



CHESAPEAKE BAY FOUNDATION
Saving a National Treasure

June 18, 2022

Sent via email:
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Re: Comments on NASEM Report on Potential Impacts of Gold Mining in Virginia

Ms. Johnson and Ms. Regier:

The Southern Environmental Law Center and the Chesapeake Bay Foundation offer the following comments to inform the National Academies of Sciences, Engineering, and Medicine (NASEM) committee report on the potential impacts of gold mining in Virginia. Thank you for your consideration of these comments, and please let us know if our organizations can provide additional information or otherwise assist your efforts.

Sincerely,

A handwritten signature in black ink, appearing to read 'Kristin Davis'.

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**A Summary of Legal and Policy Issues Related to
Potential Impacts of Gold Mining in Virginia**

Submitted by
the Southern Environmental Law Center and
the Chesapeake Bay Foundation

to

the National Academies of Sciences, Engineering, and Medicine,
Committee on the Potential Impacts of Gold Mining in Virginia,

June 18, 2022



The Southern Environmental Law Center (“SELCS”) is a 501(c)(3) nonprofit and nonpartisan organization with offices in Virginia, Georgia, Alabama, North Carolina, South Carolina, Tennessee, and the District of Columbia. SELCS’s mission is to protect the basic right to clean air, clean water, and a livable climate; to preserve the environment and biodiversity of the South; and to provide a healthy environment for all. Through more than 35 years of legal advocacy, community partnerships, and regional planning, SELCS has influenced environmental policies and protections regionally and nationally. SELCS is also committed to reflecting greater racial and cultural diversity and embedding equity and inclusiveness throughout our work, which includes continued support of environmental justice communities in our region.



CHESAPEAKE BAY FOUNDATION
Saving a National Treasure

The Chesapeake Bay Foundation (“CBF”) is a 501(c)(3) nonprofit public interest organization. CBF’s mission—carried out from offices in Maryland, Virginia, Pennsylvania, and the District of Columbia—is to restore and protect the ecological health of the Chesapeake Bay through dedicated education, advocacy, restoration and litigation. CBF’s mission also includes a commitment to environmental justice. As such, and on behalf of our 200,000 members and e-subscribers across the United States, CBF is committed to addressing matters that will impact the health of the Chesapeake Bay and all of those who live and work within the Bay watershed.

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I. Introduction

Our organizations are glad that that National Academies of Sciences, Engineering, and Medicine (“NASEM”), and this esteemed Committee specifically, is undertaking the critical work of evaluating the potential impacts of industrial gold mining in Virginia, with particular respect to public health, safety, and the welfare of Virginians. We appreciate the time and efforts that each Committee member and NASEM staff are devoting to this work.

Our aim in submitting these comments is to provide additional useful information within the scope of your work. We do not seek to cover all areas of concern; rather, we are highlighting particular issues with which our organizations have experience and knowledge. These comments were informed by information contained in a report by Dr. Ann Maest regarding potential environmental and public health impacts of gold mining, which we understand will be submitted to you shortly.¹

As you know, the Commonwealth of Virginia has no experience with modern, industrial-scale gold mining. Indeed, Virginia has minimal experience with modern metals mining. Not surprisingly, Virginia has not developed laws and regulations to govern mining of gold or other metals. While Virginia lacks experience with modern gold mining, the environmental and public health impacts from gold mines in the United States are well-known and widely reported. Damage typically occurs through hazardous leaks, spills, and accidents; acid mine drainage; and airborne pollutants. All of these pose a serious risk to the abundant waters with which Virginia is blessed and on which Virginians rely—from our streams, rivers, springs, and other surface water to the groundwater that feeds them.

As the Committee considers the various potential impacts of industrial gold mining in Virginia, we urge you to keep in mind the major differences between Virginia and the Western United States in terms of climate, especially precipitation levels. While the gold mining that occurs in the arid western United States can provide information and examples for your consideration, the vastly different climate and abundant water present in Virginia is a key difference that increases many of the risks of gold mining. For example, from February 2020 through January 2021, counties in Virginia’s Gold-Pyrite Belt received around 49 to 72 inches of precipitation.² Compare that to the approximate three to nine inches of precipitation received

¹ ANN MAEST, POTENTIAL ENVIRONMENTAL AND HUMAN HEALTH EFFECTS OF GOLD MINING IN VIRGINIA (June 2022) [hereinafter “Maest report”].

² NOAA, Nat’l Ctrs. for Env’t Info., *Climate at a Glance Tool*, <https://www.ncdc.noaa.gov/cag/>. We conducted County mapping and used the following criteria for each state: Parameter- Precipitation; Year- 2021; Month- January; Time Scale- 12-month. We evaluated the following counties for each state: *Virginia*- Appomattox, Buckingham, Charlotte, Culpeper, Cumberland, Fairfax City, Fairfax County, Fauquier, Fluvanna, Goochland, Halifax, Louisa, Manassas, Manassas Park, Orange, Prince William, Spotsylvania, Stafford; *Nevada*- Elko, Esmeralda,

during that same period in Nevada counties with active gold mining.³ Using the same criteria, relevant Arizona counties received five to seven inches and Colorado counties received eight to 27 inches.⁴ Appomattox County, Virginia received 24 times the amount of annual precipitation than Esmeralda County, Nevada did.⁵ The impacts of gold mining in these locations would vary greatly based on this factor alone.

Among our highest concerns, the risks posed to Virginia’s drinking water are profound, with the damage from contamination often permanent. As you will read in the Maest report, over three million Virginians rely on drinking water that comes from drinking water surface intakes in close proximity to and downstream of potential sites for gold mining (mines and prospects). Of course, the threat to drinking water is but one of many risks to public health and our natural resources.

We urge the Committee to grapple directly and completely with the significant risks, feasibility, and likelihood that Virginia is prepared to undertake this new industry with any level of confidence in the ability to do so safely. This is the best—and perhaps only—opportunity for a group of experts to comprehensively consider the potential impacts of gold mining on our water and other natural resources, as well as the health and safety of Virginians. This information is critical to public officials and the public as they consider whether modern industrial gold operations have a place in Virginia.

In light of this, we urge the Committee to avoid framing its recommendations as advice for how to implement gold mining safely in Virginia. In 2021, the General Assembly of Virginia directed the Secretary of Natural Resources, the Secretary of Health and Human Resources, and the Secretary of Commerce and Trade to establish this study of the potential impacts of industrial gold mining in Virginia after citizens discovered that a company had been conducting exploratory drilling in Buckingham County. Given that this study arose from citizen concerns that gold mining could not be done safely in Virginia, it is not a foregone conclusion that industrial gold mining can proceed in Virginia safely and with adequate protections of public health and natural resources. Instead, the Committee’s report should recognize that all options, including bans or limitations on industrial gold mining in its entirety or on specific mining and processing methods, remain on the table.

The scope of the Committee’s work is very broad: to (1) describe the geology and minerology of gold deposits in Virginia; (2) summarize Virginia’s existing regulatory framework; and (3) evaluate the impacts of gold mining and processing operations on public

Eureka, Humboldt, Lander, Mineral, Nye, Pershing, White Pine; *Arizona*- Maricopa, Mohave, Yuma; *Colorado*- Chaffee, Clear Creek, Costilla, Gilpin, Gunnison, Hinsdale, La Plata, Lake, Moffat, Montezuma, Montrose, Ouray, Park, Saguache, Teller.

³ *Id.*

⁴ *Id.*

⁵ *Id.*

health, safety, and welfare in Virginia. Because of the varying geology and minerology throughout the Commonwealth and the fact that gold deposits have been found both within and outside the Gold-Pyrite Belt, individual mining operations could seek to use a wide variety of methods for mining, processing, and waste management. The Committee should evaluate all such methods that may be viable in Virginia, regardless of non-binding claims by industry stakeholders or others that certain methods and technologies would or would not be used in the Commonwealth. Under the current laws and regulations of Virginia, all methods remain on the table. Accordingly, the report should evaluate potential impacts from the full range of possible mining practices that could be used in Virginia.

Having said this, we appreciate the relatively short time available in which the Committee has to complete its report, and we are sympathetic to the difficulties in doing so. Where a full analysis of a potential risk cannot feasibly be completed, we urge the Committee to identify the risk in need of further consideration, even if it is not fully described or evaluated. Readers, including Virginia regulators and policymakers, will likely assume the report contains an exhaustive accounting of potential impacts of gold mining in Virginia, given the purposes for which it was commissioned. Please highlight where that is not the case.

We also urge the Committee to consider industrial gold mining *as it occurs in the real world*, not merely how it could occur if human error, equipment failures, and storms of alarming magnitude could be eliminated. Please be realistic about the likely effectiveness of mitigation measures and best management practices to prevent the adverse effects that accompany this industry, and bear in mind the real-world limitations of these measures, which are designed to minimize impacts, not eliminate them. Please consider that even where these measures are developed and committed to, there is ample evidence showing that these measures are rarely implemented fully and properly on-the-ground, greatly reducing their actual effectiveness. The Committee should investigate, or highlight the need for Virginia to investigate, the actual effectiveness of these measures in proposed mining activities in conditions similar to those that could be encountered in Virginia.

II. Regulatory Framework and Permitting Process in Virginia

A new gold mining operation in Virginia would require a patchwork of state, local, and federal permits, but the specific permits or reviews required would largely depend on the site location and operating plan. This may leave gaps in environmental protection, especially since Virginia's current regulatory framework was not designed with gold mining operations in mind, and Virginia does not have a comprehensive state environmental review process for mineral mining activities (see *infra*, III.A).

A. Mining Regulatory Framework and Permits

1. Permitting & Operations

A combined mining permit and safety license from the Virginia Department of Energy (“VDOE”) is required for all commercial mineral mining operations in Virginia.⁶ Permit applications must include a map, aerial photograph, or plan of the affected area,⁷ as well as an operations plan with a reclamation provision.⁸ Virginia’s mineral mining regulations also include performance standards that govern a number of factors related to mining activities,⁹ but many of the statutory and regulatory requirements dictating the contents of or timelines associated with operations or reclamation plans have a high level of generality and are insufficient (see *infra*, III.G).¹⁰ Mining operators are initially required to obtain a reclamation performance bond of \$3,000 per affected acre¹¹ but are eligible participate in the Minerals Reclamation Fund after five years of successful operation.¹² (see *infra*, III.H).

Notice of the permit application must be given to the chief administrative official of the county or city where the proposed mine site is located, all public utilities on or within 500 feet of the permit boundary, and to landowners whose land is within 1,000 feet of the permit boundary.¹³ These landowners may file written objections with VDOE and may request a public hearing within 10 days.¹⁴ In practice, this short timeframe poses difficulties for laypersons to do the necessary research (or consult an expert) to prepare an informed objection. There is no opportunity for any other impacted, concerned, or interested members of the public to participate in the permitting process. Furthermore, if a permit holder seeks to renew an application or to

⁶ See Va. Code §§ 45.2-1205(A), 45.2-1124. A VDOE brochure for applicants explaining the application process is available at: <https://energy.virginia.gov/mineral-mining/documents/BROCHURES/NewPermitBrochure.pdf>.

⁷ *Id.* § 45.2-1205(C); 9 VAC 25-31-50.

⁸ Va. Code §§ 45.2-1206(A), (B); 4 VAC 25-31-130.

⁹ 9 VAC 31-330 to -550.

¹⁰ For example, the reclamation provision must also state the actions to be taken for reclamation, which are to be “conducted simultaneously [with the mining operation] insofar as practicable” and in accordance with schedules based on “various individual mineral types,” Va. Code § 45.2-1206(B)(2), 4 VAC 25-31-360, but VDOE has no mineral-specific regulations or guidance for these schedules.

¹¹ Va. Code § 45.2-1208; 4 VAC-25-31-220; 4 VAC 25-31-240.

¹² Va. Code § 45.2-1234; 4 VAC 25-31-320.

¹³ Va. Code §§ 45.2-1205, 45.2-1210; 9 VAC 25-31-170(A).

¹⁴ Va. Code § 45.2-1210; 9 VAC 25-31-170(B)(6).

increase the size of the mining site, no additional notice to local officials, public utilities, or landowners is required.¹⁵

2. *Impoundments*

While VDOE also bears the primary responsibility for regulating impoundments and impounding structures used in mineral mining operations within the Commonwealth,¹⁶ it only has the power to regulate dams and impoundments only above a certain size regardless of the contents of the material being retained and its potential for harm to human health and the environment.¹⁷ The mineral mining regulations impose a patchwork of requirements depending on the type of impoundment, the material being impounded, and the size and capacity of the impoundment,¹⁸ and different design standards apply depending on whether a waste disposal impoundment has the capability to impound water, liquid or slurried tailings, or non-liquid materials.¹⁹

For impoundments that contain liquid, the regulations include construction, maintenance, and inspection requirements and apply a dam hazard classification scheme from Virginia's Department of Conservation and Recreation regulations, which regulates non-mining dams in the Commonwealth.²⁰ The hazard considerations include "potential loss of human life or damage to the property of others downstream."²¹ The regulation further explains that the "potential loss of life" includes consideration of "impacts . . . that are likely to cause a loss of human life, including but not limited to impacts to residences, businesses, other occupied structures, or . . . roadways."²²

B. Water Regulatory Framework and Permits

1. *Section 404 Permits*

Industrial-scale gold mines would require a Section 404 permit under the Clean Water Act ("CWA") from the U.S. Army Corps of Engineers ("USACE") to fill streams, wetlands, and

¹⁵ Va. Code § 45.2-1210(C).

¹⁶ Va. Code § 45.2-1300 *et seq.*

¹⁷ Va. Code § 45.2-1301. Those that are "designed to impound water or silt to a height of (i) five feet or more above the lowest natural ground level within the impounded area and has a storage volume of 50 acre-feet or more or (ii) 20 feet or more, regardless of storage volume." *Id.*

¹⁸ 4 VAC 25-31 *et seq.*

¹⁹ 4 VAC 25-31-400.

²⁰ 4 VAC 25-31-500(A); 4 VAC 50-20-40.

²¹ 4 VAC 50-20-40(B).

²² *Id.*

other water bodies located on the mining site.²³ Under guidelines developed by the U.S. Environmental Protection Agency (“EPA”) to implement Section 404(b)(1) of the CWA, which the USACE must apply in its review of discharge permits,²⁴ “no discharge of dredged or fill materials shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.”²⁵ This means the USACE may only grant a Section 404 permit for the “least environmentally damaging practicable alternative” for a proposed project.

The USACE’s permitting regulations also require a comprehensive analysis of whether issuing a permit would be in the “public interest” based on a careful weighing of the proposal’s benefits against its costs and reasonably foreseeable impacts.²⁶ This analysis includes consideration of the potential direct, indirect, and cumulative impacts of the proposed project on historic properties, wetlands and water quality, floodplains and flood hazards, fish and wildlife habitat, economics, and the general public welfare.²⁷ In addition, the USACE must consider whether there is a public or private need for the project.²⁸

2. Virginia Water Protection Permit

Before a Section 404 permit may be issued, Virginia’s Department of Environmental Quality (“VDEQ”) must either certify that the project complies with state water quality standards or waive certification.²⁹ Virginia’s Section 401 certification is implemented through the issuance of a Virginia Water Protection (“VWP”) permit.³⁰ Without a VWP permit, it is unlawful to:

²³ 33 U.S.C. §§ 1344, 1362. The Haile Gold Mine in South Carolina required a Section 404 permit to fill wetlands and streams in the location of the mine’s facilities. USACE, *Final Environmental Impact Statement for the Haile Gold Mine Project* 1-24, 7-2 (2014), available at <http://www.hailegoldmineseis.com/feis.html>; USACE & S.C. Dep’t Health & Env’t Control, *Joint Public Notice of Permit Modification*, SAC-1992-24122 (Mar. 3, 2021), https://scdhec.gov/sites/default/files/media/document/BOW_HGM_JointPublicNotice.pdf.

²⁴ See 33 C.F.R. §§ 323.6(a), 320.4(a).

²⁵ 40 C.F.R. § 230.10(a); see also, *B&B P’ship v. U.S.*, 133 F.3d 913 (4th Cir. 1997).

²⁶ See 33 C.F.R. § 320.4(a)(1).

²⁷ See *id.* The USACE regulations further provide that the appropriate weight and level of analysis to be given to each factor will be determined by its “importance and relevance to the particular proposal.” *Id.* § 320.4(a)(3).

²⁸ 33 C.F.R. § 320.4(a)(2)(i).

²⁹ 33 U.S.C. § 1341. If the state waives certification, USACE must still ensure that the discharge will not violate any state water quality standards before issuing a Section 404 permit. See 40 C.F.R. §§ 230.11(c), 230.12(3)(ii).

³⁰ Va. Code § 62.1-44.15:20(D).

1. Discharge into state waters sewage, industrial wastes, other wastes, or any noxious or deleterious substances;
2. Excavate in a wetland;
3. Otherwise alter the physical, chemical or biological properties of state waters and make them detrimental to the public health, or to animal or aquatic life, or to the uses of such waters for domestic or industrial consumption, or for recreation, or for other uses; or
4. On and after October 1, 2001, conduct the following activities in a wetland:
 - a. New activities to cause draining that significantly alters or degrades existing wetland acreage or functions;
 - b. Filling or dumping;
 - c. Permanent flooding or impounding; or
 - d. New activities that cause significant alteration or degradation of existing wetland acreage or functions.
5. Discharge stormwater into state waters from Municipal Separate Storm Sewer Systems or land disturbing activities.³¹

Additionally, some surface water withdrawals may also require a VWP permit.³² In order to issue a VWP permit, VDEQ must “determine [] that the proposed activity is consistent with the provisions of the CWA and the State Water Control Law and will protect instream beneficial uses”³³ and other state laws.³⁴ In Virginia, all waters are designated for the following uses:

1. Recreational uses, such as swimming and boating;
2. Propagation and growth of a balanced, indigenous population of aquatic life, including game fish;
3. Wildlife; and
4. Production of edible and marketable natural resources, e.g., fish and shellfish.³⁵

³¹ *Id.* at §§ 62.1-44.5, 62.1-44.15:20.

³² 9 VAC 25-210-310(A).

³³ Va. Code § 62.1-44.15:20(B).

³⁴ 9 VAC 25-210-50(B)(1).

³⁵ 9 VAC 25-260-10. *See also*, Va. Dep’t of Env’t Quality, *Criteria, Designated Uses, Antidegradation*, <https://www.deq.virginia.gov/water/water-quality/water-quality-standards/criteria-designated-uses-antidegradation#>.

While these designated uses apply to all Virginia waters, Virginia also identifies specific water segments or segments of water for additional uses that require additional standards, such as a public water supply.³⁶ VDEQ has established water quality standards—both narrative and numeric—for various uses of surface water³⁷ and groundwater.³⁸ VDEQ may also not issue a VWP permit “[f]or the discharge of any radiological, chemical, or biological warfare agent or high-level radioactive material into surface waters.”³⁹ Additionally, Virginia has a general VWP permit that authorizes up to two acres of impacts to nontidal wetlands or open water and up to 1,500 linear feet of nontidal stream bed impacts for certain mining activities without individualized review.⁴⁰

3. *Virginia Pollutant Discharge Elimination System Permits*

Under Section 402 of the CWA, a National Pollutant Discharge Elimination System (“NPDES”) permit is required “for the discharge of any pollutant, or combination of pollutants” into water bodies.⁴¹ This program is implemented in Virginia as the Virginia Pollutant Discharge Elimination System (“VPDES”) permit program.⁴² Gold mining operations could require a VPDES permit to discharge treated wastewater and stormwater runoff depending on its operations.⁴³ Some discharges from mining operations may be permitted under general VPDES permits,⁴⁴ which eliminate individual review of a project’s discharges and instead prescribe general conditions that must be met in order for the permit to be applicable.

³⁶ 9 VAC 25-260-10.

³⁷ 9 VAC 25-260-140; *see also*, 9 VAC 25-260 generally.

³⁸ 9 VAC 25-280-40 (statewide groundwater criteria); 9 VAC 25-280-50, 70 (groundwater criteria by physiographic province).

³⁹ 9 VAC 25-210-50(B)(2). Some gold mining waste could fall into this category.

⁴⁰ 9 VAC 25-690-30.

⁴¹ 33 U.S.C. § 1342(a)(1). The CWA defines “discharge of a pollutant” to mean “any addition of any pollutant to navigable waters from any point source [,]” 33 U.S.C. § 1362(12), where “navigable waters” is defined as “the waters of the United States.” 33 U.S.C. § 1362(14).

⁴² Va. Dep’t of Env’t Quality, *Surface Waters – Virginia Pollutant Discharge Elimination System*, <https://www.deq.virginia.gov/permits-regulations/permits/water/surface-water-virginia-pollutant-discharge-elimination-system>.

⁴³ The Haile Gold Mine in South Carolina was required to obtain a NPDES permit for the discharge of treated wastewater and stormwater into Haile Gold Mine Creek. S.C. Dep’t Health & Env’t Control, *Haile Gold Mine – Water Permits*, <https://scdhec.gov/environment/environmental-sites-projects-permits-interest/haile-gold-mine-hgm/haile-gold-mine-water-permits>.

⁴⁴ *See e.g.*, 9 VAC 25-151.

4. Groundwater Withdrawal Permit

The Gold-Pyrite Belt and gold ore deposits in Virginia are generally located in the Piedmont region of the Commonwealth. A state groundwater withdrawal permit, however, is only required for the Eastern Virginia or Eastern Shore Groundwater Management Areas of Virginia⁴⁵ for new groundwater withdrawals exceeding 300,000 gallons per month.⁴⁶ Although large amounts of water are needed for industrial mining operations, only mining operations in these Groundwater Management Areas would require a groundwater withdrawal permit.

C. Air Pollution Regulatory Framework and Permits

Under Title V of the Clean Air Act (“CAA”),⁴⁷ permits are required for major sources of criteria and hazardous pollutants⁴⁸ and modern gold mines can be significant sources of particulate matter. Title V also requires permits for sources of hazardous pollutants belonging to a regulated source category,⁴⁹ and “gold mine ore processing and production facilities” are regulated as sources of mercury.⁵⁰ This means an industrial gold mine would need to obtain a Title V operating permit if it utilizes any of the following processes: “[r]oasting operations, autoclaves, carbon kilns, preg tanks, electrowinning, mercury retorts, or melt furnaces.”⁵¹

In Virginia, Title V permits are issued by VDEQ in accordance with Virginia’s State Implementation Plan and other requirements.⁵²

⁴⁵ 9 VAC 25-600-20.

⁴⁶ 9 VAC 25-610-50(1). Public notice and a 30-day comment period is required prior to issuance of a groundwater withdrawal permit, 9 VAC 25-610-250, 270, and a public hearing may be requested by interested persons but is not required. 9 VAC 25-610-270.

⁴⁷ 42 U.S.C. § 7401 *et seq.*

⁴⁸ 42 U.S.C. § 7661a(a). A source is considered a “major source” if it emits more than 100 tons per year of any criteria pollutant, 42 U.S.C. § 7602(g), ten tons per year of any hazardous pollutant, or twenty-five tons per year of any combination of hazardous pollutants. 42 U.S.C. § 7412(a)(1).

⁴⁹ 42 U.S.C. § 7761(a).

⁵⁰ 40 C.F.R. § 63.11640.

⁵¹ 40 C.F.R. §§ 63.11640, 63.11651. A study conducted of the Haile Gold Mine in South Carolina concluded that the mine required a Title V operating permit under this subpart. S.C. Dep’t of Health & Env’t Control, *Statement of Basis: BAQ Air Permitting Decisions (draft) 2* (2019), http://scdhec.gov/sites/default/media/document/1460-0070.0tv.sob_.pdf.

⁵² 9 VAC 5-80-50 to -300. The CAA authorizes states to develop Title V permit programs in accordance with minimum requirements promulgated by EPA. 42 U.S.C. § 7761a(b). For EPA’s minimum requirements, see 40 C.F.R. § 70.

D. Environmental Justice

Gold mining operations in Virginia would implicate the Virginia Environmental Justice Act (“VEJA”), which established that “[i]t is the policy of the Commonwealth to promote environmental justice and ensure that it is carried out throughout the Commonwealth, with a focus on environmental justice communities and fenceline communities.”⁵³ The VEJA defines environmental justice as “the fair treatment and meaningful involvement of every person . . . regarding the development, implementation, or enforcement of any environmental law, regulation, or policy.”⁵⁴ The VEJA goes on to define fair treatment as “the equitable consideration of all people whereby *no group of people bears a disproportionate share of any negative environmental consequence resulting from an industrial, governmental, or commercial operation, program, or policy.*”⁵⁵ The VEJA defines an environmental justice community as “any low-income community or community of color.”⁵⁶ The VEJA further defines a low-income community as one in which at least 30 percent of the population is classified as low income.⁵⁷

In December 2021, the Virginia Attorney General issued an opinion stating that the VEJA is self-executing and noting that, under it, agencies are required to consider environmental justice in permitting actions.⁵⁸

E. Environmental Impact Review Regulatory Framework

Gold mining operations that require a major federal action—which, in many cases, would be the issuance of a Section 404 permit by the USACE—must also satisfy the requirements of the National Environmental Policy Act (“NEPA”).⁵⁹ NEPA requires federal agencies to take a “hard look” at the environmental consequences of major federal actions⁶⁰ through the preparation

⁵³ Va. Code § 2.2-235.

⁵⁴ Va. Code § 2.2-234.

⁵⁵ *Id.*

⁵⁶ *Id.*

⁵⁷ *Id.*

⁵⁸ Applicability of Va. Code §§ 2.2-234–235, Op. Att’y Gen. 20-064 (2021). Specifically, the Attorney General offered his opinion on whether the Director of VDEQ was required to consider environmental justice in determining site suitability for a landfill.

⁵⁹ 42 U.S.C. § 4331 *et seq.*

⁶⁰ *Kleppe v. Sierra Club*, 427 U.S. 390, 410 n.21 (1976); *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989); *Nat’l Audubon Soc’y v. Dep’t of Navy*, 422 F.3d 174, 187 (4th Cir. 2005) (“The hallmarks of a ‘hard look’ are thorough investigation into environmental impacts and forthright acknowledgements of potential environmental harms.”).

of an Environmental Assessment or an Environmental Impact Statement.⁶¹ This searching environmental review is designed to ensure that “unquantified environmental amenities and values” are given “appropriate consideration in [the] decisionmaking” of federal agencies⁶² and that alternatives to the major federal action are considered.⁶³

There is currently no analogous state-level environmental review process for gold mining operations that do not require major federal actions (see *infra*, III.A).

F. Local Regulatory Framework and Permits

In addition to federal and state requirements related to regulating mining operations, local authorities in Virginia have the power to restrict or prohibit mining through their zoning authority. In the case of zoning, including with respect to mining, authority has been expressly granted to localities by statute:

Any locality may, by ordinance, classify the territory under its jurisdiction or any substantial portion thereof into districts of such number, shape and size as it may deem best suited to carry out the purposes of this article, and in each district it may regulate, restrict, permit, prohibit, and determine the . . . excavation or mining of soil or other natural resources.⁶⁴

Localities therefore have the authority to restrict or prohibit mining in the absence of a more specific statute preempting that authority. And the Virginia Code contains a savings clause that makes it clear that the state mining statute neither occupies the field nor conflicts with local ordinances that are at least as stringent as the state requirements with respect to non-coal mining permitting and reclamation:

- A. Any locality may establish standards and adopt regulations dealing with the same subjects dealt with in this chapter so long as such standards and regulations are no less stringent than those adopted by the Director.
- B. This chapter shall not be construed to repeal any local ordinance or regulation or charter provision in any locality where such provision is no less stringent than the standard adopted by the Director. The Director may waive the application of this chapter if, in his opinion, a locality in which mining operations are being conducted has enacted and is enforcing zoning ordinances dealing with the subject matter and prescribing standards and regulations not less stringent than those set forth in this chapter. If the

⁶¹ If a major federal action will be “significantly affecting the quality of the human environment,” an EIS must be prepared. 42 U.S.C. § 4332(C).

⁶² *Id.* § 4332(B).

⁶³ *Id.* § 4332(C)(iii).

⁶⁴ Va. Code § 15.2-2280(4).

Director waives any provision of this chapter, the operator shall comply strictly with all the provisions of the ordinances of the locality in which the operation is located.⁶⁵

In this way, the General Assembly provided for a cooperative approach to mining rather than a displacement of local authority.

G. Other Regulatory Frameworks and Permits

Other statutes, regulatory requirements, and permits that could apply to Virginia gold mining operations in certain circumstances may include, but are not limited to:

- The Safe Drinking Water Act;⁶⁶
- The Resource Conservation and Recovery Act;⁶⁷
- Sections 9 and 10 of the Rivers and Harbors Act;⁶⁸
- The Endangered Species Act;⁶⁹
- The Bald and Golden Eagle Protection Act;⁷⁰
- The Migratory Treaty Bird Act;⁷¹
- The Fish and Wildlife Coordination Act;⁷²
- The Magnuson-Stevens Fishery Conservation and Management Act;⁷³
- Section 106 of the National Historic Preservation Act;⁷⁴
- The Coastal Zone Management Act; and⁷⁵

⁶⁵ Va. Code § 45.2-1227.

⁶⁶ 42 U.S.C. § 300h(b)(1)(A). If a gold mine were to inject mine waste below drinking water sources or utilize in-situ leaching practices—where leaching solution is injected into rock rather than applied to ore after it is removed from the ground—a SDWA would likely be required.

⁶⁷ *Id.* § 6901 *et seq.*

⁶⁸ 33 U.S.C. § 401 *et seq.*

⁶⁹ 16 U.S.C. § 1531 *et seq.*

⁷⁰ *Id.* § 668 *et seq.*

⁷¹ *Id.* § 703 *et seq.*

⁷² *Id.* § 661 *et seq.*

⁷³ *Id.* § 1801 *et seq.*

⁷⁴ 54 U.S.C. § 300101 *et seq.*

⁷⁵ 16 U.S.C. § 1451 *et seq.*

- Permit requirements from the Virginia Department of Transportation.⁷⁶

III. Gaps in Virginia’s Regulatory Framework

The patchwork nature of the existing regulatory framework means that various state agencies regulate different aspects of potential gold mining operations. As a result of this siloed regulatory regime, it is possible—even probable—that no entity is responsible for or capable of evaluating the full breadth of potential impacts. This creates a high risk that environmental, social, and economic impacts of a gold mining operation could be left unexamined. In addition to this multi-agency dilemma, there are critical gaps within the regulations of specific agencies. These gaps are discussed below.

A. No State-Level Environmental Review Analogous to NEPA

As discussed above, the environmental review process required by NEPA would apply only where a Virginia gold mining operation would require a major federal action, such as issuance of a Section 404 permit by the USACE. If there is no major federal action triggering NEPA, Virginia laws and regulations do not require an analogous comprehensive, state-level review of environmental impacts and associated public participation process for mineral mining activities. This type of review, however, is particularly important in the context of gold mining given the potentially significant impacts of mining activities on the environment and human health, safety, and welfare.

Where similar risks exist from other resource extraction activities, Virginia law has required a comprehensive environmental impact review process. For example, operators who wish to drill for gas or oil in Tidewater Virginia (an area along the western shore of the Chesapeake Bay) must submit an environmental impact assessment along with their application to drill.⁷⁷ The environmental impact assessment must analyze the project’s risks to human health, safety, and welfare,⁷⁸ and include the “probabilities and consequences” of accidental discharges during the drilling, production, and transportation process on wildlife, air and water quality, and land and water resources; “recommendations for minimizing any adverse economic, fiscal, or environmental impacts”; and an examination of secondary—or indirect—environmental effects of induced development from the project.⁷⁹ In this way, the environmental impact assessment provides a broad evaluation of the comprehensive impacts of a potential oil and gas project in one document.

⁷⁶ See e.g., Va. Dep’t of Transp., *Land Use Permits*, <https://www.virginiadot.org/business/landUsePermits.asp>; 24 VAC 30-151.

⁷⁷ Va. Code § 45.2-1646(B).

⁷⁸ *Id.* § 45.2-1646(B)(1).

⁷⁹ *Id.*

Each project’s environmental impact assessment is published in the Virginia Register of Regulations for review and comment by state agencies and the public.⁸⁰ VDEQ reviews all comments and ultimately provides findings and recommendations to the VDOE within 90 days.⁸¹ VDOE must then consider those findings before granting a permit.⁸²

The requirement for a comprehensive environmental impact review with public participation for oil and gas projects in Virginia’s Tidewater region acknowledges the potentially serious consequences of drilling and production, in light of both the risks endemic to the oil and gas industry and the strong need to protect the Commonwealth’s valuable natural resources. These same reasons highlight the need for an analogous comprehensive assessment of a gold mining project’s potential impacts to human health, the environment, and community vitality. Without such a process in place, there is a significant risk that any gold mining operation not involving a major federal action would evade critical environmental review.

B. Environmental Justice

Pursuant to the Virginia Environmental Justice Act (“VEJA”), it is “the policy of the Commonwealth to promote environmental justice and ensure that it is carried out throughout the Commonwealth, with a focus on environmental justice communities and fenceline communities.”⁸³ The potential for permitting of industrial gold mining operations in various communities throughout Virginia raises many concerns related to environmental justice (“EJ”). EJ, as defined in the VEJA, requires the “the fair treatment and meaningful involvement of every person” and that no group of people should “bear[] a disproportionate share of any negative environmental consequence resulting from an industrial, governmental, or commercial operation, program, or policy.”⁸⁴ Because the Committee’s charge necessarily implicates evaluation of environmental justice concerns, as discussed below, and because Virginia’s existing regulatory framework does not ensure sufficient protection for environmental justice communities, the Committee must consider environmental justice as a central part of its work.

1. Direct fit of environmental justice within the Committee’s scope of work

Among other topics, this Committee is “evaluat[ing] the impacts of potential gold mining and processing operations on public health, safety, and welfare in the Commonwealth of

⁸⁰ *Id.* § 45.2-1646(C). The public has at least 30 days to review and comment. *Id.* § 45.2-1646(C)(1).

⁸¹ *Id.* § 45.2-1646(C)(3).

⁸² *Id.* § 45.2-1646(D).

⁸³ *Id.* § 2.2-235. A “fenceline community” is “an area that contains all or part of a low-income community or community of color and that presents an increased health risk to its residents due to its proximity to a major source of pollution.” *Id.* § 2.2-234.

⁸⁴ *Id.* § 2.2-234.

Virginia.”⁸⁵ As part of this evaluation, the Committee is considering “whether existing air and water quality regulations in the Commonwealth are sufficient to protect air and water quality.”⁸⁶ Both of these inquiries directly implicate environmental justice.

Focusing on public health, safety, and welfare is inherently linked to environmental justice concerns. Communities of color and low-income communities (“EJ communities”) are often disproportionately impacted by natural resource extraction. These impacts are caused in part by the application of air and water quality regulations that fail to consider cumulative impacts from existing pollution sources and account for underlying sensitivities to certain pollutants and the relative health of communities. In order to evaluate the potential impacts of gold mining on the public health, safety, and welfare of Virginians, the Committee must consider whether and how such operations—which are industrial, commercial, and regulated by federal, state, and local governments—could have disproportionate environmental and public health impacts on EJ communities.

Given the broad geographic scope of Virginia’s Gold-Pyrite Belt, it is likely that many potential gold mining and processing sites would intersect and potentially affect EJ communities. For example, prospecting is currently underway in Buckingham County, an area that is home to several EJ communities. The VEJA defines an environmental justice community as “any low-income community or community of color.”⁸⁷ The VEJA further defines a low-income community as one in which at least 30 percent of the population is classified as low-income.⁸⁸ EPA’s EJSscreen tool shows that all of Buckingham County falls within this low-income classification.⁸⁹ In fact, some portions of Buckingham County are classified in the bottom 93rd percentile of income for Virginia.⁹⁰ Given that ongoing gold prospecting is already happening in an EJ community, the Committee must recognize that the need to consider environmental justice in evaluating public health protections is more than just a hypothetical exercise.

Additionally, the Committee’s consideration of whether existing regulations would sufficiently protect air and water quality from gold mining and processing also has environmental justice implications. While air and water quality regulations are generally meant to protect all populations from pollution, we know that there are certain pollutants for which no

⁸⁵ NASEM, *Potential Impacts of Gold Mining in Virginia: “What will this study do?”*, <https://www.nationalacademies.org/our-work/potential-impacts-of-gold-mining-in-virginia>.

⁸⁶ *Id.*

⁸⁷ Va. Code § 2.2-234.

⁸⁸ *Id.*

⁸⁹ EPA, *EPA’s Environmental Justice Screening and Mapping Tool (Version 2.0)*, <https://ejscreen.epa.gov/mapper/>.

⁹⁰ *Id.*

level of exposure is safe and that certain communities, including many EJ communities, have existing health concerns that may necessitate more stringent pollution controls.

Courts evaluating environmental justice considerations in Virginia and the protectiveness of National Ambient Air Quality Standards (“NAAQS”) have determined that simply relying on compliance with NAAQS to conclude there are no disproportionate impacts where a proposed air pollution source will affect an EJ community is insufficient.⁹¹ Rather, an assessment of potential impacts to surrounding communities must consider *the particularized risks of pollutant exposure faced by the community in question*.⁹² Accordingly, in evaluating the adequacy of Virginia’s laws to protect air and water quality, the Committee must consider whether current processes ensure that granular analyses are undertaken to determine the on-the-ground impacts of proposed extraction activities. As discussed below, current processes that would apply to gold mining operations are insufficient in this regard.

Lastly, it is worth remembering that the Virginia General Assembly explicitly intended for environmental justice to be a central aspect of this work. The 2021 legislation that led to the creation of this Committee required the study group to include representation from the Virginia Council on Environmental Justice, as well as members of various stakeholder groups, including “representatives of potentially affected communities in localities with significant deposits of gold . . . and residents of Native American communities in such localities.”

2. *Lack of a regulatory framework to implement the VEJA*

Virginia’s Attorney General opined in 2021 that the VEJA is self-executing and that agencies are thus required to consider environmental justice in permitting actions.⁹³ There is, however, currently no regulatory framework for agencies to implement the requirements of the VEJA in their permitting actions. Without a systematic process for agencies to incorporate meaningful involvement of EJ communities in decisionmaking processes, and without clear guidance for evaluating whether pollution authorized under a permit will cause disproportionate impacts, the VEJA alone does not sufficiently protect EJ communities.

While some Virginia agencies have stated goals of incorporating the requirements of the VEJA into their regulatory programs, the agencies that would regulate gold mining operations in Virginia, including VDOE and VDEQ, lack a formal regulatory framework to implement the

⁹¹ *Friends of Buckingham v. State Air Pollution Control Bd.*, 947 F.3d 68, 92 (2020) (faulting the Virginia State Air Pollution Control Board for rejecting the idea of disproportionate impact because air quality standards had been met, explaining that “environmental justice is not merely a box to be checked, and the Board's failure to consider the disproportionate impact on those closest to the Compressor Station resulted in a flawed analysis”).

⁹² *Id.* (emphasis added).

⁹³ Applicability of Va. Code §§ 2.2-234–235, Op. Att’y Gen. 20-064 (2021). Specifically, the Attorney General offered his opinion on whether the Director of VDEQ was required to consider environmental justice in determining site suitability for a landfill.

VEJA. For example, VDEQ’s policy states the need to ensure “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, faith, disability, or income with respect to the administration of environmental laws, regulations, and policies”⁹⁴ and VDEQ has created an Office of Environmental Justice tasked with ensuring “the fair and meaningful involvement of all people into the development, implementation and enforcement of environmental laws, regulations and policies across all VDEQ programs.”⁹⁵ Yet VDEQ still lacks any regulatory framework for considering environmental justice for each of its regulatory and permitting programs. Absent such regulatory processes, VDEQ still falls short of imposing any concrete protections for vulnerable communities.

In short, despite the VEJA’s instruction to state agencies to consider environmental justice and ensure that EJ communities do not bear a disproportionate share of negative environmental impacts resulting from agencies’ permitting actions, agencies—including VDOE and VDEQ—have not promulgated regulations to do so. The Committee needs to acknowledge this regulatory void in its report, as well as grapple with the disproportionate impacts that gold mining could have on the healthy, safety, and welfare of EJ communities in Virginia as a result.

C. Lack of Regulations for Gold Exploration

Although Virginia recognizes the need to regulate coal exploration—which can have similar impacts and poses many of the same risks as gold exploration—Virginia does not yet regulate exploratory activity in its mineral regulations. The Committee should consider this gap in its analysis and resulting report.

Before a mine facility is built, the area must be explored for mineral deposits through excavation, drilling, seismic disturbances, and construction of roads for site access.⁹⁶ Exploration can significantly degrade local land and water resources by removing vegetation and topsoil, damaging habitats, creating roads, altering drainage flows, diverting streams, and contributing to local and regional air, water, light, and sound pollution for residents and ecosystems.⁹⁷ Abandoned drilling holes can be dangerous for human health and local species, and unregulated chemicals used in exploration can degrade the local environment.⁹⁸ Despite these risks, there are currently no mineral mining regulations for exploration in Virginia, and VDOE’s mining permit process does not require any documentation of exploratory activity. Compounding the risks

⁹⁴ Va. Code § 10.1-1183 (B)(4).

⁹⁵ Va. Dep’t of Env’t Quality, *Environmental Justice*, <https://www.deq.virginia.gov/get-involved/environmental-justice>.

⁹⁶ See THOMAS MICHAEL POWER, *LOST LANDSCAPES AND FAILED ECONOMIES: THE SEARCH FOR A VALUE OF PLACE* 107 (1996).

⁹⁷ See M. SENGUPTA, *ENVIRONMENTAL IMPACTS OF MINING: MONITORING, RESTORATION AND CONTROL* 20 (2nd ed. 2021), <https://doi.org/10.1201/9781003164012>.

⁹⁸ *Id.*

posed by the exploration itself, companies are also not required to reclaim sites where they have conducted exploration.⁹⁹

Exploration for minerals often employs the same techniques as those used for coal exploration, which Virginia does regulate, indicating a clear deficiency in Virginia's mineral mining regulations by comparison. While gold is generally mined at a smaller scale than coal, gold mining can be incredibly inefficient and requires tons of rock to be removed to produce one ounce of gold.¹⁰⁰ For this reason, regulations like those which apply to coal exploration should apply to gold exploration.

In the context of coal mining in Virginia, exploration is prohibited in high value ecological areas, including but not limited to wetlands and streams, seasonal habitat areas, and reproduction areas.¹⁰¹ Written notice¹⁰² or a permit¹⁰³ for coal exploration activities is also required, depending on whether more or less than 250 tons of coal will be extracted.¹⁰⁴ However, a weight metric on the order of tons should not be used to differentiate between the applicability of exploration regulations for gold, as gold is mined on a much smaller scale. For context, the United States produced a total of 187,000 kilograms of gold in the 2021 calendar year, and all states with industrial gold mining operations other than Nevada and Alaska produced a total of 28,100 kilograms in 2021.¹⁰⁵ If Virginia were to regulate gold mining exploration based on weight metrics, a smaller weight-based restriction would likely be necessary.

Under Virginia's coal exploration regulations, a public comment period is also required when a permit is issued for an exploration activity.¹⁰⁶ In contrast, only landowners within 1,000 feet of a mineral mining area are only notified at the application stage (as opposed to the exploration stage) for a mineral mine permit, and only these landowners (not the general public)

⁹⁹ 4 VAC 25-31-70(A)(3).

¹⁰⁰ For example, one of the largest metal mining corporations required between 2 and 91 tons of rock to produce one ounce of gold in 2013. Sam Ro, *Here's How Many Tons of Rock You Have to Mine Just for an Ounce of Gold*, BUSINESS INSIDER (Apr. 24, 2013), <https://www.businessinsider.com/tons-of-rock-for-an-ounce-of-gold-2013-4>.

¹⁰¹ 4 VAC 25-130-815.15(a).

¹⁰² 4 VAC 25-130-772.11.

¹⁰³ 4 VAC 25-130-772.12. A permit is required when the exploration activity will remove more than 250 tons of coal. *Id.*

¹⁰⁴ 4 VAC 25-130-772.11(a).

¹⁰⁵ See USGS, *Mineral Industry Survey: Gold in January 2022*, tbl. 1 (Apr. 2022), available at <https://www.usgs.gov/centers/national-minerals-information-center/gold-statistics-and-information>.

¹⁰⁶ 4 VAC 25-130-772.12.

may request a hearing or file written objections.¹⁰⁷ Failure to even provide notice, much less a public comment period, for gold exploration activities limits the ability of affected landowners and relevant state agencies from being aware of, and weighing in on, activities that have the potential to significantly impact the local environment.

Regulations for exploration of gold should also consider whether companies sell any gold extracted during exploration. There are currently no regulations in place to regulate or prohibit the sale of materials extracted during exploration during mineral mining, but Virginia coal mining regulations require a permit for the sale of coal extracted during exploration unless the coal is sold for testing purposes.¹⁰⁸

Virginia also does not have reclamation or financial assurance requirements for mineral mine exploration, although it does have such requirements for coal exploration sites.¹⁰⁹ Traditionally, gold exploration requires large amounts of vegetation to be cleared and exploratory holes be drilled to determine whether minerals are present at depth.¹¹⁰ Exploration activities can be conducted over a wide area and can include drilling holes or other geophysical modifications.¹¹¹ Restoration of natural landscape features and revegetating disturbed areas is crucial for proper ecosystem function once exploration is completed.¹¹² Other states with historic gold mining activities, like Nevada, have more extensive regulatory requirements for exploration and associated reclamation activities.¹¹³ Reclamation—and reclamation bonding—should be required for all exploratory mining sites in Virginia given the substantial impact these activities have on the environment.

D. Deficiencies in Water Protections

Virginia is blessed with abundant water, and Virginians rely on it for myriad uses—from providing drinking water and recreation to humans to providing critical habitat for our native brook trout and endangered fish like the Atlantic sturgeon and candy darter. As the Maest report details, the risk to Virginia’s water from industrial gold mining is very high and the damage—typically from hazardous leaks, spills, and accidents, as well as acid mine drainage—can be catastrophic. Unfortunately, current gaps in Virginia’s mineral mining regulations would likely

¹⁰⁷ Va. Code § 45.2-1210(A).

¹⁰⁸ 4 VAC 25-130-772.14.

¹⁰⁹ Va. Code § 45.2-1008(A).

¹¹⁰ See Ass’n for Mineral Exploration, *Reclamation Guide for Mineral Exploration: Undertaking Reclamation* (Aug. 5, 2020), amebc.ca/tools/reclamation-guide-for-mineral-exploration/.

¹¹¹ See Nat’l Mining Ass’n, *Facts about Coal and Minerals* 10-11 (2016), <https://nma.org/wp-content/uploads/2016/11/factbook2016-3.pdf>.

¹¹² See Ass’n for Mineral Exploration, *Reclamation Guide for Mineral Exploration: Undertaking Reclamation* (Aug. 5, 2020), amebc.ca/tools/reclamation-guide-for-mineral-exploration/.

¹¹³ Nev. Rev. Stat. Ann. §§ 519A.180, 519A.190.

lead to impairment of Virginia’s drinking water and violations of the CWA from gold mining activities.

1. *Lack of regulation of cyanide and other chemicals used in gold mining*

Virginia’s mineral mining laws and regulations have no specific state regulations that prohibit or control the use of cyanide, which has high potential to contaminate groundwater and surface water, or other chemicals in gold mining that pose similar risks to the environment and public health and safety.¹¹⁴ This is particularly true given Virginia’s high rainfall and the proximity of potential mining sites to a great deal of surface water.

In modern gold mining, cyanide is used to extract gold from oxide ores with little to no sulfur content.¹¹⁵ “As the sulfur content of an ore increases, the efficiency of cyanide bonding to gold decreases[,]”¹¹⁶ and free cyanide can leach into local water supplies.¹¹⁷ As the Maest report indicates, given the use of cyanide in gold mines in South Carolina and the type of deposits discovered in Virginia, it would be highly likely that cyanide could be used to concentrate and process gold in Virginia if mining moves forward.

While some mining companies voluntarily follow the International Cyanide Management Code (“ICMC”), which contains heightened standards for cyanide management and is intended to improve transparency around chemical handling at mines and protect human health and the environment,¹¹⁸ such adherence is not required in Virginia. The Committee should consider Virginia’s lack of regulation to prohibit, or at least control, the use of cyanide and other chemicals in gold management, and acknowledge the high risks that such gaps in regulatory control present. Moreover, given the heightened risks related to cyanide usage, the Committee should recommend that Virginia consider, with public input, a prohibition against the use of cyanide in gold mining operations in Virginia.

¹¹⁴ NASEM, *Potential Impacts of Gold Mining in Virginia: Open Session 1* at 1:37:33 (Dec. 15, 2021), <https://www.nationalacademies.org/en/event/12-15-2021/potential-impacts-of-gold-mining-in-virginia-open-session-1>.

¹¹⁵ See EPA, EPA’S NATIONAL HARDROCK MINING FRAMEWORK at A-14 (Sept. 1997), https://www.epa.gov/sites/default/files/2015-10/documents/hardrock_mining_framework_0.pdf

¹¹⁶ *Id.*

¹¹⁷ See generally R. Eisler & S.N. Wiemeyer, *Cyanide Hazards to Plants and Animals from Gold Mining and Related Water Issues*, 183 REVS. OF ENV’T CONTAMINATION & TOXICOLOGY (2004), https://link.springer.com/chapter/10.1007/978-1-4419-9100-3_2.

¹¹⁸ Int’l Cyanide Mgmt. Inst., *International Cyanide Management Code*, <https://cyanidecode.org/>; Int’l Cyanide Mgmt. Inst., *The Cyanide Code: Frequently Asked Questions* at Question 9, <https://cyanidecode.org/about-cyanide-code/frequently-asked-questions>.

2. *Inadequate standards and practices to protect drinking water*

In Virginia, drinking water standards do not provide a regulatory backstop to protect drinking water quality from mining pollution. Contamination of surface water from gold mining activities could affect over three million people who get their drinking water from sources downstream of Virginia’s Gold-Pyrite Belt and would ultimately place the burden and costs of water treatment on these communities instead of the mining operator.¹¹⁹ Furthermore, while a number of the pollutants associated with gold mining have drinking water standards, some of these standards are secondary drinking water standards, including for sulfate, meaning they are non-enforceable guidelines.¹²⁰ And these standards only apply to waterworks.¹²¹ Private wells are not subject to drinking water testing in Virginia, and over 20 percent of Virginians rely on private wells as their primary source of drinking water.¹²² Additionally, mines are also often large water users,¹²³ and there is limited oversight of well drilling and withdrawal in Virginia.¹²⁴

Industry best practices recommend robust water management practices at mining sites to help prevent or minimize water contamination and impacts on water quantity. For example, the Initiative for Responsible Mining Assurance (“IRMA”) provides detailed recommendations for local and regional collaboration about water management, site characterization and prediction of potential impacts to water resources, planning for impact prevention and mitigation, and monitoring and adaptive management.¹²⁵ It is also important to recognize the limitations of best

¹¹⁹ SELC, *Virginia’s Surface Drinking Water Systems Downstream of the Gold-Pyrite Belt* (Nov. 3, 2021), https://friendsofbuckinghamva.org/friends/wp-content/uploads/2021/11/6-Gold-Pyrite_DrinkingWater_November-3-2021.pdf.

¹²⁰ EPA, *Drinking Water Regulations and Contaminants* (Feb. 17, 2022), [https://www.epa.gov/sdwa/drinking-water-regulations-and-contaminants#:~:text=Drinking%20Water%20Contaminants-National%20Secondary%20Drinking%20Water%20Regulations%20\(NSDWRs\),or%20color\)%20in%20drinking%20water](https://www.epa.gov/sdwa/drinking-water-regulations-and-contaminants#:~:text=Drinking%20Water%20Contaminants-National%20Secondary%20Drinking%20Water%20Regulations%20(NSDWRs),or%20color)%20in%20drinking%20water).

¹²¹ *See*, 12 VAC 5-590-340, tbls. 340.1-340.7. A “waterwork” is “a system that serves piped water for human consumption to at least 15 service connections or 25 or more individuals for at least 60 days out of the year.” 12 VAC 5-590-10.

¹²² *See* Va. Household Water Quality Program, Va. Dep’t of Health, *Well Informed Virginia*, <https://wellwater.bse.vt.edu/well-informed-virginia.php>.

¹²³ INITIATIVE FOR RESPONSIBLE MINING ASSURANCE (IRMA), IRMA STANDARD FOR RESPONSIBLE MINING, IRMA-STF-001, 131 (June 2018), https://responsiblemining.net/wp-content/uploads/2018/07/IRMA_STANDARD_v.1.0_FINAL_2018-1.pdf

¹²⁴ *Id.* For example, a groundwater withdrawal permit is only required in Groundwater Management Areas, which are largely comprised of counties in eastern Virginia. *See* 9 VAC 25-600-20.

¹²⁵ IRMA, IRMA STANDARD FOR RESPONSIBLE MINING, IRMA-STF-001, 132-49 (June 2018), https://responsiblemining.net/wp-content/uploads/2018/07/IRMA_STANDARD_v.1.0_FINAL_2018-1.pdf

management practices (“BMPs”) and mitigation measures. For example, modeling and estimations may not be based on real-world conditions and measures may not be fully implemented in practice.¹²⁶ One study found that mitigation failure was a contributing factor to water quality impacts at 64 percent of all hardrock mining sites analyzed.¹²⁷ Therefore, while BMPs and mitigation measures are designed to minimize harm from mining activities, their use cannot, and does not, avoid all harms to water resources.

3. Lack of baseline sampling and monitoring requirements

Although Virginia’s mineral mining regulations require that mining activities “be conducted so that the impact on water quality and quantity are minimized,” they lack any baseline monitoring and sampling provision for these operations that would enable detection of changes to water quality.¹²⁸ Absent such a requirement, Virginia’s regulations provide insufficient requirements and protections to meet this statutory requirement.

This would not be the first time that such a gap related to an extractive industry has been identified. In 2014, VDOE began a process to develop new regulations for oil and gas drilling that, among other things, would require baseline water testing for key constituents in waters surrounding a proposed drilling site. The new regulation also required subsequent testing around the drill sites.¹²⁹ This baseline and subsequent testing for known constituents of concern is the mechanism that allows state agencies, drilling companies, and nearby landowners with concerns about their drinking water to assess whether water quality has been adversely impacted. The Committee should evaluate this need with regard to gold mining, which presents many of the same threats to nearby waters, and identify any gaps in its report.

4. Water quality impacts due to Virginia’s use of mixing zones

Virginia’s regulation of discharges to state waters under its delegated CWA program has the potential to allow for acute water quality impacts. For example, Virginia’s treatment of mixing zones under the VPDES permit program should also be considered in the context of gold

¹²⁶ See e.g., JAMES R. KUIPERS ET AL., *BUKA ENV’T & KUIPERS & ASSOCS., COMPARISON OF PREDICTED AND ACTUAL WATER QUALITY AT HARDROCK MINES: THE RELIABILITY OF PREDICTIONS IN ENVIRONMENTAL IMPACT STATEMENTS (2006)*, <https://41p14t2a856b1gs8ii2wv4k4-wpengine.netdna-ssl.com/assets/uploads/archive/files/publications/ComparisonsReportFinal.pdf>.

¹²⁷ *Id.* at 189–92.

¹²⁸ 4 VAC 25-31-360.

¹²⁹ 4 VAC 25-150-95(G). But even this regulatory regime is lacking. The groundwater sampling must only be repeated once, within 12 months of setting the production casing or liner. *Id.* at 4 VAC 25-150-95(A), (D).

mining operations.¹³⁰ Mixing zones allow VDEQ to ignore water quality standards under certain circumstances in the evaluation of VPDES permits. Unfortunately, the current regulations provide no limitations on which pollutants may be appropriate for the use of a mixing zone and no limitations on metals or other pollutants that bioaccumulate.¹³¹ The regulations also provide minimal limitations on the use of thermal mixing zones for heated discharges.¹³² Among other recommendations, industry best practices suggest that surface water mixing zones should be as small as practicable and should not interfere with pre-mine use of the water.¹³³ It is also recommended that companies undertake a risk assessment to determine specific health risks for humans and the environment around and in this mixing zone and consider metal accumulation in local sediments, which can result in cumulative negative impacts on water quality and wildlife.¹³⁴ The failure to limit water pollution combined with the vague delineation of mixing zones can result in serious reduction of water quality and worsening of downstream impacts.

5. *Potential noncompliance with sulfate groundwater criteria*

As the Maest report indicates, there may be particular needs for water treatment related to sulfate resulting from gold mining operations. Virginia's sulfate groundwater criteria are regionally dependent, with the lowest criteria applying to the Piedmont and Blue Ridge region where gold mining is currently proposed.¹³⁵ It may be difficult to maintain this standard if sulfate ore containing gold is processed at an industrial scale in Virginia. As discussed in the Maest report, the potential accumulation of sulfate downstream would likely require treatment for sulfate removal in order to comply with Virginia's regional sulfate standards. The Committee should consider this potential need for water treatment.

E. Failure to Account for Naturally Occurring Radioactive Materials in Gold Ore

Naturally occurring radioactive materials (“NORM”) such as uranium, radium, and thorium are present throughout the environment.¹³⁶ As discussed in the Maest report, uranium is

¹³⁰ A “mixing zone” is “a limited area or volume of water where initial dilution of a discharge takes place and where numeric water quality criteria can be exceeded but designated uses in the waterbody on the whole are maintained and lethality is prevented.” 9 VAC 25-260-5.

¹³¹ 9 VAC 25-260-20(A).

¹³² 9 VAC 25-260-20(B)(11).

¹³³ IRMA, IRMA STANDARD FOR RESPONSIBLE MINING, IRMA-STF-001, 133-34 (June 2018), https://responsiblemining.net/wp-content/uploads/2018/07/IRMA_STANDARD_v.1.0_FINAL_2018-1.pdf

¹³⁴ *Id.*

¹³⁵ 9 VAC 25-280-70.

¹³⁶ Nev. Dep't of Health & Human Servs., Div. of Pub. & Behavioral Health, *Naturally Occurring Radioactive Material (NORM) - FAQs*, https://dphh.nv.gov/Reg/NORM/dta/FAQs/NORM_-_FAQs/.

present in some gold ores, including those in Virginia. Because mineral mining can produce large quantities of waste, radioactivity can be present in tailings and can pose harm to human health and the environment.¹³⁷

Many companies test sites extensively for heavy metals like arsenic, copper, and zinc to determine potential contaminants,¹³⁸ but, as highlighted in the Maest report, uranium is often not included in preliminary testing. VDOE also has not yet adopted any regulations related to the identification, handling, storage, and disposal of materials containing concentrated NORM in any mining context.¹³⁹ Other states like Nevada, however, are currently developing more robust regulations to address NORM from mineral mining operations.¹⁴⁰ By failing to require mining operations to consider NORM or other secondary contaminants from naturally occurring sources, Virginia's regulations leave a potential gap in water protection.

F. Inadequate Regulation of Mineral Mine Impoundments

One of the most significant areas where a stringent regulatory program is needed is the management of dams and impoundments at gold mining operations. Virginia's current regulatory framework does not provide adequate protections for the dams and impoundments associated with gold mining and processing, especially given the many toxic materials these structures are likely to hold.

Gold mining operations use a multitude of hazardous chemicals to process raw materials,¹⁴¹ and gold mines often use dams and impoundments to form retention ponds to store these waste minerals and chemicals ("tailings").¹⁴² Tailings pond breaches can be disastrous for

¹³⁷ Nev. Dep't of Health & Human Sers, Div. of Pub. & Behavioral Health, *Naturally Occurring Radioactive Material (NORM) - FAQs*, https://dpbh.nv.gov/Reg/NORM/dta/FAQs/NORM_-_FAQs/.

¹³⁸ M.O. Fashola et al., *Heavy Metal Pollution from Gold Mines: Environmental Effects and Bacterial Strategies for Resistance*, 13 INT'L J. ENVT'L RES. PUB. HEALTH 1047 (2016), <https://www.mdpi.com/1660-4601/13/11/1047>.

¹³⁹ See STATE REVIEW OF OIL AND NATURAL GAS ENVIRONMENTAL REGULATIONS (STRONGER), *Commonwealth of Virginia 2016 Follow-Up State Review Report* at sec. 7, <http://www.strongerinc.org/wp-content/uploads/2016/12/2016-Virginia-Follow-Up-State-Review-Report.pdf>.

¹⁴⁰ Nev. Dep't of Health & Human Servs., Div. of Pub. & Behavioral Health, *Naturally Occurring Radioactive Materials (NORM) and Technically Enhanced Naturally Occurring Radioactive Materials (TENORM)*, https://dpbh.nv.gov/Reg/NORM/NORM_-_Home/.

¹⁴¹ Gordon Ritcey, *Tailings Management in Gold Plants*, 78 HYDROMETALLURGY 3 (2005).

¹⁴² Darren Lumbroso, *Modelling the Brumadinho Tailings Dam Failure, the Subsequent Loss of Life and How It Could Have Been Reduced*, 21 EURO. GEOSCI. UNION 21, 21 (2021).

the local environment and nearby communities.¹⁴³ Unfortunately, the frequency with which these spills and dam failures occur is increasing globally.¹⁴⁴ Perhaps even more concerning is the fact that the failure rate for tailings dams is orders of magnitude higher than that for traditional water storage dams.¹⁴⁵ Often, these structures are designed as permanent fixtures in the landscape despite usually being constructed out of the cheapest materials available.¹⁴⁶ Lower grade construction materials are a significant factor contributing to these dams' frequent failures.¹⁴⁷

In Virginia, the regulations for each type of mineral mine impoundment use vague language that gives a significant degree of latitude to a permittee to design the impoundments. For instance, regulations explicitly require only that non-liquid impoundments must be designed using "current, prudent engineering practices,"¹⁴⁸ rather than imposing specific minimum design criteria. Also of concern is the fact that the regulatory program includes a number of inconsistent references, as well as references to long-repealed statutes and regulations, evidencing an outdated regulatory scheme.¹⁴⁹ Simply stated, these inconsistencies show that Virginia's mineral mining impoundment regulations require meaningful review and updates before any gold mining impoundment could be safely regulated.

The dam hazard approach in the Department of Conservation and Recreation ("DCR") regulations that is applied to mineral mines also fails to account for other potential risks most likely to occur from gold mining operations, such as water quality impacts. For example, the hazard classification focuses on the sheer volume of liquid being impounded, rather than the potential risks associated with the materials being impounded.¹⁵⁰ Agency guidance interpreting dam hazard evaluation regulations also fails to include any consideration of chemicals or toxic

¹⁴³ *See id.* (describing the horrific losses to human life as well as natural and economic resources following a tailings dam failure in 2019).

¹⁴⁴ J.R. Owen et al., *Catastrophic tailings dam failures and disaster risk disclosure*, 41 INT'L J. DISASTER RISK REDUC. 1, 2 (2019).

¹⁴⁵ Zongjie Lyu, *A Comprehensive Review on Reasons for Tailings Dam Failures Based on Case History*, 2019 ADV. CIV. ENG'G art. no. 4159306, 2 (2019). Over the past century, the recorded failure rate has been 1.2% for tailings dams and 0.01% for water storage dams. *Id.*

¹⁴⁶ *See id.* (noting that these structures are often comprised of waste material themselves).

¹⁴⁷ Zongjie Lyu, *A Comprehensive Review on Reasons for Tailings Dam Failures Based on Case History*, 2019 ADV. CIV. ENG'G art. no. 4159306, 2 (2019).

¹⁴⁸ 9 VAC 25-31-400(C).

¹⁴⁹ *See e.g.*, 4 VAC 25-31-270(B) (stating that that "[w]ater and silt retaining dams" that do not meet Chapter 13's size criteria are subject to the "Minerals Other Than Coal Surface Mining Law," a repealed code provision).

¹⁵⁰ *See* 4 VAC 50-20-40.

substances being impounded for influencing the hazard determination.¹⁵¹ In order to protect human health and the environment, impoundment hazard classification must consider the specific risks associated with the materials being impounded. For tailings impoundments, which are documented to be more likely to fail than water-retaining dams,¹⁵² the toxic substances in the tailings must be considered when assessing hazard potential.

As discussed below, impacts of climate change are increasing,¹⁵³ and Virginia's regulatory framework also fails to adequately ensure that future climate conditions are factored into regulatory decisions being made now so that impoundments constructed now can withstand the future realities of an altered climate. For example, high hazard impoundments are required to be designed to address a "probable maximum flood."¹⁵⁴ However, the probable maximum flood only accounts for current meteorologic and hydrologic conditions, without any forecasting of increased storm intensity, duration, and frequency.¹⁵⁵

Finally, the mineral mining regulations currently allow for the use of "refuse piles" as impounding structures.¹⁵⁶ The use of cheap or unsuitable construction material is often a contributing factor when a tailings dam fails.¹⁵⁷ Virginia would benefit from a heightened standard applied to the construction of tailings dams to ensure impounding structures are constructed from appropriate material. To this end, IRMA has several promising template mine waste regulations that should be considered.¹⁵⁸

Virginia's regulatory framework for impoundments is inadequate to support a new industry like gold mining. Without significantly more stringent and detailed regulatory requirements for impoundments, the public health, safety, and welfare of the Commonwealth cannot be ensured.

¹⁵¹ VA. DEP'T CONS. REC., DCR-VSWCB-039, VIRGINIA SOIL AND WATER CONSERVATION BOARD GUIDANCE DOCUMENT ON IMPOUNDING STRUCTURE HAZARD CLASSIFICATION PROCEDURES (Sept. 7, 2016), <https://www.dcr.virginia.gov/form/dcr-vswcb-039.pdf>.

¹⁵² Zongjie Lyu, *A Comprehensive Review on Reasons for Tailings Dam Failures Based on Case History*, 2019 ADV. CIV. ENG'G art. no. 4159306, 2 (2019).

¹⁵³ *See infra*, III.I.1.

¹⁵⁴ 4 VAC 25-31-10; 4 VAC 24-31-500.

¹⁵⁵ 4 VAC 25-31-10.

¹⁵⁶ Va. Code § 45.2-1301.

¹⁵⁷ Zongjie Lyu, *A Comprehensive Review on Reasons for Tailings Dam Failures Based on Case History*, 2019 ADV. CIV. ENG'G art. no. 4159306, 2 (2019).

¹⁵⁸ IRMA, IRMA STANDARD FOR RESPONSIBLE MINING, IRMA-STF-001, 123 (June 2018), https://responsiblemining.net/wp-content/uploads/2018/07/IRMA_STANDARD_v.1.0_FINAL_2018-1.pdf.

G. Sparse Closure and Reclamation Planning Requirements

As is clear from the history of abandoned mine cleanup, the environmental and societal costs of mining often materialize after mining stops, whether permanently or intermittently. It is widely recognized by industry, regulators, scientists, and engineers involved in mine design and permitting that it is critical the entire lifecycle of mining, from cradle to grave, be addressed at the beginning of the process rather than as an afterthought of the operational period. Planning for the closure and reclamation of exploration, mining, and processing activities at the outset is therefore extremely important.¹⁵⁹ Detailed closure and reclamation plans that outline concrete objectives needed to implement a well-defined site outcome are key to protecting surrounding communities and the environment in the long-term. They also provide valuable information for assessing adequate financial assurances for mining operations (see *infra*, III.H).

Virginia's existing statutory and regulatory requirements related to reclamation planning are extremely sparse and give VDOE and the permittee significant leeway in determining the final conditions of the post-mining site and the timeline for implementing all reclamation activities.¹⁶⁰ Mine operators must submit a reclamation plan as part of their initial permit application,¹⁶¹ but only general categories of information are required to be included in the plan: "a statement of the planned land use to which the disturbed land will be returned through reclamation, the proposed actions to assure suitable reclamation, and a time schedule for reclamation," as well as specification of "[t]he method of grading; removal of metal, lumber, and debris, including processing equipment; buildings; and other equipment . . . and revegetation."¹⁶² Reclamation is also required to be conducted simultaneously with mining operations where practicable.¹⁶³

Requirements for reclamation planning, however, can be much more detailed and some states have an entirely separate permitting process for reclamation plans.¹⁶⁴ IRMA's Standard for Responsible Mining provides several specific items that should be included, at a minimum, in

¹⁵⁹ "It is now widely recognized that the objectives and impacts of reclamation and closure must be considered from project inception." *Id.* at 69.

¹⁶⁰ Va. Code § 45.2-1206. There are also no regulations in place for exploration activities. See *supra*, III.C.

¹⁶¹ Va. Code § 45.2-1206.

¹⁶² 4 VAC 25-31-130(3). In the case of underground mines, "plans for closing or securing all entrances to underground workings" must be included. *Id.*

¹⁶³ Va. Code § 45.2-1206(B)(2); 4 VAC 25-31-130(1).

¹⁶⁴ For example, Nevada issues Mining Reclamation Permits. Nev. Div. of Env't Prot., *Reclamation Branch*, <https://ndep.nv.gov/land/mining/reclamation>.

these plans.¹⁶⁵ Ultimately, the plan should show that it is “compatible with the protection of human health and the environment, and it must demonstrate how affected areas will be returned to a stable landscape with an agreed post-mining use.”¹⁶⁶ Among other things, the IRMA standards also recommend reviewing and updating plans (and financial assurances) “when there is a significant change to the mine plan, but at least every [five] years,” providing interim reclamation progress reports to stakeholders when requested, and providing at least 60 days for stakeholders to comment on the plan.¹⁶⁷

Virginia’s current requirements regarding mine operation and reclamation planning also do not fully account for post-closure site management. The statute and regulations seem to focus on returning the site to a beneficial land use proposed by the permittee instead of ensuring long-term compliance with environmental and other laws after reclamation activities are completed.¹⁶⁸ Given the significant risks and uncertainties associated with the impacts of gold mining, the need for long-term, post-closure maintenance, monitoring, and treatment in addition to reclamation is a strong possibility at gold mines in Virginia. It would therefore be important for Virginia to include post-closure planning and monitoring requirements as part of its operations and reclamation plans.

H. Insufficient Financial Assurances

The boom-bust cycle of the gold mining industry means there is a risk that some operators would cease to exist during the period necessary to execute the full scope of closure, reclamation, and post-closure management. Furthermore, the long-term commitments and contingencies needed to remediate these sites—many times in the face of unexpected environmental impacts—means reclamation and post-closure care can be extremely expensive

¹⁶⁵ IRMA, IRMA STANDARD FOR RESPONSIBLE MINING, IRMA-STF-001, 69-76 (June 2018), https://responsiblemining.net/wp-content/uploads/2018/07/IRMA_STANDARD_v.1.0_FINAL_2018-1.pdf. For IRMA’s post-closure planning and monitoring, post-closure water treatment, and post-closure financial surety recommendations, see *id.* at 73-75.

¹⁶⁶ *Id.* at 70.

¹⁶⁷ *Id.* at 72.

¹⁶⁸ “Reclamation refers to the process of rehabilitation and stabilization such that disturbed land is returned to its former or other beneficial uses. Closure refers to the activities that are required to maintain compliance with environmental regulations during and following completion of reclamation.” *Id.* at 69 (internal citations omitted). The Virginia Code defines “reclamation” as “the restoration or conversion of the disturbed land to a stable condition that minimizes or prevents adverse disruption and the injurious effects of such disruption and presents an opportunity for further productive use if such use is reasonable,” Va. Code § 45.2-1200, and there is no reference to post-closure management in the statute or regulations.

and time intensive.¹⁶⁹ Without strong financial assurance requirements in place to mitigate these risks, costs of closure, reclamation, and post-closure management could be borne by the public instead of the mine operators.

Currently, Virginia has very limited financial assurance requirements for mineral mine operators. Virginia utilizes an extremely low, statutorily prescribed per-acre bond rate that is based solely on the number of acres disturbed by the mining operation. Mine operators with less than five years of satisfactory operation in the Commonwealth must provide bonds or other financial assurances of \$3,000 per acre of disturbed land.¹⁷⁰ Mine operators with five or more years of satisfactory operation in the Commonwealth automatically join the Mineral Reclamation Fund and pay, at maximum, \$500 per acre of disturbed land into the Fund.¹⁷¹ Given that each mining operation carries risks unique to its specific operations plan and site, gold mining operations should not be eligible for pooled financial assurance programs. Additionally, liability for mineral mine operators in Virginia only extends for the duration of the mineral mining operation through the completion of reclamation¹⁷²—Virginia’s mineral mining laws and regulations do not seem to contemplate long-term, post-closure management (see *supra*, III.G).

¹⁶⁹ For example, the potential for acid mine drainage formation can be hard to predict, and there are both historical and modern mining examples of acid mine drainage requiring active treatment in perpetuity. See S.R. JENNINGS ET AL., RECLAMATION RSCH. GRP., LLC, ACID MINE DRAINAGE AND EFFECTS ON FISH HEALTH AND ECOLOGY: A REVIEW 16 (2008), <https://earthworks.org/cms/assets/uploads/2018/12/55-S.R.-Jenning-et-al.-2008.-Acid-Mine-Drainage-and-Effects-on-Fish-Health-and-Ecology-A-Review.pdf>. See also, JAMES R. KUIPERS ET AL., BUKA ENV’T & KUIPERS & ASSOCS., COMPARISON OF PREDICTED AND ACTUAL WATER QUALITY AT HARDROCK MINES: THE RELIABILITY OF PREDICTIONS IN ENVIRONMENTAL IMPACT STATEMENTS (2006), <https://41p14t2a856b1gs8ii2wv4k4-wpengine.netdna-ssl.com/assets/uploads/archive/files/publications/ComparisonsReportFinal.pdf>.

¹⁷⁰ Va. Code § 45.2-1208. See also, Va. Code § 45.2-1212(A); 4 VAC 25-31-240. Regulators have noted that this figure was established through negotiations between the Commonwealth and mining operators, and likely is more reflective of grading and stabilization needs than needs associated with water contamination. NASEM, *Potential Impacts of Gold Mining in Virginia: Open Session 1* at 1:54 (Dec. 15, 2021), <https://www.nationalacademies.org/en/event/12-15-2021/potential-impacts-of-gold-mining-in-virginia-open-session-1>.

¹⁷¹ The operator makes an initial payment of \$50 per acre estimated to be affected by the mining operation during the next year into the Minerals Reclamation Fund, Va. Code § 45.2-1235, and then makes a yearly payment of \$12.50 per acre estimated to be disturbed during the course of the following year. *Id.* Any prior performance bonds held by the operator for the mine are released upon entry into the Mineral Reclamation Fund. Va. Code § 45.2-1236; 4 VAC 25-31-230(B).

¹⁷² Va. Code § 45.2-1212(B) (establishing when mineral mining bonds shall be released); 4 VAC 25-31-230(A) (providing the duration of bond liability for mineral mining operators with less than five years of satisfactory operation in the Commonwealth); 4 VAC 25-31-320(C) (providing when deposits into the Minerals Reclamation Fund shall be released or retained).

Since many of the financial assurance requirements are statutorily prescribed, legislative changes would be needed to establish more protective requirements in Virginia.¹⁷³

In many cases, reclamation and closure costs far exceed the rates established in Virginia and post-closure management may be required far into the future, if not in perpetuity. For example, the Goldstrike Mine is an open pit gold mine operated in Nevada with 9,028 acres of disturbance currently authorized and estimated closure costs of \$122 million.¹⁷⁴ In South Carolina, the EPA has assumed responsibility for cleanup activities at multiple gold mines after mining operator bankruptcy and ballooning reclamation costs.¹⁷⁵ In Virginia, VDOE estimates current mining reclamation costs are between \$8,000 and \$12,000 per acre and has noted that \$3,000 per acre is a “fraction of the cost” of what would be needed in most instances.¹⁷⁶ This bond amount would also be insufficient, for example, to clean up a chemical spill in the case of a gold mining operation that uses chemicals for extraction.¹⁷⁷

Furthermore, calculating financial assurances based on a flat rate fails to account for the true costs of reclamation and post-closure management. It does not allow for the consideration of site- and operation-specific characteristics that influence closure, post-closure, and reclamation requirements, costs, and timelines,¹⁷⁸ and it does not provide an economic incentive for mining

¹⁷³ See Va. Code §§ 45.2-1208, 45.2-1212(A), 45.2-1235.

¹⁷⁴ BARRIK GOLD CORP., TECHNICAL REPORT ON THE GOLDSTRIKE MINE, EUREKA AND ELKO COUNTIES, STATE OF NEVADA, USA, NI 43-101 Report, at 1-11, 20-5 (Mar. 22, 2019), <https://www.sec.gov/Archives/edgar/data/756894/000119312519083752/d650661dex991.htm>.

¹⁷⁵ NASEM, *Potential Impacts of Gold Mining in Virginia: Open Session 2* at 1:09 (Jan. 19, 2022), <https://www.nationalacademies.org/event/01-19-2022/potential-impacts-of-gold-mining-in-virginia-open-session-2>.

¹⁷⁶ NASEM, *Potential Impacts of Gold Mining in Virginia: Open Session 1* at 1:54 (Dec. 15, 2021), <https://www.nationalacademies.org/en/event/12-15-2021/potential-impacts-of-gold-mining-in-virginia-open-session-1>.

¹⁷⁷ Va. Energy, *Third Meeting of State Component of Gold Mining Study*, at 0:43 (Apr. 21, 2022), available at <https://energy.virginia.gov/mineral-mining/GoldMiningStudy.shtml>.

¹⁷⁸ For example, Nevada provides a Standardized Reclamation Cost Estimator tool for mine operators to estimate reclamation costs based on factors such as site specifications, equipment, labor needs, and revegetation requirements. Nev. Div. of Env’t Prot., *Standardized Reclamation Cost Estimator (SRCE)*, <https://ndep.nv.gov/land/mining/reclamation/reclamation-cost-estimator>. IRMA has developed a list of minimum factors that should be considered when determining reclamation and closure costs. IRMA, IRMA STANDARD FOR RESPONSIBLE MINING, IRMA-STF-001, 71 (June 2018), https://responsiblemining.net/wp-content/uploads/2018/07/IRMA_STANDARD_v.1.0_FINAL_2018-1.pdf. These cost estimates should be informed by the mining operator’s closure and reclamation planning. See *supra*, III.G.

operators to limit the environmental damage of their operations in the first place.¹⁷⁹ It also does not allow for the consideration of additional reclamation and closure scenarios, such as unplanned closure during the maximum reclamation liability, or the opportunity to periodically evaluate the sufficiency of financial assurances in light of changes in operations and other costs.¹⁸⁰ Moreover, many of the challenges for reclamation and long-term management will only increase as the future impacts of climate change come to fruition. Many of these unknown impacts would not have been able to be accounted for during the reclamation planning process.

Ultimately, insufficient financial assurances can lead to contaminated sites that become public liabilities that must be addressed by taxpayer money or under the Comprehensive Environmental Response, Compensation, and Liability Act (“CERCLA” or “Superfund”).

I. Failure to Account for Climate Change

The effects of climate change must be considered when assessing the potential impacts of gold mining operations in Virginia on public health, safety, and welfare. These effects may pose significant risks and uncertainties to active mining operations and reclamation activities and jeopardize the health and safety of nearby communities and the environment.

1. Impacts of Climate Change on Gold Mining Operations

Mining groups have begun to outline the various risks climate change poses to their infrastructure, operations, and worker safety,¹⁸¹ and climate change is already influencing mining policy decisions in other countries.¹⁸² Any assessment of gold mining operations in Virginia must appropriately account for how climate change is already affecting the proposed mining site

¹⁷⁹ See, e.g., BC FIRST NATIONS ENERGY AND MINING COUNCIL, USING FINANCIAL ASSURANCE TO REDUCE THE RISK OF MINE NON-REMEDATION: CONSIDERATIONS FOR BRITISH COLUMBIA AND INDIGENOUS GOVERNMENTS 5-6 (Nov. 2019), <https://fnemc.ca/wp-content/uploads/2015/07/Using-financial-assurance-to-reduce-the-risk-of-mine-non-remediation.pdf>.

¹⁸⁰ For example, IRMA recommends reviewing and updating reclamation and closure plans and/or financial assurance with there is a significant change to the mine plan, but at least every five years. IRMA, IRMA STANDARD FOR RESPONSIBLE MINING, IRMA-STF-001, 77 (June 2018), https://responsiblemining.net/wp-content/uploads/2018/07/IRMA_STANDARD_v.1.0_FINAL_2018-1.pdf

¹⁸¹ JULIA NELSON & RYAN SCHUCHARD, ADAPTING TO CLIMATE CHANGE: A GUIDE FOR THE MINING INDUSTRY, BSR (2010), https://www.bsr.org/reports/BSR_Climate_Adaptation_Issue_Brief_Mining.pdf.

¹⁸² Scott Odell et al., *Mining and Climate Change: A Review and Framework Analysis*, 5 THE EXTRACTIVE INDUS. AND SOC'Y 201 (2018), <https://www.sciencedirect.com/science/article/abs/pii/S2214790X1730148X>.

and how the site would be affected through the duration of post-closure activities.¹⁸³ Failure to adequately plan for vulnerabilities to, and changes in, extreme precipitation (including the intensity, frequency, and duration of precipitation events), drought, and temperature that are associated with climate change presents a significant risk to gold mining operations and surrounding communities and ecosystems.¹⁸⁴

Given the presence of toxic materials in gold mining and the permanence of mining operations in the landscape detailed in the Maest report, it is especially crucial to consider trends in future hydrology in order to prevent contaminant releases from gold mines, such as tailings dam collapses.¹⁸⁵ Increased precipitation in areas with historic metal mining has also been shown to increase the mobility of legacy contaminants, like lead, as floodwaters take-up and transport toxins,¹⁸⁶ and preliminary research shows a connection between extreme storm events and pulses of concentrated acid mine drainage releases.¹⁸⁷ In order to prevent the spread of toxins from gold mining operations, it will be necessary to plan for extreme events driven by climate change.

Throughout the Southeast, extreme rainfall has already become more frequent and damaging.¹⁸⁸ The amount of water vapor the air can hold increases as the atmosphere warms and creates conditions for storms to release more rainfall. If today's emissions levels remain constant, the number of extreme rainstorms in the Southeast could increase by two to three times

¹⁸³ For example, IRMA recommends that mining operators' analysis include climate change projections when developing mine waste source characterization and impact predictions. IRMA, IRMA STANDARD FOR RESPONSIBLE MINING, IRMA-STF-001, 124 (June 2018), https://responsiblemining.net/wp-content/uploads/2018/07/IRMA_STANDARD_v.1.0_FINAL_2018-1.pdf.

¹⁸⁴ For a summary of impacts especially relevant in the Southeast, see LYNNE CARTER ET AL., IMPACTS, RICKS, AND ADAPTATION IN THE UNITED STATES: FOURTH NATIONAL CLIMATE ASSESSMENT, VOL. II, 745-808 (Reidmiller et al., eds. 2019), https://nca2018.globalchange.gov/downloads/NCA4_Ch19_Southeast_Full.pdf.

¹⁸⁵ See *supra*, III.F. See also, M. A. Llano-Serna et al., *Insights into Rainfall-Induced Tailings Run-Out*, Conference Paper: Tailings and Mine Waste 17 (Nov. 2017), https://www.researchgate.net/publication/321126066_Insights_into_rainfall-induced_tailings_run-out.

¹⁸⁶ S. Foulds et al., *Flood-Related Contamination in Catchments Affected by Historical Metal Mining: An Unexpected and Emerging Hazard of Climate Change*, 476-77 SCI. OF THE TOTAL ENV'T 165 (2014), <https://www.sciencedirect.com/science/article/abs/pii/S004896971301560X>.

¹⁸⁷ Kirk Nordstrom, *Acid Rock Drainage and Climate Change*, 100 J. OF GEOCHEMICAL EXPLORATION 97 (2009), <https://www.sciencedirect.com/science/article/abs/pii/S0375674208000861?via%3Dihub>.

¹⁸⁸ DAVID R. EASTERLING ET AL., PRECIPITATION CHANGE IN THE UNITED STATES, CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, VOL. I, 207-230 (Donald J. Wuebbles et al. eds., 2017), <https://doi.org/10.7930/J0H993CC>.

the historic average by the end of the 21st century.¹⁸⁹ Before the end of the century, extreme summer thunderstorms that typically result in 100-year flooding events in the Southeast are expected to result in between 40 and 80 percent more rain than the same storms do today.¹⁹⁰ Climate change is also increasing the risks of tropical storms and hurricanes. The Atlantic basin sees more major hurricanes (i.e., Category 3 or higher) today than it did before the 1980s,¹⁹¹ and the warming climate is producing greater storm surge,¹⁹² rainfall,¹⁹³ and property damage¹⁹⁴ each time a hurricane hits.

2. Impacts of Gold Mining Operations on Climate Change

In addition to being impacted by climate change, gold mining operations are also contributors to climate change as a source of greenhouse gas (GHG) emissions. Gold mining operations create direct GHG emissions through the burning of fossil fuels “in mining and processing operations, transportation of ore and electricity generation at remote sites, and fugitive emissions,” and indirect GHG emissions through the use of electricity, “primarily in refining and smelting operations.”¹⁹⁵ Modern gold mining operations should be required to quantify and report on GHG emissions from its operations and to develop and implement GHG emissions reduction strategies.¹⁹⁶ Virginia has established a sector-wide goal of net-zero GHG emissions by 2045,¹⁹⁷ and it would be important that state agencies assess the GHG impacts associated with gold mining operations in the Commonwealth, and that operators are required to report and reduce their GHG emissions.

¹⁸⁹ *Id.*

¹⁹⁰ Andreas F. Prein et al., *Increased Rainfall Volume from Future Convective Storms in the US*, 7 NATURE CLIMATE CHANGE 880 (2017), <https://doi.org/10.1038/s41558-017-0007-7>.

¹⁹¹ Peter J. Webster et al., *Changes in Tropical Cyclone Number, Duration, and Intensity in a Warming Environment*, 309 SCI. 1844 (2005), <https://doi.org/10.1126/science.1116448>.

¹⁹² Ning Lin et al., *Physically Based Assessment of Hurricane Surge Threat Under Climate Change*, 2 NATURE CLIMATE CHANGE 462 (2012), <https://doi.org/10.1038/nclimate1389>.

¹⁹³ *See e.g.*, Christina M. Patricola & Michael F. Wehner, *Anthropogenic Influences on Major Tropical Cyclone Events*, 563 NATURE 339 (2018), <https://doi.org/10.1038/s41586-018-0673-2>.

¹⁹⁴ Morris A. Bender et al., *Modeled Impact of Anthropogenic Warming on the Frequency of Intense Atlantic Hurricanes*, 327 SCI. 454 (2010), <https://doi.org/10.1126/science.1180568>.

¹⁹⁵ IRMA, IRMA STANDARD FOR RESPONSIBLE MINING, IRMA-STF-001, 160 (June 2018), https://responsiblemining.net/wp-content/uploads/2018/07/IRMA_STANDARD_v.1.0_FINAL_2018-1.pdf

¹⁹⁶ *See*, for example, the reporting, quantification, and reduction strategies for industrial mining operations recommended by IRMA. *Id.* at 160–63.

¹⁹⁷ Va. Code § 45.2-1706.1(A). This provision is within the Mines, Minerals, and Energy title of the Virginia Code.

J. Failure to Consider Indirect Effects on Communities

The Gold-Pyrite Belt and gold ore deposits in Virginia are generally located in the Piedmont region of the Commonwealth. Many of the communities in this area are rural and agricultural in character. In addition to the direct effects of mining exploration and operations on air, water, and environmental quality on local and regional populations, the Committee and Virginia need to consider the indirect effects that industrial mining can bring to a community's health and character.¹⁹⁸ Industrial gold mining has the potential to disturb the rural benefits of the area through increased noise and light pollution, large-scale removal of vegetation and habitat degradation, and higher amounts of traffic.¹⁹⁹ Property values may decrease, in turn decreasing property taxes for the state.²⁰⁰

Other industries may also be negatively impacted by the environmental consequences of chemical contaminants and waste. Agriculture is the single largest economic sector in Virginia, generating over 70 billion dollars annually and 334,000 jobs.²⁰¹ Successful crop yields depend on a multitude of factors, including but not limited to soil conditions, microbial organisms, nutrient concentrations, clean water supplies, and well-draining land.²⁰² These often-delicate conditions can be disturbed by sudden changes in water flows, water quality, or upstream environmental degradation.²⁰³

The boom-bust cycle of mining may further exacerbate gold mining's negative environmental and economic impacts on local communities.²⁰⁴ Opportunities for employment are often advertised as a primary economic benefit for communities considering industrial mining operations in their area;²⁰⁵ however, employment opportunities are usually overestimated in mining proposals due to uncertainties of operations, as the number of workers required for a project depends on the size of the mineral reserve, the future of mineral pricing, and the total

¹⁹⁸ See THOMAS MICHAEL POWER, *LOST LANDSCAPES AND FAILED ECONOMIES: THE SEARCH FOR A VALUE OF PLACE* ch. 4 (1996).

¹⁹⁹ See *id.* at 112.

²⁰⁰ See *id.*

²⁰¹ Va. Dep't of Agriculture and Consumer Servs., *Agriculture Facts and Figures*, <https://www.vdacs.virginia.gov/markets-and-finance-agriculture-facts-and-figures.shtml>.

²⁰² See EPA, *Ag 101* at 71, 81, 85-86, 92, 95 https://www.epa.gov/sites/default/files/2015-07/documents/ag_101_agriculture_us_epa_0.pdf.

²⁰³ *Id.*

²⁰⁴ See THOMAS MICHAEL POWER, *LOST LANDSCAPES AND FAILED ECONOMIES: THE SEARCH FOR A VALUE OF PLACE* 102-11 (1996).

²⁰⁵ *Id.* at 112.

costs of mining.²⁰⁶ Furthermore, mining jobs often require highly specialized technical skills that many local community members will not have, meaning the jobs will be given to residents outside the community.²⁰⁷ While there is a possibility the community may receive short-term economic benefits from the flow of disposable income from these workers, many mineral mines are in isolated areas with sparse commercial development.²⁰⁸ Therefore, there may be limited opportunities for these communities to convert this short-term cash flow into longer term benefits. Furthermore, the high costs of environmental remediation have the possibility to completely offset any short-term, localized economic benefits from disposable income flows.²⁰⁹

As the Committee considers direct impacts to the public health, safety, and the welfare of Virginians, we urge you to also consider these potential indirect impacts, which are not currently addressed in Virginia's mineral mining regulations.

IV. Conclusion

If Virginia proceeds with modern industrial gold mining, it would present a myriad of adverse impacts to our environment, public health, safety, and welfare. Virginia's current regulatory framework was not designed for this type of mining and contains numerous gaps, both in terms of process and substance. We urge the Committee to fully utilize the information contained in these comments, as well as in the forthcoming report of Dr. Ann Maest, when formulating its findings and recommendations. And we thank you for your work.

²⁰⁶ *Id.* at 107. The estimated yield for the gold deposits in Virginia has not yet been calculated, so estimation of total community impacts may be difficult.

²⁰⁷ *Id.* at 108.

²⁰⁸ *Id.* at 109.

²⁰⁹ *Id.* at 112. *See also supra*, III.G.