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*29 NOT YOUR FATHER’S MINE: THE ROSEMONT COPPER MINE AND DRY STACK TAILINGS

Will the proposed Rosemont Copper Mine in the Santa Rita Mountains of Arizona really include a dry stack tailings facility? Will Augusta Resource Ltd., the owner of Rosemont Mining Corp., even take the mine into production, or will it sell the property with permits for a profit, as it has exclusively done in the past? And, if so, what then?

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*30 INTRODUCTION

This Article concerns dry stack tailings of the proposed Rosemont Copper Mine to be located in the Santa Rita Mountains, about thirty miles southeast of Tucson, Arizona. Because the Rosemont Copper Mine proposal includes provisions for a dry stack tailings facility, this research explores the efficiency of dry stack tailings in general, including identifying mines that have employed dry stack tailings and information regarding the success or problems caused by dry stack tailings at these mines.

In addition to examining issues involved in dry stack tailings, this Article also examines Coeur Alaska, Inc.’s successfully implemented Kensington Gold Mine, located about forty miles northwest of Juneau, Alaska, in the Tongass National Forest. In 1998, the EPA issued a Record of Decision for the Kensington Mine, approving a project plan that included a dry stack tailings facility. That project ultimately did not go forward. A second proposal, which was essentially a scaled-down version of the 1998 proposal, received approval in a 2004 EPA Record of Decision. However, the dry stack tailings facility had been eliminated from the second proposal, which now relied on a liquefied tailings storage facility. Liquefied tailings storage facilities, considered the industry norm, are cheaper than dry stack tailings facilities to manage and operate. However, with regard to environmental impacts, liquefied tailings facilities are much more precarious in the long term due to abiding toxicity once cleanup and restoration are undertaken, if and when such cleanup and restoration actually takes place. This Article asks, at what point in the process were the dry stack tailings eliminated from the Kensington plan? The Article then seeks to identify reasons why.

The Kensington Gold Mine is significant in relation to the Rosemont Copper Mine because of precedent that was set in litigation brought by the Alaska Earthjustice office, which opposed the Kensington mine plan that included liquefied tailings. The focus of this litigation, which was ultimately decided by the U.S. Supreme Court in favor of Coeur ***31** Alaska,[1] was the permit provided to the Kensington mine that allowed the company to use Lower Slate Lake, a navigable waterway teeming with aquatic wildlife, as the liquefied tailings storage facility for the mine. The litigation focused on the Earthjustice legal team's contention that the permit violated the Clean Water Act. While the Ninth Circuit held that the permit, allowing a navigable, live, aquatic body to be used as a tailings storage facility, was a violation of the Clean Water Act, the Supreme Court held in a six-to-three decision that it did not.

The comparison of these two mines, one proposed, the other implemented, while by no means conclusive in terms of the prospects for the Rosemont mine, will hopefully elucidate some potential issues with respect to the ultimate direction the Rosemont mine may take if it goes forward.

I. TAILINGS[2]

The management of tailings storage facilities from mine operations typically represents the most significant environmental liability associated with the mine.[3] Several recent incidents reflect either a failure to manage tailings storage facilities competently or an unfortunate--in some cases, perhaps even a casual--disregard for the long-term effects of tailings on the environment.[4] This has resulted in intense scrutiny of the mining industry, with particular attention paid to the treatment of mine waste products, based on an increasing perception that the industry itself and the treatment of its waste products are incompatible with protection of the environment.[5] This "bad rap" that the mining industry carries is nothing new. Displeasure and aversion to the effects of mining go back hundreds of years, if not more, as reflected in a quote from 1556 attributed to George Bauer, also known as Georgius Agricola, who is widely considered the founder of geology:

> The strongest argument of the detractors of mining is that the fields are devastated by mining operations ... further, when the ores are washed, the water used poisons the brooks and streams, and either destroys the fish or drives them away ... thus it is said, it is clear to all that there is greater detriment from mining than the values of the metals which the mining produces.[6]

***32** In one way, the sixteenth-century quote from Agricola is reflected in the nineteenth-century sentiment that "plus ça change, plus c'est la même chose."[7] In reality, things *have* changed significantly since the sixteenth century and the nineteenth century in terms of the technology available to mining companies and the scale of mining in which these companies, now primarily multinational corporations, engage. However, the issue of mine stewardship and the legacy of damage inflicted on succeeding generations through the disposal of waste materials still dog the industry. These problems are perhaps more true in the twenty-first century, due not only to the scale of operations but also to the vigilance of environmental groups intent on preventing further environmental degradation.

In the 1800s, two significant developments changed mining dramatically. The development of froth flotation and the use of cyanide for the extraction of gold from ore both set the stage for the large-scale commercialization of mineral extraction. By greatly increasing the ability to mine low-grade ore bodies, however, these processes resulted in the production of still-larger quantities of tailings with even finer gradation. Their introduction did not result in parallel developments to accommodate the need for greater diligence with respect to tailings disposal. Consequently, "disposal practices remained largely unchanged and, as a result, more tailings were being placed and transported over greater distances into receiving streams, lakes and oceans."[8]

As more remote mining districts began to attract a diversity of industries, conflicts arose with respect to sharing natural resources, especially water. Tailings plugged irrigation ditches, obstructing and contaminating downstream flows. Farmers began to notice lower crop yields from tailings-impacted lands. A market for litigation quickly developed, centered around mine waste management and various claims of rights to water that ensued from increased economic activity and development. This litigation in turn supported the development of legal precedents that eventually brought to an end the era of unregulated and uncontrolled disposal of tailings.[9] In order to continue mining, mine operators constructed dams in streams to retain tailings, in accordance with only a basic provision that such dams be built high enough to contain statistically infrequent floods.[10] Many of these dams failed following heavy rains, forcing reconsideration of their construction. This problem led to the adoption of a hand-labor construction method that relied on a staggered system of berms serving as dam walls, with each succeeding berm built higher than the one preceding it. This "upstream" dam construction model continues to be implemented today, though construction is enhanced by the advantage of mechanized earth-moving equipment.[11]

***33** Martin and Davies describe the development of tailings-dam technology as occurring on an empirical basis geared primarily to the construction practices and equipment available at the time. Such development was largely without the benefit of engineering design in the contemporary sense.[12] In fact, the authors maintain that despite the widespread understanding of fundamental engineering principles and their potential application to mine tailings dams, it was not until the 1960s that these principles were adopted, refined, and widely applied.[13] Even after centuries of attention paid to the adverse environmental consequences associated with mining and to the advances in geotechnical understanding of mines, tailings dams were still being constructed into the 1970s with little or no consideration for the geochemical issues involved. As a result, tailings impoundments were rarely designed or operated with reclamation and closure in mind.[14]

The growing presence of the environmental movement, beginning in the 1970s, has led to an increased importance of environmental issues in mine construction and waste disposal from mining operations. More attention is being paid to the physical stability of tailings impoundments as well as to their potential chemical effects.[15] Yet, the record with respect to tailings dam failures is still dismal. Mark E. Smith, a civil and geotechnical engineer and a founding principal of Vector Engineering, Inc., points out that a ""killer" dam failure occurs once every five years, with an average of 100 people killed in each event.[16] Martin and Davies, on the other hand, suggest that the situation is not so bleak, stating that dam failings are "relatively infrequent events that are unrepresentative of modern mining industry success in safe tailings disposal, although the rate of failures remains unacceptably high."[17] They also add that the reporting of such events is incomplete and often biased; there is no worldwide database of failures; and the problem is one of poor stewardship rather than poor engineering.[18]

Despite the lack of a worldwide database of dam failures from mining operations, Martin and Davies report that there were no fewer than six significant failures between July 1999 and October 2000, a rate equivalent to 40 to 50 significant failures per decade.[19] They also report that there are approximately 3500 active tailings impoundments worldwide,[20] and that major failures occur at a frequency of less than two to five per year, or about 0.1% (a ***34** higher rate than Smith reports), with minor failures occurring at a rate of thirty-five per year, or about 1.0%.[21] They compare this failure rate to reviews of the history of failures of conventional water-storage earth dams, which indicated that the probability of catastrophic failure of a conventional earth dam during any given year is about one in 10,000, or 0.01%.[22]

A major cause of failures is liquefaction. Liquefaction is the process by which soil with high moisture content starts to act like a liquid. It is "characterized by the sudden collapse and extensive, very to extremely rapid run-out of a mass of granular material or debris, following some disturbance .... The consequent loss of strength gives the failing material briefly a semi-fluid character and allows a flow slide to develop."[23] Liquefaction is caused by an increase in pressure in the water held in cracks or pores of soil and is often triggered by severe vibrations from an earthquake or mine blasting. Deep blasts will create much more pressure than blasts that take place near the surface of the earth.[24] Whereas dynamic liquefaction failures affect relatively shallow mines with relatively limited destructive potential, static, or flowslide, liquefaction events do not require an earthquake or other severe vibrational impacts to trigger failure in the dam; the trigger can be the introduction of water by rain, snowmelt, or even irrigation.[25] Static liquefaction events have only recently been identified and studied, and the leading predictive model was advanced as recently as 1998.[26] Key to the significance of liquefaction events is their "terrible, destructive history. In the last four decades and including all types of mine wastes [we have] averaged one killer flowslide each five years with an average of fifty deaths per event. Beyond the sheer human disaster are the raw economic impacts, which can devastate any company."[27] Despite efforts by Martin and Davies to downplay the frequency of events, they acknowledge in a separate paper the seriousness of static liquefaction, stating:

> Within the entire range of failure modes that have occurred at tailings impoundments[,] static liquefaction is likely the most common, and at the same time the least understood ... [with] the possibility of its occurrence ... often ... overlooked in the search for other causes of failure. Static liquefaction, and the resulting flowslide of liquefied tailings materials, is shown to be a relatively common phenomenon among the more dramatic tailings

> impoundment failure case histories. Static liquefaction can be a result of slope instability issues alone, or can be triggered as a result of other mechanisms.[28]

*35 II. DRY STACK TAILINGS FACILITIES

The environmental risks posed by conventional liquefied tailings facilities are not limited to the physical instability issues described above. As Davies indicates:

> The amount of water that is 'lost' to the voids in the stored tailings, seeps or evaporates from the tailings impoundments is something being increasingly viewed by critical regulatory and public eyes that insist on evaluating whether there are viable alternatives for any given proposed mining development. This pressure to seek alternative tailings management approaches exists today and the future will likely only see these pressures intensified.[29]

Davies maintains that conventional tailings impoundments are still the best alternative for the majority of operating and proposed mines around the world despite significant problems with stewardship, which he identifies as the main source of the various problems described above.[30] Nonetheless, there is widespread acknowledgement that dry stack, also referred to as "filtered," tailings present an opportunity to mitigate the dangers of liquefaction and a viable method of to achieve significant water conservation. However, non-slurried tailings alternatives are likely suitable only to a minority of projects given the operating conditions necessary for this method of storage. In particular, mines located in arid locations or very cold regions are perhaps best-suited to employ filtered storage facilities. This is due to the lack of water and a stricter regulatory environment focused on water conservation in the first case, and the long winter season and the effects of deep cold on liquefied tailings operations in the second. In addition, as water becomes scarce, the cost of hauling liquefied tailings increases. For example, water scarcity results in increased pumping costs, and, as tailings become a wet cake and can no longer be pumped, they will require additional transportation methods.[31] With increased water recovery, however, the tailings are more available for alternative storage situations, such as stacking, requiring no dam for retention and no associated tailings pond.[32] There is a cost-benefit advantage to using filtered tailings as well.[33] The recovery of water reduces capital costs and provides an offset to the capital and operating costs of the tailings system. On the other hand, water surcharge storage constitutes an additional expense that must be factored into the design and operating costs of a filtered tailings system. Depending on the application, this could be a small reservoir or tank. Far more efficient water recycling is achieved by reclaiming the bulk ***36** of the water in or near the mill.[34] According to Davies, the amount of water "stored" in a dry stack facility will typically be 25 to 50 percent less than in a conventional slurried impoundment, even if 100 percent pond reclaim efficiency is achieved with the impoundment.[35]

Another advantage of dry stack tailings is the ease of progressive reclamation and closure of the facility.[36] In fact, the facility can often begin reclamation very early in the life of the project.[37] The advantages presented by early reclamation include greater control over fugitive dust, greater control over the use of reclamation materials, and lower short-and long-term environmental impacts of the project. This kind of progressive reclamation often involves temporary covering of the dry stack material, as well as vegetative restoration of the tailings slopes and surfaces.[38]

Just how prevalent are dry stack tailings? Not very, but no one knows for sure. Filtered tailings have thus far not received the attention that other dewatered tailings have received. Davies indicates there are but a handful of publications on dry stack tailings, and they are rarely mentioned in conference proceedings.[39] This lack of internal recognition makes evaluation from outside the field difficult. AMEC Earth & Environmental, Inc., a global engineering and consulting firm that in the 1990s developed a global database of tailings facilities, identifies two problems with capturing accurate data on filtered tailings. First, many of the projects using filtered tailings are new and have proprietary systems or operating issues that owners are reluctant to have published. Second, few owners are documenting their projects, even where the issues mentioned above are not present.[40] While the number of dry stack tailings facilities is apparently growing, no one can point to an overall operating economic advantage creditable to the practice.[41] AMEC nonetheless indicates that, for at least three of the currently operating dry stack projects they have catalogued, the increased operating cost was sufficiently negated by other factors, including decreased regulatory, closure, and liability costs.[42]

***37** It is also worthwhile to note some of the water management issues involved in a filtered tailings facility.[43] AMEC provides the following summary. First, surface water should not be permitted to be routed towards a dry stack, and project design and preparation must account for catchment and routing of precipitation, including snow melt in colder climates. It is also necessary to design perimeter ditches or flow-through drains that will be available during a hydrological event. Typically, two systems are employed for surface and groundwater control: a collection and diversion system for non-contact water, i.e., natural surface water and groundwater from the surrounding catchment area that has not yet come into contact with the tailings; and an interception and collection system for contact surface water, impacted groundwater, and seepage from the dry stack. Finally, the subject of facility lining is important and will almost certainly become an issue on any project, whether dry stacked or not.

III. THE PROPOSED ROSEMONT COPPER MINE

The Rosemont Copper Mine is a proposed open-pit mine developed by the Rosemont Mining Company, a subsidiary of Canadian multinational Augusta Resource Corporation ("Augusta"). The project will be located on public and private land, the former constituting approximately 4000 acres, made available for commercial mining development at extremely low cost.[44] Augusta, which was incorporated in 1937, states on its Annual Information Form (AIF)[45] that it currently has only one material subsidiary, the Rosemont mine property. It also states unequivocally that the company "has no history of production" and that "the Company has never recorded any revenues from mining operations."[46] The AIF states clearly that Augusta has never engaged in production. It also states that "the Company has no revenue and does not expect to generate any revenues until completion of construction at the Rosemont Project and Rosemont reaches commercial production in the latter part of 2013."[47]

It is difficult to determine Augusta's intentions with respect to the Rosemont mine given the inconsistencies between the company's lack of a production history and its stated ***38** plans for production as described in the Rosemont proposal. The company's recent legacy involves acquiring properties, investing in certain "improvements" such as obtaining all relevant permits and investing in on-site construction, and then flipping the property. Augusta is currently engaged in these activities in Arizona save for the final step. Thus, it is possible that what remains in Augusta's Rosemont investment strategy may amount to nothing more than "flipping" the Rosemont properties, much the same way a residential landlord would purchase a house, make some improvements, and then sell at a profit. There is nothing in Rosemont's statements that distinguish its previous actions from its current intentions or assert that its current business model is in any way different from the past. One could presume that if the company intended to break with its past practices of developing a site and then selling it without actually mining it, this innovation, after seventy-five years of doing business one way, would be articulated.

The significance of Rosemont's historical business model may have bearing with respect to the company's proposed plans for a dry stack tailings facility. In its various filings, Rosemont does not hesitate to proclaim the value and sustainability of its dry stack tailings plans. For example, according to Rosemont's Section 404 permit application,[48] the virtues of the proposed mine's dry stack tailings facility, which it claims will ultimately measure approximately 987 acres in area, are described as: eliminating the need for an engineered embankment and seepage containment system; maximizing water conservation and minimizing water makeup requirements, resulting in a more compact site; and allowing opportunities for concurrent reclamation and dust control.[49] While the Section 404 application does not detail plans for reclamation and closure, those issues are discussed in Rosemont's separate ""Reclamation and Closure Plan."[50] Elsewhere in Rosemont's promotional materials and permit applications, the proposed mine's environmental protections and state-of-the-art technology and processes have been touted as exemplary and in keeping with principles of sustainability. The company has gone so far as to boast that Rosemont is "not your father's mine."[51]

It appears that Rosemont is making some investment in dry stack tailings technology. According to an August 2010 report in Engineering and Mining Journal, Rosemont Copper placed a $31 million order with FLSmidth, a manufacturer of dry stack ***39** technology, for fourteen AFP IV automatic filter presses.[52] According to FLSmidth, the units ordered by Rosemont will be the largest in the world and will "set a standard for sustainable practices by using half as much water while simultaneously reclaiming a dry-stacked tailings area by re-vegetating throughout the life of the mine."[53]

The $31 million investment, notwithstanding its size, does not prove that Augusta intends to proceed with actual production. When viewed from the perspective of an investment designed to encourage public acceptance, as well as to secure environmental approvals essential for a profitable sale of the project prior to commencement of actual production, the $31 million figure may seem reasonable, if not small, compared to the gains to be made if the project turns out to be significantly more profitable.

The circumstances therefore necessitate some speculation as to what might happen if Augusta follows precedent and sells the Rosemont Copper Mine project to another developer--one who engages in production that may not utilized the innovations that Augusta has proposed. Given that dry stack tailings are an expensive alternative to impoundments, a firm purchasing the Rosemont project at a premium may look for cost savings associated with actual production.

IV. THE KENSINGTON GOLD MINE

The Kensington Gold Mine provides a valuable example when addressing concerns raised by the proposed Rosemont mine.[54] The Kensington mine is an underground gold mine located approximately forty-five miles northwest of Juneau, Alaska, in the Tongass National Forest. The Kensington project underwent three iterations of environmental review and was previously permitted in 1998.

In 1990, the Kensington Venture, a joint venture between Coeur Alaska, Inc. and Echo Bay Exploration, first submitted plans to develop the mine to the U.S. Forest Service (USFS). The USFS completed the Final Environmental Impact Statement (FEIS) in 1992. The 1990 plan included underground mining to recover the ore; processing of the ore via flotation, cyanidation, gold refining; and disposal of the tailings in a tailings impoundment built in the Sherman Creek drainage. The impoundment was sized to accommodate 30 million tons of tailings. The proposal included discharging wastewater to Lynn Canal following treatment and shuttling employees to the mine site using helicopters. The project proposed the use of liquefied petroleum gas to fuel on-site generators. A marine terminal, developed at Comet Beach in Lynn Canal, would handle supply deliveries and gold ***40** shipments. The Kensington Venture never obtained all the permits necessary to build the mine, and in 1995, Coeur Alaska became the sole stakeholder in the property. That same year, Coeur Alaska submitted an amended Operations Plan (OP) to the USFS. In June 1996, Coeur Alaska revised the 1995 plan in response to issues raised during scoping.[55]

The 1996 amended plan included backfilling a portion of the tailings in the mine and disposing the remaining tailings in a 20-million-ton dry tailings facility (DTF) constructed between Sherman and Sweeny Creeks. The 1996 plan was analyzed in the Final Supplemental Environmental Impact Statement (FSEIS) and approved by the USFS in a Record of Decision (ROD), signed in August 1997. Coeur Alaska obtained all permits necessary for construction from federal, state, and local authorities, including a National Pollution Discharge Elimination System (NPDES) permit from the EPA, issued on May 14, 1998 (Permit No. AK-005057-1). The permit authorized discharge of drainage from the Kensington portal, which would then be treated and discharged to Sherman Creek. It also authorized the discharge from the permitted DTF to Camp Creek and the discharge of domestic wastewater to Lynn Canal.[56]

The 1996 proposal never moved forward, however, due ostensibly to falling gold prices, and in November 2001, Coeur Alaska submitted another amended OP to the USFS. This plan, which initiated a second Supplemental Environmental Impact Statement, proposed a number of changes to the 1996 approved plan. These changes included moving the location of the processing facilities; eliminating the DTF and replacing it with an impoundment in Lower Slate Lake for tailings disposal; changing site access plans; and employing a different means of transportation. The operation would also mine a smaller portion of the ore body that contained higher average gold concentrations. The 2001 amended plan formed the basis for Alternative B for the December 2004 FSEIS. The USFS selected Alternative D in a ROD signed on December 9, 2004. Coeur revised its OP to conform to Alternative D in May 2005, and the USFS approved the plan the following month.

Several reasons were cited in the EPA's 2004 ROD[57] for the 2001 amendments to the OP. According to the ROD, the overall changes were "intended to improve efficiency and reduce the area of surface disturbance associated with the 1997 mining plan and to ***41** provide more reliable transportation and access by improving worker safety during transit to the site and eliminating shipping delays related to weather and sea conditions at Comet Beach ...." Tailings disposal would require a smaller area of surface disturbance under the proposed action compared to the 1997 plan by utilizing a twenty-acre lake, Lower Slate Lake, for tailings storage.[58] Coeur Alaska's *Final Plan of Operations for the Kensington Gold Project*, issued in May 2005, makes a similar assertion regarding the elimination of the DTF:

> A reduction in the surface disturbance was realized by eliminating the need for a new large personnel camp and the elimination of a dry tailing facility in favor of subaqueous disposal of tailings behind a rock-filled dam at Lower Slate Lake. Reclamation of the tailings lake includes flooding the equivalent acreage of productive

> natural soil that currently exists in Lower Slate Lake for the recolonization of vegetation and benthic organisms. Studies have indicated that recolonization of the flotation (low metal content) tailings may eventually contribute a greater aerial extent of habitat than what currently exists in Lower Slate Lake.[59]

It is not clearly stated in these documents what else might have precipitated the change from a DTF to an impoundment that threatened potential destruction of Lower Slate Lake, plans and descriptions for restoration and reclamation notwithstanding.

The change from a DTF to a tailings storage facility (TSF) or impoundment had substantial effects on more than the Lower Slate Lake in the Tongass National Forest. The subsequent Coeur Alaska litigation resulted in a profound reinterpretation of the Clean Water Act by the Supreme Court.[60] Before passage of the Clean Water Act in 1972, mining companies frequently dumped their tailings into the nearest river or lake, regardless of catastrophic consequences for the environment and human health. In 1982, the EPA adopted regulations specifically prohibiting the use of navigable waterways as tailings dump sites for all new gold mines.[61] The EPA studied the mining industry nationwide and concluded that the discharge of mine tailings into navigable waters was unnecessary because feasible alternatives existed and were already in use at most mines.[62]

In a puzzling reversal, Coeur Alaska claimed that the practice of lake dumping of tailings was necessary despite the alternatives discussed above and Coeur Alaska's own ***42** proposal in 1997 to include a DTF.[63] In fact, the EPA determined that dry stack disposal of tailings at the Kensington Mine was the environmentally preferred alternative.[64] This method has also been used successfully and profitably at the nearby Greens Creek Mine.[65] Despite rewriting the proposal to include a DTF in 1997, Coeur Alaska decided not to develop the Kensington mine, allegedly due to falling gold prices.[66] When the project was resuscitated in 2004 without the DTF, Coeur Alaska and several conservation groups worked together with regulatory agencies to develop a paste tailings plan as a substitute for the DTF.[67] Paste tailings disposal is similar to dry stack disposal, but the tailings contain more water and are a toothpaste-like consistency. The tailings are spread over a lined and contained area where they dry and harden, in some cases with added cement.[68] State and federal regulatory agencies involved in the permitting of the paste plan predicted that it would have been fully permitted by December 2008.[69] According to the Southeast Alaska Conservation Council which was one of the conservation groups working with Coeur Alaska on the paste tailings disposal proposal, in September 2008, just before the permitting process was complete, Coeur Alaska unexpectedly abandoned the paste tailings option to gamble with its controversial lake dumping plan in the Supreme Court.[70]

Why did Coeur Alaska take its chances with a court case that would uproot the Clean Water Act rather than proceed with the environmentally friendly option that the EPA supported? Without evidence documenting specific reasons, one is unable to answer that question. However, one can surmise that, in the waning days of the Bush administration, the company may have taken a calculated risk. Perhaps with encouragement from regulators hostile to environmental regulations, Coeur Alaska decided it was the right time to challenge the Clean Water Act in the hope or expectation that the Supreme Court would welcome the opportunity to weaken the Act's implementation.

If Augusta's purpose for the Rosemont Copper Mine is not to actually mine but rather the profit from "flipping" the site, we are left to wonder: who, if anyone, will actually develop the mine and according to what set of plans? What will a second owner propose and to what lengths would they be willing to go to achieve their plans? The Kensington example ***43** is instructive because it shows how radically different the original plan can be from what is actually implemented. It is also shows the risks a company may be willing to take, even betting on a Supreme Court decision, to achieve its goals.

CONCLUSION

Definite conclusions about Coeur Alaska's motivations for Kensington and Augusta's intentions for Rosemont are difficult to draw. What is clear, however, is that vagaries exist regarding the rationale for Kensington's actions, and uncertainties remain embedded in the Rosemont plan. As the Rosemont mine proposal proceeds, it would be helpful to obtain insight into the reasons for Kensington's decision to abandon all plans for environmentally friendly dry stack tailings storage. Given what happened at Kensington, and given Augusta's history of nonproduction, environmental activists would do well to keep an especially keen eye on Rosemont and its tailings storage plans as the project continues through the various stages of development.

*44 APPENDIX

GLOBAL DRY STACK TAILINGS FACILITIES[71]

MINE	LOCATION	ORE TYPE
OPERATING MINES		
Redwater	Alberta, Canada	Gypsum
J.C.I.	South Africa	Uranium Leach
Grooteguluk	South Africa	Coal Fines
WMC	Australia	Gold plant
Australian Iron & Steel	Australia	Coal Fines
C.S.B.P.	Australia	Phosphoric
Namhae Chemicals	Korea	Phosphoric Acid
Isdor Durnacol	South Africa	Coal Fines
ZCCM	Zambia	Copper
Steep Rock Calcite	Ontario, Canada	Calcite
Alwinsal Potash	Saskatchewan, Canada	Salts
JR Simplot Co.	Idaho, USA	Phosphoric Acid, Gypsum
Sigeco	Indiana, USA	FDG Gypsum
China National Chemical	China	Phosphoric Acid/Gypsum
Vaal Reef	South Africa	Gold/Uranium
Randfontein Estates	South Africa	Gold/Uranium
Chingola	Zambia	Copper
El Sauzal	Chihuahua, Mexico	Silver/Gold
Alamo Dorado	Sonora, Mexico	Silver/Gold

Spinifex Ridge	Australia	Molybdenum
La Coipa	Chile	Data unavailable
Greens Creek	Alaska, USA	Gold/Silver/Zinc
Raglan	Quebec, Canada	Lead/Zinc
Pogo	Alaska, USA	Gold
Mantos Blanco	Chile	Copper
GEcamines	Zaire	Copper
Wallsend Mt. Th.	Australia	Coal
Alcoa	Australia	Alumina
Nabalco	Australia	Alumina
Nixon Fork	Alaska, USA	Gold
Eskay Creek	British Columbia, Canada	Copper
Lihir Island	Papua New Guinea	Gold
Mantos de Oro	Chile	[data unavailable]
TVS Gold	Montana, USA	Gold
Bwana	Zambia	Copper
Blue Diamond	USA	Sand & Gravel
Blue Star	USA	Sand & Gravel
A.J. Dean	USA	Sand & Gravel
Owl Rock	USA	Sand & Gravel
Vulcan Material	USA	Sand & Gravel

FEASIBILITY STUDIES COMPLETED		
Ok TEdi	Papua New Guinea	Copper

IZOK Lake	Northwest Territories, Canada	Copper, Zinc, Lead
Kensington[72]	Alaska, USA	Gold
Red Mtn.	British Columbia, Canada	Gold
Volcan	Peru	Copper, Zinc, Lead
Mineral Ridge	Nevada, USA	Gold
Aqua Rica	Brazil	Gold
Rio Blanco	Peru	Copper
Inco Mine	New Caledonia	Nickel

CLOSED MINES		
Mineral	Hall Montana, USA	Gold

Footnotes

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1 Coeur Alaska, Inc., v. Se. Alaska Conservation Council, 557 U.S. 261 (2009).

2 Tailings are left over after separating the valuable portion of an ore from the valueless portion. Mine tailings are usually produced in a "“slurry” form, which is a mixture of fine mineral particles and water. The slurry often has a very thick, almost sludge-like consistency.

3 T.E. MARTIN, M.P. DAVIES, S. RICE, T. HIGGS & P.C. LIGHTHALL, STEWARDSHIP OF TAILINGS FACILITIES (2002), *available at* http:// pubs.iied.org/pdfs/G01027.pdf [hereinafter MARTIN & DAVIES].

4 *Id*. at 3.

5 *Id*.

6 *Id*. The date given for the quote is 1556. Agricola died in 1555 but his greatest work, DE RE METALLICA, was published posthumously in 1556.

7 Jean-Baptiste Alphonse Karr, LES GUÊPES (FR.), Jan. 1849, at vi. Translation: “The more things change, the more they stay the same.”

[8] MARTIN & DAVIES, *supra* note 3, at 5.

[9] *Id.* (pointing out that this is largely true in the Western world, though noting that unregulated disposal practices persist in many areas in the developing world).

[10] *Id*.

[11] *Id*.

[12] *Id*.

[13] *Id*.

[14] *Id*.

[15] *Id*.

[16] MARK E. SMITH, LIQUEFACTION IN DUMP LEACHING (2002), *available at* http://www.ausenco.com/uploads/papers/64056_Liquefaction_in_Dump_Leaching.pdf. Smith's statement about dam failures was indicated as being recent in 2002.

[17] MARTIN & DAVIES, *supra* note 3, at 7-8.

[18] *Id.* at 8.

[19] *Id*.

[20] Michael P. Davies, *Impounded Mine Tailings: What Are the Failures Telling Us*?, 94 CANADIAN MINING & METALLURGICAL BULL. 53, 54 (July 2001), *available at* http://www.infomine.com/publications/docs/Davies2001.pdf.

[21] MARTIN & DAVIES, *supra* note 3, at 9.

[22] *Id*.

[23] SMITH, *supra* note 16, at 1 (citing J.N. HUTCHINSON, MORPHOLOGICAL AND GEOTECHNICAL PARAMETERS OF LANDSLIDES IN RELATION TO GEOLOGY AND HYDROGEOLOGY 3-35 (1988)).

[24] David Dunning, *Mine Blasting and Liquefaction*, EHOW.COM, http:// www.ehow.com/facts_7837190_mine-blasting-liquefaction.html (last visited Jan. 23, 2011).

[25] SMITH, *supra* note 16, at 1.

[26] *Id*.

[27] *Id.* at 2.

[28] Michael Davies, Ed McRoberts & Todd Martin, *Static Liquefaction of Tailings -- Fundamentals and Case Histories*, 23 ASSOC. ST. DAM SAFETY OFFICIALS 1 (2002), *available at* http:// www.infomine.com/publications/docs/Davies2002c.pdf. *See also Chronology of Major Tailings Dam Failures*, WISE URANIUM PROJECT, http://www.wise-uranium.org/mdaf.html (last updated July 30, 2011) (chronology of major tailings-dam failures from 1960 through July 2011).

[29] Michael Davies, *Filtered Dry Stacked Tailings -- The Fundamentals*, 2011 Proc. TAILINGS & MINE WASTE 1, *available at* http:// www.infomine.com/publications/docs/Davies2011.pdf.

[30] *Id.*

[31] *Id.*

[32] *Id.* at 3 (pointing out the filtered tailings are not dry, but unsaturated).

[33] *Id.*

[34] *Id.*

[35] *Id.*

[36] *Id.*

[37] *Id.*

[38] *Id.*

[39] *Id.*

[40] AMEC has developed a database of filtered tailings, reproduced for this Article as Appendix A. *See infra* note 41, at 28-29. By AMEC's own admission, this list is not comprehensive but nonetheless provides some, if not the only, consolidated information on the global prevalence of dry stack tailings facilities.

[41] AMEC EARTH & ENVTL., INC., ROSEMONT COPPER COMPANY FILTERED TAILINGS DRY STACKS CURRENT STATE OF PRACTICE FINAL REPORT (2008), *available at* http:// www.rosemonteis.us/files/technical-reports/012312.pdf [hereinafter AMEC].

[42] *Id.*

[43] *Id.*

[44] The General Mining Act of 1872, ch. 152, §§ 1-16, 17 Stat. 91 (1872), allows prospecting and mining on public lands. The

legislation set the price for a land claim between $2.50 and $5.00 per acre. The price has remained the same since the Act's passage.

45 The Annual Information Form is a required filing in Canada's provinces. Canada does not have a national securities regulatory agency; instead, securities regulation is handled individually by the country's provinces. Augusta states on its AIF that it is a reporting issuer in British Columbia, Alberta, Saskatchewan, Maintoba, Ontario, New Brunswick, and Newfoundland and Labrador, and is required to make filings on a continuous basis thereunder. All filings are available through http://www.sedar.com.

46 AUGUSTA RES. CORP., ANNUAL INFORMATION FORM OF AUGUSTA RESOURCE CORPORATION (2011), *available at* http:// www.augustaresource.com/Theme/Augusta/files/doc_financials/AIFMarch292011.pdf.

47 *Id.* at 8.

48 A Section 404 permit is a key feature of the Clean Water Act of 1972, 33 U.S.C. §§ 1251-1377 (2012), and authorizes the applicant to discharge a point-source pollutant into the waters of the United States.

49 WESTLAND RES., INC., SECTION 404 PERMIT APPLICATION FOR THE ROSEMONT COPPER PROJECT (2011), *available at* http:// www.rosemontcopper.com/assets/files/404 Permit Application - Complete Package 101011.pdf.

50 TETRA TECH, ROSEMONT COPPER PROJECT RECLAMATION AND CLOSURE PLAN (2007), *available at* http:// www.rosemontcopper.com/ReclamationPlan/Chapters/Contents.pdf.

51 Telephone Interview with Lisa Froelich, Coordinator, Save the Scenic Santa Ritas (Sep. 6, 2012).

52 Steve Fiscor, *Filtration Becomes a Viable Option for Environmental Compliance*, ENGINEERING & MINING J., July-Aug. 2010, at 68, 68, *available at* http://www.e-mj.com/index.php/features/460-filtration-becomes-a-viable-option-for-environmental-compliance.html.

53 *Id.*

54 U.S. ENVTL. PROT. AGENCY, RECORD OF DECISION: KENSINGTON GOLD PROJECT 1 (2005), *available at* http:// yosemite.epa.gov/r10/water.nsf/NPDES+Permits/CurrentAK822/$FILE/Kensington_ROD_ FINAL.pdf. The following description of the Kensington Gold Mine is taken from the Introduction in the EPA's Record of Decision.

55 *Id.* at 2. These issues were not discussed further in the final ROD, from which this descriptive background to the project has been obtained. If it were possible to obtain the pre-amendment OP from 1995, it would be useful for comparison to the 1996 OP; unfortunately, it is not readily available. This Author's extensive research yielded nothing that expanded upon the reasons for abandoning the dry stack tailings facility that were provided in the 2004 ROD. Note also that the original 1991 OP did not contain a dry stack tailings facility.

56 *Id.*

57 *Id.* The ROD was issued to document the decision by the EPA to issue the NPDES permit for discharges from the Kensington portal to Sherman Creek, for discharges of treated domestic wastewater to Lynn Canal, and for discharges from the proposed tailings storage facility (TSF) to East Fork Slate Creek.

58 *Id.*

[59] COEUR ALASKA, INC., FINAL PLAN OF OPERATIONS FOR THE KENSINGTON GOLD PROJECT (2005), *available at* http:// dnr.alaska.gov/mlw/mining/largemine/kensington/pdf/poo2005.pdf.

[60] MARTIN & DAVIES, *supra* note 3, at 2; Coeur Alaska, Inc. v. Se. Alaska Conservation Council, 557 U.S. 261 (2009).

[61] 40 C.F.R. § 440.104(b)(1) (1982).

[62] SE. ALASKA CONSERVATION COUNCIL, TAILINGS DISPOSAL OPTIONS FOR THE KENSINGTON MINE 1 (2009), *available at* http:// seacc.org/mining/kensington/tailings-disposaloptions-for-the-kensington-mine_ 03_12_09.pdf [hereinafter SEACC].

[63] *Id.*

[64] Letter from Marcia Combs, Dir., Alaska Operations, EPA, to Colonel Timothy J. Gallagher, Dist. Eng'r, Dep't of the Army (Aug. 20, 2004), *available at* http://seacc.org/mining/kensington/epa-letter-on-pref-alternative-kensington.pdf/at_download/file. The reference to Alternatives A and A1 in the letter, alternatives that the EPA describes as its preference, refers to plans that included a DTF.

[65] U.S. FOREST SERV., GREENS CREEK TAILINGS DISPOSAL FINAL ENVIRONMENTAL IMPACT STATEMENT, VOLUME II APPENDICES (2003), *available at* http://dnr.alaska.gov/mlw/mining/largemine/greenscreek/pdf/feis2.pdf.

[66] SEACC, *supra* note 62, at 1.

[67] *Id.*

[68] *Id.*

[69] *Id.*

[70] *Id.*

[71] AMEC, *supra* note 41, at 28-29.

[72] RECORD OF DECISION: KENSINGTON GOLD PROJECT, *supra* note 54 (indicating how dated this data might be, as the Kensington mine was in the feasibility-study phase in the 1990s).