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Modified: February 20, 2006

EXPOSURE PROFILE FOR WEYERHAEUSER RECOVERY BOILER PROJECT

SUMMARY:

An intake clinic was conducted in Thunder Bay, Ontario, for those workers who were employed on the air emission recovery boiler project from 2002-2004 at Weyerhaeuser, in Dryden, Ontario. From interviewing approximately 400 workers, there were numerous complaints of adverse health effects reported from exposures to working in gases from the adjacent stack emissions. There were also exposures reported from heating of the insulation product, sewer gas and paint and welding fumes.

From review of Ministry of Labour reports and various consulting companies retained to conduct air sampling onsite, the majority of readings indicated contaminant levels that ranged from non-detectable to well-below the occupational exposure limits. It is important to note that most of the sampling was conducted when there was not a prevailing Southwest wind. It was wind from a Southwest direction when the workers would report emissions from adjacent stacks blowing into the work areas, and the majority of their symptoms.

In addition to stack exposures, there were also reports of emissions of hydrogen sulfide from the sewers, and exposure to noxious gases from the insulation lining the boiler and pipes. Many workers filed work refusals during the start-up phase of the boiler in November of 2003. They also reported adverse symptoms from exposure to the “cooking” of the insulation material.

There were also concerns reported regarding the validity of the gas testers that worked for the contractor due to their inexperience, as well as methods used for calibrating equipment.

There were also issues surrounding the use of respirators on this job site. The workers were only provided with escape respirators from April 2002 until June 2003, when the MOL issued orders to provide half-piece masks with organic vapour and particulate cartridges. The workers were told that if an odour was present in their work area, they should put on their respirators and request air testing. If results of the sampling indicated levels that are below the occupational limits, they should continue to work while wearing respirators. However, in speaking with the workers, many did not wear their respirators. Reasons cited for the lack of use, included reduced visibility and ability to communicate with their co-workers and difficulty breathing with heavy work loads. The respirators

provided also did not protect workers against carbon monoxide, nitrous oxide and methanol, which are constituents of the stack emissions.

Workers report that exposures which they encountered while working on the air emissions project, resulted in adverse health effects.

INTAKE CLINIC INTRODUCTION:

An intake clinic was conducted in Thunder Bay, Ontario on November 12 and 13, 2004 for those workers that worked on the Weyerhaeuser air emissions new recovery boiler project (RB4) between 2002 and 2004. The workers have reported poor air quality as a result of exposure to plumes from adjacent stack emissions blowing into the work area. They also reported emissions from other sources in their work area. Interviews were conducted with each worker that attended the clinic, gathering information on their overall work history, work history specific to RB4, and social and medical history. Of specific interest was any type of symptoms that the workers may have experienced during their work on RB4 or since completion of the job.

From discussions with several union members involved, from the conducted questionnaires and from a review of air monitoring information on file, an exposure profile has been created. There is difficulty in quantifying individual worker exposure by their specific trades, due to the variability in their jobs as well as their working location in the recover boiler. Therefore, the workers could more easily be quantified by the duration of time working on the project and the intensity of the exposures from the stack.

Appendix A is a collective list of common chemicals involved in the pulp and paper industry specific to the Weyerhaeuser mill in Dryden, Ontario. They include the chemicals listed on the National Pollutant Registry Inventory (NPRI) from Environment Canada and those chemicals for which Weyerhaeuser reportedly monitors. Also included are chemicals that have been reported in the literature to be associated with the pulp and paper industry.

PROJECT TIMELINE:

There were several trades working simultaneously on the RB4 project. These included electricians, plumbers, welder-fitters, pipefitters, boiler makers, iron workers, millwrights, labourers, operating engineers and carpenters. According to several union members, the following working timelines existed for each of the trades:

- Electrical: April 2002 - June 2004
- Pipefitter/plumber/fitter welder: April 2002 – June 2004
- Millwright: September 2002 – January 2004
- Carpenters: April 2002 – April 2004
- Labourers: April 2002 - June 2004
- Iron workers: April 2002 – February 2004
- Operating engineers: April 2002 – June 2004

Specific tasks for several trades are listed below:

Construction millwrights – install, maintain, retrofit and remove conveyor systems and other manufacturing equipment; assemble/disassemble turbines and generators; rig, move, place, align heavy equipment and machinery; weld.

Construction boilermaker – assemble, erect and maintain boilers, tanks, pressure vessels, heat exchangers, pollution control system; erect and connect support structures for installation using hoisting, rigging, welding and fitting equipment; plumb and align components; weld, bolt and torque the fasteners of component pieces and sections; set-up, maintain and operate oxy-fuel, shielded metal arc, tungsten inert gas, plastic and stud welding equipment.

Construction boilermaker welder – set-up, maintain and operate oxy-fuel equipment; maintain and operate shielded metal arc welding equipment as well as other types of welding; operate propane and oxy-fuel including components and controls to pre-heat materials to be welded; assemble/disassemble hoisting and rigging equipment.

Insulators – sheet metal workers installed inner sheet siding on building and then insulators installed insulation (fiberglass), then external siding.

The actual amount of time that each worker was employed on the RB4 project is recorded on their intake questionnaires. The durations have ranged from a couple of weeks, up to almost two years.

As indicated, different workers/trades began work on RB4 at various times, and at various stages of the process. Those that started at the beginning of the project, worked erecting the steel frame. Individual floors were then erected, followed by siding. In total, there are 18 floors in the RB4. The workers have reported that when construction reached approximately the 5th-6th floors, the RB4 reached the height of the old recovery boiler stack. It is at this time that they reported an increase in exposure to plume emissions from adjacent stacks. Subsequently from this point forward, they reported an increased exposure to emissions, from the old recovery boiler stack. The majority of complaints were reported on days when there was wind from a Southwest direction. Information on wind conditions was obtained from Environment Canada for the Dryden area, to determine prevailing winds for 2002 and 2003. Statistics from 2002 indicated prevailing SW winds in the month of April. There were also several days in March, May-July with reported SW winds. In documentation provided by a safety representative for Westwood Electric, numerous days of SW winds were noted in November of 2003 and January-March of 2004.

DISPERSION MODELING REPORTS:

An air dispersion modeling report prepared by AMEC Earth & Environmental Limited was provided to KCI Construction (General Contractor for the project), dated October of

2002. The report summarized an investigation of twenty-three (23) emission sources that predicted how the emitted materials are diluted as they move through the atmosphere. The purpose was to determine the impact of the current facility operations at Weyerhaeuser on the construction site for the installation of the new recovery boiler.

The emission sources were modeled using the US EPA AERMOD-PRIME dispersion model. The following contaminants were modeled: acetaldehyde, particulate matter (PM), sulfur dioxide (SO₂), oxides of nitrogen (NO_x), hydrogen sulfide (H₂S), carbon monoxide (CO), carbon dioxide (CO₂), and total reduced sulfides (TRS). The report concluded that while the modeling did not return maximum predicted concentrations in exceedance of the Ontario occupational exposure limits (OELs), there were concentrations of several combustion gasses (i.e. carbon monoxide, carbon dioxide and nitrous oxide) that were elevated to a point to warrant concern. The concentration of particulate matter was high and was measured at 93.7% of the Ontario standard. The report indicated that, as the point of maximum concentration is determined strongly by meteorological or process conditions occurring at any given time, the concentration, height and direction of the plumes will also change at any given time. *Therefore, it is expected that higher concentrations than those reported could occur over short periods of time.* The “old” recovery boiler precipitator stack was reported as the major source of all of the modeled contaminants, with the exception of acetaldehyde. *The direction of the wind on the day of analysis was such that it would carry the plume in the direction of the construction site.* It was reported that these conditions favour low dilution of the stack gases and a high incident of contact with the construction site. The report also concluded that the 8-hour average levels for *particulate matter, CO and CO₂ were marginally within the limits, however the modeled levels are higher during shorter intervals and are of possible concern.* The authors noted that during winter months, the higher levels of the contaminants would concur with the presence of condensing steam originating in the stack. It was recommended that work scheduling for the upper floors of the construction site should be based on prevalent wind direction. As the data indicated that wind in the direction from the old recovery boiler stack is rather frequent (27% of the time, SW+SSW+WSW directions), work on the upper levels of the construction site are likely to be subject to periodic cautionary interruptions. It was also concluded that the *TRS contaminant that is typically expected with the kraft chemical process, was not found to be a concern at this site.*

In a previous report from AMEC, dated September 26, 2002, the issues surrounding plume visibility, odour threshold and exposure limits were discussed. It was noted that plumes may be visible due to the nature of the materials within the plumes or due to the moisture content and temperature differences between the plume and ambient air (i.e. warm moist air emitted to cooler air). It was also reported that the visibility of the plume is not an indication of the toxicity, however it can assist in determining whether an operation is running and can also assist in determining wind direction and whether the emissions are carried into the work area.

AIR SAMPLING REPORTS:

A) Pinchin Environmental, Inc. (Pinchin)

In response to a work refusal on June 3, 2003, Pinchin was retained to conduct air sampling. Occupational Hygienist Ryan Mallard, conducted short-term area samples for sulfur dioxide, hydrogen sulfide and carbon monoxide, using an Industrial Scientific TMX 412 direct-reading monitor. Short-term grab samples of chlorine gas and methyl mercaptan were also taken using Gastec colourimetric indicator tubes. The results of the air monitoring indicated that area concentrations of all agents monitored were below their respective OELs. Several notes were made by R. Mallard in the report dated July 15, 2003. He reported that there were three make-up air units supplying air to the lower floors of the building (1st through 5th). It was noted that the intake of these three units was on the east side of the building (away from the stacks). It was noted that the make-up air units which have their intakes located on the west side of the building were not being used, due to the possibility of contaminated emissions entering the building. R. Mallard concluded that the results of this survey did not require additional control measures to further reduce employee exposure; however he did make the following recommendations, that I have summarized as:

- The development of a written operating and maintenance program to ensure engineering units are adequately maintained and operating efficiently and effectively.
- Half-facepiece respirators should be assigned to workers to control nuisance odours present (with the 3M 6000 series respirators and the 60932 cartridges that are currently available) Note: 60932 is not a 3M cartridge in the 6000 series; as he indicated that they are currently available, it is assumed that he was referring to the 60923 cartridges).
- The use of half-facepiece respirators with multi-gas cartridges should be used by those who feel discomfort or annoyance as a result of exposure to stack emissions. R. Mallard recommended that employees should put on their respirators if they detect an odour and call to have their air tested. If the gas concentrations are within the acceptable limits, the employees should continue to work, while wearing their respirators. It was also recommended that employees should be evacuated from areas where the concentration of hydrogen sulfide exceeds the OEL (10 ppm) and should not return to the area until further testing can confirm that the concentration is within acceptable ranges.
- A respiratory protection program should be established.
- Ongoing air monitoring, which should include weather conditions (temperature, relative humidity, wind direction and wind speed).

A DRAFT report was on file from Pinchin to Aron Gratias, Project Safety Manager with Kamtech (previously KCI Construction), dated July 31, 2003. The report outlined the air sampling results collected by R. Mallard on July 23, 2003. An air sample was collected during welding on painted metal at the Kamtech construction site at Weyerhaeuser. A short-term grab sample was taken using a "Lung Sampler" and a Tedlar bag. The sample was analyzed for volatile organic compounds (VOC). The results of the analysis

indicated that the area concentrations of all agents monitored were below the respective OELs. There are several areas of this report that are blackened out and cannot be read (in particular, it appears as though a section is discussing mixtures and therefore this will not be commented on). R. Mallard made general recommendations in the report that were similar to those made in the previous air monitoring report.

In another DRAFT report from Pinchin to A. Gratias, dated September 22, 2003, it was reported that Mr. M. Anthes conducted occupational hygiene monitoring on August 12 and 13th, 2003. He conducted short-term area grab samples using a Tedlar bag which was analyzed for a sulfur compounds scan. He also conducted short-term grab samples of hydrogen chloride, acetaldehyde, ammonia and methanol, using Gastec colourimetric indicator tubes. The area concentrations for all agents monitored were below their detectable limits and below their respective OELs.

Pinchin conducted air sampling on various levels of the new recovery boiler on November 25, and 26, 2003. Samples were analyzed for total suspended particulate and metals and the results indicated levels below their respective OELs. Long-term formaldehyde and phenol and short-term nitrogen dioxide measurements were also below limits.

B) Kamtech and union representatives air monitoring

In a review of documentation provided by a safety representative working on the RB4, there were numerous reports of eye, throat and respiratory tract irritation. There were also numerous reports of foul and offensive odours of sulfur, chlorine, ammonia, tall oil, burning paint and liquor (part of chemical process; black, green, white liquors) noted at different times from October 2003 until February 2004. Numerous complaints of plumes of smoke in the RB4 work area, mainly during prevailing SW winds were reported. It appears as though the building or section of the building (mainly the 18th floor) were evacuated several times in November of 2003. According to most workers, only those that were working on the 16th-18th floor of the RB4 would have been exposed to emissions from the stack after the last section of sheet metal siding was erected in late 2003. *Others have reported that this was not the case.*

A log book was provided by a union safety representative (dated October 20, 2003 until April 14, 2004), summarizing results from gas testing (hydrogen sulfide, carbon monoxide, sulfur dioxide, ammonia, methyl mercaptan and chlorine dioxide) that he conducted when working on the project. It was reported that the *Industrial Scientific TMX 412* data logger and multi-gas tester was used to monitor for the above noted contaminants. Following a review of the log book, there were several key exposure notes that I have summarized as:

- Several high readings of H₂S (ranging from non-detectable up to 291 ppm); the 8-hour Ontario Time-Weighted Average Exposure Value (TWA_{EV}) for H₂S is 10 ppm and the Short-Term Exposure Value (STEV) is 15 ppm (it is important to note that the workers worked 10-hour days and it would be expected that the

- TWAEV for a 10-hour shift would be lower; the hours worked varied between workers and several reported working 50+ hours/week); from all of the readings noted, there were 13 readings above the TWAEV. When questioned on the high reading of 291 ppm, the union representative indicated that there were no workers present in this environment. He reported that the area had already been evacuated (Jan 24, 2004).
- Several methyl mercaptan readings above the 8-hour TWAEV of 0.5 ppm, ranging from non-detectable to 5 ppm; 9 readings above limits.
 - Several high readings of SO₂, ranging from non-detectable to 14 ppm; the 8-hour TWAEV is 2 ppm, STEV is 5 ppm (6 readings reported above TWAEV).
 - Several high readings of CO (ranging from non-detectable to 145 ppm); TWAEV is 35 ppm (proposed 25 ppm), STEV is 400 ppm (5 readings reported above TWAEV).
 - The majority of the higher readings of H₂S were reported on the ground floor, in the digesters and the evaporators; there were also two high readings reported on the roof of the concentrator in March of 2004; it is important to note that several of the higher readings were taken in the mornings and low levels were reported in same areas by afternoon; there appeared to be a leak from the sewers on January 14, 2004.
 - The majority of higher readings of methyl mercaptan were reported in digesters and on ground level; it appears as though methyl mercaptan measurements were not taken until January of 2004; there was one non-detectable reading taken in November of 2003.
 - From the log, there were numerous reports of foul odours; including tall oil, paint fumes, ammonia, sulfur, black liquor, chlorine.

Daily inspection reports were provided by a trade worker, summarizing air samples taken from September 22, 2002 until October 21, 2002. It was indicated on numerous days that no monitoring was performed on the recovery boiler building and the recovery boiler control room building due to the wind direction (it is difficult to determine during which wind directions he would not monitor, as numerous wind directions reported). The trade worker sampled for oxygen (as a %), CO, H₂S and combustibles (LEL), using the *Industrial Scientific TMX 412* sampler. The high and low values were provided, as well as the daily average. The trade worker reported negative and drifting readings on September 23, 2002. *Young Environmental Systems Inc. (YES-205-4) Air Quality Monitor*. The trade worker monitored for CO₂, CO, temperature and relative humidity with this sampler. On October 1, 2002, the *Emnet Corporation Target* monitor was used in the recovery boiler and the new black liquor tank and digester building. The Emnet Corporation Target was used to monitor for oxygen, CO, H₂S, LEL and broad range hydrocarbons (BRH). There was mention of malfunctioning of the Emnet monitor on October 7, 2004. The trade worker conducted several chlorine air samples using Gastec colourimetric detector tubes.

When examining the results from the monitoring, levels reported ranged from non-detectable to low levels. The ranges for each contaminant are reported below (they are ranges of the average daily values):

- H₂S: ranged from 0 to one reading of 0.3 ppm
- CO: ranged from 0 to one reading of 0.1 and one reading of 0.2 ppm
- CO₂: ranged from 0 to one reading of 337 to 449.1 ppm
- Combustibles: no reported levels found
- Cl: ranged from 0 to one reading of 1.7 ppm (a high-level reading of 3.4 ppm was measured on September 30, 2002 in the chemical plant)
- O₂: ranged from 20 to 21.2%

There were 10 days where the trade worker noted a SW-SSW wind. The worker reported that monitoring was not conducted 3 times in the Recovery Building and Recovery Building Control Room due to the wind direction.

Summary of exposures reported by workers:

From discussions with several union members and from interviews conducted with workers, the following exposures were reported:

- 3rd to 5th floor – workers exposed to tall oil when mixing in tall oil building; work area evacuated several times; tall oil was exhausted into 3-5th floors.
 - pipe gallery – from tall oil plant, cut into RB4 building; air appeared to be vortexed into building
- There are cement floors on the 3rd, 6th, 8th, 13th and 16th level; pockets of gas could have been trapped in between cement floors.
- Exposure to emissions from stacks on the 4 or 5th floors, up to top floors, due to openings in building envelope and pressure differentials. This would result in emissions coming in prior to roof closure. Workers also reported negative pressure, which drew air back into building through doors (had to replace doors several times).
- It was reported by that exposure to stack emissions stopped for most workers when the last piece of tin siding went up in October 2003 (with the exception of those working on 16th-18th floors); although other workers have indicated otherwise.
- September to October 2003, connected sewer to RB4; exposed to sewer gas (H₂S).
- Fibrex: mineral wool insulation
 - Heat pipe; cooking insulation, burning smell, smoke; workers felt eyes closing, dizzy, loss of balance – when boiler started up, insulation wrapped around pipes was heated and emitted fumes (Nov 2003).
 - Fibrex (96-99% mineral fibres and 1-4% cured phenol formaldehyde binder); may emit some by-products (CO, CO₂, N₂, ammonia) during the “burn-off” of the binder when insulation reaches around 235°C/450°F; will subside after 6-8 hours; according to Mr. D. Burke, MOL Hygienist, extent and concentration of “off-gassing” by-products will depend on the amount of insulation present, process temperatures, ventilation provided, etc.

- By-products produced by the cured paint on the boiler and associated parts during the initial boiler start-up (ventilation required); following complaints in the fall of 2003, painting was conducted on the night shift.
- CO exposure from numerous heaters operating in RB4, during winter months. Several workers reported up to forty (40) heaters operating consecutively.
- Workers reported a sewer gas smell on a walkway.

MERCURY ISSUE:

Several workers from the RB4 project initially contacted the clinic as a result of high mercury levels. This prompted other workers to receive mercury testing. Blood mercury concentrations ranged from mostly low to approximately 200 nmol/L. Mercury has not been involved with the kraft chemical process for many years, since coal has been discontinued as an energy source. It is not believed that exposure to this mercury is the cause of the workers complaints.

A report on file from the Ontario Ministry of Labour (MOL), dated September 29, 2004, addressed the issue of mercury in the workplace and blood levels of mercury of several workers. The report was based on a visit of September 14, 2004. Several comments and findings were noted in the report by Dr. L. Wong, Medical consultant and D. Burke, Hygiene consultant. They reported that in discussions with Weyerhaeuser, mercury has not been used in the processes at the mill since 1975. It was reported that mercury had been used at the chemical plant in the chlor-alkali process. It was noted that mercury is now present in enclosed instrumentation switches and test vials.

The blood mercury levels of some workers were reported to be below the American Conference of Governmental Hygienists (ACGIH) Biological Exposure Indices (BEIs) level of 80 nmol/L. Dr. Wong concluded that the reported blood mercury levels do not indicate significant occupational exposure to mercury and concluded that no adverse health effects are expected from these levels. An air sampling report for mercury from Pinchin conducted in August 2004 was commented on in this MOL report. It was noted that eighteen of twenty-six samples indicated non-detectable levels of mercury. Several samples indicated minimal levels; four samples indicated exposure of less than 1% of the occupational exposure limits for Ontario; another sample indicated minimal levels (1% of the exposure limit based on a 12-hour shift (4 samples), and one each of 2%, 17%, 20%, 23%). The authors of the MOL report concluded that the potential for mercury exposure at this workplace is low but exists; should any mercury-containing product break or leak and the mercury is not cleaned up properly. A mercury management program was recommended and information concerning mercury was provided to the local doctors.

MINISTRY OF LABOUR (MOL) REPORTS:

In a MOL *Premise/project form*, relating to an August 27, 2002 visit, inspector Ron Moro indicated that he was to review the following during his visit “*designated technician for gas testing/to be obtaining permanent monitors for oxygen/combustibles/H2S/carbon monoxide*”. Confirmation of what he reviewed is not documented.

In a follow-up visit and report (MOL *Premise/project form* relating to a December 3, 2002 visit), inspector R. Moro reviewed the AMEC air dispersion modeling report. He also reported to review that the monitor for H₂S/CO and combustibles was located on the 9th floor, that personal monitors for H₂S were in place, that the 3M organic vapour/particulate respirators were provided, that fit testing was completed, that full time gas testing was in progress, and that evacuation procedures were in place.

A MOL *Premise/project form* (June 3, 2003), reported that:

- The construction at the time was in various stages; structural steel erection of the top economizer building portion was being installed; the exterior of the building was being closed in; mechanical equipment was being installed, tie-ins to the existing plant were being done; electrical work was in progress; piping and the boiler were being erected.
 - The building was enclosed to the 15th floor, 16th floor and higher floors were not enclosed.
 - The existing mill was immediately west of the new construction site and was still operating at full capacity.
 - The stack emissions from the existing mill were blowing into the construction work area when the winds are from the W, N, S (worker representatives have indicated that there were no problems when the wind blew from the north).
- The existing Kraft mill uses a number of chemicals in its process
- There was a work refusal on June 3, 2003 due to emissions in work area.
- The gases that were tested for include O₂, combustibles, H₂S, CO, SO₂, Cl, mercaptan.
- 18th floor haze: when boiler fired up; exhaust grilles were taped off.

Norm Bondar, MOL inspector, reported that R. Mallard had walked the entire building, conducting air testing. N. Bondar reviewed the testing results from May 21, 2003 until June 3, 2003 and indicated that aside from a 93 ppm reading of CO on May 25, 2003, all other readings fell within the acceptable guidelines for the gases noted above.

In a *Premise/project form* completed by N. Bondar, regarding a visit on June 4, 2003, it was reported that the project was inspected from floor to floor, starting at the top (the 16th floor at the time). It was reported that gas testing was done by R. Mallard (Hygienist for Pinchin), A. Gratias and J. Gratias. Some of the following items were noted and are summarized below:

- 16th floor: floor is not enclosed; an odour was present; no readings were recorded.
- 14th floor: the make up air units were operating (were they drawing clean air?); a positive outward air flow was noticed.
- 13th floor: no recordable readings; positive airflow reported.
- 12th floor (where the old recovery boiler stacks tie into the new stack; expected to be tied in by later part of June 2003): it was expected that most of the odours were entering the new building through these openings; were sealed off; no odours

- were present; no instrument readings were recorded; positive air flow was noted on this floor.
- 11th floor: permanent gas detector mounted on this floor near the stack breaching which has not been tested since Feb 2003; no instrument readings were recorded on this floor; positive air flow.
 - 10th floor: make-up unit noted on this floor; positive air flow.
 - 8th-9th floor: no readings recorded on this floor.
 - 7th floor: a definite odour present in roof area onto the concentrator building; *the exhaust plumes from the stacks of the existing mill were blowing toward the roof of the area*; there were no instrument readings recorded on the roof area or the 7th floor area.
 - Ground floor - 6th floor: make up air units operating; no instrument readings.
 - 3rd floor condenser area: slight odour detected; 9 ppm CO reading registered beside a worker who was smoking; CO returned to normal when instrument was moved.
 - Pipe gallery: slight odour was detected; no instrument readings were recorded.
 - Tall oil plant: designated as a restricted area requiring respirators to be worn at all times; noticeable odour was detected; it was noted that when the door to the portion of the building was left open, odour migrate into the work area.
 - Transformer vault, the MCC room in the control room complex, the control room: inspected, air tested with no readings detected.

In the report, it was noted that N. Bondar, A. Gratias and R. Mallard had a conference call with D. Burke, MOL Hygienist to discuss the potential work refusal. D. Burke discussed air sampling results from May 21-June 3, 2003, as well as procedures, equipment used, calibration of equipment and qualifications of testers. It was concluded that air testing results were within acceptable limits and that there were, *“no grounds to support a work refusal.”* D. Burke also noted that the 3M respirator with the 60923 cartridges (suitable for organic vapour/sulfur dioxide/hydrogen sulfide/chlorine/hydrogen fluoride/particulates (P100)) were suitable for workers to wear while they were working. A concern of the workers was that they were not sampling for all chemicals. This cartridge is suitable for protection against certain organic vapors and particulates, chlorine, hydrogen chloride, sulfur dioxide, chlorine dioxide, hydrogen sulfide (escape only), ammonia, methylamine, formaldehyde or hydrogen fluoride.

It was noted that the workers were advised to put on their respirators when they smelled an odour and to contact their supervisor to request sampling in the area. They were also informed to leave the area if they were feeling ill or if the odour was bad. N. Bondar completed his report by indicating that, *“their was no evidence to support a work refusal by the workers on the new air emissions project at the Weyerhaeuser plant.”*

Minutes from a June 8, 2003 meeting regarding air quality issues on the air emissions project were on file. In attendance were numerous representatives from Kamtech (including Aron Gratias), Weyerhaeuser and various unions. N. Bondar (MOL inspector) and R. Mallard (Pinchin) were also present at the meeting. According to the minutes, air

quality issues were discussed by R. Mallard, including odours and respirators. It was also reported that the following issues were discussed and addressed:

- HVAC units on east side will have charcoal filters installed
- Tom Jones is sealing up building with plywood;
- re-routed recirculation fans to clear air on top of boiler;
- alarms were installed in building for evacuation;
- gas testing to be conducted around the clock;
- increase from 4 to 10 gas testers;
- personnel monitoring; and
- half mask respirators to be mandatory “to be worn on your person at all times”.

During a June 24, 2003 follow-up visit, N. Bondar issued an order requiring A. Gratias and all gas testes to be provided with a refresher training course on gas testing equipment and calibration from a qualified person. At this follow-up A. Gratias indicated that they have begun issuing workers the 3M half face masks and that the workers have been fit-tested. A. Gratias also reported to the MOL that he trained a member from each trade to conduct gas testing and that he now has 9 workers doing continuous gas testing on day shift and 4 on the night shift. In the report, A. Gratias indicated that testing was done for the following chemicals:

- oxygen
- carbon dioxide
- sulphur dioxide
- mercaptans
- hydrogen sulphide
- chlorine (LELs)
- chlorine dioxide

In a July 7th, 2003 report from D. Burke, it was reported that KCI Construction conducts daily monitoring for the following contaminants: methyl and ethyl mercaptan, sulfur dioxide, chlorine and chlorine dioxide (using colourimetric detector tubes), hydrogen sulfide (using continuous personal monitors, portable direct reading units and stationary monitors), oxygen, carbon monoxide, carbon dioxide and combustible gases (using portable reading units). An order was issued by the MOL to provide refresher training to gas testers and for equipment calibration. *It was reported by a health and safety representative that the re-fresher training course for all gas testers was completed in July or August 2003.* It was noted by D. Burke that all written records of air sampling results should be made available to the workers. *It was reported by a health and safety representative that sampling records were hard to get and for the most part, unavailable.* It was also recommended that air sampling for methyl and ethyl mercaptan be conducted by a Certified Occupational Hygienist (CIH) or a Registered Occupational Hygienist (ROH), in accordance with recognized air sampling techniques and methodologies (as opposed to the current colourimetric detector tubes that cannot measure down to the occupational limit). *It was reported by a health and safety representative that only Pinchin tested for ethyl mercaptan and that he (electrician gas tester) tested for methyl*

mercaptan using tubes that would measure from 0.1 ppm to 5.0 ppm. Monitoring for methyl mercaptan did not commence until January 2004. D. Burke noted that air sampling was conducted for carbon monoxide on the 5th, 15th and 16th floor during this visit, using colourimetric detector tubes. No detectable levels were found. Air sampling for hydrogen sulfide was also conducted with a colourimetric tube on the 16th floor. No detectable levels were found. It was reported that on the day of sampling, the prevailing wind was blowing the adjacent exhaust stack plume (the old recovery boiler) away from the project. D. Burke concluded that under different conditions, the stack plume may be blown towards the project, which is likely to increase the complaints of odour.

A subsequent report, dated September 15, 2003, from D. Burke and Dr. L Genesove, MOL Physician, summarized air sampling conducted at the worksite. They were onsite on September 3, 2003 to investigate air quality issues. D. Burke commented on the Pinchin report dated August 27, 2003, that was summarized earlier in this exposure profile. He reported that levels of methyl and ethyl mercaptan, hydrogen sulfide, sulfur dioxide, carbon disulfide, propyl mercaptan, dimethyl disulfide, hydrogen chloride, acetaldehyde, ammonia and methanol indicated non-detectable levels and one sample that was well below the OEL. It was indicated that the longer shifts (i.e. 10-hour) and the additive effects were taken into consideration. There was no elaboration on this comment of additive effect and the extent to which it was taken into consideration.

In minutes from a meeting on September 3, 2003, in which Dr. Genesove and D. Burke were present, Dr. Genesove made a few comments. He indicated that if workers are working in the haze or plume directly, the high particulate matter may result in eye and throat irritations. Dr. Genesove indicated that this may occur even if the gas levels are low. He reported that the plume can also cause lung function problems due to the physical properties of the smoke. He indicated that these symptoms may persist. *Dr. Genesove commented that workers should not work directly in the visible plume.*

In an October 23, 2003 MOL *Premise/project form*, it was reported that employees noted sewer gases from the operating plant migrating into the new project. Other concerns of workers included:

- Prevailing winds were reportedly still bringing in stack emissions of the adjacent mill.
- Workers were reportedly still getting sick when air test readings were below acceptable levels.
- Exposure to an unknown chemical cocktail.
- Reporting fatigue even after wearing a respirator all day.
- Exposure to smoke when riding the elevator.
- Fear of being laid off if they exercised their rights under Ontario's Occupational Health and Safety Act.
- Lack of communication.
- Unaware their respirators do not protect against carbon monoxide.

During this workplace visit Dr. L. Wong commented on the WSIB claims that have been filed from workers at this project. She indicated that she had reviewed the claim forms and most of the reports indicated that the irritants associated with the emissions would most likely be responsible for the symptoms that were recorded.

Also during this visit, D. Burke questioned high carbon monoxide readings that were recorded on September 5, 2003, completed by Pinchin. The 18th floor readings were consistently high for the full work shift (50-80 ppm). A worker went off sick on this day with symptoms of dizziness, weakness, and fatigue. D. Burke questioned as to whether or not workers were exposed to these readings and if so, did they have the proper respiratory protection (*respirator cartridges did not protect against CO*). D. Burke questioned as to why the area was not evacuated. A. Gratiis indicated that no workers were exposed to the gas; that the workers were working approximately 40 ft. east of where the readings were taken. It was reported by a concerned worker, that an evacuation protocol was in place, however not followed. The worker did report that there were mock evacuations conducted.

D. Burke visited the site on November 27, 2003 due to work refusals on the recovery boiler project. It was reported that thirteen (13) workers refused to work on November 25, 2003 and another sixty-five (65) refused to work on November 26, 2003 (in a MOL *Premise/project form* (dated December 1, 2003), it was reported that fifteen (15) insulators submitted work refusals at approximately 9:00 am on November 27, 2003). The reasons given for refusing to work included concerns about the “fumes” from the new boiler insulation. D. Burke reported that the new boiler was being brought on line (gas-firing) and there were emissions from the “Fibrex” mineral wool insulation that lined the exterior of the boiler and some associated piping. There were also concerns reported regarding decomposition by-products from the paint (alkyd enamels and epoxy) on the boiler and the suitability of the respirators provided. The new boiler was initially started on November 6, 2003. It was reported to D. Burke that a haze was present on the 18th floor on November 25, 2003 and that some workers were noticing eye irritation, sore throats, etc. It was reported that three (3) exhaust grille openings on the roof had been tarped off. These grilles were uncovered and axial-flow fans were placed in the openings to direct air out of the building on November 25, 2003. D. Burke indicated that Pinchin had been retained to conduct air sampling to address work refusal concerns. Preliminary results of short-term sampling conducted on November 25-26th, 2003 indicated non-detectable levels of airborne formaldehyde, phenol, ammonia and nitrogen dioxide. It was reported that the boiler was not running at high temperatures on these days. Long-term sampling for formaldehyde, phenol fibres and particulates was also conducted and results were to be provided to the MOL upon completion (*report is not on file; according to a MOL Premise/project form dated December 1, 2003, all test results were within acceptable limits*) and a work refusal was not supported. Air sampling was also conducted during the visit on November 27, 2003 for carbon monoxide, hydrogen sulfide and oxygen. Levels of carbon monoxide ranged from non-detectable to 8-9 ppm (on the 14th floor, SW by “economizer”). Levels of hydrogen sulfide were non-detectable and oxygen levels were measured at 20.9%. D. Burke concluded that all the above results indicated levels within the respective OELs. There was an order issued that written

procedures are required to be established to address emissions from insulation that has yet to be installed. The procedures are to address issues such as engineering controls, PPE, and worker training. D. Burke reported that certified particulate respirators (e.g. P100) should be worn at all times by workers that are installing mineral fibre insulation. He also reported that suitable interim respiratory protection is also available, with protection against formaldehyde (3M 60926).

Respirators:

Up until June 2003, the workers were provided with escape-only respirators. Following orders from the MOL, they were provided with 3M half masks and 60923 cartridges (organic vapour and P100). These masks only protect against certain organic vapours, sulfur dioxide, hydrogen sulfide (escape only), chlorine, hydrogen fluoride, and particulates (P100). Carbon monoxide, methanol and nitrogen dioxide are not filtered by these cartridges. In a later report by the MOL, it was reported that cartridges 60926 were available onsite. This cartridge is suitable for protection against certain organic vapors and particulates, chlorine, hydrogen chloride, sulfur dioxide, chlorine dioxide, hydrogen sulfide (escape only), ammonia, methylamine, formaldehyde or hydrogen fluoride.

It was noted that the workers were advised to put on their respirators when they smelled an odour and to contact their supervisor to request air sampling in the area. If the gas concentrations are within the acceptable limits, the employees should continue to work, while wearing their respirators.

However, many workers reported that they only wore their respirators on an intermittent basis or not at all. They indicated that they were difficult to work in. Reasons cited for not wearing their respirators included:

- masks would fog up (visibility issues)
- unable to communicate with coworkers (safety issues)
- difficulty breathing when conducting heavy work
- freezing of the plastic in extremely cold weather

Wind directions:

From all the reviewed materials (especially the MOL reports) and in discussions with nearly 400 workers, it appears as though the majority of the complaints of poor air quality occurred when there was a prevailing wind from the Southwest direction. This wind direction resulted in the exhaust stacks from the adjacent mills blowing into the work area. It was noted that plumes would enter into the work area.

As of approximately September-October 2003, when the building was fully enclosed, this was not as significant an issue (however, some workers indicated that emissions from the stack were still a problem; entering through holes and cracks in the structure). Workers indicated that the majority of the problem areas as of the end of October 2003 were the construction elevator and stairwells, used for access to work (electricians working on lighting).

From examination of the available air monitoring reports and Environment Canada information on wind directions for the Dryden area, it appears as though there was only one day where there was a Southwest wind when air monitoring was conducted by Pinchin or the Ministry of Labour. Pinchin air monitoring results from June 3, 2003 reported that all readings for CO, SO₂ and H₂S were below detectable limits (BDL) with the exception of 3-6 ppm of CO and BDL-0.3 ppm SO₂ (11th floor outside, SW corner) and BDL-5ppm of CO (7th floor concentrator roof). It was reported that when these levels were detected, exhaust plumes from the stacks were blowing directly towards the SW corner and sampling location. There was 0.1 ppm of chlorine detected on the 6th floor and readings for methyl mercaptan were BDL in this same area.

Gas testers:

From correspondence with a worker on the project, it was reported that the gas testers were young, related and in his opinion, had no prior experience in gas monitoring. The worker reported that gas testers calibrated their equipment in contaminated air and that the lead gas tester would “half walk, half run” throughout the boiler when testing. From reviewing MOL reports, it is apparent that the gas testers received initial training, however orders were given to receive refresher training from a certified trainer.

OPINION:

From the information available from union representatives, Ministry of Labour, consulting companies involved on the project, and the approximately 400 workers interviewed, it is apparent that workers had the potential to be exposed to emissions from adjacent mill stacks when the wind was blowing from a Southwest direction. Although the majority of air samples conducted by the MOL and Pinchin ranged from non-detectable to well below the Ontario occupational exposure limit, there was still the potential for workers to be exposed to higher levels of gases that were not captured by the sampling results. It appears that all but one day of air sampling were conducted on days where the wind was not blowing adjacent stack emissions into the worksite. Also, the majority of sampling conducted involved short-term, instantaneous and area sampling, which is only representative of the specific sampling time. This could result in higher or lower peak levels not being captured.

From examination of air sampling results from several union workers, it is apparent that the possibility of exposure to elevated levels of contaminants (carbon monoxide, hydrogen sulfide) was possible. It is important to remember that there were concerns of the testing conducted by the contractor and several trade workers. There were concerns that the gas testers were inexperienced which raised concerns of the validity of the reported values. It has been reported that there was a lack of training on use and calibration of the equipment. The MOL issued orders involved training of gas testers from a certified company and our information indicates that this did occur.

The MOL was onsite several times throughout the course of this project, due to several work refusals and complaints from workers. The hygienist and medical staff informed the workers that they should not be working in the plume of adjacent stack emissions. If they detected an odour, they were told to put on their respirators and call for a gas test. If the results reported gas levels within acceptable limits, they were to work with their masks on. If there were reported levels above acceptable standards, they were to evacuate the area. However, many workers reported difficulties with wearing the masks and reported that they were not able to work in them. It is important to remember that workers were only provided with appropriate respirators and cartridges in June of 2003. Some workers began the project in April of 2002. Also, the cartridges did not protect against several exposure contaminants, including carbon monoxide, methanol and nitrogen dioxide. Workers also reported a fear for their jobs if they stopped working.

As previously outlined, it also appears as though there were other sources of exposure on this project. These included exposures to tall oil emissions, phenol-formaldehyde insulation during the start up of the boiler, paint and welding fumes, and sewer emissions. Workers have reported adverse health effects from several of these sources and in fact submitted work refusals from exposure to insulation wrapped around pipes, when the boiler was started up.

C. DeDiana, MHSc. OEH
Occupational Health Co-ordinator

Attachments: Appendix A: Chemicals in pulp and paper processes.

Documents reviewed for completion of Exposure Profile

Ministry of Labour	Premise/project form	27-Aug-02
Ministry of Labour	Premise/project form	3-Dec-03
Ministry of Labour	Premise/project form	22-Jan-03
Ministry of Labour	Premise/project form	3-Jun-03
Ministry of Labour	Premise/project form	4-Jun-03
Ministry of Labour	Premise/project form	5-Jun-03
Ministry of Labour	Premise/project form	24-Jun-03
Ministry of Labour	Premise/project form	7-Jul-03
Ministry of Labour	Hygiene report from June 24, 2003 field visit	3-Sep-03
Ministry of Labour	Premise/project form	26-Nov-03
Ministry of Labour	Premise/project form	27-Nov-03
Ministry of Labour	Premise/project form	1-Dec-03
Ministry of Labour	Premise/project form	19-Feb-03
Ministry of Labour	Premise/project form	14-Sep-04
Ministry of Labour	Professional and Specialized Services - work refusal report	28-Nov-03
Pinchin		
Environmental, Inc. Pinchin	Occupational Hygiene Consulting report	15-Jul-03
Environmental, Inc. Pinchin	Occupational Hygiene Consulting report-DRAFT	31-Jul-03
Environmental, Inc. Environmental	Occupational Hygiene Monitoring-DRAFT	22-Sep-03
Canada	Hourly data reports	2002-2004
Weyerhaeuser	Meeting minutes re: MOL air quality investigation issues	3-Sep-03
Weyerhaeuser	Memorandum re: Emergency shutdown procedures during liquor fire	13-Jan-04
Weyerhaeuser	Memorandum re: Action plan for 2003 Air Emissions issue-October	22-Oct-03
Weyerhaeuser Environmental	Meeting minutes re: MOL air quality issues investigation	23-Oct-03
Canada	National Pollutant Release Inventory - Weyerhaeuser	2002
AMEC	Dispersion Modeling Report	Oct-02
AMEC	Dispersion Modeling Report	Sep-02
KCI	Trades worker air monitoring data	Sept-Oct 2002 Oct 2003-April 2004
Trade union	Personal log book	2004

Appendix A: Chemicals in Pulp and Paper Processes	
suspended particulate matter	
sulphur dioxide	
oxides of nitrogen	
carbon monoxide	
total reduced sulphur compounds:	hydrogen sulphide
	methyl mercaptan
	dimethyl sulphide
	dimethyl disulphide
methanol (VOC)	
acetone (VOC)	
acetaldehyde	
formaldehyde	
hydrochloric acid	
sulphuric acid	
ammonia	
aromatic hydrocarbons:	benzo(a) anthracene
	benzo(a) phenanthrene
	benzo (a) pyrene
	benzo (b) fluoranthene
	benzo (g,h,i) perylene
	benzo (j) fluoranthene
chlorine	
chlorine dioxide	
dibenzo (a,h) anthracene	
dioxins and furans (chlorinated comp)	
ethylene glycol	
fluoranthene	
hexachlorobenzene	
indeno (1,2,3-CD) pyrene	
manganese (and compounds)	
mercury (and compounds)	
nitrate ion	
nonylphenol polyethylene glycol ether	
phenanthrene	
pyrene	
Tall oil (black liquor soap)	
<i>Paints:</i>	
*xylene, c9-c14 aromatic HC, iso-butanol, epoxy resin, 1-Metoxy-2-propanol, solvent naphtha	
<i>Insulation:</i>	
*mineral fiber, cured urea extended, phenol/formaldehyde	
<i>Other VOCs:</i>	
terpenes	
phenols	

chloroform	
methyl ethyl ketone	
fly ash	
coarse particles	
fine particles	
<i>Other potential exposures:</i>	
hypochlorite (HClO, NaOCl, Ca(COCl)2)	
sodium hydroxide	
hydrosulphite	
<i>Lime Kiln</i>	
raw lime	
CO	
HCL	