OSU/TRIHYDRO PFAS WORKSHOP FOR PUBLIC WATER AND WASTEWATER SYSTEMS

MAY 19, 2022

HYBRID EVENT

This transcript was auto-generated by the webinar. Please forgive typos.

0:26
Just a little bit background about our program, we are waiting on the grants from the United States Department of Agriculture, to provide technical assistance on site emergency management to rural communities, tribe.

0:45
Some communities, we population less than 2500.

0:49
So, in 20 19, USDA requires us to include these laws, our education and outreach.

1:01
At that time, I had zero knowledge and TFS.

1:04
So, a couple of slides, and that was how I was able to get in contact Tweets Anger. And I had your team to put this together.

1:19
Last year, in training, last year, we had our first walk shopping today. We're here for the second one.

1:33
So, and, we have amazing speakers, so, stay tuned for that.

1:39
Just a little housekeeping for those in pressing restrooms out on the other end of the room and there, coffee, outside and lunch will be here at noon also.

1:55
And for those who need core might need a credit for attending this training, there is also a form that you can fill out and then submit it to Shelly.

2:09
She's right over there so you can get traditionally those attending online you can fill out your farm incentive to DEQ, the Department of Environmental Quality, OK.

2:24
That's all right, OK, shall we say if you all you have to do is to suddenly your certificates to DEQ and then you are good to go.

2:36

Um, so, without wasting much time, I will go ahead and introduce our first speakers and also call on doctor can eat since he is our host on campus to give us a brief welcome notes and then, we go ahead, which has been the presentation OK.

3:04
All right, doctor Chen ... as the Director of Things I Mean to Science graduate program at Oklahoma State University campus. Previously, his position can serve as the Assistant Dean of Engineering at Oklahoma State University, and the director of Research Center.

3:27
It is satisfied, satisfied, hazardous material manager.

3:32
In addition to his academic contribution to Oklahoma State University, doctor ... solve 18 years as environmental, health and safety manager for American Airlines.

3:45
That's a each host area of research, include PFS.

3:50
So those waste money means Environmental chemistry, industrial and financial sustainability, an industrial ....

3:59
He served as manager of the following committees, Hazardous Waste Management Advisory Council for the State of Oklahoma, Environmental Federation of Oklahoma Hazardous and Solid Waste Committee, State of Oklahoma PFS Committee.

4:18
In addition, doctor E has also has numerous articles, articles on PFS, and directed and co alter the FSP, FAS sampling guidelines for the state of Oklahoma.

4:34
Sell.

4:36
Yes.

4:37
Yeah. And that's an aid is presenting alongside.

4:43
OK, doctor Adrea, let you survive.

4:50
Let me survive is an Environmental Engineer and microbiologist American Airlines and will remain check compliance and safety.

5:00
Doctor Silva, graduated with a PHD in Microbiology and Selma, you care about biology from Oklahoma State University, Um, specializing in molecular tools and microbial processes impacting environmental mitigation and production of biofuels.

5:20

The final semester, she was accepted into issues, professional science, master's program in environmental science and management, retreat directed career paths.

5:34
Aim to apply science through Roes Yeah. She holds today with American Airlines and first started initially collaboration with doctor Tennant eat.

5:47
Which continue to this day, have primary role within making airlines include environmental program management and regulatory compliance with plain water, apt programs, sideshow, mediation, and management of aerospace PFS. So that's a problem.

6:08
That's the E, and no, totally just server.

6:20
Can hear me OK?

6:22
Yep, Page people from Boston, we don't even need a microphone, but leave it there. OK. So, first of all, welcome to Oklahoma State University. I have to do a mini recruiting. You ever thought about your Master's degree?

6:39
Please contact me after this seminar a lot.

6:43
I see a lot of Members students, here and so, that's my plug for a Master's degree in Oklahoma State University. Welcomes you Who's also interested in most seminars I attend.

6:55
They addressed one topic like treatment to P fast today was really impressed that witnessed myself would be the dressing.

7:05
For the aerospace space age at the last PFS, Doctor ..., Department of Chemistry, more chemistry of PFS.

7:16
Shellfish showed DEQ, Clean Water Act down the legal aspects of PFS shoots accurate laboratories chemical analysis of PFS, Frank Adress texts Molecular disposal.

7:36
PFS toxicology fast read, treatment to PFS.

7:43
So what is nice about this seminar today rather than eight hours of one issue, it's going to be a nice variety I think for everybody for everybody, OK?

7:56
Right, I click on it, like click, OK.

8:04
So, here is the agenda for today.

8:08
Getting five professional hours is good.

8:12
You can submit questions, I guess some questions online, is that correct: OK, fantastic.

8:19
OK, OK, fantastic.

8:21
Housekeeping, I think you've already done this, all right.

8:24
And we've already had the introductions, OK, Is our lawyers. Were they asked us to put this in? You can read that. But, bottom line, we're not, lawyers are not, politicians were both environmental scientists. These are the uses our opinions.

8:41
The aerospace examples given today are universal, we've talked about jet fuel, to cater to domestic aircraft, aircraft military, jet fuel. So we use examples. We're not saying specifically. This is only United Airlines, Delta air lines or American wines were talking universal, and, again, just like jet fuel universal kinds of things.

9:07
To get things in perspective, I think these numbers are really interesting.

9:13
billion dollars, four billion, yeah, sediment between dupont, encounters.

9:21
And I believe that sentiment is to deal with the next issue, $671 million want a lawyer.

9:33
one law firm, how much he has won so far from Dupont Khumbu was nice movie by Hidden Dark Wadhams.

9:44
If you have an opportunity to see a movie, it's a really good movie, 200 million estimated amount of work with greater than one nanogram of PFAS in the water.

9:57
99.7, this is this is an estimate of the amount of miracles that have P fast. In the bloodstream, we believe it's higher than that.

10:08
So far, 28, 54, lots of locations in the United States that are contaminated with PFS, 6, 94.

10:17
And this was, this year, the amount of military bases contaminated with P Fass, 15 member states in the United States, contaminated groundwater with P fast, 10000, 10000, the estimated number of molecules we believe are AMP fast.

10:38
What is P fast? start off?

10:41
How the flow alkalis substances wholey, chemistry means more than one.

10:49
Whoa.

10:52
Alcohol means carbon.

10:54
So we have a carbon chain. We can either covalent bond one fluorine atom to fluorine atoms on the end. It's possible to bond three fluorine atoms. That's all P facets. That's all it is.

11:09
It's amazing, something so simple. It's so complex.

11:14
Use this as an umbrella term. Again, we believe, are about 10000 different chemicals.

11:20
In most people, an industry, we don't actually say names, recently, the common name we say Teflon unkind, our Cortex scotchgard a triple F. It's so much easier than say the entire molecular name.

11:35
To us is it's a large, large oak tree with 10000 reais. Each leaf represents one molecule.

11:47
This is how complex this situation is, definitely will suffer touch start date for this training. Underneath the tree is the Root System.

11:59
Is all that mass underneath we don't know about the precursors.

12:05
We're not sure how many precursors there are put PFS.

12:09
This is how large and complex this problem is.

12:14
How do we get here its fastest fountain, Greater than 99.7% of the blood banks, almost every human on Earth.

12:22
You can find it in polar bears, North Pole, South Pole. Eagles, most aquatic life has already been contaminated with PFS.

12:31
It is ultimately addict and I love this one here. So, surprise, they found. Bass. On the top of Mount Everest, they find P fast. Along the trails around adverse is a tiny magazine, and I love this question, Why over harmful chemicals and Mount Everest? You think about the terrorists are coated with TFS.

12:56

The clothing is coated with P fast. The boots are coated with PFS, the ropes are coated with TFS.

13:04
Food packaging was coated with PFS and we're wondering why is this mountain so contaminated with TFS?

13:12
It's pretty interesting question.

13:15
Totally.

13:17
Also, use truly, we could start from innocence, great quote All things true: wicked start from innocent, a freshly minted PHD student freshly minted he's 28.

13:31
A college maybe a year or two doctor Plunkett, most with dupont, trying to develop a gaseous refrigerant coolant.

13:39
Let the experiment go too long, he made mistakes He simply made mistakes.

13:45
You accidentally develop the first solid floor related hydrocarbon. He did not mean to do this.

13:51
There was a waxy solid that proved to be at that time the most slippery, most inert material in existence at that time.

13:59
Today we call it test lawn, the chemical name is Pauline Tetrafluoroethylene, but the common name is Teflon. Here's a re-enactment of him doing this.

14:09
I love to see Re-enacts, a failed experiment, but change the world. What do you think This? Interesting Dupont tried over and over again to market This didn't stick to anything.

14:23
So Dupont puts it on a shelf and says, this was a failed experiment no, we wasted all this money. Was shelved.

14:33
Again was supposed to be a gas and that gas, by the way, was supposed to go General Motors Carlos as your air conditioner air conditioner refrigerant. That was the goal for General Motors.

14:47
Years later, four years later, the United States, Germany, and Japan.

14:52
You think about this. All three countries had, at that time, really good theoretical physicist, absolutely brilliant.

15:01

These were the top individuals in the world: Germany and Japan had my opinion the top individuals to retrieve them. all three countries were using the gaseous Diffusion Protocol.

15:14
But with this protocol separating uranium 235 from 238, it's extremely corrosive.

15:23
Dupont chemist. Remember this failed experiment. He reran the Tesla because nothing else was working. Encoded the diffuser with Teflon. Endless successful.

15:35
Germany and Japan were unaware of Teflon at that time, did not have just one and could not separate these two to enrich uranium.

15:44
Here's a typical gaseous diffusion protocol separating U 235 from U turn 238.

15:52
The concept which they did was coat everything with Teflon, in addition, make a semi permeable membrane out of Teflon out of Teflon. It worked, we were the first country to make the atomic bomb then every job, every CEO every gasket.

16:09
We see the manufactured are actually made from Teflon.

16:17
Think about this. This is an interesting from Chemistry perspective. Simultaneously, not individually, simultaneously, this material was exposed to uranium hexafluoride.

16:31
Gaseous state extremely corrosive HF gas, hydrofluoric acid gas, extremely corrosive, high pressures, high temperatures and alpha radiation without breaking down.

16:50
OK, to me, what was amazing is when they started with someone's PFS incinerator and I kept saying what we learnt from the world more true.

17:04
You put this in a similar way, or it's either gonna go one inch in, places where it's up the stack, or to what's going to stay in yash.

17:11
It's not going to break that carbon fluorine bond.

17:16
I mean, it's been exposed to this already.

17:18
This is my teaching moment from World War two.

17:22
This carbon fluorine this covalent bond, doctor Rivers Target target, or more about this, is carbon fluorine bond resistance.

17:31

In chemistry, we use the word recalcitrant English, that simply means stubborn.

17:37
But in chemistry means to not break that bond, recalcitrant to biological attack, when you think of all the wastewater plants in the United States of the world.

17:50
Here's micro-organisms two.

17:54
Broke down Janneke Matter, it's recalcitrant to it.

18:00
We do not have any chemical we can add that can break that carbon fluorine bond And we saw more attack again. We're right now experiment to find out what temperature will it take to break that co op carbon fluorine bond.

18:16
Is again, unaffected or anything the precursors we talked about, may actually convert to to actual P fast molecules but at the present time unaffected by conventional wastewater treatment systems.

18:36
All right.

18:37
Can everyone hear me OK? Alright. So now moving from historical lessons learned from doctor Ian. Thank you doctor ..., that was wonderful. So we've learned about the creation of P fast. We've learned about some of the historical uses that were essential that really were important.

18:56
And we've learned about why it's so difficult to now break it down to get rid of it once it is in the environment. So looking at key for us in the environment, one of the most significant challenges with finding boss in the environment is really finding the source.

19:13
one of the most important vectors of ... for the Clean Water Act. And just in general is the sanitary sewer.

19:20
And we're going to talk about more that more. So unfortunately, PEAT fast materials, they are everywhere and in high concentrations, which I think most of you in this room already aware of.

19:32
All right.

19:32
So sources of ...

19:35
to the environment unfortunately come to us a lot of the time worse.

19:41
Red button.

19:43
Ah, OK sources. The ... to the environment but a lot of the time come to us directly from the sanitary sewer.

19:52
Many of these sources are domestic. So if we look at the first one here, many of them come from household products and their uses.

20:00
So these products and the dusts that they generate, we also have food and food packaging. So once you use those, also the wastes and even our personal care products. So, we have there PFS and a lot of those when you use them then think about when you wash, take a shower. It all goes right down the drain.

20:24
We also have lead sheets from waste disposal sites, so including landfills.

20:29
We have people from the manufacturers themselves, manufacturers and formulators.

20:34
We also have industrial users that either knowingly or unknowingly use ... in their processes.

20:42
We have the essential users of ... fast. This includes defense, aerospace, medicine, and technology.

20:49
Then we also have certain individual PFS containing products that are really considered on their own because they generate such a large ... waste stream. Perfect example of that and one that we're going to talk more about is the Triple F's.

21:04
So, when it was created back in the 19 forties, yeah, they didn't find a use for us for this Teflon course doctor.

21:13
You talked about using it then during World War II. And then shortly after Teflon, its use just really exploded. So they started putting in everything from frying pans to ironing board covers. They really just found that and especially for the pots and pans, if you use it, your food didn't stick.

21:32
It was easier to clean up and of course that was very popular.

21:36
So exposure continues here for wedding gifts.

21:40
It became so popular that it really was the thing to give and the thing to receive They even the center on here they call it happy pans People enjoyed it so much Because it was such a joy to use it they started calling them happy pans. And I like this last one here choose a pan Like you choose a man. It's what, it's What's on the inside that counts. Some really clever marketing.

22:03
All right. And so, even for children's play Sets, they would add, So if you look at this one right here.

22:10
So Teflon t-set just like moms. So not only were you getting it from the actual Cooking and Production of Foods, you are also getting it even the children were being exposed to it in their play toys.

22:22
All right?

22:23
So some additional common PFS products generally anytime you see the word stain resistance, those PFS, this includes carpets, fabrics, furniture, and the household dusts.

22:37
Generally, anytime you see the word waterproof, there's ...

22:41
this includes your backpacks, tense, shoes, and your clothing and gloves.

22:47
All of these things are also very important when sampling for PFOS now.

22:52
Alright, so this the clothing and glass foods, you're gonna get a lot of them Cortex, clothing, hats, gloves, et cetera, You're timex any adhesive paper products are posted polyester or nylon clothing or hats any new clothing. So most new clothing is actually coated with something to protect it until it reaches the purchaser, so stain resistance, scotchgard things like that. To make it look good and keep it looking good until you purchase you wash it.

23:22
So there are some exceptions here. 100% cotton generally, is not coded PFS.

23:28
So any clothing that has been washed with a fabric softener.

23:32
Now I think for most of us that's all of our clothing does any. So you can see it really impacts us a lot on a daily basis on a daily basis.

23:41
Also any clothing that is chemically treated for insect repellents, ultraviolet protection stain resistance. Those all contain PEAT moss.

23:50
So and also then, any clothing that has ever been washed with any of these things contains P foss, and then, of course, important for the sanitary sewer, all of the laundry wash waters.

24:03
So, personal care products got sunscreen, ike theme, moisturizer, shaving cream, favorite fragrances, hairspray, make up, the polished toothpaste, et cetera, et cetera. You get the point here.

24:15
So, all these personal care products that we use that contain PFS, then whenever you wash your hands, take a shower, they go directly down the drain, champion, cleaners and the new shower.

24:27
The cosmetics categories are especially high in flooring. All of those really desirable characteristics such as long, lasting waterproof.

24:39
All of those are really the ... components in that make it they get it those properties.

24:46
So some additional products, low density polyethylene, waterproof field books. Treated paper, blue eyes, plastic clipboards, binders, sharpies. Those of you that didn't know sharpies, pre wrapped foods such as snacks, candy bars, energy bars, etcetera.

25:03
And even, microwave popcorn.

25:07
So in this slide, I bet you can find one of your favorite types of microwave popcorn on the side. I know I can.

25:15
But really, it shows this was a study that showed that most of the brands of popcorn, at least all of these that they've tested here, were like the containers were likely treated with us.

25:27
When India also looked at several fast food containers and they showed that for desserts and bread wrappers, that 56% of them content PFS for burgers and Sandra Trump as it was roughly 38% for paper 20% and save for their paper cups. They did not find any pitfalls in the ones that they sample, but that does not mean that there is not P plus in these paper products. We will see there definitely is.

25:53
All right. So as recently as March 24th of this year, Consumer Reports really took this a step further.

26:00
They really looked at the concentrations of total organic fluorine. Then many of you are fast in many of the popular, fast food brands.

26:11
So first thing that I want you to remember is that the EPA Lifetime Health Advisory for PFOA and PFOS is set at 70 parts per trillion, OK. Now what they looked at here was total organic chlorine, So this isn't directly PFOS and PFOS. But if you just look at here for McDonald's, the bad for french fries, 250 million parts per trillion, or total organic farming, so not directly relatable to the 70 parts per trillion, PFOS and PFOA. But it still shows.

26:43
there's a lot of fluorine and P fast in these products. Alright?

26:48
I think that's remarkably high bag of cookies similar, 250, chicken nuggets, 219, et cetera.

26:54
You see the point 13, very similar, but for its bag of cookies, up to 345 million, all right. Chick fil a was a surprising one for me, for that chicken sandwich.

27:07
The rapper 553 million.

27:11
Don't know what I hit. How do I go back?

27:16
Thank you.

27:17
OK, You spoke about Canada.

27:25
Oh, quite obvious.

27:29
Oh, please.

27:33
There you go.

27:34
All right, did I mute it? Can everyone still hear me?

27:37
Is there any way to nurse, the online people can hear us, OK, All right.

27:43
So, moving back to Taco Bell is good a place as any to resume, I guess. And so, Taco Bell was high as well. It had high amounts of P fast inland. They were lower than what we saw at McDonald's Burger King and chick fil a and others that still significant significant amount of ... in the wrappers.

28:04
All right. So how do we tie that back to ... in the environment? But collectively, these exposures generate very complex undefined mixtures of ... within domestic waste and waste waters.

28:17
And in fact, in April of 2002, so just this year, and article, an SMT looked at a large dataset of from municipal wastewater treatment plants looked at seasonal patterns and long term trends and average concentrations.

28:35
And overall, they found that historically, it was the industrial discharges to sewers that caused the majority of ... emissions from wastewater treatment plants. But more recently, it appears that ... from domestic sources accounts for most of the load.

28:54
The Minnesota Pollution Control Agency has seen a lot of this as well. Almost every closed landfill that it overseas has PFS groundwater contamination.

29:03
In fact, the PFAS levels can be up to one thousand times the state drinking water safety standard.

29:12
So, I know this map is very busy, but it really shows the suspected industrial discharges of PFOS. If you see the orange and red colors distributed throughout there, those are known and suspected users of pathos.

29:26
The little blue dots, if you can see those, hopefully, everyone can see that.

29:31
The blue dots, those are airports, and they are on there because of their use of a triple F.

29:36
The purple and the green are the areas that I want you to take a look at them. The purple are Waste Disposal Facilities and the Green Our Sewage and Waste Water Treatment Plants.

29:49
And so, overall, with this report they identified about 480,000 suspected industrial and municipal sites that are discharges of PFOS.

30:01
Now, last year, EPA published a preliminary report on potential industrial discharges.

30:09
It included the P plus manufacturers and formulators and also identified several, industrial, several target industrial user categories. They selected five as their highest priority categories and this included the organic chemicals, plastics, and synthetic fibers. So this really included your manufacturers and formulators of pitfalls and, of course, anyone that uses chlorinated chemicals in producing their products.

30:37
The metal finishing category. Historically, they have used P fast as human missed suppressants.

30:43
They've also use them for wetting agents and surfactants, pulp paper and paper board.

30:48
You can think about all of those paper food packaging that we just looked at. So, anytime that you have a water repellant stain resistance or grace root systems, you're going to have PFS Textile. Mills. This really aligns with the clothing options that we saw, and commercial airports, because if they're a triple F use.

31:11
Alright, so this report overall describes ... uses. And it also talks about the types, concentrations, and averages that were detected.

31:21
So switching gears just a little bit, what recommendations do we have, and then yes, also hope for the future.

31:28

Alright, so for some industries, alternatives to PFS are, are already currently available, and where possible it is recommended to eliminate or substitute your products.

31:42
The big problem with this, though, is the industrial users must have knowledge of the ... chemical ingredients within manufactured and purchased products in order to make that happen.

31:54
one big, one big problem with this is that safety data sheets. The STS is that you get with purchased chemicals don't always list the ... ingredients.

32:04
In fact, if the P false is inner product in less than 1%, or if they are considered Confidential or proprietary or a trade secret, you might not see it at all.

32:16
Now for, for comparison within chlorinated firefighting forms, This category that we really are looking at for ..., the percentage of PFAS in the concentrate is only approximately 1.5%.

32:30
So that really makes you think imagine how much fast, maybe escaping, unknown an undetected into our environment from the use of undeclared PFS products.

32:43
And so, of course, a big recommendation is a need for better disclosure of P false ingredients within safety data sheets.

32:51
This is critical for industry making procurement and waste management decisions. But it's also important for upcoming in PDS and pretreatment sampling, permitting a compliance and remedial design.

33:04
EPA just released a memo dated April 28 and it really talks about addressing and reducing ... discharges from point sources and increasing monitoring of us. And we're going to talk about this more later on in the day.

33:22
Our last recommendation is for industries that have known historical uses of PFOS.

33:27
Additional equipment, decontamination or even possible replacements may be needed with the product substitutions, to prevent residues and historical and discharge of historical ... types.

33:39
two main categories that come to mind are thin, metal finishing facilities, and a triple F users.

33:47
So historically, the Department of Defense has been the largest user of a triple F This map shows 704 military sites with known and suspected discharges of ..., and what you can see is that really everywhere I did it again. All right.

34:03

Let's see. How do I get back to?

34:10
OK, I apologize, I don't know what I'm hitting on this. Alright. So, pretty much everywhere that they looked for, pupils. When they started looking at these military sites everywhere, they looked, they found it and that's really one of the big drivers of changing the mil spec, which is the military specification that requires the use of chlorinated foam in a triple F, OK?

34:31
So, with that, I'm going to pass it over to doctor Yee.

34:41
Fire suppression phones in getting people from this is, that the copper, let's talk about this, but it's so interesting about these 492 was the first phone, the Russian engineer, chemist Alexandra, actually developed the very first forum. And to the right here, you see the fire extinguisher. When I was a young lad, East Coast, every school, every classroom we've had one of these and I remember, you have to invert it for it to work.

35:15
It contain water, sodium carbonate, aluminum sulfate weeks together you get foam and carbon dioxide. That is the very first. It's been used for many, many years. The advantage of it it contains water sodium carbonate, aluminum sulfate.

35:35
It does not contain PFS, wonderful for paper fires, for wood fires like that. But unfortunately, people find out real quickly. Sometimes you put this on a petroleum just sort of flammable liquid, and all it does is spread the fire.

35:53
So these kinds of plans are developed mid 19 eighties for cutting wildfires, a class A real advantage, it loads or surface tension of the water assessment, writing with saturation of the class a few years. And again, we chose trees, that kind of stuff. There were plenty of water found over and over again, that it can penetrate the debris and extinguishes embers Amber's at depth. Which, which is really nice.

36:28
Again, for a house like this, these class A phones work quite well paper wood.

36:35
But they do not work on flammable liquids right before World War II, a brilliant chemist, doctor Julian, developed these protein phones.

36:48
These phones of offerings were made with horse hopes, cow hoofs, and chicken feathers of all things and these protein based phones we use to extinguish fires during World War two. It's interesting, from a historical perspective, how many lives, he say, during World War two, having these protein based phones on the ships.

37:17
During Second World War, it was number one.

37:19

It's getting that degree, It's good, they do biodegrade, you get some of the ocean in a fire degrades The bad thing on a ship they have especially wrote to a relatively short shelf. Life isn't that long. So, it's good and bad.

37:39
The other problem is a flow slowly. And, the other problem, they found out during World War two in this one little spot: Spot and the fire, then resumes.

37:51
So the key with these protein forms: if a lawyer was good, a lot was great because you want it to cover every age.

38:01
19 30 to 19 70 US Navy use these protein firms we call class be flammable, combustible liquids. Unfortunately, again, these were not as effective as modern phones.

38:17
19 67 was sort of a pivotal point. July 29.

38:23
USS Forrestal Ship station off and move to Vietnam in the Gulf of Tonkin.

38:32
Terrible fire on the ship and 130 feel innocent.

38:41
Soldiers killed, 160 more were seriously burnt.

38:47
This was a terrible, terrible tragedy during 1967 Life magazine Which was a popular magazine back.

38:55
Then big story on this, we may be already had a patent, 966 roosa movies patent A triple that people don't really actually the Navy patent.

39:09
This what is a triple F the acronym stands for aqueous film forming foams, aqueous means water soluble F through a filter layer between two phases. Are you trying to do we try to get a film between oxygen, and we have about 21% oxygen in the flammable hydrocarbon, which is generally jet fuel.

39:36
F changing, make, is a mass of small bubbles there for ACCC, is a mass of ... that makes a film between the hydrocarbons and oxygen. How simple is that?

39:51
Like imagine if you were to take a phone, an ad, a a P fast molecule that does not burn, does not decompose Danish recalcitrant. What do I DO? I DO, fire extinguishing material.

40:12
Again, entropy of X is a fire suppression with with PFS and here you can see a picture here is a triple FNS blanket, cools.

40:23

So, it has many, many advantages on, on a triple F 2006 C five Galaxy Aircraft by the way.

40:34
Back then 2006 these tracks and approximately 52,000 gallons of jet fuel.

40:45
What do you craft?

40:47
52,000 the joke was: took through corridors of jet fuel to fill one aircraft for one certainty.

40:58
That is how much fuel these things contained terrible fire to hit 70. Crew members.

41:06
Any passengers They used a triple F, 0 fatalities zero injuries.

41:15
This is the advantage of being able to pull out a fire within 1 to 2 minutes, 1 to two minutes and not to be more than 10 lakh.

41:30
Unfortunately the aircraft is on fire.

41:34
You want something that can put out a fire within 1 to 2 minutes.

41:39
That is the advantage of a triple F This ability to save lives very quickly.

41:46
Unfortunately, that does contain PFS, these profiles. Deer Park, in Texas at 2019.

41:58
1, fire, and again, these tanks are relatively close to each other, almost like dominoes, one after the other, after the other, thousands upon thousands of gallons.

42:09
You can see them start with spray the triple F, and it's, I mean, if you have a giant fire.

42:18
Does, so tanks, This is the idea of fire suppressant, It does work very, very effectively.

42:28
The other advantage, a triple, I think can be used with a handheld hose or a new system for behavior data system actually comes from. The ceiling will show photos of that. And this is a typical Danish system. You have to concentrate the drum, you simply add water at the ceiling, and you get this phone.

42:51
This is a very, very short clip, very short. It's one minute.

42:55
When I was with American Legion, I'd go we would let them go, about 15 minutes.

43:03

When this was done. This is just one minute. You have anywhere between 6 to 10 feet of foam.

43:10
I've been involved in that. one does some of these. one doesn't anymore.

43:17
It is like a blizzard that I came from ever seen, because you literally could, you could not see your hand in front of your face even 3 or 4 inches away.

43:30
It's, it is unbelievable when they're done. This is what it says right in the middle of one and again 6 to 10 feet of this phone here.

43:40
It is empty, and just a couple of minutes later, when they say it's like nothing you've ever seen.

43:48
It's a military helicopters.

43:53
You can just get a perspective of how many feet of foam.

43:57
That's it.

43:58
That's a tech. You can imagine how much foam is on there.

44:05
Let's assume one of the guy that wrote this six foot in height.

44:09
To give you a perspective, this is just a couple of seconds, couple of minutes.

44:15
Here is a young lady in the military cleaning up a triple F.

44:21
Uh, I do not recommend. you're getting exposed like that.

44:28
Put yourself in my position, just manager of a large hangar, and I mean large hangar at least 5 sometimes 5 large aircraft.

44:40
The debut system went off the morning three weeks or even missing or never showed up that day. You do not know Anyone hear me. You don't have just five mechanics or 10 mechanics hundreds of mechanics working on the aircraft.

44:57
What do you do, what do you do?

45:00
And the unfortunate thing is you open the doors you, because you feel that you always it really, that you're thinking about.

45:11
The person have a stroke, that the person to have a heart attack is the person injured, on the floor of the hangar two, to give first aid to that individual, just as quickly as possible, the finger's status, not snow.

45:29
That is not snow.

45:31
This is what it actually looks like when you open the doors.

45:38
By the way, please don't use a snowboarder.

45:43
two becomes airborne.

45:44
It's very, very difficult because, it does become airborne in this what, sometimes, what they, what it looks like, again, This is not So this is a triple F On the aircraft carriers, the exact same thing.

46:03
They do not know how many men are, yeah, that phone to account for all the serve, the soldiers.

46:13
And so they, everything is opened up. Any early suite. And you can imagine where this is going. You can imagine.

46:27
Yeah.

46:33
OK, so what are we going to do about it? Aerospace HLS in the 21st Century.

46:39
So the goal, for both military and civilian aerospace, is to maintain enough enough of the emergency response capabilities of fluoridated firefighting farms.

46:51
But an environmentally acceptable replacement.

46:54
They want it to be protective of human lives and assets.

46:58
And the goal really is to switch to a non fluoridated fell, so they want to eliminate non critical use the PFS, and where it is critical use shorter chain replacements.

47:11
They're also looking at non firm alternatives, and improved fire detection and response. But we're gonna see, is that a lot of the times, when these systems activate, at least, within hangars, it's not directly in response to a fire.

47:26

They do want, as I said, they do want to convert to a fluorine freephone. Here it is either a triple F, or F three.

47:33
They do desire a drop in replacement, and it sounds simple.

47:39
But what we're going to see is it's really not that simple, OK? So, there are several great guiding criteria for replacement, several things that we do have to meet, besides just finding a form and putting it into our system.

47:52
So, the Department of Defense, they are the ones that currently have the most spec. And you may have heard that term before, but the most spec for a triple F, but the most spec is really the military specification. It's a performance standard that requires of chlorinated.

48:10
In fiscal Year 20 20, the National National Defense Authorization Act really set the plan for replacing both the mil spec and the farm and moving to a non for needed alternative.

48:23
Alright, The Federal Aviation Administration is planning to adopt the guidance given by the Department of Defense, and they really outlined their plan in the FAA Reauthorization Act of 2018. They said that they would, if they are wanting to move to a ... last year. In response.

48:43
To that, they did put out to search alerts, and we'll go over those in a second.

48:49
We also have to meet the National Fire Protection association's Guidance ...

48:55
standard on aircraft hangars.

48:59
And, unfortunately, there's many, many others. So, quite often for hangers, you also have to meet insurance requirements, so, Factory, Mutual, Global Property, Loss Prevention, National Aerospace, standard, United Facilities criteria, International Building Code, Underwriters, Laboratories, et cetera. So, there's a lot of requirements and replacing a ball.

49:18
OK, this is really the outline, we're going to go through each one of these quickly.

49:23
But this is, these are the objectives of the NDA, the fiscal Year 20 20.

49:30
So the first one is no later than January 31st of next year. So it's coming up quick.

49:36
Is to publish a new, no spec is to modify them expect to allow for a flooring freefall. Now that involves also having a fully free from identified to go to. Right.

49:51

Also, by October of next year, in 20 23, they are you cannot purchase. So, I needed firms, generally, have a shelf life of 10 to 15 years. If not longer, you check the performance of them every year, as long as they still meet the performance. You can continue to use the DOD has come out and said, as of next October, October 2023, you can no longer purchase any phones that have greater than one part per billion of total pathos in it.

50:22
Currently, and over the past 2 or 3 years, the most spec that we have right now has been changed just little by little. And currently what you can have is you can no longer purchase a fluoridated phone right now that has long chain PFS, has to be shorter chain P fast. But also just as a as an audible thing, it can still have up to 800 parts per billion of PFOS and PFOA even in the ones today. So as of next October, you cannot purchase anything with one great with greater than one, part per billion total pathos.

50:59
The following October, October, 2024, the Department of the Department of Defense, is saying that they will no longer purchase any fuss.

51:08
Any foreign aided foams, anything that any floor needed?

51:12
Any forms that contain P fast as of this state? Now, of course, they've, they've put a little caveat in there. They may extend this up to two years. But so at the max, what they're saying is, by 2026, there were no longer purchase. Or use chlorinated, firefighting phones.

51:31
Seems like a long time in the future, but really to get all of these things stems, it's a really really short timescale.

51:38
So what are some of the things that they're looking at besides fluorine free films, Several non foam alternatives, but actually non non a triple S alternatives? So, the first one here, this ignitable, liquid drainage for the Assembly and I do have a picture.

51:56
So this is really a platform that you can put under aircraft under fuelers. It has holes in it in a section so that when there is a ..., it removes the fuel and puts it into containment so you don't need chemicals. You don't need water for this.

52:13
High expansion fans over here, these are a type of phone, but a triple F there what's known as low expansion. So they really rely on a small farm blanket and a layer of soil needed surfactants. These high expansion funds do not have the tornado components so they rely on a very thick foam blanket in order to extinguish the fire.

52:36
Alright, We'll also, they are also looking at trenched nozzles and why are these different? Trends? Charles's will use a of thawing Freephone replacement, but instead of being the hangar dilution system that uses a lot of material, then ends up in 10 to 15 feet of these actually come up out of trenches and the floor. They spray less. And then you also have the

benefit of having the trench and the flow which will contain at least some Not all but some of the prettiest foam.

53:07
They're also looking at water only options. So we've got water only sprinklers and water mist. And then one of the big ones here is the optical flame detection. So we're looking on approved fire detection and response because right now, significant portion of the times that these systems are activated their false discharges.

53:29
So that's the military side. That's the Department of Defense. When we're looking at the Civil aviation side, we're really looking at the FAA and the 2018 fetter Reauthorization Act.

53:42
Within that, they require. they stated that you will no longer require the use of firefighting foam. Excuse me. Firefighting foam containing PFS by October fifth, 2021.

53:55
And yes, that date has come and gone. Right?

53:58
So what did they do? Last year, they published to certain alerts.

54:02
one in June saying that for testing of your aircraft rescue and fire fighting vehicle, you no longer needed to use the chlorinated film. You could use water and you can use the specialized testing from, which did not contain P us. You didn't have to use P foster testing.

54:19
Later, in October of last year, they did come out and save it.

54:23
No longer have to use co-ordinating firefighting funds at airports.

54:26
Sounds like great news, right?

54:29
But what they did say, is that the existing performance standards that they still have to meet, which are the DOD standards, are unchanged.

54:37
So, what does this mean? It means the airports are still required to use them that meets mil spec.

54:43
Then, they've also committed to adopting the Department of Defense changes to the most spec and alternatives. But, as we just saw, this is not planned to happen until the Year 20, 23 to 20 26, OK? So it looks like, unfortunately, for needed, firms will still be in use, at least for the next couple of years.

55:02
Alright.

55:02

So in FTA 4 oh 9, the standard for aircraft hangars, the Fire Protection Research Foundation, just published your report in January.

55:13
And really, they looked at all the data that they can find for the past, as long as the film had been used. And what they found is really that few firms system activations occur in response to fires involving fuze fuel spills.

55:29
Most activations are false discharges.

55:33
When these false discharges occur, they generate large amounts of unnecessary film, which would cry, which require disposal, are costly to replace result an appreciable damage to aircraft buildings, and the environment. And I think doctor ... mentioned a story where it's very closer to aircraft, the skin of the aircraft, but it's also crusade to say, if it gets out when that day, which is, it's hard to contain it in the hangars. If that gets out and will fall on, say, employee, cars and vehicles, they would end up having to repaint the vehicles because it's very corrosive to the paint.

56:07
Then they also, so in this, in this report, they recommend using a risk based approach to determining firefighting needs. So, they also recommend considering alternatives to ... funds.

56:22
So, that's within the US. What are they doing internationally?

56:25
Well, major, international airports, the ones that you see up here, are already using peremptory foams, OK? So, many places in the world are getting by without for native tongue, already, so we know it's coming. It's just not here yet for the US. Overall conclusions, for this part, there are still several hurdles to overcome and replacing a triple F in the US military and the military and civilian aerospace. Many viable alternatives already exist, but research is ongoing. Department of Defense, an FAA for Somebody's they're still required to meet the Mil spec.

57:02
No single technology is suitable for all.

57:07
And both military and civilian aerospace will continue to evaluate available technologies to find the best fit for each mission, need, and level of risk.

57:24
Internship issues, people have asked me about, because you see, that should be movies. I think it was three, or wouldn't work, because movies work.

57:35
There's a triple i-phone putting out fires.

57:38
I tell people, I've been aerospace. Well, since 19 89, I have never actually seen a triple.

57:47

I've used, every day illusion we had, was an accident every single one.

57:53
And the infrared detector would have stopped receiving one of those.

57:59
Um, that's how I mean, that's how they are, especially when we stopped smoking in the hangars and those kinds of things.

58:09
It just became uh, I've never seen actually, I live in a movie, OK, I get this question all the time that this material is so bad.

58:21
Just Bain.

58:22
Just ban PFS, it's so simple. You can do an executive order. Baby it.

58:29
The problem is, when you think about it, if you were in a medical doctor the exact same properties of P, fastest, chemically inert, this recalcitrance material that makes it so dangerous to our society forever chemical are the ideal building blocks.

58:51
Think about this for surgery if you were searching is chemically inert, biologically inert and never asks forever.

59:01
So today, we look at the contact lenses. We put contact lines. A lot of them contain P Fass vascular grafts, implantable medical devices.

59:16
These angioplasty restore blood through the audit really think about you on something.

59:22
You're going to put in somebody's out when you're going up, but you don't want to replace it forever.

59:29
You want to chemically inert and biologically note. It's not going to degrade.

59:35
These stones have been used for years.

59:38
Strength, graphs, aneurisms, the exact same thing. Hard patches when a baby is born in between the ventricles, is also think about it. You're not going to be using stainless steel.

59:52
You're not going to be using aluminum.

59:54
You around something that is a flexible be chemically C biologically, and learn. What are you going to use SPSS.

1:00:04
Means PFS, meshes, if you need surgery, most likely you've got that mesh you, tracheotomy, you look at the modern tracheotomy's, stainless steel anymore. Today actually says Teflon tracheotomy tubes. They are so proud of it.

1:00:29
What can you do today? How about today wife and I, we replaced our Teflon plans Pontoon plans pans and replaced it with the non tech long pants.

1:00:39
I recommend the American made stainless steel cast iron class or any ceramic alternative but just stay away from the old Teflon pots and pans, popcorn old school.

1:00:54
You know, a pop up, just just be careful, any kind of microwaveable, popcorn. A lot of those, they do not want the grease dripping on you.

1:01:07
You think about how hot that Greece is of a product in that bag. They want something to coat the bag so, it doesn't drip on. You wouldn't hurt you or they've been using it using P fast for years. Again, copper old-school, add a little mini vegetable.

1:01:30
Actually, gold school.

1:01:33
Do not boil. Your water people say, Well my ..., water, please do not boil it.

1:01:42
Water boils at 212.

1:01:44
We're not even sure how high P fast burrows we believe. It's about 500 degrees. The destruction temperature went yes, since about one thousand degrees C.

1:01:55
All you're doing is concentrating P fast. That's all you're doing.

1:02:00
Coach jackets gloves again.

1:02:03
Good school before World War two, waterproofing, and you think about the Sales on Ships. Today they're all synthetic before World War two. They have a cost. Emile coated, with beeswax, and other natural products. No, P, fast, the advantage, you don't have to cause health issues to your workers. Some examples you, By the way, in the PFAS, sampling SOP use the state of Oklahoma, we actually put these kinds of issues in There, is, a lot of these are associated waxed cotton.

1:02:43
This is what you're looking for. Water repellant yes, they are. Isn't good, Is SP Fast? Nothing is good as PFS nothing right now. But again, they've been used for literally for decades. A lot of these materials like Snowshoe Shield you look at the SDS contains is Bees wax.

1:03:08
The other thing I would recommend, especially on i-tunes, besides just enough, if you are childbearing age.

1:03:16
The state of Oklahoma has published the P fast sampling Guidelines.

1:03:22
Yeah, you're going to sample.

1:03:25
Here are the sunscreen, So Next slide's a little bigger.

1:03:31
These, we know, do not contain PFS.

1:03:36
Again, if your child bearing liege, I would strongly recommend, look at the state of saipan guidelines and uses for your personal care.

1:03:48
So, these are approved sunscreens, also had the privilege of working with you to develop the following sample guidelines. In general, the PFAS sampling SOP is drinking water for fish shade, sediment if you're going to take a soil sample.

1:04:10
Mister Lynch, surface water, etcetera, so these guidelines, which sits on ... website.

1:04:19
In addition to that, whether it is sunscreen or insect repellent, again, if you're childbearing age, I would strongly recommend pull this up and look at what insect repellents do, not contain PFS.

1:04:37
Those are the ones I would recommend using.

1:04:41
Wow.

1:04:42
People say, well, why can't you look at makeup?

1:04:46
You look at show you, whatever it is, tell people one thing you could do was just look for the name of the molecule flow.

1:04:57
because it shows carbon has never been in nature. Covalent bond mutual fluorine, atom. I don't know, maybe, inside of a volcano. But we never found that.

1:05:09
So when you see this flow, these molecules, these are man-made PFS molecules.

1:05:17
Now, the cosmetic people know people I've gotten smart about this.

1:05:22

So they're using these acronyms, paying to actually means this.

1:05:29
We're calling this, Just call Pay 10 is actually this ... Is actually this, so the retiring PFS, and I wish in the future cosmetic, shaving cream, whatever.

1:05:47
Like Proposition 65 in California.

1:05:50
You will have some kind of a detail or sign on the product. Yes, this does contain P France.

1:05:56
I think people are very surprised on how much material use on a daily basis, contains P facts.

1:06:06
If you purchase a home water system.

1:06:11
My recommendation is get one that has approved the NSF, NC standard 53 for carbon filters are 58 for reverse osmosis systems.

1:06:25
one over the other.

1:06:28
The recommendation and I tell this to fly fisherman get rid of this. Do not purchase or use this flow carbon fishing line goes school.

1:06:40
I've done, it, moved back to, not just, just nylon Which's, works great.

1:06:49
Thank you very much. Are there any questions?

1:06:55
Thank you.

1:06:57
Yeah.

1:07:03
Yes, sir.

1:07:05
Yes, Military Board, we're using today.

1:07:14
Robert J: All right, they're much more important.

1:07:22
Thank you.

1:07:24
Right?

1:07:26

But not moving the other direction, easier problems. Could you repeat the question with people on the Internet? So, give me a better chance to more succinctly said. So, you said the military aspects were moving towards shortchange, ... So it just caught me as a surprise because that's actually a more challenging environmental problem to try to remediate. So, I'd be kind of curious what their motivation for, moving towards a short chain, as opposed to moving towards a longer chain ...

1:07:58
OK, so I think, this is really one of those cases where, as the textile, as the information is coming along, we're learning things now that we could have really used in previous years. I think it was a jump back when we first started looking at the problems with ..., the DOD did jump. Manufacturers were coming out and saying that The C six Alternatives for Less Harmful, we didn't have the research yet to show that they are just as harmful, and in some cases, more. And so they did switch and put the shorter chain them to their products. Now, one of the problems with that is there also may use the shorter, and then you won't find this on anything, but when they use the shorter chain PFS product, instead of using a small amount of the larger changes, in order to maintain the function of it, they had to put a whole lot more of the short chain in there.

1:08:47
So, I don't think it's something that they were really wanting to do originally. I think that's something that just, you know, it's something they did not have the information on the short chains when they made that decision.

1:08:59
Yeah, mobility. Yes, and as doctor, as doctor, I just mentioned, the mobility of the short chains. So, of course, as we know, the short-term, not only are they more toxic, but they are also more mobile and the environment.

1:09:14
Any other questions, any other questions?

1:09:18
Anything from people online? Products like Teflon pads cortex fabrics, different from this limited?

1:09:32
Can exposure to loose?

1:09:36
I don't think I read that. Right?

1:09:46
Different finance ... is a limited exposure to use.

1:09:49
if you different, So, overall, we made them, they are longer chain and they're supposed to be bound to these products, but what we've seen overall is that they don't stay bound to these products. They do actually slough off. They do come off some of them, if they are Poly Florida, to compensate you, break into smaller per ... compounds, and that those then do end up being consumed and released into the environment.

1:10:17
Yeah!

1:10:21
A good example of that is a lot of the ... that you find on Mount Everest.

1:10:25
That really came from It didn't come from liquid sources, it certainly didn't come from a triple F. It came from the hikers that are going up and bringing their tents water with resistant clothing, et cetera.

1:10:42
OK, Thank you, Yeah.

1:10:53
Briefly mentioned on one of the sites, sites that they were doing some air monitoring, sampling for us, is that muscle related to like the dust and things that you said slough off of the fabrics and carpets And whatever it is, we're finding that it's in air molecules like finding.

1:11:12
I'd love to hear more about that.

1:11:16
Hmm.

1:11:18
A lot of the monitoring, IFRC is going to be from the manufacturers. You're making gore tex.

1:11:25
Are you making?

1:11:26
And now, obviously Cortex is a brand name, but you're making the P fast to make my jacket waterproof for my shoes waterproof. I believe a lot of the air monitoring will be those kinds of stack conditions.

1:11:46
Yeah.

1:11:52
Yeah, so, you mention about boiling water.

1:12:00
That scares me a little bit because I am someone who love rice, so I love cooking or ice right on the stove and I allow my well that's well before I ever again, so I'm wondering is there are like, um, any recommendation of what I can do?

1:12:27
If you are drinking water already is not contaminated with PFS, consuming weis will have no effect whatsoever, whatsoever, but if you're drinking water is contaminated with PFS, um, and fortunately anytime you even salt water, all you're doing is concentrating salt.

1:12:49
P Fast is the exact same way, You're not going to be able to remove it.

1:12:54
Yeah, so.

1:12:58
And, by the way, that's the reason why City of Tulsa monitors are drinking water for PFS. Yeah.

1:13:08
This is show a child water quality director at DEQ.

1:13:13
If you have bacteria, contamination in the drinking water system, issues, the blue water advisory, please, before you consume it, it's a different issue.

1:13:27
We don't want to to concentrate metals, We don't want to concentrate chemicals like PFS, but you have to know about contamination you're trying to address.

1:13:40
So, if you're drinking water system is not contaminated with being fast, and you do have the chance of contamination or confirmed bacterial contamination, we definitely want the water to address that contamination.

1:13:57
So I have to be careful about which contamination, how you treat what you're trying to treat.

1:14:05
So, I just wanted to clarify that, excellent point, It, as a recommendation, if your water is contaminated with both, my recommendation is, go through it, is, he approved granular activated carbon to remove the PFAS, then boil over water.

1:14:24
Therefore, you kill micro-organisms and you are removing the PFS.

1:14:35
Thank you.

1:14:46
Sandra Palettes Toxicologists, I'll be speaking with later on this question is not about the communist. Very good, thorough presentation, appreciate certain context.

1:15:00
Maybe it's a two part question, Little bit abstract, or can this tab we know that there is on long term presence and the potential effects of paypass starting from the long chain to short chain now.

1:15:17
So within the aerospace industry, stereo recognition enough for the industry to start phasing out, all the P fast on any PFS, maybe just some of them.

1:15:34
And then maybe that's the second part of the question doctor ...

1:15:38
see, uh, in general industry as their attitude towards PFS, and potentially also taking actions to eliminate it intentionally.

1:15:52
And this is an addition to us as consumers, making choices accordingly.

1:15:59
All right. Well, to start to speak for aerospace, whether or not there is recognition about the dangers and the concerns of PFAS in these products, And I would I would Absolutely, Absolutely.

1:16:10
Yes, there is, especially in the products where we know that P fast is, where we know that it contains P fast, Things like the triple F I think we went through a lot on the Department of Defense and civilian space, and their efforts on removing the ... components from a triple F. Now, for items, where we may not know all of the floor native components, I think that's still up and coming. So a lot of the products that you use an aerospace, they have to have these remarkable capabilities that unfortunately really can only be done right now by fluorine, so those, I think, are coming, but they're not here yet.

1:16:52
Yeah, where should be a question, in my opinion, is.

1:16:58
Open the future, SDSS Yeah, let's say, above 100 parts, per billion, or whatever it is, If there's P fast, you're notified, in addition to that. I'm hoping one day, and I didn't even. Notice, this is pure sanitizer.

1:17:17
Wipes contains P Fast are some interesting other day. I was younger.

1:17:25
I win and just got some wipes my eyeglasses that were Foggy Lab long.

1:17:32
And as a chemist, I look at the ingredients.

1:17:36
I did not realize all this anti fog, which material that you're putting on your eye glasses, which are just assembly, or two, away from your face, all contain PFS.

1:17:50
But there was no, there was no label, so to injury, I wished we had better disclosure. Yeah.

1:17:57
And so just to follow up on that a little bit. I think that does make it hard from the consumer and from the industry side, But also for wastewater treatment, and for the regulatory side, we really don't know what all is getting downstream to the ....

1:18:17
OK, thank you so much Yeah, that was a great presentation. I really enjoyed it, and I hope you guys did that, so. So now, we can go for break and come back and adds.

1:18:36
Same 45, feel free to grab water outside, and, oh, my God, we have ..., dot! Me! Sorry.

1:18:53

Yes.

1:44:37
Yeah, I think it's time. I know we are enjoying all the nets watching me, So. Our next speaker is Shelly Chadha.

1:44:56
From the Oklahoma Department of Environmental Quality.

1:45:00
Charlene obtained a degree in chemical engineering and biotechnology from the University of Oklahoma.

1:45:10
She has me being the Water Quality Division Director of the Oklahoma Department of Environmental Quality since January 1, 2018, and has 29 years of experience in drinking water and the wastewater profession.

1:45:27
Today, she oversees drinking water, wastewater.

1:45:31
stormwater. What do we use?

1:45:36
Operator, certification and training.

1:45:40
In addition to activities at the Q, she is aware, we've trustee member of the National Drinking Water Advisory Council, and hoes knew that she was impositions input as follows, um, Association of Safe Drinking Water, Administrators, Groundwater Protection Council, Association of Clean Water Administration, administrators, Oklahoma Environment Association. So let us.

1:46:16
Thank you.

1:46:20
Morning, everyone. It's great to be here with you. So just one quick, in my role as the Water Quality Director at Oklahoma, DEQ, Overseeing operator certification, be sure to fill out a form down front, for those of you present in the room. And if you will fill that out and give that back to me, I will get that submitted. So you will get your operator certification Continuing Education credits, for today. Just be sure you give that to me, or you can put a bear with all of my stuff. And those of you online, if you send us your certificate, Brandon will get that entered for you, so you get credit, as well.

1:47:01
So with that, it's kind of a tough act to follow. A lot of great information on the aerospace industry, and kind of how we got to where we are today.

1:47:12
So, I'm going to talk about the exciting regulatory aspect of P fast. We were talking at the break is, if you know, it's kind of it, an interesting time to really do the fascinating and I find myself

using those words over and over as we talk about PFS and what's happening with PFS, where it's going. And we keep talking about it as, if it's this brand new thing, and as we heard this morning, it's not new.

1:47:42
It just now starting to deal with the chemicals that are in our environment.

1:47:49
OK, so, I will just say, I have a lot of slides and a lot of information but you all will have access to them. So some of it I'm just going to gloss over because we've already talked about it and you don't care maybe about some of the intricacies. But I do want you to have access to that information.

1:48:10
So, as we've already discussed. Is ubiquitous, there are a lot of chemicals there, everywhere, everything, we do everywhere.

1:48:23
We go, we come into contact with these chemicals and we know, depending on which chemicals we're talking about, they can have a wide variety of health impacts, not just the end result of a premature death. There can be impacts to our children, impacts to all of us, just as we go through our day to day lives.

1:48:46
Uh, so we are talking about a regulatory sense of, Oh my gosh, EPO is doing all this, and it's on a fast track, and we're getting ready to have all of these regulations on. How are we going to comply?

1:48:59
Well, even from a regulatory perspective, we've been talking about this since 2009.

1:49:07
And that's not that long ago, except it's about halfway through 2022. So we have been talking about this a long time, and it shouldn't be a big surprise that we're starting to see some of the regulatory activities. So we started talking about PFAS compounds in 2009. That's when we first got the preliminary or provisional health advisories. We saw P PFOA and PFOS show up.

1:49:40
a candidate contaminant list for what we might be looking for in drinking water, what we're going to do, some of the preliminary work to get ready for regulation.

1:49:51
The unregulated contaminant monitoring sprit, which actually occurred starting in 20 13, really started looking ahead.

1:50:01
He's asked levels in actual drinking water.

1:50:05
Not, well if a system chooses to look for where they think they might have a problem, this is part three.

1:50:14

Nationwide.

1:50:16
Drinking water, review, looking at what do we say, How often does it occur? Should we be regulating?

1:50:24
Then, we had our first official health advisory on the drinking water side, for environmental programs, that public health protection, that's the 70 parts per trillion.

1:50:37
Then it got a little murky, as is additive, is that each individual could, it be a high level of law on the lower level of another.

1:50:47
And this is what started the cascade of federal agencies doing one thing, various states, doing another thing. And in trying to be protective, we created confusion across the country.

1:51:03
Why is New Hampshire one levels OK in Oklahoma are used in the EPA number, so it looks different?

1:51:12
Just a lot of things that are starting to happen in the regulatory world, then we saw the next round of A candidate list where EPA is looking at, OK. We might need more information.

1:51:28
OK.

1:51:30
So we kind of continue down this path, we're starting to speed up, we're getting closer to where we are today. EPA did make a positive regulatory determination to regulate, set a maximum contaminant level an MCL for PFO and PFOS.

1:51:49
We're also starting to see EPA doing more and more, looking at other, uh, PFAS compounds, should we branch out? Should we look a little further than I just?

1:52:07
It's having some Internet connectivity issues.

1:52:11
Here we go.

1:52:13
OK, I don't know how I did that, So, sorry. Seems to be a common theme today. Technologies awesome when it works and then when the humans start messing with it, sometimes it doesn't co-operate. Operator, so we now, know EPA is starting to look at some of these other PFAS compounds, we know. We're now starting unregulated contaminant monitoring Row five. I've heard some of you talking today That you just got your notifications. That you are participating in that program.

1:52:51
Which basically, if you are you drinking water system over 3300 you are participating.

1:52:56
This is an EPA direct implementation rule and then they are also looking at some smaller systems. So if you did it, those riders, those requests you have questions you can call DEQ will help you work through it. We're already getting questions on, OK, I got this, is this. And what if somebody really trying to figure out that this is a required drinking water regulation? We also know that EPA has told us they will be publishing setting the MCOs and an MCL G, which those are the maximum contaminant level goals. So that will be coming very soon.

1:53:44
Data, Let's say, means the EPA uses words like soon MNN forthcoming and so when we see it, we know it's here and we try to get you that information.

1:53:59
Some toxicity assessments have been going on the last two years, by EPA. These are important because they come to us, in the form ultimately is held the library's goals, are actual limits. So right now, but we know in 20 21 EPA did release updated toxicity assessments for P A, B, S and in October for Next Gen.

1:54:29
We know that they're working on for five others. So those we will be waiting to see, three weeks ago the director of the Office of Science and Technology for EPA.

1:54:43
So that before the end of spring 2022 we would have health advisories are the PSP as a next gen.

1:54:53
And as well, as the end of April is the first amazed that spring does the third week of June.

1:55:04
OK, so I don't know if that's really a thing that's buying time, but I kind of feel like we are going to see something coming from EPA on the health advisories between now and the end of June.

1:55:23
So, EPA has done a lot of work. A lot of that work they do amongst themselves are within the federal family of agencies.

1:55:33
Um, sometimes the states get invited as co regulators Sometimes we're on the outside.

1:55:40
It just depends on EPA's approach on the particular issue, but one way that we do kinda get a glimpse into what's happening is the tube, Federal Advisory Committees that are created through a statutory process.

1:55:56
Members have to be nominator, they have to meet special criteria to be afforded to these roles.

1:56:04
And then, they have meetings that are open to the public, which, in some ways, that has been extremely challenging the last couple of years. In some ways, it's been much easier to engage, because everybody's remote, it's not just one person, or two people are, the stakeholders and the council members are remote, and things are happening online.

1:56:32

So, the first advisory committee that has been working on paypass issues, is the science advisory board.

1:56:40
They specifically took up the PFS issues.

1:56:44
and they're meeting in 20 21.

1:56:48
They were looking at documents, research study is hearing from experts and they were looking at what should the MCOs are the MCL GA's look like for PFS and potentially others in drinking water? And also, what new drinking water regulations might look like nationwide to try to eliminate some of the patch work? That's happening, particularly in the New England states.

1:57:23
The one thing that that information can it brought through discussion is they are looking at reference doses, everything for PFOA, PFOS, being decreased.

1:57:36
We've heard the term reduced by an order of magnitude.

1:57:43
So we're already in parts per trillion.

1:57:46
So then that takes it to parts per quadrillion.

1:57:51
Only do that, since everything we touch, you know, we've now touched PFS, so this is going to be particularly challenging and sampling analysis, and ultimately, treatment.

1:58:09
So the National Drinking Water Advisory Council, I've put the link to the last meeting. Where you can go there.

1:58:18
You can see all of the materials, the comments, the discussions. And this is also where our future meetings will be announced. The meeting materials by federal law have to be made available to everyone.

1:58:35
So it's a great place to get really good information. You know, the source of the information. You know, If it's a manufacturer, you know, if it's a drinking water system, you know.

1:58:48
If it's a regulator, you know where the information originate. So then you can decide how much weight you put in this document versus that document.

1:59:00
Sometimes there does get to be a little bit of competing interests because anyone has the opportunity to submit for consideration any information.

1:59:11

We spent a lot of time in this meeting talking about what's going to happen with PSB as a next gen.

1:59:19
There are some really good graphs, graphical information showing how as a way of seeing a decline in PFOS and P fast, we're seeing increases in some of the other PFAS chemicals.

1:59:38
As something you can no longer produce it, OK, how do we modify it a little bit, and something that was shared, that while we are seeing these increases in some of the other chemicals, they may not be as toxic, OK?

1:59:57
So, maybe, maybe not. It's not as toxic, well, I guess that's moving in the right direction.

2:00:05
But I still think we're gonna have to see a lot of changes in manufacturing process and specs for, OK. I did not touch anything.

2:00:15
I'm not sure.

2:00:22
To Boeing. Just corner of my eye, some of that switch. I don't know why it's doing that. I'm sorry about that. Oh, no, no problem.

2:00:31
I just wasn't sure how to fix it.

2:00:34
We know we're going to see a lot of changes and as we see our health advisories and our goals change as we get more of these toxicity assessments in place, we're going to be seeing more and more regulation. We're going to have to see a continuation. The development of new products.

2:00:58
No one wants to add law flame retardants.

2:01:04
That seems like a really bad idea. But we need to figure out how do we do that in a way that is safer than what we're doing right now.

2:01:14
OK.

2:01:19
OK, so drinking water treatment for PFS, we know traditional treatment technologies are not.

2:01:30
We may have some treatment units and styles that do an acceptable job, or an OK job.

2:01:37
But really, when it comes down to these low levels of PFAS, traditional treatment is not going to get us where we need to be.

2:01:46

We know EPA is looking at ways three options for treatment activated carbon.

2:01:56
We're now it's very effective. It does a great job. Getting into, OK, how much, either activate or granulated carbon do you need?

2:02:07
How quickly does it become fouled? How do you reclaim it, or dispose of it?

2:02:15
NSA, if appropriate, manner.

2:02:18
We don't want to be using activated carbon. And we are collecting all those PFS. And now we're going to take it to an insulator.

2:02:30
And as you heard doctor Lee talk at earlier, well, boy, yet not getting their 500 degrees, we know we're not getting there.

2:02:40
How many places can you hit a thousand degrees or even higher?

2:02:47
That's not very likely.

2:02:49
Today, that may change.

2:02:52
So, we don't want to transfer from the carbon to the air, so now you have the deposition onto the land, your house, the playground, the fish.

2:03:05
So we have to figure out how do we reclaim that carbon, so that we're not having to build hundreds and thousands of hazardous waste landfills to try to collect all of this PFS, contaminated waste?

2:03:23
I want to exchange, this one's kind of interesting to me. I had to do a little research on that. It's not your standard ion exchange. We do have a few ion exchange plants in Oklahoma.

2:03:36
But there are special plates. And the operation is very specific to attract the PA fass chemicals, the compounds.

2:03:46
But then, again, how quick grading your plates file. How did you hear reclaim them? How do you properly dispose of them?

2:03:56
What does this operation and maintenance look like?

2:04:00
Nano filtration that reverse osmosis. We know it is incredibly effective.

2:04:06
It's an incredibly effective treatment for tons and tons of things.

2:04:13
Looking at just one application of reverse osmosis is, to me, although not drinking water and ...

2:04:20
specific, magnifies what this looks like in Oklahoma, in a particular industrial treatment if you treated the water with reverse osmosis.

2:04:31
We would be building 3 to five I'm sorry.

2:04:35
We'll be building 25 to 35 brand-new solid waste landfills, just to dispose of the solid materials.

2:04:46
That's not going to happen across the country let alone in Oklahoma.

2:04:54
Where you have very low TDS, you may have better luck with reverse osmosis but you are still generating a large amount of solids.

2:05:04
And if you don't go all the way to a dry, solid, or dry enough to go to a landfill, then here now, looking for underground injection control rolls where you can inject the slurry, anybody, fan earthquakes. You know, we've been down that road, on the gas side and tornadoes, at least, we know they're coming. You can go outside and watch them come, but, just show up, and that's what, I'll start running.

2:05:37
So, we can solve one problem by creating another problem.

2:05:44
So we have to find the right solution for each of our communities.

2:05:49
Then sometimes we don't like it, but, you know, we have applied the dilution is the solution approach to other drinking water contaminants.

2:06:00
When we look at how some cities have managed arsenic or chromium other metals, if they have five wells that have very low arsenic and one well, that's a little above.

2:06:17
Well, by the time it's branded, it's where you are the MCO, um, yeah, we may have to apply some duct tape baling wire approaches.

2:06:30
As we work with our small communities, if they show PFAS contamination, or really any MCL violations or any contamination problem, we have to work with them to figure out how we can do the best job we can to make sure people have safe, adequate drinking water.

2:06:52
So that's something that's definitely going to be a challenge.

2:06:59
As with all things, another issue here, we've talked about operator certification, and everybody fill out your form so you get your training hours.

2:07:10
But how many of you in your training are trained to properly operate and maintain nano filtration and reverse osmosis?

2:07:23
Not very many.

2:07:24
That's very specialized becoming more common.

2:07:30
But you have an operator in bar south-west Oklahoma who has a C license is the only operator and it's the first time I've had somebody with a ... license because they've had a de license the fur.

2:07:49
The only operator, the next closest operator, is 30, 40, 50 miles away.

2:07:57
Yes.

2:07:58
Weekend, with the infrastructure money, and we can build you a plant that can do this, but who's going to operate it, and how can they pay the person, the amount of money that it takes, to retain someone who can operate this advanced technology?

2:08:16
So just for perspective in Oklahoma, we've got about 14 London: drinking water systems, almost 900 in our community water systems. These are towns and rural water districts.

2:08:31
There are 365 of them are schools.

2:08:35
They're shopping centers with restaurants.

2:08:40
And then we have things that are this non trend.

2:08:45
Then the non transient non community, they're the ones that you have people consistently present drinking the same water, but they are not a town. They are not a real water district.

2:08:57
The non communities several the power plants where they're located, they have their own water system.

2:09:04
We have some, uh, strip malls that are just on the edge of town, but not quite where they have.

2:09:15
OK, so Clean Water Act, the wastewater side.

2:09:20
Similar process though, though it's been lagging a bit big things, the advance notice of proposed rulemaking For the effluent limitation guidelines related to PFS manufactures, that was resigned, and so it is now a requirement under the current administration.

2:09:42
We have the Clean Water Act regulatory roadmap, that's part of the overall PFS roadmap.

2:09:49
We have all of the industrial sources, the pretreatment side, looking at manufacturers of PFS Electroplating apparently, OK.

2:10:06
Thank you for letting me know you have something that is being important for those of you that have discharge permits.

2:10:19
There is a new water quality standard for aquatic life criteria for PFAS that has been released.

2:10:29
A draft, but EPA is working toward finalizing that.

2:10:36
If that happens, then Oklahoma will have to figure out what we do with it. Do we adopt it? Do we don't?

2:10:44
EPA has told us that as permits are drafted, anything that is an EPA federally issued permit will have P fast monitoring in it.

2:10:56
We've seen that in the north-east where EPA has permitting authority, we've also seen EPA putting PFS monitoring in stormwater Discharges.

2:11:07
Um, whoo, waiting on EPA to do their study, related to fish tissue monitoring across the country, that will help to inform similar regulatory decisions and water quality standards.

2:11:22
In the winter, is when EPA plans to finalize the aquatic life criteria, and we know that EPA is working on P fast rate limits and monitoring requirements for bio solids, and we know that they also are working on a model that monitors or models all PFAS compounds. And if you were to hit a certain level in that model, then you would be required to go in and monitor for a whole suite of PFS Chemicals.

2:12:00
So, again, from a DEQ perspective, who does this effect?

2:12:07
Now for municipal facilities, there are about 740 For industrial facilities, it's about 2500.

2:12:16
A lot of those are related to stormwater.

2:12:22

An hour at a time, so I just want to touch on a couple of other things, and we can talk later, if you have specific questions, infrastructure below. This is the publicly owned water, wastewater facilities.

2:12:38
There's a ton of money out there.

2:12:41
It's broken down into all kinds of different sub categories.

2:12:47
But this is the funding that is specific to emerging contaminants which P FAS.

2:12:56
It's considered an emergent contaminant because of where it is in the regulatory process. Even though we talked about, it's not really emerging. We're just starting to care about it more and more.

2:13:06
Uh, looking on the drinking water side, there's also other set of funding, but it's for nothing but addressing let. So this is the emerging contaminants money.

2:13:19
And if you have questions about that, you can get with me and I'll tell you who you need to talk to on how to apply and figure out if your project would be eligible.

2:13:31
We've talked about laboratory challenges when you have to be super careful that you don't contaminate your samples. We know a lot of our laboratory equipment. Also, those parts in those equipment contain PFS.

2:13:47
So that's something that is going to be challenging, and you've heard doctor talk about our relationship and working on getting a finalized sample guidance for use at Oklahoma.

2:14:03
This is important for those of you who are doing sampling. These are the EPA approved methods as of right now.

2:14:12
Um, the 633 method right now is a single lab validation method.

2:14:20
The EPA is working with Department of Defense to get that fully validated.

2:14:27
The observable organic florine method is something that EPA is starting to use and encourage others in order to kinda screen the likelihood of having P fast so that you can do this method as opposed to chasing, you know, bracket, chemical, whack a mole kind of approach.

2:14:52
K, Radburn, surplus, similar timelines.

2:14:57

Again, we're expecting final advances, proposed rulemaking to come out. That is where we will see exactly how EPA is planning to regulate with the final coming out about a year from now.

2:15:16
Similarly, impacts, not only impacts the baby manufacturers, but it could also impact owners of property operators.

2:15:29
We have to be careful about what we do with drinking water and wastewater facilities. They don't manufacturer PFS, but they get it through household trash. They get it through industrial streams.

2:15:45
Oklahoma has tried two years in a row to do the Oklahoma Paypass Act. It has not passed.

2:15:53
It would specifically regulate what we would consider high concentration, high concentration PFS It's not your chick fil a wrapper, but it would include anything that was generated as a PA fast, not consumed.

2:16:11
It would require a plan of how this would be handled. It would require the generator to maintain liability.

2:16:22
It specifically left exempted things like household waste. But the biggest thing that it did was because what we're starting to see as states, particularly North East, outlawed the disposal of PFAS waste in their state.

2:16:41
They put it on a truck. They put it on a train and they ship it to another state to dispose of it.

2:16:47
So we were trying to you know it.

2:16:49
PFS keeps the designation that it has, wherever it is generated, But this did not pass.

2:16:59
So there's still a lot of conversation in that could come back.

2:17:04
So do you choose perspective?

2:17:07
The biggest thing is this black circle box.

2:17:13
We're trying to protect public health.

2:17:15
We're trying to protects the environment, but we're also trying to not create additional issues. We want to see unintended consequences.

2:17:27

We want to see the elimination of the manufacturing of these chemicals. We want to see a reasonable scientific approach, not just a shotgun approach and whatever happens. And the EPA, lack of regulation, kind of thing. How are we going to figure this out? We would like to see collection efforts.

2:17:49
For some of the farms that are out there.

2:17:54
We would like to see an exemption so that the tax payers of a small town aren't paying to treat PFS that was generated through an industrial process or an industrial use.

2:18:09
So those are really important things that we want to regulate where it's generated, not the receivers, which oftentime are the PO TW is, they're receiving it.

2:18:21
And then they have to figure out how to treat it.

2:18:23
And that really impacts those pretreatment programs, but ultimately, the theory of whoever passes on the cost of treatment to their citizens and their visitors and their industry. So we want to try to figure out how we best manage that.

2:18:44
So, with that, I know we're right up against time. I don't know if we have time for questions. If we do that, it's great. If we don't, I'm going to be here all day.

2:18:57
Minutes. That's OK.

2:18:59
Next.

2:19:02
Yeah.

2:19:16
So my question.

2:19:18
Based on, you see, among three results, that you know, the monitoring that we've done in PFAS, thus far in the state of Oklahoma, what is your perspective on the current state of PFAS contamination, in drinking water in Oklahoma, and how do you think that might change with UC Iran five?

2:19:38
So, based on the first round of monitoring, we had one water system that had detectable levels, um, thanks.

2:19:56
That was all.

2:19:59
So that's, I think it's a good time.

2:20:01
There were not as many systems monitoring.

2:20:04
Then, I think we're going to see more detections, um, partly because we are sampling many more systems, and partially because our detection levels have changed.

2:20:23
So I think we're likely to say more, I am hopeful that we're not happy to know, my gosh, like this, we know it has to be so totally different because we have this widespread contamination.

2:20:38
We've been very fortunate.

2:20:41
Well, we have had detectable levels at our military bases, and some of that is surface level, so, some of it is ground water.

2:20:53
In most cases, that groundwater was shallow, groundwater, and it was more of a confined aquifer situation as opposed to, you know, the Garber Wellington or something. We have had a couple of incidents, instances where there was some contamination found offsite, and the military base was very responsive.

2:21:22
They provided bottled water to those homeowners and paid to this city, the cost to extend waterlines to those individual whales, to those homes.

2:21:36
So we've been able to manage it so far.

2:21:40
I think we're going to see bigger challenges, but I'm hopeful.

2:21:43
And based on what we've seen so far that it's not going to be the extreme cases we've seen in some places with contamination but time will tell.

2:21:58
All right, thank you all.

2:22:01
Yeah.

2:22:05
Great presentation.

2:22:08
So that leads us to the next speaker.

2:22:14
Jim, from the Associate Professor of Chemistry at Oklahoma State University, in 2000.

2:22:24
Doctor Levy said he's playing foosball for ...

2:22:32
as Sodden as a university.

2:22:35
And in this time, a BS degree in Chemistry with math and Physics minor after watching in an immunology lab with doctor William and Brian.

2:22:50
He graduate school at the University of Kansas in the Chemistry Department working with doctor Joan Tangy when he if L P D.

2:23:03
Catalase decouple oxidative called Brain Reaction after earning his PHD in 2010 Jimmy took a postdoc position. We don't touch on at the Yale University where he developed.

2:23:23
That's allies as symmetric key actions.

2:23:27
In 2012, Jimmy started his independent career at Oklahoma State University as an Assistant Professor of Chemistry, where he has developed a research program focused on advancing the ads, seem to cease to innovative approaches.

2:23:47
In his efforts, he has developed expertise in chlorine chemistry by demonstrating numerous new chemical reactions that's around X, ..., synthesis of challenging.

2:24:04
Yet disabled remix, it must be, in 2007, ..., Latino analysts promoted to associate professor of chemistry and of chemistry in 2018. That's so we've got a nice touch on.

2:24:24
Well, co-founded a company, Weaver's lab, labs that focuses on applied chemistry problems including P phosphate mitigation, detection and destruction.

2:24:39
They called me as received grants from U S Air Force and NIH for the development of smart materials specifically designed to remediate the fast from groundwater.

2:24:53
Welcome. Thank you for the invitation that. I'm. Making you read that, it's, it was quite a mouthful. OK, I'm not seeing just advance.

2:25:10
All right, let me turn on coiner, You guys see that on it? All right, I'm going to try to remember to use this, other people online can see what I'm pointing to that. I apologize, chemistry tends to develop its own words, and then other people, you know, it's almost like a foreign language.

2:25:30
So, I'm gonna kind of the chemical perspective on ..., and I'm really excited about this. This is actually work that has come had stems from our company that we formed, and, you know, most of the companies here today, this is really the efforts that I'm gonna present and show you guys. So just a little bit of background about me and why I started the growth, and Duncan, Oklahoma down here, this little button, and moved to Oklahoma City area. And then to Kansas,

up in the north-east, there became a jayhawk. Then, yeah, I was fortunate enough that there's a position open. The year I tried to go into the bucket. Managed to land that position, back it up on the state, So I was kind of a return home for me. And then in 20 18, we started this company has a terrible way to look at less than the mental, more applied problems. And so ... kinda came up as that. So what do I do at OSU? My primary assignment is teaching and developing premier research program, where we train the next generation of students. So here's system.

2:26:29
The thesis that I've had the pleasure of working with, really great. I know, I train PHDs, and help them develop their research program, and a whole army of undergraduates that have come through there. But the other aspect of what we do is we really try to develop visionary chemistry that kinda leads society forward, and how they do chemistry. And so that's kind of the goal. So here's one example.

2:26:54
I tell you this little snippet, I try to give you some sense of where I develop some of the expertise that we've leaned on. So this is ... might or might not recognize, that's always several of you in here. Hopefully take it. It's a top 10 Blockbuster drug, a top 10 selling drugs. A year for a couple of decades. Now, I was developed by Merck. It's an anti diabetic drugs. And so, if you have Type two diabetes, there's a good chance to take it. So, you know, actually, the hardest part of that molecule that you saw there was actually a trifle, unneeded, narrow range that you see. The rest of the molecule is fairly complex, but that actually is the hardest part, is synthesized. And so, we had this crazy idea.

2:27:37
Maybe we can make it from a relatively simple molecule hexafluoride benzene, which has its simple, not because it already has the difficult to make carbon fluorine bond in place. We just have to learn to take off the undesired ones, we'll call this function .... So, this is a bit of an audacious idea, because potential, but really, and that's why there's other people that have also thought about this. And I've been trying to develop it over the years. Carbon bonds are limited in nature.

2:28:11
There are about 12 that, are known natural products, but generally speaking, nature has not it does not add the molecular machinery to make carbon fluorine bond or to break carbon fluorine bond, which leads to some of that long term. effects of ....

2:28:31
But that's even for the synthetic chemists are really very few modes of activation that comes down to the fact that's, what the bottom line? The red sea is, unlike the other allergens that, you know, chlorine bromine and iodine. This is actually a volume is closer to that of a carbon hydrogen.

2:28:50
So it's a very small font, and that's that's similar.

2:28:55
The kinetic robustness, why are we not advancing?

2:29:00

Just gotta click down here. OK, the other issue about bots are the strong, so this is a measure of the bond strength. This is the homiletic bond dissociation energy. And what we see is that, this is the strongest single bond, known to be made with carbon atoms in the universe as compared to carbon chlorine. Bromine, these get relatively weak pretty quick.

2:29:26
And if you put it with a lot of noise nor to the strength goes up even more so.

2:29:33
So it's a really clean, kinetically robust bond. So that really limits the number of ways that you can actually break these molecules.

2:29:42
So what we've heard, some insight here, what we realized is that a lot of issues, kinda what, this industry, and these ideas had never really made it to the main stage, but we explored this idea of adaptive mutation, never supposed to. But that's OK. And so the idea was that we could use an Electron to fragment that. And I'm gonna just kinda go into this. So this is what the company Merton codecs as a presidential Green Chemistry Award for their synthesis that took this relatively simple molecule that already has the three florian's in it and made the final drug. And just three chemical steps. 84% chemical yield, I think, for that. and and their byproducts were like a commodity, chemical, and water that they made in their CO two really amazing chemistry.

2:30:30
Well, they didn't tell you, though, is that, To get that started, do chemistry. That was dirty enough that there's no way in the US, will do this chemistry, right? So, we shipped this over to see is the places that are less the discriminating and what, OK. So, yeah, that's kind of pulling back the curtain there. But, anyway, this innovative aspect we were able to show that we can couple of steps, take a commercially available highly correlated molecule and actually carve off our scope out the data flowing that we want from this.

2:30:59
And so this really, has this key, critical, innovative step, that we developed here, which allows us to remove both this coin, and let's say, you're in the right locations, to give us the right path in Virginia. And so, anyway, Sets and trying to further improve, upon this, but that was, it can condense synthesis there and so that's how, we kind of innovate. But in doing this, you know, we think a lot about it. So at this point, we publish some 23, 2 reviewed papers and chemistry journals, and filed several patterns on the topics that I spent time thinking about organic fluorides and and the properties that they have. But, you know, give you your PTSD at your College Chemistry course, but I think you guys are smart TV. So, if you think so historian up here at the top right of the periodic table, it's the lightest of the halogens. almost has. Electrons have to have one more that have a complete octet. We'd like to say. But maybe every space for Electron will be filled.

2:32:00
That's what happens with Neon right here, OK. But one of the things that you'll notice is that it has a 1.6, 3 Atomic radii. I compared that to hydrogen over here at 1.54, 4 oxygen to 1.71. So it's actually pretty close in size to a hydrogen. So that means that when you replace hydrogen on organic molecule with light, it doesn't actually, stare directly or inside has really changed the nature of that molecule. If you were to put on, those get quite a bit larger. Right.

2:32:29

And so that means that, you know, they take on different structures, though. It would be if you put a hike or, you know, if you replace a CH with a carbon chlorine, you'd get a different structure than if you replaced it with a point.

2:32:41
So for things like no binding proteins, things like that. So oftentimes, we're able to incorporate them into, let's say, like a natural product that has some bio efficacy, and it doesn't. Instead, it's the same target. Oftentimes, we're able to use this to really enhance the properties of that. OK, so another physical change here at home.

2:33:02
It's upright.

2:33:09
OK, yes, sometimes acting out.

2:33:14
Yes released.

2:33:18
Move the pointer.

2:33:21
Yeah.

2:33:24
There's an attack or the other big difference is the electro negativity. Right? And so here's a periodic table that as you move up to the right these become negative so if we consider what happens when you replace a CH bond with a look at the difference in the Electron negativity. There is a relative electro negativity so you just need to know which one's more electro negative. So hydrogen as 2.2, carbon 2.5. That means that, you know, this will be the positive end on that CH bond will be positive. But when we replace it with fully, that's more electro negative. That means, what we call it the dipole, effectively which end of that bond will be polarized. There's a flip their, that occurs because of that. And so that's another way in which for a winds up, having really remarkable of *** is because of its electro negativity of the molecule.

2:34:19
OK, and so what are the, the final things, which has a group?

2:34:23
Really significant implications, so thanks for bearing with me and thinking about this is the polarizability because our Florida, so electro negative, when you put them all over a molecule, you cause that molecule to become a basically really static in terms of where the electrons want to go. Those flooring, so very tightly to the electrons, they don't share. the fluorine, does not share electrons. Well, OK.

2:34:46
So greedy electron quarter and so what that means is the overall molecules. When you consider something like ..., that molecule is not very polarized because what we like to say, meaning that when you put it in the electric field, it doesn't change its shape because of that.

2:35:06

And that has a lot of implications because that's generally true for most organic most organic molecules.

2:35:15
So, let's look at how some of these the fluoridation affects the physical properties of these. So here I have at the top like acid and the ... acid, ... acid, ... acid, which is also up there, and then, one of the tools of Sonic acid.

2:35:35
OK, so, first thing you should notice is that it dramatically acidify the molecules, such as ... acid, is P J, so PJ is a measure of the equilibrium. Basically, the transfer of the protons of water molecule, so we're talking about this proton O H OK, as I should start point 7 8 for the ... acid ... zero point five Just to be clear, this first unit. This is a logarithmic scale, and these are orders of magnitude. So it's, it's, you know, 10000 times more acidic by having these florian's on here that when they are there.

2:36:12
And so, at this picture this PKI shape and water, people will be completely ionized more than 99% of it will be in the oh minus and H three L plus category. Like it will separate ionize, OK. This is the C P. So, this is a calculated P or partition coefficient basically, this is looking at how much that molecule wants to go into the organic layer often all versus water. And so, again this is a logarithmic scale, so these are orders of magnitude out here in this first digit.

2:36:50
The lower, the smaller this number is, the more it wants to go into the water layer, and she said, you can dissolve basically a 1 to 1 mixture of optimistic and water.

2:37:00
Whereas what P So, you can dissolve 13 grams per liter, OK? Digressing.

2:37:08
Yes.

2:37:08
So, every time we add CF two units there basically we make this molecule to PEAT talks or less and less water soluble, and so, let us go in between these three right. So here we have already talked about these two, but now if we just add two more CF two units to this molecule, you drop down to zero point six seven grams per liter there. So, a pretty significant decrease in the water soluble. Hence, my question earlier to you. Why would you say, Well, the last soluble are the easier it is to basically remove it? Another key thing to what numbers acids with the same, Latin root may have one more CO two unit than the corresponding carboxylic acid and corresponding less soluble so.

2:37:55
To know what the acid to the ...

2:37:58
acid, you see that there's about a two order of magnitude are two fold Decrease not quarters two fold: Decrease in the solubility factor two.

2:38:11

Then, just primary takeaway is basically the same amount of attractive interaction to water. That's all because, it always comes to the head group here, the carboxylic acid or the ... acid, that's the part of the molecule that really wants to interact with water and that's the same for all of these. Same as how much of the rest of the molecule does not interact with water so you can get this as opposing forces a balance between the arts.

2:38:39
Otherwise, it's not really shown here but you see a dramatic loss in the polarizability and then really importantly, this is probably not a name that's known by many people but you see a loss of what's called the van der Waals interactions.

2:38:51
And so, this is basically a function of this loss polarizability, and that really matters. For reasons I'll get into in the next couple slides, so they're typically environmentally stable or, you know, as a result, given the moniker Forever Chemicals, OK, so this is an example of episodic thing, kind of like this. This is the part that will interact the way this is the basically doesn't like the war, OK. So, here's an example of activated carbon at the molecular level. The activated carbon units for these non covalent bonds with contaminants, OK? And they work because this is a really soft, very, polarized electric field because of all these benzene rings effectively. And as a result, it will basically works to polarizability. So, if you're a highly polarized molecule like most organic molecules, it works great.

2:39:42
This is why you can put it in there, and it'll take the order food, because those volatile organic molecules basically get caught up in this surface. Along the edges, you will see. Today spawns a carbon out there. And these can undergo hydrogen bonding with this part of the molecule. But really, because this doesn't like Vander Walls, and it doesn't have much in terms of vendor van der walls. It doesn't actually have very strong interactions with activated carbons.

2:40:11
The other big technology that we can consider using to remediate ... ion Exchange Resin. So it looks something like this. So, it's a polymerized monomer that contains basically an ammonium ion on it.

2:40:24
And as a result, this, this positively charged ion, is stuck in the solid enchant, really move. Because it's covalent bond it. But, it's, it's not right. And so, if you replace that, or if you wash over the carboxylic or the Sultan and it will exchange with this anion right here. And what that does that allows you to basically trap out the negatively charged one. This interaction is basically electrostatic a major positive, and negative charge, attract each other. So, as long as you keep the positive charge locked in place, the negative charge will go away. And so this works pretty well, but we'll get into that kind of. Next slide.

2:41:02
Alright. So the good, the bad, the ugly activated, carbons, they're cheap. They're familiar, we've used them quite a bit in the technology, in treating water. An industry, you know, the, the, the bad, as they realize I'm pretty, extremely weak, Attractive interactions, and this becomes decreasingly effective as your P fast becomes more water loving, or more water filling. So, the smaller they are, more they're gonna, you know, the less this is going to work.

2:41:33

Um, then the, the Ugly to Southern dislodging by, PFOS, the pathos.

2:41:40
That may be bounded by competitive, binding, Almost every other kind of contaminant near water will bind to activated carbon stronger than ....

2:41:51
OK, so that means if I don't know, there's a sudden warmup of the outside water that you're treating. And, and there's an algae bloom. Guess, what's getting dislodged the ..., that broader activated carbon? And, so, suddenly, what you thought was, well, controlled is not, and, so, that can be a real problem.

2:42:08
Then, you can regenerate these. But, I mean, there's two problems about when you start heating this. You have the heat of the one thousand degrees at the bees are really certain that you're not sending them up into the sky on accident. And there's been evidenced that does happen more often than not just talking about ion exchangers. So typically these are actually pretty broadly accepted. That Coulomb interaction is pretty good but they can be extensive and regeneration as possible with these. But you have to usually send those off to get that done and use hazardous solvents to do that. And that requires generally speaking a special facility to do that as well they they are subject to competition from other ions.

2:42:52
So if you're using a hard water source with openness, lots of chloride ended up, know, these can be problematic and they can also, they lose their effectiveness when you get to a short enough change once.

2:43:06
So, here's the thing, and I'm going to speak to this, but imagine a chemistry. We have this ad. It's like this also like.

2:43:13
So the spring all this up.

2:43:18
For some time in a number of different applications, organic chemists have used basically binding the storage source phasing As an attractive interaction, like, we used it for a number of different ways to exploit isolation, things like this. But really, this has not been done. And water remediation. As far as we can tell. There's, there's, there's been a few people exploring it. But we wanted to ask the question, could we exploit this force towards daisy to effectively and efficiently remediate pizza sauce?

2:43:48
And that's what the team has been working on for awhile, so I'm not gonna go into the synthesis of it. And for you guys, but that batch, effectively, we built the library of sorbent materials that have are well defined on the surface, where we can actually glean information about how the surface chemistry that impacts people are mobile. And so, you know, they're all based on a silica thing we teamed up with Alice Air Force Base, who graciously allowed us to go onto their various samples, water from the contaminated sites. So, here's a breakdown that was determined by pace analytical lab of what was then the water. And, so, we have, here is just graphically it

what the structure is here, this social stomach acid, the ..., but, the biggest was an SRE hetzel carboxylic acid and then ... was the fourth most abundant one and then, P, P a B S.

2:44:43
So, the potential folic acid and then have to know it lala, carboxylic acid and ...

2:44:50
acid, OK. But those are the ones that we were able to detect, and so we started trying this with the materials.

2:45:01
We also compared it against group granular activated Carbon ion Exchange.

2:45:07
Aye.

2:45:08
PAC, the side are powdered Activated Carbon.

2:45:14
So the orange ones so just keep that solid versus hashes from two different well sites that we sampled them and they do have different amounts of the different PFOS and then it's over here. I've got to hurry, though, but largely to say I'm gonna skip over a little bit of this. We did see very no differences in how they performed. Our differences between the long chain versus the short chain was that we were able to see We're pretty excited. You know, we see that SMB stands for floor above anyway. We were able to pull the ... acid. So this is one that really struggles even against, ion exchange is not great when it gets overloaded.

2:46:01
That goes first, GAC was pretty much an effective against some of the shortage, and the ones, and so was the PAC against the PSB, OK?

2:46:12
So, let's get to some of the other exciting things. Broadened. Our questioner said, Well, how's that working against? some of the other? ones that we didn't have the method set up the test for Senate Treated samples where we took 50 mils of our samples. And I didn't actually explain this terribly, well here.

2:46:29
What we're looking at is the difference between control sample that was not treated. And our samples, So, just to be clear, we're not pre treating this in any other way than putting our sorbet material in there.

2:46:40
But we take 50 miles, or the Sorbent plus, 30 milligrams, return probing them, and then we allow those to incubator two hours. Yeah, there we go.

2:46:53
And and then we basically took off the material centrifuge it move it over. And then, this is, what's left as a result of that, you know, what slept in the water? And so again, you know, some of these do not work well, I guess the short channel and so this purple or blue is the ... acid.

2:47:14

And so we don't see it didn't work well. But others did, actually worked pretty well. And so we can glean out of this. I can actually stare at this for quite awhile and try to take away all kinds of messages. one of the things I do want to highlight, because I believe material I'm really excited about it, is this F M V eight, it was across the board, generally effective against long chain and short chain ones. Some of the other ones, and I'll point to the defense and the structures in just a second Like 12, you know, it really fills with somebody, or it doesn't do nearly as well with.

2:47:45
Go for the butane carboxylic acid and get no guessing.

2:47:51
GAC, really, with, when it comes to some of them, perform terribly, well, I haven't changed, though, you know, it was fairly effective. It didn't work so well with the ..., but it did for the rest of these.

2:48:05
And so, you, know, if you have enough ion exchange, it will probably handle that reasonably well for us, OK, So just a few structures in the lessons here. So these two, you didn't actually even see it easy. There's some that we made. They're pretty similar to a couple of chlorinated. So it does that are actually commercially available already. But they actually didn't work well for us because what we found was that it was really important to be able to Basically, there's so much chlorinated component on that we couldn't webisodes. And so, you know, some of these will also kind of surprising. You didn't see this 1 this 1. We actually saw stability issues with an amide bonds should be a pretty chemically robust, but it looked like it was breaking down under these conditions and so, you know, we kind of just continued our effort. There are 6 and 10. So here's the structures.

2:48:55
And the big difference, right, is that six as a score and any component, whereas 10 does not.

2:49:00
So that's what I'm talking about. We can come back and we can glean what. We can now look at performance and then relate it back to the structural differences. So it's a six versus what we see is that 10 basically was completely unaffected. So P FBA, reasonably to the launch events that, you know, completely with both cases on the PSB was was it wasn't start with what appears to be a little bit.

2:49:32
Yeah.

2:49:35
No.

2:49:39
It was not terrible, actually.

2:49:43
Confused, and what I thought I was going to say there.

2:49:48
What, we show you the next one, that once. Again, 12 is the structure of these results here. It shows the structure for 12 and for a storage tank.

2:50:02
And so the slope or what the score is actually really good. In this case, there's less.

2:50:10
Yeah, we got almost all of it.

2:50:12
In a case where the PFP is also to agree, and that's why I was confused.

2:50:22
We will see that it's got. This one doesn't actually perform very well. Removing a short chain, What separates Louis region, really improved the selectivity of that, OK, so just a couple of things. So anytime you make a functional lies material, you're going to drive up the cost of that material. This is definitely going to be more expensive than activated carbon. At least I'm asked a mass basis: it's more effective and if you could potentially recycling regenerated and we use it in a safe manner, the effective manner. That could be potentially, really useful.

2:51:00
And so, what we saw, that was that when we had the latest version, this is rather an anticipated, it actually allowed us to basically load the material, use it to remote P fast. Then, we, we disorder of the P fast. By watching it with some buffers, that process is still needs to be optimized to some extent. But we were able to basically strip all the ... off of it. And then we use that same material, and we did that through five cycles. But what you see is, again, we're looking at what we were able, what percentage we were able to remove, compared to the control. And what we saw was that we had basically very little loss and activity over time with them. The difference of statistical variation. Now, 12 is there. And we didn't have the foreign component there. We saw a dramatic loss and activity, after just a few cycles, And so, this was something I was really stoked about when we sell these results.

2:51:56
But that's where anybody can put it actually seems to help increase some activity towards people, ethos, and probably takes other stuff from this. water, will remember, this is not treated this scam straight up out of the ground, notion that stuff, maybe contaminating our raw material. Or some of it. And so in the case of the parts of the native one, that's probably not sticking to it nearly as well, OK? Here are thermal stability. So this is only a Marine right here. This terracycle actually serves as a really great for helping to electro statically attach. So ion Exchange Resin is typically use these ammonium like this over here on the left.

2:52:36
And does not only stable, most of them are only rated to be heated up at 40 degrees Celsius, right? And so you can actually follow this. This is a TGA experiments, so this is basically the initial weight looking at it as a function of temperature. And so as you look at this, you see basically this one slide that really have time for basically decreases all the way down. So this material is definitely decomposing with temperature on the contrast both MBA, FMB 12 if we follow this red line what you see is that there's actually is quite thermally stable. This is about 250 degrees there. Before we start to see a pretty dramatic blocks where we see some thanks cleaving, it's changing its mass and the same was true that this is only in based one as well. And so, yeah, so the ..., these are typically robust. You're not we're not expecting these to undergo deacon.

2:53:26

The composition under normal conditions are probably not going to be treating any water 250 degrees Celsius.

2:53:32
But if you think about, you know, potentially wanted to incorporate it into their applications, that can be actually pretty important. But let's move all the way to do. This kind of concludes what I need to say, that no takeaways are that the current technologies, marginally remediate Longchamp ethos and we'll certainly fail. But in the instance, a shorthand ... combination of electrostatic hydrophobic regions on the sorbent all, can lead to a sort of a material that's capable of actually capturing, even the short chain once. And can do that very effectively and selectively the use of them. That is only enhances that binding. And the thermal stability and the incorporation of a florist tell improves the binding selectivity and the regeneration of the materials.

2:54:21
So next phase, you might want to do next. Well, we're looking at kinetic studies, deep material characterization within some stability studies to make sure that we know what I'm going to cause unintended problems, then optimize optimization of regeneration process. And then working with other partner companies to try to perform cation specific test to see if we can work with them to get our stuff into their materials. SAED, two State funding, and that is that we were funded this project source, as well, as the NIH and Federal projects. And, so, I also need to disclose I definitely have a conflict of interest or owner of the company. So, if there's somebody actually presented Cutthroat, not my academic work that I'm doing here. Right over there. If you have any questions, we're happy to answer, and we're happy to it.

2:55:20
Any questions? We're looking for people that might be interested in responding to this good place to be subject to. Any questions you have.

2:55:28
Yeah.

2:55:30
Hey.

2:55:44
So during the regeneration of the materials, or did you do a solvent? How did you dispose of that?

2:55:53
Yeah, It's a question of what we do and what we've done. A guessing we wasted along with some of our other waste. I'm guessing I don't actually know what they did with it. It's certainly a sub optimal process, at this point. We still have a lot of parameters that we want to exploit or investigate how to make that happen. A bigger question, I'll before that, I didn't know how much we actually concentrated force because it binds a strong way to a material that removing it from our materials not trivial.

2:56:27
It was a good thing if you're trying to pull it out of water. But, you know, but I'm confident that there's other parameters that we can play, especially given that we can warm it up to.

2:56:36

But ultimately, we want to be able to concentrate it then, and then, if you can stick into that bucket, know, we can wait until chemists come up with a better plan for destruct destroying the material. But that's that's I think we should be able to do that. get into the details later if you're interested.

2:56:57
Then contribute time back.

2:57:00
This firecracker the question indicated, Tab.

2:57:06
Silence, I like, they tend to work together nicely.

2:57:11
and application here is analogies. Essentially, you're finding fire with fire.

2:57:17
So, from the regulatory perspective, how would you know that unintended consequences, a theme today, that your residence cartoons are now being picked up by some type of analytical, but the knowledge, the context of regulations, meeting, trying to treat so.

2:57:43
So while they are different than mess, that can detect things down to, you know, high resolution, so sub mass unit resolution. So just because it's the weather that CH 2 CH 2 nitrogen there versus the way to check on there.

2:58:04
Yeah.

2:58:04
Let's say 10, carbons, egg contains, some photos that we could definitely does take. That that was coming off of material. But it's certainly a question that we want them ensure any potential users that, you know, we're not stepping on fire, so to speak. But the amount that we have is actually going to be pretty small compared to the amount that you're removing from water eventually. So that's kind of catalytic effect so to speak.

2:58:33
Thank. You guys.

2:58:40
OK.

2:58:47
Cannot tell Eva you brought back a little bit of my chemistry memory.

2:58:56
OK, so that leads us to our next speaker before we go to lunch, Aye, Done our case, Shani, Donna is the Director, Director of, that's all in the Oklahoma City Office, lacroix and don't V ....

2:59:21
We got bradley's has been focused on environmentally and NIJ areas.

2:59:28
Don has worked on projects in 41 states and five foreign countries.

2:59:35
He has interacted closely with numerous state and federal agencies, including the Environmental Protection Agency and the means of justice in 2001 Don was nominated by the Western Governors Association to become assistant administrator the radiation at the EPE, but ultimately decided to remain in private projects.

3:00:04
Yes.

3:00:05
Interface, with various White House administrations and agencies regarding global climate change.

3:00:14
As both, in house, an outside counsel, done, responsibility for a wide range of legal matters at International Manufacturing facilities.

3:00:27
Way he engage regulators and other foreign officers, officials to resolve issues, he has experience with European Union Regulatory Matters, and has negotiated trade barriers issues between various countries. Has worked with supply chain logistics, operations, and compressing.

3:00:53
More than 60 countries has experience with laws, regulations, and international law.

3:01:01
Convention impacting most means of Global Commons.

3:01:06
Has represented a number of industry sectors, including exploring, exploration, and production, may stream transmission, refining, Pulp, and Paper, Space and Cement manufacturing, and his Bachelor of Engineering doctor from the University of Oklahoma.

3:01:30
He's lice and I think Oklahoma and Fats takes us by association and it's an American college of Environmental Lawyers Fellow.

3:01:43
He frequently rights and lectures throughout the United States on variety of energy and environmental issues.

3:01:52
Welcome.

3:01:53
I guess or peace online, OK.

3:01:59
OK, can everyone hear, are we good on that end?

3:02:07
Yes, we can hear you.

3:02:09
All right, if you want to advance to the first slide, thank you for that kind introduction.

3:02:14
And my understanding is, I'm going to direct to advance each slide on this end, and if you'll help me there.

3:02:23
First of all, I want to want to say thanks for the opportunity to try hydro. I apologize for not being in Tulsa.

3:02:30
I'm actually here in my office, in Oklahoma City, late yesterday afternoon, I had an issue arise that demanded I'd be here, right after lunch today, so I couldn't be two places at once, but regret not being able to attend in person. I've been involved in a number of ... matters for about 2.5 years.

3:02:53
And I will tell you just listening from the start of the presentations this morning and also having sat in a number of presentations, including with US. EPA.

3:03:04
This is the best presentation from a group of folks that I've seen on the issue of P Basu and I know we still have a number of other things.

3:03:14
I know accurate lab is going to present Danny Gang, Danny chanced, excuse me, later. And so I'm looking forward to that. They do a nice job in terms of the analytical work.

3:03:26
So, one of the things I will mention and I spent a two year sabbatical term D corporation, and, uh, and it was a company that spun off the Chemical Division.

3:03:40
We inherited a lot of different liability. The punchline to this story is ultimately, the US government recouped about five billion.

3:03:50
That's with a B billion dollars for a whole litany of issues, including nuclear liability and and Korea, so type things and other manufacturing plant responsibilities.

3:04:04
But a $5 billion settlement at the time is the largest environmental settlement in US. History, prior to the BP blowout in the Gulf.

3:04:14
Why do I mentioned this?

3:04:16
Well, I mention it because I think the the issues around P foss will dwarf any environmental liability case that we have seen, and the history of the US. Judicial System.

3:04:32
And I'll explain why as we go on, hear a bit throughout the presentation. I'll try to get through this, especially Canada, everybody's ready to get on to lunch.

3:04:42

But as you've heard from some of the speakers, we have a, A health advisory at drinking water health advisory. it's 70 parts per trillion.

3:04:52
Now this advisory is not enforceable.

3:04:55
but as I'll describe here in a second, you will see that that has not stopped various states from taking action. And certainly, from a litigation perspective, there have been a number of settlements. And we'll talk about that. Doctor ...

3:05:08
mentioned some of that a little bit earlier. If you could change the slide, please.

3:05:20
So let's go back quickly and just recap some things. ... is a priority for the current administrator. Michael Reagan. Mister Reagan came from the State of North Carolina. He had a couple, really two primary issues that he was focused on in a big way.

3:05:39
While he was the administrator there in North Carolina, one of those was P false.

3:05:44
And he and his agency, under his leadership, had a significant settlement, excuse me, with Moore's Law, which was the spinoff of dupont on the Cape Fear River.

3:05:58
And so he has taken that concern onto the federal level to Washington.

3:06:04
There were three actions announced, and you've heard some of this already.

3:06:08
This morning, three actions announced by EPA last month, The Clean Water Act aquatic life criteria.

3:06:17
You also had EPA issuing a memo to use the Clean Water Act Permitting Authority that it has, particularly NPD S, type authority.

3:06:29
two, to comprehensively require monitoring on potential sources of P foss.

3:06:35
And of course, that's particularly for folks in the audience or online, I notice there's a number of municipalities present, one of the places, two of the places that they're going to be looking at very, very aggressively, and I think Shelley hit on some of this, is wastewater plants are a big concern, and also water treatment plants for potable water in communities are concern.

3:07:02
So the EPA has also published a new draft method to measure, add suitable organic fluorine in water samples, and you've got a lot of technical people there that have spoke on these issues, that are a lot more knowledgeable than I am.

3:07:19

Next slide, please.

3:07:22
So what is going on in Oklahoma?

3:07:26
There, you gotta remember from the standpoint of what happens, the ...

3:07:33
issue generally was being generated on a national level, which is consistent with all other regulatory activities EPA typically takes on an issue. Eventually it gets pushed to the states who are actually the authority that it implements and adopts additional regulations at times.

3:07:52
But the states typically get really involved on the, where the rubber hits the road in terms of regulatory, adoption and enforcement. Oklahoma is no different.

3:08:03
The Solid Waste Management Advisory Council met in July of 2001.

3:08:09
A discuss the draft of ... rules.

3:08:12
The initial focus in Oklahoma was on landfills and then one of the major reasons that people are focused on this is because there is a concern That's that, for example, Oklahoma not just take care of its own issue internally, but Oklahoma doesn't want to become a dumping ground for ... materia.

3:08:36
And so, all the states are sort of jockeying with each other and making sure that they don't become that state or a group small group of states.

3:08:45
That actually becomes a little too liberal in terms of taking on this waste material because it will become there's a reason P fast and all of its constituents. But which, by the way, you've heard from other people. At this point, we believe it's it encompasses more than 10000 compounds.

3:09:04
The initial focus is just on a view by the federal government.

3:09:08
But, from the standpoint of disposal, they called the fear forever chemical for a reason.

3:09:14
They're extraordinarily difficult to thermo destruct, Incinerators probably don't have the capability to do that and, in fact, what we probably have already seen is the likelihood that inadvertently through no fault of anyone incinerators probably had this material in their waste stream, particularly in municipal waste.

3:09:38
And it's gone right out the stack and has been distributed as a result of the air emissions. So, any way back to the landfills.

3:09:48

What Oklahoma is wanting to do is is focused on landfills initially, the language is broad enough enough to encompass industrial facilities, which I work with, primarily in my practice.

3:10:02
And so, you know, the, the one thing, and I'll give you an example.

3:10:08
As I said, I've been working extensively on this issue and on several locations.

3:10:15
Throughout the US, I had a client call me from a state, uh, I'll just say, well North of Oklahoma last week, and they looked at their fire suppression system.

3:10:27
They really don't have concerns about P faucet in their manufacturing process, but through an investigation, they found it in the fire suppression system.

3:10:37
So they are now in the process of trying to make, well thought out decisions about eliminating ... from the suppression system, but they have to do it in a way that's protective of their facilities, of course.

3:10:52
And then the question is: where does it go? Where do you dispose of it?

3:10:55
So, these, these questions are coming up routinely now, whereas before, they seem to be sort of slow and in, in developing.

3:11:06
Also in Oklahoma, there's a definition of P Fos Waste.

3:11:11
And there's a, and I'll talk just briefly in a second about the Pitfalls Waste Act.

3:11:17
But, but it removes the requirement, goes regulation, that the ...

3:11:21
contain high concentrations of PFOS for all categories. And except the final, any other Way section, what all that means is there's some jockeying going on about how this is going to be defined. That's the bottom line.

3:11:37
Next slide, please.

3:11:41
So let's talk about, briefly, the National Defense Authorization Act. And that's been mentioned in some of the other presentations. I won't belabor this.

3:11:50
In fiscal year 20 20.

3:11:54

Certain pitfalls, substances were added to the toxic release inventory requirements. I would suggest to any folks in industry out there, or even cities if, but particularly industry, you need to look and make sure that you don't have some reporting requirement in the TORI.

3:12:14
DOD has been mentioned several times there in this phase out why is DOD so prevalent? Well, it's really pretty simple.

3:12:21
The DOD is the easy target.

3:12:24
First of all, it is known through.

3:12:27
Things like fire pits where they practice control of aircraft fire, for example, whatever they may have done, on site, at a location, at a, at an airbase military base, for example, the DOD's under the jurisdiction, the Federal government, obviously.

3:12:46
And so they, the feds, have more of an opportunity to impact those kinds of facilities quickly, So I think that's why you're seeing action there.

3:12:56
There's also going to be increased, ... obligations under the Safe Drinking Water Act that's already been mentioned.

3:13:04
A fiscal year 20 21, the National Defense Authorization Act did define P four, similar to what Oklahoma is looking at currently, But these are works, many of these things that I'm talking about, our work are a work in progress, and there are going to be additional things that will have to happen before a lot of this stuff becomes final. Next slide please.

3:13:34
Just a quick recap and again, you're looking at fiscal year 20 21.

3:13:39
Somebody previously mentioned there's a lot of money out there. Certainly.

3:13:44
we're probably now starting to feel the inflationary impacts of so much spending, but but there is one point four billion dollars for remediation at DOD facilities, $90 million for research, $15 million for the Centers for Disease Control to just to study the health implications. And of course, you saw what levels of PFAS were present and for instance, the chick fil a bag and those sorts of things.

3:14:11
Nobody really knows definitively what the health impacts are. So there's going to continue to be a lot of the studies that are going on.

3:14:21
Ultimately, the federal statute or prohibits DOD from procuring items containing P fos.

3:14:29

And you've heard about cookware, carpet and those sorts of things. So DOD is taking the brunt of the statutory impact. And again, at this point, next slide, please.

3:14:42
Um, so in fiscal year 20 22, DOD has to establish establish a taskforce this year to address P foss.

3:14:52
Um, I think this is a interesting thing, the third bullet there is a temporary moratorium on DOD incineration of course, particularly with President Biden.

3:15:03
And, you know, he had a son that that died of cancer. And I know the president has made several statements about.

3:15:11
He believes that that his illness could have been caused by exposure to burn pits in the Middle Eastern time, he served, and son served in the military.

3:15:22
I think as part of that mentality that exist in Washington, they're put they've placed this moratorium on incineration for concern about disbursement of these chemicals throughout the environment.

3:15:35
There's also public disclosure, disclosure requirements, and other activities that the federal government will have to immediately engage in.

3:15:44
Next slide, please.

3:15:47
So, let's talk about the state, or set the stage. What are they doing now? We know we know all this action is going on the federal level, and I should back up and say one thing.

3:15:59
There there are efforts inside Congress to make P fos, a circular hazardous substance, or a superfund hazardous substance, what does that mean?

3:16:12
Well, in the world I've lived in as a lawyer for 37 years, particularly working for a time at a very large multinational corporation.

3:16:20
Oh, had a lot of Superfund sites throughout the United States, if a substance gets listed under surplus as the hazardous substance.

3:16:28
First of all, it becomes joint and several liability.

3:16:31
So, if the site cost $100 million to clean up, even if you know, company ABC, Contributed, you know, $200,000 worth of substances.

3:16:43

If everybody else is bank drug bankrupt, literally, in theory, at least in theory, you can be responsible for the whole the entire $100 million cleanup. So these are the kind of issues that are being grappled with.

3:16:57
I can tell you, again, before I jump to the stage, there's enormous lobbying effort that's going on in Washington because a lot of folks are very concerned about what this could do to literally the financial future of some huge companies in this country.

3:17:14
Should this, these substances be the subject of super fun on the state level.

3:17:22
This is completely separate than what the federal government is doing.

3:17:26
Um, this, there are 20 states, at least 20 states, with regulation, or guidance pertaining to drinking water.

3:17:35
There are 11 of these states that have a concentration lower than 70 parts per trillion.

3:17:42
There are six, at 70 parts per trillion, and three, with a higher concentration than 70 parts per trillion.

3:17:49
Now, when I got out of law school, a number of years back, we were testing in the parts per million, with an M, And we thought that was a big deal.

3:18:00
Shortly after I get out, it was, it became parts per billion with a B, and that was phenomenal. Now, we are at parts per trillion.

3:18:11
And there are in some instances where we're now testing sub part per trillion levels.

3:18:19
And I'll leave that, too.

3:18:22
To Danny to talk about accurate. I'm sure he has some thoughts about that. But the challenges of looking at some of these levels that are present in the environment, it's pretty staggering.

3:18:34
The last date I'll mention is made. In 20 21, they, they adopted a law banning P False products.

3:18:41
They have a phased approach with the sale of new products, containing intentionally added people. Now, what does that mean? Well, there's some some operations out there. They don't even know. they have a boss in the process at this point.

3:18:57

So, you know, Maine is, that's a very aggressive law, but there may be some flexibility there and, you know, as a practitioner with clients that operate in multiple states, it used to be that you just had to be mostly concerned about, you know, the proposition.

3:19:15
In California, being the, the biggest concern enter in terms of chemical analysis.

3:19:23
But, that's not the case anymore.

3:19:25
You gotta be careful and understand what's going on in a lot of different states. Now that the, the other thing vein is doing by 2022, either banning biosolids containing P boss in, laying the application. So, think about this. Where is this stuff going on?

3:19:42
We're really good.

3:19:44
These are the policy issues that we're, we're grappling with and if main bans those substances, I can guarantee you the place that they would first go is across the state line.

3:19:56
So if you about Maine or you're up in the north-east, you might have some concern about that, just like Oklahoma has had concerns about the implication of these materials.

3:20:07
Next slide, please.

3:20:11
Well, this, let's talk just a little bit more about the Oklahoma proposed statute.

3:20:19
There was a, and we're talking about a bill that was introduced in 20 21 session and moved out of committee, but no further action was taken as of May sixth, 2022 and the highlights in the pending bill in Oklahoma.

3:20:35
Oh, DEQ has to promulgate rules for storing, treating and disposing of ....

3:20:40
There's a financial liability, or generators of ...

3:20:45
waste, and again, various parties, you have generation, transportation, and it would be similar to either under the Red Grow the Resource Conservation and Recovery Act, which is waste disposal, or depending on if any of these substances ever get caught up and super fun.

3:21:03
There could be a bit of different treatment, but bottom line is Oklahoma is looking at liability for generators of the waste and then they look at that from a definitional standpoint, a triple F, which is doctor Edye and others have talked about that, the firefighting foam.

3:21:22

And then though, the statute will look at waste containing high concentrations, a P forest, and then there's there's a number of things, sub bullets under that that, that, that the statute attempts to address.

3:21:36
Next slide, please.

3:21:44
OK, so we hit a little bit on the regulatory front.

3:21:49
We've talked a bit about the efforts that are going on statutorily in Congress.

3:21:55
The States are addressing these issues, everybodys, grappling with it.

3:22:01
And on top of that, and think about this for a SEC.

3:22:05
There's a, there's a 70 part per trillion, at least federal, 70 part per trillion.

3:22:12
Health advisory standard.

3:22:14
Yeah, what we're going to talk about very briefly here is a number of cases that have already settled.

3:22:24
And you kind of go in your mind, might think.

3:22:26
How can this happen under these circumstances?

3:22:29
Know, this is only a health advisory, yet. We are parties that are filing lawsuits and collecting very large settlements.

3:22:36
For example, Vermont.

3:22:38
Several residents settled with saint Gobain for 34 million, Minnesota. The Attorney General settled with three M, 850 million.

3:22:48
Delaware, 3550 lawsuits were settled with Dupont for $670 million in Michigan.

3:22:58
A number of residents settle for with three M and GP, Georgia Pacific, for nearly 12 million.

3:23:05
And in Ohio, there's multi district litigation. It's been settled with Dupont and related companies for 83 million. Well, what's going on here?

3:23:15
What's going on is that just because something hasn't had a regulatory limit established for, it doesn't mean you can't be sued for it.

3:23:26
Particularly if it's an issue related to groundwater, drinking water, surface water, excuse me, those sorts of things, because, and even in Oklahoma, I would, I would suggest that you cannot cause a condition of pollution in Oklahoma and whether that be to the, to the groundwater or to the surface water.

3:23:49
If that sort of scenario develops, then you could probably you likely will get some regulatory attention.

3:23:57
Even if they don't have specific requirements, particularly if there's a health concern, but from a litigation standpoint, the place you get exposure is under what are called, the common law theories of nuisance trespass. You don't have the right to create a nuisance either. If I have a company in the spreads ...

3:24:21
to the environment, and crosses the property line onto your, your property, there are all kinds of legal theories that allow these civil lawsuits to proceed.

3:24:31
So, the thing you have to be careful of is, you think, well, you know, the government hasn't really settled down on a lot of this.

3:24:38
I should, you know, I shouldn't be subject to a lot of liability at this point, and that is clearly an incorrect interpretation, and if you've thought that. Next slide, please.

3:24:52
There's also a couple of, there's more than this, but a couple of pending litigation cases that I think are pretty fascinating.

3:25:01
The first one is that Thomas Veera case, that's in New Jersey.

3:25:07
It's a class action lawsuit. And, of course, the theory is, you know, you have a class of people all that, or have similar exploded exposures.

3:25:16
And in this case, the plaintiffs are showing a water utility company for PFAS contamination of the county's drinking water supply.

3:25:26
Yeah, if you're a city, you need to be concerned about this one.

3:25:30
Are you a water utility?

3:25:32

Which typically, in my representation of cities, you have the city entity, and then underneath it usually have the utility authority, which is a subset of the city, but a separate entity.

3:25:45
And then, of course, in this case, the water utility brought a separate lawsuit against three M, brought them into the lawsuit as a defendant, into the, know, this particular class action suit. The reason they did that, they said, hey, it wasn't our problem. three M created this problem, so they brought them in.

3:26:04
The other case, which is interesting, which kinda plays into the explanation or earlier some of the Apache packaging materials that consumers are exposed to is the macdowell versus McDonald's court case that was filed in the Northern District of Illinois.

3:26:19
That case was recently filed in March, and that, too, is a class action against McDonald's.

3:26:25
Are the packaging that they use, which contains P fos and allegedly exposed consumers?

3:26:32
Next slide.

3:26:54
No, I don't know why I'm muted, Can you hear me again, hopefully.

3:26:58
So where do we, Where do we go from here?

3:27:01
The last slide.

3:27:04
As I mentioned, states are in the lead to start adopting legislation and regulations.

3:27:12
EPA is on the heels of the States, both from a Congressional standpoint, as well as a regulatory standpoint.

3:27:22
Let me make a comment about this.

3:27:25
It's not a political statement in any form or fashion, but yet it is, This issue will not go away.

3:27:33
I've been around a long time, I've worked with a lot of different EPA, offices, different White House, Democrat, Republican, interface with lots of different people, you get a lot of different political appointees coming in and out of these organizations.

3:27:50
The career people are there for a long time.

3:27:53

And they're long-term thinkers and in this case and this blue, with respect to this blue, they are exactly right to be concerned and to be focused. What am I saying?

3:28:06
Well, what I'm saying is, President Trump was in office, P Fos was moving this whole ... concept, continue to move ahead.

3:28:17
Yeah, there are a lot of other things that, that maybe got slowed down, or policy issues people didn't like.

3:28:23
The Trump BVA understood that there's a problem, and they even continue to move this ahead.

3:28:29
Obviously, with the bindi administration, this whole issue is accelerating rapidly.

3:28:35
In other words, politically policy wise, this issue will never go away and that's a very, very important thing.

3:28:44
Second thing is a liability track already exists, even with the murkiness, the regulatory statutory scheme.

3:28:55
As you sit there and look at this picture in front of you, it's sort of like being at the optometrist, where they start moving those little lenses in front of your eyes. Which one's better. And at first, it's very, very blurry.

3:29:08
It's starting to clear up a little bit for us.

3:29:12
But even so, there's still a liability track, and a lot of people, again, are losing sight of this fact.

3:29:20
This is P fost's, the environmental issue of our time is going to be here probably for the next 10 or more years in a major, major way.

3:29:33
We're all going to be struggling with it.

3:29:36
So what should I do?

3:29:39
My advice to clients routinely is identify where P fos material is present, whether you're a wastewater plant or water facility.

3:29:49
Um, think about this, If you're a municipality, you've allowed, historically there have been no materials that have been land apply, it's likely that those materials could have contained pitfalls.

3:30:05

So the question then is are, well, I'm liable for that as a municipality. Or if I land applied that, and I used to pick up this material and land, apply them, I liable.

3:30:16
The question is, Maybe you are.

3:30:18
But you don't know.

3:30:19
You can't even get to that step, unless you, and you identify where the P fos exists in your system.

3:30:27
Then, secondly, analyze your options, and be very thoughtful about this.

3:30:32
As you can see, this is a very technical area, and involves a lot of thought, and needed thought, and consideration.

3:30:41
Then, the third thing I would say, There was a wise PHD chemist told me one time.

3:30:50
And advise the client the best time to fix your roof, is when the sun is shining.

3:30:56
Well, the sun is shining today, and that we're not overly or heavily regulated, at least yet, but it is coming and it's coming fairly rapidly.

3:31:08
So, you might be able to take certain actions today or two years from now, you may not be able to take. And that may cost you a lot more money in terms of remedial costs and those sorts of things. So, those are just a few thoughts I know we're past our, our lunchtime. I'll be happy to try to take any, any questions.

3:31:41
I do have a question mmm hmm.

3:31:49
OK?

3:31:57
I'm having difficulty hearing on this.

3:32:06
Can you?

3:32:09
Barely.

3:32:18
OK, yes I can hear OK, I have two questions I'll put them both out there and then you can answer with means prohibition of the land application of biosolids.

3:32:32

What's your thought on the possibility of that setting the Federal precedence?

3:32:37
And a second question.

3:32:40
Is there any discussion of what the decimation of high concentration will be in the permitting?

3:32:48
Yeah, I'll take your first one. Your second part first.

3:32:57
You, doctor Edar, others are Shelley may have some late breaking information, but I don't have a good feel for what high concentrations mean.

3:33:09
The last conversation I had with that with the DEQ, because it's, it's sort of like when I was in law school, and one of the justices, they were trying to, they were grappling with a case that dealt with **** **********, and the justice said, Well, I can't define it. But I know it when I see it.

3:33:31
Um, so, that's your classic, non answer.

3:33:36
I'm not sure there's been a definition of, of, of what high concentration mean, there may be other, or others that are sitting there, and ever better feel for that, then, as to your first question.

3:33:49
I do think that there's a possibility that the biosolids, an issue in Maine could spill over.

3:33:56
Now, look, I've worked in nearly every state in the country with the regulators, in those states, and, and there are some states that are just much more difficult regulatory than others.

3:34:11
Maine generally, maybe, is one of those states, I could name others, that I think are more aggressive, and, and quite honestly, likely more influential with the EPA.

3:34:24
But, I don't know. I think a lot of this is up for debate. But, I do think biosolids. Keep your eye on that ball.

3:34:32
Because I think he does have the possibility of having legs and and running outside of Maine in terms of its influence in other places.

3:34:45
No.

3:34:49
Yeah.

3:34:52
Show me come.

3:34:56

Shelley. So, yes, absolutely Is getting bombarded constantly with requests to prohibit the land application, or by science? We have been touring in Oklahoma, a lot of inquiries about what are we going to do about this toxic sludge that's been land applied over. We asked questions, they're talking about biosolids. We're also getting questions along the lines of why are you allowing this probe and human manure that's contaminated with industrial race too?

3:35:35
Kill our farmland.

3:35:38
So there are lots of commentary at all levels.

3:35:43
EPA is trying to grapple with it.

3:35:47
They don't want to prohibit land application.

3:35:52
At least the people at EPA that I would say, are kind of at my level, the office directors, or even the assistant administrators, But they may not be the ones making the decision. Ultimately. It may be a Congressional decision. And, you know, people in New England, it's super easy to go to Washington, DC. and voice your opinion.

3:36:15
Very large states that are known for aggressive regulation have senators and congressmen and women in leadership positions.

3:36:26
So they do have that influence when it comes to where you are legislative decision making and that's not always based on the science.

3:36:40
I think EPO right now, they are hiring 3 to 5 new scientist into the Office of Science and Technology, to do nothing but biosolids work.

3:36:55
For the first time In about 15 years I'm hearing things like revamping the 503 regs. We haven't heard that in a really long time and the focus is on PFS.

3:37:11
I think we're going to see something, I don't don't know what something is.

3:37:16
Oklahoma will be waiting to see what EPA does absent an absolute horrendous crisis type situation. We will not be out in front on additional regulation biosolids.

3:37:34
But every city, every utility rate payers for wastewater services need to be paying attention because I do think we're going to see some movement from EPA in the next couple of years or so.

3:37:53
Great comment.

3:37:57
And, Shelley, can I ask you a question?

3:38:00
And we briefly talked about this before, No, I made the comment.

3:38:06
Technically Oklahoma doesn't have a regulation directly addressing P falls.

3:38:13
Do you agree with me that the D DQ, particularly your division, they are at the agency.

3:38:23
If you saw a situation where you had high concentrations, a P for us in a in a water treatment plant or, you know, a surface water body or something or a source of P fawcett was going into a surface water body?

3:38:41
Does DEQ have authority to address that in your mind?

3:38:46
So, we will be using something like our Public health staff showed, our Emergency Operations statute or a general nuisance statute. So, we, we do have avenues that if it was an emergency situation, we have mechanisms.

3:39:05
When at that point we could issue rotors, we can do voluntary borders as opposed to unilateral orders. But we definitely have the ability, if we were faced with what we considered a crisis situation or an extreme situation that we needed to address, we don't have to have regulations in place. It's just a much cleaner, easier, more straightforward from we're dealing with a camera or an actual limit that is established either by EPA or DEQ.

3:39:45
Exactly. And I agree, I agree.

3:39:48
Yeah.

3:39:50
And to follow up on that question.

3:39:56
I'm look I'm picking on Oklahoma, because you're here, but Yeah.

3:40:01
Do you do you have new authority and do you have the intestinal fortitude?

3:40:08
To actually NGO's simply say, we shall test.

3:40:14
The bio solid outlets in the state just do a one-time test, let us see where we are. I mean, because you could test the ... tradeoff centrifuge and simply require a one-time test.

3:40:30

Couple hundred bucks. Somebody would know what's there. And you just have a benchmark of where you live and act.

3:40:38
So, if there was the political will to do that, it's pretty straightforward, um, I'm not a person who gets to make that decision. And so, a regulation by EPA that we're implementing, we have to have specific legal authority from the legislature to mandate that everyone does something that's not an emergency, that's not an instance. We don't know that there's a problem.

3:41:15
Now, scientists can, they can, legitimate argument, we don't know if we have a problem, unless we check in. There are all kinds of other things.

3:41:26
So, I'm now going to answer you directly, but what I'm gonna say is, it's highly unlikely in the current administration that we would be doing. Something like that, that we are, as the state agency, an arm of the executive branch of the catheter.

3:41:48
And so I don't expect that we will be doing that.

3:41:53
However, things change, stranger things have happened.

3:41:59
I think a lot of our larger cities are doing that monitoring. It's just not required. So, they're not reporting it to us.

3:42:07
But, we know it's happening, and I'm assuming, and I'm hoping that, those that are doing that monetary, if they see something that is concerning, that, they would let us know. So, we could work collaboratively.

3:42:24
And, if we started seeing that on voluntary monitoring, that's a good way to push to that next level.

3:42:33
Of, at least, all that disposed of biosolids on a regular basis.

3:42:38
We have a lot of assistance and, dispose of biosolids every 20 to 30 years because the total retention ligand system that's large enough to maintain that on-site so, we managed to answer with probably the best I can do.

3:42:53
In Chile.

3:42:54
If I could take the flip side on, behalf of, if, if I were advising a city or a community or someone who owned a, you know, a PO TW um, I would actually, given where we're at, and the policy political cycle, and where we're at, and the regulatory cycle, and where, with what you're seeing in litigation, It's ongoing out there.

3:43:20
I would advise clients, just like I said, at the very end of my presentation, You need to know, if, if you have P false in your system, you need to know that, because if you, if you stick your head in the sand, I think the consequences could be much more aggressive in the future.

3:43:44
OK, quite an interesting conversation, and so if you have more questions about this topic, I guess we have a roundtable discussion later today. So keep all your questions and we can talk more about that. And, Don, thank you for a great presentation.

3:44:08
We have a lunch break, so. Enjoy your lunch. So, you guys.

3:44:15
Yes. Yes.

3:46:46
Yeah, OK.

3:46:55
OK, Welcome back, everybody.

3:47:01
I hope me and I launch break so it's Alex wasting much time, I will go ahead to introduce spica.

3:47:16
Um, our next speaker is Andrea Perez.

3:47:23
Is the senior toxicologists try hijra as bas satisfy toxicologists with about 20 years of experience in industry, consulting, and governance.

3:47:38
Andrea is uniquely qualified to support projects involving damage to the environment by Jamaica agents, including contaminants of imagine consents, tweaks based this radiation insights, consumer product safety SS means, omega exposure, regulatory compliance, products, the washing, tell tricks to walk us, ..., upkeep, and well-being, livestock, and wildlife success.

3:48:12
Community and regulation concerns.

3:48:15
He is published, professional, was key area of expertise include: applied toxicology, human health, and ecological weeks assessments, mitigation or regulation.

3:48:30
History, subplot, Fate, and Transport by Accumulation Assessment, weeks based, Mediation, Design, and the reach, communication.

3:48:41
He is an active member of engineers, National, and international organization, dedicated to environmental issues, and he is a frequent contributor to conversations occurring in his field.

3:48:57

Also, in addition to that, Andrew, has been amazing to run this tax on the USDA grants. It's been a great help to us and our recruits results will be fast.

3:49:14
Reached his house, we were able to kick start training some P phi. So, let's welcome, Andrew.

3:49:21
Aye.

3:49:25
Thank you for this tradition. Can y'all hear me now?

3:49:30
Thank you.

3:49:31
A couple of microphones. Hopefully that comes in. Well, so, thank you for having us here.

3:49:38
Thank you, doctor Lee, Go to gym or allowing us to use the facilities and have the in person our show this year as well as the online option, Hema referred to the last of them we had last year, which goes pretty much online only, with a few folks in the room.

3:50:03
So, it's so nice for us to be able to meet in person.

3:50:07
So, with this, let's take a little bit of a detour from two PFS world in terms of remediation, assessment's, sampling, and even some of their heavy duty regulations.

3:50:24
And let me spend some time specifically on the health effects of PFS.

3:50:34
I will try to tie in, um, various aspects that the speakers already presented, and maybe even those speakers who will be presenting on the topics of us, because I did preview all the slides.

3:50:55
So, I think that if you think, ..., you should remember this.

3:51:04
Oh, bullets.

3:51:05
And one is that I think there's no doubt that increasingly be fast, are being looked at as chemicals to be regulated.

3:51:18
There's consequences to that.

3:51:21
And the reason why they're being looked at it's because they are omnipresent.

3:51:27
They are persistent. Some of them can be bag cumulative.

3:51:32
And because of that exposure, there's always potential for adverse effects of human health and environment.

3:51:42
I also remember that we're still learning about the toxicology of PFAS compounds, this group, although we have quite a few studies of the two species of that tree and a root system.

3:51:58
Doctor Paul Dry and Render Tree, um, presented ..., all the other leaves and the roots still are on their way in terms of truly understanding their impacts on you.

3:52:19
So these are some of the points I talked about but I do want to underscore what Shirley also present because that's the message worth repeating over and over again.

3:52:34
Do realize that. We should be concerned primarily with human health impacts of human. Yes. There's laboratory animals.

3:52:44
There is in-vitro in vivo studies.

3:52:48
Even bio genetic models can predict potentially ...

3:52:56
effects, but there is no better way to put your fingers on cause and effect.

3:53:02
Then the response from the human population.

3:53:06
And these are the five associations that numerical science and regulators were able to correlate between the people's exposure, some over there was quite high in occupational setting, and the actual effects at the clinical level.

3:53:30
These are them so, regulation of cholesterol, then responses of a learner, in terms of their enzymatic signature.

3:53:45
There's also some type of immune response to PFS impacting how we respond to vaccinations, including covered Borrower.

3:53:56
There's also thyroid hormone effects.

3:54:00
And there's also an indication of some type of birth fertility impacts, so this is pretty well it.

3:54:06
And this is consistent with what the EPA would list as a skier indications of the impacts of peanuts.

3:54:15
Everything else does not have a clear base, is linking specifically to human responses, keep that in mind.

3:54:25
And there's also impacts on the wildlife, as Shelly and Don indicated, the aquatic life criteria developed by EPA, speaks to those points, though, we know that wildlife systems do not seem to be very responsive or sensitive to people.

3:54:48
So, we are still learning about P, So, this is the insert actually from the ...

3:54:55
Science Advisory Board Meeting documentation, that speaks to what we know all we have been learning.

3:55:06
A longer timeline about it, too must study ..., species, STP, flow, MP false.

3:55:15
Surely indicated while we've been talking about P fast since two thousands, we have also been learning about PFS, and we're not there yet: I think we may be comfortable enough with Booties tube to start regulating those compounds.

3:55:35
What about the other 10000 compounds?

3:55:38
Doctor Edye dimension, we're just not there yet.

3:55:41
Even now, there's just attempts to study.

3:55:45
Right.

3:55:48
Another, not spec pessah toxicologists, I would like you to pay attention to, is the progression of the steps that need to occur.

3:56:00
So it's like a Swiss cheese alignment process between that PFS exposure and then the actual clinical disease effects.

3:56:13
And this concept is well recognized in the world, Wants to cut your risk assessment, This is the adverse outcome pathway.

3:56:26
So a series of initiating and sequential events have to take place so that cancer is a great example.

3:56:37
You do get a cancer day after you're exposed to carcinogens.

3:56:41

It takes a long time and very convoluted process in your body has to take place for you to actually demonstrate accounts.

3:56:51
So the point of this pathway is that there are lot of physical, normal, physical process between exposure or ...

3:57:05
effects that your body can deal with.

3:57:10
So we have defense mechanisms.

3:57:12
We have detoxification pathways, or simply folks, I'm not sensitive.

3:57:19
I'm sure, you know, people who smoke all their life, you never get cancer, They never will, because they don't have specific alignment with ..., just never well.

3:57:31
Yet secondhand smoke or it will never smoked actually mitigate cancer and say I never smoked pork somehow lung cancer.

3:57:40
Well, because of your body's responses to the same thing with PFAS, OK.

3:57:46
So keep that in mind, And this is important because, in my opinion, the current regulations are not taking place at the end point of this path. Right?

3:57:59
They're actually taking place very clearly here.

3:58:02
Well, your body still has a chance to remediate the problem.

3:58:08
And in a way, I view the regulatory bodies as jumping the gun, a little alecia body deal with it because professes, to me only chemical contaminant. We ingest ... every day.

3:58:24
There's thousands of them, OK? And we are still alive and I think our life expectancy has been increasing over decades.

3:58:33
So, that's something to keep in mind context.

3:58:38
So here it is.

3:58:39
This is a summary of APIs, um, examination of the toxicity in effects in support of the M C L G to the maximum contaminant level guideline development. So this is essentially the sausage making the science that goes into it.

3:59:01
So they have identified 350 ...

3:59:06
studies on human subjects and 338 for ....

3:59:11
The other compound, mostly study there are some animal studies models, but the outcome is good, because they are focusing on the receptor interest us.

3:59:23
But also, look at the types of responses each study brought to bear.

3:59:30
In terms of the response, we have to ...

3:59:36
in developmental culture, bhaskar productive, That's a, that's a pretty good mix, but actually, there could be some sponsors, they may not be taught to adverse effect.

3:59:50
This is really quick, I'm going to spend too much time on it, but this is the context of how the MCL MCL Jason developed specifics for us here, and the timeline.

4:00:03
So, I'm going to skip through this one now. So, let's talk about how an MCO GED guideline is developed.

4:00:13
Because this is important, just so we can look and see what all that data will go into.

4:00:24
So the most important driver in all this, hastie toxicity, reference dose.

4:00:32
And this is used mathematically in concert with the drinking water intake, which are standard for EPA, adults, and children, so there's not much room there.

4:00:44
And also, there's some debate about relative source contribution. And I'll talk about I've explained it.

4:00:52
But essentially, what it means is that how much of sources, out the water, would EPA allow you to have?

4:01:03
So, just to kill it that way.

4:01:06
All right. So here's the outline of this scientific approach.

4:01:11
The point of this slide is very comprehensive, very systematic.

4:01:16

As such, it's good science.

4:01:18
I don't think there's anything about the process.

4:01:22
Does anyone toxicologists, risk assessors scientists, would really have issues with and then speaking specifically to the M C G development, which is for drinking water?

4:01:36
We're just ingestion through drinking water pathway these studies to look at specifically at the exposure.

4:01:44
So there's no extrapolation between a scan or voice to be exposed to PFS.

4:01:54
This is another also exemplary style slide, taken from EPA's assessment, toxicity.

4:02:05
And again, this speaks to very systematic, very comprehensive, very thoughtful or evaluation of all the lines of evidence affects the strengths, the weaknesses, and then the subsequent ranking up.

4:02:20
So from the process perspective, the churning analysis, the filtering of the data, the process is very, very sound quite comprehensive. And the last sort of side, this is two most important part presentation if you can try to absorb information here.

4:02:41
So, what do you see in front of you?

4:02:44
These are the toxicity reference values, which is the most critical component of the MCL G equation, as proposed recently by EPA for P.f.r. and P zones.

4:02:56
And here are the key points for you to take to take a look at.

4:03:03
In terms of the magnitude of those reference concentrations, this is in Norway on precedent, because if you look at this scientific exponential, almost talking double digits here, so it's negative now, OK? So, that's a lot, OK? That's mine.

4:03:26
And then in context of the EPA's 2016 health advisory, we have been hearing about today of 70 parts per trillion.

4:03:39
That's 10000 times lower.

4:03:43
So, what we did in 20 16.

4:03:47

Fast forward to 20 22, We've dropped bye four orders of magnitude, OK, So that's, that's significant.

4:03:56
The question is why, What happened, OK, why are we so low everywhere, it's allowed before?

4:04:04
and to demonstrate, good point, I was making previously use that, rather than looking at the manifestation of the disease after our bodies were not able to deliver.

4:04:21
We're looking, we're looking now at the immune effects.

4:04:26
So the end stop EPA is chosen is how our bodies are.

4:04:33
Specifically our bodies respond if someone wrote to be immunize with tetanus and give Terry vaccines, so in a way, what is the importance of that.

4:04:53
What if my body's still vaccinated against these two diseases, irrespective of pathos or not?

4:05:02
And they're now looking at, they don't look at the ...

4:05:06
or day corresponding steps to actually cause health impact.

4:05:14
So, this, this is why we are looking at potentially.

4:05:21
Health advisories are orders of magnitude lower.

4:05:24
And then surely is probably having a heart attack because she talked about unintended consequences, and all of you who will have to deal with a standard, so low.

4:05:38
That's technically infeasible, Unobtainable, Daniela, what is the sympathetic ear in the regulatory space to deal with that?

4:05:49
I know the MCL G Buyer rule should be as close to MCOs.

4:05:57
They don't have to be because the MCS kimi negotiated taking cost, feasibility, technologically, and otherwise into consideration, but it's unlikely that these tools diverged by four orders of magnitude.

4:06:13
So that's something, another context here is we understand that PCBs, a bad things, dioxins are really bad.

4:06:24

And we know that these are really magic contaminants and environment, yet, looking at the magnitude of these toxicity reference values, what EPA scientists are telling us, dot P fast effectively, and it's toxic as PCBs, and dioxins.

4:06:46
That's the reality, check, someone.

4:06:49
The EPA has to tech because it's not working at right now for those who do these contaminants day in and that we are in the business of teaming up PCBs and dioxins.

4:07:01
We are and we don't see the same issues.

4:07:06
PFS asked with these guys, so just a disconnect there. So, this is another example of how EPA's prosecutes information, but this is for the cancer effects.

4:07:19
There's information out there, bad.

4:07:23
These tasks are concerned, no chance, yet at least four P, false EPA's evaluation of Toxicity does not seem to be strong evidence, so it's all my fault.

4:07:39
And the problem with that study is that the associative relationship between PFS exposure and cancer wasn't based on adults. Muslim males.

4:07:54
Age 55 to 78.

4:07:57
And there's sufficient medical literature indicating that renal cell carcinoma, a part of getting old, that's normal.

4:08:09
So, that's another disconnect that scientists have issues with is that it's not represented.

4:08:18
All right.

4:08:18
You should be looking at entire population form.

4:08:23
Children to, adults, not just focusing on adults, adult males was going to get top cancer, anyway, regardless of peatlands.

4:08:32
So, that's another disconnect I wanted to share with you. And the ... contribution. real quick.

4:08:39
The point you make is that even though we are really going after regulation of tap water, tap water is very small proportion of the overall intake.

4:08:52
We talked about the object talk about the wrappers. Look through the other sources.

4:08:57
So, diet, indeed, is recognized as the has the highest contributors saw.

4:09:04
Looking at top lawyer is disability.

4:09:07
Partial Popper approach that EPA's take.

4:09:11
So, moving forward, make sure we have enough time for my, for the next speaker, Mary, Rutter, recharger. But I call this little fun with arithmetic.

4:09:25
EPA hasn't done this publicly, but I have using their equations their methodology I can calculate very simplistically, what do you predicted?

4:09:38
MCF G will be and I come up with 51 parts per quadrillions Earlier, I don't think we can measure that day. Can you measure that?

4:09:53
Tomorrow May?

4:09:58
We're working on it, right?

4:09:59
All right.

4:10:00
So, yeah, So, this is, this is less than number, that the regular community, water suppliers and anybody else can actually practically implement.

4:10:11
So, that's a no-go, then, also, from the perspective, they can do the same thing.

4:10:17
There is a great value calculator by APA, It's the original student level, same thing as Plug and Play, we can plug in those, reference, those values, keep everything as default, and actually you can derive all those.

4:10:33
Scrutiny levels for top law will be water soluble, sediment ground strips, everything.

4:10:40
So you can, you can run those through, and you can see that the scientific exponentials can also be quite low, and again, because of the address those value. So with this, I'm coming to the end of my presentation, and this is some take home messages.

4:11:00

I think there's no doubt that you'll be sharing, not less about PFS. There'll be more, no rush regulations.

4:11:08
The only thing, I hope, is that the scientists at EPA will take heat up the public comments, pulp, public comments were made in line with what are presented to you.

4:11:21
And then they will revisit their approach and come up with regulatory limits, a little more workable, and recognize the fact that this has to be applied, have to be practical.

4:11:34
And, then, with this, thank you for attention, TechSoup, for coming out, to Thank you for being Online, and that's it, that there's any questions.

4:11:43
There's a ton of questions, or later.

4:11:46
Alright, so, last time, you know, and she's pointing to the next speaker. So, with this, thank you, and there will be an open forum at the end, so, we can maybe discuss that, Thank you.

4:11:58
Yeah.

4:12:03
Thank, you, Andrew. I was listening to G Suite, and then, after his presentation, questions.

4:12:10
OK, our next speaker is also from tri Hydro, made me aware that has over 30 years of experience in water, wastewater, reclaimed, stormwater, and biosolids projects throughout the nation.

4:12:26
He possesses a wealth of technical knowledge and expertise, demonstrating innovative and cost effective solutions and maintain strong client relationships.

4:12:38
He is hands-on engineer, balances, administrative and technical projects, aspect Tweets and fusses Communications, maintaining Schedule and Budgets and Accomplishing project objectives.

4:12:56
Reid has experience with planning and design of complex water and wastewater treatment, storage pumping and conveyance facilities.

4:13:07
Reid has received many grants.

4:13:10
Acclaim for Innovative Solutions, value added mindsets and the Jetties decision making to achieve clan schools, budget adherence, and regulatory compliance.

4:13:25

Complementary to his experience with water and wastewater treatment, we takes a holistic approach focused on new technologies to address, imagine contaminants, such as polyfill or substance PFS.

4:13:43
And 1, four dioxane and mitigation mitigating future impacts is planned, designs supervised and conducted field investigation for surface water, groundwater, and soil impacts from ... Mentos petroleum Hydrocarbons before us?

4:14:08
Oh, my, OK, but show them how to count, Has provided visible evaluation and application of innovative media technologies, such as bio, augmentation, bio remediation, in C two chemical oxidation.

4:14:28
It's a remediation, remediation, pump, and treat with advanced oxidation.

4:14:33
We act as a system.

4:14:35
Multi phase extraction slides APL extraction, and the money tod machover I'm to nation.

4:14:43
OK, We can see you!

4:14:57
MR.

4:14:58
Again, that turkey sandwich is falling asleep right now, I assumed about the wakeup wakeup.

4:15:06
So thanks for being here. Very happy, they don't let me out much. So we'll see how it goes.

4:15:13
So this is a site, one of the most beautiful places that this is Jackson Hole, Wyoming, and, uh, they have an airport.

4:15:21
And they play with firefighting foam out there, those firefighters' they'd love to practice.

4:15:28
And they practiced a little much because they've got a ... problem.

4:15:31
And also, they've got soil, which relatively thin on top of alluvial Olivia layer of a lot of the ground, all the things and a very high water level. So you have things like P fast and other chemicals, quickly getting into the local streams and rivers. So, what we're doing out there is, is monitoring, in this case, the plume, trying to measure what the limits are the blue bar. And then you'll be recommendations somewhere down the line of how we contain it, how we treat it.

4:16:04
Today, we're going to talk about treatment. So we've had been really pretty fast, oh my God. It's everywhere. We're all gonna grow an extra help. Make sure.

4:16:17
And so you talked about it That changed forever typical. It's a very complicated chemistry. There's a lot of variants. There's a lot of the precursors out there, but really it's that persistent, it's a bio cumulative chemical. So everyone in the roads in the environment, depending on your level of exposure, it's very individualized. You know, if you eat fish from someplace, those downstream of where they live three and post your notes, you're probably going to have more chance of getting ..., then somebody else. So a lot of factors are going to be very individualized.

4:16:57
Where you are and what you do and how much breaking water you take out of those plastic water bottles that are supposed to be so good for you.

4:17:06
So you know, we look at here and we say well, let's see, oh, to do it, I know it's there, mmm hmm.

4:17:23
Sometimes it just click OK. See if it doesn't then, those suckers. They're coming in from everywhere. They're just gonna give us, what are we gonna do about it?

4:17:38
The it really gets me, hasn't taken the really bodily overwritten marker when you cook in the microwave. And you get that crossed. The border on the side of the package and he actually scrape a kernel, decided to get that really closely that you're doomed your pizza. Boxes to.

4:17:57
No.

4:17:58
We do need help. And I'm happy to be part of the engineering community, because what we do is provide solutions. We're here to solve problems.

4:18:07
We know, Houston, we have a problem. They got a thousand engineers to go figure it out, you know, and get them back. So that's what we want to do.

4:18:15
What do we do now?

4:18:19
Don't do anything hastie, OK, just like Andrew said, we don't know the endgame is going to be.

4:18:27
We don't know where the regulations are going to end up.

4:18:31
We just don't know.

4:18:33
So, when you find a solution, it needs to be the right solution, because you're going to spend several million dollars if you are a facility, trying to treat .... If you have a significant, I'm talking millions of dollars per facility.

4:18:50
Are you going to spend a million dollars in the right way of doing the right thing? Work. if you view it.

4:18:55
Sorry, the ... family, but you don't get the other.

4:18:59
Oh, 4885. No.

4:19:05
You're never gonna get sued, so make sure you get the right ones. But really, it's about assessment.

4:19:11
Get out there, you've got, if you've got ..., raw water, you gotta go out and test the limits. How much growth.

4:19:19
What is the nature of my facility? Emma, I have to say that I have enough acreage that the contamination that might be in the groundwater isn't contained within the limits of my property.

4:19:30
What, what is the likelihood that? It's migrated outside of my property?

4:19:34
If it migrates outside my property, wasn't just going into a nursery school or something like that, there are factors that have to be considered about where you are, what has to be done? You have to look at the big picture. So you have to assess the problem. You have to define. What kind of ... parameters, what precursors do, I have?

4:19:58
No.

4:19:59
Typically, we're looking at somewhere around 12 of them were like, the worst ones that were, that's in my samples, the lab, you know, there could be around forever.

4:20:11
10000, it's just to leave account.

4:20:14
So, we have to be practically what we were doing, and probably will be flowing testing will be important, because it's going to be very generalized test, is going to say, You test the top 12.

4:20:28
Didn't test this, to see kind of how the mouth mass balance is, to see alright, rehab, percent of our pathos in these top row. And there's 2%, and the other to come up with remediation then. Which one does it take? Does it take how does it take?

4:20:46
So, again, assess, review, Playdon, Budget then take action.

4:20:56

So I'm going to talk about some treatment options. Some things that, that we're using today. Some things we're seeing out there.

4:21:04
So, the good thing is, there's, there's some money out there available from the government. The EPA is what we talked about, has been taking this very seriously.

4:21:12
Department of Defense, You know, the guys, that spend a million dollars on a hammer. They are spending money on P five because they realize that they have february reservations all over the country. All over the globe.

4:21:25
And they have been a huge contributor to contamination of facilities.

4:21:32
We knew that all that actually what that, a triple F was a bad thing. They were just trying to put out fires in practice when they had a disaster.

4:21:40
But now we have another disaster. So, so, they're a big contributor to do some of these funding mechanisms, that we're looking at.

4:21:49
So, we'll talk specifically about that.

4:21:53
Absorbed gives granular activated carbon, Shinto, critical oxidation. We're going to talk about ...

4:22:03
and maybe anything else written for: so the pre foss treatment granular activated carbon.

4:22:13
It does a good job, It works on, rather than Most any phase.

4:22:18
Whether it's grown, longer duration, water, it's proven, technology has been around, has its limits. It has its pros and cons. It has to be displays that it's expensive. Is it a hazardous waste when it comes up? Is it not, isn't really? What happens to all of that gas will regenerate it. Is it regenerated hot enough to make sure that it's not just reading the P five hours? that shows that the card is it destroy it during that process? So, as to be considered?

4:22:57
What type of brain are activated carbon use?

4:23:02
Most of my applications, we always looked at a coconut shows the best if you're going to use green activated carbon, use coconut shells though the most observer, but now with PFAS chemicals.

4:23:13
Very like the bitumen is co pay. That can be good for our coal miners. You know, because that now really shut down coal mines to power power plants, but now, we have to go fight the ... problem. So it could be a good thing.

4:23:26
We'll have to look at kind of P fonts you have.

4:23:31
When you look at the use of green activated carbon in these vessels, you have to look at the time, the intuitive call, the empty bed contact time.

4:23:42
And that is true exposure of the water to the granular activated carbon as it flows through, because the longer it has to set in there, the more likely it is absorbed.

4:23:56
A lot of times we're looking at 10 to 15 minutes, honestly, Will resize genius like this, resize, a bigger than that. We, we convince our clients that you need a factor of safety more than that, that's not enough time.

4:24:09
Generally, we're going at least 20 minutes, if not longer, because, again, it's cheaper to build a little bit bigger vessel, to have a little bit more time. But what I have to dump it out suck it out with a vacuum truck and cynical landfill.

4:24:24
So, uh, sure that that laborious task maybe is more annualized. Hopefully you do it once a year, once every two years. So, we try to size, Things are longer term. But, again, it's site specific species specific show change don't accumulate as well in the gray black carbon, then the longer change. So, all of that has to be considered when you, when you look at that.

4:24:53
There wasn't technology, um, very promising.

4:24:57
So, as we talked about this, this really is one of the top ways to remove. I mean, you cannot remove a lot of down to 9 to 10. I mean, it's, it's amazing what you can do with the right residence and there's, there's a lot of them coming out at least these residues or beach look like little plastic beads and their peers and so we developed is charged.

4:25:23
So, the ethos is is an addict, recharge and in the resin is positively charged and so it's drawn into it and it's attached to that bond and Although there are single use Resin. So if you have a small batch of spirit or something, sometimes you will use a single use though. So they come out there and they'll do like groundwater extraction or or wherever the cleanup is. Run it through there, and then hopefully you're done.

4:25:56
But for the most part, people are not done with one application. It's a forever chemical.

4:26:03
It's a forward problem. You're not gonna get it cleaned up out of your groundwater. You're not gonna get it cleaned up out of the leachate out of your landfill. If you have it, you're gonna have it probably forever.

4:26:15

What we're trying to do is, can we create containment to keep it on your property? So that, so that it's not traveling outside and contaminating areas outside of what you control.

4:26:27
So the residents are really good because they can be regenerated.

4:26:34
And so, when you have to deal with, what do I do with that regenerated material? That the waste that comes off of it?

4:26:41
This is one company that has a, has a pretty good mousetrap.

4:26:48
Looking at it there for quite a while, have some potential applications for a couple others like this.

4:26:54
But in this case, this is, uh, E C T Square.

4:26:59
Your storage unit has the resin in the first vessel. And then what you have is what is regenerated very generated with a solvent?

4:27:09
So, the solvent actually goes in extracts the P fos out of the resident, goes into the distillation process, roads in separating incarcerated. So, now you've been to things.

4:27:20
You've captured the ..., you've now concentrated the pathos, hi.

4:27:27
Destroyed, you still have it?

4:27:30
All right.

4:27:33
From what I've seen, the resident said last almost indefinitely. I mean, they have been out there 10, 15 years in there.

4:27:41
It was live as developed by Dupont, and is it, it, just it, alas it keeps going.

4:27:48
What you have, though, is now you've got the backwash of it. Now, you have concentrated, and so, now you have to go through what they call their super low.

4:27:57
Well, in this case, are super, go under activated carbon.

4:28:02
So, when there's a life cycle that, however. Because, it's highly concentrated and, because then, they can use they can control what, they're sending back to, that, at a very controlled way.

4:28:14

They go sit at extreme A show about, so, the absorption rates in the activated carbon, or a much volume of carbon needed Julie can last anywhere from 1 to 2 years before they have to dispose of it. So, very different from the bachelors that are treating a dilute stream.

4:28:35
The concentrated stream is, it's up to you, better in the carbon so that it actually has a very long life, but again, you're not destroying it. You're kind of putting it down for somebody else's problem, some other landfill.

4:28:53
Um.

4:28:55
Here's an example of comparisons, and again, I'm gonna give you an example, but this is one, OK, should 1 place 1 application with very specific parameters? So, again, this is not necessarily going to be true in your location, or wherever you might be. But, in this case, they did a pretty much a parallel comparison between granular activated carbon and using the ion exchange tried to do a very similar setup.

4:29:24
So, one of the things we look at is, dead volume.

4:29:30
So if I had a thousand pound, granular activated, carbon vessel, it's got so many gallons in it. You know, let's say it's got 3000 gallons, a bed volume. You know, we look in cubic feet or how do you do it. But every time you go through and feel that, that's a bed volume. So when you compare, how many times until I get breakthrough, that's going on, detecting whatever my detection limit is coming out of that vessel and say it's saturated, OK?

4:30:01
So you're getting 13,000 volumes to 171 bed 500,000 dead by was with the Resin.

4:30:10
And when we look here, we can see that, whoa, over to the left, you've got the granular activated carbon, you can see it reaches break through fairly fast, whereas in the, when you look in the other on the, uh, ion exchange, he didn't need to reach breakthrough here. They just kept on going.

4:30:34
So, it is very effective in getting all those down to detect limits, with, with ....

4:30:42
And it works on most of the species, long chain, a little less on, on there, but it gives you a really good average absorption, and they can get better by doing backlashes more often. They can get much even lower limits.

4:31:01
We're going to reach breakthrough, then just keep Washington and sending it and taking the solution out, concentrated, but it gives more open pullovers in their system to absorb it even more readily.

4:31:13

Now, one of the things about the ion exchange and even more so, probably the greener activated carbon is both have a certain amount of porosity and every grain of granular activated carbon early grade resin, those are taken up by other things. First, they're going to be taken up by, seems bad, but other carbon compounds with back in the water. So so it's like they're going to use a stage before that. So pretreatment in both cases, is very important. At a minimum, you need to have really good filtration cartridge filter some. Some people even want to do it for the things, to maybe take out some of the more volatile organic carbons and other things that might be there to leave no room for the P fast. That's why that Action plan that I talked about at the front was so important.

4:32:06
Because failure to plan the entire system, is going to cost you more in the downstream treatment that you're really trying to do, because you're not going to get the results that you want.

4:32:20
It talks about reverse osmosis.

4:32:22
Reverse osmosis is really good.

4:32:25
It's been shown to remove the long change. The short change does a really good job at both.

4:32:32
Um, I worked in Florida with a lot of reverse osmosis door solidity.

4:32:40
Almost every city on the West coast of Florida along the Gulf Coast, actually use a small plant.

4:32:46
So always always issues. Our captioner Oh, it's terrible. Your operators, you know, aren't always easy. It is.

4:32:56
It's easier than a standard water plant it. So, mechanized, since it's so scary to control, everything is I'm scared to know. Very small plant operator doesn't have to walk around 10 different clarify ocean basins. You know, on on 20 acres of land, it's always been a warehouse. Everything is very computerized. There's test to see, when you break the inner cylinder, that you need to go and plug that new. I mean, it's not the beach that people make it out to be something that is, the industry has gotten very good at it. The problem is that, it doesn't destroy it. You still have five to 50% rejects stream, which now more concentrated. It's also for that. Now you have to do that. So so now I have this waste stream that deal with there are places that they use deep, well injection for that.

4:33:52
Whether just worried about from the salinity is they put a lot of times they send it out to the ocean, But we use it for P foss treatment. That's not going to work, so you do have this concentrate screen that you can deal with.

4:34:05
Another option with ... is nano filtration.

4:34:09

So one of the things we look at is we look at the porosity, so. So it is a membrane synthetic membrane with micro holes in it. So, really push the molecules go through the molecules are larger stop.

4:34:27
So that's the idea that ... molecules are a little bit bigger than the water molecules, they stay on the other side of the membrane. Same thing with salt.

4:34:35
Nano filtration is similar to that.

4:34:37
Yeah. They had gotten to a nano filtration, starch. It goes down and goes up.

4:34:44
But there's actually nano filtration that's available soon in ceramic membranes.

4:34:51
Now, the membranes are very nice for industrial, are treated because what we do is we're just fouling issues. First bio fouling, there's all kinds of other material that's in the water. You have to do pretreatment.

4:35:04
But if you can use ceramic like nano filtration membranes, they can be more robustly clean. So normally, we've got what's called the pollen metric moves that literally looks like spaghetti noodles. That the water goes through soaks out. And then, they have to be backwash.

4:35:24
The issue with the ceramic is even hit them with Acid.

4:35:27
I mean, you can knock those things and really, really good and clean, and that's important for industrial applications And you also have a drastic difference in pressure. When I had to push water reverse osmosis membrane, I'm using like 80 bar pressure that's high, will not appreciate the nano filtration. I'm already dropping down to maybe 10 bar. So, difference of pressure is energy. That's pumps, that are entailed everything, every pipe, every job, that I'm having a super pressurized water, squeeze it through that tight membrane.

4:36:03
But if I can use nano filtration, just that difference, I can still pull out the the ..., but now I've got I've got much too much energy involved to do it.

4:36:17
This was really nice I like this one, I hope these guys get this going because this is the towel, and they've come up with supercritical water. Oxidation now.

4:36:30
They didn't invent this, this has been used to destroy Agent Orange. Destroyed all kinds of biological weapons, chemical weapons, other things for years.

4:36:40
It really does, is state of a slight under super heat and pressure.

4:36:47

So, what you're going for is this supercritical water point where you're, you're compressing the water, you're heating the water.

4:36:56
Then, all of a sudden, you release it like, you shake up, the sprite can release, that pressure comes out as these micro bubbles that are super energetic. And they really started to form hydraulic height.

4:37:12
The the radicals that breakdown and want to come in and provide that energy, these O, H radicals and in doing that these hydroxyl radicals was trying to say, they go after almost any carbon, and they break that carbon bond. They break those following bonds, they do they knock it out of the park.

4:37:34
And when they do that, you will ever have any ... molecules let.

4:37:40
It takes out the big change. The small change, the precursors, you replace with CO two carbon monoxide, You've got, you may have ... acid but that can be neutralized with simple sodium hydroxide. And you've got a note shot. So you've got a waste stream, but it's a manageable re stream. It's not a hazardous waste waste stream.

4:38:06
But right now, they're doing 50 gallons a day, 50 gallons a day.

4:38:12
So when I'm dealing with a stream to somebody's drinking water plant or something like that, it's pretty small.

4:38:20
So so they haven't quite skilled up yet to get to millions of gallons a day, you know, 50 gallons a day is not a whole lot.

4:38:28
I've got one to land there 50 gallons a minute, so, and that's a, that's a tiny string. OK, so, they got to get somewhere to get at scale. And right now, they're kind of in a movie trailer which looks like something you, grad, students will put together. I mean, if they're doing the best they can, but they got a ways to go. But very promising. They are, commercially they have done commercial applications that are, I would say, beyond what I would call a pilot test. They have been effectively removing heat loss at some size, and they, they, they are definitely ready to send this out, and they're at the final stages of really getting this approved by the EPA.

4:39:12
Let's do another thing again, let's see.

4:39:15
Yeah.

4:39:20
The mouse, OK.

4:39:26

Thank you.

4:39:28
Again on that vision part of the process.

4:39:30
Showing the different stages are a few bells and whistles and gizmos in this lot to maintain. But you've got high pressure heat exchangers, separation, separation in the water column, you generate some corrosive gas and other things that you have to deal with. So it makes you gotta have the right equipment. You gotta have the right, is a painting of that. But, again, very promising technology because it is one of the few that actually destroys all levels of ....

4:40:01
Now, there's been a lot of promise with this. This is fractional ization.

4:40:10
What this does is it takes advantage of what a lot of the ... is It's based on the surfactant that foaming action, That really inherent in Rupee Fast.

4:40:21
This takes advantage of micro bubbles that actually slowed the pathos and separated out of the water column. And they do it very effectively. I mean, it's getting 99% reduction in ... throwing it out.

4:40:36
So what you're getting here is, again, separation and concentration, but you're not getting treatment.

4:40:43
But you're doing a great job in separating this.

4:40:48
They have also shown on the slide again they've taken this one step further and you have a zone for actualization.

4:40:56
So instead of just using air you're doing ozone.

4:41:01
Now, ozone is normally a strong oxidant that we look at but in this case it's not strong enough to actually destroy the ....

4:41:11
Really strong enough to do is it provides a higher bonding so that the binding of the ozone molecule that binds it comes up and fill that out. There's more attractive, the fossils able to attract even more. So the official, so you can go even lower by using the ..., the air. So again, this technology is there now. It's being used in Australia, It's it's coming to Suddenly and feel to America and any time now, It's on its way. I know the guy that runs this and he said, we're building this right now. We're building 1, 10 times better than than what we do in an Australia Because it's got to be bigger. Because we're gonna use it Texas.

4:41:57
So, that's bad for Oklahoma, right?

4:42:03
Now, you can see, it's it's not it's not simple. There's a lot of vessels in this, but it does fit in a containerized trailer. So, so, you can take a Standard 8 by 38 by 30 foot trailer, and this is something that can be brought to a site, can be setup either permanently, on a temporary basis. And so, you've got the different vessels that are generating the fractional ization. And you've got the collectors that the vessels that do the collection after that.

4:42:35
But, anyway, again, not treatment, collection and concentration.

4:42:44
So, those were just done treatment. They're out there.

4:42:49
We have some other treatment that's also available.

4:42:53
And, I just want to mention some of these because, they all have merit.

4:42:59
They all have pros and cons, and they're all being developed and funded because, uh, you know, the Department of Defense, They have those deep pockets. EPA has some deep pockets. There's political will now, across the states and across the federal government to do something. And so, they're really developing a lot of these processes.

4:43:20
I've used some these advanced oxygenation.

4:43:23
Now, that will also uses either ozone or UV combines it with hydrogen peroxide.

4:43:30
So, what they do is, they take the hydrogen peroxide, like a 30% mix, Put it in with the water worthy of an eye.

4:43:39
Generally, I don't want to use much because there's a high energy costs generator UV.

4:43:45
A lot of times, we do the ozone generator, it uses less energy, but both of, what they do is, they excite the hydrogen peroxide molecules and actually split the hydrogen peroxide. So, you think, I'm adding hydrogen peroxide. A very good oxygen. I'm adding a really good oxygen together in the water.

4:44:05
They don't do anything.

4:44:06
But when you combine them together, then what you do is, you split the hydrogen peroxide into the hydroxyl radical.

4:44:15
and for that second, that hydrogen peroxide radicals in there, it destroys anything.

4:44:24

It's going to take out the BHCS.

4:44:26
It's going to take out everything else first, before it takes out the .... But if you put it in there, eventually get them to be fast and check that out too.

4:44:34
but it does an excellent job of destroying those, you know, those elements.

4:44:40
However, the equipment itself is somewhat finicky.

4:44:44
Lot of pretreatment is still read it included, so you have to consider the application, but they do have pilot unit available. So give as part of that assessment, You should really consider having somebody come out and pilot test certain technologies, or your actual facility, and do a performance specification, says, I need to go from here to here to be considered.

4:45:07
And make sure that they're giving you that kind of result.

4:45:11
Um, the ultrasound is solid chemical is actually somewhat similar to the supercritical water, except in this case I'm actually using sound waves to generate high energy cavitation bubbles within the fluid.

4:45:26
And those high energy cavitation bubbles, at that point, that tiny pinpoint jittery extreme pressure and extreme heat.

4:45:36
In doing that, they generate free radicals well, by breaking the molecules themselves and those radicals will oxidize and take out pathos. They've had some good success with that. The plasma technology is somewhat similar. You're actually creating a high energy.

4:45:59
Water, waste, water and breaks down the fast molecules, the electro chemical, oxidation several several may I guess economists is promoting that as is there a panacea.

4:46:16
They developed is electrodes that can withstand the environment and show up because there are usually in the water with a lot of a lot of current. And those electrodes are going in and actually causing a cathode and anode So they're they're pulling whoopee fast over two to the electrode and destroying it. So, again, here's a disruption. technology.

4:46:40
However, there are so short chains that may get through that don't write down, it breaks, breaks a long chain, but by tweaking the currents and voltages and what they're doing their work in minimizing, those are column like byproducts. So they've been working on this. And there are also one of these funded by EPA technologies. And they're getting they're pretty close now with applying it and they're not getting the byproducts. So they're actually doing a really good job of reducing it.

4:47:11
Um, go back to deep, well injection oil industry out here. Same thing. A lot of places where a lot of dry holes that go down to 10000 feet, are well below the water table.

4:47:25
And if any, if installed, right, and done right, Deep well injection is an option. But it's, it's regulated. It's very expensive.

4:47:34
If you're going to drill a deep well for just this purpose. A lot of times you're going to a site, you know, a waste management or somebody else that that has that kind of permitted site. But to the extent that it's available, it's a place to put the ...

4:47:50
as long as it's maddison done safely.

4:47:53
Incineration, really we've talked about that the EPA has put a moratorium on, sorry, the Department of Defense, just put a moratorium said, you can't go to are you at your military bases?

4:48:06
You can't just assume this to it, it's because we weren't really sure, it's completely evolved to astronauts because we're looking at no way we get to a thousand degrees Celsius to break it down or they truly getting one thousand degree Celsius to do that because if they're not, they're just releasing it to the air.

4:48:27
So, but it does work, right? So it's a matter of, you know, is the technology being managed? Right? We know people never make mistakes. Operators are really great, they never ***** up out there, so there's, no, there's no problem. We know that works.

4:48:46
It is something that truly does a good job.

4:48:49
But there are some, there's some hesitation with it or regulatory basis right now.

4:48:55
So with that, I just wanted to go over some of the technology that's out there to actually treat it. Remember, treating people like anything, is subject to your site, your particular characteristics, what's going on.

4:49:12
Not every one of these technologies can be used for drinking water because, you know, we're, we gotta have a product that still safe. And we don't want to create other byproducts that are there in the drinking water too. So, you know, you have to consider what kind of water much reading and listening and go and also.

4:49:32
Keep up to date, attend courses like this, seminars, so that you get the latest information of what's available, and, and hire an engineer like Android, and he'll tell you what's what's out there and what's safe writing Android. But with that, thank you very much.

4:49:51
OK, Thank you very much read. So we will save questions for me and took a roundtable, and it's a quick break.

4:50:07
I guess we're all sitting slip a little bit. Yeah, the NIJ OK.

4:50:18
And then, if you need upgrades, please fill out the forms. So it means to show you.

4:50:30
Those can suddenly be S two D cube.

4:50:36
All right.

4:50:44
Yeah?

4:50:45
Yeah.

4:50:48
OK.

5:07:02
OK.

5:07:08
So I love speaker from accurate environments.

5:07:13
Chance, he's the technical director for actuates environments, the largest ... in the state of Oklahoma.

5:07:25
He has a BS degree in cellular biology from that's Eastern state university.

5:07:33
Danny has over 20 years of experience on the water and wastewater industry.

5:07:38
He.

5:07:39
he is also analyzing shut up Oklahoma Department of Environmental Quality drinking water and wastewater certification classes.

5:07:53
Danny has been with accurate since 2001 and has taught certification classes since 2006.

5:08:02
He was the program manager before being selected as technical director and general manager of Accurate environment, which includes three locations in Oklahoma.

5:08:19

Then, he is the primary instructor for on-site training, ..., QA, QC Development Program, that's Games, Training to Public Water Systems and Industries, ..., Compliance Suite, Department of Environmental Quality.

5:08:43
He also played a crucial role, inaccurate labs, best.

5:08:47
You'll see certification for PFAS in 2012, as well as the Principal Investigator for EPA is.

5:08:59
Yeah, this one in two thousand eighteen, O P, fast sampling, so let me go back to you, OK?

5:09:13
OK, thank you for the introduction, everybody can hear me OK?

5:09:17
OK, perfect, thank you to you, and doctor ..., and Andrea and Hydro.

5:09:25
Uh, Don ... for those comments are, I appreciate it, so, again, I'm, the technical director for accurate environments.

5:09:37
Today, I'm going to talk about sample collection methodologies.

5:09:44
I was talking with Andrew before, for me to talk about, and it was, you know, something practical, so fear what's what's the most practical thing for most of you are? Are you going to be dealing with this at your water wastewater plant? You'll need to know how to collect samples.

5:10:02
So, so, we'll talk about, just real brief introduction to the methodology, some of the testing methods, and then we'll talk about sampling.

5:10:17
So, typically, fast methodology.

5:10:20
Generally, CMS MSMS, Tandem Mass spec Detection, sometimes we call triple quad, can go for a very low, almost down to parts per trillion.

5:10:36
Patrol, started doing the, the analysis closed for drilling was kind of the go of the analysis. And since then, as we've talked about earlier. We're looking quite a bit lower than that now.

5:10:51
So L CMS instrumentation, unfortunately, is very expensive. It's couple hundred, $300,000 per instrument.

5:11:02
As an environmental lab, and processing samples, we need some redundancy, so unfortunately, that would require us to purchase Lewis, too. So, it's very expensive. It's definitely cost prohibitive.

5:11:15
So, anywhere between 14,000, we've heard 10000 quite a few times today.

5:11:23
These different K five compounds are an existence.

5:11:26
The CMS really just looks at specific compounds so, I was with Caroline Yeah, I think probably the largest lab It's usually the largest list that I saw I live a life. support was about 40 compounds, were doing 29 right now. If you have to buy standards for each one of these standards are very expensive.

5:11:49
And each one, that you buy a standard for, your building a calibration curve and, and it's, it's just very time consuming. We're not able to look at all 10000 somebody else out there, you can only imagine, so I honestly these P fast especially running the isotope dilution, and so on with all your different internal standards extracted, non extracted, it's, it's quite a chore just to do the one that, so.

5:12:19
Um, EPA possible methods have had an emphasis on drinking water.

5:12:25
The examples, you see, amar, ..., that's been kind of the focus last, you know, so, the ..., for example, it was six compounds. So, not bought. At that time, there's not a false analysis going on.

5:12:50
So, six week, kinda thought A thought.

5:12:54
See what's out there.

5:12:56
So, we'll go ahead and do these six, and see what what kind of results we get. So, by using APM as at 5 37, so forth, between 10 to 90 parts per trillion.

5:13:11
So, we were talking about earlier, partial Australian back, then it was relatively easy to see, again, we were shooting for 10 and so, but not quite Trillium, ... So, now, actually 37 and kinda during the ...

5:13:30
method, the same R three laboratory started doing modifications. People want to know about wastewater sludge applications with my mother.

5:13:43
And so, the fact that it's our method is very specific to drinking water, doesn't just any other matrix, it's just tracing.

5:13:50
So.

5:13:52

If they didn't have any other method for 633 and a few minutes, but they didn't have any other methods, and so lab started modifications, for extraction, season, and so on.

5:14:07
I wanted to also, that is that they weren't specific, again, this standardized for one laboratory to another, you know, nobody really don't want to talk to somebody else. They'll get you information and this is somewhat proprietary.

5:14:22
So that's a modification style and move for solids and liquids either hazardous waste, always wear out, or something like that. So, again, a lot of times proprietary. It's hard to tell. What what method modifications were done.

5:14:41
So, then, you see a five K around. It's actually a sampling, won't start. The lab certification processes is pretty much finished by now.

5:14:54
But the sampling will start at 22, 23, and goes through 2025. So we are accurate, labs is certified for these EMR five.

5:15:05
It has 29 pathos, comp.

5:15:08
So much more extensive than the six we're looking at before. The only other thing besides P fast, in this seminar, this lithium, so the really, really focus on this P foss and trying to see exactly what we've got out there. So we've got two methods: whether it's an important 1 and 5 33 there's reporting I was between 2 and 8, so much, much lower than before.

5:15:35
Now, kind of the goal for everything is about is about to sample volume and what the matrix is. A lot of times, we can get down below, so.

5:15:45
But the actual use AMR reporting levels are today.

5:15:51
We didn't have a 46 method, 83, 27. This is it's really more of a dilution method.

5:15:58
You get wastewater other types of matrices, just the water's, edge them down and run an LLC. So not not super useful, but as something other than drinking water that she could cite.

5:16:17
Method 633 will tell you about this here in a second. But it is true in solid samples including tissue.

5:16:26
This is, know, it's, it's, there's a controversy about mehsud, 16, 33.

5:16:32
I think, it's, it's very kind of saying it's trying to do a lot of things, and, honestly, at this point, I have anything else, and so it is a draft method, so hopefully, we'll get some other laboratories to

do some validation. Currently only validated by a single laboratory. So we'll see, and I'll talk more about some of those.

5:16:59
Controversial complex seven minutes, so there's ASTM method.

5:17:03
So I'm not familiar with the methods. I know this. But they do have ones that are very similar to the EPA methods and are validated so on.

5:17:18
Then there's some people. Generally speaking, there aren't any carbon fluorine bond. As we mentioned earlier, that that are naturally occurring. I mean, there's a few, and there is fairly where you got your back yard. You're not going to find it. And so, if you do, that's a false. Now. So, we're using this organic soy and bond as a basis for measuring these PFAS compounds. So, I'll talk a little bit about that here in a second about measuring the compound. It just gives you a total total pathos.

5:17:57
Now, you're measuring the free fluoride, and this isn't just a general ..., but measuring.

5:18:03
By ion chromatography sample is combustor the thousands of legacy. We've heard that the temperature quite a few times today, you see, and then, you tell me that for it.

5:18:14
So, the difference in those two are making the assumption that those are the organically bound fluorine. And that's your P foster, pathos, concentration.

5:18:24
So, again, as we mentioned earlier, it's not it's not specific to a particular call about it. It's a total sell.

5:18:37
So, it should be used, and somebody mentioned just a minute ago, I tried to, this needs to be used in conjunction with LC MS. So, the idea of ...

5:18:47
and P.t.f.e., or whatever it is, but, then, also, you do a total, you say, you know, there's maybe 20% identified, but at least we have a total concentration. So, still, very good information, and doing those in conjunction is very helpful.

5:19:11
So, CMS laboratories offer analysis, again, with a targeted list online. So, check with us, get this call, You know, make sure that we use those specific and works well for your project.

5:19:26
Talking about this here in a second, about sampling program, if you have a program that you're doing, before you send samples off, make sure that you check what measures are running. I list the have, and the textual elements that it's going to be appropriate for what you're doing.

5:19:43

At the moment, some of the hazardous waste samples, some of the really high concentration to deal with that. We're looking at, you know, the numbers. When you send something in that set up, the percentage concentration of that can be devastating to a laboratory. So, you know, getting up to the lab, but, you know, make sure that they understand your particular situation kind of what you're expecting.

5:20:16
Times, you have no idea what to expect and says, that's reasonable, but.

5:20:21
So, it's very difficult. Make sure you've got your program setup.

5:20:26
So we're getting very, very low numbers, unfortunately, as we've heard all day long as these compounds are found in common consumer products. So, sample, for me, you ought to be your sample, you have to be very careful.

5:20:41
Doctor, he has a sampling SLPs and and so our requirements for GQ very comprehensive list of things that actually some of the things that air Life sunscreens emotions and song. It's got a list of the ones that are OK to use. So, before going out and doing that, some of these things I mentioned, you can look on that list and actually see which ones are are acceptable.

5:21:11
So, contamination, again, cause my personal care products, solutions, cosmetics, sunscreens, it's always fun, LBP, glass, brutalize, patch.

5:21:25
Now, it's not glass, is not so much of an issue as these, some of these compounds can be adsorbed onto the glass.

5:21:34
Can also be caused by pre-packaged foods, Aluminum. Even though method 633 missions, wrapping tissue and aluminum foil, we've done some couple of test laboratory, and found pathos on the second. May not we all feel that at least the ones that we, we did the test. We did get a positive result.

5:22:01
Be careful, you know, check. Maybe there's a risk that particular ones, particular brands are OK. But in general, I would probably stray away from the world.

5:22:11
Post it notes are, today, a new and watch clothing, and any of the stain or water resistant material is going to be loaded with P fast. So, what is it safe to use HTTPS a polypropylene? And we'll talk a little bit about sampling containers? And those are typically the two types of sampling data.

5:22:32
Recommended stainless steel, um, Natural Gas and Ziploc bags. So goodness for nitrile gloves and zip up X, I know.

5:22:46
There is at least those two are at least two.

5:22:53
So So we thought, anything else, you don't want to go through all the containers and the P and so on, maybe Teflon leds and then go do your ethos samples. So let's first make sure you guys in new gloves on a short flashover lines, just make sure you get a good representative sample, whether it's from the distribution system, rather, we should get a good representative sample.

5:23:24
Collect these directly into your sampling containers. So don't collect them into a glass container loop for me. Collect directly into these containers. Just trying to avoid contamination of some of these can be fast low. And then obviously, as we've heard, you know, some of these are definitely false.

5:23:41
Hi, it's fairly new nitrile gloves between each sampling location keeps container lid off of the surfaces of the size is all over the place.

5:23:55
And just make sure you, you protect those as much as possible.

5:23:59
Now, once you collect those samples, I see a lot of people with their normal environmental samples, which, for most things, this is fine.

5:24:09
Collect the sample, and then, in the cooler with ice, and it's just bobbing around inside of there. You don't know what that containers that coolers made of ice has come from. With everything that gets contaminate the things that that's that's not a safe flight sample. So, once you get the samples, put those back out of it. And then you can put it on ice.

5:24:36
So, we're talking about the methods here in a second about, you know, temperature requirements, assign definitely temperature requirements for ..., so it can go on the sampling.

5:24:51
So. This is for drinking water, again, as polypropylene container, a little bit of truism of offer in the air.

5:25:02
You can see the temperature is less than 10 degrees C for the first 48 hours. So that gives you a little bit of time to do that. And then once it's at the laboratory, you are 14 days holding time. So it's stored less than 60 received.

5:25:18
But that's, that's, that's your 14 day hold time. Now for 5 30, very, very similar sam polypropylene container HTTP container, little ammonium acetate.

5:25:30
And it's, again, gives you a little bit of time first, 48 hours less than 10 times up to 28 days. So that's one of the complaints, about 16, 33 method, is consistency between methods, still, 14 days, I guess, fireside enough. It's not too much of an issue.

5:25:51

So 28 is just just just extra SWA, 46, 827. Again, it's for Brown water. It's, It's again, just a dilution, but let's just say three C is storage, and it is 14 days.

5:26:10
Now, What some of you are waiting for 16 33?

5:26:14
All right, lots of different matrix.

5:26:19
It's It's A least. as far as the matrices is trying to try to analyze. So for samples The HTTP by paramilitary Watch, it freezes. So you need to leave space for expansion.

5:26:35
It's less than ... to get it to a lab, then freeze it at the laboratory.

5:26:40
So that's one of the compliance, as well, should do a large volume of large freezer, which is and could be a problem now, once they give you 90 days. So that's helpful.

5:26:56
Tissue. Essentially, this would be where your slides and other things would fall into ... lab, and then frozen once again. So, I about, is another complaint about this method. Is that I mentioned 48 hours for the for the aqueous 24 hours for the tissue. But it just says when you get at the lab, it needs to be less than six degrees. So again, continuity is.

5:27:28
days For the tissue of the reservoir can be much better and 24 hours to get it there. And again, I want to suppose so.

5:27:44
Now, as far as to say so we talked about contamination and all sorts of issues, ways, EOP, for somebody, or sample, or even intended.

5:27:51
And so, now, we'll talk about field, you see, how we can, we can check to make sure that the results and their Sample didn't come from you, a sampling equipment, or something in the, in the site itself. So, the Voice.

5:28:13
Which, all those are just used for, for verification. So Sanford first, fairly difficult is sampler must obtain P foster the water for laboratory or so We thought somebody mentioned earlier about some of the analytical equipment containing tough on and and other things, saying: what's your water purification systems that we've talked about this before. That there's all inside of these water purification systems. And so we've got certified laboratory by certified is that they need to analyze that. So you click that water, make it a particular lot of water, do the analysis and verify that it's less than whatever the requirement is, whether it's a third of the workforce or the reporting limit, depend on your project.

5:29:07
So, then, that should be documented stored for later on, because somebody's inevitably going to ask for that. So.

5:29:19
Water is taken in the field, and along with empty sample containers, Now, this water is transferred to those empty containers and the field. So, any dust or anything that might be, particularly at that site, we had talked about, maybe things that our laws and so on could get in that sample.

5:29:39
So, once you put a sample of a seal it put in your zip lock bag and then bring it back to Laboratory. So, again, it's treated just like a sample from that point forward. So, clean water poured into a sampling of data out on on-site.

5:29:56
Then there's a X, So, for sampling equipment, maybe a school or a according to buy something like that that you can have on the field that doesn't have contamination as well. So if this P three water running across that point wise, or whatever it is either going to test, you're going to, collect, that will say.

5:30:19
So, Let's say that your equipment like, You send that to the laboratory it just to make sure that there's, there's no contamination.

5:30:30
Tripwires, maybe a little controversial as well. So it's the same thing, except near, you feel your ceiling, and it goes just along for the ride with containers. And then, you know, bought back on, sam. I said, everything else is just to look to see if the actual transportation storage conditions themselves would add to any of your ... concentration.

5:31:07
So, just simply write them as it's 5 37. That was the original use, AMR, 3. 5, 37.1 and 533, that's the current DCNR three, starts in January of 2023.

5:31:21
Hundred 27.

5:31:23
Stop, not add up to a huge amount of samples but it's more of a dilution method, 633. Again, it's a draft right now, so we're kind of hoping, maybe get some validations, maybe a few modifications to it before it's before Smith official.

5:31:40
And then the, to the total abandoned flooring, um, contamination, we talked about these all along, different, different personal care products and, and food packaging, and so on, things are safe, is again, our two same basis, nitrile gloves, and ziplock bags, then sample, sample what containers? What preservation? And again, this is not normally something that we're just going to be able to make up yourself.

5:32:13
So get in touch with us, get in touch with the lab, you know, they'll, they'll give you all that, that equipment and sampling containers, and so on.

5:32:23
You see, so the video field.

5:32:26
You see a museum art, the field QC for the ... you guys are going to be doing.

5:32:32
Uh, only requires equipment blanks, so, or excuse me only required field reagent like, sorry, only feel like snow snow trip. I just feel like, so they've done this the fast with the 537 For these are my three any issues with that. The event actually good for the metals, for the SMR three And it became sort of problematic. So with the lithium this time, there's no requirement for that. But for these five thirty seven point one in five hundred thirty three, there is a requirement for field reagent bikes.

5:33:10
Um, any questions?

5:33:12
I figured there might be a few question. I have two comments. one is, yeah, I do not use a little leaves.

5:33:24
I'm sorry, Yeah. two comments. one.

5:33:29
Room for, the second comment is, normally sampling the rural part of Oklahoma you don't have you forgot to get distilled water. Will go to Wal-Mart or k-mart or something and you store to get distilled water.

5:33:48
You cannot do this with PFS you have to plan ahead of time because to ensure because they're going to be testing.

5:33:58
With this thing LLC, mass spec, the ... concentration is below the detection limit.

5:34:07
But it's below the detection limit.

5:34:09
It's amazing to me is all these water purification systems when I took a pop mind in my laboratory which fueled Teflon.

5:34:18
The same thing we're analyzing for, if you look at the valves and gaskets, yeah, so those are two comments the question, what do you think you need to deal with?

5:34:28
Yeah. That's a good question. So, it's, it's very cost prohibitive, as well. So, I think that's, you know, we're looking at ... five right now. Looking at getting through with it, and regulation. I'm not sure. somebody mentioned today that there's EPA's working on at CRS.

5:34:51
You know, they come out with something more, definitive way, too, to jump too far into it and then have made the wrong choice, kind of that VHS and beta situation. So I want to make sure we're jumping in the right the right pool. So until we go over more guidance and regulation, and some of the methods come out. So we were glad, again, the time on .... We're glad to see it.

5:35:21
I know there's some controversy with it, but it is, thank goodness, there's something besides just the drinking water method.

5:35:28
So, with everybody and their modifications, and it's, things are a little bit, a little bit crazy, with, with the analysis.

5:35:35
Yeah, absolutely.

5:35:38
Any questions?

5:35:40
Yeah.

5:35:47
OK, just random method, 600 to 3 mm, part of our coalition, to master pronunciation.

5:35:57
Draft method will come out, I'm so glad you're pointing out the amount, large amount of value that requires.

5:36:06
That's alright, but imagine Lauren, 500 bottles. And these sides have multi, multiple sites.

5:36:16
Sure, extra care to see, Of course, in the landmark, for you to send you away.

5:36:23
And then you have a map, of course, that you have to worry about that practicality is just not So uncommon in that really rigorously as a way to roll back.

5:36:37
And the second question, just like we know that the universe of P for a species so large so essentially sky's the limit.

5:36:47
And then knowing the regulator's role, regulate as many people as possible as a class. So it's a catch all like fast, right?

5:37:00
What do you see industry? I know.

5:37:03
It's a tough question how many of us know can practically do analyzable? Yeah, we're good question. So that's that's specifically based on the sale are. So UCI as a list It's 29 for that.

5:37:21
These standards again, it is cost prohibitive, standards are very expensive. And with the desktop version, you have to buy all the internal standards are extracted, not extracted and it's, it's insanely expensive. Not readily available, I mean, you can get others. Thank goodness, there's a, there's a couple of companies that we buy our strong consistent. But, for us, I think that's probably a 40 or so, maybe this is kinda the same word for trying to add all time. But right now,

that's, that's really where we got was from us, for the use EMR. So, again, you know, we could do for somebody else, but as, you know, things are the mass back and so on. We can do do more with the ISO delicious, just gets very difficult.

5:38:15
So, Yeah. Yeah.

5:38:27
Pretty clean Bottles, as I said previously, and Zan.

5:38:32
Yes. And verify that the client already. Yes, but not the purchase.

5:38:43
Yeah. I think most of the containers that you get these days are probably pretty claimed or had some sort of certificate of analysis now. But follow a certificate of analysis is that they probably don't have a false certificates your normal balls and semi volatiles and so, on.

5:39:00
So, as long as you, like, we were getting, I would actually say, potatoes for our QC.

5:39:07
So, without the reagent likes and all that, if we validated those, those methods are those containers so I Will go out and purchase your own containers without knowing that they've been validated It might be a unfortunate surprise, so.

5:39:36
OK, Perfect. Thank you.

5:39:44
OK, Good.

5:39:50
OK, ... Thank you, Danny.

5:39:56
So our next presenter is Maureen.

5:40:02
Change.

5:40:04
he knows the past marketing and communication consultants from takes us money.

5:40:14
He has been a testimony for now for 16 years, Frank, and a BS degree in chemical engineering from the College of Engineering.

5:40:26
Frowns joined the Hazardous waste business in 19 87.

5:40:31
He's waste experience include what funds in the incineration, inorganic, wastewater treatment, biological, waste, water treatment, hazardous feel, meeting cement pain and underground injection segments.

5:40:50
He coins name, represents excess money on the back community advisory councils, his company's outreach to low-cost local, state, and federal officials.

5:41:07
Frankly, the developed means of Texas money for the ...

5:41:11
business reach has safely managed over 18 million gallons of aqueous PFS Waste.

5:41:20
He has the right to present PFS, Sustainability, community participation, and the use of deep, well injection two chemicals for your team.

5:41:32
Galvanizing all the states and the national industry associations, franke, smiling.

5:41:41
So he's: Why schwann for 48 years 49.

5:41:47
Yeah, OK Yeah, he has one daughter and two wonderful grandson's jollies any activities that include includes his grandson. That's beautiful. Welcome Frank.

5:42:09
Thank you all very much. I really I guess that's my best achievement, isn't it?

5:42:17
My single best achievement in my life is to be married to my love for 49 years and Right now to figure out different number five. Oh, So, any ideas, let me know.

5:42:32
But, anyway, you know, it's what's interesting, is we've talked about pathos all day long.

5:42:37
And community partners, it's just some things which we haven't talked about that hope to share with you. A bit of background, really, about what you've heard my bio.

5:42:52
But my perspective is it's a little different in that it's much more practical. We're going to be talking about disposal and destruction of foss.

5:43:02
Basically, methods which are currently available, versus, you know, all the technologies under development would be mostly on that. Also, the perspective is, we are very highly regulated.

5:43:16
Business, and our clients are also extremely, highly regulated businesses.

5:43:22
So we have a unique perspective in that the regulations that apply to our customers apply to us and they normally apply to us a little bit my stringently because of the fact that we accept materials. So, we did 75, sugared, that, what we're talking about? wastewater. So you folks said, Upright wastewater plants.

5:43:44
We're not talking directly to you, but it's regulations develop as they deal with other chemicals.

5:43:49
Some of the people who who would be sending large amounts of ...

5:43:55
to your facilities, you might not want them to do that.

5:44:00
You might want them to manage it on site or manage it some other way. And so what we're talking about may apply to you as well, but not, not directly.

5:44:12
My background and experience has all been in hazardous waste.

5:44:16
Uh.

5:44:18
And I just I like to say that NP fuss it's learning share activity.

5:44:24
I spend now, was president for 15 years for succession planning.

5:44:30
Asked me to be a consultant.

5:44:34
Occupied now than I was before.

5:44:37
I judge it by my Saturday afternoons.

5:44:40
I'm working. When I was president. I didn't.

5:44:44
So, but this is a very enjoyable thing, how many of you are ..., I know Overhears or summary?

5:44:54
But live it, and I do, it makes so much enjoyable for me. So to learn and share.

5:45:03
So obviously for me today to be here with you, and be here with the people who've spoken, I'm taking notes, I'm learning, and my desire is to share.

5:45:14
Learn a lot, and then share with people, and I'll say this before it, if I forget about it later.

5:45:19
But the fact that you've invested your time and effort to be here, I would like to be considered a resource for you in the areas where I could be a resource to you.

5:45:29
... says she knows all encompassing it, then maybe a little specific thing.

5:45:35
So, with that, just start here, OK?

5:45:44
OK.

5:45:51
Chalk guidance ...

5:45:54
spoke about disposal and destruction based on what's available and commercial.

5:46:02
In other words, they didn't go in, they talk about all the technologies in development, but didn't spend a lot of time in them because, they weren't available, and people were, like, What do we do with this stuff?

5:46:15
Anyhow, a couple years ago, I was just talking about it, but then, what do we do with it?

5:46:20
You know? So, and some of that they pointed out.

5:46:24
That the regulations that they said they'd have it by the spring of 220, 22, which now you get technically, that's on July, June 21st, they put out guidance for data habit by the NDA.

5:46:38
one, yeah, from the NDA and just when it was published, one here from the NDIA.

5:46:45
So anyway, I won't talk much disposable destruction options, It did give us that recently, we won't talk about what it is.

5:46:54
It says in what it doesn't say, but options from the highest to lowest uncertainty. So I'm gonna, I'm gonna flip.

5:47:01
I'll show you what the options are.

5:47:03
Then I'm going to flip them and we'll talk about hazardous, uneven injection.

5:47:08
I'd be closed in Central. Why do you use technology?

5:47:12
But almost the least understood, even by people who've been in the business for a very long time.

5:47:19
It's just not understood, Uh, and so, it doesn't matter where I got, doesn't matter, But I've talked to, and I'm hoping there'll be a lot of questions. So I'm really not the last presentation.

5:47:31

Because we do have a discussion after this, and I'm hoping that it'll be, a lot of you will have a lot of questions, not only about what I say, but what's been said today.

5:47:40
So we'll talk a little bit about underground injection and why talk about something that's kinda been alluded to today in a couple of ways in a couple of presentations.

5:47:50
And that's the non regulatory drivers, know, we all know that we all know about circular. We mean, you may know about surplus. You may know whether or not it's going to be hazardous waste and it's listening on table. What's a Table eight?

5:48:06
Hazardous constituents.

5:48:08
Uh, I'm going to specifically hone in on one topic, which is environmental justice, which I haven't heard today.

5:48:16
So I want to I want, I want to dive into that.

5:48:19
So you'll have to put up with some of some of the other stuff we talk about to get to something that I think is important regardless of what you do or how you do it when it comes to us. It's not just all the regulatory stuff. Not just the toxicity which are all important.

5:48:35
But environmental justice. And I couldn't lever a presentation without giving. You probably got about three pages. There are four slides that, there are references that you can use.

5:48:49
If you want to follow regulations, you can go to these this specific sites or references to get information.

5:48:59
OK, the guidance document, I'm like, say, it was, it was put out in the December of 2020.

5:49:07
And it, actually, I think, down here, somewhere, it's going to be updated in that by the end of next year, 20 23. So, this is the guidance we have now. Again, updated at the end of next year.

5:49:21
and, like, say, the reason was for the 2020 India.

5:49:26
Uh, and commercial covers, now, what's interesting, is now we're starting to understand a little bit about the the triage here.

5:49:36
They're starting to talk about the materials that it covers.

5:49:41
And of course, by, by reference, there seems that it does not cover.

5:49:44
So covers a triple F a lot about that.

5:49:48
Soil's textural, spent water treatment, Gerald's, etcetera.

5:49:53
And these spent, you know, spent treatment, materials, and Landfill Leachate, which I call the elephant in the room.

5:50:03
Very large situation, OK?

5:50:06
So what it doesn't do, so some people look at it negatively say, well, it doesn't tell me anything.

5:50:12
It gives you information about technologies but it doesn't specify anything.

5:50:17
It doesn't specify that you must use them.

5:50:19
It doesn't specify a treatment standard.

5:50:22
It doesn't tell you what technology to use, and I think, in their language, and I think it's appropriate, that the language was not written that way, it wasn't written to tell you what to do. It was really to help people start evaluating.

5:50:36
And I think so on pointed out earlier, were a couple of years ago, you really didn't know what direction of the direct go, but I think those of you who follow it, have a better understanding of where they're going and have a lot more likelihood that they're going to certain things are going to happen. So.

5:50:54
Um, talks about.

5:50:58
The population's now, sorry, Negative comment about Administration, Sharon. This came out in December 2020, Republican President.

5:51:10
This came out under a Republican president and had a very substantial section on vulnerable populations and the role that, and permitting other things that relate to environmental justice.

5:51:24
It's not just and I think that's the other thing that I didn't cover here don't have time for here, but a lot of that legislation has been bipartisan.

5:51:34
You know, because a lot of people are interested in this issue, and it's kind of good to see that it's not, might be one thing, that side 100%, one way or the other.

5:51:45
So, so it talks about health effects, and the development publishers will get into that.

5:51:52
And then community engagement, which even before this, you know, being and living in industrial worlders, industrial clients, and, I quote the social contract, you might have social comment, excuse me.

5:52:06
You may have a record permit. You may have all kinds of permanent. But if you don't have a social permit in your community, you're probably not going to be in business.

5:52:15
And precise, maybe the spear, the tip of the spear on this.

5:52:20
Um, OK, often, so that what they do said, What does, they said, What is, Instead of using risk or other terms, which might show some bias or something.

5:52:33
They used the lowest uncertainty.

5:52:36
So the first one listed is storage.

5:52:39
Hey, storage. You're not doing anything with it.

5:52:43
You're not responsible in the future for which you did, because you haven't done it yet.

5:52:50
Say something.

5:52:53
Depends on how much you have, and the likely we'll actually do that. Some are using it to make decisions, to decide what to do, actually storing it. But as a practical matter, if you really have a lot of it, you really may not be a good option and you've got the risks of containers and leaking. And all the other things that come with storage.

5:53:10
So, we're not going to talk about storage but they did good things into three classes of underground injection, landfill's, incineration, or thermal treatment or straight groupings.

5:53:22
And within those three groupings, they separated out tradition, non hazardous versions of all of them.

5:53:31
And, which was interesting to a lot of people in 20 20, we're in 20, I guess it was in 20 20 Research incineration, hey, I work for incineration Company for years, but it's kind of like an easy button get saturated where it was just burn it.

5:53:51
And then, something happened that changed all that.

5:53:55
So, incineration one from the Easy button two now, the lowest option in terms of uncertainty or highest uncertainty if you will and which is kind of an incredible You know, we talked about the DOD certain states have actually banned the burning of uh, foster within their states and other state came close to doing it.

5:54:23
Some incinerators have voluntarily cease to mature the others that aren't, uh, so, anyway. So, we'll start from the bottom combustion units.

5:54:36
Um, positives, maybe, I don't know.

5:54:39
I mean, there might be an overall play plan, but if they can't get to the destruction removal efficiency, temperature, time, and concentration that's required, they may have no play within us, giving them the benefit of the doubt they listed them.

5:54:58
And, you know, in other words, if someone were to take a non record unit.

5:55:04
I know a lot of these are the thermal units would be non rep, could be non record.

5:55:07
And if they go non record, I think some of the combustion things that better land, at reference centers could be employed by them.

5:55:16
Of course, uncertainties still have the admission discharge and rather it is and I think that's been talked about.

5:55:23
You know, if you're not combusting what's happening with the unconverted or food products of incomplete combustion Incinerators causes it to destruction technology It has some rubber ashur does permit, and that's kind of a pervasive thing is that you have another layer of protection, another layer of regulation, another facility on new methods in which they use to manage materials.

5:55:51
And as I mentioned, EPA is working to address these uncertainties not exactly sure where they're at with that.

5:55:57
You know, I went discussion with someone today that I'm not sure where that said, whether it's it cat Mouse.

5:56:04
I don't want to show too much or wherever, but that has to happen before it gets fully resolved.

5:56:11
And then I mentioned the uncertainties today or because they found products of incomplete combustion outside of a reference center.

5:56:22
Um, course, the questions on the admissions.

5:56:25
And here's another top we haven't talked a lot about, but we regulate water a lot on solid ground. But air and air transport is a big issue.

5:56:36
And of course, the cost and capacity and we will talk about incineration. Today you can call the reference interview. You want to ship something.

5:56:44
I mean, you might have to wait two months to get it in there. So it's a great solution, or could be, or hopefully, will be a great solution. But capacity is an issue, And, of course, you can build them on site, I suppose.

5:56:59
You know, pretty much in all these things Now Not Hazardous, subtitled, the landfill.

5:57:04
She now as containment, yeah, there's, they're permitted to have double on either build now double liners and lead shapes.

5:57:12
Uncertainties are: Landfill gas emissions, now: they're trying to talk about the gas. You know the positive aspect of the landfill is what's happening regarding that gas and PEAT bogs.

5:57:23
Uh, the capacity for liquids, the whole idea of Leachate Man management.

5:57:30
Then accumulation persistence papers and what happens, know, come circle, or come? Hazardous waste, or some other designation, which puts it under much higher, higher. Regulation is, Will it be Sustainable subtitled?

5:57:43
See, uh, again, it's better because it has hazardous waste permit. The idea is that it might have containment for long term storage.

5:57:56
However, it's still as issue of ...

5:58:01
management in the landfill because it's going to persist.

5:58:05
It's not gonna really go away very quickly, and again, typically the impact of what future hazardous regulations are going to do to that end, they all special. You know, it's all spelled out pretty much in the interim guidance document.

5:58:22
So, So, underground injection, you know, someone talked about Class two wells. I don't know.

5:58:30

I don't know. Well, maybe people are doing it. No, she couldn't do it in class too well for oil. But so class one, non hazardous, industrial, underground injection.

5:58:41
In the positive sense, it's really the technology for that doesn't have zero discharge, you know, no discharges to water.

5:58:50
And the like to very much easier, permanent process, and to some extent minimizes the migration of the fluid.

5:58:59
The uncertainties, are the fate of it?

5:59:02
Deciding criteria you are, now sitting in, Oklahoma citing criteria is a little different than it is on the Gulf Coast, where they're in a low seismic activity. There's.

5:59:15
So those are big factors, uh, then capacity, and then, of course, what happens if a manager does?

5:59:23
Uh, class one enters injection.

5:59:26
So here we have been talking about something that's not even yesterday switched, and we're treating it like it as if it's the worst of all hazardous waste. In other words, the management, the risk of it.

5:59:40
You know, we heard from our attorney, the attorney that spoke and you will see that how important that is.

5:59:48
So, that people are literally don't waste incinerators Gallager waist deep wells for a material that's not even hazardous waste.

5:59:59
And you'll learn a little bit why that is, but so no discharges it's managed, doesn't have similar. Manages hazardous waste.

6:00:08
So it's under wrecker Underserved, TORI, the Geological setting criteria is much more strenuous than for a class one, Well, certainly for sure, a lot more strange and class to us if they were trying to be converted.

6:00:27
But the other part is you can be used to volume reduction technologies like ARO or soil evaporation or something where someone's concentrating something and refer it, what do you do with this stuff?

6:00:40
It's concentrated If it's in the right time, it in deep, well, maybe an option for what I kind of didn't mention.

6:00:49
Instead, the, the ...

6:00:53
water could be hazardous, can be managed.

6:00:58
I think you saw that little five I think it was in doctor each slide. The little fire, the facility on the right lower right-hand corner.

6:01:06
There's our facility, the admin portion of our work, next to that fire.

6:01:14
Turned out, bad for us.

6:01:16
But good for us, because all listed waste.

6:01:19
You coach key codes, some characteristic codes, as well as .... And so they had to have a home for the sharing. Cheese are very stringent setting criteria.

6:01:30
We're looking at a map of the US and look anywhere, where there's a lot of mountainous or a lot of unusual geology without even pinchas shipping tell that they're not going to be available.

6:01:42
So tent typically is the mid-west, Upper mid-west, the Gulf Coast, and a few other areas where these things can even be cited, you know, reasonably.

6:01:53
So that's a negative for underground injection, especially hazardous wells, and it's for liquids primarily, someone mentioned flurries.

6:02:05
No, capacity and cost of transportation are all factors.

6:02:09
So, parties, I think part of what people should be learning from this is that, and I learned this from, what's a gentleman saying, who's the Oklahoma, the Q director. They said Thompson wasn't.

6:02:25
Scott Charles said at a car, I think it was him at that conference and embarrassed to go. If we try to regulate all P fast, we're going to regulate none of it.

6:02:35
And so I mean there's takeaways beyond what I'm talking about that I think has to be.

6:02:41
We have to come to some sense as to what we're going to go after what's important to go after that because the word ubiquitous stands for two things: Hobbes and ....

6:02:52

Yeah, I used to use that word with my grandson to learn ubiquitous.

6:02:58
That was before us, but so that's the second kind of use it was in P plus, so the traditional uses, the reason why people would use it is that it's already being used for hazardous waste being listed. Listed hazardous waste.

6:03:15
You know, all types of things flammable. Sulfides acids, pretty much everything.

6:03:22
And so, I've got a question that I'd like to ask folks about April. Was anyone want to guess at how much hazardous waste that is produced on site?

6:03:38
That goes that is injected into Class one hazardous steeples United States.

6:03:43
What percentage of all that hazardous waste know, we haven't people saying it to incinerators, to landfills, to fuel bundling facilities we have them send you get, ever. Which were.

6:03:55
I'm very much, right? That's a deep. Well, it's kind of. It's oh, it's bad. It's, uh.

6:04:03
It's kind of old-fashioned, right, to be using, deep breath for handling something like this.

6:04:09
Your, you're absolutely.

6:04:14
I'm sorry, but it's very common. It's that it's very narrowly used.

6:04:21
Uh.

6:04:23
now when you learn a little bit about it, we talked about, you know, Safe Drinking Water Act.

6:04:30
It comes, it's a child at the Safe Drinking Water Act.

6:04:34
This will assert a child the better child of protecting groundwater, a child, or protecting water sources. There's no carbon footprint.

6:04:44
There's no air emissions, so want to show you, it's currently used.

6:04:51
I mentioned, for us, it's being used for wastewater no fast manufacturers users.

6:04:59
A triplet producer is a triple abusers.

6:05:04

Refineries, terminals or wherever.

6:05:07
Rinse orders, leachate's, groundwater, compliments, onside, Wastewater technologies like mostly Yaro because it's a reduction technology.

6:05:19
Then, uh, find that could be finite. Some of them are very large or long term projects where you don't have the time to install on-site solutions.

6:05:29
You can't really justify it for that.

6:05:31
So, uh, my trusted go away.

6:05:37
Yeah.

6:05:42
Oh, Oh, my charges here. OK.

6:05:46
Well, I'd tell you that the 78.8% of this waste generated in the United States at sites goes down class one, hazardous deep wells.

6:06:00
That number was 42%, 2007.

6:06:06
And so the use of deep wells as a percentage has been going, when what happened was not here, but ever, the curve showing a bar chart, showing that the generation of hazardous waste on site has been going down, as most that part is true. It's been going down.

6:06:24
But you said, we're also being because water discharge standards have been going up or obtain more stringent for industry?

6:06:34
Think within ..., you're gonna see more of that.

6:06:36
So, we'll be relying on the technologies, whether it would on-site or offsite work. So.

6:06:47
The characteristics of it, separately, you know, it can't be anything that has to filter, it has to be compatible.

6:06:54
It has to be mostly water going into formations where you might be filtering down to a micron before you injected a thousandth of an inch and has to be compatible with the formation and with the other materials.

6:07:11

Uh, No debris. So we're not out of place to send your carbon in .... Please send your carbon or the solids or soils or things like that.

6:07:25
Um, taming primates is is a tough thing for a new keep, well.

6:07:33
The geology dictates that you may have a need for it, but if you don't have the geology, you're not going to get one.

6:07:39
And the petition has made, may take you a year in some states, typically run by the state. The no migration petition for hazardous is run by the federal EPA. They never relinquish that, and that can take 4 or 5 years.

6:07:55
OK, the non regulatory drivers, which I wanted to get to, right?

6:07:59
I don't know where I am on time, but I'm getting, Oops, close ending chip.

6:08:05
But voluntary actions. So back to that whole idea that there really isn't any business that's comes from regulations, because there isn't.

6:08:12
It, are generally are none, in, some states may have some, but it's a lot of voluntary action by a company to reduce their liability.

6:08:24
Uh.

6:08:25
So they dispose of it on site. on-site treatment.

6:08:28
They wish put restrictions at zero discharge concerns, trucking company, or trucking companies will not fall ... portal.

6:08:38
It's got to do that.

6:08:40
Concerns by truck washes.

6:08:42
People are searching for parts per trillion.

6:08:45
You've got a lot of places to go looking for it. Right.

6:08:48
Um, and then lawsuit sediments.

6:08:51
Vulnerable populations, environmental justice, general duty clause, that is the catch all.

6:08:58
So there's no regulation, but if you make, if you damage the environment, you knew since, I think that's brought up, right? If you're a nuisance, if you are drinking water, if you do any of those things, those general duty. Cause it's much easier to say, your treatment standard is 10 PPM 10 PPB for 10 PPT than it is to say that.

6:09:24
I should not create a nuisance odor or something called general duty. So, a lot most, everything has been caused by that then, retroactive liability concerns about retroactive liability.

6:09:37
And so there's a lot of, uh, risk decisions.

6:09:40
I think that, uh, Don shandy kind of covered that with us quite a bit.

6:09:50
Just say OK, so, it's to be considered, you know, roles and regulations of all departments across all government agencies, so that's a big statement.

6:10:01
It's, it's as such, it's a part of every action.

6:10:05
Every bill, every proposal regarding Pete Fos, includes environmental justice and or vulnerable populations typically bet the same thing.

6:10:17
In the guidelines, I mentioned that the house should be five section X at which it didn't pass.

6:10:24
Again, a lot of a lot of information on on how the interests of vulnerable populations was going to be addressed and all of that BPA roadmap for us, uh, and so it's not just the generator anymore, the receiving facility.

6:10:43
If you're a ... fonts, you're gonna be subject to the same rules, regulations and requirements to do certain things as it results as it reflects your community.

6:10:56
And so, it's an effluent limitations. It's an, all of it, now, you know about G H A screening tool.

6:11:05
OK, very good, very good.

6:11:07
Actually, which, so, uh, all the talk about environmental justice, but DPA has put out something called the EJ Screening Tool.

6:11:18
So you can go and put a longitude and latitude any address of any place in the country. And it will give you information on all the demographics of that area.

6:11:30

Everything from the education level, the age level, the, uh, I guess the ethnic and racial breakdown, the amount of income per capita amount of children under five invalid people like over 60 or something. It's, it's pretty comprehensive. So if you haven't become familiar with it, I'm giving you that, this site, where you can find that.

6:11:55
But, uh, it basically requires a lot of things.

6:11:59
So just because you're not generating, it doesn't mean you might not have some responsible or your clients, in some cases, under your consultants.

6:12:09
That factor is a huge factor on what you do here.

6:12:15
So, uh, expend underground injection, how safe it is Already managing a lot of this stuff, that mismatch.

6:12:25
Where do I how do I get back to something here, brings our expert.

6:12:30
I want to show you the list of references. And then I'll close.

6:12:34
Yeah?

6:12:37
Oh, Yeah, so I've given you Go to the next page, just click on.

6:12:47
OK, so right, so good references On underground injection give you references on P Foss, I've given references.

6:12:59
I already mentioned Tosca recording You know which has gone on for for us now And so I have all these references for you to to use, be happy to use.

6:13:09
Uh, A lot of this is part of other presentations I might do, but not this particular one.

6:13:16
Hopefully that helps any, any questions for me before we go to our account?

6:13:28
Just one quick thing here, what's the highest Ration.

6:13:34
She said.

6:13:37
Know, there's not, there's not a limit. Delineated design is compatibility with the other material we take.

6:13:45

And the compatibility with confirmation it typically is, say, for example, in pure a triple X The issue is, is normally the surfactant package that goes along with the ... not to pay us itself. You mean? The pure, mature yep.

6:14:06
They really, truly all. We would have to, which we've taken some pure material, tends to be in smaller quantities. So, we take very large quantities, It's in wastewaters it's in fire waters. You know, we're taking men can inject you know a couple hundred thousand gallons a day or something. But pure material.

6:14:27
It's something we'd actually probably doing totes.

6:14:30
And because we did it in bulk and we're not going to put it into one vertex because it'd be sitting there for awhile.

6:14:39
Great.

6:14:40
Chart, both.

6:14:43
Thank you.

6:14:45
You thought about a couple of other out of the box?

6:14:52
Yeah, charge differently for that.

6:14:59
Typically is, I'd say properties rule, I mean, things that are easy to inject are easy to inject.

6:15:09
Uh, know, versus, and whether it has 50 plus or not. There's some ... is ...

6:15:18
alluded to there's a column tweeners, where you have material that is not, it's mostly water, but as surfactants in order for it not to be something you can inject easily. And they will be more expensive, So that is much bigger driving force, there.

6:15:36
What the individual chemical, it's.

6:15:46
Well, thank you very much.

6:15:53
OK, Thank you, Thank you very much. Right.

6:16:01
Yeah.

6:16:04

So, it's?

6:16:08
Yeah.

6:16:11
All right, so, it's discussion time, but before we go so discussions, alcohol and shetty to talk more about credits for engineers and so.

6:16:28
OK, so the question for those of you that are in the room for operator training credit for DEQ, we didn't have phones in here, so please leave those with, maybe, if you're online looking for ... operator training, submit your certificate that you will get to us, to get that credit for engineers.

6:16:52
You need to keep a copy of the agenda and your certificate.

6:16:58
And when you renew your license, you provide that information to the P board, and they are the ones that handle that.

6:17:07
They don't approve it in advance, but as long as you have your certificate and the agenda, there's generally no issues with getting out continuing education credits.

6:17:24
Thank you, Sharon. Try Hydro has worked with us. So it's one certificate. And everybody gets it. And we got that worked out in advance, so we didn't have to do it after the fact.

6:17:38
Good. So we'll call on all speakers to at least take the fronds role for discussions and questions.

6:17:50
Beta one, You guys. Yeah.

6:17:53
Yes.

6:18:03
Get either one, and I'll just pass hot mix, and they can.

6:18:07
We, OK.

6:18:16
Aye.

6:18:21
OK?

6:18:25
Yeah?

6:18:31
OK, yeah.

6:18:42
Yeah?

6:18:45
Wow.

6:18:48
Yeah.

6:18:50
Yeah?

6:18:54
Yeah.

6:18:57
Yeah.

6:19:15
I'll work on that.

6:19:17
All right.

6:19:18
Yeah.

6:19:20
We have a few questions from the first 1 is 4.

6:19:26
Oh, Navy.

6:19:30
Why she glass not be used for PFAS sampling and analysis? That's a good question. So, it's not a high bias, but they believe it could be a low bias. so some of these compounds could stick to the glass. Whenever, whenever it's stored, they're going to stick to it. And that's part of the reason the methods, they don't want you to sub sample, from these water samples, that you're going to take that entire container and rinse it out.

6:20:04
But that would be that would be the main reason is that these I believe some of these will stick to that glass, and give you a false false low bias.

6:20:15
Yeah.

6:20:21
OK.

6:20:24
How does the Equipment Blake work when sampling soils are solids?

6:20:30

So, the equipment like, know, you've got to whatever you're using corn device or trowel or something like that. You just kind of rents that, that sampling equipment with the pathos, free water.

6:20:46
Collect that rent, Say, be treated just like a sample, and send it in With those samples. Like, that's cool. That's in the same.

6:20:55
Shipping it in the same cooler, you know, and so on, but that's, that's really before you started the sampling, a lot of programs are you require one at the start of the day to check all of your equipment, some, Maybe a little bit more stringent to where they're going to want to do it in between.

6:21:15
I specifically mentioned the equivalent bikes buds, like for example, you see Emaar five, for every sample you.

6:21:24
There's going to be an accompanying rage at blank or field blank, excuse me, Field region like.

6:21:32
so if you're collecting four samples that day, you will have four accompanying equipment or a reagent likes. So H depends on the program.

6:21:44
This question is for Andrew in terms of effluent standard steam.

6:21:49
Do we know which PFAS compounds will be regulated now and in the future?

6:21:57
I guess.

6:22:00
Context for our presenter today, OK?

6:22:04
Pharma and PFOS, hmm.

6:22:08
Shall be regulated first, shallow solution, additional Charlotte PFAS compounds, That will be next progression first.

6:22:24
The next firm, after that.

6:22:29
For us, compounds, ...

6:22:34
MP four, I'll just chime in on that a little bit, that we know EPA is working on genetics and PFAS.

6:22:48

Don't know exactly what that means, other than they have already presented information to the science advisory board for those. So I would expect to see those sooner rather than later as well.

6:23:01
And then on the biosolids, which is related to clean water at discharge, I think we're gonna see at least ... and PFOS.

6:23:16
I think EPA has indicated that we may see those as soon as the end of the year or certainly within the next 18 months, sometimes. Slow presentations.

6:23:31
Way to look for options have to speak, and that's Terrible class, and that's where Toto ...

6:23:44
concert so many pieces then they can do a simple mass flux to reference values equivalent to the most toxic to, which is kinda carcinogens. Wow. So, that's the button.

6:24:05
Mmm hmm.

6:24:07
Now listen to discussions.

6:24:10
Professor ...

6:24:13
Barlow, on the roadmap stage, once they realize how difficult it's going to be, role in the future to regulate the visual compounds.

6:24:25
So, to continue this will be just to grow with the class.

6:24:30
Maybe something like PCBs, dioxins, That's a good example of PAHs sometimes, too.

6:24:38
All right.

6:24:40
Questions from online? Slide Where I showed BP fast levels in the handbook or apps is that measured in the rap or in the hamburger? In other words, it the right way. She looks good question. What is the likelihood of reaching into the handbook or deleted? It's a great question shows that was done on the wrapper itself. We do not know how much of it leaches out.

6:25:10
However, when we think about it, if you will out greasy burger or whatever.

6:25:15
it is, just by probability. You have something hot and greasy. You have a pretty good vector.

6:25:30
Next question.

6:25:32

Not directed, not sure I'm interested to know how the circle of liability will be addressed for municipal biosolids land application, especially many land application sites that are private land under contract with even with the municipality.

6:25:48
OK, let's make it Great question.

6:25:56
So I will give you an honest answer first and then I'm going to speculate.

6:26:03
I don't think we met Is the answer. I definitely think there's more to come.

6:26:10
Now, what we do know, unless there is an exemption, things are going to get pretty messy in a hurry, or the municipalities or those land owners, in some cases where they're growing food crops and then what happens? Here, OK, the grocery store. So on and so on.

6:26:36
I know there's a lot of effort on both sides of this issue. in Washington, DC trying to carve out the exemptions, and we're certainly in favor of that window. And municipalities are the wastewater utilities and all of that burden.

6:26:59
Because remediation cleanout in addition to disposal, We know with all of the contracts, some of it is simply a month to month. Or once a year where biosolids are spread on private property. That is done with a permission.

6:27:22
And, in some cases, with the landowners even paying or receiving that material is that suddenly becomes a hazardous waste and then testing shows that there is ... that is a hazardous waste in the soil on that property. I don't think we know how that's going to look, but it's becomes the municipality or the utility has provided that to the landowner.

6:27:52
Um, We could have a whole lot of liability shifted away from the generators to the receivers and the users of products.

6:28:04
But I just, I don't think we know what's going to happen as somebody else may have a better idea or better information, or a different, but they're speculation of what's going to happen.

6:28:17
So I am happy to hand over the mic to whoever.

6:28:23
This is, Dawn. I said, I take that, actually, I'm on two calls at once, but that's another story.

6:28:36
I think, you know, under circling, the traditional legal analysis is, if you're an owner, if you're an operator, if you are a generator or the waste, if you're a transporter of the waste, if you're an arranger of the material, surplus has often been described from a liability standpoint as the most draconian statute ever adopted.

6:29:04
And I think that's absolutely correct. Now.

6:29:08
I think the comment about EPA and the folks in Washington struggling with this is exactly correct.

6:29:15
Because, particularly when it comes to cities, they don't exactly have a lot of abundance of money sitting around in there in their treasury.

6:29:26
So this could be an extremely costly issue under the traditional sharklet analysis.

6:29:36
So, I think that there's a lot of work to be done there, There could be carve outs, There could be a lot of different approaches here, but that's what concerns me. As a lawyer.

6:29:47
If you look at the traditional way circle has been applied, it could have impacts just up and down the stream of commerce in a way that could be very dramatic.

6:30:12
Yeah.

6:30:18
Right?

6:30:22
Yeah.

6:30:23
Right.

6:30:30
Yes. That is where you'll get that. Yeah. We provide all that. We Certify before it goes out. So it, on the container, There'll be a lot number written? And when he gets back, that's recorded, and that's, that's its requirement by the EPA. So, not, not optional.

6:30:50
Very cool.

6:30:56
Right.

6:30:59
Great.

6:31:11
So, I guess my question is probably for a day in Utah.

6:31:16
To bring in a wastewater sample and a biosolids sample, you would do use that method 16 33, correct.

6:31:27

It is a draft method I know. That's, it seems to be, that's what the method that they're, they're leaning towards a Clean Water Act. The, I believe that, that that's even what they're asking for.

6:31:42
But, but, yes, you could.

6:31:45
Do, you could ask for 16, 33, We also do, Because we haven't had this until recently, for the last 5, 6 years, we've, we've done a modification to the 5, 37, or 533 as well. So, at this point, there's no requirement.

6:32:03
So, you know, you could, you could.

6:32:07
So if we were kind of doing, just wanting to find out what is mad.

6:32:14
With this method not being approved, at all.

6:32:19
The best to go and this point, and when we think this method will be approved No, no, I would. I mean, I think it's a pretty good at this point as to draft.

6:32:28
Which is a little odd situation, but this is no problem, right.

6:32:38
We generally use it, 537.5, 33, use an extraction protocol. Exactly those obligated.

6:32:51
Yeah. It is a modification.

6:32:53
But we've, we've done that for lots of people and those people like you guys, I just want to want to have some sort of idea of what, what you're looking at and see if you might have some issues down the line. At least. Like I said, it's, it's, there's no regulation necessarily in Oklahoma for it yet, so it's perfectly fine.

6:33:13
I would just add that 633 is what EPA is recommending. It's not required, it's only single lab validated.

6:33:24
Once they get it, motor labs, validated, they will go through the rulemaking process. They're recommending so that there's more of a one size fits all, when you start looking at data, making sure it will stay with the same method. But it is not required. And there are a lot of labs that are saying not until it is actually promulgated, or we're going to use it because the details may change slightly in that, could make a difference.

6:33:59
Up to the lab and the requester of the sample to work out what they think is most appropriate, and D to stay, and out of that, until we get something in regulation.

6:34:19

OK, I have a question for you. What I am, the chief frank.

6:34:28
Malady muscle samples, as well, we will report the data with a qualifier for your specific program is that very well, could invalidate the results that you get.

6:34:43
So, depending on the compound, you know, if it's kind of like a method line, if you're if you get a result for something, that you also gotten the sample that would, you know, that would be basically, and invalidate that result. So, if it's for a different compound, then, you know, you have the data as qualified, but, yes, basically, the hours that would invalidate for the ...

6:35:06
five program absolutely invalidated and would require racing, OK, thank you.

6:35:22
Right in the regulation, Although.

6:35:25
Sure.

6:35:35
This question is also for Danny.

6:35:36
I just thought of you say you might not know but what would you say is the success rate versus the failed test hostility sample rate like results you get in? For like a quiver ...

6:35:50
reagent oh very little We have no issues with with passing.

6:35:56
In fact, uh, I don't remember the last time we've had a result in a field reagent, Blanck.

6:36:05
So it is very I mean people, especially now people that are doing the testing are well aware of the situation and sampling requirements. And and so on. Now, when it comes to the use EMR, there's a lot of people that have never dealt with this before, and, and it might be a little bit higher. And there'll be some re sampling to be done, but at this point, it's almost almost nine. I honestly can't remember. The last time we are, so, very, very minimal. And for all the ones that we did for .... None.

6:36:38
Yeah, that worked out very well. Yeah, Question.

6:36:53
So, my question, you know, all day today, we've heard a lot about P fast and a lot about kind of the murky regulatory atmosphere that exists regarding P for us right now.

6:37:06
Um, so, my question, anybody can answer this, from the Utilities perspective.

6:37:13
Is it advisable for us to go ahead and screen no waste water, drinking water outside of the current regulations right now? Because there already is a track for liability that is, you know, going on in

other states, is that someone with the utility would have to be concerned about where to find something in our water?

6:37:36
This is Dawn, I might take that one.

6:37:40
Um, I gotta tell you, and I've worked closely with utilities.

6:37:46
I would be very nervous.

6:37:48
At this point, if I add a discharge from a facility and I I didn't make any effort to understand if if there was P thoughts, contamination in that in that stream.

6:38:03
That waste stream and the water stream, whatever it may be. And here's why because ignorance is not going to be an offense at some point.

6:38:13
And, and I think that if there is an issue, it's better to know now and to address it at this point because it's never gonna get easy from a legal perspective.

6:38:27
And so I think it's best to try to grapple with it.

6:38:31
And that's probably is, eat, is done, is the preferable option in my mind.

6:38:38
Among a set of options, none of which is very good, be honest.

6:38:43
I'm going to jump on the bandwagon a little bit and say right now, there is an enormous amount of federal funding available to address, but EPA calls emerging contaminants and PFAS compounds are definitely one of them.

6:39:03
If you start sampling now, and you can start planning within your wastewater utility or drinking water utility, you can do some planning and still have time to tap. And, we have this infrastructure money for five years. If you're sampling now, and start finding some things, you can do some studies. And this is, on the drinking water side. one of the few opportunities you have.

6:39:36
Do you get funding for something that's not already a violation?

6:39:41
Please pass habs, and lead lead service lines. Those are the areas got under the drinking water state revolving fund That you don't have to be in violation in order to access that money and use it on the claim on the right side it's a little bit different.

6:40:02
But if you are doing sampling routing, find the fast or influence.

6:40:10
After a certain treatment process, now's the really good opportunity to find out what it is aside from the liability, but get access to funding to start making some of those treatment upgrades that you may be required to do anyway. Or, two after you've already gotten started, and so you're ahead of the game at that point.

6:40:32
And, Shelley, if I could add 1, 1 other comment as well.

6:40:39
I don't want to get too technical from a legal perspective, but if if you're going to consider doing this, you should consult with your legal counsel, because who might want to take measures to set up the attorney client or the attorney work product privilege?

6:41:00
And so that's something that we could probably talk about for an hour, which I won't do, But But I would highly suggest you, if you're going down this path that you talk with your counsel.

6:41:12
This is Angela, how it's supposed to be done.

6:41:15
I mentioned that When clients ask us what to do and what's the best course of action to pursue.

6:41:21
Those has to retain who attain a lawyer, make sure that discovery is protected.

6:41:28
But on the second now, in support of early testing detection and getting how the message is as follows, a lot of communities are getting sophisticated and they can grab a bottle sampling.

6:41:45
This happened in Flint, Michigan, happy now, everywhere else, K fear, the message will come out sooner or later, and it's better, Dad now, before anybody faces here with that.

6:42:02
So, I will just tell you, what are, the first I will call it a lead Scalar we had at a school.

6:42:15
The science class decided to test for lead samples all over the school and had an enormous amount, high level red showing envy.

6:42:27
What does that ruins restrooms.

6:42:31
Are They were alarmed The public water supply, that Fed the school was alarmed and when people who were not high school students and high school science teachers took the samples, it was a very different result late in the afternoon, hot water tabs, where the kitchen and a re circulating pump.

6:42:56
There were all kinds of things that we know, as professionals are not good places to sample because they will distort reality.

6:43:05
So, yes, people take samples all the time, and they don't necessarily know how, but, That's out there, always the AP fans, it's harder to Stanford, to run some basic chemistry, but it's getting much more affordable.

6:43:21
And if you're really concerned, and you have that additional thousand hours between neighbors that you all put together and do a bunch of sampling, uh, you want to control the narrative. You don't want the narrative to control you.

6:43:43
Had a question for reach the chemical constituents of the super loader material in the ion exchange regeneration, train.

6:43:58
It's easy, it's gack carbon.

6:44:02
So they are super those is what they dispose of the cognitive side and into how concentrated material that comes back to it.

6:44:14
But they're running it through extremely slow and so we'll get it in very long time to absorb it into the green activated carbon.

6:44:24
And I say that even though we talk about fast, getting breakthrough very quickly with greater activated carbon, because they run it through at extremely low exposure, they still say they get as much as to merge generally out of that part of your system before they have to dispose of nitrogen carbon.

6:44:47
Hmm?

6:44:50
OK, that is the aim of this training deign to you very much because this was very informative and we've learned a lot about .... I also wanted to say thank you to Andrew and try hydrating for this great black machine. And also, thanks to our sponsors, the United States Department of Agriculture, for sponsoring solid Waste program.

6:45:23
And thank you, everyone, for coming. I hope you learned, as much as I did. And you drive save for those online. Have a wonderful day, and everyone, have a wonderful day.

6:45:42
Thanks for coming up. Now.

6:45:48
Sounds good.