## Ardrey, Brenda

**From:** Fitch, Charlene
**Sent:** Wednesday, June 25, 2014 11:16 AM
**To:** 'Power, Brian'; Ardrey, Brenda; Nagel, Chris; Boessen, John
**Cc:** mbeaudoin@cecinc.com; Johnson, Tim; Getting, James
**Subject:** RE: Small void area filling application

Mr. Power,

Thank you for your submittal, I have a couple of questions on what was submitted.

1. As submitted the proposal still does not state what material will be used and the design/mix ratios. It states" *granular materials suitable for filling applications consistent with the requirements of MDNR regulations, such as soil, cement, bentonite, or industrial residues.".* The properties of soil, cement, bentonite, and or industrial residues vary greatly. I would assume you are proposing to use different material and different mix ratios for different situations at the landfill. Please verify and identify generally what situations will use what materials.
2. When asked to identify measures taken to ensure the undercap drainage is not impacted or occluded. You responded in *Response 5: It may be necessary to create bulkheads to prevent fill from flowing downhill or into undercap drains or other areas where it is not desired. Sand bags or tubes, plywood barriers, and other means will be employed as necessary for this purpose. Locations of use will have to exclude those areas where there is potential to enter collection systems, clog, or negatively impact leachate removal.* I would assume the bulkhead is constructed above the cap, correct?, If so, how will the undercap drains be protected? Would this be a situation that uses fast set concrete?
3. My 3rd question may be answered in your response to number 1. In the submittal, when I combine all the responses it appears the fill will be a malleable fill that deforms, with a permeability of 1 x 10 – 5 cm/sec and is capable of supporting foot and vehicle traffic. Again the properties of each type of fill may very depending on the materials used. Please verify.

Let me know if you need any clarification on any of my questions.
Thanks
Charlene

*Charlene S. Fitch* P.E.
Engineering Section Chief
Solid Waste Management Program
Department of Natural Resources
PO Box 176
Jefferson City MO 65102
Fax (573) 526-3902
Phone (573) 526-3940

**From:** Power, Brian [mailto:BPower@republicservices.com]
**Sent:** Tuesday, June 24, 2014 8:40 AM

**To:** Fitch, Charlene
**Cc:** mbeaudoin@cecinc.com; Johnson, Tim; Getting, James
**Subject:** Small void area filling application

Mrs. Fitch,

Per your request below are responses to the questions that you had concerning the flowable fill application. This application is anticipated to be a very good solution to filling in small voids created by settlement and to minimize odors.

Question 1:

- Identify the materials that will be used i.e. concrete, aggregate, fly ash, water.

*Response 1: The dry fill component will consist of granular materials suitable for filling applications consistent with the requirements of MDNR regulations, such as soil, cement, bentonite, or industrial residues. The material would be very fine with a maximum of medium sand-sized particles, minimizing potential for abrasion damage to the FML.*

Question 2:

- Is the flowable fill going to be excavatable or harden?
  List the permeability.
  List the desired strength and density.
  Will it be air entrained and/or use foamers?
  What is set up time?

*Response 2: The objectives for flowable fill repairs are as follows:*

- *Fill the cracks/voids so that the synthetic cap is supported at all places;*
- *Result in a fill that is malleable so that it provides seal during future deformations with a low- to medium-strength clay consistency and an expected permeability in the range of* $1x10^{-5}$ *cm/s;*
- *Use non-combustible material that is introduced without added or entrained air or oxygen:*
- *Allow re-excavation and removal of material if needed in future,*
- *Create a subcap surface that supports foot and vehicle traffic*
- *Minimize damage to the FML; and*
- *Minimize odors during the performance of the repair.*

Question 3:

- Identify where the fill will be used on the landfill and the estimated quantities, if know. If filling around a well is there a maximum quantity you will place before stopping and reevaluating the situation?
- List what you use the fill for, i.e., filling around wells, low areas to promote drainage or just fill?
- Will the cap be sliced open for fill or filled through a smaller hole in cap?

*Response 3: Flowable fill would be used only for small "spot-treatment" applications. A typical crack, as observed during soil filling of previous cracks, may be about 50 feet long and two feet deep requiring about 8 cubic yards (CY) of flowable fill. A typical void around a well casing, like those observed during the February 2014 inspection and documented in Area of Concern 1, would be about six feet diameter and five feet deep requiring about 2 CY of fill.*

Question 4:

- How will it be placed? Will you use a pumper truck? Drive on the landfill with trucks and use chutes? How will the cap handle these heavy loads? The cap design we reviewed identified it as only being suitable for light duty trucks.
- What is the proposed ingredient combination? What proportions/ratio or will you use a mix design? If a mix design which one, or will the mix design vary depending on the application?
- Identify the standards to be used. (ASTMs)
- Are you using a manufactured product or will staff mix on site? If a manufactured product, list suppliers. Will fill be delivered by ready mix company or someone else? Will it be made on site? If mixed on site, identify the parameters for mixing on site.

*Response 4: The contractor's proposed approach is as follows:*

1. *Position small pneumatic tanker with dry fill component on suitable perimeter access road or main corridor landfill access road;*
2. *Add potable water to the dry fill material to create slurry of desired consistency in the tanker (no air will be deliberately entrained);*
3. *Position grout pump between the tanker and the target crack/void;*
4. *Cut a small incision in the FML to allow insertion of grout hose;*
5. *Position grout hose through incision and as far into crack/void as possible;*
6. *Pump flowable fill in while retracting grout hose until void is full; and*
7. *Repair the incision in the FML with extrusion welding techniques, applying patches as necessary.*

*Flowable fill would be used only for small "spot-treatment" applications. A typical crack, as observed during soil filling of previous cracks, may be about 50 feet long and two feet deep requiring about 8 cubic yards (CY) of flowable fill. A typical void around a well casing, like those observed during the February 2014 inspection and documented in Area of Concern 1, would be about six feet diameter and five feet deep requiring about 2 CY of fill.*

Question 5:

- With flowable fill being self-leveling, how will you use it on slopes?
- Identify measures taken to ensure the undercap drainage is not impacted or occluded.

*Response 5: It may be necessary to create bulkheads to prevent fill from flowing downhill or into undercap drains or other areas where it is not desired. Sand bags or tubes, plywood barriers, and other means will be employed as necessary for this purpose. Locations of use will have to exclude those areas where there is potential to enter collection systems, clog, or negatively impact leachate removal.*

Question 6:

- Will a seal be put down around the wells so the fill will not flow down into the well and cause a blockage?

*Response 6: Voids around well casings will likely require addition of bentonite pellets in the bottom of the void to create seal prior to application of flowable fill. Prior to filling we will identify the screen location of a well so that the repairs will not compromise well operation.*

Question 7:

- How will settlement be measured if you are placing flowable fill in areas to promote drainage?

- Identify how large blocks of fill, if used, will impact the slope stability of that area.

*Response 7: The amount of fill to be placed using this application is very small (dozens of cubic yards) and locations will be so isolated that the filled areas may not even be picked up by the 100-foot or 50-foot grid and will not create a driving force that is significant enough to affect stability.*

Question 8:

- If using around a well, will it adhere to well and be hanging in the air after settlement happens or will it drag the well down, or will it have low enough strength to break apart?

*Response 8: The mix will result in a malleable fill material that should be able to conform to movements and deformations.*

Question 9:

- Will anything be installed over the fill to prevent abrasion to the cap from underneath?

*Response 9: The material would be very fine with a maximum of medium sand-sized particles, minimizing potential for abrasion damage to the FML,*

Question 10:

- Most flowable fills do not resist freeze thaw, will this cause excessive grit to get into collection system as the fill is subjected to freeze thaw conditions?
- What amount of liquid separation will the flowable fill have, it takes a large amount of liquid to make flowable fill and some will decant out. How many gallons per cubic yard do you anticipate decanting out?
- What will you do if flows to toe of the cap and builds up?
- Where will excess liquids go as the flowable fill cures; into the landfill waste mass, run under cap to under drains, or both? Will additional liquid flowing through soil cap cause additional settlement or slope stability issues?
- What effect will this have on other systems in place; will it clog under drains and drain lines, build up in grit chambers and sumps? If grit gets into sumps, what effect will this have on the pumps?

*Response 10: The subcap system can accommodate flows with fine grit and the OM&M Plan requires programmatic cleaning of collection structures. This is an important issue and Bridgeton will require the contractor to develop method and materials to minimize this impact.*

As you are aware this is a time sensitive project and we would greatly appreciate an expedited review. Please feel free to contact me with any questions you may have.

Sincerely,

Brian J. Power
Environmental Manager
Bridgeton Landfill, LLC.
13570 Saint Charles Rock Road
Bridgeton, MO 63044

Phone: (618) 410-0157
Email: bpower@republicservices.com