

KEYNOTE ADDRESS

MAY 14, 2018 7:00-8:30

MS. CARLY LETTERO: Before we get started I would just like to remind you to silence your phones and also ask that you not take photos this evening during the keynote.

And before I tell you a little bit about the Tribunal and introduce Sandra Steingraber I would like to begin by acknowledging that Corvallis is located in the traditional territory of the Chepenefu or the Mary's Rivers Band of the Kalapuya. And after the Kalapuya Treaty in 1855 Kalapuya people were forcibly removed to what are now the Grand Ronde and Siletz reservations.

Jan Michael Looking Wolf is an enrolled member of the Kalapuya Confederated Tribes of Grand Ronde and he's also a world renowned Native American flute player. When he heard about Sandra Steingraber's work and the Tribunal he offered to compose a song for this evening along with Dana Reason who is a composer and musician and good friend of the Spring Creek Project.

And so we've invited Jan and musicians to debut this new song this evening and they have generously offered to donate all the proceeds of this song, which they've already mastered, to help with the
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1 fight against fracking.

2 The song doesn't have a name yet so I invite
3 you, while you're listening to it, to imagine what you
4 might name it and then tomorrow on social media we'll
5 ask for your suggestions and pick one of them. So I
6 would like to welcome our musicians [Applause].

7 MR. JAN MICHAEL LOOKING WOLF: How is
8 everybody doing? Good?

9 The song is a beautiful song but it's actually
10 an hour and a half long. So most of tonight will be
11 this song.

12 I just want to say my name is Jan Michael and
13 here I'm here with Dana and Ryan Biesack and Keith
14 Summers. And, Carly, it's an honor to be here for this
15 event. We really enjoyed writing this song and
16 recording it.

17 And, you know, I am half Irish. My mom is
18 5-ft tall and she's almost full-blooded Irish and my
19 dad's like 6'3 and he's native of this land.

20 Like she'd mentioned I'm Kalapuya, Santiam
21 Kalapuya. I actually speak my own language and I just
22 want to introduce this song by saying that for us the
23 inspiration was water.

24 Water for all people of the world is so
25 important. We're not the only indigenous people here.
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1 I mean we're all indigenous. You all have indigenous
2 ancestors who came from a thing called oral tradition.
3 That means there wasn't a written language.

4 So we all go back to time immemorial from an
5 indigenous person who really understood and respected
6 how to properly use water. Water is so important.

7 Just as I've introduced this song there's been
8 two to three children who aren't with us now because
9 they didn't have clean water. But we're here tonight
10 and it's beautiful and tonight we play this song for
11 them, we play this song for Carly and we play this song
12 for the cause. Thank you.

13 [Song performance] [Applause].

14 MS. CARLY LETTERO: When Jan and I were
15 corresponding about that song he wrote in an e-mail
16 thank you for your commitment to Mother Earth and all
17 who stand on her, swim in her water and fly in her sky.

18 And I thought that was such a beautiful thank
19 you and I would like to extend that same thank you to
20 all of our musicians this evening.

21 How many of you got a chance to go upstairs
22 and check out the Pop Up Art Gallery? Awesome.

23 Well, this show, Unsilenced: Art And Sounds of
24 Resistance, will be open after we wrap up here until
25 about 8:30. And so I invite you to check it out after
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1 the keynote if you haven't already.

2 They are going to breakdown a few things here
3 while I keep us going.

4 There are posters and sound submissions from
5 Corvallis and from across the U.S. in the gallery
6 upstairs and there is a listening room integrated into
7 the gallery. And I would like to thank Jason Fick and
8 Dana Reason and Allison Johnson and Mike Gamble and
9 Melody Owen for conceptualizing and collaborating on
10 that project.

11 I'd also like to thank Melody Owen, who is a
12 student in the Environmental Arts and Humanities
13 graduate program for curating the poster show and
14 curating the exhibit that was right around the corner in
15 this wonderful little gallery. If you haven't seen it
16 yet this CEI's Art Works Gallery and that was hanging a
17 week before this evening.

18 I would also like to thank our local
19 incredible bookstore, Grassroots Books & Music and
20 Sierra is here with books. She'll be here after the
21 keynote and Sandra will be right here signing and so,
22 hopefully, we'll have a nice flow there.

23 I would like to thank the Ceres Trust for
24 helping to bring Sandra Steingraber this evening to
25 Corvallis.

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1 For many people the concept of a Tribunal is
2 vaguely familiar and so I thought I might begin by just
3 introducing it a little bit.

4 In the very late 1960's and early 1970's a man
5 named Lelio Basso testified at tribunals about human
6 rights violations in Vietnam and in Latin American. And
7 after those tribunals he thought it would be a really
8 good idea to establish a Permanent Peoples' Tribunal.
9 And his vision was that a Permanent Peoples' Tribunal
10 would serve as an instrument and also a platform to give
11 recognition and visibility and voice to people suffering
12 violations of their fundamental human rights.

13 And so nearly 40-years later the Permanent
14 Peoples' Tribunal, which is based in Rome, has held 44
15 sessions all over the world. Most recently in London on
16 Myanmar's crimes against the Rohingya and Chetnians
17 peoples.

18 So anyone in the world can propose a session
19 to the Permanent Peoples' Tribunal and that's exactly
20 what a very small group of people did about four years
21 ago. In early 2014 Tom Kerns and Anna Grear and Damian
22 Short came together to petition the Permanent Peoples'
23 Tribunal to take on fracking and climate change.

24 And that petition convinced the Permanent
25 Peoples' Tribunal that there were potentially grave
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1 violations of human rights happening because of fracking
2 and climate change and so they decided to devote the
3 45th Tribunal to that topic.

4 It's been a really busy couple of years since
5 then. Four pre-tribunals were conducted, two in Ohio,
6 one in Virginia and one in Australia. More than 200
7 witnesses have testified. There have been 17 Amicus
8 Briefs submitted by 14 attorneys and 20 non-
9 governmental organizations in seven countries on five
10 continents.

11 All of those people, in some way or another,
12 are scheduled to testify and speak this week before a
13 panel of 10 judges who are from six different countries.

14 And this session of the tribunal is historic
15 for a number of reasons. The Permanent Peoples'
16 Tribunal has had sessions on environmental issues in the
17 past, including in Chernobyl or about Chernobyl and
18 Bhopal but this is the first time that they're taking on
19 an environmental issue that is as wide-reaching, that
20 can affect everyone of us who lives on earth now and in
21 the future.

22 This session is also historic because it
23 expands the scope of the Permanent Peoples' Tribunal for
24 the very first time to include arguments about the
25 rights of nature in addition to the rights of humans.
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1 And for the first time the entire Tribunal is
2 on-line, which is an inclusive format that the Tribunal
3 is excited to try out because it gives people from
4 around the world the opportunity to testify and also to
5 follow along.

6 And so it's really been an honor for the
7 Spring Creek Project to co-organize the Tribunal because
8 it so closely aligns with our commitment to working on
9 the most urgent and daunting environmental issues of our
10 time.

11 And the format is something new for Spring
12 Creek Project but at its core the Tribunal is about
13 story telling. The Tribunal offers people from around
14 the world the opportunity to tell their stories. It's
15 courageous story telling and the Spring Creek Project is
16 really proud to support it.

17 And so throughout the week attorneys will take
18 these courageous stories and along with scientific
19 findings they are going to weave them into arguments
20 that they are going to present before this international
21 panel of judges that has been appointed by the Permanent
22 Peoples' Tribunal.

23 And then after the Tribunal the judges are
24 going to convene, probably for a few months, and write a
25 judicial opinion about if and how fracking constitutes a
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1 breach of human rights. And that judicial opinion then
2 can be used by peoples and communities around the world
3 to change the conversation about fracking and climate
4 change and thus change the policies and laws and norms.

5 And in this way the Tribunal offers an
6 international stage for story telling to be
7 transformational. And that is exactly what Spring Creek
8 Project is dedicated to doing to telling stories that
9 have the power to shift the trajectory of environmental
10 devastation toward a future that is just and restorative
11 for all living beings.

12 And so throughout the week each session of the
13 Tribunal is going to be available on Spring Creek
14 Project's youtube page and Facebook page.

15 I also just learned that the Unitarian
16 Universalist Congregation is going to be showing a
17 viewing of the tribunal. And so if you want to sit with
18 folks and watch it they're going to be open every day
19 and you're welcome there.

20 Spring Creek Project has also been hosting a
21 series of lectures called the Bedrock Lectures on Human
22 Rights and Climate Change for the last 16 weeks leading
23 up to the Tribunal and those are available on our web
24 site and youtube page.

25 If you would like to learn more about Spring
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1 Creek Project I invite to join our mailing list in the
2 lobby.

3 Sandra Steingraber is often quoted for saying
4 that we are all members of a great human orchestra and
5 it is now time to play the Save The World Symphony. You
6 do not have to play a solo but you have to know what
7 your instrument is. What instrument you hold and find
8 your place in the score.

9 And this evening and the Tribunal are possible
10 because so many people have found their place in the
11 score.

12 Over the last few years dozens of people have
13 volunteered thousands of hours behind the scenes to make
14 this Tribunal happen. And I especially want to thank
15 Tom Kerns, who was one of the three people who
16 originally petitioned the Permanent Peoples' Tribunal,
17 for really his unwavering dedication to making this
18 happen for the last four years. It simply wouldn't have
19 happened without his willingness to step out of his
20 comfort zone again and again and to just forge ahead.

21 I also want to thank Kathleen Dean Moore who
22 many of you know is a great writer and philosopher.
23 She's also a great connector and she first brought the
24 idea of the Tribunal to Spring Creek Project.

25 I want to thank Gianni Tognoni, who is the
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1 Secretary General of the Tribunal and has been with us
2 every step of the way and also Simona Fraudatario who is
3 the Coordinator of the Tribunal in Rome.

4 And special thanks to the graduate students in
5 the Environmental Arts and Humanities Program who have
6 helped conceptualize and run the Tribunal in the months
7 leading up to it, really the year leading up to it, and
8 also this week.

9 And finally a really deep thanks to my Spring
10 Creek Project staff, Shelly Stonebrook and Emily Grubby.
11 It's a small daily miracle to work with people who are
12 so hopeful and good and joyful. So thanks for every
13 detail.

14 Sandra Steingraber is the really the perfect
15 person to Keynote the opening session of the Tribunal
16 because she has been a courageous story teller for
17 decades. She's an ecologist, a cancer survivor and an
18 author who explores the links between human rights and
19 the environment.

20 Her work focuses on chemical contamination,
21 climate change and fracking. She's the award winning
22 author of three books including the acclaimed Living
23 Downstream, Having Faith and Raising Elijah.

24 She's been featured in two documentaries,
25 Living Downstream and very recently Unfractured.
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1 She's received many honors for her work as a
2 science writer, including in 2011 a Heinz Award. And
3 that award came with a \$100,000.00 cash price that she
4 donated to the anti-fracking movement.

5 And then a year later she then become the
6 cofounder of New Yorkers Against Fracking, which is a
7 state-wide coalition of more than 280 grassroots
8 organizations. And she cofounded Concerned Health
9 Professionals of New York and serves as a science
10 advisor to Americans Against Fracking.

11 Her work has been featured all over the place,
12 in many publications, and she's earned what I think are
13 some of my favorite nick names for a writer because of
14 that. Rolling Stone has called her the Toxic Avenger.
15 And Sojourner Magazine has called her a "poet with a
16 knife". She's been named Woman Of The Year by Ms.
17 Magazine and Person Of The Year by Tree Hugger and one
18 of 25 visionaries who are changing the world by the Utne
19 Reader.

20 She's a recipient of the biennial Rachel
21 Carson Leadership Award and she recently edited the
22 book, Rachel Carson: Silent Spring and other Writings on
23 the Environment, which is a really beautiful edition that
24 was added to the Library of America this year. It just
25 came out but you'll want to check it out when you can.
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1 She is a contributing essayist and editor at
2 Orion Magazine and a distinguished scholar and resident
3 at Ithaca College in New York.

4 So please join me in welcoming Sandra
5 Steingraber. [Applause].

6 DR. SANDRA STEINGRABER: Thank you for
7 that amazing introduction. A spot for all my audio
8 visual aids up here.

9 What an honor to serve as the opening Keynote
10 Speaker for the historic Permanent Peoples' Tribunal
11 Session on Human Rights, Fracking And Climate Change.

12 This is a convocation many years in the
13 making. Bravo to our hosts the Spring Creek Project and
14 Oregon State University here in Corvallis for bringing
15 us together in this elegant White Side Theater and by
16 live-streaming around the world.

17 As with so many good ideas this week long
18 series of hearings was inspired by the actions of an
19 extraordinary individual, the philosopher and ethicist
20 Dr. Tom Kerns who I hold in highest esteem.

21 Thank you, Tom [Applause].

22 As you've heard the Permanent Peoples'
23 Tribunal is an august international forum. Its origins
24 story is as an investigation of human rights breaches
25 during the war in Vietnam.

1 Since then its hearings have examined
2 abridgments of human rights standards in Bhopal, India,
3 in the Ukranian city of Chernobyl and most recently
4 among the Rohingya and Chetnian refugees of Myanmar.

5 Today we've begun an exploration into the
6 potential human rights violations of a newish technology
7 called unconventional high volume hydraulic fracturing
8 combined with horizontal drilling, so called fracking
9 for short.

10 Fracking is what the industry calls it and
11 fracking is what the enemies of that industry both call
12 it.

13 Fracking is a technology developed at the end
14 of the 20th century in sparsely populated western
15 regions of the United States using public money from
16 taxpayers.

17 In a line fracking turns fresh water into a
18 poisonous club to smash apart shale bedrock in order to
19 extract otherwise unattainable bubbles of oil or natural
20 gas, methane, trapped inside of that rock.

21 Fracking has since spread east, west, north
22 and south, including to the densely populated regions of
23 the northeast where I live and to Southern California
24 and to the bread basket of midwestern agricultural
25 regions.

1 A dramatic increase in fracking over the past
2 decade in the United States has pushed oil and gas
3 extraction operations into heavily populated areas. At
4 least 6% of the US population, 17.6 million Americans
5 now live within a mile of an active oil or gas well. A
6 number that includes 1.4 million children and 1.1
7 million elderly people. At least 8.6 million people are
8 served by a drinking water source located less than a
9 mile from a well pad.

10 These facts alone, along with emerging
11 evidence revealing that fracking sites and associated
12 fracking infrastructure are disproportionately sited in
13 non-white, low income and indigenous communities, both
14 in the United States and in countries like Argentina,
15 Mexico and Canada where fracking has been exported,
16 means that it is right and necessary to understand the
17 potential for human exposures and accompanying adverse
18 impacts, not only as an issue of public health but
19 fundamentally as an issue of human rights.

20 My frame for this Keynote tonight is the
21 biologist, Rachel Carson, whose 1962 book Silent Spring,
22 about the unintended consequences of pesticides like
23 DDT, sparked a revolution in environmental consciousness
24 and is rightly credited as a founding force of American
25 environmentalism.

1 It was the second great honor of my life this
2 year to edit this new collection of Rachel Carson's
3 environmentalist writings for Library of America,
4 including Silent Spring but also some never before
5 published letters and speeches.

6 And I should say that Library of America
7 exists to canonize iconic American writers and pledges
8 when they collect the writings of an American author and
9 reissue them that they will be kept in print forever,
10 eternally.

11 So it's like watching an actor receive their
12 star on the Hollywood Walk Of Fame to see a Library of
13 America collection. It's long overdue that Rachel Carson
14 should receive her star but here it is and I had the
15 great honor and privilege of being able to edit this
16 collection this year.

17 In these writings, in this book Carson makes
18 clear that the environmental crisis is first and
19 foremost a crisis of human rights. And it's that
20 element of her writing that I want to foreground and
21 embrace for our purposes tonight.

22 Carson writes, "If the Bill Of Rights contains
23 no guarantee that a citizen shall be secure against
24 lethal poisons distributed by either private individuals
25 or by public officials it is surely only because our
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1 forefathers, despite their considerable wisdom and
2 foresight, could conceive of no such problem."

3 And she went on in lyrical descriptive prose
4 to trace the invisible drift of pesticides from the
5 atmosphere into our rivers, aquifers, breast milk, egg
6 shells of song birds and into, finally, the subcellular
7 machinery of our own bodies creating genetic injuries
8 and blazing trails for cancer, birth defects and altered
9 development.

10 Her panoramic language that takes us from crop
11 dusters into groundwater and into the nucleus of cells
12 is an artistic exploration in which language becomes a
13 cinematic camera showing us the connections in the
14 natural world that are otherwise invisible to us.

15 So I want to take a Carsonesque approach
16 tonight and speak to you first as a creative writer and
17 use language as a camera to take you down into the dark
18 heart of the planet, into the bedrock that lies beneath
19 our feet and I want to rewrite for you, as a landscape,
20 that this bedrock of our nation is not a void, a
21 lifeless place of inertia darkness with oil and gas
22 pocked inside the rock but, rather, it is a living
23 ecosystem, a subterranean coral reef, if you will, that
24 is teeming with life, a habitat that is animate and
25 beautiful and is connected to the carbon cycle by
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1 metabolizing organisms who live there and thus is
2 connected to us here at the sunlit surface.

3 Rachel Carson reminds us that wars waged
4 against the web of life will sooner or later transform
5 the cells of our own bodies into battle fields. And
6 this is also true when we turn the weapons of
7 destruction against our nations bedrock.

8 So let's begin here.

9 400 million years ago shallow seas overlay
10 parts of the North American continent. One of them was
11 in the part of the world that I live in the northeast
12 and the shallow ocean that extended from approximately
13 where the Catskill Mountain Range now is all the way to
14 the middle of Ohio.

15 And I, who live in the Finger Lakes region of
16 upstate New York, would have lived along its northern
17 banks of the sea. The southern reach went all the way
18 into West Virginia. The ocean floor became a graveyard
19 of the organisms who lived here.

20 And remember 400 million years ago was before
21 fur, before back bones, before three and four chambered
22 hearts, before breasts, before eyeballs, before fins and
23 flippers. The organisms we're talking about who lived
24 here were sea lilies, squid, diatoms and plankton. And
25 when they died they fell to the bottom of the sea and
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1 that ocean began to fill with silt because it was
2 surrounded by mountains and as the mountains eroded they
3 turned into dust. And dust changed its name when it
4 falls into the water and then we call it silt.

5 Mountains are full of entire periodic charts
6 of elements but as these mountain ranges eroded the
7 elements drifted with the silt into the bottom of the
8 ocean. These are things like barium, strontium,
9 uranium, lead, mercury. So these elements became part
10 of the floor of these shallow seas.

11 So the organisms died and they fell to the
12 ground, the bottom of the ocean by gravity but, because
13 of earth's atmosphere wasn't as oxygenated 400 million
14 years ago as it is now, there were not yet land plants.
15 The organisms didn't have enough oxygen to completely
16 decompose. So, instead, they turned into bubbles of
17 methane, which is carbon with four hydrogens or a
18 heavier hydrocarbon molecule or something that we would
19 call petroleum or oil.

20 So not just across the northeast but also in
21 North Dakota, in California, in Oklahoma, in Texas these
22 similar oceans existed at similar times and these
23 phenomenon went on.

24 So eventually then these corpses were covered
25 by the silt that fell upon them and they were buried and
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1 eventually then the whole ocean floor petrified and
2 turned from silt into shale. And these organisms were
3 then trapped as bubbles of oil or natural gas inside the
4 rock itself. And they've stayed there like that for 400
5 million years. Those hydrocarbon bubbles of oil and gas
6 are the quarry of fracking.

7 But these ancient ocean floors that became our
8 shale bedrock are not just a graveyard. They are also a
9 living ecosystem. They are inhabited by living
10 organisms now. Some are bacteria but many others occupy
11 an ancient domain of life called archaea. And these
12 organisms feed on the hydrocarbons that are down there.
13 They also, some of them, feed on radioactive decay.
14 They're strange. They have, some of them, arsenic
15 instead of phosphorus in their DNA.

16 And now I'm just going to speak to my fellow
17 biologists in the room and the rest of you can kind of
18 float with this for a minute.

19 They lack electron transport systems, which is
20 very unusual for organisms. We don't see that in living
21 things who live here on the earth's surface. And the
22 way they can avoid oxidate stress without an electron
23 transport system is that they actually send electrons
24 out into the surrounding rock.

25 They're organized into colonies in order to do
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1 this and they use nanowires to send across themselves a
2 large number of electrons and, thus, they alter the rock
3 and change it from one element to another.

4 So I'm going to pause here for a minute and
5 make kind of a theological or philosophical query. What
6 I'm saying is that the biologic is the creator of the
7 abiotic. These organisms are down there a mile below
8 our feet making rock, altering it and reshaping it and
9 turning it into something else.

10 And altogether geologists believe that these
11 deep life organisms by a biomass actually exceed the
12 biomass of living things here on the sunlit surface of
13 our planet.

14 That's why I say we need to think of our
15 bedrock as kind of a subterranean coral reef, another
16 world down there that we may not know much about but
17 whose destruction and poisoning may have consequences
18 for us.

19 So fracking uses water, 2 to 20 million
20 gallons per frack job and sends it down into that shale
21 by drilling straight down into it and then turn the
22 drill bit sideways and tunneling like a robotic mole for
23 another mile or more.

24 And first we send down explosives into that
25 tunnel to start fracturing the shale but what really
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1 widens those cracks is water. So fresh drinking water
2 is then sent down the hole.

3 Water is not compressible under high pressure
4 and you can imagine what kind of pressures are required
5 because the lithostatic pressure of the earth pressing
6 down on the shale a mile or more of substrate above the
7 shale bedrock has to -- in order to blow that up down
8 there, water has to be under immense amounts of pressure.

9 And if it were only water that was used as the
10 agent for fracking it wouldn't work because as soon as
11 you release the pressure to let the gas flow out all of
12 the fractures that you create you turn the bedrock into
13 shards at this point. They would all close up again as
14 the weight of the earth presses down upon them. So
15 instead sand is added to fracking fluid, and not just
16 any kind of sand, but silica sand. Because the grains
17 of silica sand are shaped in such a way that they resist
18 crushing under immense pressure.

19 So really the water is used to create the
20 fractures but also to shoot the sand grains into the
21 cracks created and like tiny door stops they hold open
22 those spaces so the bubble of oil or gas can then escape
23 and go up the bore hole after the pressure is released.

24 But in order to get sand down the hole and
25 around the bend without settling out and clogging the
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1 pipe you need to thicken that water with jelling agents
2 to move the sand around the bend and shoot it into the
3 cracks. So jelling agents are added to fracking fluid
4 along with things like friction reducers and anti-
5 scaling agents.

6 But those living organisms, those bacteria and
7 those archaeas that are down there at that depth, will
8 feed on those gelling agents and they'll grow inside the
9 pipes and interfere with the flow of gas. And so
10 powerful biocides are added like glutaraldehyde to
11 fracking fluid, which is why it's so toxic, because we
12 have to engage in a mass extermination campaign, an
13 underground pesticides spraying program of the bedrock
14 in order for fracking to work.

15 And some of the water that is used to liberate
16 the bubbles of oil and gas remains trapped within the
17 fractures zone and, as such, has now been permanently
18 removed from the hydrologic cycle forever entombed among
19 the fractured shards.

20 And I want to pause here a moment and ask
21 another philosophical question about humans making water
22 disappear. We've never done that before to actually
23 remove water from the hydrologic cycle, ground water
24 that is the mother of rivers, that flow to the sea, that
25 evaporate into clouds, that fall as rain or snow and
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1 rise again as mist and fog, we've never done that
2 before.

3 Fresh water is only 1% of all the water
4 available on earth. Most of it, 98% of it is sea water,
5 2% of the earth's water is fresh water, and a half of
6 that is frozen at the poles. So that only leaves 1% of
7 water to be part of the living cycle of which we are all
8 65% water by weight. So by weight we are 2/3rd's rain
9 drops.

10 And so what does it mean that we're making
11 water disappear in a time of a climate crisis when lack
12 of availability of fresh water is getting more insecure.

13 The water used to fracture shale will never
14 again flow as a river, never again rise as mist, never
15 again rise as sap, never become nectar attracting bees,
16 never again blood plasma or breast milk or tears or
17 cerebral spinal fluid or the breath of our exhaled lungs
18 on a cold winter day or never the snow flakes on that
19 day.

20 Some of the water travels back up to the
21 surface, that's called flowback fluid, and it contains
22 not only the chemical additives that were used to turn
23 the water into fracking fluid but also now it contains
24 brine, heavy metals, radioactive elements, all those
25 things that were deposited by the eroding of ancient
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1 mountain ranges that are now inside the shale. Toxic
2 elements that wouldn't hurt anyone as long as they're
3 trapped down below but now we are going to bring them up
4 to the surface.

5 The result is a massive amount of poisonous
6 liquid waste and we have a problem with no solution
7 because no technology exists to turn fracking waste back
8 into drinkable water. Its safe containment is for
9 eternity. It could be reused to frack another well but
10 not unless it's highly diluted because the more you use
11 it the more salty and toxic and corrosive it becomes.

12 So the practice is to inject it in other deep
13 wells where it has been definitively linked to earth-
14 quakes because fracking fluid contains anti-friction
15 agents.

16 Remember a fracking bore hole is only about 5-
17 inches or so in diameter and to shoot that vast amounts
18 of water with that kind of pressure you need to reduce
19 the friction. So you make fracking fluid very
20 slippery. But if you then inject it back down in to the
21 earth it lubricates fault lines and allows rock
22 formations to slip past each other and that is how
23 earthquakes are generated. We have absolute proof about
24 this link.

25 So this raises to me another ethical question
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1 about generational inequity. How is it right that this
2 generation of people alive now can liquidate the bedrock
3 and enjoy the profits from the oil and gas that we blow
4 the bedrock up to extract and then produce toxic waste
5 which must be curated eternally by our children and
6 grandchildren who will receive none of the profits.

7 But I want to widen the lens now and take an
8 even a bigger view of fracking because it really doesn't
9 start with the drill bit screwing into the ground. It
10 starts in the upper midwest with the mining of fracked
11 sand.

12 Frack sand mining has now become the No. 1
13 export of the state of Wisconsin, more than cheese.
14 Wisconsin is exporting itself and it's changing its
15 landscape to do that. The coolies and hills and bluffs
16 of Wisconsin are disappearing. They're made of
17 sandstone and that sandstone is made of grains of silica
18 sand that are in high demand for fracking.

19 So we have all these frack sand mining
20 operations going on in Minnesota and Iowa and Wisconsin
21 and in my part of the world in down state Illinois where
22 I grew up.

23 Silica sand makes silica dust and silica dust,
24 like asbestos, is linked to lung cancer. It's also
25 linked to silicosis. So although the people in the
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1 upper midwest live far from the fracking fields their
2 bedrock is being extracted and blown apart to be carted
3 off to the place in the world where I now live, to be
4 shoved into the ground, to hold open the cracks in the
5 destroyed bedrock of the northeast or taken to the
6 fracking fields in the Bakken shale of North Dakota or
7 Colorado.

8 And then where does the gas go or the oil go
9 after it comes out the ground?

10 Well, there is a massive amount of
11 infrastructure involved to take that oil and gas from
12 the point of its extraction to wherever the burner tip
13 is. And that takes the form of pipelines and compressor
14 stations and hundreds of underground and above ground
15 gas and oil storage facilities.

16 And here in the northwest LNG facilities where
17 natural gas, through the energy intensive process of
18 cryogenics, is super-chilled so it can be loaded on to
19 tankers and taken to places where pipelines can't run,
20 such as across the ocean.

21 And, of course, the story doesn't end there
22 because methane leaks at every step of this process from
23 the moment the drill bit goes into the ground and
24 contacts the shale methane is pouring out of the hole.

25 It pours out of the valves of every single pipeline, of
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1 every single compressor station along the way.

2 And the result is that methane is being loaded
3 into the atmosphere. Methane 86 times more powerful
4 than carbon dioxide at being able to trap heat in our
5 atmosphere. More methane leaks from fracking operations
6 than we previously appreciated, which means natural gas
7 via fracking is not any cleaner for the climate than
8 coal, and it may be worse.

9 Methane emissions are 20 to 60% higher than
10 previously thought. The ongoing surge in methane levels
11 are now driving climate impacts and a sharp uptick in
12 global methane levels since 2006 is largely attributable
13 to fossil fuel extraction processes, notably fracking.

14 So let's pause here for a minute and consider
15 these molecules of methane in the atmosphere and remind
16 ourselves that carbon, when we talk about decarbonizing
17 and loading the atmosphere with carbon, carbon is not
18 the first name for carbon dioxide.

19 Carbon comes in two flavors, carbon dioxide
20 and methane. And these are two naturally occurring
21 components of our earth that actually make life on earth
22 possible. Let's just pause for a moment and consider
23 that.

24 So methane comes from dead things. Carbon
25 dioxide is our exhaled breath of all living things. And
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1 both of these molecules have the ability, when struck by
2 thermal radiation, which is heat, to vibrate. So when
3 methane and carbon dioxide are in our atmosphere and
4 then the earth's surface turns away from the sun at
5 night the light from the sun, the light energy entirely
6 vanishes but the heat energy does not entirely vanish,
7 if it did we would all -- it would be like the Disney
8 movie Frozen. Our oceans would turn into ice rinks
9 every night. Our blood plasma would freeze stiff.

10 That doesn't happen because two molecules,
11 methane and CO₂ when the sun's heat energy bounces off
12 the surface of the earth and bounces back into the
13 atmosphere and encounters a molecule of CO₂ or methane,
14 those molecules begin to vibrate and their vibration
15 traps the heat. That's what we mean when say it's a
16 greenhouse heat trapping gas.

17 So these vibrational molecules, all dancing
18 all night long up in the sky, prevent us from dying
19 every night. So they're the living's exhaled breath and
20 the dead. The living and the dead conspire together to
21 make life possible on earth. So it's good that we have
22 greenhouse gases.

23 And, by the way, of the two molecules, CO₂
24 lasts longer in our atmosphere than methane. Methane is
25 more potent at trapping heat but it will fall apart
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1 after about a decade whereas CO₂ goes on trapping heat
2 for a century. Which means your exhaled breath will out
3 live you. You will be dead and gone but your breathing,
4 your whole lifetime of breathing, has changed the
5 chemistry of the atmosphere and those molecules of your
6 exhaled breath, representing all the things that you did
7 to metabolize all your life, will go on trapping heat
8 for the people and all the living organisms, all of our
9 relatives, that come after us.

10 And, of course you know, through the miracle
11 of photosynthesis, that some of that CO₂ will be taken
12 out of the atmosphere by our friends the plants, who
13 take them through their stomata of their leaves --
14 remember that in 7th grade, the stomata -- and combine
15 them with sunlight and water from the earth up through
16 the roots and through the miracle of photosynthesis spin
17 that into sugar and form the beginning of the food
18 chain.

19 So for all of the earth's history that
20 photosynthesis and the exhaled breath of all the animals
21 have existed in a kind of balance but 150 years ago when
22 we exhumed the cemeteries of Devonian to animals and
23 plants and this unholy trinity of fossil fuels, oil,
24 coal and gas, and we lit those bodies on fire in the
25 crematoria that we call power plants, we loaded up our
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1 atmosphere with 40% more CO₂ than pre-industrial levels
2 and almost tripled the amount of methane.

3 So now at night we have many more dancing
4 vibrating molecules and it's like a blanket that we
5 can't kick off. And the consequences, as you know,
6 involve melting ice caps, rising seas and, of course,
7 the acidification of the ocean because CO₂ turns into
8 carbonic acid when it falls into ocean water.

9 Our plankton stocks are now in trouble because
10 of rising acidity levels and also because of the rising
11 surface temperatures of the ocean. Phytoplankton
12 provide us half of the oxygen in our atmosphere, land
13 plants provide the other half, and so 1 out of every 2
14 breaths that we breathe is brought to us by the world's
15 plankton. And if the plankton are in trouble, my
16 friends, we are in trouble as well.

17 And if you're hearing this science for the
18 first time then that is a failure of my field. If you
19 hear about the falling Dow industrial stocks but not
20 about the plankton stocks and how they're doing when you
21 turn on your cell phone every morning or you read the
22 ticker in Times Square, ask why we have a public
23 conversation about economic stocks but not about
24 ecological stocks? And why aren't scientists having
25 public conversations with us about these issues?
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1 So I've talked to you now as a creative writer
2 and that was my best attempt to use language to create a
3 visual picture for you, both down in this landscape that
4 no one has seen, not even the frackers who are
5 destroying it, and up in the upper reaches of our
6 atmosphere where gases trap heat for us.

7 And now I want to switch things up a bit and
8 talk to you as an activist and tell the story of how we
9 defeated the shale gas army in New York state and won a
10 statewide ban on fracking in 2014. [Applause].

11 We did that.

12 So in 2009 I was invited back to Cornell
13 University where I'd previously been on the faculty to
14 give a talk on the public health implications of
15 fracking. And I was surprised by the invitation because
16 I didn't know much about fracking then and I didn't
17 realize the toxic chemicals that were used.

18 And when I discovered they included things
19 like glutaraldehyde and benzene, and that formaldehyde
20 was often released, those are chemicals I know very well
21 from my earlier work. So I went to work investigating it
22 and I was stunned and shocked by what I learned.

23 And in the summer of 2011 I went across the
24 United States to look at places in the west where
25 fracking was actually happening to begin to kind of do
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1 some field work on what this actually looked like and
2 what I should be thinking about.

3 I took my kids with me and we were camping the
4 whole time. So we called it sort of like camping with
5 drill rigs. And it was when I was in Utah interviewing
6 people in the Redrock community of Utah about proposed
7 fracking operations that I got two phone calls. One was
8 to say that the student, Tim DeChristopher, was about to
9 be sentenced for his action as a civil disobedient in
10 attempting to stop fracking in the area where I was
11 actually studying. He was going to be sentenced in a
12 federal courtroom in Salt Lake City and I was asked to
13 come and speak there outside the courtroom while he was
14 being sentenced. So I did. And it was my first
15 experience with civil disobedience.

16 So Tim was sentenced for his peaceful actions
17 that actually did succeed in stopping fracking. He was
18 sentenced to two years in federal prison and he was
19 hauled out of the courtroom by federal marshals in
20 handcuffs and manacles.

21 And then everyone in that area filled the
22 streets during rush hour and simply sat down. And in my
23 mind there was one image that I couldn't shake and it
24 was an image of a young woman holding a sign that said,
25 "Climate Justice Now" who sat down on the tracks of the
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1 light rail commuter train and then here came the train
2 full of commuters and it had to slow and stop. She held
3 her sign.

4 And on the side of the first car of that
5 train, that street car, was a public service
6 announcement by the American Cancer Society that had a
7 pink ribbon and a slogan that said "Just Get A
8 Mammogram."

9 And I thought well, here it is, my life in
10 public health. Just get a mammogram versus climate
11 justice now. We can either detect problems after
12 they've already arisen or we can try to prevent them.

13 The next day I was back in the field and I got
14 a phone call from Theresa Heinz Kerry letting me know
15 that I was the lucky recipient of this year's Heinz
16 Award which came with this \$100,000.00 check.

17 Had I not just been through what I'd been
18 through the day before I might have thought, oh, what a
19 great windfall. I can use this to do my research.
20 That's what scholars and writers mostly do when these
21 things happen, lucky things happen.

22 But, instead, I decided I wanted to do climate
23 justice now, not just get a mammogram, and I wanted to
24 use the money not just to study fracking but to stop it.

25 [Applause].
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1 I had just heard Tim DeChristopher say to a
2 judge "I don't want -- I'm not asking for mercy. I'm
3 asking you to join us. This is what love looks like."

4 So I went back to my unfractured state of New
5 York and I let it be known that I wanted to somehow
6 unite all of these local groups that were springing up
7 all over trying to stop fracking into a mighty
8 state-wide coalition. I didn't know how to do that.
9 I'm just kind of a nerdy biologist.

10 But there were some people who had some
11 political skills and they included groups like Frack
12 Action, Catskill Mountain Keepers, United For Action,
13 Food And Water Watch. And so there were kind of five
14 groups plus me, this crazy biologist with a check, and
15 we all kind of pitched in and we started New Yorkers
16 Against Fracking.

17 We were only these handful of groups at the
18 beginning but more and more groups joined us and by the
19 time we banned fracking in 2014 there were more than 400
20 groups as part of our coalition. And they included
21 Businesses Against Fracking which, itself, was a
22 coalition of a thousand different businesses. Faith
23 Leaders Against Fracking, more than 500 churches and
24 synagogues, and so on.

25 And so we changed the public opinion on
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1 fracking and we took the governor's base away from him.
2 So it now was a bigger problem for him to diss us than
3 it was to diss the oil and gas industry.

4 And as this mighty social movement began
5 unfolding I was able to retreat and do what I do more
6 comfortably, which is to analyze data. That is how I
7 became a cofounder of Concerned Health Professionals of
8 New York. We became the scientists in residence to the
9 anti-fracking movement. And we began to analyze the
10 data, to translate the data into plain and simple
11 English and not only bring it before our state
12 legislatures in testimony and write memoranda for our
13 governor, and our commissioner of health and our
14 commissioner of the environment, but also take it to
15 people.

16 Myself and my colleagues in the sciences and
17 medicine spent the better part of two years speaking
18 every Friday and Saturday night in a church basement
19 somewhere, in a Rotary Club, in a junior high school
20 auditorium, in a town hall, in a public library and we
21 gave our Fracking 101 PowerPoint presentation.

22 When we started there were only 65 studies in
23 the peer reviewed published literature about the risks
24 and harms of fracking. Our goal was to keep the
25 moratorium that we had going. Our feeling was that a
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1 could staple it and mail it to the governor. Now you
2 can see with 1,300 studies all peer reviewed and
3 footnoted it's quite a mighty document. And now we keep
4 bringing out these editions every year to help other
5 states and other nations to provide them good data for
6 their own fight.

7 But I guess I want to close this part of my
8 talk off by saying, yes, science won a ban on fracking
9 in New York state but science alone did not win. If
10 science alone could make good public policy we would
11 have solved the climate crisis and we would all be using
12 solar power now, right. We had good science on climate
13 at least 20 years ago, if not before.

14 But science together with activism was our
15 winning combination. Activism and social change created
16 the ability for science to speak so that the governor
17 could announce that, yes, science -- that the science
18 on fracking was troubling. There were public health
19 risks and this become the way forward for our state.

20 And so now we're engaged in a process where
21 we're trying to allow the governor to wear the mantel of
22 climate hero. Turn our state into an incubator and
23 laboratory for renewable energy.

24 This is the governor who saw sea water
25 sloshing through our subway system after the 2012
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1 hurricane Sandy. So we want him to play that role for
2 us.

3 At the same time, even though we banned
4 fracking, we haven't yet banned fracking infrastructure.
5 So New York state is still used as a staging ground for
6 pipelines, compressor stations, natural gas power plants
7 and gas storage depots are still being built-out.

8 My work involves fighting those too. And when
9 we fought against the gas storage facility that took
10 over the salt caverns underneath Seneca Lake, which is
11 where I live and a source of drinking water for 100,000
12 people -- so I'll back up and say a Houston based gas
13 company bought five miles of prime lake front property,
14 not because it enjoyed the view or loves our wineries,
15 but wanted to get access to the holes in the ground left
16 over by a century of salt mining and use those holes as
17 a gas station for the products of fracking before -- so
18 the price could go up before it could put it into
19 pipelines and send it to east coast markets.

20 Storing gas in what is called interbedded salt
21 and shale formations is one of the most dangerous ways
22 to store gas and has led to fatalities in other states.

23 So we thought that was a bad idea and we
24 attempted to do, for that fight, for what we were doing
25 with the fracking fight, which is to do really good

1 science on the hydrology of using salt caverns to store
2 compressed gas, the flow of ground water, how our lake
3 could become salinated, what would happen to the
4 wineries, what would happen to air quality with the
5 flare stacks and all the associated infrastructure, but
6 we failed.

7 In this case the decider was not our state but
8 rather the Federal Energy Regulatory Commission who
9 simply said, after all of our testimony and all of the
10 work we had done, we're simply not looking at that and
11 went ahead and approved the project.

12 So then began a civil disobedience campaign.
13 I decided if you wouldn't listen to my data as a
14 biologist then you will listen to my mother's body. I
15 gave birth just down the road from this facility in my
16 son goes to summer camp not far away and there is no
17 good evacuation plan. So I'll place my mother's body in
18 between the truck with the drill head and the place
19 where the truck with the drill head wants to go and the
20 driveway of this facility.

21 Over two and a half years 650 people felt the
22 same. So we had 650 arrests. And then the company
23 decided to cancel its gas storage expansion plans.

24 [Applause]

25 There is something about 93-year old great-
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1 grandmothers blocking your driveway that makes for
2 really bad press. And I should say that that campaign
3 involved a lot more than civil disobedience. It involved
4 municipal ordinances. It involved the wine business
5 coalition petitioning. A lot of things went on behind
6 the scenes. The cinematic part of it, the part for
7 which we got national/international media, were the
8 arrests.

9 Civil disobedience is a powerful thing and I
10 discovered I'm actually good at going to jail. I'm good
11 at going to jail because I'm a good cancer patient. I
12 know how to lie in an MRI machine motionless for 30
13 minutes. I know how to lie in bed with a Heparin lock
14 and an IV drip with a backless blue cotton gown. I know
15 how to push the IV drip down the hallway holding the
16 back of my blue cotton gown shut with the other hand.
17 And, thus, I'm good at shuffling up a set of stairs with
18 ankle manacles and handcuffs. I'm good at being in a
19 cell where the lights are on all night and the food is
20 terrible because it's just like being in a hospital.

21 A hospital has a call button but they never
22 answer it anyway. Jail cells don't but what's the
23 difference, right? Probably the most relaxing two
24 weeks I've ever spent.

25 So I want to ask you, What would you go to
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1 jail for? Would you go to jail for water, to protect
2 water, would you do that? Question for your
3 discernment.

4 Now lastly I want to speak to you as a
5 scientist. I've spoken to you as a writer. I have
6 spoken to you as an activist. Now I just want to tell
7 you some of the science of fracking and give you a
8 flavor of this compendium of ours which has been
9 submitted, by the way, as a testimony for the fracking
10 tribunal. And here is how we talk about fracking in
11 this document of ours.

12 Emerging trend No. 1. Growing evidence shows
13 that regulations are simply not capable of preventing
14 harm. Studies reveal inherent problems in the natural
15 gas extraction process such as well integrity, failures
16 caused by aging or the pressure of fracking itself and
17 in the waste disposal process.

18 These issues can lead to water contamination,
19 air pollution with carcinogens and other toxic
20 chemicals, earthquakes and a range of environmental and
21 other stressors inflicted on communities.

22 Some of fracking's many component parts, which
23 include the subterranean geological landscape itself,
24 are simply not controllable. Compounding the innate
25 unpredictability of the fracking process, the number of
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1 wells and their attendant infrastructure continue to
2 proliferate, creating burgeoning cumulative impacts.

3 The size of individual wells keeps growing
4 with the horizontal portions of a single well now
5 exceeding as far as two miles or more underground.
6 Fluid injections once typically three to five million
7 gallons per fracked well can now easily reach 20 million
8 gallons.

9 The injection of extreme volumes of fluids
10 creates significant deformations in the shale that are
11 translated upward a mile or more to the surface. Along
12 the way these pressure bulbs can impact in unpredictable
13 ways faults and fissures in the overlaying rock strata,
14 including strata that intersect fresh water aquifers.
15 Thus, pressure bulbs may mobilize contaminants left over
16 from previous drilling and fracking and mining
17 operations.

18 No set of regulations can obviate these
19 potential impacts to ground water. No set of
20 regulations can eliminate earthquake risks.

21 Well sites leak far more methane and toxic
22 vapors than previously understood and they continue to
23 leak long after they are decommissioned.

24 Abandoned wells are significant sources of
25 methane leakage into the atmosphere. Based on findings
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1 from New York and Pennsylvania they may exceed current
2 total leakage from oil and gas wells currently in
3 production.

4 Plugging abandoned wells does not always
5 reduce methane emissions and cement plugs themselves
6 deteriorate over time. Further, many abandoned wells
7 are unmapped and their locations unknown.

8 No federal or state agency routinely monitors
9 methane leakage from abandoned wells. Leakage rates
10 among abandoned wells are wildly variable. 4% of wells
11 nationwide are responsible for half of all methane
12 emissions from fracking operations. Predicting which
13 wells will become super-emitters is not possible.

14 Further much of this leakage is engineered
15 into the routine operation of fracking extraction,
16 processing and transport infrastructure as when vapors
17 are vented through release valves in order to regulate
18 pressure.

19 Here is another section. Emerging trend No.
20 4. Public health problems associated with drilling and
21 fracking include poor birth outcomes, reproductive and
22 respiratory impacts, cancer risks and occupational
23 health and safety problems.

24 Studies of mothers living near oil and gas
25 extraction operations consistently find impairments to
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1 infant health, including elevated risks for low birth
2 weight and pre-term birth.

3 A 2017 study that examined birth certificates
4 for 1.1 million infants born in Pennsylvania found poor
5 indicators of infant health and significantly lower
6 birth rates among babies born to mothers living near
7 fracking sites.

8 A 2015 study found a 40% increase in the risk
9 of pre-term birth among infants born to mothers who live
10 nearby drilling sites.

11 A 2014 Colorado study found elevated incidence
12 of neural tube defects and congenital heart defects.

13 New studies in Texas and Colorado found
14 associations with infant deaths, high risk pregnancies
15 and low birth weight.

16 A 2017 pilot study in British Columbia found
17 elevated levels of muconic acid, a marker of benzene
18 exposure in the urine of pregnant women living near
19 fracking sites.

20 An emerging body of evidence from both human
21 and animal studies shows harm to fertility and
22 reproductive success from exposure to oil and gas
23 operations, at least some of which may be linked to a
24 dozens of known endocrine disrupting chemicals used in
25 hydraulic fracturing.

1 A 2017 Colorado study found a higher incidence
2 of leukemia among children and young adults living in
3 areas dense with oil and gas wells, while a Yale
4 University research team reported that carcinogens
5 involved in fracking operations had the potential to
6 contaminate both air and water in nearby communities in
7 ways that may increase the risk of childhood leukemia.
8 The Yale team identified 55 known or possible
9 carcinogens that may be released into the air and water
10 from fracking operations. Of these 20 are linked to
11 leukemia.

12 Other documented adverse health indicators
13 among residents living near drilling and fracking
14 operations variously include exacerbation of asthma,
15 increased risk of hospitalization, ambulance runs,
16 emergency room visits, self-reported respiratory
17 problems and rashes, motor vehicle fatalities, trauma,
18 drug abuse and gonorrhea.

19 Pennsylvania residents with the highest
20 exposure to active fracked gas wells were nearly twice
21 as likely to experience a combination of migraine
22 headache, chronic nasal and sinus symptoms and severe
23 fatigue. And it goes on.

24 So I have spoken to you as a scientist, as an
25 activist and as a writer. And to close us out I'm going
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1 to do kind of a multi-media presentation and I am going
2 to go backwards starting with science and then activism
3 and then end with poetry.

4 For all of those listening around the world
5 who may be on the front lines we hope they're useful to
6 you.

7 So now I am going to show you -- that was me
8 as a scientist -- now I'm going to show you the trailer
9 for a new documentary film called Unfractured, which
10 just won a big award, by the way, as the best
11 documentary in a film festival in Dallas, Texas, Earth
12 X, which is actually interestingly partly sponsored by
13 the oil and gas industry.

14 And so I think I am impressed with the
15 independent mindedness of the jurors and the money
16 received by the filmmaker prompted her to turn around
17 and donate the prize money to front line communities
18 fighting fracking so that they can bring the film to
19 their communities for free. So she's doing 50 free
20 screenings with this.

21 And this documentary film tells the story of
22 how we won the fracking fight in New York state and it's
23 told through my eyes. It's just one person in a large
24 opera of people. So I'm the kind of through-line of the
25 story.

1 And Kathleen Dean Moore this is for you whose
2 writing that I've learned so much from. It's a poem for
3 the Marcellus. Marcellus is the name of my bedrock that
4 I live above. And Marcellus, by the way, was named
5 Marcellus because Marcellus is a Roman warrior who got
6 too overconfident. Was actually run through by a spear
7 on his own battlefield. And Marcellus also became, for
8 Shakespeare, a character in Hamlet. He's the one that
9 says, "There's something rotten in the state of
10 Denmark." That's his line.

11 There's also a line in here from Shakespeare
12 from Julius Caesar; "Oh pardon me thou bleeding piece of
13 earth that I am meek and gentle with these butchers."

14 That's iambic pentameter but the rest of it is
15 written in hip hop rhythm.

16 Marcellus below us.

17 Marcellus below us.

18 Marcellus, tell us who are you?

19 Older than fishes.

20 Older than spinal cord and bone and in the
21 green day of trees.

22 Older than pollen dust, than seeds, bedrock of
23 grief.

24 Subterranean coral reef.

25 Microbes and nanowires.

1 Electrically conductive hypersaline fires.

2 Marcellus our cellar.

3 Marcellus unlike us.

4 Fissured and fossiled sacrophagus of sea
5 lilies and squid.

6 Ego and Id.

7 The whole periodic table and you; uranium,
8 barium, radium, lead.

9 Marcellus home of the dead.

10 Toluene, mercury, benzene, brine, arsenic.

11 The River Styx 500-million years thick.

12 In you, Eurydice, Hades, Moloch, Charon's
13 boat. Hades, Moloch, ransom note.

14 Marcellus deserved the name given him who
15 waged war and gained fame for the sacking of
16 Syracuse with the Battle of Gaul only to lose to an
17 enemy and fall at home.

18 No exit plan.

19 Some say your success was embellished.

20 General Marcellus tell us who called you the
21 sword of Rome?

22 Saudia Arabia below our feet.

23 A prolific monster says Wall Street.

24 A sure thing. A shale.

25 Play. Play. Play.

1 Place your bet.

2 Marcellus, a minor character who guides Hamlet
3 away from his father's ghost.

4 Here, sign this lease and let's make the most
5 of it.

6 Enter now Mark Anthony breaking bread with
7 Bobby Kennedy.

8 Jealous.

9 Et tu Marcellus.

10 Oh pardon me though bleeding piece of earth
11 that I am meek and gentle with these butchers.

12 Hades, Moloch, Charon's boat.

13 Oh pardon me though bleeding piece of Hades,
14 Moloch, ransome note.

15 Piece of earth that I am meek and gentle with
16 these butchers.

17 Marcellus who are we?

18 Drill, syringe, derrick vein.

19 Two junkies argue how many carbon atoms can
20 dance on the head of a pin?

21 Marcellus, quick, tell us.

22 I hear the trucks. They're not far.

23 The plan is to reduce you to rubble.

24 There is no Hubble telescope for you.

25 No 24-hour spill cam for us.

1 Are you a box inscribed with the name Pandora
2 or a scroll on which is written the names of us
3 all?

4 Holy the rock and the fissure and the salt and
5 the diatoms fall.

6 Holy the unfractured.

7 Holy the wall between you and us, Marcellus.

8 Holy the cave.

9 Holy the soluable.

10 Holy the hall.

11 Holy the unmapped and abandoned well.

12 Hell, I know you're down there.

13 Mom always said don't blow up the basement.

14 Hades, Moloch Charon's boat.

15 Hades, Moloch, ransom note.

16 Let me love you from a long way up.

17 Holy the water.

18 Holy the cup.

19 Thank you.

20 [Applause].

21 You guys know how to clap. Thank you.

22 So I've been given the high sign for a few
23 comments and questions and I can't see you very well.

24 Is there a way to put the house lights up in here.

25 MS. CARLY LETTERO: If we can get the
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1 house lights up and I have a mic. If you would like to
2 raise your hand I can come to you if you have a
3 question.

4 MS. ALLISON MILLER: Thank you and thank
5 you for a wonderful evening and incredible, incredible
6 gift you've given all of us tonight.

7 My name is Allison Miller and I am a sister of
8 Tony Flagg. He's a CEO for United Grain, which is a
9 wheat company right out of Vancouver and it's owned by
10 the Japanese and they grow wheat in the northwest and
11 they have a rail car system that is all their own.

12 And one day my brother called me and says I
13 was so excited. I wrote a contract with a fracking
14 company allowing them to use our grain cars to haul
15 their fracking sand while we're not hauling grain.

16 Were you aware of that? I was floored.

17 DR. SANDRA STEINGRABER: No, I didn't
18 know that. Thank you.

19 I mean fracking turns things inside out, not
20 just our bedrock, right? I mean I can tell you that in
21 2011 when I went through Texas at the beginning of my
22 study on fracking there was a terrible heat wave and a
23 drought that summer. It was 109 degrees as I drove
24 through the panhandle and there were fracking trucks
25 full of water going to the fracking sites even as the
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1 rest of the landscape they were driving through looked
2 like a moonscape of cracked earth with like dead cattle
3 and people had handwritten signs in their front yard
4 that said "I need water. You haul.. I pay." And yet
5 there was still water to take to the fracking sites.

6 So I think the reprioritization that fracking
7 has brought, you know, no grain, but sand. We're dying
8 from lack of water but there's water to blow a part the
9 beckrock. This is part of the human rights issue, the
10 abrogation that is fracking.

11 Thank you for telling us that.

12 What else?

13 AUDIENCE MEMBER: You're an amazing,
14 inspirational person and I've been just awed by you
15 tonight as I'm listening to you talk about fracking. I
16 work on nuclear history so I see a lot of resonance
17 between what you're saying about contamination and I'm
18 wondering if you connect -- the contamination that we're
19 seeing today does it start with nuclear weapons, that
20 allowing of radiation, that allowing of contamination?

21 It seems to have expanded and expanded from
22 that point but I just wondered what you thought about
23 those connections and because we're talking about
24 climate change and very often a solution to climate
25 change is given as nuclear power.

1 DR. SANDRA STEINGRABER: Yeah, we can
2 talk about that a bit.

3 So that connection was certainly clear to
4 Rachel Carson, right. So she herself had her eyes
5 opened by the atomic age. And the way it was opened was
6 that it was a new idea in the 1950s that you could
7 detonate an above ground nuclear device three time zones
8 away and then the radioactive strontium in baby teeth
9 shed by children a few months later in the east coast
10 would go up.

11 And so now we understand how that is
12 connected. Radioactive strontium is released into the
13 upper stratosphere. It's carried by the prevailing
14 winds west to east. It sifts down into grass. The cows
15 eat the grass. Strontium follows calcium into bone and
16 into breast milk and so it ends up into the cows' milk,
17 children drink the milk, it ended up in their skeleton
18 including in their teeth. They shed them. They put
19 them under their pillows.

20 And there was an initiative at the time of
21 scientists who were collecting baby teeth that parents
22 would send in, the Tooth Fairy Project or something like
23 that, and they could see spikes in radioactivity among
24 children following, you know, the appropriate time lags,
25 following these explosions.

1 And that changed Rachel Carson's thinking
2 because it was just a new idea that something that
3 happened half a continent away could change the ecology
4 here. And she began to apply that thinking to pesticide
5 drift.

6 In fact I'll just read you -- Rachel Carson,
7 by the way, was keeping two secrets. I'll probably need
8 reading glasses for this. She was keeping two secrets
9 while writing Silent Spring.

10 One, that she was dying of breast cancer and
11 she did not want her enemies in industry to know that
12 because she feared that her scientific objectivity would
13 be called into question. Her science would be impeached
14 and it would allow them to further discredit her.

15 And the other secret was that she loved a
16 woman whose name was Dorothy Freeman. And they wrote
17 love letters back and forth to each other. And Rachel
18 tried out her ideas on Dorothy. And one of them was to
19 tell Dorothy about how the atomic age had altered her
20 thinking.

21 And that's the passage that I have in mind to
22 just read to you because reading it she could -- I
23 mean, well, see what you think. It seems to me that she
24 could have written it today and it still has resonance
25 for us with climate. So she writes this.

1 "I suppose my thinking began to be affected
2 soon after atomic science was firmly established. Some
3 of the thoughts that came to me were so unattractive
4 that I rejected them completely.

5 "It was comforting to suppose that the stream
6 of life would flow on through time in whatever course
7 that God had appointed it. And to suppose that however
8 the physical environment might mold life that life could
9 never assume the power to change drastically or even
10 destroy the physical world.

11 "These beliefs have almost been part of me
12 for as long as I have thought about such things. To
13 have them even vaguely threatened was so shocking that,
14 as I have said, I shut my mind. I refused to
15 acknowledge what I couldn't help seeing. But that does
16 no good and I have now opened my eyes and my mind and
17 may not like what I see but it does no good to ignore
18 it.

19 "So it seems time that someone wrote of life
20 and the light of the truth as it now appears to us."

21 So that's kind of what gave her the courage to
22 write Silent Spring.

23 And as for your other question we don't need
24 nuclear power to replace fossil fuels. I mean that's
25 really clear. That's really clear.

[Applause]

1
2 If you -- you don't need to take my word for
3 it check out the Solutions Project. The Solutions
4 Project.org, which is an initiative, an on-line
5 initiative that kind of does for renewable energy what
6 we tried to do with the compendium. In other words,
7 take a lot of complicated science and make it really
8 easy to understand.

9 And in the case of the Solutions Project it's
10 an on-line initiative with all kinds of visuals. And so
11 one of the scientists involved is my colleague Mark
12 Jacobson, a physicist at Stanford. And so he has worked
13 out a proposal, a blueprint for how each state of the
14 Union could entirely switch over and decarbonize and get
15 off fossil fuels and go completely renewable, including
16 transportation, and how you would do it. How you would
17 finance it. How long it would take. How many jobs would
18 be created. So the economics are all there.

19 And my state of New York, for example, would
20 rely quite a lot on offshore wind. I haven't looked at
21 what the portfolio is for Oregon but I commend it to you
22 to take a look.

23 Mark is very clear that you don't need nuclear
24 to get there. So that's a lot of good news.

25 And that doesn't mean that we have to rely on
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1 batteries or things that haven't been quite -- that
2 aren't deployed yet. This is like on the shelf
3 technology that we have now that, of course, as we adapt
4 it it will get better as we go.

5 But, in other words, the good news is we don't
6 have to wait for technological breakthroughs.

7 Everything we need is right here and the economics all
8 work as well as the science.

9 So there is a lot of good news out there. So
10 it's our job, it's our life's work as the adults who
11 happen to be alive at this moment in history where we
12 have about ten years to get off of carbon before we hit
13 those runaway tipping points. And then no matter what
14 we do, you know, it's a runaway train. Then it becomes
15 a real tragedy. But we're not in that doom place yet.

16 So if we're not in it then it's ethically our
17 responsibility to make sure we don't -- you know, the
18 canoe doesn't go off the edge of the cliff. And so we
19 have to paddle as fast as we can.

20 So, again, I invite you all to think about
21 what you would go to jail for. What other skill sets do
22 you have that you can apply to this great historical
23 moment where we are going to divorce our economy from
24 its current ruinous dependency on fossil fuels.

25 And, I mean, the fossil fuel party is over.
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1 It's just that that those guys aren't leaving the stage,
2 right? They're not going to self-deport. And so we have
3 to get very creative at pushing them off and ushering
4 the renewable energy in.

5 And I think there are many kind of ideas for
6 how to do this but the Solutions Project is as good as
7 any place to start. If you're new to this I would just
8 Google that and see what you think.

9 MS. CARLY LETTERO: Thank you, Sandra, and
10 thanks to every one for coming this evening. Sandra is
11 going to be up here up front to sign books and Sierra is
12 going to be at that table from Grassroots to sell books.

13 The show is still upstairs for a little bit so
14 I invite you to check out the Pop Up Gallery if you
15 haven't done that.

16 Thanks for coming everyone and thank you.

17 DR. SANDRA STEINGRABER: You're welcome.

18 [Applause]

19

20 [youtube.com/watch?v=ReA79dX1Mdg]

21

22

23

24

25