Video Transcript: *ENVIRONMENTAL RESEARCH TO IMPROVE FOOD SAFETY*

A film by Ludmila Pachepsky

00:00 – *Calm and soothing background music. Video title is displayed as camera pans over scene of fields and trees.*

00:11 - *Sound of machinery is heard. Outdoor experiment is shown in progress in an outdoor field: an irrigation device that simulates rainfall is spraying water over a grassy area, and people are working under the artificial rain.*

00:23 – *Introduction begins, with Dr. Dan Shelton speaking to camera. Caption is displayed briefly: Dr. Dan Shelton, research leader*

Dan Shelton:

Hello! My name is Dan Shelton; I am the research leader of the Environmental and Microbial Food Safety Laboratory. And, the research you are going to hear about today is conducted in this laboratory. I want to give you some background on this project, the work you are about to hear, because putting the site in the place, getting all the equipment together, has been quite a long process, and you are seeing, essentially, the culmination of quite a lot of work.

[00:53 – Panoramic view of large experimental site is shown as Dan continues to speak]

I initiated this project back in the late nineties. I became aware of this site then,

[01:00 - camera returns to view of Dan]

And originally it had been built as a lysimeter site by the Nuclear Regulatory commission to study a leaching. It's a great site. They went into a great deal of trouble to build up a large amount of dirt, and they embedded in this large amount of dirt several different what I will call lysimeters. They dug them out to the depth of about 10 feet.

[01:25 – bird's-eye view of the experimental site is shown]

They are completely lined and they are completely surrounded by gutters, so that any water that either infiltrates into the lysimeter or runs off can be collected.

[01:36 - camera returns to view of Dan]

So, once I became aware of this site, I realized that it would be ideal for the kinds of runoff studies and infiltration studies that we need to conduct to understand how pathogens, their fate and transport in the environment. Of course, I had collaborators on this project. Colleagues at the time were Dr. Ali Sadeghi, and Dr. Al Isensee, and also a visiting scientist at the time Dr. Asad Ruhi. We were all working together to prepare this site with very specific soil types which we had trucked in from other sites. That was a very interesting process where we had all this soil excavated by a Gradall, which we normally see where there is a road construction work, and several dump truck loads of soil brought in. And the site manicured, so to speak, with this Gradall, to create soil of a certain depth and of a certain slope. At the time we created two of these lysimeter sites, one

with a 20% slope and the other with a 10% slope. At the same time, because of the size of the plots, we wanted to have fairly consistent rainfall, simulated rainfall, and so a rainfall simulator was constructed. You will hear about it later more from Randy. The machinist was Paul Bosley, but also Dr. Asad Ruhi was also very much involved in the design of the rainfall simulator. When it all was ready, the initial work was done by a graduate student, now Dr. Reza Roodsari, he was at the University of Maryland, and he conducted his PhD research at these plots looking at the flow of bovine E. coli, from bovine manure as it would flow down this 20% slope on either vegetative or bare soil plots. It was very interesting, and it became very obvious at that point in time how vegetation affects the flow and how it facilitates infiltration of bacteria. For bacteria and pathogens, ideally, we want them infiltrating into the soil rather than running off with the surface water. So, you are going to see a lot more about this in the coming segments. That just gives you some background of how this whole project began.

[04:00 – photo of a group of researchers working at the site]

Narrator:

Since then, scientists from 10 countries conducted research at this site.

[04:07 – photos of the current 5-member field team of researchers: Dr. Yakov Pachepsky, project lead scientist; Dr. Karl Vanderlinden, visiting scientist from Córdoba, Spain; Dr. Gonzalo Martínez, visiting scientist from Córdoba, Spain; Randy Rowland, Support Scientist; Ryan Blaustein, hydrological technician]

The team is currently studying fate and transport of manure-borne E. coli. This bacterium is at home in the gut of mammals and other vertebrates. However, it can also live in soil and water and in biofilms that can form on some moist surfaces. Even though most E. coli strains don't cause illness, it is an indicator organism, one that water quality managers use to measure fecal contamination. When it is found in surface water, agriculture or urban runoff is often implicated as the source.

04:42 – Calm and soothing background music. Video of fields and trees in the background. Beltsville, Maryland, October 2011.

04:53 – Sound of machinery is heard as the video shows researchers working at the experimental site, examining details at ground level underneath the rainfall simulator. Background music.

05:34 – Dr. Yakov Pachepsky project lead scientist, is interviewed (by unseen narrator) at the experimental site.

Narrator:

What do you expect to learn about pathogens and their fate from the results of this experiment?

Yakov Pachepsky:

We know that we have good stuff coming from animals. We have meat, we have milk, we have a lot of stuff but we have also pathogens coming from the other side of the animal. And these pathogens move, and they come to the water, and they may come to the produce which we eat. So we really need to know how these pathogens move in nature, to prevent their coming to food. One of the issues, of course, is how they are released from the blobs that an animal leaves on the pasture or from the manure which is applied in the field. We know that the more rain we pour the more pathogens we are getting. What we don't know is, when the manure blob is getting drier and it sits there, is it the same rate with which pathogens are coming from the blob or manure material to

the runoff and then going to the rivers, lakes, streams and other sources of water. So we would like to know this, and this experiment is about that. Every week we have more and more dry manure sitting on our plots and we will be irrigating it to see if the rate of the release of bacteria is the same.

07:10 – Colorized image from scanning electron microscope (SEM), showing pathogenic E. coli on a lettuce leaf. Image is shown at about 16,000 times normal size. Background music.

07:26 – Photo of cows in the pasture, overlaid with text of question for Dr. Pachepsky: What kind of manure do you use in this experiment?

Yakov Pachepsky:

The typical animal waste; we took the bovine slurry from our farm here in Beltsville and mixed it with the bedding material, again from this place, to get some typical consistency of this manure.

07:48 – Video of the experimental work continuing under the artificial rain.

07:53 – Randy Rowland is interviewed (by the unseen narrator) at the site.

Narrator:

Randy Rowland is a driving force of these experiments. Without his creativity and golden hands, the field experiments, and this one in particular, could not be conducted. These experiments usually have some unique components. Some unusual measurements have to be made, and some unusual techniques have to be applied, to collect samples when you work with microorganisms. For example, this rainfall simulator does not have analogues in this country. Randy, could you please tell us about this device?

Randy Rowland:

We put between 8 and 10 cm of water an hour using this equipment. We've got it down to about 7 now, but we can adjust the pressure and the amount of distribution of the rain depending on what kind of pressure is there and also the height—we can raise or lower the simulator. So we can get less or more of water distribution.

Narrator:

How do you feel about your work that needs a lot of invention and a lot of creativity?

Randy Rowland:

Big part of it is that I just enjoy coming up with a new design. Everything is very unique every time, and there are always challenges. It's very gratifying when you design something interesting.

09:22 – Video of continuing experimental work at the site. Calm and soothing background music plays as the narrator describes the work as it progresses.

Narrator:

The distribution of rainfall across the plots needs to be measured. Jars to collect water are installed at the plot perimeters.

[Background music ends as narrator continues.]

Ryan is taking samples of manure from each plot before irrigation. The initial contents of E. coli and other manure components will be measured in these samples.

Soil samples are taken to measure soil water content. A sampler is hammered into the soil, then soil samples from the top 5 cm and 5 to 10 cm layers are separated and placed into plastic bags.

Finally, the rainfall simulation begins and samples are collected every 5 minutes. Karl and Yakov measure the amount of rainfall across the experimental plots.

11:34 – Calm and soothing background music. Photos of the current 5-member field team of researchers: Dr. Yakov Pachepsky, project lead scientist; Dr. Karl Vanderlinden, visiting scientist from Córdoba, Spain; Dr. Gonzalo Martínez, visiting scientist from Córdoba, Spain; Dr. Randy Rowland, Support Scientist; Ryan Blaustein, hydrological technician]

11:41 – Dr. Yakov Pachepsky, project lead scientist, is interviewed (by the unseen narrator) in his office.

Narrator:

Can the results of this experiment be used in other locations?

Dr. Yakov Pachepsky:

Results of this and similar experiments will be used to develop mathematical models of fate and transport of microorganisms coming from animal manures and animal waste. These models will describe mechanisms of fate and transport, and, they can be calibrated which means that they can made suitable to work in specific geographic settings. In this way, these models become a way to package the knowledge that we acquire in experiments and make it available for people who are actually doing management decisions. We think that these models will become a part, and an organic part, of bigger environmental simulators developed in the Agricultural Research Service of the United States Department of Agriculture. Such simulators as SWAT and APEX are very widely used, have more than 5000 groups of users all over the world. And we want to enhance the capability of these models to be able to describe the water quality in terms of the microorganisms' presence in them. Our ultimate goal is to be able to use models to evaluate potential and actual microbiological water quality. We are talking about the waters used for irrigation, for recreation, and other human use purposes. In irrigation, specifically, we want our food and our water safe.

13:42 – Background music. Photo of an assemblage of fresh produce items (apples, oranges, tomatoes, bell peppers, limes, carrots, radishes, scallions, celery, cranberries), overlaid with text: "We want our food safe"

13:55 – Film credits begin as background music continues.

"Environmental Research to Improve Food Safety" film by Ludmila Pachepsky, former USDA researcher. Photo of Ludmila Pachepsky.

Music by David Beard. Please visit www.davidbeardmusic.com for Original score & Stock Music.

Photo of Jo Ann Van Kessel. Narration by Dr. Jo Ann Van Kessel.

Colorized SEM image of E. coli (shown earlier in the video). Photo courtesy of Peter Cook and Steven Ausmus, USDA Agricultural Research Service.

[transcript revised 10 April 2012]