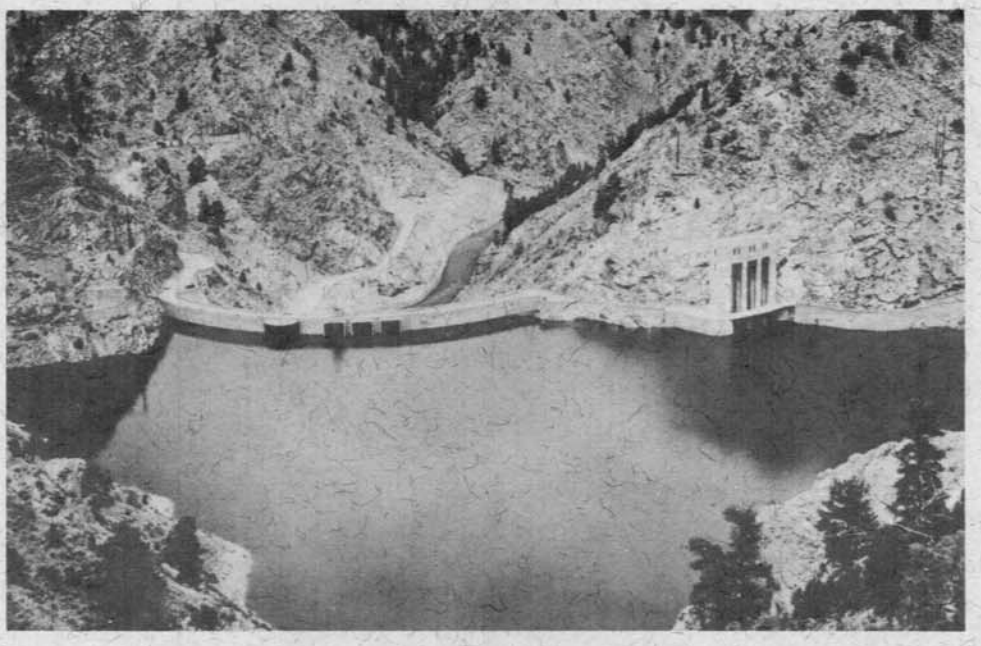
WATER OPERATION AND MAINTENANCE

BULLETIN NO. 88

JUNE 1974



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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 bulletins, 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.

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

COVER PHOTOGRAPH:
SEMINOE DAM - Alcova Reservoir, Kendrick Project, Wyoming. Upstream face of the Dam as seen from the viewpoint on the highway above the lake. Holdover reservoirs like this contribute their full measure in storing water for future use. During the 1970 runoff season, the placid water in this scene would have surged downstream in one turbulent destructive force without the works of man. Photo P144-700-270

UNITED STATES DEPARTMENT OF THE INTERIOR
Rogers C. B. Morton
Secretary

BUREAU OF RECLAMATION
Gilbert G. Stamm
Commissioner

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INTRODUCTION

When selecting gravel envelope for agricultural pipe drains, soil texture can be determined by a simple method and within acceptable accuracy by following standard descriptions of soil properties as described in the article starting on page 1.

"Are You Safety Minded," is the title of the article on page 5. It points out some interesting facts about safety that are often just overlooked.

An article on page 7, shows how a park technician of the Ozark National Scenic Riverways, solved a perplexing problem of balancing equipment being used with front-end loaders through a unique counterweight idea.

How metal fumes can create hazardous conditions is described in the short article on page 9. This common hazard can be prevented with proper care and planning.

A new skimming device designed to pick up any floating pollutant is explained in the article starting on page 10.

Prepare, Present, Try-out, Follow-up, are four most important ingredients for good employee training, and the article on page 13 describes all four in step-by-step detail.

Avoid machinery belt failure with a little preventive maintenance is the advice given in an article on page 15.

Saving fuel is the responsibility of everyone, and reading the article on page 16 will give some insight on how this goal may be accomplished.

A SIMPLE METHOD FOR SELECTING[1] GRAVEL ENVELOPE FOR AGRICULTURAL PIPE DRAINS

Specialized personnel are not always available to select envelope material to be placed around subsurface pipe drains. Therefore, contractors, irrigation district construction personnel, and farmers should be acquainted with a simple, but reasonable reliable method for determining the suitability of available material. Suitability of material for an envelope depends, for the most part, on rate of flow of ground water from the in-place soil to the drains, permeability of the envelope material, and gradation of the material.

While the permeability of sand-gravel mixtures can be quite simply determined, many physical and chemical soil characteristics not readily or easily measured must be known to determine the rate of flow from the soil, making this determination one to be performed by specialists when high accuracy is necessary. However, field experience and many carefully performed soil permeability tests have indicated that a reasonable relationship usually exists between rates of flow in a given soil and its texture and structure. Soil texture can be determined in the field within acceptable accuracy for this purpose by relatively inexperienced personnel if they carefully follow standard descriptions of soil texture characteristics.

Table 1 on the next page for determining minimum envelope permeability was developed on the basis of this measured relationship between soil permeability and texture. This table shows the minimum envelope permeability requirements for the most common soil textures for an envelope 4 inches thick surrounding the pipe drain. If a plastic or asphalt-saturated felt sheet is placed over the top half of the pipe drain, the permeability values should be doubled.

To use Table 1, compare the feel and appearance of a sample of soil taken at about the depth of the proposed drains with the various soil textures described. Select the texture that fits best and read the minimum envelope permeability in inches per hour. If the drain is constructed in coarse sand or gravel, the excavated material can be used as the envelope, care being taken that none of the top soil is mixed with the sand or gravel.

To test for permeability of the envelope material, follow these simple steps:

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[1] Written especially for this publication by R. J. Winger, Jr., Chief, Drainage and Groundwater Branch, Engineering and Research Center, Denver Federal Center, Denver, Colorado.

Table 1

MINIMUM ENVELOPE PERMEABILITY FOR VARIOUS SOIL TEXTURES

Soil texture	General Description	Minimum envelope permeability inches/hour
Medium Sand	Sand is loose. Individual grains can be seen readily. No cast forms when a dry or moist sample is squeezed in the hand.	50
Loamy sand	Sand is loose. Individual grains can be seen or felt readily. Contains small amount of silt and clay. No cast forms when a dry sample is squeezed. Cast forms in a moist sample that crumbles when touched.	35
Sandy loam	Contains much sand. Individual sand grains can be seen and felt. Sand grains tend to stick together because of the amount of silt and clay present. Squeezed when dry, cast forms that crumbles readily. Moist cast will bear careful handling.	25
Loam	Contains about equal amounts of sand, silt, and clay. Feels somewhat gritty yet fairly smooth and plastic. Squeezed when dry, a cast forms that will bear careful handling. Moist cast can be handled freely.	15
Silt loam	Smooth feel when wet. Contains some fine grades of sand, and a small amount of clay which gives a slight plastic feel. When dry it may appear quite cloddy but lumps can be readily broken and when pulverized it feels soft and floury. When wet, the soil readily runs together. Either dry or moist, it will form casts that can be freely handled without breaking but when moistened and squeezed between thumb and finger, it will not "ribbon" but will give a broken appearance.	10
Clay loam	Plastic when moist. Dry sample usually breaks into hard clods. Squeezed when moist, cast forms that will bear much handling. Can be kneaded into heavy compact mass.	10

1. Place 4 inches of the pit run material, free of vegetable matter, clays, or other deleterious substance in any nontapered gallon can from which the bottom has been removed and a copper window screen soldered over the bottom.

2. Drop can on ground from about 1 inch above ground 10 times to eliminate large voids.

3. Refill can to 4-inch mark and slowly lower it into a larger pail of water until 3 inches of water stands above the upper surface of the test sample.

4. Lift the gallon can above the water surface in the larger pail to provide for free drainage, and pour water through the material for about 1 minute maintaining the 3 inches head of water over the material.

5. Stop pouring water into the can and determine the time in minutes and seconds for the water level in the can to fall the 3 inches to the surface of the material being tested. (The stopwatch should be started when the water level in the can is on a mark 3 inches above the surface of the 4-inch-thick envelope material and stopped as the last free water disappears from the surface.)

6. Repeat the test at least three times to obtain an average time.

The permeability of the envelope material can then be estimated from Table 2 below.

Table 2

Permeabilities of test sample 4 inches thick based on time required for water level to drop 3 inches to level of soil.

	Time	Estimated permeability
	Min:Sec.	Inches/Hour
Less Than	2:00	70 +
	2:41	50
	3:50	35
	5:23	25
	8:58	15
	13:26	10

If the permeability of the envelope test sample is about 20-25 percent less than recommended in Table 1, a different source of envelope material

should be found or some of the finer materials should be screened out of the available material to increase its permeability. If the pit run material has equal or greater permeability than recommended in Table 1 and if it is reasonably well graded, it will be satisfactory for use as envelope material. To be reasonably well graded means there should be a good representation of both sands and gravels with maximum gravel size about 1-1/2 inches in diameter.

Example

a. Description of in-place soil at about drain depth.
Feels somewhat gritty, yet fairly smooth and plastic. Squeezed when dry, a cast forms that will bear careful handling. Moist cast can be handled freely without breaking.

b. From Table 1, it is probably a loam texture, with a required minimum envelope permeability of about 15 inches per hour.

c. Three permeability tests of the pit run material averaged four (4) minutes and 20 seconds.

d. From Table 2, it can be seen that the permeability is greater than 25 inches per hour, which would be adequate. Therefore, if the pit run material is reasonably well graded, has no visible vegetable matter, clay balls, silts, or other substances that could cause a drop in permeability after a period of time, it is suitable for placing around pipe drains in the soil.

* * * * *

SWIMMING AND BOATING are two very popular forms of outdoor recreation, along with skin and scuba diving. The National Safety Council has devoted considerable time and effort in developing safety education information about activities in and around water since it estimates that 6,800 lives are lost by drowning on the average each year in the United States.

Precautions to be taken and rules for safe enjoyment in swimming (particularly for youngsters), boating, organizing equipment for bathing beaches, types of flotation aids, and how to plan group projects for beginners as well as experts, are all topics on which the NSC provides interesting leaflets. Camp counsellors, directors of youth activities, physical education directors, and group leaders will find ample material for a program or two in "Safety in the Water," "Safety on the Water," "How to Stay Up and Not Drown," available without charge from the National Safety Council, 425 N. Michigan Avenue, Chicago, Illinois 60611. If more extensive information is desired, ask for the additional material that is available for a small fee.

ARE YOU SAFETY MINDED?[1]

Whenever someone asks you the question, "Are you safety-minded?", are you able to give an unqualified "Yes," or do you have some doubts in your mind?

You may say, "Sure, I'm safety-minded. My record proves it, because I've never had a disabling work injury!"

If you think that you are safety-minded because you've never had a disabling injury, it is a sign that you don't understand the full meaning of safety. Thinking about the Law of Self-Preservation and following through safely should be a part of your every day work. The safety of our bodies starts in our minds--safety comes from thinking and thinking is done between the ears. Remember that wrong thinking, or not thinking at all, is the cause of most accidents!

Being safety-minded is related to how you think and plan for safety. The way you use your minds will determine part of the answer to the question, "Are you safety-minded?"

Planning ahead is part of your job--it simply means thinking things through and acting accordingly. So part of being safety-minded is planning, thinking, and acting.

The lack of proper thinking is reflected in how we act. Acting one way or another will determine whether we are injured or not. Take the fellow who uses a grinder regularly and figures that he can get by without using his goggles. Maybe he's been getting away with it for a long time, but sooner or later he's going to lose an eye.

Do you know what "wool-gathering" means? That's a form of daydreaming that we sometimes do. It means that our mind is wandering--we are thinking about many things other than the work that is being done. Thinking about our bills, our recreation, or even the fishing trip that we are going to take on our vacation, can involve us in a work accident.

When I say, "Don't indulge in wool-gathering while on the job," I mean "Concentrate on the work at hand."

After an accident it's too late to say "I just didn't think!" Maybe afterwards you won't even be able to tell the story of what happened. Planning, thinking, acting, means checking every step and being ready for the unexpected. You must: plan before doing the job, think while doing the job, and act safely until the job is completed.

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[1] A 5-minute safety talk, reprinted from the Industrial Supervisor, dated February 1974, published by the National Safety Council, Chicago, Illinois.

If you do all three of these things, I won't even have to ask you if you are safety-minded. It will be quite obvious to me and everyone else. It will affect our safety record, too. But--more important--it will mean that you won't be hurt in an accidental work injury.

Planning, thinking, and acting should also include a good amount of looking for the hazards that exist on your job! You must look for all of the things that someone else might overlook. For instance, oil or grease around a machine, and a paper cup on the lunchroom floor are things that should be wiped up or picked up.

Don't look around for someone else to wipe up the oil slick or to pick up the loose object. Just stop a moment and do it yourself.

It's a good idea to be a "question-asker" if you don't know the safe way of doing a job. If you don't know, ask questions. Just remember that the man who's smart enough to admit his ignorance is the one who is going to come out ahead. He's the one who has a good chance of being known as a safety-minded worker.

You will be a safety-minded worker if you do all the things that I've talked about plus the following ten things:

1. Follow instructions; don't take a chance; and if you don't know, ask.

2. Correct or report unsafe conditions.

3. Don't horseplay; avoid distracting others.

4. Comply with all safety rules.

5. Help keep everything clean and orderly.

6. Use the right tools and equipment for the job and use them safely.

7. Use, adjust, and repair equipment only when authorized.

8. When lifting, bend your knees; get help for heavy loads.

9. Use prescribed protective equipment; wear safe clothing; and keep them both in good condition.

10. If you are injured even slightly, tell your supervisor. He will see that you get first aid and a doctor if you need one.

* * * * *

COUNTERWEIGHT FOR FRONT-END LOADERS

(Reprinted by permission from a recent issue of GRIST, a publication of the National Conference of State Parks, Washington, D.C.)

At Ozark National Scenic Riverways, front-end loaders not equipped with permanent rear wheel weights used back hoe or brush hog equipment attached to the rear to provide counterweight. This was a disadvantage because these pieces of equipment take up 6 to 8 extra feet, and they were susceptible to damage in this usage. Without a counterweight the tractor (or other machine) would spin and not load properly; and when the scoop was full and raised, the machine was top heavy on uneven ground.

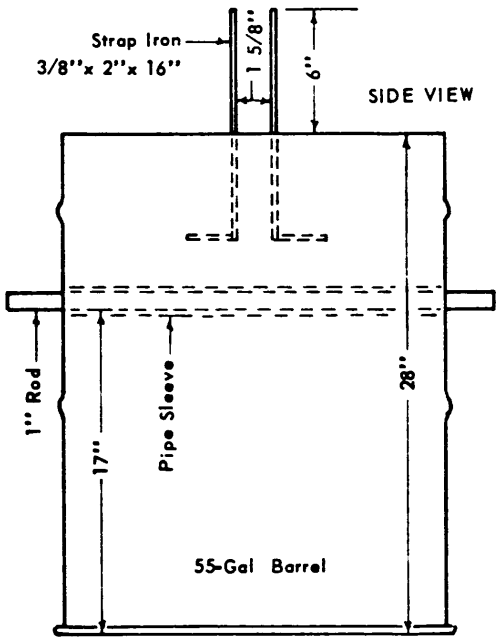

Figure 1

Lloyd Rainbolt, park technician, Ozark National Scenic Riverways, Van Buren, Mo., made the counterweight from a 55-gallon steel drum. Figure 1 at left is a side sketch of this device and Figure 2 below shows the top view. This weight fits on the three-point hitch at the rear of a tractor. It is easy to hook up, and low enough so the operator can see over it, overcomes the problems mentioned above, and is inexpensive.

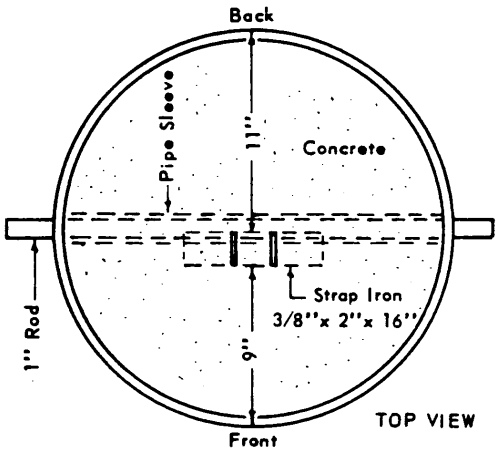

Figure 2

Materials needed:

- 1 55-gallon steel drum
- 1 piece of 1" pipe, 20-1/2" long
- 1 rod, 1" Diameter, 27" long (old power take-off rod)

- 1 piece of iron bar or strap, 3/8" thick x 2" wide and 32" long
- 1 dressed 2" x 4" x 22" long oak or pine (any material 1-5/8" thick)

Cut barrel down to 28" height and burn a hole on each side (opposite each other) 17 inches from the bottom and big enough to accommodate a 1-inch pipe. Place the pipe through the holes. Cut the iron bar into two 16-inch pieces.

Heat one end of each bar and make a 3-inch "L" in each. In the other end of each iron bar, drill a 3/4-inch hole 1-3/4 inches from the end of the piece to the center of the hole. Fasten each bar to the sides of the dressed 2" x 4" with the 3/4-inch hole up and in such a way that when the 2" x 4" lies edgeways across the top of the barrel the tops of the bars will be 6 inches above the top of the barrel. The center of the 3/4-inch holes should be 9 inches from the front and 11 inches from the back of the barrel. The 3/4-inch holes should be facing the same way as the holes in the barrel.

After the above has been accomplished the second phase is easy:

Fill the barrel with concrete. Take about 3 inches off each end of the 1-inch rod to fit into the three-point hitch. Drill a small hole into each end of the rod, 1/2 inch from the end, for a lock ring to be inserted. Put 1-inch rod in pipe to hook up. If rod wears, it can be changed. The approximate weight is 380 to 425 pounds.

* * * * *

Irrigation Brought Wealth

The Columbia Basin Project in central Washington has turned a half-million acres of semi-arid land into irrigated farmland, and in 1973 produced a crop valued at approximately $200 million.

Water to the farms is delivered from Franklin D. Roosevelt Lake behind Grand Coulee Dam by an irrigation system built by the Interior Department's Bureau of Reclamation.

Water was first delivered to project lands in 1948 when 119 irrigable acres were under cultivation. This is compared with the 473,854 acres that were irrigated for crops last year.

The major crops produced last year were alfalfa hay, sugar beets, potatoes, and field crops such as corn and wheat. A number of fruits and vegetables also are grown in the Columbia Basin.

The farms range in size from 10 to 160 acres, with the average 90 acres. Last year, 5,510 farms were operated.

* * * * *

METAL FUME FEVER

Reprinted from the National Safety Council's Research and Development Section Safety Newsletter.

A worker was hospitalized with what was subsequently diagnosed as "metal fume fever". This disease, which has symptoms resembling those of an acute attack of influenza, is caused by the inhalation of zinc oxide fumes. The symptoms usually occur within four to six hours after exposure and recovery occurs within 24 to 48 hours.

In this particular case, the worker entered a confined space, i.e., an underground pipe trench, to cut galvanized pipes with a torch. He performed this task without the benefit of respiratory protection or artificial exhaust ventilation, and the outcome was a "classic" case of metal fume fever.

Workers and their supervisors should be reminded that cutting or welding on any coated metal presents a possible exposure to fumes of toxic metals, e.g., zinc, cadmium, and lead. Furthermore, the associated hazards are increased if such operations are to be performed in confined spaces or areas with poor ventilation.

Ideally, fume generating operations should be performed in the presence of satisfactory exhaust ventilation. However, situations exist where ventilation control measures are not feasible. In these latter situations, personal respiratory protective equipment may be adequate. In any event, the industrial hygiene group should be consulted (1) to evaluate the potential hazard of a fume generating procedure and (2) to recommend appropriate control measures.

GAS CYLINDER FALL

A man received a fractured foot when he released a rope around eight compressed gas cylinders tied to a post. The cylinders fell like ten pins. It is a poor practice to gang chain cylinders. Individual cylinder securing devices should be provided for all cylinders in the receiving areas.

* * * * *

SKIMMING THE WATERWAYS...ONCE-OVER LIGHTLY[1] IF THE NEED ARISES!

Accidental oil spills, a buildup of small trash, almost any floating pollutant can be removed easily and harmlessly from the water with a device designed by Jerry Farmer, Maintenance Foreman at San Joaquin Field Division, San Joaquin, California, and built to his specifications by Jim Bryant, Operation and Maintenance Section. This tool, a floating surface skimmer, has been used with success at Edmonston forebay, and can be used wherever needed. Jerry anticipated the rest of the maintenance engineering community with his skimmer. He produced it some time ago and only recently did an European firm announce their development of a similar device.

Description

Sheet metal, 1/16-inch thick, and steel angle of similar thickness was used to construct the skimmer. The metal was bent and welded to form a basic structure of two, rectangular, floatation chambers set one on each side of a square table-like metal tray. In the center of this "table" is the entrance to the suction pipe: a tube of sheet metal about 2-1/2 feet long and 22 inches in diameter, terminating in a coupling for the suction hose. Fitting down over the suction pipe opening a removable screen made of expanded steel mesh welded to a circular frame prevents trash and weeds from being drawn down into the pump. Both the floatation tanks and the suction pipe can be seen in Figure 4 on the next page, and closeup views of the screen and suction opening are presented in Figure 5.

The key to the skimmer's success lies in the peculiar properties of a hollow, rectangular flap of sheet metal which closes the front end of the floating table. Arrow Number 1 in Figure 4 indicates this flap which is a flexible weir capable of floating free or being held at various upright attitudes by a steel rod mounted across the top of the skimmer table (see Arrow Number 2, Figure 4; also, see Figure 5).

The entire skimmer measures three feet in height, from the suction hose coupling to the top of the float-tanks. Table height can be adjusted in the water by means of a floatation-tank mounting arrangement of slots and retaining nuts. This can be seen in Figure 4 and also in Figure 6 on page 12; an idea of the construction and bracing of the skimmer is also conveyed by these illustrations. Total weight is approximately 280 pounds.

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[1] Reprinted by special permission of the Editor, from Technical Bulletin No. 19, dated September 1973, published by the State of California, Department of Water Resources, Sacramento, California.

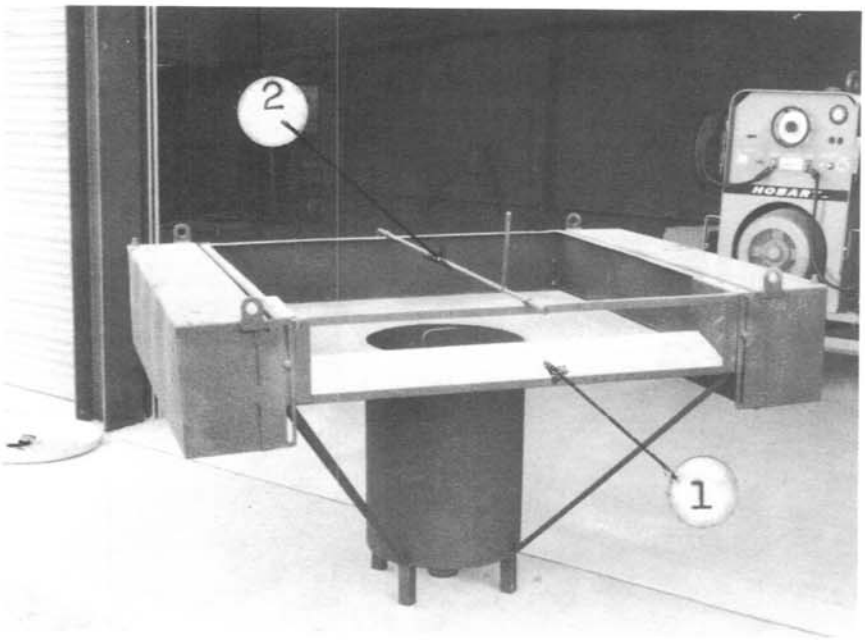

Figure 4 PX-D-74665

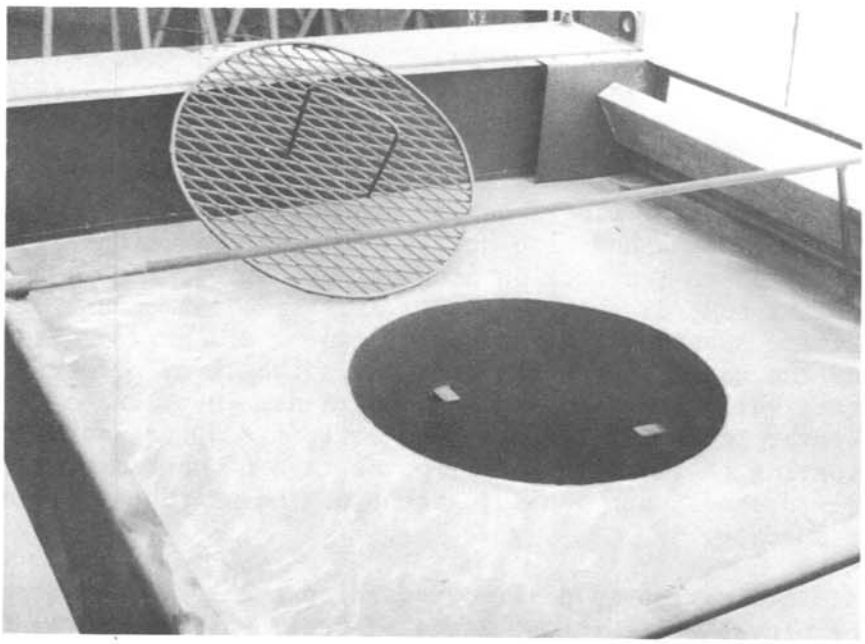

Figure 5 PX-D-74664

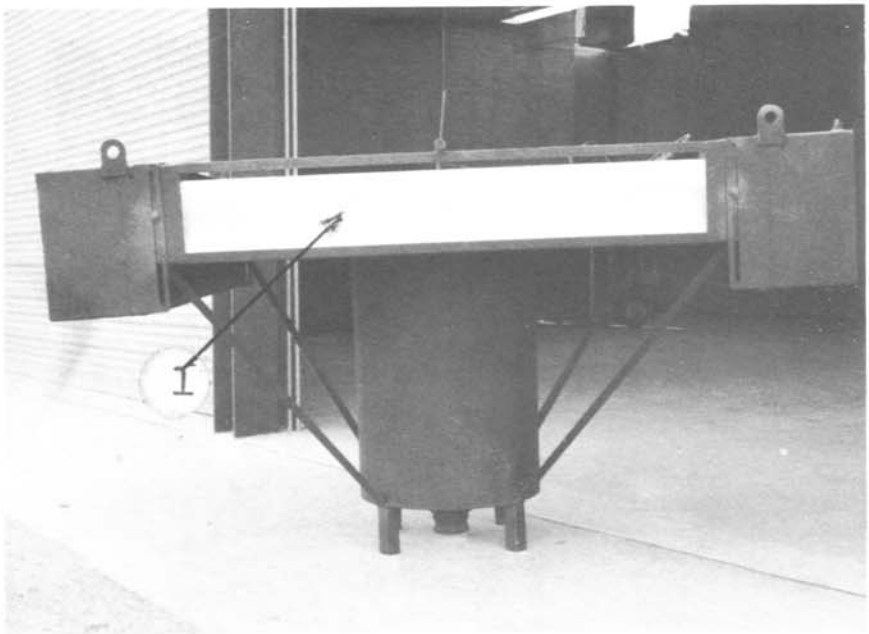

Figure 6 PX-D-74663

Operation

Contamination might come from any direction: from a vehicle entering the aqueduct, a buildup of trash or dead fish, leakage from a cross-over pipeline, oil from a hydraulic line in a plant. No matter what the cause, when needed the skimmer is hoisted onto a truck or trailer (by the four corner hoisting eyes), is hauled to the site, and lifted out into the water. The float tanks are then adjusted until the weir-board floats in a neutral position.

In operation, the skimmer floats beside a power boat or raft which carries the suction pump and also acts as motive power. One side of the pump is coupled to the suction connection on the skimmer, the other side of the pump discharges into a bank-side tank truck or, if the contaminating substance is non-toxic, can be discharged onto the ground beyond the canal bank. The boat moves the skimmer forward at a moderate rate while the pump and weir-board act just like a swimming pool skimmer to remove the oil, chemical, trash, or whatever substance is floating on the water. The percentage of contaminant-to-water recovery depends upon the adjustment of the weir-board relative to the water surface.

If additional information is desired regarding the above mentioned water skimmer please write to the State of California, Department of Water Resources, Division of Operations and Maintenance, 1416 Ninth Street, Sacramento, CA. 95814.

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KEY TO GOOD TRAINING - HOW TO INSTRUCT[1]

Here is What You Should do Every Time You Instruct:

STEP 1. PREPARE the worker to receive the instruction

a. Put him at ease. Remember he can't think straight if you make him embarrassed or scared.

b. Find out what he already knows about this job. Don't tell him things he already knows. Start in where his knowledge ends.

c. Get him interested. Relate his job or operation to the final product, so he knows his work is important.

d. Put him in the right position. Don't have him see the job backwards or from any other angle than that from which he will work.

STEP 2. PRESENT the operation

a. Tell him, show him, illustrate, ask.

b. "Put it over" in small doses. He (the same as all of us) can catch but six or eight new ideas at one time and really understand them.

c. Make the key points clear. These will make or break the operation--maybe make or break him.

d. Be patient and go slowly. Get accuracy now--speed later.

e. Repeat the job and the explanation if necessary.

STEP 3. TRY OUT his performance

a. Have him do the job, but watch him.

b. Then have him do it again, but have him explain to you what he is doing and why. All of us find it easy to go through motions and not really understand what we are doing. You want him to understand.

c. Have him explain the key points.

d. Correct his errors, but don't bawl him out or indicate that he is "thick" or "dumb."

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[1] Reprinted from Safety and Security for Supervisors, dated February 1974.

e. Continue doing all this until you know he knows. He may have to do the job half a dozen times.

STEP 4. FOLLOW-UP

a. Put him on his own. He has to get the feel of the job by doing it himself.

b. Tell him whom he should go to if he needs help. Make this definite--yourself or someone you designate.

c. Check him frequently--perhaps every few minutes at the start to every few hours or few days later on. Be on the lookout for any incorrect or unnecessary moves. Be careful about your taking over the job too soon, or too often. Don't take it over at all if you can coach him.

d. Get him to look for key points as he progresses.

e. Taper off this extra coaching until he is able to work under normal supervision.

* * * * *

OXYGEN
LIFE GIVER - AND KILLER[1]

Oxygen is not always the breath of life. It can be a terrible killer. We are reminded of this by two recent serious accidents.

In the first case, an oxygen cylinder instead of a nitrogen cylinder was delivered to a process, where a four-stage compressor was used to increase the nitrogen pressure to 5,000 psi and inject it into the process. The operator said, yes, he did have a lot of difficulty hooking the right hand thread of the oxygen cylinder into the left hand threaded nitrogen system, but he managed. The result of his labor was a loud explosion as soon as the oxygen reached the well-oiled compressor. It could have been worse. Only the compressor was destroyed.

The second case was worse. This operator tried to blow oil from the plugged drain of an oil separator on an ammonia refrigeration system. This was an improper procedure in the first place, but he used an oxygen cylinder for pressure, also. When the oxygen contacted the oil, the explosion not only cleared the drain but it pretty much cleared the room. Unfortunately, the accident resulted in a fatality.

Are all your employees aware of the hazard from oxygen cylinders? Perhaps you should tell them again.

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[1] Reprinted from the National Safety Council's Research and Development Section Safety Newsletter.

MACHINERY BELT ADVICE[1]

An employee of a leading heavy machinery manufacturer in the U.S., Mr. Burt A. Dundas, has some practical advice on heavy machinery belts. If they are not properly maintained in storage, deterioration will accelerate resulting in downtime at critical production periods. Combines are particularly susceptible to maintenance orientated belt failure, he said.

When the harvest season is over, many of the big combines are parked outside without any cover, exposed to weather. Belts remaining on the units are under tension and develop flat spots where they contact the sheaves. The once smooth and shiny sheaves begin to rust and deteriorate.

When the combine returns to the field, the exposed belts will most likely perform poorly or fail completely under load. As a belt moves from one sheave to another, the flat spots pound like hammers on the sheaves and bearings. In addition, the rusty sheaves work like grinding compound on the belt sides, constantly grinding the protective surfaces.

Result: premature belt failure in the field caused by lack of simple preventive maintenance while the unit is idle.

Many of these failures can be avoided by following a belt maintenance program at the end of the season. Belts have to be properly aligned, run with recommended tension and be on proper sheaves during the season. To insure maximum belt life continued maintenance and proper storage is essential.

Mr. Dundas suggests the following four simple maintenance steps at the end of season for added belt life, even if the unit is under cover:

1. Remove all belts.
2. Coil belts in a loose coil so that they are not kinked.
3. Store belts in a dry, cool area.
4. Oil belts contact surfaces on the sheaves to prevent rusting.

The result will be prolonged belt life, less chance of downtime and added harvest profitability. The cost: just a few hours of your time.

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[1] Reprinted by special permission of the Editor, from the Irrigation Journal dated January/February 1974.

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FUEL (Gasoline) SAVING IDEAS[1]

Right now, America is faced with an energy shortage. Many people refer to it as the energy crisis.

It came about because our growing population and technology have created a huge demand on our energy sources.

It came about because many of today's cars require more gasoline per mile than ever before. That's because today's engines are designed for lower exhaust emissions...an unfortunate by-product of which is lower mileage. And because air conditioners and other power options on today's cars reduce mileage even more.

Environmental considerations have ruled out use of many traditional sources of energy and delayed utilization of others.

What You Can Do:

Slow down! It's one of the most important and most practical things you can do to save gasoline.

If you drive at 50 mph instead of 60 mph, you can save about one gallon in ten.

Just how important is it to save that one gallon in ten? Well, if every American used just one gallon of gasoline less a week, there wouldn't be any shortage.

Plan your trips carefully. Here's one area where you can really help. Before you leave, think about all of the stops you have to make. Try to avoid covering the same area twice and before you leave any particular area, ask yourself if there's anything you've forgotten. You might save yourself one of those "short trips back to pick up something you forgot."

When your engine idles for long periods of time, it wastes gasoline. If you're stopped for a long train, turn your engine off. It won't make the train shorter, but it will save gasoline.

Avoiding jackrabbit starts is another way to get better mileage. Besides wasting fuel, they also cause undue strain on your engine and transmission. And they wear down your tires. All that is a big price to pay just to be the first one to reach the next red light.

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[1] Reprinted from a pamphlet on energy conservation, distributed by the Oil Industry of America.

Not only does rapid acceleration waste gas, but so does rapid braking. You can eliminate the need for a lot of braking by not following other cars too closely. And when you do have to apply the brakes, slow-and-easy is the best way. Take your foot off the accelerator well before you begin to brake. Let your engine slow you down as much as possible. You'll get more miles out of a gallon of gas as well as a set of brakes.

Your car's air conditioner uses a lot of energy. Energy that comes from your gas tank. When it's running, you get about one less mile out of a gallon. So if it's not a real hot day, try rolling down a window instead of turning on your air conditioner. It's a sure way of saving gasoline.

A sure way of getting bad mileage is to rest your foot on the brake while you're driving. Especially if you've got power brakes. It causes a lot of drag. Wears out brakes, makes your engine work harder, and drains your tank faster.

A good tip for getting better mileage on a long trip is to drive at a steady speed. Instead of constantly speeding up and slowing down, hold your foot as steady as you can on the accelerator pedal.

You might want to consider radial tires next time you put new tires on the car. Radial tires usually last longer, hold the road better, and increase your mileage up to 6%.

Do you drive a long way to work? So do a lot of others. If you know other people who live near you and work near you, why not suggest a car pool to them. You'll be doing each other a favor.

And also remember, sometimes there's a better way to get where you're going other than by car. Public transportation is one...if it's available in your area. And for short trips in nice weather, you might even consider walking...or riding a bike. It's fun. It's healthy. And all you burn is a few hundred calories.

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The purpose of this Bulletin is to serve as a medium of exchanging operation and maintenance information. Its success depends 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.

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