

Diving Deeper: Episode 21 (April 7, 2010) – How do we respond to oil spills?

(INTRO)

HOST: Welcome to Diving Deeper where we interview National Ocean Service scientists on the ocean topics and information that are important to you. I'm your host Kate Nielsen.

Today's question is....How do we respond to oil spills?

Oil spills can happen in our rivers, bays, and the ocean. Spills are often caused by accidents involving tankers, barges, pipelines, and even refineries. These accidents usually occur when the oil is being transported to us.

To help us dive a little deeper into this question, we will talk by phone with Amy Merten on oil spills. Amy is the NOAA Co-director of the Coastal Response Research Center with NOAA's Office of Response and Restoration. Hi Amy, welcome to our show.

AMY MERTEN: Hey Kate, thanks a lot for inviting me here today to talk to you and your listeners – I'm really excited to talk to you about oil spills and how NOAA responds to these events.

(IMPACTS OF OILS SPILLS)

HOST: Amy, before we get into how we actually respond to oil spills, it would be great to talk about why oil spills happen in the first place.

AMY MERTEN: Well, they happen mainly because we are so dependent on oil in the U.S. We use about 700 million gallons of oil every single day. And how do we use oil? We're heating our homes, we're fueling for our cars, we use oil to make plastics for you name it – toys, radios, computers, and even medicines. Oil's a fundamental part of our economy and our way of life.

If we continue to need oil, we're going to continue to have spill risks. We have oil moving around the country in high volumes – in ships and barges and pipelines and trucks – so that oil is getting to us minute by minute. So the ships have the potential to cause these larger spills that we think about and we see on TV, but really the biggest source of oil to our waterways is from nonpoint source, kind of the small spills in parking lots from you and me and everyone else is actually contributing to more oil pollution in the water than a big ship would.

HOST: Thanks Amy, I didn't know that the amount of oil that runs off of land from our daily activities is actually a bigger source of oil in our waterways than the oil that we typically think of after ship collisions with some of these larger oil spills. What does oil do once it is released into the environment?

AMY MERTEN: Well Kate, most of the time oil is going to be less dense than water, so it's going to float on top of the water.

Oil, once it hits the water and because it's lighter it's going to spread out on top of the water, and if you did this in a laboratory it would spread out uniformly, but since we have wind and currents in the environment, it's going to spread out in a patchy way.

As it continues to spread out, it's going to get thinner and thinner and thinner and so when you look at it, it

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will look like almost a rainbowy sheen, and so you might be familiar with seeing these things after a heavy rainstorm on a parking lot or on the roads. So it looks like that on the water too when you're looking at it from a helicopter for example.

HOST: Amy, that's interesting that these same sheens that we see in our parking lots from oil is how oil on the water looks if you're up in the air in a helicopter looking down. How does oil impact plants and animals?

AMY MERTEN: Well, oil spills can be really harmful to plants and animals particularly birds, not necessarily just marine birds, but if we have a spill inland, birds and mammals are very vulnerable. And I'll talk a little bit about that in a minute.

Fish and shellfish may not be exposed right away, but again might be exposed if that oil becomes entrained in the water column or somehow interacts at depth versus just staying on the surface, that'll happen from a wind situation or a stormy situation, or depending on what the oil type is it might be light enough that it'll disperse into the water column.

I'm sure your listeners have seen dramatic photos of oiled birds and oiled otters and things of that nature. And what happens is the oil, it's not really a chemical response that happens, the oil gets on the feathers and fur and it makes it so the animal can no longer insulate itself from the cold in the water, so it loses all of its ability to repel water so it basically ends up dying from hypothermia. It will try to get the oil off its feathers or its fur and it will start preening and then it will start ingesting oil and then there is a toxic component to it and basically they end up dying from dehydration. So feathers and fur do not do well with oil.

HOST: Thanks Amy, I think so many of us have seen these horrible images, on the news following a spill, of birds and wildlife covered in oil, but we don't often think about what happens, we just feel so bad when we see these poor little guys covered in oil like that.

AMY MERTEN: Yeah, it's really dramatic. And you know one thing I do want to mention is, as part of our response community, we actually have specialists that are trained to deal with oiled wildlife so only professionals go out and capture oiled birds and oiled seals and otters. And they know exactly how they're going to clean them, where they're going to take them to to try to clean them up. Sometimes they are able to totally rehabilitate them and put them back out in the environment. I just wanted to make the point that, we have those veterinarians and trained volunteers and specialists that work with us side by side.

HOST: It's wonderful that there's a team out there just to handle the impacts of oil to wildlife and to really be able to respond and clean them up and maybe even return them then back in the wild and just save them. Amy, what is the biggest oil spill in U.S. history?

AMY MERTEN: Kate, the biggest oil spill in U.S. history is the *Exxon Valdez* that occurred 21 years ago just last week. So, if you remember the spill, it happened in Prince William Sound, Alaska when an oil tanker ran aground and lost almost 11 million gallons of crude oil.

While this sounds like a lot, it is only a small fraction – less than two percent – of the total amount of oil that we use in one day, so pretty amazing. Just to try to give you guys an idea of what 11 million gallons would look like, try to think about, 11 million gallons would fill up nine school gyms or approximately 430 classrooms. So again, we're talking about a large volume that's really hard to imagine in the environment.

After the hurricanes of 2005 – Hurricanes Katrina and Rita and I think probably everyone's familiar with

those – Louisiana experienced over eight million gallons of oil, so fairly large amounts of oil were lost to the coastal marsh environment.

But I would like to make the point that smaller spills also have impacts too. So, if you have a small spill next to an area where birds are nesting or migrating to, you can have a really large impact. Or you can have a smaller spill on a really nice day in a city environment and have large impacts to how tourists are seeing that place and impacting people's ability to get to the water. So large spills have dramatic impacts, but small spills also can have some dramatic effects as well.

HOST: Thanks Amy for your point that no matter how big a spill is, there are still dramatic impacts. When these huge volumes of oil enter the environment, how does this affect our economy?

AMY MERTEN: We definitely do know how it impacts us economically, I'll just give you a few examples. There was a barge spill on the Mississippi River and it closed the major thoroughfare of the Mississippi River for several days, so you can imagine that was costing millions and millions of dollars as a lot of our energy supply, our food supply goes through the Mississippi corridor. There was also a spill on the Delaware River, Delaware Bay area, several years ago and they had to close down a nuclear power plant and could not produce power for millions of people in Delaware and Pennsylvania and New Jersey so you can see how that would also cause significant loss in economic revenues, so again that was several millions of dollars lost.

I would also like to point out that anyone that's working on the water, so fishermen are always severely impacted by spills and their ability to go out and fish and even the perception of should they go out and fish is always a really big issue. So spills affect lots of components of the economy.

(RESPONDING TO OIL SPILLS)

HOST: Thanks Amy. These are really startling numbers, really startling statistics that you're sharing with us today – both on the incredible volume of oil that can spill after a ship collision, but also these huge impacts to our economy. How do we clean up after oil spills occur?

AMY MERTEN: Well we have a couple of tools that we can use to start cleaning up a spill after they occur. It really depends on what type of oil gets spilled, as I mentioned, all oil's different and it's made up of lots of different other chemicals so it behaves differently sometimes than what you might expect. The weather really impacts what we can do, so if it's a stormy day, there's not a lot we can do. It depends on how far away the spill is from bird and animal resources, how far away it is from people, on what we can actually do.

So we tend to use a few key tools that we've been using for a long time. So kind of our first approach is trying to use things in a mechanical capacity, so we use booms, which are floating barriers that keep the oil contained. So you can put a boom around a vessel or you can put a boom to block an inlet or a wetland area so the oil doesn't go into that area, making it harder to clean up. And we also have these specialized boats that skim the oil off of the surface, so taking advantage of oil floating on water. Skim it into a container and then take it back and offload it and recycle it and reuse it.

So that's kind of what we like to do if we can, but we have some other things we can do. We can burn oil in place, so right there on the water, if we can get it thick enough, we can actually burn it there. We can burn it in a marsh. We can also use things called dispersants and what dispersants are they're chemicals that actually break the slick up into smaller droplets. It doesn't remove the oil from the environment, it just makes it smaller, gets it off the surface. So you might use that if you're trying to protect birds so if you have a lot of birds in the area and you're going to trade off that resource and put the oil into the water column.

So, we don't use those very much, but we do have them available.

HOST: What are some of the benefits or disadvantages for all of these different cleanup options?

AMY MERTEN: Yes, there's definitely pros and cons to all of those options. Once the oil's in the water, we know we have a bad situation, so what we're trying to do is to minimize that situation and try to use things that get it out of the environment as fast as possible, but also in an environmentally sound way.

So we sometimes don't remove all of the oil from a shoreline, we don't get it squeaky clean and the reason for that is if you blast a rocky shoreline, for example, with high pressure hot water, and this was actually done in the *Exxon Valdez*, you change the physical and chemical makeup of that substrate. So the organisms that were there, can't recolonize because it's now different. So it actually impacts recovery, if we get rid of the bulk oil and then leave some residual oil, nature will take care of that.

We do sometimes burn oiled marsh areas because you can't actually put people and equipment into a marsh because you do definitely more damage then because you put the oil down into the substrate, into the mud and the sediments, and then it can't naturally recover.

HOST: I imagine that this will vary for each spill, but approximately how long does it take to clean up after a spill? Are we talking days or weeks or even years?

AMY MERTEN: It really, really depends. It depends on how much is spilled, and it depends on what environment, how far resources are to get there, and under what conditions – what weather conditions. So, just to give you an example, there was a big spill a few months ago, 450,000 gallons, which is a relatively large spill today, in the Houston Ship Channel and the cleanup was relatively easy because most of the oil, there was response equipment very close, so people could act on it really fast, but most of the oil was contained with booms and also hardened shorelines. The weather was relatively good and calm, so it made skimming really effective.

But for an example there was a spill in Alaska in Aleutian Islands in December several years ago, and storms came in after the spill and we weren't actually able to start cleanup until the spring. So in that situation, a lot of the oil was not recovered, basically because we couldn't get people out there safely to clean it up until spring and then years after.

HOST: How do we respond to spills in the Arctic when oil spills happen in ice?

AMY MERTEN: Well in the Arctic we would use the same methods that I described, it just will take us longer to get there in the Arctic, at least the way we're structured and where people live right now. In the Arctic, it's all predicated on being able to actually get to the spill and get to the spill safely. So if we can't get there because it's too foggy or stormy or icy, then the spill is going to sit there until we can get there.

HOST: Amy, can we determine how successful we are at cleaning up an area after an oil spill?

AMY MERTEN: Sure. We definitely try to do a mass balance and what that means is that we have some ways of understanding how much got spilled, so we might know the tank size of the tank that got ruptured and how much oil entered the water from that tank or potentially entered the water from that tank.

We know how much skimmers pick up, they're pretty good at calculating how much they're recovering. We also have models to estimate how much of the spill was lost to things like evaporation, or dissolution – so

chemicals coming off of the oil and into the water, or photooxidation – so that's the sun breaking down chemicals in the oil.

On the shoreline, we spend a lot of time trying to figure out how much oil is on the shoreline. We estimate the bulk of oil on the shore and then we go back after cleanup and estimate how much is still there.

We also work with our injury assessment and restoration specialists to monitor how long it's going to take for the environment to really recover after the spill.

HOST: Amy, how do we learn from past spill response and test out new cleanup techniques?

AMY MERTEN: We as NOAA really try to apply science to the cleanup methods that we're recommending and we try to follow how those cleanup methods work in how long it takes things to recover so that we can apply that better in the next situation. So we spend a lot of our time, when we're not on a spill, working with our colleagues in industry and the Coast Guard and academia on talking about our lessons learned from those spills and what could we have done better and what were the things that worked really well, what are the things we need to try in the future.

So we do have an R&D component where we know we want to improve our models for example or we want to improve some of our assessment techniques so we work with the academic community to help us move those forward. We also spend a lot of time holding training, so we help people understand the best science for cleaning up spills. We also participate in drills, so in that situation we spend a lot of time with the people we would be responding with, talking through some of what would we like to try if a spill happens in this marsh, what types of things are we learning from other countries that we might apply in the U.S. So those types of conversations happen a lot.

HOST: Amy, can you talk more about an oil spill drill and why it's important?

AMY MERTEN: We just participated in a major exercise, it's called the Spill of National Significance. The reason it's called that is because the spill scenario was so large that one region couldn't clean it up so we had to bring in equipment and people from all over the country to help deal with the scenario and so we played it like that. So we had people come to a real Command Center, we set it up the way that we would use it in a real spill so the responsible party was there, the Coast Guard, all the state agencies, local communities, NOAA, were all there working together. And what was so important about that is we were establishing a working relationship – it's easier to go work with someone on a spill if you already know them, so that's our huge part of the drill just making sure that you understand the other person's point of view, you understand who they are, what they need, and then we work through the situation – it does feel like you're on a real spill.

(ROLE OF NATIONAL OCEAN SERVICE IN OIL SPILL RESPONSE)

HOST: It's great that time is invested to prepare before a spill, getting everybody together because this will help things run more smoothly in the event that a spill actually happens. Amy, what's the role of the National Ocean Service in responding to oil spills?

AMY MERTEN: Well, the U.S. Coast Guard and the U.S. Environmental Protection Agency are actually the first federal responders for a spill. So, the Office of Response and Restoration, which sits in the National Ocean Service, along with staff from other offices in NOAA work to support the federal on-scene coordinators – the Coast Guard and EPA. So what we do, in the Office of Response and Restoration for a spill, is we first

provide trajectory models, so forecasts of where the oil is going to go.

We actually get on-scene and conduct overflights to assess the extent of the spill and ground truth our models, so we have a lot of experience doing that. We spend a lot of time coordinating shoreline assessment surveys and spending a lot of time walking shorelines and calculating how much oil is there. And then we work with the Coast Guard and the responsible party to evaluate what the cleanup options are available and again we try to do this in the most practical and environmentally sound way, so we jointly develop a plan on how to actually do the cleanup.

HOST: Can you explain the trajectory models that you just mentioned?

AMY MERTEN: Sure, so trajectory models are computer models that take into account the winds and the currents during the time of the spill to help forecast where that spill is going to move. So our oceanographers actually run this model in real time and get it to the Command Center so people can start understanding what resources are at risk, what protection strategies need to get put into place.

So the models help the responders get ahead of the spill so they know where we think it might be going, they can put equipment, so they can put some boom out, and prevent it from actually hitting the shoreline in that area.

The ocean has buoys and sensors in it and we know where those are so it's part of the Integrated Ocean Observing System and we actually can stream in that information real time – we can stream in weather information, we can stream in tide information, current information, and all of that gets pulled in to run these trajectory models to make them more accurate and predictable.

We actually have a computer program, it's actually a Web site, called the Environmental Response Management Application, that actually gives you the picture of these different pieces being streamed in and then you can put the oil trajectory model into this picture and then you can see your shorelines that have resources at risk.

HOST: It's great that we have the data and expertise to forecast where oil will move and even be able to do something as you mentioned like placing a boom in an area to prevent it from spreading further and causing even more damage. Sounds like there are so many roles that your office and really so many other agencies play in response and cleanup from an oil spill. Is there anything our listeners can do to help support this?

AMY MERTEN: Sure. Yeah, Kate there is. I think the main role for listeners is that we do all have a part to play maybe not so much in responding to the spills, but in helping to prevent them. We can avoid dumping oil and oily waste into the sewer or the garbage and we can also do some other things that reduce our use of oil in the first place, so we may take more walks or use our bikes more or take the bus rather than using our car, so all of those things that we can do that reduce the use of oil actually leads to less oil being transported, and therefore a reduce of the risk of a future spill. So we all have a responsibility for spills because we're all using oil and we all can make a difference and find solutions to the problem.

HOST: Thanks Amy, these are great examples of actions that we can really all take to help us reduce our use of oil and in some cases things we could every day. Do you have any final closing words for our listeners today?

AMY MERTEN: Sure. Thanks for the opportunity. I really like talking about my job and although spills are not

fun things to deal with, it is nice to be able to participate and be able to see recommendations go into action and actually help the environment. Here at NOAA we spend a lot of time and effort being prepared to respond to all different types of oil spills in all sorts of different areas including internationally. We really spend a lot of time understanding the science beyond oil spills and training people on the science behind oil spills – and that's really what we're trying to bring to the response community, so that when we are responding, we do it in the best way possible and we can clean up and restore our coastal communities.

HOST: Thank you Amy for joining us on today's episode of Diving Deeper and talking more about the impacts of oil spills to our environment and the economy, how we respond to these, and even what we can all do to help. To learn more about oil spills and response efforts, please visit response.restoration.noaa.gov.

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That's all for today's show. Please join us for our next episode on tsunamis on April 21st.

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