- Geosyntec was retained by the State of New Jersey as an independent consultant to review and evaluate options to address odor problems caused by H2S at the Fenimore landfill.

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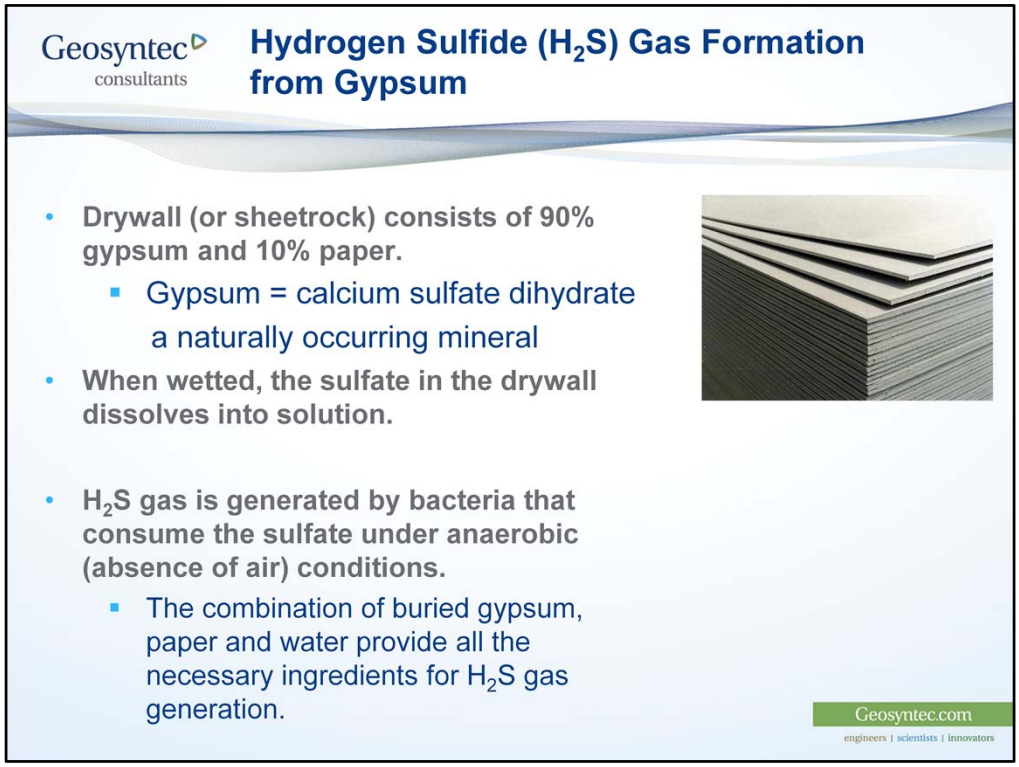
Presentation Overview

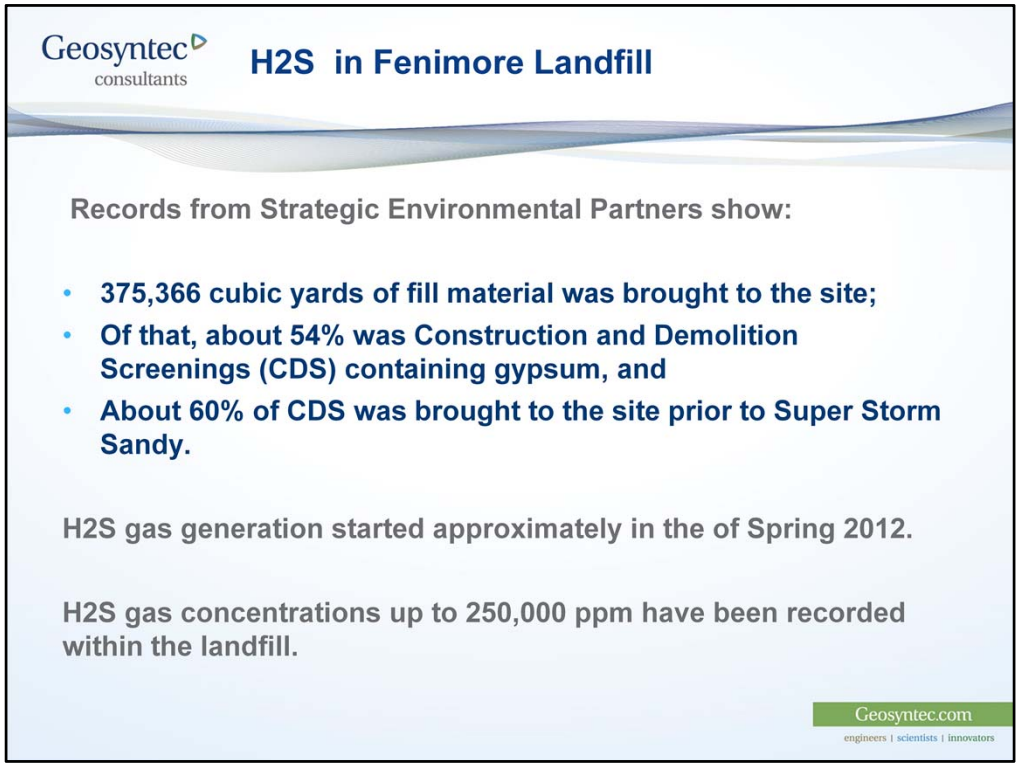
- H2S gas in Fenimore
- Evaluation of Landfill Gas Abatement Options
- Summary and Conclusions



- H2S is produced by sulfur reducing bacteria (SRB) that process the sulfur in gypsum wall board. The bacteria thrive in an environment that is dependent on pH, moisture, and an oxygen deficient environment know as an anaerobic condition. Temperature is also a factor. The gypsum is a major component of the Construction and Demolition Screenings (CDS) (ground up wall board) used for fill at the site.

- Sheetrock contains gypsum, a natural mineral that contains sulfur. When gypsum is buried and allowed to get wet, the calcium sulfate slowly dissolves and anaerobic bacteria (that live where there is no oxygen) will use the sulfur as an energy source and create H2S gas.

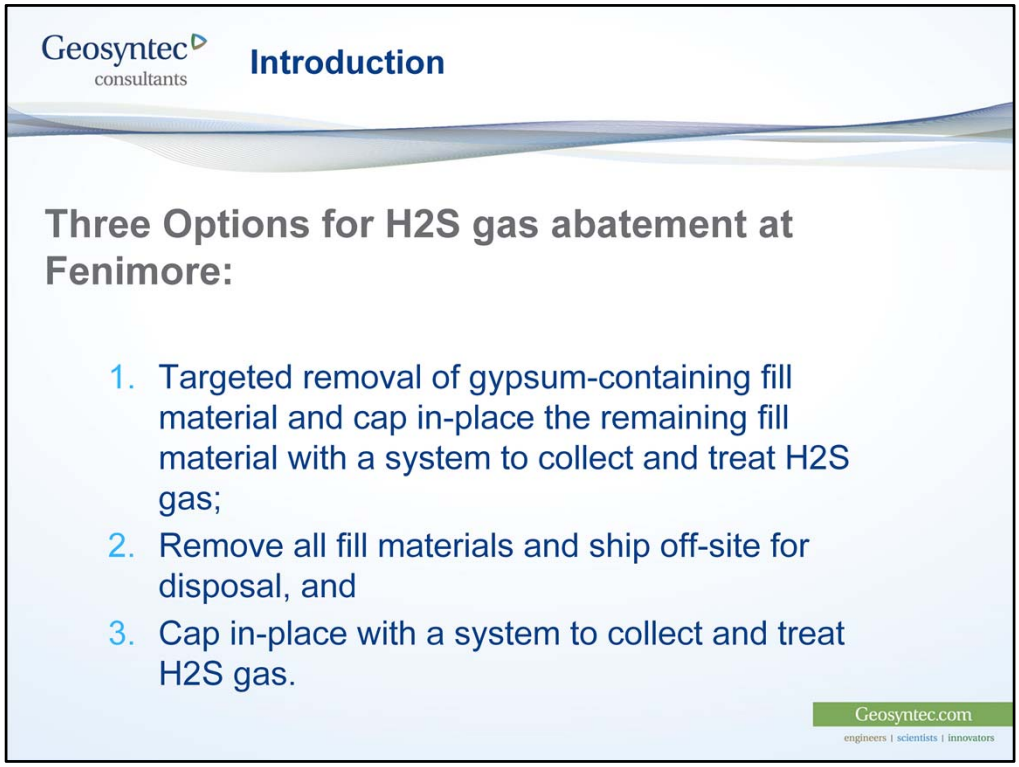
- That gas then builds up and is stored within the “pore spaces” of the material deposited in the landfill (empty spaces) until it has no place to go but into the air. This process will continue until either all the sulfur in the gypsum is consumed or the environment within the landfill is dried out. Drying out the environment within the landfill will slow and eventually stop the process. Because the gypsum must be wet for the bacteria to use, drying out the landfill will slow down the bacteria and H2S gas production



- According to SEP's records, a total of 375,366 cubic yards of various fill material was brought to the Fenimore landfill between December 2011 through June 2013.

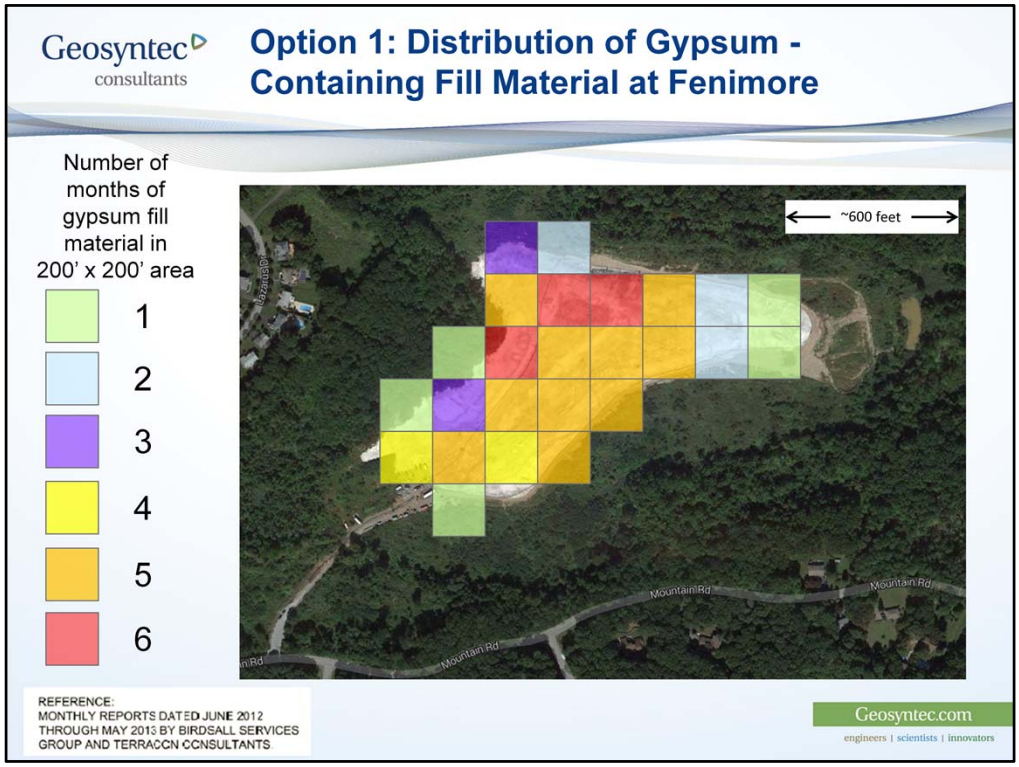
- Of that, about 54% was CDS containing gypsum and most of the CDS (60%) arrived at the site before Super Storm Sandy. Over half of the material brought to the site by SEP has the potential to generate H2S. The period of time that is needed to start the generation of H2S is variable but in this case approximately four (4) months.

- Since more than half of the material can generate H2S, there is a significant quantity of H2S stored within the pore spaces of the material deposited in the landfill. This stored gas is substantial and at great concentrations.



- There are three options we looked at:

  * targeted removal of most contaminated with capping and gas collection;
  * excavation, and
  * capping in-place with gas collection and treatment.



- SEP records kept during operations identified the date, volume, and location of materials that were brought in and landfilled. This slide shows a breakdown of where gypsum-containing materials were placed. As you can see, they were spread all over the site prior to the State take over of the landfill.

- Because of this, we can't skim off a section or excavate just a portion of the site. You would have to move everything in order to sift out the sheetrock, and you still couldn't be sure at the end that you got it all, so you would still have to install a cap. Therefore, trying to remove hotspots is really not an option. So you need to look at either total removal or cap in-place.

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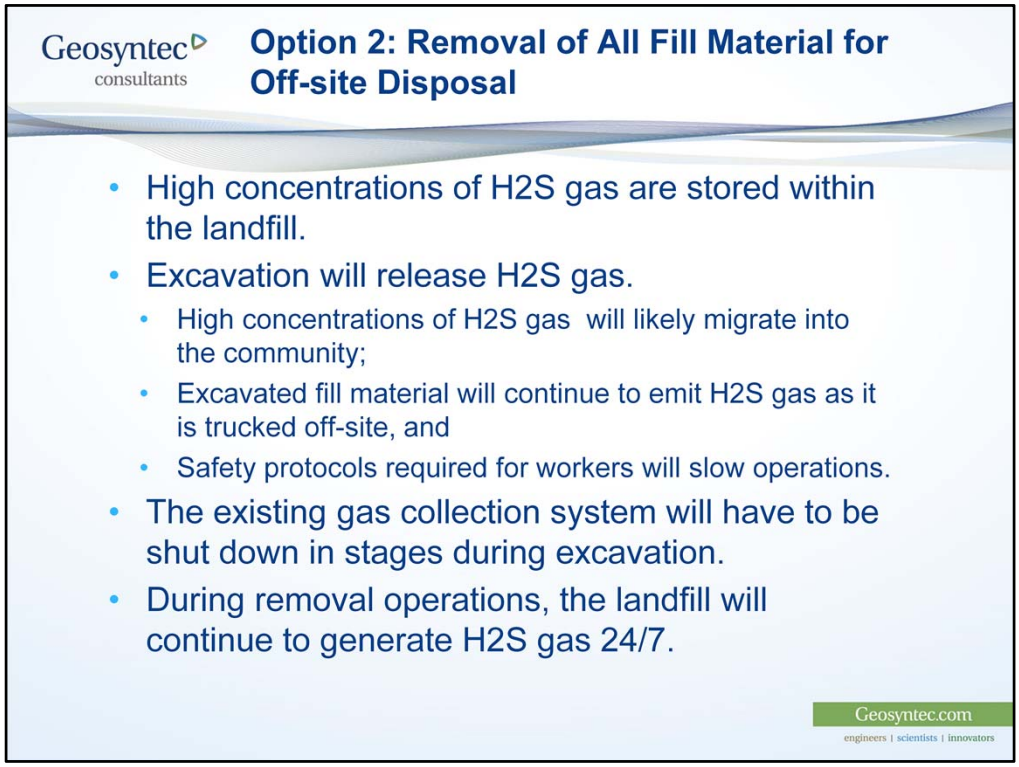
Option 1: Targeted Removal - Conclusion

- Targeted removal of hot spots is not possible because gypsum materials are throughout the site.
- Therefore, no cost analysis was conducted

- Here is what a typical waste excavation job looks like. Big excavators dig up the waste and put it in a truck. You see that digging into a landfill is not like digging a hole in the ground. The surface is uneven, and you have to create benches to get access.

- In this picture, the waste being removed did not generate H2S gas, but at Fenimore, the H2S gas makes things more complicated. Let's review the issues.



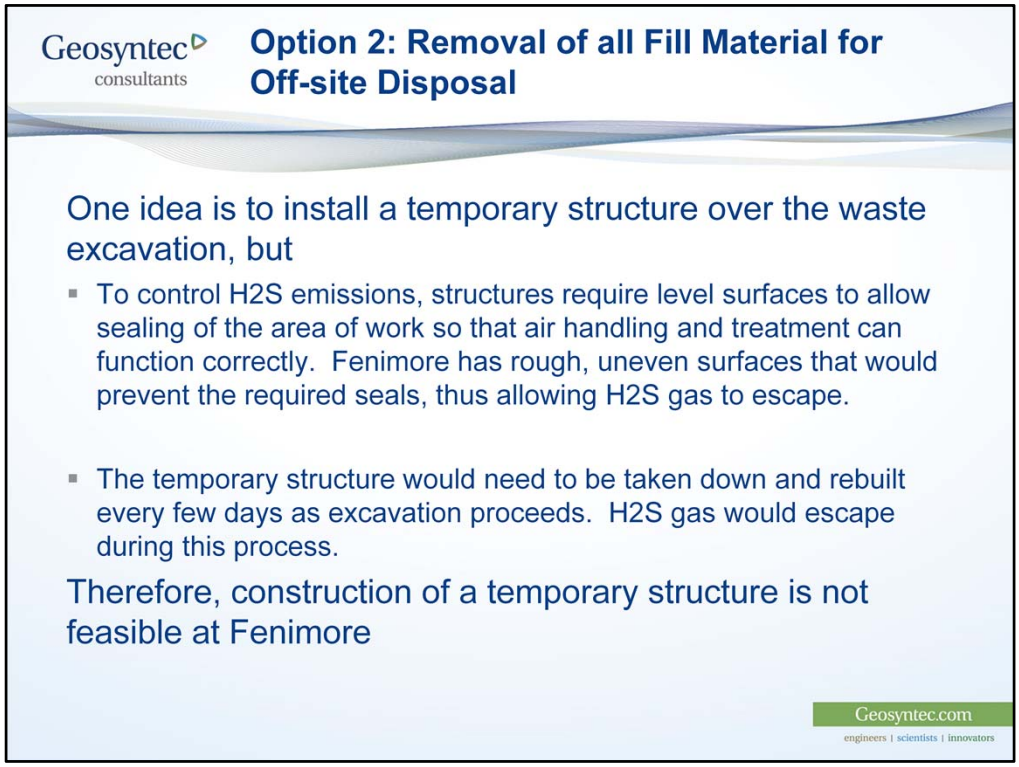
- All the voids in the landfill are currently filled with H2S gas. This would escape into to the air during excavation.

- Because of this, all of the workers that are close to the excavation area would have to have supplied oxygen so they wouldn't be exposed to the H2S gas.

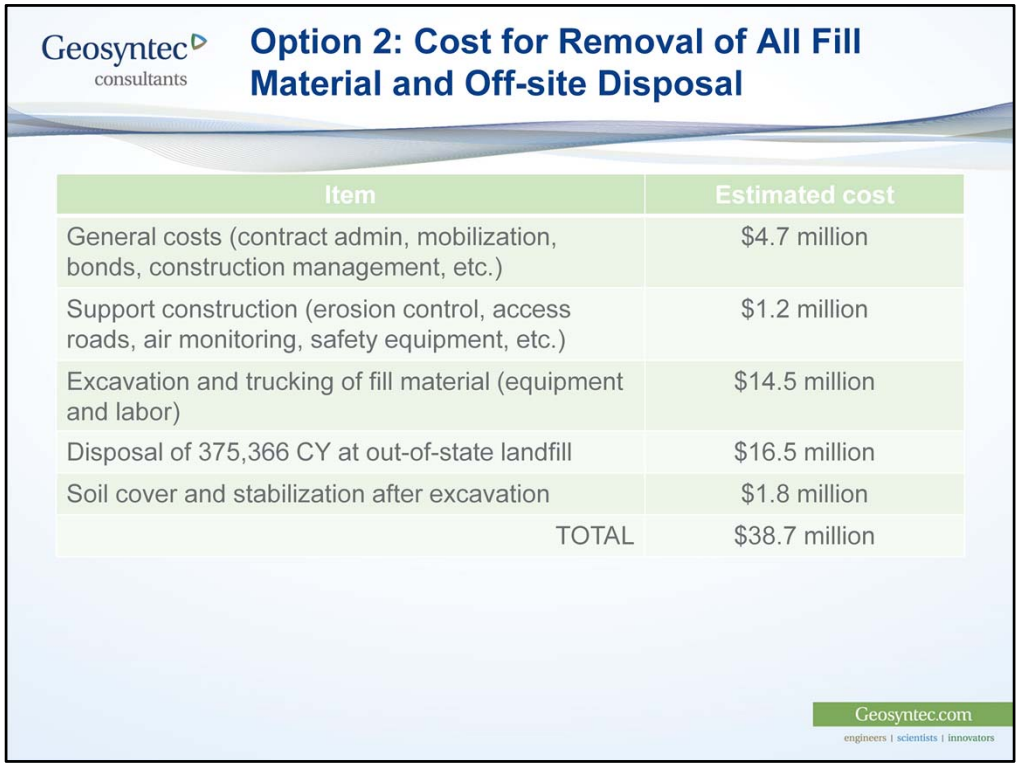
- In addition, the steep slopes of this site and the numerous safety protocols that workers will be required to follow will slow progress of work on the site. Because of this, excavation is expected to take a minimum of 16 months, with several more months to import soils to cover the site and plant vegetation.

- Throughout excavation H2S in significant concentrations will be released. In addition even with best efforts to control gas emissions, as the loaded trucks leaves the site, and moves through the community to the final disposal site, gases will be emitted. Thus during excavation, the potential for a great deal of odor to be released will exist and residents downwind or along the paths the trucks take are expected to be impacted.

- The gas collection system that is operating at the site would have to be shut down in phases during excavation. The phases would be pretty big, because if the suction applied to the landfill is short-circuited by the excavation, then the whole operation shuts down. So now you not only have odors being generated during construction, but a risk that they can't be controlled on nights or weekends either.



One idea to control the H2S is to construct a temporary building over the excavation area so you can collect the gas and treat it. But this is unfeasible because of the issues associated with excavating a landfill.



- The estimated summary of the costs for removing all of the fill brought in since 2012, which includes the cost of excavation, hauling and disposal is approximately $38 million. It is important to note that the gypsum materials brought into Fenimore are not recyclable. They are the leftovers after recyclable materials are removed from demolition wastes. Therefore, they have to be disposed in a landfill, which is expensive. The nearest commercial landfill that would accept this material is in Pen Argyl, Pa., about 40 miles away.

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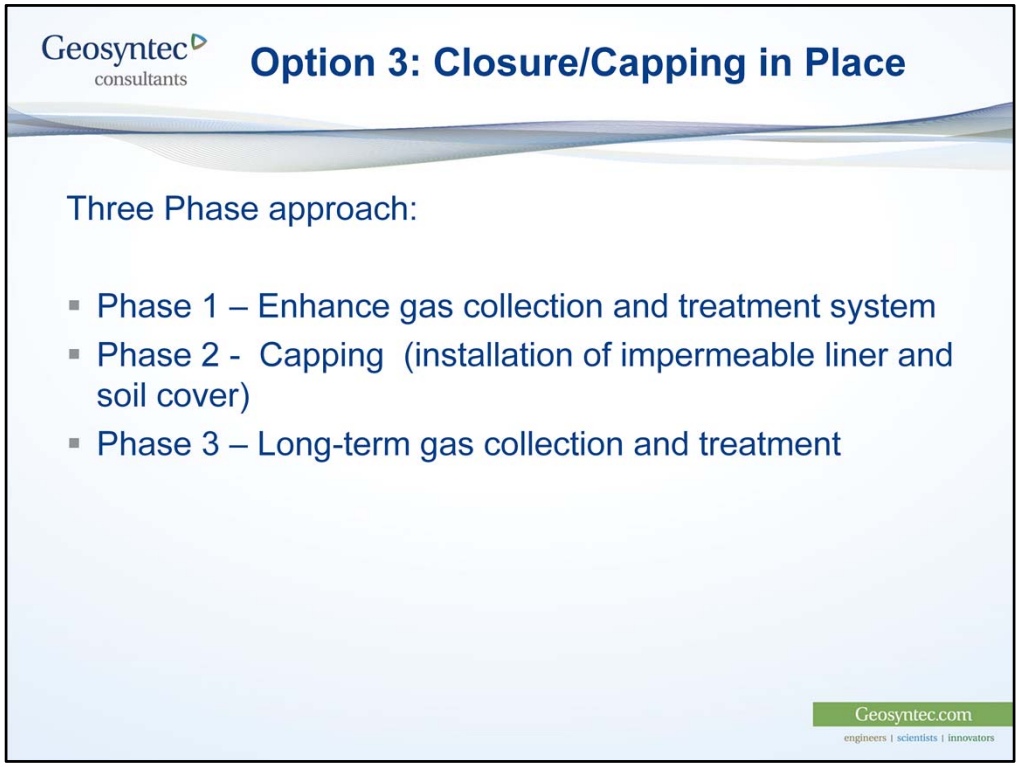
Option 2: Removal and Offsite Disposal - Conclusions

- Uncontrolled release of significant concentrations of H2S gas to the community is likely and could occur 24/7;
- This situation is expected to continue for 16 months;
- Significant daily truck traffic through the neighborhood is required;
- Fill material being hauled off will emit H2S gas along the roads even with best efforts to minimize;
- Exposure risk to workers from H2S gas;
- Significant cost estimated at $38.7 million.



Now let's look at the third option available

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Option 3: Closure Capping - Phase 1

- Expand and enhance gas collection from 9 to 30 wells, and remove H2S from entire area in early Spring 2014.
- The expanded system will be completed prior to the summer when people are outside more.
- The expanded system is expected to collect and treat the vast majority of gas that is generated.

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Option 3: Closure Capping - Phase 2

- Capping minimizes disruption of the landfill and the potential to release H2S gas;
- Summer months of 2014 will be used to stockpile clean soil to reduce daily truck traffic in the Fall 2014;
- The installation of an impermeable liner by December 2014 provides an effective barrier to gas and will further dry out the waste (reducing H2S generation) while complementing the gas collection system;
- Final grass cover Spring of 2015 with completion by June 2015.

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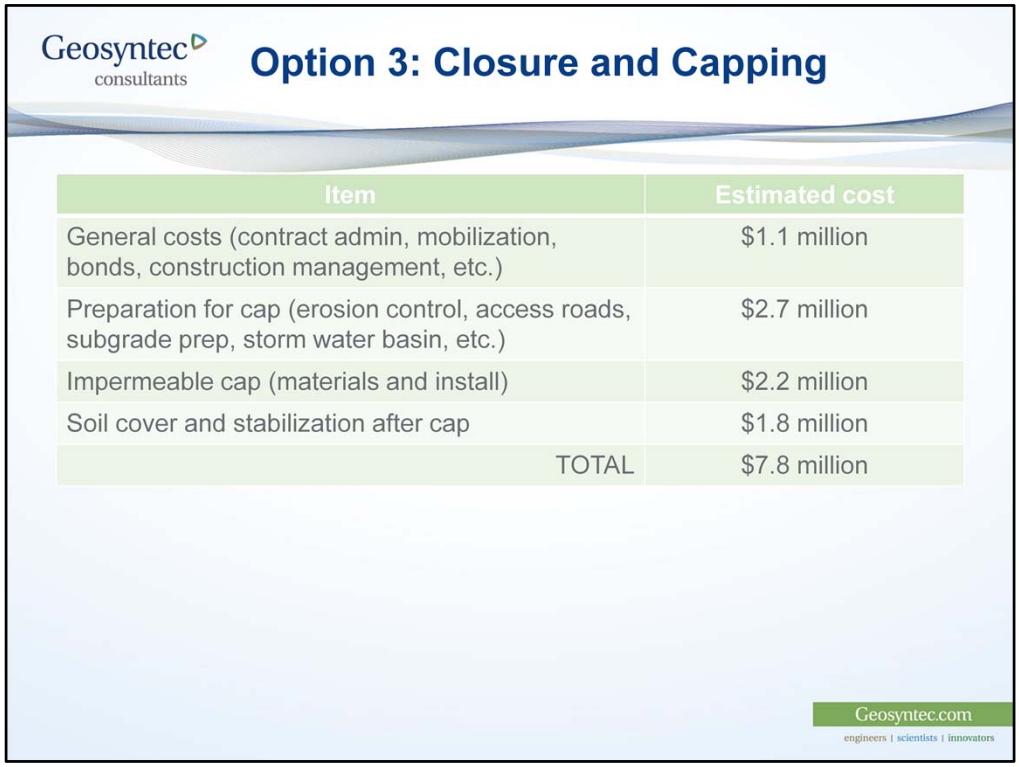
Option 3: Closure Capping - Phase 3

- Remove interim oxidizer/scrubber treatment system. Technologies being evaluated involve using dry material to filter H2S from the gas, and
- Long-term maintenance of the cap and gas collection and treatment system.



This cost estimate was prepared by Berger

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Option 3: Closure and Capping - Conclusion

- Provides continuous control of H2S gas;
- Minimizes disturbance of the gypsum fill material;
- Provides complete encapsulation by December 2014;
- Significantly reduces daily and overall truck traffic;
- Significantly reduces the potential for H2S gas generation by preventing moisture from getting in;
- Substantially controls and reduces potential H2S gas exposure to the community.

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Summary

- Targeted excavation (removal of hot spots) is not feasible because gypsum fill materials are throughout the site.
- Full excavation will result in uncontrolled release of H2S gas into the community and along the roads used for trucking for an estimated 16 months.
- Full excavation would require a longer timeline for closure and extended H2S gas exposure to the community;
- Full excavation would require about 25,000 round trips in and out of the site for an extended period of time.
- The cost of full excavation and removal is estimated to be about $38.7 million, approximately 5 times the cost of capping.

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Summary (continued)

- Capping in-place with gas collection will effectively prevent odors from H2S gas.
  - reduces risks associated with H2S gas to the public and workers.
  - can be completed without disrupting the improvements already made to the H2S gas collection and treatment system.
  - can be completed in a shorter time frame thus abating H2S gas exposure in the community faster and sooner.
  - will require significantly less daily and overall truck traffic than full excavation.