Biosolids Recycling: Restore, Reclaim, Remediate

The program opens with shots of a family in a kitchen. We see bottles and cans landing in a recycling container. We then see shots of recycling trucks and workers in a residential neighborhood collecting materials. We also see household recyclable materials being sorted at a transfer facility. These shots then dissolve to shots of a washing machine being loaded, a shower being turned on, someone washing dishes, and a close up of a hand flushing a toilet.

Narrator: Community based recycling programs are more popular than ever. Reducing the waste stream to already jammed landfills by recycling plastic, glass, metal, and paper just makes sense. It also makes environment awareness part of our daily routine.

Most people don't realize though, that the 200 gallons of wastewater a typical family of four generates every day can also be recycled.

Narrator: Once wastewater leaves a home, it's processed at treatment facilities where liquids are separated from solids, purified, and then safely returned to waterways.

The solids are also processed to eliminate any disease causing bacteria, viruses, and parasites. What remains is a nutrient rich natural fertilizer, known as biosolids.

For years, these biosolids were inefficiently landfilled, ocean dumped, or incinerated. But today, with restrictions tightening and costs for landfilling and ocean dumping rising, communities are realizing the benefits of biosolids recycling.

The animated title: "Biosolids Recycling: Restore, Reclaim, Remediate" appears. We them see shots of biosolids being used on farmland.

Narrator: Currently, agricultural is the number one outlet for biosolids. Through biosolids application, rich organic nutrients can be restored to overworked soils, thereby increasing crop yields. In many regions, biosolids are provided to farms free of charge, reducing costs to farmers, and in turn to consumers.

A graphic showing the location of biosolid reclaimed coal mines in Pennsylvania is shown along with live shots of the surface coal mines as the narrator continues.

Narrator: Restoring nutrients to agricultural lands seems the most logical application for biosolids, but alternative uses have been in use for years.

In the bituminous coal fields of north-central Pennsylvania, biosolids are used as a soil amendment to reclaim surface mines. After spent mines are backfilled and recontoured, biosolids are incorporated into the soil. The soil is then reseeded as the final step of the reclamation program.

John Uzupis of Wheelabrator Water Technologies is introduced, and explains along with the narrator the process of using the biosolids on the mines as we see more images of the reclaimed mines.

John Uzipis: The field behind us is part of a mine site known as the Mountain top Mine. And the biosolids application started almost 5 years ago.

John Uzipis (cont.): Biosolids, compared to commercial fertilizer applications, have very similar germination times and initial establishment. The biosolids become much more impressive though, after the first year, when everything seems to come together and you get a bloom of growth.

Biosolids, by their organic nature are slow release. So the nutrients are available as the microbes digest or decompose the material, they make the nutrients available to plant growth so its sustained for significant periods of time.

A skyline shot of Philadelphia is followed with images of the city's biosolid recycling center as Bill Toffey, the city's Biosolid Utilization Manager is introduced.

Narrator: The biosolids are trucked to the mines from Philadelphia. The city's 72 acre Biosolid Recycling Center is one of the largest centralized biosolids processing facilities in the country, and has been recycling the solids from wastewater generated by 2.3 million people into biosolids for over 20 years.

Bill Toffey: The Philadelphia Water Department made a commitment back in the mid ‘70s to the EPA and to the state that would end the practice of ocean disposal, and embrace land application of biosolids.

One of our longest standing programs for recycling has been the program to use our product to reclaim bituminous strip mining lands in north-central Pennsylvania. Over the last nearly 20 years now, we’ve reclaimed about 4,000 acres of land using 700,000 tons of biosolids products.

More shots of mine reclamation are shown as the narrator and Bob Brobst, Biosolids Regional Coordinator for US EPA Region 8 talk about the potential for biosolid use.

Narrator: For surface mining reclamation, biosolid application is actually the preferred fertilizing program; a cost efficient, effective and eco-friendly means of restoring the land to productive wildlife habitat. But even with programs like this, one third of all biosolids being processed nationwide still remain unused.

Bob Brobst: The municipalities are continuing to produce this product and most of them have established programs to either land apply, or use or dispose of this, but only 50% of the useable biosolids are actually land applied for beneficial purpose.

Shots of scientist working at the USDA Agricultural Research Service are shown as the narrator and Rufus Chaney, Chief Agronomist for that agency, explain new investigations into biosolids uses.

Narrator: Developing and implementing better ways to use this excess is crucial. For the last 30 years scientists at the USDA Agricultural Research Service in Beltsville Maryland have been experimenting with alternative uses for biosolids. With an eye towards hazardous waste sites, and in particular contaminated smelter and mining operations, these researchers believe that biosolids have real remediation potential.

Rufus Chaney: So it works good on coal mines. What does it do about zinc mine waste? I see it as a straightforward extrapolation of available knowledge applied to one of the toughest problems that the environmental agencies have: Of barren contaminated mine waste and smelter-polluted mountains that have been barren since 1950 or longer in some cases.

Narrator: Through a collaboration with US EPA's Environmental Response Team, the USDA has found a partner that if the technology proves itself, could make a sizable dent in the surplus of municiple biosolids.

Harry Compton of the US EPA / ERT is introduced and along with the narrator, explains EPA's relationship with the USDA

Harry Compton: The biosolids, or composted biosolids technology, seem to be most appropriate for metals-contaminated sites**.** And specifically, we're encouraging their use at large area metal sites, where they're looking at literally hundreds of acres, or even square miles of contaminated mine land from base metals mining or smelting.

Narrator: Soil samples from these EPA sites are shipped to the USDA's Environmental Chemistry Lab where they're blended with composted biosolids and other amendments like limestone.

As the narrator continues, animation illustrating how biosolids limit bio-availability is shown

Narrator: These tailor-made biosolids not only jump-start plant growth by increasing fertility, they also have the ability to fix or bind heavy metals, thereby reducing their phyto and bio-availability.

Simply put, the contaminants are still present in the soil, but can't be absorbed by plants or animals. Even if they're ingested, they remain bound as part of a compound and passed through the body.

Rufus Chaney and Harry Compton return to give additional details on biosolids' "fixing" abilities and how they're used in the field.

Rufus Chaney: If I add the limestone to keep the pH at say 6.5 or above, I've added phosphate and iron in the biosolid to bind heavy metals, including zinc and lead and cadmium.

It ends up that they're not taken up by plants and they only become less available with time**.** That's because they get more deeply bound into the iron and the organic matter and the other stuff in the soil that make it non-bioavailable to plants or to animals.

Harry Compton: The USDA folks basically give me a recipe of biosolids addition and lime addition and other amendments to give me the optimum conservative treatment for the kind of application we would perform.

A graphic map locating Leadville, CO dissolves into a scenic shot of the mountains of Colorado. We then see a group of people working outside followed by shots of barren lands damaged by mine tailings as the narrator continues.

Narrator: With the USDA's recommendations in hand, EPA and the state of Colorado recently teamed with the City of Denver to conduct field-scale testing along the floodplain of the Arkansas River.

Mining in that region of Colorado, particularly around the town of Leadville, had been a boom to the region for over a century, but not without a cost to the regions pristine alpine environment.

During seasonal flooding over the last 100 years, mine tailings were deposited along river's bank. The silt contained elevated levels of heavy metals which killed vegetation, escalated erosion, and striped what little top soil remained.

Dr. Bernard Smith, a rancher from the area is introduced and gives some background info on the region. The narrator explains how biosolids are being used.

> **Dr. Bernard Smith:** This material from the mills entered the Arkansas River and from there, it entered the irrigation ditches, and all of these metals from the mouth of California Gulch on south. This further killed a lot of the forage on the meadows, So a lot of waste material high in metal content came down all the streams, because at that time we did not have any settling ponds for the mills.
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> **Narrator:** To try to get these soils healthy enough to support plant life again, 15 to 20 truckloads of biosolids are being hauled every day over the mountains from Denver Metro's wastewater treatment facility, which has the resources to process, custom blend, transport, and land apply biosolids.

Steve Frank, of Denver's Metro Wastewater Reclamation District is introduced and details his groups role in the remediation. Shots of their facility are also screened.

Steve Frank: We're actually a branch of local government here in the metropolitan Denver area. We serve some 55 local governmental entities, and we provide wastewater processing for those local governments.

Metro Wastewater Reclamation District's biosolids are an excellent quality biosolids. We have an outstanding pretreatment program which prevents unwanted materials from getting here in the first place. We have an outstanding laboratory program for analyzing the biosolids, and we produce a material that far exceeds the EPA's requirements for what's called an EQ biosolid with respect to metals.

Mike Zimmerman, EPA Region 8 On Scene Coordinator is introduced and gives some specifics on the site.

Mike Zimmerman: We've identified 149 hot spots in the 11 mile reach here within the floodplain of the Upper Arkansas. And our objectives are to treat the worst sites first. We're trying to encapsulate, immobilize, reduce the release of heavy metals into the river, into the environment. We're trying to affix the heavy metals so that they're not bio available, is our basic goal.

The narrator, along with Sally Brown of The University of Wisconsin explain the way Biosolids are blended as we see annimation and shots of the biosolids being applied to the soil .

Narrator: Collaborating with biosolid specialist on site as well as in the lab has allowed researchers to experiment with different mixture ratios and application techniques on a larger scale.

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Sally Brown: When you're going to a certain site, you have to look at the site, discuss and try to figure out what the problems are at a site that are limiting plant growth, and based on that come up with a specific amendment for each site that will try and address each of those problems.

What you can do with the bio solids, is mix lime directly in, its a very straightforward procedure. You use a front end loader, 1 scoop to 5 scoops, or, depending on the lime rate that you need to add.

And just by turning it around a little bit with a loader, you can get a decent mix, and what you have when you add the bio solids and the lime together is the potential for the alkalinity that you're adding with the lime to move through the profile with the bio solid so that you can not only fix the acidity at the surface 6 or 10 inches, **Sally**

Brown (cont.): but hopefully you'll get down to 24 and even further; that's what we've seen in the research plots.

Shots of team members gathering soil samples from the site are shown as the narrator, Dr. Smith and Bob Brobst talk about the benefits of remediating the site.

Narrator: Analytical results of the pilot tests at Leadville indicate that the biosolids treated soils reduced the available metals, thereby reducing lethal toxicity to living organisms.

What this means to the locals is that after almost 100 years, the land can finally be put back to productive use.

Dr. Bernard Smith: As these historic mine wastes are re-vegetated, the landowners hope to have some forage suitable for raising various types of livestock. We will have an area along the Upper Arkansas River that will support fish life, be a wonderful wildlife habitat, and be an enjoyable place for people to come and play.

Another graphic map, this time locating Bunker Hill, Idaho, is shown along with shots of Sally Brown colllecting samples at the site as the narrator and Sally Brown give the details.

Narrator: USDA and EPA are also collaborating at another metals site near Kellogg, Idaho. At the abandoned Bunker Hill smelter facility, airborne contaminates killed plants along the hillsides, leaving the soil susceptible to the forces of wind and rain. The erosion then striped the steep slopes of nutrient laden topsoil and any hope of natural revegitation.

Sally Brown: When you have a site like this, you have problems associated with poor physical properties of a soil. That's basically a result of there being no more organic matter left in the soil.

Animation showing how biosolids deliver nutrients to poor soils is shown while Sally Brown explains.

Sally Brown: Biosolids are about 50% organic matter. So when you do a heavy biosolids application, your rebuilding a lot of the organic matter in the a-horizon of the soil.

Biosolids are basically your whole recommended nutrient table for plants. Nitrogen, phosphorus, some potassium, calcium, magnesium. There's a whole long list of elements that are

Sally Brown(cont.):essential for plant growth and biosolids basically have all of those elements

The animation ends. Shots of scientists touring and taking samples at the site are shown as Sally Brown continues.

Sally Brown: There are two aspects of the biosolids project at Bunker Hill. We've treated uplands with biosolids, that's been in place for about 3 years, and we treated a wetland with a biosolids compost, and that's been in place for about 1 year.

What we used was biosolids in combination with wood ash on the hillsides. The wood ash is a locally available residual. Its very high in phosphorous and potassium and its a very high calcium carbonate equivalent material.

More annimation illustrates how the biosolid and wood ash mixture adheres to the landscape.

Sally Brown: In addition, when you're mixing the biosolids and wood ash together, they get to be a very highly adhesive material, so they'll stick to the hillsides. And so that's why those two materials were used here.

And we've been real happy with the results we've seen so far. The biosolids on the uplands portion have maintained a really

Sally Brown(cont.): vigorous vegetative cover for the 3 years that they've been in place.

On the wetland, what's really nice is that now when you drive past the wetland, you hardly blink, because it looks like a wetland, like any of the wetlands in the area, whereas before it looked almost like a moonscape, like it was filled with quicksand.

Shots from a public meeting in Leadville addressing biosolid application at are shown as the narrator, Rufus Chaney, and Harry Compton talk about public acceptance and safety.

Narrator: Initially, the general public was somewhat skeptical of biosolid recycling. But initial fears of pathogens and naturally occurring heavy metals in biosolids are being replaced by enthusiasm due to assurances from the scientific community.

Rufus Chaney: USDA can never, let's say tolerate, let alone accept and recommend, a use of a new material like biosolids until the safety has been rigorously shown.

And so in 1989-93 in the last go around in rules in 1980, and the first go around of federal rules, USDA, Food and Drug, and EPA worked together to make sure the rules protected everything of the use of that land; for gardens, for children playing, for wildlife, for livestock, for adults, for crops.

Narrator: Inviting local representatives to visit application sites and biosolid processing plants has also been beneficial. Usually, once a community realizes the cost benefits as well as the advantages over traditional treatments, they're more willing to accept biosolids recycling as another "green" solution.

Harry Compton: Politically its very cost-effective as well because most folks out there appreciate seeing a landscape of lush green and / or trees rather than cement or denuded landscape.

Steve Luftig, Director of EPA's Superfund program is introduced and talks about his agency's commitment to remediating with biosolids.

Steve Luftig: Its a very promising technology. Its inexpensive compared to other technologies and it takes two wastes, sludge and wasteland, mining waste, mixes them together and gets a positive result.

And we're very hopeful that as we try it more and more and learn more and more about how to apply it, how to amend the soil, how to keep it in place, what plants will grow under what conditions, that we'll be very useful technology in the future.

Rufus Chaney of USDA appears for the last time and wraps the program up.

Rufus Chaney: This isn't a one-year or one-season fix, because we correct all the problems the soil had from the pollution. Again its science, its only applied science. And what you do is hunt for the least expensive way to apply that science.

You go to a Bunker Hill or a Leadville where its been dead for 30 years and its not going to recover by any natural process we know of.

We apply a tailor-made iron-phosphate-rich biosolid and some carbon and we can get legumes and grasses thriving on that site within, as soon as the seeds can germinate.

They've held up year after year in soils with percents of zinc; all the science says its fixed persistently. The design makes it fixed persistently, and I'm confident from, again, the basic research side and the experience side that its the persistent remediation that we've been seeking for these many years.

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