

insoluble oils, from produced water. Additional removal of soluble pollutants can also be achieved, but it is not as significant as the reduction of conventional pollutants such as total suspended solids and oil and grease. EPA has considered several types of filtration systems as part of this rulemaking, including granular, membrane and cartridge filtration technologies. EPA's assessment of granular filtration is based in part on data collected from a coastal oil and gas facility as part of the offshore subcategory rulemaking (Three Facility Study). Although economically achievable, granular filtration was rejected as the technology basis for controlling discharges in this proposed rule. EPA's evaluation of granular filtration performance data indicates that while this technology does provide some removals of priority and nonconventional pollutants, the pollutant removal efficiency of granular filtration (in the range of 46–68 percent oil and grease removal) is generally not as effective as that attainable through improved operation of gas flotation technology (general oil and grease removal efficiency have been shown to be 90–95 percent). In addition, the capital and annual operating and maintenance costs associated with granular filtration are significantly higher than the costs of improving gas flotation systems.

EPA did not select membrane filtration as a technology basis for this proposed rule because it has not been sufficiently demonstrated as available to support national effluent limitations at this time. Membrane filtration is a commercially demonstrated technology in other industries and several manufacturers have been developing this technology for use in treating produced water. Although not yet available to the oil and gas industry, some operators have shown interest in the technology and limited testing of these systems has taken place. In developing the final limitations for the offshore subcategory, EPA determined that because of operational problems (e.g., fouling of the membrane, actual treatment capacity less than design capacity) this technology did not support use as a technology basis for final effluent limitations. (See 58 FR 12481; March 4, 1993.) In the absence of any data to the contrary, EPA believes that this technology still is not available for full-scale systems capable of long-term, effective treatment of produced water.

In evaluating reinjection of produced water, EPA noted that a number of coastal oil and gas sites were using

cartridge filters as part of the treatment system. EPA collected wastewater samples to characterize the efficacy of cartridge filtration to determine whether this technology should serve as a basis for effluent limitations and standards. EPA's evaluation of cartridge filtration performance data indicates that this technology is capable of providing oil and grease removal only marginally better than that currently required by the existing BPT effluent limitations. In addition, EPA's evaluation did not identify any significant removals of the priority and nonconventional pollutants present in produced water. Thus, cartridge filtration was not selected as a basis for limiting produced water discharges.

3. Injection

EPA also considered using injection technology as a basis for setting a more stringent requirement under this rule. With the exception of Cook Inlet, injection of produced water is widely practiced by facilities in the coastal subcategory as well as in the onshore subcategory. Injection technology for produced water consists of injecting it, under pressure, into Class II UIC wells into underground formations. This option results in no discharge of produced water to surface waters.

Treatment of the produced water prior to injection is usually necessary, and such treatment often includes removal of oil and suspended matter by BPT oil separation technology followed by filtration technology. The removal of suspended matter prior to injection is required to prevent pressure build-up and plugging of the receiving formation and/or to protect injection pumps from damage.

While EPA determined that filtration was not a technology appropriate for serving as the basis for control of effluent prior to discharge, filtration was considered relevant technology for use as pretreatment prior to injection, thus, it is included as part of the basis for the injection technology option. EPA determined from information gathered on site visits in the Gulf coast area, as well as from industry contacts, that cartridge filtration is generally used following BPT oil/water separation technologies at injecting facilities accessible by water only. For facilities accessible by land, it was determined that rather than pretreat produced water using filtration, it is more cost effective to perform periodic well workovers on the injection well to remove clogged material from the wellbore. However, for facilities treating produced water flows greater than 64,000 bpd, EPA determined that it would be more

appropriate to employ granular filtration after BPT separation technology because it is more cost effective to use this technology for higher flows rather than cartridge filtration.

4. Other Technologies

In developing effluent limitations for the offshore subcategory, EPA also considered other technologies such as carbon adsorption, biological treatment, chemical precipitation, and hydrocyclones. (See 56 FR 10688; March 13, 1991.) Carbon adsorption was rejected as a technology basis because the limited use of this technology did not give sufficient performance data to enable a full evaluation. Biological treatment was rejected because of problems associated with biologically treating the high dissolved solids (brine) waters. Operational problems and an inability to quantify reductions of priority pollutant metals led to rejection of chemical precipitation. Hydrocyclones were rejected as a technology basis for BAT/NSPS effluent limits because the performance data available demonstrated only that it was capable of meeting existing BPT limits for oil and grease, and data were lacking regarding removals of priority pollutants. EPA has not received any new information regarding treatment efficacy (as measured by priority pollutant removal) for these technologies, and is not aware of any information which would support conclusions different than those made for the Offshore Guidelines.

5. Options Considered

Five options were considered by EPA in developing BCT, BAT, NSPS, PSES and PSNS limitations for produced water. These options were based on either injection, improved gas flotation, or a combination of these technologies. The 5 options are listed below with limitations for oil and grease associated with the options allowing discharges:

Option 1—(BPT All): EPA has included as an option setting effluent limitations equal to the existing BPT requirements. Oil and grease would be limited in the effluent at 48 mg/l monthly average, and 72 mg/l daily maximum.

Option 2—(Improved Flotation All): All discharges of produced water would be required to meet limitations on oil and grease content of 29 mg/l 30-day average and a daily maximum of 42 mg/l. The technology basis for these limits is improved operating performance of gas flotation. The specific numerical limit of 29 mg/l 30-day average and 42 mg/l (daily maximum) are based on the statistical analyses of performance of