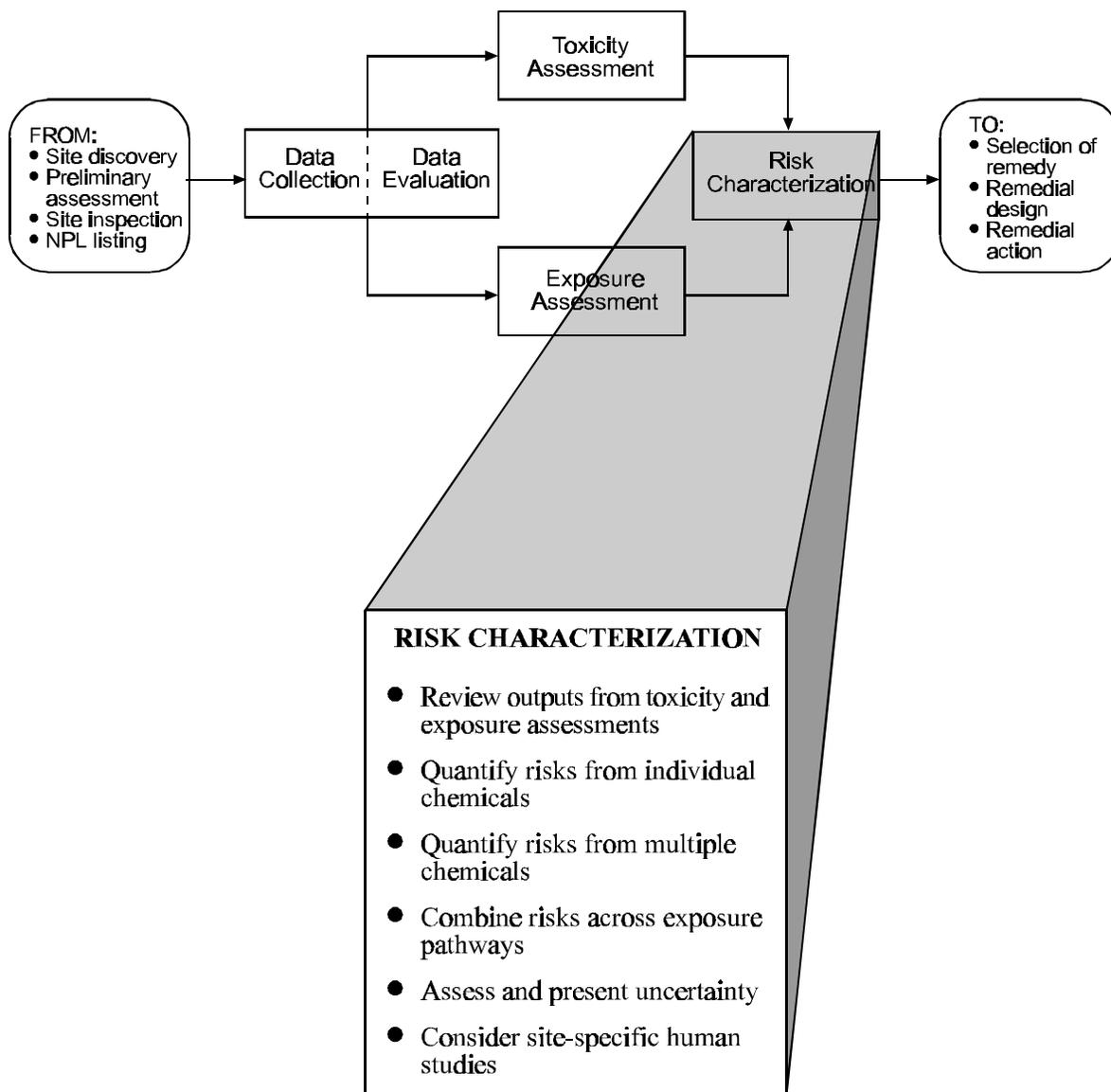


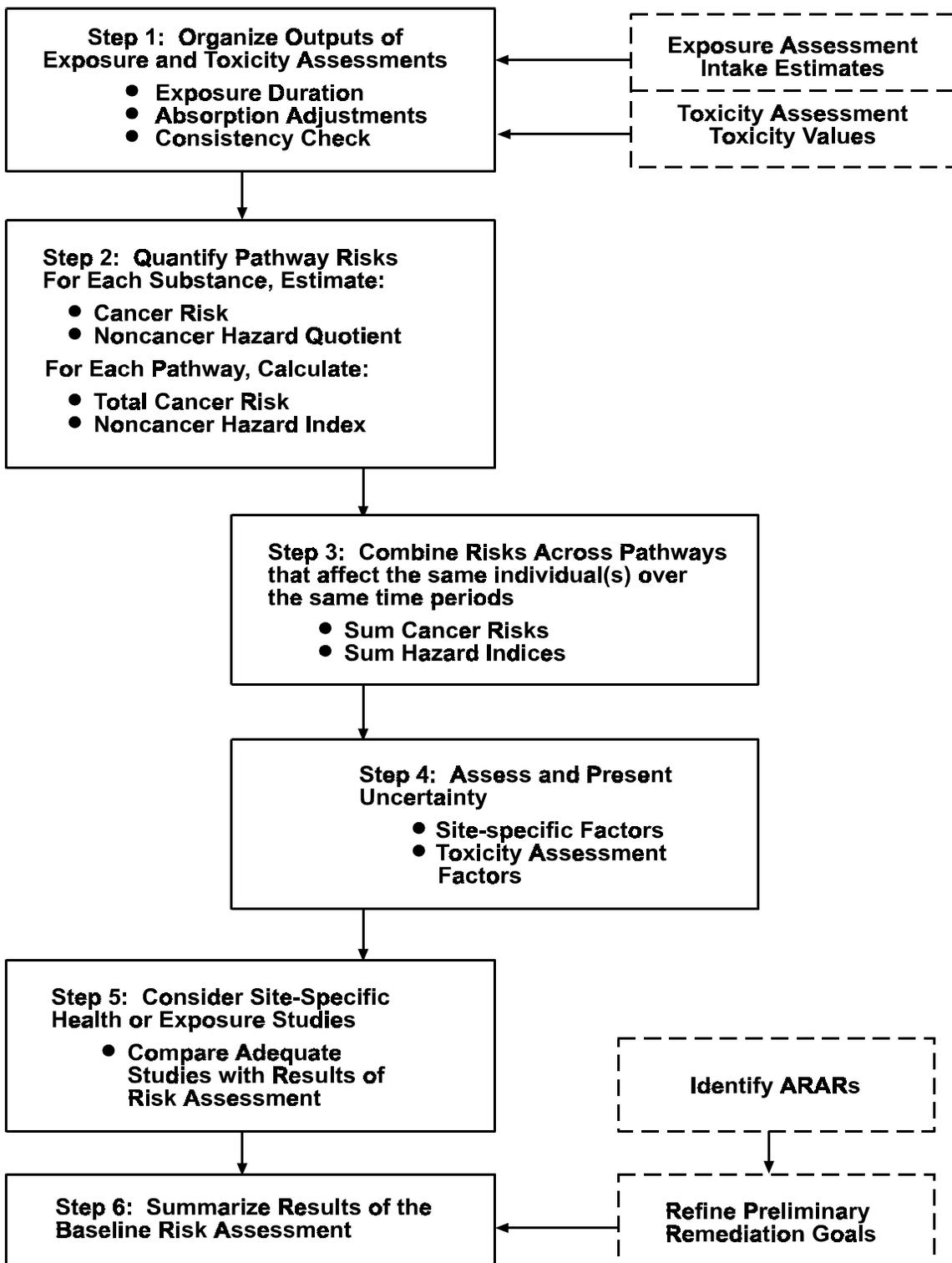
# CHAPTER 8

## RISK CHARACTERIZATION



## EXHIBIT 8-1

### STEPS IN RISK CHARACTERIZATION



**EXHIBIT 8-2**  
**EXAMPLE OF TABLE FORMAT FOR CANCER RISK ESTIMATES**

Chemical	CDI (mg/kg-day)	CDI Adj. for Absorp.	SF (mg/kg-day) <sup>-1</sup>	Weight of Evidence	Type of Cancer <sup>a</sup>	SF Source	SF Basis (Vehicle)	Chemical- specific Risk <sup>b</sup>	Total Pathway Risk <sup>b</sup>	Total Exposure Risk <sup>b</sup>
<b>Exposure Pathway: Ingestion of Contaminated Private Well Water</b>										
Benzene	0.00025*	No	0.029*	A*	Leukemia	HEA	Water <sup>c</sup>	7x10 <sup>-6</sup>		
Chlordane	0.00015*	No	1.3*	B2*		IRIS	Water <sup>c</sup>	2x10 <sup>-4</sup>	2x10 <sup>-4</sup>	
<b>Exposure Pathway: Ingestion of Contaminated Fish</b>										
Chlordane	0.00008*	No	1.3*	B2*		IRIS	Water <sup>c</sup>	1x10 <sup>-4</sup>	1x10 <sup>-4</sup>	
<b>Nearby Residential Population in Area Y – Total Cancer Risk (weight of evidence predominantly B2)<sup>d</sup></b>										3x10 <sup>-4</sup>

\* Values for illustration only.

<sup>a</sup> Identify type of cancer in this table for Class A carcinogens only.

<sup>b</sup> All cancer risks should be expressed as one significant figure only.

<sup>c</sup> Slope factor based on dose administered in drinking water and assumed absorption fraction of 1.0.

<sup>d</sup> Summarize weight of evidence for carcinogens contributing most to the total cancer risk estimate.

SF = Slope Factor

CDI = Chronic Daily Intake

## EXHIBIT 8-3

## EXAMPLE OF TABLE FORMAT FOR CHRONIC HAZARD INDEX ESTIMATES

Chemical (mg/kg-day)	CDI (mg/kg-day)	CDI Adjusted for Absorption (mg/kg-day)	RfD (mg/kg-day)	Confidence Level	Critical Effect	RfD Source	RfD Basis (Vehicle)	RfD Uncertainty Adjustments	Modifying Factor	Hazard Quotient <sup>a</sup>	Pathway Hazard Index <sup>a</sup>	Total Exposure Hazard Index <sup>a</sup>
Exposure Pathway: Ingestion of Contaminated Private Well Water												
Phenol	0.1*	No	0.6*	M	Kidney, liver	IRIS	Water <sup>c</sup>	H,A,S,L <sup>d</sup>	1*	0.2		
Nitrobenzene	0.0001*	No	0.0005*	M	Several	IRIS	Water <sup>c</sup>	H,A,S,L*	1*	0.2		
Cyanide	0.0003*	No	0.02*	M	Thyroid	IRIS	Water <sup>c</sup>	H,A*	5*	0.02		0.4 <sup>b</sup>
Exposure Pathway: Ingestion of Contaminated Fish												
Phenol	0.08*	Yes	0.6*	M	Kidney, liver	IRIS	Water <sup>c</sup>	H,A,S,L <sup>d</sup>	1*	0.1		
MEK	0.005*	Yes	0.05*	M	CNS fetotox	IRIS	Water <sup>c</sup>	H,A,S*	1*	0.1		0.2 <sup>b</sup>
Nearby Residential Population in Area Y – Total Chronic Hazard Index												0.6 <sup>b</sup>

\* Values for illustration only.

<sup>a</sup> All hazard indices and hazard quotients should be expressed as one significant figure only.

<sup>b</sup> If the hazard index is greater than 1.0, see Section 8.2.2 for guidance on possible segregation of hazard index by endpoint.

<sup>c</sup> RfD expressed as administered dose.

<sup>d</sup> Uncertainty adjustment of 1,000 used to

represent combined H, A, S, & L extrapolations. Confidence Level: L = low, M = medium, H = high.

Abbreviation for Uncertainty Adjustments:  
Factor of 10 used for each adjustment,  
unless indicated otherwise.

H = variation in human sensitivity

A = animal to human extrapolation

S = extrapolation from subchronic to chronic NOAEL

L = extrapolation from LOAEL to NOAEL

MF = Modifying factor for EPA verified RfDs. This factor represents professional judgement on overall data base not specifically addressed by uncertainty adjustments.

CDI = Chronic Daily Intake

RfD = Chronic Reference Dose

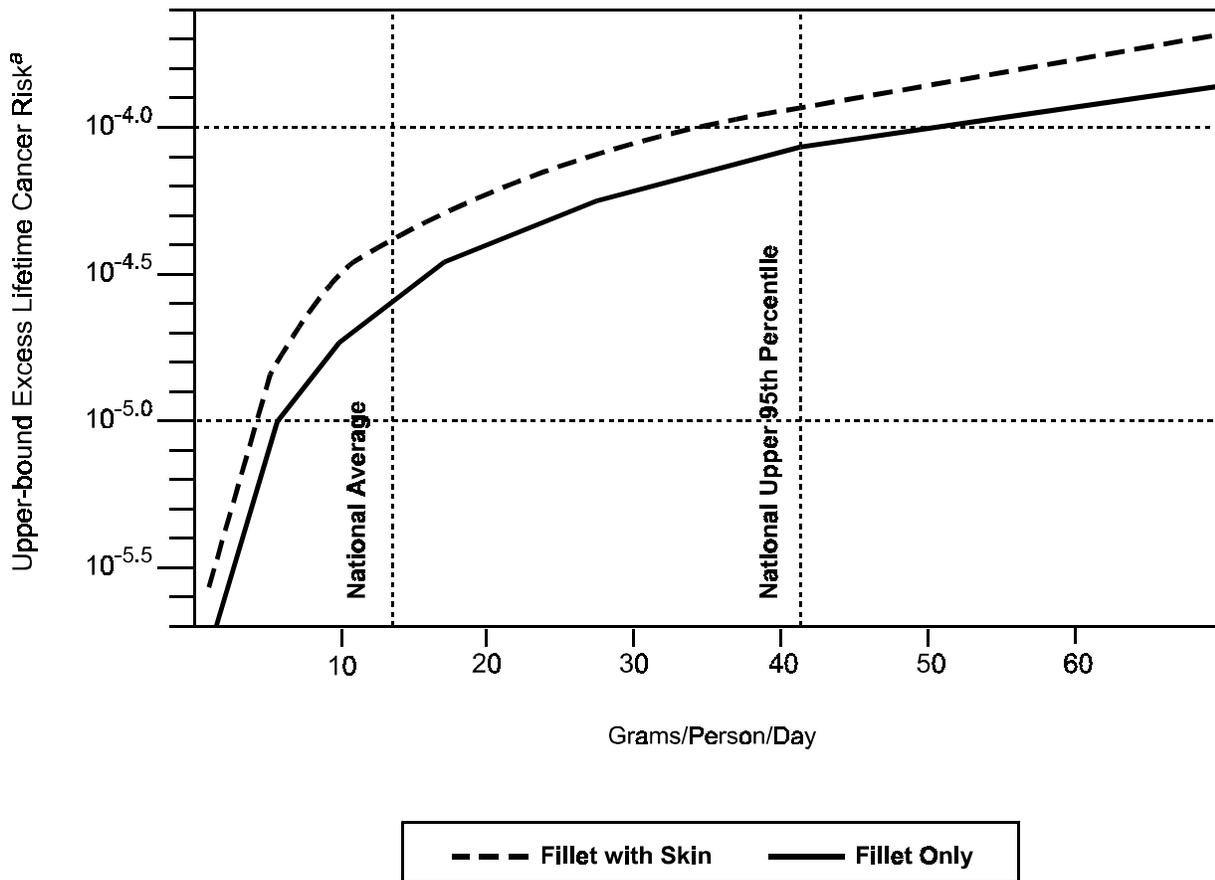
## EXHIBIT 8-4

### EXAMPLE OF TABLE FORMAT FOR SUBCHRONIC HAZARD INDEX ESTIMATES

Chemical	SDI (mg/kg-day)	SDI Adjusted for Absorption	RfD <sub>s</sub> (mg/kg-day)	Critical Effect	RfD <sub>s</sub> Source	RfD <sub>s</sub> Basis (Vehicle)	RfD <sub>s</sub> Uncertainty Adjustments	Modifying Factor	Hazard Quotient <sup>a</sup>	Pathway Hazard Index <sup>a</sup>	Total Exposure Hazard Index <sup>a</sup>
<b>Exposure Pathway: Ingestion of Contaminated Schoolyard Soil/Six Years</b>											
Manganese	0.02*	Yes	0.5*	CNS, repro.	HEA	Water <sup>c</sup>	H, A*	1*	0.04		
Selenium	0.0008*	Yes	0.004*	Several	HEA	Water <sup>c</sup>	H, A*	1.5*	0.2		
Mercury	0.00001*	Yes	0.0003*	CNS	HEA	Water <sup>c</sup>	H*	1*	0.03		
Tin	0.006*	No	0.6*	Liver, kidney	HEA	Food <sup>c</sup>	H, A*	1*	0.01		0.3 <sup>b</sup>
<b>Nearby Elementary Schoolyard – Total Subchronic Hazard Index</b>											0.3 <sup>b</sup>
<p>* Values for illustration only.</p> <p><sup>a</sup> All hazard indices and hazard quotients should be expressed as one significant figure only.</p> <p><sup>b</sup> If hazard index is greater than 1.0, see Section 8.2.2 for guidance on possible segregation of hazard index by endpoint.</p> <p><sup>c</sup> RfDs expressed as administered dose.</p> <p style="text-align: center;"><b>Abbreviation for Uncertainty Adjustments:</b> Factor of 10 used for each adjustment, unless indicated otherwise.</p> <p>H = variation in human sensitivity A = animal to human extrapolation L = extrapolation from LOAEL to NOAEL</p> <p>MF = Modifying factor for EPA RfD<sub>s</sub>. This factor represents professional judgement on overall data base not specifically addressed by uncertainty adjustments.</p> <p>SDI = Subchronic Daily Intake RfD<sub>s</sub> = Subchronic Reference Dose</p>											

**EXHIBIT 8-5**  
**EXAMPLE OF PRESENTATION OF IMPACT OF EXPOSURE ASSUMPTIONS**  
**ON CANCER RISK ESTIMATE**

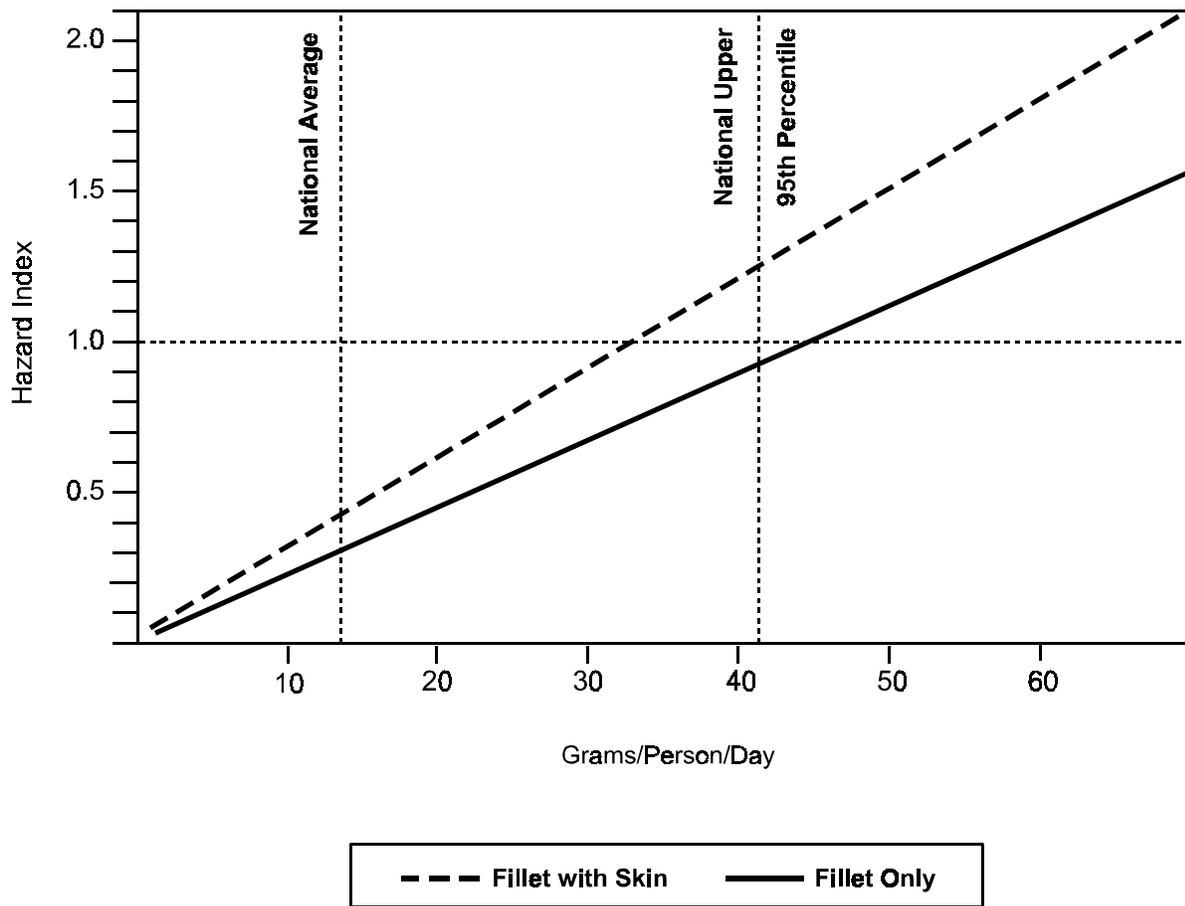
**Ingestion of Fish Contaminated with Chemical X  
(30 mg X/Kg Fish Wet Weight)**



<sup>a</sup> The risk of developing cancer is plotted on a log scale. A risk of  $10^{-4}$  indicates a probability of 1 chance in 10,000 and a risk of  $10^{-5}$  indicates a probability of 1 chance in 100,000 of an individual developing cancer.

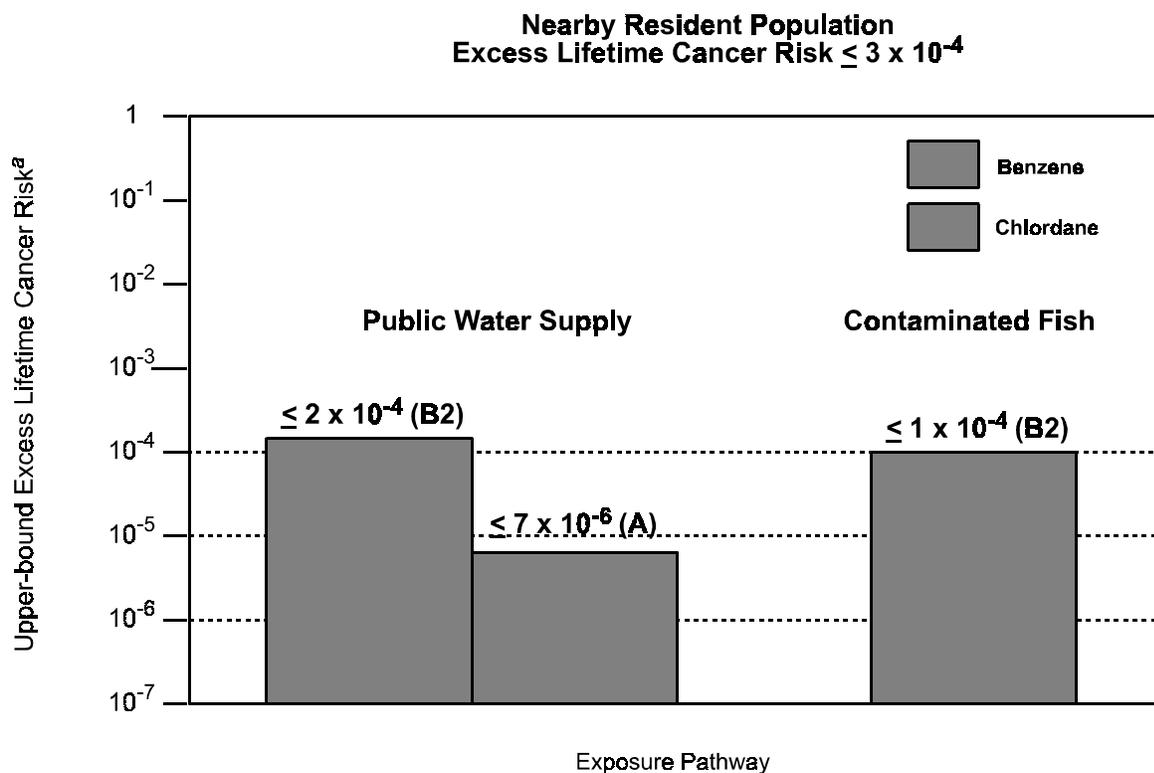
**EXHIBIT 8-6**  
**EXAMPLE OF PRESENTATION OF IMPACT OF EXPOSURE ASSUMPTIONS**  
**ON HAZARD INDEX ESTIMATE**

**Ingestion of Fish Contaminated with Chemical Y**  
**(10 mg Y/Kg Fish Wet Weight)**



## EXHIBIT 8-7

## EXAMPLE OF PRESENTATION OF RELATIVE CONTRIBUTION OF INDIVIDUAL CHEMICALS TO EXPOSURE PATHWAY AND TOTAL CANCER RISK ESTIMATES

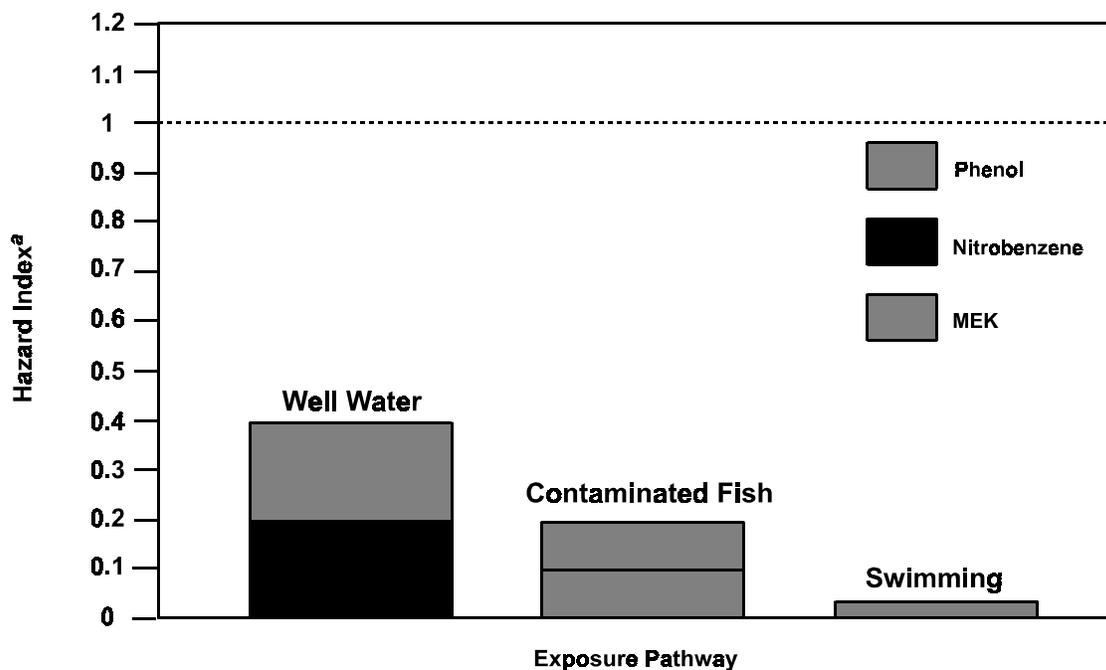


<sup>a</sup> The risk of developing cancer is plotted on a log scale. A risk of  $10^{-4}$  indicates a probability of 1 chance in 10,000 of an individual developing cancer. Risks of  $10^{-5}$  and  $10^{-6}$  correspond to probabilities of 1 chance in 100,000 and 1 chance in 1,000,000 respectively. Values in parentheses represent EPA's weight-of-evidence classification of the agent as a potential human carcinogen: A = human carcinogen; and B2 = probable human carcinogen (with sufficient evidence in animals and inadequate or no evidence in humans).

**EXHIBIT 8-8**

**EXAMPLE OF PRESENTATION OF RELATIVE CONTRIBUTION OF INDIVIDUAL CHEMICALS TO EXPOSURE PATHWAY AND TOTAL HAZARD INDEX ESTIMATES**

**Nearby Resident Population  
Chronic Hazard Index = 0.6**



<sup>a</sup> The hazard Index is equal to the sum of the hazard quotients (i.e., exposure level/RfD) for each chemical. It is not a probability; a hazard index or quotient of  $\leq 1.0$  indicates that it is unlikely for even sensitive populations to experience adverse health effects.