Implementation of Impenetrable Concrete in Liquid Reservoirs

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Abstract

Concrete is a versatile construction material. Concretes in use today, are formulated with very specific performance characteristics in mind and include lightweight, heavyweight, non-osmotic, porous, fiber-reinforced, mass, high-performance and cellular concretes to name just a few. Each provides specific characteristics or properties for their intended use. These properties are achieved by intentional formulation and control of such variables as cement content and type, pozzolan type and content, aggregate type, admixtures used, the addition time and rate of those admixtures, as well as other, often subtle, differences. Concrete has also shown good performance as a general-purpose material for constructing non-permeable and non-osmotic structures such as fluid containers. Based on the mixture design and how it is placed, concrete can be almost impermeable. Guidelines for construction and mixture design are offered. Nevertheless, at regions of joints or discontinuities or while confronting severe situations such as long-time contact with strong acids other provisions should be considered in order to maintain the concrete impermeability. There are several means such as air-entraining, adding a synthetic fiber, a pozzolan like fly ash or silica fume, ground slag, and a superplasticizer to the concrete mixture that really help reduce the permeability of concrete. In this paper, some practical methods to make concrete structures non-osmotic or non-permeable such as taking advantage of waterstops as well as sealants are investigated. Besides, some curing methods which help maintain concrete in good position according to its osmosis condition are also discussed. The key factors affecting porosity are examined, as well as their relationship to moisture-related failures of seamless products. It is really apparent that the best way to eliminate moisture transmission problems is to prevent it by creating a concrete which has minimum shrinkage and capillary pores. This is done by carefully controlling the concrete mixture design with attention paid to minimizing total water, keeping the w/c ratio low, using PVC, expansive rubber, and metal waterstops as well field molded or performed sealants. Not only will this provide the least permeability, but it also provides the most durable concrete.

Keywords: Non-Osmosis, Non-Permeable, Coating, Liner, Sealant, Waterstop

1. INTRODUCTION

Concrete is a good, general-purpose material that is easy to work with and has good resistance to a wide range of chemicals. When properly designed and constructed, concrete containment structures are impermeable, for all intents and purposes (See Fig.1.1). So reinforced concrete is now the most widely used material for tanks, sumps, and liquid containers particularly below grade. Usage of non-osmotic concrete is an essential aspect in maintenance of hazardous materials especially because of environmental issues (hazardous materials are defined as having one or more of the following characteristics: ignitable, corrosive, reactive, or toxic). Some reinforced concrete compression members, such as the walls of tanks, are also highly resistant to buckling during seismic events, unlike the walls of steel tanks. Reinforced concrete's thermal conductivity and protective qualities make it highly resistant to failure during fires. As one may notice, concrete can be utilized as a proper substance in cases where resistance against permeability is required. Meanwhile, there may exist some deficiencies at regions like construction or expansion joints which can then be surmounted by the means of some sealants or waterstops. Nonetheless, some chemicals, such as strong acids, are so aggressive to concrete that all of the above will have little or no effect on chemical attack resistance. In these cases chemically resistant coatings or liners are recommended to make concrete structures non-osmotic.

U.S. Environmental Protection Agency (EPA) listed wastes are organized into three categories under RCRA: source-specific wastes, generic wastes and commercial chemical products. Source specific wastes include sludges and wastewaters from treatment and production processes in specific industries, such as