ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Aquifer Protection Program (APP) Permit

SUMMARY and RESPONSE
to
PUBLIC COMMENTS

Hermosa Project
South32 Hermosa Inc.

Permit No. 512235
LTF 101257

Response to comments received during the public comment period:
August 23, 2024 to October 18, 2024

Prepared By:
Arizona Department of Environmental Quality (ADEQ),
Groundwater Protection Section

Date: February 06, 2025

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1. INTRODUCTION

a. Summary

The Hermosa Project (Mine) is located approximately 5 miles south of the Town of Patagonia, Arizona. The approximate latitude and longitude of the Mine is: 31° 27' 59.4" North and 110° 43' 35.8" West. South32 Hermosa Inc. (South32), formerly Arizona Minerals Inc., purchased the historic January and Norton Mine Claims, the Trench Camp Mine Claims, and associated Tailings Pile/waste rock from the ASARCO Trust in early 2016. Historic tailings piles from various locations at the site were relocated and placed on a lined permanent containment as part of the ADEQ Voluntary Remediation Program. Under the current permit amendment, the Tailing Storage Facility expansion, referred to as "TSF1", will increase the geomembrane lined footprint laterally from the current footprint of approximately 28 acres to approximately 55 acres. TSF1 will have a maximum stacking height of 243 feet resulting in an increase in the maximum elevation from 5,175 feet to 5,275 feet. TSF1 will employ a composite lining system consisting of 60 mil double-sided textured High Density Polyethylene geomembrane overlying either 12 inches of compacted Low Permeability Soil Layer or Geosynthetic Clay Liner in designated areas. Dry stack historic and production tailings are the primary material placed in TSF1. Water treatment solids from WTP1 and WTP2, core cutting solids, drill cuttings, assay rejects, sediments from vehicle and equipment wash sumps, and sediments from stormwater BMPs constitute a small amount (<2%) of the total TSF1 volume.

The Individual Aquifer Protection Program (APP) permit covers the entire lifecycle of the facility including its operational, closure, and post-closure periods.

b. Public Notice Comments

The public comment period originally was from August 23, 2024 to October 6, 2024. Due to miscommunication during the public hearing about the end of the comment period, the public comment period was extended to October 18, 2024. The preliminary decision to issue an Individual APP permit and the associated public hearing was published in the *Nogales International* on August 23, 2024. A public hearing was held in person on October 2, 2024 at Patagonia Union High School located at 200 Naugle Avenue, Patagonia, AZ, from 6:00 to 8:00 pm. This summary of public comments received and associated ADEQ responses is prepared in accordance with the Arizona Administrative Code (A.A.C.) R18-9-109.

Any commenter who is adversely affected by issuance of this permit has the right to file an appeal on the issues raised in their comments, and request a hearing on the final decision as an appealable agency action under Arizona Revised Statute (A.R.S.), Section pursuant to Arizona

Revised Statute (A.R.S.), Section § 41-1092. You have the right to obtain a hearing on this appealable agency action, pursuant to A.R.S. § 41-1092.03, by filing a written request for a hearing with ADEQ within thirty (30) days of receipt of this determination. A Request for Hearing or Notice of Appeal is filed when it is received by ADEQ's Hearing Administrator as follows:

Hearing Administrator
Office of Administrative Counsel
Arizona Department of Environmental Quality
1110 W. Washington Street
Phoenix, AZ 85007

The Request for Hearing or Notice of Appeal shall identify the party, the party's address, the agency and the action being appealed and shall contain a concise statement of the reasons for the appeal. Upon proper filing of a Request for Hearing or Notice of Appeal, ADEQ will serve a Notice of Hearing on all parties to the appeal. If you file a timely Request for Hearing or Notice of Appeal you have a right to request an informal settlement conference with ADEQ under A.R.S. Section 41-1092(06). This request must be made in writing no later than 20 days before a scheduled hearing and must be filed with the Hearing Administrator at the above address.

2. CHANGES TO THE INDIVIDUAL APP PERMIT BASED ON RESPONSE TO COMMENTS

No changes were made to the permit.

3. RESPONSES TO COMMENTS

The table below lists the commenters.

Commenter #	Commenter Name	Submitted Vi(a
1	Carolyn Shafer	Verbal Comment
2	Chris Werkhoven	Verbal Comment & eMail
3	Vanessa Register	Verbal Comment
4	Alexander Johnson	Verbal Comment & Written Comment
5	Chuck Klingenstein	Verbal Comment
6	Adriane Hofmeyr, Patagonia Area Resource Alliance (PARA)	SmartComment

7	Misael Cabrera	SmartComment
8	Brent Musslewhite, South32 Hermosa Inc.	SmartComment
9	Steve Trussel, Arizona Mining Association (AMA)	SmartComment
10	Ted Maxwell, Southern Arizona Leadership Council	SmartComment
11	Zach Yentzer, Tucson Metro Chamber	SmartComment

Comments received during the public comment period are presented below, followed by ADEQ's responses. Written comments received on the official record were received during the formal Public Comment period and verbal comments received on the official record were received during the Public Hearing.

Commenter #1 – Carolyn Shafer

This is less a comment on the permit than a request for clarification of the permit. The way I read the permit, this is for the expansion of the tailings area from 28 acres to 55 acres. I believe, on information that we have from drone pictures in 2019 and 2024, that the acreage of the 55 acres was already developed and I'd just like to confirm that. And this permit is about authorizing South32 to use that entire area now. So that's one thing I am looking to clarify.

I don't see where they're going to expand it on the existing property from 28 to 55, and it seems logical that it is already that size. And coming from a business background, that makes sense that, when they were out there constructing this, why not construct it at 55 instead of 28 because they are on site? And this amendment now appears to be official saying that it is permitted to be used for the tailings.

The second question/comment that I had that I would like clarification on is this was originally for stacking of specifically -- besides historical, it was exploration decline of shaft development rock solids associated with the water treatment filter cages and a few other things.

This permit now seems to be allowing additional material from the expansion to happen, and I wanted to ask if ADEQ has been on site to look at that large area for materials that haven't already been deposited there.

Are those items that were clearly authorized under the prior permit, or were things deposited there that you didn't know about and are now a part of the permit? Thank you.

ADEQ Response: *This permit amendment authorizes the expansion of the TSF from 28 acres to 55 acres. ADEQ has confirmed that construction work beyond the current footprint has not started; however, it should be noted that placement of pollutants beyond the current permitted footprint is not allowed until permitted and would be a violation of law should that occur.*

Regarding the comment related to materials allowed to be placed on the TSF, placement of additional materials have been permitted through multiple permit amendments, and the current amended permit allows additional materials to be placed on the TSF which include production and historical tailings, development rock from exploration and future mine development, soil and rock from construction cuts, including PAG, solids associated with water treatment including filter cake, core-cutting solids, drill cuttings, assay rejects, sediments from vehicle and equipment wash sumps and sediments from stormwater best management practices.

Commenter #2 – Chris Werkhoven

Verbal comment:

My name is Chris Werkhoven, and I live in Sonoita just up the road here, and I would like to make a few comments about the permit that is being proposed.

I read through all the papers including the application. It's always interesting to do, although it takes a lot of time. It's 1,500 pages or something like that. You'll know a lot from what is there and learn also from what's not there. And so let me start with one point on that, and that is you already said 55 acres, 243 feet high. It's strange that that is $10 million dollars of material. That is about 2,000 feet higher than you announce today. That's a lot of kinetic energy when it comes down because it will come down one way or the other. And with it, it will take the tailings, of course, and the tailings will have large amounts filled of metals, pretty unfriendly metals, so to speak, including lead, manganese, and mercury. You don't want to have that in your backyard. To avoid that, the mine engineers proposed to do a dry stacking which is an interesting approach. It doesn't require a dam to hold back liquids and things like that. The permit is to keep it dry because, if it isn't dry, it will eventually liquify and then, because the height, it will come down whichever chooses the way to go.

That may take a while to do so, but the main source for the liquefaction is, of course, rainfall and when you read in the calculations as people do estimations about how much

rain needs to liquify. We find out that in 2017, there was a really interesting change of weather into a barrel that made it, in 2017, a thousand-year storm. Basically, like the one you just saw in the southern part of our country. You have seen what that means; right? So, 2017 must always have a (indiscernible). So, I think in these calculations, people need to do a real calibration about what is going to happen in the next 100 years because that's what the lifespan of this mine is when the people are still around. What will happen after that is not known, and that brings me to the second subject when you look at the disclosure part of the permit doesn't disclose anything. There is no described procedure of how the treatment will treat the tailings of the pile of waste material. So, it's, to my opinion, a really big question how you can permit something that doesn't have a described end? Thank you.

ADEQ Response: *TSF stability is a component of review during APP permitting. The APP requirements ensure stability of the TSF through design review, monitoring, recordkeeping and reporting throughout the life of the facility.*

The facility is designed to manage water for a 100-year, 24-hour storm event. This design is in line with Mining BADCT which recommends that the minimum design storm be the 100-year, 24-hour storm event. The Tailings Storage Facility TSF1 Operations, Maintenance and Surveillance (OMS) Manual contains the additional measure during and after the storm event to ensure the integrity of the TSF1 and water management system.

Soil liquefaction occurs when saturated soil loses its strength and behaves like a liquid due to increased pore water pressure, leading to a loss of shear strength. It can be triggered by static liquefaction (caused by gradual loading or stress changes) or earthquake liquefaction (caused by seismic shaking).

Regarding seismic liquefaction, stability analyses were conducted for a 2,500-year seismic events for pseudo-static analysis. These exceed the BADCT recommended analysis for the Maximum Probable Earthquake (MPE), which represents the largest earthquake with a 100-year return interval.

Regarding static liquefaction, soil must be saturated to liquefy, making dry stack tailings, with over 75% solid content, less susceptible to liquefaction compared to conventional tailing dams. The permit for South32 includes Compliance Schedule Items #6 and #7, which require that the Construction Quality Assurance (CQA) and site investigation evaluate the probability of static liquefaction during the operation.

To mitigate the risks of pore water pressure buildup within the TSF, TSF1 design includes high-density polyethylene (HDPE) pipes to gravity-drain fluids into an external pond, eliminating the

need for pumping. Additionally, pore pressure and phreatic levels are monitored using piezometers.

eMailed Comments:

1. ***The design of TSF1 complies with ADEQ's original 2003 BADCT that very likely will not protect public health and the environment with an adequate margin of safety***

Arizona statutes prescribe that for the construction of TSF1 the permit applicant must adhere to the guidelines as published by ADEQ in its Best Available Demonstrated Control Technology (BADCT) handbook for mining. In many places of the TSF1 application references to such compliance are made.

> *The objective of a compliance is to assure that TSF1 during operations and after post closure there is no cause or contribution to an exceedance of air, soil and water quality standards*

However, the BADCT as used for the design of TSF1 was first published in 2003 after several years of preparation during which information was consulted that was published even decades before that. BADCT is meant to implement engineering and operational practices that create an adequate margin of safety, but without regular updates, will not be able to do that using best available practices in estimating the risks of hydrologic and seismic events, the two major causes of catastrophic failure of structures that are among the largest manmade ones on earth, ie metal-mining tailings impoundments or dams.

Recorded failures have caused unparalleled loss of life and ever lasting property and environmental damage, the cost of which are typically borne by local communities. Lessons learned point to a need to use probabilistic methods rather than deterministic methods to guide designs that must last in perpetuity, the horizon of which may be 10,000 years or the time past since the last ice age.

That implies that very conservative approaches are needed to determine the consequences of extreme meteoric and seismic events rather than rely on specific hazard numbers that may be flawed. After all, unlike water containment dams or even nuclear reactors, tailings piles cannot be removed.

Of particular concern is the fact that APP2 is dedicated to a dry- stack tailings storage facility, a relatively new technology for which even today only limited safety reporting exists, let alone in the decades before 2003 when post-closure experiences were actually non-existing.

Nevertheless, in case of the development of seismic design parameters that are supposed

to prevent "loss of life due to slope failure", APP2 states that the more recent "recommendations from ANCOLD (2019) and GISTM (2020) were only considered" (page 77). Moreover, none of those criteria "specifically address dry stack TSFs and are written for traditional slurry facilities (page 109)". This lack of enforceable requirements is an uncomforting starting point for an APP application.

Failure of dry stack dams is known to depend on how well filtering, drying and compaction is controlled on-site to obtain the desired "engineered fill" and how reliable subsequent water management is during operations and after post-closure to avoid liquefaction at any point in time and in particular during earthquakes. After all, the tailings stack is now its own "dam".

Liquefaction of TSF1 tailings has the potential of easily overtopping the embankments of TSF1 and USCP and cause a flow of toxic tailings downstream to the Sonoita Creek watershed. Such a collapse will have not only a large, immediate impact on public health and environment, but one that will last for centuries.

According to International Committee on Large Dams (ICOLD), world-wide tailings storage failures remained steady at about 1 per 8 months which makes it very likely that also the APP2 for TSF1 will not be able to avert what is considered as inevitable.
Making this quantitative by estimating the probability of failure is not part of BADCT and is thus not included in APP2. This is a lack of transparency that needs to be addressed.

ADEQ Response: *ADEQ acknowledges that the Arizona Mining BADCT Guidance Manual (Manual) has not been updated since 2004. It is important to note that the Manual is a non-binding, substantive policy statement and does not limit ADEQ or its applicants in designing and constructing facilities that exceed the standards outlined in the Manual. As a result, ADEQ is APP not bound to or limited by the Manual and in fact, as described below, the Permittee has designed the facility using current best practices that meet or even exceed the Statutory requirements of A.R.S. 49-243.*

The Permittee has committed to Global Industry Standard on Tailings Management (GISTM) and International Commission on Large Dams (ICOLD) standards for dam safety that go beyond the current BADCT guidance. The GISTM Dam Safety standards have been designed considering recent dam failures across the world to protect public health and environment. ICOLD is promoting the safety of large dams around the world by developing international standards, encouraging best practices, and fostering global collaboration. Dam safety is a complex and multifaceted issue, and ICOLD's efforts help ensure the long-term stability and security of these critical infrastructure assets. It should be noted that ADEQ does not have the authority to enforce either GISTM or ICOLD in the State of Arizona.

APPENDIX B Seismic Hazard Report provides a site-specific seismic hazard analysis (SHA) that was conducted for the Hermosa Project, and its findings were incorporated into the facility's design. Additionally, the updated 2023 USGS National Seismic Hazard Model aligns with the primary seismic sources identified for the site, recommending new seismic values that are significantly lower than those used in the TSF1 design criteria; thereby making the TSF1 design more conservative. Table 4.1 of the Appendix B presents the Probabilistic Design Accelerations and 10,000 years return period is PGA (g) of 0.22.

For detail, please refer to page 72 of Attachment A "Hermosa Lined TSF Design Amendment" Section 7 "Geotechnical Evaluation" within the Aquifer Protection Permit Significant Amendment Application, dated December 21, 2023. The permit contains numerous monitoring requirements, performance standards, and contingency requirements related to TSF1 safety and stability such as Sections 2.3.1, 2.6.2.1, 2.6.2.6, 2.6.2.7, 2.6.3, and 4.2, Table 8, as well as compliance schedule items 3, 6, 7, 8 and 9 in Section 3.0.

ADEQ is not aware of any recorded failures that are related to dry stack tailings facilities. Currently, recorded failures are related to hydraulic deposition of the tailing dam. Unlike traditional tailings storage methods that involve slurry and water, dry stacking involves dewatering tailings to a consistency that allows them to be compacted into dry stacks or piles.

Filtered tailings, placed according to operational specifications, will remain resistant to liquefaction throughout operations and closure. This is due to their dilatant shear behavior (increasing the volume during shearing) and low hydraulic conductivity. The low hydraulic conductivity helps resist moisture changes and prevents the saturation of the tailings, a key factor in avoiding liquefaction. Probabilistic calculations for stability are not required; however, industry uses them for informed, risk-based decision-making. However, probabilistic calculations are not inherently more conservative, as they depend on subjective methods and probability parameters based on operational history. In contrast, deterministic calculations are more commonly used in practice and are considered objective and more conservative due to their reliance on fixed values. The material properties assumed for the project align with current geotechnical practices for similar TSF projects. Please note that the TSF report required by CSIs #6, #7 and #9 compares the TSF performance with the design, and any necessary changes will result in design modifications

The expanded Tailings Storage Facility (TSF1) will be a lined facility designed to contain dry stack (filtered) tailings. The Underdrain Collection Pond (UDCP) is double-lined with leak detection. TSF1 will not function as a dam, but as a landform primarily composed of filtered tailings, with smaller

quantities of materials outlined in Section 2.2.1.1.4 of the permit. The facility is designed to manage tailings in a dry stack configuration, and the associated risks and failure modes have been thoroughly analyzed and it was determined to meet legal requirements.

2. ***Existing metal mobilization and impairment in the Patagonia Mountains watersheds is not disclosed as a Site-Specific Factor in the APP2 application***

   More than one decade ago, US Geological Survey (USGS) and the University of Arizona (UoA) already designated the Patagonia Mountains as a "Mineralized Ecosystem". Toxic metal compounds from abundantly available mineralized rock and legacy mine draining, have been and still are, mobilized by precipitation events. This phenomenon includes toxic compounds dissolved or suspended as particles in runoff water or adsorbed to eroding soils and streambed sediments.

   Shown too was that eventually, metal accumulation in vegetation can lead to threats to the human food chain.

   > *Continuous discharges as planned for in APP2 will exacerbate the mobilization of toxic metals and as modelled extensively in the APP1 application, claimed to fully infiltrate shallow aquifers even before the downstream confluence with the alluvial aquifer of Sonoita Creek, the main source of drinking water of many residents.*

   Under "Site-Specific Characteristics" in Draft Permit, Place ID 18640, LTF 101257, Significant Amendment, page 13, Section 2.2.2, S32 replies: "Not Applicable". This ignores the just mentioned demonstration in all APP applications so far, that the discharges as planned for do infiltrate the vadose zone and affect regional groundwater quality at some point in time. As per Fig 1-1 of BADCT, this means Individual BADCT guidelines must be adhered to which specifically requires an Aquifer Loading Plan where adequate monitoring must take place at a suitable POC.

   In APP2 (and preceding APPs) only a "conceptual" POC is proposed to monitor discharges in Harshaw Creek by which S32 fails to demonstrate that there will be no cause or contribution to an exceedance of aquifer water quality standards due to discharges in Harshaw Creek.

ADEQ Response: *ADEQ acknowledges the presence of mineralized ore bodies within the Patagonia mountains, which is evident from the mining history in this area. This was considered by evaluating potential sources of heavy metals loading to the Harshaw Creek watershed. ADEQ concluded that it was highly unlikely that the treated water from the outfall would leach heavy metals from the streambed material based on the following:*

- *ADEQ's 2003 TMDL Study showed that the Harshaw Creek is not impaired downstream of Outfall 2 and the lack of iron oxide staining or salt residues within the drainage suggests that the conditions within the creek were not impacted by historic acid mine drainage.*

- *South32 has engaged in remediation of historic site activities and treating mine impacted water from the January Adit, moving historic tailings onto a new lined TSF. These activities will have a positive impact on the Harshaw Creek drainage downstream of the Hermosa Mine*

- *ADEQ assessed that the pre-dominance of coarse-grained material comprising the streambed was not conducive to absorbing trace metals that could later be leached to surface water or groundwater. This differs from streambeds consisting of fine-grained material with higher cation exchange capacity, which generally have a higher adsorption potential for trace metals and subsequent releases to surface water and groundwater.*

- *South32 Seeps and Springs Catalog confirms the non-impaired nature of Harshaw Creek downstream of Outfall 2. In-stream water quality data from Harshaw Creek aligns with the results and conclusions of the 2003 TMDL Study. ADEQ will review updates to the Catalog to monitor any changes in the geochemical nature of the in-stream water quality.*

- *The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Cleanup of the Lead Queen Mine, which is located along a tributary to the reach of Harshaw Creek that is downstream of the outfall. The U.S .Forest Service installed a hydraulic plug at the main adit, reducing the amount of acid mine drainage and metals loading in the Harshaw Creek watershed. The CERCLA cleanup also included the excavation and hauling of waste rock material to a single below-ground consolidation cell. A total of 11 zeolite gabion basket structures were also installed in the stream channel at various locations downstream of the main adit in order to mitigate stormwater impacts to the watershed.*

- *The remediation of the Upper Harshaw Creek mine site (i.e., Un-named Mine, Endless Chain Mine, and Morning Glory Mine) included the removal of waste rock and tailings from the watershed above the WTP2 outfall.*

The conceptual monitoring well at the point of compliance (POC) is appropriate given that the discharge from WTP2 is required to meet discharge limits (DL) set forth in the permit and if monitoring for discharge quality reveals exceedance of DLs, the permittee is required to follow

contingency and corrective actions as outlined in the permit. Additionally, an Alert Level (AL) (established at 80% of the aquifer water quality standards (AWQS) concentration) exceedance will also trigger contingency actions specified in Section 2.6.1 of the permit. The discharge monitoring is therefore more conservative because contingency actions can be taken more swiftly in the event of an AL exceedance given that groundwater monitoring at the POC located more than 9 miles downstream of the outfall may take months or even years to detect a potential release.

Regarding the use of "Not Applicable" in Section 2.2.2 of the permit, this section is intended to list any site-specific characteristics that may be applicable to a permitted facility. Examples of site-specific characteristics include, but are not limited to: hydraulic passive containment, low permeability, depth to groundwater, etc. The Hermosa Project did not present any site-specific characteristics that affect the design of the APP regulated facilities.

3. ***ADEQ has not demonstrated that TSF1 drainage chemicals do not lead to premature failure of the liner under actual operational - and post closure conditions***

   In APP2, there are frequent references made to the positive experience of the TSF liner system as a barrier against infiltration of toxic tailing drainage into soil and groundwater. However, this system has only been in operation since 2018 to store legacy Trench Camp tailings that may not be representative of those produced from Taylor ores and those tailings will be stacked to much larger heights as well, exerting a much higher pressure on the liner.

   The list of chemicals that the liner is resistant to includes sulfuric acid, but resistance is only to a limited extent (page 1154). This acid always is a main component in the drainage fluids from sulfide containing ores, like those of the Taylor Deposit. After decades of operation, drainage may become concentrated in places where transport by gravity became ineffective, eg at topographical-low spots.

   The manufacturer warns that "certain polar liquids and mechanical stress can lead to stress cracking so that "specifications are not necessarily valid for all applications" and therefore states that "chemical resistance testing under the specific service conditions should not be precluded (page 1139)". APP2 does not report on chemical resistance testing of the liner under stress conditions which could mean that the liner lifetime is much shorter than anticipated.

   APP2 reports on page 120 that the chemical composition of drainage is "variable, will be slightly acidic but far below the acidity threshold that is tolerated by the geomembrane". The chemical analysis results are unexpected considering that tailings do produce the well

documented "Acid Mine Drainage", the reason for granting the VRP to AMI in the first place.

The cited data refer to the chemical analysis of leachates obtained from tailing samples following several laboratory-based leaching methods (page 1381). This is obviously not representative for a leachate that has percolated for many years, possibly decades, through a tailings pile that is several hundred feet high. The actual composition of leachate samples collected from TSF1 (or from TSF for that matter) is not reported in APP2 and not used to perform the testing recommended by the liner manufacturer.

The draft permit uses a lifetime of 20 years for the liner and describes inspection for cracks and punctures, or even the monitoring of the amount of drainage collected from the layer in between the double liner of the UDCP that is "conveyed to a sump for removal" (page 74). APP2 fails to provide corresponding replacement criteria and how to replace or repair the TSF1 liner once it holds 10 million ton of waste material.

ADEQ Response: *Arizona Revised Statute 49-243(B)(1), requires that the design and operation of a tailings storage facility (TSF) not cause or contribute to a violation of AWQS or further degrade the aquifer at applicable POC monitoring locations.*

The existing and new tailings have been characterized using industry-standard methods to assess their potential for acidic contact water or metal release. Material characterization for the production tailings is detailed in Attachment B of the APP permit Significant Amendment Application. The TSF will utilize a composite liner system, consisting of a geomembrane over a compacted low-permeability soil layer or geosynthetic clay liner (GCL). Technical specifications for the GCL are provided in Appendix E.2 of Attachment A, with GCLs expected to last over 100 years under normal conditions. Upon closure, the TSF will be capped to shed meteoric water and minimize infiltration. The TSF will be constructed over a period of 8 -10 years, while the cover designed for post-closure will ensure the facility minimizes infiltration through TSF1.

The GCL and HDPE specification indicates limited resistance, with reduced tensile strength and elongation at break when exposed to aqueous sulfuric acid concentrations greater than 98%. In comparison, the solutions in the TSF as presented in Attachment B, Table 2 (in the column labeled pH, Saturated Paste) of the APP permit application, indicates the pH would be circumneutral (typically between 6.5 and 7.5). In addition, the downgradient POC well (POC-2) is installed to detect potential release from the TSF1 or the UDCP.

4. ***Deposition of airborne, metal-containing particles from TSF1 is not considered as a new source that can cause or contribute to an exceedance of soil and water quality standards***

There is no information in APP2 available on the issue of wind erosion of TSF1 where air-suspended, metal-containing particles will deposit on soils, surface waters and biota at any given distance from TSF1, during life-of-mine, post closure, as well as for an undetermined duration after post closure.

Only for NAAQS compounds, deposition may be regulated via a so-called secondary standard and listed for some compounds and particles. Relevant here is PM2.5 and Pb, and values for both show the same number for Pb but a lower number for PM2.5 compared to the primary, inhalation-based, lifetime exposure health standard.
Since the modeling of the Hermosa Mine emissions has shown compliance with primary standards, ADEQ concludes in its Response to Public Comments that "public welfare is protected, including the preservation of soils and surface water". It also states that there are no tools or guidelines available to verify compliance.

However, any source that can cause or contribute to an exceedance of a safe standard is not allowed and since the Patagonia Mountains has many impaired areas for soil and surface water, any discharge of metal containing particles should be avoided.

Moreover, deposition is estimated as part of the air dispersion modeling but only for a particular emission year with no requirement to estimate the accumulated amounts over the life- of-mine, let alone into perpetuity. A good first approximation is that the accumulated concentrations are simply the addition of all years of dumping tailings. For deposition on soils and stagnant water that approach will be more accurate compared to deposition on streaming water surfaces. Such accumulation may readily lead to an exceedance of safe standards.

An example of the rate of deposition at a given air concentration can be found in the study of Teresa Bowers et al of the environmental consulting company Gradient, titled: "Prediction of Soil Lead Recontamination Trends with Decreasing Atmospheric Deposition". It shows accumulation of Pb in residential soils near a Pb smelter in Missouri under varying operational conditions of the smelter.

From this unique work it can concluded that at an average air concentration of 1 microgram Pb per cubic meter, about 1 ppm of Pb is added per year as an average concentration close to the surface of exposed soils. Considering the history of the Patagonia Mountains and even the town itself when it comes to mining and smelting, it may be not surprising to find reported metal concentrations in soil that are well over 100ppm.

To what level TSF1 emissions will accumulate pollutants on nearby soils and water is a factor that needs verification as particles and receptor areas are different in nature, are

submitted to different environmental conditions, have different metal transportation characteristics and may show different bio- availability potentials to local biota.

> *It is surprising that similar accumulation studies have not been encouraged in a state like Arizona that is littered with mines and enormous tailings piles imposing ongoing threats to public health and the environment*.

Bottom line is that TSF1 is a new air pollution source in an already impaired area that will last into perpetuity. Therefore, accumulated deposition cannot be ignored as a contribution to safe standard exceedances of soil and water, the extent of which needs to be estimated as part of the APP2 application and granting.

ADEQ Response: *As designed by Arizona Law, the APP permit regulates discharges of pollutants to Arizona's groundwater to protect groundwater quality. As such, ADEQ does not have the legal authority to base the APP permitting decision on air quality impacts. You may review information for the ADEQ Air Quality permit at: https://www.azdeq.gov/aqd/hermosa-south32*

5. ***APP2 lacks a probability of failure assessment on liquefaction of TSF1***

Although considered safer than slurry-based and dam protected TSF designs, there is not decades of safety records on dry stacking, certainly not now the severity of climate change induced rainfall appears to be increasing and stack heights keep increasing as well, both facilitating liquefaction.

The obvious advantage of a dry stack is that it does not need a dam to contain tailings slurries as dam breaches still are the #1 cause concerning socio-economic and environmental damage of mining. On the other hand, the tailings pile itself now has to hold together.

TSF1 uses a so-called "upstream" design, which is the least expensive but also least capable in keeping adhesion between tailings particles strong enough. Dry stacking therefore requires some expensive and serious operational practices to avoid liquefaction and subsequent flooding of downstream areas with toxic waste.

The safety of a geotechnical engineering structure like a TSF is typically judged, like in this APP2, by means of a Factor of Safety (FoS). The FoS number is obtained by considering the ratio between the strength and the stress of an engineering element, like in Table 4.1, page 112, where some of design criteria elements have a value larger than 1.0 and are thus considered sufficiently safe. However, it is not clear what each of the elements represent while each FoS score has no safety margin, like a standard deviation.

Considering the many elements involved that affect TSF overall safety, it is more rational to determine the sensitivity of each of those elements on its FoS and obtain a cumulative ”probability of failure” histogram. From such a histogram the mean FoS for all variables is included with a standard deviation while the probability of failure number can be obtained as the area ratio for FoS below 1.0. That number can be found acceptable or not and in the latter case the project will not be approved and a tighter control of parameters will be required. Table 4.1 provides only piece meal information and is insufficient to make such a judgment.

Variabilities Involved for TFS1

Next to height and slope, examples of operational elements key to the probability of failure are the particle size -, moisture content - and compaction control, etc.. On page 1167, for instance, it is stated that in case of 85% iso the target value of 93% compaction, the FoS will be below the minimum allowed value of 1.0. Another example is mentioned on page 103 where a two orders of magnitude range in permeability is reported between tailings tested in 2020 vs tailing tested in 2022. Instead of assigning a probability range, it was decided to only accept the 2022 data as input for FoS, based on “expected” trends” and “engineering experience”. Many dam failures in the past could be attributed to similar misjudgments due to not recognized variabilities in tailing properties.

Other variables that should be included is the control of the so-called phreatic level (below which tailings are saturated facilitating liquefaction) that is influenced by rainfall and water management, the latter including the availability of adequate pumping caused by extreme weather, power outages, blocked access, earthquake damage, etc.

Another example is the use of a 100-year/24-hr flood and not the Probable Maximum Flood (PMF) as after all, in 2017 a 1,000 year event was recorded for the Patagonia Mountains (page 1352) already. This event was modeled as part of the water balance determination but considered “extremely unlikely to occur during the relatively short operational lifetime of the facility”. A conservative probabilistic approach should have used the PMF information.

Similarly, for the Maximum Credible Earthquake (MCE) the Santa Rita fault was taken as most conservative because of it is the most nearby location (30 km) but that fault has no recorded history making any determination of its damage potential, highly speculative (page 239). In contrast, the 1887 San Bernardino Valley earthquake (along the re-activated Pitaycachi Fault in an area of otherwise low seismicity) in Mexico has been estimated as of 7.2 magnitude (by Dubois et al, 1980), the largest earthquake known in Arizona and in the western US, with California excepted, causing considerable loss of life and considerable damage, was of high energy and a focal depth as deep as 15 km and started many mountain fires due to falling rock. This event was followed by 3 other earthquakes (not

listed in APP2) in the 4-5 magnitude range. The warranted conservative probabilistic approach would be to take this earthquake as being located at the Hermosa Mine site which would have made any dam design prohibitively expensive.

In conclusion it is worthwhile to quote Jack Caldwell in "Long term risk of tailings dam failure" by David Chambers and Bretwood Higman, 2011, page 18, footnote 24:

> *"….I believe those who focus on single causes of failure are deluded. There is no single reason for failure of a mine geowaste facility. All failures that I have known are the result of a string of minor incidents. If but one of this string of incidents had been dealt with, no failure would have occurred. This is pretty much standard accident theory these days, although it seems not to have entered the otherwise bright minds of those who write on the failure of mine geowaste facilities.*

Conclusions made about tailings dam failures include the use of local "earth" as a construction material and lack of quality control over the years that the "dam" is rising in height and becoming more susceptible to failure.

ADEQ Response: *ADEQ does not agree that a probability of failure assessment is appropriate to determine liquefaction risks. Please refer to ADEQ's response to Commenter #2 – Chris Werkhoven's verbal comment for Liquefaction for details regarding liquefaction.*

The dry stack material will be compacted and has no starter dam like conventional tailing upstream that has high risk of liquefaction due to the method of disposal. TSF1 material is more than 75% solid content, much higher than conventional tailings, which typically are around 55% solid content. The filter material will be placed and compacted to 95% of the Proctor density; therefore, dry stack failure is not comparable to that of a conventional TSF deposition. The permit contains numerous monitoring requirements, performance standards, and contingency requirements related to TSF1 safety and stability such as Parts 2.3.1, 2.6.2.1, 2.6.2.6, 2.6.2.7, 2.6.3.5, and 4.2, Table 8, as well as compliance schedule items 3, 6, 7, 8 and 9 in Part 3.0.

Relating probability to a factor of safety (FOS) is not appropriate. The limit equilibrium method is the standard and current practice for evaluating TSF slope stability, and probabilistic design accelerations have been provided in Table 4.1 of the Appendix B, which aligns with accepted tailings dam design guidelines and BADCT. The performance reports required by CSI # 5, 6, 7, and 9 will monitor TSF performance against initial assumptions and evaluate the FOS throughout the

facility's lifespan, with any significant variations prompting design changes and permit amendments. The probabilistic approach, which relies on historical data, lacks a guarantee of conservative analysis, as failure probabilities are subjective and operation-specific. In contrast, the deterministic approach is objective and satisfies the ADEQ BADCT requirement for assessing TSF1 design safety. During operations, performance reports will monitor TSF1's performance against its design. Probabilistic analysis exceeds BADCT, which relies on deterministic standards that focus on achieving regulatory compliance through established design criteria. While BADCT provides a robust baseline for minimizing risks, probabilistic analysis expands on this by offering a deeper evaluation of uncertainties, rare events, and long-term conditions and does not translate to conservative results.

Regarding the "variabilities" concerns expressed:

- *The use of 2022 tailings permeability data over 2020 data, has been determined to be appropriate. Permeability does not factor into the stability model for calculating the safety factor. Additionally, the 2022 data is more representative due to an updated grind size that reflects changes in mine planning and better matches the ore body to be mined.*
- *The control of the "phreatic level" and potential liquefaction due to extreme weather is addressed by the design of TSF1, which includes a gravity-based system to collect and convey fluids via HDPE pipes to an external underdrain collection pond. Additionally, real-time monitoring of excess pore pressure and phreatic levels is required with existing piezometers, and the installation of eight additional vibrating wire piezometers required by the amended draft permit, to further monitor phreatic conditions, with alert levels established for the phreatic surface elevation.*
- *The stormwater conveyance structures were designed to accommodate and convey the Probable Maximum Flood (PMF), which exceeds the BADCT criteria of the 100-year/24-hour flood plus freeboard, as detailed in Section 9 of the TSF1 Design Report. Additionally, an updated water balance analysis incorporating data through 2022, including the large 2017 event, was provided by South32 as requested by ADEQ during the amendment review process.*
- *The closest fault to assess potential damage from the Maximum Credible Earthquake (MCE) is addressed by a site-specific seismic hazard analysis (SHA) performed for the Hermosa Project, which was used in the facility's design. Additionally, the 2023 USGS National Seismic Hazard Model supports the seismic sources identified for the site and recommends lower values than those used in the TSF1 design criteria; thereby making the TSF1 design more conservative. The TSF1 design based on deterministic assumptions is more robust compared to one based on probabilistic assumptions. The risk of an*

earthquake damaging the dry stack design is significantly lower compared to conventional tailing dams, particularly in upstream construction.

6. ***APP2 does not demonstrate that post-closure passive treatment is able to protect public health and environment in perpetuity***

In APP2 the definition of "post-closure" is a finite time period of 30 years after "closure". Closure may not solely be determined by the depletion of the Taylor Pb and Zn ores and capping the TSF1 with a "protection" layer. Figure 2-14 of the PoO, page 52, shows post-closure to start at year 77 after approval of the PoO, the latter most probably meaning the final EIS issuance scheduled for September 2026. Hence post-closure may end in 2133 with the longest lasting extraction operation being the Clark Mine for Mn, making the total operations last for about 70 years. To be noted at this point:

> *In APP2, the period after post-closure is not named or covered by any measures that could protect public health and the environment*.

It has been emphasized extensively ever since the APP was granted that during post-closure, underdrainage of TSF1 will be passively treated in the UDCP. This means, of course, that development, testing and on-site qualification of this treatment can only start after extraction of Mn ore has ceased and the Hermosa Mine stops being a profit center for S32. This schedule is confirmed in the PoO.

Considering the bad experience with other mining projects when it comes to funding and execution of tailings maintenance obligations, this application should not be granted without a reasonable demonstration that the intended measures will remain effective in perpetuity within an adequate margin of safety. The chance it can remain effective even without supervision and regulation is reviewed below.

Passive Treatment.

Relevant details on the workings of the intended system can only be found under the cost estimate presented on page 1505 of APP2. Those tables reveal that during the 30 years of post- closure, every 10 years "limestone" is replaced, and sludge is removed while the media used in the not further defined BCR, or BioChemical Reactor, needs to be replaced every 4 years. The use of a 15,500 sqft MRB, or Manganese Removal Bed, is mentioned on page 1506/1507. Its workings are not explained either but includes potassium permanganate recycling using pumps and a piping system that needs maintenance. On page 1508 it is stated that the liner lifetime is 50 years and thus "no replacement" is needed during post-closure.

From the above it appears that the system is less "passive" than suggested and that already 20 years after post-closure, the lifetime of the liner has expired. It will not be replaced.

Permit "revision" must be done every 5 years, but it is not mentioned what this procedure includes and revisions stop at year 30. All that is indicating there is indeed no maintenance or agency supervision after year 30 of the post-closure timeframe.

APP2 does not provide any information on how long after post- closure the intended treatment remains effective in neutralizing metal containing drainage that can cause or contribute to an exceedance of soil or water quality standards. The statement that a "cap-layer" will minimize drainage is highly speculative considering that erosion will reduce its effectiveness in a relatively short time (see Comment #7)

Spillways

Precipitation water is supposed to be stopped from penetrating the stored tailings by the application of a "1-2 foot cap layer" and avoid contact with tailings by runoff water at the same time. It is not estimated what the long term integrity of this layer is, nor how fast erosion can make the layer ineffective, nor how effective the applied re-vegetation will be under climate change and soil nutrition levels offered.

To be noted is that the existing emergency spillway of TSF1 will be removed and replaced by two new, open channel "closure spillways" in order to pass PMF storms that may have been in contact with TSF1, one draining into Harshaw Creek, the other into Alum Gulch. During post closure the former drainage cannot be monitored on possible surface or groundwater quality exceedances at a point of compliance (POC) because the Harshaw Creek watershed only has a "conceptual" POC (POC- 4).

By referring to the required contingency procedures of page 1580 for "slope and berm failures", "an exceedance of an Aquifer Quality Limit" nor "an impact on soil or groundwater" can be determined as the "applicable POC" is only conceptual, which fails to protect public health and the environment during and after post-closure.

Last but not least, there is even less experience with post-closure technology than there is with tailings storage itself which increases the risk exponentially that assumptions made are not sufficiently conservative to protect public health in perpetuity. Or, "The likelihood of extreme events is proportionally large in the long-term phase." (ICOLD, 1996a, page 35)"

ADEQ Response: *Pursuant to A.A.C. R18-9-A202(A)(9), South32 submitted a closure strategy as part of their application. South32 is required to submit a detailed closure plan to ADEQ within 90*

days following notification of closure in accordance with A.R.S. §§ 49-243(K)(6), 49-252 and A.A.C. R18-9-A209(B).

Post-closure monitoring requirements typically include the parameters established for routine groundwater monitoring in the permit. The proposed post-closure monitoring period is for 30 years and will be extended as required to demonstrate the post closure monitoring would be satisfactory. ADEQ has the authority under post-closure activities to require the installation of a monitoring well and conduct groundwater monitoring at the conceptual POC well locations in the event that clean-closure cannot be achieved. At the time of closure, ADEQ will approve the design of the cover to reduce infiltration and improve moisture removal, utilizing methods such as enhancing evapo-transpiration through fine-grained soils or vegetation during closure plan approval. When the mine reaches the end of its operational life, and closure plans are submitted for ADEQ review, the adequacy of the cover and its depth may change based on new information on which could result in additional result in additional cover being required to prevent impacts to groundwater associated with stormwater impacts and infiltration.

ADEQ's authority under A.R.S. Section 49-243 (N)(3) requires an applicant to "demonstrate financial responsibility to cover the estimated costs to close the facility and, if necessary, to conduct post closure monitoring and maintenance". The estimated closure costs are $13,159,546, and post-closure costs are $11,498,363, for a total of $24,657,909. The financial assurance mechanism has been demonstrated through a "performance surety bond" as per A.A.C. R18-9-A203(C)(2. If, during the post-closure period, pollutants are detected at POC-2 above the AWQS and if the liner associated with the passive treatment system is observed to be damaged, liner replacement would be required.

7. ***APP2 does not consider erosion of TSF1 tailings that may cause or contribute to an exceedance of soil and water quality standards downstream of TSF1 into perpetuity***

   Since the Patagonia Mountains represent a mineralized eco-system as described by USGS in its 2007 publication titled: "Understanding Metal Pathways in Mineralized Ecosystems", Circular 1317, erosion per definition involves water but when air is present, metal compounds are leached from mineralized rocks that are exposed by natural or by anthropogenic processes, the latter including leaching from mine tailings storage piles. Such leachates are mobilized downstream in various forms, ie as chemicals dissolved in stream water or as suspended precipitates or particulates.
   Under water deficient conditions, the latter may become noticeable by eye as evaporative salt deposits in streambeds, all depending on the size of particles that happens to precipitate out due to changes in water chemistry, like noticeable from pH measurements.

Dissolved compounds leached from sulfide containing minerals such as extracted from the Taylor Deposit, will produce sulfuric acid that lowers the pH of stream water. That phenomenon is well known as Acid Mine Drainage and can be found at numerous places across the Patagonia Mountains.

Erosion of the TSF1 tailings

In a 2001 study, titled "Spatial variability of sediment erosion processes using GIS analysis within watersheds in a historically mined region, Patagonia Mountains, Arizona", Open-File Report 01- 267", Laura Brady and Floyd Gray of USGS in Tucson, Arizona, and two authors from the University of Arizona in Tucson, Arizona, determined that because of a "previously excavated material status", historic mine tailings have a very high erosion rate. The same study determined that the legacy Trench Camp Mine tailings may have an estimated erosion rate of 178 tons/acre/year, while the highest number of 326 tons/acre/year was found for the close by Sunnyside Mine tailings, probably due to higher terrain relief factors at the latter location.

In a subsequent 2008 paper titled: "Tracking acid mine-drainage in Southeast Arizona using GIS and sediment delivery models", the same authors correlate erosion of legacy mine tailings with local assessments of pH and metal concentrations in stream water providing more information about metal mobilization in the Patagonia Mountains and the likelihood water and soil may have become impaired.

Assuming all future 55 acres of TSF1 will have the same erosion rate as USGS determined in 2001, the stored capacity of about 10 million tons can be totally eroded in about 1,000 years. Erosion materials will be found along the Alum Gulch and Harshaw Creek streambeds, but most may settle along the Sonoita Creek streambed and at the bottom of Lake Patagonia.

Since TSF1 tailings are dried and compacted, erosion may be slower than estimated for the original Trench Camp tailings. Nevertheless, the 2012 University of Arizona thesis of Katherine Eddleman, titled: "Bioaccumulation of Heavy Metals from Soils to Plants in Watersheds Contaminated by Acid Mine Drainage in SE Arizona", shows in Figure 21, page 99, the change in metal concentration found in sediments and soils along Sonoita Creek going from the source near Sonoita to near Lake Patagonia. Only at the confluences with Harshaw Creek and subsequent streams originating from the Patagonia Mountains, metal concentration values increase substantially above background, corroborating the prediction of Laura Brady about the source of this pollution.

It is worth mentioning that the use of the soil analysis results shown in the Figure 21 in the Eddleman thesis, was given by the earlier quoted Floyd Gray actin as the USGS "chief investigator on the Sonoita Creek soils project". Both investigators nor the Director of the

office of USGS in Tucson were found willing to comment on this reporting as part of the appeal on APP1 in 2022, and again not as part of these comments.

> *No soil investigations have been performed by ADEQ in spite of the promise to do so "in a later phase of the investigation" as "earlier USGS findings suggest that streambed sediments are the primary source of pollutant loading", "…and (USGS) contend that flows through sediment and evaporative salt deposits will trigger loading, regardless of season (page 16 and 20 of the ADEQ/USGS Upper Harshaw Creek TMDL report".*

Also On page 20 of the TMDL study: The USGS has concluded that mine dump erosion and the accumulation of evaporative salts from acidic, metal-enriched discharge from abandoned mine sites are the largest contributors to degraded streamflow during storm events (personal comm, Floyd Gray, USGS, 05/31/02).

Moreover, in support of the Eddleman reporting on metal accumulation in soils and vegetation are the extensive findings of USGS reported in 2020 for the Red Mountain area, which is part of the watershed of Harshaw Creek. In this report, authored by Maurice Chaffee and titled: "Geochemical and Mineralogical Study of the Red Mountain Porphyry Copper-Molybdenum Deposit and Vicinity, Santa Cruz County, Arizona", Scientific Investigations Report 2019–5077, metals observed in soils can be "fingerprinted" with samples taken from exposed rock, suggesting that leaching from native rock indeed is the source of metals in soils. Of interest too is that observed values are very close to what Eddleman reported for samples taken across all main watersheds in the Patagonia Mountains. Chaffee also found that metal accumulation in native shrubs and trees occurs, much like Eddleman found for native grasses.

<u>Erosion of TSF1 Cap Layer</u>

Of interest is to compare the erosion timeframe of the 1-2 foot, re-vegetated cap layer that is intended to avoid long term erosion of the tailings upon post-closure and thereafter. This layer is also not original, ie is "previously excavated", but due to intended re-vegetation, assumed to be less prone to erosion. The erosion may therefore be somewhere in between Trench Camp tailings and the Encinal Mixed Oak/Semidesert Mixed Grass listed by the authors of the mentioned publication as vegetation typical for the area. Keeping everything else the same, a 2 ft layer may be eroded in approximately 100 years leading to the conclusion that "natural" cap layers can only delay erosion of TSF1 tailings by a small fraction of what it takes to erode the complete TSF1 stack.

Erosion transports tailings and their metal content much slower than liquefaction may do but the effect is the same: Materials that have high levels of toxic metal compounds are

being dispersed via the earlier mention post-closure spillways via the streambeds of Alum Gulch and Harshaw Creek, over large downstream areas such as the Sonoita Creek alluvial plains and Lake Patagonia. That process will likely cause or contribute to an exceedance of soil and water quality standards.

> *The granting of APP2 will only add to metal mobilization showing its consequences to the human food chain, a conclusion clearly expressed in the 2012 Eddleman University of Arizona thesis and pointed at in the 2020 Chaffee paper of USGS.*

Again, omitting the mentioned public reports as Site-Specific Factors in APP applications is not allowed and can lead to permit revocation by the Director of ADEQ. After all, the burden of proof is on the applicant of the permit as the law requires "a demonstration that there will be no cause or contribution to the exceedance of a quality standard". Unfortunately, the word demonstration can be explained in many different ways as observed during earlier experiences with the appeals court.

ADEQ Response: *Pursuant to A.A.C. R18-9-A202(A)(9), South32 submitted a closure strategy in their application. South32 is required to submit a closure plan to ADEQ within 90 days following notification of closure in accordance with A.R.S. §§ 49-243(K)(6), 49-252 and A.A.C. R18-9-A209(B).*

Upon closure, a cap will be placed on the TSF, with stormwater diversion and runoff controls implemented throughout operations and closure. Regarding potential erosion of the TSF1 cover material, the closure and post-closure plans include ongoing reclamation monitoring and maintenance to address reseeding and erosion of the growth media cap. The closure cap will be supported by armoring berms along the exterior slopes and a rock layer on the top surface of the TSF. In the event of prolonged erosion of the closure cap, the armoring berms, rock layer, and a compound slope design (with benching on open slopes) will help reduce runoff velocities, minimizing the risk of further erosion."

ADEQ evaluated potential sources of heavy metals loading to the Harshaw Creek watershed and determined that it was highly unlikely that the treated water from the WTP2 outfall would leach and mobilize heavy metals from the streambed material. Please refer to ADEQ response to emailed comment #2 from Commenter #2 - Werkhoven.

Commenter #3 – Vanessa Register

I object to the following: The membrane for the tailings; the tailings trash being placed on my public land. A private company should not be able to put their waste on our land and go from 28 to 55 acres.

Page 14 (of the APP) we still don't have sectional locations of water sampling when we requested that you actually have one. The other sample I saw like the well levels, they're going to see annual, and what I don't like South32 taking their own samples and doing their testings.

ADEQ Response: *The APP regulates discharges of pollutants to Arizona's groundwater to protect groundwater quality. ADEQ lacks the legal authority under the APP permit to base a licensing decision on the land ownership, either private, state, or federal land. Regardless of the facility's location, the applicant must adhere to relevant regulations and permit requirements associated with the APP permit. The 2022 APP permit application for the Mine does not include the deposition of tailings on federal land. In the event this activity was an objective of the Permittee, an amendment to the current permit would be required.*

Most federal and state public health and environmental programs, including those under the Clean Water Act (CWA), Clean Air Act, and Safe Drinking Water Act, require permittees to conduct self-monitoring as part of their compliance obligations. ADEQ's APP has over 450 permits with active monitoring statewide, all of which involve self-monitoring reporting. Based on A.A.C. R18-9-A206, ADEQ determines the necessary monitoring to assure compliance with permit conditions and applicable AWQS. The APP permit specifies the type and method of monitoring, reporting frequency, and reporting interval. ADEQ has stipulated these terms and conditions in the APP permit framework which requires sampling plans, the utilization of Arizona Department of Health Services certified laboratory analysis, Quality Assurance/Quality Control (QA/QC), and Chain of Custody. Self-monitoring is an effective way for a permittee to perform the monitoring and reporting actions necessary to ensure compliance with the permit and protection of public health and the environment. Additionally, ADEQ routinely conducts inspections of regulated facilities and may collect samples at any time.

Commenter #4 – Alexander Johnson

Verbal comment:

My comment, first of all, is a general one, and I am convinced that this plan in its entirety is practically absurd. Hydrologically, it's been proposed to create a cone depression. And as everyone knows, unless it's ice, you can't carve a cone in water. It doesn't work.

Who didn't go to middle school science? It's going to increase in breadth, and it's going to cause many, many square miles of desiccation of the surface because there's no

groundwater to percolate or to feed springs and so it turns the whole watershed on its head.

It's taking all the water from the upper half and putting it into the lower half, which it's not used to that kind of a thing, and that's going to be an ecological disaster for the lower half and a dead zone of many square miles on the surface dead.

Because one of the qualities of water -- a quality, this is not a quantity. This is a quality, and this is what the ADEQ should be concerned with is that it sustains life. All life needs water, H2O. And water is also very practical.

And I'm not a physicist, but I know that water has hydraulic force, and the water in the mountain is making it into a stable house of cards. The water fills up the (indiscernible) of the – and when its taken out, who knows when it's going to happen. It's going to subside. That's kind of proven in the rest of the United States where there are always lands falling in.

So anyway, so I would really like ADEQ to consider those qualities that water has. And I don't see in the plan that South32 has seeked to minimize any of the results, any of the results from the tailings, from the water discharge from the pumping, from whatever their plan is.

This is a company that is a part of an international consortium which has engineers who are working to mine the visible depths of the ocean. This is a lot more than the 4,000 feet which South32 proposes, eventually, to get to which is 3,000 feet below Patagonia. Why can't their engineers come up with a different plan? A different idea?

ADEQ Response: *ADEQ's authority to achieve its mission of protecting public health and the environment pursuant to the APP is under A.R.S. Title 49 and A.A.C Title 18 Chapter 9. By law, ADEQ is required to issue an Individual APP permit to an applicant if all requirements in statute and rule are met. The APP solely regulates discharges of pollutants to groundwater in order to be protective of groundwater quality. The APP does not regulate groundwater pumping.*

The cone of depression refers to the drop in water levels or pressure caused by pumping from a well. In unconfined aquifers, it's a direct depression of the water table. In confined aquifers, it's a reduction in pressure around the well. The well creates a hydraulic gradient, causing water to flow towards it, resulting in a cone-shaped depression in the surrounding aquifer. Please see the ADEQ response on the next comment for detailed elaboration on the cone of depression.

Written comment:

South32's patently absurd plan to "create a cone of depression" in the ground water table around the proposed mine site to depths of 2000 to 4000 feet. It is impossible to "carve" a cone shaped hole in liquid water: Water will continue (to) fill that "hole" until the depression is many times as wide as the depth. This proposal makes it impossible for the ADEQ to protect the aquifer.

The plan's result would turn the aquifer upside down and completely disrupt its function. That alone should be enough to encourage ADEQ to reject that plan entirely.

Also, the results of the plan, if enacted, would be to desiccate the top half of the Harshaw Creek watershed, transforming many square miles of surface area into a desert. It would inundate the lower half of the aquifer with far more water than it is able to accommodate, thereby destroying an entire ecosystem.

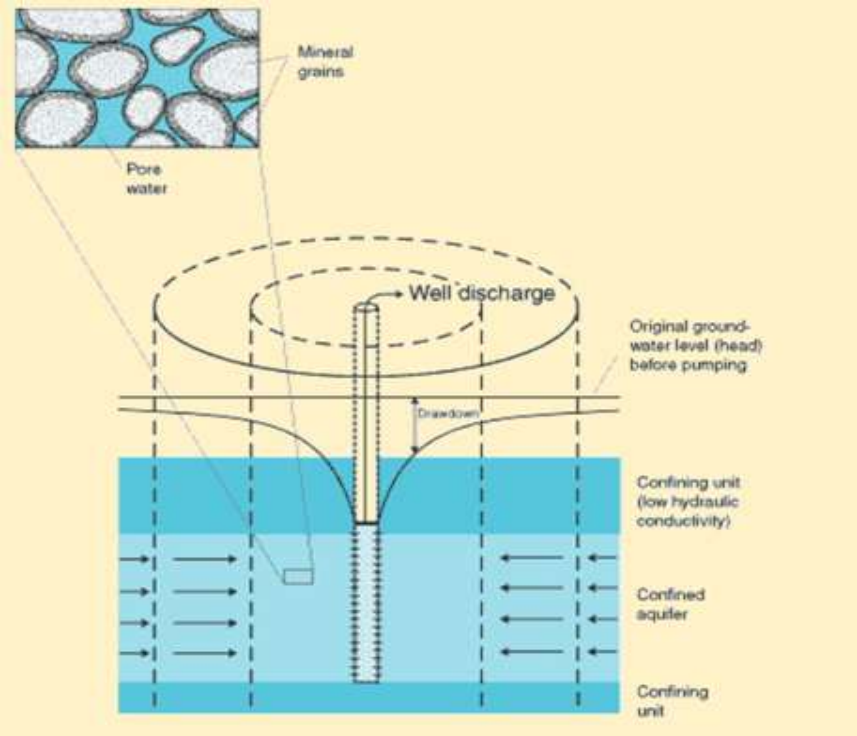
I urge the ADEQ to consider the qualities of the H2O affected by this plan:

1. The first quality is that of supporting life. Life on earth is sustained by water, H2O. The protection of the aquifer is the protection of the life that depends upon it.
2. A second quality of water is hydraulic force that exerts in filling voids and stabilizing geologic and earth formations around it. Removing the water is de-stabilizing the environment.
3. South32 presents no plan to minimize or mitigate or even address either of these serious consequences. They should do so. South32 is but one company of a world wide mining consortium that has engineers working at highly sophisticated levels in many parts of the world. They should be able to invest in alternate plans that are not as disruptive and likely to ruin an important recharge shed on which many downstream communities depend.
4. It will take countless years for this aquifer to be restored as a watershed, especially in this arid region suffering from long term drought already.
5. There are other concerns as well, many of which have been voiced by others:
    a. For example the raising of the water table downstream of the discharge point threatens more severe storm flooding downstream. Also of concern is the "pushing" of the contaminated mineral flow in that alluvium down stream into the surrounding areas, affecting people, plants and animals adversely.

I respectfully ask the intelligent and conscientious people at ADEQ to recognize these profound threats, and to require South32 to propose a better plan. By its very name, isn't this the mandate of the ADEQ to PROTECT the aquifer?

ADEQ Response: *The Aquifer Protection Program, as designed by state law, regulates discharges of pollutants to groundwater. The program does not regulate dewatering.*

Note that the depression of the aquifer surface from a pumping well is called the cone of depression. Pumping from a well in groundwater creates a conical-shaped area. In an unconfined aquifer (i.e., water table surface), this is an actual depression of the water levels. In confined aquifers (i.e., artesian surface), the cone of depression is a reduction in the pressure head surrounding the pumped well. Conceptually, the pumping well creates a hydraulic gradient between the water in the surrounding aquifer and the pump intake within the well. This causes water to flow radially towards the well. As groundwater flows towards the well, water levels or pressure in the aquifer around the well decreases. This creates a cone shaped depression around the pumping well as shown in the schematic diagram below.



Conceptual diagram showing cone of depression (USGS: https://pubs.usgs.gov/circ/circ1186/html/boxa.html)

Please note, that while not a part of the APP, groundwater modeling was performed by South32 in support of the mine pre-feasibility phase. South32 will continue to monitor the wellfield and surrounding wells during dewatering and mining operations. In addition, South32 will continuously monitor groundwater elevations and groundwater quality through a voluntary well

monitoring program for downgradient well owners. South32 also monitors the local seep and spring hydrology (https://south32hermosa.com/en_US/news-resources/environmental-studies-and-documents/hermosa-spring-and-seep-catalog-version-3-0-february-2024) to evaluate potential hydroogical impacts caused by the mine dewatering activities..

In addition, while also not required under APP, streamflow modeling and flooding modeling were conducted by South32. Additional information regarding the WTP2 discharge comparison to naturally occurring storm events is provided in the January 25, 2021 technical memorandum prepared by Ecological Resource Management Consultants.

Commenter #5 – Chuck Kligenstein

After 22 years of public service and a planning commissioner, an elected official also working in just about over half the states west of Mississippi, I come to public hearings to get educated. I didn't get educated. I feel that the comments made by you, sir, while ADEQ's initial dipping of my toe in the water didn't really tell me what the heck I'm looking at. And when I look at 1,586 pages of permit application, a 7-page letter requesting information from the ADEQ, and South32's response is 24 pages, that's a boatload of information for me to absorb. I'm not a scientist, I'm not an expert, and I'm a layperson, and I'm pretty smart. At least, I thought I was.

So, I agree with Carol, Chris, Vanessa, and Alex and Christian on that response only because that's the only information I received tonight other than there's a lot of stuff happening up there 5 miles from my home. And I just wondered what is the reason you're having this public hearing other than law requires it? Isn't it to educate the public about the job you're doing to protect us, health, safety and welfare? That's what it's all about, and I have to trust you because that's all I've got at this point. And yes, perhaps as a citizen I should have taken the time to read all of this documentation, but how the heck do I go through all this scientific information I have no clue about?

So, at the end of the day, I have to trust you so I sure hope you know what you're doing because I haven't a clue, and I have not heard anything here tonight except some great comments from the public.

ADEQ Response: *ADEQ strongly supports and encourages public engagement on all Agency actions. For APP permits, state regulations require a public comment period for 30 days according*

to A.A.C. R18-9-109 (A)(3). The purpose of an ADEQ public notice and engagement is to inform the public about environmental issues, proposed projects, or permit applications that may affect local communities or the environment. It provides an opportunity for community members, stakeholders, and other interested parties to review, comment on, or participate in decision-making processes. The goal is to ensure transparency, gather feedback, and promote public involvement in environmental protection efforts. ADEQ held a community meeting on August 21, 2024 at Patagonia Elementary and High School and the public hearing at the same location on October 2, 2024. Information regarding the current amendment and previous permits have been provided at the ADEQ Hermosa Project - South 32 permit of interest page. While a public hearing, such as the one held on October 2, 2024, may present limited information about the proposed permit, the purpose of the hearing is to receive formal public comments.

The APP is in place to ensure the facility's design, construction and operation will be protective of groundwater quality, including closure and post-closure. Pursuant to A.R.S. Section 49-243 (B)(1), an applicant seeking a permit must demonstrate that "the facility will be designed, constructed and operated to ensure the greatest degree of discharge reduction achievable through application of best available demonstrated control technology, processes, operating methods or other alternatives, including where practicable, a technology permitting no discharge of pollutants."

ADEQ has reviewed the Permittee's application and determined that the best available demonstrated control technology has been incorporated into the facility design. The APP permit requires the facility to utilize engineering controls, actively monitor, and implement specific operational criteria including but not limited to: visual inspections, monitoring and reporting, corrective actions, spill response procedures, and closure and post-closure actions.

Additionally, ADEQ's robust inspections and compliance program performs routine and complaint-response inspections to ensure the Permittee is complying with permitted conditions. If the Permittee is not complying with defined requirements, ADEQ utilizes the Compliance Handbook to take appropriate action to resolve any potential impacts to soil, surface water or groundwater.

Commenter #6 – Adriane J. Hofmeyr, PARA

1. ***The APP Continues to Violate A.R.S. § 49-244 by Failing to Require a Real POC in The Harshaw Creek Aquifer***

See 2021 Comments. Furthermore, the Draft Permit proposes several major changes to the APP, including doubling the footprint Tailings Storage Facility (TSF) as "TSF1" from 28 acres to 55 acres, and tripling its permitted capacity from 2.6 million cubic yards to 8 million cubic yards.[1] The Draft Permit also proposes to revise the Pollutant Management Area (PMA) and Discharge Impact Area (DIA) to reflect this new expansion. As a reminder, the Hermosa Project mine straddles both the Alum Gulch and Harshaw Creek watersheds and drains into both aquifers[2].

Incredibly, even given these massive changes to the permit, ADEQ fails to require any changes to the Points of Compliance (POC) monitoring wells, which are a required component of APP permits via A.R.S. § 49-244.[3] ADEQ continues to fail to require that South32 install and maintain even a single Point of Compliance (POC) well for groundwater monitoring downgradient in the Harshaw or Sonoita Creek aquifers, in conformance with A.R.S. § 49-244. Instead, ADEQ continues to require only one actual well for Alum Gulch aquifer (POC-2). The Draft Permit still contains just two conceptual (imaginary) POCs for Harshaw and Sonoita Creek aquifers (POC- 3 and POC-4). Moreover, the conceptual POC in Harshaw Creek is on private land and the owner of the land signed an affidavit that he would not allow a point of compliance on his property. *See* **Exhibit B** hereto. This means ADEQ continues to fail to require any groundwater monitoring anywhere on the Harshaw side of the mine project.

Even at the one real POC well in Alum Gulch, ADEQ is still only proposing to require compliance groundwater monitoring only semi-annually in the Draft Permit. This is radically insufficient considering the radical expansion of the TSF and other changes in this Draft Permit. Monitoring at POC-2 must be increased to at least monthly and additional real POCs should be installed in the Alum Gulch aquifer, at an absolute minimum. ADEQ must also require multiple real POCs be installed on the Harshaw Creek side with regular monitoring, at an absolute minimum. Anything less than this is an ongoing violation of ADEQ's legal responsibilities under A.R.S. § 49-244 and Arizona's Aquifer Protection Program.

ADEQ Response: *As part of the review for this amendment ADEQ determined that the facility changes do not warrant any modifications to the monitoring network, including the conceptual POC wells. In an appeal from a previous APP permit issued to South32 in August 2021, P-512235, the Arizona Court of Appeals ruled that A.R.S. § 49-244 does not require installation of monitoring wells at points of compliance. As the Court explained,*

[1] APP Significant Amendment Application (December 2023) at page 13.
[2] This fact has been acknowledged and testified to by South32's experts as well as ADEQ's experts. *See* PARA's Proposed Findings of Fact and Conclusions of Law (March 21, 2022) at page 15.
[3] https://www.azleg.gov/ars/49/00244.htm

"South32 need only ascertain through investigation and calculation that the groundwater at the point of compliance meets water quality standards."

As the Superior Court stated in affirming ADEQ's issuance of the previous permit, P-512235, LTF 83040, issued in August 2021:

"Arizona law states that the point of compliance "shall be a vertical plane downgradient of the facility that extends through the uppermost aquifers underlying that facility." A.R.S. § 49-244. The statute identifies where compliance must be achieved, i.e., at a vertical plane down gradient of the facility. The statute does not define how compliance is to be measured. The statute does not expressly or impliedly require a monitoring well at the point of compliance."

2. ADEQ Fails to Meet the Requisite Standard of Review at A.R.S. § 49- 324(C) for This Permit

For reasons stated in PARA's 2021 Comments (*see* 2021 Comments), as well as for reasons included herein in these comments, ADEQ continues to fail to meet the requisite statutory standard of review for this Draft Permit at A.R.S. § 49-324(C) which provides that "[d]ecisions by the director shall be affirmed by the appeals board unless, considering the entire record before the board, it concludes that the director's decision is arbitrary, unreasonable, unlawful or based upon a technical judgment that is clearly invalid."[4]

ADEQ's Decision to Grant this Draft Permit fails to meet the standard of review at A.R.S. § 49-324(C) because it is arbitrary, unreasonable, unlawful and/or based upon a technical judgment that is clearly invalid.

A. ADEQ Contradicts Itself on Major Aspects of This Draft Permit

ADEQ recently issued a Decision to Grant a renewed AZPDES discharge permit to South32 for the Hermosa Project mine (Permit No. AZ0026387). As part of that renewal and comment process, ADEQ repeatedly insisted and ultimately decided that "This permit only authorizes discharges to Outfall 001 related to historic mine drainage water and tailings…" ADEQ also stated that "Based on South32's July 7, 2023 letter, Part I.A.1.b. of the [AZPDES] permit states that 'the only allowable discharges from Outfall 001 are drainage water from historic workings associated with January Adit, drainage water from historic tailings, and stormwater.'" [5]

[4] https://www.azleg.gov/ars/49/00324.htm
[5] Excerpts from ADEQ's Response to Comments 1 and 2, Response to Public Comments for AZPDES Permit AZ0026387 (July 3, 2024).

Yet the TSF is already permitted to contain, and already contains, multiple non- historic materials. ADEQ has long been aware of this, and the 2018 and 2021 APP Permit materials acknowledge this. Even South32 acknowledged in August 2020 "[t]he current TSF is permitted to store historic tailings from Tailings Piles 1 through 4, development rock from the Exploration Decline, filter cake from Water Treatment Plant 1 (WTP1), core cutting material from exploration core sample preparation, and construction PAG." South32's APP Permit Significant Amendment Application (August 2020) at page 14. The current Draft Permit Executive Summary at page 3 states that "Dry stack historic tailings and production tailings are the primary material placed in TSF1. Filter cake from WTP1 and WTP2, core cutting solids, drill cuttings, assay rejects, sediments from vehicle and equipment wash sumps, and sediments from stormwater BMPs constitute a small amount (>2%) of the total TSF1 volume." Since WTP2 is known to have been discharging for over a year, filter cake from WTP2 has been placed on the TSF for over a year.

In the Draft Permit Executive Summary at page 4, ADEQ notes that in addition to historic tailings, multiple non-historic materials are being permitted for placement in TSF1 including production tailings, development rock from exploration and future mine development, soil and rock from construction cuts including PAG, solids associated with water treatment including filter cake, core-cutting solids, drill cuttings, assay rejects, sediments from vehicle and equipment wash sumps, and sediments from stormwater BMPs.

These comments do not propose to offer additional comments on the AZPDES Permit No. AZ0026387. Rather, these comments compare ADEQ's statements and assertions made in the AZPDES Permit to this current APP Draft Permit and note that they contradict each other on major, critical details of this project. Given these contradictions on major factual and technical aspects of the Hermosa Mine project, it is impossible for ADEQ to meet its requisite standard of review at A.R.S. § 49-324(C). Accepting ADEQ's statements regarding the composition of the TSF as true means that discharge from Outfall 001 is a legal impossibility, yet for unknown reasons, ADEQ continues to proceed with this Draft Permit to allow potential future discharge from Outfall 001. ADEQ's decision to issue this Draft Permit despite these major issues fails to meet the standard of review at A.R.S. § 49-324(C) as it is arbitrary, unreasonable, unlawful and based upon a technical judgment that is clearly invalid. ADEQ must clarify how these statements in the Draft Permit and AZPDES can ever be reconciled, and discharge from Outfall 001 could now ever occur.

ADEQ Response: *The standard of review in A.R.S. § 49-324(C) applies only in appeals of permitting decisions before the Water Quality Appeals Board. Regardless, ADEQ's decision to issue the permit*

is reasonable and supported by the permit application. Note that only treated water from the January Adit is permitted to discharge at Outfall 1 (Permit Section 2.2.1.3).

Additionally, because of the differing goals and requirements of the two programs (AZPDES and APP), restrictions that apply under one permit may not be relevant to the other permit. AZPDES permits must comply with the Federal Clean Water Act (CWA), whereas APP is a state program with different requirements. The AZPDES permit is more restrictive than the APP in regards to water that can be discharged from outfall 001 and concerns about additional water from non-historical material are only relevant to the AZPDES permit.

B. ADEQ Has Not Required South32 to Appropriately Analyze the Consequences of TSF and UDCP Failure

South32 is a company member of the International Council on Mining and Metals (ICMM).[6] In response to the catastrophic failure of a tailings dam at Brumadinho, Brazil, in January 2019 which resulted in 272 deaths including 258 mineworkers, the ICMM, the United Nations Environment Programme (UNEP), and Principles for Responsible Investment (PRI) released the Global Industry Standard on Tailings Management (GISTM) on August 5, 2020 (ICMM-UNEP-PRI, 2020). Company Members of ICMM were obligated to fully comply with the GISTM by August 5, 2023 (ICMM, 2020, 2021). The expectation for compliance with the GISTM is well- established in Australia, the United States, and the mining industry globally. South32 acknowledges that it is bound by the GISTM. *See* South32's Contingency Plan in the application at Attachment E (p. 43) (which was only obtained via public records request).

Requirement 2.3 of the GISTM states that mining companies must "Develop and document a breach analysis for the tailings facility using a methodology that considers credible failure modes, site conditions, and the properties of the slurry … the results should include estimates of the physical area impacted by a potential failure, flow arrival times, depth and velocities, and depth of material deposition" (ICMM-UNEP-PRI, 2020). According to Requirement 2.4, "[i]n order to identify the groups most at risk," mining companies must "refer to the updated tailings facility breach analysis to assess and document potential human exposure and vulnerability to tailings facility credible failure scenarios" (ICMM-UNEP-PRI, 2020). According to Requirement 15.1, mining companies must "[p]rovide local authorities and emergency services with sufficient information derived from the breach analysis to enable effective disaster management planning" (ICMM-UNEP-PRI, 2020).

The key word in the preceding requirements is "credible." Thus, the need for a dam

[6] https://www.icmm.com/en-gb/our-story/our-members

break analysis does not depend upon whether failure is "reasonably foreseeable," but only upon whether failure is "credible." According to the GISTM, "[t]he term 'credible failure mode' is not associated with a probability of this event occurring" (ICMM-UNEP-PRI, 2020). Thus, "credible" simply means "physically possible," no matter how unlikely. According to Safety First: Guidelines for Responsible Mine Tailings Management, a "credible failure mode" is "a physically possible sequence of events that could potentially end in tailings dam failure" (Morrill et al., 2022).

The Draft Permit contains no provisions assessing consequences of failure of the TSF, TSF1 and/or the Underdrain Collection Pond (UCP or UDCP). The only language in the Draft Permit that attempts to deal with consequences of failure is the sentence at Section 2.6.3.5. (page 23) stating, "[i]f the slope for the TSF or the UDCP becomes unstable to the point of failure and results in a discharge," then certain actions must follow (mostly just reporting). This provision does not in any way comply with South32's obligations under the GISTM. Moreover, the statement is meaningless. The Draft Permit does not define "stable" or "failure" nor does it tie any specific actions to specific observations to prevent or respond to TSF failures. It is standard practice for regulatory agencies to include and incorporate standard mining terminology in permits, as opposed to meaningless company euphemisms.

Failure of the TSF, TSF1, and Underdrain Collection Pond (UCP or UDCP) is credible. NewFields (2024) has noted the UDCP "is classified as an intermediate dam with a low hazard potential under ADWR criteria" (page 42). Filtered (dry) tailings facilities are vulnerable, and filtered (dry) stack filtered TSFs similar to the TSF and TSF1 in this instance, have failed in other instances around the world, including just last month at a mine in Mexico owned by Minera Cuzcatlán.[7] A filtered (dry) tailings facility failure also occurred in 2022 at the Pau Branco mine in Nova Lima, Brazil, causing serious harm.

Not only does the Draft Permit not address catastrophic failures of the TSF, TSF1, or UCP, it also does not address "failures" as defined by, for example, the US Federal Emergency Management Agency (FEMA), which defines "failure" in relation to the UCP as "Any malfunction or abnormality outside the design assumptions and parameters which adversely affect a dam's primary function of impounding water is properly considered a failure. Such lesser degrees of failure can progressively lead to or heighten the risk of a catastrophic failure. They are, however, normally amenable to corrective action" (FEMA, 2004). Although FEMA (2004) primarily deals with water- retention dams, the same document clarifies that "[i]n addition to conventional structures, this

[7] *See* articles on the dry stack tailings dam spill into the El Coyote River here: https://www.educaoaxaca.org/local-authorities-accuse-federal-attorney-for- environmental-protection-has-not-acted-on-new-mining-contamination-in-oaxaca/ and https://desinformemonos.org/denuncian-derrame-de-presa-de-jales-secos-de-la- minera-cuzcatlan-en-el-rio-coyote/.

definition of 'dam' specifically includes 'tailings dams,' embankments built by waste products disposal and retaining a disposal pond."

The Contingency Plan in the application at Attachment E (titled "Contingency and Emergency Response Plan") was not publicly posted online as part of ADEQ's Permit of Interest webpage or by South32. Rather, it had to be obtained via public records request. This document fails to adequately analyze the consequences of TSF, TSF1, and UDCP failure. It merely outlines certain documentation if the TSF, TSF1, and/or UDCP "becomes unstable to the point of failure" and results in a discharge or overtopping. Furthermore, this document appears to only have been drafted as recently as December 2023, while the TSF and UDCP have existed at this site for nearly 8 years. This violates Requirement 13.1 of the GISTM which requires such a plan be prepared, tested, and updated "at all phases of the tailings facility lifecycle" or more frequently if triggered by a material changes. Furthermore, the plan must be "based on credible flow failure scenarios and the assessment of potential consequences." This has not occurred in South32's Contingency and Emergency Response Plan.

Moreover, the Draft Permit does not require South32 to engage in any preventative action regarding TSF, TSF1 or UDCP failure.

Finally, the Draft Permit does not take into account the danger to human life posed by the close proximity of the TSF and TSF1 to the immediately-adjacent mining infrastructure. This unusually close proximity should have been taken account in a consequences-of-failure analysis but was not.

ADEQ Response: *The catastrophic failure of the tailings dam at Brumadinho, Brazil, in 2019, was linked to static liquefaction in the context of a conventional upstream tailings dam. South32, in contrast, uses dry stacking for its tailings management.*

Please refer to Commenter #2, Chris Werkhoven, for additional comments on liquefaction.

ADEQ does not have authority to enforce the Global Industry Standard on Tailings Management (GISTM), ICMM guidelines, or other international tailings standards. However, the Permittee has committed to following the GISTM, which exceeds current Best Available Demonstrated Control Technology (BADCT) guidelines for dam safety. These GISTM standards have been developed in response to recent global tailings dam failures and are designed to increase protection of public health and the environment.

A contingency plan is required by the APP as a part of the application and is a permit condition. However, the APP does not require an Emergency Response Plan (ERP) for the TSF and Upstream

Development Control Plan. ADEQ requested these plans from South32, and the company has voluntarily provided the ERP. Attachment E of the APP permit application, contains both the contingency plan and ERP. The ERP portion of the document is only related to TSF1, while a Contingency Plan has been in place since September 2021, and the current version is dated December 2023.

The likelihood of a failure of the dry filter tailings is extremely low, and in the unlikely event of a failure, it would be localized, unlike a conventional tailings dam failure. The dry filter tailings will be carefully placed and compacted to further minimize the risk of failure.The permit establishes numerous monitoring requirements, performance standards, and contingency plans to ensure the safety and stability of TSF1. These include provisions in Parts 2.3.1, 2.6.2.1, 2.6.2.6, 2.6.2.7, 2.6.3, and 4.2, as well as compliance schedule items 3, 6, 7, 8, and 9 in Part 3.0, along with Table 8.

ADEQ's authority to protect public health and the environment under the APP comes from A.R.S. Title 49 and A.A.C. Title 18 Chapter 9. The APP, as designed by state law, solely regulates discharges of pollutants to groundwater to protect water quality, and does not have the legal authority to regulate to address catastrophic failures as defined by, for example, the US Federal Emergency Management Agency (FEMA), which defines "failure" in relation to the UDCP.

The existing UDCP according to the Arizona Administrative Code (AAC), Title 12 Natural Resources, Chapter 15 Department of Water Resources is a jurisdictional Dam. The existing UDCP was permitted through the Arizona Department of Water Resources (ADWR) Dam Safety and complies with all relevant ADWR requirements.

C. ADEQ Fails to Consider Available Information on WTP2 Waste Solids, Including Moisture Content

The Draft Permit at page 9 states: "WTP2 water treatment solids are anticipated to be hauled and placed in the TSF at a rate of approximately 4,380 cubic yards per year from the stage one filter press and approximately 146 cubic yards per year from the stage two filter press for an aggregate total of approximately 4,526 cubic yards per year. WTP2 water treatment solids material properties are assumed to be similar in nature to WTP1 water treatment solids and therefore the placement criteria are the same for both materials." (Emphasis added). The Draft Permit further states that these anticipated properties are based on a single control sample from 2019.

The Draft Permit provides that based on this single control sample from 2019, anticipated moisture content of the tailings based on dry weight of solids, upon arrival

to the TSF, is 363%. This is highly unusual and raises serious technical questions and concerns. How will drying occur? Will this wet material be added directly to the TSF stack and spread around to dry (as implied at page 11 of the Draft Permit)? Has this ever been tried and tested before? What is the target moisture content? South32 does not clarify, and ADEQ does not appear to question how this high level of evaporation and air-drying is expected to occur at the TSF here.

ADEQ does not appear to question this proposal but rather accepts it, which does not constitute a reasonable or sound technical judgment.

ADEQ is well aware that WTP2 has been operational and actively discharging via Outfall 002 for over a year. This means, presumably, that the water that has been sent to WTP2 has also been treated prior to discharge. Since this treatment is occurring and has been ongoing, there are waste solids being generated at WTP2 which are available for analysis of their material properties. ADEQ must acknowledge this and consider the available data regarding WTP2 waste solids as part of its required analysis and review before granting this Draft Permit. Anything less fails to meet the standard of review at A.R.S. § 49-324(C).

ADEQ Response: *One of the materials allowed to be placed in TSF1, pursuant to Section 2.2.1.1.4 of the permit, is solids from water treatment. Section 2.2.1.1.4.1 reads "Moisture content will be 363% (based on dry weight of solids) upon arrival to the TSF." This high moisture content is for the filtercake, not the tailings itself. The details can be found in the New Fields report, "Hermosa Project Tailings Storage Facility 1 (TSF1) Aquifer Protection Permit (APP) Significant Amendment Best Available Demonstrated Control Technology (BADCT) Design" in Section 11, Facility Operation.*

As mentioned in the report, miscellaneous material (permitted and new materials) will account for around 12,000 cubic yards per year for 8 years, which is approximately 1.25% of total storage volume. "Other materials", pursuant to Section 2.2.1.1.4, make up less than 2% of the total filter tailings and the material properties would be insignificant to overall TSF1 stability. Table 7.2 in Attachment A, "Hermosa Lined TSF Design Amendment" in the APP permit application, provides the material properties for these other materials, which have been considered in the stability analysis. CSI #9, which states "The permittee shall submit a Tailings Facility Progress Report in accordance with Section 2.7.4.1", will confirm the material placed aligns with the initial assumptions used for slope stability modeling. In the event of a discrepancy in design and performance of the TSF1 , the permittee is required to adjust the design based on field performance information.

As mentioned in the permit for WTP1 and WTP2, "Upon placement on the TSF, water treatment solids from WTP1 and WTP2 shall be spread and dried to reduce the material moisture content. This material shall then be mixed with tailings, on site native borrow material and/or development rock at a minimum ratio of 3:1 (tailings/on-site native borrow/development rock to water treatment solids). After mixing, the material shall be moisture conditioned to within 2 percent below and 3 percent above the optimum moisture content. The material shall be placed in 12-inch maximum loose lifts and compacted to 93 percent of the maximum dry density as determined by ASTM D698." . The majority of the TSF1 material is the filter tailing that will be produced on site from the filter plant. Attachment A "Hermosa Lined TSF Design Amendment", section 3.4. "Future Filtered Tailings (Synthetic)" in the APP permit application provides the geotechnical properties of the future filtered tailing. The moisture content of the filtered tailing would be varied from 10 to 14% in order to reach the optimum moisture content. Filtered tailings at the Hermosa Project will be placed according to Technical Specifications that require a minimum of 93% relative compaction and moisture content within 3% of the optimum, as defined by ASTM D698.

The placement will be verified through Construction Quality Assurance (CQA) monitoring and cone penetration testing (CPT), with results submitted to ADEQ upon completion of the field program as mentioned in CSI #7 and Appendix E Technical Specifications within Attachment A. These Technical Specifications are based on laboratory testing of the filtered tailings. It should be noted that the APP regulates discharges of pollutants to Arizona's groundwater to protect groundwater quality. The APP does not regulate the specific processing or mineral processing methods used for extracting minerals or drying the tailing material; this is determined by the applicant. Regardless of the mineral processing method chosen, the Permittee has to meet AWQS.

D. Insufficient Evidence of Tailings Testing

In its July 10, 2024 letter at Comment #2, ADEQ flagged the following sentence from South32's Significant Amendment application at page 73: "[i]f instability is identified, slope stabilization may be required." ADEQ then asked: "*[p]lease provide the Geologic Hazard Assessment study for the site. In the absence of such a study, it would be considered CSI in the permit.*" In its response to ADEQ's question, South32 appears to have declined to provide such a study. ADEQ still did not require a Geologic Hazard Assessment in the Compliance Schedule Items (CSI) listed at Table 7 in the Draft Permit. Given the radical expansion of the TSF into TSF1 proposed by this Draft Permit, this Geologic Hazard Assessment should not be required after the permit. Rather, ADEQ must not issue this Draft Permit until after this assessment is completed and its results analyzed and considered. Furthermore, ADEQ must require South32 to conduct stabilization or some other form of preventative remedy if instability on the TSF or TSF1

is identified. Any amount of instability on the TSF or TSF1 constitutes a level of failure, since it is outside of compliance with the intended design objectives. ADEQ must require these failures be addressed to protect the environment and human health before granting this Draft Permit.

In its July 10, 2024 letter at Comment #7, ADEQ noted that "*for BADCT, undrained stability is required. Please provide the undrained stability analysis including both Peak and Residual factors of safety (FOS)*". The NewFields Memo dated May 31, 2024, provided by South32 to ADEQ in response to this question (Attachment G) concludes at page 8: "[a]t the request of ADEQ, an undrained stability evaluation was completed to calculate factors of safety in the event a widespread undrained response is mobilized in the entire filtered tailings mass. An undrained response throughout the entire tailings mass is not expected. It is considered a highly conservative assumption, given that any undrained response in the tailings mass is expected to be localized and temporary." This undrained stability testing appears to have been based exclusively on laboratory test results and did not include any on-the-ground testing at the existing TSF.

In its July 10, 2024 letter at Comment #17, ADEQ requests that South32 "*supply the earthquake deformation analysis for the liquefaction analysis. In the absence of such deformation analysis, consider it a Construction Quality Control/Quality Assurance (CSI) requirement to provide earthquake deformation analysis specifically for the filter dry stack.*" South32 did not provide this information, instead revising its NewFields TSF1 Design Report at page 30 to state that "[l]iquefaction of natural foundation overburden below the TSF was not considered a hazard due to groundwater conditions at significant depth and the thin veneer of overburden overlying near surface rock." ADEQ still did not require an earthquake deformation analysis in the Compliance Schedule Items (CSI) listed at Table 7 in the Draft Permit. It is further noted at Comment #34 that only historic earthquake events above 4.0 magnitude were considered by South32, the entire range of seismic events were not even considered. This is insufficient, given the high consequences of failure of TSF or TSF1 and the threats it would pose to human life and the surrounding environment. ADEQ must not issue this Draft Permit until after this analysis is fully completed and its results analyzed and considered.

In its July 10, 2024 letter at Comment #18, ADEQ requests that South32 "provide the static liquefaction analysis and include the critical state line for static liquefaction. In the absence of such deformation analysis, consider it a Construction Quality Control/Quality Assurance (CSI) requirement to provide the static liquefaction analysis specifically for the filter dry stack." South32 did not provide this information, instead

asserting that "static liquefaction cannot be triggered" and that the critical state line for future production tailings may be developed and reported after 8 months of filtered tailings placement. Again, ADEQ still did not require a static liquefaction analysis in the Compliance Schedule Items (CSI) listed at Table 7 in the Draft Permit. This is insufficient, given the high consequences of failure of TSF or TSF1 and the threats it would pose to human life and the surrounding environment. Conducting critical tailings analyses after the Draft Permit is issued is not appropriate and fails to meet the standard of review required of ADEQ. Rather, ADEQ must not issue this Draft Permit until after this analysis is completed and its results analyzed and considered.

ADEQ Response: *To clarify the various dates mentioned in the comments: The main application, titled Aquifer Protection Permit Significant Amendment Application P-512235 for Santa Cruz County, Arizona, was submitted by South32, Hermosa Inc. on December 22, 2023. The RAIS (Comprehensive Request for Additional Information) letter was issued by ADEQ on April 5, 2024. South 32's response to this request was received on July 3, 2025.*

Regarding Comment #2, in December 2023 South32 provided information about the Geologic Hazard Assessment study across various sections of the application. The response letter dated July 10, 2024, clarified the locations of these sections within the main application. Since the geological hazards were adequately addressed in multiple sections, no Compliance Schedule Items (CSI) were added to the permit.

Regarding Comment #7, currently no filter tailings are being produced at the site. As a result, the application relies on laboratory testing. ADEQ reviewed South32's assumptions regarding residual strength and found them to be within the acceptable range within the industry published papers from the Mine and Tailing Waste Conferences for the TSF facilities. The permit requires the facility to conduct cone penetration testing (CPT) and the results will be submitted to ADEQ upon completion of the field program, as outlined in CSI #7, to validate the design assumptions and ensure the operational performance of the filter tailings.

Regarding Comment #17, Section 7.1.4 of Attachment A, "Hermosa Lined TSF Design Amendment" of the APP permit application presents the minimum FoS of the Pseudostatic analysis. The deformation analysis would be performed when the FoS of the pseudostatic analysis is less than one. According to Figure 1 on page 251 of the Mining BADCT (Appendix E), the deformation analysis should be conducted if the pseudostatic analysis does not meet the required factor of safety (FOS). Since the pseudostatic analysis meets the required FOS, no deformation analysis is needed for the earthquake analysis and the information is satisfactory.

Regarding Comment #18, currently no filtered tailings are being produced at the site and laboratory testing was relied on during the application evaluation. Please refer to Commenter #2, Chris Werkhoven, for comments on static liquefaction. As mentioned, soil needs to be saturated to liquefy, which makes dry stack tailings, with over 75% solid content, less prone to liquefaction than conventional tailing dams. CSIs #6, #7 and #9 will provide information to ADEQ on the TSF construction that aligns with the initial assumptions used for slope stability modeling and static liquefaction. South32 will provide the critical state line and evaluation of the static liquefaction for future filter tailings and will be included in the first Annual Report that is submitted after a minimum of eight months of filtered tailings placement.

E. Additional comments

The Draft Permit's substitution of actual monitoring at an actual POC with a requirement that South32 submit an annual report which must include "groundwater monitoring results from MW-9" (Draft Permit, p. 27, 2.7.4.1) does not constitute monitoring as required by statute.

The Draft Permit allows South32 to transport contaminated water across the property from the TSF, TSF1, UCP and WTP1 (Draft Permit, p. 6, 2.1) without requiring any showing that the transport infrastructure to WTP2 meets BADCT ((Draft Permit, p. 12, 2.2.1.1.5). The infrastructure that will connect the TSF, TSF1, UCP, WTP1 and WTP2 is a conveyance that is an integral part of the discharging facilities (A.R.S. § 49-201(19)) and is subject to BADCT in order to comply with A.R.S. § 49- 243(B)(1).

The Draft Permit relies on South32's AZPDES Permit No. AZ00226387 to excuse aquifer monitoring in the APP permit. At a minimum, this violates A.R.S. § 49-255.01(G) which provides that AZPDES permits "shall not be combined with" APP permits.

PARA incorporates all arguments made on the above and all issues submitted to Maricopa County Superior Court in case no. LC2022-000259-001 DT in relation to South32's APP permit, attached hereto marked **Exhibit C** and fully incorporated herein.

ADEQ Response: *The groundwater monitoring at MW-9 is not a substitute for groundwater monitoring at the point-of-compliance. The permit requires discharge monitoring at the WTP2 outfall to ensure groundwater is protected through compliance with AWQS at the point of discharge. Compliance is achieved through routine discharge monitoring at the point of discharge rather than the point of compliance, which is more conservative and stringent because it does not allow for any dilution of pollutants upstream of the point of compliance. South32 will collect*

groundwater samples from MW-9 to monitor periodic changes in groundwater geochemistry and groundwater flow elevations rather than for making determinations of permit compliance and enforcement. South32 will report the MW-9 monitoring data to ADEQ on an annual basis as required in Section 2.7.4.1 of the permit.

The transport infrastructure and pipe conveyance at the mine site is exempt from the APP program as specified in A.R.S. § 49-250(22).

The AZPDES Permit No. AZ00226387 is not a substitute for meeting the statutory requirements of the APP. As described above, the routine discharge monitoring at WTP2 outfall satisfies the compliance requirements at the point of compliance. The AZPDES and APP permits have separate monitoring requirements, each outlined in their respective permits. The APP permit relies on its own monitoring to ensure compliance.

NOTE: Additional attachments included comments and other associated documents submitted during a previous amendment.

ADEQ Response: *ADEQ provided responses to comments submitted during a previous amendment issued under LTF No. 83040 on August 25, 2021.*

Commenters #7 Misael Cabrera; #8 Brent Musslewhite, South32; #9 Steve Trussel, AMA; #10 Ted Maxwell, Southern Arizona Leadership Council, and #11 Zach Yentzer, Tucson Metro Chamber

The above commenters provided comments in support of the issuance of the permit.

ADEQ Response: *ADEQ acknowledges the comments.*