

[Form 2 (to be reported to Committee on Countermeasures for Contaminated Water Treatment and to be disclosed to public)]

Technology Information	
Area	5: Management measures to block groundwater from flowing into the site
Title	Groundwater Extraction Using Syphon Technology In Place of Mechanical/Electrical Pumping
Submitted by	Westinghouse Electric Company, LLC/GZA GeoEnvironmental, Inc.
<p>1. Overview of Technologies (features, specification, functions, owners, etc.)</p> <p>Syphon technology allows groundwater to be extracted from wells without the use of electrically driven mechanical pumps. The technology is applicable to sites where there is significant downward slope to both the ground surface topography and the water table, such as at the Fukushima Daiichi plant between the upland mountains and the power block plateau. Appropriately sized tubing is inserted to near the bottom of the well and is then extended down-slope to a point at or below the design groundwater depression elevation in the well. At this elevation, the tubing can be discharged into a gravity storm drain, or a vacuum breaker can be installed and the tubing continued to the ultimate discharge point. The tubing is then filled with water, and the syphon is initiated. Once initiated, the syphon will continuously extract water from the well until the water level in the well is pulled down to the syphon discharge elevation (the bottom of the syphon tube in the well must be below the design discharge elevation). The rate of extraction is highest when the water in the well is at its highest elevation above the design depression elevation, and proportionally decreases as the design depression elevation is approached. Once the depression elevation is achieved, the syphon pumps the exact amount of groundwater flowing into the well, and thus automatically maintains the design depression.</p> <p>The primary advantages of this technology are that it:</p> <ul style="list-style-type: none"> <li>• Does not require running electrical power to the extraction wells;</li> <li>• Does not consume electrical power to extract the groundwater;</li> <li>• Does not require pumps in the wells, nor does it require the controls (such as water level float switches, transducers, variable freq. drives, etc.) to control the pumps ;</li> <li>• Does not require maintenance, and thus on-going worker exposure, as would be</li> </ul>	

required for electrical / mechanical pumping systems;

- Automatically varies the extraction rate to match variations in the groundwater flow rate due to precipitation events, for example;
- There are no mechanical moving parts and thus operates automatically without requirements for routine inspection / maintenance.

2. Notes (Please provide following information if possible.)

Technology readiness level (including cases of application, not limited to nuclear industry, time line for application): Groundwater extraction via siphon, as described above, is a readily accessible and proven technology, which is underpinned by rather basic physics. As such, if selected, it can be immediately implemented once the design and specification phases are completed.

Challenges: The only significant challenge for this technology would be the limitation of maximum depth of groundwater extraction to that associated with the vapor pressure of water (i.e., about 25 feet of water). This limitation can be partially offset by lowering the high-point elevation of the syphon in the wellhead via pitless adapters and trenching.

Others (referential information on patent if any): References and additional supporting documentation can be provided upon request.

**【Areas of Technologies Requested】**

- (1) Accumulation of contaminated water (Storage Tanks, etc.)
- (2) Treatment of contaminated water (Tritium, etc.)
- (3) Removal of radioactive materials from the seawater in the harbor
- (4) Management of contaminated water inside the buildings
- (5) Management measures to block groundwater from flowing into the site
- (6) Understanding the groundwater flow