Creosote: Prescription For The Future, Part Two

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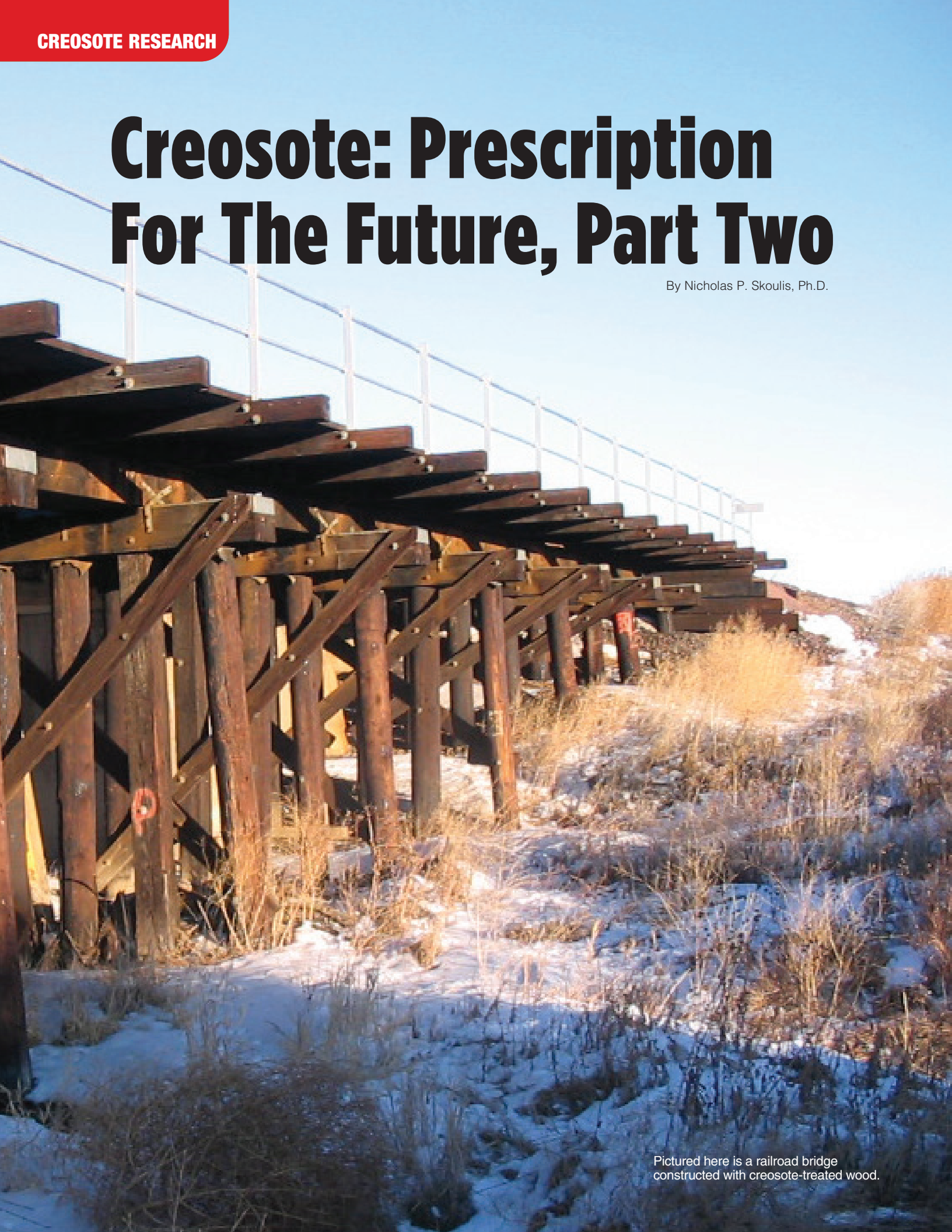

Pictured here is a railroad bridge constructed with creosote-treated wood.

Editor's Note: The below represents the final installment of a two-part series on creosote and creosote-preserved wood. Initially planned for presentation at the annual conference of the American Wood Protection Association, this installment will be included in American Wood Protection Association's "Book of Standards." These papers will also be presented at the upcoming Railway Tie Association Conference.

Creosote is a pesticide with significant use as a wood preservative that has the potential to be toxic to humans following large exposures or through chronic repeated exposures. Several epidemiological studies have shown no increase in serious health effects and no increases in mortalities from malignant and non-malignant cancers when compared to the national U.S. mortality rate.

Introduction

Oral exposure to creosote is rare, as the typical route of exposure is through contact with the skin from surface residues on wood treated with creosote. The Acute Dermal LD_{50} is >2000 mg/kg for creosote (where creosote is applied topically as a single dose to the backs of animals to an area approximately 10 percent of the body surface area that is held in place with a semi-occlusive patch for 24 hours[1]) and, when laboratory animals were exposed to 2000 mg/kg no animals died with no visible effects observed in any of the animals exposed[2].

Creosote Dermal Toxicity

Creosote is classified as a Toxicity Category III, as low to moderate toxicity; however, at the time of the test (1993) the highest dose required to be tested was 2000 mg/kg so the Dermal LD_{50} is most likely much greater than 2000 mg/kg.

However, as stated above, the main route of exposure to the general public is from coming into direct contact with wood treated with creosote and, more specifically, to the residue of creosote on the surface of the wood.

Fasano (2012) applied creosote to small coupons of wood, 105 µL of ^{14}C-creosote, which was intended to mimic the residue of creosote on the surface of the wood, and the potential transfer of residue of creosote on the surface of the wood to the skin.

The treated wood coupons (pine and oak) were applied to the shaved area of the rats (10 cm^2) on the dorso-lumbar area and left in place for eight hours. Following exposure to the skin of the animals, creosote was washed off with dilute soap and water. The results showed that 1.5 to 1.6 percent of the creosote was absorbed[3].

This overly excessive exposure scenario shows that only a small fraction of the creosote residue from the surface of the treated wood is absorbed across the skin in rats, and when taking into account that rat skin is more permeable than human skin. Previous work carried out with creosote showed that rat skin is eight times more permeable than human skin[4,5], making the expected dermal absorption in humans to be 0.2 percent. Thus, making the dose of creosote extremely small from dermal contact, which greatly diminishes concerns for toxicity following dermal contact.

Creosote tends to stay in the wood once it has been treated. As an example, even after 50 years of service, a majority of the creosote applied to wood ties is still in the ties.

While one can get creosote residue on the hands from handling ties, the dermal absorption, as stated above is extremely low and any remaining residue can be washed off. Only a very small and insignificant fraction (0.2 percent) could be absorbed into the body, resulting in an extremely small "dose."

While some of the PAH constituents of creosote are considered to be carcinogenic, it is important to recognize that carcinogenicity studies are carried out in laboratory animals where they evaluate PAHs by applying them to the skin or force feeding the animals daily for the lifetime of the animal. Again, the main exposure to creosote is from dermal contact, not through oral exposure, and laboratory animals, such as rats, have been shown to absorb creosote eight times greater than what would be expected in humans, making any potential human dose very small.

Supporting this are several cohort studies of workers handling creosote and creosote-treated wood who reported no serious chronic health conditions, including cancer, when their health was compared to the general public[6,7,8,9].

The only study to have identified an excess of skin cancers in creosote workers was carried out in Scandinavia[10] (where the chemical make-up of creosote may differ from that in North America), and the study contains major limitations including small numbers of subjects, uncertain exposure to creosote, concomitant exposures to other chemicals and extended exposures to sunlight (creosote is known to be phototoxic), and the lack of control for smoking and other potential confounders. Additionally, no other studies of creosote workers have reported similar outcomes.

Wong and Harris (2005) evaluated 2,179 workers from 11 wood-treating plants in the United States where wood was treated with creosote-based preservatives, between 1979-2001. The mortality for the entire cohort for either site-specific cancers or non-malignant diseases and found that the entire cohort mortality was lower than expected, when compared to the U.S. national mortality rate[11].

Conclusions

In view of the small population exposed, the proper interpretation of these cancer ▶

[1] Product Safety Labs Acute Dermal Toxicity in Rats. Protocol No. P322RAT. Revised 08/31/2017.

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[3] Fasano, WJ. Creosote-Treated Wood: In Vitro Dermal Absorption of Creosote in the Rat. DuPont Haskell Global Centers for Health & Environmental Sciences, Newark Delaware. Laboratory Project ID DuPont-19303-1378. Creosote Council III unpublished report September 28, 2012.

[4] Fasano, W.J. AWPA P1/P13 Creosote: In Vitro Kinetics in the Rat and Human Skin. DuPont Haskell Laboratory for Health and Environmental Sciences, Newark Delaware Laboratory Project ID: DuPont-21647. Creosote Council unpublished report. April 30, 2007.

[5] Fasano, W.J. AWPA P1/P13 Creosote: In Vivo Dermal Absorption in the Rat. DuPont Haskell Laboratory for Health and Environmental Sciences, Newark Delaware, Laboratory Project ID: DuPont-19622. Creosote unpublished report. July. 2. 2007.

risk estimates is that wood treatment workers exposed to creosote over the course of a working lifetime will experience no additional cancers. Accordingly, any added cancer risk posed by exposure to creosote falls within normally accepted regulatory risk and poses no elevated cancer risk[12].

Furthermore, any exposures to the general public from creosote-preserved wood products would be expected to be significantly lower than the creosote wood treating workers studied, as creosote treating workers are involved in handling freshly treated wood and while appropriate personal protective equipment are worn by the workers who are handling creosote treated lumber eight hours per day five days per week.

In addition, creosote is a heavy-duty wood preservative and is classified as a restricted use pesticide (RUP) making it only available to certified applicators[13]. While the general public can come in contact with creosote-treated wood, it would be expected to be limited and incidental, which would result in significantly less exposures to creosote.

It is worth noting that repeated direct exposures to the skin from small quantities of creosote over a long period of time can result in dermal irritation that is characterized by blistering and/or reddening of the skin and can result in an increased sensitivity to sunlight . Proper personal protective equipment such as gloves and long-sleeved clothing and taking actions such as washing any exposed skin can greatly limit this potential result.

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[7] TOMA, 1979. Cross-Sectional Health Study of Workers of Four Forest Products Plants of Koppers Company Inc. Volume A. Tabershaw Occupational Medicine Associates (TOMA). EPA/OTS number: FYI-OTS 0285 0385. U.S. EPA/OPTS Public Files.

[8] TOMA, 1981a. Cross-Sectional Health Study of Workers of Four Forest Products Plants of Koppers Company Inc. Volume A. Tabershaw Occupational Medicine Associates (TOMA). EPA/OTS number: FYI-OTS-0285-0385. U.S. EPA/OPTS Public Files.

[9] TOMA, 1981b. An Epidemiologic Study of Mortality among Workers at the Koppers Coal Tar Plants. Conducted by Tabershaw Occupational Medicine Associates, P.A., Rockville, MD. EPA-OTS/86-870001549. NTIS/OTS0515709.

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[11] Wong O, Harris F. 2005. Retrospective cohort mortality study and nested case-control study of workers exposed to creosote at 11 wood-treating plants in the United States. J Occup Environ Med 47: 683–97.

[12] The Sapphire Group, Inc. Cancer Risk Assessment for Creosote Wood Treating Workers. Prepared for the Creosote Council III. February 2008.

[13] United States Environmental Protection Agency. Registration Review Draft Risk Assessment for Creosote. DP No. 453299. September 24, 2019.

[14] Agency for Toxic Substances and Diseases Registry (ATSDR). Creosote Health Effects. November 2006