CHAPTER 6
EXPOSURE ASSESSMENT

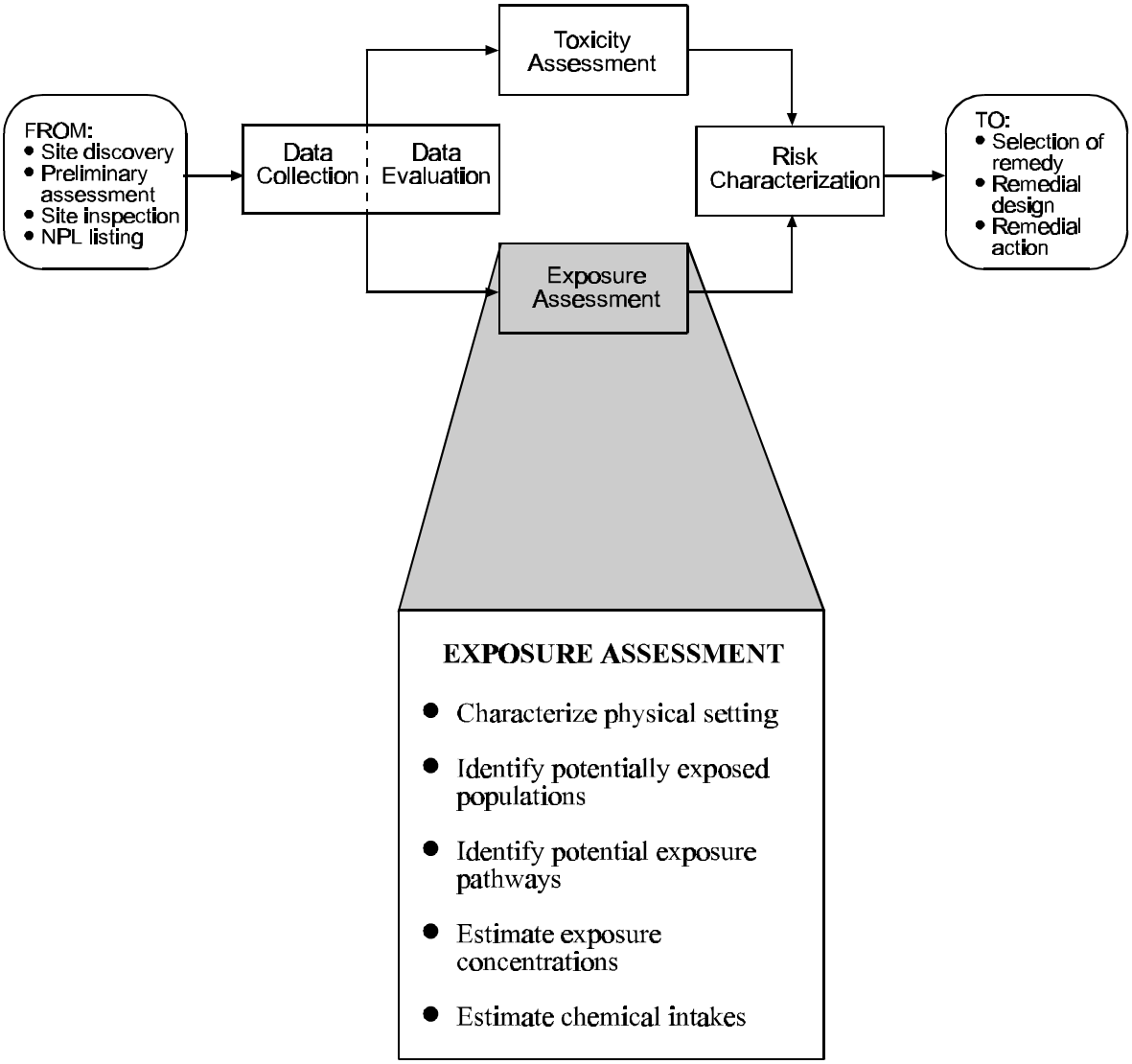


EXHIBIT 6-1
THE EXPOSURE ASSESSMENT PROCESS

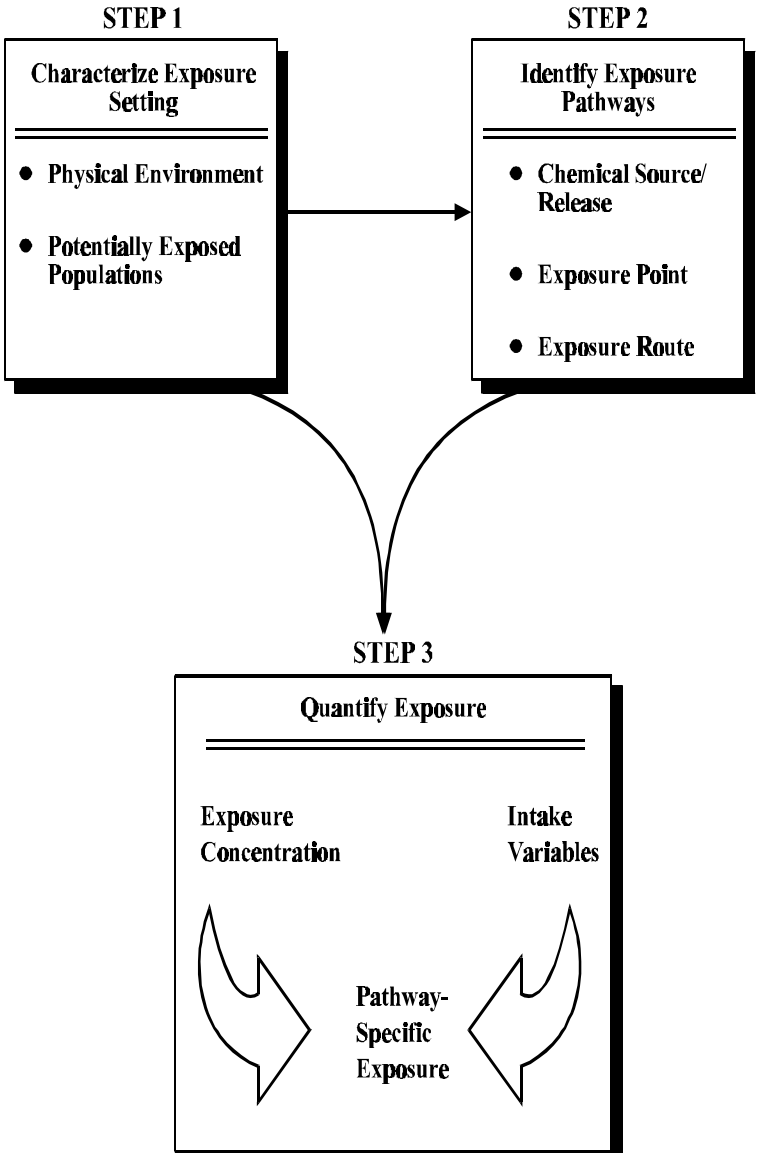


EXHIBIT 6-2

ILLUSTRATION OF EXPOSURE PATHWAYS

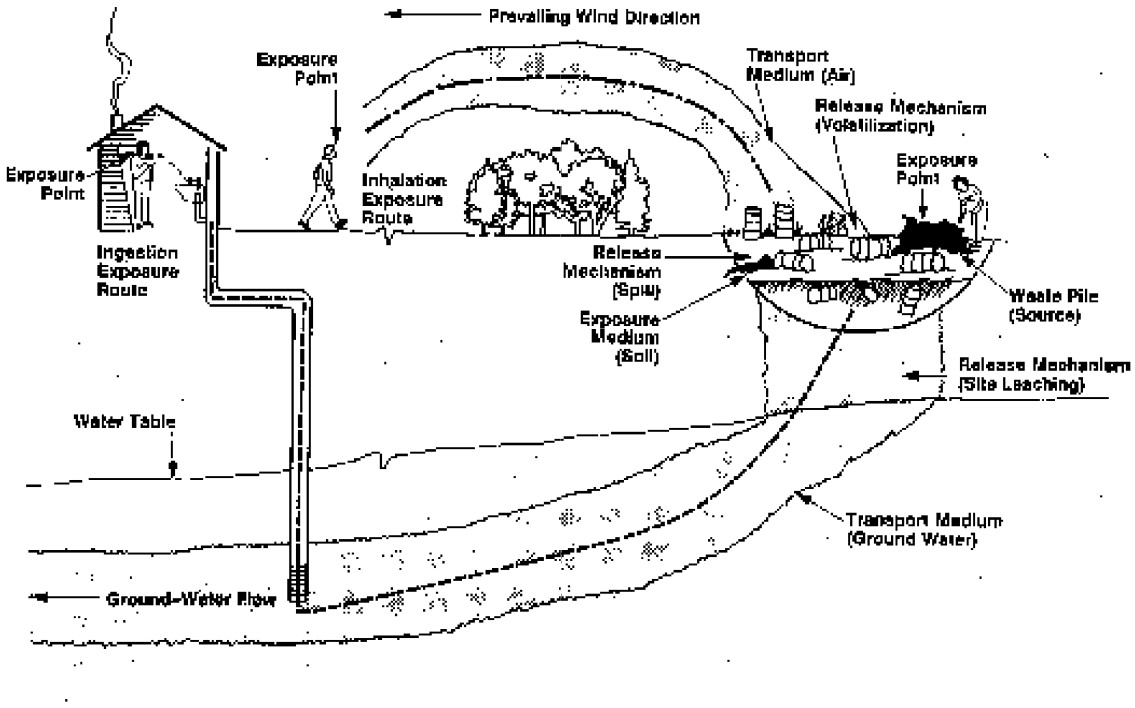


EXHIBIT 6-3

COMMON CHEMICAL RELEASE SOURCES AT SITES IN THE ABSENCE OF REMEDIAL ACTION

Receiving Medium	Release Mechanism	Release Source
Air	Volatilization	Surface wastes -- lagoons, ponds, pits, spills Contaminated surface water Contaminated surface soil Contaminated wetlands Leaking drums
	Fugitive dust generation	Contaminated surface soil Waste piles
Surface water	Surface runoff	Contaminated surface soil
	Episodic overland flow	Lagoon overflow Spills, leaking containers
	Ground-water seepage	Contaminated ground water
Ground water	Leaching	Surface or buried wastes Contaminated soil
Soil	Leaching	Surface or buried wastes
	Surface runoff	Contaminated surface soil
	Episodic overland flow	Lagoon overflow Spills, leaking containers
	Fugitive dust generation/ deposition	Contaminated surface soil Waste piles
	Tracking	Contaminated surface soil
Sediment	Surface runoff, Episodic overland flow	Surface wastes -- lagoons, ponds, pits, spills Contaminated surface soil
	Ground-water seepage	Contaminated ground water
	Leaching	Surface or buried wastes Contaminated soil
Biota	Uptake (direct contact, ingestion, inhalation)	Contaminated soil, surface water, sediment, ground water or air Other biota

EXHIBIT 6-4

IMPORTANT PHYSICAL/CHEMICAL AND ENVIRONMENTAL FATE PARAMETERS

K_{oc} provides a measure of the extent of chemical partitioning between organic carbon and water at equilibrium. The higher the K_{oc}, the more likely a chemical is to bind to soil or sediment than to remain in water.

K_d provides a soil or sediment-specific measure of the extent of chemical partitioning between soil or sediment and water, unadjusted for dependence upon organic carbon. To adjust for the fraction of organic carbon present in soil or sediment (f_{oc}), use $K_d = K_{oc} \times f_{oc}$. The higher the K_d, the more likely a chemical is to bind to soil or sediment than to remain in water.

K_{ow} provides a measure of the extent of chemical partitioning between water and octanol at equilibrium. The greater the K_{ow} the more likely a chemical is to partition to octanol than to remain in water. Octanol is used as a surrogate for lipids (fat), and K_{ow} can be used to predict bioconcentration in aquatic organisms.

Solubility is an upper limit on a chemical's dissolved concentration in water at a specified temperature. Aqueous concentrations in excess of solubility may indicate sorption onto sediments, the presence of solubilizing chemicals such as solvents, or the presence of a non-aqueous phase liquid.

Henry's Law Constant provides a measure of the extent of chemical partitioning between air and water at equilibrium. The higher the Henry's Law constant, the more likely a chemical is to volatize than to remain in water.

Vapor Pressure is the pressure exerted by a chemical vapor in equilibrium with its solid or liquid form at any given temperature. It is used to calculate the rate of volatilization of a pure substance from a surface or in estimating a Henry's Law constant for chemicals with low water solubility. The higher the vapor pressure, the more likely a chemical is to exist in a gaseous state.

Diffusivity describes the movement of a molecule in a liquid or gas medium as a result of differences in concentration. It is used to calculate the dispersive component of chemical transport. The higher the diffusivity, the more likely a chemical is to move in response to concentration gradients.

Bioconcentration Factor (BCF) provides a measure of the extent of chemical partitioning at equilibrium between a biological medium such as fish tissue or plant tissue and an external medium such as water. The higher the BCF, the greater the accumulation in living tissue is likely to be.

Media-specific Half-life provides a relative measure of the persistence of a chemical in a given medium, although actual values can vary greatly depending on site-specific conditions. The greater the half-life, the more persistent a chemical is likely to be.

EXHIBIT 6-5

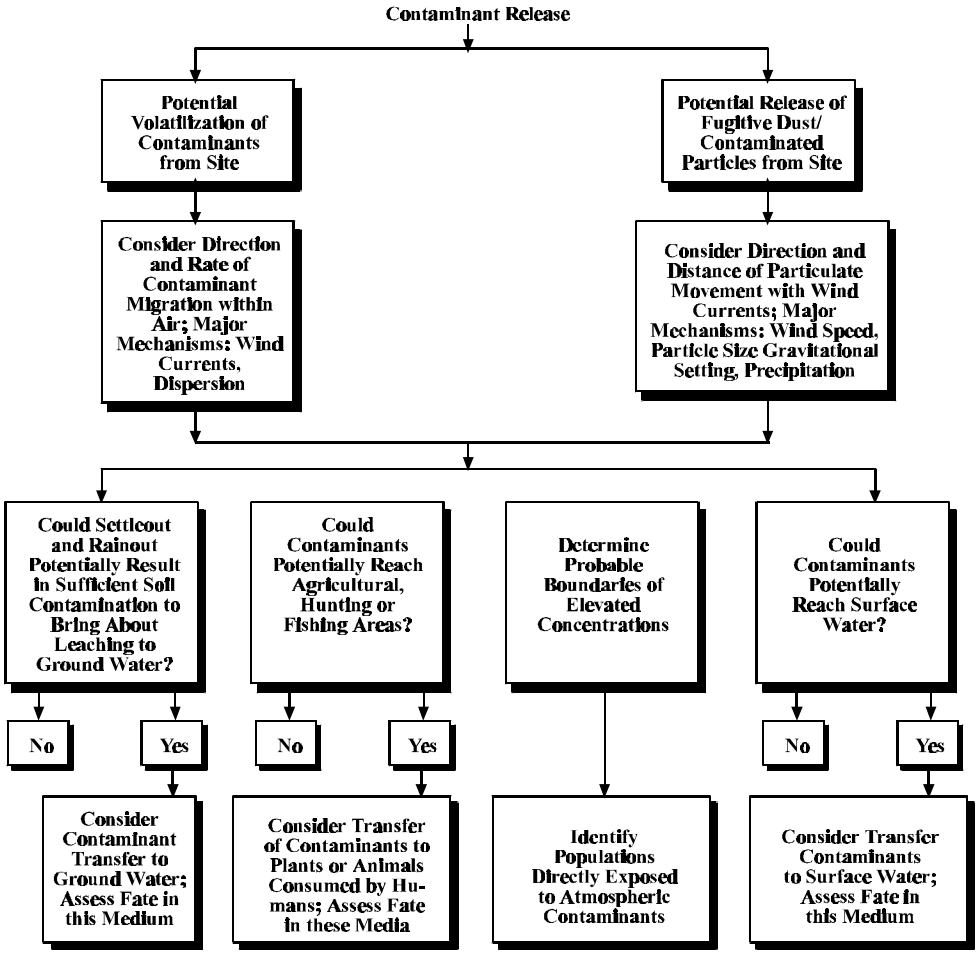
IMPORTANT CONSIDERATIONS FOR DETERMINING THE ENVIRONMENTAL FATE AND TRANSPORT OF THE CHEMICALS OF POTENTIAL CONCERN AT A SUPERFUND SITE

- **What are the principal mechanisms for change or removal in each of the environmental media?**
- **How does the chemical behave in air, water, soil, and biological media? Does it bioaccumulate or biodegrade? Is it absorbed or taken up by plants?**
- **Does the agent react with other compounds in the environment?**
- **Is there intermedia transfer? What are the mechanisms for intermedia transfer? What are the rates of the intermedia transfer or reaction mechanism?**
- **How long might the chemical remain in each environmental medium? How does its concentration change with time in each medium?**
- **What are the products into which the agent might degrade or change in the environment? Are these products potentially of concern?**
- **Is a steady-state concentration distribution in the environment or in specific segments of the environment achieved?**

EXHIBIT 6-6

FLOW CHART FOR FATE AND TRANSPORT ASSESSMENTS

Environmental fate and transport assessment: atmosphere



Source: Adapted from EPA 1988b

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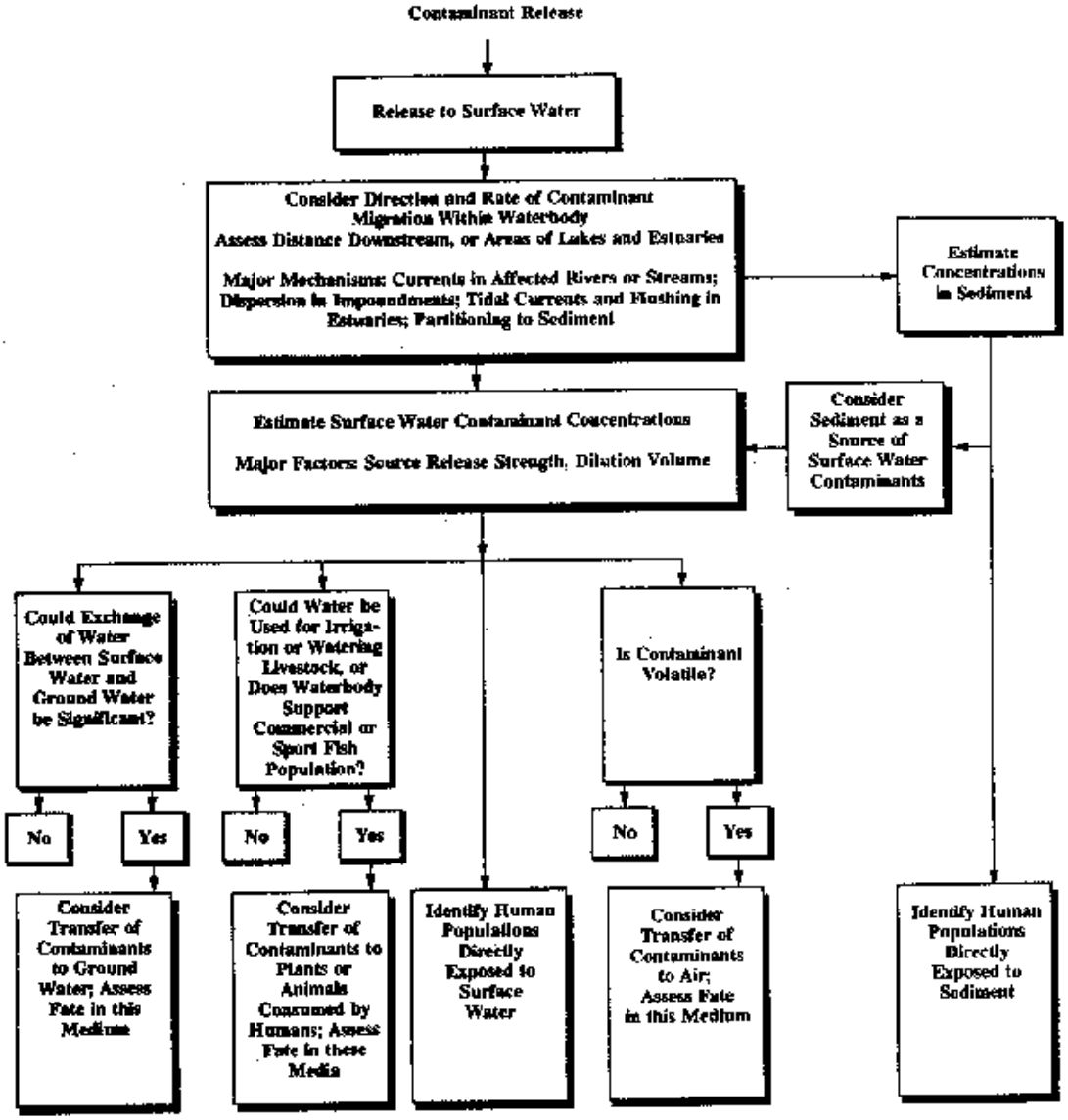
EXHIBIT 6–6 (continued)

FLOW CHART FOR FATE AND TRANSPORT ASSESSMENTS

Environmental fate and transport assessment: surface water and sediment



Source: Adapted from EPA 1988b.

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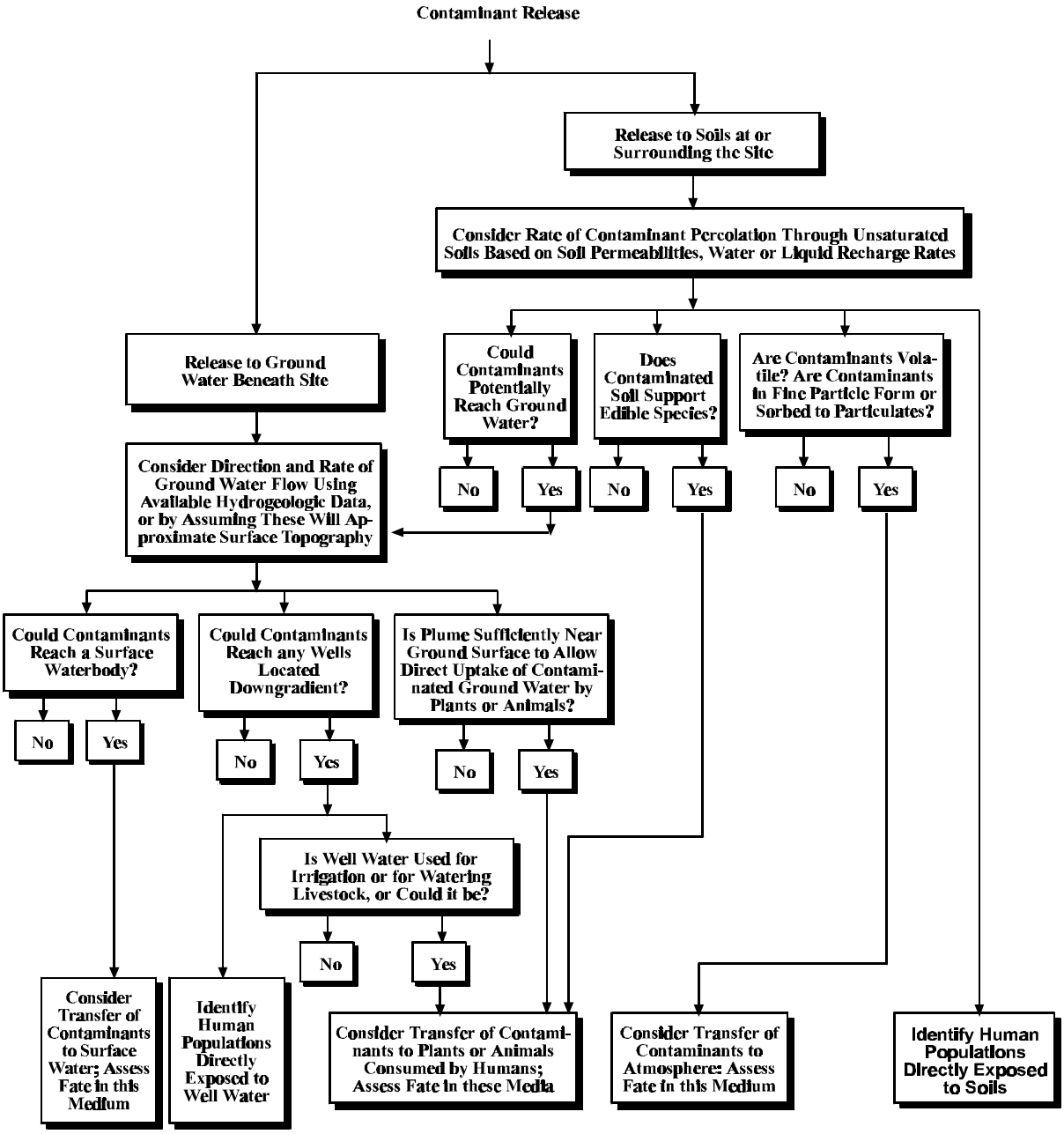
EXHIBIT 6-6 (continued)

FLOW CHART FOR FATE AND TRANSPORT ASSESSMENTS

Environmental fate and transport assessment: soils and ground water



Source: Adapted from EPA 1988b