Oregon Department of Energy Determination

Chemical Waste Management Corrective Action Plan
Responding to February 2020 Notice of Violation

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More information about the Notice of Violation and subsequent actions are available on ODOE's website, including an FAQ Document.

Oregon
Kate Brown, Governor

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March 24, 2021

James Denson
PNW/BC Environmental Protection Manager
Waste Management
7227 NE 55th Ave
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Mr. Denson,

The Oregon Department of Energy (ODOE) has completed its review of the Corrective Action Plan submitted by Chemical Waste Management of the Northwest (CWMNW) on September 8, 2020 and all comments submitted to ODOE during the public comment period between September 8 – November 8, 2020. As described below, ODOE concurs with CWMNW's preferred Alternative 1 as the final remedy, provided that it incorporates the amendments described in this determination.

During the comment period, ODOE held two public meetings, one virtual and one in-person, at which we described the alternatives analysis and proposed monitoring actions in the Corrective Action Plan, and fielded questions and comments from the public. We have responded in writing to all public comments as an attachment to this determination.

The Corrective Action Plan (CAP) with its addenda presents the findings of a preliminary screening and evaluation of a number of remedial technologies to address the Bakken Oilfield Waste that was subject to ODOE's Notice of Violation on February 13, 2020. The CAP included a detailed analysis and comparative risk assessment for two remedial alternatives: Alternative 1: Closure-in-Place with Monitoring, and Alternative 2: Excavate and Redispose the Bakken Waste. Based on the comparative analysis and risk assessment, and on the criteria established in the Notice of Violation, the CAP indicated the preferred alternative was Alternative 1: Closure-in-Place with Monitoring.

ODOE conducted an extensive review of the CAP, its addenda, subsequent supplemental analyses, and comments submitted by members of the public. ODOE has determined that either alternative would likely meet the regulatory standards of long-term protectiveness of human health and the environment, but agrees that the CAP's preferred alternative is more protective of human health and the environment in the short-term. ODOE therefore largely

accepts implementation of Alternative 1 as the final remedy, with amendments described below.

ODOE came to its conclusion to concur with CWMNW's plan after carefully considering the CAP, its addenda, and public comments. The comments submitted to ODOE (attached hereto) expressed several important concerns with the proposed alternative and recommend a number of additional radiological monitoring requirements for the facility. ODOE agrees with many of these recommendations and requires the following modifications to CWMNW's preferred alternative.

1. ODOE finds that modifications to the groundwater monitoring program proposed in the CAP are necessary. The modifications are as follows:
    a. The default groundwater monitoring program will follow CWMNW's proposed 5-year interval for radionuclide analysis in the wells immediately upgradient and downgradient from Landfill L-14 during landfill operations and post-closure. The next radionuclide groundwater sampling event will occur in 2021.
    b. If, in the future, the higher-frequency monitoring data for non-radionuclides suggest that there may be a potential release from the lined landfill (i.e., failure of the landfill liner), the Oregon Department of Environmental Quality as the permitting authority will require the facility to enter a Compliance Monitoring phase including increased monitoring. Upon initiation of the Compliance Monitoring phase, CWMNW would notify ODOE and include monitoring for radionuclides in the Compliance Monitoring schedule. Radiological monitoring results would be directly reported to ODOE.
    c. The final enacted alternative shall be amended to state that the groundwater monitoring plan shall require monitoring for radionuclides following landfill closure, during the 30-year post-closure period.
2. ODOE finds that annual radiological sampling and analysis is required for the onsite wastewater treatment plant solid media, including flocked solids, spent filters, and carbon filter beds. CWMNW is responsible for confirming on an annual basis that these materials do not constitute radioactive waste prior to their disposal in the landfill.
3. ODOE finds that annual radiological sampling and analysis is required for the leachates produced by Landfill L-14 during the operational and post-closure periods for that landfill. The analytical results of this sampling shall be reported to ODOE upon receipt. CWMNW is responsible for confirming on an annual basis that these materials do not constitute radioactive waste prior to their disposal in the landfill.
4. ODOE finds that annual radiological sampling and analysis is required for the combined leachate stream from all onsite landfills during the operational and post-closure periods for the CWM facility. A sample shall be collected from each of the two retention ponds that receive effluent from the wastewater treatment facility. The analytical results of this sampling shall be reported to ODOE upon receipt. CWMNW is responsible for

confirming on an annual basis that these materials do not constitute radioactive waste prior to their disposal in the landfill.

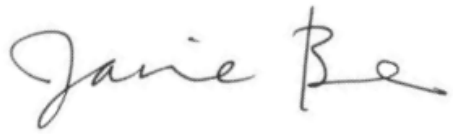
5. The Radiological Monitoring Plan in Attachment G of the CAP shall be implemented, and ODOE encourages CWMNW to complete installation of the proposed radiation portal monitor at the earliest possible opportunity. The plan shall be subject to revision by ODOE and CWMNW as deemed necessary to minimize the risk of noncompliance with applicable disposal laws.
6. ODOE further requires that a standalone annual compliance report be submitted to ODOE containing the following information:
    a. List of any radiological portal alarm occurrences, a description of the waste, associated waste profile and analytical/investigatory information, description of correspondence with the state, and ultimate waste disposition;
    b. Description of any incidents (e.g., portal alarms) involving materials known or suspected to contain Naturally Occurring Radioactive Material or other radiological materials above screening limits;
    c. Profile certification of leachate and onsite wastewater treatment plant solids including radioanalytical data;
    d. Listing of waste profiles for which CWMNW reviewed and sought concurrence with ODOE that the profile does not appear to qualify as “radioactive waste” for purposes of disposal in Oregon; and
    e. A calibration/maintenance log of portal monitor and associated equipment.

A revised CAP with the amendments required above, CAP addenda, all pertinent supporting documentation, all supplemental analyses, and any other corrections or clarifications shall be compiled into a single, comprehensive report submitted to ODOE. Please label this report "Final Corrective Action Plan" with the date of submission.

Please submit the Final Corrective Action Plan as described in this determination within thirty (30) days of receiving this letter.

We appreciate CWMNW’s cooperation in the Corrective Action process over the past year. If you have questions, please feel free to contact Maxwell Woods at 503-551-8209 or at Maxwell.Woods@oregon.gov.

Sincerely,



Janine Benner
Director
Oregon Department of Energy

Attachment 1. Oregon Department of Energy Responses to Public Comments on the Chemical Waste Management of the Northwest Corrective Action Plan, September 2020

Table 1. Public Meeting Follow-Up Responses

The following comments were made during a live webinar on September 30, 2020. Recordings of the morning webinar and the evening in-person public meeting in Arlington, Oregon, including public comments and agency responses, may be found on the ODOE website at https://www.oregon.gov/energy/safety-resiliency/Pages/Radioactive-Waste-Disposal.aspx. ODOE has provided a supplemental response for two questions from the morning webinar for which a written response was requested. The comments are excerpted from a longer series of remarks, which may be found in the recorded audio.

ID	Commenter	Comment	Response
Supp. 1	Scott Forester (webinar)	To take a satellite view, you're very good at talking about type of curies per liter of this and that and per gram, let's take a look at this. Back in the 70s the citizens of the state of Oregon both Republicans and Democrats put on the book to say no radioactive dumping in Oregon. You don't have a radioactive dump in Oregon, and you yourself said that what is it quote "It's not going to be a radioactive landfill, it's not going to become a radioactive landfill, it never will." I think I characterized that well. The thing is it is right now. We are a radioactive dump. It happened. So for 50 years we were fine but apparently the Oregon Department Energy and its personnel within never even conceptualized that there would be a possibility of low-level radioactive waste being dumped. That seems ludicrous that for fifty years, there was no discussion that this could be a possibility and that we would take preventive actions. Only after we got a tip again from an anonymous citizen that if we did not have that tip we would not be discussing today. So the thing is, I mentioned one of your other commenters said maybe in the future that there could be a proposal of a law to have a radioactive waste landfill. Now this basically is a foot in the door. So you'll be able to say when the dust settles here, so to speak, well, you know, we dealt with that though, it's a one off. But what you really did is set a precedent as well, which is hey, there could be a really great lobbyist that says, "You know, we already have like two and a half million pounds of radioactive waste in there already, why don't we go ahead and make it a low level radioactive waste repository?" And you never know what the vagaries of politics are in the future that maybe they say, hey we can manage it and make a lot of money and that's jobs. Paying jobs managing the United States radioactive waste from all these closed nuclear power plants. So, why wouldn't that be a possibility?	I don't really know how to answer that other than just to say it's a good consideration, what you bring up. *Follow up:* Well that's good. I'd like you to consider it in writing. *Follow-up written response post-webinar:* ODOE remains committed to upholding state statute, which prevents the establishment of a radioactive waste disposal facility. If there were an effort through the legislature by others to propose a change to this statute, ODOE would faithfully communicate the concerns we heard from the Arlington community and members of the Oregon public as a result of this disposal incident. ODOE would provide unbiased information regarding risks and tradeoffs associated with any considered change if asked by the legislature to submit expert testimony. While other states have chosen to allow these types of facilities, Oregonians have made a policy decision to prohibit them. The response to this recent incident indicates a strong preference to preserve and strengthen Oregon's prohibition against the disposal of radioactive waste.

Supp. 2	Scott Forester (webinar)	So actually, I do have pride in the state of Oregon. We may not be perfect, but I think we do things pretty darn good, but we can always have room for improvement. A message needs to be sent and the message that needs to be sent is that if you actually take a law that for as far as we know had never been violated in half century and it was violated and only for thank God a tip from a citizen that we found out that this dump was happening that we are going to take this most stringent measures possible you want to hit a company that makes billions of dollars waste management incorporated in their subsidiary chemical waste management. 210 million dollars is more like the ticket now, you know. Those are dangerous jobs, you mentioned risk. There's risk in everything including burying chemical. Based where you know what there's also a risk to the idea that Oregon makes laws and that law should be followed and that were estate they can basically dumped on right dumped on in this case radioactive dumping and then we're not going to do anything about it, we're just going to call it a cost of doing business and this half million dollar concept that's getting some radioactive Geiger counter or something to test incoming stuff that needs to be done anyway, but that is like a pittance. So it's gonna be a lot of high-paying jobs people are gonna have scuba. They're gonna be well-trained it's gonna take ten years that's ten years of high-income jobs, they're probably Union jobs, there's gonna be a lot of activity there and also every single day that those workers are out there waste management and corporated and chemical waste management we think into itself, you know, what we're never gonna do that mistake again any comments or? I would like comment in writing.	*Follow up written response post-webinar:* ODOE's goal with the Corrective Action Plan analysis has been to identify the best and safest decision for the radioactive materials currently buried in the landfill. The commenter makes a case that it should be possible with worker safety protocols to accomplish the excavation alternative with an acceptable risk to those who would be paid to do the work, and that the associated cost to the company would serve as a warning to future violators that the state takes a strong stance against the disposal of radioactive waste within the state. We appreciate the points made, but on the whole we disagree that this would be the best and safest response. First, while the work may be accomplishable, it is, as the commenter acknowledges, dangerous. Regardless what worker safety protocols and equipment are in place, there is an irreducible and uncertain amount of risk that would be involved. In order for the state to make the taking of such risks mandatory, even if the work itself is performed voluntarily by employees for pay, there must be a higher risk corresponding to not taking action. The purpose of the RA/CAP was to determine whether such action could be justified on the basis of a larger potential risk to future members of the public, and the analysis found that it cannot. Any resulting justification for putting lives in danger today would be to satisfy state standards and a perception of future risk that is not supported by the evidence or the science of radioactive waste management. Furthermore, the fact that this waste would be legal to dispose in a similar landfill in other states (or in fact landfills with fewer engineered barriers), speaks to the fact that it is not that the waste itself is too dangerous to dispose, only that it is Oregon's law that it not be disposed here. The other major argument in favor of the excavation alternative is the deterrence message it would send to future potential violators of the state's radioactive waste disposal laws. We agree that the high cost of the excavation alternative would send a message, but ODOE believes that the circumstances of the violation do not warrant such a response, and it would not be right to put

			people in harm's way if the sole remaining purpose for action is to cost the landfill operator money as a warning to others. ODOE has determined that other less dangerous options exist to strengthen the state's deterrence capability. ODOE recently completed rulemaking through the Energy Facility Siting Council for its OAR 345 Division 29 rules, a significantly increasing the penalty for illegal disposal of radioactive waste within the state. Further, ODOE is working with the Oregon legislature to strengthen many aspects of the state's radioactive waste disposal prevention program, including increased investigative, enforcement, and preventative powers and an ability to strengthen the state's definition of radioactive waste relative to the standards currently being adopted in other states. ODOE has also improved its outreach to landfills regarding Oregon's radioactive waste laws and is working on further improvements to how the agency's prevention program is implemented. Together, ODOE is bringing multiple tools to bear to send a message that any future violator of the state's radioactive waste disposal law will encounter a strong and potentially very costly response.

Table 2. Responses to Written Comments Received During the Public Comment Period

Comment ID	Commenter	Comment	Response
A1	Larry Glass	My main concern is implementation and maintenance of a strict regime of assessment to ensure radioactive wastes are never accepted at CWMNW Arlington in the future. To this end, I urge the OR Department of Energy to mandate implementation of passive radiation screening for all trucks or other conveyances arriving at CWMNW Arlington to deliver wastes in the future. Further, dynamic groundwater monitoring should be in place to catch any migration of radionuclides into the local groundwater. Third, OR DOE should not rely on CWM-performed testing for monitoring wastes at the Arlington site but should mandate that an independent laboratory perform such monitoring on a schedule devised by OR DOE and to report results to OR DOE directly, rather than having CWM report results to DOE.	Regarding the commenter's point about the need for passive radiation screening at the landfill, ODOE agrees. As part of the monitoring plan included with the Corrective Action Plan (Attachment G), Chemical Waste Management of the Northwest (CWMNW) is installing a portal monitor that will provide passive radiation screening for all shipments entering the landfill. Regarding future groundwater monitoring, as part of the corrective action, CWMNW is proposing to include radionuclide sampling to the facility's groundwater monitoring program during both the operational years and in the post-closure period of at least 30 years. The duration of post-closure monitoring requirements are established by the Oregon Department of Environmental Quality, which oversees the permit for the Chemical Waste Management of the Northwest landfill in accordance with the Resource Conservation and Recovery Act. Section 2.1 of the Corrective Action Plan contains information about the existing groundwater monitoring system. WM has proposed to add radionuclide monitoring every five years during the landfill's operation and the post-closure period (anticipated to be approximately 30 years), which would be in addition to the existing annual or semi-annual monitoring for chemicals such as VOCs and PCBs. Due to the expected slower migration of radionuclides in soil compared to the chemicals planned to be monitored, ODOE has determined that migration of disposed non-radioactive chemicals to groundwater, while not likely due to the landfill's engineered containment systems and naturally dry environment, would occur before any arrival of radionuclides in groundwater. In response to the public comments received, ODOE and WM have agreed to the following modifications to the proposed groundwater monitoring program for naturally occurring radionuclides: 1. The default groundwater monitoring program will follow WM's proposed 5-year interval for radionuclide analysis in the wells immediately upgradient and downgradient from Landfill L-14 during landfill operations and post-closure. The first radionuclide groundwater sampling event under this plan will occur in 2021. 2. If in the future, the higher-frequency monitoring data for non-radionuclides suggest that there may be a potential release from the lined landfill (i.e., failure of the landfill liner), the Oregon Department of Environmental Quality as the permitting authority will require the facility to enter a Compliance

			Monitoring phase including increased monitoring. At this time, WM would monitor for radionuclides on the same Compliance Monitoring schedule as for non-radionuclides. 3. The final enacted alternative shall be amended to state that the groundwater monitoring plan shall require monitoring for radionuclides following landfill closure, during the 30-year post-closure period. Regarding the commenter's point about the need for independent laboratory testing of monitoring samples, ODOE agrees. All compliance sampling at the WM facility is analyzed by third-party laboratories. Additionally, before wastes are placed in the landfill, generators that may be reasonably anticipated to produce NORM materials must submit samples on at least an annual basis to National Environmental Laboratory Accreditation Program (NELAP)-certified independent labs. CWMNW sends those labs to ODOE with an attached Quality Assurance/Quality Control (QA/QC) report as part of the waste screening process. In addition, the planned passive radiation portal monitor would be independently calibrated and maintained by a third-party company, and relevant documentation would be preserved for ODOE review in an annual report.
A2	Larry Glass	Lastly, I think that best practices based on science and expert assessment and recommendations should inform the disposition of the contaminated wastes. As a layperson, I think that retention of the wastes at Arlington is preferable than relocation to ID (or wherever a suitable waste site is identified). The relative risk of sequestration on site is low compared to relocation and the cost of relocation seems prohibitive.	Thank you for your comment. Based on ODOE's review of the science and the specific technical analysis, we agree.
A3	Larry Glass	I would urge DOE to examine immobilization techniques to ensure the radionuclides do not enter the surrounding soil, surface soil, air or groundwater.	Thank you for your comment. In the context of waste disposal, "immobilization techniques" tend to refer to ways a waste can be packaged or converted into solid physical forms to reduce its innate mobility prior to placement in a landfill. Because the waste in question has already been disposed, there are no feasible options for further immobilization after the fact, so instead the focus becomes the efficacy of containment within the landfill environment and the potential severity of release over long periods of time. In this case, the landfill is designed and operated to minimize migration of all contaminants, and reduce exposure of waste materials to air and water. Engineered features include multiple liners under the landfill, a leachate collection system, dust suppression activities during operation, and an eventual engineered cap to minimize or prevent infiltration of water (which is the primary mobilizing force for waste in the future).

			As part of the Corrective Action Plan, Waste Management contracted a drone flyover radiation detection survey of the landfill where the Bakken waste was disposed. The survey indicated that the wastes at their depths today do not present a hazard at the surface. The Risk Assessment performed by the landfill also calculated the potential risk from airborne dispersion of radionuclides during disposal and found the risk to be virtually zero. The Risk Assessment further evaluated the potential risk from the recirculation of landfill leachate onto the surface for dust control and similarly found the potential risk to workers and the public to be extremely low. Based on these findings, and WM's plan to install a passive radiation portal monitor at the facility entrance, ODOE is not requiring air monitoring at the landfill or on the site boundary. Groundwater will be monitored for radionuclides periodically. The Risk Assessment and Corrective Action Plan considered multiple future scenarios, including one where the landfill cap and liner failed immediately upon closure and a person lived in a house on top of the closed landfill and drank from the shallow aquifer underlying the landfill, ignoring the fact that the water is naturally non-potable and very low flow. This highly unlikely (and legally prohibited) confluence of events nevertheless resulted in at most a one in 1 million probability of developing a fatal cancer, and the time of maximum risk was estimated to be approximately 260,000 years in the future. For all of these reasons, ODOE is not requiring additional immobilization techniques in this situation in order to safeguard public health or the environment.
A4	Larry Glass	Additional monitoring should be deployed between the Arlington site and the Columbia River, including monitoring of surface waters that run into the Columbia as well as weather-related runoff emanating from the site. We must do all we can to safeguard the Columbia from contamination. Homes and businesses in the area near the Arlington site should be checked for radioactive contamination regularly, including local water delivery systems as well as individual homes and businesses. In case of any identified contamination outside of the Arlington site, CWM should be responsible for all costs of mitigation and losses to the community that may result (e.g. relocation of residents, business losses, drinking water supplies, etc.).	Thank you for your comment. We agree that protection of the Columbia River and the nearby community from the migration of radioactivity is a critically important goal for the corrective action in response to this situation. Based on the multiple lines of evidence and technically credible modeling presented in the Risk Assessment and Corrective Action Plan, ODOE agrees with the conclusion that the radioactive material in its current disposal context poses no significant threat to surface water, groundwater, workers, or nearby residents and communities, both now and into the far future. As described in the Risk Assessment and supported by the environmental studies accompanying the landfill's permit, there is no known surface water that flows from the landfill to the river. Page 3 of the Corrective Action Plan states, "There are no natural surface water bodies on the CWMNW facility; however, some precipitation from the areas surrounding the CWMNW facility eventually ponds to the south in Alkali Canyon [away from the river], where it eventually evaporates (CH2M Hill, 2008). Precipitation that runs off of the active cells in the landfill is retained on site in evaporation basins, as per the stormwater permit with the Oregon Department of Environmental Quality (DEQ).

			A naturally non-potable groundwater is present approximately 80 feet below the base of the landfill. This groundwater flows toward the southeast (away from the Columbia River) until it encounters the side of Alkali Canyon. Due to the low flow of this groundwater feature, water evaporates from the exposed canyon and floor before it can form a surface water seep. Additionally, the modeling in the Risk Assessment/Corrective Action Plan (RA/CAP) found that any Bakken waste radionuclides migrating from the landfill in the future would already be at concentrations low enough to meet safe drinking water standards at the point they would reach the groundwater directly underneath. Once in the groundwater, concentrations would decrease further due to dilution. Given the landfill's engineered features (multiple liner system, leachate collection system, and planned post-closure cap), the regional climate, and the properties of the underlying groundwater aquifer, the Department finds it is extremely unlikely that waste would migrate to a source of potable water or, ultimately, the Columbia River. The monitoring plan included with the Corrective Action Plan includes sampling of groundwater for radionuclides to confirm that the aquifer is not impaired. If impact is detected in the future, ODOE will work with DEQ and the responsible parties to ensure that the public is protected at the expense of responsible parties.
A5	Larry Glass	As a layperson, I am not versed in such techniques, but perhaps some type of substrate adsorption could be implemented to reduce the possibility of migration of the radioactive material out of the containment area. I also think that a thick concrete cap should be added to any soil cap to prevent the possibility of accidental or malicious uncovering of the dangerous waste. Additionally, monitoring devices should be installed around the site(s) where the waste is to be sequestered as well as signage and motion-sensitive lights and light and infrared cameras to prevent intruders from accessing the site. DOE should be automatically alerted to any intrusion or disruption at the contaminated	The hazardous waste landfill site closure plan is consistent with the restrictive requirements for a RCRA subtitle C landfill[1] and will be regulated by the Oregon Department of Environmental Quality. The post-closure landfill cap would be designed to prevent water transmission (e.g., storing precipitation in winter so it may evaporate in summer) and to be largely "self-healing" in the event of seismic activity. The existing permit contains a fencing and security protocol to prevent inadvertent intrusion into the landfill post-closure, and deed restrictions on the landfill property will act as an administrative control on future digging. The deed restriction will include information regarding the contents of the landfill to notify future people about the potential hazards. Another aspect of the post-closure care requirement is an ongoing periodic site stability inspection. The Department of Energy will coordinate with DEQ as to when post-closure inspections and monitoring events occur, and will accompany the inspection team on a regular schedule to ensure that the appropriate standard of care is being taken.

[1] The Resource Conservation and Recovery Act, Subtitle C, regulates the management of hazardous wastes and prescribes specific design and operational requirements for hazardous waste disposal facilities.

		site. Regular inspections and testing for contamination should be performed by DOE and not be left to CWM to conduct. Thank you for your consideration. Larry Glass Florence, OR 97439	Based on this comment, we had a conversation with DEQ as to whether a concrete layer or a remote-sensing network would be allowable and advisable under RCRA closure protocols. It was the determination of both agencies that the existing landfill design and public access controls are consistent with other hazardous waste landfills around the country and adequate for long-term public protection from the radioactive materials in the landfill. Because of the dispersed vertical and lateral locations of the waste disposals across the 32 acres of landfill over the approximately three-year period (See Appendix D of the Corrective Action Plan), the scale of any malicious action needed to exhume a hazard-significant quantity of this waste would be enormous, conspicuous, and expensive; and as such, ODOE finds this unlikely to occur. The Risk Assessment and Corrective Action Plan evaluated the potential risk associated with a future intruder drilling a well directly through the closed landfill and intersecting with one of the TENORM disposal locations. This would be an unlikely occurrence because the landfill property and a large surrounding buffer area is privately owned, and the closure requirements in the hazardous waste landfill permit will require permanent land use controls preventing such activity. Nevertheless, should such a drilling excavation occur in the future and be unfortunate enough to intersect with one of the dispersed waste disposal locations, the estimated risk associated with spreading the contaminated drill cuttings on the surface and living in a house built on top of them would create an additional six in 1 million risk of developing a fatal cancer due to the radioactivity in the material. Because of the combined low probabilities of encountering the waste and low risk level resulting from such exposure, ODOE and DEQ finds that the addition of a concrete cap or intruder surveillance measures would not add a significant safety factor above the already planned post-closure features and controls.
B1	Steve Siegel	How is the engineering of the Chemical Waste Management facility that accepted radioactive waste different from facilities in other states that are legally licensed to accept the waste?	The CWMNW facility is a RCRA subtitle C facility, meaning it has met the design requirements to safely dispose of chemical hazardous wastes. The landfill has a permit from DEQ. Per the EPA (https://www.epa.gov/hwpermitting/hazardous-waste-management-facilities-and-units#landfills), design features of a Subtitle C facility include: • double HDPE liner • double leachate collection and removal systems • leak detection system • run on, runoff, and wind dispersal controls • construction quality assurance program • installation and maintenance of a final cover

			• continuing operation of the leachate collection and removal system until leachate is no longer detected • Maintaining and monitoring the leak detection system • Maintaining ground water monitoring • Preventing storm water run on and runoff • Installing and protecting surveyed benchmarks By comparison, a low-level radioactive waste disposal facility licensed by the Nuclear Regulatory Commission or an Agreement State (Oregon is an Agreement State) must comply with 10 CFR Part 61. The licensing requirements for a facility include the ones listed below, but the complete list may be found in the regulation: • An analysis demonstrating a reasonable assurance that dose-based performance objectives will be met, specifically, "Concentrations of radioactive material which may be released to the general environment in groundwater, surface water, air, soil, plants, or animals must not result in an annual dose exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public. Reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable." • Design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed. • The disposal facility must be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required. • The facility must meet certain site suitability requirements such as: o Ability to be characterized and monitored. o Any projected population growth is unlikely to result in performance objectives not being met. o Avoids having known natural resources, free of areas of flooding or frequent ponding. o Sufficient depth to the water table such that groundwater intrusion into the waste will not occur. o Avoids areas where significant surface geologic processes (e.g., erosion, landslides) would affect performance objectives. • The facility must meet certain design requirements include the following:

			○ (1) Site design features must be directed toward long-term isolation and avoidance of the need for continuing active maintenance after site closure. ○ (2) The disposal site design and operation must be compatible with the disposal site closure and stabilization plan and lead to disposal site closure that provides reasonable assurance that the performance objectives will be met. ○ (3) The disposal site must be designed to complement and improve, where appropriate, the ability of the disposal site's natural characteristics to assure that the performance objectives will be met. ○ (4) Covers must be designed to minimize, to the extent practicable, water infiltration; to direct percolating or surface water away from the disposed waste; and to resist degradation by surface geologic processes and biotic activity. ○ (5) Surface features must direct surface water drainage away from disposal units at velocities and gradients that will not result in erosion that will require ongoing active maintenance in the future. ○ (6) The disposal site must be designed to minimize, to the extent practicable, the contact of water with waste during storage, the contact of standing water with waste during disposal, and the contact of percolating or standing water with wastes after disposal. • 10 CFR Part 61 also includes operational requirements of the disposal facility, such as maintaining disposal package integrity, filling void spaces, limiting the dose rate at the surface of the cover, accurate mapping of disposal units, and appropriate buffer zones. The licensee must also have plans for taking corrective measures if migration of radionuclides would indicate that the performance objectives of subpart C may not be met. • After the disposal site is closed, the licensee responsible for post-operational surveillance of the disposal site shall maintain a monitoring system based on the operating history and the closure and stabilization of the disposal site. The monitoring system must be capable of providing early warning of releases of radionuclides from the disposal site before they leave the site. In summary, the requirements for a Subtitle C landfill are similar to those of a low-level radioactive waste landfill, including landfill design best practices for site stability and water management, and operational and post-closure monitoring of groundwater. The CWMNW facility is not a radioactive waste disposal facility. However, the Risk Assessment conducted in response to the Notice of Violation was designed to demonstrate that from a radiation perspective, a future resident living on the landfill would not receive a dose in excess of unrestricted land use standards or the standards of 10 CFR Part 61.

B2	Steve Siegel	In what ways is CWM's environmental and worker safety protocols different than those at facilities in other states that are legally licensed to accept the waste?	The Chemical Waste Management of the Northwest facility is a RCRA Subtitle C Hazardous Waste Landfill, and such facilities require stringent worker safety protocols to protect workers from the risks associated with exposure to non-radioactive hazardous chemicals. At the CWMNW facility, all landfill workers are required to wear personal protective equipment including respirators, and are supposed to stay inside their vehicles to the extent possible when working within the landfill footprint. The potential pathways of concern for the Bakken oilfield waste would be inhalation of radon gas, accidental ingestion of dust, or direct exposure (i.e., "shine") due to standing too close to a waste source. The Risk Assessment confirmed that the existing worker safety measures at the landfill, coupled with the fact that several feet of soil and other materials are currently shielding people from contaminant mobilization or exposure, serve to make the risk to past, present, and future workers virtually nonexistent. As the landfill continues operation, the depth of burial will increase and the risk will decrease even further. Because the federal government does not regulate the disposal of Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) like the Bakken Oilfield Waste that was disposed at the CWMNW landfill, each state regulates TENORM independently. As a surrogate, ODOE staff researched the environmental and worker safety requirements for low-level radioactive waste disposal facilities licensed by the NRC under 10 CFR Part 61. Our review found that the existing protocols at the CWMNW facility appear to be consistent with the NRC requirements.
B3	Steve Siegel	How does the long-term financial assurances proposed by CWM to pay for problems that may occur at the facility after its closure compare to the financial assurances at facilities in other states that are legally licensed to accept the waste?	A low-level radioactive waste disposal facility licensed by the NRC under 10 CFR 61 is required to, "provide assurance that sufficient funds will be available to carry out disposal site closure and stabilization, including: (1) Decontamination or dismantlement of land disposal facility structures; and (2) closure and stabilization of the disposal site so that following transfer of the disposal site to the site owner, the need for ongoing active maintenance is eliminated to the extent practicable and only minor custodial care, surveillance, and monitoring are required." An applicant must also provide "a binding arrangement, such as a lease, between the applicant and the disposal site owner that ensures that sufficient funds will be available to cover the costs of monitoring and any required maintenance during the institutional control period." Comparable requirements also apply to RCRA Subtitle C landfills, which the CWMNW facility is via a permit provided by the Oregon Department of Environmental Quality. RCRA requires, "all treatment, storage and disposal facilities (TSDFs) to demonstrate that they will have the financial resources to properly close the facility or unit when its operational life is over, or provide the appropriate emergency response in the case of an accidental release." (https://www.epa.gov/hwpermitting/financial-assurance-requirements-hazardous-

			waste-treatment-storage-and-disposal). Post-closure care costs include long-term maintenance of the unit or facility, monitoring, and record keeping during the required post-closure care period. According to DEQ, the Waste Management facility is currently covered by a financial surety instrument, which includes closure costs and post closure care for 30 years for the entire facility. The required amount of financial surety is reassessed on an annual basis or any time the permit for the facility is modified.
B4	Steve Siegel	How does the long-term environmental monitoring after closure proposed by CWM compare with monitoring in other states that are legally licensed to accept the waste?	The long-term environmental program for the CWMNW landfill is consistent with the requirements for a RCRA Subtitle C Hazardous Waste Landfill. The program includes ongoing groundwater monitoring for 30 years or until the post-closure landfill cap results in a cessation of leachate production (i.e., until the landfill becomes a "dry capsule"). The DEQ permit for the facility also requires regular inspection of the landfill cap post-closure to assess its integrity and repair any anomalies found. Because the federal government does not regulate the disposal of Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) like the Bakken Oilfield Waste that was disposed at the CWMNW landfill, each state regulates TENORM independently. As a surrogate, ODOE staff researched the Nuclear Regulatory Commission's post-closure monitoring requirements for low-level radioactive waste facilities in 10 CFR 61.53. The requirement does not include specific scope or duration of monitoring, but requires more generally that, "post-operational surveillance of the disposal site shall maintain a monitoring system based on the operating history and the closure and stabilization of the disposal site. The monitoring system must be capable of providing early warning of releases of radionuclides from the disposal site before they leave the site boundary." NRC guidance on environmental monitoring (https://www.nrc.gov/docs/ML0530/ML053010320.pdf) further states, "The post-operational monitoring ensures that the site continues to meet closure requirements. At this time, most of the environmental sampling can be terminated except for groundwater monitoring, which must be carried on to provide data to support long-term impact evaluation . . . After site closure, the primary path for radionuclide release to the environment is through groundwater. The groundwater monitoring program for the operational phase should be continued during the initial period after site closure but can be gradually reduced if no potential problem is identified." ODOE finds these requirements to be generally comparable and consistent.
B5	Steve Siegel	How much longer does the radioactive waste accepted by CWM pose a potential environmental and public health threat than waste disposed of at	The duration of radioactivity associated with naturally occurring radioactive materials varies from seconds to millennia depending on the nuclide of interest. The half-life (i.e., the amount of time required for half of the radioactivity to decay) of radium-226, which was the chief radionuclide of interest in this case, is

		solid waste and hazardous waste landfills in Oregon? How does the proposed environmental monitoring and financial assurances in CWM's plan compare with legally operated facilities in Oregon?	approximately 1,600 years. The radium then decays to other shorter- and longer-lived nuclides, but it is generally true that the radionuclides in question remain hazardous over very long time periods. Similarly, different hazardous chemicals permitted to be disposed in a RCRA Subtitle C landfill (which the CWMNW landfill is) have varying hazard durations. While some chemicals would be expected to naturally break down over time, other hazardous constituents, such as heavy metals, will retain their hazardous properties essentially forever. It is for this reason that the requirements for RCRA hazardous landfills and low-level radioactive waste disposal facilities have many similarities. It is worth noting that the CWMNW facility is the only hazardous waste facility in Oregon and one of approximately 21 in the nation. To be clear, the facility is not a radioactive waste disposal facility. Please see the responses to comments B3 and B4 for a discussion of environmental monitoring and financial assurance requirements.
B6	Steve Siegel	What steps is the Department of Energy taking to ensure that persons who act illegally do not financially benefit from their actions, to the detriment of public health, the environment, and to businesses that operate within legal requirements?	In response to the CWMNW violation, ODOE initiated a rulemaking through the Energy Facility Siting Council and formed a Rulemaking Advisory Committee to suggest revisions to strengthen OAR 345 Division 29, which is the rule that defines the civil penalty structure the state may use in response to violations of the state's prohibition against the disposal of radioactive waste. The final revised rules were adopted by the Council in February 2021 and will provide a strengthened deterrence against the illegal disposal of radioactive waste.
B7	Steve Siegel	What measures are available to DOE to ensure that CWM does not profit from and has sufficient financial disincentives to prevent delaying implementation of measures the state determines are appropriate to protect public health and the environment?	As previously described, ODOE initiated a rulemaking through the Energy Facility Siting Council and formed a Rulemaking Advisory Committee to suggest revisions to OAR 345 Division 29 that will strengthen ODOE's financial deterrence capabilities and incentivize corrective actions by responsible parties. The final revised rules were adopted by the Energy Facility Siting Council in February 2021. ODOE is also working with the Oregon legislature during the 2021 session to clarify and strengthen its authority to dictate corrective actions and preventative measures when it determines such actions are necessary to ensure that the law prohibiting the disposal of radioactive waste within the state will be met.
B8	Steve Siegel	<u>Comments</u> The Oregon public, its workers, and our environment deserve all protections offered in other states. This is the case always, but especially in an instance when the underlying activity of accepting radioactive waste is illegal in Oregon and in other states. Under these circumstances, Oregon DOE should ensure that CWM promptly implements the most protective measures,	Thank you for your comment. Based on ODOE's comparative review of the requirements of low-level radioactive waste disposal facilities and RCRA Subtitle C disposal facilities, coupled with the results of the Risk Assessment that ODOE required to be developed for the TENORM wastes subject to the violation, we have determined the following: • The results of the risk assessment indicate that the amount and concentration of the TENORM waste in its current disposal location was not sufficient to present a past, current, or future threat to human health or the environment. This finding would still be true if the engineered features of the CWMNW facility (cap, liner, and leachate collection system) failed immediately upon site closure.

		and require CWM to amend its plan to identify and include those measures. In the event CWM fails to promptly implement protections that at a minimum are required in other states, DOE should notify the public and CWM, and take all actions necessary to ensure CWM funds and implements those measures.	• ODOE understands the value being communicated by this comment, but we disagree that the CWMNW facility should be held to all standards of a low-level waste facility, particularly requirements associated with licensing a facility to accept radioactive waste, as that would be inconsistent with the state prohibition against establishing such a facility. • ODOE's review of the substantive requirements of other facilities that accept similar wastes is discussed in our responses to comments B1-B5. Based on this review, we find that no additional measures are necessary to protect human health and the environment, although monitoring will be expanded to include radionuclides. • As described in our determination, WM is implementing procedures to ensure that illegal disposal of radioactive waste does not happen again (see Comment A1 and https://www.oregon.gov/energy/safety-resiliency/Documents/2020-09-08-ODOE-CAP-RA-Memo.pdf).
C1	David Hupp	*What has happened at Arlington should never have happened and must never happen again.* The core questions to be addressed are what can be done to mitigate the harm, how to hold Chemical Waste Management responsible for their action, and how to assure Oregonians this will never happen again.	We agree with the assertion expressed here. The Corrective Action Plan contains proposed preventative measures to provide confidence that unlawful disposal of radioactive materials will not occur again at the CWMNW landfill. See also: https://www.oregon.gov/energy/safety-resiliency/Documents/2020-09-08-ODOE-CAP-RA-Memo.pdf Separately from this corrective action process, ODOE is also undertaking additional education and outreach to landfills, generators, and other related entities to better ensure Oregon's radioactive waste laws are known and understood. ODOE also recently completed a rulemaking through the Energy Facility Siting Council to update our corrective action and civil penalty structure in OAR 345 Division 29, in an effort to strengthen the agency's deterrent associated with its disposal laws. ODOE is also working with the Oregon legislature during the 2021 session to clarify and strengthen its authority to dictate corrective actions and preventative measures when we determines such actions are necessary to ensure that the law prohibiting the disposal of radioactive waste within the state will be met.
C2	David Hupp	**Mitigation** In ODOE's summary document "Radioactive Waste Disposal in Oregon" (www.oregon.gov/energy/safety-resiliency/Pages/Radioactive-Waste-Disposal.aspx), I find this astonishing statement: "In consultation with other State of Oregon agencies, ODOE determined there is no current threat to landfill workers, the public, or the environment from this waste." Further,	The statement regarding "no current threat" was originally made in February 2020 at the time ODOE issued the Notice of Violation. The statement applied to the window of time between when we discovered that the waste existed in the landfill in September 2019 and the time when a formal decision could be made about how to manage potential future risk associated with the waste (supported by the Risk Assessment). It also reflected an expected negligible past risk to landfill workers, based on professional and expert judgment. Our preliminary analysis from early 2020, after consultation with the Oregon Department of Environmental Quality and Oregon Health's Radiation Protection Services, was that given the known concentrations of natural radioactivity in the waste and the fact that its current depth of burial is sufficient to shield against

		"ODOE directed the landfill operator to prepare a risk assessment to formally evaluate potential past, present, and future risk from the waste, and to develop a corrective action plan to outline the processes the company will put in place to prevent this from happening again." How on earth can ODOE determine "no current threat" prior to completion of the direct risk assessment? If there is "no threat to the environment", what is there to mitigate?	radiation exposure, there was no immediate threat to the workers, the public, or the environment. A study from a recent TENORM incident in Kentucky, involving comparable concentrations of radionuclides, provided support for the conclusion that past risks to landfill workers and the public during the period of actual waste disposal were also likely to have been minimal. These assertions were ultimately supported by the September 2020 risk assessment. The assertion of “no current risk” was not a statement about the potential for future risk, which is why the formal long-term Risk Assessment was necessary. Upon finding that there was no imminent threat to public health requiring immediate action, the agency had the time to be deliberative and perform a more in-depth analysis to support a final corrective action response.
C3	David Hupp	I move on to the document "Corrective Action Plan (CAP) Chemical Waste Management of the Northwest, Inc. Facility Arlington, OR", dated September 1, 2020 and prepared by some Boston outfit called Gradient, to find the summary of Chemical Waste Management's view of mitigation. On page 40 the company suggests that "Both of the remediation alternatives reduce the potential environmental mobility of the Bakken oilfield waste by containing it through a combined liner/cap/leachate collection system," but then claims that "Reduction of toxicity of the Bakken oilfield waste is not relevant, because radionuclides cannot be destroyed or degraded (other than by natural decay)." The first of these statements summarizes the minimum of what the State of Oregon must require of Chemical Waste Management. The second statement is a self-serving absurdity on its face. The rest of the document is 481 pages of pulp filled with distracting and impenetrable academic nonsense.	Oregon required CWMNW to perform an analysis that follows the substantive requirements and criteria of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). One of the nine CERCLA criteria evaluates a remedy’s effectiveness based on its ability to “reduce a waste’s toxicity, mobility, or volume through treatment.” The language referenced in this comment asserts that whether the Bakken oilfield waste is closed in place or exhumed and disposed in another landfill out of state, its reduction in mobility may be assumed to be roughly equivalent. The quoted language about reduction of toxicity is making a technically accurate comparative statement that the toxicity of radioactivity may not be reduced via “treatment” in the same way that some hazardous chemicals may be treated to reduce their toxicity. Therefore, reduction of mobility is the applicable measure of effectiveness when assessing radionuclides under this CERCLA criterion. ODOE’s Nuclear Safety division has determined that the technical quality of the Corrective Action Plan is strong enough to support a decision. Our two public meetings on September 30, 2020, which were recorded and made available for public access via our website, were designed to help make the complicated aspects of the analyses more accessible to people who might be unfamiliar with the specific methods that were required to produce the analysis, and to allow questions and dialogue regarding the methods, analysis, and results. We hope this document sharing questions, comments, and responses serves the same purpose.

C4	David Hupp	Beyond this opinion I strongly recommend the Arlington landfill be designated a Superfund site, because the Bakken fracked-gas wastewater disposal is interstate, I do not want Chemical Waste Management involved in managing the site beyond constructing the "combined liner/cap/leachate collection system". Beyond what financing can be wrested from this scofflaw company I want federal taxpayers to foot the bill, not just Oregon taxpayers.	Thank you for your comment. We considered the recommendation but disagree for the following reasons. It is not within the authority of ODOE to designate the CWMNW facility as a Superfund site. We interpret the comment to mean that the site should be addressed under applicable state (ORS chapter 465) or federal (Comprehensive Environmental Remediation, Compensation, and Liabilities Act (CERCLA), sometimes colloquially called "Superfund") hazardous substance cleanup laws. Those laws address releases of hazardous substances into the environment and require cleanup to applicable risk based standards. "Superfund" or fund-lead national priority list (NPL) sites are typically cleanup sites in which the responsible party cannot pay for the required work. Sites in which the responsible party can pay for the required work are referred to as "RP-lead" NPL sites. Permit requirements known as RCRA "corrective action" requirements will require a cleanup equivalent to ORS chapter 465 or CERCLA if there are releases into the environment that threaten human health or the environment. Additionally, because the landfill is a RCRA-permitted facility, it is more likely action would be taken under the RCRA permit than for the site to be listed on the NPL. As noted elsewhere in this response, DEQ has permitted the CWMNW facility as a RCRA Subtitle C hazardous waste landfill, and DEQ maintains ongoing responsibilities for compliance with its permit. These landfills are designed to provide a safe permanent disposal sites for hazardous wastes. DEQ has been involved in the response to the illegal disposal at the CWMNW facility and issued a separate notice of violation in 2020. The Risk Assessment performed during this process determined that the maximum excess lifetime cancer risk to future receptors (including workers, potential future members of the public, and wildlife) would be within the state and federal risk range. According to DEQ, the CWMNW facility is currently covered by a financial surety instrument, which includes closure costs and post closure care for 30 years for the entire facility. The required amount of financial surety is reassessed on an annual basis or any time the permit for the facility is modified.
C5	David Hupp	Responsibility Chemical Waste Management surely, at the very least, violated whatever contract it has with the State of Oregon. As it has violated state law (ORS 469.525),	The CWMNW facility is permitted by DEQ, which has initiated enforcement actions on the landfill operators for violation of its permit conditions and laws related to the lawful disposal of solid waste within the state. The DEQ enforcement action does involve a civil penalty. Continued operation of the landfill under its DEQ-issued RCRA permit is a decision not made by our agency.

		it must be prosecuted to the fullest extent of the law, heavily fined, then told to take its business elsewhere, and management of the Arlington dump turned over to some organization that is more trustworthy. I refer to this company as "scofflaw" because they, and their parent company, Waste Management, Inc., have a long and well-documented history of illegal and unethical behavior (see extensive references at www.corporations.org/wmi/index.html). Further, as one trained in economics I have recognized their monopolistic price-fixing and other anti-competitive practices for decades.	ODOE's primary concerns are that the best and safest corrective action is selected in response to the radioactive materials already placed in the landfill, and that Oregon's radioactive waste disposal laws are followed in the future. The Corrective Action Plan has demonstrated to our satisfaction that Alternative 1 (in place closure of the subject wastes) will be protective of human health and the environment, and prevent potential worker and public risks associated with exhuming the wastes for re-disposal elsewhere. As part of the corrective action, CWMNW is proposing new procedures, to be overseen by ODOE, as well as significant infrastructure investment to better screen for radioactive materials and prevent an event like this from occurring again. ODOE also recently completed a rulemaking through the Energy Facility Siting Council for OAR 345 Division 29 to update our corrective action and civil penalty structure, and to strengthen the agency's deterrent associated with its disposal laws. ODOE is also working with the Oregon legislature during the 2021 session to clarify and strengthen its authority to dictate corrective actions and preventative measures when ODOE determines such actions are necessary to ensure that the law prohibiting the disposal of radioactive waste within the state will be met.
C6	David Hupp	**Assurance** How can Oregon state government assure me and other citizens this damage to our environment will never happen again? The prohibition law (ORS 469.525) is in place, but perhaps it is not strong enough and/or perhaps it has not been adequately implemented. The law prohibits the placement of radioactive waste absolutely. It states that ODOE stands ready to help Oregon companies deal with this. But is it adequate to absolutely prohibit the importing of waste from other states? I don't know. As a former government employee trained in economics I fully realize that adequate implementation of laws requires an adequate budget. If that is part of the problem, then I expect state agencies to take the initiative and strongly make the necessary proposal to the Legislature, and not wait for the initiative to come from an individual	Thank you for your comment. In response to lessons learned from this situation, ODOE has initiated multiple efforts to strengthen the state's ability to prevent the disposal of radioactive waste within the state. First, ODOE has increased its outreach efforts to landfills and in-state generators of NORM wastes to increase awareness of the radioactive waste laws and rules and how they apply. Second, ODOE initiated a rulemaking through the Energy Facility Siting Council and formed a Rulemaking Advisory Committee to suggest revisions to strengthen OAR 345 Division 29. This set of rules establishes the agency's capabilities regarding notices of violation, enforcement actions, and civil penalties. The final revised rules were adopted by the Council in February 2021 and will provide a strengthened deterrence against the illegal disposal of radioactive waste. Finally, the Department is also working with the Oregon legislature during the 2021 session to clarify and strengthen its authority to dictate corrective actions and preventative measures when ODOE determines such actions are necessary to ensure that the law prohibiting the disposal of radioactive waste within the state will be met. We also recognize and appreciate that a comprehensive prevention program requires staff time and resources.

		legislator. The governor's weight must be brought to bear here. This *cannot* happen again!	
D1	Columbia Riverkeeper	ODOE Should Complete Its Own Independent Risk Analysis As a private, for-profit company, Chem Waste has a clear motivation to produce a risk assessment and CAP that is most favorable to its own financial interests. When the public first learned of the illegal dumping at Chem Waste's facility, Columbia Riverkeeper and others urged ODOE and the State of Oregon to independently investigate the facility and the risks to human health and the environment associated with Chem Waste's acceptance of the waste. In some respects, ODOE did investigate Chem Waste. According to ODOE, with Chem Waste's cooperation, the agency worked to determine the volume and nature of the waste that came to Arlington and some of the circumstances that led to its illegal disposal in Oregon. However, we remain concerned that ODOE's assessment of the impacts of the pollution that Chem Waste proposes to leave in its Arlington landfill rely largely, or even exclusively, on information developed and put forward by Chem Waste and its consultants. In addressing the impacts of the pollution, ODOE has put Chem Waste in the driver's seat with respect to developing a Corrective Action Plan. In reality, the onus is on the agency to ensure that the public is adequately protected.	ODOE technical staff were involved with the risk assessment design and implementation. We are satisfied that the methodologies performed were conducted appropriately and impartially by risk assessors who are well-respected in their fields. At ODOE's request, the assessors added additional levels of pessimism to the analysis so it includes a "worst case" level of risk. The analysis itself built on what ODOE finds to be the most reliable data available about the waste in question (based on third-party laboratory analysis of annual waste samples and WM's waste disposal volume/location tracking database). Transportation data provided by the State of North Dakota helped to validate the waste volumes and characteristics used in the analysis. The analysis methods were consistent with technical best practices and employed modeling methods developed by the Environmental Protection Agency, Nuclear Regulatory Commission, International Commission on Radiological Protection, the U.S. Department of Energy, and others. ODOE reviewed the appropriateness of each methodology until we were satisfied that the contractors had used the correct tools for the job. We agree that the onus is on ODOE to ensure that the selected alternative is protective of the public. We have been involved through all significant decision points associated with the plan. We will continue to be engaged and verify that the actions taken fulfill the plan, and that the data continue to indicate that the public is protected.
D2	Columbia Riverkeeper	We have reason to be concerned about Chem Waste's conclusions, and ODOE's apparent willingness to defer to Chem Waste. Chem Waste has	We disagree with some of the assertions made in this portion of the comment. At present, leachate data for radionuclides is only available from one moment in time. Therefore, it is inaccurate to state that concentrations of uranium, thorium, and their decay products have "sharply elevated," although we would

		already made public statements that have proven incorrect. For example, in March 2020, Chem Waste asserted in a public meeting that they did not expect to see increased radioactivity in the leachate because the illegally dumped radioactive fracking waste consisted of filters which the company expected to hold the radioactive pollution in place. However, in May 2020, Chem Waste released a Preliminary Leachate analysis showing that radionuclide levels far exceeded drinking water standards, and radioactive pollution had impacted the leachate. Chem Waste now asserts that leachate management can remain largely unchanged, despite sharply elevated levels of uranium, thorium, and other radionuclides. We remain concerned that the practice of using radioactive leachate for dust suppression may become more risky over time if the leachate becomes more and more radioactive.	agree that the levels are higher than expected natural background. Currently there is not sufficient data to establish a causal link between the leachate concentrations found in May 2020 and the disposal of the subject Bakken waste in the 2016-2019 period. ODOE agrees that additional monitoring and data collection for radionuclides in the leachate is a reasonable precaution, and we have included a requirement for Waste Management to certify annually that the leachate does not qualify as radioactive waste as defined in OAR 345-050. While ODOE does not regulate to the drinking water standard, leachate from a hazardous waste landfill is not potable anyway, and therefore is not subject to those standards under the existing DEQ permit. A second point within this section warrants additional discussion. The comment expresses concern that the landfill's, "practice of using radioactive leachate for dust suppression may become more risky over time," if the levels in the leachate continue to rise. We partially agree with this comment, but based on the analysis we determined that there would need to be an extraordinary increase in leachate concentrations before a significant health effect would be realized. ODOE required the landfill to develop a leachate risk analysis in response to concerns raised by Columbia Riverkeeper at the March 2020 public meeting on this topic (https://www.oregon.gov/energy/safety-resiliency/Documents/2020-05-29-CWM-Prelim-Leachate-Analysis.pdf). The leachate analysis determined that the dose to a maximally exposed individual (a landfill worker) associated with leachate management practices would be 0.22 millirem per year for every year working at the landfill. At this dose rate, the corresponding risk of developing a fatal cancer (based on dose conversion factors used by the EPA) would be an additional one in 1 million probability after approximately six years of work. However, this analysis was biased toward pessimism in a number of ways: • Inhalation and soil ingestion pathways for the landfill worker are considered unlikely because all personnel working inside the landfill footprint wear personal protective equipment (PPE) that includes Tyvek suits, gloves, respirator, and safety glasses. For this assessment, it was assumed a worker continually did not wear any PPE, in violation of landfill procedures, and thus a hypothetical dose via inhalation and soil ingestion was included in the calculation. • The worker is assumed to be outside of their vehicle standing on a freshly sprayed landfill surface for a half hour per day for 250 days per year (or 50 five-day work weeks). This is not likely because worker safety and exposure protocols at the facility preclude anyone from being outside of the cab of a vehicle on the landfill surface unless they are absolutely required to do so. This pessimistic assumption was a leading contributor to the dose calculation because it increased the total time of possible exposure and placed the worker closer to the landfill surface where they could receive direct gamma exposure (which decreases with shielding or physical distance from the source). The analysis

			concluded that 96% of the reported maximum potential dose came from external exposure. In reality, the worker would not be subject to such doses if they remained in their vehicle higher off the ground. Furthermore, 60% of the external gamma dose came from natural potassium-40, which is a natural radionuclide that is not associated with the radium-bearing waste that is the subject of this corrective action. • The dose to the worker based on the assumptions above is further artificially increased because the calculation assumed that the landfill conducted 50-years' worth of spraying on the landfill surface with no new cover material, in order to build up concentrations of nuclides in surface soil for purposes of the calculation. In reality, the surface is continually being covered with new wastes and fill materials as a function of the normal operation of the landfill. If this 50-year accumulation of spray were covered by one meter of cover material (which is what would really be happening as the elevation of the landfill rises with each new load disposed), the dose to the worker drops to zero. The leachate management analysis report also compared the May 2020 leachate values against state standards and estimated worker dose rates as follows: • Currently, the highest uranium concentrations found in the leachate are 358 pCi/L, whereas the concentration at which the leachate would represent "radioactive waste" prohibited from in-state disposal is 10,000 pCi/L (Table 3 in OAR 345-050). • The report found that if the leachate concentrations were to increase to the state's Table 3 limits for the soluble form (at which point the waste would be called "radioactive waste" and be unsuitable for in-state disposal), the annual dose to the landfill worker (the maximally exposed individual) after a 50-year buildup time would be 5.8 mrem/year. This dose is a small fraction of the 100 mrem/yr federal public dose limit. • In order to represent a 100 mrem/year dose to the landfill worker, the uranium concentration in the leachate would need to exceed 630,000 pCi/L (again, at its highest, the actual uranium concentrations found in the leachate are 358 pCi/L. In summation, it is important to not lose sight of the fact that the projected dose in the leachate analysis report is based on an unrealistic scenario that assumes a 50-year accumulation of leachate and that the landfill and its workers don't take their normal safety precautions, and the resulting risk was still low. ODOE agrees that additional monitoring and data collection for radionuclides in the leachate is a reasonable precaution, and we have included a requirement for annual leachate radionuclide sampling results to be reported to ODOE. If concentrations approach state disposal limits, additional analysis would be warranted.

			ODOE is also requiring that the flocked solids and carbon filter beds be analyzed for radionuclides annually to ensure that they meet the applicable standards for in-state disposal.
D3	Columbia Riverkeeper	Given that Chem Waste's public assurances regarding the leachate have already proven untrue, we strongly urge ODOE to not take the company at its word. We encourage ODOE to conduct its own, independent assessment of whether the leachate could have any long-term natural resource impact, or whether further monitoring might suggest that changes in leachate management practices are warranted. As a paid contractor of Chem Waste, the firm that completed the analysis cannot be considered independent and unbiased. At the very least, ODOE must take its own hard look at the assumptions made in the risk assessment and CAP.	Based on our independent review of the leachate analysis conducted by the landfill's technical contractors, we have concluded that the methods employed were technically valid given the available data. Please see also the response to comment D2 regarding additional leachate and wastewater treatment monitoring.
D4	Columbia Riverkeeper	If ODOE Accepts Chem Waste's "Preferred Alternative" of In-Place Closure, Additional Monitoring Should Be Required. Chem Waste asserts that leaving the waste in place ("Alternative 1") presents less risk to workers and the public than exhuming and removing waste to another landfill ("Alternative 2"), presumably in Idaho or elsewhere. In its presentation during the public meeting in September, ODOE indicated that it generally concurred with a preference for Alternative 1. If ODOE finds that the risks associated with disturbance of the other hazardous chemical (non-radioactive) wastes legally disposed of in the landfill would outweigh the risks of leaving the fracking waste in place, ODOE needs to require much more robust monitoring to ensure that this holds true over time.	Thank you for your comment. ODOE agrees that additional monitoring should be required. ODOE and WM have agreed to the following modifications to the proposed groundwater monitoring program for naturally occurring radionuclides: 1. The default groundwater monitoring program will follow WM's proposed 5-year interval for radionuclide analysis during landfill operations and post-closure. The next radionuclide groundwater sampling event will occur in 2021. 2. In the future, if the higher-frequency monitoring data for non-radionuclides suggest that there may be a potential release from the lined landfill (i.e., failure of the landfill liner), the Oregon Department of Environmental Quality as the permitting authority will require the facility to enter a Compliance Monitoring phase including increased monitoring. At this time, WM would monitor for radionuclides on the same Compliance Monitoring schedule as for non-radionuclides. Please see also the response to comment D2 regarding additional leachate and wastewater treatment monitoring.
D5	Columbia Riverkeeper	Our primary concern relates to the leachate and Chem Waste's apparent plan to continue to spray	Thank you for your comment. In light of the point raised here, we agree that the term "no direct exposure" for workers may not be accurate in a case where a worker was outside their vehicle on the landfill surface

		untreated leachate on the surface of the landfill for dust suppression. The CAP states that there is "no direct exposure" to the radioactive fracking waste for workers or the public now that the waste is buried, but this claim is blatantly misleading. Radioactive leachate is pumped to the surface and used—untreated—for dust suppression. This provides a potential exposure pathway to the radioactivity from the radioactive fracking waste. Chem Waste argues that the risk is minimal. However, it is not accurate to say that there is “zero” exposure to workers or the public. To ensure that the risk remains “minimal”, as Chem Waste asserts, ODOE should require frequent monitoring of radioactivity levels in the leachate to determine whether radionuclide levels (some of which, like uranium at 358 pCi/L, are already quite elevated) are increasing.	after leachate spraying had taken place but before a new layer of fill had been placed to cover the spray. We note, however, that landfill worker safety procedures prohibit walking on the landfill surface unless absolutely necessary, so any such exposure would likely be small and short-duration. The response to comment D2 describes in detail the multiple layers of pessimism in the leachate risk analysis, which estimated a low 0.22 mrem/yr dose for a worker spending 30 minutes per day for 250 days per year, without PPE, and assuming a 50-year, uncovered, accumulation of leachate directly on the landfill surface. Correspondingly, a short-duration, unlikely worker exposure under normal landfill operating conditions may reasonably be expected to be below a level of health concern. As will be discussed in greater detail in our response to comment D8, any potential dose associated with leachate spraying would only be applicable during the landfill’s operating years. Once the landfill has been closed, capped, and drained of remaining leachate, no additional surface redistribution of leached wastes would occur. We disagree with the contention that leachate spraying on the landfill poses a risk to members of the public, given that the landfill is surrounded by a buffer zone owned by Waste Management and the nearest resident is located approximately two miles away. The leachate risk analysis report included a risk calculation for the nearest resident, using an EPA air dispersion model and local meteorological data, and found that the maximum dose would be $4.7x10^{-4}$ millirem per year from soil exposed to leachate used as dust control, $3.8x10^{-6}$ millirem per year from inhalation of any leachate that remains suspended in air, and $4.4x10^{-10}$ millirem per year from the landfill disposal of wastewater treatment flocked solids and carbon filter media. These very small doses may be compared against the 350 millirem per year annual average background radiation dose in the US, or a risk equivalent of approximately a one in 1 million probability of developing a fatal cancer for every 2 additional millirem a person is exposed to. ODOE agrees that additional monitoring and data collection for radionuclides in the leachate is a reasonable precaution, and we have included a requirement for annual leachate radionuclide sampling results to be reported to ODOE. If concentrations approach state disposal limits, additional analysis would be warranted. ODOE is also requiring that the flocked solids and carbon filter beds be analyzed for radionuclides annually to ensure that they meet the applicable standards for in-state disposal.
D6	Columbia Riverkeeper	Without more frequent monitoring, ODOE and DEQ may not have the information necessary to protect the public if the radioactive makeup of the leachate	Thank you for your comment. We agree that leachate characterization should be conducted on a regular basis. Please see the response to comment D2 regarding additional leachate and wastewater treatment monitoring. As with the case of Environmental Restoration Disposal Facility (ERDF) at Hanford, leachate will

		changes over time. The concentration of radioactivity in the leachate may not be stable, and it may increase over time to levels that present greater risks to workers or the public. A 2017 study evaluated the Environmental Restoration and Disposal Facility (ERDF) at Hanford, as well as three other low-level radioactive waste sites. At ERDF, the study observed: "[i]n addition, the U concentration in ERDF leachate increased from 212 to 3,060 μ g/L during the first decade of data, and then leveled off at approximately 1,500 μ g/L. In contrast, at the other sites, the U concentration remained relatively constant (OSDF, ICDF) or dropped over time (EMWMF)." As ODOE knows, these are different facilities with different systems, but the possibility certainly exists for radioactivity to increase over time at the Chem Waste facility. In the event that uranium concentrations decrease in leachate, the public will have to wonder where this uranium was ultimately deposited. If it is no longer in the landfill's leachate, has it simply been distributed via dust across the landscape? In either case, the experience of an order-of-magnitude increase of uranium in ERDF leachate should prompt ODOE to consider a much more intensive monitoring regime for the Chem Waste facility, particularly considering the current concentration of U-238 in L-14, cell 1 at 358 pCi/L.	only accumulate until the final cover is installed. It is important that the data is collected with enough frequency to ensure that variations similar to those observed in ERDF are captured and accounted for while the landfill is operating. It is also important to continue leachate characterization as the landfill dries out post-closure, to ensure that the leachate is managed and disposed in compliance with state laws.
D7	Columbia Riverkeeper	Other states have been forced to deal with leachate monitoring as a result of radioactive fracking waste issues, and some of the lessons from their experiences may be helpful for ODOE to consider. The Western Organization of Resource Councils (WORC) recommended to North Dakota that "leachate [] be analyzed for radionuclides at the	Thank you for your comment and for providing this additional information. We have reviewed the WORC report. Given the landfill's engineered features (multiple liner system, leachate collection system, and planned post-closure cap), the regional climate, and the properties of the underlying groundwater aquifer, ODOE finds it is extremely unlikely that waste would migrate to a source of potable water or, ultimately, the Columbia River. However, we recognize the value of managing uncertainty in a precautionary and adaptive manner.

		same frequency as groundwater samples are collected," and "[i]f radionuclides are detected in the leachate at a concentration greater than drinking water maximum contaminant levels, then the groundwater monitoring network must begin analysis for radionuclide parameters." The same report recommends a much higher frequency of monitoring for leachate and down-gradient groundwater, on a monthly basis when leachate shows radioactivity levels that exceed drinking water standards (which has occurred at the Chem Waste facility). We encourage ODOE to review the recommendations put forward by WORC and to consider how their ideas may deepen the agency's consideration of whether the leachate management system at the Chem Waste facility can safely continue unchanged.	ODOE agrees that leachate characterization should be conducted on a regular basis. Please see the response to comment D2 regarding additional leachate and wastewater treatment monitoring. The WORC recommendations provide a good general suite of decision rules for groundwater monitoring, but we believe that a modified set of decision rules are appropriate in the site-specific case of the CWMNW landfill due to its design features as a RCRA Subtitle C hazardous waste landfill (multi-liner system and post-closure cap), high-evaporation regional climate, natural subsurface environment, and pre-existing monitoring regime for hazardous constituents. The duration of post-closure monitoring requirements is established by the Oregon Department of Environmental Quality, which oversees the permit for the Chemical Waste Management of the Northwest landfill in accordance with the Resource Conservation and Recovery Act. Section 2.1 of the Corrective Action Plan contains information about the existing groundwater monitoring system, which includes annual or semi-annual sampling for hazardous constituents in upgradient and downgradient wells sunk into the shallower, non-potable aquifer. Currently there is no known or suspected breach in the multi-layer HDPE liner system, nor migration of constituents originating from the L-14 landfill where the Bakken waste was disposed. Therefore, in this case we disagree with the specific applicability of a decision rule requiring groundwater monitoring for radionuclides if they are present in the leachate. If migration of constituents from the landfill were to occur, the existing groundwater monitoring system would detect the presence of more mobile hazardous chemical constituents well before the NORM radionuclides in the Bakken waste would reach the upper aquifer (the Corrective Action Plan calculated that the time to peak dose in groundwater resulting from the Bakken waste would occur approximately 260,000 years from today). As part of the corrective action, WM is proposing to add radionuclide sampling to the facility's groundwater monitoring program during both the operational years and in the post-closure period. The response to Comment D4 describes additional modifications to the groundwater monitoring program that ODOE is requiring in our final determination.
		The risks associated with surface exposure remains significant during landfill operation.	Please see responses to Comments D8 through D15.
D8	Columbia Riverkeeper	The CAP identifies Alternative 1 as Chem Waste's preferred alternative because it is less expensive and,	As the comment points out, uranium is a hazardous constituent exhibiting chemical toxicity in addition to its radioactivity. As such, it is already a regulated constituent in the DEQ permit for the CWMNW facility. For the

		allegedly, would result in lower risk to current and future workers. However, Chem Waste's assessment sidesteps the potentially changing nature of the radioactive pollution in the leachate that the company sprays on the surface of the landfill for dust suppression purposes. Chem Waste's Preliminary Leachate Analysis shows the following Table (see below), which clearly demonstrates that uranium, thorium, and other radionuclides are present at elevated concentrations in the leachate. For reference, EPA's maximum concentration limit for drinking water for uranium is 30 micrograms/L, which corresponds to roughly 20 pCi/L.9 Accordingly, the leachate is almost 18 times the drinking water standard at the present time, and we do not yet know if the trend is upward or downward. U-238 is extremely long-lived, and it has the potential to move with groundwater if it escapes containment. As an alpha emitter and a metal that is toxic to kidneys, it is also dangerous to people when it is inhaled or ingested. Other radionuclides present in the leachate carry additional hazards, as well. [TABLE]	purposes of the laws enforced by ODOE, the leachate sampling results to date indicate that the leachate does not contain NORM in high enough concentrations to constitute "radioactive waste" prohibited from disposal in the state (found in Table 3 of OAR 345 Division 50). While ODOE does not regulate to the drinking water standard, leachate from a hazardous waste landfill is not potable anyway, and therefore is not subject to these standards under the existing DEQ permit. Regarding the potentially changing nature of the leachate constituents, please see our other responses related to leachate management, as well as our response regarding inclusion of leachate monitoring for radionuclides as an additional condition in ODOE's final determination in response to the Corrective Action Plan. Leachate will only accumulate during the operational years of the landfill until the final cover is installed and during the initial post-closure years while the landfill dries out. The leachate is not used for drinking water and does not currently have the ability to migrate to drinking water sources below the landfill due to the liner and leachate collection system. Comparing the current leachate concentrations to drinking water standards does not have a bearing on determining the potential risk to public health or the environment that would warrant different management. The potential risk associated with leachate spraying was addressed via the May 2020 Leachate Management Risk white paper found on the ODOE website and in our responses to comment D2. ODOE's determination is that the current leachate management practices do not pose a significant risk to human health or the environment, but that additional ongoing monitoring of the leachate is a reasonable precaution. Following completion of the landfill operational years, the permit for the landfill as a RCRA Subtitle C Hazardous Waste landfill requires that the facility be capped and that the leachate collection system continue operation until no further leachate appears in the collection system. This will result in the landfill resembling a "dry capsule" as it enters its post-closure performance years. The post-closure cap will be designed in such a way to encourage storage of winter precipitation until it can evaporate in the drier months. All constituents found in leachate during the operational years will have been redeposited in a diffuse fashion at varying depths across the 32-acre landfill and will be contained alongside the hazardous chemical wastes within the cap and liner closed landfill system. As an extra layer of pessimism in the Corrective Action Plan, ODOE required that the analysis consider the potential impacts in the event the cap and liner system were to immediately fail upon landfill closure. The analysis found that even in such a case, as well as other pessimistic factors such as the receptor living directly

			on the landfill surface and drinking the water from the naturally non-potable shallow aquifer underlying the landfill, the maximum risk of developing a fatal cancer as a result of the radioactivity in the Bakken wastes was between one in 1 million and six in 1 million. The peak dose from groundwater consumption (assuming the aquifer was used for drinking despite being naturally non-potable and too low flow to support a family) was calculated to occur at a time 260,000 years from today.
D9	Columbia Riverkeeper	To understand the long-term impact of the leachate and its management on workers, nearby members of the public, and the environment, ODOE should require additional monitoring to understand whether the nature of the leachate is fluctuating over time. The system may have the impact of concentrating radioactive contamination by recirculating contaminated water again and again through the same contaminated landfill cells. It is premature to conclude that Alternative 1 is preferable without also considering the impact of the leachate management system. At the very least, ODOE should require regular, long-term monitoring to ensure the risks are well understood going forward.	Please see prior responses to Comment D2 regarding additional leachate monitoring.
D10	Columbia Riverkeeper	At a basic level, the facility's leachate system seems like an ill-advised process—to take untreated leachate from the bottom of the landfill (where it may not pose a risk) and spray it untreated on the top of the landfill, where it not only poses a risk to the facility workers but accrues more radioactivity over time. Alternatively, if the radioactive leachate spraying results in the lowering of radioactivity levels in the landfill, this may indicate that the leachate spraying has simply distributed radioactive pollution into the surrounding environment. Again, this seems like a questionable approach when the underlying concentration of radioactivity in the leachate could be a changing factor.	The recirculation of landfill leachate for dust suppression and compaction is an accepted management practice. 40 CFR 264.30I(j) requires that if a landfill contains material that is subject to wind dispersal, the material to be managed to prevent wind dispersal. As described in responses to previous comments: • Concentrations of NORM radionuclides in leachate meet the state standard for disposal within the state as not meeting the definition of "radioactive waste" per ORS 469.300 and OAR 345 Division 50, Table 3. • The leachate risk analysis, which ODOE required the landfill to complete, demonstrated minimal risk to workers and virtually no risk to the public under a combination of pessimistic assumptions not reflective of actual landfill operational conditions (see responses to Comment D2 for details). ODOE concurs with the findings of the report that at current concentrations, the current leachate management approach does not pose a significant risk to human health or the environment.

			• Following landfill closure, leachate will no longer be generated. The leachate management question is only directly applicable during the operational years. • ODOE agrees with the point made in this and other comments that ongoing monitoring for radionuclides in leachate is a reasonable precaution. If concentrations approach state disposal limits, additional analysis of the current leachate management practice would be warranted.
D11	Columbia Riverkeeper	At Hanford, the Pacific Northwest National Labs published an overview of dust suppression approaches used and their varying levels of success and potential pitfalls. The PNNL study does not directly contemplate the use of contaminated leachate for dust suppression. Rather, it considers the use of "freshwater," and it notes that the "over application of water may increase infiltration and cause mobilization of contamination." While Chem Waste is convinced that the high-evaporation environment in Arlington will prevent mobilization of contaminants, the current radioactivity levels in L-14, cell 1 where leachate is used for dust suppression may suggest that any additional liquid will further mobilize contaminants in the system. Additionally, the use of contaminated leachate for dust suppression appears inconsistent with Hanford's typical use of "freshwater" for dust suppression. Practices at another low-level radioactive waste disposal facility, the on-site disposal facility (OSDF) in Fernald, Ohio, also appear not to use leachate for dust suppression, although large volumes of dust suppression water are used. According to a 2008 study of the site, "[t]he function of the OSDF is to isolate impacted material from the environment for up to 1,000 years to the extent reasonably achievable, and, in any case, for 200 years," and to "provide leachate containment and collection within the OSDF to prevent OSDF leachate	ODOE is not in a position to direct the CWMNW facility's leachate management practices unless they are found to exceed state standards for disposal or present an unacceptable risk to public health or the environment. We do not determine that such a basis for restriction exists. The introduction of water to landfills for dust suppression and compaction is an accepted management practice. 40 CFR 264.30I(j) requires that if a landfill contains material that is subject to wind dispersal, the material to be managed to prevent wind dispersal. An EPA study from 2000 reported, "The recirculation of landfill leachate is not prohibited by federal regulations, although many states have prohibited the practice. EPA estimates that 348 million gallons of landfill wastewater are recirculated back to Subtitle D non-hazardous landfill units each year." https://www.epa.gov/sites/production/files/2015-11/documents/landfills-eg_dd_2000.pdf The reference to the cited PNNL study, and specifically the concept that, "over application of water may increase infiltration and cause mobilization of contamination," is not applicable in this circumstance. At Hanford, many contamination sources are present throughout the subsurface or in unlined burial trenches where additional water infiltration from above has the potential to increase migration of contaminants to underlying groundwater. By contrast, any water introduced into the CWMNW facility (and any waste mobilized by the water) is contained by the landfill's liner and leachate collection system and redisposed in the landfill. Furthermore, water is only applied to the landfill during its operational years (in addition to natural precipitation while the landfill is open). Following landfill closure, per the requirements of the RCRA Subtitle C permit, the facility will be capped, infiltration will cease, and the leachate management system will continue operation until leachate accumulation ceases. Over long periods of time it may be assumed that the landfill cap and liner will eventually fail. For the sake of bounding the potential effects of this eventuality, ODOE required the Risk Assessment and Corrective Action Plan to assume in its baseline scenario that both the cap and liner failed to perform properly immediately upon landfill closure. The analysis concluded that no significant risk to human health or the environment would result from the Bakken waste, even without the cap and liner present.

		from entering the environment." Accordingly, our understanding is that this low-level radioactive waste disposal site did not use leachate for dust suppression. Leachate recirculation occurs in some municipal and chemical waste landfills, but it is not clear that this is a common practice in radioactive waste landfills. If the agency has not done so already, ODOE must evaluate whether the use of radioactive leachate is a typical practice in low-level radioactive waste facilities. If not, this may further underscore the potential unadvisability of this approach being used in Arlington.	As mentioned in the response to Comment D6, the ERDF landfill at Hanford, which manages both radioactive and chemical wastes, does recycle its leachate for dust suppression and other purposes provided it meets the waste acceptance criteria for the landfill and complies with applicable land disposal regulations. (Source: https://pdw.hanford.gov/document/E0050616). (http://www2.clarku.edu/mtafund/prodlib/legal_advocates/round5/Waste_Disposal_Facilities.pdf, p. 13). The Envirocare (EnergySolutions) mixed waste disposal facility in Utah (which accepts both low-level waste and chemical hazardous waste) also permits spraying of leachate for dust suppression (https://documents.deq.utah.gov/waste-management-and-radiation-control/facilities/energysolutions/DSHW-2014-017941.pdf, p. 5). By contrast, the US Ecology Low Level Radioactive Waste disposal facility on the Hanford site does not recycle leachate because it has no liner or leachate collection system.
D12	Columbia Riverkeeper	The leachate assessment notes that "[l]eachate spraying is not expected to result in a large amount of water infiltration because spraying only occurs when evaporation is high." This environment would seem highly conducive to concentrating radioactivity in both the surface and in the leachate itself over time. As leachate is sprayed, some of the water evaporates and the rest returns to the landfill, becoming more concentrated in radioactivity as it filters back down. It may also slowly mobilize more and more of the radioactive contamination in the filter socks. With the leachate already testing at three times the drinking water level for thorium and 18 times for uranium, the public should expect Chem Waste and ODOE to regularly monitor the situation in the affected cells (particularly L-14, cell 1) to ensure that the leachate levels don't dramatically increase before the landfill is decommissioned and capped.	Please see prior responses on this topic regarding potential leachate risk and additional leachate monitoring. Specific to this comment, the leachate both dilutes the contamination (by spreading leachate across the whole landfill footprint at varying depths) and "concentrates" the contamination as the leachate carrier evaporates or causes the contamination to adsorb to other wastes and soils within the landfill. The leachate risk analysis showed that even a 50-year accumulation of leachate on the surface would not pose a significant risk to workers.
D13	Columbia Riverkeeper	In addition to risks relating to the leachate itself, we are concerned about potential risks related to the soil in and near the landfill. Chem Waste's own Preliminary Leachate Analysis acknowledges the	The leachate analysis referred to in this comment assumed that a 50-year accumulation of radionuclides from leachate was deposited at the surface of the landfill as part of its risk calculations. The analysis also supposed that a worker would spend 30 minutes per day, 250 days per year, standing atop the freshly sprayed landfill with no shielding from landfill accumulation or soil cover and no physical protection from wearing PPE or

		potential for radioactive contamination to build up in the landfill soil over time. The Leachate Analysis notes that, [t]he leachate applied as dust control scenario theoretically results in the build-up of radionuclides in soil over time. This report assumes this material is suspended into air and contributes to external exposure for a person standing on the landfill surface. As discussed earlier, this scenario is considered unlikely as all landfill workers wear respiratory protection while working on the landfill. The CAP asserts that dust exposure poses a low risk to workers because of the use of respirators, but the study should also consider whether a change in leachate management practices—including not using the leachate for dust suppression—may reduce risks to workers. The risk assessment largely dismisses impacts to neighboring properties, however, the build-up of radioactivity in the soil as a result of leachate spraying will depend on the level of radioactivity in the leachate, which itself may increase over time. It is worth reconsidering whether spraying leachate for dust suppression, and the resultant buildup of radioactivity in soils, is a necessary risk for the ongoing operation of the Chem Waste facility.	being in their vehicles at a greater distance from direct gamma radioactivity exposure. Despite these unrealistic pessimistic assumptions, the associated risk from the accumulated leachate was only 0.22 millirem per year (compared to annual average US background of approximately 350 mrem/yr). In risk terms, this dose corresponds to an approximately one in 6 million excess probability of developing a fatal cancer as a result of exposure. The leachate report also considered the potential effects to the nearest resident resulting from airborne dispersion and calculated a potential dose of 4.7E-04 millirem per year, which is an exceedingly low dose. Additionally, the drone flyover gamma survey of the landfill surface demonstrated that the levels of radioactivity at the surface in and near the landfill are within a reasonable range of regional background radiation levels. Because of the conservatism in the leachate risk analysis (discussed in the response to comment D2), we see no evidence that accumulation of leachate radionuclides in landfill soil poses a significant risk to worker or public health. Further, because workers are already required to wear dust protection respiratory PPE to protect from the potential chemical hazards at the landfill, any change to leachate practices related to radionuclides would result in no practical or significant improvement to worker safety and health. As mentioned in the response to Comment D2, ODOE agrees that continued monitoring of radionuclides in landfill leachate is a reasonable precaution.
D14	Columbia Riverkeeper	The risk assessment also notes that runoff from the spray operations is collected using the landfill internal stormwater collection system and sent to a separate lined stormwater pond at the north end of the current landfill. The Risk Assessment states, “All stormwater from the facility is moved by on-site stormwater conveyances to on-site stormwater retention ponds that do not	This comment seems to be addressing both the onsite stormwater management system and the landfill leachate management system. Regarding the stormwater system, it is reasonable to expect that precipitation feeding into this system would have fallen on the “outer slopes” of a landfill (which would be covered by clean fill material) and thus not come into contact with contaminants. It is therefore unlikely for this system to be a sink for radiological contaminants. Regardless, any rainwater that accumulates in the temporary lined stormwater ponds is disposed in the landfill and does not leave the site except via evaporation. . Precipitation falling on the “inner slopes” of an open landfill would be collected by the leachate management system.

		discharge to any of the local rivers, streams, or other water bodies." While it is reassuring that on-site ponds will not immediately discharge to any local water bodies, the potential exists for increasingly radioactive leachate to cause the build up of radioactivity in these locations, as well, potentially causing a radioactive risk in the future. Additionally, when the leachate cannot be used for dust suppression, it is placed in one of two on-site evaporation ponds. These are additional locations that could see a build up of radioactivity over time. It also creates the possibility that these areas could generate radioactive dust that could pose a risk to workers or blow onto neighboring areas. While Chem Waste asserts that these risks are minimal, we remain concerned that the leachate management practices may contribute to a worsening concentration of radioactivity in soils, wind-blown dust, and the leachate itself.	As stated in the May 2020 CWMNW Leachate Analysis, liquids are only placed in the referenced retention ponds after they have been treated with chemical flocculants, a carbon filter bed, and undergone confirmatory testing. Section 4.2 of the analysis specifically addresses potential releases from the lined evaporation ponds. It notes that, "radionuclides entering the evaporation pond will be much less than what is emitted through the leachate being applied to the landfill surface for dust control. Additionally, the on-site evaporation ponds only receive treated leachate during times of limited evaporation." A representative of WM provided additional information that over the past 30 years, approximately 6-8 inches of material has built up in the lined evaporation ponds. Their expectation is that this material consists of regional dust that has blown into the ponds. When the levels of water in these ponds decrease, the material forms a hard crust that decreases the likelihood of dust remobilization. As discussed in previous comments, the analysis of leachate application to the landfill surface found the maximum possible dose to be very low, even assuming a 50-year accumulation of leachate application. Because the evaporation ponds will contain lesser concentrations of radionuclides and receive liquids less often only during times of low evaporation (i.e., during wet weather periods), the associated risk is correspondingly going to be lower than the already low estimates for direct leachate application. The addition of annual leachate waste stream and wastewater treatment plant residue certification described in response to Comment D2 will further provide confidence that radioactive wastes will not be disposed in the evaporation ponds. However, in response to this comment, WM has also agreed to sample the sediments in the onsite evaporation ponds this year to confirm that radionuclides are not building up over time. These sediments will be sampled again prior to final site closure.
D15	Columbia Riverkeeper	We urge ODOE and Chem Waste to reconsider whether the use of radioactive leachate is appropriate for dust suppression, and the overall impact of potentially increasing levels of radioactivity in the leachate. The potential for risks to change over time seems significant. The CAP assumes that the facility will continue to operate for another 30 years following the illegal disposal of the Bakken oilfield waste, after which an engineered cover will be	Thank you for your comment. Please see our responses to prior comments in this section, which include additional leachate system monitoring and a strategy for reevaluating the leachate management practices if results indicate further analysis is warranted to ensure that state law is being followed and public health is protected.

		installed. While the CAP proposes some monitoring, the timing of the monitoring may be too spaced out to provide enough information to correct a problem as it arises. Furthermore, the monitoring is not linked to any specific action or re-evaluation process for how the landfill is being managed.	
		The risks associated with the leachate will continue after the landfill is capped.	Please see responses to Comments D16 through D19.
D16	Columbia Riverkeeper	Over the long term, we remain concerned that the radioactivity Chem Waste introduced into Arlington could impact soils, groundwater, and the people and other biological life who may interact with them for hundreds, thousands, or even millions of years. It is difficult to project how the facility may change over time. For example, if the surface barrier fails before the liner, it may result in elevated levels of radioactivity in the vadose zone or even in groundwater if the liner creates a small, perched pool of groundwater. At that point in the future, maybe hundreds of years from now, if an intruder or a nearby resident were to introduce a well into the area, they could become exposed to radioactivity levels dramatically exceeding EPA's drinking water standard. It is difficult to conclude at this point, given the elevated levels of radioactivity in the leachate, and given the absence of information showing whether these levels are increasing or decreasing, that there is no possibility of future impacts to groundwater and future potential users of the area. ODOE must acknowledge the potential natural resource damage that has resulted from Chem Waste's illegal dumping of radioactive fracking waste in Arlington.	The scenario described in this comment is interesting and warrants additional discussion. To begin, the Risk Assessment and Corrective Action Plan does consider a future scenario where both the cap and the landfill liner fail simultaneously immediately post-closure, in order to evaluate the potential risks associated with the migration of the Bakken waste out of the landfill in a "worst case" scenario. This comment, however, supposes a scenario in which the cap has failed but the liner has not, creating a "bathtub effect" where incoming precipitation infiltrates the landfill and collects at the bottom of the landfill above the liner. This scenario then must suppose that the following additional circumstances occur: • It must be assumed that despite the facility existing in a semi-arid location with 109 inches of dry pan evaporation per year, precipitation nevertheless collects within the landfill and is not evaporated. • A person takes up residence on or near the landfill surface in opposition to the land use restrictions that are required to be in place following closure of the landfill. • A person living on the landfill drills a well through the landfill waste, but ceases drilling before the drill itself punctures the landfill liner (which would allow any trapped water to drain out and leave a dry well). If the well driller does not puncture the landfill liner, the amount of water retained above the landfill liner would likely be low quantity and the lens of water would likely be thin vertically. This circumstance assumes the well driller is able to locate this lens and stop drilling in time to preserve the liner integrity. This circumstance also assumes that the driller does not possess knowledge of the expected depth to groundwater such that they would not suspect something was amiss when they encounter a shallow, low quantity source of water. Further, it is unlikely that there would be a sufficient water column to install a submerged pump in the perched pool. • Because the quantity of water in this hypothetical "perched pool" would be small relative to the needs of a family, any potential use of this water would be short duration. This would necessitate further drilling and would negate hazards associated with prolonged dose exposure. • The scenario assumes a driller would not notice the presence of containerized and possibly grout-encapsulated hazardous wastes brought up in drill cuttings as they penetrate the landfill.

			• The scenario does not account for the other, likely more hazardous, effects of encountering chemical wastes in the trapped leachate. Standard practice today is to test wells for hazardous constituents, so this scenario must assume that this practice is discontinued or else it would discover the presence of hazardous chemicals and be deemed unsuitable for human consumption. To evaluate the potential impacts of a "bathtub scenario" to the groundwater calculations in the Risk Assessment, WM's contractors performed a supplemental analysis, which is included as Attachment 2 to this document. <u>Summary Conclusions by ODOE</u>: For the reasons described in the first part of our response, ODOE believes the combination of circumstances necessary for the existence of a member of the public drinking directly from a future landfill "bathtub" make this risk extremely unlikely. The supplemental analysis in the second part of the response further demonstrates that, in the event a bathtub effect were to form and then later release all at once, the risk to underlying groundwater would not be appreciably different from the original analysis in the Risk Assessment. ODOE has concluded that the risks associated with this scenario have been assessed adequately and in a reasonable and technically defensible manner.
D17	Columbia Riverkeeper	At a minimum, ODOE should seek to implement additional monitoring in place after the landfill is capped to ensure the cap is working and leachate isn't collecting and moving to groundwater. Currently, leachate is approximately 18 times the drinking water standard. Over time, both the cap and the liner could fail, resulting in a vadose zone and ultimately groundwater contamination. As described above, the liner may cause the vadose zone to become more saturated above the liner, and if radioactive contamination remains present and concentrates radioactive pollution in this water, the risk could be greater than Chem Waste has acknowledged.	As a RCRA Subtitle C Hazardous Waste Facility, the CWMNW landfill is already subject to post-closure groundwater monitoring and ongoing monitoring of the stability and integrity of the landfill cap. Additionally, continued leachate collection operation will be required after the cover cap is emplaced, until it can be demonstrated that no further leachate is collecting in the system and the cap is operating as intended. Please see responses to Comments D2 and D4 regarding ODOE's requirement for additional monitoring of both the groundwater and the leachate. As discussed previously, the Risk Assessment and Corrective Action Plan baseline scenario assumes that both the cap and the landfill liner fail simultaneously immediately post-closure, in order to evaluate the potential risks associated with the migration of the Bakken waste out of the landfill in a "worst case" scenario. Despite these and other pessimistic assumptions, the corresponding maximum potential risk to a future resident and groundwater user at the landfill was approximately one in 1 million excess probability to develop a fatal cancer associated with the Bakken waste.
D18	Columbia Riverkeeper	Chem Waste offers a confident view of the future of the Arlington landfill, asserting that its post-closure impact on the environment will be negligible. In a changing climate, their confidence is misplaced. We	It is ODOE's conclusion that the risks described in this comment were adequately addressed in the RA/CAP. As the comment recognizes, the potential risks associated with the naturally occurring radioactive materials in the Bakken waste depend on the pathway of exposure. Specifically, the potential pathways of risk are limited to:

		remain concerned about the radioactive waste that Chem Waste has illegally accepted and its potential to escape into the environment in ways we do not anticipate due to the effects of climate change. The half-life of U-238 is 4.5 billion years. The half-life of thorium is even longer. These alpha-emitting pollutants pose a particular risk if they are brought to the surface, mixed with soil, and inhaled as dust. Further, as ODOE acknowledged in its presentation in September, the production of radon gas could also pose a long-term risk. All of these risks may change over time as the climate shifts, potentially dramatically. According to Oregon State University's Fourth Oregon Climate Assessment Report, "[e]xtreme precipitation events are likely to increase by 20 percent in eastern Oregon, with heavy rainfall potentially resulting in slope instability, landslides and transportation closures." ODOE and Chem Waste should have done far more to consider how changing, extreme precipitation events may alter the performance and impact of the landfill during operation and after closure of the facility.	• Direct exposure to waste, including in soil and dust. Due to the known depth of disposal of the wastes, ranging from 18-195 feet below the surface of the eventual post-closure cap, this is not an available pathway for exposure under any future scenario. The one exception would be potential risks associated with a well driller puncturing the waste and bringing it to the surface in proximity to a residence. This unlikely risk was evaluated in the Risk Assessment. • Consumption of groundwater containing radionuclides that migrated from the landfill into an underlying aquifer. This potential pathway for risk was evaluated in the Risk Assessment. The analysis considered a case with multiple compounding worst-case scenarios, including a future resident living on a then-closed landfill surface and drinking water from a well at the edge of the landfill despite the water in the underlying aquifer being too low quantity to support a family and naturally non-potable. Under this scenario, the analysis concluded that the risk of cancer morbidity due to the radioactivity in these wastes would be up to one in 1 million, but likely far less, at a time 260,000 years in the future. Future concentrations in groundwater are also calculated to remain well below drinking water standards for the radionuclides in question. • Inhalation of radon by a future resident living in a house on top of the landfill. The Risk Assessment also evaluated this potential, though illegal and highly unlikely, pathway. The assessment concluded that the dose and corresponding risk of zero based on the average depth of disposal for the waste. If for the sake of pessimism it is assumed that the future person locates their house directly atop the single shallowest disposal location (18 feet below ground on a sloping surface), the corresponding dose was 4.2 millirem per year, which is still very low and within any possible legal limits. We acknowledge the uncertainty posed by climate change and how it may potentially affect earth system parameters such as regional precipitation, local erosion rates, and slope instability. Despite these uncertainties, ODOE is similarly confident that the risks associated with even unlikely scenarios is sufficiently low that the uncertainties associated with climate change do not significantly change the conclusions of the Corrective Action Plan's analysis. Long-term stability of the facility is an aspect of the engineering design and closure process under RCRA and the landfill's hazardous waste permit with DEQ. As noted in conversation with DEQ, the slope stability analysis for the cover system in the permit was designed with a safety factor of 1.83, well above the industry standard of 1.5. The permit requires monthly inspections to assess the integrity of the cover and to repair any anomalies found, both during the operational period and during the 30-year post-closure period.
D19	Columbia Riverkeeper	Given the significant uncertainty of climate change impacts and the unsure picture of how much radioactivity will concentrate in leachate or future	The approach we are taking is to focus specifically on the waste that was the subject of the notice of violation. The risk assessment and corrective action plan have, in our determination, made a defensible case that the risk of leaving those wastes in the landfill meet legal limits (including the leachate itself meeting the state's

		groundwater, we simply cannot agree with Chem Waste's bland assertion that "the groundwater exposure pathway is not a concern for human health or ecological receptors under either remediation alternative, even assuming hypothetical future potable water use drawn from Landfill L-14." Chem Waste is asking us to ignore the currently elevated levels of radioactivity in the leachate and to assume that future risks will never emerge, even in a chaotic and changing environment. This is simply too large a leap to take with dangerous, long-lived contaminants. If Alternative 1 appears to offer less risk than Alternative 2 because Alternative 2 would expose workers and the public to contaminants, then ODOE must be honest about the long-term consequences of the approach it is taking. It may be the case that Chem Waste has created a situation where there are no truly good options.	legal concentration limits for disposal) and would present a negligible risk to the public and environment long into the future, even in the event that a person were to live on the landfill at some point in the future and drink water from the non-potable shallow aquifer underlying the site. By contrast, excavating these wastes, which are currently dispersed throughout the landfill at depths up to 50 feet due to the three-year period of disposal, would be a massive undertaking and represent potentially far greater risk to both workers and the public. For the purposes of the laws enforced by ODOE, the leachate sampling results to date indicate that the leachate does not contain NORM in high enough concentrations to constitute "radioactive waste" prohibited from disposal in the state (found in Table 3 of OAR 345 Division 50). While ODOE does not regulate to the drinking water standard, leachate from a hazardous waste landfill is not potable anyway, and therefore is not subject to these standards under the existing DEQ permit. However, we understand the point this comment is making. We deem it unlikely that the leachate results today resulted from the Bakken wastes disposed within the three years prior to the sampling. This landfill has been in operation since the late 1970s, accepting the universe of hazardous chemical waste. Because the additional preventative measures proposed in the Corrective Action Plan were not in place, and evidenced by the fact that this present situation occurred due to a misapplication of Oregon's definition of radioactive material, it cannot be stated with certainty that other wastes containing uranium or other naturally occurring radionuclides have not been disposed in the landfill at some point over the past 40-plus years. Additionally, the potential exists that waste materials that would meet state thresholds nevertheless may have accumulated in the landfill over time. CWM is cooperating with ODOE and is currently conducting a review of all active and recent waste streams to assess whether other materials in violation of Oregon law may have been disposed in Waste Management-owned landfills. ODOE remains committed to upholding state statute, which prevents the establishment of a radioactive waste disposal facility, and we approve of the additional measures the landfill plans to put in place to ensure that no additional radioactive waste materials are disposed in the landfill. We also agree with the comments recommending monitoring of the leachate and underlying groundwater to establish an understanding of what radioactivity may exist within the landfill and how it migrates over time. In the end, we will be left with a landfill that meets the substantive requirements and safeguards of a radioactive waste disposal facility, yet in which the disposal of wastes exceeding the state's definition of "radioactive waste" are and have always been prohibited. If the leachate data we gather between now and the time of landfill closure decades from now suggest that more must be done to protect public health and the environment for the long-term, then the state will have the responsibility to ensure that those actions are taken.

D20	Columbia Riverkeeper	In conclusion, Columbia Riverkeeper urges the Oregon Department of Energy to not accept the Corrective Action Plan (CAP) submitted by Chem Waste as written. The CAP downplays the risks associated with leaving the waste in place and fails to provide adequate monitoring for the leachate, which already shows elevated levels of radioactivity. We appreciate ODOE's willingness to engage with the public, and we urge ODOE to delve more deeply into how to address the risks that may arise from illegal radioactive fracking waste disposal in a changing climate, in a landfill that was not designed for low-level radioactive waste, in a community that did not ask for, anticipate, or deserve this pollution risk.	Thank you for your detailed and well-reasoned comments. We hope you will find our specific responses to have adequately addressed your concerns.
E1	League of Women Voters	Our review of the anticipated egregious health and environmental risks the RA/CAP outlines as associated with exhuming and relocating the illegally accepted radioactive waste leaves us with no choice but to support CWM's preferred alternative of in-situ closure, but we have significant discomfort with that alternative. Implementation of the preferred alternative of in-situ retention will fail to satisfy a number of important public and local community concerns, many of them voiced during public hearings about this matter since its discovery. We share those concerns. These include, but are not limited to the following:	Thank you for your comment. Please see our responses to Comments E2-E15, which address your concerns in detail.
E2	League of Women Voters	a. There have been no procedures in place at the state level that were able to discover the transport and disposal of this quantity of illegal materials and number of shipments over three years. Without the "tip" from a North Dakota resident, the chances are good that Arlington would still be accepting such waste. We will add that, given the enormous quantity	State statutes prohibit disposal of radioactive material and define what that means, but do not clearly identify an enforcement mechanism or program for enforcement or prevention. EFSC's Administrative Rules describe the process of identifying violations, but do not establish an enforcement program. As a result, ODOE has acted as a resource to clarify questions about the applicability of Oregon's rules defining exempt waste streams and to deny certain waste streams that exceed our standards. This incident provided an opportunity to evaluate whether changes are necessary as far as the enforcement of Oregon's radioactive waste disposal rules.

		of such waste that is produced daily by the oil and gas industry in other states and the limited number of TENORM licensed landfills in operation, we cannot have confidence that the Arlington experience has not been replayed in other landfills across the state. While we acknowledge that there are difficult challenges to developing and implementing a monitoring and surveillance system that would be able to identify *and* disincentive illegal transport and otherwise correct these concerns, we encourage the Department to prioritize research and development of such a system.	Regarding procedures at the state level to discover future instances of transport and disposal of radioactive waste within the state, the following safeguards are in place or are actively in development: • In order to increase understanding of Oregon's rules on radioactive waste disposal, the Oregon Department of Energy sent a notice to all landfills in the state in February 2020, reminding them of regulations prohibiting disposal of radioactive waste in Oregon and making them aware of Technologically Enhanced Naturally Occurring Radioactive Materials in particular; encouraging them to contact us with any questions; and providing contact information. Reminder notices will be sent to landfills on an annual basis. • In July 2020, ODOE initiated a rulemaking through the Energy Facility Siting Council and formed a Rulemaking Advisory Committee to suggest revisions to strengthen OAR 345 Division 29, which is the rule that defines the civil penalty structure the state may use in response to violations of the state's prohibition against the disposal of radioactive waste. The final revised rules were adopted by the Council in February 2021 and will provide a strengthened deterrence against the illegal disposal of radioactive waste. • ODOE is in the process of developing an enhanced radioactive waste disposal prevention program. We envision this similar to a "community policing" effort that will involve developing a complete map of the in-state disposal system and establishing direct relationships with all potential waste generators and disposers in the state. • ODOE is pursuing additional monitoring and enforcement authority through the legislature to improve and verify state-wide compliance with our existing disposal rules. We believe such statewide action requires affirmation from the Oregon State Legislature that the agency can exercise such preventative enforcement authority, so it is part of a legislative concept currently being considered during the 2021 legislative session. • If statutory changes are made, we will initiate a rulemaking process for OAR Division 50 and appoint a rulemaking advisory committee to assist us in a revising our Administrative Rules, with the intention of tightening our standards and to provide for more tracking and enforcement authority as necessary. We note that the CWMNW facility is one of a limited number of chemical hazardous waste disposal facilities in the United States, and therefore it was the facility most likely to be approached by out-of-state producers of oil and gas production wastes containing TENORM. We believe that the Notice of Violation and Corrective Action process has not only led to a stricter waste acceptance program at the CWMNW landfill, including a new waste profile screening and laboratory analysis process for potential TENORM generators, a consultation step with ODOE, and on-site radiation detection equipment (described in detail in Appendix G of the

			Corrective Action Plan), but the statewide negative attention associated with this event has also served as a caution to all other landfill operators in the state to be more cognizant of the state's radioactive waste disposal laws.
E3	League of Women Voters	b. There is no remedy in the preferred alternative for the stigmatizing presence of over a thousand tons of radioactive waste buried near the community of Arlington. As stated, in our view, removal as described in alternative #2 would fail to meet the threshold criteria of overall protectiveness, but it would eliminate the psychological and economic burden on the community of being home to a radiological zone. Community members played no role in having this happen, but they are paying what several have said is an unfair price that feels in some ways higher than the company has paid.	During the four public meetings ODOE held virtually and in Gilliam County, we heard the community concerns related to the perceived risk and stigma associated with the presence of radioactive materials inside the CWMNW facility. We also recognize that this facility has for decades been legally operating as a disposal facility for hazardous chemical wastes, which in some cases are inherently more dangerous and longer lasting than radioactive wastes – yet we also acknowledge that the word "radioactive" has powerful connotations absent any context. The Corrective Action Plan does not include measures for direct restitution to community landowners to remedy any feared potential future decrease in property value associated with this incident. It is our belief that the process to remedy the violation of state law is not the appropriate vehicle for such action. However, we disagree that the preferred alternative provides no remedy whatsoever. The existence of a comprehensive and technically credible risk assessment, developed as part of the corrective action process, can serve to put the naturally occurring radioactive material in the context of its actual risk to future members of the public and the environment, and in so doing provide context that may help to increase confidence that the wastes are safe within the landfill long into the future. A simplified way of thinking about this waste is that it came up from beneath the earth, was concentrated by human activity, and then returned to the earth and spread back out in a different place than it started. It is clear that Oregon should not have been that place by the standards we set for ourselves, and action is being taken to prevent this from happening again. However, we believe that the corrective action process has resulted in information being widely available to the public to show that this waste, while unwanted and not to be repeated, is not dangerous where and how it has been disposed. Additionally, environmental monitoring at the CWMNW facility will provide regular information to ODOE and other state agencies, and based on the monitoring information, ODOE would take additional protective action in the future if warranted to protect human health and the environment.
E4	League of Women Voters	c. On a related noted, there is concern that, as long as TENORM that exceeds Oregon's legal limit is in the ground at the Arlington Landfill, there could in the future be pressure to redesignate that landfill to accept more radionuclide-bearing waste. Would the community's wishes against that action be honored in the face of aggressive lobbying effort by the industry?	ODOE remains committed to upholding state statute, which prevents the establishment of a radioactive waste disposal facility. If there were an effort by others through the legislature to propose a change to this statute, ODOE would faithfully communicate the concerns we heard from the Arlington community as a result of this disposal incident. ODOE would provide unbiased information regarding risks and tradeoffs associated with any considered change if asked by the legislature to submit expert testimony.

E5	League of Women Voters	d. Regardless of even legitimate findings that the potential for harm to the human or natural environment from radionuclides is minimal, there is no shortage of examples across the nation where such perceptions have been erroneous or such guarantees have turned out to be false	Thank you, we appreciate the comment and are well familiar with the role of long-term uncertainty in radioactive waste management from ODOE's work providing oversight of the Hanford Nuclear Site cleanup. We have addressed uncertainty management in the following ways:
			• Compounding pessimistic assumptions in the long-term modeling, including:
			  ○ Future receptors (e.g., including a scenario where a resident lives on top of the closed landfill in the future and drinks water from the site despite the lack of a potable water source; and inclusion of a radon sensitivity case assuming a person places a house directly atop the shallowest of the 64 disposal locations);
			  ○ The performance of the landfill's engineered features (e.g., requiring the baseline groundwater analysis to assume immediate failure of both the cap and liner systems);
			  ○ Waste concentrations (e.g., ODOE required the analysis to include a sensitivity case wherein the entire volume of disposed waste was equal to the highest concentrations recorded in laboratory sampling from the annual waste profiles).
			• A requirement for continued monitoring of the groundwater and landfill leachate (added in response to public comments received on the RA/CAP), for an extended period of time post-closure. This continued information will allow the agency to identify and adapt to unexpected conditions in the future.
			
			In all long-term decisions regarding the performance of a coupled engineered and natural system, there is some amount of irreducible uncertainty. The approach to risk and uncertainty management reflected in this corrective action process draws upon pessimistic analyses to bound uncertainty and ongoing monitoring to enable adaptive management.

E6	League of Women Voters	e. The analysis of risks under each of the two alternatives included in the RA/CAP is based on discussion of a limited number of hypothetical situations. It notably lacks any discussion of risks associated with the preferred alternative in the event of even a minor earthquake, let alone the expected "Big One." For these reasons alone, the analysis therefore lacks certainty to reach the conclusion that the preferred alternative would present "relatively few human health and ecological exposure pathways of concern" as claimed by CWM.	Thank you for your comment. Under a Cascadia Subduction Zone earthquake scenario, it is widely expected that major ground movement effects on landforms (e.g., landfill slopes) and human infrastructure (e.g., caps and liners) would be limited to areas west of the Cascade mountain range (https://www.oregon.gov/oem/Documents/01_ORP_Cascadia.pdf). Furthermore, the landfill elevation approximately 700 feet above the Columbia River would prevent any potential effects from even a very large tsunami. In addition, the absence of faults in the vicinity of the CWMNW facility (based on geological surveys conducted during the 1970s siting of the Pebble Springs nuclear power plant, which was later abandoned), reduces the risk of catastrophic failure at the facility due to a smaller localized earthquake. Nevertheless, the analysis in the RA/CAP does implicitly bound the unlikely effects of a Cascadia earthquake by assuming early failure of the landfill cap and liner. Even without these protective engineered features, the analysis found that risks associated with the wastes at their final disposal depths would be negligible. In the

<table>
<tr><td></td><td></td><td></td><td>unlikely event that an earthquake caused a slope collapse at some future time, we expect that the appropriate state authorities, including ODOE and DEQ, would be involved in the remedial action effort to ensure that the wastes disposed in the landfill remain safely isolated, including the hazardous wastes lawfully disposed at the facility.

Regarding the limited selection of receptors, consistent with standard practice in long-term risk assessment methodology, the RA/CAP exposure scenarios were selected to represent “maximally exposed individuals” from a range of receptor classes (e.g., onsite resident, offsite resident, workers), which would serve to bound other variant exposure scenarios, representing lesser risk.)</td></tr>
<tr><td>E7</td><td>League of Women Voters</td><td>2. We have concluded that the Leachate Management system described in the RA (at 2.1.3) has been inadequately investigated as a potential, ongoing, and possibly cumulative source of unsafe radionuclides in the air and dust where it could be inhaled or ingested. In addition to humans, we can imagine that animals, especially birds, could also be harmed.

The current and planned practice in contaminated cells in Landfill L-14 involves pumping radionuclide-bearing liquids (leachate) to the surface from each of four cells and handling it in one of two ways:</td><td>Regarding the concerns about the leachate representing a potential ongoing and cumulative source of radionuclides in air and dust, please see our responses to Comments D2-D14.

In response to this specific comment, WM’s contractor conducted a supplemental screening analysis to determine whether the current concentrations of leachate present a source of potential harm to ecological receptors (i.e., animals). This analysis demonstrated that birds and other ecological receptors are not at risk from a radiological standpoint. The details of the analysis are replicated below:

The leachate source term is shown below (from Table 8 of section 4.1 in the May 2020 leachate report).

<table>
<tr><th>Radionuclide</th><th>Total conc (pCi/g)</th></tr>
<tr><td>U-238</td><td>2.53E+00</td></tr>
<tr><td>U-234</td><td>2.73E+00</td></tr>
<tr><td>Th-230</td><td>4.37E-01</td></tr>
<tr><td>Ra-226</td><td>4.68E-02</td></tr>
<tr><td>Pb-210</td><td>1.28E+00</td></tr>
<tr><td>Th-232</td><td>1.08E-01</td></tr>
<tr><td>Ra-228</td><td>1.15E+00</td></tr>
<tr><td>Th-228</td><td>7.72E-01</td></tr>
<tr><td>U-235</td><td>7.09E-01</td></tr>
</table>
</td></tr>
</table>

			This source term was input to ERICA and a Tier 1 assessment was run for a terrestrial ecosystem. The ERICA tool (Environmental Risk from Ionising Contaminants: Assessment and Management) is a software-based ecological radiological risk modeling software developed by the European Union to support environmental risk assessments (http://erica-tool.com/erica/). Screening values of 40 µGy hr-1 for terrestrial mammals and birds and 400 µGy hr-1 for plants were used, consistent with U.S. Department of Energy and ICRP guidance (DOE 2002; ICRP 2014). The Tier 1 assessment met these screening values, and thus a more detailed assessment was not necessary. Further, according to the ERICA assessment, birds are not the most sensitive organism, but rather lichen and bryophytes. To demonstrate that birds are adequately protected from the leachate, a Tier 2 assessment was run that utilized the maximum leachate U-238 concentration of 358 pCi L-1 (keeping other values the same). Three separate runs of the model were also performed, varying the time on soil and in air from: • 100% on soil • 50%/50% on soil/ in air • 100% in air In all three cases the dose rate for birds was below the screening value of 40 µGy hr-1 by two orders of magnitude (~0.4 µGy hr-1). The highest screening dose rate (with the maximum, unrealistic source term) was 293 µGy hr-1 for lichen and bryophytes, which is still below the screening value for these organisms (400 µGy hr-1).
		a. By spraying it over the surface of the landfill for dust-control. This practice is presumably the same as is employed in other areas within the hazardous waste sectors of the Arlington Landfill, but our concern is that at least the potential for airborne release of radioactive material in the leachate is not well enough understood for safe cross-over application.	The leachate management analysis provided in May 2020 specifically considered the potential risks associated with airborne transportation of leachate during spraying operations. Key findings included the following: • The nearest resident is over 2 miles away from the landfill. Any airborne transport of radionuclides in leachate would be so dispersed in air that the dose to an offsite resident would be functionally zero. • The leachate management analysis assumed in its calculations that a fraction of spray remained airborne and was subject to atmospheric transport and dispersion. The calculation also computed the suspension of radionuclides in the surface layer to the air after the sprayer is moved. Section 3.4 of

			the leachate analysis report describes the methods used to calculate airborne dispersion, which are based on EPA-developed models and year-round meteorological data from the landfill vicinity. • Section 5.1.2 of the leachate report contains the dose calculation results. The total annual radiation dose from blown leachate-covered soil (dust) calculated for the nearest offsite resident was 0.00047 millirem per year, an extremely low dose compared to the ~350 millirem per year average annual background radiation dose in the U.S. The dose from airborne liquid leachate spray was significantly lower, with total annual doses calculated at 1.4×10–4 mrem, 3.4×10–5 mrem, and 3.8×10–6 mrem for the landfill worker, laboratory worker, and nearest resident respectively.
E8	League of Women Voters	b. By trucking it to the onsite water treatment plant, where it is treated and pumped into holding ponds. Treatment is not discussed in terms of its ability to confront TENORM. Evaporation of liquids in holding ponds can be anticipated, but disposition of residue is not specified. Could some residue be disbursed into the air as dust or could birds or other animals come in contact with it in the ponds? The EPA's website is woefully cursory and out of date, but they acknowledge that water containing radionuclides that is treated results in build-up in a wastewater treatment system. How is that residue managed in CWM's system?	Sections 4.2 and 5.2 of the Leachate Management Analysis report, provided in May 2020, contain information specific to the concern in this comment. As stated in the report: "Typically, the on-site evaporations ponds have liquid volumes in them throughout the year thereby eliminating the emission of the miniscule fraction of radionuclides that pass through the on-site wastewater treatment system." In other words, water cover in the evaporation ponds prevents the mobilization of pond bottom residues. WM reported that presently the ponds contain 6-8 inches of material on the bottom that they expect is the result of regional dust blowing into the ponds. As the ponds evaporate, the exposed bottom sediments form a hard crust that reduces the potential for windblown dispersion away from the ponds. In response to this comment, WM has agreed to sample the sediments in the onsite evaporation ponds to confirm that radionuclides are not building up over time. These sediments will be sampled again prior to final site closure. The water in the evaporation ponds has already passed through the wastewater treatment plant, which removes radionuclides in suspended solids via the treatment methods used (p. 27 of the leachate report). For this reason, radionuclides entering the evaporation pond are expected be much less than what is emitted through the leachate being applied to the landfill surface for dust control. To assess the unlikely case where wind blowing across the lined evaporation pond surface results in a release of radionuclides, Section 4.2 of the analysis contains a calculation using a pessimistic (higher than expected) concentration of radionuclides in pond leachate and found that the estimated airborne concentration would be 0.08 picocuries per cubic meter of air, or 62,500 times lower than the state standard in OAR 35 Division 50, Table 3. Approximately six times per year, residues from the wastewater treatment plant are cleaned out and disposed in the landfill. In Section 4.1, the report determined that the solids will contain concentrations of radium-226 at approximately 1/100th of the state standard for legal disposal. Table 16 in Section 5.2 of the report shows that the dose to a landfill worker associated with the disposal of the residues (assuming the

			same person is present at all disposals) would be approximately 1.6x10-3 millirem per year, which is a very low dose. The dose to the nearest current resident is far lower at 4.4x10-10 millirem per year. ODOE is also requiring that the flocked solids and carbon filter beds from the wastewater treatment plant be analyzed for radionuclides annually to ensure that they meet the applicable standards for in-state disposal. Based on the analysis in the leachate management report and the additional monitoring that will be required in response to public comments, ODOE is satisfied that the wastewater treatment plant residues pose a negligible risk to workers and the public.
E9	League of Women Voters	The CAP reports that sample tests of leachate taken in March had acceptable levels of radionuclides and concluded that this technology bears no appreciable risk, but we have concerns. For one, page 22 of the CAP, Table 4.1, Summary of Potentially Relevant Hazardous Waste Landfill Remediation Technologies, offers disbursal into the air as one way of disposing of leachate from hazardous waste. It also notes a water treatment option. In the narrative following, the Plan fails to track how analysts moved from that table of options to the technologies included in the preferred alternative where those two technologies are employed, but the analysts indicate that some options in Table 4.1 are not appropriate for waste containing radionuclides because, "Unlike many organic contaminants, such as petroleum hydrocarbons, radionuclides cannot be destroyed or degraded (except through natural decay)." (Tables 4.2 and 4.3 are referenced, but missing.) In our view, the discussion leaves open the question of whether surface spraying for dust control or water treatment are appropriate technologies in this case, where radioactive materials have been buried in a mix with hazardous materials in a landfill designed for only hazardous materials.	Please see our responses to comments D2-D14, which address many leachate-specific concerns. The Preferred Alternative in the Corrective Action Plan does not propose to dispose of the landfill's leachate by dispersing it in the air. Leachate spraying is performed exclusively for the purposes of dust control and is directed down onto the landfill surface for re-disposal within the facility rather than up in the air to be dispersed and transported away. Similarly, the leachate management report from May 2020 describes how during wet periods of low evaporation, the wastewater treatment plant is used to manage leachates instead of direct spraying onto the landfill surface. Section 4.2 states that the wastewater treatment plant effectively removes radionuclides from the leachate via its treatment processes. The treatment plant solid residues, including any radionuclides removed from the leachate, are cleaned out approximately six times per year and disposed in the landfill. In response to the comments received, ODOE is requiring that the flocked solids and carbon filter beds from the wastewater treatment plant be analyzed for radionuclides annually to ensure that they meet the applicable standards for in-state disposal.

E10	League of Women Voters	We have been unable to locate resources that outline separate protocols for landfills licensed to accept TENORM. The EPA's website provides little more than a description of such materials and is so outdated that wastes produced by hydraulic fracturing are not even mentioned in the report posted. There may be other matters related to leachate that we haven't identified. To reiterate, we question whether this issue has been adequately explored.	Please see our response to D11 for a discussion of EPA standards for leachate recirculation and practices at other landfills managing radioactive materials. To be clear, Oregon is not proposing to establish standards that would allow landfills to accept TENORM wastes.
E11	League of Women Voters	We urge ODOE to require that more thorough analysis and discussion of management of radionuclide-bearing leachate be added as a supplement to the RA/CAP. We also recommend that the Department include in its determination a requirement for frequent sampling and testing of leachate, ensuring that results are obtained and reported for all cells in which TENORM waste has been buried to account for individual differences in cell content, burial depth, and so on. Testing and reporting should also be required for radionuclide levels released in air, on the landfill's surface, and in a manner that would reliably determine risk related to the management alternative involving utilization of water treatment facilities and evaporation ponds. This monitoring and reporting should continue until all landfill sectors containing the contaminants are capped and leachate production ceases.	The leachate management report made available in May 2020 was a preemptive supplement to the RA/CAP, in direct response to public and stakeholder concerns expressed during the March 2020 public meeting in Arlington. ODOE concurs with the conclusions of the analysis that the current leachate management practices are protective of public health and the environment. As part of the Corrective Action Plan, Waste Management contracted a drone flyover radiation detection survey of the landfill where the Bakken waste was disposed. The survey indicated that the wastes at their depths today do not present a hazard at the surface. The Risk Assessment performed by the landfill also calculated the potential risk from airborne dispersion of radionuclides during disposal and found the risk to be virtually zero. The Risk Assessment further evaluated the potential risk from the recirculation of landfill leachate onto the surface for dust control and similarly found the potential risk to be insignificant. Based on these findings, ODOE is not requiring air monitoring at the landfill or on the site boundary. As mentioned in prior responses to comments, ODOE agrees that additional monitoring and data collection for radionuclides in the leachate is a reasonable precaution, and we have included a requirement for annual leachate radionuclide sampling results to be reported to ODOE. If concentrations approach state disposal limits, additional analysis would be warranted. ODOE is also requiring that the flocked solids and carbon filter beds be analyzed for radionuclides annually to ensure that they meet the applicable standards for in-state disposal. WM has also agreed to sample the sediments in the onsite evaporation ponds to confirm that radionuclides are not building up over time. These sediments will be sampled again prior to final site closure. Environmental monitoring at the CWMNW facility will provide regular information to ODOE and other state agencies, and based on the monitoring information, ODOE would take additional protective action in the future if warranted to protect human health and the environment.

E12	League of Women Voters	3. We believe care must be taken to ensure that the information and conclusions (or recommendations) presented in CWM's RA/CAP are not, now or in the future, characterized as evidence that TENORM waste with higher levels of radioactivity than Oregon law currently allows can be accepted and managed without harm to the public or environment.	Thank you for your comment. ODOE remains committed to upholding state statute, which prevents the establishment of a radioactive waste disposal facility. If an effort through the legislature by others were to propose a change to this statute, ODOE would faithfully communicate the concerns we heard from the Arlington community as a result of this disposal incident. ODOE would provide unbiased information regarding risks and tradeoffs associated with any considered change if asked by the legislature to submit expert testimony.
E13	League of Women Voters	The CAP concludes: Overall, the RAC dose and risk assessment results show that there are relatively few human health and ecological exposure pathways of concern based on current or reasonably anticipated land and water uses in the vicinity of the CWMNW facility (see Sections 2-5). While we lack the technical and scientific expertise, as well as time, to assess the accuracy of either the information presented or the calculations used by CWM to arrive at this conclusion, we have concerns that the voluminous and complex document that justifies it could be misinterpreted or even misused, for example to justify opening Oregon up to acceptance of fracking waste. Thus far, the state has had relatively little experience with this issue. Indeed, ODOE has been very clear throughout this process that, while Oregon's prohibition of disposal of TENORM with radioactivity levels above 5 pCi/g has been on the books (ORS 469.925 and OAR 345-050) for decades, the Arlington affair is the first known occasion of violation. Whether we have been extraordinarily lucky or simply unaware of previous violations due to the difficulty of discovery and lack of effective surveillance mechanisms is unknown. What is known is that there is an enormous quantity of the same type of waste that is currently buried in	Thank you for your comment. We agree that the disposal of TENORM waste from the oil and gas industry is a significant national issue, and we further agree that Oregon should maintain and increase its vigilance. Please see our response to Comment E2 for a discussion of ODOE's efforts to strengthen and clarify its radioactive waste disposal prevention program. In addition, CWM is cooperating with ODOE and is currently conducting a review of all active and recent waste streams to assess whether other materials in violation of Oregon law may have been disposed in Waste Management-owned landfills.

		Arlington's Landfill-14 being produced every day, that the high rate of production has been going on since around 2005, and that the industry must find ways to dispose of it. The Environmental Protection Agency's (EPA) website provides no information about either current quantities of TENORM waste production from fracking or availability of disposal sites. In general, it is extraordinarily cursory and outdated on the topic of fracking waste, but they post a Report to Congress dated 2000 (five years prior to the beginning of fracking proliferation) stating that "Total amounts of TENORM wastes produced in the Untied (sic) States annually [in 1993] may be in excess of 1 billion tons." It goes on to say that, "Nuclear Regulatory Commission (NRC) staff calculations show that the disposal of the annual production of TENORM in industrial landfills could easily exceed $100 billion." And, it continues, "This situation causes a dilemma because of the high cost of disposing of radioactive waste in comparison with (in many cases) the relatively low value per ton of the product from which the TENORM is separated. In addition, relatively few landfills or other licensed disposal locations can accept radioactive waste. However, TENORM materials exempt from NRC regulation are routinely disposed of without being labeled "radioactive material." Also, large quantities of TENORM are currently undisposed and may be found in many of the thousands of abandoned mine sites around the nation." As noted, decades have passed and a fracking boom has ensued since that report was released. But it is clear that the amount of waste has increased astronomically, along with the cost of disposal, and	

		the development of appropriate disposal locations has not even remotely kept pace. Generators of that waste and the service chain that serves them face a challenge that, as long as fracking continues, will not go away. It is important to ensure that Oregon remain vigilant.	
E14	League of Women Voters	We recommend that ODOE, in its determination pertinent to this RA/CAP, state clearly and definitively that its acceptance of CWM's RA/CAP in justification for the preferred alternative does not imply or constitute concurrence with CWM's assertion that, "Overall, the RAC dose and risk assessment results show that there are relatively few human health and ecological exposure pathways of concern [italics added] based on current or reasonably anticipated land and water uses in the vicinity of the CWMNW facility (see Sections 2-5)." We do not believe CWM has demonstrated that. We urge the Department to state explicitly in its determination that it accepts the preferred alternative (assuming it does) because alternative #2 is potentially too dangerous and harmful to the human and natural environment.	Thank you for your comment. It is not clear to us, based on your comments and our responses, specifically in what ways the RA/CAP does not demonstrate with reasonable assurance that the waste in its current disposal context does not pose a significant risk to human health or the environment. We agree with the sentiment expressed in this and another comment that Alternative 1 represents the best out of "no good" options. In our view, Alternative 1 is only a viable alternative because of the reasonable assurance provided by the RA/CAP analysis, coupled with additional periodic monitoring. We are also encouraged by the practices WM is implementing to ensure that they comply with the law. As part of the corrective action, Waste Management has proposed the installation of an automated radiation portal monitor to screen all future waste loads entering the site. The company has also already enacted a new waste verification process, which involves direct sampling and radiological measurement of representative wastes associated with each waste profile that may contain TENORM, followed by a check with ODOE to seek concurrence that disposal of the wastes represented by the waste profile is legal in Oregon. This two-step verification system will provide the company, and ODOE, greater confidence that the company is taking appropriate safeguards to operate the facility in accordance with Oregon statutes and rules. Finally, we point to the recently completed rulemaking for OAR 345 Division 29, which strengthens Oregon's enforcement and penalty system for future violations of the law as additional disincentives.
F1	Jennifer Miller	CLEARLY the law was broken. They knew they were breaking it year after year. And it's sad that our tax dollars go to employ Oregon officials who get bought off to sweep it all under the rug. Damn, how much were you ALL paid for these shipments of LETHAL RADIOACTIVE WASTE? "Oh, the landfill didn't know" my [*profanity*] I was so proud of my State until I happened upon this. Convenient that it's during a PANDEMIC! There's NO WAY to make these extremely high numbers safe for Oregon's! Nor can I believe you are all just getting away with it! Tell them	Thank you for your comment.

		to dispose of their OWN damn nuclear waste. Money IS the root of all evil! This is all just a smoke screen. Ship it back and return the money! DO THE RIGHT THING [*profanity*]!!!!	

Attachment 2: Supplemental Analysis of CWMNW cap failure before liner failure (the "bathtub effect")

In response to a public comment, ODOE requested the landfill's technical contractor to conduct the supplemental analysis included below.

This so-called bathtub effect was evaluated using two scenarios:

- Scenario 1: Cap fails before liner and entire landfill fills with water followed by liner failure
- Scenario 2: Cap fails before liner and liner fails after water fills up to the level of the TENORM waste.

Scenario 1

Assuming the overall thickness of the landfill is 63 m (208 ft) and a porosity of 0.41, the volume of water that would accumulate in the landfill before overflow would be

$$63 \text{ m} \times 0.41 = 25.8 \text{ m}$$

Assuming natural infiltration after cap failure of 3.5 mm yr^{-1}, it would take 7,380 years to fill the landfill.

$$(25.8 \text{ m})/(0.0035 \text{ m/yr}) = 7{,}380 \text{ years}$$

In this scenario it is assumed that the landfill is completely filled with water, the liner fails, and all the accumulated water is released. This simulation was performed using a modified version of the base case groundwater assessment model. For modeling purposes, the thickness of the landfill is rounded to 60 m and the time of failure is rounded to 7000 years. Modifications were as follows:

- The landfill was discretized into 30 cells that were 2-m thick each (60-m) that were added to the top of the model domain above the waste. In the base case, the top of the model domain was the waste.
- All cells in the landfill were assigned an initial saturation fraction of 1.0. All new cells in the model domain were assigned an initial inventory of zero.
- Radionuclide inventories in the 0.178-m thick waste cell were decayed and ingrown for 7,000 years because the simulation starts when the liner fails.
- No releases are assumed to occur while the liner remains intact.
- It was necessary to increase the saturated hydraulic conductivity of the Selah formation from 0.145 m yr^{-1} to 3 m yr^{-1} to accommodate the higher water fluxes from drainage of the landfill.

The flux of water out the bottom of the landfill to the vadose zone is illustrated in Figure 1. For comparison, the base case water flux is shown. For the bathtub scenario, the water flux is zero until failure of the liner.

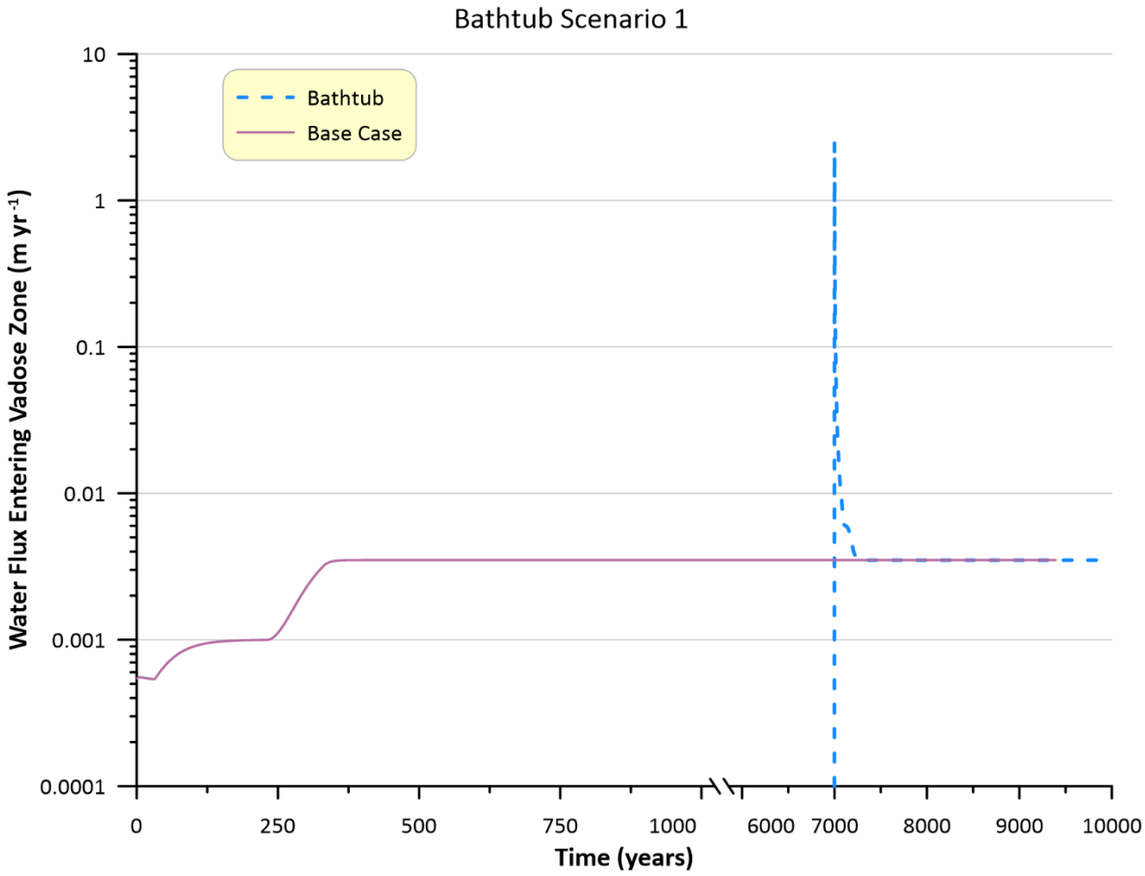


Figure 1. Water fluxes as a function of time for the base case and bathtub scenario 1. Note the break in time in the x-axis.

Using this water flux and the decayed and ingrown radionuclide inventories in the base case, fluxes to the aquifer (Figure 2), concentration in the aquifer, and drinking water ingestion doses were calculated (Figure 3). The fluxes for U-238 in the bathtub scenario shown in Figure 2 are counterintuitive because they are smaller and occur later than the base case. This is a result of diffusion and dispersion of the radionuclide inventory in the additional water in the landfill. Recall in the base case, the top of the domain was the waste layer which had a no-flux boundary condition. Thus, radionuclides were forced to move downwards. In the bathtub model there is 60 m of landfill water above the waste for radionuclides to diffuse and mix in, resulting in lower pore water concentrations and lower fluxes because radionuclides are no longer restricted to a single 0.178-m cell but allowed to spread out into multiple cells in the landfill. The net result is lower peak fluxes and later peak times. While the wetting front (which is a wave front) moves rapidly through the vadose zone, it does not carry radionuclides with the wave. Instead, radionuclides move as a function of the time and spatially dependent pore velocity in each cell. The front passes rapidly and water fluxes return to base case conditions after passage. Thus, the overall transport time is determined by the natural infiltration rate of 3.5 mm yr^{-1} which dominates all times after passage of the wetting front.

The doses shown in Figure 3 indicate that lower peak doses are observed for the bathtub scenario and they occur later than the base case. Most of the dose is due to the ingrowth of Ra-226 and Pb-210 from uranium in the source term. All doses are substantially below the residual TENORM standard of 25 mrem yr^{-1}.

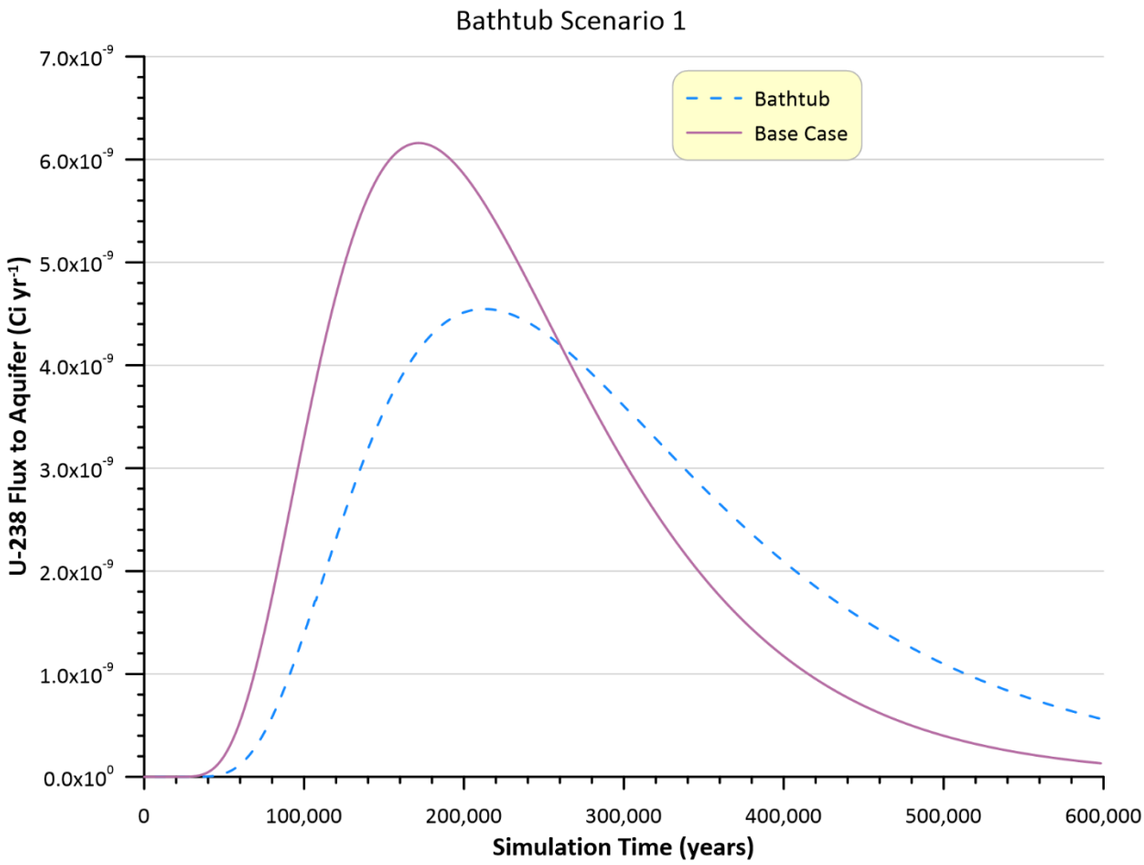


Figure 2. Uranium-238 fluxes to the aquifer for the base case and bathtub scenario 1.

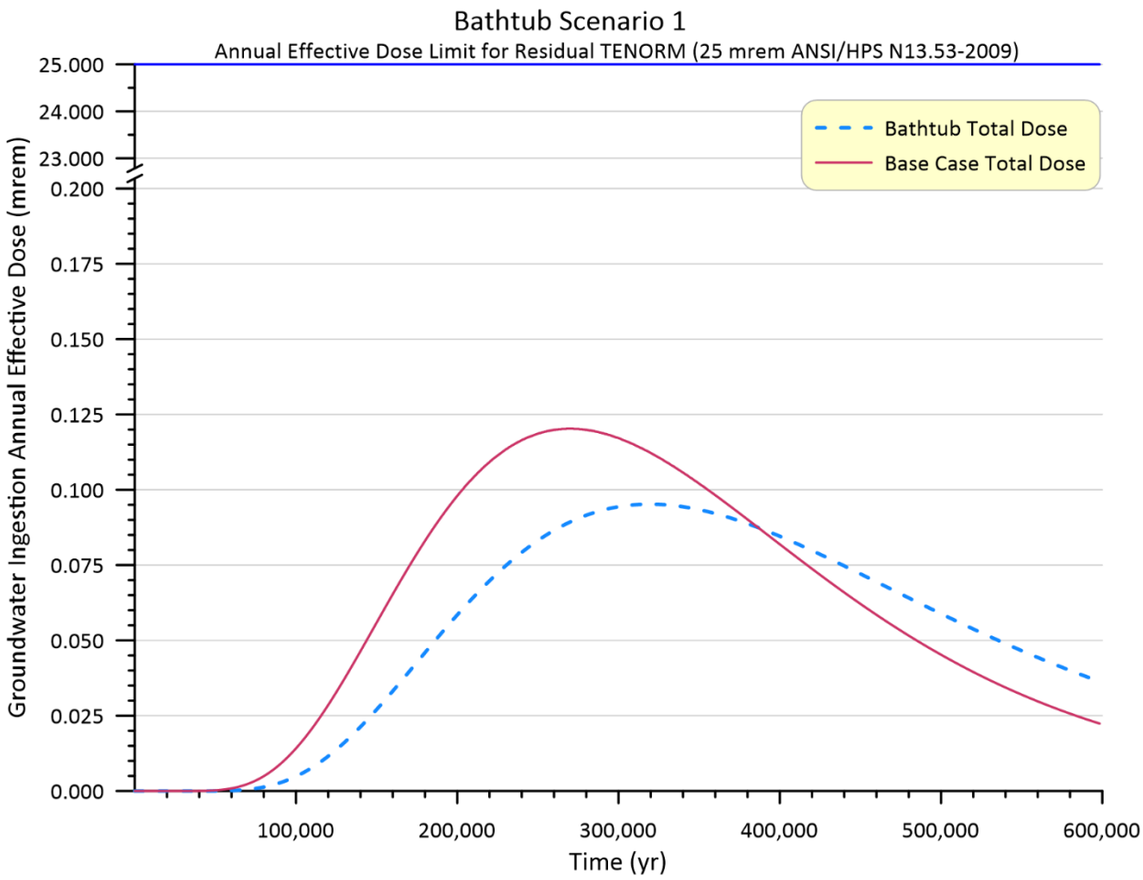


Figure 3. Groundwater ingestion dose as a function of time for the base case and bathtub scenario 1.

Scenario 2

Bathtub scenario 2 simulates the case where the cap fails before the liner and water backs up to the waste zone. At this time, the liner fails, and radionuclides are released to the vadose zone. Bathtub scenario 2 consisted of the following changes to the base case model:

- Water fluxes were set at the failed cover rate of 3.5 cm yr^{-1} for all times after closure.
- The waste layer was assumed to be fully saturated at the start of the simulation.

This analysis did not require any extension or re-discretization of the model domain. The water fluxes are shown in **Error! Reference source not found.**. Water fluxes entering the vadose zone for this scenario start much higher than the base case, and quickly reach 3.5 cm yr^{-1} for all time. The initial water flux in this scenario is lower than 3.5 cm yr^{-1} because the soil in the first cell of the vadose zone is initially dry due to the presence of the liner.

Fluxes to the aquifer (**Error! Reference source not found.**) and drinking water doses (**Error! Reference source not found.**) are almost identical to the base case. There were differences between the fluxes and doses in the third decimal place (bathtub scenario higher than base case), but these differences are not discernible in the graph. This is because any increase in water fluxes is quickly dampened within the vadose zone. This bathtub scenario and the base case scenario reach steady state water flux after about 400 years. This time is very short compared to the vadose zone contaminant transit time of about 20,000 years. Transport through the vadose zone is ultimately controlled by the steady-state infiltration through the failed cap, which is the same for both the bathtub scenario and the base case scenario.

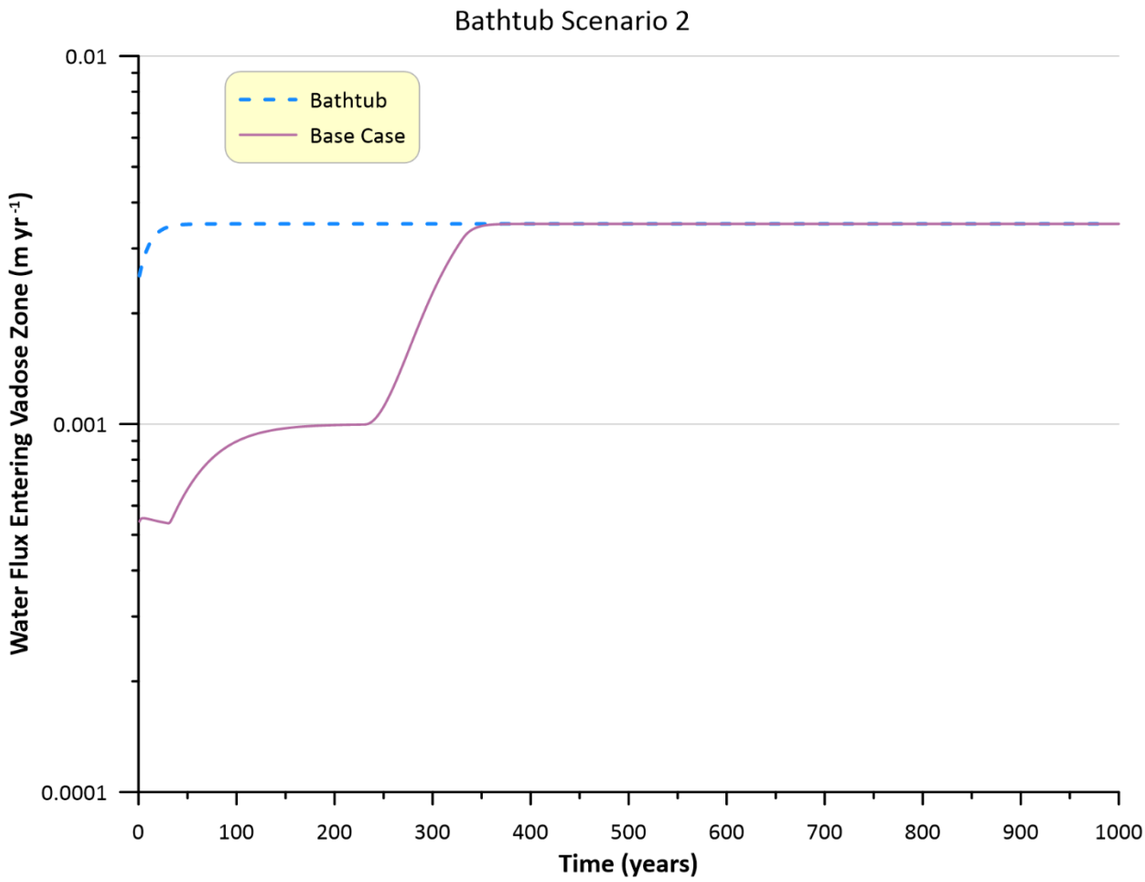


Figure 4. Water flux entering the vadose zone as a function of time for bathtub scenario 2 and the base case analysis.

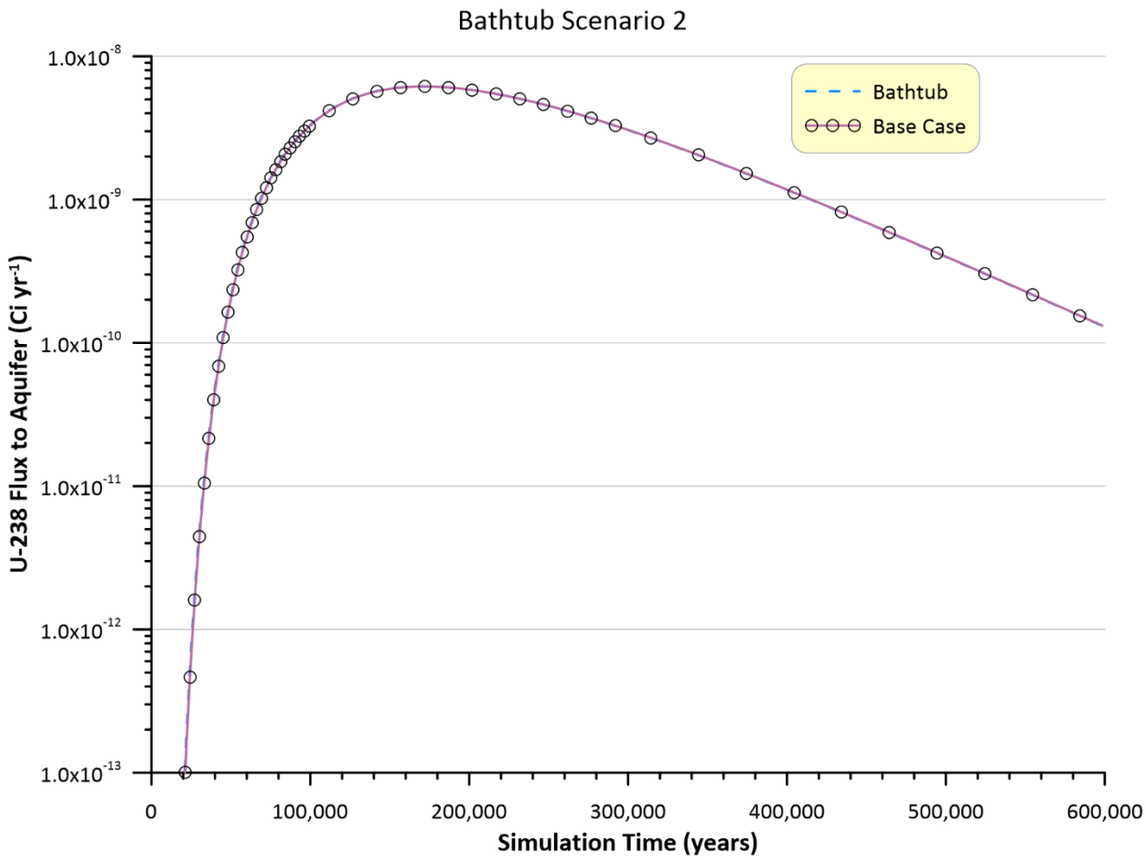


Figure 5. U-238 flux entering the aquifer as a function of time for the bathtub scenario 2 and the base case analysis.

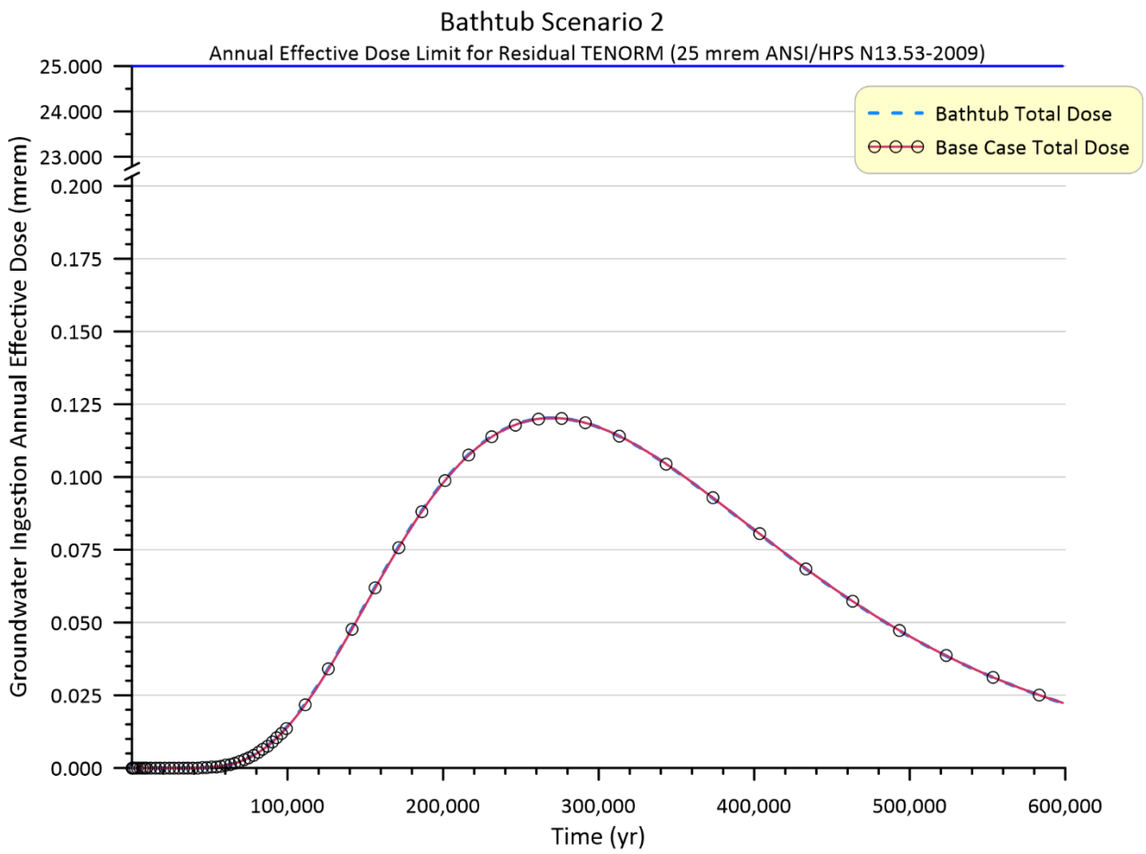


Figure 6. Drinking water dose at the downgradient edge of the source as a function of time for bathtub scenario 2 and the base case analysis.

Original public comments received by ODOE by November 7, 2020

From: Larry Glass <personal email redacted>
Sent: Friday, October 2, 2020 3:27 PM
To: ODOE Comments * ODOE
Subject: CWMNW Arlington: Radioactive Waste Remediation and Management

Thank you for providing materials associated with the process of remediation and future management of radioactive waste at the CWMNW Arlington site.

My main concern is implementation and maintenance of a strict regime of assessment to ensure radioactive wastes are never accepted at CWMNW Arlington in the future. To this end, I urge the OR Department of Energy to mandate implementation of passive radiation screening for all trucks or other conveyances arriving at CWMNW Arlington to deliver wastes in the future. Further, dynamic groundwater monitoring should be in place to catch any migration of radionuclides into the local groundwater. Third, OR DOE should not rely on CWM-performed testing for monitoring wastes at the Arlington site but should mandate that an independent laboratory perform such monitoring on a schedule devised by OR DOE and to report results to OR DOE directly, rather than having CWM report results to DOE.

Lastly, I think that best practices based on science and expert assessment and recommendations should inform the disposition of the contaminated wastes. As a layperson, I think that retention of the wastes at Arlington is preferable than relocation to ID (or wherever a suitable waste site is identified). The relative risk of sequestration on site is low compared to relocation and the cost of relocation seems prohibitive. I would urge DOE to examine immobilization techniques to ensure the radionuclides do not enter the surrounding soil, surface soil, air or groundwater. Additional monitoring should be deployed between the Arlington site and the Columbia River, including monitoring of surface waters that run into the Columbia as well as weather-related runoff emanating from the site. We must do all we can to safeguard the Columbia from contamination. Homes and businesses in the area near the Arlington site should be checked for radioactive contamination regularly, including local water delivery systems as well as individual homes and businesses. In case of any identified contamination outside of the Arlington site, CWM should be responsible for all costs of mitigation and losses to the community that may result (e.g. relocation of residents, business losses, drinking water supplies, etc.).

As a layperson, I am not versed in such techniques, but perhaps some type of substrate adsorption could be implemented to reduce the possibility of migration of the radioactive material out of the containment area. I also think that a thick concrete cap should be added to any soil cap to prevent the possibility of accidental or malicious uncovering of the dangerous waste. Additionally, monitoring devices should be installed around the site(s) where the waste is to be sequestered as well as signage and motion-sensitive lights and light and infrared cameras to prevent intruders from accessing the site. DOE should be automatically alerted to any intrusion or disruption at the contaminated site. Regular inspections and testing for contamination should be performed by DOE and not be left to CWM to conduct.

Thank you for your consideration.

Larry Glass
Florence, OR 97439

From: <personal email redacted>
Sent: Saturday, October 10, 2020 9:34 PM
To: ODOE Comments * ODOE
Subject: Public Comments and Questions on Chemical Waste Management's Corrective Action Plan

Thank you for accepting public questions and comments on CWM's corrective action plan.

Questions

How is the engineering of the Chemical Waste Management facility that accepted radioactive waste different from facilities in other states that are legally licensed to accept the waste?

In what ways is CWM's environmental and worker safety protocols different than those at facilities in other states that are legally licensed to accept the waste?

How does the long-term financial assurances proposed by CWM to pay for problems that may occur at the facility after its closure compare to the financial assurances at facilities in other states that are legally licensed to accept the waste?

How does the long-term environmental monitoring after closure proposed by CWM compare with monitoring in other states that are legally licensed to accept the waste?

How much longer does the radioactive waste accepted by CWM pose a potential environmental and public health threat than waste disposed of at solid waste and hazardous waste landfills in Oregon? How does the proposed environmental monitoring and financial assurances in CWM's plan compare with legally operated facilities in Oregon?

What steps is the Department of Energy taking to ensure that persons who act illegally do not financially benefit from their actions, to the detriment of public health, the environment, and to businesses that operate within legal requirements?

What measures are available to DOE to ensure that CWM does not profit from and has sufficient financial disincentives to prevent delaying implementation of measures the state determines are appropriate to protect public health and the environment?

Comments

The Oregon public, its workers, and our environment deserve all protections offered in other states. This is the case always, but especially in an instance when the underlying activity of accepting radioactive waste is illegal in Oregon and in other states. Under these circumstances, Oregon DOE should ensure that CWM promptly implements the most protective measures, and require CWM to amend its plan to identify and include those measures. In the event CWM fails to promptly implement protections that at a minimum are required in other states, DOE should notify the public and CWM, and take all actions necessary to ensure CWM funds and implements those measures.

Thank you for considering these comments.

Steve Siegel
Portland, Oregon

From: David Hupp <personal email redacted>
Sent: Monday, October 12, 2020 1:05 PMODOE Comments * ODOE
To: BENNER Janine * ODOE; MINER Jason * GOV; Fred.Boss@doj.state.or.us;
Cc: feldon.leah@deq.state.or.us; SEN Courtney; REP Kotek; Dan Serres
Subject: Rulemaking on Radioactive Waste Disposal in Oregon

Director Benner:

I am submitting this letter in response to the Oregon Department of Energy's (ODOE) request, dated September 9, 2020, for rulemaking responses to the *Chemical Waste Management of the Northwest Risk Assessment and Corrective Action Plan*. But I send this as a direct communication to you, with copies to the Department of Environmental Quality, the Governor, the Attorney General, and Oregon legislative leadership because the issues here extend far beyond the scope of this rulemaking and may require new legislation or budget action.

Also I communicate with you because I believe you are a human being who cares to do the right thing in correcting this mess at Arlington. I knew your parents and admired your late mother, Nancy, as a friend.

I have been an Oregon resident for nearly a half century, 35 of those years in Portland. I am a former ODOE employee and a successful Intervenor before the Energy Facility Siting Council. I worked for two governors, one Democrat and one Republican. From my time in the San Francisco Bay Area, I know some of the background of Waste Management, Inc., which informs my view of them.

What has happened at Arlington should never have happened and must never happen again. The core questions to be addressed are what can be done to mitigate the harm, how to hold Chemical Waste Management responsible for their action, and how to assure Oregonians this will never happen again.

Mitigation

In ODOE's summary document "Radioactive Waste Disposal in Oregon" (www.oregon.gov/energy/safety-resiliency/Pages/Radioactive-Waste-Disposal.aspx), I find this astonishing statement: "In consultation with other State of Oregon agencies, ODOE determined there is no current threat to landfill workers, the public, or the environment from this waste." Further, "ODOE directed the landfill operator to prepare a risk assessment to formally evaluate potential past, present, and future risk from the waste, and to develop a corrective action plan to outline the processes the company will put in place to prevent this from happening again." How on earth can ODOE determine "no current threat" prior to completion of the direct risk assessment? If there is "no threat to the environment", what is there to mitigate?

I move on to the document "Corrective Action Plan (CAP) Chemical Waste Management of the Northwest, Inc. Facility Arlington, OR", dated September 1, 2020 and prepared by some Boston outfit called Gradient, to find the summary of Chemical Waste Management's view of mitigation. On page 40 the company suggests that "Both of the remediation alternatives reduce the potential environmental mobility of the Bakken oilfield waste by containing it through a combined liner/cap/leachate collection system," but then claims that "Reduction of toxicity of the Bakken oilfield waste is not relevant, because radionuclides cannot be destroyed or degraded (other than by natural decay)." The first of these statements summarizes the minimum of what the State of

Oregon must require of Chemical Waste Management. The second statement is a self-serving absurdity on its face. The rest of the document is 481 pages of pulp filled with distracting and impenetrable academic nonsense.

Beyond this opinion I strongly recommend the Arlington landfill be designated a Superfund site, because the Bakken fracked-gas wastewater disposal is interstate, I do not want Chemical Waste Management involved in managing the site beyond constructing the "combined liner/cap/leachate collection system". Beyond what financing can be wrested from this scofflaw company I want federal taxpayers to foot the bill, not just Oregon taxpayers.

Responsibility

Chemical Waste Management surely, at the very least, violated whatever contract it has with the State of Oregon. As it has violated state law (ORS 469.525), it must be prosecuted to the fullest extent of the law, heavily fined, then told to take its business elsewhere, and management of the Arlington dump turned over to some organization that is more trustworthy.

I refer to this company as "scofflaw" because they, and their parent company, Waste Management, Inc., have a long and well-documented history of illegal and unethical behavior (see extensive references at www.corporations.org/wmi/index.html). Further, as one trained in economics I have recognized their monopolistic price-fixing and other anti-competitive practices for decades.

Assurance

How can Oregon state government assure me and other citizens this damage to our environment will never happen again? The prohibition law (ORS 469.525) is in place, but perhaps it is not strong enough and/or perhaps it has not been adequately implemented. The law prohibits the placement of radioactive waste absolutely. It states that ODOE stands ready to help Oregon companies deal with this. But is it adequate to absolutely prohibit the importing of waste from other states? I don't know.

As a former government employee trained in economics I fully realize that adequate implementation of laws requires an adequate budget. If that is part of the problem, then I expect state agencies to take the initiative and strongly make the necessary proposal to the Legislature, and not wait for the initiative to come from an individual legislator. The governor's weight must be brought to bear here.

This *cannot* happen again!

David Hupp
Hood River OR 97031
personal email redacted

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November 7, 2020

Max Woods
Asst. Director, Nuclear Safety & Emergency Preparedness Division
Oregon Department of Energy
550 Capitol St. NE
Salem, OR 97031

Submitted via email to ODOE.Comments@Oregon.gov

RE: Chemical Waste Management of the Northwest Risk Assessment and Corrective Action Plan

Dear Mr. Woods,

On behalf of Columbia Riverkeeper, I am writing to urge the Oregon Department of Energy to conduct its own independent analysis of the risks associated with leaving radioactive fracking waste buried in Chemical Waste Management's ("Chem Waste") Arlington, OR facility. As the entity responsible for correcting the illegal waste disposal, Chem Waste has a strong incentive to submit a risk assessment and Corrective Action Plan (CAP) that is drafted as favorably as possible to the company's own financial interests. Short of an independent analysis, ODOE must take a hard look at the documents submitted by Chem Waste and not simply accept them as written.

Nationwide, the oil and gas industry has hidden the costs associated with the disposal of waste generated from hydraulic fracturing ("fracking")—often by disposing of toxic and radioactive waste in unsuspecting or underregulated landfills.[1] [2] This practice has been lucrative for the fossil fuel industry, saving fracking operators and waste haulers millions of dollars in

[1] Gaffney. 2019. "A Small Town's Battle Against Radioactive Fracking Waste." (Note: The story from Kentucky is very similar to what happened in Arlington.)
https://www.nrdc.org/onearth/small-towns-battle-against-radioactive-fracking-waste
Also see: Western Organization of Resource Councils (WORC). 2015. "No Time to Waste."
http://www.worc.org/media/notimetowaste1.pdf
[2] Nobel. 2020. "America's Radioactive Secret." Rolling Stone Magazine.
https://www.rollingstone.com/politics/politics-features/oil-gas-fracking-radioactive-investigation-937389/

disposal fees. Chem Waste has participated in and profited from this pattern of illegal dumping by illegally accepting a staggering 2.5 million pounds of radioactive fracking waste, mostly consisting of filter socks. Oregonians expect and deserve protection from dangerous pollution of this kind. Columbia Riverkeeper appreciates the work that ODOE is undertaking to strengthen and clarify Oregon's rules to address radioactive waste. However, ODOE needs to use the authorities it has available to it now to ensure the waste does not create a long term risk for the region and also to ensure this never happens again. By asking tough questions about how Chem Waste has impacted Oregon, we hope that Oregon can set an example that can be followed by other communities who find themselves similarly impacted by sloppy and illegal handling of radioactive fracking waste.

We appreciate the effort the ODOE staff have given to providing public participation materials and a public meeting in Arlington. And we were glad to hear ODOE staff acknowledge during the September public meeting that community members in Arlington and beyond have been frustrated and angered by Chem Waste's illegal acceptance and dumping of radioactive fracking waste in Arlington and the relatively mild enforcement consequences for their actions. Even with DEQ's $60,000 fine, Chem Waste will pay only a few cents in penalties for every pound of radioactive fracking waste they dumped in Arlington. Going forward, ODOE has a duty to protect the public from the risks associated with Chem Waste's actions. To that end, ODOE's review of the risks associated with the waste disposal and the most protective corrective action must be independent and robust. Riverkeeper continues to have serious concerns regarding many of the assumptions Chem Waste makes in its risk assessment document and CAP—specifically with respect to the leachate.

I. ODOE Should Complete Its Own Independent Risk Analysis.

As a private, for-profit company, Chem Waste has a clear motivation to produce a risk assessment and CAP that is most favorable to its own financial interests. When the public first learned of the illegal dumping at Chem Waste's facility, Columbia Riverkeeper and others urged ODOE and the State of Oregon to independently investigate the facility and the risks to human health and the environment associated with Chem Waste's acceptance of the waste. In some respects, ODOE did investigate Chem Waste. According to ODOE, with Chem Waste's cooperation, the agency worked to determine the volume and nature of the waste that came to Arlington and some of the circumstances that led to its illegal disposal in Oregon. However, we remain concerned that ODOE's assessment of the impacts of the pollution that Chem Waste proposes to leave in its Arlington landfill rely largely, or even exclusively, on information developed and put forward by Chem Waste and its consultants. In addressing the impacts of the pollution, ODOE has put Chem Waste in the driver's seat with respect to developing a Corrective Action Plan. In reality, the onus is on the agency to ensure that the public is adequately protected.

We have reason to be concerned about Chem Waste's conclusions, and ODOE's apparent willingness to defer to Chem Waste. Chem Waste has already made public statements that have proven incorrect. For example, in March 2020, Chem Waste asserted in a public meeting that they did not expect to see increased radioactivity in the leachate because the illegally dumped radioactive fracking waste consisted of filters which the company expected to hold the radioactive pollution in place.[3] However, in May 2020, Chem Waste released a Preliminary Leachate analysis showing that radionuclide levels far exceeded drinking water standards, and radioactive pollution had impacted the leachate.[4] Chem Waste now asserts that leachate management can remain largely unchanged, despite sharply elevated levels of uranium, thorium, and other radionuclides. We remain concerned that the practice of using radioactive leachate for dust suppression may become more risky over time if the leachate becomes more and more radioactive.

Given that Chem Waste's public assurances regarding the leachate have already proven untrue, we strongly urge ODOE to not take the company at its word. We encourage ODOE to conduct its own, independent assessment of whether the leachate could have any long-term natural resource impact, or whether further monitoring might suggest that changes in leachate management practices are warranted. As a paid contractor of Chem Waste, the firm that completed the analysis cannot be considered independent and unbiased. At the very least, ODOE must take its own hard look at the assumptions made in the risk assessment and CAP.

II. If ODOE Accepts Chem Waste's "Preferred Alternative" of In-Place Closure, Additional Monitoring Should Be Required.

Chem Waste asserts that leaving the waste in place ("Alternative 1") presents less risk to workers and the public than exhuming and removing waste to another landfill ("Alternative 2"), presumably in Idaho or elsewhere. In its presentation during the public meeting in September, ODOE indicated that it generally concurred with a preference for Alternative 1. If ODOE finds that the risks associated with disturbance of the other hazardous chemical (non-radioactive) wastes legally disposed of in the landfill would outweigh the risks of leaving the fracking waste in place, ODOE needs to require much more robust monitoring to ensure that this holds true over time.

Our primary concern relates to the leachate and Chem Waste's apparent plan to continue to spray untreated leachate on the surface of the landfill for dust suppression. The CAP states that there is "no direct exposure" to the radioactive fracking waste for workers or the public now that the waste is buried, but this claim is blatantly misleading.[5] Radioactive leachate is pumped to

[3] *See 53 minute mark of this video of the town hall. https://www.youtube.com/watch?v=Zfj8Tb5YzIs&t=3196s*
[4] Chem Waste. May 2020. Preliminary Leachate Analysis. Table 1.
[5] Corrective Action Plan at 32

the surface and used—untreated—for dust suppression. This provides a potential exposure pathway to the radioactivity from the radioactive fracking waste. Chem Waste argues that the risk is minimal. However, it is not accurate to say that there is "zero" exposure to workers or the public. To ensure that the risk remains "minimal", as Chem Waste asserts, ODOE should require frequent monitoring of radioactivity levels in the leachate to determine whether radionuclide levels (some of which, like uranium at 358 pCi/L, are already quite elevated) are increasing.

Without more frequent monitoring, ODOE and DEQ may not have the information necessary to protect the public if the radioactive makeup of the leachate changes over time. The concentration of radioactivity in the leachate may not be stable, and it may increase over time to levels that present greater risks to workers or the public. A 2017 study evaluated the Environmental Restoration and Disposal Facility (ERDF) at Hanford, as well as three other low-level radioactive waste sites. At ERDF, the study observed: "[i]n addition, the U concentration in ERDF leachate increased from 212 to 3,060 μg/L during the first decade of data, and then leveled off at approximately 1,500 μg/L. In contrast, at the other sites, the U concentration remained relatively constant (OSDF, ICDF) or dropped over time (EMWMF)."[6] As ODOE knows, these are different facilities with different systems, but the possibility certainly exists for radioactivity to increase over time at the Chem Waste facility. In the event that uranium concentrations decrease in leachate, the public will have to wonder where this uranium was ultimately deposited. If it is no longer in the landfill's leachate, has it simply been distributed via dust across the landscape? In either case, the experience of an order-of-magnitude increase of uranium in ERDF leachate should prompt ODOE to consider a much more intensive monitoring regime for the Chem Waste facility, particularly considering the current concentration of U-238 in L-14, cell 1 at 358 pCi/L.

Other states have been forced to deal with leachate monitoring as a result of radioactive fracking waste issues, and some of the lessons from their experiences may be helpful for ODOE to consider. The Western Organization of Resource Councils (WORC) recommended to North Dakota that "leachate [] be analyzed for radionuclides at the same frequency as groundwater samples are collected," and "[i]f radionuclides are detected in the leachate at a concentration greater than drinking water maximum contaminant levels, then the groundwater monitoring network must begin analysis for radionuclide parameters."[7] The same report recommends a much higher frequency of monitoring for leachate and down-gradient groundwater, on a monthly basis when leachate shows radioactivity levels that exceed drinking water standards (which has occurred at the Chem Waste facility).[8] We encourage ODOE to review the recommendations put

[6] Tian et al. 2017. "Chemical Characteristics of Leachate in Low-Level Radioactive Waste Disposal Facilities."J. Hazard. Toxic Radioact. Waste, 2017, 21(4): 04017010.
https://ascelibrary.org/doi/pdf/10.1061/%28ASCE%29HZ.2153-5515.0000361
[7] Western Organization of Resource Councils. "No Time to Waste." p. 38.
http://www.worc.org/media/notimetowaste1.pdf
[8] Id at 56.

forward by WORC and to consider how their ideas may deepen the agency's consideration of whether the leachate management system at the Chem Waste facility can safely continue unchanged.

1. **The risks associated with surface exposure remains significant during landfill operation.**

The CAP identifies Alternative 1 as Chem Waste's preferred alternative because it is less expensive and, allegedly, would result in lower risk to current and future workers. However, Chem Waste's assessment sidesteps the potentially changing nature of the radioactive pollution in the leachate that the company sprays on the surface of the landfill for dust suppression purposes. Chem Waste's Preliminary Leachate Analysis shows the following Table (see below), which clearly demonstrates that uranium, thorium, and other radionuclides are present at elevated concentrations in the leachate. For reference, EPA's maximum concentration limit for drinking water for uranium is 30 micrograms/L, which corresponds to roughly 20 pCi/L.[9] Accordingly, the leachate is almost 18 times the drinking water standard at the present time, and we do not yet know if the trend is upward or downward. U-238 is extremely long-lived, and it has the potential to move with groundwater if it escapes containment. As an alpha emitter and a metal that is toxic to kidneys, it is also dangerous to people when it is inhaled or ingested. Other radionuclides present in the leachate carry additional hazards, as well.

Table 1. Radionuclide Concentrations in Leachate Sump Water. Italicized Values Were Less than the Lower Limit of Detection (LLD) and Represent one-half the LLD value

	Radionuclide Concentration (pCi L^{-1})					
Radionuclide	L-14 cell 1	L-14 cell 2	L-14 cell 3	L-14 cell 4	Average	OAR 345-050-0025 Table 1 Value
U-238	358	6.53	73.9	*6.5*	111	1.0E+04
U-234	332	10.8	83	*7.5*	108	1.0E+04
Th-230	50.3	*1.65*	*1.65*	3.6	14.3	1.0E+02
Ra-226	1.2	*0.85*	0.75	*0.35*	0.79	1.0E+02
Pb-210	*13.5*	*6.5*	*6.5*	13	9.88	1.0E+02
Th-232	25.8	*1.35*	1.6	*0.36*	7.28	1.0E+02
Ra-228	24	*10*	*10*	*10.5*	13.6	5.0E+02
Th-228	32.9	0.672	0.573	*8.04*	10.5	1.0E+03
U-235	14.6	1.8	*6.5*	*6.5*	7.35	1.0E+04
K-40	126.4	427	474	474.72	375	5.0E+02
H-3	*250*	*250*	596	*250*	336.5	3.0E+07

Table 1 from Preliminary Leachate Analysis. May 2020. Source: Chem Waste.

[9] Uranium MCL is 30 micrograms/L, which converts to about 20 pci/L according to the MN Dept of Health - https://data.web.health.state.mn.us/uranium-messaging and the NH Dept of Health - https://www.des.nh.gov/organization/commissioner/pip/factsheets/dwgb/documents/dwgb-3-11.pdf.

To understand the long-term impact of the leachate and its management on workers, nearby members of the public, and the environment, ODOE should require additional monitoring to understand whether the nature of the leachate is fluctuating over time. The system may have the impact of concentrating radioactive contamination by recirculating contaminated water again and again through the same contaminated landfill cells. It is premature to conclude that Alternative 1 is preferable without also considering the impact of the leachate management system. At the very least, ODOE should require regular, long-term monitoring to ensure the risks are well understood going forward.

At a basic level, the facility's leachate system seems like an ill-advised process—to take untreated leachate from the bottom of the landfill (where it may not pose a risk) and spray it untreated on the top of the landfill, where it not only poses a risk to the facility workers but accrues more radioactivity over time. Alternatively, if the radioactive leachate spraying results in the lowering of radioactivity levels in the landfill, this may indicate that the leachate spraying has simply distributed radioactive pollution into the surrounding environment. Again, this seems like a questionable approach when the underlying concentration of radioactivity in the leachate could be a changing factor.

At Hanford, the Pacific Northwest National Labs published an overview of dust suppression approaches used and their varying levels of success and potential pitfalls. The PNNL study does not directly contemplate the use of contaminated leachate for dust suppression. Rather, it considers the use of "freshwater," and it notes that the "over application of water may increase infiltration and cause mobilization of contamination."[10] While Chem Waste is convinced that the high-evaporation environment in Arlington will prevent mobilization of contaminants, the current radioactivity levels in L-14, cell 1 where leachate is used for dust suppression may suggest that any additional liquid will further mobilize contaminants in the system. Additionally, the use of contaminated leachate for dust suppression appears inconsistent with Hanford's typical use of "freshwater" for dust suppression. Practices at another low-level radioactive waste disposal facility, the on-site disposal facility (OSDF) in Fernald, Ohio, also appear not to use leachate for dust suppression, although large volumes of dust suppression water are used. According to a 2008 study of the site, "[t]he function of the OSDF is to isolate impacted material from the environment for up to 1,000 years to the extent reasonably achievable, and, in any case, for 200 years," and to "provide leachate containment and collection within the OSDF to prevent OSDF leachate from entering the environment."[11] Accordingly, our understanding is that this

[10] Yonkofski et al. 2018. Pacific Northwest National Labs. "Water Application for Dust Control in the Central Plateau: Impacts, Alternatives, and Work Strategies." https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-28061.pdf

[11] Bonaparte et al. 2008. Design, Construction, and Performance of Low-Level Radioactive Design, Construction, and Performance of Low-Level Radioactive Waste Disposal Facility Waste Disposal Facility https://scholarsmine.mst.edu/cgi/viewcontent.cgi?article=2972&context=icchge

low-level radioactive waste disposal site did not use leachate for dust suppression. Leachate recirculation occurs in some municipal and chemical waste landfills, but it is not clear that this is a common practice in radioactive waste landfills. If the agency has not done so already, ODOE must evaluate whether the use of radioactive leachate is a typical practice in low-level radioactive waste facilities. If not, this may further underscore the potential unadvisability of this approach being used in Arlington.

The leachate assessment notes that "[l]eachate spraying is not expected to result in a large amount of water infiltration because spraying only occurs when evaporation is high."[12] This environment would seem highly conducive to concentrating radioactivity in both the surface and in the leachate itself over time. As leachate is sprayed, some of the water evaporates and the rest returns to the landfill, becoming more concentrated in radioactivity as it filters back down.[13] It may also slowly mobilize more and more of the radioactive contamination in the filter socks. With the leachate already testing at three times the drinking water level for thorium and 18 times for uranium, the public should expect Chem Waste and ODOE to regularly monitor the situation in the affected cells (particularly L-14, cell 1) to ensure that the leachate levels don't dramatically increase before the landfill is decommissioned and capped.

In addition to risks relating to the leachate itself, we are concerned about potential risks related to the soil in and near the landfill. Chem Waste's own Preliminary Leachate Analysis acknowledges the potential for radioactive contamination to build up in the landfill soil over time. The Leachate Analysis notes that,

> [t]he leachate applied as dust control scenario theoretically results in the build-up of radionuclides in soil over time. This report assumes this material is suspended into air and contributes to external exposure for a person standing on the landfill surface. As discussed earlier, this scenario is considered unlikely as all landfill workers wear respiratory protection while working on the landfill.[14]

The CAP asserts that dust exposure poses a low risk to workers because of the use of respirators, but the study should also consider whether a change in leachate management practices—including not using the leachate for dust suppression—may reduce risks to workers. The risk assessment largely dismisses impacts to neighboring properties, however, the build-up of radioactivity in the soil as a result of leachate spraying will depend on the level of radioactivity in the leachate, which itself may increase over time. It is worth reconsidering whether spraying leachate for dust suppression, and the resultant buildup of radioactivity in soils, is a necessary risk for the ongoing operation of the Chem Waste facility.

[12] Preliminary Leachate Analysis at 3.
[13] Chem Waste's assumption that the radioactivity would remain in the filter socks has already proven false, as evidenced by the high radioactivity of the leachate. See Table 1 in Preliminary Leachate Analysis.
[14] Preliminary Leachate Analysis at 28.

The risk assessment also notes that runoff from the spray operations is collected using the landfill internal stormwater collection system and sent to a separate lined stormwater pond at the north end of the current landfill. The Risk Assessment states, "All stormwater from the facility is moved by on-site stormwater conveyances to on-site stormwater retention ponds that do not discharge to any of the local rivers, streams, or other water bodies."[15] While it is reassuring that on-site ponds will not immediately discharge to any local water bodies, the potential exists for increasingly radioactive leachate to cause the build up of radioactivity in these locations, as well, potentially causing a radioactive risk in the future. Additionally, when the leachate cannot be used for dust suppression, it is placed in one of two on-site evaporation ponds. These are additional locations that could see a build up of radioactivity over time. It also creates the possibility that these areas could generate radioactive dust that could pose a risk to workers or blow onto neighboring areas. While Chem Waste asserts that these risks are minimal, we remain concerned that the leachate management practices may contribute to a worsening concentration of radioactivity in soils, wind-blown dust, and the leachate itself.

We urge ODOE and Chem Waste to reconsider whether the use of radioactive leachate is appropriate for dust suppression, and the overall impact of potentially increasing levels of radioactivity in the leachate. The potential for risks to change over time seems significant. The CAP assumes that the facility will continue to operate for another 30 years following the illegal disposal of the Bakken oilfield waste, after which an engineered cover will be installed.[16] While the CAP proposes some monitoring, the timing of the monitoring may be too spaced out to provide enough information to correct a problem as it arises. Furthermore, the monitoring is not linked to any specific action or re-evaluation process for how the landfill is being managed.

2. The risks associated with the leachate will continue after the landfill is capped.

Over the long term, we remain concerned that the radioactivity Chem Waste introduced into Arlington could impact soils, groundwater, and the people and other biological life who may interact with them for hundreds, thousands, or even millions of years. It is difficult to project how the facility may change over time. For example, if the surface barrier fails before the liner, it may result in elevated levels of radioactivity in the vadose zone or even in groundwater if the liner creates a small, perched pool of groundwater. At that point in the future, maybe hundreds of years from now, if an intruder or a nearby resident were to introduce a well into the area, they could become exposed to radioactivity levels dramatically exceeding EPA's drinking water standard. It is difficult to conclude at this point, given the elevated levels of radioactivity in the leachate, and given the absence of information showing whether these levels are increasing or

[15] Risk Assessment at 10.
[16] Risk Assessment at 49.

decreasing, that there is no possibility of future impacts to groundwater and future potential users of the area. ODOE must acknowledge the potential natural resource damage that has resulted from Chem Waste's illegal dumping of radioactive fracking waste in Arlington.

At a minimum, ODOE should seek to implement additional monitoring in place after the landfill is capped to ensure the cap is working and leachate isn't collecting and moving to groundwater. Currently, leachate is approximately 18 times the drinking water standard. Over time, both the cap and the liner could fail, resulting in a vadose zone and ultimately groundwater contamination. As described above, the liner may cause the vadose zone to become more saturated above the liner, and if radioactive contamination remains present and concentrates radioactive pollution in this water, the risk could be greater than Chem Waste has acknowledged.

Chem Waste offers a confident view of the future of the Arlington landfill, asserting that its post-closure impact on the environment will be negligible. In a changing climate, their confidence is misplaced. We remain concerned about the radioactive waste that Chem Waste has illegally accepted and its potential to escape into the environment in ways we do not anticipate due to the effects of climate change. The half-life of U-238 is 4.5 billion years. The half-life of thorium is even longer. These alpha-emitting pollutants pose a particular risk if they are brought to the surface, mixed with soil, and inhaled as dust. Further, as ODOE acknowledged in its presentation in September, the production of radon gas could also pose a long-term risk. All of these risks may change over time as the climate shifts, potentially dramatically. According to Oregon State University's Fourth Oregon Climate Assessment Report, "[e]xtreme precipitation events are likely to increase by 20 percent in eastern Oregon, with heavy rainfall potentially resulting in slope instability, landslides and transportation closures."[17] ODOE and Chem Waste should have done far more to consider how changing, extreme precipitation events may alter the performance and impact of the landfill during operation and after closure of the facility.

Given the significant uncertainty of climate change impacts and the unsure picture of how much radioactivity will concentrate in leachate or future groundwater, we simply cannot agree with Chem Waste's bland assertion that "the groundwater exposure pathway is not a concern for human health or ecological receptors under either remediation alternative, even assuming hypothetical future potable water use drawn from Landfill L-14."[18] Chem Waste is asking us to ignore the currently elevated levels of radioactivity in the leachate and to assume that future risks will never emerge, even in a chaotic and changing environment. This is simply too large a leap to take with dangerous, long-lived contaminants. If Alternative 1 appears to offer less risk than Alternative 2 because Alternative 2 would expose workers and the public to contaminants, then ODOE must be honest about the long-term consequences of the approach it is

[17] Oregon Climate Change Research Institute. 2019. http://www.occri.net/ocar4
[18] Corrective Action Pan at 33.

taking. It may be the case that Chem Waste has created a situation where there are no truly good options.

III. Conclusion

In conclusion, Columbia Riverkeeper urges the Oregon Department of Energy to not accept the Corrective Action Plan (CAP) submitted by Chem Waste as written. The CAP downplays the risks associated with leaving the waste in place and fails to provide adequate monitoring for the leachate, which already shows elevated levels of radioactivity. We appreciate ODOE's willingness to engage with the public, and we urge ODOE to delve more deeply into how to address the risks that may arise from illegal radioactive fracking waste disposal in a changing climate, in a landfill that was not designed for low-level radioactive waste, in a community that did not ask for, anticipate, or deserve this pollution risk.

Sincerely,

Dan Serres

Conservation Director

Columbia Riverkeeper

LEAGUE OF WOMEN VOTERS® OF OREGON

The League of Women Voters of Oregon is a 100-year-old grassroots nonpartisan political organization that encourages informed and active participation in government. We envision informed Oregonians participating in a fully accessible, responsive, and transparent government to achieve the common good. LWVOR Legislative Action is based on advocacy positions formed through studies and member consensus. The League never supports or opposes any candidate or political party.

November 7, 2020

To: Oregon Department of Energy, Nuclear Safety Division
550 Capitol Street, NE
Salem, OR 97301
ODOE.Comments@oregon.gov

Re: Chemical Waste Management of the Northwest's (CWM) Risk Analysis and Corrective Action Plan, including CWM's Preferred Alternative - **Comments and Concerns**

The national League of Women Voters (LWV) believes that "*natural resources should be managed as interrelated parts of life-supporting ecosystems. Resources should be conserved and protected to assure their future availability. Pollution of these resources should be controlled in order to preserve the physical, chemical and biological integrity of ecosystems and to protect public health.*" All state and local Leagues, including LWV of Oregon, adhere to and support this position. It is on this basis that we offer these comments on CWM's Risk Assessment and Corrective Action Plan (RA/CAP), provided to the Department (ODOE) in fulfillment of a requirement in the Notice of Violation (NOV) issued on February 13, 2020 for CWM's acceptance of 1,285 tons of waste with radioactive levels in excess of legal levels delivered in a total of 64 loads between May 2, 2016, and September 16, 2019.

The Department required in the NOV that, "Based on the risk assessment and valuation of alternatives, CWM Arlington shall propose a preferred alternative for final corrective action." They also required that, "Alternatives shall include at minimum two alternatives: exhumation and lawful disposal of all wastes exceeding the definition of "radioactive materials" in OAR 345-050-0006: and in-situ closure." In fulfilling the Department's requirement, CWM has provided a voluminous and highly technical and complex document that fully and unequivocally supports the preferred alternative of in-situ closure.

Our review of the anticipated egregious health and environmental risks the RA/CAP outlines as associated with exhuming and relocating the illegally accepted radioactive waste leaves us with no choice but to support CWM's preferred alternative of in-situ closure, but we have significant discomfort with that alternative.

1. Implementation of the preferred alternative of in-situ retention will fail to satisfy a number of important public and local community concerns, many of them voiced during public hearings about this matter since its discovery. We share those concerns. These include, but are not limited to the following:

    a. There have been no procedures in place at the state level that were able to discover the transport and disposal of this quantity of illegal materials and number of shipments over three

years. Without the "tip" from a North Dakota resident, the chances are good that Arlington would still be accepting such waste. We will add that, given the enormous quantity of such waste that is produced daily by the oil and gas industry in other states and the limited number of TENORM licensed landfills in operation, we cannot have confidence that the Arlington experience has not been replayed in other landfills across the state. While we acknowledge that there are difficult challenges to developing and implementing a monitoring and surveillance system that would be able to identify *and* disincentive illegal transport and otherwise correct these concerns, we encourage the Department to prioritize research and development of such a system.

b. There is no remedy in the preferred alternative for the stigmatizing presence of over a thousand tons of radioactive waste buried near the community of Arlington. As stated, in our view, removal as described in alternative #2 would fail to meet the threshold criteria of overall protectiveness, but it would eliminate the psychological and economic burden on the community of being home to a radiological zone. Community members played no role in having this happen, but they are paying what several have said is an unfair price that feels in some ways higher than the company has paid.

c. On a related noted, there is concern that, as long as TENORM that exceeds Oregon's legal limit is in the ground at the Arlington Landfill, there could in the future be pressure to redesignate that landfill to accept more radionuclide-bearing waste. Would the community's wishes against that action be honored in the face of aggressive lobbying effort by the industry?

d. Regardless of even legitimate findings that the potential for harm to the human or natural environment from radionuclides is minimal, there is no shortage of examples across the nation where such perceptions have been erroneous or such guarantees have turned out to be false.

e. The analysis of risks under each of the two alternatives included in the RA/CAP is based on discussion of a limited number of hypothetical situations. It notably lacks any discussion of risks associated with the preferred alternative in the event of even a minor earthquake, let alone the expected "Big One." For these reasons alone, the analysis therefore lacks certainty to reach the conclusion that the preferred alternative would present "relatively few human health and ecological exposure pathways of concern" as claimed by CWM.

2. <u>We have concluded that the Leachate Management system described in the RA (at 2.1.3) has been inadequately investigated as a potential, ongoing, and possibly cumulative source of unsafe radionuclides in the air and dust where it could be inhaled or ingested</u>. In addition to humans, we can imagine that animals, especially birds, could also be harmed.

   The current and planned practice in contaminated cells in Landfill L-14 involves pumping radionuclide-bearing liquids (leachate) to the surface from each of four cells and handling it in one of two ways:

   a. By spraying it over the surface of the landfill for dust-control. This practice is presumably the same as is employed in other areas within the hazardous waste sectors of the Arlington

Landfill, but our concern is that at least the potential for airborne release of radioactive material in the leachate is not well enough understood for safe cross-over application.

b. By trucking it to the onsite water treatment plant, where it is treated and pumped into holding ponds. Treatment is not discussed in terms of its ability to confront TENORM. Evaporation of liquids in holding ponds can be anticipated, but disposition of residue is not specified. Could some residue be disbursed into the air as dust or could birds or other animals come in contact with it in the ponds? The EPA's website is woefully cursory and out of date, but they acknowledge that water containing radionuclides that is treated results in build-up in a wastewater treatment system.[1] How is that residue managed in CWM's system?

The CAP reports that sample tests of leachate taken in March had acceptable levels of radionuclides and concluded that this technology bears no appreciable risk, but we have concerns. For one, page 22 of the CAP, Table 4.1, Summary of Potentially Relevant Hazardous Waste Landfill Remediation Technologies, offers disbursal into the air as one way of disposing of leachate from hazardous waste. It also notes a water treatment option. In the narrative following, the Plan fails to track how analysts moved from that table of options to the technologies included in the preferred alternative where those two technologies are employed, but the analysts indicate that some options in Table 4.1 are not appropriate for waste containing radionuclides because, "Unlike many organic contaminants, such as petroleum hydrocarbons, radionuclides cannot be destroyed or degraded (except through natural decay)." (Tables 4.2 and 4.3 are referenced, but missing.) In our view, the discussion leaves open the question of whether surface spraying for dust control or water treatment are appropriate technologies in this case, where radioactive materials have been buried in a mix with hazardous materials in a landfill designed for only hazardous materials.

We have been unable to locate resources that outline separate protocols for landfills licensed to accept TENORM. The EPA's website provides little more than a description of such materials and is so outdated that wastes produced by hydraulic fracturing are not even mentioned in the report posted.[2]

There may be other matters related to leachate that we haven't identified. To reiterate, we question whether this issue has been adequately explored.

We urge ODOE to require that more thorough analysis and discussion of management of radionuclide-bearing leachate be added as a supplement to the RA/CAP. We also recommend that the Department include in its determination a requirement for frequent sampling and testing of leachate, ensuring that results are obtained and reported for all cells in which TENORM waste has been buried to account for individual differences in cell content, burial depth, and so on. Testing and reporting should also be required for radionuclide levels released in air, on the landfill's surface, and in a manner that would reliably determine risk related to the management alternative involving utilization of water

[1] https://www.epa.gov/radiation/tenorm-wastewater-treatment-residuals

[2] "Evaluation of EPA's Guidelines for Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM) Report to Congress," June 2000.

treatment facilities and evaporation ponds. This monitoring and reporting should continue until all landfill sectors containing the contaminants are capped and leachate production ceases.

3. We believe care must be taken to ensure that the information and conclusions (or recommendations) presented in CWM's RA/CAP are not, now or in the future, characterized as evidence that TENORM waste with higher levels of radioactivity than Oregon law currently allows can be accepted and managed without harm to the public or environment.

   The CAP concludes:

   > Overall, the RAC dose and risk assessment results show that there are relatively few human health and ecological exposure pathways of concern based on current or reasonably anticipated land and water uses in the vicinity of the CWMNW facility (see Sections 2-5).

   While we lack the technical and scientific expertise, as well as time, to assess the accuracy of either the information presented or the calculations used by CWM to arrive at this conclusion, we have concerns that the voluminous and complex document that justifies it could be misinterpreted or even misused, for example to justify opening Oregon up to acceptance of fracking waste. Thus far, the state has had relatively little experience with this issue. Indeed, ODOE has been very clear throughout this process that, while Oregon's prohibition of disposal of TENORM with radioactivity levels above 5 pCi/g has been on the books (ORS 469.925 and OAR 345-050) for decades, the Arlington affair is the first known occasion of violation. Whether we have been extraordinarily lucky or simply unaware of previous violations due to the difficulty of discovery and lack of effective surveillance mechanisms is unknown.

   What is known is that there is an enormous quantity of the same type of waste that is currently buried in Arlington's Landfill-14 being produced every day, that the high rate of production has been going on since around 2005, and that the industry must find ways to dispose of it. The Environmental Protection Agency's (EPA) website provides no information about either current quantities of TENORM waste production from fracking or availability of disposal sites. In general, it is extraordinarily cursory and outdated on the topic of fracking waste, but they post a Report to Congress dated 2000 (five years prior to the beginning of fracking proliferation) stating that "Total amounts of TENORM wastes produced in the Untied (sic) States annually [in 1993] may be in excess of 1 billion tons."[3] It goes on to say that, "Nuclear Regulatory Commission (NRC) staff calculations show that the disposal of the annual production of TENORM in industrial landfills could easily exceed $100 billion."[4] And, it continues,

   > "This situation causes a dilemma because of the high cost of disposing of radioactive waste in comparison with (in many cases) the relatively low value per ton of the product from which the TENORM is separated. In addition, relatively few landfills or other licensed disposal locations can accept radioactive waste. However, TENORM materials exempt from NRC regulation are routinely disposed of without being labeled "radioactive material." Also, large quantities of

[3] "Evaluation of EPA's Guidelines for Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM) Report to Congress," June 2000, citing S. Cohen and Associates, Inc., 1993, Preliminary Risk Assessment of Diffuse NORM Wastes, Prepared for U.S. EPA under contract No. 68D20155, May 1993.

[4] Ibid, citing New Jersey Department of Environment Protection, Commission on Radiation Protection, Soil Remediation for Radioactive Materials Proposed New Rules: N.J.A.C. 7:28-12, DEP Docket Number 11-99-06-697.

TENORM are currently undisposed and may be found in many of the thousands of abandoned mine sites around the nation.[5]"

As noted, decades have passed and a fracking boom has ensued since that report was released. But it is clear that the amount of waste has increased astronomically, along with the cost of disposal, and the development of appropriate disposal locations has not even remotely kept pace. Generators of that waste and the service chain that serves them face a challenge that, as long as fracking continues, will not go away. It is important to ensure that Oregon remain vigilant.

We recommend that ODOE, in its determination pertinent to this RA/CAP, state clearly and definitively that its acceptance of CWM's RA/CAP in justification for the preferred alternative does not imply or constitute concurrence with CWM's assertion that, "Overall, the RAC dose and risk assessment results show that there are *relatively few human health and ecological exposure pathways of concern* [italics added] based on current or reasonably anticipated land and water uses in the vicinity of the CWMNW facility (see Sections 2-5)." We do not believe CWM has demonstrated that. We urge the Department to state explicitly in its determination that it accepts the preferred alternative (assuming it does) *because alternative #2 is potentially too dangerous and harmful to the human and natural environment.*

Thank you for your consideration of these comments.

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[5] Ibid. citing S. Cohen and Associates, Inc. 1989, Radiological Monitoring at Inactive Surface Mines, report prepared for the U.S. Environmental Protection Agency, February, 1989.

From: Jennifer Miller <personal email redacted>
Sent: Sunday, November 8, 2020 12:46 AM
To: ODOE Comments * ODOE
Attachments: Screenshot_2020-11-07-23-30-55-881_com.google.android.apps.docs.jpg; Screenshot_2020-11-07-23-23-46-087_com.google.android.apps.docs.jpg; Screenshot_2020-11-07-23-30-40-074_com.google.android.apps.docs.jpg

CLEARLY the law was broken. They knew they were breaking it year after year. And it's sad that our tax dollars go to employ Oregon officials who get bought off to sweep it all under the rug. Damn, how much were you ALL paid for these shipments of LETHAL RADIOACTIVE WASTE? "Oh, the landfill didn't know" my ass! I was so proud of my State until I happened upon this. Convenient that it's during a PANDEMIC! There's NO WAY to make these extremely high numbers safe for Oregon's! Nor can I believe you are all just getting away with it! Tell them to dispose of their OWN damn nuclear waste. Money IS the root of all evil! This is all just a smoke screen. Ship it back and return the money! DO THE RIGHT THING ASSHOLES!!!!