

# **H. 532 Section 5 Study**

## **Monthly Progress Report September 2007**

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## Background and Introduction

The Section 5 study is being conducted in two Phases. Phase I of the Section 5 Study was completed in January 2007, culminating in a detailed Phase I project report. Phase I focused on the assessment of existing data and studies, and led to the identification of new data to be collected in Phase II. The current stage of the Section 5 Study involves continued data collection and interpretation, leading to an holistic assessment of environmental and public health impacts.

Progress this month, and plans for future work, are as follows.

## Oversight Team Meeting

On September 17, 2007, we met with members of the Oversight Team (O.T.) and other interested parties. (See <http://www.omyainvermont.net/docs/Section%205%20Updates/09.17.07.Sect5-Mtg-Agenda.pdf> for this meeting agenda). Notes of the meeting will be posted following O.T. review and approval.

## Hydrogeology and Surface Water

Groundwater level measurements made in August were reviewed in conjunction with data from drilling logs, geophysical logs, and well-yield records. Taken together, the data continue to indicate a pattern of converging groundwater flow from the tailings management areas (TMAs) toward the center of the site, continuing on to the north.

Water-level data from the Pittsford Italian Quarry (PIQ), and data from existing and new wells on the downgradient northern end of the site, indicate that a portion of site groundwater flows to the PIQ (due both to the presence of the open quarry *per se*, and to active pumping therefrom).

Analytical results for flotation agent constituents in groundwater monitoring wells, on-site surface water, off-site residential wells (near the Verpol Plant), surface water at the Hogback Quarry, and residential wells near the Hogback Quarry were received. In one groundwater sample (from Well 2), the laboratory reported finding 52 µg/L of tall oil hydroxyethylimidazoline (TOHI) and 41 µg/L of aminoethylethanolamine (AEEA). Given poor recovery of AEEA from site samples, we estimate that the true value is closer to 100 ppb. AEEA was also detected in the PIQ surface water, at concentrations of 100–200 µg/L. No flotation agent constituents were detected in any other samples.

Low concentrations of stearic acid were found in four on-site monitoring wells, the PIQ quarry, and the Crusciel Spring.

Petroleum hydrocarbons were detected at low levels in four on-site monitoring wells.

Dissolved iron was detected in both on-site monitoring wells and off-site residential wells. Concentrations in residential wells were typically in the range of 400-500 µg/L. Concentrations in on-site monitoring wells ranged from 430 to 25,000 µg/L. The highest iron concentrations were measured in samples collected immediately adjacent to the TMAs.

Dissolved manganese was detected in both on-site monitoring wells and at one off-site residential, nondrinking water well (the Eugair Barn well, at 39 µg/L). Concentrations in on-site monitoring wells ranged from 0.9 to 3,000 µg/L. As with iron, the highest manganese detects were found in wells immediately adjacent to the TMAs.

Arsenic was detected in on-site and off-site groundwater. Concentrations in off-site residential wells ranged from non-detect to 2.1 µg/L. Concentrations in on-site monitoring wells ranged from non-detect to 24 µg/L. The highest arsenic concentrations (from 10–24 µg/L) were measured in monitoring wells B, E, F, and M.

On September 17, additional samples were collected for perchlorate analysis from the Hogback quarry sump, both surface water discharge locations (north and south) from the quarry, and Otter Creek. Otter Creek was sampled at two locations downgradient of the Pittsford Florence Water District (PFWD) supply well and one upgradient location. We could not access the PFWD supply well itself that day; instead, under our direction, Bruce Babcock (Pittsford Water and Sewer Superintendent) sampled it two days later. The results are as follows:

| Sampling location               | Perchlorate in water ( µg/L) |
|---------------------------------|------------------------------|
| Hogback Sump                    | 0.44                         |
| Hogback HB-1                    | 0.49                         |
| Hogback HB-2                    | 1.5                          |
| All three Otter Creek locations | Not detected                 |
| PFWD (before treatment)         | 0.13                         |

### Hazardous Air Pollutants (HAPs)

The Phase II HAP Modeling Study is designed to assess potential exposures to pollutants in ambient air due to releases from Omya’s manufacturing processes. The focus on HAPs began with the identification of several HAPs in East Plant stack testing undertaken by Omya’s consultants during an investigation of odors. Our Phase I

evaluation suggested that HAP emissions present no significant risks to human health, but we had been unable to reach definitive conclusions due to the lack of information on emissions from the larger Verpol Plant.

Similar to our Phase I evaluation, the Phase II study has estimated concentrations HAPs in ambient air in the neighborhood and has evaluated these concentrations against toxicological data and regulatory standards. Subject to additional checking and evaluation, our results at this point indicate no significant health risks to neighbors from exposure to Omya's HAP emissions.

Both the Phase I and Phase II HAPs studies include compounds that are on the U.S. EPA's list of 188 HAPs compounds, on Vermont's list of Hazardous Air Contaminants (HACs), and other compounds that were found or are expected to be part of emissions from Omya's process and combustion sources. For simplicity, all the compounds assessed in these studies are referred to as HAPs, regardless of whether they are part of the EPA's official list.

The Phase II emissions and dispersion modeling follows standard procedures for estimating nearby ambient concentrations of compounds emitted from a point source: (1) Concentrations of the compounds of concern are measured in a stack test, (2) emission parameters such as exit velocity and temperature, and stack diameter and height are measured, (3) meteorological and topological data are assembled, and (4) atmospheric dispersion modeling is performed using these data.

The toxicological evaluation of the modeled HAPs concentrations is described in the Toxicology/Health Risk Assessment section below. Additional information on the HAPs study and modeling work will be provided at the Oversight Team meeting anticipated in mid-November, and the complete details of our study will be provided in the Section 5 Study Phase II report.

### **HAPs emissions and dispersion modeling**

Our Phase I HAP study was based primarily on emissions testing of Omya's East Plant Flash Dryer and Treater conducted in June 2006. The Phase II study includes the results of these tests as well as results of emissions testing conducted by Omya on process-related sources at the Verpol Plant in August and December 2006. The tests were performed on the Verpol spray dryer, flash dryers 1 & 2, Evaporator A, Surface Treater B, PX mills 4500B, 7000F, and 9000M and L. The test methods included California Air Resources Board (CARB) test 430 for aldehydes, U.S. EPA SW-846 Sampling Method 0030 using the Volatile Organic Sample Train (VOST), and U.S. EPA SW-846 Sampling Method 0010 for semi-volatile organics. The new testing indicates that HAPs emissions from the Verpol Plant are similar to current emissions at the East Plant (with its July 2006 process modification).

During the stack testing, elevated levels of some compounds (notably formaldehyde, acetaldehyde, acrolein, benzaldehyde, and acetone) were detected in various blank samples. We decided to perform emissions modeling without correcting for the blank levels, thus over-predicting concentrations of some HAPs. Because the maximum modeled impacts of these compounds were not in excess of levels of regulatory or toxicological concern, blank corrections were not subsequently performed.

Previous HAPs studies conducted in 2006 by TRC Environmental Corporation were aimed at identifying potential exceedances of Vermont's regulatory limits. Vermont Air Pollution Control Regulations exempt emissions from "fuel burning equipment that combusts virgin liquid or gaseous fuels." Our analysis, however, does not exempt such emissions. Instead, we quantify these emissions and add them with process emissions to assess total ambient air impacts.

Because the August and December 2006 tests did not include emission from all of the stacks and vents at the Verpol Plant, we needed to estimate untested source emissions. We did so by assuming that production sources that perform similar operations under similar operating conditions (*e.g.*, temperature and processed compounds) emit HAPs at similar rates, when scaled by the relative rates of product being processed in each device. For example, the measured HAPs concentrations in the emissions from Verpol Spray Dryer 1 were assumed to also be present in the emissions from Spray Dryer 2; and because Spray Dryer 2 operates at only 80% the production rate of Spray Dryer 1, the emission rate for each compound from Spray Dryer 2 was assumed to be 80% of the emission rate from Spray Dryer 1.

No HAPs testing has been performed on emissions from the cogeneration plants and back-up diesel generators. Therefore HAPs emissions from these sources were estimated using U.S. EPA emissions factors, which are based on tests of similar sources. Because most emissions from these sources are small relative to the process related emissions, the use of emission factors rather than measured emission rates does not introduce significant uncertainties into the overall results.

Compounds detected in some, but not all of the tests for a process source were assumed to be present at one-half of the lower limit of detection when not detected. In all, 41 compounds were detected in some on-site test and were therefore included in the HAPs modeling for the process sources. The relevant EPA emission factors for oil combustion sources contain 34 compounds of concern, 10 of which are also among those measured in the process emission testing. Therefore 65 compounds were included in our emissions and ambient air impact modeling.

Annual-average emission rates from the process-related sources were assumed conservatively to occur during every hour of the year at the rate measured during the stack testing. Annual-average emission rates from the non-process, oil-combustion sources were estimated based on Omya's Vermont Air Pollution Control Permit limits for

oil consumption or hours of operation. For short-term (*i.e.*, 1-hour or 24-hour average) emission rates from the oil-combustion sources, it was assumed that all of the sources were in operation at once. This is a conservative assumption that likely overestimates actual releases.

Dispersion modeling of these emissions was performed using the U.S. EPA's ISCST3 model based on five years of hourly meteorological data collected at the Burlington VT Airport. Dispersion modeling receptor and terrain data compiled by TRC as part of their 2006 HAPs study of the East Plant were used. Receptor locations were placed on a cartesian grid spaced every 50 meters within a 6-kilometer square centered on the facility, and every 100 meters outside this area within a 10-kilometer square. An additional 128 receptor locations, spaced every 50 meters, were included in the modeling to be located on the Omya's property boundary or fence line. The locations of the 45 actual residences (as opposed to theoretical receptors) nearest to the Omya facilities were taken from the September 2004 dust modeling study conducted by Resource Systems Group, Inc. (RSG). Overall, then, 20,120 modeling receptor locations were evaluated.

Dispersion modeling of long-term ambient air concentrations was performed assuming a unit emission rate (*i.e.*, one gram per second) from each emission source, and then the annual-average, normalized concentration at each receptor (in units of  $\mu\text{g}/\text{m}^3$  ambient air concentration per gram/second emission) was multiplied by the emission rate of each HAP (in units of grams/second), to give annual-average concentration estimates for each HAP. Modeling for short-term impacts was performed for the subset of HAPs most likely (based on standard screening analyses) to pose short-term risks. There were five such compounds: formaldehyde, acrolein, beryllium, copper (all modeled for maximum 1-hour impacts) and acetone (modeled for maximum 24-hour impacts).

The maximum modeled annual-average concentrations of selected HAPs are shown in Table 1. The maximum modeled concentrations are compared against the concentrations estimated as part of the Phase I report, Vermont's Hazardous Ambient Air Standards (HAAS), and background concentrations modeled in U.S. EPA's 1999 National Air Toxics Study. Although the Phase II maximum modeled concentrations are greater than the Phase I estimates, they are still acceptably small.

Table 2 lists the maximum modeled short-term concentrations of the HAPs assessed for potential short-term health risks. No short-term HAPs modeling was performed in the Phase I report, and none of these compounds are included in Vermont's current list of short-term HAAS values. The EPA's NATA study does not include estimates of short-term concentrations. Discussion of the toxicological significance of these results is included below. Complete modeling results for all HAPs will be included in the final Phase II report.

**Table 1. Modeled annual-average ambient concentration estimates of selected Hazardous Air Pollutants (HAPs)<sup>A</sup> and Hazardous Air Contaminants (HACs)<sup>A</sup>.**

| Chemical (HAP/HAC) | Maximum modeled concentration off-property ( $\mu\text{g}/\text{m}^3$ ) |                  | Vermont Hazardous Ambient Air Standard (HAAS $\mu\text{g}/\text{m}^3$ ) <sup>B</sup> | EPA's Modeled Background Level from the 1999 National Air Toxics Study ( $\mu\text{g}/\text{m}^3$ ) |
|--------------------|---|------------------|--|---|
|                    | Phase II modeling   | Phase I estimate |  |   |
| Formaldehyde       | 0.051   | 0.003 – 0.013    | 0.078  | 0.68  |
| Acetaldehyde       | 0.16  | 0.002 – 0.01     | 0.46   | 0.63  |
| Acrolein           | 0.010   | 0.001 – 0.005    | 0.02   | 0.013   |
| Propionaldehyde    | 0.007   | 0.001 – 0.002    | –  | 0.035   |
| Arsenic            | 0.00005   | – <sup>C</sup>   | 0.00023  | 0.000008  |

<sup>A</sup> Hazardous Air Pollutants (HAPs) are designated by the U.S. Environmental Protection Agency and Hazardous Air Contaminants (HACs) are designated by the Vermont Agency of Natural Resources.

<sup>B</sup> Promulgated under §5-261 of the Vermont Air Pollution Control Regulations. Values reflect an annual averaging period. Values for acetaldehyde and acrolein are proposed but not yet promulgated.

<sup>C</sup> Arsenic concentrations were not estimated in the Phase I Report.

**Table 2. Modeled short-term ambient concentration estimates of select Hazardous Air Pollutants (HAPs) and Hazardous Air Contaminants (HACs).**

| Chemical     | Maximum modeled concentration off-property ( $\mu\text{g}/\text{m}^3$ ) | averaging period |
|--------------|---|------------------|
| Formaldehyde | 3.7   | 1 hour           |
| Acetone      | 5.9   | 24 hours         |
| Acrolein     | 1.0   | 1 hour           |
| Beryllium    | 0.0043  | 1 hour           |
| Copper       | 0.0085  | 1 hour           |

Overall, the HAPs modeling results indicate that compounds of concern emitted from Omya's operations do not threaten the quality of local ambient air.

## Ambient Dust

Collection of ambient samples for the Dust Monitoring Study continued throughout September. Equipment problems that led to the loss of some data in August have been addressed. September sampling and monitoring contain relatively few missing data. Preliminary ambient dust and meteorological data are being evaluated.

Thirty-one bulk and surface-material samples were collected on September 10, 13, and 20. The samples included exposed soils, paved and unpaved roadway dust, and exposed bulk material at Omya and the Hogback Quarry. Preparation of these materials for elemental and crystalline silica analyses is ongoing.

Based on a review of the detection limits for U.S. EPA data on elemental analysis of atmospheric particulate matter samples and preliminary data from the Phase II Dust Study, it was determined that elemental analysis of the ambient dust and bulk and surface samples will be conducted using Inductively Coupled Plasma-Atomic Emission Spectroscopy and/or Mass Spectroscopy (ICP-AES, ICP-MS), rather than X-Ray Fluorescence (XRF). These methods should provide more useful data for the source identification and apportionment analyses.

## Toxicology / Health Risk Assessment

The detection, by LC/MS/MS, of low-to-moderate (100–200 parts per billion) levels of aminoethylethanolamine (AEEA) in groundwater on site, near a tailings management area and in surface water in the Pittsford Italian Quarry (PIQ), prompted us to further investigate the toxicology of this compound. The results of two unpublished studies, submitted in summary form to U.S. EPA by the “Ethyleneamines Product Stewardship Discussion Group AEEA Testing Consortium” (see <http://yosemite.epa.gov/oppts/epatscat8.nsf/ReportSearch?OpenAgent&CASNumber=111-41-1> and related links) indicate that AEEA is a potent teratogen (cause of birth defects — in this case, aortic malformations leading to aneurysms in newborns) in rats. No “safe” dose (that is, a no-observed-adverse-effects level, or NOAEL) for this effect has been determined in the rodent toxicity testing so far conducted. We are consulting Dr. Bill Bress of the VT Department of Health as we develop an acceptable-risk-based concentration for this compound in drinking water, under the assumption that it acts similarly in people.

We are also working with the TestAmerica laboratory in Sacramento that performs the analytical test for AEEA to determine whether method improvements can allow lower limits of reporting and detection than are currently in place (50 µg/L and about 20 µg/L, respectively). No AEEA has been detected elsewhere on the site, or in any off-site drinking water wells or other sampling points. If 20 µg/L is judged to offer an adequate margin of safety, than these non-detects provide assurance that AEEA does not pose a

health threat. If not, then the test method will need to be improved until it is adequately sensitive.

The low-level detections of perchlorate noted above are not worrisome, in our opinion. Although hypothyroidism (both overt and “subclinical”) is a public health problem in the U.S. (predominantly for pregnant women), we have found that the cause in the majority of cases is auto-immune, not lack of iodine intake, and not competition of iodine uptake by perchlorate or other anions (nitrate and thiocyanate) in our diets or water supplies. This issue will be further discussed in our January 2008 report.

We are evaluating whether hazardous air pollutants emitted by Omya (estimated in the HAP Modeling Study described above) pose a significant risk to neighbors’ health. Our preliminary findings are (1) that the estimated long-term-average concentrations of hazardous air pollutants emitted facility-wide do not pose unacceptable risk of cancer or non-cancer health effects, and (2) that the estimated short-term concentrations of pollutants (for which short-term toxicity benchmarks exist) do not pose unacceptable risks of acute effects. Our work included checking for toxicity criteria that may have been modified or published since the Phase 1 effort, and seeking criteria for some minor compounds not previously of interest.

## **Noise**

Pursuant to the noise review meeting of August 7, 2007, Omya has been conducting further source sound measurements (in-plant) with their new acoustical monitoring instrument. These “fingerprinting” measurements capture the signatures of individual noise sources within the facility (1/3-octave band analyses).

In connection with the fingerprinting sound measurements, dimensional measurements have been taken (opening size, distance from opening to microphone). These geometrical parameters will allow a calculation of the source-sound power levels (by 1/3-octave band). The sound power levels are needed as input to an overall computer model of noise emissions from the facility. This computer model will allow a determination of which individual noise sources are contributing objectionable noise at residences.

## **Quality Assurance / Quality Control**

Since the above-mentioned detections of AEEA in groundwater and surface water are apparently the first such detections anywhere, we have asked Test America to verify or refute its reporting of AEEA in on-site groundwater and surface water samples by re-running AEEA standards (that is, laboratory water to which known amounts of AEEA have been added) and on-site water samples on a second chromatographic column. Results are anticipated by mid-October.

## Anticipated Work

In October and November we will further analyze existing and newly received data, determine whether and how to collect additional data, meet with the O.T. and related parties, finalize (to the extent possible) our Conceptual Exposure Model, formulate suggestions for future work, and draft our final report.

With regard to health risk assessment, we will continue to seek and assess dose-response information and judgments concerning developmental toxicity due to *in utero* exposure to AEEA.

With respect to the dust monitoring study, we expect to submit filter and bulk/surface samples for elemental analysis. Results are expected in November.

With regard to our noise analyses:

Further sound monitoring will be conducted at the residence that has been most bothered by plant noise, including periods during a partial plant shut-down (week of October 1st). It is hoped that during the plant start-up it may be possible to identify individual noise sources affecting the residence.

Ambient sound will be monitored at a residence that is not significantly affected by plant noise. Monitoring at this proxy location, and possibly other locations, will be used to define a typical ambient sound profile for rural residences in this part of Vermont. These data will be used to establish criteria for noise mitigation in relation to residences that have experienced bothersome noise from Omya operations.

A noise review meeting at Florence is being scheduled for mid-October, to be attended by one of us (Lawrie Copley), personnel from Omya, Omya's noise consultant (HMMH), and neighbors affected by plant noise.