Collection and Treatment of Oily Wastewater:

Removal of Dilute Oily Compounds With Advanced Hydrocarbon Filtration Systems

Prepared by:

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Highland Tank & Manufacturing Company, Inc.

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ABSTRACT

The public's increasing interest is the conservation of the nation's water resources, which has directly affected many industries. Impacted industrial facilities are facing increasingly more stringent regulations covering the treatment and discharge of oily wastewater and now risk costly penalties resulting from public pressure for the government to control harmful oil spills and pollutant discharges.

Treatment and spill control can be accomplished in several ways; with an oil/water separator, and in some cases, with the addition of an Advanced Hydrocarbon Filtration System. The method of treatment depends on the concentration and the type of contaminants in question as well as the location of the discharge.

INTRODUCTION

The public's increasing interest is the conservation of the nation's water resources, which has directly affected many industries. Impacted industrial facilities are facing increasingly more stringent regulations covering the treatment and discharge of oily wastewater and now risk costly penalties resulting from public pressure for the government to control harmful oil spills and pollutant discharges.

REMOVAL OF DILUTE OILY COMPOUNDS WITH ADVANCED HYDROCARBON FILTRATION SYSTEMS (AHFS)

Because of the design limitations of coalescers, whether plate or impingement type, chemically stabilized emulsions and dissolved hydrocarbon cannot be removed from the water. These remaining categories of oil in water pose serious effluent discharge problems. Provisions for pumping the effluent from an EGOWS to secondary treatment devices is often warranted for the removal of trace pollutants to meet daunting EPA discharge requirements.

Traditional secondary treatment technologies required to remove dilute concentration levels of emulsified or dissolved contaminates are very expensive and difficult to operate and maintain. These secondary treatment systems are also particularly inefficient when oily substances are in the mix. Organoclay, activated carbon, and other traditional adsorbents are susceptible to clogging when exposed to some oily compounds. Desorption is common when solvents are present. Moreover, channeling causes premature breakthrough and impairs efficiency as only a fraction of the absorbent capacity is exposed to the contaminants.

Recent developments in the surface treatment of filtration substrates have yielded materials that physically bond to select hydrocarbons without swelling or clogging. These filtration substrates are typically natural (e.g. cotton) and synthetic materials (e.g. polypropylene). These filter substrates are infused with a unique reaction product composed of drying oils and acrylic polymers. AHFS technologies, based on these surface modified substrates, permanently attract, bond, and rapidly remove oily hydrocarbons and solvents from water without flow restriction or desorption. Figure 6. AHFS technology is operationally anti-stenotic, which means the flow spaces do not narrow as chemical compounds are absorbed. Although chemically passive, AHFS binds hydrocarbon compounds into a viscous semi-solid state. The contaminants become denser on the AHFS media. As water flows through the AHFS media, the coagulate contracts and allows the hydrocarbons to be removed without clogging, swelling or restricting flow.

EOWS with AHFS

Figure 6

The proper combination and configuration of AHFS media can create the perfect balance of efficiency, flow, and pressure drop (P < 1 psi over the media). AHFS technology has affinity for many aqueous insoluble, semi-soluble and mechanically emulsified compounds. Organic pollutants separated with efficiencies of over 99 percent including the following hydrocarbons:

- Oil and grease (O&G)
- Total petroleum hydrocarbons (TPH)
- benzene, toluene, ethylbenzene and xylene (BTEX)
- Polycyclic aromatic hydrocarbons (PAH)

Wastewater treated with a combination EOWS-AHFS technology is free of petroleum hydrocarbons (typically < 0.5 ppb). The filter units are small and, unlike granular media, easy to dispose.

DEFINITIONS

OIL: Oil means oil of any kind or in any form, including, but not limited to: fats,

oils, or greases of animal, fish, or marine mammal origin; vegetable oils, including oils from seeds, nuts, fruits, or kernels; and, other oils and greases, including petroleum, fuel oil, sludge, synthetic oils, mineral oils, oil refuse, or oil mixed with wastes other than dredged spoil. See the "List of Petroleum and Non-Petroleum Oils" on the USCG Web site at: https://homeport.uscg.mil/mycg/portal/ep/contentView.do?contentTypeId=2&channelId=30565&contend=120944&programId=117833&programPage=%2Fep%2Fprogram%2Feditorial.jsp&pageTypeId=13489&BVSessionID=@@@@1350455393.1250257064@@@@&BV_EngineID=cccdadehmkjifjkcfjgcfgfdffhdghm.0

DISSOLVED OIL: The oil fraction that forms a solution with water; or oil that is $\leq$ 0.5 microns.

EMULSIFIED OIL: Small oil droplets (in the range of 1 to 20 microns diameter) that form a stable suspension in the water as a result of the predominance of interparticle forces over buoyant forces.

FREE OIL: Oil droplets that are of sufficient size (greater than 20 microns in diameter) so that they can rise as a result of buoyant forces to form a defined oil layer on top of the water in an oil/water separator.

RISE RATE: The velocity at which oil droplets move upwards toward the surface of the oil/water separator.

OIL INTERCEPTOR: A gravity oil/water separator designed to remove free oil (150 microns or greater) and some suspended solids. Interceptors are relatively simple, requiring nothing more than an underground, horizontal, cylindrical or rectangular vessel with influent and effluent tees and divided into compartments by a series of vertical baffles.

ENHANCED OIL/WATER SEPARATOR: A gravity oil/water separator that uses more technically sophisticated methods to remove oil globules as small as 20 microns. Enhanced coalescer technology combine the features of both a flat plate coalescer and a corrugated plate coalescer into a new "self-cleaning" design that performs better than traditional plate separators. Equipped with secondary, impingement coalescers, they meet the new Underwriter's Laboratories, Inc. UL SU2215 design, construction, and performance standards for engineered oil/water separators rated at 10-ppm oil and grease.

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ABOUT THE AUTHOR

Gregory G. Aymong is Vice President of Sales for Highland Tank, the largest producer of Storage and Wastewater Treatment Tanks and in the United States. He is also the inventor of the patented Highland Tank Oil/Water Separator and Corella® enhanced coalescer technology and has worked for Highland Tank for 34 years. His numerous equipment and process patents and designs are used extensively by petroleum, industrial, municipal, military and commercial facilities worldwide for the prevention of oil, grease, and hazardous materials spills into the environment.

Mr. Aymong has worked in the industry in the United States and overseas for 40 years and has authored numerous articles on oil/water separators and storage tanks and vessels. Gregory has lectured on "Water Storage Tanks: From Construction to Rehabilitation" for Lorman Education Services. He has spoken about storage and wastewater treatment tanks at many Petroleum Equipment Institute (PEI), National Petroleum Management Association (NPMA), National Institute for Storage Tank Management (NISTM), American Society of Plumbing Engineers (ASPE), American Society of Sanitary Engineering (ASSE), Constructions Specifications Institute (CSI), Water Environmental Association (WEA), American Society of Civil Engineers (ASCE), and American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) chapter meetings in the United States and Canada.