

Matt: Take it away, Ralph.

Ralph: \*cringes at the sound of my voice\*

Hazen: I did my Ph.D at Wake Forest University but I was actually doing my research at the Savannah River site. So this site is one of DOE's big nuclear sites, where they produced material for both nuclear weapons and for civil purposes, like a strange type of nucleides that would be put into satellites and things like that as power sources. So while I was there, my doctorate work was actually looking at thermal effluence from nuclear reactors and how they are affecting bacteria – they would affect fish and caused fish disease and alligator disease. If you go to my website, that's why you see a picture of me holding an alligator

Matt: You know, that was actually my last question, you went ahead and took care of it (laughter)

Hazen: And he is dead...

Matt: Oh. God bless him.

Hazen: The BBC had done a special for NOVA, and they found out that I was one of the only people that would dive in this reservoir where these alligators were. So, they asked me to pretend that I was an alligator and pull this float around because we had radio transmitters on these alligators. And then, supposedly, they tried to catch the alligator, you see the guys in the boat being jerked around – that was all me underwater. But they didn't even acknowledge me in that movie. What were they gonna say? Especially NOVA, the epitome of science documentaries? "Thanks to Terry Hazen, for playing the alligator."

Matt: That would have looked good on your CV at the time.

Hazen: And of course, they did all of the splicing and everything, it looked like they dragged the alligator on shore when actually they had already killed that alligator. And that is the alligator that is on my website.

Matt: That's crazy.

Hazen: Anyway, I got familiar with a lot of the containment issues and problems that the Department of Energy had. And I was also working on pollution problems related to ( ) And I had a grant from the North Carolina Board of Science and Technology and later on from the Water Resources Research Institute while I was a graduate student. At one time I had two master students and a postdoc working for me as a graduate student for my Ph.D. At (Albemarle Sound) we were looking at the effects of a nitrogen fertilizer factory and a pulp mill, their effluents on (Albemarle Sound) So it's the Chowan River, there on upriver. So actually because of that work, we showed that it would increase the densities of these bacteria that would cause these fish diseases, an epizootic of these fish diseases, and in large-mouthed bass in particular, which got all the locals excited. Because of those papers and reports that we published, the state of North Carolina declared (Albemarle Sound) as a nutrient sensitive area. The nitrogen

fertilizer factory had to close down, and the warehouse plant pulp mill had to put a bunch of scrubbers in it. After finishing my Ph.D. and paying myself as a postdoc for one year, I went down to the University of Puerto Rico as an assistant professor, quickly rose up through the ranks and started studying coral reefs and effects of the Bacardi effluent on those and a tuna fish factory effluent, and in general, what we call non-point sources – so, human fecal contamination. And the problem is, fecal coliform, which are the standards for measuring recent human fecal contamination don't work in the tropics because they can survive for a very long time. In fact, I could find E. Coli in the tops of trees in bromeliads, so these epiphytes in the trees. CNN did a special science report and actually filmed me and my students taking samples. But we also worked on oil spills. There were some oil spills down in Puerto Rico and I did some work on those too. But I looked at a variety of contaminants. But I was mainly just trying to see what effect the bacteria had on that, and if there was an increased risk for humans for getting diseases and things like that.

Matt: So you've spent a lot of time looking at the genomic population of bacteria and what not?

Hazen: No – this was way back before we did genomes. And the only thing we could do was we did isolations and that sort of thing.

Matt: Wow.

Hazen: So this was way before you were born. (laughter) I was there for eight years. I was professor and chairman of the department by the time I left, and they were trying to make me dean, and I didn't want to do that because chairman of the department was bad enough – 45 faculty members, so it was a big department and it was taking up too much of my research time. Anyway. Then, the Savannah River plant made me an offer. And this time, it wasn't through ... I was working through the Savannah River ecology laboratory as part of the University of Georgia, at the Savannah River site – so this time, it was the Savannah River – what became the Savannah River National Laboratory. They actually made me an offer I couldn't refuse. SO I became the head of the environmental biotechnology section there, and we were specifically looking at microbes related to chlorinated solvents and deep subsurface and how deep that went, and were there unique organisms that degrade things that we could utilize. And so we had a gigantic culture collection and we started to do some pilofane analysis and some really basic genomic analysis back then. SO that was in – oh I started that in 1988.

Matt: And so this was part of the emerging biotechnology field, at this point.

Hazen: Right. Then I did a bunch of reviews for the department of energy, relating to that. And in the meantime, at Savannah River, I've got five patents up there that are all related to bioremediation. And those are all patented by Westing House. And Westing House ran the Savannah River National Laboratory for the Department of Energy.

Matt: Are your patents genetic patents or ...?

Hazen: They're process patents. So gaseous nutrient injection and use of triethylphosphate, which is made by Kodak – or originally was – and basically we can inject that as a gas and I've

developed some techniques for doing that. And also using methane. I demonstrated that methanotrophs will degrade over a thousand different compounds with methane monooxygenase that they produce. So that patent was probably licensed by, as far as I can tell, probably about fifty multinational companies. Whenever they used it at a government site, they didn't have to pay a royalty. But they did if they used it at a non-governmental site. But DOE didn't charge them very much because – technically DOE is the signee on my patent – and so, DOE wasn't out to make money, they were just trying to make sure that no one sold it back to them.