decisionmakers, and the public, technologies which can be used with a high degree of confidence to augment the Nation's water supplies.

In the past, much of the program's work has been accomplished by individual experiments–several at a time–being carried out at several sites across the West. The results of these projects have now been brought together and the work is concentrated in two major field research projects. These are the High Plains Cooperative Program, known as HIPLEX, and the SCPP (Sierra Cooperative Pilot Project). HIPLEX is concerned with removing the many uncertainities remaining in the technology of augmenting growing-season rainfall over the agricultural lands of the High Plains region. The SCPP's mission is to determine the feasibility of augmenting snowpack runoff from northcentral Sierra.

HIPLEX

HIPLEX (the High Plains Cooperative Program) is a joint effort among the Bureau and States and local agencies in the High Plains region. Cooperative and cost-sharing agreements have been established with the States of Colorado, Kansas, Montana, and Texas. The Bureau has primary responsibility for meteorological technology development, including the testing and verification of hypotheses, seeding system development, and evaluation. The states accepted primary responsibility for nonmeteorological technology development, including impact assessment, legal and institutional arrangements, and local decisionmaking procedures.

The field research sites are located in the vicinity of Miles City–Billings, Montana; Colby–Goodland, Kansas; and Big Spring–Snyder, Texas. These three sites were chosen because climatic conditions and cloud characteristics were either known or suspected to vary

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[1] Excerpts of paper given by Raymond B. Girardo, Adaptation Branch, Atmospheric Water Resources Management, Division of Research, Bureau of Reclamation, to the Association of Western State Engineers, September 20-23, 1977, Lincoln, Nebraska.

over the north-south extent of the region. The implications of such differences on technology transfer from one region to another are obvious.

The major objective of HIPLEX is to identify those atmospheric conditions when seeding leads to increases, no effect, or decreases in rainfall and the area and magnitude of effects. The research is intended to proceed from convective cloud systems to more extensive cloud and mesoscale systems as results and concepts provide a basis for the advancement.

Skywater has completed a 3-volume programmatic environmental statement which covers its entire program but places heavy emphasis on HIPLEX. The document is the most comprehensive study of the environmental effects of precipitation management available today.

Farmers, ranchers, and other High Plains water interests have long dreamed of additional sources of water. If Skywater can develop an effective technology–and if that technology is acceptable to the people–it may be able to produce an additional 25 or 50 mm (1 or 2 in) of rainfall during the growing season. This would be an increase of about 10 percent. Of course, there are many variables built into the problem, but it appears today that if this millimeter (inch) were available, it would translate to about $500 million annually in increased crops and secondary benefits. Other benefits to a region's water supply include partial recharge of local reservoirs to provide water for irrigation and municipal use. Crops watered by rain showers do not require intensive irrigation, thus relieving stress on reservoir and ground-water supplies.

SCPP

While HIPLEX is refining the shower technology, SCPP (Sierra Cooperative Pilot Project) in California, is learning how to enhance the Sierra winter snowpack. The object is to determine the best way to seed orographic clouds for increased snowfall at high elevations. Orographic clouds are those caused by air being lifted into colder regions of the atmosphere as it passes over the mountain barriers. The lifting chills the air and reduces its ability to hold water vapor, which condenses and becomes visible as a cloud. Some of the moisture remains as liquid droplets until it is carried beyond the mountain and sinks to lower warmer elevations where it evaporates and returns to vapor, but some also freeze and fall as snow.

The Sierra snowpack, unlike those in the main ridge of the Rocky Mountains, is a product of moist Pacific air moving over the Sierra Nevada. Although there has been considerable research performed in the Rockies, the complexities of the West Coast systems remain somewhat a mystery. This project, therefore, tends to be independent of the Rocky Mountain research and is addressing variations of problems being resolved further inland.

Early studies have indicated that there is a potential for increasing runoff from this basin alone by 370×10^6 m^3 (300 000 acre-feet).

The Drought-Relief Fallacy

There are many potential users and decisionmakers who view weather modification, specifically precipitation management, only as a drought-relief measure.

Funding and operational programs increase during drought periods, apparently with the exception that water deficits that took years to develop will be quickly replenished. Weather modification is often invoked as a desperation measure, perpetuating the hydro-illogical cycle (fig. 1). This is encouraged, in part, by the quick reaction time and relatively low cost of weather modification operations in contrast to other potential drought-relief measures.

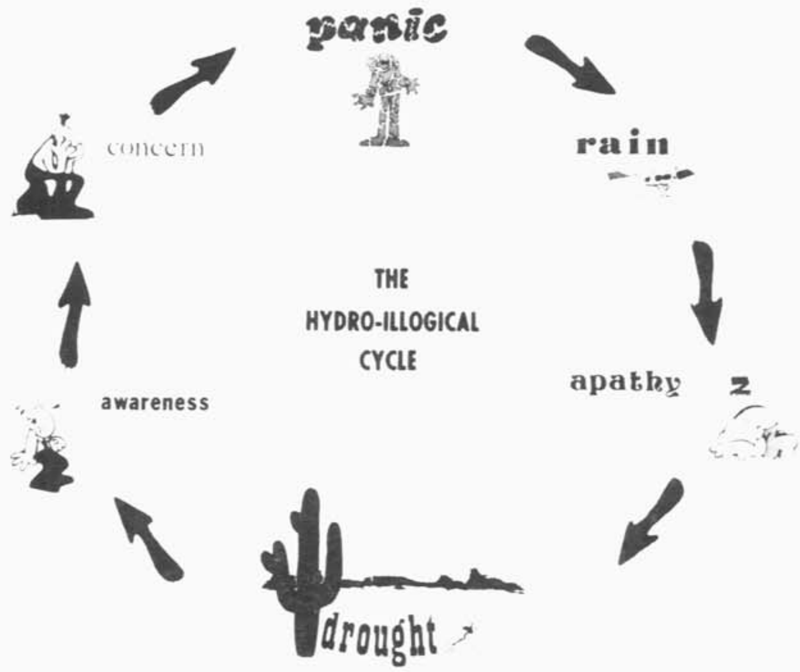

Figure 1.–The Hydro-illogical cycle.

This is, of course, a "no win" situation for weather modification. The use of weather modification during drought period is generally limited by less frequent opportunities. If all of these opportunities were exploited and if the most optimistic estimates of weather modification effectiveness were realized, the drought, while somewhat mitigated, would still persist and the effort would be viewed as falling short of expectations, if not a failure. The short history of weather modification contains ample evidence of the consequences of such apparent failures–a loss of public confidence in the claims and expectancies of weather modification.

Weather modification should be promoted as a water resource tool to be managed on a year-round basis as any other component of the total water management system. Weather modification should be used to recharge and augment water supplies whenever the opportunities arise and the situation warrants. It should be used in concert with modern agricultural and soil conservation practices to maximize much needed agricultural production during both adequate and rain-short years. It should be considered for application at any stage of crop or forage growth when additional water would be beneficial and also during vegetatively dormant periods to increase the moisture of the soil in preparation for planting.

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CRACK SEALER FOR CONCRETE CANAL LININGS[2]

The sealing of cracks which frequently occur in concrete canal linings has long been a problem for the operators of canals. Plastic tapes developed for this purpose are usually expensive and difficult to apply. A method of repairing cracks using rubberized asphalt was suggested by a contractor under contract to repair lining cracks on the Tehama-Colusa Canal of the Central Valley Project in California. On December 8, 1976, a test application of the rubberized asphalt sealer was made to seal several hundred meters (thousand feet) of cracks on the canal. The cost per meter (foot) for the rubberized asphalt was approximately half the cost for tape. After 18 months of service, the material is still in place with no obvious sign of deterioration.

The equipment consisted of a trailer-mounted unit which heated, mixed, and dispensed the material. The material was a mixture of AR-4000 asphalt and ground-up rubber in portions, by weight, of approximately 75 percent asphalt and 25 percent rubber. The ground-up rubber, from old tires, was required to contain no more than a trace of fabric or wire, to be fully vulcanized, and to be not more than 6.35 mm (1/4 in) in length, with 95 percent passing the No. 16 sieve, and not more than 10 percent passing the No. 25 sieve.

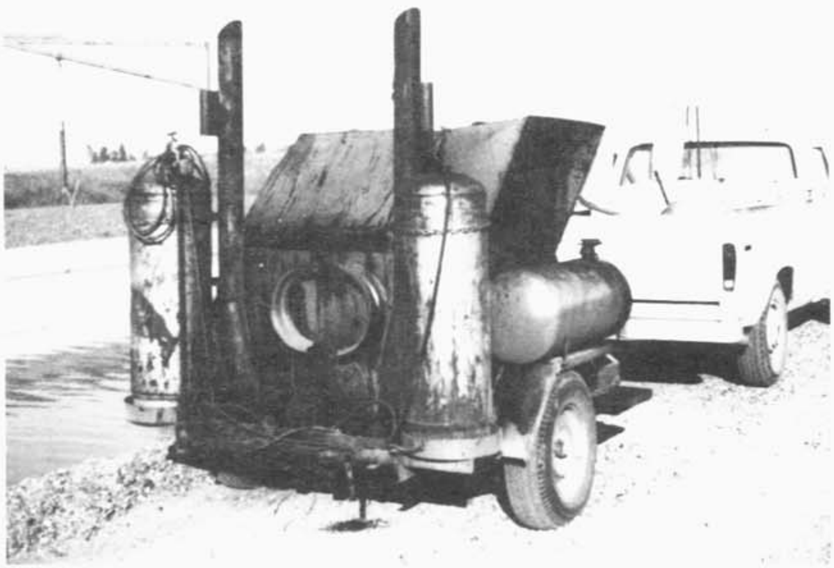

Figure 2.–Rubberized asphalt mixing and applying equipment.

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[2] This article especially written for this publication by Clifford V. Quinton, Irrigation O&M Branch, Division of Water and Land Operations, Bureau of Reclamation, Sacramento, California.

The material was applied to a sandblasted surface at temperatures between 163-191 °C (325-375 °F) through a wand with a cool handle and cutoff valve. The material peeled easily after 1 or 2 hours, but after several hours, it virtually is impossible to remove from the concrete surface. The material also penetrates into the cracks and remains flexible at very low temperatures. Figure 3 shows cracks that have been sandblasted in preparation for application of rubberized asphalt, and figures 4 and 5 show application and rubberized asphalt in place.

At this time, the only known source for the equipment or the ground-up rubber, which is sold under the name "Overflex MS," is Crafco, Inc., Phoenix, Arizona.

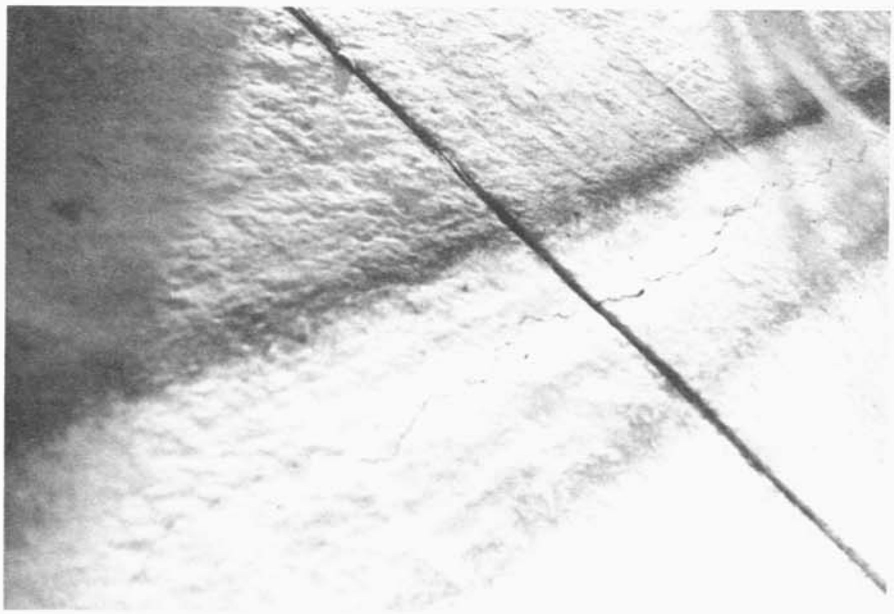

Figure 3.–Cracks in Tehama-Colusa Canal lining. Sandblasted in preparation for application of rubberized asphalt.

Figure 4.–Applying rubberized asphalt.

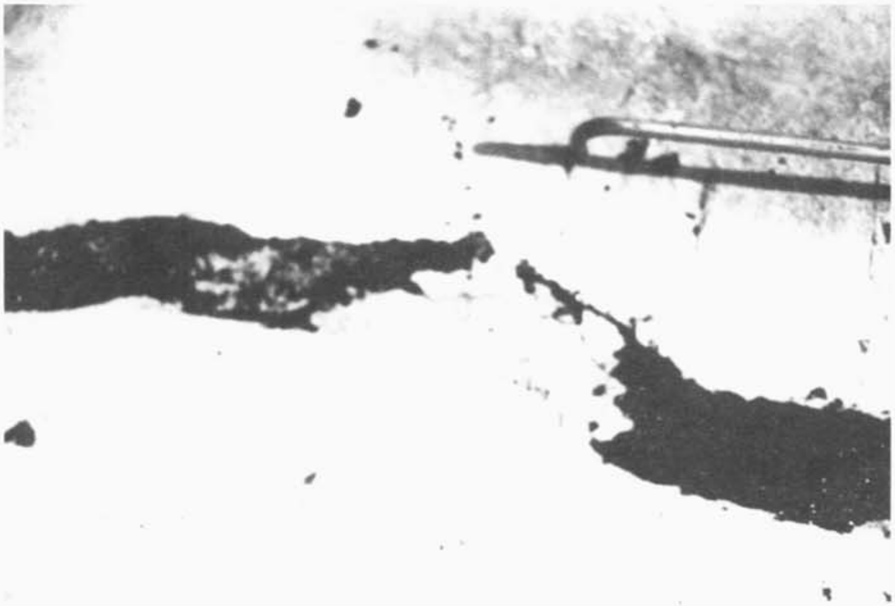

Figure 5.–Rubberized asphalt in place. Notice where material has been peeled away showing inadequate bonding.

"SICK WELLS" REQUIRE WELL DEVELOPED CURE[3]

An irrigator can save himself some crucial downtime and possibly some money by taking a close look at his irrigation wells. As agricultural engineers at North Dakota State University note in a publication about "sick" wells, "The irrigation well is the heart of any irrigation system when the water source is ground water."

Their first and strongest recommendation is to keep accurate records on each well.

Each year the irrigator should measure the static water level in the well, and then the water level when the pump is operating. The difference between the two levels is known as the "drawdown."

With these figures the irrigator can then calculate the specific capacity of the well (fig. 6), and compare it with the value determined in a pumping test by the driller when the well was new.

Equipment for conducting these tests can either be purchased or borrowed through your local county extension agent's office, according to Darnell R. Lundstrom, NDSU Extension Irrigationist.

The irrigator should also look for evidence of two main well problems which can cause a reduction in well yield. These are iron bacteria and mineral incrustation. The two problems have different origins and require different treatments for removal of the problem. However, in both cases, the result is the same: a plugged well screen and less water from the well.

Waters, with even small amounts of iron, provide a source of energy for the growth and development of iron bacteria. These bacteria gather in the form of a slimy organic substance which is found on the well screen, casing, pump, and in the water-bearing formation itself. As the bacteria builds up, it reduces the open area of the screen. If exposed to air, the substance hardens.

The remedy to this problem is to chlorinate the well in the spring and fall.

Lundstrom and his staff recommend use of either high-test dry calcium hypochlorite (H-T-H) approximately 70 percent (it's cheaper in 45.4 kilograms (100 lb) drums) or common household bleach, usually 5 percent, available in super markets. H-T-H can be purchased through swimming pool companies, well drillers, and some irrigation sales firms.

First, determine the depth of water in the well. To do this, subtract the depth to the static water level from the total well depth.

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[3] Reprinted by special permission of the Editor from the March 1978 issue of *Irrigation Age*.

Then, using figure 7, you find the amount of H-T-H or bleach needed for each 3 m (10 ft) of water in your size well (well casing diameter).

Now you're ready to chlorinate the well. Remember to use protective gloves and goggles because chlorine solutions can cause skin burns.

The easiest way is to use H-T-H pellets and drop them to the bottom of the well. Otherwise, dissolve H-T-H granules by slowly adding 37.9 L (10 gal) of water and stirring until smooth. Pour the solution to the bottom of the well through a rubber or plastic hose. Or pour liquid bleach to the bottom of the well by using a rubber or plastic hose.

Allow the solution to stand for hours in the well. Then "surge" or "rawhide" the well vigorously for 1 hour. This is done by starting and stopping the pump intermittently but not allowing water to discharge from the well.

Then flush the chlorine solution into the aquifer by putting as much water into the well as was standing in the well. Allow water to stand for 24 hours and surge the well again for 1 hour. Pump to waste until water is clear and odor of chlorine is gone.

Mineral incrustation requires placing acid in the well to dissolve the incrustation. The substance used in sulfamic acid, a commercially prepared 100 percent acid in either granular or crystalline form.

First step is to test the well for discharge and drawdown. Wells, whose specific capacity have decreased to 80 percent, should then be treated as follows:

Chlorinate the well as you would for removing iron bacteria. Then figure the amount of compound necessaary from figure 7. Screen size and length are the determining factors in this case.

For putting sulfamic acid in the well, a barrel, sprayer pump, and a hose long enough to reach the bottom of the well are needed. Of course, the operator should wear proper protective clothing as well.

Put about 113.6 L (30 gal) of water in the barrel and then add the acid and cold water detergent as a wetting agent until a weak slurry is formed. It should not be too thick.

Continue stirring while injecting the slurry into the screen area of the well with the sprayer pump and hose. Repeat the process until the required amount of acid has been used. Then flush the pump.

Then pour the proper amount of common salt or rock salt (extra coarse crystals or water softener pellets) into the top of the well to ionize the acid and make it more effective. (See fig. 8 for amount to use.)

	(New well) Year No. 1	Year No. 2	Year No. 3
Static level	3.0 m (10 ft)	2.4 m (8 ft)	3.0 m (10 ft)
Discharge	63.1 L/s (1000 gpm)	66.2 L/s (1050 gpm)	56.8 L/s (900 gpm)
Pumping level	18.3 m (60 ft)	17.4 m (57 ft)	19.8 m (65 ft)
Drawdown	18.3 - 3 = 15.3 m (60 - 10 = 50 ft)	17.4 - 2.4 = 15 m (57 - 8 = 49 ft)	19.8 - 3 = 16.8 m (65 - 10 = 55 ft)
Specific capacity = discharge drawdown	63.1 L/s (1000 gpm) 15.3 m → 1.26 L/s/m (50 ft = 20 gpm/ft)	66.3 L/s (1050 gpm) 14.9 m → 1.36 L/s/m (49 ft = 21.5 gpm/ft)	56.8 L/s (900 gpm) 16.8 m → 1.01 L/s/m (55 ft = 16 gpm/ft)
Comparison to new well—		10	80%

Figure 6.–Sample calculations for specific capacity of irrigation wells.

Well diameter	Liters of water for each 3 m of depth (gallons for each 10 feet)	H-T-H 70% chlorine kilograms per 3 m of water (pounds per 10 feet)	Bleach 5% chlorine liters per 3 m of water (quarts per 10 ft)
200 mm (8 in)	98 (26 gal)	0.09 (0.2)	0.9 (1)
250 mm (10 in)	155 (41 gal)	.14 (.3)	1.9 (2)
300 mm (12 in)	223 (59 gal)	.18 (.4)	2.8 (3)
350 mm (14 in)	303 (80 gal)	.23 (.5)	3.8 (4)
400 mm (16 in)	394 (104 gal)	.27 (.6)	3.8 (4)
460 mm (18 in)	500 (132 gal)	.36 (.8)	4.7 (5)

Figure 7.–Quantities of chlorine material to use for each 3 m (10 ft) of water in irrigation well.

Sulfamic acid treatment*

Screen diameter	Sulfamic acid	Cold water detergent	Rock salt	Corrosive inhibitor**
200 mm (8 in)	15.0 (33)	1.8 (4)	2.3 (5)	1.8 (4)
250 mm (10 in)	23.1 (51)	2.3 (5)	3.6 (8)	2.3 (5)
300 mm (12 in)	34.0 (75)	3.6 (8)	5.0 (11)	3.6 (8)
350 mm (14 in)	45.4 (100)	4.5 (10)	6.8 (15)	4.5 (10)
400 mm (16 in)	59.0 (130)	5.9 (13)	9.1 (20)	5.9 (13)
460 mm (18 in)	74.8 (165)	7.7 (17)	11.3 (25)	7.7 (17)

* Kilograms of materials for each 3 m (lb/10 ft) of screen.
** Recommended when acidizing galvanized screens or very old wells. May be purchased from firm supplying the acid product.

Figure 8.–Quantities of acid for irrigation well treatment.

Allow to stand for 4 to 6 hours and then surge the well for 1 hour.

Put in a volume of water equal to amount in the well to flush the acid into the aquifer. Let stand overnight. Pump to waste until the water is clear, and then test the well again for discharge and drawdown to see if treatment worked.

Finally, chlorinate a second time as described earlier.

The North Dakota State University engineers recommend that for badly deteriorated wells, those that have dropped by more than 20-percent capacity, an irrigation well driller should treat the well and redevelop it.

They recommend the chlorination treatment for wells before and after each irrigation season.

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THE "HAPPY HOOKER"[4]

Like several irrigation districts, the Solano Irrigation District in California serves an ever growing community. As the demand for water services increased, so did the number of underground valves and water boxes. There seemed to be a connection between this increased number of box lids and the number of broken screwdrivers, bent pry bars, and smashed fingers that tried to open them. Many a back was strained trying to get at the contents of these protection devices.

Looking for a solution to the problem, it was discovered that someone had invented a useful tool, to take care of the job. Arlan W. Tift of the Clear Creek Irrigation District had devised something he calls a "Happy Hooker."

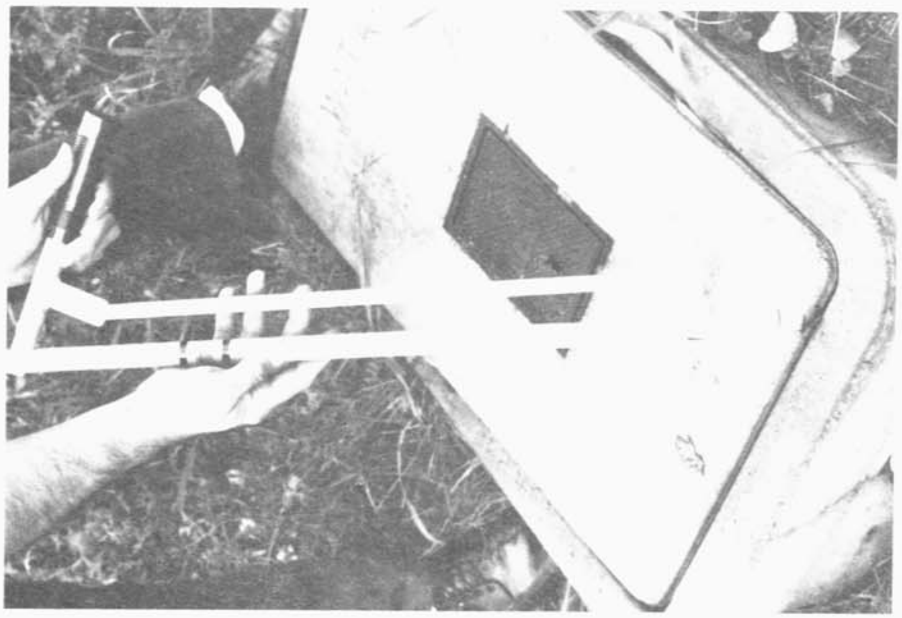

Figure 9.–Closeup of device with lifting handle down and the hook open.

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[4] Written especially for this publication by Mr. Gordon Johnston, Retired, Solano Irrigation District, California.

Using Tift's "Happy Hooker," the number of incidents in the Solano Irrigation District has decreased dramatically. His device is simple to use and is inexpensive, especially when compared to the cost of employee accident claims.

Figure 10.–The hook is inserted into the manhole lifting hole or ring. The hook is tight against the inside of the lid and lifts the lid off with ease.

Additional information on the "Happy Hooker" may be obtained by writing Arlan Tift, Clear Creek Community Services District, 5880 Oak Street, Anderson CA 96007.

LOADER SAFETY TIPS[5]

What do you do if your skid-steer loader with full bucket raised suddenly tips forward and the machine ends up resting on the extended boom and two front tires?

Keep your cool and stick with the machine is the recommendation of Sperry New Holland, farm equipment manufacturer. Following are several safety rules to help avoid this situation:

1. Select a loader with a long wheelbase which provides superior operational stability.

2. When handling a heavy load, keep the boom low whenever possible.

3. When it becomes necessary to operate a loader with a full bucket in the raised position, observe the operating load limits of the machine, avoid making turns and sudden moves, such as stopping, and check for sloping terrain and obstacles in the loader's path.

Sperry New Holland staged a demonstration of the safest way to right a loader if the machine should tip forward. To deliberately tip the machine, the loader, with packed bucket fully raised, was driven forward and then suddenly reversed to start the machine tipping.

Remaining with the machine, the operator should place the boom in the "lower" position and slowly drive the loader to the bucket. Thus, the loader rights itself.

This is safer than crawling out of the machine and forcing someone else to reenter and right it. Even if the machine stalls, the starting engine has enough torque to creep the machine forward.

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[5] Reprinted by special permission of the Editor, from the *California Farmer*, dated December 10, 1977.

SAFETY OF PERSONNEL OPERATING OR MAINTAINING GAS CHLORINATION SYSTEMS[6]

In the past 2 years, potentially serious injury situations have developed during maintenance procedures on gas chlorination systems. In one instance, a connector was broken while high-pressure chlorine liquid was trapped in the line. In two other instances, personnel unfamiliar with the equipment, personal protective devices required, or toxic properties of chlorine attempted to repair a stuck chlorine supply valve or tighten a leaky connection while the line was under pressure. In all cases, the employees were exposed to chlorine gas or liquid in sufficient amounts to require medical attention.

Since the uses of gas chlorination systems are increasing, it is recommended that the following steps be taken to assure safety of personnel involved in maintenance or operation of the systems:

1. All cabinets, lockers, or rooms housing chlorine cylinders should have adequate ventilation systems to assure removal of chlorine fumes released within the enclosure (1- to 4-minute air changes are recommended). Note: Chlorine gas is two and one-half times heavier than air and will seek lowest level in the building or area, and exhaust system intake should be near floor level with fresh air supply located so all areas of enclosure or room are swept clean of gas.

2. A specific operating procedure, including a hazard analysis, should be developed for each facility in cooperation with exposed employees and safety professionals. Procedure development should be in conformance with the "Chlorine Manual" published by the Chlorine Institute, Inc., 342 Madison Avenue, New York, NY 10017.

3. The developed procedure should be discussed with all employees involved in chlorine facility operation and maintenance and used as a subject in tool box meetings, at least semiannually. Further explicit instructions on operation and maintenance procedures should be posted at each chlorinating facility.

4. All employees, when breaking or making connections or opening or closing chlorination system valves, should be protected with adequate full-face masks, respiratory protective units, and rubber aprons and gloves. An eyewash and emergency shower system should be available for immediate flushing of liquid chlorine from eyes or body.

5. Only properly located, inspected, and tested self-contained breathing apparatus should be used for respiratory protection when employees enter an area or work inside cabinets where the odor of chlorine gas has been detected. Employees entering such areas

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[6] Written by Chief, Division of Safety, Engineering and Research, Bureau of Reclamation, Denver, Colorado.

should always be accompanied by another employee equipped with a self-contained breathing apparatus and a means for rescuing the employee entering the area.

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ENGINEER OFFERS ANTIFREEZE ADVICE[7]

Kansas State University Agricultural Engineer Earl Baugher has some suggestions on antifreeze.

The permanent type antifreeze (with an ethylene glycol base) is selling this year for about $3 a gallon and on up, depending on the quality and quantity of rust and corrosion inhibitors it contains. You get about what you pay for in this respect.

How often should you change antifreeze? Because rust inhibitors "wear out," new cars and trucks should have a change after 2 years or about 38 623 km (24 000 mi), Baugher suggests. Older vehicles should have a change every year.

For tractors and other pieces of engine-driven equipment, change antifreeze every year or every 600 hours of operation.

Of course, these are only rules of thumb, he adds. An examination of the coolant and metal surfaces in the cooling system will give a good indication of how the rust inhibitors are holding up.

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[7] Reprinted by special permission of the editor from the *Nebraska Farmer*, dated November 5, 1977.

PESTICIDE STEPS ADVISED FOR WINTER[8]

Plan to provide fall storage for pesticide equipment and pesticides.

Clean sprayer equipment thoroughly and store it in a dry condition. Replace worn parts or take note of major repairs and make them during winter months.

Store any unused pesticides that can be saved for another season in a dry place that can be locked to prevent entry by children, pets, or irresponsible persons. Avoid places where flooding is possible. Make sure water sources won't be contaminated and drainage is adequate. Wind directions should also be considered.

Storage structures should be dry, well-ventilated, easily accessible, designed to prevent fire, and separated from other structures or rooms which may contain food or feed. The area should be posted with warning signs and unauthorized entry should be prevented. Space and facilities need to be provided for decontamination of people and equipment.

Operating procedures should include maintenance of complete and up-to-date records, regular inspection of containers, advance planning and materials for dealing with spills, and regular inspection and monitoring of the surrounding area to detect contamination. Where large quantities of pesticides are stored, it is a good idea to provide police, fire, and health departments with a floor plan and records of the location and nature of pesticides.

Nearly three-fourths of the pesticide accidents that occur are "non-use" connected. Store pesticides in an area where freezing temperatures do not occur, since some emulsion-type pesticides break down.

Discard unlabeled or empty containers and any pesticide materials unfit for use. Bury them at least 457 mm (18 in) deep in an area where the water table will not be contaminated and where surface runoff will not contaminate nearby streams, ponds, or lakes.

Some pesticide suppliers will take large pesticide containers, 114- or 208-L (30- or 55-gal) drums back for repeated use. Do not use pesticide drums for livestock watering troughs, storage tanks, charcoal grills, or floats for rafts.

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[8] Reprinted by special permission of the Editor, from the *Nebraska Farmer*, dated November 5, 1977.

GPO 847-713

The purpose of this Bulletin is to serve as a medium of exchanging operation and maintenance information. Its success demands upon your help in obtaining and submitting new and useful O&M ideas.

Advertise your district's or project's resourcefulness by having an article published in the bulletin! So let us hear from you soon.

Prospective material should be submitted through your Bureau of Reclamation Regional office.