Technical Comments on Bill 36-0232
Controlled Incineration of Vegetative Debris

Good morning Senator Avery L. Lewis, Chaiman of the Committee on Government Operation, Veterans Affairs, and Consumer Protection, other committee members of the 36th Legislature of the Virgin Islands, and those in the audience.

My name is Greg Guannel, and I'm the Director of the Caribbean Green Technology Center at the University of the Virgin Islands. We develop and share knowledge on how infrastructure, ecosystems, and institutions interact in the U.S. Virgin Islands, with the goal of supporting more resilient and sustainable development.

Thank you for the opportunity to provide comments on Bill 36-0232. My goal in this testimony is to provide technical context on the proposed use of controlled incineration technologies for vegetative debris disposal. In preparing these comments, I reviewed information on how air-curtain incinerators operate, how they are used in other jurisdictions, and the operational considerations associated with their use. My comments focus on several topics: the technology itself and how it is typically used, potential air-quality considerations, the influence of weather and site location, operational and cost considerations, and how other jurisdictions, including Puerto Rico and several Caribbean islands, manage vegetative waste. I will also highlight several technical considerations in the bill related to monitoring, setbacks, and operational safeguards. These comments are intended to provide technical context to support informed decision-making and are not intended to advocate for or against the proposed approach.

1 Purpose of the Bill

Bill 36-0232 proposes to amend Act 8018 to allow the Virgin Islands Waste Management Authority (WMA) and landfill operators to dispose of vegetative debris using controlled incineration technologies, including air-curtain incinerators (ACIs). The bill also states that other methods such as composting, mulching, and shredding remain permissible options.

Air-curtain incinerators are widely used in the United States to rapidly reduce large volumes of vegetative debris, particularly after storms and land-clearing operations.

The bill also allows private individuals to burn vegetative debris generated on their property with a permit from the Virgin Islands Fire Service.

Private burning must occur 50 ft from any structure, or 15 ft from any structure if using an approved closed-top burner.

Burning must be attended and conducted during favorable atmospheric conditions.

2 Description of Technology

An air-curtain incinerator burns vegetative debris in a trench or refractory chamber while a blower forces a high-velocity air curtain over the burn pit.

The air curtain pushes smoke and particles back into the flame, increasing combustion efficiency and reducing visible smoke compared with open pile burning.

Burning reduces debris volume by approximately 90–95% and significantly reduces particulate emissions compared with open burning. Burning produces ash equal to approximately 5–10% of the original debris mass, which is transported to a landfill for disposal.

The burning of vegetative debris does generate emissions, especially fine particulate matter and Nitrogen Oxides (NOx). Carbon monoxide and other gases are generally present at lower levels and are not usually the dominant air-quality concern for vegetative debris burning.

3 Typical Uses of the Technology

Air-curtain burners are used in several U.S. states, including Florida and Texas, particularly for hurricane debris management, forestry debris, land-clearing waste. However, these states do not rely exclusively on burning for vegetative waste management. Municipal programs also use grinding, mulch production, or composting.

In most jurisdictions, air-curtain incinerators are used intermittently rather than as a continuous, year-round disposal method. Burning is often used when debris volumes exceed grinding capacity, large woody material is difficult to process, or debris must be reduced quickly to maintain landfill capacity. This happens after, for example, hurricanes.

It is sometimes suggested that air-curtain incinerators could be used to produce biochar,. Biochar is a carbon-rich material produced by heating biomass under low-oxygen conditions (pyrolysis), which preserves carbon in a stable solid form rather than converting it to carbon dioxide through combustion. When amended to soil, it increases nutrient availability while improving water retention and soil structure. However, from my understanding, creating biochar from ACI would require significant changes to their operation, including reducing oxygen supply and interrupting the combustion process.

Biochar production requires low-oxygen conditions and controlled temperatures (typically 750-1,300°F), whereas air-curtain incinerators operate at higher temperatures (1,500–2,000°F) with forced airflow to achieve complete combustion. Producing char would therefore require restricting oxygen, controlling burn temperatures, and removing material before full combustion, which can reduce efficiency, increase smoke emissions, and introduce additional operational and safety constraints. As a result, air-curtain incinerators are not typically used as a reliable or controlled method for biochar production.

Producing biochar from air-curtain incinerators would also increase operational complexity and staffing requirements, as it would require continuous monitoring of burn conditions, removal of partially charred material, and controlled cooling to prevent re-ignition. These steps go beyond typical ACI operation, which is generally designed for continuous combustion and minimal handling of residual material.

4 Air Quality Impacts

Air quality is the primary environmental issue associated with vegetative debris burning and often determines whether communities accept or oppose burn operations. Smoke plumes from debris burning can affect areas approximately 0.2 to over 1 mile downwind depending on wind speed and atmospheric conditions.

The most important pollutant associated with vegetative burning is fine particulate matter (PM2.5). EPA has established health-based air quality standards, including 35 $\mu g/m^3$ over 24 hours, and 9 $\mu g/m^3$ annually.

Health impacts associated with PM2.5 exposure include:

- Short-term:
  - asthma attacks
  - respiratory irritation
  - eye irritation
  - increased emergency room visits
- Long-term:
  - cardiovascular disease
  - chronic respiratory disease
  - increased mortality risk
- Monitoring methods commonly include:
  - EPA Method 9 smoke-opacity monitoring (10–20% limits)
  - portable PM2.5 monitors downwind of burn sites

Vegetative burning also produces nitrogen oxides (NOx) and volatile organic compounds (VOCs). In sunlight these gases can react to form ground-level ozone, which can be dangerous if they exceed certain EPA thresholds (EPA 8-hour ozone standard: 70 ppb). However, ozone formation typically occurs on regional scales, whereas PM2.5 exposure occurs locally near burn sites. For vegetative debris burning, PM2.5 is usually the dominant local air-quality concern.

Air-quality impacts depend strongly on wind speed and atmospheric stability. Lower wind speeds reduce pollutant dispersion and can increase smoke accumulation if burning occurs frequently. Typical debris-burn permits require a minimum wind speed of approximately 5 mph, and burning suspended if winds exceed 15–20 mph

Large states such as Texas and Florida often operate burn sites in rural areas with large buffer distances from homes.

Wind observations in the territory frequently show very low wind speeds (<1 m/s) overnight and early morning, followed by stronger winds during the afternoon sea-breeze period. Furthermore, Caribbean trade winds weaken during August–October, which are also the hottest months of the year. This means that burning during these months may increase the likelihood of smoke accumulation and exposure for nearby communities.

5 EPA Regulation Updates

Air-curtain incinerators that burn clean vegetative debris are regulated under U.S. EPA rules (40 CFR Part 60), which establish limits on emissions and operating conditions. These rules require that units burn only clean vegetative material, comply with visible emission (opacity) limits (typically around 10% using EPA Method 9), and maintain operational records, including the type of material burned and periods of operation.

Under the Clean Air Act, facilities that emit more than approximately 100 tons per year of criteria pollutants, or 10 tons per year of a single hazardous air pollutant (or 25 tons per year combined), are classified as “major sources” and are subject to more stringent permitting requirements. Emissions are typically estimated based on the total amount of material burned per year using standard emission factors.

In 2024, EPA updated its rules to remove certain federal permitting requirements (specifically Title V permits) for air-curtain incinerators that burn only clean vegetative debris and operate below these thresholds. However, these units must still comply with opacity limits, material restrictions, and recordkeeping requirements. If non-vegetative or contaminated materials are burned, the unit may be subject to more stringent federal standards.

EPA has also established provisions that allow expanded use of debris burning during declared emergency conditions, such as hurricane recovery, where permitting requirements may be streamlined to facilitate rapid debris removal. These provisions are specific to emergency situations and differ from routine, ongoing operations.

6 Cost and Operational Considerations

This method requires both upfront capital investment and ongoing operational and maintenance costs.

Typical costs associated with air-curtain burning include equipment purchase ($70,000 – $300,000 per unit), operational costs (e.g., blower fuel, trained operators, maintenance) as well as insurance. Some programs have reported insurance premiums exceeding $100,000 per year due to wildfire and liability classifications.

Furthermore, burn pits must be attended continuously during operation. Ash (5–10% of original debris mass) must still be transported to landfills.

7 Other Considerations

The bill establishes setback distances for private burning (50 ft from structures, 15 ft if using an approved closed-top burner). However, other jurisdictions often include additional details, such as setback distances in the range of 50–100 ft. Furthermore, the bill does not currently define maximum pile size or burn volume for private burning. Other jurisdictions have typical guidelines of:

- maximum pile diameter: 3–8 ft
- maximum pile height: 3–6 ft
- maximum burn volume: <1 cubic yard
- burn duration limited to same-day burning

Also, I noted that the bill specifies vegetative debris but does not describe procedures to ensure burn material is free of non-vegetative contaminants. If vegetative debris becomes mixed with treated wood, plastics, painted materials, or household waste, combustion can release additional toxic pollutants including dioxins, and heavy metals.

It may also be important to clarify whether marine biomass such as sargassum is included in the definition of vegetative debris. Unlike terrestrial vegetation, sargassum can accumulate trace metals from seawater, particularly arsenic, with measured concentrations in Caribbean samples often ranging from 30–120 mg/kg (dry weight). When biomass containing metals is burned, these elements do not disappear but instead concentrate in the remaining ash or may be emitted in fine particulate matter. Sargassum also contains high levels of salt (sodium and chloride), which can affect combustion processes and increase corrosion in equipment. For these reasons, several Caribbean jurisdictions treat marine biomass separately from land-based vegetative debris when evaluating disposal or processing options.

Many jurisdictions therefore require debris inspection and separation procedures before burning.

Furthermore, the bill authorizes controlled burning but does not specify:

- setback distances for WMA or landfill operations
- meteorological operating limits
- air-quality monitoring requirements
- contamination control procedures

Many jurisdictions address these issues through operational permits or regulations.

8 Alternative Green-Waste Management Programs

Many jurisdictions manage routine vegetative debris through grinding, mulching, and composting.

These methods produce materials used for landscaping, soil improvement, erosion control, or agriculture. The thinking is that composting preserves biomass and produces a usable soil product, whereas burning converts biomass into ash.

Puerto Rico has established composting and mulching programs. After Hurricane María, mulching operations processed approximately 5,000–6,000 cubic yards of vegetative debris per day. In the rest of the Caribbean, St. Lucia promotes household composting and organic waste diversion, Barbados operates green-waste composting facilities, the Cayman Islands have grinding and mulch distribution programs. Other islands have or promote similar programs. However, they do burn when volumes exceed the capacity of their operations.

9 Conclusion

Air-curtain incinerators are effective at rapidly reducing large volumes of vegetative debris, particularly after storms or land-clearing operations. At the same time, combustion produces particulate emissions that can affect nearby communities under certain meteorological conditions.

For this reason, many jurisdictions combine debris burning with other methods such as grinding, mulching, and composting, and establish operational safeguards including setback distances, monitoring, and debris separation procedures when burning occurs near populated areas.