Case Number

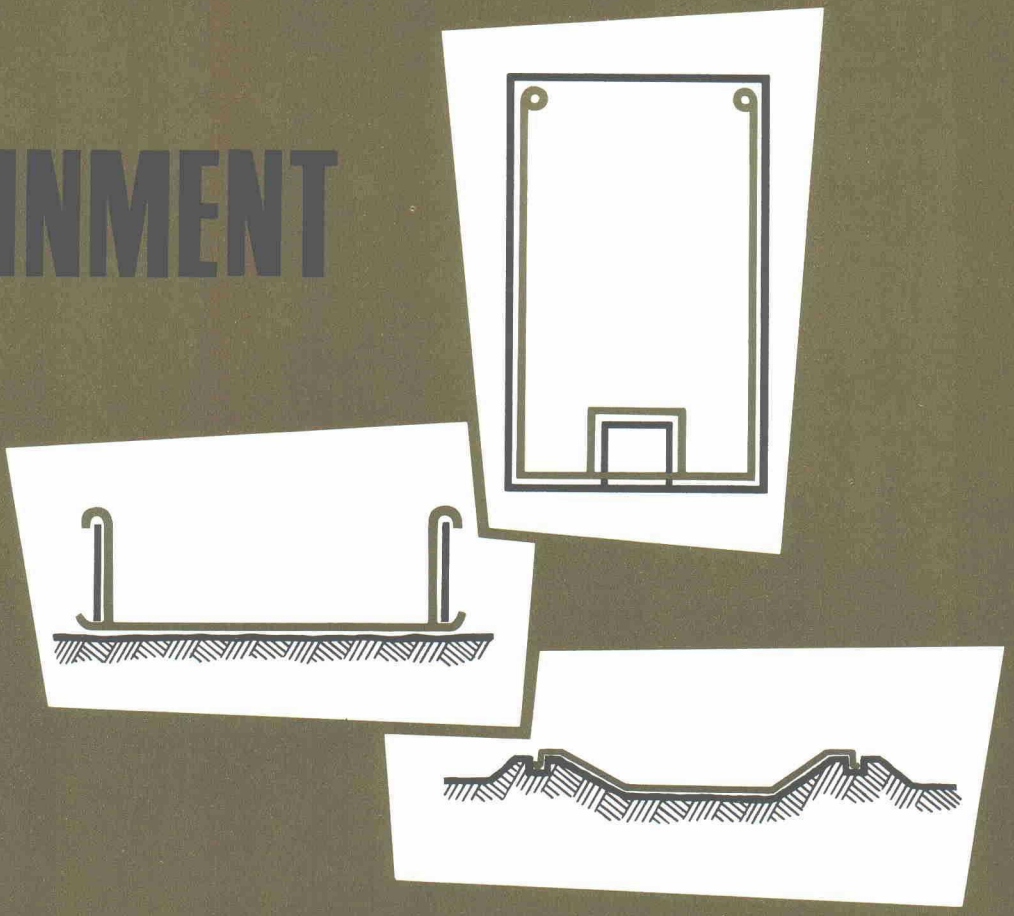
3806

Large

Exhibits

NEW SOLUTIONS TO

OILFIELD FLUID CONTAINMENT



BY UNIT LINER COMPANY

FLUID CONTAINMENT WITH UNIT LINER

Today's oilfield operators are struggling to find immediate and economical solutions to meet a growing body of rules, regulations and laws dealing with oilfield fluids. The intent of these laws is clear: to protect and conserve fresh water supplies and tillable soil. However, little has been done formally to advise the oil operator how to conduct his operations to assure compliance with legal requirements.

This folder offers several solutions by the Unit Liner Company—a company operated by men experienced in the exploration, drilling and production of oil and gas. They are fully aware of the rules and regulations issued by oil producing states to control fluids such as salt water, tank settlings and secondary recovery fluids.

Unit Liner Company now is offering three methods to positively prevent the escapement of fluids classed as containing harmful substances into fresh water supplies or tillable soil. Each method involves the use of a one-piece liner, called UNIT LINER. It delivers the performance and service life required to meet both the current legal aspect and the oil operator's economic need.

Unit Liner Company has worked closely with several material manufacturers to develop quality linings. The material supplier's representatives have inspected the service applications in the oilfields and are cognizant of the service expected of their materials by the oil industry.

Consequently, UNIT LINERS are made from materials recommended to be the most suitable for each particular application. And each lining is fabricated to your size specifications under quality-control standards—assuring a completed product that will efficiently handle the task you have assigned it.

EARTHEN PIT LINERS

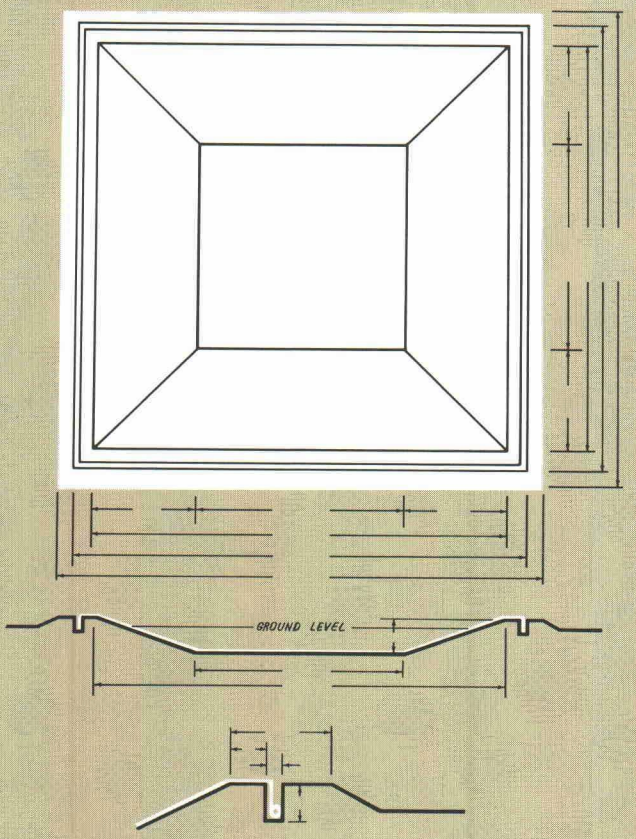
To contain large volumes of fluid, excavated pits lined with UNIT LINERS are both practical and economical. The pits can be used as holding ponds, evaporation ponds, settling basins, frac pits and emergency overflow basins.

No special pit preparation such as soil compaction is necessary. All surfaces must be free of sharp objects and debris. Fine topsoil or sand may be used on the slopes and bottom to provide a cushioned surface for the liner. Also, it is recommended that the top of the dikes be level and of sufficient height above ground level to avoid surface water run off. Normally, slopes range between 2.5:1 and 3:1.

UNIT LINERS remain flexible throughout their service life, thus eliminating damage to the material by soil shifting and settling.

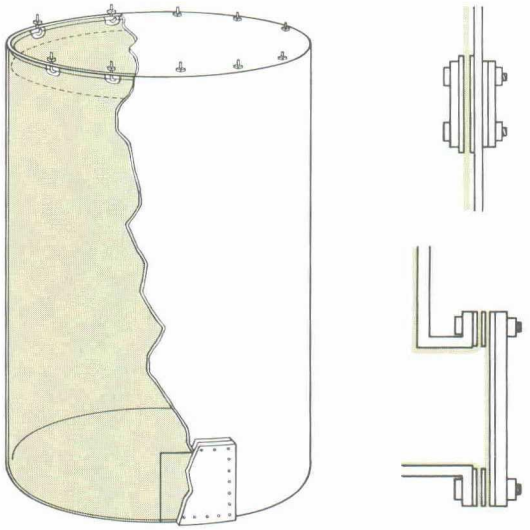
UNIT LINERS are furnished as a one-piece liner in any size to 20,000 square feet. All seams are electronically welded to assure the utmost strength and dependability. For larger pits the liner is prefabricated into maximum-size sections and joined in the field.

Whether your need is for short-term temporary storage or a pit that you can operate for many years, there is a UNIT LINER available in the best possible combination of service life and cost.



UNIT LINERS FOR STANDARD OILFIELD TANKS

UNIT LINERS are prefabricated to standard API welded and bolted tank sizes. They incorporate flanges designed in such a manner as to fit extended-neck type cleanout openings from 20 inches to 24 inches width and 24 inches to 48 inches height. All seams are electronically welded and reinforced at points of stress. Liners can be "special ordered" to fit non-standard or wooden tanks. Openings can be custom fabricated to fit virtually any tank.



Installation is easy. A flexible tubing is inserted into a scalloped hem around the top of the liner. Holes are drilled or burned and evenly spaced around the outside top perimeter of the tank. "J" bolts are installed and the liner is suspended by the "J" bolts, which are then tightened, drawing the liner to the top of the tank. This allows the liner to hang free, eliminating any possibility of damage due to tank movement caused by expansion or contraction or other forces.

The cleanout flange in the liner is fitted and gasketed into the cleanout opening in your tank. The cleanout plate is protected by a separate piece of liner material.

Pipeline openings may be sealed to existing openings by special flanges and gaskets. They may be blanked off and regular bolted tank flanges installed with special gaskets. Non-corrosive flanges are also available.

Sandblasting is not necessary. However, the inside of the tank should be clean and free from sharp or rough places. It usually is desirable to place a thin layer of sand or soft clean dirt on the bottom. If acetylene cutting or welding is anticipated, the tank must be free from explosive vapors. Bolted tanks should have the inside bolt channels covered to protect the liner. A clamp-on plastic extrusion is used for this purpose.

All of the tank hardware necessary to installation, including the desired flanges, is furnished in one package at a nominal extra cost.

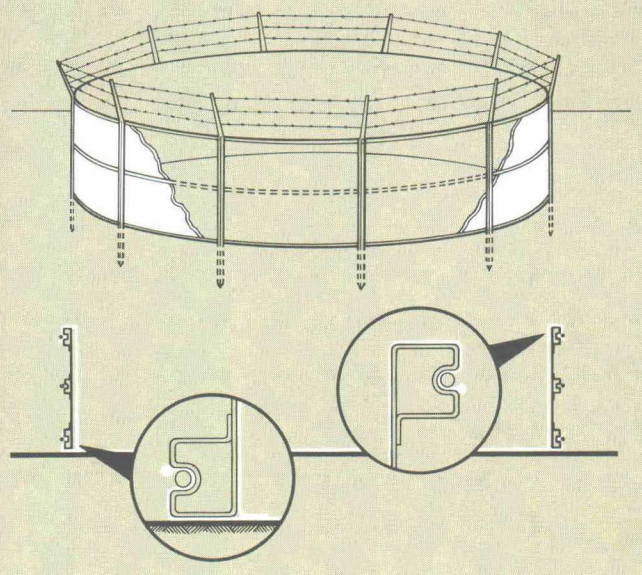
PORT-A-LINE TANK WITH LINER

This method uses a steel perimeter to support a UNIT LINER. The tank is designed for simplicity of erection and engineered to exceed capacity pressure requirements. The galvanized steel ring is prefabricated in 4 feet x 8 feet sections and rolled to conform to the desired diameter. A "filler" section is included which, when joined with the standard sections, completes the circular tank ring to the desired diameter. The entire ring unit—including hardware, fence arms, and barbed wire—comes completely packaged.

The electronically welded one-piece liner is prefabricated to fit the tank. A molded extrusion is welded to the liner at both top and bottom, which allows the liner to be securely fastened around the top rim and bottom rim of the tank. This prevents wind shifting of the liner and corrosion of the bottom tank rim.

Installation is easily accomplished. The tank site must be smooth, level and free from sharp objects and debris. If the tank site is not sand or soft earth, it is recommended that the site be covered by a layer of sand. The liner is spread out over the tank site and the side walls of the liner folded inward, exposing the flap which extends outward in a complete circle from the bottom of the liner. The tank ring is assembled around the liner and sits on the flap extension.

Assembly is accomplished by placing two of the lightweight 4 feet x 8 feet sections (weighing less than 100 lbs. each) end to end and inserting a special connector cleat that forms a continuous joint between the two sections—no bolting necessary.



Additional sections including the "filler" section are added in a like manner, forming a steel ring around the liner. Support cables are installed around the tank ring in the grooves provided, with

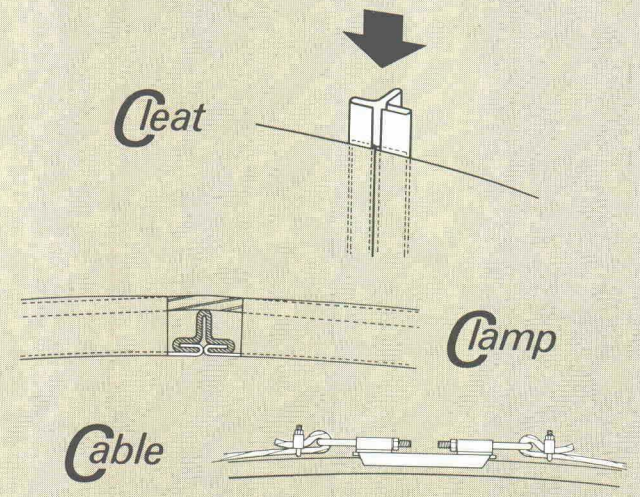
the preformed liner extrusions or extensions lapped around the top and bottom tank rims and under the top and bottom support cables. All support cables are tightened by special adjustable cable clamps to a snug fit. Thus, the tank ring is adequately and firmly supported to withstand capacity pressures. A 5/16" bead completely around the outside edge of the liner at top and bottom retains the liner under the support cables. Fence arms are attached to the top of the tank rim as provided, and wire is fastened to the arms to complete the Port-a-Line tank installation.

Special tooling ensures that all Port-a-Line parts may be quickly assembled properly with no field cutting, bolting, or fitting. Similarly, it is a simple matter to dismantle for salvage or transfer and reassembly at a new site.

Tanks are provided in incremental diameters from 12 feet to 120 feet—capacities 80 to 8000 barrels. Metal gauge and cable size are increased as diameter is increased to maintain safety factor.

The section connector cleat is available in 4 foot lengths (exact tank depth), or in 5½ foot lengths with one sharp end which is driven into the ground 18 inches to resist tank movement by strong winds.

SIMPLICITY OF INSTALLATION



The Unit Liner Company is a division of J & H General Contractors, Inc., of Wewoka, Oklahoma. Both companies are operated by men experienced in the exploration, drilling and production of oil and gas. J & H General Contractors operate daily in the oilfields. They have developed the service knowledge, ability and equipment required to cope with the wide range of field problems continually confronting the oil operator.

UNIT LINERS are *the* most practical and economical means ever devised for positive containment of oilfield fluids. The three methods included in this folder offer proven, effective solutions to the pit and tank leakage problems experienced today.

For samples, design information and quotations, please write:

Unit Liner Company
P. O. Drawer 1460
Wewoka, Oklahoma 74884

Unit Liner Company
P. O. Box 15495
Tulsa, Oklahoma 74115

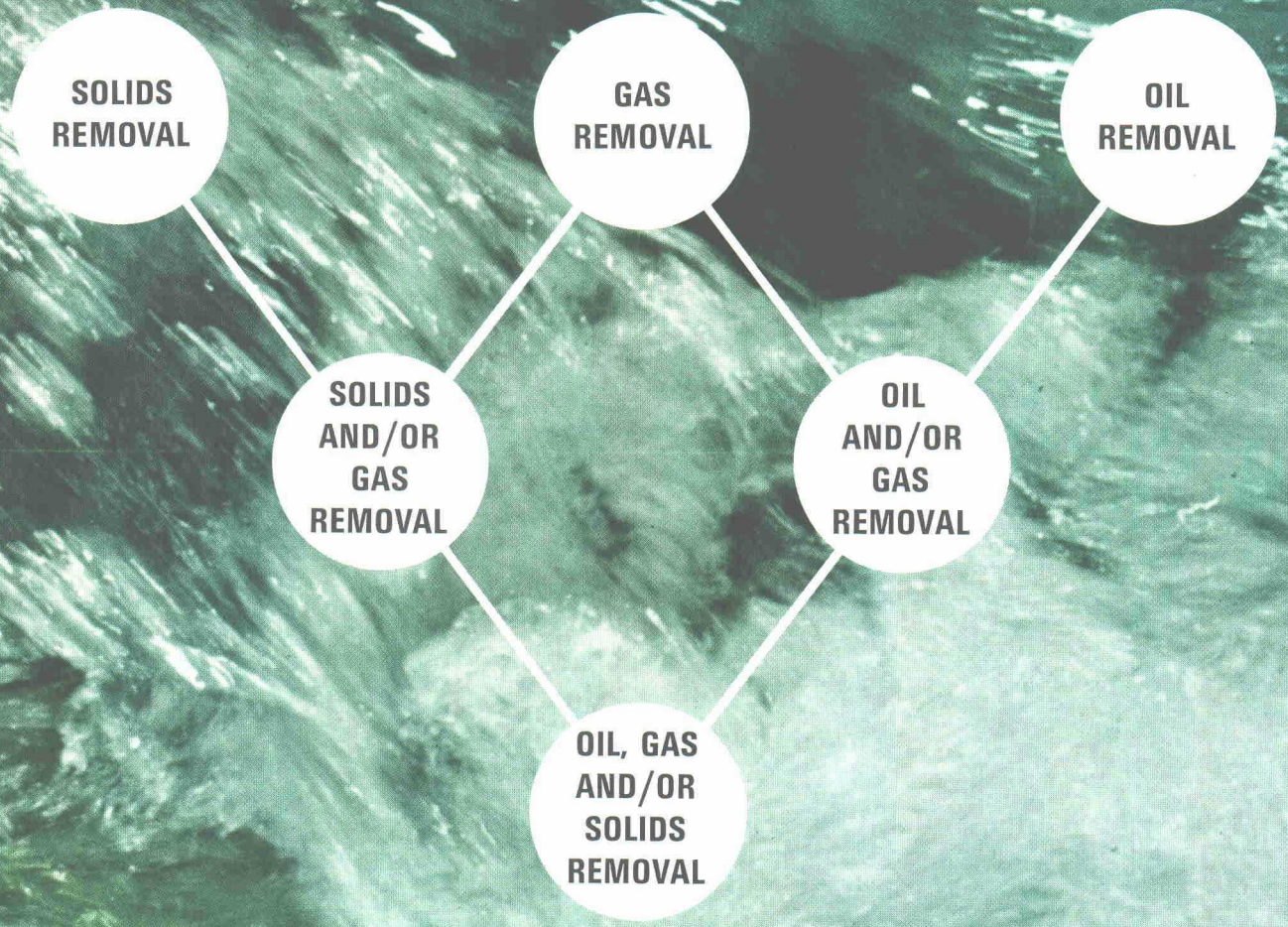
UNIT LINER COMPANY

PRINTED IN U.S.A.

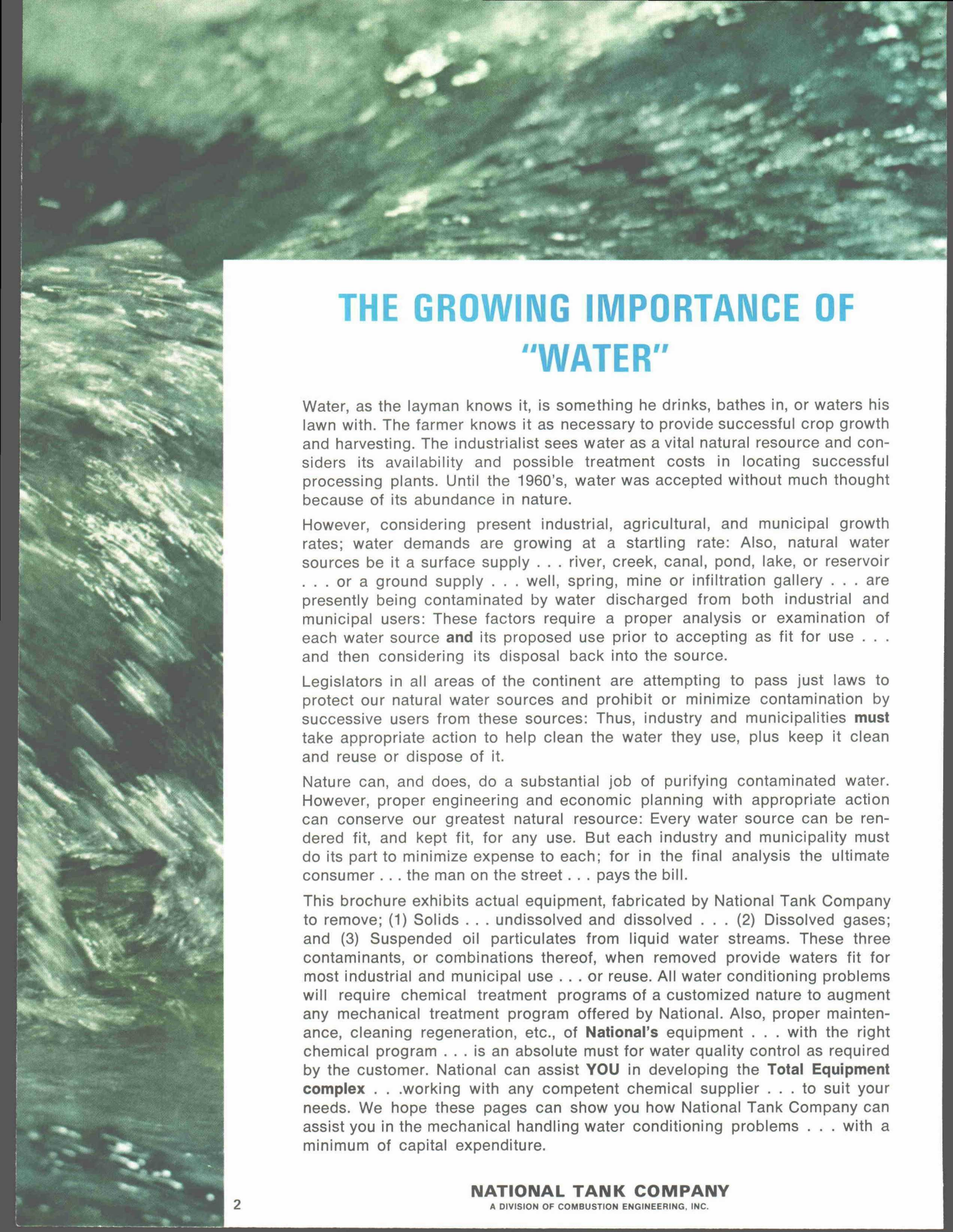
NATIONAL TOPICS
ENGINEERED PRODUCTS
VOLUME 30 NO. 3

WATER

CONDITIONING EQUIPMENT



NATIONAL TANK COMPANY
A DIVISION OF COMBUSTION ENGINEERING, INC.



THE GROWING IMPORTANCE OF "WATER"

Water, as the layman knows it, is something he drinks, bathes in, or waters his lawn with. The farmer knows it as necessary to provide successful crop growth and harvesting. The industrialist sees water as a vital natural resource and considers its availability and possible treatment costs in locating successful processing plants. Until the 1960's, water was accepted without much thought because of its abundance in nature.

However, considering present industrial, agricultural, and municipal growth rates; water demands are growing at a startling rate: Also, natural water sources be it a surface supply . . . river, creek, canal, pond, lake, or reservoir . . . or a ground supply . . . well, spring, mine or infiltration gallery . . . are presently being contaminated by water discharged from both industrial and municipal users: These factors require a proper analysis or examination of each water source **and** its proposed use prior to accepting as fit for use . . . and then considering its disposal back into the source.

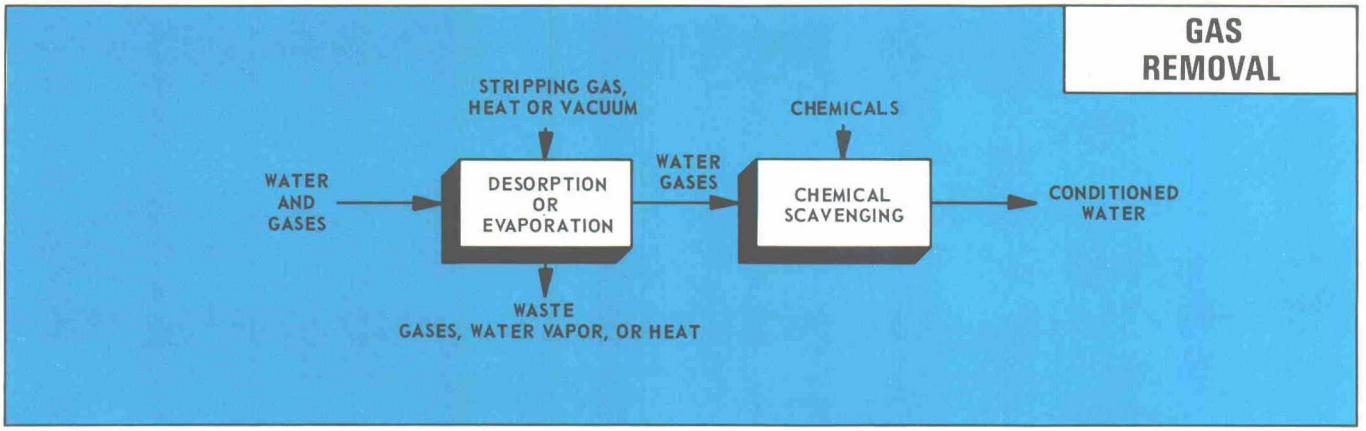
Legislators in all areas of the continent are attempting to pass just laws to protect our natural water sources and prohibit or minimize contamination by successive users from these sources: Thus, industry and municipalities **must** take appropriate action to help clean the water they use, plus keep it clean and reuse or dispose of it.

Nature can, and does, do a substantial job of purifying contaminated water. However, proper engineering and economic planning with appropriate action can conserve our greatest natural resource: Every water source can be rendered fit, and kept fit, for any use. But each industry and municipality must do its part to minimize expense to each; for in the final analysis the ultimate consumer . . . the man on the street . . . pays the bill.

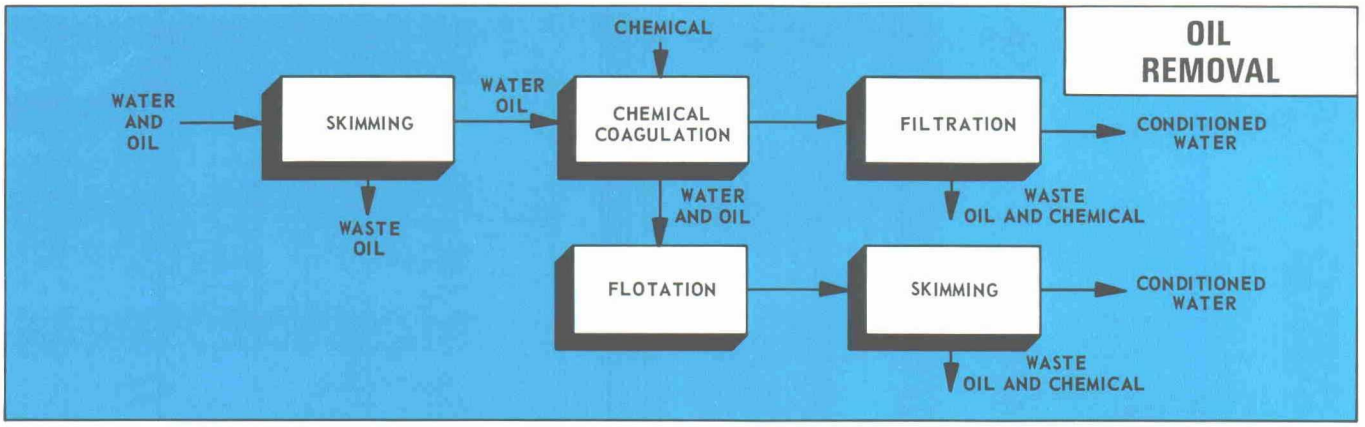
This brochure exhibits actual equipment, fabricated by National Tank Company to remove; (1) Solids . . . undissolved and dissolved . . . (2) Dissolved gases; and (3) Suspended oil particulates from liquid water streams. These three contaminants, or combinations thereof, when removed provide waters fit for most industrial and municipal use . . . or reuse. All water conditioning problems will require chemical treatment programs of a customized nature to augment any mechanical treatment program offered by National. Also, proper maintenance, cleaning regeneration, etc., of **National's** equipment . . . with the right chemical program . . . is an absolute must for water quality control as required by the customer. National can assist **YOU** in developing the **Total Equipment complex** . . .working with any competent chemical supplier . . . to suit your needs. We hope these pages can show you how National Tank Company can assist you in the mechanical handling water conditioning problems . . . with a minimum of capital expenditure.

WATER CONDITIONING SYSTEMS

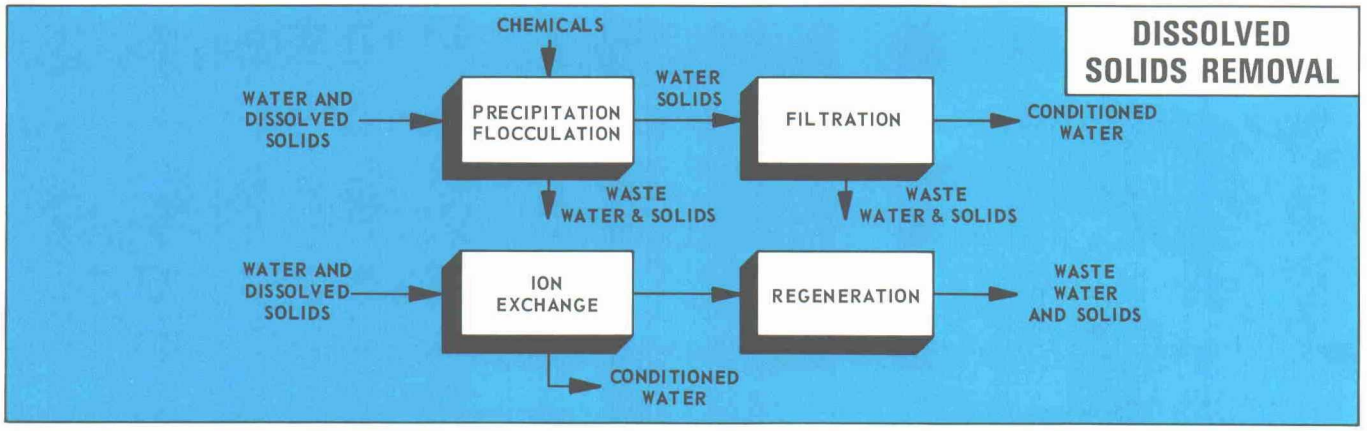
GAS REMOVAL



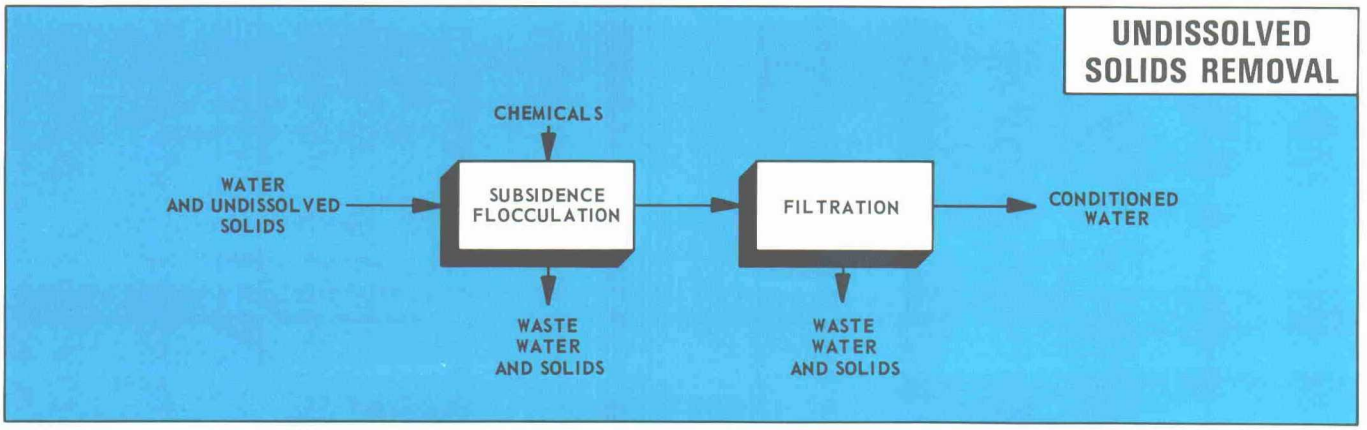
OIL REMOVAL



DISSOLVED SOLIDS REMOVAL



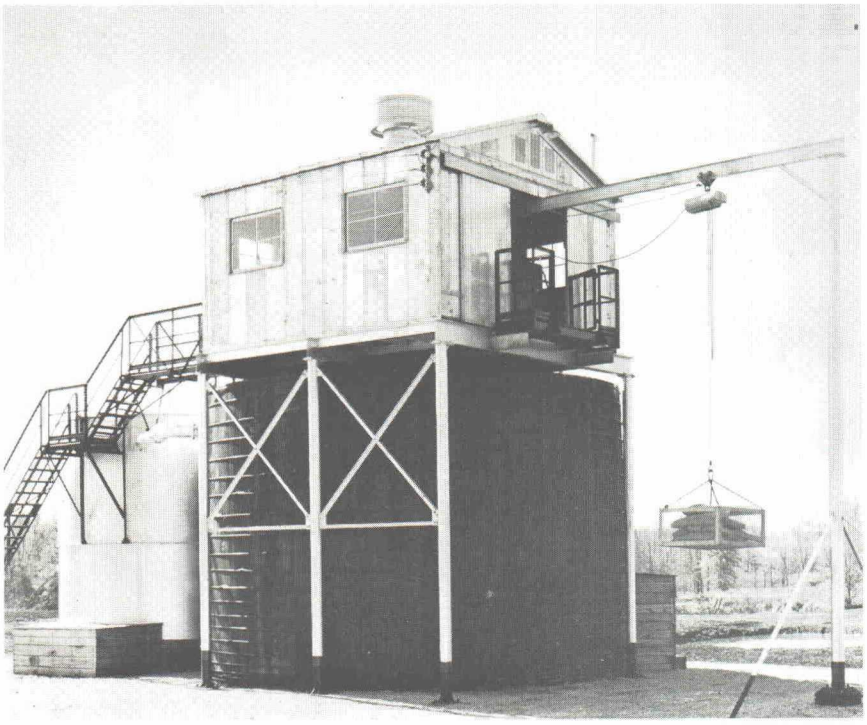
UNDISSOLVED SOLIDS REMOVAL



STABILIZATION AND CLARIFICATION TANKS

National Stabilization and Clarification systems are used for two basic situations. They are designed (1) to purify water to use and for (2) treatment of contaminated or 'dirty' water before discharge from a plant.

The process of water purification is done in three steps in sequence. These are (a) rapid and vigorous mixing of the required additive chemicals, (b) gentle motion for floc formation, and (c) a quiet zone for settlement of solids. The floc coagulation is the vehicle for removal of the suspended and precipitated solids.



24′ x 16′ "National" Stabilization and Clarification System designed in a Redwood Tank for extremely corrosive water. Two dry chemicals are automatically fed within the externally supported process control and chemical storage building. Purified water surge tank is located beside the processing system. This entire system was designed and constructed by National Tank Company.

The process is completed in a short time due to the "up-flow" principle. A portion of the preformed precipitants are recirculated into the mixing zone. This has a "seeding" action which accelerates the precipitation of certain mineral salts, and subsequent coagulation.

The National Water Stabilizer and Clarifier has wide flexibility. The rate of mixing and circulation is varied to meet the specific need by an adjustable speed control. The slurry pool level is controlled automatically by regulating the sludge draw-off rate. Flow rates can be constant or regulated to variable rates, depending on specific need.

MATERIALS

The internal baffles, mechanisms, and other parts of the National Water Stabilizer and Clarifier are available in a variety of materials and finishes. These include steel which is painted, plastic coated, or hot dipped galvanized after fabrication. The internals are available for installation in the customer's wood, steel, or concrete tanks. National offers complete installations in tanks furnished in wood, welded steel, or bolted steel construction.

Hot dipped galvanized bolted steel tanks are recommended for long life and minimum maintenance. National recommends Redwood tanks with plastic coated internals for the most corrosive applications.

SUSPENDED SOLIDS REMOVAL

If aeration and retention time are not sufficient to remove dissolved solids and stabilize the water under treatment, **it is necessary to add chemical.**

Chemical treatment is best accomplished in a tank. Rapid and thorough mixing of chemical with the raw water is essential.

To follow the flow: The raw water is introduced into a central flume or the **primary mixing zone** which houses an impeller, which serves as a pump and a mixer. The flume is contained inside a hood which serves to separate the zone of clear water from the zone of slurry.

The impeller is driven by a **variable speed drive** and circulates the slurry through the flume at a rate of several volumes to every volume of raw water.

After intimate contact of the raw water with the slurry in the flume, it travels into the **secondary zone** (the annulus between the flume and hood) in a downward path and at a reduced velocity, where precipitation and agglomeration of particles takes place.

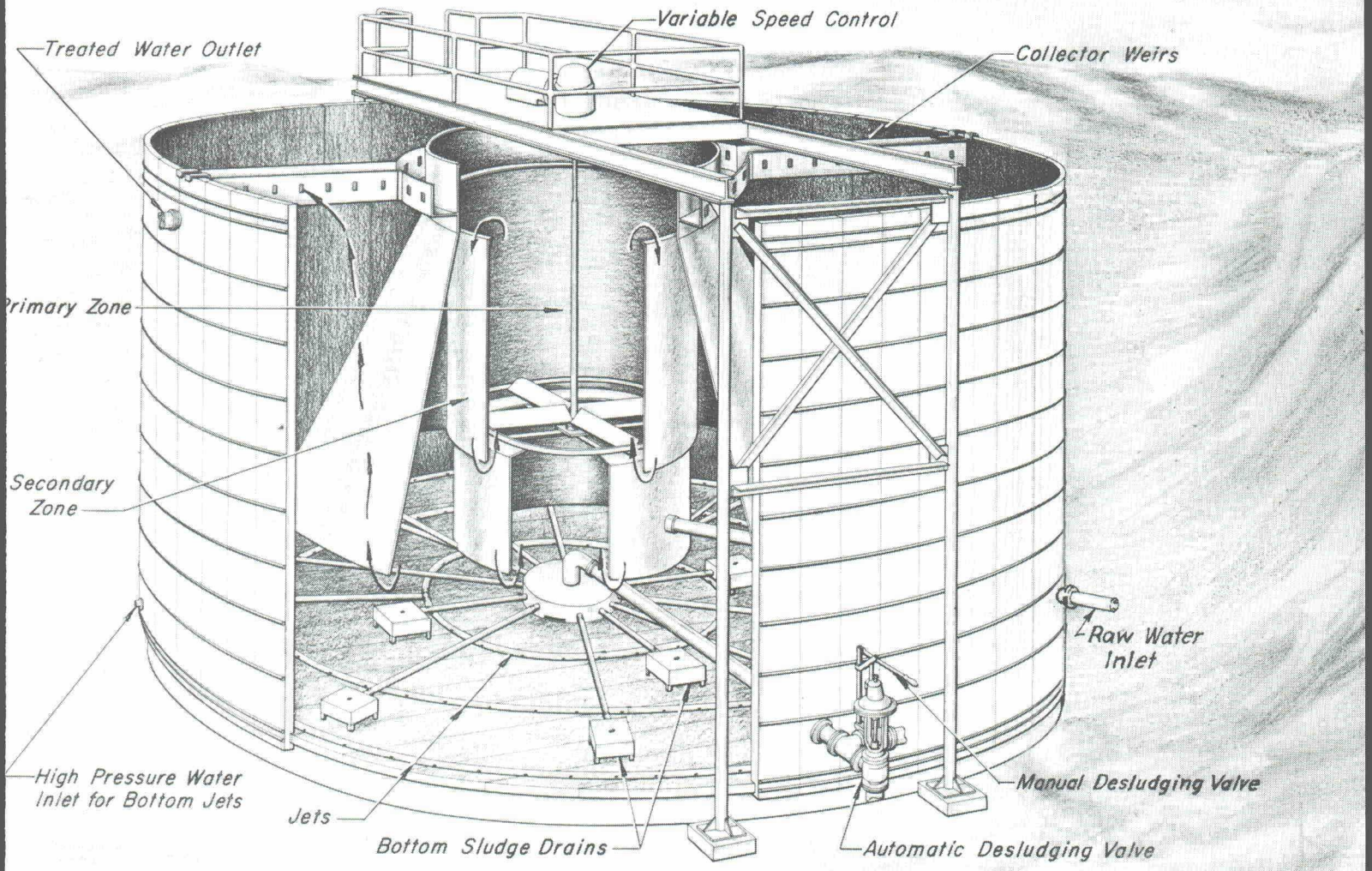
The heavier or larger particles settle to the bottom and are drawn off automatically through the anti-channel drain boxes. **(A feature of the National Unit.)**

The slurry that was not used in the agglomeration or accretion process is circulated to be used again.

The addition of certain chemicals will cause undesirable solids to precipitate and be removed. The analysis of the water will determine what chemical to use. In the process a certain amount of chemical is used so additional chemical is added to the primary zone to compensate for that used.

The treated water travels under and around the hood into an area of reduced velocity permitting any particles in the stream to settle out. The result is a stabilized clear water being drawn off to the filters.

In a tank is the best way
- Rapid mix
- Gentle motion floc formation
- Quiet zone for solid settling



This cutaway view of a National Stabilization and Clarification system shows the various features of the unit, and the flow path of the water.

RAPID FILTERS
GRADED BED TYPE OR POROUS PLATE TYPE

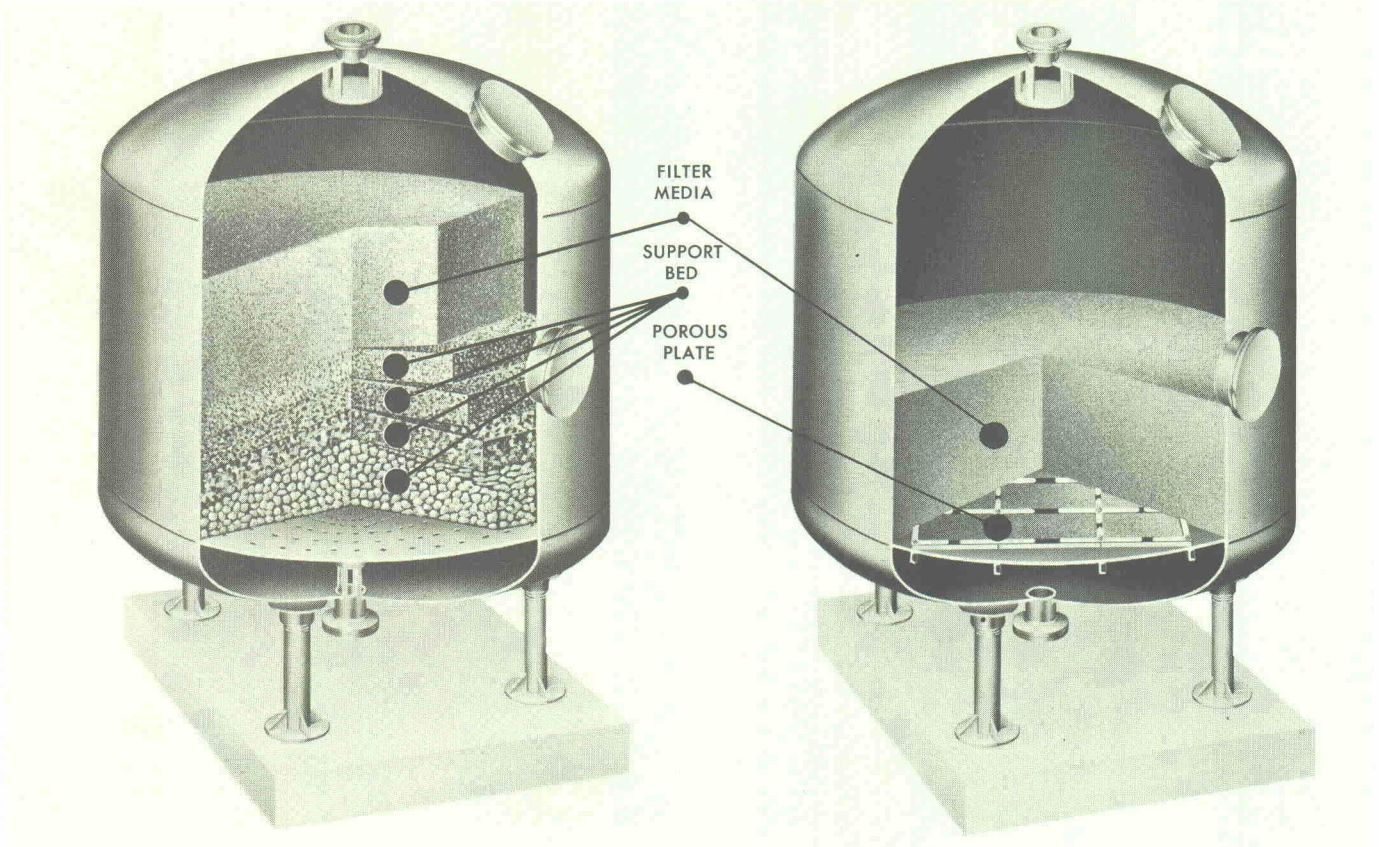
CAPACITY: Filtration capacity of Rapid Mechanical type filters (either type shown) is affected by fineness of top layer filter bed media, and porosity of filter cake collected on the bed. Supporting Structures merely support the filter-media beds and neither one affects the capacity of the filter. The capacity is the same in either type with comparable filter-media and operating conditions.

PRESSURE DROP: Within the operational capacities of either type filter, the pressure drop thru clean filters after backwash cycle is less than six (6) inches of water. Pressure drop increases with fineness of top layer of filter bed media and filter cake deposition. Essentially the same in either type.

BACKWASH RATES: Backwash rates should be ample to expand the fine media section by at least fifty (50) per cent. Supporting structures or media are not disturbed at such rates. The same for either type when the filter-media is the same material.

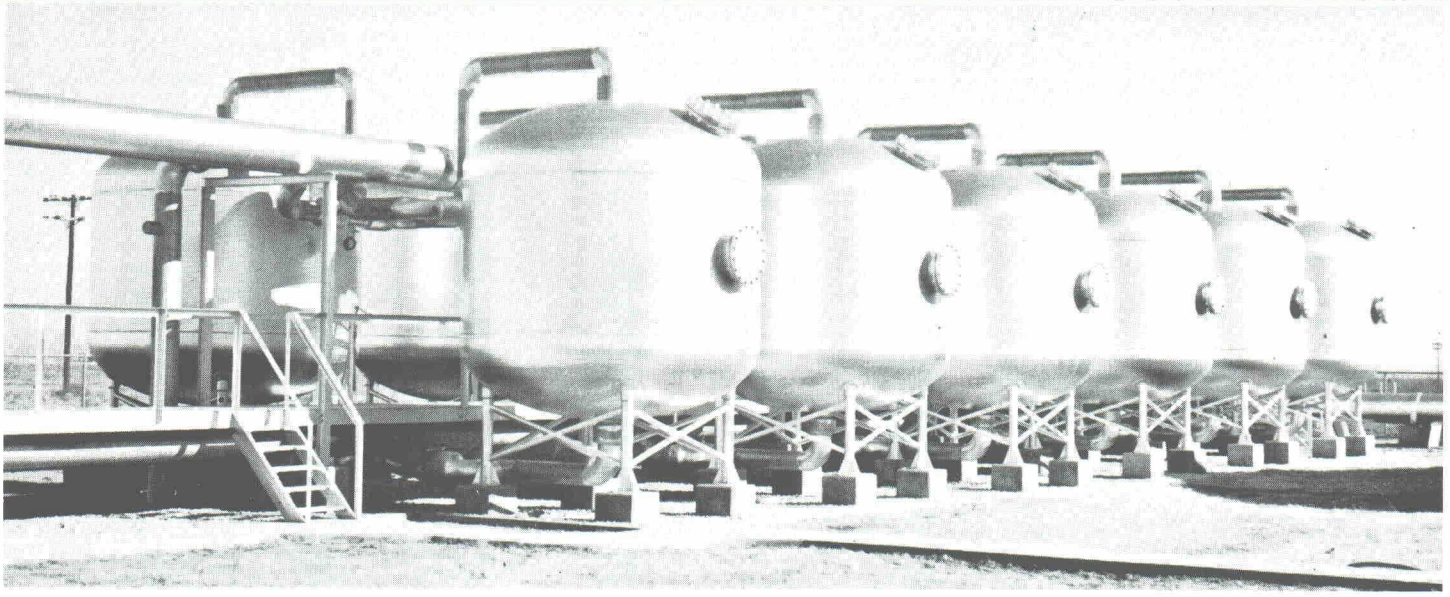
QUALITY OF FILTERED WATER: Quality of water is associated with filtering ability. Filtering ability has to do with fineness of top layer filter bed media and porosity of filter cake. The finer the media, the better the quality of water. Supporting beds have no measurable effect on the quality of water. The same thru either unit when using same filter-media.

ECONOMICS OF THE TWO TYPES: This is best determined after knowing the type media to be used. The permeable bed plate type filter (Illustration Right) can be fabricated with a shorter overall vessel height. If this is of prime importance then that is the controlling factor and not the related media costs. Usually, the first costs and upkeep of the graded bed type are less.

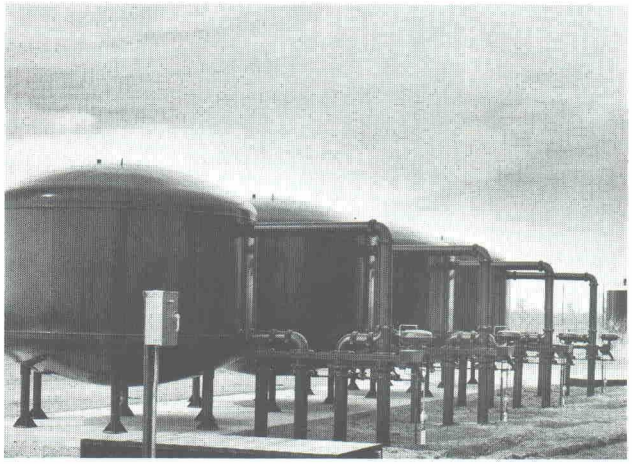


Cutaway views of the two common types of National Mechanical Pressure Filters show the graded support bed and the alternate fused porous aluminum oxide support. Alternate inlet and outlet connection locations are available to fit the customers' requirements.

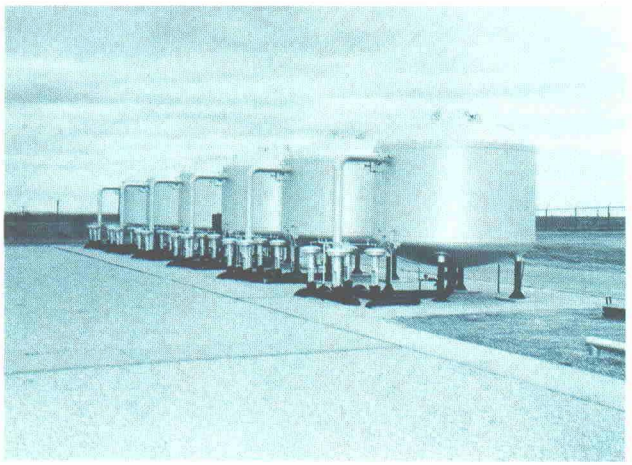
SUSPENDED SOLIDS REMOVAL



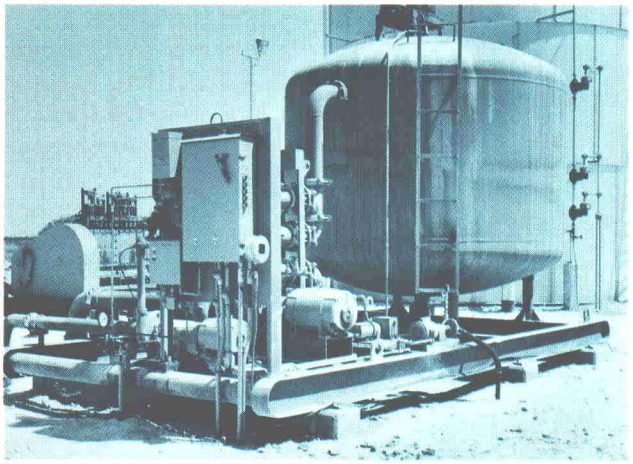
Special National Tank Company filtration system. 12 — 10′ x 5′ Mechanical Pressure Filters constructed to 200 psig Code Working Pressure. Other special working pressures available.



4 — 12′ x 5′ 40 psi ASME Code Filters with four valve automatic filter manifolds.



6 — 10′ x 5′ 40 psi filters with anodes and singly operated diaphragm butterfly valves in an automated filter manifold.



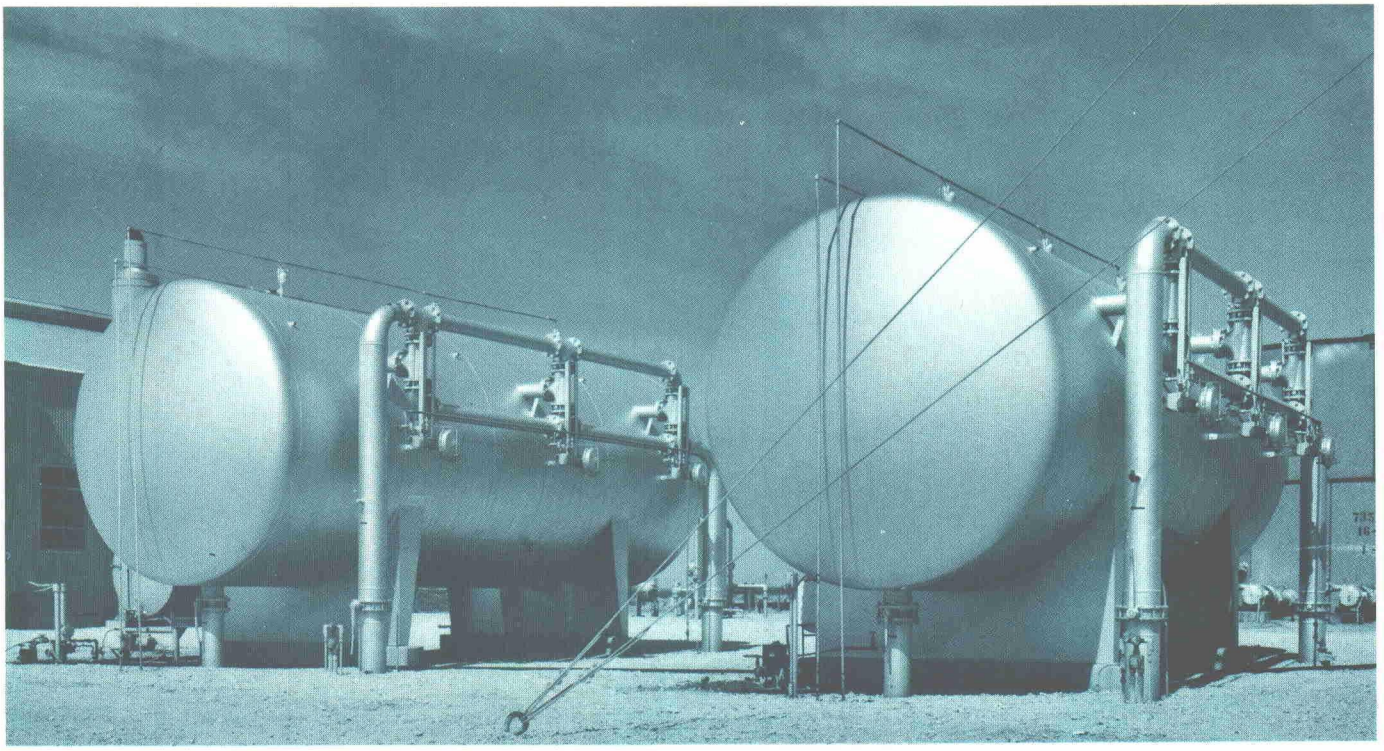
10′ x 5′ 40 psi W.P. fully automated filter skid with feed and backwash pumps, coagulant and detergent feeder, and automated mechanical rake.

National Mechanical Pressure Filters are available in diameters from 2 to 12 feet.

Many standard and special working pressures are offered. Code construction is available on order.

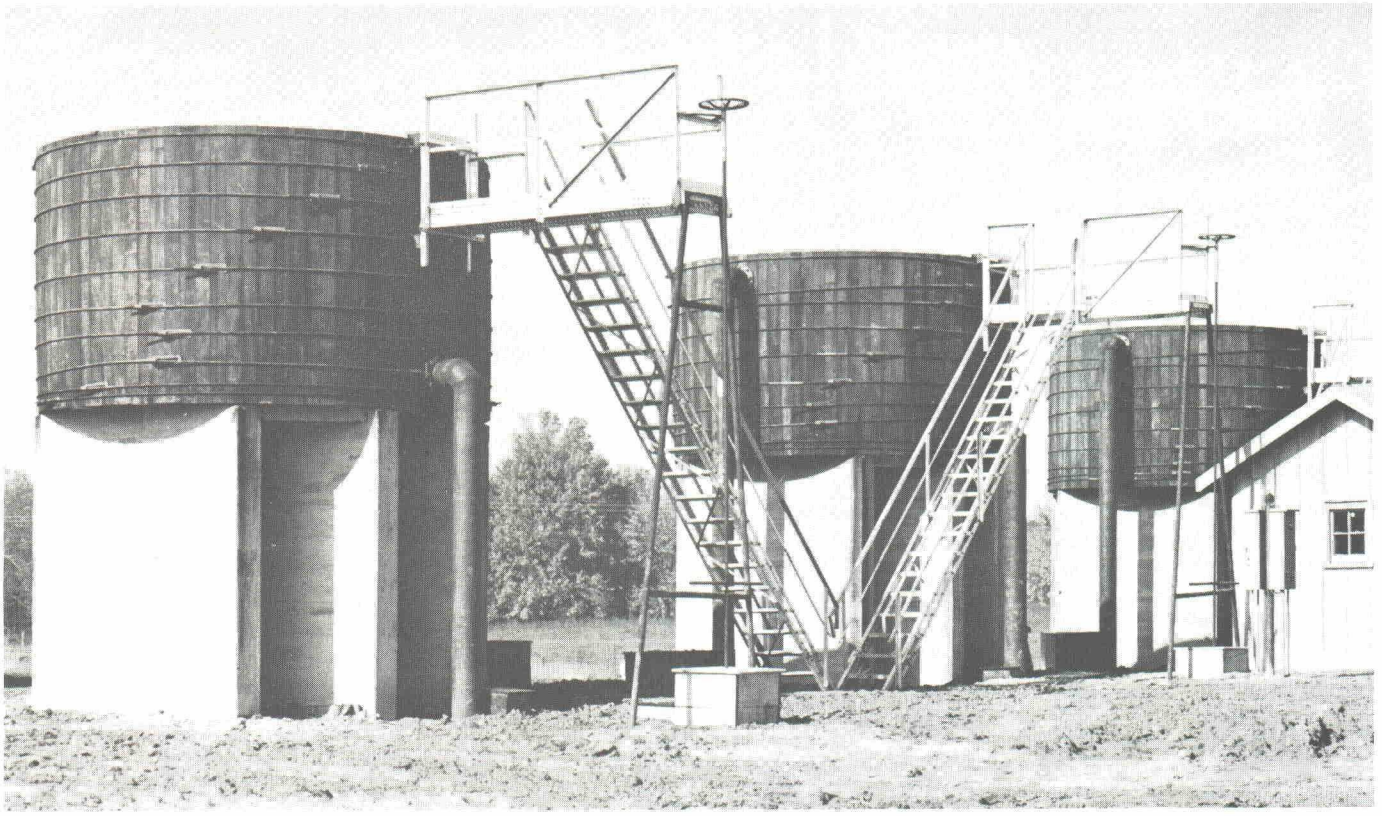
Various combinations of inlet and outlet locations are offered to suit the installation requirements.

SUSPENDED SOLIDS REMOVAL



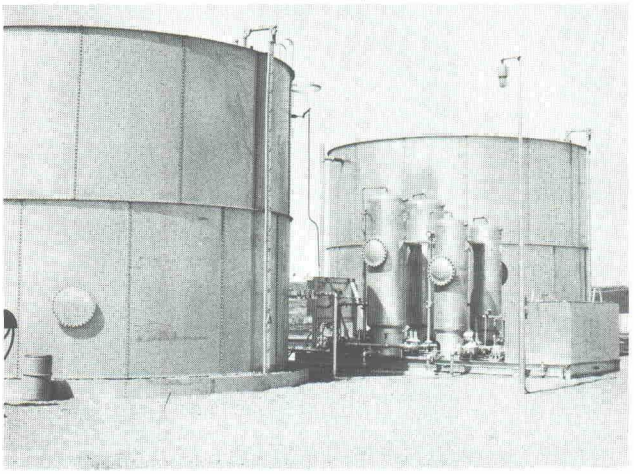
2 — 10′ x 25′, 3 compartment horizontal multicell filter vessels with automated filter manifolds.

REDWOOD GRAVITY FILTERS



3 — 14′ x 10′ Redwood Gravity Mechanical Filters are elevated to give the required discharge pressure head. The complete internals are of Redwood or epoxy coated steel to eliminate the effects of extremely corrosive water.

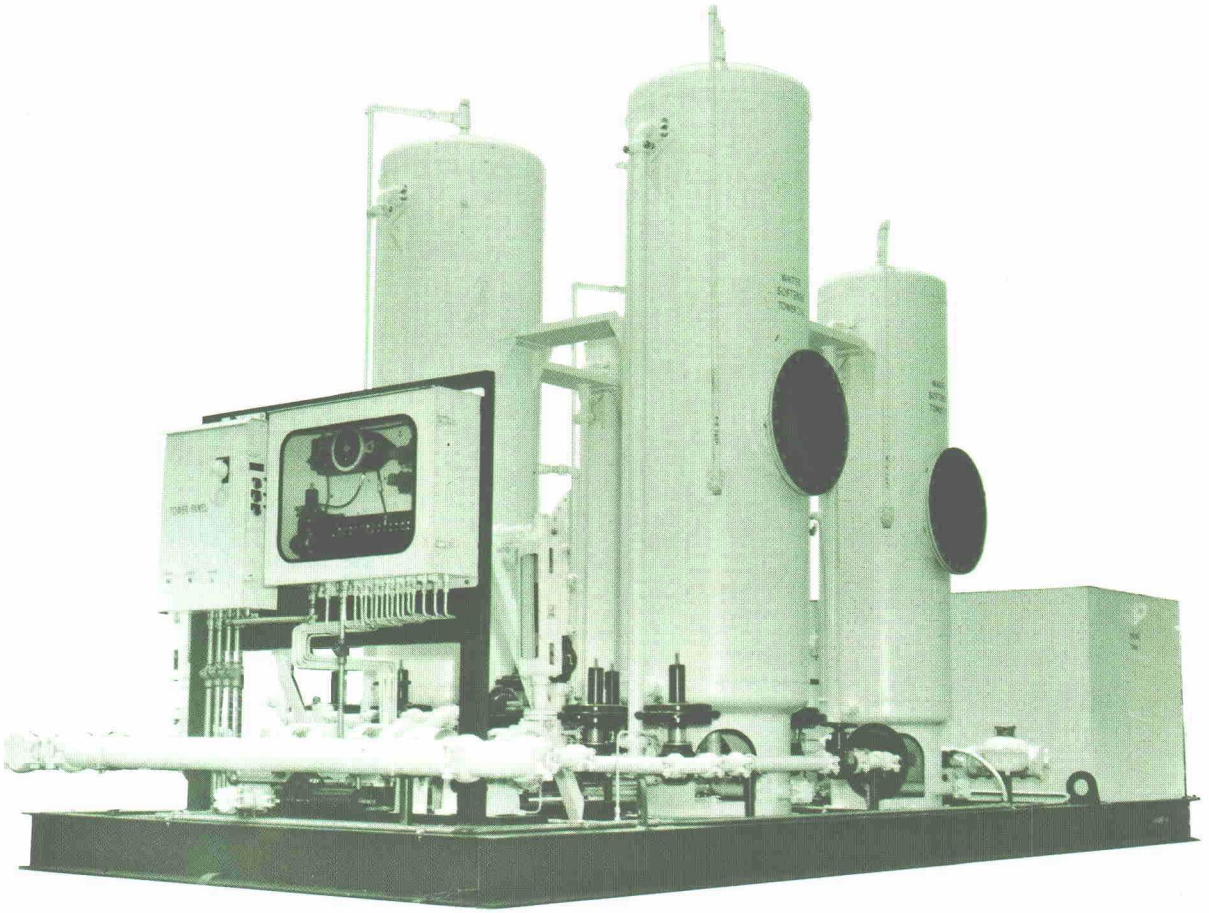
ION EXCHANGE SYSTEMS



INTRODUCTION

National Tank Company Ion Exchange Systems were developed to fill the need for small portable water purification stations. These systems have been highly successful for applications such as feedwater softening for steam generators and other boiler equipment.

This Ion Exchange System is a sodium zeolite cation exchange type consisting of four exchange towers, a brine tank, control panel, valving, pumps, etc., mounted on a pre-piped skid for ease of installation and portability. Each pair of exchange towers operates independently permitting regeneration of one pair without interrupting the inservice cycle of the other pair. The use of two series connected towers takes advantage of the higher regenerated capacity of the resin within the downstream tower, thus we have a primary softener and a polishing softener.



ION EXCHANGE SYSTEMS

OPERATION SEQUENCE

The Ion Exchange System operation sequence may be followed in the illustrations below. The large flow diagram shows complete hookup and components in the system. The green arrows indicate flow sequence with towers 1A and 1B on stream to provide softened water. The blue arrows show the flow sequence when towers 2A and 2B are in the regeneration cycle. In the Ion Exchange System there are eight steps in the flow sequence as described in the following.

#1 This is the normal flow pattern when the towers are in the process of converting raw water to softened water to feed the steam generator.

#2 After a period of operation the towers must be regenerated. The first step in this process is to backwash the primary tower by reversing the flow and passing the water upward through the bed. This loosens, expands, and regrades the bed.

#3 The next step is to backwash the polishing tower in the same manner.

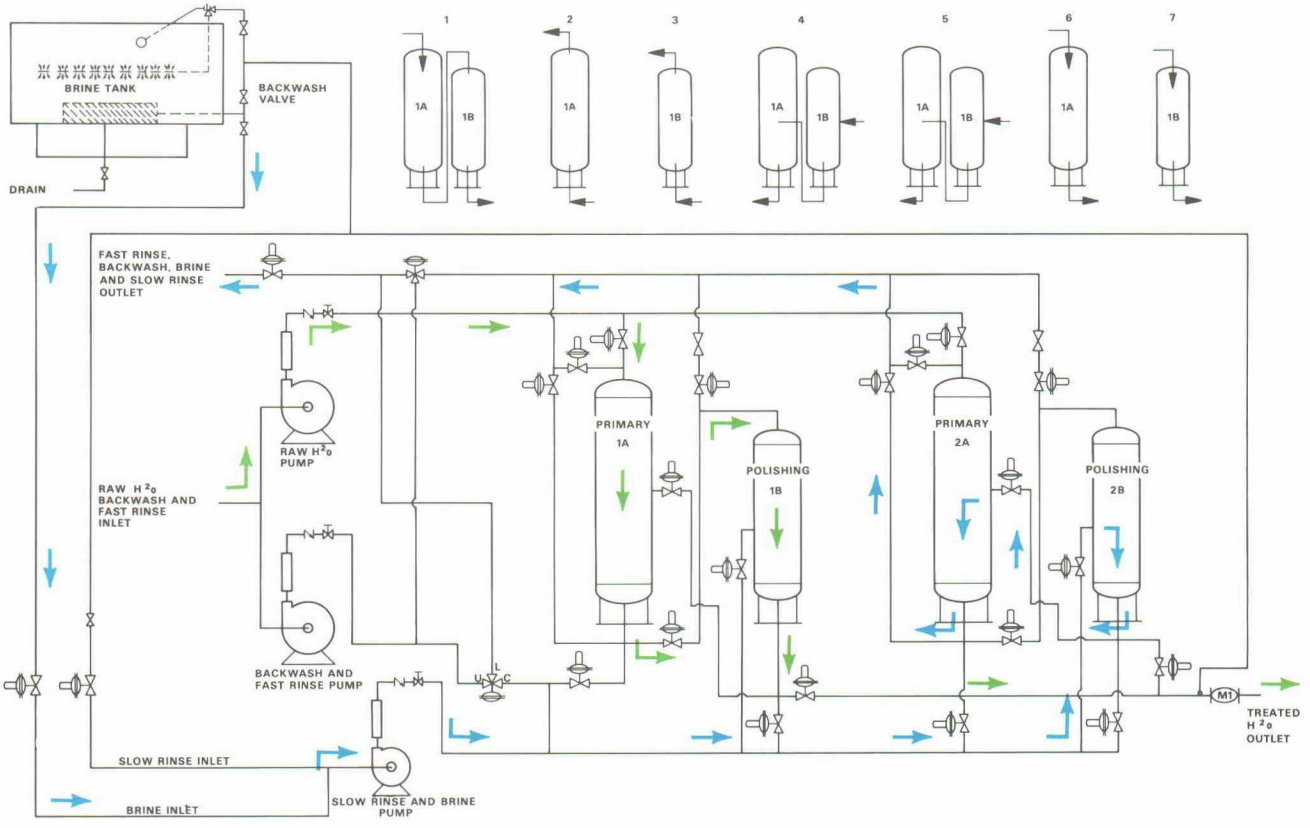
#4 The brine is now passed through the beds to replenish the sodium ion content of the bed.

#5 Softened water is now run slowly through the towers gradually flushing and diluting the brine.

#6 Raw or softened water is now applied to the primary tower in a downflow rinse to remove excess brine and repack or settle the resin bed.

#7 The polishing tower is now downflow rinsed in the same manner.

#8 Regeneration is now complete and the primary and polishing towers are shut down and held in standby until the other pair of towers have exhausted their sodium supply, at which time the regenerated towers take over.



FORCED DRAFT AERATORS, DEGASIFIERS

Aerators are used for two general purposes. One is to rid water of **undesirable** dissolved gases. These include hydrogen sulfide and carbon dioxide. Beside the chemical benefits, it serves to remove noxious odors and taste. The other use is to speed the oxidation and subsequent removal by precipitation of iron and manganese. This is the result of intimate mixing of excess oxygen with the water.

National Aerators are available in any size to meet a specific requirement!!!

National Aerators operate by flowing water to the top distributor tray. This tray divides the water into small trickles of water falling downward or countercurrent to the updraft of air. The air disperses the water into fine droplets which gives intimate contact with the excess of air. The droplets hit a splash tray which starts the process anew. This process is repeated several times over.

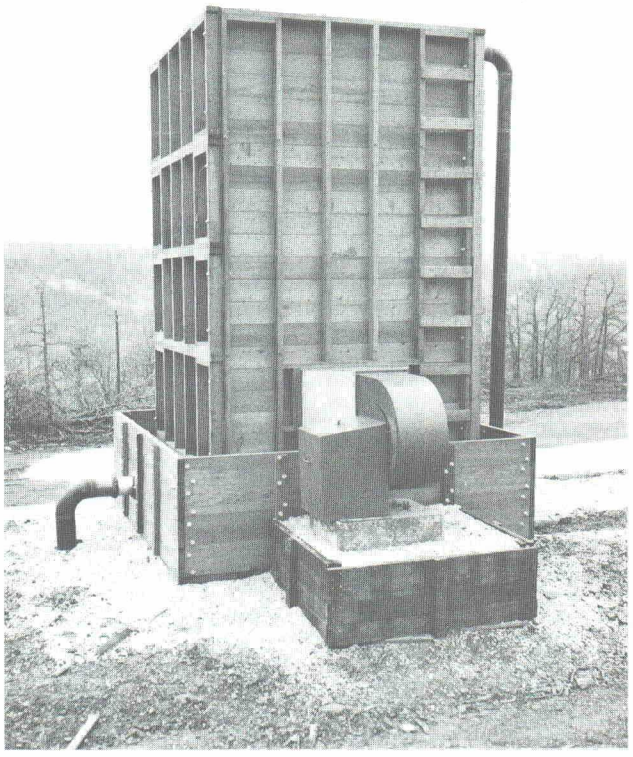
Air is blown into the aerator at the bottom and flows upward and out of the top. Any foreign gases are discharged with the air. The volume of air can always be controlled, by proper size and speed of the blower.

National Forced Draft Aerators are fabricated from Redwood and are furnished with corrosion resistant hardware. The splash trays are available in Redwood or Porcelainized steel. The coated steel trays are stronger, easier to clean, and extremely resistant to breakage during cleaning, but somewhat higher in cost.

The blower is a heavy duty industrial type designed for continuous duty. It is coated with a coal tar epoxy to resist corrosive atmospheres.

National Aerators are available in metals such as aluminum and steel instead of Redwood if desired.

All Aerators are prefabricated and ready for field assembly. The trays are easily removed for cleaning.



Typical National Redwood Forced Draft Aerator. Note weather shielded blower motor, and Redwood basin for liquid seal, water collection and withdrawal.

Small National Redwood Forced Draft Aerator with side panel removed. Note the Splash Baffles which slide out for ease of cleaning.

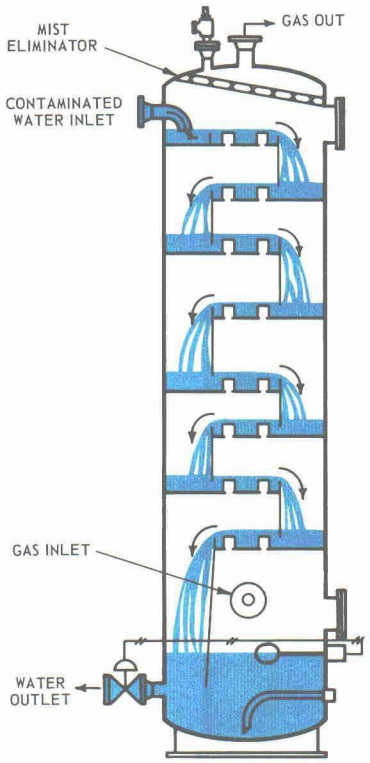
DESORPTION UNITS FOR NOXIOUS GAS REMOVAL

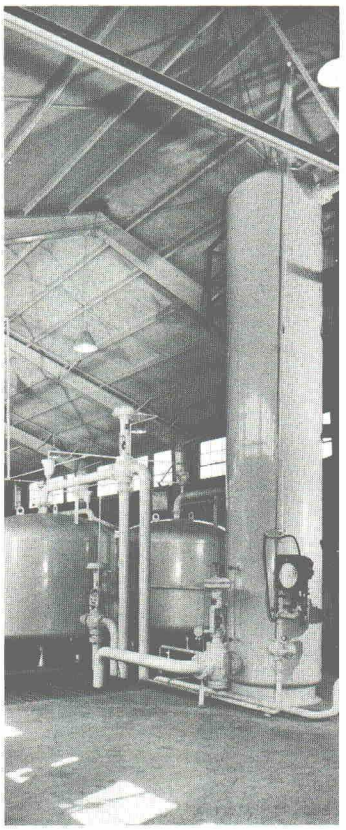
STRIPPING TOWER FOR OXYGEN REMOVAL

Many processes require oxygen-free water. National Tank Company has fully developed several deaerator vessels for this application.

Oxygen content in water can be reduced to 0.5 ppm by using natural gas or an inert gas stripping effect in a tray type tower, counterflowed with the water. This unit is simple to operate and has lowest initial cost.

Chemical scavenging with sodium sulfite or hydrazine will provide oxygen free water.





National Deaerator utilizing natural gas to strip oxygen from water.

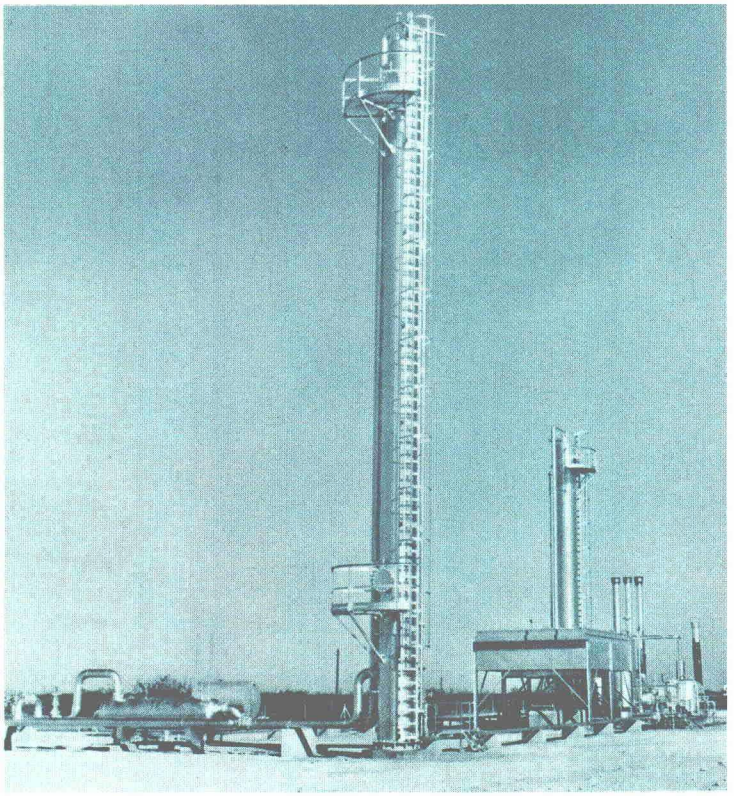
STRIPPING TOWER FOR HYDROGEN SULFIDE REMOVAL

A unique application of the stripping gas (or desorption) phenomena was utilized to remove hydrogen sulfide gas from water solution for a West Texas oilfield requirement.

A "sweetened" methane gas stream was used to effect the water stripping effect in lieu of oxygen. It minimized corrosion and maintained a closed system. Hydrogen sulfide content above 300 ppm was reduced to less than 5 ppm in this process.

Alloy tray parts, plus full vessel internal corrosion-resistant coating of carbon steel water-wetted surface was furnished as part of the system.

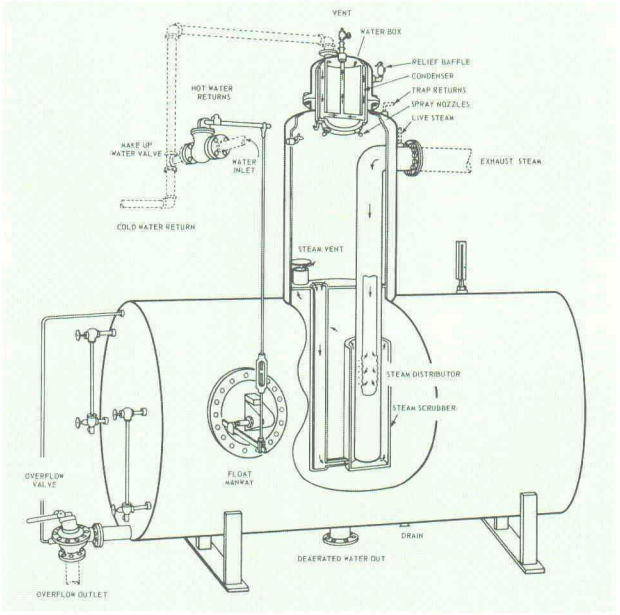
Chemical scavenging with chlorine can replace the hydrogen sulfide content to zero ppm.

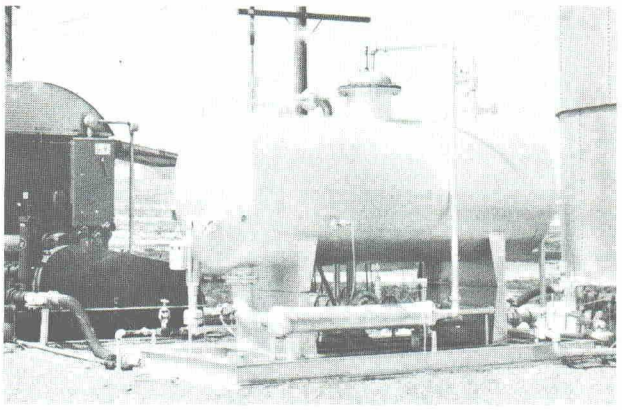


DESORPTION UNITS FOR NOXIOUS GAS REMOVAL

SPRAY TYPE DEAERATING HEATER

Also for noxious gas removal, National Tank Company offers a spray type deaerating heater. Water temperature is raised by intimate contact with steam. The initial heating reduces the gas content below 0.3 ml/liter. The final scrubbing reduces the gas content to 0.005 ml/liter or less. Carbon dioxide methane, and nitrogen are removed along with oxygen, and a closed system is maintained. This type of equipment is most economic if waste steam heat is available in sufficient quantities.



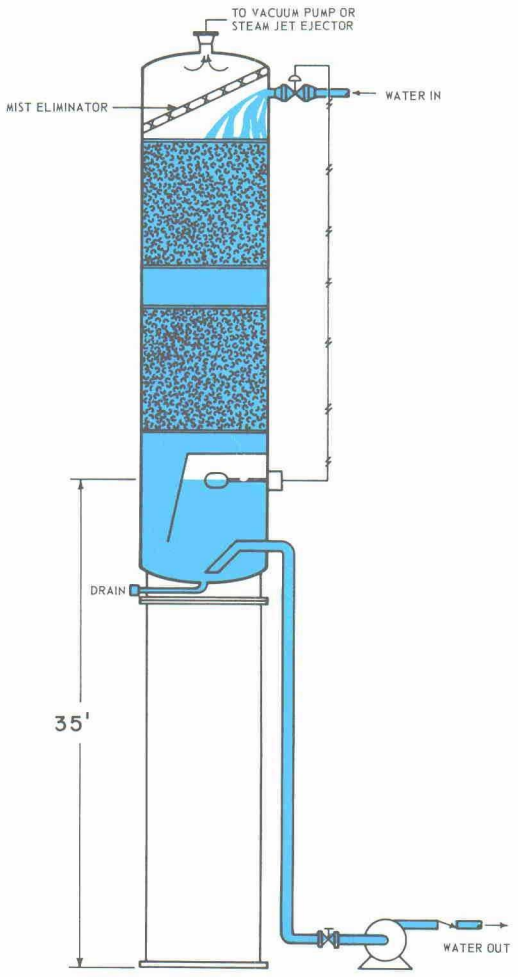


VACUUM TOWER SYSTEM

Processes requiring oxygen-free water where no stripping gas or waste steam heat is available can be supplied by utilizing an evacuated type deaerating vessel. Oxygen content is lowered to less than 0.5 ppm by reducing the internal "atmosphere" of the vessel, in which water is passed downward over an arrangement of packing to provide a continuous cycle of thin surfaces.

A vacuum pump, or steam jet ejector reduces the vessel's internal atmosphere to within a few-hundredths mm Hg of the vaporization point of the water bath, depending upon water temperature, to effect solution gas removal.

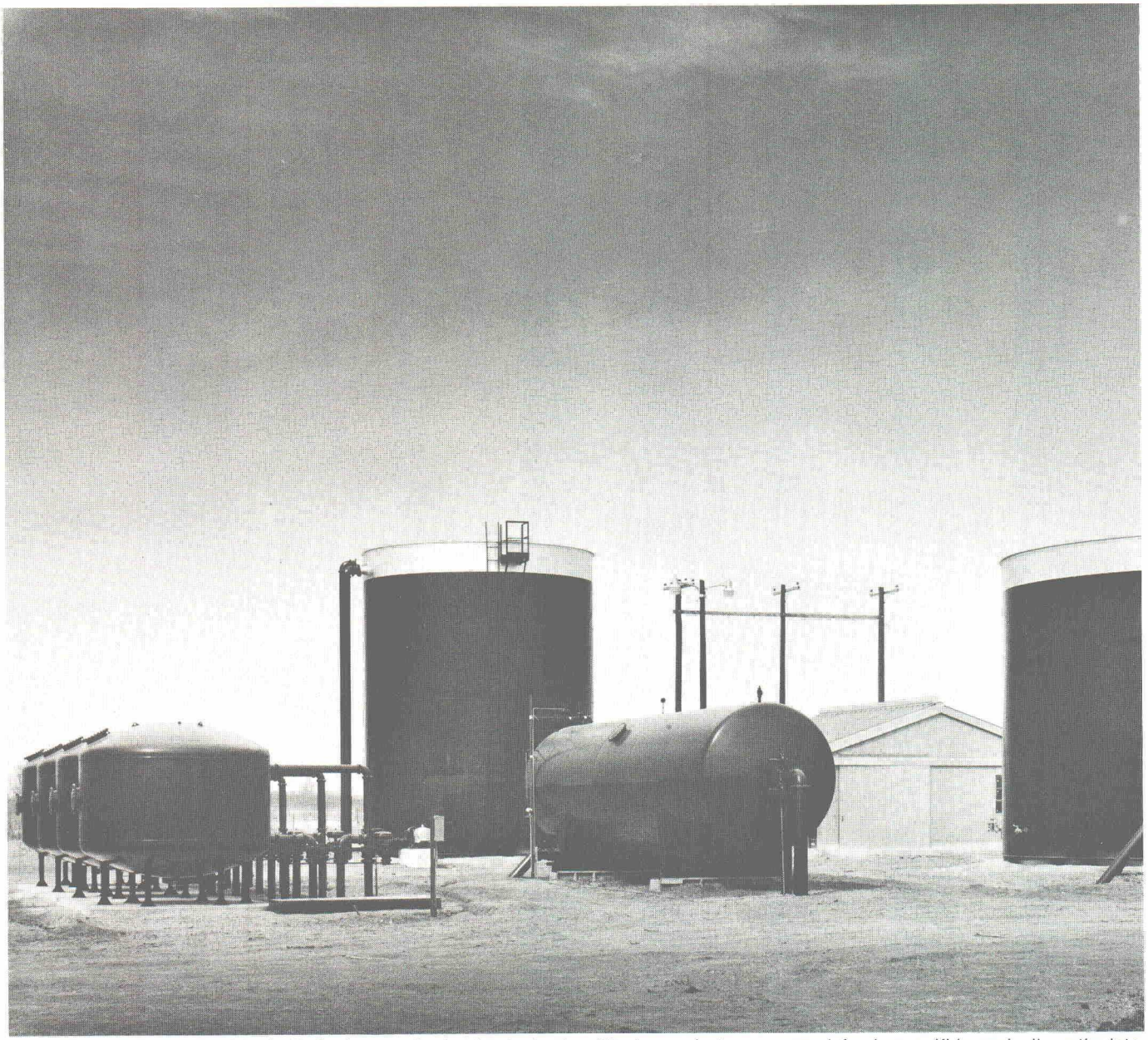
The evacuated type deaerating vessel requires elevation of the vessel a minimum of 35 feet to provide NPSH for pump withdrawal from the tower. This element plus the vacuum pump component makes the evacuated system slightly more costly and more complicated to operate than a stripping gas system.



OIL REMOVAL

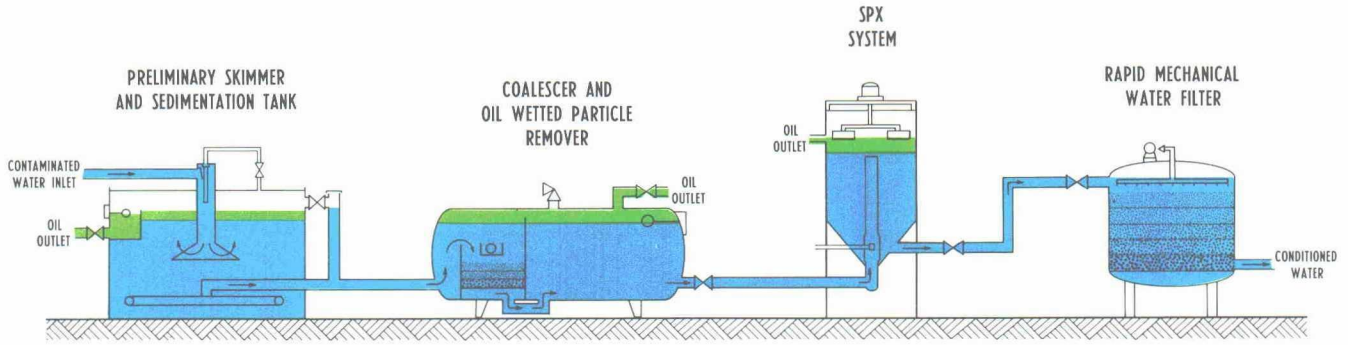
National Tank Company offers a complete family of oil removal systems to meet the continually increasing demand for clean unpolluted water by the oil production industry. The following illustrates many of these systems and shows the versatility obtained by multiple component arrangements. Due to the widely varying degrees of oil contaminated input waters and the required contamination reduction for disposal or reuse, each system must be individually selected to meet its specific requirements.

On the following pages each of the individual components are described and illustrated in detail. These components represent the latest state of the art in National's never ending water pollution research. For your next water treating problem ask your National man to assist you in the TOTAL EQUIPMENT COMPLEX that is necessary to provide effluent water fitting your requirements.

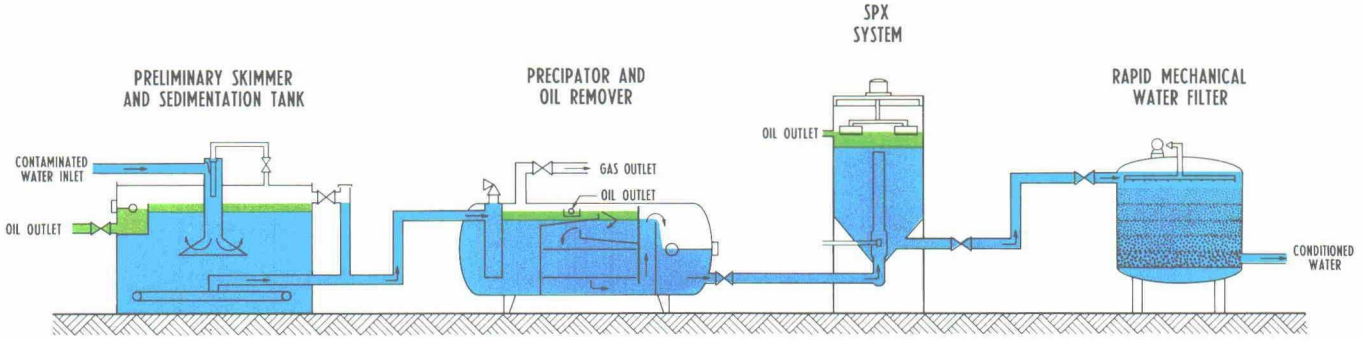


This installation depicts Multicell Coalescer, final skim tank plus filtering and storage vessel for iron sulfide and oil particulate removal.

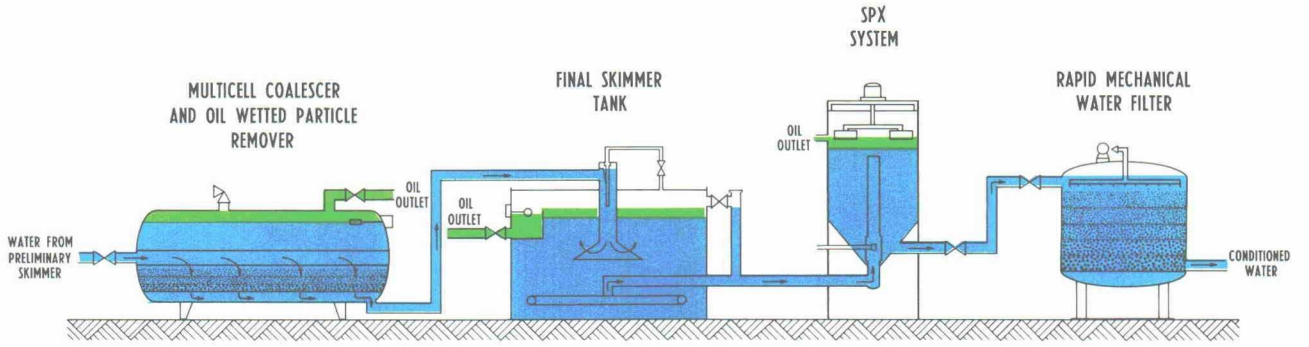
OIL REMOVAL



This equipment arrangement is suggested for removing suspended oil particulates from waters containing suspended (and oil wetted) solids such as iron sulfide or sand. The dual-compartment coalescer design illustrated is limited to throughout rates through 15,000 BPD.

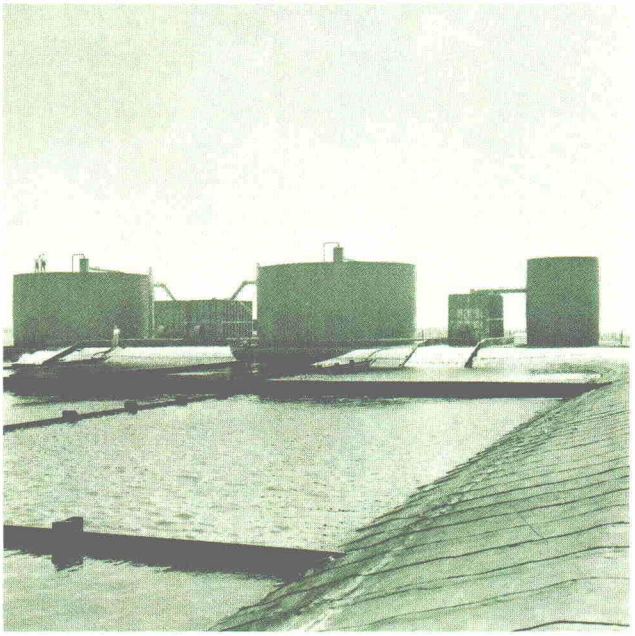


This equipment arrangement is suggested for removing suspended oil particulates from waters containing **no suspended solids or has any scale forming tendencies.** Each piece of equipment illustrated may be optional, depending upon the nature of suspended oil content in the raw water stream **and** the desired level of suspended oil content in the total system effluent.



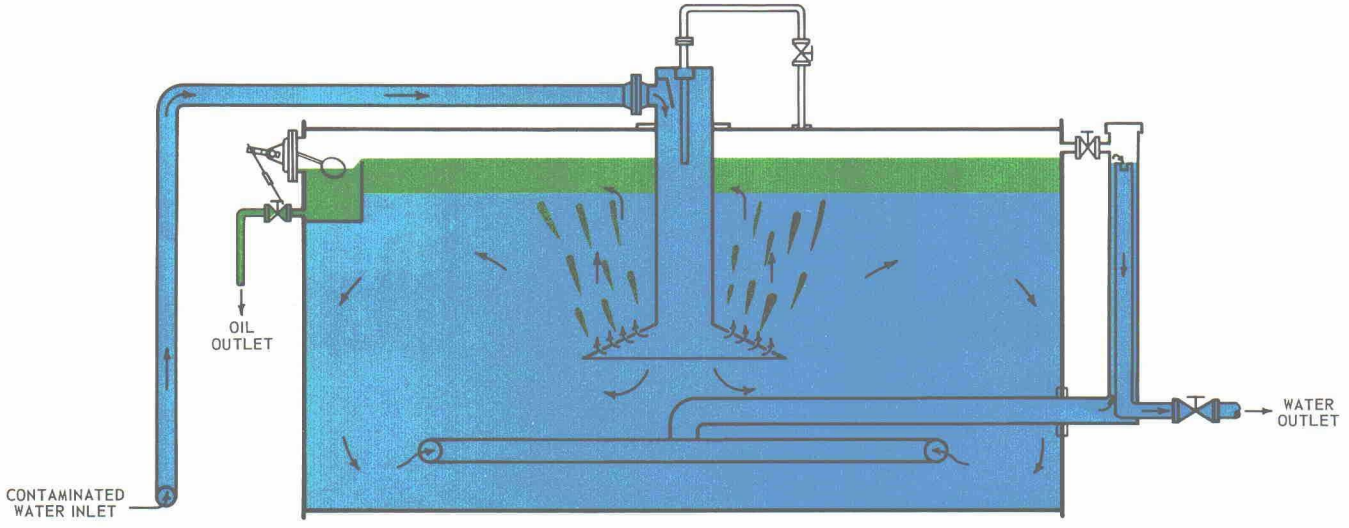
Here a repeat of the coalescer vessel equipment arrangement is illustrated for throughout rates above 15,000 BPD. These higher rates require the utilization of two separate vessels in coalescing and skimming normally provided in a single vessel at lower rates. See photo on preceding page . . .

SKIMMER AND SEDIMENTATION TANK



National Tank Company offers Skimmer and Sedimentation Tanks made of wood or metal, for closed treating systems. Water enters the vessel at the top and travels down an enlarged flume where solids settle out and free oil rises to the top to be skimmed off. Clean water is drawn from the vessel by way of an outside siphon.

The Skimmer and Sedimentation Tank is normally used upstream from other oil removal equipment to eliminate the bulk of free oil and sedimentation. Input water may be chemically treated to speed separation. These units are available in a large range of sizes.

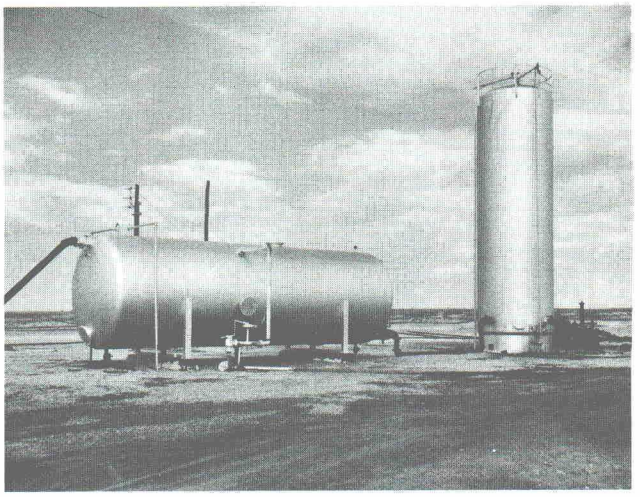


PRECIPITATOR AND OIL REMOVER

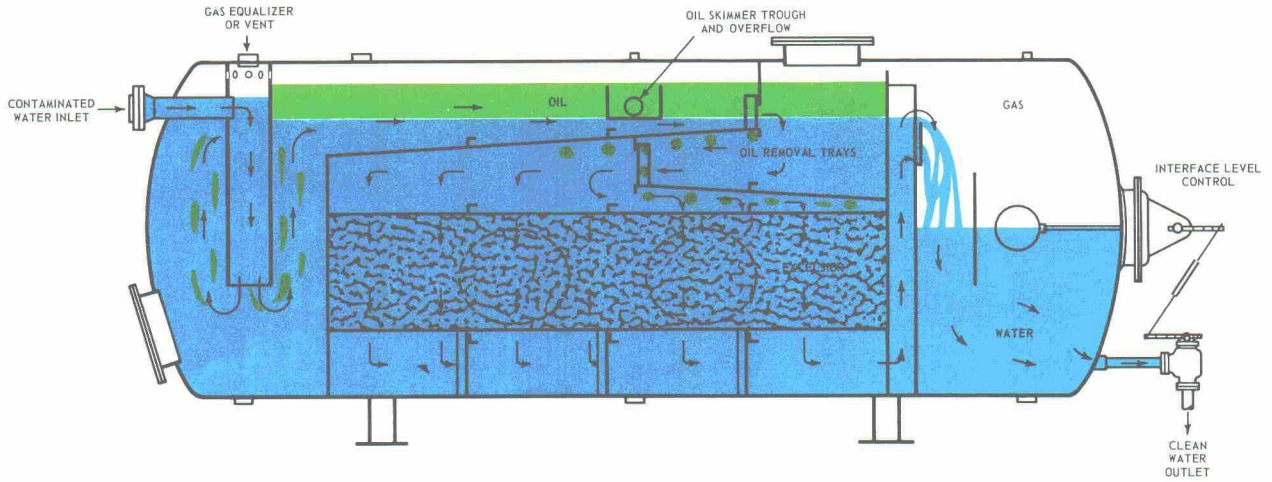
The NATIONAL HORIZONTAL PRECIPITATOR AND OIL REMOVER is used where a large volume of water is to be handled and precipitants are not present, in a closed system.

Water is introduced through a flume downward into an enlarged section where velocity is greatly reduced. Any free oil rises to the top of the vessel. The water then travels through an excelsior section where minute suspended oil particles are coalesced. This oil rises to the skimming section and is drawn off. The water travels to a surge chamber and out to a pressure accumulator tank.

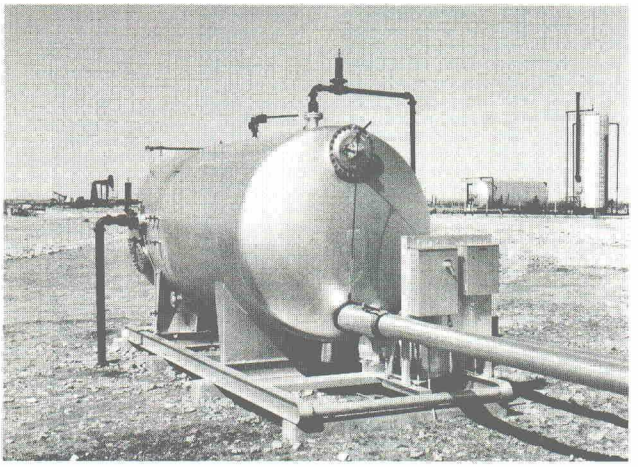
Skimming alone will not properly condition water. Coalescing is required for complete removal of minute oil particles, which is successfully accomplished in this unit. These units are available in a large range of capacities and sizes.

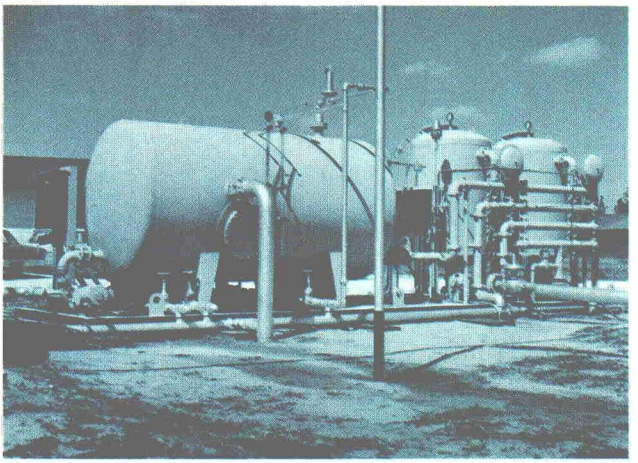


This closed salt water injection system operates unattended, automatically. The 10' x 30' horizontal precipitator and oil remover receives production from a "watered out" well and cleans it of recoverable crude. The 10' x 30' vertical pressure storage accumulator is equipped with necessary float equipment to automatically operate the triplex injection pump.



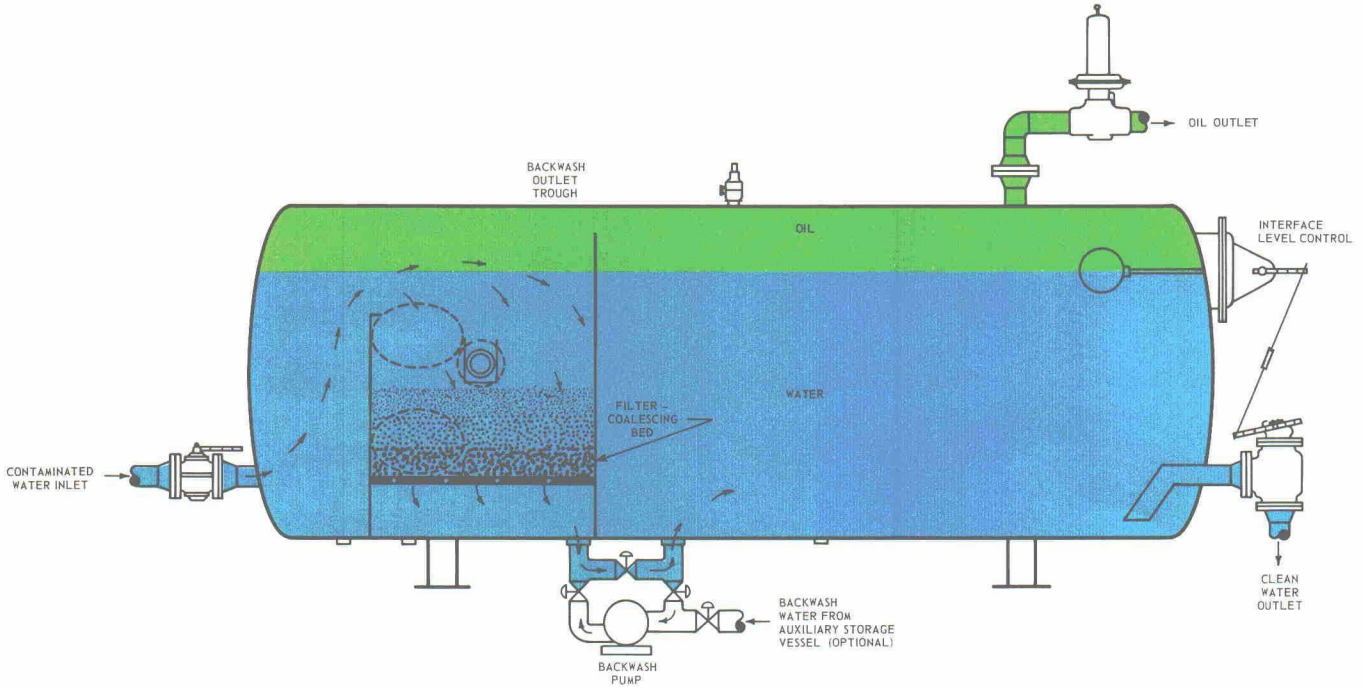
COALESCER AND OIL WETTED PARTICLE REMOVER



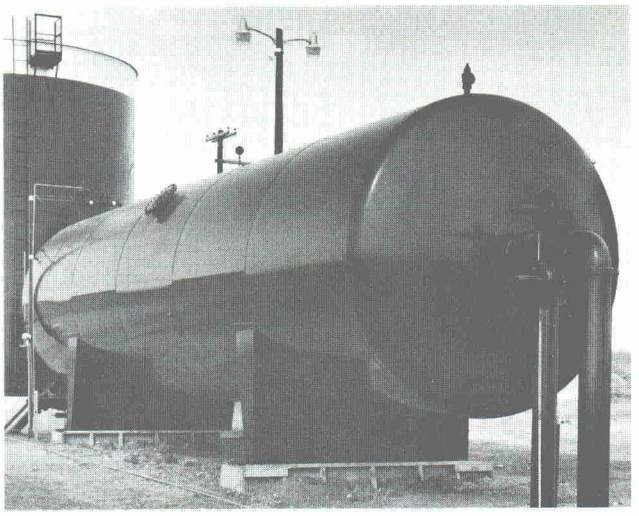


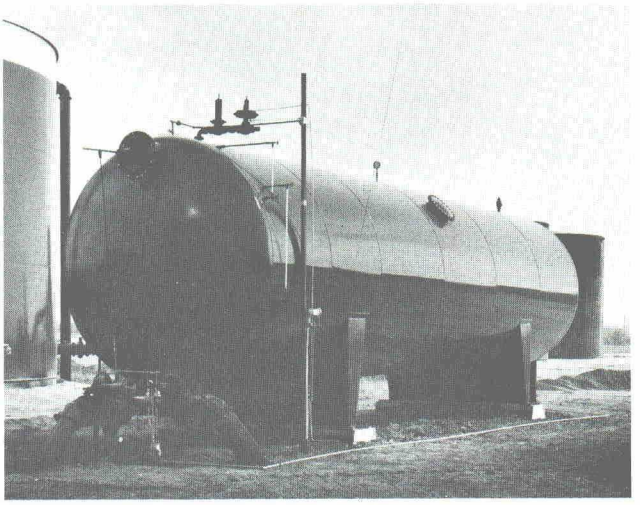
The National Coalescer and Oil Wetted Particle Remover is recommended where the water contains oil wetted particles such as iron sulphide. Packed excelsior sections will become rapidly plugged by oil wetted particles.

Water is introduced into the vessels at a preliminary setting section where heavier solids fall out and free oil rises to the top of the vessel. The water then travels through a graded filter bed where oil wetted particles are filtered out and finely dispersed oil particles are coalesced to particle size sufficient to rise out of the water to be skimmed. After filtering, the water passes to the final settling and surge section of the vessel. These vessels are offered in several sizes up to 15,000 BPD capacity.



MULTICELL COALESCER AND OIL WETTED PARTICLE REMOVER

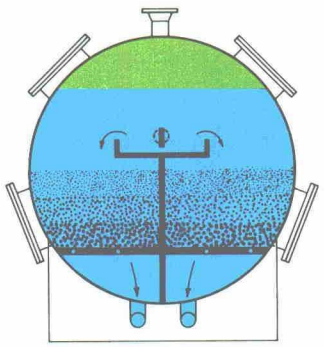


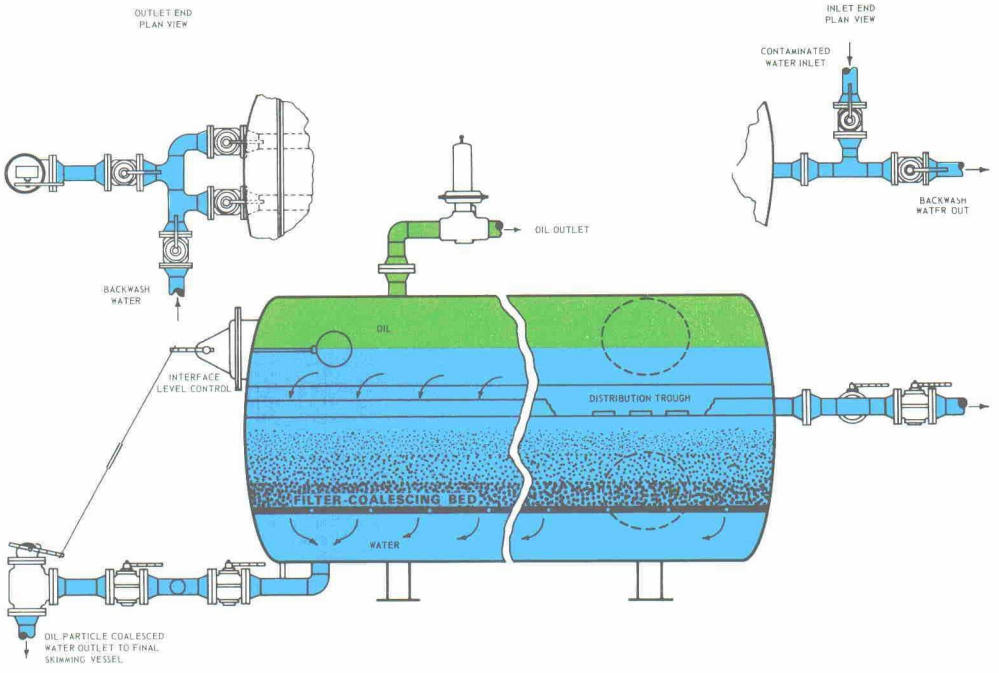


PATENT NO. 2,935,195

The National Multicell Coalescer and Oil Wetted Particle Remover is required where oil wetted particles are present in the water and capacities greater than 15,000 BPD are required. Due to the high flow requirement and resulting large filter section the final oil separation is accomplished in another vessel . . . a skimming tank.

Water is introduced into the vessel where a trough distributes it over the filter media. Free oil rises to the top and the water travels through a graded filter bed where oil wetted particles are filtered out and finely dispersed oil particles are coalesced to particle size sufficient to rise out of the water to be skimmed. The filter bed and lower portion of the vessel is divided into two sections and independent clean water outlets provided for each section. Each filter-coalescing bed is backwashed independently.





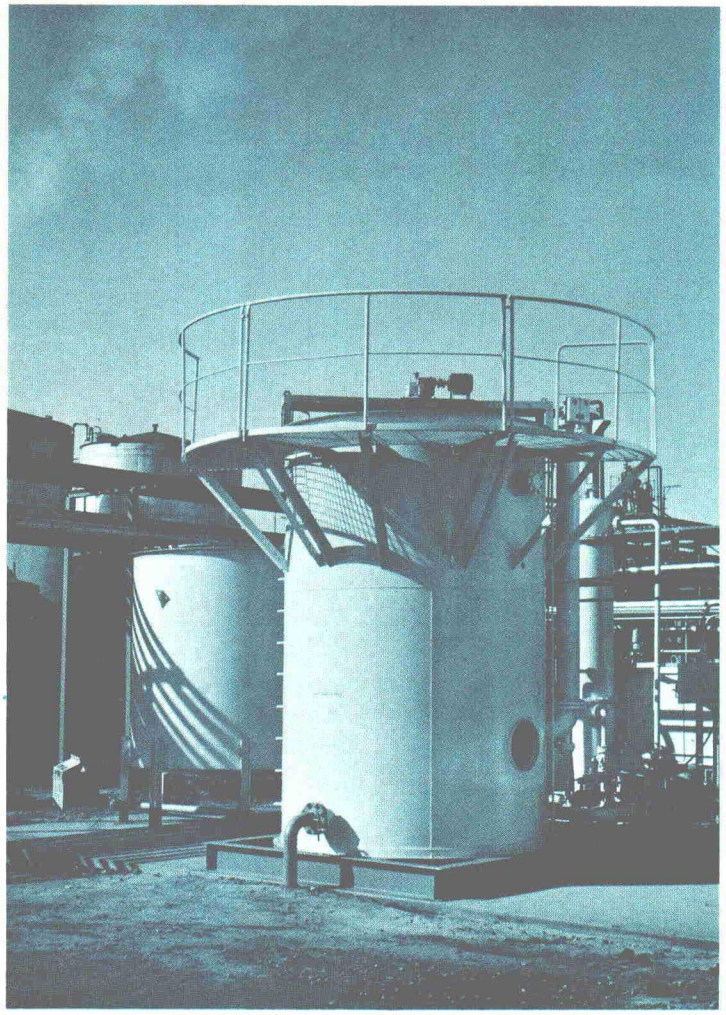
INTRODUCTION

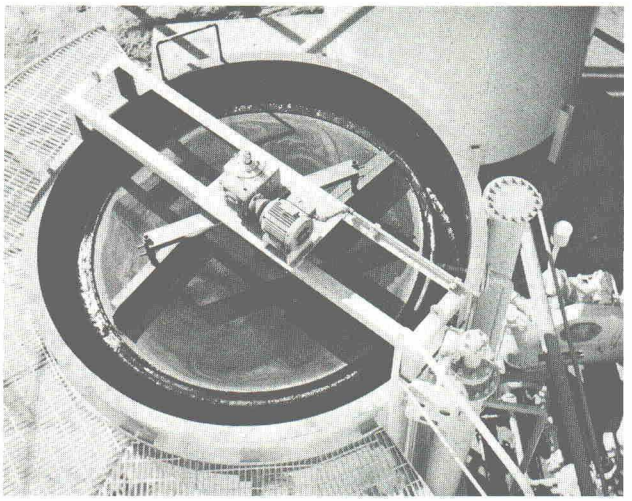
The National Tank Company Suspended Particle Extractor (SPX) provides a very effective means of removing oil and/or wetted particulates from water systems. This system represents one of the most important advances in pollution control equipment in recent years. The SPX provides the answer to continually increasing pollution control requirements and the need for maximum oil removal in water and steam flooding applications. The National SPX, without chemical treatment, has consistently removed from 70 to 85 percent free-entrained oil from oilfield produced brines when influent contaminent levels range from 100 PPM to 1000 PPM. With proper addition of selected chemical coagulants, 90 to 95 percent oil removal can be effected. Above 1000 PPM influent contaminent levels a National preliminary oil skimming vessel is recommended, especially where effluent requirements are below 50 PPM.

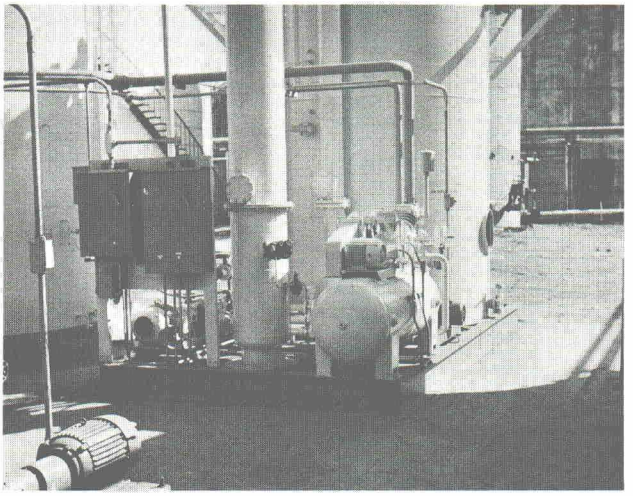
SUSPENDED PARTICLE EXTRACTOR (SPX)

Even greater efficiencies to more than 99 percent can be accomplished by the addition of a downstream filter to remove remaining traces of the oil-coagulant floc. Proper selection of chemicals and a downstream filter used with the SPX unit has proven successful in lowering effluent oil particulate content to 1.0 PPM.

Complete shop assembled packaged SPX systems with capacities to 19,000 bbl. per day can be furnished. With a minimum of field labor, units of greater capacity can be assembled at the job site from large prefabricated elements.







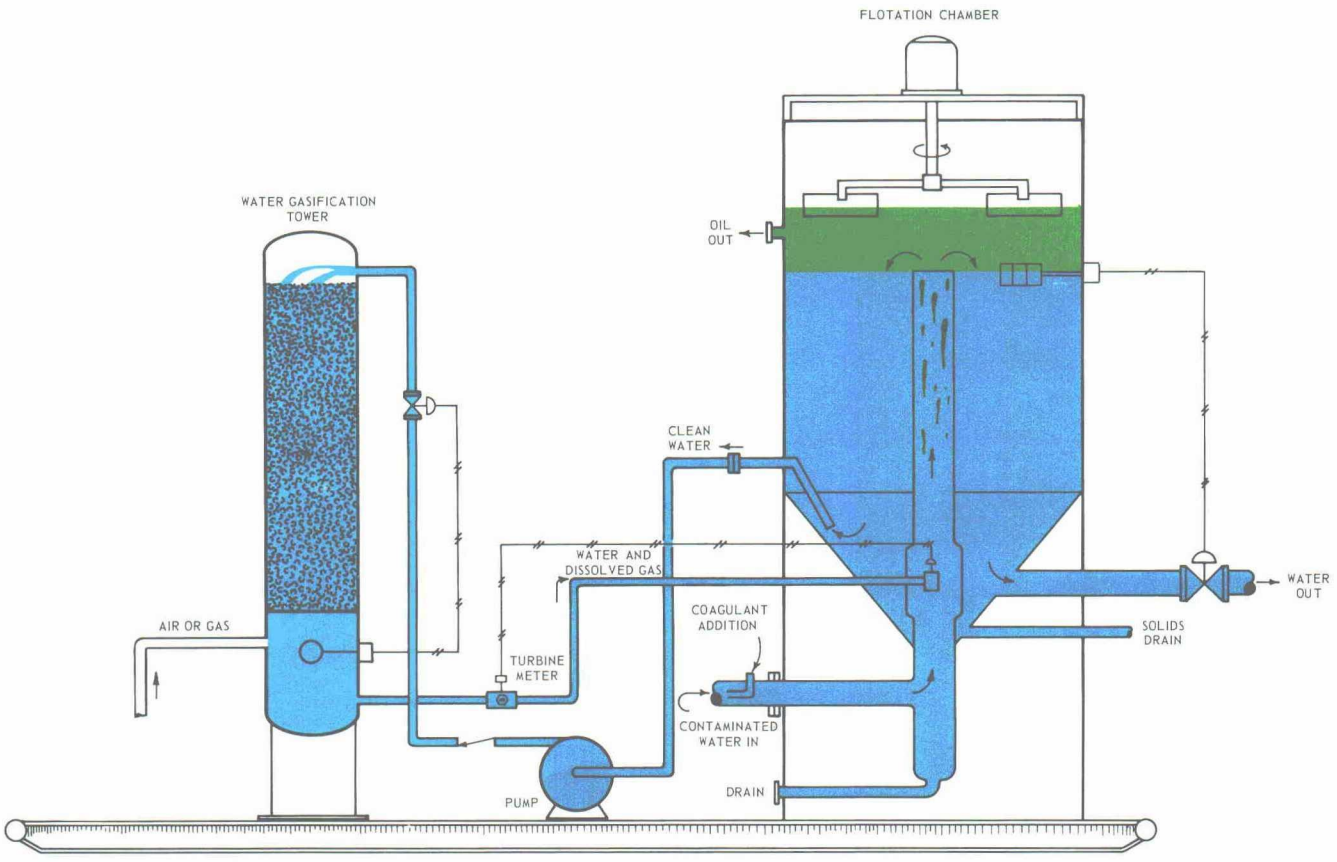
SUSPENDED PARTICLE EXTRACTOR (SPX)

OPERATION

In the National Tank Company SPX System each gallon of polluted water is saturated with millions of microscopic sized gaseous bubbles to assure a high probability of bubble attachment to each and every particle suspended in the water. Bubbles are generated by a unique process including a pressurized gas saturated recycle stream.

Polluted water enters a central flume of the vessel (Refer to flow diagram). A coagulant may be added prior to entry at the flume when required. Polluted water travels up the flume and becomes saturated by the gas bubbles. Particulates are carried to the top by the attached bubbles where a rotary scraper pushes them into the oil outlet trough. Proper water level within the tank is controlled by means of the liquid level control and throttling valve in the effluent water line. The conical bottom and sand drain provide a discharge route for sand and non-floatable debris. To generate the bubbles for flotation, a side stream of clean water is taken and pressured through a pump into the gasification tower. Air, Nitrogen, or Natural Gas is supplied to the tower and is absorbed by the water in the packing. The gas laden water from the bottom of the tower is applied to the flotation unit by a precision turbine flowmeter set point controller.

PATENTS PENDING

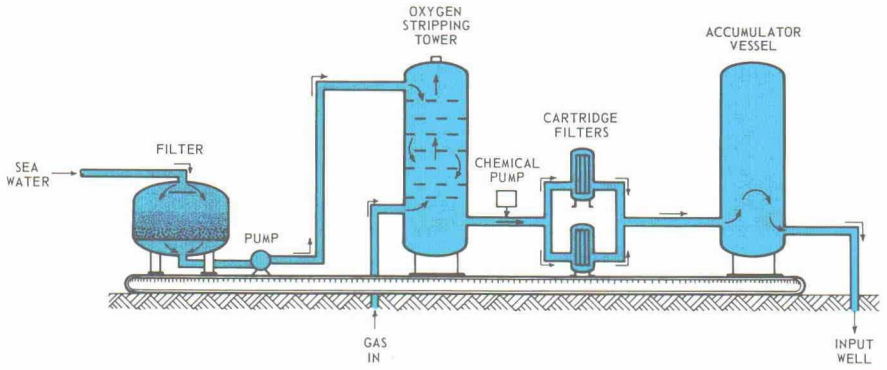


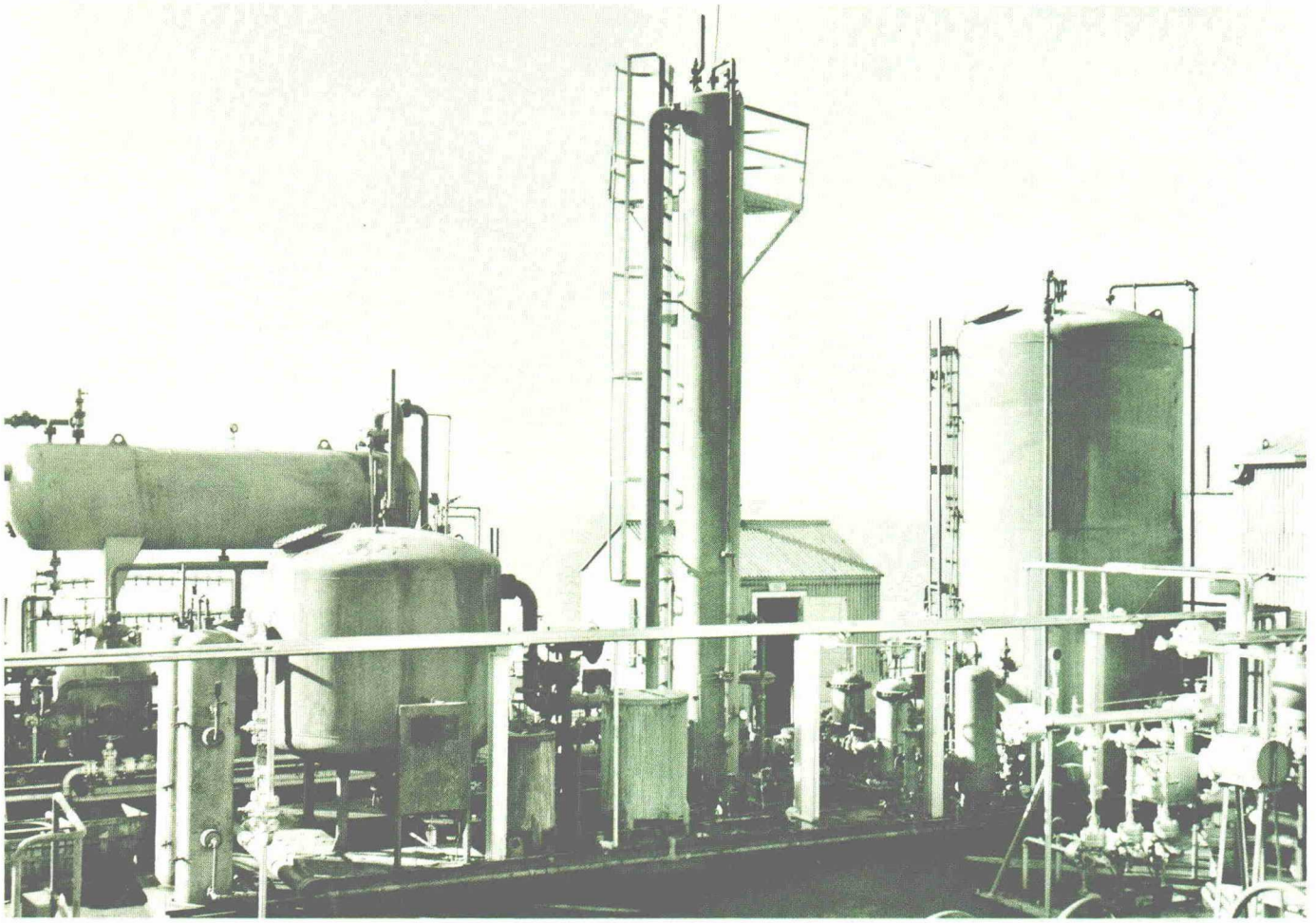
MULTIPLE CONTAMINENT REMOVAL

On previous pages of this brochure individual components offered for oil, gas, suspended solids, and dissolved solids removal were described. In many applications two or more of these components are used together for removal of multiple contaminants. The following are a few of the complete systems offered by National Tank Company.

CONDITIONING OF SEA WATER FOR WATER FLOOD

In coastal areas the use of sea water for water flood injection is made practical by this system. A Rapid Mechanical Filter is used to remove the bulk of suspended solids. The Stripping Tower removes dissolved oxygen reducing corrosiveness of the water. Chemical injection plus dual cartridge filters provide final polishing. The Accumulation Vessel provides storage for the injection water.

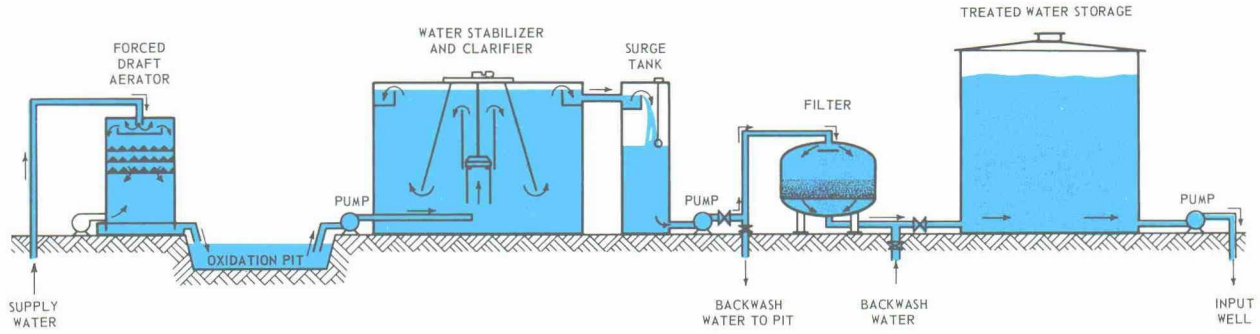




MULTIPLE CONTAMINENT REMOVAL

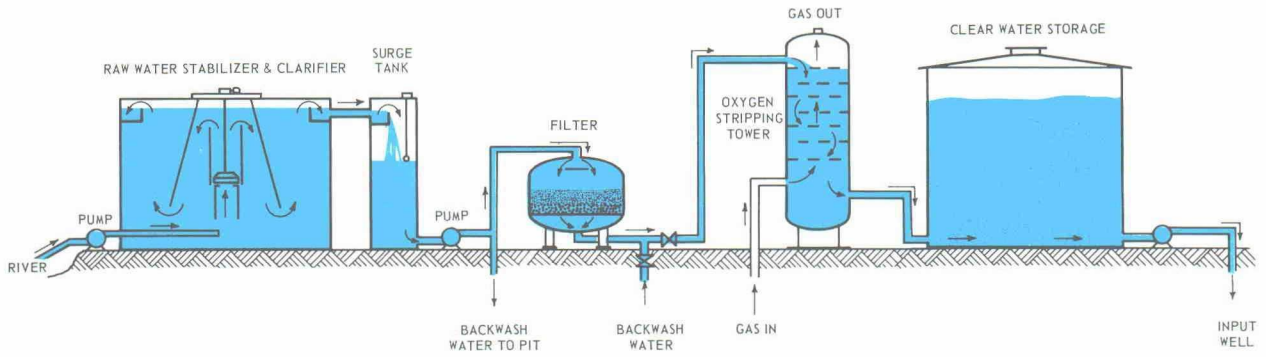
CONDITIONING OF SUBSURFACE WATER FOR WATER FLOOD

The illustration below shows a typical system for conditioning well produced water. This is an open system in which the water is aerated, chemically treated and filtered prior to injection. The forced Draft Aerator rids the water of dissolved gases such as hydrogen sulfide, while suspended solids are removed by the Raw Water Stabilizer and Clarifier Tank and Filter.



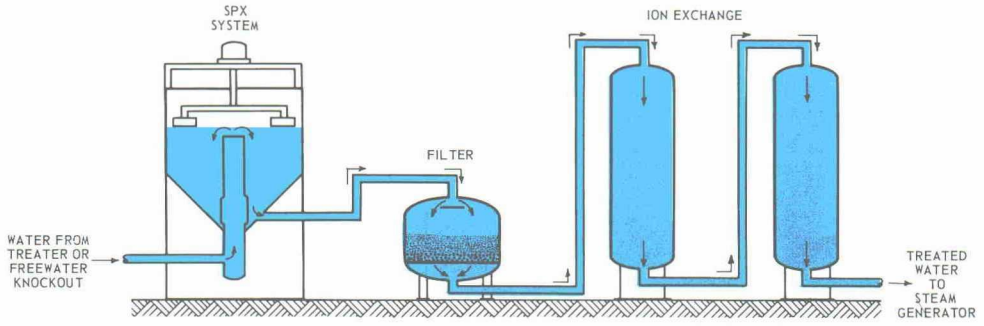
CONDITIONING OF SURFACE WATER FOR WATER FLOOD

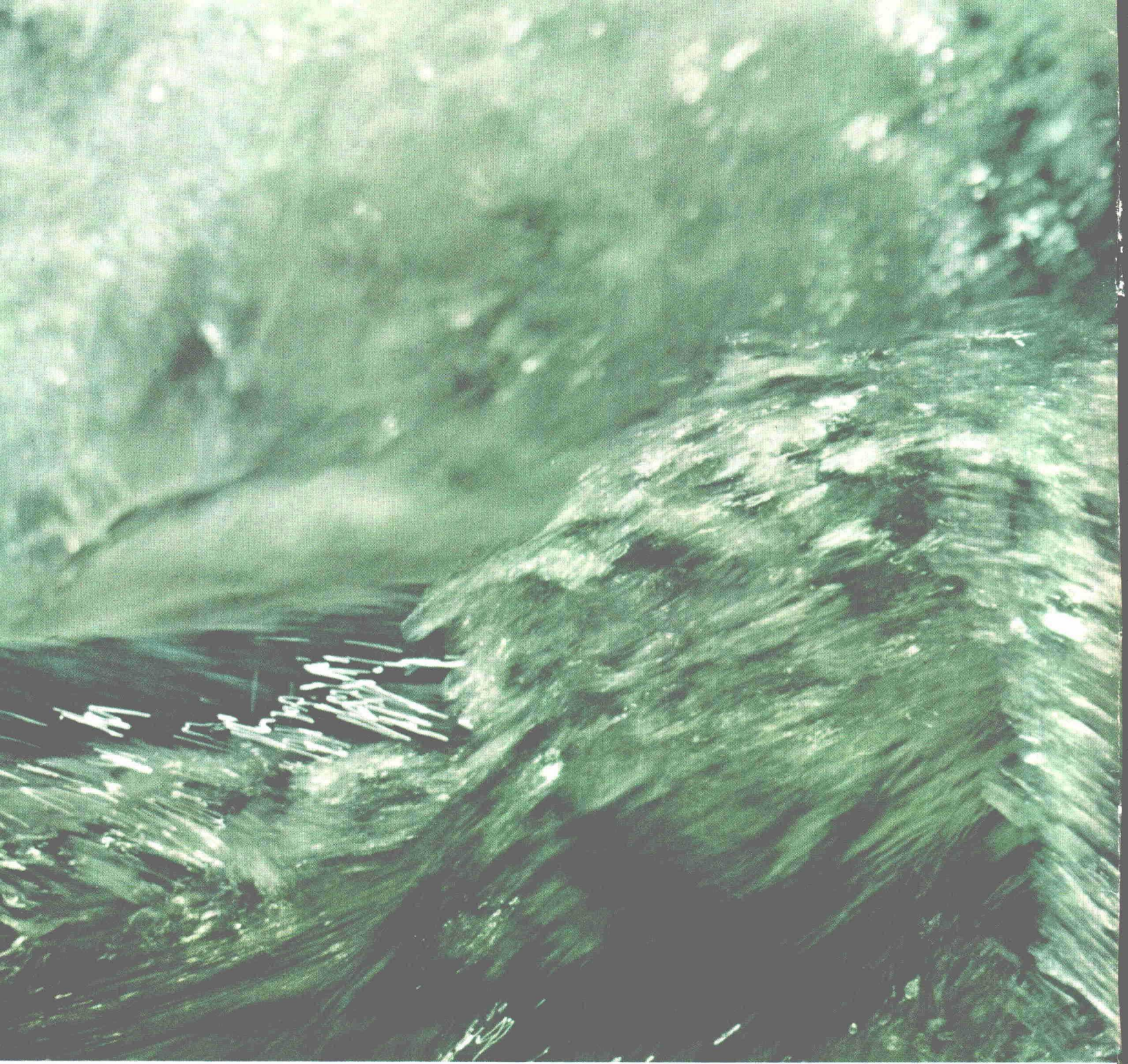
In this application river water is being used as the source for water flood. The Raw Water Stabilizer and Clarifier Tank by the use of chemicals removes the bulk of suspended solids. The Oxygen Stripping Tower removes dissolved oxygen reducing the corrosiveness of the water. Filters are used for final solid removal.



REUSE OF PRODUCED WATER FOR STEAM FLOOD

Water removal from produced oil may serve as the source for steam flood applications, if the water is properly conditioned. In this application a SPX System is used to remove oil and remaining traces of oil-coagulant floc are removed by the filter. An Ion Exchange system is then used to remove undesirable dissolved solids resulting in a water suitable for feeding the steam generator.





NATIONAL TANK COMPANY

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