CROZET PHYTOREMEDIATION

VIDEO PROGRAM

CLIENT SCRIPT DRAFT #2

6/21/07

1. The program begins with shots of "traditional" clean up sites where excavation and transportation are used. The EPA logo along with text Reading "Superfund" also appears as the narrator begins.

Narrator: EPA's Superfund program protects citizens from the dangers posed by abandoned or uncontrolled hazardous waste sites. In the past, getting these sites cleaned up often required a significant outlay of energy and non-sustainable resources.

The traditional approach for contaminated soil has been to excavate the material and haul it away. Unfortunately, this operation has a domino effect, by disturbing uncontaminated areas, including the clean fill needed to backfill the excavation.

2. The text reading " Superfund" slides up and additional text reading "Green Remediation" appears. As the narrator continues we see shots

where Green Remediation is being utilized including Phytoremediation, Bioremediation, Biosolids Recycling, and Native Plant Revegetation.

Narrator: Now EPA has introduced a Green Remediation initiative for these sites that considers the environmental effects of the remedial strategy early in the process, and incorporates options to maximize the net environmental benefit of the cleanup. From the selection and design of the remediation technology, to the management of on site activities, to the use of energy conservation and alternative sources of clean energy, Green Remediation helps save natural resources and taxpayers money.

3. Shots of Crozet, VA and workers unloading plants at the site are shown as the narrator continues.

Narrator: Outside the small Virginia town of Crozet, EPA is doing just that, by using phytoremediation to remove arsenic contamination from a residential property. Phytoremediation uses specially selected plants to remove or reduce the risk of contaminants in the soil, water, sediments, and air.

The 2 acre site, a former orchard, is contaminated with arsenic which is a by-product of pesticide application on fruit trees.

4. USEPA Region 4 OSC Myles Bartos is introduced. While Myles explains some of the sites history we see archival black & white footage of pesticides being applied to trees.

Myles Bartos: Prior to 1972 there was legal application of pesticides, lead arsenates, DDT, DDE and DDD. EPA banned them in 1972. However, there's a lot of orchards that still had their product on the soils. And since then, a lot of these orchards have been sold off and developed into residential properties.

Arsenic doesn't break down like DDT, DDE and DDD does, so that is a little more pervasive in sticking around. It's not very mobile so it actually stays in place where it is. And that's actually helping us because we don't have to go chasing it to deep depths. Essentially the top roughly zero to six inches are contaminated.

5. Shots of residents walking on the contaminated property are shown along with shots of the crew handling the plants as the narrator continues.

Narrator: The contaminated areas of the hillside are accessed by adults, children and pets on a daily basis. Because Arsenic is a

known carcinogen, mutagen, and is detrimental to the immune system, the soil needed to be cleaned up.

Phytoremediation was chosen because if conditions are favorable, the technology can be effective, while having minimal impact on existing topography and the ecosystem. Phytoremediation is also considered an In-Situ, or in place remediation approach, which means the contaminated media isn't transported off site. And since plant cultivation and harvesting are relatively inexpensive processes, phytoremediation has significant cost saving advantages compared to traditional clean up methods.

6. Scott Fredericks, a Biologist with USEPA/ERT is introduced. As Scott speaks we see shots of a traditional excavation remediation.

Scott Fredericks: Superfund has been around 25 years. We've learned a lot about, if you dig and haul, it's a very energy-intensive operation. You have huge equipment that takes a lot of money to operate. Instead of bringing in a lot of heavy equipment, being very disruptive knocking down all these trees, hauling off all this dirt and putting it someplace else, and then trying to find some clean soil to bring back in here, they're trying to do an In-Situ extraction using these ferns.

7. Close up shots of the ferns are shown as the narrator continues.

Narrator: The ferns being planted were developed at the University of Florida and licensed to Edenspace, a leader in the use of plants for environmental protection and renewable fuels.

8. Dr. Michael Blaylock of Edenspace Systems Corporation is introduced. Shots of the ferns along with an animated graphic depicting how the plants remediate the arsenic are shown as Dr Blaylock and the narrator continue.

Michael Blaylock: We've done a lot of work looking at different plants and their ability to accumulate arsenic. And we found that really only ferns in this particular genus – Pteris ferns – accumulate arsenic. And they take up arsenic to a very high concentration. They tolerate high arsenic concentrations in their leaves and they do a remarkable job of extracting it from the soil.

Narrator: In fact, the hyper-accumulating 'Victory' variety of Pteris vittata (terrace vit-tah-ta) sold by Edenspace, under the label Edenfern, holds concentrations greater than 200 times more than other plants tested for Arsenic phytoremediation, and is adaptable to conditions in a variety of climates.

9. Shots of the property owner, Jim Dugan, walking on the property and watering the ferns are shown as the the narrator and Jim explain.

Narrator: USEPAs relationship with the property owner also helped in choosing phytoremediation.

Jim Dugan: I feel a real close connection to the property. And I wanted to be at the property sort of like if you have a patient in the hospital. You want to be there with that person. And I consider this land my responsibility, and I have been able to work with the EPA members. They're really friendly and they don't mind my so-called interference.

10. Shots of site preparation and planting are shown as the narrator, Michael Blaylock, and Myles Bartos continue.

Narrator: Getting the job done is relatively simple. Areas of the hillside with elevated levels of arsenic were mapped into 30 by 30 foot plots, then tilled to a depth of approximately four inches.

Michael Blaylock: The goal here is to be able to optimize plant growth. Because if we get the plant roots to develop well, and get

the plants to grow well, they will take out more arsenic from the soil. So we want to do everything we can to prepare the site and to try to optimize the plant growth.

Myles Bartos: We did soil composition testing to see what sort of nutrients we need to apply. In this case we did a very mild nitrogen-based fertilizer, slow-release formula, put a little lime in to neutralize some of the soil. Once we do that, we lay down landscape fabric, and cut holes in it in a one square foot area. And in this particular case you're doing 30 X 30 grids.

Michael Blaylock: Then we transplant the ferns in. And from then on out it's a matter of keeping them wet until the roots get established in the soil. And providing the shade that they need in an environment like this, that's easy because of the trees.

Narrator: In the few areas where direct sunlight could reach the ferns, 60% shade cloth was placed over the plot to improve plant growth.

11. Shots of the team putting together the irrigation system are shown as the narrator and Myles Bartos explain.

Narrator: For irrigation, the plots were divided into two systems. The first system utilizes a spring at the top of the hill close to the residence which gravity feeds into a storage tank, which in turn gravity feeds the fern plots.

Myles Bartos: The other half we're going to use a solar panel pump to pump up and let it gravity feed down to holding tanks to feed the plants, to keep in moisture. You can't water them too much.

Narrator: A low pressure drip tape irrigation system was installed to deliver fresh water to the ferns during dry spells. During periods of adequate rainfall, water from the spring will be diverted and recovered into the storage tanks for later use.

12. Additional shots of the crew prepping, planting, and watering additional plots are shown as the narrator continues.

Narrator: The ferns will be grown for approximately five months or until night temperatures drop below freezing and plant growth and biomass production ceases. The fern biomass will be harvested, and then sampled for arsenic content. Because arsenic levels in the

harvested plants are expected to be below prescribed levels, they can then be disposed of in a municipal landfill.

Shots of soil sampling are shown as the narrator and Michael Blaylock continue.

Narrator: Soil sampling will be conducted at the end of the growing season and compared to pre-planting samples to determine the ferns effectiveness.

Michael Blaylock: We're hopeful that for many of these areas that we're doing, that we can do it in one season. In some areas the arsenic concentrations are higher and it will take more than one season we anticipate. But for a large part of this site, we think we can do in it one year.

13. Shots from through out the project are shown as the narrator, Michael Blaylock, Scott Fredericks, and Myles Bartos make closing comments.

Narrator: Phytoremediation is idea for targeting small areas like the 30 by 30 plots at the Crozet sites. The technology does have limitations though. At some sites contamination may just be too

deep for plant roots to reach. But under the right conditions, phytoremediation is a win for clean up teams and the public.

Michael Blaylock: One thing that I love about the work that I do is that everybody really likes this approach. People generally like the idea of being able to use a plant to take contamination out of the soil, that's something that has a lot of public appeal and I get a lot of positive feedback for it.

Scott Fredericks: And nothing succeeds like success. So this site is important, I think, because it represents what's it is we're seeing more of across the country in other states, especially on the west coast – old orchards that are being built upon, people retiring on them or they're just building homes as part of urban sprawl.

With this technology, It's very low impact and you're not using a lot of energy. What we're using here are sustainable, or clean energy forms. We're using solar panels to drive our pumps for the drip irrigation system and we're using a minimal amount of energy.

Myles Bartos: The goal here is not to be green, but it's a really good secondary thing. Our goal is to protect public health and the environment. This happens to be an alternative technology that will

do that with less waste and just a greener atmosphere. So it actually goes along with the EPA initiative of going green and it also achieves our tasks within the removal program to protect public health from imminent and then substantial threats.