RESPONSE TO PUBLIC COMMENTS SUMMARY
TAP-SSC CLASS II LANDILL (IDL 60-0213)
MOUNT PLEASANT, TENNESSEE

This response has been prepared by Division of Solid Waste Management (DSWM) with the assistance of TriAD Environmental Consultants, Inc., on behalf of Tennessee Aluminum Processors, Inc. and Smelter Service Corporation (TAP-SSC). The document is structured in a point-by-point **COMMENT/Response** format, with comments appearing in standard text, and responses appearing in *italics* to delineate the two.

COMMENT 1: According to EPA Toxic Release Inventory (TRI) and Quarterly Reports sent to TDEC under Agreed Order terms, TAP wastes are disposed of in the Waste Services of Decatur municipal solid waste landfill near Bath Springs, Tennessee. SSC wastes are also disposed in that landfill, according to TRI reports. That landfill has a liner that consists of (top to bottom) a 60-mil HDPE liner or a geosynthetic clay liner (GCL), and 2 feet of $1x10^{-7}$ cm/sec compacted clay. Even with this liner, which is similar to what has been proposed by TriAD, groundwater beneath the landfill and the nearest receiving stream is contaminated with smelter waste constituents as evidenced by samples collected from an underdrain beneath the liner that discharges to a sediment basin and then to the receiving stream. Concentrations of chloride, as one example, were 620 mg/L in the underdrain beneath the liner and up to 17,000 mg/L in the nearest stream downgradient from the landfill. As a result, the composite liner is clearly incapable of preventing leakage of smelter wastes.

<u>Response 1:</u> *The referenced landfill located near Bath Springs, Tennessee is a commercial landfill receiving wastes from numerous sources, including special wastes, and is not a dedicated landfill receiving only TAP and SSC materials. Without further information, a claim, that a composite liner system is incapable of preventing leakage, is insufficient, insofar as the source for the existing groundwater impact has not been determined. The contamination present would more likely be related to waste handling operations than to liner leakage. Furthermore, the proposed TAP-SSC Landfill will include a double composite liner and a leak detection layer to prevent leakage. The liner system will consist of the following, from top to bottom:*

- *a 2-foot-thick leachate collection system*
- *a 60-mil HDPE liner*
- *a geosynthetic clay liner*
- *a 60-mil HDPE liner*
- *a 2-foot-thick clay liner*
- *a leak detection layer*

U.S. Environmental Protection Agency (EPA) promulgated its Subtitle D landfill design standards with the express goal of protecting human health and the environment. Tennessee's standards are more stringent than the federal standards in that a 5 foot thick compacted clay buffer is also required. The proposed design for the TAP-SSC landfill are even more protective in that a second synthetic liner/leachate system has been included.

COMMENT 2: Groundwater monitoring data for the Environmental Waste Solutions (EWS) landfill in Camden, Tennessee, a landfill with the exact same liner type that is proposed by TriAD, clearly indicates leakage of that landfill within a few months after waste was first placed. The liner system at that landfill consists (from top to bottom) of a 60-mil HDPE layer, a geosynthetic clay liner (GCL), a 2-foot compacted clay liner, and a soil geologic buffer. The landfill is a monofill that only accepts smelter wastes. Groundwater samples collected from the *first* sampling event since waste was first placed clearly shows leakage of the liner to the uppermost water table aquifer. Statistically significant increases (SSIs) of aluminum, chloride, barium, vanadium, and zinc were reported in up to two downgradient wells. The highest reported concentrations of sulfate, ammonia nitrogen, aluminum, magnesium, manganese, potassium, and sodium — all indicators of smelter wastes — were reported in the most hydraulically downgradient well nearest the property line and receiving stream.

Response 2: *The EWS landfill in Camden has a liner system that is not "the exact same liner type that is proposed by TriAD" for the TAP-SSC Landfill. The EWS liner is a single composite liner, whereas the entire TAP-SSC Landfill will be underlain by a double-composite liner system.*

Regarding the EWS ground water results, the only waste constituents showing statistically significant increases over background data are Arsenic, which is above MCL in the up-gradient well (MW-1) and has been detected at high levels in all four sampling events prior to waste being placed in the landfill, and Barium, which was only slightly higher than background and is likely naturally occurring.

Chloride, which is an indicator parameter, has shown statistically significant increases in MW-2 and MW-3. MW-2 has shown increasing trends w/ the chloride level in the four background events ranging from 1.9-1.3 ppm, while the two most recent sampling events have detected levels of 34 and 44 ppm. This data does not indicate that a breach in the liner has occurred.

See also the Response to Comment 1.

COMMENT 3: The hydrogeologic investigation performed by the applicant did not meet the *minimum* standards established by TDEC. Further, although the report was first submitted to TDEC on May 17, 2010, the report did not include the results of 194 Geoprobe soil borings that were installed starting April 12, 2010 within and immediately around the proposed landfill footprint. The report therefore did not include or even consider all relevant geologic and hydrogeologic information that was collected from the site. The investigation, its report, and its conclusions should therefore be rejected as being incomplete and inaccurate.

Response 3: *The hydrogeological report was prepared in accordance with Tennessee Rule 1200-1-7-.04(9)(a), which is the only legal standard governing the preparation of a hydrogeological report. The revised August 18, 2010 Hydrogeological Report and the February 7, 2011 TAP-SSC* Comments in Response to Public Comments Received on

Draft Permit, *which was prepared to address concerns/comments made after the public meeting adequately meet the minimal requirement. Finally, Geoprobe data were not only considered, but were used in developing the engineering plans for the site.*

COMMENT 4: The May 2010 hydrogeologic report and its August 2010 addendum failed to include the results of 194 Geoprobe soil borings. Mapping of those results by Global Environmental clearly shows that three large bedrock depressions, interpreted as sinkholes and horizontal fractures in the bedrock, exist beneath the proposed landfill and the proposed sediment basin.

Response 4: *The 194 Geoprobe borings were not included in the Hydrogeological Report. The borings were not performed as part of the necessary hydrogeological investigations, but to comply with local zoning requirements. The data were included in the Operations Manual and were considered in design of the landfill. The evidence provided does not support the depressions as being horizontal fractures in the bedrock or potential sinkholes at the site.*

COMMENT 5: The applicant argued that since the site had been extensively mined, the site was not complex and a less-comprehensive hydrogeologic investigation was warranted. This conclusion completely understates the risks associated with siting a landfill at this site because of the lack of native soil, the presence of extensive bedrock joints and cutters exposed during mining, and the significant potential for unstable site conditions, as defined by TDEC.

Response 5: *In Section 4.0 of the Hydrogeological Report, the basis for the position that this site is not hydrogeologically complex is because only one bedrock formation underlies the site and only two distinct types of overburden are present. In addition, past mining operations at the site, which resulted in the removal of overburden, left less soil to characterize during the hydrogeologic investigation and exposed bedrock for direct visual examination in lieu of additional coring. Less soil to characterize reduced the volume of testing required and exposed bedrock allowed more effective classification of bedrock units.*

COMMENT 6: The hydrogeological investigation and the associated design submitted to TDEC did not meet minimum TDEC criteria that requires that borings be placed no greater than 200 feet apart. Instead, the typical boring and test pit spacing presented in the report and the associated design was up to 450 feet apart. That large spacing resulted in missing important geologic and hydrogeologic features that underestimate the geotechnical risks of the site and will result in the inability to effectively monitor for a release of contaminants from the landfill under the proposed monitoring system.

Response 6: *Guidance does not constitute rule, and DSWM does not use guidance or draft guidance in place of professional judgment and site-specific needs as agreed to by both the regulated entity and DSWM staff.*

The criteria for a hydrogeological investigation were met as explained in Response to Comment 3.

COMMENT 7: Test pits (21 were dug on 170 acres) and soil borings (14 were drilled on 170 acres) were not placed in the required triangular pattern consistent with TDEC criteria. In fact, they were only placed where it was most convenient - along compacted dirt roadways. Further, only 3 soil borings and 13 test pits were even completed within the 39-acre landfill footprint.

Response 7: *Soil borings and test pits were not located only "along compacted dirt roadways" as would be revealed by a review of the Site Plan presented with the Hydrogeological Report. Most test pits and borings were located off of the pre-existing "roadways," with several placed in areas to which a bulldozer had to clear access. Although the commenter is correct in his count of test pits and soil borings within the proposed footprint, they fail to add the two bedrock core holes (from which Shelby tube soil samples were collected) and the over 75 Geoprobe borings that were also drilled within the footprint. Further, the triangular pattern mentioned by the commenter exists only in the DSWM guidance document referred to in his Comment 6. Guidance cannot be interpreted as Rule.*

COMMENT 8: Test pits and soil borings were not placed to adequately characterize the subsurface geology in terms of bedrock pinnacles, cutters or solution-enlarged joints in the bedrock, groundwater in the lowest-lying irregularities in the bedrock, or groundwater along preferential pathways within the bedrock.

Response 8: *Test pits and soil borings were not intended to characterize the bedrock features – core holes, monitoring wells, and visual observation of exposed bedrock were used for that purpose.*

COMMENT 9: No soil borings were drilled in the area of the proposed sediment pond, as required in the minimum TDEC criteria.

Response 9:. *Guidance does not constitute rule, and DSWM does not use guidance or draft guidance in place of professional judgment and site-specific needs as agreed to by both the regulated entity and DSWM staff. Geoprobe borings were placed in the sediment basin area, with results from those borings used in the design of the landfill, as reported in the Operations Manual.*

COMMENT 10: Although test pits were dug in lieu of using borings, those test pits were unable to determine soil compaction (by blow count equivalent), in-situ permeability (by Shelby tube samples), depth to bedrock beyond the 10-foot reach limit of the backhoe, or the presence of voids in the soil — all extremely important landfill design considerations.

Response 10: *Test pit excavation is a common investigatory tool used in subsurface explorations, allowing visual observation of a greater cross sectional area of soil stratigraphy than can be provided by split-spoon or Geoprobe sampling. Test pits also* *facilitate the collection of a large volumetric sample from a known depth for Proctor and remolded permeability testing. The pits and boreholes were placed to adequately characterize the site hydrogeology. Adequate soil compaction and hydraulic conductivity data were collected from the soil borings.*

COMMENT 11: Contrary to what the applicant concluded, piezometers that were installed in the 14 soil borings drilled to the top of bedrock show that widespread groundwater *does exist* on top of bedrock because each boring where piezometers were installed in the deeper areas of bedrock had significant measurable amounts of groundwater. Had the applicant developed a bedrock contour diagram with the results of the 194 Geoprobe borings prior to submittal of the landfill design and installation of wells, piezometers could have been properly located to show widespread top-of-bedrock conditions. This top of bedrock groundwater likely extends into the epikarst / weathered portions of the bedrock across the site and especially along bedrock fractures and joints pattern in the bedrock. The hydrogeologic investigation reported by the applicant, was insufficient to identify these conditions; therefore, the conclusion that the groundwater is "perched" and is not continuous is not based upon fact.

Response 11: *There is no indication from subsurface site investigation that groundwater exists at the top of bedrock in other than isolated perched areas. As described in the Hydrogeological Report: "Recharge to the limestone occurs through the overburden, and the perched water typically represents infiltrating surface water that has not yet migrated into the fractured bedrock. There are only isolated perched zones on top of rock, as is typical of cutter-pinnacle groundwater flow. Even within cutters, however, the water is not widespread. For example, during Geoprobe drilling, water was encountered in boring 11F-1, where the top of bedrock was at approximately the same elevation as at boring B-6, in which top-of-rock water was also encountered. However, other borings in which bedrock was encountered at lower elevations than in 11F-1 encountered no water; for example, at 10E-1 in the same area of the site, and multiple borings along the western and southern edges of the site. (Borings within the boundaries of the former tailings pond are not included in perched water discussions due to the nearly universal wet soil conditions present in this still-saturated area.) If there were "widespread" groundwater at the top of rock, many other borings would have encountered it, especially those borings drilled to top-of-rock elevations lower than those borings in which water was encountered.*

That the water encountered in several soil borings is properly described as perched (i.e., above the uppermost continuous aquifer) may be found by comparing the elevations of water levels within the soil-boring piezometers and water levels within the monitoring wells. Despite water-level data being separated by over two years, it is still apparent that the water level measured in boring B-12 was over 10 feet higher than the highest yet measured at nearby monitoring well MW-2, and over 25 feet higher than the lowest yet measured in MW-2.

COMMENT 12: The piezometers and groundwater monitoring wells did not adequately determine the seasonally high and low groundwater conditions on top of bedrock because the wells were not sampled during the wettest time of the year, the monitoring points were not in the areas with the shallowest groundwater, and the number of monitoring points was not sufficient.

<u>Response 12:</u> *Tennessee Rule 1200-1-7-.04(9)(a)3.(ii) states:*

> *"A tabulation of water table elevations (if encountered within the limits of drillings) measured at the time borings were performed and at least two additional measurements over a period of at least one week so as to allow water elevations to stabilize. If an estimation of the seasonal high water table cannot be made utilizing this data and other existing information, then the Commissioner may require water table elevations to be collected over a period up to one year."*

As noted in the Hydrogeological Report, in referring to the soil-boring piezometers, "The seasonal high water table was not encountered to the depths explored." (See Response to Comment 11, above, for further discussion of perched water.) Because only isolated perched zones were encountered by the soil borings, the commenter's statement regarding the piezometers being insufficient is incorrect. Nevertheless, soil-boring piezometers were monitored for water levels as described in the Rule during December 2006, a time of average rainfall, and were reported in the Hydrogeological Report.

As described in the Hydrogeological Report, monitoring wells MW-1, MW-2, and MW-3 were installed to the uppermost continuous water-bearing zone at the site in March 2010 and have been periodically monitored for water level and water quality since that time. Water levels from April 2010 were reported in the Hydrogeological Report and later levels have since been reported for November 2010. Water levels were highest in April and June 2010, although groundwater flow direction has varied between south-southwest to south-southeast.

COMMENT 13: The number of undisturbed Shelby tube samples collected was grossly insufficient in meeting TDEC's one per three-acre requirement. Although 13 undisturbed Shelby tube samples were collected for the entire 170-acre site, only 4 samples (only 1 per 10 acres) were collected from the 39-acre landfill footprint and, of those, they were all collected along compacted access roads; one was at an elevation higher than the proposed liner; none were collected from the soil nearest the bedrock where the permeability is expected to be the highest; and none were collected from the mined out area where loose soil and minimal compaction would be expected. As a result, the design failed to characterize the permeability of soils where the permeability and instability would be the greatest. This information is necessary to ensure structural stability beneath the constructed geologic buffer and liner.

<u>Response 13:</u>

Tennessee Rule 1200-1-7-.04(9)(a)(3.(i)(I) describes the necessary testing for hydraulic conductivity:

> *"The saturated hydraulic conductivity of undisturbed samples of soils underlying the site which are to be used in meeting soil buffer requirements;"*

Six undisturbed permeability tests (saturated hydraulic conductivity) were performed on samples collected from the site. These soil samples are representative of the material that will be used for geologic buffer. The fact that two of the samples were collected from areas outside the proposed landfill footprint does not negate their applicability, so long as the material is representative of the same type of soil found within the footprint, as they are. Two samples, those with the highest conductivity, were collected from borings installed along "compacted access roads." The other samples, those with the lowest conductivity, were collected from areas away from "roads." As for the "mined out" area in the southern portion of the site, soil thickness there is generally insufficient for use as buffer. Therefore, after removal of any loose or unsuitable soils, a buffer will be constructed in this area using re-compacted clay from other areas of the site, making undisturbed hydraulic conductivity testing in this area largely irrelevant.

Permit conditions were added to confirm the presence and suitability of geologic buffer during construction of the landfill.

See also the Response to Comment 9.

COMMENT 14: The hydrogeologic investigation failed to include any of the minimum components of TDEC's carbonate limestone rock investigation criteria — criteria that were specifically developed to evaluate the potential of sinkhole subsidence and collapse in limestone bedrock like what occurs at this site. TDEC specifically recognized in that document the potential for regolith / soil collapse into voids in the underlying bedrock by conduit flow through cavernous bedrock during storm events and by modifying drainage at or near the site by concentrating stormwater runoff into sinkholes, retention basins, and ponds.

Response 14: *Guidance does not constitute rule, and DSWM does not use guidance or draft guidance in place of professional judgment and site-specific needs as agreed to by both the regulated entity and DSWM staff. Further, no evidence, either surface or subsurface, of subsidence features or sinkholes was observed during the investigation.*

COMMENT 15: The hydrogeologic investigation report underestimated the karst conditions on-site by depending on the absence of *surface* features (sinkholes) as indicators of karst — features that had been completely excavated during surface mining on-site. The TriAD investigation also characterized the Hermitage Formation as a local aquitard to limit downward movement of groundwater; however, this conclusion is not valid. Dr. Nick Crawford concluded in his work for the Associated Commodities Corporation (Smelter Services Corporation) landfill located to the south in the same geologic conditions that the upper Hermitage Formation that lies beneath the Bigby Limestone is cavernous, allowing groundwater to drain through cutters in the lower Bigby Limestone into solution-enlarged caverns in the Hermitage. Groundwater in the Hermitage then discharges at springs into surface water streams.

<u>Response 15:</u> *The Hydrogeological Report and other submittals note the lack of both surface and subsurface evidence for sinkholes at the site, and do not rely solely on surface evidence as alleged in this comment. The commenter states "the upper Hermitage Formation that lies beneath the Bigby Limestone is cavernous, allowing groundwater to drain through cutters in the lower Bigby Limestone into solution-enlarged caverns in the Hermitage." The key words in the commenter's paraphrasing of Dr. Crawford's work are "upper Hermitage Formation." In fact, the upper portion of the Hermitage Formation, known as the Dalmanella coquina facies, does sometimes develop solutionally enlarged karst conduits. However, the Dalmanella coquina is only the uppermost bed in the Hermitage Formation, accounting for no more than 5 feet (based on core recovered from the site) of the formation's total thickness of over 70 feet in the vicinity of the proposed TAP-SSC Landfill. The remaining, lower, much thicker portion of the formation, called the argillaceous limestone facies, does act as a regional and local aquitard and a lower limit on cutter development in the Bigby Limestone. This generally acknowledged fact has been widely published for many years, including in Dr. Crawford's work on the ACC Landfill, which the commenter cites in their comment. A conceptual model of the area's hydrogeology developed by Dr. Crawford and presented in his ACC work clearly shows this geological fact.*

COMMENT 16: The hydrogeologic investigation failed to include these *minimum* carbonate bedrock investigation criteria:

- additional soil and bedrock borings,
- a door-to-door groundwater use survey,
- water table maps for low and high-flow conditions,
  potentiometric surface diagrams of the water table aquifer including wells on contiguous properties,
- groundwater flow velocities of all water-bearing zones at both low and high flow conditions,
- qualitative dye trace studies with dye breakthrough curves to assess groundwater discharge into springs on adjacent properties.

<u>Response 16:</u> *The commenter fails to cite a source for the list presented in this comment. However, as with the previously referenced* Draft Carbonate Rock Investigation Guidance Policy *(DSWM, 1993), any such list can only provide a range of possible investigation tools, and does not constitute a requirement. Investigation at any given site must be designed based on site-specific needs and conditions; indeed, site-specificity is a fundamental principle of any environmental or engineering investigation. As already noted, the submitted Hydrogeological Report has been found by DSWM staff to meet the requirements of the relevant Rule, and the investigations were designed with input from DSWM staff to ensure collection of adequate data for landfill design.*

COMMENT 17: The two cross section engineering drawings (Sheet 8, Cross Sections A-A' and B-B') included in the Part II Permit Application do not include accurate top of bedrock elevations (as required by Rule 1200-1-7-.04, (9.) (b.) Engineering Plans, 3. (iv.))

representative of the soil borings and test pits. In fact, only one boring (B-11) and its associated top of bedrock elevation was even shown on nearly 2,700 feet of cross sections — and the location of that boring was not even correct. The illustrated top of bedrock elevations presented in the engineering design are therefore not based upon fact. This information should clearly be shown to illustrate where the applicant plans to blast away bedrock to construct the proposed 5-foot geologic buffer, to illustrate the water-bearing zones in the soil and bedrock, to illustrate where the geologic buffer will be constructed and where in-situ conditions will be used for that buffer, and to illustrate the required separation between the bottom of the liner and the seasonal high groundwater table.

Response 17: *The cross section profile locations were placed to provide the most representative cross section of the proposed landfill liners and cap, without regard to the location of borings. The location of boring B-11 on Cross Section B-B' is offset and for illustrative purposes only since it does not actually fall on the cross-section. This offset does not affect the design of the landfill as there is nearly 8 feet of geologic buffer at this borehole location, significantly exceeding the required 5 feet. In addition, the top-of-rock elevation shown on the cross sections was generated using data collected from Geoprobe borings spaced over the length of the sections. The Geoprobe borings are not shown on the cross sections because they were conducted for local, not State, permitting purposes. The cross sections, as provided, include all of the information required in the Rule.*

COMMENT 18: Although the hydrogeologic investigation concluded that the upper-most bedrock was pinnacled, the bedrock contour portion of the cross sections does not reflect any such pinnacles.

Response 18: *The cross sections show the top-of-rock elevations as revealed by the Hydrogeologic and Geoprobe investigations.*

COMMENT 19: According to Mr. Joseph Thomas, P.E. who worked for Stauffer Chemical Company, the former operator of the strip mine at the site, the former tailings pond in the proposed Phase 2 portion of the landfill never held water — even with engineering amendments - and its use as a tailings pond was terminated early in 1990. The southwest portion of the tailing pond, which corresponds to the bedrock depression identified by Global Environmental, was the leakage point. A limestone bedrock cutter beneath the pond was filled with phosphate mine slag, and then capped with clay at the surface of the pond. Even then, the pond continued to leak. Further, soil with little inherent soil compaction and permeability now occurs at the site. Phosphate rich soil was excavated and hauled away from the site, and the remaining excavated mine spoil was never replaced or compacted, creating a differential settlement concern. The targeted phosphitic zone in the soil was within the lowest-lying areas of the bedrock, particularly along and within lateral cutters or joints in the bedrock.

<u>Response 19:</u> *Mr. Thomas did provide verbal comments during the December 8, 2010, public hearing and written comments in a letter to Mr. Mike Apple dated January 25, 2011. The commenter has stated in their comment that Mr. Thomas told him Pond #20 "never held water – even with engineering amendments – and its use as a tailings pond was terminated early in 1990." Mr. Thomas, however, in both his verbal and written comments, notes that the pond did hold water, even before the engineering amendments, just not enough water to supply the needs of the washing plant. As he states in his January 25 letter, "There was an area between these cutters [exposed cutters in the bottom of the pond] and the dam adjacent to the Maury County Airport that did hold a volume of water. The depth was quite shallow." Later in his letter, in which the pond repair and modification are described, he states, "I know that tailings [from Pond #15] were successfully deposited and contained in the bermed area immediately accessible to the return standpipe and that water was returned to the plant. I do not know how long this upper area was used or if they ever tried to utilize the remaining portion of the pond. I think the Globe Plant washing operation was shut down sometime in 1990." Therefore, according to Mr. Thomas' description, rather than try to ensure water retention for the entire pond Stauffer constructed a smaller, pond-within-a-pond by building clay berms, and this pond was successful in holding sufficient water for plant use. Mr. Thomas' account therefore differs substantially from that of the commenter.*

From Mr. Thomas' account, it is likely that the initial pond construction was inadequate to the purpose and that this, rather than inherent geological features, was responsible for the pond leaking. He described observing "exposed limestone cutters in the bottom of the pond" during his initial inspection of the problem. Why these cutters were exposed is not explained, but it seems likely that inadequate construction was responsible. It is further noted by Mr. Thomas that the pond bottom was sealed using "a clay liner of 6 – 8 inches deep." The performance of such a thin clay liner cannot be compared to the performance of a double-composite liner system constructed over a 5-foot-thick clay buffer, as is proposed for the TAP-SSC Landfill.

COMMENT 20: Mr. Thomas testified at the Public Hearing for the proposed landfill that Stauffer Chemical spent approximately $200,000 trying, without success, to keep the Lower Pond tailing pond from leaking into the underlying bedrock.

<u>Response 20:</u> *See Response to Comment 19.*

COMMENT 21: According to Mr. Thomas, phosphate mining slag from furnaces was placed in bedrock cutters beneath the proposed Phase 2 of the landfill, and the chemical composition of that slag waste and its affects on future groundwater monitoring for contaminants are unknown. Without a detailed investigation to know where the material is located and its chemical composition, the waste presents a threat to future groundwater monitoring.

<u>Response 21:</u> *The presence of groundwater impact from past mining operations has been documented in the Hydrogeological Report as amended August 19, 2010. The presence of "mining slag" in the pond area may be contributing to this impact. However, since* *this impact is known and accounted for, it will not interfere with proper groundwater monitoring of the landfill.*

COMMENT 22: The hydrogeologic investigation did not thoroughly characterize the groundwater conditions, soil type, soil permeability, the occurrence of voids and soft, low-strength areas in the mined-out soil, or voids in the bedrock of the site. Instead, the investigation used for the design only included points along the roadway where the soil is the most compacted.

Response 22: *See Responses to Comments 7 and 10.*

COMMENT 23: Phosphate mining dating to the early 1900s beneath the entire proposed landfill footprint resulted in a site that was never properly reclaimed.

Response 23: *The past use of the site for phosphate mining has been thoroughly documented in previous submittals. It is likely that there were multiple phases of surface mining at the site, and the site was also modified through construction of ancillary structures such as a tailings pond.*

COMMENT 24: According to Mr. Thomas, virtually all native soil was stripped from the site during phosphate mining operations. Although non-phosphitic soil remained on-site near where it was excavated, that soil has very little natural pollutant attenuation ability because it was never re-compacted.

Response 24: A*s noted previously, an adequate soil investigation of the site was performed by the applicant in accordance with the Tennessee Rule Chapter 1200-1-7.*

COMMENT 25: Soil closest to the bedrock and beneath the planned geologic buffer represents a potential for regolith collapse.

Response 25: *The commenter provides no documentation for their opinion that the soil closest to the bedrock represents a potential for soil collapse. It is true that soil at the soil-bedrock interface often has less cohesive strength due to increased soil moisture, and if soil piping takes place it does begin at voids in the bedrock. However, over 200 borings at the site have not identified any risk of soil collapse.*

See also the Response to Comment 64.

COMMENT 26: The groundwater monitoring system was specifically designed and installed to *exclude* the uppermost water-bearing zone, contrary to TDEC requirements for installing an early warning leak detection system.

Response 26: *As documented in previous submittals and in Response to Comment 11, the uppermost aquifer at the site is within the limestone bedrock. As previously documented in the TAP-SSC Comments in Response dated February 7, 2011, Rule 1200-1-7-.04(7)(a) requires that the "uppermost aquifer" be monitored at a landfill site. The monitoring* *system installed at the site was designed to meet the requirements of the Rule, and does so. Casing off the upper, perched groundwater at the top of rock is standard procedure to allow monitoring of only the zone of interest, to ensure the integrity of the well, and to prevent cross-contamination or dilution of the zone of interest.*

COMMENT 27: According to the hydrogeologic investigation report, two wells (MW-1 and MW-2) were constructed to specifically *exclude* the uppermost groundwater zone because the applicant determined that zone to be "perched" and not the "uppermost continuous groundwater-bearing zone". In fact, those wells were constructed with a cemented isolation casing to *exclude* the upper-most groundwater on top of bedrock and within weathered, mud-filled zones in the bedrock closest to the landfill liner. As a result, the existing monitoring system is incapable of detecting the earliest release to the upper-most aquifer beneath the landfill should a leak occur.

Response 27: *See Response to comment duplicates Comment 26*

COMMENT 28: No fracture-trace analysis was performed to determine joint occurrence or position to assist in placing the wells for the highest likelihood of detecting an early release from the proposed landfill.

Response 28: *Any surface expression of subsurface fractures, beyond very obvious, large-scale valleys, would have been obliterated decades ago by the mining operations.*

COMMENT 29: MW-2, installed by TriAD as a downgradient well, is the only well installed along a preferential pathway in the karst bedrock, perhaps explaining why the well already shows contamination based upon monitoring results submitted in the August 2010 addendum to the hydrogeologic report. This well is located within the sinkhole that was identified by Global Environmental from a bedrock map constructed from 194 Geoprobe borings — information that was never considered by TriAD prior to submitting the report, the addendum, or preparing the landfill design.

Response 29: *The commenter fails to identify on which "preferential pathway" MW-2 is located. In fact, MW-2 yields less water than the other wells on site, indicating that it is located on a flow path that is less preferential than those monitored by MW-1 and MW-3. The comment that data from the Geoprobe borings were not used in designing the landfill has been previously addressed.*

COMMENT 30: TriAD has determined that the uppermost groundwater atop the weathered bedrock is semi-confined aquifer under pressure; therefore, producing upward pressure into the soil nearest the geologic buffer. If the liner is constructed too close to the seasonally high semi-confined water table, this upward pressure can saturate the liner system, resulting in loss of strength of the soil beneath the liner, differential settlement of the liner and sub-soils, and failure of the liner and leachate collection system.

Response 30: *The uppermost aquifer at the site is located within the underlying bedrock, not above the bedrock, and the liner will be located above the water table. A permit condition has been added which requires confirmation of minimum separation distance between ground water and the liner prior to construction of the system.*

COMMENT 31: The proposed groundwater monitoring system includes no monitoring of the numerous springs in the immediate vicinity of the landfill, even though the hydrogeologic investigation identified McNeese Spring as a likely groundwater discharge point. Further, the investigation did not sample any spring or surface water to provide an indication of baseline conditions. Spring and surface water monitoring points should be added after completion of a comprehensive karst feature inventory field investigation that has never been performed.

Response 31: *Tennessee Rule 1200-1-7-.04(7)(a)3 requires that all detection monitoring points be capable of monitoring the quality of groundwater passing under the compliance boundary of the landfill, which in this case is the property boundary. McNeese spring, and any other off-site locations, are located beyond the compliance boundary and are therefore not suitable groundwater monitoring points per the Rule.*

COMMENT 32: The applicant has not determined what affect that blasting will have on groundwater flow patterns, the ability to monitor the uppermost groundwater zone after the blasting occurs, or how the blasting will affect the structural integrity of the epikarst conditions.

Response 32: *Blasting, if required at this site, will be conducted on excavated, exposed pinnacles and will not therefore impact the groundwater monitoring system or the rest of the bedrock at the site. If any changes in site conditions are noted they will be reported, as is standard, to DSWM. A permit condition has been added which requires that DSWM be notified prior to blasing to confirm that these limitations are followed.*

COMMENT 33: The hydrogeologic investigation report concluded that groundwater contamination already exists at the proposed landfill site, and that the contamination is due to phosphate mining operations —not the adjacent TAP manufacturing plant. This conclusion is invalid because the most contaminated well (MW-2) is likely hydraulically downgradient from the illegal smelting waste pile on TAP property, and the groundwater is already contaminated with aluminum smelting waste constituents.

Response 33: *All groundwater elevation data collected to date show that the TAP facility is either hydraulically downgradient or cross-gradient from the site, depending on seasonal changes. The smelting waste pile to which the commenter refers is over 450 feet west of MW-2. Further, and most importantly, there is no evidence of chloride impact to the groundwater at the site, which would be present if smelting waste had affected the groundwater.*

See also Response to Comment 34.

COMMENT 34: Severe groundwater contamination at the adjacent TAP plant property has been well documented since at least April 1985, and that contamination has migrated laterally to at least one spring -McNeese Spring south of the plant and the proposed landfill. Chloride was reported in the spring at 3,070 mg/L on April 19, 1985 and then up to 37,200 mg/L on August 13, 1987. Chloride concentrations from January 1994 to April 1996 in wells B2 and B3 reported by TAP (wells assumed to be on TAP property) were routinely greater than 20,000 mg/L. Chloride concentrations in McNeese Spring, which discharges to Quality Creek, were still routinely greater than 20,000 mg/L from 1994 through 1996. TriAD concluded in their hydrogeologic investigation that McNeese Spring is also a likely groundwater discharge location for groundwater beneath the proposed landfill. Any positive sample results from that spring in the future after the landfill is built would therefore be inconclusive of the source of the contaminants.

Response 34: *As documented in previous submittals and in other responses in this document, there is no indication that groundwater at the proposed landfill has been impacted by secondary aluminum smelter waste. Further, as noted in Response to Comment 31, McNeese Spring is beyond the point of compliance for the proposed landfill and is therefore not an appropriate monitoring location.*

COMMENT 35: The hydrogeologic investigation report concluded that the groundwater in well MW-2 at the landfill is already contaminated with, according to TriAD, the most leachable constituents found in smelting wastes: ammonia nitrogen, chloride, magnesium, and sodium. Ammonia nitrogen was 5.6 times higher than the background well (MW-1); magnesium was 6.3 times higher; chloride was 2.6 times higher, and sodium was 53 times higher.

Response 35: *There is no evidence of chloride impact to water samples collected from MW-2. Recent sampling data have demonstrated that chloride concentrations in samples from background well MW-1 are nearly identical to, and in one case greater than, chloride concentrations in samples from MW-2. All chloride concentrations in site groundwater to date are within normal background ranges for groundwater in middle Tennessee. Although ammonia is slightly elevated in samples from MW-2, the measured concentrations are still orders of magnitude below the concentration of ammonia present in salt-cake-related leachate and will therefore pose no hindrance to the detection of possible releases from the proposed landfill. Historical evidence from other landfills at which salt cake has been disposed and which have later reported releases of leachate clearly indicates that chloride and ammonia will be present if the metals sodium, magnesium, or potassium are present.*

COMMENT 36: TDEC has determined that another spring west of the TAP plant property is also contaminated with at least one smelter waste contaminant, ammonia nitrogen (1,300 mg/L). That groundwater flows to an unnamed tributary and then to Quality Creek.

Response 36: *Because the commenter reports this "spring" as being located west of the TAP facility, it is therefore a significant distance from the compliance boundary of the proposed landfill. The noted 'spring" is beyond the compliance boundary and unrelated to groundwater at the proposed landfill.*

COMMENT 37: TDEC required in the August 16, 1988 Agreed Order with TAP that an investigation be performed to determine the extent of contamination of groundwater and surface waters on and around the TAP plant — both being contaminated by aluminum smelting wastes. That detailed investigation, including soil borings and groundwater monitoring wells, has *never been performed*.

Response 37: *The hydrogeologic report submitted as part of this landfill application meets the requirements to characterize the proposed landfill site. This comment is related to a separate area.*

COMMENT 38: TDEC required in the August 1988 Order that a plan for cleaning up the groundwater and surface water be submitted. To date, that plan has never been submitted. The only remedial action that has been implemented is to continue to remove the wastes and attempt to keep the waste pile covered — neither measure being able to cleanup existing groundwater contamination that is already migrated off-site, quantify the vertical or horizontal extent of the contamination, or determine the rate and direction of contaminated groundwater flow beneath the plant and off-site.

Response 38: *See Response to Comment 37.*

COMMENT 39: Without this detailed groundwater and soil investigation on the TAP plant property to know what contaminants exist, TDEC will be unable to evaluate the results of groundwater monitoring at the landfill to determine if a release has occurred from the landfill. As such, the landfill cannot be effectively monitored, and the permit should be rejected.

Response 39: *This comment was addressed in the Responses to Comments 33, 34, 35 and 37.*

COMMENT 40: The applicant has acknowledged that soil at the proposed landfill, which will be used to construct the liner and geologic buffer, is already contaminated with high amounts of constituents (primarily metals) that are also found in groundwater wells nearest the TAP plant. Instead of considering the more likely possibility that contaminants are migrating from the TAP plant, the applicant only considered the former phosphate mining operations as a source — even though the contaminants on the proposed landfill property are more closely related to smelting wastes, not phosphate mining wastes.

Response 40: *As documented in the August 19, 2010, addendum to the Hydrogeological Report, the elevated concentrations of certain metals in a subsurface soil sample collected from the tailings in the former tailings pond are consistent with the former mining operations. The commenter has failed to explain why these metals, identified in* *material derived directly from the soil washing done for the mining, "are more closely related to smelting wastes" and provides no evidence to support this position.*

COMMENT 41: One soil sample (the only one collected for the entire 170 acre site) has shown high concentrations of contaminants that are also high in aluminum smelter wastes: ammonia nitrogen (2.79 mg/kg); aluminum (35,800 mg/kg); arsenic (11.4 mg/kg); barium (24 mg/kg); chromium (20.9 mg/kg); lead (24.7 mg/kg); nickel (33.1 mg/kg); magnesium (3,970 mg/kg); potassium (9,140 mg/kg); sodium (491mg/kg); and zinc (70.1 mg/kg).

Response 41: *The August 19, 2010, addendum to the Hydrogeological Report identified and explained the higher-than-typical-background concentrations of aluminum, barium, iron, magnesium, nickel, total phosphorus, and sodium that were identified in the sample of mine tailings. The commenter failed to explain their assertion that ammonia at 2.79 mg/kg is a "high concentration." Ammonia is commonly found in nature, where its nitrogen forms an essential plant nutrient, and ammonia, along with common ions, is expected to be enriched in the mine tailings that were sampled. However, we are aware of no typical background concentration for ammonia in Tennessee soils, and the commenter does not cite one. Several other metals concentrations that he identifies in this comment as "high" – arsenic, chromium, lead, and zinc – are in fact typical of natural background soils as documented by the Tennessee Division of Remediation (TDoR) and the United States Geological Survey (USGS). Additional metals data are commented on in subsequent comments.*

COMMENT 42: The concentration of arsenic in the soil sample (11.4 mg/kg) exceeds the EPA Regional Screening Levels (RSLs) for Superfund Sites: 7.1 times higher than the protective concentration at industrial Superfund sites (1.6 mg/kg) and 29 times higher than the protective concentration at residential Superfund sites (0.39 mg/kg). As such, the liner and geologic buffer cannot be constructed with contaminated soil. The source and extent of that contamination has not yet been determined, because only one shallow sample has even been collected.

Response 42: *The commenter implies that soil contamination is present if the concentrations of inorganic constituents exceed RSLs. This is not true, and is based on a misapplication of U.S. EPA screening levels. The EPA website on which the User's Guide for the Regional Screening Levels (RSLs or SLs) is presented clearly requires that risks to human health and the environment be determined based on conditions at each site, taking into account the concentrations of inorganic compounds that naturally occur in the area. In the case of arsenic, there is much background concentration data from sites in Tennessee. TDoR has compiled these data and determined that arsenic is typically present in natural soil at concentrations up to about 10 mg/kg, very close to the 11.4 mg/kg detected in the mine tailings sample.*

COMMENT 43: The concentrations of metals in the soil sample collected at the proposed landfill site greatly exceed typical background for that area. For example, aluminum in the soil sample (35,800 mg/kg) is almost 7,000 times higher than what the US Geological

Survey (USGS) has determined is typical. As a result, the data suggests existing contamination in the soil — the source of which has yet to be defined.

<u>Response 43:</u> *The 1984 USGS paper cited in this comment concludes that the 35,800 mg/kg of aluminum in the tailings pond sample is 7,000 times higher than typical background. Apparently, the assumption is made that typical background was approximately 5.1 mg/kg (35,800 ⁄ 7,000 = 5.1). In Table 2 of the USGS paper, typical background aluminum for the eastern United States is stated as being 5.7 <u>percent</u>, not 5.7 mg/kg. The aluminum results were posted as percent, as noted in the "Element" column of the table. Aluminum data are presented as percent because aluminum is the third most common element in the earth's crust and is generally very abundant, with concentrations in the thousands or tens-of-thousands mg/kg. By USGS definition, the concentration of aluminum in the tailings sample from the site is well within typical background concentrations. Other elements presented as percent in the USGS table include the very common crustal elements iron, potassium, magnesium, and sodium – elements that are also prevalent in the mine tailings sample from the site.*

COMMENT 44: The applicant concluded that the proposed landfill can be effectively monitored by testing for chlorides and ammonia nitrogen only - neither of which have an enforceable primary drinking water standard under the Safe Drinking Water Act. Secondly, the groundwater at the plant is already contaminated with high levels of chlorides and ammonia. The current groundwater monitoring system at the landfill is incapable of determining the origin of chlorides and ammonia nitrogen (or any other constituent) that might appear in MW-2 and MW-3.

<u>Response 44:</u> *The lack of a primary drinking water standard for chlorides and ammonia is irrelevant when performing detection groundwater monitoring at a landfill site. As clearly stated in Rule Chapter 1200-1-7, the determining factor in detecting a release is whether there is a statistically significant increase (SSI) over background groundwater concentrations. These SSIs can be detected using either intrawell or interwell statistical evaluations. If there is a verified SSI for even one constituent, the facility must determine whether the landfill is the source and initiate assessment monitoring to characterize the impact. The applicant has been performing background groundwater monitoring at the site since June 2010 and will continue with detection monitoring if the landfill is constructed.*

COMMENT 45: The groundwater monitoring program used by the applicant to develop the hydrogeologic investigation report (May 2010) and its subsequent addendum (August 2010) provided deceptive results that were not designed to report all constituents that are possible in the groundwater and cannot be used to establish statistical background concentrations. First, the May 2010 report only provided the results (April 2010 event) of a partial list of contaminants for three wells and one soil boring groundwater sample: chloride, ammonia-nitrogen, nitrate-nitrite, dissolved solids, cadmium, aluminum, barium, beryllium, iron, magnesium, and sodium. Secondly, the follow-up samples required by TDEC had unusually high detection limits when compared to TDEC and EPA drinking water Maximum Contaminant Levels (MCLs).

For example:

- antimony (<0.02 mg/L) — up to 3.3 times higher than the MCL (0.006 mg/L),
- arsenic (<0.02 mg/L) — up to 2 times higher than the MCL (0.01 mg/L),
- beryllium (<0.004 mg/L) — equal to the MCL (0.004 mg/L),
- cadmium (<0.005 mg/L) — equal to the MCL (0.005 mg/L), and
- thallium (<0.02 mg/L) — up to 10 times higher than the MCL (0.002 mg/L).

Response 45: *As explained in the Hydrogeological Report, the initial groundwater sampling at the site was performed using the list of constituents used in groundwater monitoring at the ACC Landfill, which accepted only aluminum smelting wastes. DSWM had previously approved that list, and years of monitoring have shown those constituents to be of greatest concern. As also explained in the addendum to the Hydrogeological Report, the applicant subsequently expanded that list to include the Rule 1200-1-7-.04 Appendix I inorganics plus site-specific indicator parameters for the June 2010 event and to the full Appendix I list plus site-specific indicator parameters for the July 2010 event. The full Appendix I list is the same list required for groundwater detection monitoring at municipal solid waste landfills. These steps were taken at the request of DSWM staff. The Groundwater Monitoring Plan presented in the Operations Manual specifies that groundwater sampling at the facility will include analysis for the Appendix I inorganic constituents plus site-specific indicator parameters. The groundwater monitoring program was and is designed to detect constituents that might be expected from the type of waste disposed, as allowed by Rule 1200-1-7-.04(7).*

The comment reports that the arsenic MCL is 0.01 mg/L. This is incorrect as it pertains to solid waste landfills (public drinking water supplies in Tennessee must meet the lower, drinking-water MCL). Rule 1200-1-7-.04 establishes certain MCLs for the purposes of groundwater monitoring at landfills. This list, known as Appendix III, shows arsenic to have an MCL of 0.05 mg/L, which is greater than the highest laboratory detection limit yet reported for samples from the site. Further, as this commenter notes, the detection limits for beryllium and cadmium are equal to the MCLs for those constituents and are therefore capable of measuring concentrations exceeding the MCLs. DSWM guidance requires the detection limits of antimony and thallium to meet levels below the MCL. This will be required in future sampling events.

COMMENT 46: The source(s) of benzene (a known carcinogen) in MW-2, the well nearest the TAP manufacturing plant, has not been determined. Further volatile organic compounds (VOCs) have only been tested in the wells one time (July 23, 2010), and semi-volatile organic compounds (SVOCs) have never been tested. Acetone has been reported in slag from the TAP plant and can possibly be in the leachate and groundwater. As such, four (4) quarters of seasonal VOC groundwater samples should be collected from landfill monitoring wells, from all adjacent plant property springs, and from monitoring wells that should be installed on the TAP manufacturing property.

<u>Response 46:</u> *The commenter's concern that volatile organic compounds (VOCs) might pose a risk to groundwater from disposal of aluminum smelting waste is not possible. The materials to be disposed in the proposed landfill have been heated to approximately 1,500ºF in a furnace, effectively eliminating VOCs. TCLP testing of both baghouse dust and salt cake have shown that no leachable TCLP-list VOCs, including benzene, or semi-volatile organic compounds (SVOCs) are present. The waste sample, which the commenter refers in this comment, sample 214767, June of 1995, showed no detectable VOCs except for a trace (0.859 mg/kg) of acetone. Acetone is a common laboratory contaminant that often appeared in laboratory reports, particularly in the 1990s when that sample was analyzed. Further, a sample of waste from TAP was analyzed for total SVOCs in 2001 and none were detected. The results of that analysis were also included in the addendum to the Hydrogeological Report.*

As reported in the addendum to the Hydrogeological Report, benzene was detected in a groundwater sample from MW-2 at a concentration well below the MCL for that constituent. This comment is irrelevant to the permitting of the landfill because, as noted above, VOCs are not a component of the waste to be disposed.

COMMENT 47: The three groundwater monitoring wells and the groundwater monitoring program completed to-date are: (1) incapable of determining statistical background water quality that has not been affected by leakage from the landfill because a sufficient number of samples has not been collected, and (2) incapable of determining groundwater quality passing beneath the downgradient compliance boundary. These conclusions are based upon: samples have not been analyzed at the correct detection limits; the uppermost groundwater has not been sampled; a representative number of samples to determine statistical background has not been collected; and existing contamination in the groundwater (MW-2, MW-3 and springs off-site from the manufacturing plant) has not been thoroughly defined.

<u>Response 47:</u> *This comment duplicates several other comments already addressed, see Responses to Comments 11, 33, 34, 44, and 45.*

COMMENT 48: Unless and until soil borings are drilled and an adequate number of groundwater monitoring wells are drilled on the TAP manufacturing property and the proposed landfill site, neither the applicant nor TDEC can determine if the contaminants that will likely occur in groundwater around the landfill are due to the smelting wastes from within the landfill, from contaminated soil used to construct the liner and geologic buffer, from historical and ongoing contamination at the TAP plant, or from the former phosphate mining operation.

<u>Response 48:</u> *This comment duplicates several other comments already addressed, see Responses to Comments 34, 40, 41, 42, and 43.*

COMMENT 49: The hydrogeologic investigation failed to recognize the surface karst geologic conditions on-site, even though the topographic survey included in the first hydrogeologic investigation for the site shows two large surface depressions in the west and southwest portions of the site, and the hydrogeologic investigation showed karst groundwater flow conditions. Those surface land depressions exactly match depressions in the bedrock when the 194 Geoprobe soil boring results are considered — demonstrating the subsidence effects of the sinkholes in the bedrock. The applicant concluded that there are "no observable surface expressions of karst features" in an attempt to say that karst conditions were not present at the proposed landfill.

Response 49: *The site topographic map included with the Hydrogeological Report does reveals a large surface depressions in both the southwest corner and west-central portions of the site. The first feature in the southwest corner was specifically addressed in the Hydrogeological Report (Section 5.6). This feature is the dammed upper portion of a small valley that once connected directly to the downgradient portion of the valley across Hoover-Mason Road. It is a topographic depression because the berm was constructed, at its western end, sometime before TAP purchased the property. It does not necessarily represent subsidence effects. The other surface depression, in the west-central portion of the site, is the former mine tailings pond. This pond was created to hold water and therefore is shaped like a depression. It is not caused by subsidence. There is a third surface depression, immediately to the west of and abutting the site. However, this feature, created by the construction of the cross wind runway at the airport, is no more indicative of karst subsidence than the other two.*

COMMENT 50: The applicant has not met any requirement of Chapter 1200-1-7-.04 (2) (q.) that requires a facility proposed in karst terrain to demonstrate that there is no significant potential for a surface collapse, the groundwater conduit flow would not contribute to surface collapse potential, and the groundwater flow is not conduit flow which could cause groundwater degradation.

Response 50: *The exact, complete wording of Tennessee Rule 1200-1-7-.04(2)(q) is:*

> *"Karst Terrane – If a facility is proposed in an area of highly developed karst terrane (i.e., sinkholes, caves, underground conduit flow drainage, and solutionally enlarged fractures) the applicant must demonstrate to the satisfaction of the Commissioner that relative to the proposed facility siting:*
>
> *1. There is no significant potential for surface collapse;*
> *2. The ground water flow system is not a conduit flow which would contribute significant potential for surface collapse or which would cause significant degradation to the ground water; and*
> *3. Location in the karst terrane will not cause any significant degradation to the local ground water resources.*
>
> *The above referenced demonstration may require the installation of piezometers, the developing of a potentiometric-surface map of ground water, conducting geophysical surveys, dye tracing or other specific requirements deemed necessary by the Commissioner to evaluate the proposed site to his satisfaction."*

There are two important points regarding this Rule. First, the Rule states clearly that it applies in cases where landfills are "proposed in an area of highly developed karst *terrane (i.e., sinkholes, caves, underground conduit flow drainage, and solutionally enlarged fractures)." The language of the Rule defines highly developed karst terrane as exhibiting all of the listed features, signified by the use of the word "and." The proposed site's surface and subsurface has been extensively explored and no evidence of sinkholes or caverns has been identified. Therefore, the site does not meet the definition of "highly developed karst terrane."*

COMMENT 51: Had the applicant considered the surface and subsurface features at the site, the site would clearly qualify as an "unstable area" as defined by TDEC solid waste rule Chapter 1200-1-7-.01(2.).

Response 51: *An unstable area is defined in Tennessee Rule 1200-1-7-.01(2) as follows:*

> *"Unstable area" means a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity of some or all of the landfill structural components responsible for preventing releases from a landfill. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terranes."*

Karst terranes are therefore identified in the Rule as possibly, but not necessarily, constituting unstable areas, based on the use of the word "can" in the list of possible examples. As previously addressed in this and other submittals, the proposed site is located in a karst terrane consisting of cutter-pinnacle development and fracture/conduit groundwater flow. However, it is not "highly developed" karst, and the Hydrogeological Report and the engineering design submitted with the Operations Manual, which identified and considered the surface and subsurface features of the site, have adequately addressed the stability issues raised by the presence of cutter-pinnacle karst.

COMMENT 52: The applicant concluded that the "in-place soils which will be utilized as buffer will provide a stable foundation for the landfill". This assumption is not based upon actual conditions when the results of the Geoprobe and split spoon soil boring investigations are considered. The settlement analysis performed by the applicant concluded that the settlement would be "limited based on the anticipated thin natural soil overburden thickness (5 to 10 feet)". In contrast, soil thicknesses were extremely variable and up to almost 30 feet deep in the areas beneath the proposed landfill and sediment pond where the bedrock sinkhole depressions exist.

Response 52: *Please see Responses to Comments 64 and 68.*

COMMENT 53: The stability analysis performed by the applicant only considered slope stability of the clay liner, the HDPE liner components, the GCL liner component, and the protective sand layer. It *did not* include subsidence or collapse estimates of naturally occurring soil or mine spoil beneath the geologic buffer or the liner system once wastes are placed or the soil beneath the sediment pond once the sediment pond contains water.

Response 53: *This statement is incorrect. Please see Responses to Comments 64, 68, and 69.*

COMMENT 54: The hydrogeologic investigation failed to identify substantial subsurface karst bedrock features that exist beneath the proposed landfill. As such, the engineering design did not consider the potential for collapses of the mine spoil and overburden soil due to voids and lack of compaction in the soil, any loss of future buoyant forces when groundwater conditions change, or the formation of soil regolith arches with the seasonal rise and fall of the groundwater on top of bedrock and within the epikarst.

Response 54: *See Responses to Comments 5, 11, 12, and 25.*

COMMENT 55: The applicant opined that no soil borings were advanced in the entire southwest (Phase 1 landfill and sediment pond) portion of the proposed landfill because bedrock was consistently at or very near the surface based on the very limited soil borings and test pits in the landfill footprint. If the applicant instead had also used the 194 additional Geoprobe soil borings in their hydrogeologic investigation report, the data clearly would have shown that well-developed karst bedrock conditions exist as evidenced by bedrock cutters / solution-enlarged joints occurring approximately 10 to 20 feet below ground surface in that area.

Response 55: *The actual wording in the Hydrogeological Report (Section 4.2) is: "No soil borings were drilled in the southwestern portion of the Site except at MW-3. Test pits in this strip-mined area had easily reached refusal on bedrock; therefore, no exploratory drilling was needed." The commenter noted, multiple Geoprobe borings were ultimately advanced in the southwestern portion of the site. The Geoprobe data from the southwestern portion of the site confirmed the presence of generally thin to non-existent soil and more uniform bedrock surface in that area.*

The bedrock surface elevation in the southwestern portion of the site is the lowest at the site and is therefore closer to, and even partly within, the Hermitage Formation. Weathering of the Hermitage Formation does not typically produce cutter-pinnacle karst and will therefore be more reflective of surface topography than the more easily eroded Bigby Limestone.

COMMENT 56: The bedrock contour diagram that utilizes the additional 194 Geoprobe borings that were not included in the hydrogeologic investigation report shows solution-enlarged sinkholes and pinnacles in the bedrock. One bedrock pinnacle up to 22 feet tall was mapped.

Response 56: T*he bedrock-surface maps generated by the applicant show no evidence of "solution-enlarged sinkholes." The maps show bedrock pinnacles since the site was characterized as having cutter-pinnacle karst development.*

COMMENT 57: The orientations (directions) of the main solution enlarged sinkholes and horizontal fractures in the bedrock are generally parallel to the east-west and north-south. The depth and horizontal extent indicate well-developed contaminant migration pathways of preferential conduit-type groundwater flow.

<u>Response 57:</u> *Groundwater flow has already been described as dominated by fracture and solution-channel features. See Responses to Comments 49, 50, and 69.*

COMMENT 58: The engineering design plans to blast shallow pinnacles of bedrock, without even a mere estimate of where the pinnacles are. In fact, the engineering drawings do not even show a pinnacle, clearly indicating their insufficiency for engineering plans.

<u>Response 58:</u> *This comment repeats what was discussed in Responses to Comments 17 and 18.*

COMMENT 59: The engineering design directs all stormwater runoff from the landfill into karst bedrock with no surface water outlet beneath Hoover-Mason Road. Runoff from the sediment basin overflows into a wetland in the southwestern corner of the property, where bedrock is extremely shallow and there is no surface water drain outlet from the property. Increasing runoff into the bedrock increases the potential for soil regolith collapse, according to TDEC guidance for limestone bedrock investigations.

<u>Response 59:</u> *The engineering plans show that structural fill will be placed in the southwestern portion of the site to promote drainage and prevent sediment basin discharge from ponding on the site. Storm water will not be conveyed through the bedrock.*

COMMENT 60: The 194 soil borings advanced by TriAD failed to collect a single soil sample for characterization of even the most basic, yet extremely important information such as soil type and depth of saturated zones.

<u>Response 60:</u> *Soil type and depth of saturated zones were adequately established during the hydrogeological investigation, as demonstrated in previous submittals. The Geoprobe boring investigation was not designed to obtain such data.*

COMMENT 61: The soil borings and TriAD's rudimentary determination for the presence of groundwater was performed during the driest times of the year. TriAD drilled 170 borings in April 2010, which was the third driest (3.23 inches) month of that year. The additional 24 borings were drilled in September 2010, which was the driest month (1.39 inches) for that year. The second driest month was February (2.99 inches) leading up to the April investigation. As a result, their determination of groundwater elevations from those borings relative to seasonal highs cannot be correct.

<u>Response 61:</u> *During March of 2010, Mount Pleasant received 5.38 inches of rain, according to the National Weather Service, which made it the 22nd wettest March since 1953. This may explain why, during the April Geoprobe investigation, several areas of the site were inaccessible to the drilling rig due to standing water, and were drilled later that year (September) during the dry season. The Geoprobe investigation was not conducted to determine the seasonal high water table.*

COMMENT 62: The seasonal high water table and horizontal extent of that high water table has still never been determined, even though TDEC rules require such a determination. TriAD has concluded that the water table was "perched" and varies in size seasonally. None of the investigations completed to-date has determined what the seasonal groundwater variation actually is in terms of horizontal extent and seasonally high elevations.

Response 62: *See Responses to Comments 11 and 12.*

COMMENT 63: Two bedrock contour diagrams (by TriAD; one made by hand, another using AutoCAD) both illustrate clear evidence of substantial karst bedrock conditions beneath the proposed landfill and the proposed sediment basin. The bedrock diagrams illustrate a bedrock "cutter", or elongated bedrock fracture, beneath the proposed Phase 2 landfill, and that fracture is almost 1,300 feet long, up to 30 feet deep, and approximately 150 feet wide. Another elongated bedrock fracture almost 1,300 feet long, up to 20 feet deep, and approximately 100 feet wide exists beneath the proposed Phase 1 landfill footprint. Finally, another approximately 1,300-foot long, 30-foot deep, and 150-foot wide bedrock depression also exists along the southern perimeter of Phase 1 footprint and beneath the proposed sediment pond. All of these significant fractures have an east-west orientation.

Response 63: *Some bedrock may be encountered during construction. Permit conditions have been added to address placement of geologic buffer over such areas. An additional permit condition has been added which does not allow rock blasting without the preparation of a blasting plan and approval by DSWM.*

COMMENT 64: The Geoprobe soil investigation completed by TriAD clearly indicates unstable geotechnical conditions in the soil that overlies the bedrock — soil that will lie beneath the proposed geologic buffer for the proposed landfill. Of the 35 Geoprobe borings drilled in the Phase 2 footprint and the 41 drilled in the Phase 2 footprint (of the 194 total borings drilled), 63 percent of those borings had "soft" to "very soft" soil conditions. Soft or un-compacted conditions existed for the entire depth of those 76 boring and that softness generally increased closer to the top bedrock. When these soft descriptions are compared to standard penetration test (SPT) results from split spoon samples collected by TriAD from borings in the same area, the results show blow counts as low as weight-of-the-hammer, 1 blow, and 2 blows per 6-inch interval. These results correspond to a soil shear strength of less than 250 pounds per square foot - strongly suggesting that the soil is incapable of supporting the weight of the geologic buffer, the liner, and the wastes.

Response 64: *Areas of soft soils were encountered during the exploration, at depths varying from near the ground surface to immediately above the bedrock surface. Soft surficial soils will require remediation to properly support the proposed buffer, liner, and wastes. Therefore, after the site vegetation and topsoil has been stripped, the exposed soil subgrade will be reviewed. In addition, the exposed subgrade will be proof-rolled with a fully loaded, rubber tired, tandem axle dump truck. Any soft or unstable soils will* *be repaired by over-excavating the soft soils to a firm stratum and backfilling with engineered fill.*

It is true that soft soils exhibiting blow counts of 2 or less and shear strengths similar to the value provided in Comment 64 are common within this geologic profile both near the bedrock surface and between bedrock pinnacles. The soft soil present between bedrock pinnacles is shielded to a large extent from the weight of the soil overlying it by stress redistribution or "arching" of those materials by the bedrock pinnacles. Indeed, stress re-distribution or "arching" accounts for the fact that sudden shear failures have not occurred at the site where soft soils zones are overlain by 10 to 40 feet of soil overburden.

The soft, surficial soils encountered will be exposed and repaired during the initial site grading activities. The subgrade repair during site grading activities will also enhance the described "arching" effect that will limit the stresses within deep, isolated soil joints. The "arching" effect will also assist in distributing the stresses over a larger area thereby reducing the potential for "abrupt" differential settlement. See also Response to Comment 69.

COMMENT 65: The bedrock contour diagrams do not support the TriAD conclusion that the Hermitage Formation does not contain significant karst geologic features and limits the downward migration of groundwater from the proposed landfill area. TriAD concluded that the top of the Hermitage Formation is approximately 645 feet MSL (mean sea level), yet bedrock elevations in sinkhole areas of the bedrock immediately adjacent to the proposed landfill footprint are as low as 625 feet MSL — or 20 feet below what TriAD has determined to be the top of the formation. This indicates that the upper-most member of the Hermitage Formation does *not* limit the downward migration of groundwater and that the member has significant karst features that allow rapid groundwater migration and extremely variable groundwater fluctuations.

Response 65: *The elevations of the bedrock surface in the southwest corner of the site, the only area of the site in which bedrock surface is at or lower than 625 feet msl, do not represent cutter development. This area is not immediately adjacent to the landfill footprint but is in the area of the sediment basin. A comparison of the bedrock-surface map to the surface topography shows that the bedrock surface in this area generally mimics the surface topography, forming a small valley that trends roughly east-west and drains to the west-southwest. The Geoprobe and test-pit data in this area of the site show no evidence of karst development or sinkholes.*

COMMENT 66: TriAD concluded that the "vast majority" of the borings that had observed groundwater were in the former tailings pond, suggesting that the tailing water is *the* source of that saturation — not naturally occurring groundwater. This conclusion is not supported by fact because (1) no tailing water has been sent to the pond for the last 21 years; (2) the pond was abandoned in 1991 as a tailings pond because it would not hold water; (3) the areas with saturated soil conditions both within and beyond the tailings pond area also correspond to the areas with the lowest lying bedrock elevations; and

(4) the saturated soil borings correspond to horizontal and vertical fractures in the bedrock that were mapped by TriAD. Although groundwater was also reported in borings C-2 and B-11 during drilling, TriAD did not report these conditions on their Figure 2 bedrock diagram where other borings with groundwater were identified.

<u>Response 66:</u> *The bedrock surface map in the Hydrogeological Report shows that Boring B-11 has having water. However, no Geoprobe borings in that area encountered water, despite both series of borings having been drilled in times of roughly equivalent rainfall (November-December 2006 recorded 8.56 inches of rain, while March-April 2010 recorded 8.40 inches of rain). It must also be noted that descriptions of soil core retrieved from sonic drilling, as is the case with boring C-2, cannot be relied upon for moisture determination because the drilling is done with water.*

As to the claim that borings in the former tailings pond encountered "naturally occurring groundwater," it is best to individually address each point:

1) *The lack of tailing water being directed to the pond "for the last 21 years" is irrelevant. The pond was constructed to retain water, which it did as described in the response to Comment 19. Further, the mine tailings consist of very fine clay particles, an excellent material for the retention of the rainwater that has accumulated in the pond since it was abandoned. Sections 4.1 and 5.4 of the Hydrogeological Report describe the test pits excavated into the pond and the type of soil found there. Beneath a thin layer of dryer clay, these test pits encountered saturated conditions within the mine tailings, which consist of medium yellow-brown clay, classified as CH, or high-plasticity clay, according to the USC system.*
2) *As demonstrated by Mr. Thomas' written statement (Comment 19), the pond most certainly held water. That the pond holds some water during the wet season to the present day can clearly be seen both in the field and on some aerial photographs, and is noted in Comment 97.*
3) *His claim that the borings encountered water only in the areas with "the lowest lying bedrock elevations" is clearly not true. Borings 7C-1 and 8C-1 both encountered the pond-related water, yet they are located on pinnacles, not in cutters.*
4) *TriAD did not map "horizontal and vertical fractures" in the bedrock, but only provided two of many possible interpretations of the bedrock-surface data. Therefore, the geographic distribution of borings in which water was encountered cannot be correlated to fracture patterns, and there is no basis for the claim that the wet borings were located only on fracture trends.*

COMMENT 67: TriAD identified in their field notes, a stream within 50 feet of the Phase 1 footprint. The streams were adjacent to borings 3C-1 and 3C-2. The location of this stream indicates that the landfill footprint is located too close to the stream — closer than the allowed 200-foot buffer in the regulations. TriAD identified another stream approximately 300 feet to the south of Phase 1 near boring 1E-2, and that stream flows into the sinkhole that is planned to be converted into the landfill sediment basin.

<u>Response 67:</u> *The Geoprobe boring notes were prepared by a field geologist unfamiliar with the regulatory definition of a stream. As determined by the qualified scientists employed by the State of Tennessee and the Corps of Engineers, there are no jurisdictional wetlands or streams at the site. The proposed landfill meets the stream buffer distance requirements. Further, as noted in the Response to Comment 49, there is no evidence of a sinkhole in the southwestern portion of the site.*

COMMENT 68: TriAD concluded that the site is not "unstable", according to TDEC rules, because "soils were evaluated for subsidence by a geotechnical engineer and found to be suitable for landfill construction". This statement is not correct and is misleading. First, the geotechnical evaluation made by TTL on behalf of TriAD for the Operations Manual only evaluated the *slope* stability of the geologic buffer and liner and did not evaluate the strength of the soil beneath those liner components and its ability to support the load. Second, the geotechnical soil analyses only determined suitability of the soil as a constructed liner once excavated and re-compacted under optimum moisture content. As a result, soft, low strength soil conditions exhibited in soil borings beneath the landfill and the sediment basin represent unstable geologic conditions. The engineering design presented by TriAD did not include complete excavation and re-compaction of *all* soil down to bedrock for the entire site. As such, the site *does exhibit* unstable characteristics, and the design should be rejected.

<u>Response 68:</u> *Settlement calculations were performed based on the results of the exploration and laboratory testing. This calculation was used to model the performance of the liner system under the weight of the proposed landfill. Specifically, the maximum shear strength that would develop within the liner as a result of the expected differential settlement was modeled and compared with the tensile breaking strength of various 60 mil HDPE geomembranes, which will be used in the liner system. Bedrock pinnacles were modeled at a spacing of 15 feet apart and extending from the bottom of the liner to depths of 40 feet below the ground surface. The results of this analysis indicate that the lowest tensile breaking strength of any of the geomembranes considered is at least twice the maximum shear stress developed. Therefore, provided the site is properly prepared, the on site soils and liner system have been "evaluated for subsidence" and found suitable for the proposed construction.*

As discussed in the Response to Comment 64, soft soils are commonly encountered within this geologic setting, particularly near the soil/bedrock interface. Specifically, if the subgrade is prepared in accordance with the recommendations provided in Comment 64, the site is expected to be stable. See also Response to Comment 69 below.

COMMENT 69: The engineering design places the bottom of the compacted clay liner within as little as 2 feet to the top of bedrock, when actual boring depths to refusal are used. TDEC does not consider limestone bedrock to be a "geologic buffer". As a result, the cross section drawings in the design do not meet the minimum 5-feet of lx10^6 cm/sec or 10 feet of 1x10^5 cm/sec soil permeability requirement between the bottom of the liner and the seasonal high groundwater table.

<u>Response 69:</u> *As described in the Operations Manual and depicted on the Engineering Drawings, a minimum 5-foot geologic buffer, if not present, will be established between the existing bedrock surface and the clay liner. A permit condition has been added which requires inspection of the base grade of excavation for rock, voids, soft zones or wet zones and requires further investigation as needed. An additional permit condition requires confirmation of the geologic buffer thickness in those areas where the buffer will consist of in place soils.*

COMMENT 70: Although the aluminum waste is much more unstable and reactive with precipitation / water than household garbage, the permit does not require any more stringent daily or intermediate cover requirements beyond what TDEC requires for a household garbage landfill. As a result, no special precautions are required in the permit to reduce the amount of leachate generated. The 6-inch daily cover and the 12-inch intermediate requirements are not stringent enough to minimize the production of large amounts of leachate and ammonia gas. The permit should require that an initial 6-inch layer of compacted, low permeability clay be placed immediately after waste is placed and that an additional 6-inch compacted clay layer be added at the end of each operating day — resulting in a 1-foot layer of compacted clay over each daily placement of wastes.

<u>Response 70:</u> *Daily cover will be placed at the end of the operating day and before any rain event. A synthetic cover may be used in conjunction with the daily cover in the event that sufficient compaction cannot be achieved. In addition, a synthetic cover will be used in conjunction with intermediate cover requirements. Both daily and intermediate cover operations will exceed typical Class I Landfill permit requirements for such cover. A permit condition has been added which requires testing of the soil material to be used for daily cover to confirm that the soil is of a type, which will minimize infiltration.*

COMMENT 71: Although the applicant plans to cover the wastes with soil on a daily basis, significant amounts of leachate will still be produced. The applicant has estimated in the Operations Manual that a *minimum* of 1,800,000 gallons of leachate will be generated (150,000 gallons/month) per year. As a result, one can expect significant ammonia gas production that will vent to the surface, almost 2 million gallons of reactive leachate coming in contact with the liner every year, and significant amounts of leachate that will require off-site treatment.

<u>Response 71:</u> *The modeling is done to provide conservative estimates of leachate generation to size leachate storage tanks. The leachate modeling did not take into account the planned synthetic covers that will dramatically reduce the amount of leachate typically generated. The corresponding gas generation will be also be reduced due to this reduction in storm water infiltration.*

COMMENT 72: TDEC Design Guidance for aluminum smelters seeking a landfill permit are required to prearrange for leachate disposal with a wastewater treatment plant that is capable of effectively treating leachate containing high levels of chlorides and ammonia. The permit applicant did not specify what facility will be used.

Response 72: *As stated in the Operations Manual, arrangements have been made with both Onsite Environmental of Nashville and Aqua Treat, Inc. of Chattanooga to accept the leachate that will be generated by the TAP-SSC Class II Landfill. Correspondence letters from both companies confirming their ability to accept leachate containing levels of chlorides in the range of 5,000 to 50,000 mg/l, and levels of ammonia (as N) in the range of 1,000 to 5,000 mg/l are provided in Appendix 6 of the Operations Manual.*

COMMENT 73: The Mt. Pleasant wastewater treatment plant has been unable to comply with its own ammonia nitrogen discharge limits because contaminated groundwater from the TAP plant is infiltrating into the sanitary sewer collection system.

Response 73: *The current Mount Pleasant wastewater treatment system will not be utilized to treat the leachate generated by the TAP-SSC Class II Landfill.*

COMMENT 74: Although TDEC stated at the Public Hearing that the landfill would have the same double-liner as required by the EPA for a hazardous waste landfill, the statement is not accurate. The design presented by the applicant is not as stringent. Hazardous waste landfills are required to have a double leachate collection system, one above *and* one below the first composite liner. The proposed design only includes one leachate collection system above the first and only composite liner component beneath the landfill footprint. Given the hazardous and reactive nature of the wastes, a second leachate collection piping system should be required beneath the entire landfill footprint.

Response 74: *The landfill will have a liner system that is functionally equivalent to that required by EPA for hazardous waste landfills, with two geomembrane liners, a leachate collection and removal system above the top liner, and a second leachate collection and removal system (which functions as a leak detection system) below that primary liner. However, unlike the "standard" hazardous waste landfill requirements, the proposed leak detection system will be constructed below both composite liner systems instead of between them. Construction in this manner will provide a mechanism for detecting and collecting a leak beneath the entire landfill. The geocomposite material proposed for the leak detection system provides demonstrated, equivalent performance to a 12-inch aggregate collection layer making the incorporation of pipes into the layer unnecessary. This liner design is considered more than adequate to contain the aluminum waste to be placed in the landfill.*

COMMENT 75: TDEC also stated that the proposed landfill would be double-lined throughout the landfill footprint - with a HDPE liner component above *and below* the clay liner. However, neither the engineering design drawings nor the Operations Manual show that such a double liner will be constructed. The engineering design should therefore be rejected. The Operations Manual only specifies a liner that consists of a 2-foot compacted clay component, a 60-mil HDPE layer above the clay, a geosynthetic clay liner (GCL) above the HDPE, and then a 60-mil HDPE layer above the GCL. Although details in the engineering design drawings show a HDPE layer beneath the clay liner underneath the leachate collection sumps, the component apparently does not extend throughout the entire landfill footprint, and this additional liner component was never discussed in the Operations Manual - suggesting that it is not part of the design.

Response 75: *See the Response to Comment 74 above. As depicted on Sheet 9 of the Engineering Drawings, two 60-mil HDPE liners will cover the entire waste disposal area thereby providing a double liner throughout the landfill footprint. An additional 60-mil HDPE liner will be placed below the leachate collection sump as part of the leak detection system. The proposed system is clearly described in the permit application documents.*

COMMENT 76: The Operations Manual stated that the applicant reserves the right to use a GCL that is not double-sided with a 60-mil HDPE component on each side of the bentonite clay portion of the GCL. That intention should be rejected because of the high chloride content of the wastes / leachate and the admitted liner degradation that occurs when chlorides contact the clay. A GCL without a double-sided HDPE layer risks degradation of the clay component.

Response 76: *A GCL with manufacturer-bonded geomembranes in which the bentonite layer is bonded to one or more 60-mil HDPE liners may be utilized as an alternate to individual 60-mil liner deployment. In either case, the GCL will be protected both above and below by a 60-mil HDPE liner. See also Responses to Comments 77 and 78.*

COMMENT 77: TDEC has recognized that any clay component of a landfill liner below high chloride-content wastes is prone to leakage because "this type of leachate will decrease the effectiveness of the clay liner because the ions disrupt the way clay particles hold back water" to eventually "increase its permeability". TDEC's solution to this problem is to include the composite, HDPE component beneath the GCL to protect the constructed clay liner. This approach fails to recognize that HDPE liner components often leak.

Response 77: *The clay liner at this proposed landfill will be protected from exposure to high chloride concentrations by a 60-mil, textured HDPE liner, a GCL, and a second 60-mil, textured HDPE liner. See also Response to Comment 78.*

COMMENT 78: High chloride concentrations typical of aluminum wastes can permeate through composite liner components to cause the hydraulic conductivity of the clay and GCL bentonite liner components to increase several orders of magnitude because the clay components can shrink and crack, resulting in piping / conduit flow. Once the clay liner cracks, pollutants can migrate much more rapidly to the underlying groundwater.

<u>Response 78:</u> *This scenario for piping and conduit flow would require there to be significant head on the liner system. The liner system is designed to drain so that leachate does not remain in contact with the liner. The clay liner and geosynthetic clay liners will be further protected from waste material and leachate by dual 60-mil HDPE liners.*

COMMENT 79: GCL liners are particularly vulnerable to failure if the GCL is exposed to hydrated conditions (e.g. groundwater). TriAD has not demonstrated that the GCL will be placed above the seasonal high groundwater table to prevent damage to the GCL.

<u>Response 79:</u> *Water level information obtained during the hydrogeologic and Geoprobe investigations indicates that the liner will be will above the uppermost aquifer at the site. A permit condition has been added which requires confirmation of the minimum separation distance between ground water and the liner prior to beginning construction of the liner system.*

COMMENT 80: Waste contaminants are able to permeate through composite liner layers through the expected holes in the man-made portions of the liner. Well-constructed, new geo-composite liners commonly have holes that are defects in the liner. As such, these liners are almost never installed without holes; the typical frequency of holes ranges between 2.5 to 25 holes per hectare (approximately 10 holes per acre); and the typical assumed hole diameter is 11 millimeters. Even for a well-constructed 39-acre landfill, the landfill industry *expected* number of holes in a man-made HDPE and GLC layers that are slightly smaller than a dime is therefore up to 390 -not including man-caused tears or punctures during installation and operation.

<u>Response 80:</u> *The GCL between the two HDPE liners will provide two functions. First, its presence will limit the migration of any leachate that might penetrate a defect in the overlying HDPE liner. Second, expansion of the bentonite layer will serve to seal the overlying penetration and prevent continued release. The proposed double-liner system will further prevent leachate infiltration by adding a second HDPE and clay liner barrier. See also Response to Comment 81 below.*

COMMENT 81: The thin nature of GCL and HDPE liners make them susceptible to accidental punctures and tears. A 60-mil thick HDPE is slightly less than 1/16-inch thick. The typical GCL thickness is only 1/4-inch thick.

<u>Response 81:</u> *The proposed HDPE and GCL materials are utilized in landfill and reservoir applications nationwide due to their documented strength and durability. The thin, lightweight nature of the material enhances their ability to be deployed without damage. In addition, an extensive Construction Quality Assurance program will be conducted during liner construction and installation, which will require monitoring and testing to verify that no damage to the liner system occurs during installation. The worst damage can occur during placement of the lateral drainage layer. A permit condition has been added which requires the two feet of drainage material to be placed all at once and for this construction be constantly monitored by a construction inspector.*

COMMENT 82: TDEC has acknowledged that all composite-lined landfills (HDPE on top of a clay liner) that have received aluminum smelter wastes have groundwater contamination that can be directly attributed to that waste. As such, one can expect the proposed design to eventually leak, even with the additional HDPE and GCL components.

Response 82: *Ground water contamination which has been confirmed by DSWM has been from unlined landfills or from landfills with clay only liners.*

COMMENT 83: Contaminants in aluminum processing wastes are able to permeate proposed liners even without holes or tears in those liners. Contaminants can permeate through the liner by molecular diffusion. Molecular diffusion transport of contaminants with a high chloride content (e.g. aluminum wastes) occurs through a liner even *without* holes or defects and is a function of the concentration of the waste — the higher the concentration, the more diffusion occurs.

Response 83: *HDPE is chemically resistant to constituents present in aluminum smelter waste and will provide an effective barrier to leachate infiltration. In fact, a 2004 paper by Rowe and Brachman (Assessment of Equivalence of Composite Liners) contains the following description of diffusion-related migration through HDPE: "For HDPE geomembranes commonly used as liners in municipal solid waste landfills, the geomembrane is an excellent diffusive barrier to water and hydrated ions (e.g.* Na^{+}, Cl^{-}, Zn^{2+}, Ni^{2+}, Mn^{2+}, Cu^{2+}, Cd^{2+} *and* Pb^{2+}*), but is not a good diffusion barrier for organic compounds such as toluene and dichloromethane." With regard to chloride, the paper concluded, in part: "Given the very low leakage rates through both the GM/CCL/AL and GM/GCL/AL systems, and the fact that the GM provides an excellent diffusive barrier to chloride, practically no chloride passes through the liner over the service life of the geomembrane." (The acronyms used were: GM – geomembrane (HDPE liner); CCL – compacted clay liner; GCL – geosynthetic clay liner; and AL attenuation layer (clay layer)). It must be noted that the Rowe and Brachman paper dealt only with a single HDPE layer, not the two proposed for the TAP-SSC Landfill.*

COMMENT 84: Molecular diffusion-controlled breakthrough of contaminants through one plastic sheeting landfill component occurs in two (2) to three (3) years, and the diffusion rate of chloride through an un-weathered, water-saturated clay liner at a hazardous waste landfill can occur in approximately five (5) years.

Response 84: *The two-to-three year "breakthrough of contaminants" as used in the Lee paper refers to "waste components" from MSW landfills, not specifically chlorides. The second part of the comment, relating to chloride migration, pertains only to saturated clay liners in the absence of HDPE. Therefore, the statement presented is misleading and is not applicable to the proposed liner system at the TAP-SSC Landfill because the system will be a combination of two HDPE layers and non-saturated clay.*

COMMENT 85: The TAP waste analytical results submitted in the August 2010 hydrogeologic report addendum were insufficient to determine all current possible constituents in leachate. The only waste sample results that were submitted in support of the landfill application were TCLP metals for baghouse dust (March 2000 sample), TCLP metals for baghouse dust (July 2001), TCLP metals for salt cake (September 2009), and total metals for baghouse dust (July 2010). No samples of salt cake or slag were reported for total, compositional analyses.

Response 85: *DSWM believes that these waste streams have been properly characterized in the application. Waste characterization is used to evaluate landfill design in the following manner. Pursuant to Subtitle D of the 1976 federal Resource Conservation and Recovery Act ("RCRA"), Federal and State regulations have been established that include criteria/standards for the location, design, operation (including groundwater monitoring and corrective action), and closure and post-closure care of "municipal solid waste landfills." The objective of these criteria/standards is to ensure that these facilities contain the wastes that are placed in them and prevent releases that might pose a significant risk to human health or the environment. Such municipal solid waste ("MSW") landfills – also known as "RCRA Subtitle D landfills" or, in Tennessee, as "Class I landfills" – are intended to receive household wastes and all types of other physically solid wastes whose disposal is not otherwise regulated under Federal and State programs for managing hazardous wastes, radioactive wastes, PCB materials, etc. This includes a wide range of other wastes generated by municipalities, businesses, institutions, industries, utilities, etc. These wastes obviously represent a very wide range of physical and chemical characteristics. MSW landfills are even intended to receive hazardous wastes generated by households and conditionally exempt small quantity generators. As a result, the criteria/standards for MSW/Class I landfills are very stringent, and the landfill technology (materials and design) that has developed to meet those criteria/standards is capable of long-term, effective performance under a variety of physical/chemical conditions.*

In Tennessee, a landfill that will receive industrial wastes but not MSW is considered a "Class II landfill." However, Tennessee's rules provide that such landfills must still comply with the standards for Class I landfills unless a variance or waiver is granted based on a demonstration by the applicant that a standard is inapplicable, inappropriate, or unnecessary to his facility, or that it is equaled in effect by alternative standards or requirements. For the TAP-SSC Landfill, no variances or waivers from the applicable Class I landfill standards were requested, and TAP and SSC in fact offered a more stringent landfill design incorporating two membrane liners. In addition, the landfill has been designed and will be operated to comply with some additional requirements that TDEC established in guidance issued in March 2010 for landfills receiving secondary aluminum smelting wastes. TDEC developed this guidance based on the problems of managing such wastes that TDEC had experienced here in Tennessee and observed in other states. DSWM therefore believes that the proposed landfill will be adequate to effectively contain the wastes.

Tennessee's landfill permit application requirements at Tennessee Rule 1200-01-07-.04(9)(c)9 require only that the Part II permit application include a narrative, with appropriate references to the engineering plans and hydrogeological report, which

"Describes the types and anticipated volumes of solid wastes to be disposed of and the sources which generate the waste, and for special wastes, the physical and chemical characteristics of the wastes and any special handling procedures to be utilized." The aluminum wastes from TAP and SSC that are to be disposed in the landfill are special wastes, and the data that was submitted provided adequate characterization of the materials for purposes of evaluating the permit application. DSWM have a long history in managing the wastes involved and have developed a good understanding of the problems associated with its management – including the constituents that may be released into the environment. Additional waste characterization information has actually been submitted to TDEC in response to the questions about whether or not the wastes are hazardous wastes pursuant to Tennessee Rule 1200-1-11-.02. For Class II landfills such as the TAP-SSC Landfill, Tennessee Rule 1200-01-07-.04(7)(b) allows TDEC to tailor the list of groundwater monitoring parameters from the Appendix I and II lists required for Class I landfills. Parameters have been selected from these lists that are characteristic of the wastes to be disposed in the landfill and indicative of leachate from such wastes. The salt cake, bag-house dust, and refractory wastes from TAP and SSC are inorganic residues from the high-temperature smelting of scrap metal and aluminum-rich industrial by-products such as aluminum dross. There is no reason to think that potentially significant quantities of toxic organic materials are contained in the raw materials that are fed into the smelting furnaces, and even less reason to think that potentially significant quantities of toxic organic materials would survive or be created in the high-temperature process. There is thus no reason to test the wastes generated by the process for toxic volatile or semi-volatile organic compounds, or to include such compounds as groundwater monitoring parameters. Previous testing has confirmed that there are no potentially significant concentrations of such compounds in the TCLP extract. Thus, because the wastes to be placed in the landfill are inorganic in character, the groundwater monitoring parameters selected for use at the proposed landfill will include only inorganic constituents. This will include the full list of inorganic constituents identified in Appendix I of Tennessee Rule 1200-01-07-.04 for use at Class I landfills as well as some additional inorganic constituents such as chloride, sodium, potassium, and ammonia that are known to be indicative of leachate from such wastes.

The groundwater monitoring parameters will also include the full range of toxic metals of concern for a Class I landfill.

As EPA has noted, any combustion source from a high-temperature industrial furnace to a campfire will generate tiny amounts of dioxins and furans. Pursuant to federal Clean Air Act and Toxic Release Inventory regulatory requirements, both TAP and SSC have reported that their smelting furnace wastes will contain very small amounts of dioxins and furans. The concentrations of such materials in the wastes are miniscule, and there is no risk of significant release of dioxins and furans from these wastes via leachate or any other means.

COMMENT 86: The SSC waste analytical results submitted in the August 2010 addendum were also insufficient to determine all current possible constituents in leachate. The only waste sample results that were submitted were for TCLP metals, total metals, and chlorides for salt cake (January 1992), total metals and acetone for slag (June 1995), TCLP metals for slag (March 2000), chlorides, potassium, and sodium for salt cake (April 2000). No recent results for any sample were provided.

Response 86: *See Response to Comment 85.*

COMMENT 87: The limited number of samples from both TAP and SSC did not account for variability in the wastes for all wastes and all constituents. Chlorides concentrations from three slag samples collected from SSC for example in 1992, varied up to 53 percent. More samples should have been collected to represent that variability and to ensure understanding of the characteristics of the wastes prior to selecting a liner design and prior to permit application submittal.

Response 87: *See Response to Comment 85.*

COMMENT 88: Although used refractory bricks will be disposed in the landfill, no analytical results from either TAP or SSC refractory brick wastes were provided and as such, their contents are unknown. Since they are unknown, the groundwater monitoring program to establish background and routine monitoring for such constituents cannot be determined.

Response 88: *The ground water monitoring program is designed to detect soluble waste constituents, which are found in leachate from these waste streams. The ground water monitoring parameters in this permit include the same parameters as those used in the other secondary aluminum waste landfills in Tennessee. DSWM has reviewed the hazardous waste determinations for the refractory waste streams, which are attached to this document. These documents show that such materials do not contain potentially significant concentrations of such toxic heavy metals. DSWM will however require that heavy metals be added to detection monitoring.*

COMMENT 89: Refractory bricks from furnaces can contain high amounts of heavy metals, and some of those metals can be leachable.

Response 89: *See Response to Comment 88.*

COMMENT 90: According to EPA TRI Reports for both TAP and SSC, aluminum smelting wastes that are generated at both plants and are disposed of off-site in Tennessee-permitted Class I and Class II landfills contain dioxin and "dioxin-like" compounds. Recently generated wastes from all waste types from both facilities should be sampled for dioxin and all dioxin-like compounds such as furan.

Response 90: *See Response to Comment 85.*

COMMENT 91: Samples of all current materials planned for disposal should be analyzed individually and combined for one year for total metals, TCLP leachable metals, water leachable metals, total chlorides, total ammonia nitrogen, total VOCs, total

SVOCs, and dioxins and furans. The leaching methods should include analytical procedures that are reflective of predicted pH, water content, and temperature conditions.

Response 91: *See Response to Comment 85.*

COMMENT 92: The aluminum smelter waste is clearly reactive with water, forming toxic ammonia gas and hydrogen and acetylene gases that under the right conditions can be explosive. Uncontrolled ammonia gas emissions and neighbor complaints have been frequent at the Environmental Waste Solutions (EWS) smelter waste monofill in Camden, Tennessee since shortly after smelter wastes were first placed in that landfill.

Response 92: *In their hazardous waste determinations for their salt cake and bag-house dust wastes, TAP and SSC have confirmed that these wastes can contain small amounts of aluminum that can react with water to create ammonia and other gases. However, TAP and SSC have determined that the amounts of such gases that may be generated are not sufficient to cause these wastes to be hazardous wastes. Ammonia monitoring requirements and a requirement for a response plan have been added to the Facility Specific permit conditions for the subject permit. The final step in the response plan, if necessary is placement of synthetic membrane over the fill area and collection of reaction gases for treatment. Special design and operational features have been incorporated into the permit requirements to prevent or minimize waste exposure to water. These include storage of waste under roof at the site of generation, use of a plastic tarp for both daily cover during inclement weather and as part of the intermediate cover.*

Permit conditions have been added to address potential issues with generation of ammonia, including an ammonia monitoring requirement, temperature monitoring and restrictions on placement of the initial waste layer. See also the Response to the Comment 1.

COMMENT 93: The Geologic Map of the Mt. Pleasant area (1964) illustrates a stream valley on the proposed landfill site. The map also illustrates widespread phosphate mining at the site and the Mt. Pleasant area. In general, the only areas that were not mined along the Quality Creek corridor near the TAP plant were secondary stream valleys and hilltops. One such stream valley exists along the southern portion of Phase 1 of the proposed landfill. TriAD recognized that this stream valley exists; however, they still concluded in their first hydrogeologic report that "no permanent water bodies" exist at the site because of their belief that the flow in that stream is seasonal.

Response 93: *The Geologic Map and Mineral Resources Summary of the Mount Pleasant Quadrangle shows no stream in the small valley that parallels, and is near the southern boundary of the site. Despite this lack of data, the commenter refers to this feature as a "stream valley" and a "stream." The published date of the geologic map is 1964. At that time, mining had apparently not impacted this small valley. On the more recent, 1986 (photo revised) topographic map, the small valley is not shown because that portion of the site is mapped as a disturbed area, indicating that sometime between 1964* *and 1981 (the date of the aerial photos used for the 1986 photo revision) the small valley was either mined or otherwise disturbed by mining activity.*

The commenter has used the 1964 geologic map, which shows no stream, as a basis for challenging TriAD's conclusion that no stream exists on the property. This is done despite the fact that the later USGS topographic map doesn't even show the valley through which he claims a stream flows, let alone a stream.

COMMENT 94: A 1899 topographic map illustrates a perennial blueline stream on the proposed landfill site. According to a 1903 update of that map, that stream originates in the highest elevations of the landfill soil borrow area (called the "Upper Pond" tailings pond area of the site). Its exact location relative to the proposed waste disposal cells and the sediment basin should be determined to ensure the required 200-foot buffer separation to prevent surface water or near-surface groundwater from that stream from coming into contact with wastes and liner components.

Response 94: *The printing of a blue-line stream symbol on a 1903 topographic map is not relevant to the consideration of a landfill permit in 2011, unless the alleged stream is still present. No such stream currently exists. Site-specific stream-determinations often reveal blue-line streams to not be streams at all, and a site-specific stream determination on a 1903 stream cannot be accomplished.*

COMMENT 95: The perennially saturated, standing water conditions observed along Phase 1 of the proposed landfill site are consistent with what would be expected from a historically perennial flow stream. Mining operations may have destroyed the natural stream channel but would not have removed the perennial flow and would not have destroyed the bedrock conditions of the stream valley. A portion of the southwest berm of the Upper Pond tailings pond has been excavated to form an outlet ditch, presumably to allow flow from that upper stream to connect to the stream along Phase 1 of the proposed landfill.

Response 95: *See Responses to Comments 94, 96, and 97.*

COMMENT 96: The most downstream portion of that stream channel along the southern edge of Phase 1 is a jurisdictional wetland per the US Fish and Wildlife Service Wetland Inventory Map. Groundwater seeps and springs on the south side of Hoover-Mason Road are likely a groundwater discharge point(s) that then flow overland to Quality Creek, a navigable water. This wetland likely exists because there is no surface outlet (channel or culvert) of the historical stream channel beneath Hoover-Mason Road.

Response 96: *As noted in the Wetlands Mapper Documentation and Instructions Manual (August 2010), the online wetlands map "is not intended to provide legal or regulatory products." Further, it notes: "Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities." This means that a site-specific wetland determination must be made by the appropriate regulatory agencies. In this* *case, both TDWPC and the U.S. Army Corps of Engineers were consulted regarding wetlands at the site and both agencies concluded that no jurisdictional wetlands exist at the site.*

COMMENT 97: According to the Wetland Inventory Map, a wetland exists in virtually one-half of the entire proposed Phase 2 landfill area. See attached map. The location of that wetland matches the subsided bedrock conditions that are evident from a bedrock contour diagram produced by the Geoprobe investigation. This wetland location also matches where saturated soil conditions were noted in soil borings and piezometers that the applicant drilled to the top of bedrock. These conditions indicate that a large, mature wetland exists in the exact footprint of Phase 2. Further, the saturated surface soil conditions in this area would represent a minimum seasonally high groundwater table.

Response 97: *As noted in the Response to Comment 96, the inclusion of an area on the NWI is irrelevant with regard to activity limitations, unless the state and federal regulators claim jurisdiction. In the case of the former tailings pond, the U.S. Army Corps of Engineers noted in a March 31, 2010, letter that the wetlands at the site "appear to be isolated from navigable waters and their tributaries," and "are not considered waters of the U.S. subject to Corps of Engineers' regulatory jurisdiction." With specific regard to the tailings pond referred to in this comment, TDWPC, in an April 13, 2010, letter noted "these ponds are contained and retained within the limits of private property in single ownership which do not combine or effect a junction with natural surface or underground waters."*

COMMENT 98: The results of the 194 Geoprobe borings and the continued presence of standing water, flowing water, and saturated soil conditions where the stream occurs on the historical topographic map strongly suggests that the stream still exists. As such, the stream should be recognized and afforded appropriate protection with the required 200-foot buffer that is not currently being met.

Response 98: *Based on the lack of a stream on the 1964 and 1986 maps, it is assumed that this comment is referring to the stream portrayed on the 1903 map. This comment is responded to in Comment 94. In addition, the pond water is not connected with natural surface water, as found by TDWPC and as described in the Response to Comment 97.*

COMMENT 99: The applicant has not determined the exact location of that stream channel along the eastern Phase 1 and 2 landfill areas to ensure that the landfill is located more than the minimally required 200-foot buffer from the stream. Saturated conditions in some Geoprobe borings along the eastern landfill footprint suggest that the stream channel and its associated flow still exist in the un-compacted mine spoil. If so, the required 200-foot separation has not been met along the eastern landfill footprint.

Response 99: *See Responses to Comments 94 and 98.*

COMMENT 100: According to the Wetland Inventory Map, a jurisdictional wetland exists in the most *upstream* portion of the Upper Pond tailing pond where the landfill borrow area would be. This wetland area corresponds to the historical headwater location of the stream identified in the 1903 topographic map and it also represents the only portion illustrated on the 1964 geologic quadrangle map where mining did not occur — possibly due to the perennial stream conditions.

Response 100: *As noted in Response to Comment 97, these ponds are not jurisdictional wetlands, in part because they have no connection to surface water.*

COMMENT 101: The Lower Pond tailings pond was abandoned by the former mine operator because it would not hold water, indicating that no "liner" (as suggested by TriAD) exists to hold mine tailing water. Further, the berm around the pond has long since been bulldozed to flatten the area, indicating that the saturated wetland conditions that exist are perennial shallow groundwater conditions and not seasonal surface water runoff or tailings water. Saturated wetland conditions in that area are quite possibly more related to bedrock flow conditions of a sinkhole, as indicated on the bedrock contour diagram.

Response 101: *This response is to this comment can be found in the Responses to Comments 19, 66, and 97.*

COMMENT 102: Whose job is it to police this landfill once operation is actually started? Will the City be responsible at their cost to monitor what goes in the landfill?

Response 102: *Permitted landfills are routinely inspected at random by TDEC. Industrial landfills are inspected a minimum of 4 times per year.*

COMMENT 103: The concentration of properties (182) on the proposed landfill site is very high. What would be considered a high concentration if 182 pieces of property is not?

Response 103: *TDEC requires disposal facilities to be located, designed, constructed, operated, and maintained such that the fill area are, at minimum 500 feet from all residences. The number of residences within the vicinity of a proposed facility has no bearing on our review.*

COMMENT 104: Why would TDEC say TAP and SSC meet all of M-3 regulations for a landfill? The Ashwood Historical District penetrates approximately ½ mile deep into the 1 mile radius?

Response 104: *TDEC does not regulate local M-3 requirements. M-3 is a local ordinance, and not an issue within the purview of TDEC.*

COMMENT 105: Our air, noise, surface water and underground water are already affected these Aluminum Plants. Would not TDEC expect this situation to be even worse with a salt cake landfill?

Response 105: *The landfill is designed to receive waste for rapid cover and disposal to minimize impacts to both air and water. Noise is a local ordinance issue, and not one regulated by TDEC.*

COMMENT 106: Why would TDEC make a tentative decision to grant the landfill permit when these 2 companies have such poor record (37 NOV's and at least 6 Commissioners Orders)?

Response 106: *Ongoing regulatory issues with regards to TAP and SSC at other locations are results of past practices that, at the time, were deemed to be acceptable practices for the management of the wastes in question. The proposed facility design and environmental control measures meet or exceed the current state and federal standards for Subtitle D landfills.*

COMMENT 107: Next to the proposed landfill is a 6,000 ft airport. The damage to this airport has been a constant problem. Why would TDEC approve a landfill next to such a fine airport?

Response 107: *Landfill location restrictions near airports apply to municipal landfill facilities, where the birds pose a hazard to aircraft. This rule does not apply to other types of landfills, where birds do not pose a threat.*

COMMENT 108: The proposed site only takes in account the next 30 years. Where do we go from there?

Response 108: *The owners of the facility are still responsible for site upkeep beyond the operating and post-closure care periods.*

COMMENT 109: If the permit is denied, how often and how soon can the companies reapply?

Response 109: *The permitting process would have to start over, beginning with approval from applicable local authorities. No provisions for a specified delay period prior to re-application are contained in the Solid Waste Processing and Disposal regulations.*

COMMENT 110: Does TDEC have any waste facilities of this sort within city limits or similar distance to a populated area the size of Mt. Pleasant? If so, please cite those cases and their impact. If not, on what basis is a decision of this magnitude being made to place such a facility at the proposed location?

Response 110: *TDEC must evaluate each permit application it receives based upon its own merits.*

COMMENT 111: Does TDEC have any case of waste facilities of this sort with impacts on air and water quality, for an area such as Mt. Pleasant?

<u>Response 111:</u> *TDEC must evaluate each permit application it receives based upon its own merits.*

COMMENT 112: Will the "by product" from Tap and SSC be the only "by product" from only the two plants in Mt. Pleasant, or will their "sister" plants located in places other than Mt. Pleasant be allowed?

<u>Response 112:</u> *The permit will only allow for disposal of waste generated at the TAP and SSC facilities located in Mt. Pleasant.*

COMMENT 113: TAP and SSC say it is not cost effective to truck their waste "by product" 60 miles or so. How can it be cost effective to build and maintain the proposed landfill forever?

<u>Response 113:</u> *Cost analysis is not a consideration for TDEC in the permitting process.*

COMMENT 114: Why is it not cost effective to use reclaiming systems already available in Germany, Canada and other countries to extract the aluminum now?

<u>Response 114:</u> *Cost analysis is not a consideration for TDEC in the permitting process*.

COMMENT 115: Are these two aluminum recyclers' good corporate citizens and can they be trusted to not pollute the ground and water of the good people of Mt. Pleasant, TN?

<u>Response 115:</u> *This is a speculative question, and response to it is inappropriate.*

COMMENT 116: There is technology available to process salt cake that is 100% recoverable. TDEC should be focusing on this rather than burying salt cake in the City Limits of a small town.

<u>Response 116:</u> *While there may be other technology available for processing of salt cakes, TDEC does not have the authority to compel facilities to implement a specific process simply because it is more efficient. Plainly stated, it is beyond the scope of existing Solid Waste Processing and Disposal regulations to do so. TDEC's Division of Solid Waste Management is charged with reviewing incoming solid waste management facility permit applications for completeness and compliance with existing state solid waste management program regulatory requirements.*

COMMENT 117: If it rains on the landfill, then it produces ammonia. At what level is it hazardous to health, especially that of children? How can you ensure that levels of ammonia gas will not be hazardous?

<u>Response 117:</u> *Prior to initial placement of waste, Tennessee Aluminum Processors, Inc. and Smelter Service Corporation must commence an ammonia monitoring and measurement program to track the generation rates and volumes of ammonia gas* *produced by landfill operations. This information shall be used to develop an ammonia mitigation program for future phase development. Additionally, provisions must be made for temperature monitoring in all gas vents. It is further recognized that maintaining a dry environment will minimize the potential for gas production. A permit condition has been added to require documentation that the daily cover of 6 inches be a clay soil, which can be compacted to achieve a low permeability. Intermediate cover must include a synthetic cover component on top of 12 inches of clay soil component.*

COMMENT 118: Aluminum Chloride is a far better deicer than sodium chloride or calcium chloride. Why not use this waste to deice the roads if it is not hazardous?

Response 118: *This comment is unrelated to the permitting process for the proposed TAP-SSC landfill, and forced consideration of landfilling alternatives is beyond the purview of TDEC.*

COMMENT 119: If it has been stated that all landfill liners leak, then why is a new landfill being allowed?

Response 119: *EPA promulgated its Subtitle D landfill design standards with the express goal of protecting human health and the environment. Tennessee's standards are more stringent than the federal standards in that a 5 foot thick compacted clay buffer is also required. The proposed design for the TAP-SSC landfill is even more protective in that a second synthetic liner/leachate system has been included.*

COMMENT 120: Over time plastics decompose and deteriorate and the landfill will eventually leak and release leachate into the groundwater. If you approve this landfill, aren't you putting the water supply of Mt. Pleasant and surrounding area at serious risk?

Response 120: *EPA promulgated its Subtitle D landfill design standards with the express goal of protecting human health and the environment. Tennessee's standards are more stringent than the federal standards in that a 5 foot thick compacted clay buffer is also required. The proposed design for the TAP-SSC landfill are even more protective in that a second synthetic liner/leachate system has been included.*

COMMENT 121: What precautions have been considered to keep runoff from the Aquifer(s) beneath the property and the creek bordering our property?

Response 121: *Tennessee's Solid Waste Processing and Disposal regulations require that a groundwater monitoring network be developed/installed to determine that groundwater underlying the facility has not been impacted by the landfill. See also Responses to Comments 123 and 126.*

COMMENT 122: What precautions have been made to contain the resulting particulates from salt cake?

Response 122: *The regulations require, and the operations plan makes provisions for daily cover of the waste materials.*

COMMENT 123: They said that they would fix the landfill where it wouldn't leak, but can you guarantee us that it is 100% leak proof?

Response 123: *EPA promulgated its Subtitle D landfill design standards with the express goal of protecting human health and the environment. Tennessee's standards are more stringent than the federal standards in that a 5 foot thick compacted clay buffer is also required. The proposed design for the TAP-SSC landfill is even more protective in that a second synthetic liner/leachate system has been included.*

COMMENT 124: Has there been seismic sub service procedures to determine sinkholes on the proposed site?

Response 124: *TDEC is assuming that the comment relates to seismic subsurface investigations. The site was investigated by test pit and drilling techniques (i.e., Sonic Core, Air Rotary, Power Auger & Geoprobe).*

COMMENT 125: If core holes have been drilled, how and what was the determination? What basis was used to determine the amount and placement of core holes drilled if any?

Response 125: *Two core holes and three monitoring wells were drilled into bedrock. The holes were drilled to a minimum depth of 20 feet into bedrock. The placement and depths of the holes were based on the recommended minimum drilling requirements in the Hydrogeologic Investigation Guidance Document.*

COMMENT 126: Composite-lined landfills have proven ineffective in preventing leachate migration from landfills and monofills that are used for disposal of smelter wastes from TAP and SSC.

Response 126: *The proposed TAP-SSC Landfill will include a double composite liner and a leak detection layer to prevent leakage. The liner system will consist of the following, from top to bottom:*

- *a 2-foot-thick leachate collection system*
- *a 60-mil HDPE liner*
- *a geosynthetic clay liner*
- *a 60-mil HDPE liner*
- *a 2-foot-thick clay liner*
- *a leak detection layer*

EPA promulgated its Subtitle D landfill design standards with the express goal of protecting human health and the environment. Tennessee's standards are more stringent than the federal standards in that a 5 foot thick compacted clay buffer is also required.

The proposed design for the TAP-SSC landfill is even more protective in that a second synthetic liner/leachate system has been included.

COMMENT 127: The hydrogeologic investigation performed by the applicant and used to develop the design did not meet minimum standards required by TDEC to properly characterize the geology and groundwater conditions at the proposed landfill site. As such, the engineering design and the hydrogeologic investigation upon which it is based should both be rejected.

Response 127: *The hydrogeologic investigations performed meet the requirements for a Class II disposal facility.*

COMMENT 128: The hydrogeologic investigation and engineering design failed to recognize the threats associated with the un-reclaimed phosphate strip mine on-site and did not characterize the soil and bedrock conditions that were associated with that strip mine.

Response 128: *The irregular surface and spoils from mining operations will be leveled and re-compacted to meet landfill buffer and liner design criteria.*

COMMENT 129: The groundwater monitoring system is incapable of effectively monitoring preferential pathways atop of and within limestone bedrock, incapable of determining the seasonal high potentiometric surface elevation of the water-bearing zone closest to the liner, and incapable of determining what affects the seasonal high groundwater (including storm flow) will have on the stability of the liner system.

Response 129: *The groundwater monitoring system meets the regulatory requirements for a Class II disposal facility.*

COMMENT 130: The groundwater monitoring system is incapable of determining if contaminants in the groundwater are a result of leakage from the landfill, existing groundwater contamination from the adjacent TAP plant, or from contaminated soil that will be used to construct the liner and geologic buffer. As a result, an extensive investigation should be performed on the proposed landfill property and the adjacent TAP manufacturing plant to delineate the nature and extent of contamination that already exist.

Response 130: *Background groundwater quality will be established before any waste is received at the landfill. Since pre-existing groundwater impacts will be known and accounted for, those impacts will not interfere with proper groundwater monitoring of the landfill.*

COMMENT 131: The proposed engineering design failed to recognize that the site is located in an unstable area as defined by TDEC, failed to determine the potential for subsurface soil collapse beneath the liner, and failed to include any engineering design specifications to mitigate the soil collapse potential.

<u>Response 131:</u> *The potential for unstable areas and subsurface soil collapse has been adequately addressed with a secondary liner system, and base-grade leveling and re-compaction to meet landfill buffer and liner design criteria.*

COMMENT 132: The follow-up Geoprobe hydrogeologic report submitted by TriAD eight (8) months after the hydrogeologic report that was used to design the landfill and almost two (2) months after the public hearing, was insufficient to characterize soil and groundwater conditions and clearly showed unstable geotechnical and geologic conditions beneath the proposed landfill and its associated sediment basin.

<u>Response 132:</u> *The potential for unstable areas and subsurface soil collapse has been adequately addressed with a secondary liner system, and base-grade leveling and re-compaction to meet landfill buffer and liner design criteria.*

COMMENT 133: The proposed liner design and leachate control measures are not adequate to protect groundwater and surface water.

<u>Response 133:</u> *The proposed TAP-SSC Landfill will include a double composite liner and a leak detection layer to prevent leakage. The liner system will consist of the following, from top to bottom:*

- *a 2-foot-thick leachate collection system*
- *a 60-mil HDPE liner*
- *a geosynthetic clay liner*
- *a 60-mil HDPE liner*
- *a 2-foot-thick clay liner*
- *a leak detection layer*

EPA promulgated its Subtitle D landfill design standards with the express goal of protecting human health and the environment. Tennessee's standards are more stringent than the federal standards in that a 5 foot thick compacted clay buffer is also required. The proposed design for the TAP-SSC landfill is even more protective in that a second synthetic liner/leachate system has been included.

COMMENT 134: Waste samples have not been adequately characterized to determine current composition and whether wastes are characteristic hazardous waste. Additional characterizations should be required before TDEC accepts the applicant's claim that the waste is non-hazardous.

<u>Response 134:</u> *TDEC reevaluated the Hazardous Waste Characterization and determined it to be non-hazardous. See Attachment 1.*

COMMENT 135: The engineering design places wastes on top of regulated wetlands and closer than the required stream buffer.

Response 135: *Both TDEC's Division of Water Pollution Control and the U.S. Army Corps of Engineers were consulted regarding wetlands at the site, and both agencies concluded that no jurisdictional wetlands exist at the site.*

COMMENT 136: TAP and SSC have not demonstrated that their waste is not hazardous waste.

Response 136: *The applicant has in fact made the required hazardous waste determination. EPA has promulgated no approved analytical methods for reactive or ignitable solids, and allows for generators to use process knowledge to be used in hazardous waste determination.*

COMMENT 137: The landfilling of these wastes has caused numerous problems, demonstrating that these wastes are hazardous.

Response 137: *While management of salt cake has been problematic, no demonstration has been made that salt cake is hazardous as per the RCRA definition of the term. Tennessee Solid Waste Processing and Disposal regulations have the category of "special waste" which applies to wastes that are difficult or dangerous to manage, and the Division is of the opinion that salt cake qualifies for that classification.*

COMMENT 138: The TAP and SSC waste contains toxic constituents, which should require hazardous waste listing by the Solid Waste Disposal Control Board.

Response 138: *Tennessee's hazardous waste program largely mirrors the federal Subtitle C hazardous waste program, including a mirroring of the federal lists of hazardous wastes, as well as the listing criteria for characteristic hazardous wastes. We have no knowledge of any other state that has ever tried to pre-emptively declare aluminum dross or aluminum salt cake to be a hazardous waste, except Kentucky in 1980, when the Kentucky Department of Environmental Protection (KDEP) submitted a letter to the U.S. Environmental Protection Agency (EPA) requesting an evaluation of salt cake fines in reference to 40 CFR 261.23 (a) (4), hazardous waste characteristic of reactivity. At that time, EPA concluded that the salt cake fines should be regulated as a hazardous waste, based on information supplied by KDEP inspection reports. In 1981, the generator (Barmet Aluminum Corporation) filed a civil action in the United States District Court against the EPA and KDEP, protesting their intent to regulate salt cake fines as a hazardous waste. The United States District Court, Western District of Kentucky handed out a decision on August 5, 1981, declaring that salt cake fines are not a hazardous waste material within the meaning of the Solid Waste Disposal Act, 42 U.S.C.S. 6901, et seq. and KRS Chapter 224. To our knowledge, EPA has not declared that aluminum salt cake is a hazardous waste since that time (1981).*

COMMENT 139: Continued landfilling of salt cake waste is unsustainable and there are recycling and/or reclamation options available.

Response 139: *The landfill permit application has been reviewed and found to be in compliance with the solid waste management rules and regulations for the design, construction and operation of an industrial waste landfill. The Division, while encouraging recycling whenever feasible, has no authority to mandate that any and all recyclable materials be recycled.*

COMMENT 140: DSWM should deny the permit application because of ongoing violations of solid waste laws and regulations by both TAP and SSC.

Response 140: *Ongoing regulatory issues with regards to TAP and SSC at other locations are results of past practices that, at the time, were deemed to be acceptable practices for the management of the wastes in question. The proposed facility design and environmental control measures meet or exceed the current state and federal standards for Subtitle D landfills.*

ATTACHMENT 1

State of Tennessee
Department of Environment and Conservation
Division of Solid Waste Management

DATE: March 3, 2011

TO: Garey Mabry
Program Manager
DSWM Hazardous Waste Program

FROM: Robert S. Nakamoto [Original Signed]
Regulatory Compliance Section
DSWM Hazardous Waste Program

SUBJECT: Review of Waste Determination
Tennessee Aluminum Processors (TAP)
Smelter Service Corporation (SSC)

Attached are review comments on the issue of Aluminum Salt Cake. During this review, I could not identify any information that justified contesting the facility's hazardous waste determination or that warranted requesting any additional data or testing related to their hazardous waste determination. The information submitted and reviewed, along with related information, clearly supports managing the material as a special waste, under Tennessee's solid waste regulations found in Rule Chapter 1200-01-07. My analysis supports that on a practical level, that this is the best option that is most protective of human health and the environment.

Comments on the Hazardous Waste Determination

Who is responsible for the hazardous waste determination? The generator of the waste is responsible.

(b) Hazardous Waste Determination [40 CFR 262.11]

A person who generates a solid waste, as defined in Rule 1200-01-11-.02(1)(b), must determine if that waste is a hazardous waste using the following method:

1. He should first determine if the waste is excluded from regulation under Rule 1200-01-11-.02(1)(d).

2. He must then determine if the waste is listed as a hazardous waste in Rule 1200-01-11-.02(4).

(Note: Even if the waste is listed, the generator still has an opportunity under Rule 1200-01-11-.01(3)(c)to demonstrate to the Commissioner that the waste from his particular facility or operation is not a hazardous waste.)

3. For purposes of compliance with Rule 1200-01-11-.10, or if the waste is not listed in Rule 1200-01-11-.02(4), the ***generator must then determine*** *whether the waste is identified in Rule 1200-01-11-.02(3) by either:*

(i) Testing the waste according to the methods set forth in Rule 1200-01-11-.02, or according to an equivalent method approved by the Commissioner under Rule 1200-01-11-.01(3)(b); or

(ii) Applying knowledge of the hazard characteristic of the waste in light of the materials or the processes used.

4. If the waste is determined to be hazardous, the generator must refer to Rules 1200-01-11-.02, .05, .06, .09, .10 and .12 for possible exclusions or restrictions pertaining to management of the specific waste.

5. This subparagraph does not apply to individual wastewaters streams as described in 1200-01-11-.03(2)(a)2 in cases where the generator makes a hazardous waste determination on the conglomerate flow. A proper determination of the conglomerate flow must include both an evaluation of the hazardous waste characteristics of the conglomerate flow as defined in Rule 1200-01-11-.02(3) as well as an evaluation of the facility's wastewater generating processes to confirm the presence or absence of listed hazardous wastewaters as defined in Rule 1200-01-11-.02(4) in the wastewater.

Regulatory Agency Role
It should be noted that the regulatory agency's role is one of oversight. We do not make the hazardous waste determination, but we are responsible, when we review those waste determinations, for ensuring, to the best of our ability, that they are correct. For example, inspectors will often review hazardous waste determinations during inspections. To that end, additional comments are below.

One characteristic of concern is reactivity.
I have highlighted the areas of potential concern.

Rule 1200-01-11-.02(3)(d)

(d) Characteristic of Reactivity [40 CFR 261.23]

*1. **A solid waste exhibits the characteristic of reactivity if a representative sample of the waste has any of the following properties**:*

(i) It is normally unstable and readily undergoes violent change without detonating.

(ii) It reacts violently with water.

*(iii) **It forms potentially explosive mixtures with water.***

*(iv) When mixed with water, it **generates toxic gases, vapors or fumes** in a quantity **sufficient to present a danger to human health or the environment**.*

*(v) It is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, **can generate toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment**.*

(vi) It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.

(vii) It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

(viii) It is a forbidden explosive as defined in 49 CFR 173.51, or a Class A

> *explosive as defined in 49 CFR 173.53 or a Class B explosive as defined in 49 CFR 173.88 (as those Federal regulations exist on the effective date of these Rules).*

Comments on this characteristics

Numerous documents and sources were consulted. In particular one key source was the May 19, 1980 Federal Register. On page 33109, in regard to the reactivity definition, the EPA stated, ***"This definition was intended to identify wastes which, because of their extreme instability and tendency to react violently or explode, pose a problem at all stages of the waste management process."***

We see that EPA intended this definition to cover waste with "extreme instability" that could "react violently" or "explode". It follows that it was not intended, as a rule, to cover waste that only had moderate or minor instability that when they reacted, did not react violently or explode. Thus, some things that do react would be reactive, while other things that react, because of a slower and lesser rate of reaction, would not meet the reactive hazardous waste definition.

For aluminum salt cake, when it is exposed to water, gases can be emitted and heat can be generated. EPA clarified that in order to meet the legal definition of being a reactive waste, the gases must be emitted in "a quantity sufficient to present a danger to human health or the environment." Again, while aluminum salt cake can emit gases, the rate and quantity does not appear to remotely approach the threshold for being classified as "extremely unstable" or "reacting violently". Like sharps, metal waste, etc. aluminum salt cake does possess its own hazards, but of a quantity insufficient to warrant legal classification as a reactive hazardous waste.

Another characteristic of concern is the characteristic of ignitability.
I have again highlighted the areas of potential concern.

Rule 1200-01-11-.02(b)

(b) Characteristic of Ignitability [40 CFR 261.21]

1. A solid waste exhibits the characteristic of ignitability if a representative sample
of the waste has any of the following properties:

> *(i) It is a liquid, other than an aqueous solution containing less than 24 percent alcohol by volume and has flash point less than 60° C (140° F), as determined by a Pensky-Martens Closed Cup Tester, using the test method specified in ASTM Standard D 93-79 or D 93-80 (see 40 CFR 260.11; Rule 1200-01-11-.01(2)(b)1), or a Setaflash Closed Cup Tester,*

using the test method specified in ASTM Standard D 3278-78 (see 40 CFR 260.11; Rule 1200-01-11-.01(2)(b)1).

(ii) It is not a liquid and is ***capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture*** *or spontaneous chemical changes* ***and, when ignited, burns so vigorously and persistently that it creates a hazard.***

(iii) It is an ignitable compressed gas.

(I) The term "compressed gas" shall designate any material or mixture having in the container an absolute pressure exceeding 40 p.s.i. at 70 [deg] F or, regardless of the pressure at 70 [deg] F, having an absolute pressure exceeding 104 p.s.i. at 130 [deg] F; or any liquid flammable material having a vapor pressure exceeding 40 p.s.i. absolute at 100 [deg] F as determined by ASTM Test D-323.

In the May 19, 1980 Federal Register, on pages 33108 and 33109, EPA commented on slags. They stated:

A number of commenters argued that EPA improperly included in its definition of ignitable solids, wastes such as slags which are liable to cause fires through "retained heat from manufacturing or processing"

EPA agrees that these wastes should not be designated as hazardous and has accordingly deleted the phrase "or retained heat from manufacturing or processing" from the definition of ignitable solids. EPA was originally concerned that wastes such as slags, if placed in a landfill, could present a hazard by raising the temperature of other wastes to their flashpoints. It is now convinced that the likelihood of such high volume wastes being placed in a landfill is sufficiently small as to not warrant their regulation.

On page 33108 EPA also commented:

EPA agrees that the proposed definition of solid ignitable wastes was perhaps imprecise and could stand clarification. It has no intention of designating such things as wastepaper and sawdust to be hazardous and is only interested in capturing the small class of thermally unstable solids which are likely to start fires through friction, absorption of moisture or spontaneous chemical changes. Accordingly, to eliminate any misunderstanding, we have changed the definition of ignitable solid to read ". . .and when ignited burns so vigorously and persistently that it creates a hazard.

Comments
In regard to ignitability, while aluminum salt cake can generate heat when exposed to moisture, it again is on the lower end of being a threat. It must also be noted that aluminum salt cake does not "burn so vigorously and persistently that it creates a hazard". Every material has its own hazards. For example, water is necessary to life but in the wrong place at the wrong time, can pose a threat to human health and the environment. Sawdust, and other similar type flammable dusts, in certain cases are an explosive hazard. Wastepaper, and other materials like dry wood, leaves, etc., if not properly handled, can also be a safety risk. However, these types of materials are not hazardous wastes.

In conclusion, for aluminum salt cake, while it can react it is not a substance of extreme instability nor does it react violently or explode, nor does it burn so vigorously and persistently to create a hazard.

National Consistency
We make a very substantial effort to ensure that our program is consistent with EPA and other states. We are required by our Memorandum of Agreement and related federal and state laws, regulations, and guidance, to maintain a program that is consistent with the federal program. We also value the input and research of other states. We also sometimes review information from other countries to gather ideas on how other countries are handling similar issues.

We do this to ensure our program meets, or exceeds, national standards of environmental protection so as not to make Tennessee a "pollution friendly" state. We also seek to provide a clear and logical framework for the citizens of Tennessee to operate their organizations and businesses in, whose laws and regulations are similar to the federal government and other states. While we have minor differences with EPA and other states in some areas, on the whole our program is operated with strict attention to national standards and guidelines, as well as other state's programs.

In this case, the waste in question is not some newly generated waste that we are reviewing a waste determination on for the first time. Instead, it is a waste with a very long and extensive track record of analysis and review. In the past thirty years, aluminum dross and aluminum salt cake have not been classified as a hazardous waste. These waste determinations have been reviewed numerous times by EPA and many other states. These agencies have evaluated whether aluminum salt cake was a reactive or ignitable waste.

Aluminum recycling is a widespread activity in the U.S. While we acknowledge that this material must be handled with adequate precautions, we are forced to conclude that for any state agency to classify it as a hazardous waste would not only be inconsistent with the regulatory definition, but would also be in direct opposition to thirty years of federal reviews and reviews by numerous states.

Such an unsupportable decision could not survive a legal challenge and would be inconsistent with the national program and federal guidance.

Solid Waste and Practical Concerns
Tennessee recognizes that some solid waste, while not meeting the legal or practical definition of being a hazardous waste, can be difficult or dangerous to handle. Tennessee's Solid Waste Regulations in Rule 1200-01-07-.01(2) states, *"Special Wastes" are solid wastes that are either difficult or dangerous to manage and may include sludges, bulky wastes, pesticide wastes, medical wastes, industrial wastes, hazardous wastes which are not subject to regulations under Department rules 1200-01-11-.03 through 1200-01-11-.07, liquid wastes, friable asbestos wastes, and combustion wastes.*
Aluminum Salt Cake clearly falls under the Tennessee definition for being a special waste.

Tennessee's Solid Waste Program, recognizing the need for safely handling of this special waste has made provisions to ensure the waste is properly managed. The briefings that I have attended clearly support that our Solid Waste Program's staff has taken the proper steps to work with facilities that generate and handle this material to protect human health and the environment. The steps that the involved parties have taken appear to be nearly equivalent to the steps that would be required under Subtitle C (the hazardous waste regulations).

On a practical level, no advantage would be gained by managing the material as a hazardous waste. Instead, the cost would rise, and vast amounts of fuel and labor would be needlessly wasted transporting the waste to a hazardous waste facility. In a worst case scenario, the added cost could force a shut down of the facility, damaging the national recycling effort. Recovering aluminum from scrap uses 95% less energy than is used to produce aluminum from ore. *"It consumes 17 times less energy; it emits 17 times less pollution to the atmosphere; it generates between five and nine times less solid wastes, and it consumes 35 times less water."* (Management of the Salt Cake Generated at Secondary Aluminum Melting Plants by Disposal in a Controlled Landfill, by A. Gil, Department of Applied Chemistry, Public University of Navarre, Pamplona, Spain).

One of the major benefits of the recycling is typically preserving natural resources and reducing pollution. Thus, safe and legitimate recycling is vital to sustainability goals. If this area of recycling was discontinued, and equivalent production of aluminum from ore continued, tremendous amounts of energy and water would be used that were not previously used, and waste generation and air pollution would substantially increase.

Public Safety

Managing the material near the point of generation by qualified personnel who are intimately familiar with how to safely handle the material, and who have a very strong vested interest in avoiding any potential incidents, is vastly safer compared to trucking it hundreds of miles and periodically managing it on the side of the road due to a spill or at a traffic accident. Putting this bulky and heavy material on the highway would increase the chance of it being involved in traffic accidents or spills, or accidents related to the unnecessary increase in truck traffic flow. In addition, if any incidents did occur, qualified personnel are available at the production facility, and in the local and state emergency agencies and firms, to address those incidents. Thus, it is much safer for the public, and the environment, to handle the material near the point of generation. No incidents are expected, but if they did occur, qualified personnel who are intimately familiar with how to respond, and how not to respond, would be utilized versus an incident occurring on a crowded highway hundreds of miles away where the emergency responders may be encountering aluminum salt cake for the first time.

Future Recovery

At some future point, technology and/or circumstances may provide a means and adequate incentive for recovering more materials from the salt cake. Such research is on-going. If that occurs, having the material near the point of generation would greatly facilitate recovery at a future date. The material in question will be going into a mono-fill landfill, near the processing facility, thus greatly facilitating the possibility of future recovery. If it went to an off-site landfill there is a high probability it would be managed with other materials complicating the possibility of future extraction. The distance from the processing facility would also drastically reduce the practicality of future recovery.

Conclusion

Therefore, legally and practically, these materials are Subtitle D wastes, but are to be managed in way that the overall protections are equivalent to, or greater than, Subtitle C, and in a manner to facilitate the possibility of future recovery, that is more protective of human health and the environment than would be management under Subtitle C.

Documents Utilized
Besides applicable federal and Tennessee regulations and statutes (to include U.S. DOT regulations on hazardous materials), below is a partial list of the materials that were reviewed:

January 28, 2011 Letter from M. Clark Spooden, Stites & Harbison, to Joe Sanders, General Counsel, TDEC.

January 26, 2011 Hazardous Waste Determination for Salt Cake, by John E. Pugh, Executive V.P. of Business Development, Smelter Service Corporation (SSC).

January 26, 2011 Hazardous Waste Determination for Bag-House Dust, by John E. Pugh, Executive V.P. of Business Development, Smelter Service Corporation (SSC).

January 31, 2011 E-mail from Dwight Hinch to Chuck Head, TDEC, on waste determination procedures

December 8, 2010 EHow article, "Environmental Problems Associated With Recycling Aluminum"

September 2010 EPA Notice on Clean-up of Smokey Mountain Smelters

September 2010 article, "Management of the Salt Cake Generated at Secondary Aluminum Melting Plants" by A. Gil and S.A. Korili, Department of Applied Chemistry, Building Los Acebos, Public University of Navarra, Campus of Arrosadia, Pamplona, Spain.

August 10, 2010 Article from www.firelink.monster.com, "NIOSH Finds Department at Fault for 2009 Death of Firefighter".

May 17, 2010 State of Wisconsin, Department of Justice, report on an aluminum related fire, "St. Anna Firefighter Death, AI-09-5094."

March 30, 2010 MSDS by Alcoa on "Aluminum Dross with Low Beryllium"

March 3, 2010 Knox News article, "EPA to clean up abandoned aluminum smelter in Vestal"

January 28, 2010 CantonRep.com article, "Lawsuit claims American Landfill accepted aluminum dross waste"

January 26, 2010 September 21, 2009 EPA Information Website on Fort Hartford Coal Co. Stone Quarry

January 26, 2010 Beacon Journal article, “Suit alleges second Stark landfill has problems with aluminum wastes.”

December 21, 2009 TDEC Memorandum on Smokey Mountain Smelters

December 8, 2009 Ohio EPA Press Release on a site that had stockpiled aluminum dross

December 2009, Ohio EPA report on Newark Processing site (stockpiled dross at a bankrupt site).

November 2009, Macquarie Harbour Mining briefing on production and recycling of aluminum salt slag

July 19, 2009 CantonRep.com article, “Ohio EPA employee claims colleagues sought to protect Countywide landfill

December 1, 2008 MSDS by Kaiser Aluminum on “Mixture of Aluminum and Alloy Metals, Oxides and Salts.

April 10, 2008, U.S. EPA Administrative Settlement Agreement and Order on Consent for Removal Action with Republic Services of Ohio, LLC in regard to Countywide Recycling and Disposal Facility, East Sparta, Stark County, Ohio

March 22, 2007, EPA Letter, Jose Cisneros, Chief, Region 5 Waste Management Division, to Kurt Princic, Ohio Environmental Protection Agency

October 9, 2006 Washington State Department of Ecology report, “Interim Remedial Action Plan Ramco Aluminum Waste Disposal Site Port of Klickitat Industrial Park Dallesport, Washington”.

September 21, 2006, Indiana Department of Environmental Management, Secondary Aluminum Waste Advisory to Municipal Solid Waste Landfill Owners/Operators

September 6, 2006, Ohio EPA Press Release, “Ohio EPA Declares Countywide Landfill a Public Nuisance”

September 2006 ATSDR Public Health Statement on Aluminum

2006, Journal of Minerals & Materials Characteristics & Engineering, Vol. 5, No. 1, pp 47-62, “Recovery of Metals from Aluminum Dross and Saltcake” by J.Y. Hwang, X. Huang, and Z. Xu.

September 1, 2004, MSDS by W Wise Alloys on Aluminum Dross

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October 18, 2001 MSDS by Spectro Alloys Corp., “Aluminum Dross & skimmings”.

October 2001, U.S. EPA Guidance Document, “Current Perspectives in Site Remediation and Monitoring, the Relationship Between SW-846, PBMS, and Innovative Analytical Technologies

February 22, 1999 Science Daily article, “Aluminum Wastes Could Soon be Converted to Commercial Use”

November 1997 Institute for Prospective Technological Studies, “The Legal Definition of Waste and its Impact on Waste Management in Europe” EUR 17716 EN

November 15, 1996, “Hazardous Waste Characteristics Scoping Study”, U.S. EPA, Office of Solid Waste (OSW)

September 1995 U.S. EPA Sector Notebook, “Profile of the Nonferrous Metals Industry”

December 14, 1994, EPA Superfund Record of Decision, Brantley Landfill, Island, Kentucky, EPA ID: KYD980501019

March 7, 1991 Court Case, “Barmet Aluminum Corporation v. Reilly”

February 7, 1989 EPA Letter from Sylvia K. Lowrance to Robert A. Gallaher on re-use of dross from secondary aluminum smelting operations.

July 1982, Draft Final Report, “Industrial Resource Recovery Practices: Metals Smelting and Briefing prepared for U.S. EPA by Franklin Associates, LTD.

Aluminum Recycling Casebook by the Aluminum Association.