



# CIRCULAR JUSTICE?

## AN EXAMPLE OF THE CIRCULAR ECONOMY CLASHING WITH ENVIRONMENTAL JUSTICE IN THE UNITED STATES

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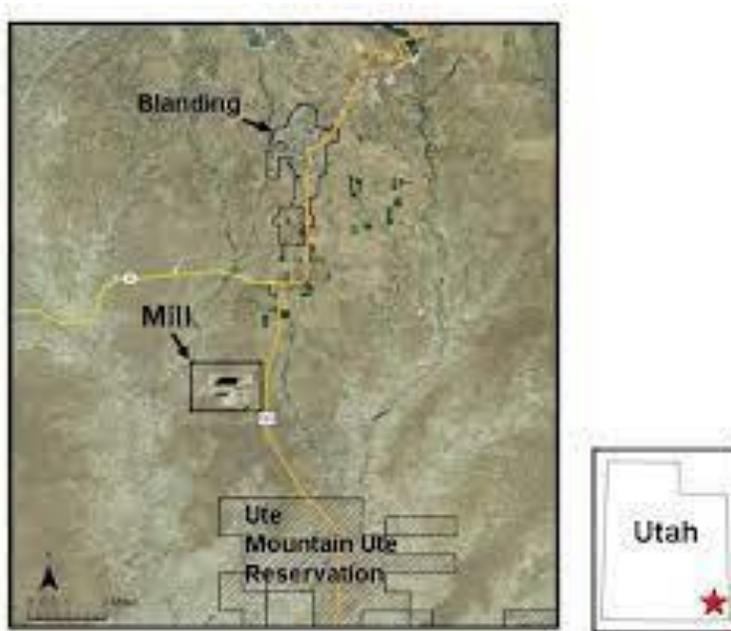
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- The opinions presented here are those of the author, and do not represent the official position of the EPA or any other agency or organization I am affiliated with.
- The purpose is to communicate and facilitate discussion.
- The author has no conflicts of interest.



Source: US EPA



# U.S. Examples of Reuse of NORM/TENORM



Examples exist of reuse of materials in the U.S., but they are not the norm.

- Coal combustion residuals (CCR) are used as an admixture to road base and cement.
- Wastewater biosolids as soil amendment.
- Phosphogypsum (PG) reuse in road base was withdrawn due to a lack of stakeholder outreach and lawsuits brought by numerous environmental and labor groups.
- Re-use of residuals makes good sense if health, economic and environmental considerations are met.

# U.S. Examples of Reuse of NORM/TENORM



- Stockpiling residuals indefinitely while waiting for a future use can cause its own environmental and liability challenges.
  - PG stacks persist, one of which failed in 2021 and polluted a nearby estuary in Florida.
- However, there has been little discussion on the resulting liabilities and risks from re-use of radioactive materials in some commodities.
  - What happens when an owner of stockpiled material goes out of business?
- While some uses of residuals can be done without impact to the public or the environment, other uses have not gone well and caused problems:
  - Uranium mill tailings in Grand Junction, CO cost over \$1.5 Billion to remediate so far;
    - About 100 contaminated properties a year are still discovered;
  - Scrap pipe;
  - Slag for roads and fill in Pocatello, Idaho.

# The Circular Economy and Environmental Justice

## Two concepts not always considered together...

As the concept of the Circular Economy using discarded substances or residues containing TENORM is evaluated in the United States (U.S.), it will need to be balanced with impacts that have traditionally disproportionately affected minorities and the poor, an issue being evaluated and addressed under the rubric of Environmental Justice.

- EPA has had an Office of Environmental Justice for some time, but only recently has it gotten the support and funding of the Administration and Congress to effectively incorporate EJ into EPA policies.
- The list of minority and disadvantaged communities that have increased levels of pollution are too numerous to list here.
- EPA has been tracking them and developing tools to help quantify the amount of harm. Many of these communities are Native American.

# Setting the Scene



## Some background information for context...

- The White Mesa Uranium Mill is located in SE Utah:
  - Near the town of Blanding (6 mi);
  - the Native American unincorporated community of White Mesa (5 mi);
  - Adjacent to the Bears Ears Wilderness Area, historical Native land.
- The mill was commissioned in 1980, making it the last conventional uranium mill constructed in the U.S.
- It was licensed by the Nuclear Regulatory Commission (NRC) until Utah became an Agreement State in 2004, which transferred authority over the mill from the NRC to the State.
- The White Mesa mill has a traditional uranium circuit, a vanadium circuit, and a circuit for processing “alternate feed”.
- Major processes include crushing, sizing, leaching, precipitation, solvent extraction, and drying and packaging.

# Business Model Evolution...



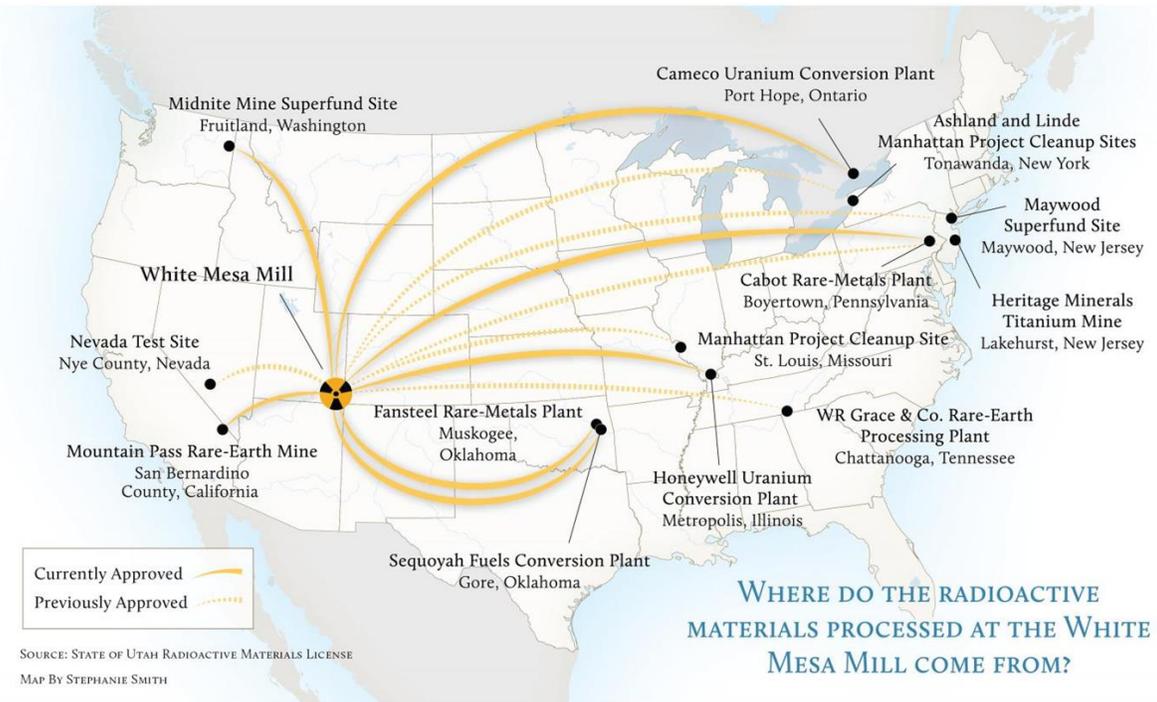
- The traditional business model for a uranium mill is for the mill to purchase ore from the mines at negotiated prices.
- Uranium is a fungible commodity, and the price fluctuates based on the market – it is not traded on commodities markets.
- The mill then processes the ore into yellowcake (a form of uranium oxide), which is shipped elsewhere for conversion, enrichment, and finally nuclear fuel fabrication.
- It is a once-through process where over 95% of the original ore is left behind as waste deposited on-site in permanent repositories.
- Notably, uranium mining is not regulated by the NRC or Agreement States, but by land agencies (e.g., Bureau of Land Management).

# Alternate Feed



- Alternate feed in theory is similar to the circular economy where the uranium mill is taking waste from another facility and processing it through the mill to recover any uranium that may be in the waste.
- Unlike the circular economy, waste resulting from reprocessing ends up disposed as waste in the uranium mill tailings impoundment, with no further use. (Maybe semi-circular?)
- The NRC did not require an economic test, and many consider the alternate feed process to be a form of sham recycling (any amount of uranium was good enough for the NRC).
- White Mesa started their alternate feed program in the early 2000s and have processed waste from multiple clients, including former sites that processed rare earths prior to environmental regulation.
- Since the waste that ends up in the impoundments came through the mill, the resulting tailings are considered uranium mill tailings.
- “Characteristic” hazardous waste allowed.
  - Specifically “listed” hazardous waste is not allowed.

# Domestic Alternate Feed Sources



Source: Grand Canyon Trust

- As of 2022, there have been about seventeen distinct alternate feed campaigns at the mill.
- The last approved waste stream was from an international source and has a connection to the circular economy project.

# Follow the Money



- Unlike the traditional model where the mill pays for ore, in the case of alternate feed, the mill charges to take the feed.
- This can save the original owner of the waste considerable amounts of money compared to disposal in hazardous waste landfills.
- By sending waste to White Mesa for whatever uranium they can recover (and sell), the waste ends up in a cell that meets hazardous waste design criteria but has not been permitted as a hazardous waste facility.
- The economics of such an arrangement is advantageous for both the generator and the mill.
- It is not clear what liabilities remain with the original owners of the waste should the impoundments fail and require corrective action under the DOE Legacy Management Program.

# U.S. policy towards supply of critical minerals changed

- Executive Orders issued under both the Trump and Biden Administrations highlights how policy changed from a globalized, just in time, downsized workforce approach for many commodities to a new focus on domestic supply and less reliance on other countries.
- In addition to the Executive Orders, both administrations utilized the Defense Production Act to deliver funding to support certain efforts to change from globalization to domestic independence.
- White Mesa has also received about \$1.90 million in funding from the DOE to investigate recovery of rare earth elements from coal combustion residuals as well as monazite.
- With the recent move away from globalization towards domestic production of critical minerals, including rare earths, the White Mesa mill is in a unique position as it has the circuits and impoundments largely in place to process and dispose of materials from the rare earths industry (and other critical minerals).

# A NEW PROJECT THAT INCORPORATES THE CIRCULAR ECONOMY

- The new project involves processing a monazite residual from a mine in Georgia (U.S.).
- No new material is mined in this case, rather monazite recovered from the initial mining and physical separation process is utilized.
- The uranium mill is processing the residual monazite primarily for its uranium content (a requirement of their license), but then additionally processing the material to produce a rare earth concentrate that is shipped and further refined into individual rare earth elements and products at Silmet in Estonia.
- The remaining wastes are disposed in the impoundments at White Mesa.
- This is an example of the circular economy using residuals from one plant for additional recovery at another.
- This project has gone from concept to production in less than two years, largely because the permits and infrastructure are already in place.

# Environmental Justice



- Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.
- This goal will be achieved when everyone enjoys:
  - The same degree of protection from environmental and health hazards, and equal access to the decision-making process to have a healthy environment in which to live, learn, and work.
- Many communities around industrial sites suffer from chronic exposure from a variety of sources, including radiation.
- EJ has become a focus of the Biden Administration.
  - EPA is demonstrating its sincerity in this area by proposing that its current office of EJ be elevated to a full Office with a political appointee as head and a line item in the budget.
  - EPA proposed that certain amounts of funding must go to disadvantaged communities going forward.

# Historic exploitation



- The Ute Mountain Ute Tribe of Utah is also an example of an EJ-impacted Tribe due to its proximity to White Mesa as well as dozens of abandoned mines in the area.
  - Local Tribe members have spoken out and challenged the mill's license for decades.
  - They fear pollution from the mill will reach their drinking water sources as well as airborne pollution from the mill and spills from trucks coming and going from the mill.
- In August 2021, the Ute Mountain Ute Tribe passed a Tribal Council resolution stating that “...the operations of the White Mesa Mill [have] had severe health impacts on the residents of White Mesa and should cease entirely...”

# Tribe is not monolithic



- The Tribe, like any group, has a diversity of opinion.
  - Native Americans make up about half the workforce at the White Mesa mill;
  - The mill is the largest employer in San Juan County;
  - It is the poorest county in Utah;
  - Many locals fear that their traditional values and way of life are threatened by the presence of the mill;
  - Yet others see the opportunity for advancement and good paying jobs in the 21<sup>st</sup> Century.
- Energy Fuels Resources (USA), established a fund in 2021 to support San Juan County.
  - The San Juan County Clean Energy Foundation was seeded with \$1 million;
  - Promise of additional funds at the rate of 1% of gross revenue from the mill;
  - Projects are still being evaluated for funding.

# Globalization has deep roots



## It Will Take Time to Turn The Ship of State...

- Churchill once said: “America always does the right thing, after they have exhausted all other possibilities.”
- The reality of the U.S. critical minerals policy and market, including rare earths, over the last three decades has been based on a globalized market.
  - Cheaper commodities from international sources took precedence over security of supply.
  - Companies were sold to foreign owners.
  - Companies sent their manufacturing overseas and abandoned their domestic workers, many losing their livelihoods forever.
  - Workforce competency in these areas is not what it once was and will have to be restored in numerous capacities.

# Defense Production Act...



- The U.S. has also allocated funding through the Defense Production Act to kickstart some of the supply chain issues.
  - Throwing money at acute problems is a traditional American approach.
- It will take an open process that includes a variety of stakeholders and willing partners to advance the circular economy approach in the U.S. with respect to radioactive materials.
- These processes are not far enough along to determine how TENORM will be addressed; it may be an impediment to reuse, but if certain conditions are met (e.g., no human direct exposure or consumption), then perhaps the economics will favor more reuse of industrial residuals over time.
- Permitting new mines will take time:
  - The executive orders do not side-step environmental review requirements;
  - but perhaps some permitting can be timelier if the agencies were properly staffed and if permit applications had all the necessary information to conduct reviews.
- It is beyond the scope of this paper to say to what extent things are held up due to legal challenges from a variety of parties, but lawsuits can hold up projects for decades.

# Not Mutually Exclusive

- Environmental Justice and reliable domestic sources of critical minerals are not mutually exclusive.
- It cannot be one or another, it must be both.
- There should be “balance” to the priorities, but history shows that one must accept that politics and policy may sometimes override fairness.
- This issue extends well beyond White Mesa.
- New mines being proposed for lithium, for example, are being challenged on environmental grounds.
- The U.S. Steel industry has a zero tolerance for any radioactivity in scrap.



# Summary



- Past industrial practices in the U.S. have been hard on communities of color and on Native American tribes.
- Early efforts at reusing uranium mill tailings in building materials and as construction fill caused over \$1.5 Billion in cleanup costs, with cleanup still continuing decades later.
- New efforts in the U.S. to reprocess residuals into useful products using TENORM are starting to occur.
- How U.S. policy will evolve is an open question, as it is tied to different approaches by the major political parties.