MIND OPEN MEDIA PRESENTS

the Loop

Episode 5: The Pressure is On!

<music up>

Levin: You're listening to The Loop, an audio series about the mud, microbes, and mammals in the Gulf of Mexico. I'm David Levin.

In Hamburg, Germany, researcher Michael Schlüter studies the Deepwater Horizon oil spill. He says that to really understand what happened on the scale of the entire Gulf of Mexico, you have to know a lot about the tiny particles of oil that formed in the aftermath of the explosion.

Schlüter: In nature, everything starts at these tiny dimensions.

Levin: Stay tuned.

<music out>

[AMBI: water sloshing in Hamburg canal]

Levin: For more than a thousand years, life here in Hamburg, Germany has revolved around water. This riverside city is one of Europe's biggest ports, and it's full of canals like this one—a narrow channel tucked behind ornate 16th century buildings.

The waterfront is a hotspot for tourists, who flock here to take pictures. But in a lab across town, a group of scientists is focused on waters half a world away, in the Gulf of Mexico.

[AMBI: Water sounds out]

During the 2010 Deepwater Horizon spill, five million barrels of oil dumped into the Gulf from a broken well on the ocean floor, more than a mile down. Most scientists thought that oil would float right up—but the strange thing is, not all of it made it to the surface.

Murawski: A substantial fraction of that oil rose up to a certain level in the ocean and stayed there in these large plumes. So we need to understand what factors actually contributed to that.

Levin: Steve Murawski is an oceanographer at the University of South Florida. He’s here in Germany to meet with an international team of researchers who are studying the spill.

Murawski says that during the blowout, oil didn’t just drift up from the well—it sprayed out, like an aerosol can.

Clouds of oil droplets formed, and they stayed suspended at different depths in the ocean.

Those clouds spread toxic chemicals into the water. They killed off plankton and other tiny creatures, which had a big impact on animals all the way up the food chain, from fish to whales.

Exactly *how* the clouds formed is still unclear. That’s what Michael Schlüter is trying to find out. He says the answer may lie in the oil droplets themselves.

Schlüter: Exactly. Everything starts with these tiny little droplets. And this initial droplet size effects the whole distribution of oil in the ocean.

Levin: Schlüter is a researcher at the Hamburg University of Technology. He’s working with Murawski’s team to learn how oil travels through the water during a deepwater blowout. At the wellhead, he says, it can shoot out at tremendous speeds…

Schlüter: …but after a certain distance, just a few meters, the momentum that pushes the oil and gas out of the well is gone, it's dissipated, and then we have just the bubbles and the droplets that are rising by their buoyancy.

Levin: As the oil droplets float upwards, they form a chaotic, swirling column. They break apart. Then glom back together. Chemicals like benzene and gases like methane bubble out and dissolve into the water.

As the droplets change in size, some of them slow down, break off from the column, and float away, creating those huge oily clouds underwater.

Or so the researchers think.

Murawski: Nobody was able to accurately sample the particle size a mile down, so we don’t actually know what it was.

Levin: Again, Steve Murawski.

Murawski: We're trying to figure out if in fact the physics and chemistry of this oil, coming up at a very high rate of speed, was sufficient to create subsurface plumes of small droplets.

Levin: To do that, Murawski says you need to track the individual droplets of oil, and watch what happens to them as they rise. Doing that in the field is nearly impossible. During the Deepwater Horizon spill, just getting *down* to the well was a big challenge—let alone following tiny bits of oil around. So instead, you have to recreate the spill… inside the lab.

That's where Schlüter comes in. He and his team are building a miniature version of the blowout inside a pressure chamber here in Hamburg.

[AMBI: footsteps, clanking]

Schlüter: Here we are. Let's take a look inside... careful…

[AMBI: Hissing sounds]

Levin: Schlüter leads me into a huge metal shipping container, where a web of hissing pipes run into a four-foot tall cylinder. It's a tank made of two-inch thick steel, and it's wrapped in black foam insulation. It looks like the hot water heater in my basement. But inside, Schlüter's recreating the conditions at the bottom of the Gulf of Mexico, where the water pressure is more than two thousand pounds per square inch, and temperatures hover just above freezing.

Malone: So I now set pressure, and I will start the pump.

[AMBI: pump kicks in starting]

Levin: PhD student Karen Malone [ma-LOH-neh] starts pumping water into the tank. When it reaches the right pressure, she'll ease a steady flow of oil though a narrow tube, to see what happens to the droplets.

Standing next to a tank like this feels like standing next to a bomb—with so much pressure inside, even a minor leak could be catastrophic.

Malone: Well… [laughs] it looks like a really small cylinder, but there's very big power inside. If you click the wrong button at the wrong time, then maybe I blow up at least myself, and maybe half the building.

Levin: An accident that dramatic is unlikely—there are lots of safety measures in place, and Malone knows the pressure lab well. But there's still an element of danger.

Steve Murawski says those hazards come with the territory. High pressure experiments like this one are the only way to tell what *really* happens in deepwater blowouts.

Murawski: You know, theoretically, we could let another well blow out and test this, but the world is sick of oil spills, so creating an oil spill in a laboratory is the next best thing.

Levin: Schlüter and Malone are recording the oil droplets in the tank using a high speed camera. They've measured their size. How they form. How they break apart and join back together. And how their speed changes in the process.

They've also recorded what happens to the methane gas that bubbles out of the oil.

On some of the droplets, it actually forms an icy crust called a methane hydrate. It looks kind of like snow, and can affect how the oil moves.

Schlüter: 14:00 You can imagine, if you have a hard shell around a flexible surface like a bubble or droplet, then the behavior, and also the rising velocity is totally different than for a bubble or droplet without this hard shell.

Levin: In other words, it slows the droplets down, so they take longer to rise. And if they take longer to rise, they're more likely to be caught in ocean currents before they make it to the surface, and spread throughout the Gulf.

The experiments in Hamburg are still in their early stages. But Schlüter is convinced that to understand the big picture, you have to start small.

Schlüter: Even if you were going to the largest scales in nature, everything starts at these tiny dimensions. And it's always very important first to know what happens at these tiny dimensions to know how the oil is distributed in the environment.

Levin: 02:18:11: So what is it like for you to kind of think about something so small that you're studying, affecting something so huge?

Schlüter: Uhhh…

Levin: Do you ever think about that?

Schlüter: No, never. That's nature! [laughs] …

Levin: He isn't philosophical about his work. It's measurements and data that make Schlüter tick—which is good, because in the coming months, Steve Murawski and his team plan to use his measurements to build a computer model of the oil. Once they know what happens as it comes out of a well, they'll be able to predict where the oil go, and how it'll move through the ocean.

So here in Hamburg, more than five thousand miles away from the Gulf of Mexico, this simulated blowout could help scientists react to *real* blowouts—which could happen not just in the Gulf, but in the waters off Brazil, Nigeria, and other countries building deepwater wells.

For the Loop, I'm David Levin.