Health Concerns Related to Creosote

Building 532

Prepared For: Eastern Health,

St. John's, Newfoundland and Labrador

Date: February 12, 2013

Prepared by:

Dr. Sidney Siu MD, FRCPC, ABOM, FCCBOM, FACOEM, DABOT, CIME, C.I.H., P.Eng., B.A.Sc, D.I.H.

EXECUTIVE SUMMARY

Dr. Siu was requested by Eastern Health in St. John's, Newfoundland and Labrador to provide an opinion on the health concerns of the workers in a 60-year-old old military base building currently used mainly as a healthcare facility. Creosote was reportedly used as a wood preservative for the beams, joists and decking in the basement/crawl space of the building.

Eastern Health has occupied the building since 1997 and on an on-going basis, there was an odour issue believed to be related to the off-gassing of creosote treated wood.

Creosote is a liquid obtained from the distillation of coal tar from coke making. It contains significant amounts of polycyclic aromatic hydrocarbons, some of which are known human carcinogens. Because creosote is a mixture of hundreds of chemicals, there is no one single occupational exposure limit.

Air sampling was done in 2007, 2009, 2012 and 2013. The most recent studies disclosed that there were no detectable levels of polycyclic aromatic hydrocarbons, but two samples detected naphthalene, a volatile component of creosote, in a low concentration.

Most polycyclic aromatic hydrocarbons are non-volatile and are not expected to off-gas unless heated. This was verified by the most recent air sampling.

The detected odour is likely from naphthalene and/or naphthalene-like chemicals that have been off-gassing from the creosote treated wood. However, the detected level of naphthalene (0.0011ppm) is far lower than the current occupational exposure limit (10ppm).

Based on the information reviewed, it can be concluded that the workers and the patients (including those for the six day treatment program) would not be exposed to any significant levels of toxic vapour, including carcinogens. Thus, the working conditions do not pose a health hazard to the workers, including pregnant workers.

The issue of unpleasant odours in the workplace needs to be addressed. Recommendations have been made.

BACKGROUND

Dr. Sidney Siu was requested by Eastern Health in St. John's, Newfoundland and Labrador to provide consultative services as it pertains to creosote at Building 532:

1) To review the air quality testing results provided by Eastern Health relating to Building 532, and other relevant information; and
2) To give direction on continued use of Building 532; and
3) To identify evidence based health hazards for staff and clients and provide recommendations for control and management as it relates to Building 532.

Dr. Siu is a qualified Medical Doctor in the Province of Ontario. He is a Specialist in Occupational Medicine with the Royal College of Physicians and Surgeons in Canada and with the American Board of Preventative Medicine in the United States. He has been certified as an Independent Medical Examiner by the American Board of Independent Medical Examiners and as a Certified Toxicologist by the American Board of Toxicology. He is also a Certified Industrial Hygienist by the American Board of Industrial Hygiene which qualifies him to review and assess occupational exposure including air sampling results. He is a Fellow of the American College of Occupational and Environmental Medicine, the Canadian Board of Occupational and Environmental Medicine and the American Industrial Hygiene Association.

The information forwarded by Eastern Health was reviewed. Ideally, a field evaluation is preferred to obtain firsthand information. The opinion provided in the report is based only on the material reviewed and on review of current scientific literature. The author reserves the right to modify the report if new information becomes available.

INFORMATION REVIEWED

1) Historical summary on building 532.
2) Air sampling report from ALL-TECH, dated June 14, 2007.
3) Air sampling report prepared by Pinchin LeBlanc Environmental Ltd., dated March 12, 2009.
4) Air sampling report prepared by Pinchin LeBlanc Environmental Ltd., dated December 18, 2009.
5) Air sampling report prepared by Pinchin LeBlanc Environmental Ltd., dated December 6, 2012.
6) Air sampling report prepared by Pinchin LeBlanc Environmental Ltd., dated January 24, 2013.
7) Air sampling report prepared by Pinchin LeBlanc Environmental Limited, dated February 8, 2013.
8) Inspection report Service NL, dated November 13, 2012.
9) Review of indoor air quality report by Amec, dated October 4, 2012.
10) Work-refusal ruling by Service NL, dated January 28, 2013.
11) Confidential (no name) medical reports on five employees with symptoms.

BUILDING 532

The following information was provided by Eastern Health on the historical events regarding Building 532.

Building 532 was built approximately 60 years ago as a military base. The structural wooden support beams and joists in the basement crawl space were believed to be treated with creosote.

Eastern Health has occupied the building since 1997. There were renovations between 2004 and 2005. New wings were added in 2005 and 2006 as the Rowan Centre (Adolescent Addiction Services) and the opioid treatment centre. Both additions are attached to Building 532, but have their own foundation.

Between August 2008 and January 2009, a new sprinkler system was installed. Fine tuning of the system was on-going until the flood in March 6, 2009 when all staff were relocated.

Methadone and Rowan Centre staff returned to the building on March 10, 2009.

Recovery Centre staff moved back to Building 532 on April 19, 2010.

In recent years, Eastern Health Regional Protection Services and Cancer Care also occupy a section of the building.

Due to several cases of skin rashes in 2012, two "sprayings" were done in June 2012 for suspected pest infestations.

Several workers have developed upper respiratory tract irritation, burning eyes, and headaches. Unconfirmed information showed that some employees have been prescribed puffers since working in this facility.

Recently, five employees were seen at a dermatology clinic and also by an allergist.

The employer retained outside consultants to conduct air sampling in 2007, February 2009, July, August and December 2009, December 2012 and January 2013.

Currently, the building houses the recovery centre on the first floor with inpatients staying for six days. The staff works between 8 to 12 hour shifts.

Building 532 is serviced by 11 Heat Recovery Ventilators (9 for the original structure and 1 for the Rowan Centre and one for the Methadone Clinic). The original structure was heated by low pressure streams and the Rowan Centre and Methadone Clinic by electric heater. The boiler room is situated underneath the main office of the original structure.

The concern was whether there was significant exposure to toxins in the air from the off-gassing of the creosote treated wood.

CREOSOTE

The information provided between page 8 and page 11 are general information about creosote and may not apply to Building 532.

Creosote (production and use):

Creosote is the name given to a liquid product from the production of coke. Coal tar is a byproduct of carbonization of coal to produce coke and coal gas. Creosote is one of the distillation products of coal tar. Coal tar contains complex mixture of polycyclic aromatic hydrocarbons (PAHs), phenols, sulphur, and nitrogen compound. The semi-solid material at the end of the distillation of coal tar is called coal tar pitch.[1] Coal tar pitch consists of six major classes of compounds: polycyclic aromatic hydrocarbons, alkylated PAHs; tar acid and tar basis/nitrogen containing heterocycles; aromatic amines; sulphur containing heterocycles and oxygen containing heterocycles. Creosote contains between 15-85% of polycyclic aromatic hydrocarbons.[1,2]

There is another type of creosote which is produced from beechwood. The wood creosote consists mainly of phenols, cresols with a characteristic smoky odour and burnt taste.[1]

Creosote is mainly used as a preservative in the pressure treatment of wood.

Creosote (exposure and health hazard):

The commonly known exposure to creosote is during the application as preservatives in the pressure treatment of wood.[3,4,5,6] The route of exposure is by inhalation and from direct skin exposure.[5,6] The health effects are best summarized by the Toxicological Profile published by the Agency for Toxic Substances and Disease Registry (ATSDR) in September 2002[1] with supplemented in August 2009[7]:

Exposure to high concentration of airborne creosote vapour can cause eye and mucus membrane irritation. It can also irritate the respiratory tract. Direct skin contact with creosote can cause a rash.

One study demonstrated that in four wood preservation plants where coal tar creosote was the main treating ingredient there was a mild change in the lung function tests.[1]

One study on 13 coal tar creosote impregnation plants in Sweden and Norway showed an increase in non-melanoma skin cancer. Smoking or sun exposure history was not taken into account.[1,5]

One recent study on workers at 11 wood treating plants in the U.S. using creosote-based preservative showed no evidence of significant increase in mortality from cancer or non-malignant disease.[6,7]

A population study in Texarkana, Texas where residence were built close to a decommissioned wood treatment plant, demonstrated that there was a higher risk of chronic bronchitis by the residence. The study showed no adverse reproductive effects.[8]

One "case-control" study showed that there is a weak link between paternal (father) exposure to creosote (from memory recall during the study) and neuroblastoma on the offspring.[9]

The International Agency for Research of Cancer (IARC) classifies Creosote as a probable human carcinogen (Class 2A), meaning that there is sufficient animal evidence, but limited evidence in humans for carcinogenicity. The polycyclic aromatic hydrocarbons are the suspected agents.[10]

Residential Use of Creosote Treated Wood:

In Canada, there is no federal regulation to prohibit the use of creosote treated wood indoors. However, Environment Canada provides guidelines on the handling of Creosote treated wood.[11] Alberta Government published that "the use of creosote treated wood should never occur indoors and should be avoided in outdoor areas frequented by people, specifically children or animals."[12] In the U.S. the EPA (Environmental Protective Agency) states that there are no approved uses of creosote to treat wood for residential use.[13]

ASSESSMENT FOR EXPOSURE TO CREOSOTE

Since creosote contains a mixture of over 100 compounds, there is no specific test method for exposure to creosote. "Coal tar pitch volatile" (CTPV) sampling, which was designed to measure the exposure to PAHs released from coal tar pitch, has been used as a surrogate measure of exposure to creosote. The contaminants to be analyzed are airborne solids and aerosols collected in glass filters and later dissolved in benzene. The results are determined by gravimetric method.[14] This sampling strategy is appropriate if the industrial process involves the production of creosote; active application of creosote (wood treatment); or disturbance of the structure i.e. welding of the railroad sleepers.

However, if the treated wood has been in the building for many years, it is unlikely that the polycyclic aromatic hydrocarbons will still be released in particulate form or in aerosols. Off-gassing will likely be in the form of vapour and the CTPV methods will not be able to capture the vapour. If a positive result is obtained using the CTPV method, it is likely not from creosote. A negative result will only indicate that the exposure to vapour has not been determined.

The appropriate testing method where coal tar creosote is not actively being used or disturbed will be testing for the total volatile organic compound (VOC) and for airborne polycyclic aromatic hydrocarbons plus naphthalene, which is the most common volatile component in coal tar creosote.[3,4,15] Other known compounds in the vapour phase may include: acenapthelene, fluoranthene, phenathrene and pyrene etc. in small quantities.[15,16]

Air sampling does not address the route of exposure through direct skin contact, which plays an important role in industrial settings and contaminated sites.

BIOLOGICAL TESTING

There is no specific blood test to determine current or past exposure to creosote. The urine test for "1- hydroxypyrene" is a surrogate measure of exposure to PAHs. Pyrene, one of the PAHs in coal tar is metabolized in the human body and excreted as "1-hydroxypyrene."[17,18,19,20,21] Diet (especially BBQ meat) and smoking can influence the results of the testing. [20,21] Since there is virtually no exposure to airborne PAHs from the off-gassing of creosote treated wood, urine testing for 1-hydroxypyrene is not indicated.

COMMENT ON THE AIR SAMPLING RESULTS

Air sampling report dated June 14, 2007:

Air testing for cresol (NOT creosote) was conducted in May 2007. All four samples were below the detectable level of 0.048ppm (occupational exposure guideline was 5 ppm).

Air sampling report dated March 2009:

Two types of air sampling were conducted in 2009, indoor air quality assessment and exposure to creosote.

The surrogate measure for adequate amounts of fresh air in a building is to measure the level of carbon dioxide in the area. Carbon dioxide is a product from respiration and if there was no source of combustion, the level will gradually accumulate due to the lack of fresh air. The current guideline for adequacy of fresh air is 1000ppm (parts per million) of CO_2. The carbon dioxide level tested in 2009 ranged between 500's-700's, only a couple of readings were above 1000ppm. This result indicated there was sufficient fresh air in the building.

Coal tar pitch volatile method was used to sample for the exposure to creosote. Five samples were taken and the samples on the second floor hallway outside the reception area and between floors on the stairways showed results of 0.18mg/m^3. According to ACGIH (American Conference of Government Industrial Hygienists, an organization that sets exposure guidelines for occupational exposure), the occupational exposure guideline for coal tar pitch volatile is 0.2mg/m^3. These results were unexpected. Based on the physical chemistry and science presented in the previous pages, it is unlikely that the results were particulates released from creosote. It is unknown what other airborne contaminants, at that time, could produce this false positive reading. It was reported that between August 2008 and January 2009, a sprinkler system was installed in the building and the creosote foundation might have been disturbed. The fine tuning of the system was on-going and likely occurring during the sampling period.

Air sampling report dated December 2009:

The air sampling were done in July, August and December 2009 and the report was released in December 2009. Various ventilations were turned on and off in the building to determine if it played a role in the degree of exposure. 48 samples were taken in various parts of the building. All of the sampling results were below the limit of detection ($0.042mg/m^3$) using the coal tar pitch volatile method.

Air Sampling report dated December 2012:

Total volatile organic compounds (TVOC) were tested during the month of November 2012. All measurements were below the detectable level of 0.1ppm.

The consultant also conducted a mould evaluation in the building. Three air samples were taken and the results were compared to outside reference. There is no statistical difference between the four samples (3+ outside reference). However, in the main office, two unexpected moulds were detected (epicoccum nigrum and aspergillus versicolor). The main office was said to be situated above the furnace room where fungal contamination was observed by the consultant. It cannot be determined whether the detection of the two fungi was accidental (brought in by the occupants) or whether there was mould contamination through the structure of the building. Building associated lung diseases have been reported from exposure to aspergillus versicolor.[22] The report also indicated that five workers in the office experienced rash, burning, and itching of the skin.

Air sampling report dated January 2013:

The air testing was carried out using the coal tar pitch volatile method plus determining the amount of airborne cresols, phenols and polycyclic aromatic hydrocarbons in the recovery centre, methadone clinic, cancer care section and Rowan Centre. Nineteen area samples were collected on December 13th, 14th, 19th and 20th. Seventeen compounds were scanned for polycyclic aromatic hydrocarbons. All sample results were below detectable levels except one

sample obtained on December 19th on the first floor hallway leading to the Rowan's Centre detected a small quantity (0.0011ppm) of Naphthalene.

Air Sampling Report Dated February 8, 2013:

Three air samples were collected on January 24, 2013, for coal tar pitch volatiles, cresols, phenols and PAHs. The area sampling was collected at the Cancer Care Section and the results detected Naphthalene at a level of 0.0010ppm. Two personal samples (one at the Rowan Centre and one at the Methadone Clinic) did not show any detectable levels of the contaminant tested.

COMMENTS

It appears that the wood treated with creosote is still off-gassing a small quantity of volatile organic compounds. This is demonstrated by the subjective evidence of the "oily smell" noted by the staff and by the objective measurements of naphthalene, which is a common component of creosote.

The route of exposure at Building 532 is from inhalation. Direct skin contact with the treated wood is not expected.

Laboratory testing has been conducted for the airborne contaminants from creosote treated wood and the most concerning polycyclic aromatic hydrocarbon, namely benzo[a]pyrene, was not detected.[3,15] The current sampling also did not detect benzo[a]pyrene or other PAHs. Therefore, it is unlikely that the workers and the patients were exposed to any significant levels of carcinogens in the workplace.

Napthalene is a solid at room temperature. Napthalene has extremely low odour thresholds (the minimal airborne concentration level under which the presence of a substance can be detected by smell). Their presence can be detected long before the occupational exposure limits are reached. The odour of naphthalene and the volatile organic vapour in creosote can be quite unpleasant. Exposure to unpleasant odours can cause various symptoms including irritation to the mucus membrane, nausea and headache.

Naphthalene is not classified as a human carcinogen by ACGIH (A4)[25], but as a possible carcinogen by IARC (2B).[26]

The medical consultation reports for the five workers with skin issues were also reviewed. At this time, it is not possible to attribute the medical condition(s) to exposure to airborne creosote or mould. A definitive cause of those symptoms has not been determined.

Mould contamination was observed in the furnace room and specific species of mould namely epicoccum nigrum & aspergillus versicolor were detected in the main office where most of the complaints were reported. The correlation between the two cannot be determined.

CONCLUSION

Based on the information reviewed, it is unlikely that the workers and the patients would be exposed to any significant levels of toxic vapour, including carcinogens. Thus, the working conditions do not pose a health hazard to the workers (including pregnant workers) and patients.

However, the odour for naphthalene and like substance can be irritating. The employer should explore means to minimize such exposure.

RECOMMENDATIONS

Even though the workers are not exposed to a hazardous level of airborne contaminants from creosote treated wood in Building 532, the odour issue needs to be rectified. The following recommendations are made:

1) Encapsulation: When it is not possible to remove/replace the source of contaminants, the second best thing is to isolate it so that the release of air contaminants will be contained. Various methods have been suggested for encapsulation. If this option is to be considered, all four surfaces of the beam need to be treated. Prior to awarding the contract, it is essential that the supplier demonstrate that the method of encapsulation actually can contain the release of off-gassing. From the information provided for this review, it may be impractical for the encapsulation process because one side of the beam and decking will be under the floor and cannot be encapsulated.

2) Thermal Control: Since off-gassing is highly dependent on temperature, the ambient temperature in the basement/crawl space should be kept to a minimum to reduce the thermal effect. This can be done by introducing fresh cold air (see recommendation 3) into the basement.

3) General Ventilation: Since most of the off-gassing are initially released into the basement/crawlspace area, additional make-up air can be introduced into these areas to dilute the unpleasant odour. The air should be exhausted directly outside if possible.

4) Sealing possible leaks: If the Heat Recovery Ventilator systems have air ducts, which supply the occupied space, located in the basement/crawl space, they should be sealed to prevent entrainment of potentially contaminated air into the system.

5) Pressure Differential: The occupied space should be kept in a positive pressure in relation to the basement/crawl space to minimize migration of potential contaminated air.

6) Air Filtration: Activated charcoal filters can be installed, such that the unpleasant odour i.e. organics vapours can be adsorbed by the activated charcoal.

It is not recommended to perform biological testing on the workers or the patients because the results do not reflect current or past exposure.

The detection of the two species of mould in the office should be addressed. The mould contamination in the basement was reported to have already been cleaned up.

February 12, 2013

Dr. Sidney Siu, MD, FRCPC
SRS/ca

Date

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