



Standard Guide for Use of Membrane Technology in Mitigating Hazardous Chemical Spills¹

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1. Scope

1.1 This guide covers considerations for the use of membrane technology in the mitigation of dilute concentrations of spilled chemicals into ground and surface waters.

1.2 This guide addresses the application of membrane technology alone or in conjunction with other technologies.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* In addition, it is the responsibility of the user to ensure that such activity takes place under the control and direction of a qualified person with full knowledge of any potential or appropriate safety and health protocols.

2. Referenced Documents

2.1 ASTM Standards:

F 1127 Guide for Containment by Emergency Response Personnel of Hazardous Material Spills²

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *concentrate, retentate*—in reverse osmosis and nanofiltration, respectively, the portion of the feed solution that does not pass through the membrane is called concentrate, while the term retentate is more commonly used for ultrafiltration and microfiltration.

3.1.2 *crossflow filtration*—a filtration process in which the feed flows almost parallel to the filter or membrane surface. It is also called tangential flow.

3.1.3 *flux*—a measure of the rate at which the permeate (or filtrate) passes through the membrane per unit area of membrane. It is reported in units of L/m²/day, m³/m²/day, or gal/ft²/day.

3.1.4 *fouling*—the accumulation of unwanted deposits or

scales on a membrane that results in a flux reduction.

3.1.5 *Langelier Saturation Index (LSI)*—a method used to determine the calcium scaling potential, that is, calcium carbonate of a membrane at concentrations below 5000 ppm TDS.

3.1.6 *membrane technology*—separation of the components of a fluid by means of a pressure gradient and a semipermeable membrane. The various classes of membrane technology are differentiated primarily by the size or molecular weight, or both, of rejected material. The main divisions are (1) microfiltration (MF), (2) ultrafiltration (UF), (3) nanofiltration (NF), and (4) reverse osmosis (RO).

3.1.7 *microfiltration (MF)*—a pressure-driven process whereby a contaminated liquid stream is separated using a filtration process involving a compatible membrane. Dead-ended and crossflow techniques are used. Suspended solids and macromolecules are removed on the basis of size. Pore size is normally 0.1 to 5.0 μm, and operating pressures usually range from 20 to 350 kPa (3 to 50 psig). Membrane materials, such as polypropylene, polytetrafluoroethylene (PTFE), and metal oxides, are frequently less susceptible to chemical degradation than those used for other branches of this technology.

3.1.8 *nanofiltration (NF)*—a pressure-driven process whereby a contaminated liquid stream is separated and purified by a process involving filtration, diffusion, and chemical potential across a compatible membrane. Divalent and multivalent species with a molecular weight above 80 are removed as are uncharged and univalent molecules with a molecular weight above 200. Operating pressures normally run between 1380 and 2760 kPa (200 and 400 psig).

3.1.9 *osmotic pressure*—as related to membrane technology, the pressure that must be applied to the more concentrated solution to halt flow of the solvent from the less concentrated solution through a semipermeable membrane into the more concentrated side.

3.1.10 *permeate, filtrate*—the stream that has passed through the membrane and is therefore free of, or has a much reduced concentration of, contaminants. Permeate is commonly used for the treated water obtained from nanofiltration and reverse osmosis processes, while filtrate is more commonly used for the treated fluid obtained by ultrafiltration and microfiltration operation.

3.1.11 *pervaporation (PV)*—a vacuum-driven membrane process applicable to the separation of liquid mixtures. During

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² *Annual Book of ASTM Standards*, Vol 11.04.