

# TECHNICAL REFERENCE

## UTILIZING SUPERABSORBENT MEDIA TO STABILIZE AND SOLIDIFY LLW AND MIXED WASTES

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### BACKGROUND

**Super absorbent medias are currently being used to help solidify aqueous LLW and Mixed Waste generated by several DOE, DOD and commercial facilities.** These products are primarily sodium based cross-linked polymers, which have a strong affinity for water. Super absorbent medias are capable of absorption ratios of up to 300:1 Absorption Under No Load (AUNL) with minimum free swell. Through a sorption mechanism, water is bound and converted into a high strength gel, which will retain its disposition throughout transportation and final disposal.

Once LLW and Mixed Waste are characterized and profiled for disposal at an approved disposal site, they are then shipped in bulk containers to their final destination. A common concern of transporters shipping this type of material is development of free water during shipment. Solids compression and condensation are two frequent contributors of unbound liquid in a sealed container. It is essential that no free liquid be present in the container upon arrival at the disposal facility, as shipments containing free liquid will not be accepted. Because of this "No Free Liquid" clause in their Waste Acceptance Criteria (WAC), these facilities strongly encourage the use of absorbing agents to eliminate any free liquids that may develop in the container during transportation.

Traditional absorbing agents such as diatomaceous earth, fly ash and lime have significantly lower absorption capabilities compared to super absorbent medias and therefore, add excessive volume and weight to the overall amount of waste. Because super absorbent medias have a much greater absorption ratio (AUNL) and do not swell excessively, they typically add less than 1% to the overall volume of waste being disposed. These products are non-biodegradable [CFR 264.314 (e)(ii)] and typically retain sorbent properties after freezing and subsequent heating to 160° F. Most super absorbent medias are nonexothermic as opposed to some of the other absorbing agents, which may be cement-based or pozzolanbased materials. This in turn will help minimize condensation during packaging and transportation.

While super absorbent medias are a very effective stabilizing agent for wastes containing primarily water and some in-organics, they are not as efficient on organic wastes containing high concentrations of hydrocarbons. A pozzolanic-based stabilizer must be used for applications requiring chemical fixation or pozzolanic cementitious curing. CETCO was introduced to the sludge removal process at the West End Treatment Facility (WETF) in 1997 during initial bench testing. The initiative was to provide an additive to the mixed waste being generated by the WETF, which would:

- ▶ Immobilize and eliminate free liquid during storage, transportation and disposal of solids
- ▶ Help solids comply with Waste Acceptance Criteria (WAC) of the final waste disposal site
- ▶ Minimize excess waste volume generated during absorption

After consideration of several clay and polymer based absorbents, CETCO 's Quik-Solid® super absorbent media was chosen based on meeting the pre-mentioned criteria and its ability to enhance the performance of solidification and stabilization processes.

Quik-Solid® is a granular cross-linked polyacrylate, which rapidly absorbs and retains large volumes of aqueous matter. The product removes water onto the surface of the granular media at absorption ratios of up to 300x by weight. Heavy metals are tied up through strong ion exchange, which helps solids pass TCLP requirement listed in the waste generators Profile Sheet.

#### ANALYTICAL RESULTS FOR TOXICITY CHARACTERISTIC – WETF SLUDGE

Metal TCLP	(mg/l)	Metal TCLP	(mg/l)
Arsenic	<.5	Lead	<.2
Barium	<5	Mercury	<.02
Cadmium	<.1	Selenium	<.02
Chromium	<.5	Silver	<.2
Copper	<1	Zinc	<.2

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Quik-Solid® is currently being utilized to help solidify Biological Sludge generated by the WETF, containing primarily calcium carbonate, Ni, Cd, U and Zn. After a de-nitrification process, the sludge is allowed to settle and further solidify prior to packaging for shipment. Quik-Solid® is blended in with these solids at a rate of approximately 7% to further solidify and eliminate free liquid prior to and during shipment to an approved disposal site.

Typically Quik Solid® and other super absorbent medias do not require mixing when applied to mostly aqueous solutions. Field tests determined that mixing the granular Quik-Solid® media into the waste solids for this application would help immobilize any water, which may release and “pool” in the solids due to solids compression during loading and transportation. The media is introduced to the sludge in a 20 cu. ft. blender on site and allowed to mix for approximately 4-6 minutes. The amount of Quik-Solid® added to the solids is determined by the physical characteristics of the solids as they are being blended. The optimal moisture content for this particular application is 16%, based on the Std. Proctor Method ASTM-D698. The operator looks at visual queues for assurance that enough media has been added and the solids will pass WAC criteria for disposal. The mixed solids are then transferred to a 43 cu. ft. container for packaging and shipment. A thin layer of Quik-Solid® is added to the bottom of the container and top of solids to contain any condensation that may occur once the container is sealed. The containers are placed on a flat bed (10 per truck) and shipped in 200 container lots as Radioactive LSA/RQ.

Pull testing is done in a set frequency (per containers) for the total shipment to insure the waste meets the generators Waste Profile Record. Each container is examined for free liquid through visible inspection and the paint filter test (EPA #9095) upon arrival at the approved disposal facility. Since shipments containing any free liquid will not be accepted by the facility, elimination of free water during packaging and any condensation accumulated during shipment is critical. The waste generator has shipped approximately 3.6 million kilograms of solids since the inception of this project. To date all shipments have been accepted by the disposal facility upon arrival, having passed the mandatory parameters listed in the generator’s Profile Record and the WAC dictated by the disposal facility.

Once the shipment has been accepted, no further treatment is required and the solids are deposited into a mixed waste cell in compliance with 40 CFR 264. These solids are used as fill in the cell due to the fact that they do not compact or blind off much like claybased solids and soils. In addition to their ideal physical make up, these solids likely hold unsaturated media, which will continue to attract and contain free liquids that may develop in the cell.

## CONCLUSION

**The use of super absorbent medias over traditional absorbing agents allows generators of LLW and Mixed Wastes to significantly reduce their cost for disposal by minimizing the total volume.** While traditional absorbing agents will be less expensive purchased on a per # basis, they typically will add more than 25% to the weight and overall volume of waste to be disposed of. Super absorbent medias are not as efficient on wastes containing high concentrations of organic matter. However, they have proven successful in solidifying aqueous solutions and immobilizing free liquids and metals, contained in solids and soils. Strong ion exchange capability allows for heavy metals to be bound & wastes to pass TCLP. The use of these more effective medias will translate into savings on disposal, while minimizing the risk of free liquids present when the solids arrive at their final destination.



Blended solids being loaded into 21st Century containers and prepared for shipment.



Quik-Solid® granular media being applied to top layer of solids prior to shipment to prevent free liquids from condensation and solids compression.