TPWKY - Special Episode Daniel Stone & American Poison

EW: [00:00:00] Hi, I am Erin Welsh and this is, this podcast Will Kill You. You're tuning in to the latest episode of the T-P-W-K-Y Book Club, a series where I bring on authors of popular science and medicine books to chat with them about their most recent work. We have covered some wonderful topics so far this season from important failures in the history of medicine.

To the evolution of human language from how bacteria phases may help us in the fight against antibiotic resistance to the promising future of regenerative medicine. And we've got more books on the horizon to check out what books you may have missed or those will feature in upcoming episodes. Head over to our website.

This podcast will kill you.com and find the extras tab under that tab. Click on the link for our bookshop.org affiliate page, which has a bunch of T-P-W-K-Y book lists, including one for this book club. Make sure you're checking back in on these lists regularly because I am always adding more to them.

If you have any books that you think would be a great fit for the T-P-W-K-Y Book Club, we'd love to hear about 'em. The best way to get in touch is through the contact us form on our website. Two last things before we move on to this week's book, and that is first. To please rate, review, and subscribe. It really does help us out.

And secondly, you can now find full video versions of most of our newer episodes on YouTube. Make sure you're subscribed to exactly right media's YouTube channel, so you never miss a new episode Drop. The 20th century was a time of profound scientific and technological progress from transportation via horse-drawn carriage to transic airplanes, from telegrams to cell phones, from sky high infant mortality rates to vaccines for dozens of previously deadly infections.

Over a mere 100 years, people's lives drastically changed, mostly for the better, but progress comes at a cost. Sometimes that cost can only be tallied in retrospect, while other times it can be predicted and thus preventable. But only if proper action is taken. When Tetraethyl leaded gasoline was developed by Thomas Midgley in the early 1920s, it seemed like a miraculous and inexpensive solution allowing cars to drive faster and farther.

There was just one small problem lead poisoning. While the manufacturers of leaded gasoline insisted that their product was entirely safe, other people like occupational health, pioneer Alice Hamilton knew the truth that if this product was widely introduced, it would lead to a global lead poisoning pandemic.

Despite these warnings, we of course know how the story ends. Leaded gasoline was sold around the world for decades before being banned, harming, untold millions. How this toxic substance was permitted to be used in spite of ample evidence of its dangers carries a powerful lesson for our society today.

In this week's episode, bestselling author and lecturer at Johns Hopkins University, Daniel Stone joins me to discuss the story of leaded gasoline and those who fought against it in his book, American Poison, A Deadly Invention, and the Woman who Battled for Environmental Justice, his compelling storytelling transports readers back to the United States in the early 1920s when it seemed like.

Anything was possible and technology would save the day. While corporations grew very wealthy in the process, stone then introduces us to an unsung hero of industrial medicine. Alice Hamilton, who fights for those who didn't have a voice, who were seen as expendable in the pursuit of progress. In Midgley and his leaded gasoline, she finds a formidable foe and the resulting battle would leave permanent scars on the health of the entire world.

The [00:05:00] story of Alice Hamilton and leaded gasoline, it's difficult to take in knowing how things end, but. It's one that we need to bear in mind given our failure to learn from the past, what will be the next leaded gasoline, the next asbestos, the next radiation. Things viewed as miraculous in their early years, but later found to be dangerous, deadly even.

Will it be microplastics? PFAS or so-called Forever Chemicals. Something else we don't yet know about. Unfortunately, we can't undo the harm that leaded gasoline has already caused, but we can use its story as a roadmap for a better future. I am really excited to share this conversation with you all. So let's take a quick break and get started.

Daniel, thank you so much for joining me today.

DS: Thanks for having me.

EW: In American poison, you tell the story of Tetraethyl leaded gasoline and the woman who fought to bring its negative health effects to light. And you

mentioned that you first came across the story of Alice Hamilton, or at least her name in a footnote.

What made you decide to dig deeper into her story and where did it ultimately lead you?

DS: Yeah, it was a footnote, which is sort of fitting for women of that era, right? To be remembered,

EW: right?

DS: In such a minor way, like that. I teach environmental science and policy to graduate students, and I'm very steeped in environmental history.

You know, what started the environmental movement 200 years ago, a hundred years ago? Who were these big people, these big events that made us start to care about the planet? And I, I teach this every semester and about five or six years ago, I came across a footnote about Alice Hamilton and I said, I've never heard of this person who is this?

And so I Googled her and, you know, read her whole Wikipedia page and I thought, wow, this, she was someone, someone real and someone influential that had completely escaped my view in the field and a lot of my colleagues too. So I dug deeper and deeper. And was continually surprised at the sheer volume of work this woman had done for the benefit of humanity, really.

Um. And got kind of, not entirely forgotten, but certainly not celebrated to the extent she deserved.

EW: She's an incredible, just a truly remarkable person. And her life journey is fascinating because it kind of takes this roundabout way where she didn't set out to become a, that one of the leaders of this new field of industrial medicine.

But yet that is ultimately what she did become. And I am. I'm wondering, you know, if you could tell me more about the origins of this field and why it emerged when it did.

DS: Yeah. I often describe her as the Aaron Brockovich of the early 20th century. A woman who took on very powerful polluting industries and tried to.

Dislodge them or derail them in ways that were dangerous. Sometimes she won, a lot of times she didn't, but she was vindicated over time in all of them. And so

this is a, a woman who was born in, uh, Indiana in 1869, right after the Civil War. She grows up in a very wealthy family among a lot of sisters and cousins who are all taught basically to be helpful.

You know, find your way to help people, whatever. It's go into law, go into medicine, go into teaching, anything that you think could improve someone else's life, not just your own. Her path is through medicine, and she becomes a doctor, which is pretty rare in those days. For a woman, you had to be from a wealthy family to.

Get into medical school and go to medical school. And so she becomes a doctor. Um, and her first kind of twist in her path comes in the 1890s when she's a doctor. But instead of being kind of a wealthy doctor who serves rich people only, she decides she wants to serve the poor and she wants to serve marginalized people, immigrants, people who don't speak English.

And this was very much not done in those days to the extent that there was really only one place that took on this kind of work that had been started by Jane Adams, uh, in Chicago. And it was called Hull House. Hull House was kind of this, uh, this melting pot of cultures and classes. [00:10:00] They called it a bridge between the classes because it was a house where.

You know, people who didn't speak English, people who didn't know how to read, people who needed help getting jobs or their kids getting daycare while they went to their jobs. It, it all sort of happened in this house. We would now call this social work or social welfare work.

EW: Mm-hmm.

DS: Um, it didn't have a name back then, but Alice Hamilton goes in and it's through here that she applies her medical skills and knowledge to helping improve people's lives.

Uh, mostly babies. What gets babies sick. But she also starts to notice that other people in the community are getting sick too. People have coughs, people have stomach issues, and she starts to draw patterns, right? All of the men who have the same kind of like deep cough work in the same factory and all the ones who have like the wrist problems are working in that other factory, and so she draws these kind of patterns that we now call epidemiology.

Back then it was called shoe leather epidemiology. 'cause you'd literally have to go from factory to factory and put these patterns together. And eventually she'd

do enough of this that she would have like a body of research that she would take to that factory or that boss or that industry and say, this thing you're doing is dangerous and here's how, or here's how to mitigate it or correct it.

And that's what started the field called occupational. Hygiene occupational medicine. She really started it.

EW: Tell me more about the primary concerns about working conditions. At the turn of the 20th century, it was not a very safe place, or most, most factories were not a very safe place to work. There was little oversight, you know?

What were some of the prevailing concerns or things that emerged during that time that kind of drove interest in this field?

DS: It was very dangerous to work in a factory and, and very underpaid. You know, there was no, no sense of what we now would call, like workplace compensation or osha or like anyone inspecting anything dangerous.

There were a series of like horrific accidents. There's a, one of the most famous is the triangle shirt, waist factory fire in New York where they locked the doors. And so all these people burned up in, in a building. That should normally have had some safety precautions. Um, but the biggest like storytelling element to this was a book in 1906 by a journalist named Upton Sinclair, who wrote a novel called The Jungle.

We've all heard of the jungle now, and it was very lightly fictionalized, but it was kind of an expose of the packing yards in Chicago and the conditions he describes were. So horrific to the extreme that it sort of woke up. The upper classes in a way that they could just completely close their eyes to this like, horrifying condition before, you know, like men burning alive and people getting their limbs chopped off and falling into vats and getting ground up with meat.

You know, just like stomach churning things that had never before gotten out in, in a big public way. And so this was an era, sort of first decade of the 20th century when people were newly confronting. Horrors in industrialization that had existed for a while, but were sort of newly coming to light.

EW: Right, right. And when Alice begins to dig into this field and she starts to observe these patterns that are coming out, especially in, in certain workers, in certain factories, you know, these, these lead factory employees with these

horrific coughs, she might not have realized that yes, this was a problem that was at least decades old, but.

When it comes to lead, I mean, this is a problem that is millennial old, like it's thousands of years, people have been being exposed to lead and experiencing symptoms of lead poisoning. Could you like briefly take me on a, a tour of like the highlights or low lights of the history of lead and the many ways that we've used it throughout human history?

DS: Yeah. I mean, lead is as old as the planet itself. Uh, it's a, it's an element, it's found on the periodic table. It, uh, existed when the earth was formed, and it also is created when uranium decays. So uranium decays into a, an isotope of lead. So we've had lead for longer than human history by a lot, uh, but we've also had it for thousands of years.

And our use, and one of the most prominent uses or use eras was really the Roman Empire. And this was the time of, again, great sort of innovation. Advances of inventions and the Romans had a lot of things they like to do with lead. Um, lead has these miraculous qualities where it doesn't corrode, it doesn't really break down.

It adds, uh, texture. It adds brighter color, it adds sweeter taste to almost everything. So [00:15:00] the Romans used it not only for their aqueducts and their plumbing. Of course, the word plumbing comes from the word, uh, plume boom in lead. Uh, that is why we call lead PB on the periodic table. Plumbing effectively is named for lead.

The Romans also used it for their cooking utensils. Uh, they used it in the powders on people's faces and makeup. They put it in food to make it taste better. Um, and of course, they put it, uh, in paints or any type of colorization to make the colors brighter. This was a sort of miraculous use. This was the miracle element.

I call it the plastic of its era, right? Yeah. That like you could basically do anything with it. It was transformative, but people started to notice that people who used it a lot started to have these effects, and this is a very long running debate in history of whether lead caused or contributed to, or was a major factor in the fall of the Roman Empire.

EW: What do you think? What's, what's your take?

DS: It is, it's unmistakable that, that the rich people used it most, especially the emperors and many of them. Are very well known to have gone crazy. Yeah, like really crazy. Yeah. Like one of 'em appointed a, a horse as a console or one would be like drooling and all of their, you know, so these effects that we now know are like caused by lead poisoning were seen back then.

Of course there were a lot of other things going on at the time, but. Um, yeah, it definitely contributed, is my opinion. Flash forward, you know, hundreds of years and we see some of these same things repeat, especially in the 19th century here in America. Lead, you know, makes great pipes. It makes, uh, makeup brighter.

It, uh, makes colors on walls and paint even brighter. So we start to basically repeat the same mistakes, um, and start to see the same effects also. Uh, so we have this long history with this same element that what's interesting I think, is it started really with rich people who enjoyed the benefits of lead the most thousands of years ago.

And over time it migrates to basically a, a poison that that is the domain and inflicted upon the lower classes and people who are less seen in the shadows.

EW: Let's take a quick break, and when we get back, there's still so much to discuss.

Welcome back everyone. I've been chatting with Daniel Stone about his book, American Poison, A Deadly Invention, and the Woman Who Battled for Environmental Justice. Let's get back into things. We all know today that lead is a poison, it is a toxin. What are some of the health effects that it's associated with, or some of the symptoms of lead poisoning,

DS: mostly neurological breakdown.

Lead has this effect on cells, where it causes cells to basically atrophy prematurely. Uh, there's a lot of reasons why biological reasons, but it's been poisonous to every living organism for this reason. It affects cellular growth. Um, it chiefly affects the brain, and that's why people start to, you know, kind of slur their words or struggle to keep thought straight.

In some cases, even mild poisoning. We see lack of impulse control. Or struggle to keep emotions, you know, together like all of these effects from very slight exposure up to lead poisoning, which of course can kill you.

EW: Prior to the introduction of Tetraethyl leaded gasoline, which we'll get to, and Alice Hamilton's recognition.

Starting to, you know, Dawn on her, these connections between lead and health, what was widely known, or what was known in medical circles about the toxicity of lead? Was it considered, oh, it might be a little bit bad, or, no amount is safe.

DS: Great question. So lead was a well-known poison even in those days, but there was debate over how much did it take to poison someone, and it was kind of like black or white.

It was like you either didn't have lead poisoning or you did binary. And so there was some number and there was a lot of debate over what the number was. It was like, at what point does too much lead make you go crazy? And as long as you stay under that number. It's fine, you know? Totally fine. And that was like the prevailing scientific opinion in those days.

A lot of debate over what was that threshold? The lead industry argued the threshold was pretty high. Um, other people argued the threshold was pretty low. Today we know that the threshold is zero. There is no amount of lead that is safe.

EW: Mm-hmm.

DS: Even [00:20:00] tiny amounts have some effect on us.

EW: Right. And so now turning to the other main character of the story, which is Thomas Midgley Jr.

He introduced the world to Tetra Ethyl leaded gasoline. When he developed this idea, or this, this product, how much was lead used in the us? Like just trying to get a picture of like, how much did the introduction of leaded gasoline change the, how much lead was used?

DS: We used a lot of lead. Um, certainly not to the degree that we used later. Much more. Um, but yeah, plumbing and paint were the main two uses in the economy, but this was also the time of the industrial revolution where we had a lot of new chemical. Uses, you know, a lot of new elements that were put into use in a new way to spark, you know, chemical reactions or to expedite the way things were made. So lead was not like the dominant thing we used in those days. It was kind of in the background one element of many.

EW: Mm-hmm.

DS: Um, I often think of it like. Like, we use a lot of things today to grow our food and, um, you know, fertilizers, insecticides, herbicides lead was one of those types of things that we used in our industrial machine. Uh, it wasn't the, the worst, it wasn't the best. It just was, it was there. And that's why it didn't really pop out immediately to Thomas Midgley as possible in gasoline. He had, he had to work toward it and, and discover it.

EW: And what is the difference between organic lead and tetraethyl lead? Is there any difference in the health effects or like the way that it seeps into the environment? Yeah, tell me about lead.

DS: Yeah, so LEAD is has two main states, organic and inorganic. Tetraethyl lead comes from an organic state, but the Tetraethyl part is four ethyl compounds that are attached on the sides. And so those are, you know, ethyl is, it is its own kind of compound. When you attach it to lead, what it basically does is it allows lead to dissolve in a gallon of gasoline. So you think of sort of mixing maybe like apple juice and orange juice. You want them to mix evenly together, but if one of 'em can't really mix, it'll just settle to the bottom. Mm-hmm.

EW: Right.

DS: So the, the tetra tetraethyl allows the lead to dissolve and that, that was like the main innovation of it that. Used lead. I mean, lead is still lead, but it, it was evenly distributed and evenly burned, uh, in a car's engine.

EW: Okay. So let's, now let's, let's talk about that development. Like how did Midgley come up upon this idea and, you know, what problem ultimately was he looking to solve with Tetraethyl? Leaded gasoline

DS: cars in those days were the biggest innovation. In maybe human history. They were, they were so exciting. Cars had been invented in kind of like the 1870s and eighties, but it wasn't until the 1890s that people start to see them more on roads. And not until the early 20th century where, you know, you start to see your neighbors buying cars and you could afford a car, and Henry Ford's assembly line cars are rolling off. But the problem cars had was basically a maximum amount of power. That would come from the internal combustion engine. The engine would burn gasoline, but the engines would burn it inefficiently or incompletely. They wouldn't burn all of the gasoline. And so over time you'd get this sort of buildup of residue and what they called

premature combustion. And the problem that did was that, you know, the, the engine can only run so powerfully before it would kind of reach its maximum and, and kind of stall out. This was known as engine knock because when this happened, the engine would make this like loud clinging sound that would announce to everybody on the road, you know, that your car was having this problem.

And, uh, again, it was like a ceiling of, uh, in the growth of car power. And so everyone wanted to figure out this problem of engine knock. How can we innovate our way past this or figure out how to make cars more powerful? And the answer was, we could make gasoline burn better. So how do you make it burn better? Well, the idea was, uh, gasoline has a quality called octane, and that basically refers to how hot it can burn. And in those days, the octane was like in the sixties, low seventies. That was high octane. Today, our lowest octane when you buy gas is 85. Right? So there's like a big, big room for growth. Hmm. And so the idea was to how do you raise the octane of gasoline to make it, you know, burn better? And the answer was, we add something to it, but what do we add to it? You know, what compound, what element, what chemical can we add to it that makes it burn better? And so this was what was really the goose [00:25:00] chase for Thomas Midgley. He was a chemist. And he wanted to be the one to solve engine knock. And so he goes to work in his lab and he tries all sorts of, you know, anything that's lying around. He tries, you know, iodine, he tries chlorine, he tries, you know, pure hydrogen, anything he can, and some of 'em work better than others. He has this test engine that he feeds everything into and sees how they run. You know, when he puts these things in. And he tries really smelly compounds. He tries really expensive ones. He, he tries, you know, two of them mixed together. And, um, it's really a goose chase. That's how he describes it. Um, and he's looking at the periodic table. And trying to figure out what will work and what won't,

EW: but that he's just like tracing down the elements, like, Hmm, we'll see. Process of elimination.

DS: Yes. Although, you know, the periodic table, the way it's arranged, of course, is by quality. So, you know, if you look at what kind of worked in one row and, and compare it against what kind of worked in another row, it's like a treasure map. You could kind of like guess which direction you need to go. And so this took almost three years for him to run through everything. And, uh, finally he gets, in 1921, he gets to lead, uh, and he tries it with this tetraethyl component to it. And it works right? And it works. Wow. It really works. And then he tries to reduce it. How much, you know, what's the minimum amount we need? And it, it's a very small amount. It's basically like a drop into a gallon

of gasoline. Very small amount. Mm. Now what's interesting here is there were other compounds at the time. That could also eliminate engine knock. And the, the most well known of all of them was, uh, ethanol, right? Ethanol is like alcohol basically. Uh, you know, you put a little bit in it, it increases the octane and engine knock goes away, but ethanol comes from like cells. So you need it from like wood, you know, pulp or. Plants that are, that are, you know, burned in the field or whatnot, and there just wasn't enough of that stuff. Now, we could've made more of that stuff, but the other problem with ethanol was that you couldn't patent it because everybody could make ethanol on their farms. You couldn't file a patent on ethanol. So that's why Midgley and his bosses at General Motors are not interested in pursuing ethanol at all. And when Tetra Ethyl LED works, they're ready to pursue that and market it as as much and as fast as possible.

EW: Oh God, that's just like such,

DS: isn't it depressing?

EW: It's so depressing. I mean there, there are so many elements, but it's like, oh, here are some other options that maybe don't lead to widespread poisoning. But because there were voices warning about the dangers of lead or leaded gasoline at the time, and midgley himself. Experiences lead poisoning and yet this doesn't really seem to alarm him or make him take a step back and go, whoa, this might be bad on a wide scale. Why is that? And is the answer just capitalism? Like Yeah,

DS: that's one. It's a big reason. But Midgley kind of had this interesting thing happen to him, and you just alluded to it in 1921. You know, he had been working with Lead Now for like six months every day in the lab in large quantity, and he gets lead poisoning. Right. And, and he, uh, you know, feels the effects in his wrists and in his breathing and his brain. And, uh, he has to go down to Florida to recover, you know, in the fresh air for months. And this is very well known. It's not like a secret either. And he's writing letters back to his bosses saying like, you know, I had too much lead. I need to, I need to, uh, recover. But one reaction could have been, wow, this has gotten outta hand. Like, this is clearly a poison. We should. Stop and do something else. But his reading of the situation was, well, I work with lead every day. Of course I got lead poisoning. You know, I, it's like I'm a, I'm a fireman who works in a burning building. Of course, I'm the first to get burned, but everybody else who works in making this stuff or burning it in their cars. It's gonna encounter it in such small quantities, much smaller, that they won't have nearly the effects that I did. So that's how he does these sort of mental gymnastics to rationalize, oh,

and by the way, it's gonna make us a lot of money too. We just have to be more careful to make sure that I or no one else gets sick again.

EW: Let's take a quick break here. We'll be back before you know it.

Welcome back everyone. I'm here chatting with Daniel Stone about his book, American Poison. Let's get into some more [00:30:00] questions. As you mentioned, he, like his goal in life was to be an inventor, and if this is his invention and the thing that he is valued for, then suddenly it's like, oh, actually this is going to harm more people, and it's wrapped up in his identity, like he's not gonna wanna reject that.

DS: No, it, it was very much a runaway train kind of situation. I mean, he had invested so much time, so much effort and you know, his, his reputation was wrapped up in it succeeding. So. It's hard to get off a train moving that fast once it leaves the station.

EW: Yeah. Yeah. And once it was introduced, tetraethyl leaded gasoline, really just enjoyed instant popularity, right? It was like everyone loved it, but then there, there were some hiccups along the way. In 1924, you tell the story of these, like these lurid reports that came out about these five workers in New Jersey. Who died from extreme lead poisoning and it was this incident that ultimately got Alice kind of involved in the fight against leaded gasoline. Can you tell me a little bit more about the context of that story and the effect that it had?

DS: Yeah, so leaded gasoline was very popular. The, you know, when it was released, because it came with this great technological leap, not only would it solve engine knock, it would allow your car to be more powerful. It would allow you to travel further and faster. I mean, it was kind of one of those like, you know, a big advance in your iPhone, like these days that like, it, it doesn't seem like there's any downside. It's great, you know, it makes life better.

EW: Mm.

DS: And it wasn't until 1924 when, uh, as you mentioned, uh, these, uh, four men, five men in New York work in a manufacturing plant that's making large quantities of Tetraethyl lead and they go. Vividly insane. And this is like the, the, the wording of, of the reports at the time when these men would like go crazy at work, you know, start fighting with people or acting like wild animals and then like, you know, they'd put in, be put into straight jackets and hauled away to an asylum, right? Like that's what they did in those days. But because it

was New York. And because all of these men died, uh, the media environment was so like ravenous there for a story and for what seemed like a conspiracy or a great big mystery. No one knew why these men went crazy. No one knew what they were working with. So these reporters hounded it for days and days and days, and all of their reports get syndicated out to papers in the country. And so everyone starts to worry. What were they working with? And when it comes out that they were working with Tetra Ethyl lead that was being put into gasoline, you know, a lot of people said, oh my God, you know, could I be next? Could this happen to me? And so it led to this great reckoning of is this too dangerous? And the government got involved and Alice Hamilton very much led the effort that, yeah, we've known for thousands of years. Lead is dangerous. And this is not an exception, this is a bad idea. And the industries should. Find something else.

EW: Why do you think that story marked a turning point for her?

DS: Well, she was used to inspecting industries and factories and finding sick men all the time. I mean, she had been doing this for almost 30 years at this point. What, what was different here was that it became such a big media story. So what had traditionally been sort of the domain of scientific journals and small reports. And, you know, her reports for, you know, state governments had suddenly become a national media storm. She also realized that unlike, you know, the work she had done in factories that, you know, she could see men getting sick from maybe not wearing gloves or not wearing masks, or, you know, working with dangerous chemicals. Something like tetraethyl gasoline had the potential to affect everybody. Right. I mean, this was, this was a problem that could affect millions and possibly billions around the world if it wasn't kept in check or regulated early.

EW: Alongside this reaction from Alice, what we see with this story that is kind of remarkable is the, is how the companies responded. And just like this, you, you, you kind of talk about this period of time, not just to this story, but to the story. The, these early warning cries about the dangers of tetraethyl leaded gasoline in these businesses that are producing at Ethyl mainly. Saying, oh, there's no problem with this whatsoever. Like, it becomes not just like a defensive campaign, but just almost like an aggressive like, stop hassling us about this. These are lies. Just a really no accountability whatsoever where they, among the first to kind of [00:35:00] utilize this corporate denial.

DS: Yeah, I mean, this was an era in American history when business was booming, right? This was the 1920s when. Everything was growing and everything was exciting and businesses and culture and fashion and dancing and

you know, everything was sort of happening at the same time. And so, you know, an American company especially one that was succeeding and making a lot of money and making people's lives better, you know, the effect of the government on a company like that, you know, it's not just that the government couldn't really do much, but they also didn't want to. Hmm. Uh, they didn't wanna, you know, get too deeply involved and pull everyone back. So, you know, there's kind of a lack of regulation to begin with, but there's also this public relations, uh, campaign also where Ethyl, because they're making a lot of money selling Ethyl gasoline, starts to engage in pr. Um, and some of the earliest form of corporate PR engage, you know, happens in this story where. You know, they try to explain to people, well, you know, actually you're not working in a factory, so you're only gonna encounter a much smaller amount of this stuff. It's like, you know, less than a drop per gallon. Uh, it's gonna be burned up entirely in the engine. Nothing comes out dirty. Don't worry. And this gets at the question of whose job is it to disprove that? Yeah, the industry is not motivated, you know, certainly does not have the incentives to diminish its own success, but also whose job is it then to be skeptical or to find counter evidence or to create counter evidence with scientific studies. And that was also a problem that was new in this era, that the, the burden of proof really fell to the public.

EW: Yeah. And you know, part of part of the reaction to that was Alice Hamilton and colleagues kind of coming together and going, we have a problem with these, these, you know, corporate produced studies showing that leaded gasoline is perfectly safe, and it's wonderful and no problem whatsoever. And. They, you know, they're pointing out the flaws. Ultimately, as, as you mentioned, the US government gets involved and there's this, this conference where the US surgeon General calls together. Everyone a little bit, seems a little slightly biased towards Ethyl. And, uh, the outcome ultimately was that a committee should be formed to conduct like one more study. All right, one more study. Let's see. Is leaded gasoline safe or not? Tell me more about. The outcome of this study and some of the problems to begin with, just leading up to whether this was actually a study that could do the job that it was, you know, commissioned to do essentially.

DS: Yeah. So this conference in May of 1925. Was really thought to be the end of the argument, right? Let's get everybody in a room on all sides of this matter and figure out what's right, what's wrong, and what we should do from here. Very nice idea. Right? And so the surgeon General brings everyone together and he arranges this conference, but he arranges it kind of selectively, where instead of like, you know, a trial where like the prosecution goes first and then the defense. Defends itself. He allows Ethyl, which is really the defendant in this case. It's not a trial, but the defendant to speak first and they, they kind of

filibuster the whole morning with all of their corporate favorable information and their corporate studies and anything they can say to promote it. And that leaves all of the doctors and the scientists and the opponents of this idea, like Alice Hamilton to go in the afternoon.

And so not only were they sort of diminished in the structure of the conference, but Alice Hamilton is also further diminished as a woman among these male scientists at this conference. So she doesn't really speak till the very end. So that alone stacks sort of what, what comes next. And as you mentioned, you know, the idea is let's have one more study. That's conducted by professional scientists who are not engaged with the industry at all, which is also a very nice idea. But, you know, ultimately there's not a lot of funding for this kind of study. The scientists who are asked to do it, they don't have a lot of time outside of their jobs. So this study that normally should be, you know, take two to three years, really be done across the country and involve a lot of people. You know, sampling a, you know, control group, what whatnot is really crammed into like four months and looked at just kind of one little factor, um, that at the end is not, you know, positive or negative, but is inconclusive. And inconclusive ultimately means there's no evidence that it's dangerous and so inconclusive means it's safe, [00:40:00] and that's how it's sort of steered by the industry outside of that review.

EW: With the this inconclusive results of this study, then leaded gasoline essentially gets the aok, not just in the US but really around the world. So how did leaded gasoline end up a across the entire globe, despite the fact that it was known to be a toxic substance? Yeah,

DS: well, once it sort of got out of that government review without any major blemishes and which was spun into it being completely safe, yeah. That stamp of approval from the government effectively was its credence around the world. And so foreign governments basically said, oh, the US government did a review of this. They didn't find it was dangerous, so we'll take it too. And they wanted to sell it in other countries because. The same reason here. It made cars more powerful. It solved this big problem. Ethyl also underpriced it, or they started to reduce the price of it over time so that more and more people would use it. This volume play eventually until kind of the early 1930s when Ethyl gasoline, this brand name is just becomes gasoline and gasoline almost everywhere has tetraethyl in it without it even being in the name.

EW: It's, it's, it's chilling, but of course we don't have leaded gasoline today. And there were some pretty incredible like steps. The, the story that you tell of the recognition of just how widespread lead like the distribution of lead is from

leaded gasoline, tell me about Claire Patterson and how his search for the age of the Earth ultimately uncovered lead contamination on this global scale.

DS: This is a wild story. So after Ethyl gasoline sort of blankets, its way across the country and eventually the world, it's just everywhere. And it is for a few decades until the 1950s when this scientist at Caltech in Los Angeles, his name's Claire Patterson, he's a geologist, a geochemist, so he's not really related to industrial chemicals at all. But his goal in his doctoral dissertation is to find the age of the earth. He wants to discover how old the earth is. No one's ever known. It's, it would be a huge breakthrough in geology. And so he undergoes to try to date uranium and uranium breaks down into lead. So if you could sort of take an ore of uranium, or I'm sorry, of lead and count, you know, how, how much of the element uranium is still in it. You can sort of work backwards and try to date the earth that way by comparing it to the rate of decay. And so he starts to do this and he has a mass spectrometer, which he uses and, you know, to, to look at chemical elements and, and, and samples. And he tries to get a reading and he can't get a clear reading because it's too noisy. That's what they call it when there's too much, you know, stuff in the sample that, that obscures what he's trying to see. Too much, too much noise. So he started, okay, I need to clean up my lab. So he starts to clean up his lab and scrub this and scrub that and make sure all the samples are clean and there's still too much noise. Like a lot of noise, and most of it's lead. And he can't figure out why. And so, you know, eventually over time, he spends years doing this. He has his whole building repi with non lead pipes. He removes the gaskets from his windows. Anything that might include just a tiny bit of lead. And you know, he starts to restrict who can come in the lab and what they have to wear and hazmat suits, whatnot.

And eventually he gets a clear reading. And Claire Patterson is the man we can thank for dating the Earth to 4.5 billion years old. That was his finding. Today. We think of it like 4.6, but it was very close. So after he makes this breakthrough in the field of geology, he starts to wonder, why was there so much lead in all these noisy samples? Where's all this lead coming from? And there was actually a pretty easy way to find out. And he goes to Greenland. And in Greenland you could take ice cores and ice has a way of forming by year. So like in the winter, the snow falls in the summer, you know, there's like a layer of dust. And then the next winter, more ice, next summer, more dust. And so you could really see year by year changes in the atmosphere. And he looks at all the cores and he goes year by year. And he discovers that all this lead. Really started in 1921 and it wasn't hard to piece together. What happened in 1921? It was the, the release, the, the creation, and then eventual release of Tetra Ethyl leaded gasoline.

EW: I mean, what a sobering moment to see that just night and day like just this tremendous rise and. The implications of that are, were also huge. And when did that [00:45:00] sort of, the, the widespread health implications of this global lead contamination, when was that realized and when did that then translate into, okay, we have to do something about leaded gasoline now?

DS: Yeah, so, uh, he sort of passes the baton in a non-official way to a, a pediatrician, a doctor who works with children named Herbert Needleman. Worked in Philadelphia, worked with kids, and he noticed, you know, a, after this sort of lead disclosure is made about how much lead there is in the world and where it came from. Herbert Needleman notices that there are children that work near his, that play near his clinic, that have these weird neurological effects, right? Like they, they're really tired, really lethargic. They don't want to play, they don't, you know, they don't behave like, like kids normally would. And so he starts to wonder what's going on. And normally in this case you would, you know, the best thing would be to inspect their bones, take biopsies from their bones, and see how much lead was in them. You can't do that with kids or really with, with anyone you know, with too many people. But he decides to collect baby teeth. You know, teeth have lead accumulation also, so he starts to offer like a silver dollar to any kid in Philadelphia who will give him one of their teeth that falls out.

And he collects a lot of them. And it's here where he starts to find these jaw dropping patterns of lead exposure that children who lived on busy roads had much higher lead in their bow, in their teeth than children who lived elsewhere. And this. Started to yield other discoveries, like children who had high ed exposure were also much harder to keep focused in class. And as they got older, these kids were more likely to engage in reckless behavior. And so over time, this body of research grows and the same patterns are found all over the country and effectively the world that counties with high lead exposure, you know, have higher crime. Then ones with low lead exposure, and as lead changed, uh, over time, so did crime loosely change with it. And so you have this, uh, connection, a, a relationship between lead and crime, lead and reckless behavior that today we now know as the lead crime hypothesis in criminology.

EW: Was anyone ultimately held accountable for the widespread use of leaded gasoline?

DS: No. No one ever. Um, not in a court case. No one has ever gone to jail for any of it. What effectively ended Ethyl gasoline and leaded gas entirely was not regulation. It wasn't this, you know, budding environmental movement. Not even these discoveries about its danger. It was a new innovation entirely. Uh, it

was a new innovation put on cars starting. Uh, in the 1970s, known as the catalytic converter, right? We all have them now. Um, and it would reduce the emissions of all sorts of bad, you know, pollution and, and gases that would come out. But lead would gunk it all up so no one wanted lead in their gasoline anymore because it would mess up their catalytic converter. And that alone was enough to dramatically reduce the amount of lead. And Ethyl Corporation tried to fight the catalytic converter, as you would expect, of course. But you know, and they disrupted the market in the 1920s with their innovation, and were eventually disrupted themselves 50 years later by another.

EW: It's the Law of Nature.

DS: Yes.

EW: Um, I, this, there's, this isn't really part of the story, but I do just wanna ask you to tell me a little bit more about Midgley's other, uh, tragic invention that would then just, his, his legacy is kind of ridiculous. First let gasoline and then chlorofluorocarbons.

DS: Yeah. Yeah. So, uh, Thomas Midgley's very celebrated after he discovers ethyl gasoline. I mean, it's. It's not only transformative to the auto industry, but everybody loves it. And every little royalty, even 3 cents on every gallon of gasoline, make General Motors hundreds of millions of dollars. So he's a very wealthy man in that, on that score, he's also still a really good chemist. He's really good at hunting and pecking and finding, you know, chemical solutions to the world's problems. And one of the big problems in the 1930s was refrigeration. Um, which effectively is the same as air conditioning. It's the same technology. Refrigeration works in this kind of like chemical circle where you evaporate a gas that gives off cold air and then you cycle that gas back through, you turn it into a liquid so it could evaporate again and just keeps cycling through. But the gas is kind of really important to get the right one. And we didn't have the right one until the thirties. And so Thomas Midgley decided he was gonna find the best refrigerant gas. And It takes him [00:50:00] not long at all, I mean less than a week to basically hunt through his periodic table, discover it, um, and it's the gas that eventually became known as freon um, refrigerant 1 34 A. The effect is transformative. I mean, this affects refrigeration, changes air conditioning, refrigeration alone, you know, helps keep medicine and food safe much longer. It extends the human lifespan. I mean, these are enormous advances. But freon and the chemicals in it, uh, also cause a slow erosion of the ozone layer. And we don't really know this until decades later when someone's, you know, some British scientists are like, why is there a big hole above Antarctica? What's going on? And they trace it back to

is one of the compounds in, uh, Freon known as chlorofluorocarbons. We call them CFCs. Uh, that, that destroy the, some of the, the elements up there. And eventually we reign it in and we eliminate the use of, of Freon in that same form. Uh, and the ozone layer is actually on, on pace, I think, to close within the next like two or three decades. Uh, but still it's a dramatic and, and horrifying. Effect and, and damage done to the planet. And it's sort of striking that the same guy, one guy, did both of these things, leaded gasoline that poisoned millions of people around the world. It's uncountable how many were affected, at least in some way by leaded gasoline. And al also the hole in the ozone layer. Um, I think, um, new Scientist magazine while I was researching, they call Midgley the single most destructive organism in the history of the planet.

EW: I mean, I, yes, yes, it is. To compare like that, his legacy. With Alice Hamilton's, it's a very striking legacy difference there. Like what impact do you leave on the world? And, uh, I, I kind of wanna like bring this full circle by talking about today. You know, the, the story of leaded gasoline is one that is familiar, right? And, and some of the elements are very familiar where there's this. Negative health effect. It's ignored for a long time after people like Alice Hamilton push for the truth to get out there. Finally, something is done about it. You, you know, things like asbestos, radiation, arsenic as chlorofluorocarbons, tobacco, you know, other toxins. Once HAI as miraculous, then are seen as harmful. Where do you think that this is playing out today? Like, have, have we learned any lessons?

DS: Oh, I mean, it's everywhere. Today. This is a very common cycle. You know, we saw it not only with leaded gasoline, but with cigarettes, um, industrial pesticides. You know, we see it today with a lot of microplastics. I think we've, we've kind of been overindulgent in how we've advanced the use of plastics and put them in everything.

Uh, that we'll probably reign in or regret later. We also have pfas, the so-called permanent chemicals, forever, chemicals that are used in almost every consumer product now that, again, make life better, easier. They're exciting, and also, you know, linked to health effects and general pollution of the planet.

Um, there's also non-industrial things that I, I think we'll also look back on with a measure of regret. One of the big ones, I think is social media, right? Which has like, transformed the world and, and benefited all of our lives in a lot of ways. But I think 50, 100 years from now, we'll look back and say, wow, that was done very fast, very recklessly with not enough guardrails and, you know, really affected not only a generation of teenagers, but.

You know, also changed our discourse, our politics, our governance, our economy in, in ways that maybe we'd have done differently. So I think there are all these things that are being tested in real time on the public, uh, which in many ways are, you know, how things happen, how innovation happens, but without sort of the close.

Supervision and watchful eye of a responsible party and, you know, a sense of regulation, these things could get outta hand. And the story shows us, you know, kind of a parable of what happened.

EW: Uh, if only we could just make sure that we listen to it. And, and he, you know, use, use history as a guidance to things that we don't have to repeat to learn.

Again, these lessons over and over again.

DS: I, I think there are Alice Hamilton's all around us at the moment who are trying to warn us. Many of them are screaming at the top of their lungs, like, stop, don't do this. But, you know, they're working in a very complicated ecosystem of ideas, of technology, of innovation, uh, with many [00:55:00] competing interests and incentives, and it's a very hard case to make.

So time is usually what makes the cases, uh, stronger and more clarifying.

EW: Well Daniel, thank you so much for taking the time to chat today. This was so enlightening. I mean, this story is, is depressing, but also there are moments of hope that I think are really important, so thanks.

DS: Thanks Aaron. Thanks for having me.

EW: A big thank you again to Daniel Stone for taking the time to chat with me. I still can't get over the story of leaded gasoline and Midgley and Hamilton and just, ugh, the legacies that we leave behind. If you enjoyed today's episode and would like to learn more, check out our website. This podcast will kill you.com, where I'll post a link to where you can find American Poison, a deadly Invention, and the woman who battled for environmental justice, as well as a link to Daniel's website where you can find his other incredible work.

And don't forget, you can check out our website for all sorts of other cool things, including but not limited to transcripts, quarantining, and placebo reader recipes, show notes and references for all of our episodes. Links to merch, our

bookshop.org affiliate page, our good reads list, a firsthand account form, and music by blood Mobile.

Speaking of which, thank you to Blood Mobile for providing the music for this episode and all of our episodes. Thank you to Liana Sci and Tom Bry Fogel for our audio mixing. And thanks to you listeners for listening. I hope you liked this episode and our loving being part of the T-P-W-K-Y Book Club, a special thank you as always to our fantastic patrons.

We appreciate your support so very much. Well, until next time, keep washing those hands.