June 26, 2020

The Honorable Patrick McDonnell
Department of Environmental Protection
Rachel Carson State Office Building
400 Market Street
Harrisburg, PA 17101

Mr. Michael Kutney, P.G. Chief, Permits and Technical Section
Department of Environmental Protection
Pottsville District Mining Office
5 West Laurel Boulevard
Pottsville, PA 17901

Re: EEC Review of Hanson's Response to DEP Comments – April 17, 2020, Department Letter, Rock Hill Quarry Hanson Aggregates Pennsylvania LLC SMP # 7974SM1 East Rockhill Twp., Bucks Co., PA

Dear Secretary McDonnell and Mr. Kutney,

On behalf of Rockhill Environmental Preservation Alliance, Inc. (REPA), enclosed please find the following comments prepared by Erskine Environmental Consulting - "Review of Hanson's Response to DEP Comments – April 17, 2020, Department Letter, Rock Hill Quarry Hanson Aggregates Pennsylvania LLC SMP # 7974SM1 East Rockhill Twp., Bucks Co., PA ".

We hope Dr. Erkine's thorough review and recommendations on the Naturally Occurring Asbestos situation at the Rockhill Quarry will provide you with sufficient technical information to support the permanent closure of the Rockhill Quarry.

We look forward to a speedy response.

Respectfully yours,

Rockhill Environmental Preservation Alliance, Inc.

cc: The Honorable Thomas Wolf, Governor of Pennsylvania
The Honorable Brian Fitzpatrick, U.S. Representative PA 01
The Honorable Steven Santarsiero, 10th Senatorial District

The Honorable Craig Staats, PA's 145th Legislative District
The Honorable Diane Ellis-Marseglia, Chair, Bucks County Board of Commissioners
The Honorable Robert Harvie, Jr., Vice Chair, Bucks County Board of Commissioners
The Honorable Gene DiGirolamo, Bucks County Board of Commissioners
Steven Baluh, P.E
Marianne Morano, East Rockhill Township Manager
Gary Latsha, PADEP
John Stefanko, PADEP
Amiee Bollinger PADEP
Virginia Cain, PADEP
Robert Fogel, PADEP
Erika Furlong, PADEP
Craig Lambeth, PADEP
Shawn Mountain, PADEP
Patrick Patterson, PADEP
James Rebarchak, PADEP
Daniel Sammarco, PADEP
Sachin Shankar, PADEP
Richard Tallman PADEP
Doug White, PADEP

Erskine Environmental Consulting

Geologic Investigations Hazardous Materials Naturally Occurring Asbestos

MEMORANDUM

June 26, 2020

Subject: EEC Review of
"Response to Comments – April 17, 2020 Department Letter
Rock Hill Quarry
Hanson Aggregates Pennsylvania LLC
SMP # 7974SM1
East Rockhill Twp., Bucks Co., PA"

The following are EEC's comments on Hanson's response to the Pennsylvania Department of Environmental Protection's (DEP) comments that are included in the Hanson document referenced above.

Only comments and responses that were directly applicable to the NOA aspect of the investigation are included.

This submittal includes the general conclusions that were arrived at during the review, followed by the supporting information which is included as EEC's comments on the responses submitted by Hanson's team as follows:

1. Responses prepared by Hanson
2. Responses prepared by EarthRes
3. Petrographic Analysis by Advance Analysis
4. Responses prepared by RJLG
5. Air Monitoring Plan prepared by Hanson

The following comments represent the opinion of EEC, and is based on the information made available by Hanson and their consultants. EEC encourages Hanson and its consultants to review this memorandum and comment on any of the information, opinions or conclusions that may be present. Please feel free to contact me if there are any questions.

Bradley G. Erskine

Bradley G. Erskine, Ph.D., PG, CEG, CHG, CAC
Erskine Environmental Consulting

401 Marina Place
Benicia, CA 94510

707-738-4917
Erskine.geo@gmail.com

Summary, Conclusions and Recommendations

Based on the review of the responses to DEP's questions by Hanson and its consultants, and supported by the reviews of the information provided previously, EEC offers these conclusions and recommendations regarding the adequacy of the Qualitative Geological Survey Report (QGSR) and Air Monitoring Plan (AMP). The general conclusion for each is summarized below, and the details that support the conclusions are found in the following sections and within previous documents submitted by EEC.

Qualitative Geological Survey Report (QGSR)

Field Sampling

EarthRes' field sampling protocols were not designed or implemented to provide an unbiased geologic investigation to fully characterize the site for NOA. An investigation should start with a delineation of each distinctly different rock unit, and then sample sufficiently to characterize each unit in terms of the natural variation in location and concentration. In this case where the diabase has been overprinted with hydrothermal alteration in the form of actinolite veining and possibly mineral overgrowth, attention should be directed at the potential for small micro veining that is likely to be present either throughout the diabase or localized, and petrographic analysis should focus on micro veining, reaction rims, and fibrous overgrowths. Regardless, each unit and subunits should have been identified and sampled in an unbiased manner with the goal of locating NOA and measuring the range in concentrations, where present. After the rocks have been characterized, the project would have the data required to allow informed decisions, conduct activity-based air testing to assess the potential for exposure, and design dust mitigation plans, risk-based perimeter air monitoring plans to verify off-site exposure to asbestos, and worker protection plans.

However, a review of EarthRes' response to DEP's comments, and the QGSP and QGSR themselves, reveal a systemic bias where sampling, which, through its design, seemed to avoid the detection of asbestos or minimizing its significance when found. Much emphasis was placed on macroscopic indications of fibrous morphology, which is rarely observable in NOA materials. Much emphasis was placed on aged field work that was interpreted as indications that NOA would not be present, even though these studies do not address asbestos mineralogy. In addition, rather than simply reporting the asbestos concentrations, EarthRes trivialized the potential impact of asbestos by conducting a mass weighted average analysis of the entire site as if it was a single unit, and characterized the result using terms such as "low concentrations" and "trace" concentrations.

Therefore, there is ample evidence that the QGSR did not fully and accurately characterize the Rock Hill quarry for NOA. DEP should have little confidence that the samples collected by EarthRes and submitted to the lab were representative of the rocks at the site.

Laboratory Analysis

RJLG's response to DEP's comments provide more direct evidence of an internal protocol that selectively removes fibers from reporting, even when the method specifically states that these fibers must be reported and included within the asbestos concentration. RJLG stated that in water samples, they removed fibers that were <5µm, and justified this on the basis of health-risk analysis that is applied to air samples. EPA Method 100.1 specifically requires these fibers to be counted and included in the calculated concentration, and both EPA and USGS have denounced these type of differential counting procedures. RJLG appears to apply a systematic approach where fibers are eliminated on the basis of aspect ratio, length, width and morphological characteristics, and eliminate fibers further on the basis of methodology used

in fields that are unrelated to geology. This systematic removal of fibers that would normally be included as specified by various test methods resulted in the under reporting or no reporting of asbestos concentrations.

Therefore, there is ample evidence that the RJLG asbestos analyses significantly under reports the concentration of asbestos. DEP should have little confidence that the samples collected by EarthRes and tested by RJLG provide a non-biased and accurate reporting of the location and concentration of asbestos at the Rock Hill quarry.

Petrographic Analysis

Advance Testing provided an analysis of the diabase for the purposes of assessing the rock for subtility as a construction material. The analysis provided no observations or interpretation regarding the potential for NOA to be present or absent. The photographs provided by Advance Testing, however, show several indications that asbestos may be present, but these fabrics, textures and structures were not analyzed.

Therefore, the petrographic analysis did not provide to DEP any information regarding the potential presence of NOA. The photographs provided by Advance Testing, however, provide evidence that is contrary to EarthRes' conclusion that there are no indications of structures or metamorphism that might be conducive to the formation of NOA. See Section 3 for examples.

Air Monitoring Plan

DEP requested that Hanson prepare an Air Monitoring Plan. DEP received a plan whose stated purpose is to *"periodically assess the potential presence of NOA fibers in air at the perimeter of the Rock Hill Quarry".* It also stated that *"The scope of this document is limited to the Rock Hill Quarry operations. It is not applicable to assessments conducted beyond the facility's perimeter".*

It would normally be assumed that the request was meant to prepare a risk-based perimeter air monitoring program designed to verify that asbestos emissions generated on the site are not adversely exposing residents and other receptors that live or work off of the site. The request for monitoring during times of inactivity would generally be interpreted as a request for "ambient" or "background" airborne concentrations that are not related to site activities. An air monitoring plan often also includes a personal air monitoring program (as specified by the OSHA standard) designed to verify that the dust control measures are successful in preventing worker overexposure by asbestos during construction.

As shown in Section 5, the draft plan is not designed for, nor will achieve, any of these three objectives.

The plan as designed has little value to the Rock Hill project, and due to the sampling methodology and chosen test methods (NIOSH 7400/7402 used for worker personal air monitoring), the reported asbestos concentrations will under report the actual concentrations, by eliminating fibers <5µm in length and <0.25µm in width.

DEP should have little confidence that the Air Monitoring Plan will provide data that accurately depict asbestos air concentrations, and verify that both workers and offsite receptors, including residents and children, will not be adversely exposed to asbestos.

Recommendations

1. DEP should reject the QGSR, all lab results, and the petrographic analysis on the basis that they did not, by design, accurately depict the location and concentration of asbestos at the Rock Hill quarry.

2. DEP should hire its own consulting geologist to evaluate the asbestos at the Rock Hill quarry. The geologist should be experienced in the field of NOA geology and mineralogy, and be fully acquainted with test methodology. The geologist should have no significant ties to the mining industry.

3. DEP should likewise hire their own laboratory that is highly experienced with NOA and familiar with EPA standards on EPA sites, and has no significant ties to the mining industry.

4. DEP should reject the Air Monitoring Plan on the basis that it does not adequately address potential exposure to the residents of the Rock Hill Township, worker protection, and background. An Air Monitoring Plan should be developed by an experienced professional, reporting directly to DEP, after a competent NOA assessment has been made. The contractor should not be monitoring their own emissions, particularly when the public is the receptor.

5. It is not unusual for the lead agency, in this case, DEP, to contract with independent consultants that are overseen and paid by the agency, and the costs are then back-charged to the applicant. This prevents a conflict of interest and decisions based on cost, and facilitates full transparency, which has not been the case from the beginning of the NOA characterization effort.

401 Marina Place
Benicia, CA 94510
707-738-4917
Erskine.geo@gmail.com

Section 1

Comments on Hanson's Response to DEP's Questions

The following are EEC's comments on Hanson's response to DEP's comments that are included in the Hanson submittal referenced above. Comments are reserved to subjects that are specific to the analysis of NOA.

DEP's comments and Hanson's responses are presented in black italic text. EEC's comments to responses are presented in normal text and highlighted in red.

DEP Comment

Please explain why drilling and sampling for asbestos was not proposed in other locations in the quarry, and explain what consideration is being given to the question of whether avoiding asbestos entirely would be easier and safer than mitigating its effect.

Hanson Response

"Drilling and sampling for asbestos was completed per the DEP approved Workplan. The Workplan scope was designed to investigate and clear a specific area intended for the next phase of mining. A significant amount of field investigation, sample collection and data analysis has been completed at the site to characterize the occurrence of asbestiform actinolite. Field observation and sample collection from boulders staged at various locations across the site and the aggregate products produced in 2018 are indicative of the diabase mined historically across many locations at the site. The geologic logging and sample analysis of core borings installed in 2019 were conducted to assess the presence of NOA within the next phase of mining at the site. The results indicate the overall absence of NOA or its very limited presence in trace concentrations in sporadic actinolite mineral veins formed within the diabase rock. Given the trace concentrations of NOA detected at the site, it is premature to consider mining avoidance until future air sampling and data evaluation is conducted to assess potential for airborne NOA fibers from mining and related activities at the site. Furthermore, Hanson has previously detailed the use of engineering controls that are widely recognized by regulatory agencies and utilized throughout the mining industry to prevent fugitive dust emissions and meet applicable standards".

EEC Comments

EEC General Comment 1a

Hanson continues to limit the scope of the investigation to the morphology named "asbestiform", rather than the constituent of concern, which is "asbestos". Both EPA and USGS do not make this distinction, and have rebuked RJLG' arguments regarding this topic. Additionally, there are no asbestos test methods relevant to the Rock Hill quarry that differentiate fibers based on crystallization morphology. As discussed below in EEC's comments on RJLG's responses (Section 3, below), RJLG continues to argue for, and apply, subjective criteria in which they remove test-method defined fibers from reporting, and as a result, significantly reduce or eliminate asbestos concentrations that should be reported.

EEC General Comment 1b

Please refer to EEC's comments on the EarthRes response to DEP's comments (Section 2, below). The use of "overall absence or very limited presence in trace concentrations" trivialize the existence of NOA in veins and diabase, which suggests an argument that airborne asbestos will be minimal. The site has not been adequately characterized for asbestos.

Hanson States: "Given the trace concentrations of NOA detected at the site, it is premature to consider mining avoidance until future air sampling and data evaluation is conducted to assess potential for airborne NOA fibers from mining and related activities at the site".

EEC Comment

The term "avoidance" as applied on earth moving sites generally refers to restricting disturbance to those units that do not contain NOA. The boundary between NOA and non-NOA units must be clearly differentiated. The data presented thus far, although inadequate for full interpretation, indicates that NOA may be present across the site, and therefore, avoidance is not possible.

Areas of avoidance are not determined by air sampling, rather, they are determined by the presence of NOA in the rock and soil materials. Furthermore, Hanson's air monitoring plan is not scoped for, nor will produce data, to assess exposure to workers, the public, or through background. Please refer to EEC's comments on Hanson's air monitoring plan for details (Section 4).

Hanson States: "Furthermore, Hanson has previously detailed the use of engineering controls that are widely recognized by regulatory agencies and utilized throughout the mining industry to prevent fugitive dust emissions and meet applicable standards".

EEC Comment

Dust control measures designed for general dust control are not fully adequate for suppression of fine asbestos particles. In particular, the disturbance of hard rock that cannot be wetted using conventional dust suppression techniques require additional and non-conventional techniques. Please refer to previous EEC submittals that discuss the challenges imposed by mining hard rock that contains NOA.

Section 2

Comments on EarthRes Response to DEP's Questions Regarding the QGSR

The following are EEC's comments on EarthRes' response to DEP's comments that are included in the Hanson submittal referenced above. Comments are reserved to subjects that are specific to the analysis of NOA.

DEP's comments and EarthRes' responses are presented in black italicized text. EEC's comments to responses are presented in normal text and highlighted in red.

DEP Comment

What site-specific observations were made to make the interpretation that the diabase is homogeneous as well as the lithology of the site in general?

EarthRes Response:

Site-specific observations of the geology include visual inspection of quarry highwalls, detailed observation and logging of 500 feet of rock core, observation of several hundred boulders, as well as observation of crushed aggregate stockpiles. These observations all fit with the published description of the York Haven diabase as described within the QGSR and indicate a homogeneous diabase without geologic facies changes, ductile shear zones, or brittle shear zones that would constitute separate units. Thin-section/petrographic analysis completed for the site indicates the mineralogy to consist of 95 percent pyroxene and plagioclase feldspar, which is consistent with York Haven diabase (see Attachment 2, Petrographic Analysis). Petrographic analysis will be completed on two (2) additional diabase samples and results will be provided in a subsequent submission to further substantiate this interpretation.

EEC Comment:

The term "homogeneous" is subjective, and its use will depend on many factors, including the scale of the unit that is being referenced. If, for example, the diabase incorporated mafic xenoliths that are not randomly distributed throughout the unit, the diabase on a small scale would be considered heterogeneous, whereas on a regional scale it might be recognized as homogeneous. However, rocks, including intrusive units, are never truly homogeneous. Point counting of pyroxene and feldspar in multiple thin sections, for example, will show a variation in pyroxene and feldspar content and ratios. Chemical analysis will also show a variation in rock chemistry. A variation in asbestos content will also vary across the unit. For this reason, homogeneity cannot be used as a basis for not collecting sufficient samples to determine the range of asbestos concentrations. Heterogeneity should be used to determine whether the rock unit should be broken into sub units, each in need of separate data sets. Each data set should consist of sufficient sample frequency to capture the lowest and highest concentration, as well as the variation.

However, the diabase, as a lithologic unit, is not homogeneous. It has been established that the unit includes actinolite-bearing veins and other veins, and these were observed to have variable lengths and widths. Micro veining that are not visible in the field are likely present throughout the unit. The sampling program should not be biased due to a subjective determination that the unit is "homogeneous".

DEP Comment

On what basis is the asbestos detection in DB-1 anomalous? What field observations, beyond visual, were used to make this determination? The literature cited is general in nature and was not addressing NOA. (Core Sampling Results, Section 6.2).

EarthRes Response

Sample DB-1 was originally intended to characterize the diabase matrix. The detection of naturally occurring asbestos (NOA) in the sample was viewed as an anomaly because published literature, diabase mineralogy, and field observations indicate NOA is not present in the diabase matrix. Upon further visual inspection, DB-1 was found to be located in a mineralized vein zone, which contributed to the detection of NOA as discussed within Section 5.3 of the QGSR. A petrographic analysis of DB-1 will be completed to provide further characterization of the sample.

EEC Comment

Breaking this down, and drawing from other responses by EarthRes and by language in the QGSP, EarthRes' reply follows the logic chain below:

1. Previous reports from 1976 and earlier did not report asbestos, and therefore, it is likely that NOA is not present in the diabase.
2. The diabase is homogeneous, its lithology is not associated with asbestos mineralization, and does not appear, in the field, to possess metamorphic structures or textures. Therefore, NOA is not expected to be present.
3. As a result, a sample was collected to characterize the NOA content of the entire unit.
4. The sample produced a positive result for asbestos.
5. The result is not consistent with the expected result, so further inspection showed that the NOA was associated with veining.
6. Repeat the biased assumption: The diabase is homogeneous, its lithology is not associated with asbestos mineralization, and does not appear, in the field, to possess metamorphic structures.
7. Therefore, NOA is not expected to be present.
8. Therefore, the NOA result is anomalous.

The definition of anomalous is: "deviating from what is standard, normal, or expected". There should be no pre-conceived assumptions, and each unit (veins and diabase, for example) should be sampled independently, and the test results should direct the conclusions. This response documents a bias that has been incorporated into the sampling program, beginning with the QGSP.

DEP Comment

Please explain how the vein volume assessment is an overestimate when mineralized veins are ubiquitous at the site. Proposed mining would presumably encounter all the veins.

EarthRes Response

The QGSR does not expressly or implicitly indicate that mineral veins within the diabase rock are ubiquitous. In fact, this terminology is misleading as it is ambiguous and implies that mineral veins are present everywhere and constitute a large percentage of the rock mass. Site observations do not support the conclusion that mineralized veins, let alone actinolite veins that are asbestiform, are ubiquitous or comprise a large percentage of the rock mass. For example, only 33 out of hundreds of boulders examined indicated mineral veining, none of which was identified as asbestiform in hand sample and only seven (7) of which had trace detections of NOA. Further, quarry face mapping indicated only nine (9) veins observed along 150 feet of highwall along Bench 1 and only four (4) veins observed along 200 feet of highwall along Bench 2. Only one vein (Vein #7) was identified as actinolite in hand sample and was found to contain NOA at low levels.

To put these numbers into perspective, the relative amount of vein material was calculated using the vein width data provided in the Bench Face Data Mapping tables contained in the

report. The vein widths of each of the thirteen (13) veins observed were added together and compared to the total footage of high wall inspected (see Attachment 3, Highwall Mapping Vein Assessment table). That data indicates a combined vein width of

5.58 feet for all thirteen (13) veins over the 350 feet of highwall inspected. Based on this data, veins comprise 1.6% of the rock exposed along the highwall. However, only one vein (Vein #7) was identified as actinolite and had a width of 8 inches or 0.66 feet. Based on this width, actinolite veining comprises only 0.19% of the rock exposed along the highwall. This estimate is comparable but lower than the actinolite vein percentage determined from the rock core data (see Table 5, Actinolite Vein Total Core Volume - Arithmetic Mean of 0.43%).

Furthermore, laboratory analysis of Vein #7 indicated it to contain 0.10% NOA. If this concentration is applied to the actinolite vein percentage calculated from the face, then the exposed highwall would contain only 0.00019% NOA:

NOA on exposed highwall = Fraction of Actinolite Veins x Concentration of NOA in Veins = 0.0019 x 0.001 = 0.0000019 or 0.00019%

These field observations and supporting calculations indicate that mineral veining and more importantly asbestiform actinolite veining is limited at the site. This conclusion is consistent with the limited amount of actinolite veining quantified in the rock cores and the trace concentrations of NOA detected in laboratory samples.

The vein volume assessment is considered an overestimate as the vein percentages for all cores were equally weighted in the assessment, even though CB-1, in particular, is located within a cluster of veins and has a significantly higher vein percentage than the other cores. Furthermore, comparison of actinolite vein percentage estimates based on the rock core data (0.43%) and face mapping (0.19%) indicates the cores encountered roughly twice the amount of actinolite veining. This data demonstrates that drilling successfully targeted actinolite veining. For these reasons, the core vein volume assessment is reasonably considered a conservative, overestimate.

EEC Comments

This comment will be addressed by pulling out several passages individually:

EarthRes Response A: *"In fact, this terminology is misleading as it is ambiguous and implies that mineral veins are present everywhere and constitute a large percentage of the rock mass".*

EEC Comment A: The term "ubiquitous" does not imply that veining constitutes a large percentage of the rock mass. It is defined as: *"present, appearing, or found everywhere"*.

While the presence of veining may not be ubiquitous macroscopically in the field, it is likely that the large veins are accompanied by numerous micro veins that are pervasive throughout the diabase. If so, the veins may actually be characterized as ubiquitous, but EarthRes has not explored this possibility. Regardless, the focus on a "large percentage of rock" further illustrates the bias that is pervasive throughout the sampling and analysis program. The Professional Geologist should not base the investigation on a predetermined and subjective view of what constitutes large or small, rather, the investigation should reveal the asbestos content, and let the data speak for itself.

EarthRes Response B*: "For example, only 33 out of hundreds of boulders examined indicated mineral veining, none of which was identified as asbestiform in hand sample and only seven (7) of which had trace detections of NOA".*

EEC Comment B:

1. This response documents more of the bias that has been incorporated into the sampling plan and carried out during sampling. The "qualitative" QGSP incorporated a screening method where samples that did not have macroscopic (field) evidence for the asbestiform habit were selectively removed for analysis. This cannot, and should not, be employed- it is well beyond any standard of practice for geological assessment for NOA. Note that EarthRes cited "trace detections." If asbestiform minerals are present in "trace" amounts, it would not be observed in hand sample. The veining should have been sampled and tested regardless of field observable fibrous minerals.

2. Seven out of 33 sampled veins constitute 21% of the veins showing detectable levels of asbestos. This is not a small amount by any measure. When the sampling bias and the RJLG differential counting procedures are considered, the data, as it stands, indicate that a significant non-reported concentration of actinolite asbestos is present throughout the diabase unit.

EarthRes Response C*: Further, quarry face mapping indicated only nine (9) veins observed along 150 feet of highwall along Bench 1 and only four (4) veins observed along 200 feet of highwall along Bench 2. Only one vein (Vein #7) was identified as actinolite in hand sample and was found to contain NOA at low levels.*

EEC Comment C:

1. Actinolite may be suspected in hand sample, but not positively identified. Micro veins are not observable. Positive identification requires petrographic or chemical analysis. In the case of NOA, positive identification requires the application of standardized test methods, generally TEM combined with EDS. EarthRes' response, again, documents a systemic bias that is pervasive within sampling and testing effort.

2. Like the references to "trace amounts", the use of "low levels" document bias. Low levels, regardless of how defined, is subjective and irrelevant. EPA and many others have shown that "low levels" may lead to significant exposures under certain conditions. The U.S. Geological Survey has made it clear that it is the role of the Professional Geologist to determine, without bias, the location and concentration of asbestos in rocks. It is then the role of other professionals to assess whether fugitive fibers that occur during disturbance may constitute a health risk.

EarthRes Response 4: *"To put these numbers into perspective…".*

EEC Comment 4

EarthRes runs through a volumetric calculation where samples that contain asbestos are combined with diabase that is inferred to be asbestos-free. This treatment is not endorsed or allowed by OSHA, EPA, or the USGS. There is a well-known adage regarding RCRA wastes: "Dilution is not a solution to pollution". EarthRes' treatment of data constitutes a mathematical dilution. It is not the role of a Professional Geologist to trivialize the content in rocks and soil, and thereby, dismiss the potential health effects during disturbance. The Professional Geologist should present the data, and it is the role of others to assess whether the disturbance activities may or may not produce airborne concentrations that may be adverse to public health.

DEP Comment

Please explain, in detail, how EarthRes determined that, "it is indicated that the CB-1 #1 sample is from mineral Vein #7" (Section 5.5). Visually, they appear dissimilar. The drill log describes voids, but the Bench Face Mapping Data does not mention voids. The Bench Face Mapping tables states that Vein #7 is approximately 8 inches wide. Intersecting the vein (via

drilling) at an angle, with respect to both the vertical and horizontal axes, will result in the vein appearing longer in the drill core. The photos provided do not show a vein of actinolite greater than 8 inches. Based on the Geologic Features and Boring Location Plan, two or three other veins (Nos. 1, 3, and 4) should have been intersected before Vein #7. These veins were not correlated in the drill logs. Looking at the bench face photographs, it would appear that more than 19.9' (the sample depth of CB-1) horizontal feet exists between Vein #7, and vein 1, 3, and 3 (sic). Properly orienting the core and surveying the bore hole would reduce uncertainty.

EarthRes Response

Vein #7 was projected along its strike and dip to evaluate the depth at which it would intersect core CB-1. CB-1#1 was then inferred to be from mineral Vein #7 based on its proximity to the intersection depth and having a description that most closely matched Vein #7, notably the presence of actinolite visible in hand sample. As discussed in the above response, Vein #7 as observed on the highwall is noted to vary in its width and could reasonably be expected to vary as it propagates into the wall toward CB-1. The small voids present at CB-1#1 is likely the result of entrapped air during crystallization of the vein material. Voids may or may not be present in Vein #7 at the rock face, but could reasonably be expected in a vein of hydrothermal origin. Small voids may be weathered on the face or otherwise unnoticeable or may have developed as the vein width decreased. The relationship between the other veins (Nos. 1, 3, and 4) would have to be determined in the same way via projection. The veins will not maintain the same separation observed at the bench face because the veins are not parallel (they strike in slightly different directions). However, as mentioned in the response above one to one correlation of veins on the rock face with veins in the rock core may not to be observed due to variation of individual veins as they progress through the diabase host rock.

EEC Comment

EarthRes states: "*The small voids present at CB-1#1 is likely the result of entrapped air during crystallization of the vein material. Voids may or may not be present in Vein #7 at the rock face, but could reasonably be expected in a vein of hydrothermal origin".*

1. Entrapped air during crystallization of the vein material is not possible. Actinolite veining does not occur near the surface, rather, it is likely produced by greenschist-facies metamorphic conditions at depth under significant confining pressures.

2. Previously, EarthRes stated that the diabase had not been subjected to metamorphism that may facilitate the crystallization of asbestos. The reference to "vein of hydrothermal origin" suggests that this conclusion has been reversed. Actinolite veining is commonly produced through hydrothermal crystallization and alteration, and experts agree that the presence of water is necessary to produce an asbestiform habit. Therefore, the diabase has been subjected to a metamorphic overprint resulting in the formation of actinolite veining, and the conditions were conducive for the crystallization of asbestiform actinolite.

DEP Comment

The noncoal regulations require complete and accurate characterization of the geology and hydrology of the area proposed for mining. Every effort should be made to fully characterize the amount, type and location of asbestos at the Rock Hill quarry.

EarthRes Response:

Sampling efforts from 2018 and 2019 have generated 90 rock samples and 99 analyses for NOA with which to characterize the site. Approximately half of the analyses (N=49) were from targeted samples including hand samples, core samples, and boulder vein samples, and half (N=50) were from composite samples including stockpiles, crusher fines, and drill cuttings.

NOA was detected at trace levels in both types of samples, with a slightly higher concentration in the Target Samples (see Table 7, Average All, QGSR). The results indicate the overall absence of NOA or its very limited presence in trace concentrations in actinolite mineral veins formed within the diabase rock at the site. This finding is consistent with site- specific observations of the geology including visual inspection of quarry highwalls, detailed observation and logging of 500 feet of rock core, observation of several hundred boulders, as well as observation of crushed aggregate stockpiles, none of which indicated asbestos visible in hand sample. This finding is also consistent with the extensive literature review completed for the site which indicates the diabase is homogeneous and consists primarily of non-asbestos forming minerals.

EEC Comment

Contrary to DEP's request, every effort has not been made to fully characterize the amount, type and location of asbestos at the Rock Hill quarry. Based on EEC's reviews of the QGSP, QGSR, and responses to DEP's comments, it appears that the NOA investigation program, through its design, failed to meet this fundamental objective. The sampling plan, execution of the plan, and test methodologies appear to reveal a systemic bias that led to the avoidance of sampling rocks that may contain NOA, under reporting or no reporting of asbestos as required by standardize test methods and general standard of practice, and trivializes asbestos concentrations by applying mathematical dilution calculations.

Section 3

Petrographic Analysis of Stone

Advance Testing

The DEP requested that Hanson provide petrographic analyses of the rocks at the Rock Hill quarry. Although the request provided little specificity, it would be assumed that the analysis would be performed in context with the issues in front of them, namely, do the rock fabrics, textures, and mineralogy support, or contradict, several representations that were made, such as no evidence for shearing, metamorphism, or other conditions that may be conducive to the crystallization of NOA?

Summary of the Petrographic Analysis

The analysis did not investigate the potential for NOA mineralization. Rather, it appears to be a very basic analysis for the purpose of aggregate suitability. On their web page, Advance Testing provides the scope of the petrographic services they provide:

> *"Our state-of-the-art petrographic laboratory is… capable of analyzing carefully prepared specimens of concrete and/or aggregate to determine its characteristics. Our team of petrographers observe the microstructure and compositional characteristics of a material. In doing so, we are able to characterize and describe the potential deleterious materials within the sample or detail if none are present".*

In addition, the web page provides the range of services:

Testable Materials: Concrete, Mortar (modern and historic), Grout, Concrete-Masonry Unit, Cement Paste, Rock, Stone, Fine Aggregate, Coarse Aggregate, Brick.

Potential Identifiable Issues: Alkali-Carbonate Reaction, Alkali-Silica Reaction, Delamination, Scaling or Spalling, Freeze/Thaw durability, Low Compressive Strength, Cracking and Micro-Cracking.

Advance Testing is a commercial lab that specializes in suitability of materials for their use in construction materials. They do not provide services related to interpretation of igneous and metamorphic fabrics, textures, and composition related to NOA.

Consider the conclusions provided in the analysis:

- The sample was determined to be diabase, composed of plagioclase, pyroxene, and opaque minerals.
- The sample has a weathering rind, composed of clay derived from the weathering of pyroxene.
- This material has a Skid Resistance Rating (SRL) of H according to the provided specification of skid ratings.

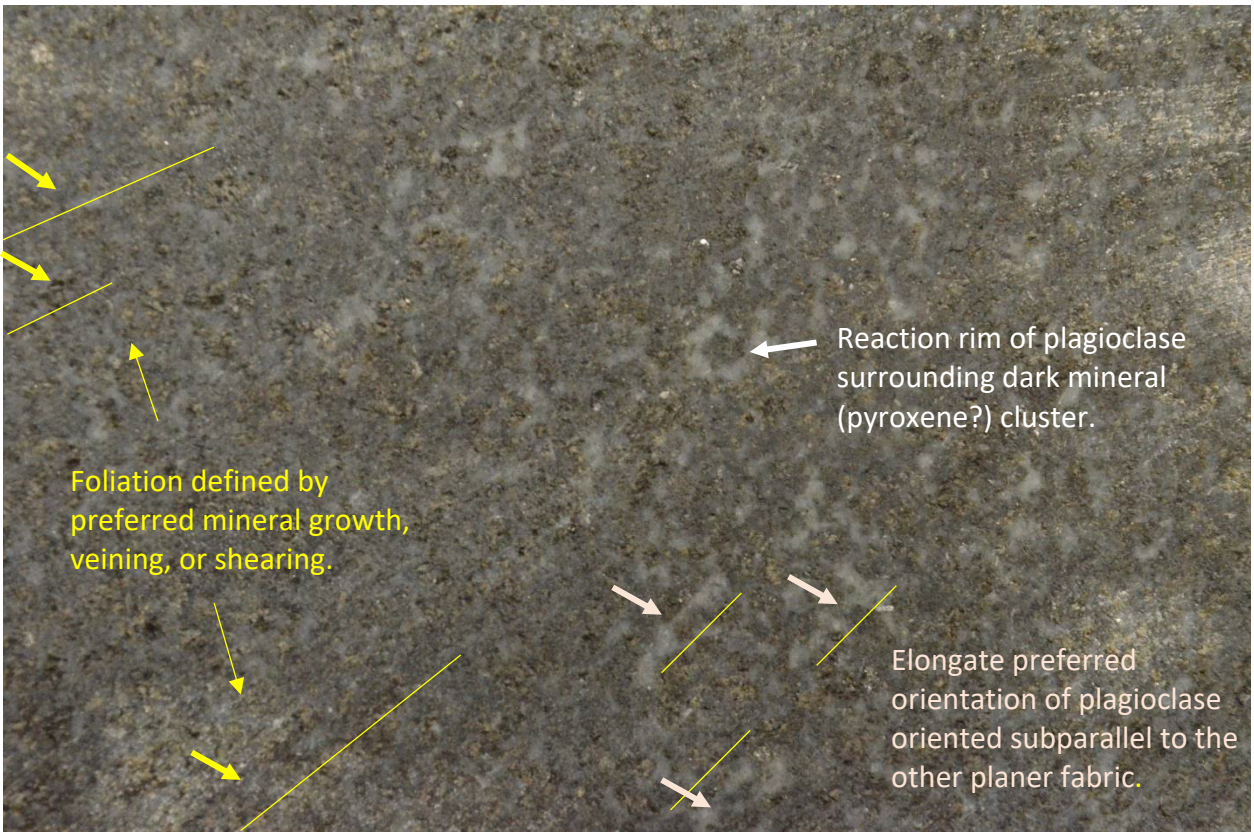
It is readily apparent that Advance Testing provided a basic analysis for the purposes of aggregate suitability, and were not instructed to conduct an analysis into the potential for NOA in these rocks. The analysis has no value to the Rock Hill NOA project.

Evidence for Processes That May be Conducive to the crystallization of NOA

It is difficult to analyze and interpret fabrics and textures from a random photograph that was selected for purposes other than NOA analysis, but the photographs show a variety of structures and textures that should have been observed and explored. These include a weak but observable foliation (planer fabric), defined by the preferred distribution of minerals, reaction rims surrounding pyroxenes that may be composed of amphibole, and post-crystallization fracturing and shearing.

The fabrics that were not investigated by Advance Testing are discussed in Figures 1 and 2, which are photographs submitted to respond to DEP's request for petrographic analysis.

Figure 1: Evidence of Fabrics that Should Have Been Investigated to Assess the Potential for NOA Crystallization



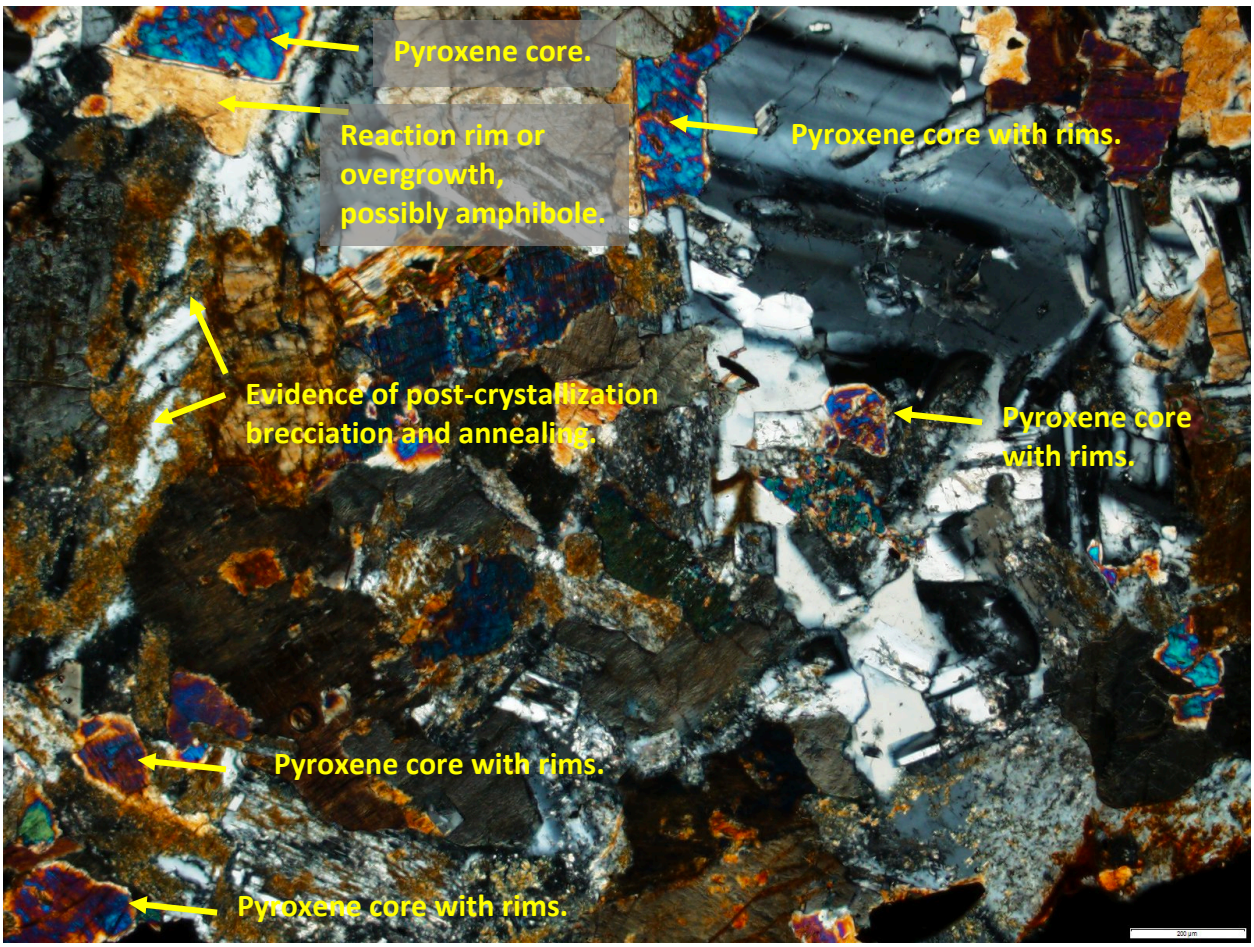
Even at this very low magnification of a polished surface of the diabase rock sample, several fabrics are observable that warrant further analysis related to the possible crystallization of NOA.

On the left, in yellow, are three examples of indications of a foliation (pervasive planar structure) defined by the preferred distribution of mafic minerals. The trend of the foliation is shown by the yellow lines, and examples of the foliation are shown by the three yellow arrows. The foliation is subtle and perhaps not noticeable by an unexperienced technician, but quite obvious to an experienced igneous or metamorphic petrologist. These fabrics, which may be related to post crystallization of the diabase, should have been examined.

On the lower right is an indication of a preferred distribution of plagioclase crystals. The elongate mineral train is subtle, but there is an indication of potential post crystallization recrystallization along a preferred orientation. Note that the orientation, shown by the yellow lines, is subparallel to the fabrics on the left. This fabric should have been observed and analyzed.

At the center is a core of an apparent pyroxene cluster surrounded by a rim of plagioclase. This may not be of important to an analyst who is focused on rock quality, but is a significant feature that would be investigated by a petrologist who is interested in syn- to post-crystallization textures and fabrics that may be conducive to the crystallization of NOA.

Figure 2: Evidence of Shear and Potential Overgrowth of Amphibole Asbestos.



EarthRes stated in the QGSR that there were no indications of metamorphic processes in the diabase, and used this determinization to support the conclusion to dismiss a potential for NOA to be present. The photographs submitted by Advance Testing indicate otherwise.

To the upper left of the photograph is a classic example of a pyroxene crystal with an exsolution or post-crystallization rim comprised of another mineral. In this case, as indicated by a very different color under crossed polarizers, is possibly, if not likely, an amphibole. This texture, common in virtually every pyroxene crystal in the photograph (as well as the other photograph provided by Advance Testing), should have been investigated. The overprinting

mineral, likely an amphibole, may have been a product of late-stage back-reaction, or a post-crystallization overprint. This very obvious fabric would have been investigated by a petrologist who is focused on the potential for NOA crystallization.

EarthRes also stated that the diabase showed no evidence of shearing that may be conducive to the formation of asbestos. However, evidence of shearing is present. In the central-left part of the photograph is a structure that appears to be a shear zone, as indicated by fractured feldspar crystals set in a brecciated (fractured and pulverized) matrix. Post crystallization micro fracturing provide conduits where hydrothermal fluids may migrate, allowing the formation of fibrous amphibole. Veins of actinolite are present on the macroscopic scale within the diabase, and smaller micro veining should have been a focus during the petrographic analysis.

Conclusion

Advance testing provided an analysis of the diabase for the purposes of aggregate suitability for use as a construction material. There is no reference to, or analysis for, the potential for fibrous minerals to be present. Thus, Hanson provided to DEP an analysis that has no value in support of their position that no evidence of shearing or metamorphism that may be conducive to the formation of NOA. The photographs provided, however, indicate otherwise.

Section 4

Comments on RJLG Response to DEP's Questions Regarding Test Methodology and Sampling Results

The following are EEC's comments on RJLG's response to DEP's comments that are included in the Hanson submittal referenced above. Comments are reserved to subjects that are specific to the analysis of NOA.

DEP's comments and RJLG's responses are presented in black italicized text. EEC's comments to responses are presented in normal text and highlighted in red.

DEP Comment

Why RJ Lee Group, Inc. "modified" EPA Method 100.1 to count the 5µm length fibers as opposed to the protocol of 0.5 µm length as specified in EPA Method 100.1.

RJLG Response

Accepted risk models… utilize data derived from epidemiology studies that measured airborne asbestos concentrations using the size parameters of length, width, and aspect ratio. The fiber dimensions used to determine the risk for asbestos-related diseases are those airborne asbestos fibers that are 5 µm or longer and aspect ratio >3:1. The method was modified to include only fibers longer than 5 µm in order to provide some comparison to assess the risk presented if those fibers were to become airborne.

EEC Comments

1. RJLG states that the EPA Method 100.1 was modified by not reporting fibers with lengths ≤5µm as required by the method. Therefore, these reports cannot be reported as valid EPA 100.1 analyses.

2. It is standard practice to report the total asbestos concentration, and many labs break the concentration into the two length categories, similar to the requirements under the EPA AHERA TEM method for air clearance. Arbitrary removal of fibers that are ≤5µm severely reduces the reported concentration, misinforming the end user, including exposure assessment professionals that must rely on the data. As an example, attached at the end of this memorandum is an EPA 100.1 analysis lab report of serpentinite-derived runoff water within a catch basin in northern California. This project was selected as an example because it is comparable to a runoff catch basin at the Rock Hill quarry.

    - In the first sample (S-1), the total asbestos concentration (all fibers and all asbestos species) was 4,994 million fibers per liter (MFL). None of the fibers detected were ≥5µm in length. If the short fibers were eliminated following the RJLG procedure, the lab would report "No Asbestos Detected" rather than 4,994 MFL. If the analytical sensitivity of 22 MFL was used as the upper potential asbestos concentration, the result would be under reported by 99.6%.

    - In the second sample (S-2), the total fiber concentration was 2,684 MFL, with long fibers comprising a partial concentration of 110 MFL. If the short fibers were eliminated following the RJLG procedure, the lab would report 110 MFL rather than rather than 2,684 MFL, which under reports the actual concentration by 95.9%.

3. The modification reduced the reported concentrations, and the impact to the analysis was

not disclosed on the reports to DEP, and likely, to Hanson and EarthRes. The selective removal of reportable fibers appears to have been the standard practice by RJLG in bulk samples as well. Both Hanson and EarthRes have trivialized the asbestos content in rock materials, using vague terms such as "trace" and "low levels". Hanson and EarthRes made these characterizations by relying on faulty data set that under reported concentrations, and their representations may have been very different if the asbestos concentrations were reported correctly. As such, all analyses submitted by RJLG should be considered invalid, and the interpretations within the sampling report and within responses to comments are also invalid.

4. RJLG cited EPA epidemiological studies and cited the criterion of >5µm length and aspect ratio of 3:1 applied in those studies as a justification to eliminate fibers that are ≤5µm in length, even though required by Method 100.1. In essence, RJLG modified the method by arbitrarily applying an EPA health-based criterion that is applied to risk assessment by inhalation, and reduced the reportable asbestos concentration accordingly. These differential counting methods were also applied to bulk samples. EEC previously discussed the application of differential counting methods employed by RJLG and the rebuttals by EPA and the USGS. The two relevant documents may be produced at the links below, highlighted in blue. Of particular significance to this question is the final conclusion by the USGS:

   "Finally, it seems appropriate in light of the issues addressed in this report, to stress that it is absolutely not the role of the analytical or mineralogical communities to make health-based decisions or to make independent analytical assessments that directly or indirectly influence health-based outcomes. It is the obligation of the analytical and mineralogical communities to provide accurate, unbiased, and scientifically sound information to the health and regulator communities so that appropriate and informed, health-related policy and regulatory decisions can be made".

The determination was made clear to RJLG, but it appears that they have chosen to dismiss it. The result has been an under reporting of asbestos concentrations as required by test methods, and a failure to report to DEP the modification which led to the under reporting.

EPA Document Site:

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwj-6LPC04TqAhWJs54KHTYcAPcQFjACegQIBBAB&url=https%3A%2F%2Farchive.epa.gov%2Fregion9%2Ftoxic%2Fweb%2Fpdf%2Frjlee-response4-20final.pdf&usg=AOvVaw03xwOpT4bpw4HIOKXQg461

USGS Document Site:

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjkx9T004TqAhWUpZ4KHZNMBfUQFjAAegQIBRAB&url=https%3A%2F%2Fpubs.usgs.gov%2Fof%2F2006%2F1362%2F&usg=AOvVaw1yzob5W-b_bBEnNFQcV57X

5. RJLG removed from reporting fibers >5µm in length and cited EPA epidemiological studies and/or risk-based calculations to support this decision. Risk thresholds by EPA protocol often employ the PCM-equivalent metric (PCMe), which applies fibers that are >5µm in length and ≥0.25µm or 0.4µm in width. This begs the question: Did RJLG also eliminate fibers based on width, and therefore, under report asbestos concentrations even further? This is not known because RJLG has not disclosed information regarding the modification of the test method, and DEP asked only to comment on the >5 µm issue.

DEP Comment

Why RJ Lee Group, Inc. did not use the same parameters (length, etc.) as EMSL used in its analysis and the impact that would have on the reported results.

RJLG Response

For the analysis of the water samples, the length parameter used by RJLG and EMSL was >5 µm and >0.5 µm, respectively. The concern with the water samples is that fibers in the water would become suspended in the air after drying. Therefore, RJLG used a size of 5 µm which is consistent with the toxicological and epidemiological studies referenced above that studied risks associated with airborne fibers.

EEC Response

1. EMSL reported the asbestos concentration as required by EPA 100.1, and RJLG did not. The RJLG data are therefore not valid. As documented above, the role of the laboratory is to produce unbiased data, and it is the role of the exposure-risk professional to apply that data for the purposes of estimating risk.

2. RJLG appears to feel that the concentration and fiber dimensions found in a bulk sample or water sample can be applied to a risk assessment related to airborne asbestos. It is well known that this is not the case. As US EPA states[1].

"Asbestos fibers pose a risk to human health overwhelmingly by way of the inhalation pathway. A relationship between the concentration of asbestos in a source material (typically soil) and the concentration of fibers in air that results when the source is disturbed is very complex and depends on a broad range of variables. Many have tried and all have failed to produce a "rule" describing this complex relationship. That is, no method has been found to predict the concentration of asbestos in air reliably as it relates to a measured concentration of asbestos in the source material. Suffice it to say, a small concentration of asbestos in source material may, when disturbed, produce a substantial airborne exposure. Not always, but sometimes."

DEP Comment

Why would the subsequent investigation of the surface water (per the QGSSP) begun on April 25, 2019 be performed to apparently less stringent parameters than the Previous Site Investigation?

RJLG Response

It is not necessarily that the water testing begun April 29, 2019 is less stringent, but rather it has been modified to focus on fibers of lengths that present risk when airborne and would be included in air monitoring testing if they were to become airborne.

[1] USEPA, "ERT HELPFUL HINTS for ACTIVITY-BASED SAMPLING FOR ASBESTOS IN AIR" https://semspub.epa.gov/work/HQ/175325.pdf

EEC Comment

The difference between the RJLG modified analysis and the EMSL analysis is not a matter of stringency. The difference is that RJLG modified the test method inappropriately mis-analysed and misreported asbestos concentrations that are less than the actual concentration, and did not report this modification to DEP. If the concentration represented by the long fibers are of interest, RJLG should have broken the total concentrations into the long and short categories, as illustrated in the attached water report.

DEP Comment

Please explain why the 1.0% limit is the correct standard to use for Naturally Occurring Asbestos?

RJLG Response

Currently, there is no relevant federal or Pennsylvania standard for natural occurrences of asbestos. However, federal standards (OSHA, MSHA, and EPA) do exist for bulk substances containing 1% or more asbestos by weight being designated as an asbestos containing material (ACM). Since this is a federal standard, each state is required to use it or a lower one if it exists. California has set 0.25% as a limit for asbestos specifically in the case of aggregate produced and sold from serpentinite, mafic, and ultramafic sources. As there is no scientific consensus on a "correct" limit for "Naturally Occurring Asbestos", to utilize the 1.0% limit in this case is most consistent with the federal standards applied across the country. While 1% is the limit for the definition of asbestos containing materials, we have reported, and will continue to report, quantities of asbestos well below 1% in the materials analyzed. If the presence of asbestos below 1% is significant for the management of this resource, that information is available.

EEC Comment

RJLG misrepresents the 1% and 0.25% Federal and California thresholds, and apply them incorrectly.

1. EPA regulates building materials where asbestos has been applied, and the ≥1% level was chosen as the threshold. These materials are defined as Asbestos-Containing Materials (ACM). This threshold was based upon the roughly 1% limit of accurate quantitation for polarized light microscopy using the visual estimation method, which was specified at the time. Also, it was found to be logical that if asbestos was applied, it would be present in concentrations that exceed 1%. Therefore, asbestos in building materials with concentrations of <1% is not considered to be applied as a building material component, and therefore, is not regulated during building demolitions or in schools.

   EPA does not specify this threshold on NOA sites, and determinations are largely based on airborne exposure. While the 1%, or other threshold, may be applicable on a cleanup site where its applicability has been documented, this 1% threshold has no relevance to a response action threshold in NOA at the Rock Hill quarry.

2. The OSHA asbestos standard is triggered when asbestos <u>in any amount</u> is disturbed within any material, including NOA, even concentrations that are reported as "<1%", "trace" or "low levels". Disturbance of asbestos in any amount triggers requirements such as an initial exposure assessment, periodic personal monitoring, training, wet methods, and other methods of compliance. Disturbance of ACM (defined by OSHA as >1%) triggers <u>increased</u> compliance measures, such as daily monitoring, increased training, demarcation of Regulated Areas and signage, and other increased levels of physical, engineering and

administrative controls.

3. The California Air Resource Board (CARB) regulates asbestos in any amount on construction sites where NOA is disturbed. The 0.25% threshold is applied to surfacing applications only, and was based on the value of a detection on one of 400 points. It was also designed specifically for serpentine rocks that, like building materials, have large percentages of chrysotile (note the title of the CARB 435 method[2]) The 0.25% threshold applies to the surfacing of access and haul roads across NOA rocks and soil and the post-construction stabilization of disturbed NOA. The stated purpose is to prevent adverse offsite exposure by wind stripping.

Therefore, the applicable threshold for response actions on NOA sites is asbestos in any amount.

DEP Comment

Please explain why PLM was chosen as the approach for determining the amount of NOA at the Rock Hill Quarry?

RJLG Response

The approach utilized includes multiple macro and micro observation tools for the identification and quantification of NOA in the samples from Rock Hill Quarry and does not rely on any single technique. The analysis begins with stereobinocular macro to micro scale observation of the as received materials, prior to grinding, to determine if coarse fibrous features are present. In addition, both PLM and TEM have been utilized for the identification and quantification of NOA in a subset of samples. Where no NOA was detected by PLM, TEM was used to confirm that finding. In every instance where TEM observed NOA and PLM did not, and the amount observed by TEM was well below the detection limit for the PLM. None of the TEM results quantified NOA greater than what was observed by PLM. The determination of the asbestos content in bulk materials is most accurately made using PLM and is the primary technique implemented in EPA 600/R-93/116 as well as CARB 435. TEM has been utilized in these samples in order to provide a thorough characterization of the minerals observed, as well as to provide an assessment of particles that may not be visible in the PLM analysis. The majority of the mass of asbestos is included in particles visible in the PLM and these larger particles are likely to be excluded from the TEM analysis due to the extremely small mass of material analyzed as well as the very small area of the prepared sample filter that is analyzed by TEM. Because of the nature of the bulk materials being analyzed, PLM is used as the primary quantifying analytical technique, but can be supplemented by TEM for further characterization and confirmation of mineral identifications.

EEC Comments

1. RJLG states: *"The determination of the asbestos content in bulk materials is most accurately made using PLM and is the primary technique implemented in EPA 600/R-93/116 as well as CARB 435."*

This representation regarding the accuracy of the PLM method for is patently false, and is not shared by the NOA scientific and regulatory community. It is well known that TEM methods are superior.

[2] California Environmental Protection agency, Air Resource Board, Method 435: Determination of Asbestos Content of Serpentine Rocks, June 6, 1991.

In addition to the limitation that fibers which are approximately ≤0.25µm in width are not visible by PLM, this method is highly inaccurate where concentrations are below 1% and the material does not contain large bundles of asbestos fibers. To illustrate, three examples of EPA determinations are presented below, and the sources are located in the respective footnotes.

a. *"Inexpensive analytical methods currently available (e.g. PLM) can detect levels of 1% or greater with some confidence. Site-specific improvements in the use of PLM analysis at Libby have led to much higher confidence in sampling results and the ability to detect and quantify asbestos levels in soils at 1% and even less than 1%. EPA is currently testing several methods to determine their ability to detect and quantify levels less than 1%"… In most of these cases, the levels of Libby amphibole in soil have been too low to quantify (these are reported as "Trace" or "<1%"), which probably corresponds with concentrations that are mainly in the 0.1-1% range"[3].*

b. *"When the asbestos content of soil is low (e.g., <1% PLM), the fraction of particles that are asbestos is small, and accurate quantification is generally very difficult. Thus, the results from these methods should generally be interpreted semi-quantitatively…. Sampling at multiple sites has shown that even when soils are non-detect by PLM, concentrations of asbestos in the air via ABS may result in unacceptable health risks"[4].*

2. RJLG states: *"The determination of the asbestos content in bulk materials is most accurately made using PLM and is the primary technique implemented in EPA 600/R-93/116 as well as CARB 435".*

EEC Comments

The reference to the two test methods in support for using PLM as the primary method for NOA is misleading. One was designed for building materials with large amounts of asbestos consisting of large bundles, and the other was designed for serpentine rocks that have large amounts of asbestos consisting of large bundles. In both cases, the agency that developed the methods conducted thorough studies to validate the methods for a specific purpose. Outside of the specified purpose, such as general NOA, the methods have not been validated, and are notoriously poor for detecting fine and short fibers (common in NOA), and quantifying concentrations below 1%.

EPA 600/R-93/116
In the introduction, the EPA 600/R-93/116 method states: *"This Method for the Determination of Asbestos in Bulk Building Materials outlines the applicability of the various preparation and analysis methods to the broad spectrum of bulk building materials now being analyzed".*

As discussed previously, the method was designed to detect asbestos that was applied to building materials in high concentrations, with the asbestos consisting of large processed bundles and fibers. The method can be applied to NOA, but it is unreliable if the purpose is to accurately quantify asbestos at low concentrations. TEM methods have become the standard for quantitation at low concentrations, or where asbestos is present as small microscopic fibers. This deficiency needs to be recognized, and the data interpreted accordingly where not used for building materials.

[3] Libby Asbestos Site Residential/Commercial Cleanup Action Level and Clearance Criteria, Technical Memorandum, Draft Final - December 15, 2003).
[4] Oswer Directive #9200.0-68 September 2008 Framework for Investigating Asbestos-Contaminated Superfund Sites

CARB 435

In the Applicability section, the CARB 435 method states: "This method is applicable to determining asbestos content of serpentine aggregate in storage piles, on conveyor belts, and on surfaces such as roads, shoulders, and parking lots". Note its title: *"Determination of Asbestos Content of Serpentine Aggregate"*.

Serpentine rocks, primarily serpentinite, often contains chrysotile in high concentrations within macroscopic veins. In this regard, it is not unlike asbestos applied in building materials. The analysis by the method is comparable to EPA 600/R-93/116, and therefore, has the same limitations for NOA, particularly where present in low concentrations. This deficiency needs to be recognized, and the data interpreted accordingly in non-serpentine rocks.

3. RJLG states: *"In every instance where TEM observed NOA and PLM did not, and the amount observed by TEM was well below the detection limit for the PLM".*

EEC Comments

The concentration of asbestos using TEM methods cannot be directly compared to values obtained using PLM via CARB 435. The methods measure two completely different things, as discussed below. Similarly, the 0.25% value ("LOD") of the CARB 435 method cannot be applied to the concentrations measured using TEM.

To illustrate, the California Department of Toxic Substances Control (DTSC) uses a two-fold process at school sites to assess whether the concentration of NOA exceeds a pre-determined threshold[5]. The CARB 435 by PLM method is used for all samples as a screening tool. If the measured value of a geologic or soil unit is ≥0.25%, significant response actions including dust control, perimeter monitoring, and post-construction capping is required without further testing.

If the results are <0.25% by the point counting method (visible but no fibers fell under one of 400 points), or asbestos is not visible ("ND"), a carefully selected representative subset of these samples (generally 25% or more) are selected for re-analysis by TEM. If the concentration is between 0.01% and 0.001%, the response actions are required (the 0.001% by TEM is considered the concentration where adverse exposure from disturbance is likely to be minimal). The capping requirement is similar: cap material in planters or on slopes that are vegetated must be below the 0.01% threshold, whereas cap material within playfields must be below the 0.001% threshold.

Thus, soil and cap material must satisfy two conditions: <0.25% by CARB 435, AND < 0.001% by TEM, for area where children will be present such as a playfield.

4. RJLG states: *"The majority of the mass of asbestos is included in particles visible in the PLM and these larger particles are likely to be excluded from the TEM analysis due to the extremely small mass of material analyzed as well as the very small area of the prepared sample filter that is analyzed by TEM".*

EEC Response

The response by RJLG indicates that the laboratory is not equipped to prepare a representative sample, and as a result, has severely under reported the asbestos concentrations.

[5] California Department of Toxic Substances Control, Interim Guidance, Naturally Occurring Asbestos at School Sites, Revised 9/24/04

The entire process from field sampling to final testing should be designed to report a concentration that is representative of the geologic unit. Laboratories employ standard techniques with a series of steps that are designed to prepare a filter that is homogeneous and representative of the submitted material. Also, the low amount of material is compensated by analyzing enough grid openings to achieve the desired analytical sensitivity, generally 0.001% to 0.0001%.

If prepared and analyzed properly, the larger fibers and bundles (>5µm) will not be excluded. If the percentage of long fibers is sufficiently low that the scan area is not large enough to measure an accurate concentration of this subset of particles, their concentration can be accurately measured using a phased magnification technique that efficiently captures these fibers by scanning a larger area that was used for the small fibers. The total concentration is the sum of the two sub-concentrations.

RJLG is claiming that their TEM analyses are excluding the larger bundles that constitute the majority of the mass in the sample. Therefore, RJLG is severely under reporting the mass concentration of asbestos in their TEM analyses. It follows that all TEM analyses are not valid representations of the actual asbestos concentration, and therefore, should not be accepted by DEP.

DEP Comment

Regulations have been cited in the QGSR as sources for a definition of Asbestos Containing Material which has been also used to define a material containing Naturally Occurring Asbestos. These regulations also prescribe methods of analysis. Please explain why an analysis method (EPA 600/R-93/116) that counts as asbestos those fibers with an aspect ratio of >20:1 may be preferable to the methods cited in the regulations that count fibers as asbestos that have an aspect ratio of 3:1 or 5:1?

RJLG Response

EPA 600/R-93/116 is not a method to enumerate and count individual asbestos fibers and does not define a fiber based on strict dimensional parameters. EPA 600/R-93/116 is the method recommended by EPA for the analysis of bulk materials to determine the asbestos content of those types of materials. The method was recommended in Federal Register, 59, p. 38970-38971 as an improvement upon the promulgated method (40 CFR §763 Appendix E to Subpart E of Part 763) and also contains a definition for "asbestiform" that was lacking in the promulgated method. The definition of asbestiform is significant, as it is recognized that non-asbestiform particles of amphibole, and other minerals, pose a significant interference in the accurate determination of the amount of asbestos present in a material analyzed by the method. There are no specific criteria for aspect ratio in the definition of a fiber in EPA 600/R- 93/116. Aspect ratio is only one characteristic of an asbestiform material that is useful for the determination of whether or not it is asbestos. The other characteristics listed in the asbestiform definition need to be considered when the possibility exists that non- asbestiform materials may be present in the material being analyzed. This is exactly the case in any situation where naturally occurring asbestos may be of concern.

EEC Comment

RJLG focuses on method EPA 600/R- 93/116, and avoids the intent of the question regarding the elimination of fibers with high aspect ratios even though specific aspect ratios are cited in test methods for air and water. They argue that general characteristics within the definitions of asbestos may be applied and replace or circumvent criteria that are clearly specified.

RJLG states: "*The other characteristics listed in the asbestiform definition need to be considered when the possibility exists that non- asbestiform materials may be present in the material being analyzed".*

RJLG has been arguing this point for many years, and is isolated in the application of differential counting protocols. As documented within this section and previous EEC submittals, EPA and USGS have unequivocally disputed RJLG's position, yet they continue to employ these methods. The arbitrary and selective differential counting procedures employed by RJLG, with no standardized rules or operating procedures, are not the standard of practice within the laboratory community.

DEP Comment

Why would EPA Method 600/R-93/116 be used for analysis if it was not promulgated by the EPA, particularly if the regulations cited for the definition of Asbestos Containing Materials contain methods of analysis?

RJLG Response

The promulgated methods are presumptive tests used in environments where asbestos was known to have existed in the form of asbestos containing building materials and were the result of negotiated rulemaking by the EPA. While EPA 600/R-93/116 is also designed to analyze building materials, it is more broadly defined, improved over the promulgated methods, and capable of capturing the characteristics necessary of a material to determine if it is in fact asbestiform or not. The promulgated methods are very narrowly defined and do not take into consideration the unique situation that exists with natural occurrences of asbestos where, if an asbestos mineral is present, it will very likely exist with non-asbestiform particles or other interfering minerals. Because of this, a more robust approach is needed to accurately determine if, and how much, asbestos might be present in a material. EPA 600/R-93/116 also provides guidance on how to utilize TEM for the analysis of bulk materials that is not present in the promulgated method. This is crucial for the identification of asbestos in naturally occurring situations as it provides a means to verify mineral identifications made by PLM. In addition, it is the clearer asbestiform definition and expanded implementation of TEM that make EPA 600/R-93/116 the preferable method for the analysis of naturally occurring asbestos over the promulgated method. Other regulated methods, CARB 435, refer to EPA 600/R-93/116 as an acceptable method for the analysis of asbestos in rocks.

EEC Comment

RJLG states: "*The promulgated methods are very narrowly defined and do not take into consideration the unique situation that exists with natural occurrences of asbestos where, if an asbestos mineral is present, it will very likely exist with non-asbestiform particles or other interfering minerals. Because of this, a more robust approach is needed to accurately determine if, and how much, asbestos might be present in a material".*

EEC agrees with RJLG: the methods are very narrowly defined, do not take in consideration a potential mix of asbestiform and non-asbestiform particles, and an approach, through EPA and OSHA test methods, should be developed if these agencies feel that this differentiation should be made. Until such differentiation is shown to be appropriate from a health-based perspective, and test methods developed that provides clear protocols, the existing test methods must be adhered to. All indications are that EPA, OSHA, USGS and other regulatory agencies feel that all elongate mineral particles as defined by a ≥3:1 aspect ratio and length ≥0.1µm or 0.5µm should be reported. RJLG's unique approach should not be accepted by the DEP.

DEP Comment

By inspection of the submitted data for aggregate samples in the QGSR, it appears that a 10:1 aspect ratio was the governing parameter in determining if a structure was asbestos or a cleavage fragment as there is only one instance found that shows a 10:1 aspect ratio that was deemed asbestos. All other structures at 10:1 or less aspect ratios were deemed to be cleavage fragments or non-asbestos. Please explain why this is a logical assumption and consistent with the regulatory definitions cited in the QGSR. Secondly, if one was using EPA 600/R-93/116, which states an aspect ratio of 20:1 should be used, why was a 10:1 ratio apparently used?

RJLG Response

It appears there may be a misunderstanding of the analytical parameters and definition of asbestiform provided in EPA 600/R-93/116. As discussed above, the definition of fiber in EPA 600/R-93/116 has no specific dimensional parameters, and the definition for asbestiform is for the description of the population of fibers that might be observed in a material. The TEM analysis of bulk materials was performed with the following criteria for enumerating fibers of any kind. Fibers observed in the TEM analysis of bulk samples are counted based on their morphological parameters: length ³ 0.5 micrometers, aspect ratio ³5:1 (per ASTM D-5756). When a fiber is observed, the mineral composition of that fiber is identified as either chrysotile, amphibole, or non-asbestos using selected area electron diffraction and energy dispersive x-ray spectroscopy. The information gathered from the fiber is compared to reference materials for the purpose of mineral identification. Of the amphibole particles identified, a determination of whether or not a fiber is asbestiform is made based on the asbestiform definition provided in EPA 600/R- 93/116. If an amphibole fiber is recognized as asbestiform it is counted as amphibole asbestos. If an amphibole fiber is recognized as non-asbestiform it is counted as amphibole cleavage.

The observation that asbestos fibers have aspect ratios generally greater than 10:1 is consistent with the asbestiform definition in EPA 600/R-93/116:

Asbestiform (morphology) Said of a mineral that is like asbestos, i.e., crystallized with the habit of asbestos. Some asbestiform minerals may lack the properties which make asbestos commercially valuable, such as long fiber length and high tensile strength. With the light microscope, the asbestiform habit is generally recognized by the following characteristics:

- Mean aspect ratios ranging from 20:1 to 100:1 or higher for fibers longer than 5μm. Aspect ratios should be determined for fibers, not bundles.
- Very thin fibrils, usually less than 0.5 micrometers in width, and
- Two or more of the following:

  Parallel fibers occurring in bundles,

  Fiber bundles displaying splayed ends,

  Matted masses of individual fibers, and/or

  Fibers showing curvature

These characteristics refer to the population of fibers as observed in a bulk sample. It is not unusual to observe occasional particles having aspect ratios of 10:1 or less, but it is unlikely that the asbestos component(s) would be dominated by particles (individual fibers) having aspect ratios of $<$20:1 for fibers longer than 5μm. If a sample contains a fibrous component of which most of the fibers have aspect ratios of $<$20:1 and that do not display the additional asbestiform characteristics, by definition the component should not be considered asbestos.

The observation that many of the counted structures had aspect ratios <10:1 indicates that the analyzed material is not entirely asbestiform, but there are fibers present that have much higher aspect ratios and lengths longer than 5 mm indicating there is a trace amount of asbestiform material present as well. This is not unusual for a naturally occurring asbestos material, as typically a range of morphologies can be present and intimately intermixed. The data collected indicate that the material present at Rock Hill is predominantly non-asbestiform, however trace amounts of asbestiform material were observed and reported. If fibers with aspect ratio between 5:1 and 10:1 were observed to possess asbestiform characteristics they too would have been reported as asbestos.

EEC Comment

In addition to the arguments made above and in other EEC submittals, it should be noted that the preparation of rock samples for NOA involve significant pulverization and grinding using a variety of techniques. Long fibers are pulverized into short fibers. Also, many geologic formations include asbestos with fibers that are predominantly short. As examples, see the water analysis attached to this memorandum and the fibrous amphibole studied in *Erskine and Bailey, 2018*. All of these true asbestiform but short fibers will be eliminated by RJLG's protocol. The RJLG protocol is unique and subjective, and not in conformance with EPA and USGS position and standard of practice for laboratories. It follows that DEP should not accept the RJLG data.

DEP Comment

Please explain the significance, in terms of protecting human health and safety, of the presence of asbestos fibers in water at the site. Citing drinking water standards seems irrelevant since none of the onsite water is proposed for human consumption.

RJLG Response

The task was to evaluate water samples collected on site for the presence of asbestos and it is beyond the scope of our work to determine what impact that might have on human health and safety. In the instance that the water available on site is to be used for dust mitigation, it is useful to understand if asbestos is present in that water as there could be potential to disperse asbestos, if present in the water, over the site which then could become entrained as dust after drying. There is no limit of asbestos in water that the EPA 100.1 result can be compared against. EPA method 100.2 is an official EPA method that measures the presence of asbestos (10 mm and longer) in water that will be used for human drinking. The EPA drinking water limit for these fibers is 7 million fibers per liter of water. The water at Rock Hill quarry was never intended to be used for drinking water, however, if it were, it would meet this EPA drinking water quality standard. The surface water at the Rock Hill quarry is intended to be used for dust suppression applications. In government (OSHA and EPA) asbestos risk assessments derived from toxicological and epidemiological studies, the fiber dimensions used to determine the risk for asbestos-related diseases were those airborne asbestos fibers that were 5 mm or longer, with a 3:1 or greater aspect ratio as seen by a phase contrast optical microscope at 400X. This microscope only sees fibers that are 0.25 mm wide or wider. For this reason, the water samples at Rock Hill quarry were additionally analyzed for these risk fiber dimensions so that an assessment could be made on whether the dust suppression water could contribute to possible airborne levels of these risk fibers.

For this reason, the water samples at Rock Hill quarry were additionally analyzed for these risk fiber dimensions so that an assessment could be made on whether the dust suppression water could contribute to possible airborne levels of these risk fibers.

EEC Comment

The RJLG response is inconsistent. It states: *"…and it is beyond the scope of our work to determine what impact that might have on human health and safety". It then states: "For this reason, the water samples at Rock Hill quarry were additionally analyzed for these risk fiber dimensions so that an assessment could be made on whether the dust suppression water could contribute to possible airborne levels of these risk fibers".*

As discussed above, RJLG should report all fibers as required by the method, and then break the concentration into the two size categories and width categories for others to assess. It is appropriate to re-state USGS's response to RJLG's argument at the El Dorado Hills site:

"Finally, it seems appropriate in light of the issues addressed in this report, to stress that it is absolutely not the role of the analytical or mineralogical communities to make health-based decisions or to make independent analytical assessments that directly or indirectly influence health-based outcomes. It is the obligation of the analytical and mineralogical communities to provide accurate, unbiased, and scientifically sound information to the health and regulator communities so that appropriate and informed, health-related policy and regulatory decisions can be made".

DEP Comment

Asbestos concentrations from the samples collected by the Department are in some cases different than those collected by EarthRes. In light of the comments above noting apparent discrepancies between asbestos definitions and laboratory reporting, please reevaluate the asbestos concentrations as appropriate. (Core Vein Volume Assessment Section 6.2)

RJLG Response

The direct comparison between laboratories can only be made on the samples where both laboratories utilized the same analytical techniques. In the group of samples submitted to EMSL by PADEP, only PLM results are available from RJLG. In all of these samples, with the exception of the Vein #7 sample, the results are identical for asbestos. For non-asbestos fibers, EMSL appears to have visually estimated the quantity and as a result produces an overestimate when compared to the point counting results obtained by RJLG for non-asbestos fibers. TEM analysis of bulk materials for asbestos is known to have significant limitations and produce results that are of limited precision and accuracy.

Given the disparate results for the Vein #7 sample between laboratories, a second aliquot of the sample was tested by PLM using EPA 600/R-93/116 with quantification by a 1000-point count and found to contain 0.2% actinolite asbestos and 47.7% non- asbestiform amphibole. While still significantly different than the EMSL result, the magnitude of this result is comparable, and indicates one of the challenges associated with analysis of geological materials.

The simplest way to resolve asbestiform definitional discrepancies, it appears in this instance, is by simple addition of the amphibole asbestos and amphibole cleavage fragment wt% results reported by EarthRes for any given sample. This is possible because RJLG has included all particles that meet the aspect ratio criteria for fibers identified in the TEM analyses. Where another laboratory has not differentiated asbestiform from non-asbestiform morphologies and included both as "asbestos" using the same counting criteria the "asbestos" wt% determined is the sum of both morphologies.

EEC Comment

A disparity between results submitted by RJLG and any other laboratory is predictable. RJLG utilizes unique and unspecified protocols that eliminate, on a particle by particle basis, asbestos that would be otherwise reported by a laboratory that follows procedures in their SOP for air and bulk analysis under the NVLAP accreditation program. RJLG has stated that they have no SOP for NOA samples, but a written procedure must exist, otherwise, two RJLG analysts will arrive at two different results. The lack of a formal SOP, intra-laboratory exchanges, and inter-laboratory exchanges result in analyses that are not precise, accurate, nor reproducible. DEP has apparently observed this, and should not accept any of RJLG's results.

401 Marina Place
Benicia, CA 94510
707-738-4917
Erskine.geo@gmail.com

Section 5

Comments on Hanson's Air Monitoring Plan

The following is a review of the Hanson air monitoring plan as referenced above.

Introduction

In their letter dated April 17,2020, the DEP requested that Hanson submit a *"draft asbestos monitoring plan, which comprehensively monitors for airborne asbestos exposure, both during periods of activity at the quarry, as well as during times of inactivity".*

Although the request lacks some specificity, it would generally be assumed as a request for a risk-based perimeter air monitoring program designed to verify that asbestos emissions generated on the site are not adversely exposing residents, children attending nearby schools, and other receptors that live or work off of the site. The request for monitoring during times of inactivity would generally be interpreted as a request for "ambient" or "background" airborne concentrations that are not related to site activities. An air monitoring plan often also includes a personal air monitoring program (as specified by the OSHA standard) designed to verify that the dust control measures are successful in preventing worker overexposure by asbestos during construction.

The draft plan is not designed for, nor will achieve, any of these three objectives, as summarized below.

Stated Purpose of the Air Monitoring Plan

The purpose (Section 3) and scope (Section 4) of the air monitoring plan is stated to be *"periodically assess the potential presence of NOA fibers in air at the perimeter of the Rock Hill Quarry".* Air monitoring programs do not assess potential presence, rather, they document actual exposures using quantitative and well-established methodology. The *"potential presence"* for asbestos in air has already been established: NOA has been detected in the rocks of the quarry, and their disturbance will produce fugitive airborne asbestos fibers, regardless of dust control measures. If the DEP approves the air monitoring plan, Hanson would need only to provide a conclusion regarding "potential presence" to satisfy the approved scope.

However, language and test methodology within the text of the plan, discussed below, suggests that the data may be used to argue that workers and offsite residents were not exposed to asbestos, even though the plan was not designed for these purposes. Previously, Hanson publicly alluded to limited test results collected during periods of inactivity, likely using the same protocols found in the air monitoring plan, to claim that residents were not exposed to asbestos during periods of activity. It can be reasonably concluded that a similar approach may be applied in the future.

To illustrate that the plan will not achieve any of the three goals summarized above, elements in the plan will be compared to each of the three air monitoring program types.

Perimeter Verification Air Monitoring

Section 3 states: *"The scope of this document is limited to the Rock Hill Quarry operations. It is not applicable to assessments conducted beyond the facility's perimeter".* Therefore, the

air monitoring plan is not scoped to assess the potential exposure to offsite receptors during disturbance of the quarry materials that contain asbestos.

Section 4 states: "*The purpose of this document is to outline practices for periodically assessing potential naturally occurring asbestos (NOA) fibers in air at the perimeter of the Rock Hill Quarry".* The term "periodically assess" technically can be met by once a week, once a month, or once a year. Perimeter monitoring must be conducted daily to have any meaning in regards to offsite exposure. Also, the reference to "assessing potential NOA fibers" has no practical meaning and is not defined. According to Section 3 and 4, this means assess for potential presence of asbestos only.

Section 6.3 of the plan provides a two-step process for analyzing samples, and proposes an "action level" to assess exposure: *"Analyze the samples by NIOSH 7400 using PCM, then reanalyze samples that exceed a "potential exposure" of 0.01 f/cc by NIOSH 7402 using TEM".* These methods, used in combination rather than independently as stated, is the standard methodology for assessing worker exposure under the OSHA standard, but should not be applied to perimeter monitoring. Note that the 7402 method does not allow calculation of a concentration, rather, it determines the ratio of asbestos to non-asbestos fibers which is applied to the original PCM concentration.

The 0.01 f/cc concentration is referred to as an "*action level based upon the US Environmental Protection Agency (EPA)'s clearance standard for asbestos clean-up".* The reference to "clearance" suggests that the 0.01 f/cc criterion is derived from the EPA AHERA regulations for asbestos removals in K-12 schools[6]. In 1986, when AHERA was enacted, EPA allowed the PCM, rather than the TEM method within the regulation, was appropriate until a sufficient number of TEM laboratories were fully accredited. Since then, the size of the space where PCM was used decreased, and now it is used nearly exclusively by consultants for small-scale short-duration projects. The general rule is that PCM may be used for small spaces such as mini-containments where the containment space cannot be occupied by two workers.

The clearance criterion of 0.01 f/cc is not risk-based, rather, it is the limit of quantitation of the method. EPA states: *"The action shall be considered complete when the results of samples collected in the affected functional space and analyzed by PCM using the NIOSH Method 7400 show that the concentration of fibers for each of the five samples is less than or equal to a limit of quantitation for PCM (0.01 fibers per cubic centimeter (0.01 f/cm^3) of air)".*

The completion criterion at schools using the standard TEM AHERA method is effectively "No Asbestos Detected". The clearance criterion for TEM is 70 asbestos structures (not fibers) per square millimeter of filter area (70 s/mm^2). The 70 s/mm^2 value was specified because in the 1970's, commercial filters were found to have, on average, 70 s/mm^2 of asbestos as a contaminant. Thus, the clearance criterion is the level that would be already present on the filter, and the effective clearance level is No Asbestos Detected outside of the 70 s/mmm^2 contaminant level. The contamination of filter problem has since been solved, and very low concentrations well below the 70 s/mm^2 are now commonly measured without thye contaminated media contribution using standard TEM techniques.

It is important to note that the 0.01 f/cc threshold is a very high concentration, and techniques have been established to measure actual concentrations at risk-based levels. For example, the California Air Resource Board (CARB) calculated, using standard EPA methodology, a risk-based perimeter concentration that was sufficiently conservative enough to protect nearby residential receptors with children. The concentration was determined to be approximately 0.00005 f/cc, based on the PCM metric, well below the 0.01 f/cc limitation of the PCM method. To overcome this limitation, CARB determined, using EPA data, that one PCM fiber was equivalent to 320 asbestos structures, measuring all lengths and widths of structures by the

[6] Asbestos Hazard Emergency Response Act, 40CFR Part 763 Subpart E.

CARB-modified AHERA protocol. The equivalent concentration is 0.016 s/cc, a concentration that can be routinely measured in perimeter samples by the CARB-AHERA protocol.

It is important to understand EPA's long-established viewpoint regarding the use of PCM for determining non-worker exposures. In the AHERA regulation, EPA states:

"The most accurate and preferred method of analysis of air samples collected under an O&M program requires the use of transmission electron microscopy (TEM). Phase contrast microscopy (PCM), which is commonly used for personal air sample analysis and as a screening tool for area air monitoring, cannot distinguish between asbestos fibers and other kinds of fibers which may be present in the air. PCM analysis also cannot detect thin asbestos fibers, and does not count short fibers. TEM analysis is more expensive than PCM analysis. However, the more accurate information on actual levels of airborne asbestos fibers that can be derived from TEM should be more beneficial to the building owner who elects to use supplemental air monitoring in the asbestos management program".

The reference to "all lengths" and "thin fibers" is important. The NIOSH 7400 PCM method counts fibers that are ≥5µm and approximately ≥0.25 µm in width. RJLG (Van Orden et al., 2016) reported that the mean width of commercial actinolite asbestos fibers is 0.18 µm, well below the visibility and reporting threshold by PCM. Considering that most researchers agree that the most potent (from a toxicity perspective) are fibers that are <0.25 µm in width. Thus, the PCM method cannot be used to report the most toxic fibers and adequately quantify airborne asbestos concentrations or assess risk to offsite receptors.

EPA's recommended approach, and one that is considered the standard of practice for non-worker exposure monitoring, is detailed in EPA (2008)[7]. The use of PCM is discouraged, and recommends using the ISO Method 10312 at *"Superfund **and other** asbestos sites".* This method enumerates fibers of all lengths, widths and aspect ratios. The data is then used as a basis to calculate a site-and receptor-specific risk-based threshold that can be used to verify that offsite receptors are not adversely exposed to fugitive asbestos particles.

Therefore, Hanson's air monitoring plan cannot be used for, and will not provide information regarding, exposure to those residing or working outside of the site perimeters.

Personal Air Monitoring for Worker Protection.

The selection of the NIOSH 7400 and 7402 methods imply that one purpose of the air monitoring plan may be to assess worker exposure during disturbance of rock that contains NOA. This is further suggested in Section 7.2 which states that samples will be *"Placed approximately five (5) feet above the ground surface (e.g. designed to approximate the breathing area of a worker or passerby to assess exposure)".* In addition, under Definitions, the document states: *"Phase Contract Microscopy (PCM) – Analysis counts fibers that are present on filters in order to give a time-weighted average of the concentration of those fibers for the volume of air sampled".* Time weighted average refers to the calculation of worker exposure under the OSHA Standard.

The OSHA Standard provides clear requirements for worker exposure protocol.

- Section 1926.1101(f)(2)(i) states a requirement for an Initial Exposure Assessment as follows:

[7] Framework for Investigating, Asbestos-Contaminated Superfund Sites, Oswer Directive #9200.0-68, September 2008

"Each employer who has a workplace or work operation covered by this standard shall ensure that a "competent person" conducts an exposure assessment immediately before or at the initiation of the operation to ascertain expected exposures during that operation or workplace…"

- Section 1926.1101(f)(1)(ii) states the requirement for the methodology of sampling:

"Representative 8-hour TWA employee exposure shall be determined on the basis of one or more samples representing full-shift exposure for employees in each work area…"

- Section 1926.1101(f)(1)(ii) states:

"Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA and 30-minute short-term exposures of each employee.

Breathing zone sampling is conducted within the breathing zone of each worker using a pump that is usually attached to the belt of the worker. A workplace or work operation refers to the task of each worker, and therefore, those applying water, operating a bulldozer, excavator, drill rig, and other tasks are sampled independently. The OSHA standard does not provide situations where a stationary sample downwind of an operation or at the perimeter can be used as a surrogate for personal monitoring.

Therefore, sampling in accordance with the air monitoring plan cannot be conducted for, and the results used, to establish worker exposure.

Assessment of Background

In the section titled: "Idle Site Background Conditions Monitoring", Hanson proposes to: *"conduct a one-time background air monitoring event", which "will last a total of two (2) days".*

Two days of sampling will not be sufficient to assess background conditions because background concentrations of asbestos, a subset of dust particles that blow over the site from upwind sources, varies dramatically depending on daily, or even hourly, conditions. Consider the relative concentration measured at a specific location during different climatic conditions:

- The concentration at a location nearer a source will be higher than one further down wind due to particle dispersion with distance,
- Concentrations in cold weather will be higher than one in warmer weather due to turbulent mixing, dispersion, and upward movement of air at times when the surface is heated,
- Concentrations during wet weather will be lower than when the soil is dry due to natural dust suppression,
- Concentrations will be higher when the wind is blowing in a direction where offsite disturbance activities are greater upwind (wind direction will heavily influence concentrations), and
- Concentrations measured in higher winds will be lower than slow or no winds due to increasing particle dispersion with increasing wind speed.

Background sampling is usually conducted at regular intervals over the course of an entire year, or even more, to capture the natural variation that occurs with changes in climate, rainfall, wind speed and wind direction. In addition, the NIOSH 7400/7402 PCM methodology is not the accepted test protocol for background sampling, and should be consistent with the protocols used for perimeter verification sampling (TEM methodology using generally accepted EPA test methods).

Therefore, the Idle Site Background Conditions Monitoring Plan will not provide meaningful information regarding background conditions at the site.

Summary and Recommendations

Hanson's air monitoring plan narrows the purpose and scope to a single objective that is not related to exposure (assess potential NOA); proposes sampling and test methodologies that when combined are designed for worker protection rather than exposure assessment; and cites action levels that are drawn selectively from unrelated regulations or guidance and do not verify exposure. In particular, the plan proposes a methodology that reports only a subset of fibers that are present, cannot detect and does not report thin fibers, and is generally used for worker exposure assessments. The proposed action level of 0.01 f/cc is very high, and based on the limitations of the proposed method. This limitation is overcome by choosing standard TEM methodology recommended by EPA and normally applied by consultants. The plan appears on its surface to measure exposure, but in actuality, mis-constructs regulatory standards and Standard of Practice, and will result in data that cannot be used for exposure assessment.

Data produced following its scope and through its design is inadequate to evaluate worker exposure during mining activities, offsite exposure during rock and soil disturbance, or background during idle periods. EEC recommends that DEP reject the plan, and prepare their own risk-based perimeter monitoring program for offsite exposure using a third-party consultant that reports directly to DEP. EEC recommends that the program follow the EPA methodology that was discussed above and within previous EEC submittals, and develop a risk-based threshold which will verify that the residents of the Rockhill Township are not adversely exposed to fugitive asbestos from quarry operations.

401 Marina Place *707-738-4917*
Benicia, CA 94510 *Erskine.geo@gmail.com*