

7.1 INTRODUCTION

During site investigations, a considerable quantity of analytical data may be collected. Each sample of impacted media (soil, groundwater, air, surface water and sediment) may have been analyzed for hundreds of chemicals. This is often an artifact of the sampling protocols that analyze for and report a large suite of chemicals, not just the chemicals that are site related. Some chemicals may have been detected; others not. Further, all of the detected chemicals may not be site-related, but instead exist in the natural environment. Or, they may pose a negligible risk compared to other chemicals. Therefore, it may be cost-effective to eliminate some of these chemicals early in the MRBCA process and not include them in the tiered risk evaluation process. Early elimination of some chemicals can focus the tiered evaluation on the chemicals that pose the most risk and therefore will drive the site cleanup.

This section presents several steps to eliminate some chemicals and focus the risk assessment on the chemicals of concern (COCs) that contribute to the total risk at a site. Figure 7-1 shows the process of eliminating chemicals. Depending on site-specific conditions, all the steps identified below may not be necessary at each site. Further, additional methods not discussed below may be used with approval from the department.

7.2 COMPILATION OF ALL DATA BY QUALITY

Typically, analytical data at a site is collected during the course of several investigations with the data included in several different reports. Thus, an important key step in managing and understanding site data is to know when the various data were collected, the analytical method used, and the quality assurance/quality control (QA/QC) criteria that were applied. The data should then be carefully evaluated to determine if the data should be eliminated, used qualitatively, or used quantitatively in the risk assessment.

Examples of data that may be eliminated include:

- Data analyzed using an outdated analytical method or a wrong and unproven method (for example, TPH concentrations using USEPA Method 418.1),
- Data that is not adequately supported by corresponding QA/QC data/measures,
- Old data that is not considered representative of current conditions, or
- Data collected prior to any remediation at the site.

Old or field screening data may be used for qualitative analysis to examine trends in the data. The elimination of any data for risk assessment purposes by these or similar criteria is based on the condition that higher quality, newer and more representative data is available. Data should not be eliminated unless better information is available or the data is clearly unusable for any purpose.

Any data that is not used in the quantitative risk assessment must be clearly identified and

the reason for its elimination determined. This information must be clearly documented in the Tiered Risk Assessment Report.

Where the contaminants of concern in soil or sediment do not readily degrade and/or migrate in the environment, “old” data may accurately or conservatively represent the current site conditions and therefore it would be reasonable to retain older data in assessing the risk if new data were not available. Examples of these types of contaminants are metals, some polynuclear aromatic hydrocarbons, polychlorinated biphenyls and polychlorinated dioxins and dibenzofurans. Due to their relative chemical/physical stability and hydrophobic nature, these compounds tend to strongly adsorb to soil and sediment, do not migrate readily under most circumstances and, due to their stability, their concentrations in the ambient environment often remain relatively constant over long periods of time. Given this, use of “older” soil and sediment data in assessing risks related to these compounds may be entirely appropriate.

However, some contaminants of concern in soil or sediment do readily volatilize, degrade and/or migrate in the environment, such as many petroleum hydrocarbon and volatile compounds including chlorinated solvents. Without the benefit of additional and more current data collection, use of “old” data for these types of compounds would be a “worst case” scenario, assuming no new spills or leaks since the old data was collected. The assumption is that the concentration at a site is probably less than what it was in the past, so if the risk assessment uses older (higher) concentration data and shows that the risk is acceptable using those concentrations, then the risk associated with what remains should also be acceptable. This approach must be carefully evaluated and must consider the nature of the chemicals of concern to avoid the pitfall of underestimating risk, such as when TCE is transformed to the more toxic vinyl chloride. In this case, use of old data could provide a false sense of acceptability if much of the TCE has been converted to vinyl chloride (which could only be known using more recent samples). In the case of petroleum hydrocarbons, the reverse could be true in that we would expect lower, less toxic concentrations over time (as evidenced by all the studies supporting environmental degradation of such compounds).

The foregoing examples are by no means all-inclusive but highlight a few considerations in the use of older data. The use of older data for the purpose of risk assessment should in no way be confused with the use of older data for other purposes. All data are integral to the site-specific understanding of contaminant fate and transport. In investigation, older data must be used to assess and depict longer-term contamination trends in soil, sediment, surface water and groundwater. In remediation, older data often represent the “starting point” in developing chemical mass balance (contaminant recovery/treatment), estimated remediation timeframe and groundwater plume stability determinations.

7.3 PARTITIONING OF DATA INTO CHEMICALS DETECTED AND CHEMICALS NOT DETECTED

The data considered usable for risk assessment should be partitioned into data for each media of concern, for example, surficial soil, subsurface soil, soil within the depth of

construction, shallow groundwater, surface water, etc. Within each media divide the samples into two lists.

- List 1 should contain all chemicals that were analyzed for but were not positively detected in any of the samples.
- List 2 should contain data for all the samples that had at least one detected value.

7.4 CONSIDERATION OF CHEMICALS NOT DETECTED IN ANY SAMPLE

With List 1 (defined above), analytes that were not positively detected in any of the samples may be eliminated from further consideration if:

- The detection limits meet the QA/QC requirements, or
- All detection limits for a particular chemical are less than the appropriate Tier 1 risk-based target levels.

If a chemical was never detected positively in any sample due to the analytical method used, but it may be site related, the media might need to be sampled again using an alternative laboratory method.

7.5 CONSIDERATION OF CHEMICALS WITH POSITIVELY DETECTED VALUES

The second list of analytes with at least one detected value, List 2, should be carefully examined. Chemicals may be eliminated with department approval based on the following considerations:

1. The maximum concentration is less than the default target levels.
2. If the chemical appears to be a Tentatively Identified Compound (TIC) and the historical site review indicates that it was not used at the site, associated with any other site operation such as fill material, nor migrated from a nearby site
3. If a statistically sufficient number of samples were collected per media including source areas and the analyte was detected in less than 5 per cent of the samples by media or source area (assuming that more than one sample was collected from the “source area” and as site conditions warrant). A 5 per cent frequency of detection implies that, out of 20 samples taken, one had a detected concentration and the remaining 19 are below detection limit.
4. The concentration of chemicals detected on site is the same or less than the concentration in background samples based on site-specific measurements. In the absence of these and with the department’s prior concurrence, background concentrations from published sources may be used for comparison purposes.

Examples of published sources include:

Tidball, Ronald R., 1984, Geochemical Survey of Missouri, Geological Survey Professional Paper 954-H,I.

Shacklette, Hansford T. and Boerngen, Josephine G., 1984, Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States, U.S. Geological Survey Professional Paper 1270.

5. The analyte is either a laboratory or sampling artifact. This would be particularly true if the chemical was also persistently detected in the QA/QC samples associated with the corresponding media of concern. (For example, if acetone is present in the groundwater but is attributed to a laboratory problem, that conclusion must be justified by acetone showing up in the associated QA/QC samples for groundwater, not in the soil or some other media. Elimination of COCs from further consideration due to laboratory artifacts or common laboratory contaminants should be supported by site-specific QA/QC information.)

7.6 ELIMINATION USING TOXICITY SCREEN

If the above screening process results in more than 30 chemicals, additional chemicals may be eliminated by the use of the toxicity screen (USEPA, 1989). The objective of this screening procedure is to identify and possibly eliminate chemicals that are likely to contribute less than 1 to 5 per cent of the total risk. Step-by-step procedures to estimate the contribution to risk are discussed below.

- Step 1: Identify the maximum concentration of the chemical in each media.
- Step 2: Select the toxicity value(s), i.e., the reference dose and the slope factor for the chemical from Appendix E. For chemicals that have different toxicity values for various exposure pathways, use the most “toxic” value, i.e., highest slope factor and smallest reference dose.
- Step 3: Estimate the carcinogenic and non-carcinogenic toxicity score by multiplying the concentration with the slope factor, and by dividing the concentration with the reference dose, respectively.
- Step 4: Estimate the site score by adding the toxicity score for each chemical and each media. A separate site score will be calculated for carcinogenic and non-carcinogenic effects.
- Step 5: Estimate the percent contribution of each chemical to the site score and eliminate chemicals that have a very low score relative to the other chemicals. In general, chemicals with a percent toxicity score of less than 1 per cent may be readily eliminated. In certain cases, depending on the distribution of the toxicity scores, chemicals with the toxicity score of up to 5 per cent may be eliminated. Tables 7-1 and 7-2 are sample spreadsheets demonstrating the above procedure.

The elimination of any chemicals as well as the rationale used must be clearly documented. Upon completion of the Tier 1, Tier 2, or Tier 3 evaluation, it may be

necessary to re-visit the chemicals that were eliminated, especially when using the toxicity screen, and make a determination whether their inclusion may have resulted in an unacceptable risk. In some cases the cleanup criteria may have to be adjusted downwards to account for the risk that these chemicals would contribute.

**Table 7-1
Calculation of Carcinogenic Toxicity Screen**

Chemical	Surficial Soil				Subsurface Soil				Groundwater				Site Toxicity	% Risk Contribution by Chemical
	C _{max}	SF	Toxicity Score		C _{max}	SF	Toxicity Score		C _{max}	SF	Toxicity Score			
			C _{max} *SF	%			C _{max} *SF	%			C _{max} *SF	%		
C1														
C2														
C3														
C4 - Cx														
Total	NA	NA			NA	NA			NA	NA				

Notes:

C_{max}: Maximum concentration

SF: Slope factor (kg-day/mg)

Site toxicity: Sum of toxicity score for each media. In this example, sum of (C_{max} * SF) for surficial soil, subsurface soil, and groundwater.

%: Percentage of total toxicity score

NA: Not applicable

Table 7-2
Calculation of Non-carcinogenic Toxicity Screen

Chemical	Surficial Soil				Subsurface Soil				Groundwater				Site Toxicity	% Risk Contribution by Chemical
	C _{max}	RfD	Toxicity Score		C _{max}	RfD	Toxicity Score		C _{max}	RfD	Toxicity Score			
			C _{max} /RfD	%			C _{max} /RfD	%			C _{max} /RfD	%		
C1														
C2														
C3														
C4 - Cx														
Total	NA	NA			NA	NA			NA	NA				

Notes:

C_{max}: Maximum concentration

RfD: Reference dose (mg/kg-day)

Site toxicity: Sum of toxicity score for each media. In this example, sum of (C_{max}/RfD) for surficial soil, subsurface soil, and groundwater.

%: Percentage of total toxicity score

NA: Not applicable

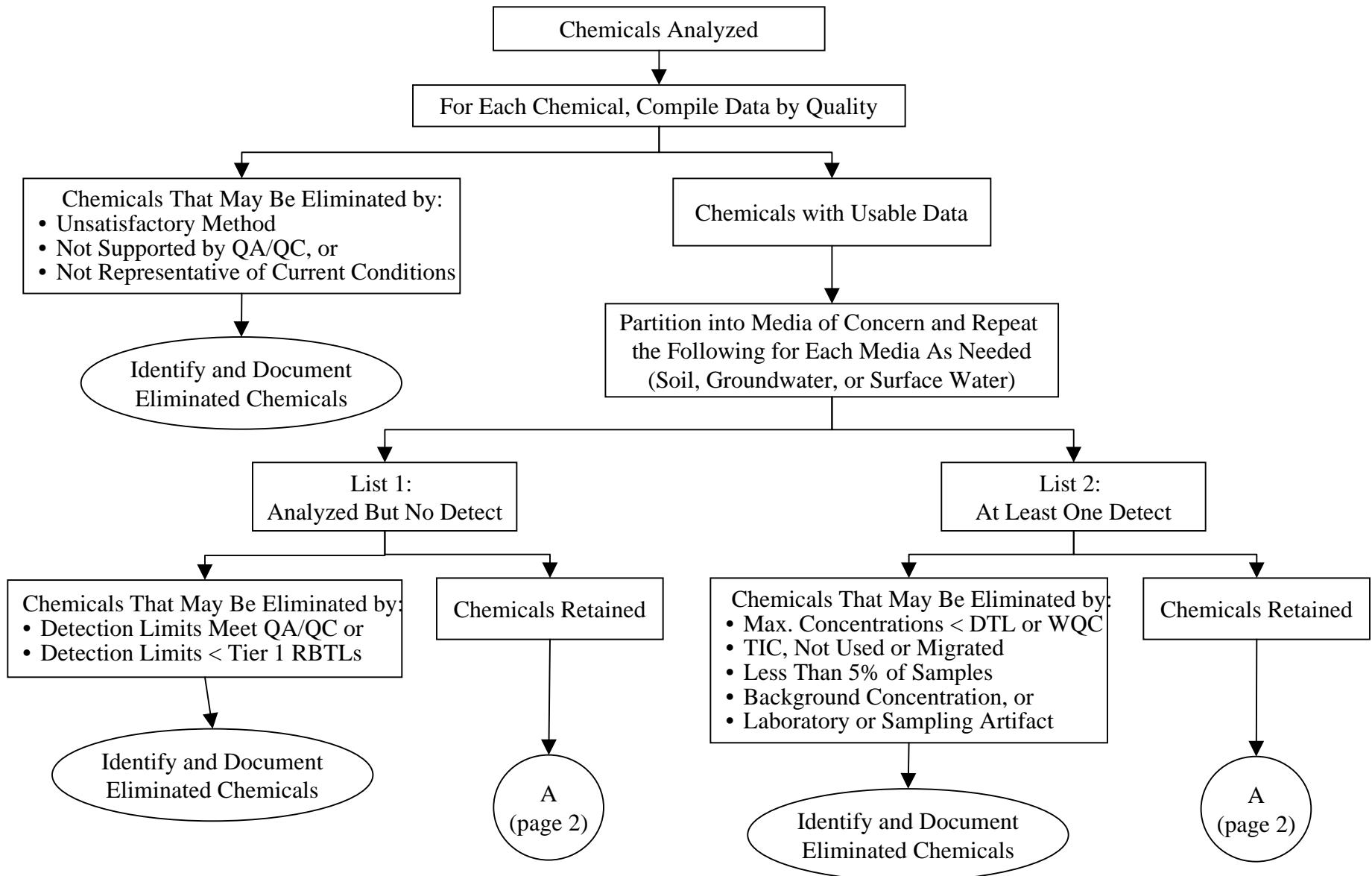
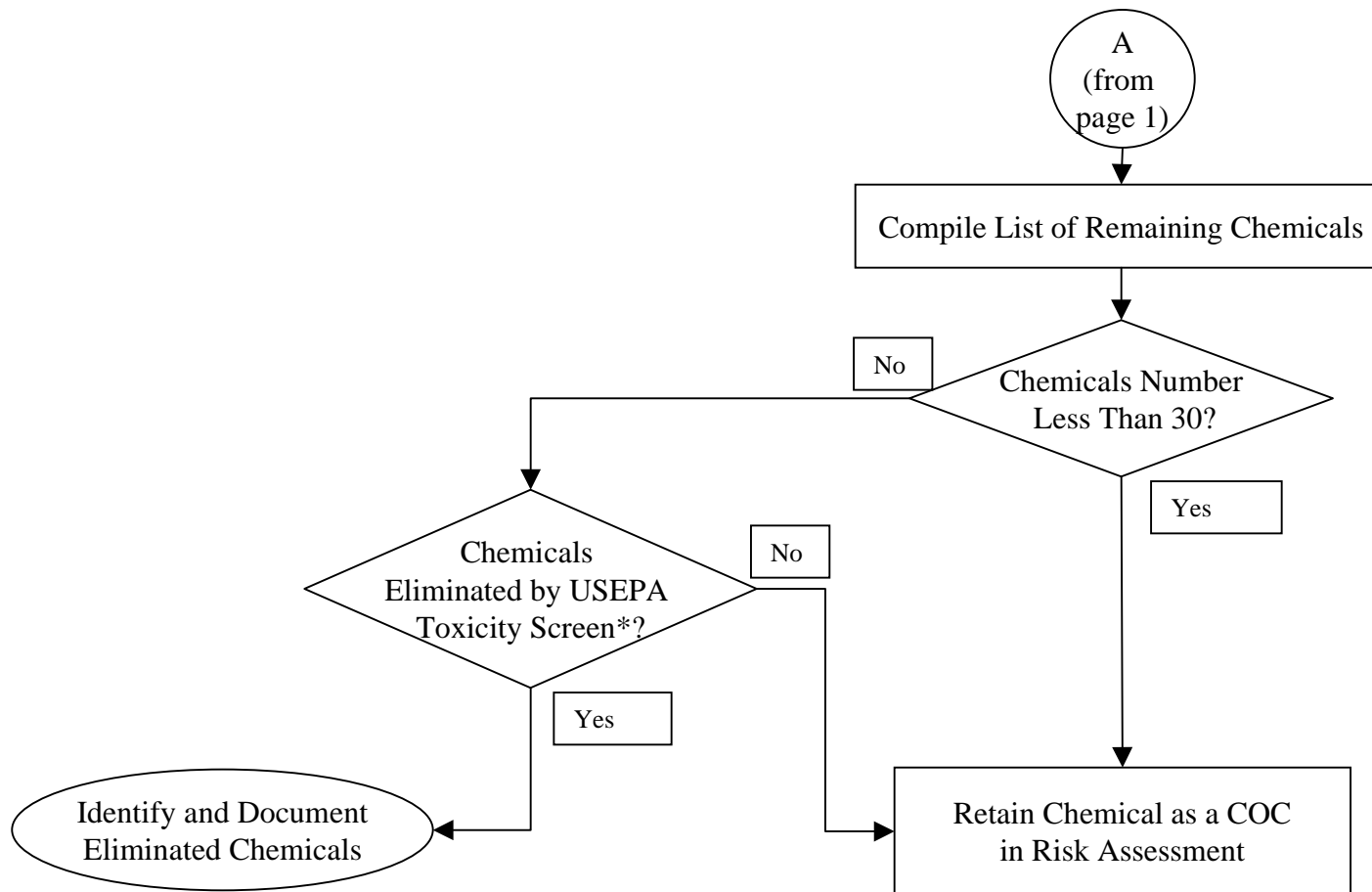


Figure 7-1. Flowchart to Determine Chemicals of Concern in Soil, Groundwater, or Surface Water (Page 1 of 2)



- *: Refer to Section 7.6
- COC: Chemical of concern
- DTL: Default target level
- QA/QC: Quality assurance/quality control
- RBTL: Risk-based target level
- WQC: Water quality criteria

Figure 7-1. Flowchart to Determine Chemicals of Concern in Soil, Groundwater, or Surface Water (Page 2 of 2)