U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION II
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To: **Site File: American Cyanamid OU8**

From: **Julie McPherson**
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Date: April 11, 2018

Re: **Assessment of Risks Using the One-Hit Model at American Cyanamid**

This memo documents the assessment of risks from exposure to the impoundment materials in OU8 and was prepared in response from a comment from the National Remedy Review Board that recommended the Region ensure that these risks were estimated using appropriate models to account for high level risks.

In 2010, a streamlined risk assessment was conducted to identify risks from direct contact exposure to the impoundment materials for OU8 of the American Cyanamid Site and compared the maximum detected concentrations of chemicals to their respective regional screening levels. The calculated risks identified for Impoundments 1 and 2 were in excess of 1×10^{-2} cancer risk for benzene.

As per EPAs Risk Assessment Guidance for Superfund Volume 1 Human Health Evaluation Manual (Part A) (EPA/540/1-89/002), risks in excess of 1×10^{-2}, calculation of risk should be conducted utilizing the one-hit equation. The one-hit equation is only applied to scenarios where the exposure dose is high, and it assumes any single "hit" of an amount of a carcinogen at a cellular target (e.g. DNA), can initiate a series of events leading to a tumor. The one-hit equation is an exponential model that limits the single chemical risk to less than one, whereas the regular linear cancer model may calculate values greater than one. The equation is as follows:

$$\textbf{Risk} = 1 - e^{(-\text{intake} \times \text{toxicity})}$$

The site is currently vacant; however, it is zoned for industrial use. Therefore, the reassessment focused on the industrial worker exposure pathway. The reassessment only focused on the ingestion pathway as it is the critical exposure pathway driving risks at the site. The risks will be underestimated considering the inhalation and dermal pathways are not included.

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The intake variable above was calculated using the following equation:

$$\textbf{Intake} = \frac{\textbf{Concentration in soil x Ingestion Rate x Conversion Factor x Exposure Frequency x Exposure Duration}}{\textbf{Body Weight x Exposure Frequency x Exposure Duration}}$$

The standard defaults factors for the variables in the Intake equation were obtained from the 2014 Human Health Evaluation Manual, Supplemental Guidance – Standard Default Factors (OSWER Directive 9200.1-120).

The exposure factors that were included to calculate intake are the following:

Impoundment 1 concentration in soil (2010 Streamlined Risk Assessment)	= 390000 mg/kg
Impoundment 2 concentration in soil (2010 Streamlined Risk Assessment)	= 61000 mg/kg
Ingestion Rate for the outdoor worker	= 100 mg/kg
Conversion Factor	= 1×10^{-6}
Exposure Frequency	= 225 days/year
Exposure Duration	= 25 years

The Intake for Impoundments 1 & 2:

Intake Impoundment 1	= 0.4875 mg/kg-day
Intake Impoundment 2	= 0.07625 mg/kg-day

The cancer slope factor used for the assessment was the more conservative value identified in IRIS (Integrated Risk Information System). The cancer slope factor for benzene is 5.5×10^{-2} mg/kg-day.

<u>One hit model</u>

$$\text{Risk} = 1 - \text{Exp}\ (-\text{Exposure Intake x Cancer Slope Factor})$$

Recalculated Risks for the Industrial Worker using the One Hit Model

Impoundment 1	=	2.6×10^{-2}
Impoundment 2	=	4.2×10^{-3}

In summary, the risks estimated for exposures to materials in Impoundments 1 and 2 using the model recommended by EPA guidance for high carcinogenic risk levels are above the acceptable risk range. Therefore, the conclusion reached in the 2010 Streamlined Risk Assessment, that exposure to these materials results in an unacceptable health risk, remains valid.