DRAFT 9-29-08

Tronox Revised Approach to Phase B Site Investigation

Comments received from the Nevada Division of Environmental Protection (NDEP) on the four draft Phase B Site Investigation Area Work Plans have significantly increased both the number of samples to be collected and chemical analytes to be tested. The estimated cost for the increased scope is about $1.3 million. Tronox has reserved $6.2 million to perform the Phase B work and faces difficult financial issues which preclude increasing the budget.

To stay within approved financial reserves, Tronox is proposing several adjustments to the work plans. The adjustments range from employing less costly methods for collecting some of the soil samples to limiting sampling in areas of the site not being proposed for closure. Each proposal is discussed in more detail below. The full list of proposed sample plan adjustments includes:

1. Use a Geoprobe™ to collect proposed soil samples at depths of 0-0.5 and 10 feet below ground surface (bgs).
2. Supplement ENSR data validation with services provided by LDC.
3. Limit samples to be analyzed for Organic Acids by Conceptual Site Model (CSM) review.
4. Limit the number of PCB congener analyses by CSM review.
5. Reduce the number of samples for Organophosphorus Pesticides (OPPs) and Organochlorine Pesticides (OCPs) by CSM review.
6. Reduce the number of soil samples collected between 10 feet bgs and the capillary fringe.
7. Limit sampling in Area III production areas, where closure is not being requested.

1 - Geoprobe™ Sampling

Recent Geoprobe™ experience with soil-gas sampling demonstrated rapid set-up and penetration of alluvial soils. Tronox proposes to utilize Geoprobe™ equipment to collect 0.5 and 10 foot bgs soil samples. The soil gas investigation demonstrated that it is very possible that this equipment could reach the target depth of 10 feet bgs. As in the original work plans, Sonic rigs will be utilized to collect deeper soil samples and in any locations where the Geoprobe™ fails to reach the desired depth. A standard operating procedure for this work will be developed and provided in the final submittal to NDEP.

2 – Supplement Data Validation

Tronox proposes to utilize Laboratory Data Corporation (LDC) in validating sample results. ENSR will coordinate the work and will work with LDC to streamline the Tronox validation process.

3 – Limit samples to be analyzed for Organic Acids (OAs) by CSM review

While OAs are not on the Tronox list of Site Related Chemicals. NDEP has requested OA analysis in many samples to determine whether OAs are migrating onto the Tronox site from the west. As shown on **Figure 1** (attached) Tronox proposes to limit expensive OA soil analyses largely to Areas I and IV, along with the Beta Ditch. Soil sampling in Areas II and III will be limited to areas where acid and storm drain systems may possibly have carried OA constituents onto the site from offsite sources. **Figure 3** shows the well locations where OAs will be analyzed in the groundwater samples collected during the Phase B investigation.

4- Limit the number of PCB Congener Analyses by CSM review

In work plan comments, NDEP has expressed concerns that PCBs may have been generated in the electrolytic processes employed on the Tronox site. NDEP has requested use of PCB method 1668 ($970 per sample) for congener analysis in addition to PCB method 8082 ($75 per sample) for Arochlor analyses. Tronox has reviewed the electrolytic processes employed at the site **(see Attachment A)** and finds no mechanism by which benzene ring compounds needed for PCB formation would be present in the electrolytic cells. Accordingly, Tronox proposes to limit the number of samples analyzed by method 1668 to those shown on **Figure 2.**

5 – Limit the number of Organophosphorous and Organochlorine Pesticide Analyses by CSM Review

Other than Hardesty Chemical, which may have produced DDT and its degradation products on the Tronox site, Tronox knows of no other pesticide production. Accordingly, as shown on **Figure 1**, proposed sampling for OPPs and OCPs has been scaled back from the extensive sampling NDEP requested. **Attachment B** includes the rationale for proposed sampling. **Figure 3** shows the well locations where OCPs and OPPs will be analyzed in the groundwater samples collected during the Phase B investigation.

6 – Reduce the number of soil samples collected between 10 feet bgs and the capillary fringe.

Tronox proposes to collect soil samples at the surface (0-0.5 feet) and 10 feet bgs to evaluate the direct contact risk pathway and determine whether site related chemicals

are migrating downward toward groundwater. Soil sampling at the capillary fringe (two feet above the water table) will determine whether constituents migrating with groundwater are being sorbed onto soils. However, rather than sampling every 10 feet between 10 feet bgs and the capillary fringe, Tronox proposes to reduce the sampling frequency. Collection of samples at 10, 25, and 40 feet is proposed. Where the distance between the 10 foot sample and the capillary fringe are less than 20 feet, it is proposed that no intermediate sample be collected.

7- Limit Sampling in Area III production areas, where closure is not requested.

In the draft Area III work plan submitted to NDEP, Tronox proposed judgemental sampling in production areas (South of F Street) while suggesting that future closure sampling could be limited to those analytes associated with the production processes. NDEP responded that it "did not necessarily concur" with the approach and would review the issue at the time of closure. To avoid duplication of sampling costs, Tronox suggests that since closure is not now being requested for the production areas, judgemental sampling be can be delayed until closure is required. Random grid samples in the production area will be collected and analyzed.

Conclusion

Adoption of the seven approaches suggested above will offset costs associated with expanding scope required by NDEP for the Phase B investigation.

Attachment A - Tronox Electrolytic Cells Did Not Produce PCBs

Tronox has operated and continues to operate electrolytic cells on the Henderson Site (Site). The Nevada Division of Environmental Protection (NDEP) has questioned whether the Tronox electrolytic cells could generate Polychlorinated Biphenyl compounds (PCBs) and has requested that Tronox sample for PCB congeners using analytical method 1668A along with using method 8082A for Arochlor PCBs. Tronox maintains that the electrolytic cells utilized at the Site do not generate PCB congeners (please see the additional information below). Tronox proposes that use of PCB analytical method 1668A should be limited to samples from the west side of the Site, where NDEP believes that PCB congeners generated off-site are entering Tronox property. Arochlor PCBs associated with electric transformers have been used at the Site and a spill of PCB transformer oil has been reported. Tronox therefore proposes to utilize method 8082A for Arochlor PCBs for Phase B Site Investigation samples.

Tronox and its predecessors have operated several types of electrolytic cells on the Site since the 1940's. These include:

- Sodium chlorate cells converting NaCl to $NaClO_3$
- Sodium perchlorate cells converting $NaClO_3$ to $NaClO_4$, and
- Manganese cells plating MnO_2 from manganese sulfate solutions.

The manganese dioxide cells in Units 5 and 6 (LOU 44) are the only electrolytic cells currently in operation at the Site. Associated conveyance lines from the processes in Units 5 and 6 to Mn-1 Pond (LOU 20) are also currently in operation.

PCB congeners are formed by reaction of chlorine with biphenyl (a molecule containing two joined benzene rings). While both the sodium chlorate and sodium perchlorate cells generated free chlorine (a degradation product of sodium hypochlorite, an intermediate compound in the electrolytic operation), neither process utilized organic compounds that could produce benzene ring structures which could then be chlorinated to PCBs. Graphite electrodes were used in early chlorate and perchlorate cells, but they are not associated with benzene ring structures. Similarly, urea ($(NH_2)_2CO$) was used to decompose hypochlorite in the chlorate and perchlorate processes, but the carbon atom in urea would not generate benzene ring structures associated with PCB formation. Currently, the manganese dioxide electrolytic cells operate on a sulfate solution and do not generate free chlorine. While the manganese cells are covered with a layer of paraffin wax to minimize evaporation, the organic wax does not come into contact with chlorine to generate PCB congeners; therefore, PCB analysis in borings associated with Units 5 and 6 and Mn-1 Pond are not required.

Tronox Rationale for Proposed PCB Sampling

Based on the discussion above, suspected PCB impacted locations, and NDEP requests, the following locations of the Tronox Facility will be sampled for PCBs.

- Soil borings along the western property boundary will be sampled for PCBs where NDEP believes that PCB congeners generated off-site are entering Tronox property. LOU 5 – Beta Ditch will also be tested for PCBs since off-site wastes entered the Tronox facility via this pathway.
- Soil borings associated with LOU 27 – PCB Storage Area, LOU 40 – PCB Transformer Spill will be sampled for PCBs.
- Per NDEP's request, soil borings located near the WAPA site will be sampled for PCBs.

NDEP has requested a specific list of borings to be sampled for PCBs, however, some of these borings have already been drilled as part of the Area I Phase B source area investigation, were found to be in areas not associated with PCBs (as discussed above), or were a bit excessive. Figure 2 shows the soil borings proposed by Tronox to be analyzed for PCBs.

The following borings requested by NDEP have already been drilled: RSAN2, RSAO2, SA57, SA48, SA180, and RSAO4.

Tronox is proposing that the following borings requested by NDEP not be sampled for PCBs: SA35, SA70, SA175, SA155, SA107, SA158, SA62, SA145, SA61, SA144, SA71, RSAM8, RSAN7, SA151, SA208, SA31, SA122, SA34, SA177, SA68, SA59, and RSAT6.

Sampling Program Rationale

Two sampling programs for PCBs are proposed and are based on locations with the potential for head and locations where surface and/or groundwater impacts may be present.

<u>Locations with Surface (0.5 feet bgs), Mid-Point, and Capillary Fringe Sampling Depths</u>
Locations with potential head are considered to be areas where percolating fluids have had the potential to facilitate downward migration of constituents in the soil column. Locations with the potential for head include:

- LOU 5 – Beta Ditch,
- LOU 35 – Truck Dumping Area,
- LOU 59 – Storm Sewer System, and
- LOU 60 – Acid Drain System.

These locations are associated with potential off-site sources. Select soil borings associated with these locations will be sampled at surface (0.5 feet below ground surface), mid-point, and capillary fringe depths. Select soil borings along the western property boundary will also be sampled at surface, mid-point, and capillary fringe depths. The red dots on Figure 2 show the proposed PCB boring locations with the above mentioned sampling depths.

Surface (0.5 feet bgs) and Capillary Fringe Sampling Depths

At locations where surface and/or groundwater impacts may be present, due to wind blown sediments and/or groundwater migration, samples will be collected at surface (0.5 feet bgs) and capillary fringe depths. Figure 2 shows the proposed PCB boring locations.

PCB Arochlor and Congener Analysis

All sample locations will be tested for Arochlor PCBs by EPA Method 8082. Tronox proposes limited analysis of samples for Arochlor and Congener PCBs by EPA Methods 8082 and 1668A, respectively. Proposes sample locations for PCBs are shown on Figure 2 (Attached). Locations proposed for 1668A analysis include:

- two locations within the Beta Ditch (LOU 5),
- one location in the former Truck Dumping Area (LOU 35) along the western property boundary,
- one location within the PCB Storage Area (LOU 27), and
- two locations at the PCB Transformer Spill (LOU 40).

Attachment B - Rationale for Proposed Tronox OPP, OCC and Organic Acid Sampling

The Tronox Site is not known to have supported production of organophosphorus pesticides (OPPs) or Organic Acids (OAs). Pesticides thought to have been produced on the Site are associated with the Hardesty Chemical lease (LOU 4), where DDT may have been produced (though production records are not available for the operation). Possible migration of OPPs and OAs from sources off-site to the west prompted NDEP in its July 21, 2008 letter, to request sampling for OPPs and organic acids in over sixty borings and numerous groundwater samples. Costs for these combined analyses exceed $220,000. Tronox proposes to demonstrate from the Conceptual Site Model, that a much reduced number of samples is adequate to characterize OPPs and OAs at the Site.

NDEP requested OPP and OA analyses in soil borings and groundwater samples in and downstream of Beta Ditch (LOU 5), the Storm Drain System (LOU 59), and the Acid Drain System (LOU 60). Each of these LOUs will be considered below:

- LOU 5 Beta Ditch – Waste discharges from the various BMI complex companies operating to the west of the Tronox Site flowed across the Site in the Beta Ditch. Some of these flows may have contained OPPs and OAs and therefore some infiltration of these contaminants into soils below the Beta Ditch is possible. Similarly, groundwater moving north-northeast from the area west of the Site may have carried contaminants onto the Site. Tronox proposes to sample soils and groundwater along the path of the Beta Ditch for OPPs and OAs. As any seepage from the Beta Ditch would pass downward toward groundwater, soil samples will be collected from the elevation at the bottom of the Beta Ditch to the groundwater capillary fringe. Soil borings north of the Beta Ditch will be sampled at the capillary fringe for OPPs and OAs. Groundwater in the alluvium along the west side of the Site is effectively separated from groundwater on the eastern portion of the Site, by a Muddy Creek “high”. Tronox proposes to sample groundwater wells screened in the alluvium along the western edge of the site. Groundwater in the upper portion of the Muddy Creek formation will also be sampled at wells.

- LOU 59 Storm Drain System – As shown on Figure 1 (Attached) the gravity flow Storm Drain System picked up water from the area west of the Site and carried it north, moving east to 6th Street, and then north to the Beta Ditch. Since the drain lines slope to the north, it is highly unlikely that water would flow in directions opposite the flow arrows shown on the Figure. Accordingly, Storm Drain

locations east of 6th Street (between Units 1 and 2) are not likely to carry constituents from the west. Also, the depth to groundwater in the area of the Unit buildings is about 40 feet, much lower than the elevation of the storm drain piping. Movement of water from groundwater to the piping is therefore not possible. Accordingly, Tronox proposes to sample groundwater wells west of 6th Street for OPPs and OAs. In the area south of Beta Ditch and east of 6th Street, groundwater sampling for OPPs and OAs is not proposed.

- LOU 60 Acid Drain System – The same argument presented above for LOU 59 applies to LOU 60 and similar sampling for OPPs and OAs is proposed. Since the Acid Drain System is located significantly above the current and past water tables, entry of OPPs and OAs from west of the Site into the Acid Drain System would be limited to the line running from the southern end of the site northward along 5th Street. That line then runs parallel to the acid drain piping north of Unit 1, draining eastward to 9th Street then north to the conveyance leading to the former Trade Effluent Ponds (LOU 1). Since the source of OPPs and OAs from companies to the west of the Tronox Site was located in the northwest portion of the Olin Site, it is unlikely that OPPs and OAs were piped south (up hill) to an Acid Drain System inlet. Accordingly, Tronox proposes to sample for OPPs and OAs along the western edge of the Site in Area I and IV.