ALASKA STATE LEGISLATURE
HOUSE RESOURCES STANDING COMMITTEE
February 10, 2023
1:01 p.m.

MEMBERS PRESENT

Representative Tom McKay, Chair
Representative George Rauscher, Vice Chair
Representative Kevin McCabe
Representative Dan Saddler
Representative Jennie Armstrong
Representative Donna Mears
Representative Maxine Dibert

MEMBERS ABSENT

Representative Josiah Patkotak
Representative Stanley Wright

COMMITTEE CALENDAR

HOUSE BILL NO. 50
"An Act relating to the geologic storage of carbon dioxide; and providing for an effective date."

- HEARD & HELD

PREVIOUS COMMITTEE ACTION

BILL: HB 50
SHORT TITLE: CARBON STORAGE
SPONSOR(s): RULES BY REQUEST OF THE GOVERNOR

01/27/23	(H)	READ THE FIRST TIME - REFERRALS
01/27/23	(H)	RES, FIN
02/10/23	(H)	RES AT 1:00 PM BARNES 124

WITNESS REGISTER

JOHN BOYLE, Commissioner-Designee
Department of Natural Resources
Juneau, Alaska
POSITION STATEMENT: Presented HB 50 on behalf of the sponsor, House Rules by request of the governor.

AARON O'QUINN

Division of Oil and Gas
Department of Natural Resources
Juneau, Alaska
POSITION STATEMENT: Co-offered a PowerPoint presentation and answered questions during the hearing on HB 50.

DAVID LEPAIN, PhD, Director
Division of Geological and Geophysical Surveys
Department of Natural Resources
Juneau, Alaska
POSITION STATEMENT: Co-offered a PowerPoint presentation and answered questions during the hearing on HB 50.

JOHN CROWTHER, Deputy Commissioner
Department of Natural Resources
Juneau, Alaska
POSITION STATEMENT: Provided comment during the hearing on HB 50.

ACTION NARRATIVE

1:01:30 PM

CHAIR TOM MCKAY called the House Resources Standing Committee meeting to order at 1:01 p.m. Representatives McKay, Rauscher, McCabe, Saddler, Armstrong, Mears, and Dibert were present at the call to order.

HB 50-CARBON STORAGE

1:02:27 PM

CHAIR MCKAY announced that the only order of business would be HOUSE BILL NO. 50 "An Act relating to the geologic storage of carbon dioxide; and providing for an effective date."

1:03:39 PM

JOHN BOYLE, Commissioner-Designee, Department of Natural Resources (DNR), presented HB 50 on behalf of the sponsor, House Rules by request of the governor. He stated that HB 50 had the potential to make history in Alaska by diversifying the state's revenue stream by monetizing the empty space underground as a new resource. He said HB 50 was proposed in response to the rising corporate demand to obtain net zero emissions by sequestering carbon underground. He reported that many of the companies operating on the North Slope have adopted objectives

to achieve net zero status for their current projects and for any new oil fields and developments. He explained that this bill would establish the framework for Alaska to provide the corporations working in the state with opportunities to meet their emission goals through the capture and utilization of carbon. He stated that the underground pore space on state land that would be used for the carbon storage is classified as a mineral resource, which means that HB 50 would allow this new revenue stream to build up Alaska's general fund and the permanent fund at the same time.

COMMISSIONER-DESIGNEE BOYLE argued that Alaska has two main competitive advantages that make developing this new resource through a permitting and regulatory structure a prudent choice. First, he explained, the state has sole ownership of a broad amount of land with geological features that are conducive to carbon storage. He opined that this is an advantage over other states that practice carbon storage but must negotiate with multiple landowners before bringing a new carbon sequestration program online. Second, he explained, the scale of viable land in Alaska creates a capacity for storage that is much larger than other areas of the country and the world. For example, he reported that the Cook Inlet area alone has the capacity to store 50 years of carbon output from an entire country.

COMMISSIONER-DESIGNEE BOYLE opined that the administration and the legislature have the opportunity to change the landscape of the state simply by allowing others to store carbon within the land. He explained that the science behind this practice was not new or unknown and that there are companies operating in Alaska which have extensive knowledge and experience with injecting gas underground and understand how the gas interacts with the rock underground over geologically significant periods of time. He emphasized that HB 50 would provide the state with the opportunity to move toward the future in a way that diversifies its revenue streams through new industry growth. He opined that the permitting regulations in Alaska are better than what exists in other states or countries and that storing carbon under those regulations would build Alaska's credentials as an area of the world known for responsible resource development.

1:09:07 PM

AARON O'QUINN, Division of Oil and Gas, Department of Natural Resources, began a Power Point presentation [hard copy included in the committee packet], titled "Carbon Capture, Utilization,

and Storage," and drew attention to an overview on slide 2, which read as follows [original punctuation provided]:

What is it?

Carbon Capture, Utilization, and Storage (CCUS) is a process to capture carbon dioxide (CO2), either from industrial processes or directly from the atmosphere, for the purpose of utilizing it for other activities or storing it underground in geologic formations

Why Now?

The CCUS market is rapidly expanding, both within the U.S. and worldwide

Federal legislation in the prior 18 months has included direct grants and tax incentives for CCUS, increasing industry interest, including outreach to the Department of Natural Resources (DNR)

Federal funds are available for states seeking Class VI well permitting, showing federal support for state primacy

Protracted project timelines and milestone requirements in the tax credit structure necessitate prompt action

Sets the stage for potentiating continued development of Alaska's oil resources, and potential major gas development

What is the potential in Alaska?

Alaska's depleted oil & gas fields, saline aquifers, and deep coal seams have significant CO2storage potential

Alaska has important competitive advantages –we own the pore space & we know the reservoirs

Fifteen other states have passed CCUS omnibus legislation that we have learned from

1:10:51 PM

MR. O'QUINN moved to slide 5, which depicted a carbon molecule, and described the carbon capture, utilization, and storage process as injecting these molecules into the subsurface while

in a hypocritical state. He shared the US Department of Energy's (DOE) definition of the process on slide 6, which read as follows [original punctuation provided]:

> Carbon capture, utilization and storage (CCUS) is a process that captures carbon dioxide emissions from industrial processes, point sources like coal-fired power plants, or from the air and either reuses or stores it so it will not enter the atmosphere.
>
> Carbon dioxide storage in geologic formations includes oil and gas reservoirs, unmineable coal seams and deep saline reservoirs --structures that have stored crude oil, natural gas, brine and carbon dioxide over millions of years.

MR. O'QUINN emphasized the natural security found in the geologic tracts that would be utilized for storage. He described a diagram of the CCUS process, on slide 7, and provided a brief overview. He explained that the carbon was captured at the source of emission, which could be an industrial facility, direct air-capture facility, or from an oil or gas field. He said that the carbon dioxide (CO2) is then transported by pipeline overland to the injection site. He added that there have been some inroads into transporting CO2 by boat. Next, he related that the carbon dioxide is compressed at the injection site and then pumped into the subsurface via an injection well.

MR O'QUINN explained the capture stage of the process on slide 8, which read as follows [original punctuation provided]:

> Myriad technologies in various stages of commercial development:
>
> 1. Pure stream carbon capture from certain industrial processes such as the production of methanol or ammonia or removing naturally-occurring carbon from natural gas
>
> 2. Capturing carbon dioxide following the combustion of fossil fuels, such as from a coal-fired power plant
>
> 3. Capturing carbon dioxide directly from the atmosphere

MR. O'QUINN detailed the ways in which captured carbon can be utilized through a pie chart depicted on slide 9 and

stated that while there are many uses for CO2, the most common utilization is enhanced oil recovery. He explained that enhanced oil recovery is a process where an oil and gas operator will inject captured carbon dioxide into an existing oil or gas formation to enhance the production of the reservoir as a tertiary means of extraction. He described the process as shown in the other visual on the slide, stating that water and CO2 are alternatively injected into the formation to push remaining oil towards the production well, which can result in additional barrels of oil produced in Alaska from wells already in operation.

1:15:34 PM

MR. O'QUINN addressed the storage of captured carbon with a diagram on slide 10 and explained that storing CO2 within the earth is accomplished by injecting it at a depth of 2,600-3,000 feet, which ensures that there is enough pressure to keep the CO2 in its supercritical state. He reported that typically these injection sites are depleted oil and gas reservoirs, aquifers, or not mineable coal seams. He emphasized the importance of porosity for CO2 storage and referred to the visual on the slide that showed increased storage capacity with increased porosity of the injection layer.

REPRESENTATIVE SADDLER asked for the definition of the supercritical state for CO2.

MR. O'QUINN replied that CO2 is stored at a certain pressure; it can reach a supercritical state where it is still gaseous but behaves more like a liquid.

REPRESENTATIVE SADDLER questioned at what temperature and pounds per square inch (PSI) of pressure CO2 becomes supercritical.

MR. O'QUINN shared his understanding that the required pressure is about 2,600 PSI but deferred to the geology expert for confirmation.

1:17:23 PM

DAVID LEPAIN, PhD, Director, Division of Geological and Geophysical Surveys, Department of Natural Resources (DNR), replied that he was unsure of the data for temperature but noted that CO2 reaches the supercritical state at 1,100 PSI. He explained that "supercritical" describes a state of matter halfway between a gas and a liquid.

Mr. O'Quinn explained why CCUS would be beneficial for Alaska, as outlined on slide 12, which read as follows [original punctuation provided]:

Bolster development of Alaska's abundant oil and gas

Federal incentives are driving investment in peer states

Environmental, Social, and Governance (ESG) concerns driving capital to projects with carbon management options

Alaska should participate in global uptick in CCUS projects

Project timelines require the state to act promptly because of the federal incentives' deadlines

Additional state revenue

1:20:39 PM

REPRESENTATIVE MEARS requested more in-depth information regarding the federal incentives for projects with decreased emissions.

MR. O'QUINN replied that he would be addressing this more in a later slide but could also provide the committee with additional information outside of the hearing.

1:21:07 PM

The committee took a brief at-ease.

1:21:51 PM

REPRESENTATIVE SADDLER referenced Mr. O'Quinn's statement about the timeline for projects to qualify for the federal incentives and asked how much of a commitment the state would have to make to qualify for the federal credits and how quickly they would have to act.

MR. O'QUINN responded that in order to receive the federal tax credits being offered, companies must begin construction on new projects by January 2033. He confirmed that the state would

have until then to get permitting structures in place but reported that CCUS projects have a development timeline similar to gas and oil projects, which he stated can be lengthy. He argued that having the regulatory statues already in place would allow project proponents the certainty to make initial investments in exploration and further development decisions along the process and ensure their access to the federal credits once the projects are completed.

MR. O'QUINN showed a map on slide 13 of worldwide CCUS projects in various states of completion, from permitted to operational. He pointed out that there are several operational projects in other parts of the U.S. and many others being developed in oil and gas jurisdictions across the world. He reported that government-imposed carbon taxes are the main driving factor for these projects in other areas of the world, but while there are some statewide caps on emissions or anticipated carbon taxes in the U.S., the main driving force for U.S. projects are the federal tax credits. He reiterated that there are also capital market pressures towards projects with lower carbon footprints that are pushing interest in the CCUS industry.

1:24:58 PM

REPRESENTATIVE MCCABE sought clarification that HB 50 is not seeking to place any taxation on the CCUS projects but rather to provide the service of carbon storage for companies that want to reduce their carbon output.

MR. O'QUINN confirmed that HB 50 does not address adding a carbon cap or tax on any industry in Alaska. He asserted that the intent of the bill is to turn the porous rock located underground in Alaska into a resource for the state and to take advantage of the market for carbon storage being created by carbon emission restrictions and offset requirements in the rest of the world.

REPRESENTATIVE MCCABE asked for confirmation of his understanding that the term "sequestration" is a synonym for storage.

MR. O'QUINN replied that is correct.

1:27:52 PM

REPRESENTAIVE MCCABE asked about Alaska's history of injecting CO2 underground, sharing his understanding that HB 50 would

allow companies outside of the state to partake in the same process that has been done by Alaska projects since the 1970s.

MR. O'QUINN responded that there are oil and gas operations that will reinject the CO2 they produce as a means of pressure support. He used the project at Prudhoe Bay as an example of experts at handling CO2 that have the appropriate infrastructure to do so at that facility. He reported that there has been continued production of oil as a result of injecting CO2 into the gas cap at that site.

MR. O'QUINN continued his presentation by describing the graph on slide 14, which depicted the projections for how many carbon capture facilities would need to be in operation across different sources of emission to meet the goal of removing all emissions from the atmosphere by the year 2070. He reported that there are currently 35 commercial CCUS projects actively injecting CO2 and that the projection shows that an additional 2,500 facilities would be needed to meet the 2070 goal. He suggested that these findings prove there will be a huge growth in the CCUS industry that Alaska is prime to take advantage of due to the state's geology and strategic position in the Pacific Ocean.

MR. O'QUINN provided an overview of the federal tax incentives on slide 15, which read as follows [original punctuation provided]:

> 45Q (CCS) Tax Credit -Inflation Reduction Act Enhancements
>
> Deadline to start construction 1/1/2033
>
> $85/ton for CCUS from industrial facilities and power plants stored in geologic formations
>
> $60/ton for utilization of captured CO2/CO for enhanced oil recovery (EOR) or to produce low and zero-carbon fuels, chemicals, and building materials
>
> $180/ton for direct air capture (DAC) carbon stored in geologic formations and $130/ton for DAC carbon used in EOR

MR. O'QUINN reported that the tax code that grants these credits has been in place for some time but that enhancements have been recently added to further incentivize the development and use of

CCUS projects to reduce emissions. He explained that collecting carbon through direct air capture (DAC) facilities has a higher rate of credit to encourage more development of these frontier technologies.

1:31:15 PM

REPRESENTATIVE ARMSTRONG referred to the proposed state fee of $2.50 per ton in the fiscal note from the Department of Revenue (DOR) and posited that adopting the federal tax credits would reduce the state's corporate income tax. She asked how long it would take for CCUS projects to become revenue positive and what that process would entail.

MR. O'QUINN explained that the $2.50 per ton of CO2 stored is the minimum amount the state can charge and would be the direct source of income to the state. He stated that he is unsure how tax credits may affect total corporate income tax.

1:32:47 PM

JOHN CROWTHER, Deputy Commissioner, Department of Natural Resources, offered to meet with DOR and bring information about the forward value of the federal tax credit and the state corporate income tax to the committee at a later date.

REPRESENTATIVE MEARS asked about how the tax credits change with the different oil well classes.

MR. O'QUINN replied that the tax credit is not tied to the class of oil well but to how the captured CO2 is used. He explained that injection well class is dictated by the concentration of CO2 that is being injected into it. He stated that he can come back to supply the committee with more information on how the class of well will affect the tax credit.

REPRESENTATIVE MEARS clarified that she was inquiring about the transition period between changing the use of a well from enhanced oil recovery to only sequestration and that she wanted to ensure the transition process was well defined.

MR. O'QUINN emphasized that any tax credits would be scrutinized by the Internal Revenue Service (IRS)and that the Alaska Oil and Gas Conservation Commission (AOGCC) would be certifying and monitoring injection volumes and barrel outputs; whether or not a company qualifies for the sequestration credit versus the EOR credit would be tracked by the state. He reported that

companies would only be able to claim the credits if they met the very specific requirements laid out in the internal revenue code.

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REPRESENTATIVE DIBERT asked for an example of a DAC facility.

MR. O'QUINN answered that there are some DAC facilities operating in Iceland but reported that because they require a large amount of energy to run, the economic benefits can be tricky unless the site has access to a renewable or low-cost source of energy.

REPRESENTATIVE MCCABE questioned whether DAC could be a solution to some of the inversion air quality issues in parts of Alaska that rely heavily on wood stoves.

MR. O'QUINN clarified that the federal tax credits are available only for capture of CO2 and that many areas affected by air pollution have issues with the accumulation of other pollutants, so any capture projects targeting those pollutants would not be eligible.

REPRESENTATIVE SADDLER shared his surprise in learning that CO2 had value in commercial uses and asked how CO2 is currently obtained for the purpose of manufacturing chemicals and zero-carbon fuels and what the market for CO2 looks like.

MR. O'QUINN replied that he is unfamiliar with the details of the CO2 market but that he is aware of its use in the medical industry and in some food production, for example, fountain soda. He stated that there are purity standards that must be achieved for the CO2 to be used for those purposes and that most CO2 is reduced to a usable material in small plants. He mentioned that the most common source he is aware of for CO2 is through Ammonia (NH3) production.

MR. O'QUINN returned to his presentation on slide 16 where he walked the committee through a diagram of the IRS timeline for companies to avail themselves of the tax credits, reiterating that construction on a CCUS project must start construction by 2033 to qualify. He explained that the process for project development consisted of multiple steps that can each take months or even years to complete. He stated that first the company will conduct an initial screening to select a location, which includes geological surveillance and extensive research.

After an area is selected, he said that the company would ask the state for an exploration permit which will be granted after a public and competitive process to ensure the project is in the best interest of the state.

MR. O'QUINN explained that further exploratory drilling may be done after the permit is granted to better understand the characterization of the resource before development. While in the exploratory stage, he stated, operators would begin securing the sources of carbon and designing the project infrastructure. He said that once designs have been completed the project would go to the AOGCC for construction permits. If the permits are approved, the next step is for the project's capital providers to finalize their investment decisions and then the construction process can commence, followed by operation of the project. He detailed the approximate timelines for each stage and reported that the initial exploration and permitting period can take up to five years.

MR. O'QUINN reiterated that construction must begin by 2033 to be eligible for tax credits and suggested that the unique factors of building in Alaska can further expand the amount of time needed to get a project ready for construction. He argued that because of the relatively short amount of time in which operators would need to initiate their projects, it is important to have a regulatory framework for CCUS projects already established as soon as possible.

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REPRESENTATIVE MEARS asked how long a project can continue to receive the tax credit once it qualifies and whether that would be for the life of the project or for a set number of years.

MR. CROWTHER shared his belief that there is a time horizon in which the tax credits are eligible for an approved project but that he would return to the committee with a definite answer.

MR. O'QUINN restated that it is important for the regulatory systems for CCUS to be in place quickly so that project operators have the certainty they need to start the long process of project development before the deadline. He reported that there is a section of the bill that allows for AOGCC to seek primacy for class 6, or CO2 injection, wells, giving them primary authority to permit those wells. He explained that this authority would be sought from the Environmental Protection Agency (EPA). He reported that the EPA has over $50 million

available in funding to help states start permitting programs for class 6 wells. He stated that passing HB 50 would allow the AOGCC to seek primacy, which would give Alaska access to that funding and build that program on federal money rather than state funds. He shared that primacy also makes the state more attractive to industry operators as many investors have stated their preference for working directly with state governments rather than the EPA for permitting and are choosing to invest in projects located in states that have or are seeking permitting primacy.

MR. O'QUINN continued his presentation on slide 17, highlighting the net zero gas emission plans for several companies currently operating on Alaska's North Slope. He stated that the companies listed are some of the largest oil and gas operators in the world and described their goals for reducing emissions as aggressive. He reported that there was a specific focus from all of these entities on the reduction of Scope 1 emissions, which he defined as direct emissions made by the company during their operation. He reiterated that HB 50 would give those companies the opportunity to meet their emission reduction goals in the state where they are operating and opined that the state should be able to take advantage of that economic opportunity.

1:48:43 PM

REPRESENTATIVE ARMSTRONG referenced the previous statement that companies in Alaska are already using CO2 injection for EOR and questioned how many oil and gas operations in Alaska are using CCUS currently and whether HB 50 would change the permitting, tax credit eligibility, or any other factors for already existing CCUS projects.

MR. O'QUINN replied that the only use of CCUS technology in Alaska is at the Hilcorp operation in Prudhoe Bay and that they are exclusively injecting their own CO2 emissions to enhance oil production. He restated that there are many projects around the world and in the U.S. that are capturing carbon for sequestration only.

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REPRESENTATIVE MCCABE reiterated that oil and gas companies are seeking out opportunities for carbon sequestration of their own volition and that HB 50 would not impose CCUS requirements but rather create carbon storage for those companies to utilize.

MR. O'QUINN confirmed that Alaska would not be introducing any CCUS requirements or emission caps and that the move towards carbon sequestration is being driven by corporate governance, shareholder input, capital markets, and informed jurisdiction taxes imposed by other areas.

MR. O'QUINN continued his presentation on slide 18 and argued that building a regulatory structure for CCUS would help address the legal challenges from the EPA to oil and gas operations located on Alaska's federal lands. He reported that the EPA has brought forth challenges against proposals such as the Willow Project for violating the National Environmental Policy Act (NEPA) by not considering the projects contribution to global carbon emissions. He suggested that by offering carbon sequestration in Alaska, the state can help those companies reduce their Scope 1 carbon liability and will hopefully reduce the amount of challenges filed by project opponents.

1:53:35 PM

MR. O'QUINN discussed the revenue possibilities on slide 19, clarifying that HB 50 is not promising any revenue to the state but stated that if operators choose to sequester carbon in Alaska, they will have to pay for the use of the underground pore space. He used the Red Trail Energy Project in North Dakota as an example of how a state can profit on carbon sequestration and explained that Red Trail captures the CO2 produced while fermenting soybeans and corn for ethanol and injects it into the earth for storage. He explained the picture of the project on the slide by pointing out the site of the injection well, the area occupied by the injected plume, and the monitoring well that ensures the injection site does not exceed the subsurface area. He reported that Red Trail is expected to inject up to 3,480 acres of subsurface area and capture 180,000 tons of carbon per year.

MR. O'QUINN stated that DNR created a projection to calculate the possible revenue a project with the same dimensions operated in Alaska would generate under the rates proposed under HB 50. He explained that the minimum rate for rent of the space during the pre-injection period would be $70,000 per year and could last about three years. After injection begins, he projected that there would be $500,000 of income from the amount of carbon captured per year. He explained that there is a price step built into the bill to account for inflation that would increase the rate per ton of carbon by five percent which would go into effect in year six of this projection. He stated that this

projection is a conservative estimate for how much revenue a single, small energy plant could bring into the state, but the department assumes most companies would pay more than the bare minimum rate.

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REPRESENTATIVE DIBERT asked for more details on the monitoring process and what would happen if the injected plume exceeded the expected subsurface area.

MR. O'QUINN described the project model pictured in more detail and reported that the predictive modeling technology is very accurate and calculates based on the shape of the geologic feature, the pressure, and the volume. Therefore, he posited, it would be unlikely that a plume would expand beyond what is predicted. In the case that the plume did exceed the monitoring area, the operator would be responsible for continual reporting to AOGCC, which would develop regulations for those occurrences. He reported that AOGCC would be empowered to bring additional property rights into the project if necessary and the owner of the additional property would be compensated. He clarified that the state is the primary pore space owner in Alaska and would be able to seek additional compensation if more area is utilized. No matter who the owner of the additional pore space is, he explained, the company would have to revisit its permit to account for the extra usage.

1:59:57 PM

The committee took an at-ease from 1:59 p.m. to 2:05 p.m.

2:05:21 PM

DR. LEPAIN took over the presentation on slide 21 by describing the physical and chemical properties of CO2 and stated that at surface pressure it presents as an odorless, colorless gas. However, he explained that when CO2 is subjected to enough pressure it becomes a super-critical liquid, which he described as a state of matter somewhere between a liquid and a gas. He stated that due to the hydrostatic gradient under the earth's surface, the pressure in underground geologic formations increases as the depth increases. He reported that injecting super-critical CO2 at a depth of 2,600 feet or below the naturally occurring pressure is enough to keep the CO2 super-critical, which is important to the CCUS process because the same reservoir can hold more CO2 when it is in a compressed,

super-critical state. He emphasized that subsurface formations must meet a particular set of criteria to be used for storage.

REPRESENTATIVE SADDLER asked about the density of CO2 in comparison to the water within the subsurface and questioned why the less dense CO2 does not rise above the water.

DR. LEPAIN answered Representative Saddler's question by continuing to slide 22 and explaining the required characteristics for an underground formation to be used as storage. He stated that sandstone formations were primarily targeted for storage because sandstone has a high porosity within its structure, which he illustrated through a picture of sandstone at the microscopic level. He emphasized that porosity and permeability must be present in the rock to make it a candidate for storage. He used an illustration on the slide depicting a cross section of the earth underneath the Kenai gas field to show that sandstone can often be found either within formations where it is in layers that are folded upwards or in an anticlinal fold. He confirmed Representative Saddler's assumption by explaining that when CO2 is injected into these bent, water-saturated layers of sandstone, the CO2's buoyancy will cause the CO2 to rise towards the crest of the fold. However, he pointed to another picture on the slide of a microscopic view of mudstone, or shale, with visibly less space between particles making it non-porous. He explained that when the sandstone within a formation is layered with mudstone, the impermeable mudstone acts as a trap to prevent the CO2 from rising.

REPRESENTATIVE SADDLER asked whether there is typically a single layer of mudstone within a formation or multiple layers.

DR. LEPAIN replied that the drawing on the slide is a good example of the typical formation that could be a candidate for storage; it shows stacked layers of sandstones separated by mudstones. He stated that each layer of sandstone is sealed by the mudstone, creating multiple reservoirs with their own seals.

DR. LEPAIN summarized slide 22 by stating that a viable underground formation would have porous and permeable sandstone layers in an entrapping formation with nonporous mudstone seals at a depth of at least 2,600 feet to provide enough pressure that the CO2 stays super-critical.

2:11:24 PM

DR. LEPAIN explained the four types of CO2 trapping on slide 23, starting with "buoyant trapping," which uses the buoyancy of CO2 to trap it within the formation as he described in detail in the previous slide. He stated that the second type is called "residual trapping," which occurs when CO2 is injected into a structure. He explained that while most of the CO2 rises to the top, there will be some left behind in the pore network. He called the third type "solubility trapping," which happens when some of the CO2 dissolves into the water within the formation. He stated that the fourth type is called "mineral carbonation," which is a process where mineral precipitates will form after CO2 is injected into rock. He reported that there is a pilot project in Iceland that involves injecting CO2 into basalt formations and creating iron carbonate precipitates; however, he stated that this kind of carbon trapping is not applicable to the rock formations found in Alaska.

2:13:26 PM

REPRESENTATIVE SADDLER asked what percentage of each applicable type of carbon trapping is found in carbon injection projects.

DR. LEPAIN replied that it is difficult to give a broad answer because the percentages are dependent on many geologic variables that are very specific to each formation.

2:14:07 PM

REPRESENTATIVE MCCABE shared his understanding that the reservoirs that would be used for CO2 storage previously held oil or gas, thus the seals capping off these reservoirs are already established as being capable of containing similar substances.

DR. LEPAIN confirmed this understanding and stated that depleted oil and gas reservoirs is one class being considered for CO2 injection. He mentioned that he will touch on the other two classes of reservoir in a future slide.

2:15:12 PM

REPRESENTATIVE ARMSTRONG noted that other projects have experienced issues due to increased seismic activity and have had to halt operation. She questioned whether there is something specific to Alaska's geology or the injection process that would put the state at less risk for seismic interference.

DR. LEPAIN stated that the way CO2 is injected into the formation will determine its effect on seismic activity and suggested that the injection rates should be closely monitored to prevent inducing seismic activity.

CHAIR MCKAY restated Representative Armstrong's question to ask what would happen to the operation of an injection well in the case of a large seismic event.

DR. LEPAIN replied that he will address that issue specifically regarding possible Cook Inlet operations, as that is a very geologically active area.

MR. O'QUINN responded to the topic of seismic activity by clarifying that the presentation will address both human induced seismic events and the risk natural seismicity has to potential projects. He mentioned that the goal of injection for sequestration is to keep the reservoir intact and not to increase the porosity of the rock, unlike other projects like disposal wells that actively break up the rock underneath, and so it is unlikely that sequestration would trigger seismic activity.

2:17:45 PM

DR. LEPAIN continued the presentation on slide 24 by listing several reasons why depleted oil and gas fields are the top choice for storage reservoirs. He stated that the reservoirs within the depleted fields in Cook Inlet and on the North Slope are proven to have effective traps and seals as they previously held hydrocarbons for millions of years without any leaks. He argued that there is no reason to believe that CO2 would act any differently within these reservoirs which makes them attractive options for storage. He suggested that the reservoirs are known entities because of the extensive data sets characterizing their properties such as shape, temperature, pressure, and water salinity. He reported that the data included robust estimates of the original oil in place (OOIP) within the reservoirs which allows geologists a better understanding of how much pore space is available. He reiterated that injecting CO2 into declining oil fields can enhance oil production.

DR. LEPAIN stated that saline formations are another option for storage and defined them as underground formations that have never been host to oil or gas and have pore spaces filled with non-potable salt water. He reported that there are extensive saline formations within existing Alaskan oil fields that could

have significant storage potential; however, unlike depleted oil and gas fields, these formations are largely uncharacterized but could be a possibility for the future.

2:20:12 PM

CHAIR MCKAY asked for further explanation of the pressure required for the proposed CO2 injections and whether it would be less than the pressure used in fracking.

DR. LEPAIN reported that the oil and gas industry is very experienced in monitoring the pressure within underground formations. He asserted that this knowledge allows operators to have a better understanding of how much pressure to use while injecting and how much stress a formation can endure. He stated that the oil and gas industry has well-tested technology that ensures any additional stress added by injection does not exceed the amount that would induce fracturing.

DR. LEPAIN continued the presentation on slide 25 to describe a third possibility for CO2 storage. He reported that there are many coal deposits within Cook Inlet that are too deep to be economically viable for mining but could be used for CO2 storage. He explained that CO2 molecules have a high affinity for coal and will attach to the coal matrix very easily and strongly. He stated that lower ranks of coal can store more CO2 than higher ranks and reiterated that that much of the coal in Cook Inlet is both too deep and too low ranked to be used in mining, making it an attractive potential option for storage.

2:22:43 PM

DR. LEPAIN summarized the CCUS process on slide 26, which read as follows [original punctuation provided]:

> Geologic storage options include: depleted and declining oil and gas fields; saline formations; unmineable coal seams
>
> Subsurface formations must be deeper than approximately 2,600 ft
>
> Formations must have porosity and permeability
>
> Formations must include traps (folds, faults, stratigraphic pinchout)

Formations must be overlain by effectively zero permeability formations –seals

Monitoring during and after CO2injection is important

DR. LEPAIN began explaining the specifics of CO2 storage in Alaska with a list of the pros for utilizing the oil and gas projects in Cook Inlet on slide 27, which read as follows [original punctuation provided]:

Thousands of feet of interbedded sandstone, mudstone, coal

10 oil fields – 5 relatively large (data rich)

38 gas fields (data rich)

Proven reservoirs and traps

1.4 billion barrels of oil produced

8.9 trillion cubic feet of gas produced

Saline formations

Large volume of pore space potentially available for CO2
Large volume of coal

Infrastructure

DR. LEPAIN addressed the previous discussion on the seismic activity of the area, characterizing Cook Inlet as a geologically active basin. He used an image that depicted the location of the oil and gas fields within Cook Inlet to show that most of these fields are located on large subsurface fold structures that owe their existence to their proximity to fault lines and subsequent geologic activity. He reiterated that the folds have been proven to hold hydrocarbons without any leaks for millions of years.

CHAIR MCKAY posited that the CO2 injection process is the inverse of the oil and gas extraction process that has been taking place in Alaska for 60 years and that it would make sense to refill the now empty subterranean "containers" with a similar type of gas to what was taken out of them.

DR. LEPAIN confirmed that the Chair's statement was correct. He then moved on to share a list arguments for storage in the North Slope that he described as very similar to those for Cook Inlet, which read as follows [original punctuation provided]:

1000s feet of interbedded sandstone and mudstone

Abundant coal west of Umiat (Federal and Native land)

More than 70 oil accumulations and several gas accumulations discovered since 1944 – several with OOIP >1 billion barrels oil

18.7 billion barrels produced through September 2022 (AOGCC)

Proven reservoirs and traps – many large fields in decline

Saline formations are extensive

Large volume of pore space potentially available for CO2 storage

Coal

Infrastructure

DR. LEPAIN stated that the main difference between the two areas is that the North Slope has much less seismic activity than Cook Inlet. He moved briefly to slide 30 to mention that the U.S. Geological Survey (USGS) has estimated that 0.9 billion tons of CO2 could be stored in the depleted reservoirs within the North Slope and noted that USGS refers to the process as recovery replacement storage.

CHAIR MCKAY sought clarification that the USGS estimate accounts only for the already evacuated oil and gas deposits and not for potential storage in coal seams or saline formations and posited that there is even more potential capacity for storage than that number suggests.

DR. LEPAIN confirmed this assumption and pointed to another study from geology experts in 2010 that estimated North Slope coal seams could store an additional 5.83 billion tons of CO2.

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DR. LEPAIN addressed the possibility of storing CO2 in the interior sedimentary basins of Susitna, Nenana, and the Yukon Flats on slide 31 and reported that they would require a lot of work to develop for CCUS projects as they are currently data poor areas, and they have very little existing infrastructure.

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MR. O'QUINN continued the presentation on slide 33 with an overview of the origins of HB 50. He reported that the department researched CCUS in three ways prior to writing the legislation. He said they started by reviewing similar legislation from peer states, particularly states with active oil and gas operations who are pursuing CCUS projects. He stated that the second step was for DRN to reach out to other state agencies, such as AOGCC and the Department of Environmental Conservation (DEC), to obtain their perspective on CCUS and how it would impact their jurisdictions. He shared that the last piece of research consisted of garnering stakeholder input and stated that DNR did so by creating a statewide CCUS stakeholder work group that included industry stakeholders and government agencies. He reported that the workgroup met several times which culminated in a full day workshop to decide the key points that the bill would need to address and the best way to handle them.

MR. O'QUINN talked about the specific peer states that were examined during the research project using a graphic on slide 34 which illustrated the states that have comprehensive CCUS legislation in place. He stated that DNR also examined the applications for class 6 primacy submitted by other states, which would allow state agencies to control the regulatory process for CO2 injecting.

MR. O'QUINN reiterated on slide 35 that DNR worked with partner agencies to complete the research necessary for this legislation and named DEC, the Division of Geologic and Geophysical Surveys (DGGS), the Division of Oil and Gas, and the AOGCC as the main partners.

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REPRESENTATIVE MEARS sought to confirm that the trigger for Alaska to seek class 6 well primacy is the passage of HB 50.

MR. O'QUINN responded that is correct; the bill includes an amendment to allow AOGCC to seek primacy for class 6 wells in addition to the existing authorization for class 2 wells.

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REPRESENTATIVE SADDLER asked for the other well classes to be defined.

MR. O'QUINN responded that to his knowledge class 1 wells are for disposal, class 2 wells deal with injecting oil fill fluids into oil and gas formations, and class 5 wells are geothermal. He stated that he was unsure about what class 3 and 4 wells are used for but reported that states can seek primacy for all 6 classes. He explained that the EPA prefers states to build a comprehensive regulatory system by seeking primacy for all classes at once, but it has allowed exceptions for class 2 primacy and is extending this exception for class 6 primacy, as well.

MR. O'QUINN addressed the specifics of the regulatory work group on slide 36, stating that a regulatory framework committee consisting members from various stakeholder groups was created to inform the regulatory decisions made in the bill. He shared that the House Resources Standing Committee had been supplied with the resulting document of the regulatory framework committee's work, which he referred to as the "stakeholder white paper." He said that it includes a general consensus from stakeholders on many of the regulations proposed under HB 50. He emphasized that the bill was not created solely by the government in "a vacuum," but that it truly reflects the input from many industry stakeholders. He reported that there were other committees created, including one that is looking into funding opportunities from DOE to help fund further storage resource characterization studies and other data collection. He shared that there is a CCUS roadmap work group which looks at the different engineering technologies available for CCUS projects and how effective they would be in Alaska. He said the final committee created was for public outreach and education and that its purpose is to keep the public as informed as possible, and he stated that DNR is planning to create a website and provide opportunities for community outreach.

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MR. O'QUINN summarized the specifics on what the proposed legislation would do, on slide 38, stating that the main purpose

is to authorize use of public land for CCUS as an extension of energy production and to structure the licensure similarly to exploration licensing which allows companies to use public land and compensate the state for it. He explained that the bill will provide for AOGCC to unitize property rights and protect the correlative rights of property owners. He reiterated that in most cases the pore space will be owned by a single entity, usually the state or a native corporation, but DNR made sure to include public protections in the case that there are private owners. He reported that the bill outlines how the injection and extraction industries would interact with each other as they would often be operating in the same area and stated that the bill empowers the AOGCC to oversee those relationships. He stated that HB 50 provides for the permitting and authorization of CO2 pipelines to be built on land leased by the state and that it codifies court findings that categorizes pore space on state land as being of "mineral character." He reiterated that the bill would allow for the state to seek primacy for regulation of class 6 wells from the EPA, which he emphasized was an important part of making Alaska an attractive place for companies to store their carbon.

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REPRESENTATIVE SADDLER asked whether using pore space for carbon sequestration would automatically prohibit any future exploration within or through that pore space.

MR. O'QUINN replied that HB 50 specifically addresses any potential conflict between injection and extraction by giving AOGCC the power to oversee any future projects that would require drilling through a storage site to access other pore space for extraction or vice versa. He emphasized that DNR does not see designating space for storage as condemning it from being used for extraction.

REPRESENTATIVE SADDLER asked what the estimated increase of cost, resources, and time would be for the additional workload this oversight would create for the AOGCC.

MR. O'QUINN replied that the fiscal note includes two new full time equivalent positions for the AOGCC and confirmed that the workload would increase as the number of permit requests for CCUS projects increased. However, he reported that there is a provision in the bill for a regulatory cost charge which would manifest as a per ton injection fee that would be established within the permit or through regulation by AOGCC. He stated

that the intent of that fee is for AOGCC to utilize it for staffing the review of new permits.

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REPRESENTATIVE MCCABE asked what the above ground footprint of an injection well would be on average and how that size would compare to other types of wells.

MR. O'QUINN returned to slide 19 of the presentation and referred to an arial view picture of an existing injection well in North Dakota. He stated that the above ground requirements are an injection well and a monitoring well, which he described as "a pipe sticking out of the ground," a small processing facility, and a pipeline to run the CO2 to the well. He mentioned that typically the pipes are laid underground and could be done as such in areas like Kenai, but they would have to be above ground on the North Slope. He asserted that the total amount of above ground space would be very minimal.

CHAIR MCKAY shared his understanding that the well count for injecting is far less than what is used for extraction.

REPRESENTATIVE MCCABE reported that his constituents have concerns about above ground footprint size but he posited that an acre or two for the facility and a minimal addition of well heads seemed to be reasonable.

CHAIR MCKAY expressed his understanding and hope that most injection projects would make use of existing pads and infrastructure with very little new impact.

MR. O'QUINN confirmed the Chair McKay's understanding.

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REPRESENTATIVE DIBERT questioned whether the state or the corporation would be liable for any damages that occurred to future facilities in the event of seismic activity.

MR. O'QUINN explained that the operator of the facility would remain responsible for any damage to or because of the injection sites for the duration of the operation and for a 10-year period after the project concludes. He stated that after the 10 years are over the corporation can obtain a closure certificate from AOGCC if all compliance standards set under HB 50 are met. He reported that when a closure certificate is granted the title of

the CO2 and all liability transfers to the state. In order to help the state pay for any costs after closure, he explained, that while the injection site is still in operation AOGCC will collect post closure fees, which get put into a joint trust fund for all facilities and are marked for the post closure period and can be used for any incidents that arise. He mentioned that the 10-year time period is what has been used in other states and is considered by the industry to be enough time for stabilization post closure. He noted that having an end to an investor's liability was very important to stakeholders.

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REPRESENTATIVE SADDLER referenced the protests and public opinion issues that occurred when the state was considering implementing fracking and asked what challenges, if any, other states have seen during their early implementation of carbon sequestration.

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MR. CROWTHER responded that one problem that other states dealt with was due to the location of the CO2 producing facilities. He explained that sometimes CO2 pipelines needed to be built across areas that were not familiar with that kind of transport system and there was resistance to pipeline construction from some landowners. In contrast, he stated that most CO2 producers in Alaska are located within regions that are accustomed to this sort of industrial land use and are much closer to potential storage sites, which would require less transportation; therefore, DNR does not anticipate public concern. He suggested that there could be public concern about other areas of approving CCUS projects in the state but reiterated that the department plans on addressing this through thorough dissemination of information about CCUS, primarily on the Division of Oil and Gas' website.

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REPRESENTATIVE MEARS shared her interest in the development of the state's business plan for CCUS projects, particularly regarding the interaction of tax credits and oil exploration versus sequestration. She opined that the House Resources Standing Committee has a lot of work ahead on HB 50 as the bill is referred to only one subsequent committee, and she inquired about the intended next steps for the process.

CHAIR MCKAY deferred discussion of next steps to later in the meeting. He sought confirmation that there are no freshwater aquafers in the North Slope that could possibly be contaminated by CO2 injections due to the area's permafrost.

DR. LEPAIN confirmed that there was continuous permafrost on the North Slope [that would prevent water contamination].

CHAIR MCKAY questioned how the revenues from CCUS projects would be utilized and whether they would follow a similar path as oil and gas revenue. He additionally asked whether there is data from other states that have passed carbon sequestration legislation that also own the subsurface mineral rights like the state does in Alaska.

MR. O'QUINN replied that the department had looked into "peer states" and explained that in foreign oil and gas jurisdictions mineral rights are usually held by the government. He reported that the State of Louisiana has a substantial amount of state land it also owns the mineral rights to, and the state has entered into commercial agreements with operators to sequester carbon within state lands.

CHAIR MCKAY explained for the public that although the term "exploration license" is being used in conjunction with CCUS projects, the bill's intent is to utilize existing reservoirs that are already well understood formations, and he sought confirmation from the departments that new exploration for sequestration would not be occurring.

3:00:57 PM

MR. O'QUINN confirmed the Chair McKay's understanding of the exploration licenses and stated that in the context of sequestration, exploration means "taking a closer look" at already known sedimentary basins and formations to ensure that the proposed storage sites have the most optimal geological conditions possible.

COMMISSIONER-DESIGNEE BOYLE clarified that the bill is not limiting sequestration to any specific geographic locations, like the North Slope or Cook Inlet, because the department recognizes that there may be power plant operators in other areas of the state who would want to conduct exploratory work to better understand the geology in their area and embark on CCUS projects. He stated that the legislation was written with as

much flexibility as possible to allow the entire state the possibility of utilizing carbon sequestration.

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REPRESENTATIVE RAUSCHER described his experience in the oil industry both on the North Slope and on the Kenai Peninsula and opined that the huge number of wells in operation in Alaska has resulted in the state obtaining a large amount of experience in how to responsibly drill new wells and an extensive knowledge of the properties of the subsurface formations that may be used for carbon storage. He shared his appreciation for HB 50 being brought forth as a way to utilize the knowledge and technology that has been developed in the state since the 60's to monetize the "leftover" subterranean formations for Alaska. He posited that introducing injection wells would be using "just an eighth" of the process currently used for extraction and that HB 50 could be a productive way to capitalize on a new oil related industry since the state is very familiar with the oil and gas industry. He expressed his confidence in DNR's research and knowledge of the existing subsurface formations.

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CHAIR MCKAY addressed Representative Mears' previous question on the next steps for HB 50, stating that any further questions could be brought to the chair or the presenters to be answered at subsequent hearings. He said that there will be a hearing where the sectional analysis of the bill and the attached fiscal notes will be discussed. He said that there would be an opportunity for public and invited testimony and that all meetings would be scheduled with plenty of public notice.

[HB 50 was held over.]

3:08:08 PM

ADJOURNMENT

There being no further business before the committee, the House Resources Standing Committee meeting was adjourned at 3:08 p.m.