

Evaluating the Local Impacts of Mercury Emissions from a Point Source

or

What happens when you do an EPA multipathway risk assessment for mercury

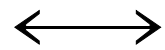
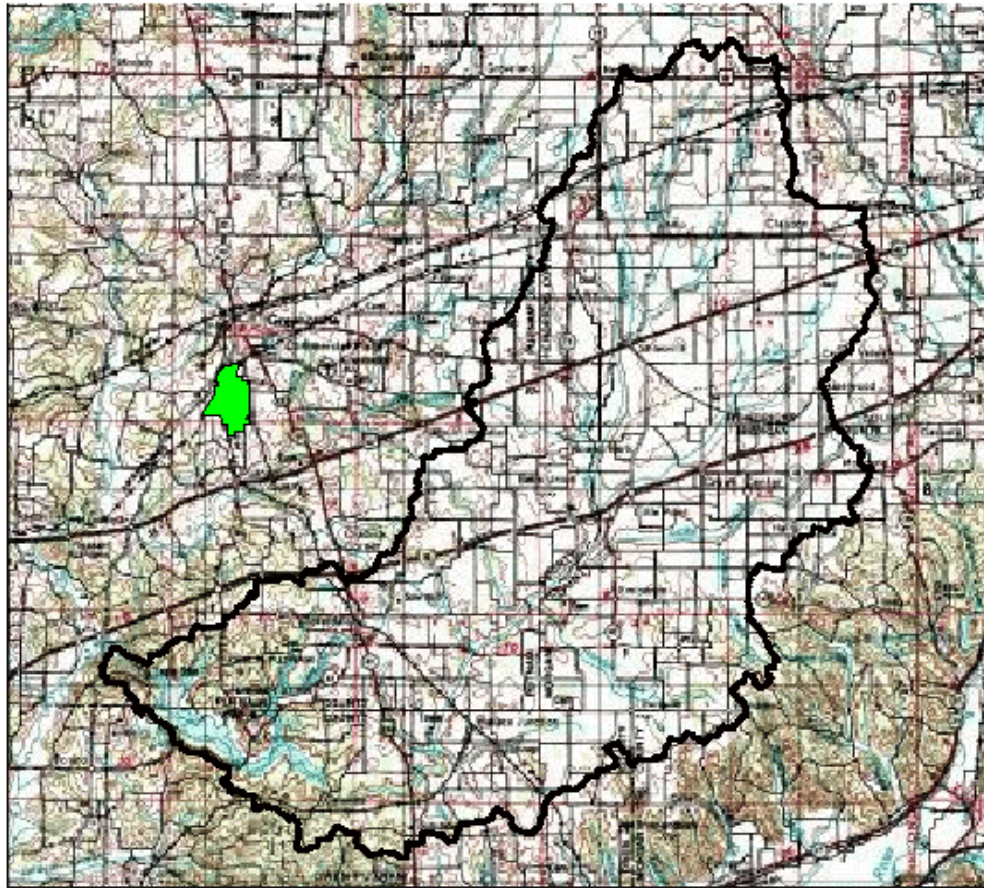
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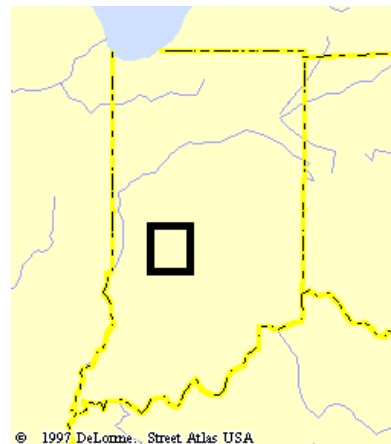
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**A&WMA Specialty Conference on Mercury Emissions:
Fate, Effects and Control**

August 21-23, 2001
Chicago, Illinois

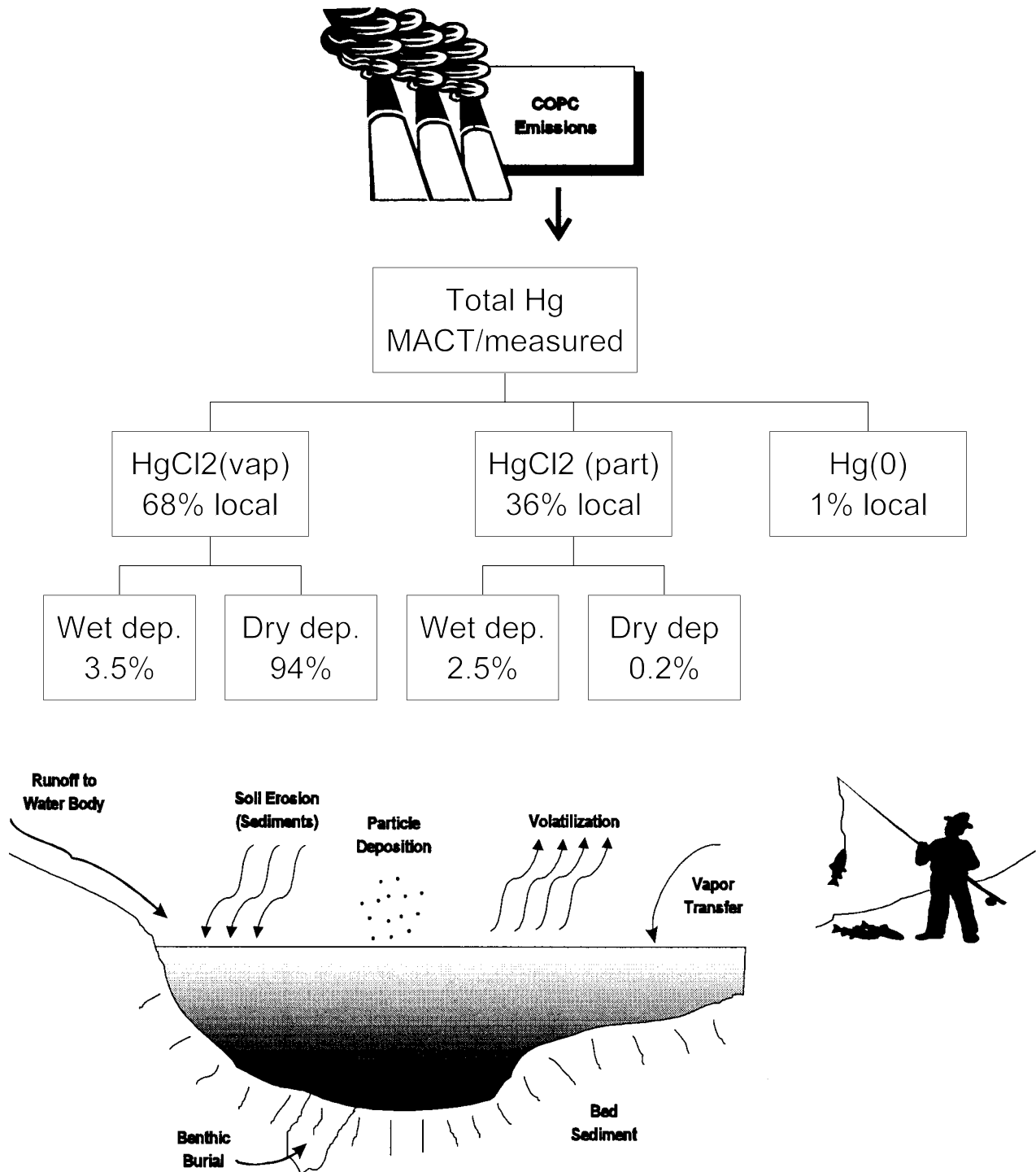


10 km



Cagles Mill Lake watershed (shown in dark outline). The lake is located in the southwestern edge of the watershed. The LSI?Greencastle facility, highlighted in green, is located to the northwest of the watershed.

The essential steps in the transport of Hg^{2+} from a local point source to humans



Mercury Results of EPA Method 0060: Multi-Metals Stack Measurements

Solution analyzed	Likely Hg species captured	Amount of Hg detected (μg)		
		Run 1	Run 2	Run 3
Probe and filter rinse	Hg ²⁺ Particulate	<0.2	<0.2	<0.2
Contents and rinse from the HNO ₃ / H ₂ O ₂ impingers	Hg ²⁺ Vapor	<6.34	<6.03	<5.98
Empty impinger rinse	Hg ²⁺ Vapor	<0.36	<0.41	<0.43
Contents and rinse from the KMnO ₄ / H ₂ SO ₄ impingers	Hg ⁰ Vapor	18.3	15.8	8.02
Final HCl rinse	Hg ⁰ Vapor	<0.46	<0.46	<0.46

Possible Options for Mercury Emission's Speciation Percentages

		Hg⁰ Vapor	Hg²⁺ Particulate	Hg²⁺ Vapor	
HHRAP Default		20	20	60	
EPA Mercury Report to Congress (Table 4-2)	Municipal Waste Incinerators	Standard	20	60	
		50% Control	40	45	
		85% Control	100	0	
	Hazardous Waste Incinerators		58	22	20
	Portland Cement Manufacturing		80	10	10
Method 0060 Measurements	All non-detects at 1/2 detection limits		80	0.5	19.5
	Vapor-phase Hg ²⁺ at calculated levels		97	1.5	1.5

Transport Issues

Dry deposition of vapor-phase Hg^{2+}

The dry deposition velocity of Hg^{2+} is assumed to be 3 cm/s based on HgCl_2 having a similar solubility as HNO_3 .

However:

1. There is no conclusive evidence to support this value.
2. SO_2 has a higher solubility than HgCl_2 which has a lower deposition velocity.
3. Using a former EPA model for estimating dry deposition velocities results in a value of 0.6 cm/s.
4. The critical value in the dry deposition estimation is the reactivity of the Hg^{2+} , which is likely no more than 18 but is assumed to be 800.

Transport Issues

Transport of Hg^{2+} into a water body by the erosion of topsoil

94% of the estimated loading of Hg^{2+} into the lake is due to Hg associated with eroding soil.

1. This is based on the Hg content of soil building up over the facility's assumed 100 year lifetime.
2. The HHRAP default assumption that the Hg content of soil is not decreased by erosion is not valid for a watershed average value.
3. The method for checking the erosion/sedimentation rate assumes that the lakes TSS is entirely erosion products.

Effect of various Bioaccumulation Factors (BAF) and methods for calculation of mercury levels in trophic level 4 fish. MACT emission rates with measure speciation.

BAF source description	Type of Hg measured in water	Calculated water concentration (ng/L)	Type of Hg measured in fish	BAF (L/kg) (5-95%CL)	Calculated fish concentration (mg/kg)
HHRAP guidance	total dissolved mercury	0.037	methyl-mercury	6.8×10^6	0.25
U.S. EPA Mercury Report	dissolved methyl-mercury	0.020	methyl-mercury	6.8×10^6 (3.3 - 14.2)	0.14
U.S. EPA Mercury Report	total dissolved mercury	0.037	total mercury	5.0×10^5 (3.8-6.5)	0.018
Cagles Mill Lake site-specific	total mercury	0.12	total mercury	4.8×10^5	0.056

Estimated incremental mercury levels in local fish due to emissions from LSI/Greencastle Cement Kiln, based on various modeling assumptions.

Emission rate	Emissions' Speciation	Bioaccumulation Factor	Trophic Level 4 Fish Hg Concentration (mg/kg)
MACT	HHRAP	HHRAP	5.9
		Measured	2.4
	Measured	HHRAP	0.14
		Measured	0.056
Measured	HHRAP	HHRAP	0.15
		Measured	0.058
	Measured	HHRAP	0.0034
		Measured	0.0014

