**FIRE RISK ASSESSMENT OF COFFIN BUTTE LANDFILL, CORVALLIS, OREGON**
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## Report Purpose

SCS Engineers has been contracted to Republic Services to assess the risks of fire associated with the Coffin Butte Landfill (the "Landfill"). This report will identify possible fire scenarios, including alternative sources, likelihood of occurrence, control measures in place to mitigate fires, and the potential for fires to expand to a size sufficient to have a material impact on the local community or environment.

## Landfill Background

The Landfill is located at 29175 Coffin Butte Road, Corvallis, Oregon 97330. It is an active municipal solid waste (MSW) landfill operating under a conditional use permit (CUP) from Benton County, Oregon, and a landfill operating permit from the Oregon Department of Environmental Quality (DEQ). The Landfill serves multiple nearby counties as a designated "Regional Landfill." The current operating permit is dated 2020 and was part of the state's required ten-year renewal process.

The site is permitted for up to 1.1 million tons of MSW per year. In the last full year of 2023, the site received about 1.0 million tons. Since the site is open six days per week, that comes to an average of about 3,200 tons per day. The site is staffed and open for waste receipt and disposal Monday through Friday from 5 a.m. to 5 p.m. for commercial access, and from 8 a.m. to 5 p.m. for public access. The site is open to all from 8 a.m. to 5 p.m. on Saturdays and is closed on Sundays.

Wastes received at the Landfill are 70 percent conventional MSW, mostly from residential and commercial sources. About 30 percent are special nonhazardous wastes, mostly from industrial sources. These include POTW sludges, industrial wastes, petroleum-contaminated soils (PCS), and other special wastes. All special wastes are approved for disposal at the Landfill by both DEQ and Republic Services. Republic has a robust Special Waste Acceptance Program administered from their corporate headquarters in Arizona. Republic reviews all applications, and sources for disposal of special wastes, to any of its landfills, and approvals are generally more conservative than even DEQ would require. Republic rejects any special waste that has any potential to be problematic to handle or bury at its landfills—especially reactive or ignitable wastes.

As at any active landfill, the Coffin Butte site has a combination of areas with final cover, intermediate cover, and daily cover. Final cover has been applied to 45 acres at present, mostly outslopes of the Landfill already at final grade. Final cover includes a prescriptive cap of geomembrane plastic sheet, cover soils, drainage layer, and vegetation—mostly grass. Intermediate cover is over 66 acres of fill, which includes 12 inches of soil topped with an exposed geomembrane cover (EGC) of plastic, which is either EPDM or a 12-mil-thick plastic tarp. Daily cover areas are held to a minimum size, generally no more than 4 acres at any time, before intermediate cover is applied instead. A tarp is applied to the active working face as Alternative Daily Cover (ADC). The ADC is fully approved by DEQ. Six inches of soil or PCS—the latter also approved by DEQ—is periodically applied as daily cover instead of a tarp.

The working face of the Landfill is the open face where waste is dumped during the working day. As is done at any active MSW landfill, wastes are exposed at the working face until the end of the day when daily cover, as described above, is applied. Good practice dictates that the working face be kept to the minimum size practicable, leaving enough room for the number of trucks dumping waste at any one time. On any given day, the working face at the Landfill is about 200 feet wide, which is appropriate for any landfill receiving as much as 2,100 tons per day.

An important environmental control at any MSW landfill is a gas collection and control system (GCCS). The intent of any GCCS is to collect as much landfill gas as possible at its source by utilizing a system of individual gas-extraction wells installed deep into the landfill. Gas collected from the wells is directed through connected header pipes, which typically provide suction and direct flow back to a single blower/flare facility.

The Landfill currently has over 300 gas-extraction wells that are mostly vertical. Most wells are plastic pipe (PVC or HDPE), but some are steel. Connective headers amount to several miles of HDPE plastic pipe. Most of those headers are buried below ground, but some are above ground and laid across the landfill surface, mostly in areas brought to final grade with final cover applied. All headers are connected together, leading to a single blower facility. From there, the gas is partly sent to a gas-to-energy plant that uses the methane to power electric generators producing power for the local electric grid. That plant has a capacity of 2,000 cubic feet per minute (cfm). There is more gas flow than the power plant can use, so the balance of landfill gas is combusted on-site in an enclosed flare. The power plant is owned and operated by PNGC, the local power company, which then transmits the electric power into its local electric grid.

The design, construction, and operation of the GCCS is regulated under provisions of the Clean Air act (New Source Performance Standards (NSPS) for MSW Landfills). The effect of the NSPS rules is to capture the majority of gas generated by landfills to reduce fugitive gas emissions from the landfill surface to atmosphere to the lowest level practicable. Design, construction, and operation of a GCCS must comply with the NSPS regulations. Semiannual reports demonstrating compliance with the operating rules under NSPS must be submitted to state and local air authorities. The Landfill also has a Clean Air Act Title V permit, with additional conditions to manage air emissions and overall air quality at the site. Routine compliance reporting on Title V is required as well. From our review of recent NSPS and Title V reporting, the Landfill appears to be in substantial compliance with both of those regulatory programs.

**History of Prior Landfill Fires**

The first notable fire at the Landfill occurred in 1999 and was its largest fire to date, as reported in local media at the time. The site was owned and operated by Valley Landfills Inc., before site ownership and operation was assumed by large national waste companies—Allied Waste and Republic Services. The fire broke out in the exposed waste area of the daily working face and reportedly came from an undetected hot load from a large waste-transfer trailer known as a “waste tipper.” Apparently, the fire was not spotted and/or responded to quickly enough and spread over the full extent of exposed waste surfaces. It reportedly expanded beyond exposed waste and burned some grass atop the Landfill and also burned and melted some of the above-ground plastic pipe serving as landfill gas headers.

Valley Landfills operating staff soon responded to extinguish the fire using a combination of smothering soils and water. On-site staff was joined by the local fire department, Adair Rural Fire and Rescue (Adair Fire), which assisted to extinguish the fire after several hours.

A second fire broke out at the Landfill's working face about six years ago. The source of the fire is unknown, but was likely from a smoldering portion of a waste load delivered to the site during working hours. The fire went undetected during staffed daytime operations and broke through to the surface during the night and spread through some of the working face before it was observed by neighbors. Adair Fire quickly extinguished the fire with water.

A third fire occurred on grassed areas adjacent to the Landfill flare. The cause of the fire is unknown, but site operators believe there may have been an ember from charcoal buildup in the flare that ignited grass. The incident occurred during the workday and was quickly extinguished by Landfill personnel. Since then, the areas around the flare at the site have been covered with gravel. With this improvement, it is believed that a repeat of a fire starting in this manner cannot occur. (The author of this report, having significant experience with landfill fires, has never heard of a surface fire starting from landfill gas flare. I am skeptical that the fire occurred from this source and believe this grass fire likely came from some other source.)

A fourth fire was reported to have occurred on May 18, 2024. It is believed that a hot load was delivered to the working face from the public convenience center at the site. Although the subject waste was delivered during the operational day, it apparently was not an obvious hot load and on fire until after the site was closed that day. At about 6:00 pm that day, a trail of smoke was seen rising from the working face of the landfill. The fire was reported to Adair Fire who mobilized to the site after first contacting site operating personnel. The site's Operations Manager and Operations Superintendent responded to the site within 15 minutes of contact from Adair Fire. Site personnel immediately used heavy equipment to extract the affected waste from the working face, moving it nearby to an area isolated from the waste at the working face. Site personnel then used the equipment to apply soil over the waste. The fire was soon extinguished. After that, the waste was observed for another hour, to ensure it did not re-ignite.

Adair Fire was on standby at the site but not needed to actively engage the fire. After a few days, the waste was moved back to the working face. It should be noted there were no grassy areas near the working face nor the area where the affected waste was moved to.

A fifth fire occurred on July 24, 2024. A small fire ignited in a grassy area near the landfill's flaring station. Again, the fire was observed from off-site and reported to Adair Fire. Adair Fire notified site operating personnel, who live nearby and mobilized to the site in 12 minutes. By then, Adair Fire had already extinguished the grass fire with water. The source of the fire is unknown. But since this event, the ground in a large area around the enclosed flare has had its grass removed and replaced by a gravel surface.

The above cases were reported to me by Landfill staff as being memorable to them with details. As at any landfill, hot loads in delivered waste occur multiple times per year and likely do so at the Landfill. Landfill staff reported that these fires have been quickly spotted and extinguished with smothering soil.

**Fire Mitigation Plans**

Adair Fire has full access to the Landfill and is available to lead or assist operating personnel in extinguishing fires at any time. Water would be used as a primary means of extinguishing fires, with pumper trucks bringing water onto the site and/or filling or refilling trucks from public water available at the site.

The Landfill has addressed a plan for responding to fires written into the Landfill Operations Plan. Section 8.1 of that Plan states:

*"In case of fire, the following actions are to be taken:*

- *The landfill operations manager and site supervisor are notified.*
- *An assessment is made as to where the landfill can expose and douse the fire using site equipment, or whether fire department help is needed.*
- *If it is decided that help is needed, the fire department is contacted.*
- *Appropriate actions are taken to divert traffic and customers away from firefighting activities.*
- *The DEQ is notified of the event."*

Several contingencies have been put in place to address any fire that may break out at the Landfill. Those measures include:

1. Soil stockpiles arranged in a U-shape are always available near the Landfill working face in accordance with Standard Operating Procedures (SOPs) developed by Republic Services corporate staff for all their landfills nationwide. If a waste truck is determined to contain a hot load, the driver is to immediately notify site operating personnel and back the load into the U-shaped soil stockpiles to deposit the waste on solid ground not connected to or a part of the working face. Once on the ground, any burning parts of the waste are quickly covered with soil by operating personnel to extinguish the fire. The waste is kept separate from the working face and is moved to the working face only after personnel determine that the fire is completely extinguished.

2. Soil stockpiles are always nearby and available for use near the Landfill working face for immediate application by site personnel to extinguish any fire detected on the landfill working face. As any landfill operator knows, the safest and most effective way to extinguish a fire at a landfill working face is to smother it with soil. This contingency is also in full accord with Republic Services SOPs for landfill fire management.

3. The site can readily use water to extinguish grass fires on the landfill or to supplement soil application at the landfill working face. The site has a 4,000-gallon water truck with spray bar and hose attachment that is used routinely in dry weather for dust control. The water truck is loaded with fresh water from a truck-loading station connected to the public water supply.

**Landfill Fire Sources, Risk Profiles, and Specific Mitigation Measures**

This section will identify the three sources of fires that have a material risk of occurring at the Landfill. For each source, we will describe how and where the fire would occur, the likelihood of occurrence, the control measures in place to mitigate fires, and the potential for fires to expand to a size sufficient to have a material impact on the local community or environment. These three types of fires are generally true for any landfill and are thus appropriate to identify as such for the Landfill. The three landfill fire sources are (1) working face fires, (2) grass fires, and (3) gas well fires.

***Working Face Fires***

As suggested above, surface fires at the landfill working face are quite common at any landfill. They generally derive from a smoldering part of a waste transfer vehicle's much larger waste load. Once dumped, the smoldering waste can expand to a larger fire when exposed to atmosphere and placed atop other exposed wastes already deposited at the working face. The key to controlling these fires is to quickly identify and extinguish them.

There are ways to avoid a hot waste load being placed atop the working face in the first place. As described above, operating personnel at the Landfill are trained to identify a hot load before it is dumped at the working face. In that case, it is dumped in a separately prepared area, atop solid ground not containing waste, with soil stockpiles always alongside to quickly cover and extinguish any fire before expanding beyond that load, much less to other waste already deposited at the working face.

While some hot loads can be managed in this manner, some inevitably are not detected until unloaded atop other waste at the working face. But again, operating personnel at the Landfill have been trained to quickly spot and contain that kind of fire before it expands beyond its original waste load. Soil stockpiled adjacent to the working face is immediately applied and compacted over the smoldering waste. Several layers of soil are applied and compacted to make absolutely sure that the fire is smothered and sealed off from atmospheric oxygen to help prevent reignition. Additional waste deposits received thereafter are placed in other areas of the working face, so the sealed-off surface atop the hot load can be observed and kept stable for the rest of the day.

The key is to quickly identify and extinguish working face fires with soil to prevent expansion. Quick reaction ensures minimal risk of the fire expanding and consuming larger portions of the working face. Although usually unnecessary, water can be applied to supplement the soil application.

There are three keys to keeping working face fires under control and tightly confined. First, keep the size of the overall working face as small as practicable during the day, appropriate for the size of the landfill operation and the number of trucks dumping at the working face at any one time. Second, cover the waste at the end of each working day, limiting air and oxygen to fuel the fire and the amount of refuse exposed to atmosphere overnight. Third, keep the working face limits, whether during the day when exposed to atmosphere or at night when covered, a sufficient buffer distance from grassland or other flammable materials.

If those provisions are implemented, the risk of a fire consuming the whole working face, much less expanding beyond to grassy areas, is de minimis. The controls put in place by the current owner (Republic Services) makes a recurrence of a working face fire as large and uncontrolled as the 1999 fire highly unlikely.

In summary, fires at any landfill's working face are not unusual, considering that wastes brought to any landfill may from time to time arrive as a hot load, with parts of the load smoldering. Republic Services has put in place a number of contingency supplies and conditions that provide a high level of assurance that such fires will be promptly identified, controlled, and extinguished without expanding beyond the limits of the hot load.

***Grass Fires***

A portion of the Landfill's existing fill areas and on-property buffer areas are grassland and subject to fires. Grass on the landfill property can be ignited from either on-site or off-site sources.

The risk is low for wildfires starting off site to come on site, and there is no history of wildfires in the area of the Landfill. This part of the county is generally wet most of the year, and wildfires are rare. Wildfires are more likely to be created and expand at higher, dryer elevations in the county, with low risk of spreading the full distance to the Landfill.

If such off-site fires did enter the Landfill, it is assumed that Adair Fire would already be working at controlling the fire. Those efforts could be supplemented by operating personnel using water from the site's water truck, or stockpiled soil would be used to smother the fire. Other control measures could be employed, such as firebreaks and soil barriers, to keep such fires off the Landfill property.

There has been some stated concern that a grass fire entering the Landfill's fill areas would be fueled and exacerbated by methane at the site—presumably by either gas in the GCCS wellheads, in above-grade gas-collection headers, or by surface emissions through the landfill cover. In our judgment, there is no risk that methane from the Landfill would further fuel a grass fire entering the site. Such wildfires have blazed across several MSW landfills with GCCS systems in place in southern California. Such wildfires may destroy portions of the GCCS gas-collection system that are above ground, but these collection systems operate under vacuum; when the plastic components burn, the vacuum is disconnected and gas flows stop. In the end, grass fires entering the Landfill site are no different from fires crossing undeveloped grassy areas far removed from landfills. The fact that it spreads across a landfill makes no difference in the size, spread, or intensity of the fire.

The next concern is grass fires that are created on the Landfill property. These fires are unlikely to come from a working face fire, since working face fires would be quickly identified and controlled within the working face itself, as previously described. Providing a buffer between the working face and grassy areas also assures that a working face fire cannot spread to grassy areas.

As previously described, one reported fire at the Landfill came from the site's landfill gas flare, reportedly via a burning ember that was expelled from the flare. We are skeptical that a grass fire came from this kind of source. Landfill flares tend to burn clean, with no residue or solids of any kind expelled from the flare. Nonetheless, the Landfill has since taken the precaution of maintaining a significant gravel-covered buffer between the flare and grassy areas with no chance of ignition.

There is some risk that vehicles at the landfill could ignite a grass fire if they operate in or travel across grassy areas. Some undercarriage parts of vehicles, such as mufflers and catalytic converters, do have elevated temperatures and have some potential to be hot enough to ignite grass or other combustible materials that may come in contact with vehicles. However, waste vehicles entering the Landfill traverse

paved and graveled roads when approaching and returning from the working face. Landfill operating vehicles mostly travel on nonflammable surfaces as well.

If a grass fire occurs on site from on-site sources, the Landfill would quickly identify it and respond with its water truck or by using other operating equipment to cover and extinguish the fire with soil. As described above, even if the GCCS gas system is burned and destroyed in the process, methane from that system or any emissions from the landfill surface have no risk of fueling or otherwise exacerbating the fire. This again is based on experience with such wildfires sweeping over landfills with and without gas systems in southern California.

In summary, we believe there is low risk of a grass fire occurring from either on-site or off-site sources at the Landfill. And if a grass fire were to develop, it would not be fueled by landfill gas in any way, including gas in wellheads or header lines. In any event, such fires could be quickly extinguished by operating staff or, if necessary, with the support of Adair Fire.

***Gas Well Fires***

A third possible source of landfill fire is a gas well fire. As previously described, a GCCS collects landfill gas at many landfills such as at Coffin Butte. A blower is used to provide suction to landfill gas wells, and gas then flows from wells through a system of connecting gas pipes known as landfill gas headers. Collected gas at the Landfill ultimately flows to the blower station where part of the gas is directed to a landfill gas-to-energy plant, and the balance to the landfill gas flare. These gas systems are carefully operated, monitored, and maintained. A precise amount of vacuum is applied to each well to provide a steady flow of methane from each gas well. If the vacuum applied and induced flow is too low, methane gas may find ways other than wells and the gas-collection system to exit the landfill as an uncollected surface emission. If too much vacuum is applied, its induced flow can generate an oversized zone of collection around a well—one that breaches the landfill surface and "short-circuits" atmospheric oxygen downward and thence into the wells and headers.

The waste inside a landfill usually decomposes in an "anaerobic" condition, since the waste is at depth in the landfill and sealed off from the landfill surface and atmosphere above. Anaerobic means lacking air or oxygen. Anaerobic conditions in a landfill generate anaerobic decomposition, which has as its primary gaseous byproducts both methane and carbon dioxide. The methane component is natural gas, the same gas used by local natural gas utilities and used to heat our homes.

If excess vacuum is applied to a gas well, it can draw oxygen into the landfill inducing "aerobic" (in the presence of air and oxygen) decomposition and oxidation, with carbon dioxide as its primary gaseous byproduct, with little or no methane. As oxidation progresses, it can end up at the extreme end of oxidation—namely, spontaneous combustion and fire.

If a GCCS is not tightly operated, monitored, and maintained, a landfill fire can break out in the manner described above. Fortunately, such fires stay subsurface in the landfill and are of a limited extent vertically and horizontally, staying in close proximity to the gas well. These fires do not manifest themselves above ground, nor do they have any potential to create a surface fire.

Nonetheless, landfill gas well fires can and do occur at landfills with GCCS gas-collection systems. Identification of these fires can be observed in gas monitoring results recorded at the gas wellhead—with elevated temperatures, increased carbon dioxide, and decreased methane. Physical signs may also

appear with rapid settlement around the wellhead, and in rare cases melted and destroyed gas wells and even low-level smoke emissions.

Being subsurface in the landfill, waste can create some challenges when it comes to extinguishing gas well fires. The first step to extinguish these fires is to close the wellhead valve, cutting any suction or gas flow from the well into the gas-collection system. Sealing off the area around the well with tight compacted soils can help cut the intrusion of atmospheric oxygen to the subsurface fire. Applying water to the landfill surface above the fire, and letting it seep into the landfilled waste below, is unlikely to directly extinguish the fire. By implementing the measures described here, the fire should snuff out on its own over time. Elevated temperatures may persist for months, but will eventually subside.

It should be reiterated that Republic Services has detailed SOPs for operating, monitoring, and maintaining gas-collection systems for their landfills. One of those SOPs addresses ways to avoid "Subsurface Oxidation Events" such as these from ever occurring. That SOP also addresses ways to identify the onset of these events and prescribes action(s) to extinguish them.

Based on our interviews of Landfill staff, no gas well fires have ever occurred at the site. From our review of landfill gas wellhead data over the past several months, including primarily the temperature of extracted gas at all gas wellheads, we see no evidence of such gas well fires at the Landfill at this time. There is always the potential for gas well fires to occur at this or any landfill in the future. However, with proper operation, monitoring, and maintenance of the overall GCCS, the potential for these fires is reduced for the future. And if such a fire were to occur, it would be quickly identified and extinguished using the techniques described above.

In summary, landfill gas well fires can be reduced or avoided altogether with proper operation, monitoring, and maintenance of the GCCS at the gas wellhead. Landfill gas fires have occurred at other MSW landfills with active gas-collection systems installed, but operating staff at the Landfill report that no such fires have occurred to date. Our review of current gas wellhead monitoring data shows no evidence that any wells are poorly operated or have a developing or current gas well fire at this time. Landfill staff have the knowledge and tools to avoid gas well fires in the future, and if one were to occur, can identify and rapidly take steps to extinguish it.

**Conclusion**

We have identified three possible sources of landfill fires that have a material chance of ever developing at the Landfill. These include (1) working face fires, (2) grass fires, and (3) gas well fires.

With the potential for a hot load to arrive at this or any landfill, working face fires have occurred at the Landfill in the past, and that potential remains. However, the controls implemented by operating staff since the 1999 fire with respect to a working face fire provide assurance that an event of that size will not reoccur. Any fire that occurs at the working face in the future will be promptly identified and extinguished with little to no expansion of that fire beyond the contents of the hot load itself.

The potential for grass fires to develop on Landfill property is low, and certainly no more than anywhere that vehicles come in proximity to grassed areas, such as alongside public highways. Fortunately for the Landfill, operating staff are well trained and attentive to identify the development of any on-site grass fires, and they have the tools and methods to quickly extinguish grass fires before they spread.

There is no history of large wildfires in the part of the county surrounding the Landfill. But like almost anywhere, given dry weather and areas overgrown with natural vegetation like grassland or forest land, that risk, although low, does exist. It is possible that such fires could spread from off-site to on-site areas at the Landfill, but we assume that any such fire, whether off site or spreading onto the Landfill, would be addressed by Adair Fire. To make clear, the presence of a wildfire sweeping across Coffin Butte or any landfill would not be exacerbated at all by the presence of the landfill, its landfill gas, or its gas-collection system. Several wildfires have swept across landfills like Coffin Butte in southern California with no evidence that the fire was in any way affected or accelerated by the landfill beneath.

Lastly, gas well fires can occur with any landfill having a gas-collection system, like Coffin Butte. However, those fires stay subsurface and localized to a given single gas well. There is no evidence that any such fire has occurred in the past at the Landfill. Our review of wellhead monitoring data indicates that none are occurring now. Considering the current procedures in place, the risk of gas well fires occurring in the future is low. And finally, if a gas well fire did occur, the staffing, procedures, and tools are in place to quickly identify, control, and extinguish those fires in the future.

Based upon our analysis, we conclude that operations at the Coffin Butte Landfill do not present a significant fire risk.