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Keeping Agriculture Alive in the Shadow of a Uranium Mine: Potential Effects and Regulatory Solutions for Virginia

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KEEPING AGRICULTURE ALIVE IN THE SHADOW OF A URANIUM MINE: POTENTIAL EFFECTS AND REGULATORY SOLUTIONS FOR VIRGINIA

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INTRODUCTION

> *Cultivators of the earth are the most valuable citizens. They are the most vigorous, the most independent, the most virtuous, and they are tied to their country and wedded to it's* [sic] *liberty and interests by the most lasting bands.*[1]

Ever since uranium was first discovered at Coles Hill in rural Pittsylvania County, Virginia, there has been great economic, environmental, and legal debate on whether that uranium should be mined, and if so, what the implications would be for the surrounding, primarily agricultural areas.[2] Although a commonwealth wide moratorium on uranium mining was enacted by the Virginia General Assembly in the early 1980's, the recent increase in the price of uranium has sparked a renewed discussion on the fate of the uranium deposit in rural Southern Virginia.[3]

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[1] Letter from Thomas Jefferson to John Jay (Aug. 23, 1785), *in* 8 THE PAPERS OF THOMAS JEFFERSON DIGITAL EDITION, at 426 (Barbara B. Oberg & J. Jefferson Looney eds. 2008), http://rotunda.upress.virginia.edu:8080/founders/default.xqy?keys=TSJN-print-01-08-02-0333.

[2] *See, e.g.*, Denice Thibodeau, *Reaction Mixed to Uranium Study Ruling*, DANVILLE REG. & BEE, Nov. 6, 2008, http://www2.godanriver.com/gdr/news/local/danville_news/article/reaction_to_uranium_study_ruling/7294/. *See generally* S.DOC. NO. 15, at 21 (Va. 1985) (showing dissent).

[3] *See* BEHRE DOLBEAR & CO., LTD., TECHNICAL REPORT ON THE COLES HILL URANIUM PROPERTY PITTSYLVANIA COUNTY 2, 70 (Apr. 29, 2009), *available at* http://www.santoy.ca/i/pdf/43-101ColesHill.pdf [hereinafter 2009 REPORT]; Dep't of Energy, Uranium Quick Facts, http://web.ead.anl.gov/uranium/guide/facts/ (last visited Oct. 27, 2009). *See also* VA. CODE ANN. § 45.1-283 (2009) (barring uranium mining until authorized by statute); Virginia General Assembly Legislative Information System, SB 5252 Uranium Mining Commission, http://leg1.state.va.us/cgi-bin/legp504.exe?081+sum+SB525 (last visited Dec. 21, 2009) (explaining that Senate Bill 525 was submitted in 2008 to establish a committee to study uranium mining in Virginia, but died in the House in early 2008). In early November

The economy of Pittsylvania County and the surrounding region has historically been powered by the textile industry, the production and sale of tobacco, and the marketing of livestock and related crops.[4] But the tobacco settlement of 1999, combined with the complete loss of the textile industry to overseas production at the end of the Twentieth Century, has resulted in a near economic collapse in a region that has become even more heavily dependent upon agricultural output as its primary economic base.[5]

Although uranium mining has the potential to bring short-term economic prosperity to Pittsylvania County, the mining and milling process, as well as the resulting waste products, also pose significant risks of contamination to the surrounding environment—risks that have been realized at other mining locations and which would likely be exacerbated by the unique hydrological environment of Virginia.[6] The increased exposure of contaminants to crops and livestock, and the natural environment and cumulative "food chain" events of unregulated agricultural products, have the potential for significant safety and health risks to consumers.[7] Perhaps more importantly, the public perception of risk or danger from uranium mining may also result in serious negative repercussions for the marketability of agricultural products from the nearby regions.[8]

This Note will discuss these issues from a legal, scientific, and regulatory perspective. This Note will first provide a comprehensive view of the risks to agricultural crops and livestock from uranium mining and milling in light of the present-day national and commonwealth legislative and

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2008, the Virginia Commission on Coal and Energy undertook a study of the risks and benefits of uranium mining at the Coles Hill location. *See* Thibodeau, *supra* note 2. Author Note: Although in local usage the relevant region is known as "Southside" Virginia, this Note refers to the region as "Southern" Virginia in response to recent efforts within the region to distinguish itself as "Southern" Virginia and for the clarification of readers not familiar with the local usage.

[4] JAMES H. JOHNSON JR. ET AL., ASSESSING THE ECONOMIC COMPETITIVENESS OF THE DANVILLE, VIRGINIA REGION 13 (Frank Hawkins Kenan Inst. Of Private Enter. and Kenan-Flagler Bus. School, Univ. of N.C., 2008), *available at* http://www.wpcva.com/content/current/chatham/economic_competitiveness_report/economic_competiveness_report.pdf [hereinafter ECONOMIC COMPETITIVENESS REPORT]; Pittsylvania County Agriculture Development, http://www.pittcoagriculture.org/ (last visited Dec. 21, 2009) (identifying agriculture as the county's primary source of revenue).

[5] *See id.* at 12–13; John Reid Blackwell, *Production of Leaf has Declined: Farmers Switch to Other Crops as Market for Tobacco Shrinks*, RICHMOND TIMES DISPATCH, July 20, 2008, at A11.

[6] *See infra* Parts I.C, II.D, III.

[7] *See infra* Part III.A–B.

[8] *See infra* Part III.C.

regulatory framework. This Note will then address the gaps in both regulation and enforcement mechanisms as they apply to uranium mining's effects on the agricultural economy of the region. Finally, this Note will provide suggestions for a means of regulating the agricultural product of the potentially affected regions of Virginia to ensure that agriculture can continue to be a successful economic base for this area, both during and long after the uranium mining process has been completed.

I. OVERVIEW OF THE COLES HILL DEPOSIT, SURROUNDING REGION, AND THE URANIUM MINING AND MILLING PROCESS

A. The Coles Hill Deposit

Initially discovered and explored by Marline Uranium Corporation, the Coles Hill deposit is located about "six miles (10 km) northeast of Chatham, Virginia the county seat" of Pittsylvania County.[9] It is approximately twenty miles north of Danville, Virginia,[10] and about forty-five miles southwest of Lynchburg, Virginia.[11] Virginia Uranium, Inc. now owns or leases the mineral rights to more than 2900 acres, including surface rights to approximately 2300 of those acres.[12] The site is located within the rolling foothills of the Appalachian mountains and is drained by two creeks, Mill Creek and Whitehorn Creek, which merge approximately one and a half miles east of the Virginia Uranium property line.[13]

There are two separate deposits of uranium at the Coles Hill site—the "North Deposit" and the "South Deposit."[14] The quantity of the uranium deposits located at the Coles Hill site is vast by any measure.[15]

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[9] PETER A. CHRISTOPHER, TECHNICAL REPORT ON THE COLES HILL URANIUM PROPERTY: PITTSYLVANIA COUNTY, VIRGINIA 4 (2007), *available at* http://www.mdcampbell.com/ColesHillUraniumVirginia.pdf [hereinafter 2007 REPORT].

[10] *Id.*

[11] *See* Google Maps, http://maps.google.com/maps?hi=en&tab=w1 (follow "Get Directions" hyperlink; then enter "Lynchburg, Virginia" as "A" and "Coles Hill, Virginia" as "B") (last visited Dec. 22, 2009).

[12] 2009 REPORT, *supra* note 3, at 9.

[13] 2007 REPORT, *supra* note 9, at 5.

[14] *Id.* at 4. The report refers to these deposits as "the South Coles Hill Deposit" and the "North Coles Hill Deposit." *Id.* For simplicity, this Note will refer to the deposits as the "South Deposit" and the "North Deposit." The report provides a detailed geologic analysis of the formation processes for the two deposits. *See id.* at 29–32.

[15] Santoy Resources, Ltd. & Virginia Uranium Inc., Investor Presentation (June 2009), *available at* http://www.santoy.ca/i/pdf/CorporatePresentation.pdf (describing the Coles Hill uranium deposit site as "[o]ne of the largest undeveloped uranium deposits in the World").

The South Deposit is estimated to contain twenty-one to fifty-five million pounds of uranium (U_3O_8), and the North Deposit is estimated to contain four to fifty-four and a half million pounds of uranium.[16] The variation in these estimates is a function of the "cutoff grade," below which mining operations would cease to be profitable, ranging from .15% U_3O_8 to .025% U_3O_8, presumably based on the price of uranium during mining operations.[17] These estimates are based on the 1982 studies done by Marline Corporation, which have not been verified since that time, but nevertheless are considered reliable.[18] The estimates were developed by drilling a total of 256 exploratory cores at the deposit location;[19] the core cuttings were sent to a radioactive disposal site in Colorado and to the Virginia Museum of Natural History, where they remain.[20] The uranium in the South Coles Hill deposit is made up of "fairly continuous shears and fractures;"[21] uranium in the North deposit is closer to the surface, and has a "disseminated . . . fairly uniform" dispersion of ore.[22]

B. The Uranium Mining Process

There are three main methods of uranium mining employed in the United States: open-pit, underground, and in-situ.[23] Open-pit mining, mostly used for uranium ore deposits less than 300 feet deep, involves removing the earth in a manner similar to open-pit mining for other minerals, using bulldozers, shovels, and other earth-moving equipment.[24] Prevalently used by the uranium mining locations in the Southwest United States, open-pit mines require the groundwater that accumulates to be pumped out, treated, and discharged into streams and rivers; this process

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[16] 2007 REPORT, *supra* note 9, at 9.
[17] *Id.*
[18] *Id.* at 9–10 (believing these estimates to be relevant and reliable, the author of the 2007 Report utilized these estimates in preparing the report for Virginia Uranium, Inc.).
[19] *Id.* at 4.
[20] *Id.* at 13.
[21] *Id.* at 25.
[22] 2007 REPORT, *supra* note 9, at 27.
[23] David Riccitiello et al., *Uranium Mining & Milling: A Primer*, THE WORKBOOK, Nov.–Dec. 1979, at 4, *available at* http://www.pecva.org/anx/ass/library/123/uraniummining milling-_primer1979.pdf [hereinafter *Uranium Primer*]; *see also* Virginia Uranium, Inc., Frequently Asked Questions, http://virginiauranium.com/faqs.php (last visited Dec. 22, 2009).
[24] *Uranium Primer*, *supra* note 23, at 4.

can affect groundwater availability and must be monitored to prevent contamination to the discharge waters.[25]

Underground mining, used in locations where the ore is more than 300 feet underground, involves driving tunnels through the underground ore deposits to create cave-like mines supported by pillars of the ore.[26] Underground mining also requires groundwater to be pumped to the surface, either for discharge or to be used as "mill process water."[27] After a section is fully mined, the area is often backfilled with the waste-products so that the ore pillars can also be mined.[28]

The third, and least often used form of uranium mining, is in-situ mining.[29] In-situ mining extracts the uranium "while leaving the host rock in place" by "pumping a leaching solution into the underground ore body, thereby dissolving the uranium into the leaching fluid."[30] This solution is then pumped to the surface, and the uranium is extracted.[31] The process continues until the uranium concentration in the solution becomes low enough to indicate that the ore has become depleted.[32]

Once the raw uranium ore has been extracted by any of the three methods detailed above, the uranium "milling" process begins.[33] In the uranium milling process, the ore is processed in order to create the final product of "yellowcake" uranium oxide (U_3O_8).[34] The milling process consists of blending, crushing, and grinding the ore and mixing the resulting product with water "to form a half liquid, half solid slurry."[35] Depending on the chemical makeup of the ore, especially its lime content, the slurry is mixed with either an acid or alkaline leaching solution and moved through a series of tanks that further remove the uranium from the remainder of the ore.[36] After several additional stages of filtration and

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[25] *See id.*
[26] *Id.*
[27] *Id.*
[28] *See id.*
[29] *Id.*
[30] *Uranium Primer*, *supra* note 23, at 5.
[31] *Id.*
[32] *Id.*
[33] Ronald H. Rosenberg, *Uranium Mining and Milling in Virginia: An Analysis of Regulatory Choice*, 4 VA. J. NAT. RESOURCES L. 81, 85 (1984).
[34] *Id.* at 83.
[35] *Uranium Primer*, *supra* note 23, at 5.
[36] *Id.*; *see also* Elizabeth V. Scott, Note, *Unfinished Business: The Regulation of Uranium Mining and Milling*, 18 U. RICH. L. REV. 615, 619 n.28 (1984) ("The proposed Pittsylvania mill will probably use an alkaline leach using sodium carbonate and sodium bicarbonate to dissolve the uranium oxide and separate it from the tailings.").

separation, the leaching solvent is removed and the final marketable product of yellowcake is dried and packaged into fifty-five gallon drums, weighing approximately 1000 pounds each.[37]

Uranium occurs in the natural environment in both U-235 and U-238 isotopes, although U-235 accounts for less than one percent of the naturally occurring uranium.[38] Nuclear fuel requires U-235, which is created from the yellowcake through a process called "enrichment," in which the uranium (in the form of U-238) is turned into a gas (uranium hexafluoride, UF_6) and then diffused through a porous membrane, resulting in a stream of U-235.[39] This method is called gaseous diffusion.[40] Whether produced through gaseous diffusion, or by other methods such as laser excitation or electromagnetic separation, the resulting enriched form of uranium oxide becomes the fuel used for commercial nuclear power plants.[41]

But, even with a supply of high-quality ore, at most four to five pounds of yellowcake are extracted per ton of ore, leaving the remaining mixture of ore, uranium, and solution, called mill "tailings,"[42] in need of disposal.[43] These tailings are recognized as posing a great potential threat to health and safety, because close to "eighty-five percent of the radioactivity in the original ore is present in the tailings in the form of unextracted uranium, radium, thorium, and other trace metals."[44] Additionally, high levels of "arsenic, molybdenum, lead, and selenium" are present in tailings.[45] These tailings are stored indefinitely in large above-ground earthen man-made reservoirs.[46] Problems associated with the long-term containment, disposal, and treatment of these toxic tailings provoke the most environmental concern.[47]

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[37] *Uranium Primer*, *supra* note 23, at 6.
[38] Rosenberg, *supra* note 33, at 86.
[39] *Id.*
[40] *See id.* at 86, 86 n.22.
[41] *Id.* at 86 n.22.
[42] *Uranium Primer*, *supra* note 23, at 7.
[43] Rosenberg, *supra* note 33, at 87.
[44] *Uranium Primer*, *supra* note 23, at 7.
[45] *Id.* at 7.
[46] *Id.* at 6. Such reservoirs are commonly referred to as "tailings ponds." *See, e.g.*, John D. Collins, *Reclamation and Groundwater Restoration in the Uranium Milling Industry: An Assessment of UMTRCA, Title II*, 11 J. NAT. RESOURCES & ENVTL. L. 23, 51–52 (1996) (describing a tailings pond embankment failure).
[47] *See infra* Part II.D.

C. Geography and Economics of the Surrounding Region

Pittsylvania County, the location of the Coles Hill sites, is the largest county in Virginia, comprising approximately 983 square miles.[48] To the south, the county borders North Carolina and the city of Danville—the former home of Dan River Inc., a major manufacturing company.[49] Since the mid 1800's, the local economy has been dominated by the textile industry and agricultural activities, most notably those related to tobacco.[50] But with the emergence of a globally competitive market, both the tobacco and the textile industries began to decline during the end of the twentieth century, with "precipitous declines" in the past ten years.[51] Dan River, Inc., which employed approximately 12,000 employees at its peak, downsized dramatically in the past fifteen years and was effectively eliminated by liquidation in April of 2008.[52] As a result, the region's unemployment has remained extremely high for much of the last decade.[53] In addition, the workforce is largely uneducated compared to commonwealth or national averages, with nearly a third (32.7%) of adults in Pittsylvania County over the age of twenty-five having less than a high school education.[54]

The non-tobacco agricultural economy of Pittsylvania County, however, has continued to do well in recent decades.[55] There are approximately 1,390 active farms in Pittsylvania County that engage in the production of

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[48] ECONOMIC COMPETITIVENESS REPORT, *supra* note 4, at 12. In comparison, the entire *state* of Rhode Island is only 1045 square miles. U.S. Census Bureau, State & County QuickFacts: Rhode Island, http://quickfacts.census.gov/qfd/states/44000.html (last visited Dec. 22, 2009).

[49] ECONOMIC COMPETITIVENESS REPORT, *supra* note 4, at 12, 16.

[50] *See id.* at 13.

[51] *Id.*

[52] *Id.* at 16.

[53] *See id.* at 15.

[54] *Id.* at 52. *Cf.* Kurt J. Bauman & Nikki L. Graf, EDUCATIONAL ATTAINMENT: 2000 3 (U.S. Census Bureau 2003), *available at* http://census.gov/prod/2003pubs/c2kbr-24.pdf (indicating that the national level of adults over twenty-five with less than a high school education is 19.6%).

[55] *See generally* Pittsylvania County Agricultural Development, www.pittcoagriculture.org (last visited Dec. 31, 2009) [hereinafter Pittsylvania County]; Pittsylvania County Agricultural Development, Farm Products Directory, http://www.pittcoagriculture.org/farmdirectory/ (last visited Dec. 31, 2009) (providing a list of crops grown in Pittsylvania County); AGRIC. MKTG. SERV., U.S. DEP'T OF AGRIC., STATISTICS FROM THE CENSUS OF AGRICULTURE: VIRGINIA: PITTSYLVANIA COUNTY, *available at* http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5056285 (showing recent growth in the amount of non-tobacco agricultural harvest, despite the decline in the amount of tobacco harvest).

crops, livestock, and dairy products.[56] The region has been actively working to promote and strengthen its agricultural economic base, with a county-wide Agricultural Development program,[57] farmer's markets,[58] and an anticipated construction of a five million dollar agricultural complex with an "indoor arena, offices, classrooms, and a banquet hall."[59] Crops grown within distance of the mining site include "tobacco, corn, wheat, [and] soybeans," and livestock consists primarily of beef cattle and swine.[60]

The physical characteristics that allow the Pittsylvania County region to be so productive agriculturally have also resulted in a significant population and large economy that would be directly affected by the operations of a uranium mine.[61] In contrast, the locations of other uranium mines in the country are all located in the sparsely populated areas of American west.[62] Virginia is unique among sites where uranium milling has been explored, or undertaken, because "it would be the first state to do so in a climate where rainfall exceeds evaporation and where many people would be exposed potentially to the resulting radiation in the water and air."[63]

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[56] PITTSYLVANIA COUNTY & DANVILLE NEWCOMERS AND VISITORS GUIDE 31 (Chatham Star-Tribune) (2009), *available at* www.chathamstartribune.com (follow "Newcomer's Guide '09" hyperlink) [hereinafter NEWCOMERS GUIDE].

[57] *See* Pittsvylvania County, *supra* note 55.

[58] *See, e.g.*, Va. Dep't of Agric. and Consumer Servs., Virginia Farmers' Markets, http://www.vdacs.virginia.gov/vagrown/frmsmkts.shtml (last visited Dec. 31, 2009).

[59] ECONOMIC COMPETITIVENESS REPORT, *supra* note 4, at 42.

[60] NEWCOMERS GUIDE, *supra* note 56, at 31. *See also* NAT'L AGRIC. STATISTICS SERV., U.S. DEP'T OF AGRIC., U.S. & ALL STATES COUNTY DATA—LIVESTOCK, http://www.nass.usda.gov (select "Livestock" or "Crops" from the pull-down menu titled "State and County Data"; select appropriate "data items," such as "Hogs & Pigs" or "Cattle and Calves"; select "1990" from drop down menu titled "From" and "2009" from drop down menu titled "To"; select "Virginia" as the "Primary Location" and "All Counties" as the "Secondary Location"; click "Add"; then click "Get Data"). In 2008, Pittsylvania County reported 50,200 head of cattle. *Id.* Of these, 21,600 were beef cattle and 5,800 were dairy cattle. *Id.* There were also close to 1,000 sheep. *Id.* According to the 1990 data (the last available year data was taken), 4,200 hogs and pigs were also reported. *Id.* Planted within the county's borders in 2007 were 47,000 acres of hay [yielding 61,200 tons], 1,700 acres of barley, 7,200 acres of corn for grain, and 4,600 acres of wheat. *Id.*

[61] *See* Pittsylvania County, *supra* note 55, at 25 (indicating the county population to be in excess of 60,000); *supra* notes 55–60 and accompanying text (discussing the county's agricultural production).

[62] See U.S. Nuclear Regulatory Comm'n, Locations of Uranium Recovery Facilities, http://www.nrc.gov/info-finder/materials/uranium/ (last visited Dec. 31, 2009) (listing the states with uranium mining and milling facilities as Wyoming, New Mexico, Nebraska, Texas, Colorado, and Utah); S.Doc. No. 15, *supra* note 2, at 21.

[63] *See* S.DOC. NO. 15, *supra* note 2, at 21 (dissent by Elizabeth H. Haskell, a member of the Uranium Administrative Group, to the Uranium Subcommittee/Uranium Administrative

Having provided a background of the surrounding area and history of the proposed mine location and uranium deposits, this Note now turns to the regulatory aspects of mining uranium in Virginia.

II. REGULATORY ASPECTS OF URANIUM MINING IN VIRGINIA

A. Virginia Mining Moratorium

The initial discovery and attempt to mine uranium by the Marline Corporation in the 1980's, and the ensuing public outcry in opposition to uranium mining, resulted in an initial one-year moratorium on uranium mining.[64] Meanwhile, the legislature established a subcommittee of the Coal and Energy Commission to determine "*if* and *how* uranium mining should be allowed."[65] After two years, multiple studies, and the creation of a new sub-group—the Uranium Administrative Group—the subcommittee determined that there was not enough information to determine how to safely regulate uranium mining at the time, and the moratorium was continued indefinitely.[66]

B. Regulation of Uranium Mining and Milling

Federal regulation of the materials and processes associated with nuclear energy originally began with the Atomic Energy Act of 1946[67].[68] The Atomic Energy Commission ("AEC") was given the responsibility of industry regulation, but the AEC was initially excluded from regulating uranium mining by wording in the statute that explained that the regulation did not apply to "source material prior to removal from its place of deposit in nature."[69] In 1978, Congress enacted the Uranium Mill Tailings Radiation Control Act[70] in order "[t]o provide for the disposal, long-term

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Group Report, which was included in the Report of the Virginia Coal and Energy Commission to the Governor).

[64] Scott, *supra* note 36, at 615–16.

[65] *Id.* at 616.

[66] *See id.*

[67] Atomic Energy Act of 1946, Pub. L. No. 49-585, 60 Stat. 755 (1946) (codified as amended at 42 U.S.C. §§ 2011–2296 (2006)).

[68] Rosenberg, *supra* note 33, at 92.

[69] Rosenberg, *supra* note 33, at 93 (citing 1946 Act § 5(b)(1)(4)).

[70] Uranium Mill Tailings Radiation Control Act of 1978, Pub. L. No. 95-604, 92 Stat. 3021 (1978).

stabilization and control of uranium mill tailings. . . ."[71] The amended Atomic Energy Act of 1954[72] expanded the AEC's reach to include regulatory and licensing authority over "source materials, special nuclear materials, and byproduct materials" such as uranium mill tailings.[73]

As the nuclear power industry and accompanying mining industry continued to grow, the states pressured the federal government for the right to regulate the nuclear activities occurring within their borders.[74] The Agreement State Program was created in 1959 in response to states' interests' in licensing and regulating areas of "public health and safety," which "fell within the traditional domain of state police powers."[75] There are several steps to becoming an Agreement State, a process utilized by the majority of states today.[76] First, the governor of the state must certify that the state is willing to "assume regulatory responsibility" for nuclear-related industries and materials.[77] The governor must also certify that the state is able to assume such regulatory responsibility and that they have "a program for the control of radiation hazards adequate to protect the public health and safety" of the state's citizens and environment.[78]

Virginia recently applied to become an Agreement State.[79] The formal application and accompanying paperwork were submitted to the Nuclear Regulatory Commission ("NRC") on June 12, 2008.[80] The application is limited to by-product materials, source materials, and non-critical quantities of special nuclear materials; according to the agreement application, the NRC would "discontinue certain regulatory authority" for those

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[71] United States Nuclear Regulatory Commission, Locations of Uranium Recovery Sites Undergoing Decommissioning, http://www.nrc.gov/info-finder/decommissioning/uranium/ (last visited Dec. 31, 2009).
[72] Atomic Energy Act of 1954, Pub. L. No. 83-703, 68 Stat. 919 (1954).
[73] *See id.* at 93–94. The definition of "source material," however, provided in § 11 of the Atomic Energy Act of 1954 (codified at 42 U.S.C. § 2014(z) (2006)), applies to already mined ore located at a milling site for processing, and not the mining process itself. *See id.* at n.63.
[74] *See* Rosenberg, *supra* note 33, at 96.
[75] *Id.*
[76] *Id* at 102.
[77] *See* 42 U.S.C. § 2021(d)(1) (2006).
[78] *Id.*
[79] Letter from Timothy Kaine, Governor of Virginia, to Dale E. Klein, Chairman of the U.S. Nuclear Regulatory Commission (June 12, 2008), *available at* http://www.nrc.gov/reading-rm/adams.html (follow "Web-based access" hyperlink; then follow "Begin ADAMS Search" hyperlink; then enter Accession Number "ML081720184" into search box, click "search" and scroll down to find matching Accession Number document).
[80] *Id.*

materials, and Virginia would assume regulatory authority.[81] After receiving a state's certification and application for Agreement State Status, the Nuclear Regulatory Commission must make several independent findings before bestowing Agreement State status for any aspect of regulation.[82] Most notably, the state's program must be "compatible" with the NRC's program, and must be at least as restrictive as the NRC's so that it protects "public health and safety."[83] Virginia, thus far, has rejected assuming regulatory authority for "the extraction or concentration of source material from source material ore and the management and disposal of the resulting byproduct material. . . ."[84] At this time, this essentially avoids commonwealth regulation of any uranium mining process such as those proposed for the Coles Hill site. Only the source material that has already left the mine in yellowcake form will be subject to commonwealth regulation.[85] Because the regulation of uranium mining in Virginia has not yet been assumed under an Agreement State application, any prospective uranium mines should be subject to the federal guidelines, both procedurally and substantively.[86] Given Virginia's current disclaimer of regulating the mining process, the regulatory framework applicable to the Coles Hill mining operation is, presently, best analyzed under the existing federal standards and procedures.

Under the federal regulatory process, any proposed uranium mining operation seeking approval to operate in Virginia must comport precisely with specific provisions of the Atomic Energy Act, and regulations issued pursuant to the Act, in order to receive a license from the NRC to mine the Coles Hill site or any other deposits.[87] This procedure includes public notice, hearings, and comments in a multi-step process that has the same minimum requirements at the state and federal level.[88]

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[81] *Id.*
[82] 42 U.S.C. § 2021(d)(2) (2006).
[83] *Id.*
[84] Letter from Timothy Kaine, *supra* note 79.
[85] *See* Rosenberg, *supra* note 33, at 94 n.63; Letter from Timothy Kaine, *supra* note 79.
[86] *See* Rosenberg, *supra* note 33, at 96 (explaining that the Agreement State Program requires a relinquishment of regulatory authority, not a delegation, by the federal government when a state becomes an Agreement State). Letter from Timothy Kaine, *supra* note 79 (explaining Virginia's Agreement State status application does not extend to mining and milling).
[87] 42 U.S.C. § 2133(a)–(b) (providing authority to issue licenses). *See generally id.* §§ 2091–2114 (outlining specific laws applying to source and byproduct materials).
[88] *Id.* § 2021(o)(1)–(3)(A). Because Virginia may eventually choose to regulate source products, the following discussion follows the statutory framework for state requirements

First, the NRC requires a written analysis of the impact on the human environment by any potential mine operation.[89] This written analysis must cover impacts to human health, impacts to the waterway and groundwater, and must also evaluate alternative sites and engineering methods.[90] Alternative sites for uranium mining, however, are not a foreseeable practicality at the Coles Hill site.[91] This analysis is also meant to address "long-term impacts, including decommissioning, decontamination, and reclamation impacts . . . including the management of any byproduct material."[92] Under the law, no "major construction" can occur in any uranium mining project before the written impact analysis is completed, made available to the public, and public proceedings have taken place.[93]

The NRC also requires that any byproduct material or land used for the disposal of byproduct material be transferred to the federal government if the government determines such a transfer is "necessary to protect the public health, welfare, and the environment from any effects associated with such byproduct material."[94] This applies to a filled-in mine site, land being used as a cover for dry tailings, tailings ponds, and remediation areas.[95]

The guidelines for long-term regulation of uranium mill tailings are set out in 42 U.S.C. § 2114 of the Act.[96] The standards for the treatment and storage of the tailings are designed to follow a cost-benefit analysis, with the risk to public and environmental health and safety balanced against "economic costs" and "other factors."[97] Although the standards are supposed to conform to those promulgated by the EPA, and be "comparable" to those under the Solid Waste Disposal Act[98],[99] judicial decisions addressing this issue have found *no* requirement that the NRC follow the EPA regulations, or seek EPA approval before changing the tailings treatment and storage standards at a uranium mine site.[100]

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which must be "compatible with the [NRC's] program for the regulation" and be approved by the NRC. *Id.* § 2021(d)(2).

[89] *Id.* § 2021(o)(3)(C).

[90] *Id.* § 2021(o)(3)(C)(i)–(iii).

[91] *See supra* Parts I.A , I.C (describing the Coles Hill deposits and the surrounding area).

[92] 42 U.S.C. § 2021(o)(3)(C)(iv).

[93] *Id.* § 2021(o)(3)(C)–(D).

[94] *Id.* § 2113 (b)(1)(A) & (b)(1)(B)(4).

[95] *See id.*; *see also id.* § 2014(e).

[96] *Id.* § 2114.

[97] *Id.* § 2114(a)(1).

[98] Solid Waste Disposal Act, 42 U.S.C. §§ 6901–6992 (2006).

[99] 42 U.S.C. § 2114(a)(2)–(3) (2006).

[100] *See, e.g.*, Envtl. Def. Fund v. U.S. NRC, 902 F.2d 785, 787, 790 (10th Cir. 1990) (holding

C. Regulatory Needs in Virginia's Environment

The environment of Virginia, and Pittsylvania County specifically, is vastly different from that of the southwest region of the United States, where all other uranium mines are located.[101] Most western uranium mines are located in sparsely populated areas, tribal lands, or government-owned land.[102] In contrast, the land surrounding the Coles Hills site is privately owned and the area is significantly more heavily populated.[103] The estimated population density of Virginia in 2008 was 197 persons per square mile, compared to other states with current uranium mines: Wyoming (five), Nebraska (twenty-three), Texas (ninety-three), Colorado (forty-eight), Utah (thirty-three), and New Mexico (sixteen).[104] The most crucial difference, however, is that of rainfall: in Virginia, unlike any other mine location, annual precipitation exceeds the annual evaporation.[105] Average annual precipitation at the Coles Hill site is forty-eight inches with monthly averages from 3.0–4.6 inches and is punctuated by thunderstorms accompanied by heavy rains during the summer months.[106]

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that the NRC's general requirements for "point of compliance and detection monitoring program[s]" for uranium mill tailings were not required to conform to EPA standards); *see also* American Mining Congress v. U.S. NRC, 902 F.2d 781 (10th Cir. 1990) (holding that the NRC could exempt a licensee from the requirement that uranium mill tailings ponds have a bottom liner); Envtl. Def. Fund v. U.S. NRC, 866 F.2d 1263, 1269 (10th Cir. 1989) (holding that, where the NRC allowed site-specific alternatives to the EPA's standard, the NRC did not need approval or even agreement from the EPA to approve licenses for uranium mill tailings disposal).

[101] *See infra* note 106 (comparing the Virginia environment to the environment of the American west); *supra* note 62 (listing states with uranium mining and milling facilities).

[102] *See* RADIATION PROT. DIV., OFFICE OF RADIATION AND INDOOR AIR, U.S. EPA, TECHNICAL REPORT ON TECHNOLOGY ENHANCED NATURALLY OCCURRING RADIOACTIVE MATERIALS FROM URANIUM MINING 2-4 to 2-7 (2008), *available at* http://www.epa.gov/rpdweb00/docs/tenorm/402-r-08-005-volii/402-r-08-005-v2.pdf.

[103] *See id.* at 2–4 (indicating that the federal government owns the land on which eighty-six percent of American uranium mines exist); U.S. Nuclear Regulatory Comm'n, *supra* note 62 (indicating the locations of western mines); U.S. Census Bureau, Cumulative Estimates of Resident Population Change for the United States, States, and Puerto Rico April 1, 2000 to July 1, 2008, http://www.census.gov/popest/gallery/maps/maps-state2008.xls (last visited Jan. 1, 2010) (showing Virginia has a higher population density than those states with uranium mining or milling facilities).

[104] *See* U.S. Census Bureau, *supra* note 103.

[105] *See* S.DOC. NO. 15, *supra* note 2, at 21.

[106] *See* 2007 REPORT, *supra* note 9, at 21. Average statewide annual rainfall from 1961–1990 was: Utah—11.86 inches; Colorado—15.47 inches; Nebraska—22.90 inches; New Mexico—13.85 inches; Wyoming—12.68 inches; and, Virginia—42.80 inches. *See also* U.S. Geological

D. Tailing Pond Risks and Examples

The risk of tailing pond failure is neither irrational nor unrealistically remote, given that many of the uranium mining and milling locations have experienced problems with tailings and groundwater restoration.[107] The most well-known of these occurred in 1979, when the embankment wall of a uranium tailings pond in Church Rock, New Mexico failed.[108] The tailings pond failure was described during congressional hearings on the issue as

> releasing 93 million gallons of contaminated liquid and 1,100 tons of hazardous solid waste into an arroyo [creek] near Church Rock, New Mexico. The radioactive and chemically dangerous materials were carried to the Rio Puerco . . . and about 20 miles into the state of Arizona, leaving contaminated residue over a distance of close to 100 miles.[109]

In comparison, 150 miles east of the Coles Hill site lies the outer bounds of the Chesapeake/Hampton Roads metropolis, located southeast of Petersburg and Richmond, Virginia.[110] Furthermore, the risk of a flood or tailings pond failure may be increased by the hydrologic conditions at Coles Hill.[111] Contamination of the underground and surface waters, as well as the area soil, could have a significant negative impact on agricultural programs in the area. The type of worst-case damage could well be similar to that of the tailings pond accident at Church Rock, which rendered the water supply for "three towns and an Indian Reservation . . . unsafe for drinking," and, in spite of the extensive, expensive remediation programs

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Survey, U.S. Dep't of the Interior, Precipitation of the Individual States and of the Conterminous States, http://www.nationalatlas.gov/printable/precipitation.html (follow "map list" hyperlink; then select appropriate map(s)) (last visited Jan. 1, 2010). Although the statewide average for Texas is 27.78 inches, the western half of the state, bordering New Mexico, receives, on average, less than twenty inches annually. *Id.*

[107] *See generally* John D. Collins, *Reclamation and Groundwater Restoration in the Uranium Milling Industry: An Assessment of UMTRCA, Title II*, 11 J. NAT. RESOURCES & ENVTL. L. 23 (1996) (describing a case study of problems with uranium mill tailings at Homestake Mill, Church Rock Mill, and Ambrosia Lake Mill in New Mexico, and Split Rock Mill, Gas Hills Mill, and Lucky Mill in Wyoming).

[108] *Id.* at 52.

[109] *Id.*

[110] *See* Google Maps, http://maps.google.com/maps?hi=en&tab=w1 (enter "Coles Hill, Virginia" and click "Search Maps") (last visited Jan. 1, 2010).

[111] *See supra* notes 105–06 and accompanying text.

over the past decades, created the possibility that the groundwater "may never be purified."[112]

III. POTENTIAL EFFECT OF URANIUM MINING & MILLING ON AGRICULTURE

A. Uranium Uptake via Agriculture

Based on current understanding of the risks and dangers of uranium mining, it is apparent that there are potential negative effects on the agricultural industry in the counties surrounding the Coles Hill site that need to be addressed. Most relevant to this Note is the risk of uranium, heavy metals, and related toxin exposure to crops–and especially livestock–that will enter the human food chain.[113] Exposure may occur in one or in a combination of ways. Contamination of the groundwater and aquifer is possible, especially if underground and deep-level mining is used.[114] Ore and uranium dust may also be transported through wind and a combination of weather systems.[115] The risk of soil, surface, and groundwater contamination through leakage, overflow, or other dysfunction of the long-term tailings ponds could have a potentially devastating impact on the local agriculture program, and warrants careful attention.[116]

The effect of uranium contamination can be spread beyond the immediate area through the concentration processes that occur while moving up the food chain: a serious concern for producers of commercially sold products & livestock.[117] Preliminary studies showed that "one of the

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[112] Scott, *supra* note 36, at 620–21.

[113] *See generally* Donald R. Rayno, *Estimated Dose to Man from Uranium Milling via the Beef/Milk Food Chain Pathway*, 31 THE SCI. OF THE TOTAL ENV'T 219 (1983) (examining quantities of potentially dangerous materials consumed by humans as a result of consuming beef and milk from herds fed on tailings contaminated foliage).

[114] *See Uranium Primer*, *supra* note 23, at 4–5, 7.

[115] *See id.* at 7.

[116] *See, e.g.*, Collins, *supra* note 107 , at 51–52. The impact of the Church Rock tailings pond failure was considered "the biggest single release of radioactive poisons on American soil" outside of the nuclear bomb tests. *Id.* at 52, *quoting* HARVEY WASSERMAN & NORMAN SOLOMON, KILLING OUR OWN: THE DISASTER OF AMERICA'S EXPERIENCE WITH ATOMIC RADIATION 147 (1982). Despite more than twenty years, millions of dollars spent on groundwater remediation from the contaminants, and placement of the Church Rock location as a Superfund site, the cleanup of the waterway has been deemed a failure. *See id.* at 53–55. The EPA has shifted its focus from remediation to simply changing the allowable contamination level to a set of new, higher, "Alternative Concentration Limits." *See id.* at 53–55.

[117] *See generally* Rayno, *supra* note 113 (examining quantities of potentially dangerous

major pathways of radiological exposure to man from uranium milling operations is through the beef/milk food chain."[118] Crops can become contaminated from nearby uranium mill tailings (containing not only U-238, but also other radionuclides and heavy metals such as thorium, radium, polonium, and lead) by two main pathways.[119] First, radionuclides can be absorbed by the roots of vegetation from soil and water sources contaminated by tailings.[120] Additionally, vegetation can be contaminated by "foliar deposition and subsequent foliar absorption of airborne radionuclides from tailings, ore, yellowcake, or particularites [dust] containing radon decay products."[121] Unfortunately, there do not appear to be any scientific studies on the rate or effects of such foliar exposure and absorption of these radionuclides.[122] Estimates of the uptake and absorption of radionuclides through root systems vary widely.[123] Given the variation in estimated plant intake of radionuclides, and the exclusion of foliar absorption as a factor, estimates have been made for concentrations in livestock grazing based on vegetation contaminated at the estimated rates.[124] Given an average intake of 18.1 kg (8.23 pounds) of vegetation by a grazing cow, uranium concentrations in such livestock would range from a minimum estimation of 2×10^5 to 5 pCi (picocuries)/L in milk, and 4×10^5 to 3 pCi/kg in meat.[125] Based on these factors and average estimated human consumption of milk and beef, individuals who lived in the vicinity of a uranium mill or used local food sources could potentially consume from

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materials consumed as a result as a result of consumption of beef and milk from herds fed tailings contaminated foliage).

[118] *Id.* at 219. This study was supported by the U.S. Department of Energy as part of the Uranium Mill Tailings Remedial Action Project in the early eighties. *Id.*

[119] *Id.* at 219–20. Relevant for and included in this discussion of uranium are all the toxic and radioactive metals found with uranium as part of the mining process and which remain in the tailings. *Id.*

[120] *Id.* at 220.

[121] *Id.*

[122] *See id.* at 223. A lack of such investigation is surprising in light of the extensive studies that have been done to explain the strong carcinogenic effect of tobacco smoking, which consistently find it is the very same foliar absorption of radon and radionuclides rising onto the underside of the tobacco leaves which caused their high resulting toxicity while being smoked. U.S. EPA, Radiation Protection: Tobacco Smoke, http://www.epa.gov/rpdweb00/sources/tobacco.html (last visited Jan. 2, 2010). In addition, a study at Los Alamos, New Mexico suggested that "resuspension of soil (by wind or rain splattering for example) could be an important agent of radionuclide transfer to plants through foliar deposition and possible subsequent incorporation into the plant tissue." *Id.* at 225.

[123] Rayno, *supra* note 113, at 223 (citing studies that showed uptake coefficients ranging from 10^5 to .2; such a wide variation indicates a need for extensive additional testing).

[124] *E.g.*, *id.*

[125] *Id.* at 226.

2×10^5 to 3 pCi each day from these food sources alone.[126] These numbers range from well below to nearly three times current average uranium intake.[127] Other foodstuffs with high uranium concentrations that would ostensibly be affected by the presence of uranium mill tailings in soil or water include root vegetables such as potatoes and turnips, shellfish, salt, fat, and oil.[128] In addition, these estimates are based on the initial soil and water levels being at the maximum allowable level under EPA guidelines, and not in violation of them.[129] The livestock uptake formula used to gauge the quantity being ingested also did not include drinking water as a source, which, in situations where uranium has contaminated drinking water, can account for a majority of uranium ingestion.[130] Even without these additional influences, "the maximum estimates for dose rates from beef/milk food-chain transport of tailings radionuclides in nearly all instances exceed those expected via a normal diet. . . ."[131]

Uranium exposure can come from air, soil, food, and water.[132] Background levels of exposure through air, for the general population, are extremely small—approximately .1ng/m^3.[133] Nearer to mines, however, background air level have been found 10 to 200 times higher, and elevated levels of airborne uranium have been measured at distances of up to eight miles from a mine site.[134] Because windborne soil and particles adhere to vegetation and foliage in varying amounts, both direct human consumption of exposed vegetation as well as consumption of livestock that have grazed exposed vegetation may result in increased levels of uranium and other heavy metals.[135] The few studies done thus far on this topic resulted in a wide range of intake and absorption, and emphasize the need for additional studies to provide a more accurate picture.[136]

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[126] *Id.*
[127] *Id.* at 226–27 (giving an estimated average dietary intake of uranium from background sources ranging from .7 to 1 pCi per day).
[128] *Id.* at 227.
[129] Rayno, *supra* note 113, at 228.
[130] *Id.* at 233. *See also*; J.K. FAWELL ET AL., URANIUM DRINKING-WATER: BACKGROUND DOCUMENT FOR DEVELOPMENT OF WHO "GUIDELINES FOR DRINKING-WATER QUALITY" 3 (2005), *available at* http://www.who.int./water_sanitation_health/dwq/chemicals/uranium 290605.pdf.
[131] Rayno, *supra* note 113, at 233.
[132] *See* Doug Brugges, Jamie de Lemos & Beth Oldmixon, *Exposure Pathways and Health Effects Associated with Chemical and Radiological Toxicity of Natural Uranium: A Review*, 20 REVIEWS ON ENVTL. HEALTH 179–82 (2005).
[133] *Id.* at 180.
[134] *Id.*
[135] *See generally* Rayno, *supra* note 113, at 221–22, 224.
[136] *See, e.g.*, Brugges et al., *supra* note 132, at 181.

Average human consumption of uranium from food ranges from 1.0–1.4 μg per day.[137] Highest concentrations of uranium are found in root vegetables, such as potatoes and onions, and in beef products.[138] An analysis of beef products coming from areas near uranium mines shows that the concentration of uranium varies by the type of tissue: livers and kidneys of exposed cattle have "approximately 4 times" higher concentrations of uranium than cattle not located near a mine, while leg bones of exposed cattle contain "13 times more uranium" than unexposed cattle.[139] But importantly, the "muscle tissue of unexposed control and exposed cattle were indistinguishable."[140] Even greater variations in uptake have been found in vegetation, where the concentration ranges from .004 pCi/g at a control site, to .3 pCi/g on lands close to uranium mines.[141] These coefficients are particularly pressing in light of the fact that the combination of agricultural setting and higher poverty rates in the region surrounding the proposed Coles Hill mine[142] may result in a higher-than-average proportion of residents consuming locally grown rather than store-bought meat and produce.

Soil is also a vehicle for the deposition of uranium, whether transported through means of wind or water.[143] When indirect consumption through food products, such as livestock, is included, water is the primary source of uranium ingestion.[144] Yet, there is significant professional discord on the maximum safe concentration of uranium in drinking water:

> The World Health Organization (WHO) has proposed a provisional health based guideline of 2 μg/L of uranium in drinking water based on a lowest observed adverse effect level (LOAEL) of 60 μg/L . . . . [t]he U.S. EPA adopted an MCL [maximum contaminant level] of 30 ug/L for uranium in drinking water. The initial proposed standard was 20 μg/L, but a cost benefit analysis of a 20 μg/L MCL suggested that the benefits did not justify the costs. The 2003 ruling applies only to community water systems (CWS) and estimates that approximately 500 CWS will have to mitigate

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[137] *Id.* at 180–81 (citations omitted).
[138] *Id.* at 181.
[139] *Id.*
[140] *Id.*
[141] *Id.*
[142] *See supra* notes 49–54 and accompanying text.
[143] Rayno, *supra* note 113, at 225.
[144] Fawell et al., *supra* note 130 , at 2–3.

> for uranium. The U.S. EPA reference dose (RfD) for daily oral exposure to uranium is 3 μg/L, 10 times lower than the established MCL, and agrees with the health based WHO guideline.[145]

It is important to remember that the amount of uranium ingested does not equate with the amount of uranium absorbed into the body.[146] "[E]xposure to natural uranium almost always involves concurrent multiple exposures to other toxic materials," however, and those materials may have different rates of absorption and uptake.[147]

B. Health Risks Associated with Uranium Mining and Milling

There is substantial medical research showing the "deleterious impact" of uranium on human health, due to both its "radioactive and heavy-metal chemical properties."[148] Absorption and inhalation of uranium "leads to malignant and non-malignant respiratory diseases, stomach and kidney cancer, kidney failure, and leukemia."[149] In addition, emerging animal studies research shows that uranium may be an "endocrine-disrupting chemical," mimicking estrogen, which leads to "increased risk of fertility problems and reproductive cancers" for both the mother and developing fetus, even at levels *below* the EPA maximum.[150] This Note will not attempt to resolve the ongoing medical and scientific debate about what forms and levels of uranium absorption, if any, are safe. Instead, this Note is based on the premise that any measurable concentrations of uranium higher than naturally occurring levels may be publically perceived

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[145] Brugges et al., *supra* note 132, at 182 (μg represents a microgram; there are one million micrograms in a gram)*; see also* PATRICK S. UDEH, A GUIDE TO HEALTHY DRINKING WATER 513 (2006) (stating that approximately .8 picocuries is equal to about 1.5 micrograms, thereby illustrating a conversion ratio of approximately .53 picocuries to 1.0 micrograms).
[146] *See* Brugges et al., *supra* note 132, at 182–83. The article notes that from 1–1.5% of uranium appears to remain absorbed in the body over the long term, in comparison with an approximate eighty percent absorption rate for lead. *Id.* at 182. But absorption rates are thought to be tremendously greater in infants, who have intestines that are "more permeable than [those] of adults because infants must absorb immunity factors, such as antibodies, from the mother's milk." *Id.* at 183.
[147] *Id.* at 190.
[148] Stefanie Raymond-Whish et al., *Drinking Water with Uranium Below the U.S. EPA Water Standard Causes Estrogen Receptor-Dependent Responses in Female Mice*, 115 ENVTL. HEALTH PERSPECTIVES 1711, 1711 (2007).
[149] *Id.*
[150] *Id.* at 1711, 1715.

as a health risk. It proposes solutions designed to satisfy both the need for a public perception of safety and whatever actual safety risks there may be resulting from nearby agricultural production.

C. Public Perception of Health and Safety Risks

The agricultural industry is often influenced as much by the public's perception of safety risks as the reality of the actual chance of a risk to health.[151] Given the general, extremely negative health and safety connotations associated with uranium mining for public opinion, it is likely that the United States Department of Agriculture ("USDA") and the commonwealth's equivalent, the Virginia Department of Agriculture and Consumer Services ("VDACS"), will address the health and safety issues of agricultural products coming from areas extremely close to a uranium mine.[152] This would not be the first time the USDA would be required to respond to the public perception of a threat, rather than the threat itself.[153]

One incident that reveals the expansive scope of preventative measures that the USDA may take was the discovery of a single cow with Bovine Spongiform Encephalopathy ("BSE," more commonly known as "Mad Cow Disease") in December of 2003.[154] Although an earlier rule was already in place that prevented the use of brains, spinal cords, and eyes, the only portions of a cow considered to be at risk for transmission of BSE; in producing food for other ruminants, the mere appearance of a potential health risk created a massive recall of any products that could have contained any byproduct from the infected animal.[155] By the time all rendered products, which could have possibly contained material from the infected animal, had been included, "approximately 2,000 tons" were recalled.[156]

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[151] *See* Linda Calvin, *Outbreak Linked to Spinach Forces Reassessment of Food Safety Practices*, AMBER WAVES: THE ECON. OF FOOD, FARMING, NAT. RESOURCES, AND RURAL AM., June 2007, at 29–31.

[152] *See infra* note 169 and accompanying text (explaining the role of the USDA and VDACS in regulation of agricultural products in Virginia).

[153] *See, e.g.*, Calvin, *supra* note 151 (discussing the long-term effects on bagged spinach from an isolated E. coli outbreak). *See also* Consumer Survey on the Impact of Perceptions of the 2006 Spinach Recall on Current Spinach Consumption, 73 Fed. Reg. 26,998 (May 12, 2008) (describing a planned FDA study).

[154] John F. Scheid, *BSE Cow in U.S. Triggers FDA, USDA Cooperative Response, New Rules Announced*, 19 FDA VETERINARIAN: CENTER FOR VETERINARY MED. (John F. Scheid, ed.) Jan.–Feb. 2004, at 1.

[155] *Id.*; Thomas O. McGarity, *Federal Regulations of Mad Cow Disease Risks*, 57 ADMIN. L. REV. 289, 302 (2005).

[156] Scheid, *supra* note 154, at 1.

The USDA takes prevention of the sale of contaminated agricultural products seriously. In the spring of 2009, the USDA recalled almost 400,000 lbs of beef from a single company, in a two-week period, as a potential source point of an E. Coli contamination.[157] This was in response to *just 23* reported illnesses of E. coli.[158] To put that quantity in perspective, for the entire year of 2008, all of Pittsylvania County reported only 21,600 head of beef cattle.[159] It is not unreasonable to conclude that, if the USDA determined livestock exposed to increased levels of uranium and heavy metals from a uranium mine posed a threat to consumer health or safety, they may well prevent all such products from being sold commercially. Such a decision would produce a devastating and likely fatal blow to the region's agricultural economy.

Public perception of risk can also have a huge effect on the national retail performance of a particular type of agricultural product, as shown by the 2006 recall of bagged spinach.[160] Although the outbreak of e. coli, which led to a recommendation that fresh bagged spinach not be eaten, was resolved and traced to a single farm within eight days, the recall had a significant dampening effect on the national demand for spinach.[161] The contaminated spinach had been linked to a single location and a single day's worth of processing on one 2.8-acre field.[162] Nearly half a year after the outbreak was contained and spinach was declared safe, the national "value of retail sales of bagged spinach was still down 27 percent from the same" time period the year before the outbreak.[163] The public perception of a health risk, even when no such risk exists and reassurances have been given by the appropriate authorities, can have a significantly devastating impact on the overall sales, price, and consumption of an agricultural product.

The fragility of public confidence extends beyond bacteria and disease to the perceived risks of radioactivity from nuclear activity.[164]

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[157] Center for Disease Control and Prevention, Multistate Outbreak of *E. Coli* 0157:H7 Infections Associated with Beef from JBS Swift Beef Company, http://www.cdc.gov/ecoli/2009/0701.html (last visited Jan. 2, 2010).
[158] *Id.*
[159] *See* NAT'L AGRIC. STATISTICS SERV., *supra* note 60, 203.
[160] *See* Calvin, *supra* note 151, at 25, 29.
[161] *See id.* at 27–28; Consumer Survey on the Impact of Perceptions of the 2006 Spinach Recall on Current Spinach Consumption, 73 Fed. Reg. 26,998 (May 12, 2008).
[162] Calvin, *supra* note 151, at 28.
[163] *Id.* at 29.
[164] *See* Gerald M. Ward, *Recent Research Involving the Transfer of Radionuclides to Milk*, 72 J. OF DAIRY SCIENCE 284, 285 (1989) (describing government precautions regarding milk products following the Three Mile Island nuclear accident).

The reactor accident at Three Mile Island, Pennsylvania in 1979 resulted in increases in the level of radionuclides in the milk of nearby dairy cattle, though not above the EPA's maximum safe amounts.[165] Although the EPA declared that there was no risk of contamination, "public apprehension adversely affected milk consumption" for some time.[166]

After the Three Mile Island accident, and the Chernobyl accident of 1986, the public's fear of the processes surrounding nuclear energy, including uranium mining, has continued to grow.[167] Such attitudes are likely to carry over to the public's willingness to accept products they consider to be associated with a uranium mining and milling site. This is an as-yet unaddressed problem, given the conspicuous absence of uranium mining and milling facilities from populated, agriculture-intensive areas.[168] Appropriate regulation is required to address both the actual health risks and the public perception and fear of health risks associated with uranium mining, to avoid similar negative outcomes for Virginia's agricultural products.

IV. REGULATION OF AGRICULTURAL PRODUCTS

A. Regulatory Organization Structure

Livestock products processed in state plants in Virginia are regulated and inspected for food safety by VDACS, the commonwealth-level equivalent of the USDA.[169] The Virginia Meat and Poultry Inspection Program "is administered by the [VDACS], and [is] granted authority under the Code of Virginia. . . ."[170] The commonwealth program "verifies and enforces regulatory requirements at 14 inspected facilities, including 5 slaughter/processing facilities, 9 processing facilities, and 95 custom exempt establishments . . . [a]dditionally, VDACS provides inspection to

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[165] *Id.*
[166] *Id.* at 286.
[167] *See, e.g.*, Thibodeau, *supra* note 2 (describing concerns about the health effects of mining uranium in Pittsylvania).
[168] *See supra* Part II.C.
[169] 2 VA. ADMIN. CODE Agency Sum. (2009)*; see also* 2 VA. ADMIN. CODE § 5-210-10 (adopting USDA regulations for intrastate transactions); FSIS DIRECTIVE 5720.2, Revision 3, dated 11/16/2004 (outlining requirements for Food Safety and Inspection Service ("FSIS") assistance in state development of inspection programs).
[170] OFFICE OF PROGRAM EVALUATION, ENFORCEMENT, AND REVIEW, FSIS, U.S. DEP'T OF AGRIC., ANNUAL COMPREHENSIVE REVIEW AND DETERMINATION REPORT: VIRGINIA 2 (2009) [*hereinafter* ANNUAL REVIEW].

36 facilities in the Federal State Cooperative Agreement Inspection Program."[171] Virginia is an Agreement State under the Federal Meat Inspection Act, which authorizes the USDA to contract with VDACS to provide enforcement of regulations equivalent to federally mandated USDA standards in the federal meat inspection plants throughout Virginia.[172] Within VDACS is the Office of Meat and Poultry Sciences ("OMPS"), which directly handles the inspection of meat products in Virginia plants.[173] Just as VDACS is the commonwealth equivalent of the USDA, OMPS is the commonwealth equivalent of the federal Food Safety Inspection Service ("FSIS") within the USDA.[174] The responsibilities and duties of OMPS and FSIS employees are identical, as are the regulations they follow.[175] Inspection plants are either strictly staffed by federal FSIS employees, or commonwealth OMPS employees, as required by the Federal-State Cooperative Act,[176] and the responsibilities and duties of the OMPS and FSIS employees are identical, as are the regulations they follow.[177] The labels, inspection legend, and destination options for products coming from either type of plant are also identical.[178]

B. Procedures

Virginia adopted the corresponding sections of the Code of Federal Regulations for the Virginia Meat and Poultry Inspection Act.[179] All livestock is examined both the day before slaughter, and on the day of slaughter, while still alive, for visible illness, disease, or other health issues.[180]

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[171] *Id.* (footnotes omitted).
[172] *Id.* at 1, 2 n.2 ("Facilities operating under the Federal State Cooperative Agreement Inspection Program (FSCIP), also known as Talmadge-Aiken plants or cross-utilization facilities, are under Federal inspection, but operate with State inspection personnel.").
[173] 2 VA. ADMIN. CODE § 5-210-20*; see also* VDACS, Regulatory Services, http://www.vdacs.virginia.gov/meat&poultry/index.shtml (last visited Jan. 2, 2009).
[174] 2 VA. ADMIN. CODE § 5-210-20 to 30 (adopting federal regulations); ANNUAL REVIEW, *supra* note 170, at 1–2.
[175] 2 VA. ADMIN. CODE § 5-210-20 to 30.
[176] Federal-State Cooperative Act, 7 U.S.C. 450 (2006).
[177] *See generally* FSIS DIRECTIVE, *supra* note 169.
[178] *See* 2 VA. ADMIN. CODE § 5-210-30 (adopting all relevant FSIS regulations).
[179] *Id.*
[180] Ante-Mortem Inspection, 9 C.F.R. § 309.1 (2009). Animals that are considered ill, are non-ambulatory, or have tested positive for tuberculosis or several other specific diseases are classified as "U.S. Suspect[s] [sic]" and are slaughtered separately from the remainder of livestock. *Id.* § 309.2. Where the disease or condition of the animal is serious enough, it must be classified as "Condemned," and disposed of by approved

In addition, livestock "suspected of having biological residues," defined as "livestock suspected of having been treated with or exposed to any substance that may impart a biological residue which would make the edible tissues unfit for human food or otherwise adulterated" are taken out of the slaughter process until either "metabolic processes have reduced the residue sufficiently to make the tissues fit for human food and otherwise not adulterated," or they are disposed of separately.[181]

Immediately following slaughter, "[a] careful post-mortem examination and inspection" is "made of the carcasses and parts thereof of all livestock slaughtered at official [USDA and VDACS] establishments."[182] Each carcass is visually examined by either a single inspector or a team with one inspecting the head and lower carcass, and another inspecting the viscera and upper carcass.[183] "The head, tail, thymus gland, and" viscera (internal organs) of each "animal to be used in the preparation of meat food products or medical products" are identified with the carcass from which they came, until the entire inspection procedure is completed.[184]

The visual inspection looks for visible disease symptoms, as well as lesions or contamination on the carcass, such as fecal matter or pus; animals which fail the inspection are labeled as "U.S. Retained" and the carcasses or portions which cannot be redeemed are marked "U.S. Inspected and Condemned" and disposed of separately.[185] A visible inspection would likely not reveal uranium presence unless the livestock had already become ill through excessive exposure.[186]

The directed sampling procedure also neglects to address uranium and heavy metal buildup in livestock tissue.[187] To determine whether livestock have antibiotic residues, which could have been used for treatment of disease by a producer prior to slaughter, a test for those residues is

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methods. Post-Mortem Inspection, *Id.* § 310.5.

[181] *Id.* § 309.16.

[182] *Id.* § 310.1(a).

[183] *Id.* § 310.1(b)(2).

[184] *Id.* § 310.2(a).

[185] *Id.* §§ 310.2–.4.

[186] While no studies directly addressing this issue could be found, given that safe quantities of uranium within organs are measured in micrograms, *see, e.g.*, Brugges et al., *supra* note 132, at 185 (discussing kidneys), it is unlikely visual inspection would reveal dangerous contamination.

[187] *See* 2 VA. ADMIN. CODE § 5-210-30 (2009) (describing CFR sections adopted). None of the adopted C.F.R. sections, including Ante-mortem Inspection, 9 C.F.R. Part 309 and Post-mortem Inspection, 9 C.F.R. Part 310, cover this type of testing. *See* 9 C.F.R. Subchapter A.

carried out for livestock: labeled as "U.S. Suspect," that have any signs of treatment or disease, that come from a producer whose other livestock have recently tested positive, and that appear healthy but are selected in accordance to a set sampling schedule.[188] The inspection process also tests for the presence of E. coli, a bacteria that can cause food poisoning, illness, and death in humans.[189] Samples are taken from the flank, brisket, and rump, and for swine, from the ham, belly, and jowl, and are taken at a frequency of a minimum of one test per 300 livestock carcasses, although one test per 1000 swine carcasses is allowed.[190] Tests for several other specific diseases are also conducted; however, at this time, no tissue is sampled for buildup of heavy and toxic metals or radiation at either USDA or VDACS plants.[191]

The lack of any regulatory process to deal with the potential contamination that a nearby uranium mine could create for commercial livestock is a major gap that will need to be addressed if the uranium moratorium in Virginia is lifted and uranium mining begins. The lack of regulation affects both the actual potential for harm to health and safety, and the public perception of risk of harm to health and safety.

V. POTENTIAL REGULATORY SCHEMES FOR AGRICULTURAL PRODUCTION

There are several possible means of addressing the risk to agricultural productions, both in terms of actual health and safety effects, as well as the public perception of such risks.

A. Continue the Uranium Mining Moratorium

From a purely agricultural perspective, continuing the moratorium on mining for the indefinite future would be the safest and most beneficial approach, given that the presence of a mine would seem to result only in risks and no foreseeable benefit for agricultural producers.

There is currently strong opposition to uranium mining from individuals, community organizations, and local governments in Virginia.[192]

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[188] 9 C.F.R. § 310.21.

[189] *Id.* § 310.25. "E. coli" is the commonly known name for Escherichia coli Biotype one. *Id.*

[190] *Id.* § 310.25(a)(2)(ii)–(iii).

[191] *See* ANNUAL REVIEW, *supra* note 170, at 7 (generally describing the diseases for which VDACS has developed testing procedures).

[192] *See* Ray Reed, *Hundreds Show Up for Uranium Mining Study Hearing*, THE LYNCHBURG NEWS & ADVANCE, Jan. 6, 2009. ("[S]peakers urged the panel to make sure

This opposition stems from a variety of concerns, including agriculture, human health and safety, economic concerns, as well as concerns over long-term contamination.[193] Indeed, even members of the Coal and Energy Commission subcommittee studying the bill have voiced opposition to lifting the moratorium.[194] In addition to the opposition by constituents and organizations, in 2008 the General Assembly chose not to pass a bill which would have established a subcommittee to study uranium mining in Virginia.[195] Elected lawmakers may be understandably hesitant about playing a role in allowing a process which carries risk of long-term, essentially permanent, harmful contamination[196] before the information and technology surrounding the process has been improved. The same public perception of the risks associated with uranium mining that present a threat to agricultural products from the area are potentially strong enough to prevent the moratorium from being lifted on uranium mining at all. It would appear that, for the agricultural sector, although only one factor in the overall cost/benefit analysis of uranium mining, the costs do outweigh the benefits, and this sector would best be served by continuing the moratorium on uranium mining. The presence of a uranium mine does not appear to provide any added benefits for agricultural production, and,

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scientists in the study take a close look at mining's impact on water and air quality, the health of nearby residents and the economic benefits versus negatives of having a mine in Pittsylvania County.").

[193] *See id; see also Proposed Uranium Mine Spurs Resolution*, THE VIRGINIAN-PILOT, Dec. 3, 2008, http://hamptonroads.com/2008/12/proposed-uranium-mine-spurs-virginia-beach-resolution (last visited Jan. 6, 2010) (describing the Virginia Beach City Council's adoption of a resolution opposing mining in Pittsylvania County, based on concerns that contamination from the uranium mine could contaminate Lake Gaston, which serves as the water source for the City of Virginia Beach).

[194] Reed, *supra* note 192 ("When the Virginia House of Delegates' Rules committee killed a bill last March that would have authorized the uranium study, [Delegate] Abbitt [a member of the study committee] played a key role in its defeat, saying that little had changed in mining methods since Virginia adopted a uranium moratorium in the mid-1980s.").

[195] Virginia General Assembly Legislative Information System, SB 5252 Uranium Mining Commission, http://leg1.state.va.us/cgi-bin/legp504.exe?081+sum+SB525 (last visited Dec. 21, 2009). SB 525 was proposed by Senator Frank Wagner and designed to establish a subcommittee to study the risks and benefits of allowing uranium mining in Virginia. *Id.* The bill passed the Senate by a vote of 36-Y, 4-N, but was tabled in the House of Delegates by a voice vote on March 3, 2008. *Id.* The current uranium mining study commission was authorized by the Virginia Coal and Energy Commission without a legislative vote. Virginia Commission on Coal and Energy: Nov. 6, 2008 Meeting Summary, http://dls.state.va.us/GROUPS/cec/110608/sm110608.pdf (last visited Jan. 3, 2009).

[196] See *supra* Parts II.D, III.B.

based on both science and social stigma, has the potential to result in a crippling of the local agricultural economy.[197]

Given the financial and political resources Virginia Uranium, Inc. utilized on behalf of a uranium mining study by the commonwealth, it is unlikely that the issue will entirely disappear.[198] In 2008, Virginia Uranium employed fifteen lobbyists for "matters relating to establishment of a regulatory program controlling development of Virginia's uranium resources."[199] The agricultural industry of Southern Virginia is but one factor among many which will determine whether and when uranium mining begins in Virginia; but, in light of the overall political and economic context, it is unlikely that Virginia's uranium moratorium will last forever. Although it would be more beneficial for agricultural interests to wait until uranium recovery and byproduct waste management technology develop to a more efficient level, such a decision is ultimately a political one. Accordingly, the remainder of regulatory proposals assume that uranium mining in Southern Virginia will become a reality.

B. Halt Agricultural Production

On the other end of the spectrum of possibilities is fully protecting public health and consumer confidence in agricultural products by enacting a prohibition against commercial sale of agricultural products in those areas which may be affected by dust, water, soil, and tailings contamination from a uranium mine. This proposal would likely have the most positive benefit on consumer safety and confidence, but it has several drawbacks that make it less than ideal from an agricultural perspective. Southern Virginia has already endured the systematic decimation of the area's main crop, tobacco, at the end of the twentieth century as a result of the settlement between the states and the major tobacco product manufacturers across the county.[200] Because there is no longer any significant market for the tobacco grown in Virginia, nearly all previous tobacco farmers receive

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[197] *See supra* Part III.

[198] John Crane, *Report Tackles Lobbying Efforts*, DANVILLE REGISTER & BEE, Nov. 23, 2008, http://www2.godanriver.com/gdr/news/local/danville_news/article/report_tackles_lobbying_efforts/7613/ ("Virginia Uranium Inc. paid nearly $100,000 to lobbyists during its efforts to get the General Assembly to approve a study to determine the safety of uranium mining in the commonwealth [sic]." (internal citation omitted)).

[199] *Id.*

[200] *See* Blackwell, *supra* note 5*; see also* Virginia Tobacco Indemnification and Community Revitalization Commission Promoting Economic Development in Virginia's Tobacco Region, http://www.tic.virginia.gov (last visited Jan. 3, 2010).

payments from the Virginia Tobacco Indemnification and Community Revitalization Funds.[201] Indeed, the amount budgeted to be paid out to Virginia tobacco farmers under the Tobacco Settlement for 2009 alone is over twenty *million* dollars.[202] It is also reasonable to conclude that many of the prior tobacco farmers have entered into or enlarged livestock operations as a response to the tobacco settlement.[203] Ending all commercial agricultural production would likely toll the death knoll for the long-term economy of Southern Virginia. Agricultural production, unlike many other career choices, requires a large up front investment in equipment, land, and production materials.[204] In addition to placing thousands of individuals in unemployment,[205] such an action would most likely heavily depress the property values of the area—values that have been primarily based on agricultural production, and which represent the lifetime investments and savings of many farmers and which, following a uranium mining operation, would be unlikely to attract other professional businesses.[206] Given that the estimated length of time for a uranium mining operation to fully deplete the Coles Hill site is approximately thirty years,[207] but agricultural restrictions from contamination would have to be held indefinitely, it is difficult to imagine that elected officials would be comfortable allowing the economy of a region to come to a close under such circumstances.

There are also logistical difficulties that would need to be addressed if the USDA, or a related agency, decided to prohibit marketing of agricultural products from near the uranium mine in the commercialized

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[201] *See* Blackwell, *supra* note 5*; see also* VA. CODE ANN. § 3.2-3108 (2009) (explaining how the fund is disbursed).

[202] Virginia Tobacco Indemnification and Community Revitalization Commission: Fiscal Year 2009 Proposed Budget, *available at* http://www.tic.virginia.gov/pdfs/aboutus/FY09ApprovedBudget.pdf (last visited Jan. 3, 2009).

[203] *See* NAT'L AGRIC. STATISTICS SERV., *supra* note 60, 203. NASS statistics show that prior to and including 2001, Pittsylvania County reported head of cattle somewhere in the thirty thousands range annually; that number hit forty thousand, for the first time (and permanently), in 2002 and was at fifty-four thousand in 2008, the most recent year for which statistics are available. *Id.*

[204] *See* Nat'l Agric. Statistics Serv., U.S. Dep't of Agric., Farm Production and Expenditures: Total and Average per Farm by Year, U.S., http://www.nass.usda.gov/Charts_and_Maps/Farm_Production_Expenditures/arms3chtl.asp (last visited Jan. 4, 2010) (showing average expenditures per farm in 2008 totaled in excess of $135,000).

[205] *See* NAT'L AGRIC. STATISTICS SERV., *supra* note 60, 203 (indicating that Pittsylvania County had 1304 farms in 2002, many of which can safely be assumed to have employed more than one person).

[206] *See* Duncan Adams, *State of Mine*, ROANOKE TIMES, Jan. 11, 2008, http://www.roanoke.com/news/roanoke/wb146611.

[207] *Id.*

market. Most notable of these is the determination of where the physical or geographic line that separates the prohibited farmland from the safe farmland would be.[208] Because the tailings from uranium mining may be spread both through the air, water runoff and flooding, and contamination of underground water supplies, it would be difficult to delineate substantively where contamination would no longer be considered a threat, both scientifically, and through the public conscience.[209] There would also need to be scientific studies in place to determine the effects on the containment of potential toxins of the weather systems Virginia experiences such as hurricanes, regular seasonal wet and dry seasons, and tornadoes.[210] Finally, there would need to be serious legal consideration of whether such a regulation would amount to a taking of private property by the government, and what, if any, compensation would be available for those deprived of their investments and property use.[211]

C. Bonding Requirement for Mining Companies

An additional option would be to require preemptive bonding of any company that would operate a mine in Virginia, in an amount sufficient to cover the possible damage to the area's agricultural viability, as a condition for obtaining a mining license. There would be several advantages to instituting a bonding requirement as a condition for licensure. A large enough bond requirement would operate as a sort of economic insurance policy for agricultural productions in the area surrounding a uranium mine. A bond could operate as an upfront payment placed in an interest-bearing account by a mining company. If livestock produced within a certain distance of the uranium mine became unable to be used for consumption, or became fully unmarketable, the bond money could be used to replace the income lost by such producers for a set period of time. In order to be effective, payment would have to be based on the safety and marketability of

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[208] *See generally* Brugges et al., *supra* note 132, at 181–82. Studies show that elevated airborne levels of uranium and tailings materials are reliably found up to 8 miles from the sites, in locations where testing has been done. *Id.* at 180. But, the studies are extremely sparse and geographically-specific, and additional studies need to be done to provide an accurate picture of any location. *Id.* at 177, 179–82.

[209] *See id.*

[210] *See generally supra* notes 106–10 and accompanying text; Bruce P. Hayden & Patrick J. Michaels, *Virginia's Climate*, UNIV. OF VA. CLIMATOLOGY OFFICE, http://climate.virginia.edu/description.htm (last visited Jan. 4, 2009).

[211] A full discussion of the takings issue is beyond the scope fo this discussion. For a detailed takings overview, see generally STEVEN J. EAGLE, REGULATORY TAKINGS (Michie 1996).

the livestock, and not on the safety of operations in the mine, as experience has shown that even those mines which are operating according to plan can potentially contaminate the surrounding areas.[212]

The idea that "any applicant for a uranium mill license must establish financial surety arrangements adequate to assure (1) decontamination and decommissioning of the mill and mill site to levels which would allow unrestricted use of these areas and (2) reclamation of tailings and other wastes in accordance with applicable NRC regulations" is not new.[213] A similar funding program played out as a product of the Tobacco Master Settlement Agreement in lieu of continued tobacco production in the region.[214]

Unfortunately, there are also significant challenges and disadvantages to a financial bonding system. The greatest obstacle to a bonding system is determining an appropriate measure of damages to bond.[215] It is unlikely that a bonding amount would be equal to a "worst-case" scenario; the previous evaluation of uranium mining in Virginia noticeably underemphasized, or fully ignored potential risks in their cost-benefit analysis.[216]

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[212] *See generally* Brugges et al., *supra* note 132, at 177 (indicating that higher levels of uranium exposure may occur in communities surrounding mine sites, even when these sites are functioning properly).

[213] *Comments on the "Study Plan for the Swanson Uranium Project, Pittsylvania County, Virgina," Submitted by the Marline Uranium Corporation and Union Carbide Corporation, April 15, 1983 to the Uranium Administrative Group* (response to Elizabeth H. Haskell, member Uranium Admin. Group, question E.3.9), http://www.cathousechat.com/cathouse_chat/files/response_to_liz_haskell_1983.pdf (internal quotations omitted).

[214] *See* VA. CODE ANN. § 3.2-3108 (2008) (describing disbursement of funds).

[215] *See* URANIUM TASK FORCE, REPORT OF THE URANIUM TASK FORCE FOR THE COMMONWEALTH OF VIRGINIA 2 (1984) ("Neither risk analysis nor cost-benefit analysis are capable of offering conclusions without appropriate qualifications."). The task force concluded that in determining whether to lift the moratorium on uranium mining, "the choice that must be made, must be made with uncertainty. . . ." *Id.*

[216] *Id.* at 33, 35. The original Uranium Task Force reported that the benefits of uranium mining outweighed the costs by a ratio of 26:1, and heavily emphasized the cost benefit analysis in their recommendation that the moratorium be lifted. *See id.* at 35*; see also* VIRGINIA S.DOC. No. 15, *supra* note 2, at 15.

> [The report's] cost/benefit calculations assume[d] no negative impacts on ground water or surface waters. It . . . assumed that there will be no leaching of radioactive wastes or heavy metals to groundwaters that are used by neighbors, no substantial polluted discharges to streams, no accidents, no long-term deterioration or collapse of the 100 foot high tailings pile by flood, earthquake[,] erosion, or design failure for the thousands of years the tailings are radioactive. These are unrealistic assumptions . . . .

Id. at 22.

A true "worst-case" scenario, such as the contamination found in the Homestake Mining Company Mill in New Mexico, shows that once contamination occurs, groundwater reclamation alone can cost millions of dollars and require decades of work to successfully solve.[217]

Because the tailings ponds and piles would present an indefinite risk to the contamination of groundwater, especially given Virginia's unique hydrological climate, it would also be nearly impossible to determine how long any financial bond provided by a uranium mining company could be held before requiring it to be returned to the company.[218]

An additional issue is determining what agricultural products could be bonded. In addition to livestock, there are numerous other economic ventures in the area that could foreseeably be harmed or inhibited by uranium mining, which may also need to be taken into account.[219] A determination of what industries might need to be bonded, and to what extent, is an issue of a much larger scope that is slated to be determined as part of the current Virginia Coal and Energy Commission study on the feasibility of uranium mining.[220]

Finally, there is some difficulty in determining who would have authority to enforce bonding requirements against a uranium mining company, given that the land in issue would be regulated by the federal government.[221] Because the federal government may ultimately have sole authority to regulate reclamation and remediation of the surrounding environment, given Virginia's choice to not assume Agreement State status for the uranium mining and milling process, such bonding would most likely be undertaken on a federal, and not commonwealth, level.[222]

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[217] Collins, *supra* note 107, at 47–50. At the Homestake Mill, some of the wells "used by nearby residents were found to be contaminated. Residents were discouraged from using these wells and were provided with bottled water by Homestake [Mining Company]." *Id.* at 47. Later, when well water contamination was shown, "Homestake agreed to construct a pipe system to bring water" from a nearby town to the community where the wells had become contaminated. *Id.* at 47–48. When the operations of the mill ceased in 1990, the Homestake reclamation plan estimated over $20 million in reclamation costs for the tailings and mill site, of which over $8 million alone was for the restoration of the contaminated groundwater. *Id.* at 48. Homestake has projected that groundwater reclamation, an as-unmet goal which has taken over twenty years to complete, will be completed by the end of 2010. *Id.* at 49–50.

[218] *See, e.g.*, *id.* at 47–50.

[219] *See generally supra* notes 55–60 and accompanying text.

[220] *See* Socio-Economic Impacts of Uranium Mining in Virginia, http://dls.virginia.gov/groups/cec/032409/impacts.pdf (last visited Jan. 4, 2010).

[221] *See supra* notes 79–86 and accompanying text.

[222] *See supra* Part II.B.

D. Commonwealth-Imposed Regulation of Agricultural Products

Even if Virginia's Agreement State application is approved by the Nuclear Regulatory Commission, the express exemption from the mining and milling process makes it unlikely that Virginia will be able to regulate the mining industry in a way that will have a significant positive impact on the regional agricultural economy.[223] What may make a more substantial impact on the continued existence of the agricultural economy is if Virginia, through the General Assembly, acts proactively to regulate the agricultural products coming from the regions surrounding the uranium mines—both the proposed Coles Hill site, as well as any future uranium mining sites within the Commonwealth.

Under the Federal State-Cooperative Act, Virginia has the authority to enact additional regulations and to promote health and safety in this sphere;[224] a state which has entered into a cooperative agreement with the federal government is vested with the authority to enact regulations equal-to or greater than those regulations imposed for the FSIS arm of the USDA.[225] Either the Board or the Commissioner of Agriculture is authorized by Commonwealth law to adopt regulations necessary to effect the statutory requirements for health and safety.[226]

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[223] *See supra* notes 79–86 and accompanying text.

[224] Federal State-Cooperative Act, 7 U.S.C. § 450 (2006).

[225] *See* ANNUAL REVIEW, *supra* note 170, at 1. Specifically:

> Under the Federal Meat Inspection Act (FMIA) and the Poultry Products Inspection Act (PPIA), FSIS sets national standards for meat and poultry inspection. Under a cooperative agreement with FSIS, States may operate their own MPI program if they meet and enforce requirements "at least equal to" those imposed under the FMIA, the PPIA, and the Humane Methods of Slaughter Act of 1978 (HMSA). The FMIA (21 U.S.C. 601 et seq.) and PPIA (21 U.S.C. 451 et seq.) provide that it is essential in the public interest that the health and welfare of consumers be protected by assuring that meat and poultry products distributed to them are wholesome, not adulterated, and properly labeled and packaged.
>
> Cooperative agreements and annual certifications of State MPI programs are contingent upon FSIS determining that each State MPI program is enforcing requirements "at least equal to" those imposed under the Federal Acts [FMIA, PPIA, and HMSA].

Id.

[226] *See* VA. CODE ANN. § 3.2-5406 (2009).

As each inspection facility is exclusively federally or state managed,[227] logistical considerations would favor having all affected livestock and produce be directed to specific, commonwealth-managed facilities.[228] By having livestock go to a specific commonwealth facility, additional regulations and staffing requirements can be limited to only a few facilities, ensuring enforcement of regulations at a more limited cost.

All facility-specific directives would work best in conjunction with a modification of existing programs to track livestock coming from the affected region, both for accountability, and perhaps also to collect data on long-term health effects for livestock. There are two current potential methods of ownership for livestock in Virginia. The vast majority of livestock are raised on individual farms from birth until taken to a centralized market where they are purchased by commercial feedlots, taken to a centralized location, and managed to gain muscle weight until slaughter.[229] Some producers also market their livestock directly to consumers.[230] For cattle, the major livestock group in the region surrounding the uranium mine,[231] there are two additional marketing options in place. The Virginia Beef Quality Assurance program allows participating producers, who meet certain guidelines, to pool their cattle together and sell them as a uniform group at a higher price.[232] The Virginia Cattlemen's Retained Ownership Program ("ROP") for cattle provides for producer ownership until livestock are slaughtered.[233] The Virginia ROP requires that producers' livestock "are commingled with other [producers' livestock] then shipped and fed as one group at the feedyard" prior to slaughter.[234] But, the current Virginia ROP requires that the cattle go to a feedlot in Iowa,[235] which

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[227] *See* Federal-State Cooperative Act, 7 U.S.C. § 450.
[228] *See* VA. CODE ANN. § 3.2-5406.
[229] *See generally* Beef Cattle Feedlots, http://www.answers.com/topic/beef-cattle-feedlots (last visited Jan. 4, 2010).
[230] *See* Paula J. Schafer, *Successful Direct Marketing of Livestock*, http://counties.cce.cornell.edu/washington/aedp/articles/marklivestock.html (last visited Jan. 4, 2010).
[231] *See supra* note 60.
[232] Mid-Atlantic Beef Quality Assurance Program Certification Manual, I-2, I-4, *available at* http://www.pa-bqa.org/Content/Manual.aspx. The certification brochure describes Beef Quality Assurance as "a program developed to ensure that beef and dairy cattle are produced and managed in a manner that will result in a safe and wholesome beef product for the consumer." *Id.* at I-1.
[233] VIRGINIA COOPERATIVE EXTENSION, VIRGINIA RETAINED OWNERSHIP PROGRAM INFORMATION BROCHURE (2009), *available at* http://www.vtbeef.apsc.vt.edu/Images/ROP%20Brochure.pdf.
[234] *Id.*
[235] *Id.*

places the slaughter facility regulations beyond the regulatory reach of the Commonwealth.

Although a retained ownership program currently exists and has many benefits to producers, it also imposes additional costs on those producers to implement.[236] But the additional cost of retained ownership, as well as processing-plant specific additional costs, would likely be much less than the economic costs of more drastic measures. Isolating the potentially affected cattle into one or a few processing facilities would likely greatly lower the administrative costs for VDACS to enforce additional regulations.

In addition to limiting the locations where additional regulations are required, the commonwealth should be able to lower administrative costs, by creating risk-specific efficient regulations and procedures that build upon those already in existence and practice under the Code of Federal Regulations.[237]

Virginia adopts by reference federal regulations for the Virginia Food Act.[238] The Virginia Code specifically provides for certain additional standards and regulations designed to promote consumer health and safety.[239] Virginia should also have the authority to adopt regulations to deal with specific issues, such as the presence of uranium and heavy-metal contamination of agricultural products, to the extent such regulations are not federally pre-empted.[240]

Virginia's General Assembly should be able to successfully enact statutes and corresponding regulations addressing the concerns uranium mining would raise, or direct the Board or Commissioner of Agriculture and Consumer Sciences to do so, without risk of federal pre-emption so long as the statutes are neither (1) in an area over which the federal government intended to have comprehensive jurisdiction; or (2) actually conflict with federal law.[241] 21 U.S.C. § 678 does not allow additional or dif-

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[236] *See id.*

[237] *See generally* Animal and Plant Health Inspection Service, 9 C.F.R. ch. 3 (2007). *See, e.g.*, Post-Mortem Inspection, 9 C.F.R. § 310.1 (providing tables for maximum speed of processing based on the number of minimally required inspectors and the distance in feet from one inspection post to another).

[238] 2 VA. ADMIN. CODE § 5-600-10 (2009) (adopting the provisions of 21 C.F.R. ch. 1 "as regulations applicable in the enforcement of the Virginia Food Act by reference").

[239] *See, e.g.*, VA. CODE ANN. § 3.2-5302 (regarding Commonwealth egg standards); VA. CODE ANN. § 3.2-5406 (providing for additional meat inspection regulations).

[240] *Cf.* VA. CODE ANN. § 3.2-5302 (regarding Commonwealth egg standards); VA. CODE ANN. § 3.2-5406 (providing for additional meat inspection regulations)*; see also* ANNUAL REVIEW, *supra* note 170, at 1–2.

[241] Grocery Mfrs. Of America, Inc. v. Gerace, 755 F.2d 993, 999 (1985).

ferent requirements;[242] but Virginia has interpreted it to mean that additional laws and regulations that serve to further the federal regulations are permissible.[243]

The relevant statutory authority states that "[a]ny livestock product or poultry product shall be deemed to be adulterated: 1. [i]f it bears or contains any poisonous or deleterious substance that may render it injurious to health. . . ."[244] By recognizing radioactive and toxic heavy metals as substances that "may render" products "injurious to health," and then recognizing their source, the commonwealth may move forward with addressing the unique problems a uranium mine can pose.[245]

Because the emerging research shows that long-term retention of uranium is concentrated in organs such as the lungs, kidney, and in the bones, new regulations should focus on these areas.[246] Commonwealth-specific regulations should address post-mortem inspection procedures, in order to reduce the stress and potential for bruising and lesions that can result from ante-mortem procedures. At a minimum, regulations should require the establishment of a baseline safe level of uranium, and heavy or radioactive material concentration in products meant for human consumption.[247] This baseline level may vary depending on the proposed use of the product. For an organ such as the liver, VDACS may wish to proactively ensure that none of the potentially affected organs are used for consumption, as the level of contamination may vary greatly from animal to animal.[248]

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[242] *See* 21 U.S.C. § 678 (2006).
[243] *See* VA. CODE. ANN. § 3.2-5121 ("The Board may adopt any edition of Food and Drug Administration's Food Code, or supplement thereto, or any portion thereof, as regulations, with any amendments as it deems appropriate.").
[244] VA. CODE ANN. § 3.2-5401. Similar statutes exist for dairy, *see, e.g.*, VA. CODE ANN. § 3.2-5211, egg, *see, e.g.*, VA. CODE ANN. § 5.2-5302, and other agricultural products, *see, e.g.*, VA. CODE ANN. § 3.2-5125.
[245] *See* VA. CODE ANN. § 3.2-5401. The commonwealth has proposed additional regulations to clarify and further the federal regulations in other specific instances where a risk has presented itself. *See, e.g.*, VA. CODE ANN. § 5.2-5302(B) (2008) (explaining that cracked eggs "may be sold only by producers or processors directly to consumers or for further processing, excluding institutional consumers").
[246] *See generally* Brugges et al., *supra* note 132, at 181, 184–85.
[247] *See supra* note 187 (explaining that there are no regulations addressing unsafe levels of radioactive or heavy metal contamination through the federal FSIS or the Virginia OMPS).
[248] *See* Brugges et al., *supra* note 132, at 181. The studies done so far have resulted in such a wide range of intake and absorption that the strongest conclusion is the need for additional studies to provide a more accurate picture. *Id.*

Although it appears that muscle tissue does not retain any significant amount of uranium,[249] regulations addressing muscle tissue are highly recommended; both because of the dearth of scientific studies of the uptake and retention across environments and species of livestock, and also because public concern and potential outcry is most likely to center around potential risks of muscle tissue—the products consumed by the public.[250] Muscle tissue can be tested for radioactive and heavy metal residue in the same way that tissue from "[c]arcasses suspected of containing sulfa and antibiotic residues" are tested, including setting a baseline safety level, and increasing the rate of testing when any carcasses show results above the baseline safety limit.[251] Implementing these policies is a proactive approach to addressing both potential and perceived threats to health and safety, while ensuring the continued commercial success of Virginia's agricultural economy.

In addition, although implementing state-specific regulations will entail a greater cost to the commonwealth and perhaps to the producers, that cost may be alleviated by working it into the cost of mining uranium, or imposing it as an additional cost on any operating mine within the borders of Virginia.[252] Given the potentially devastating effect of contamination on the marketability of locally produced livestock and crops, both of which will be regularly exposed to the outdoor environment, the adoption of a proactive set of regulations for Virginia's agricultural industry is both within the jurisdictional grasp and the enforcement power of the commonwealth.

CONCLUSION

Uranium mining, thus far limited to the arid western half of the United States,[253] may soon be moving to the rolling hills of Virginia's Piedmont region. The Coles Hill site, located in rural Pittsylvania County in the southern portion of the commonwealth, in an area historically known for its agricultural output in tobacco and livestock, as well as its textile production, is believed to hold the single "largest undeveloped deposit of

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[249] *Id.*
[250] *See generally supra* Part III.C.
[251] Post-Mortem Inspection, 9 C.F.R. § 310.21 (2009).
[252] *See supra* Part V.C. (discussing the potential for a uranium mining and milling company to pay additional costs to ensure the safety of surrounding operations that were in place before uranium production occurred).
[253] U.S. Nuclear Regulatory Comm'n, *supra* note 62.

uranium in the United States."[254] But following the demise of both the domestic tobacco and textile industries, the majority of the region's economy is based on agricultural production, with over a thousand active farms in Pittsylvania County alone.[255] Although the Coles Hill deposit has the potential to produce a large quantity of uranium, it also presents many risks.

The risks presented by a uranium mine—including contamination of the air and soil, and most notably, the risk of contamination of the water supply from the long-term storage of uranium mining tailings—concern not only the health of the residents living in proximity to the mine, but also pose a risk to the continuation of the agricultural economy that the majority of those residents depend on for their livelihood.[256] For the immediate future, Virginia has decided against regulatory oversight of the uranium mining and milling process in their Agreement State application with the Nuclear Regulatory Commission.[257] This issue is even more relevant, given that the federal regulations have been developed for areas that have significantly less rainfall than Virginia.[258]

Given the sparse, but troubling, scientific data that has emerged on the effects on vegetation and livestock near uranium mining,[259] ideally more research should be done prior to lifting the moratorium in Virginia. The political and economic realities of the situation, however, may result in the moratorium on uranium mining being lifted by the General Assembly before a full understanding of the effects is available.

Both the potential risks of uranium and other radioactive and heavy metals, as well as the public perception of the risks and health hazards associated with uranium and radioactivity present a strong case for developing and implementing a set of regulations in order to ensure the future of the agricultural economy in the regions of Southern Virginia surrounding the proposed mine site.

Because the commonwealth's legislature has the ability to enact specific laws which further and do not conflict with the existing federal regulatory scheme, Virginia is in a unique position to ensure the safety of livestock and agricultural products coming out of the potentially affected

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[254] *See supra* Part I.C.; Max Schulz, *Virginia is Sitting on the Energy Mother Load*, WALL ST. J., July 26, 2008, at A7.
[255] *See supra* Part I.C.
[256] *See supra* Part III.
[257] *See supra* notes 68–86 and accompanying text.
[258] *See supra* note 103 and accompanying text.
[259] *See supra* Part III.A–B.

regions.[260] Currently, neither the ante- nor post-mortem inspection processes deal with the potential of radioactive or heavy metal residue and contamination.[261] The potential health risks from this contamination, as well as the reaction to public perception of those risks, require that some action be taken in order to assure safety and public confidence in the food supply, and continued marketability of those products.

From a purely agricultural production standpoint, continuing the mining moratorium until all potential threats have been addressed is ideal. It is reasonably likely, however, that in the near future the moratorium will be lifted, and failing to deal with that reality is not the best course of action for the commonwealth. Without a statutory plan in place to assure safety, it is not unrealistic that agricultural production, especially livestock, may be prohibited in the areas near the mining and milling site. Although such action would assure safety, it would have a devastating effect on the region's economy. By proactively studying the science and assessing a safe rate of uptake among livestock and vegetation, the commonwealth can put in place a best estimate of maximum safe levels of radioactive and heavy metal contaminants.

The authority to set baselines and test for accumulation of toxins, as well as to create a logistical scheme for minimizing administrative costs, provides the commonwealth with the opportunity to continue the region's agricultural production. Although the mining and milling process itself will be overseen by the Nuclear Regulatory Commission,[262] Virginia's ability and willingness to enact a regulatory scheme to preserve the economy of the region will provide continuing benefits to the Commonwealth long after the uranium has departed.

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[260] Grocery Mfrs. of America, Inc. v. Gerace, 755 F.2d 993, 999 (1985).
[261] *See supra* notes 185–87 and accompanying text.
[262] *See supra* notes 68–86 and accompanying text.