

Human Health Risk Assessment for Precautionary Fish Consumption Advisory, North Saskatchewan River

Overview

Since the 16Tan pipeline incident, a precautionary fish consumption advisory has been in place for the protection of human health. Based on laboratory measurements of fish tissues, human health risk assessment calculations were performed by SLR Consulting (Canada) Ltd. to determine if the potential risks from consumption of fish downstream of the spill area in the North Saskatchewan River (NSR) are deemed acceptable. According to Health Canada (2012), acceptable risk refers to an insignificant or negligible impact on human health over a lifetime of daily exposure. The human health risk assessment involved an exposure assessment and a toxicity assessment. Carcinogenic (cancer-causing) and non-carcinogenic risks were found to be acceptable for the consumption of fish from areas downstream of the spill site on the NSR. This information is being provided to the Government of Saskatchewan to help inform their decision on if and when to lift the precautionary fish consumption advisory.

Methodology

Target species were prioritized based on recreational, commercial and traditional use value and included Walleye, Northern Pike, Goldeye, Mooneye, and Shorthead Redhorse. Tissue samples were collected from upstream reference sites (i.e. upstream of the spill release point), and downstream from the spill release point of entry into the NSR, from impacted locations. Samples were analyzed for polycyclic aromatic hydrocarbons (PAHs), percent lipids and percent moisture.

Exposure and Toxicity Assessment

PAHs in the environment can originate from human activities, as well as natural sources. Many PAHs have carcinogenic properties. The calculations quantified the exposure of a high fish consuming person (daily, year round) to the PAH compounds present in fish fillet tissues. The PAH concentrations in fish when ingested were based on the maximum concentration of each parameter measured in the datasets from the most impacted river segments and from the upstream reference sites. The use of maximum concentrations is conservative and will typically overestimate exposure and associated risks.

Potential health risks were assessed for adults, teenagers, children and toddlers. Body weight, life expectancy, relative absorption from the gastrointestinal tract, and fish ingestion rates, as specified by Health Canada, were considered. The calculations assumed a lifetime consumption of fish from the NSR (toddler through to adult life phase). Infant fish consumption was assumed to be negligible.

The assessment also used published toxicity information from human and animal studies to identify potential health risks at various levels of exposure.

Uncertainty Analysis

In general, uncertainties associated with the risk assessment are considered conservative and are likely to overestimate the levels of exposure and associated risk. For example, daily consumption rates were based on conservative assumptions that would overestimate actual level of exposure, and maximum PAH values from the datasets were used during the exposure assessment. The use of maximums will tend to overestimate exposure and associated risks.

Cancer risk and non-cancer hazards

Exposure estimates were combined with toxicity values for both carcinogenic and non-carcinogenic chemicals to estimate cancer risk and non-cancer hazards.

Potential hazards from non-carcinogenic effects are estimated by comparing exposure estimates to the acceptable level of exposure for each chemical. For carcinogenic substances, a conservative estimate of potential incremental lifetime cancer risk associated with the estimated exposure was determined, and then compared with acceptable risk levels as per Health Canada (2012). Non-carcinogenic hazards and cancer risks were found to be acceptable for maximum PAH concentrations in fish obtained from heavily impacted areas and non-impacted upstream reference sites. In summary, based on the results of the risk assessment, the calculated hazards and risks associated with ingestion of fish from PAH impacted and non-impacted areas in the NSR are considered to have an insignificant impact on human health. With other considerations, these results support lifting the precautionary “Do Not Consume” advisory.