Redefining Environmental Cost Allocation Using the Toxicity Factor

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Introduction

For many years, courts across the country have often relied on a set of six factors in allocating the costs associated with environmental remediation. While these criteria, commonly known as the Gore Factors, have been generally accepted in state and federal courts, they are not without weaknesses and criticism. Chief among the concerns raised is that they rely too heavily on subjective, qualitative factors that leave wide room for interpretation—and disagreement.

What appears to be missing in the legal wrangling over cost allocation is an appropriate tool for apportioning environmental liability that hews to the more quantitative approach that reflects the US Environmental Protection Agency’s current risk assessment paradigm quantifying carcinogenic risk and non-carcinogenic hazards. The foundation for this approach lies in a redefinition of one of those six factors: the Toxicity Factor.

Scientific and litigation support experience shows that this factor—despite being often overlooked in dispute resolution and litigation addressing the divisibility of remedial costs—is a technically-defensible, risk-based allocation process that is poised to provide more clarity and certainty for legal teams involved in complex cost allocation litigation. It is an approach that provides an objective, empirical basis for use in assessing associative harm, and, by extension, allocating costs.

This article will demonstrate how this process—a Toxicity Adjusted Paradigm (TAP)— can lead to more fair and timely resolution of cost allocation decisions in the courts, while satisfying the demands and expectations of the nation’s largest and most influential environmental regulator, the US Environmental Protection Agency.

Background on Cost Allocation and the Gore Factors

Administrative authorities become involved in cost allocation cases when there is a non-permitted, documented release of a waste. For the purposes of this discussion, this involvement occurs when:

- hazardous materials are identified, relative to a state statute or Environmental Protection agency (EPA) regulation
- a Nature and Extent investigation is undertaken
- a “site” is designated under the Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response Compensation and Liability Act (CERCLA), or state voluntary corrective action program (VCAP), e.g.
- a remedial investigation/feasibility study (RI/FS) is undertaken
- remedial/response actions implemented

The CERCLA statute does not contain overt joint and several liability language. Joint and several liability is applied under the auspices of CERCLA based on a judicial doctrine predicated on Section 433A of the Restatement (Second) of Torts. Under CERCLA, the EPA is entitled to seek restitution for the entire cost of this process from any designated potentially responsible party (PRP), regardless of degree of contribution under suit in reference to Section 107 of CERCLA. There is no obligation for the EPA to allocate costs among PRPs. CERCLA defendants seeking to avoid joint and several liability bear the burden of proving that a reasonable basis for apportionment exists.

In 1986, the Superfund Amendments and Reauthorization Act (SARA) amended Section 113 of CERCLA. A contribution action amendment, authorized in subsection 113(f) of CERCLA, allows for the redistribution of liability among PRPs—aftEPA is awarded restitution. This allows a single PRP (likely so designated by EPA as the sole or most solvent PRP) to seek monetary restitution from other PRPs. As Subsection 113(f) states, the
The amendment specifies that US district courts have exclusive original jurisdiction over all controversies arising under CERCLA. This can be problematic, since various district courts address the issue of allocation very differently, depending on site-specific data and conditions. These differences in application relate to the criteria considered and the significance of the equitable factors in derivation of an approach. Depending on which court addresses a given suit, radically different outcomes may result. And that is just what has happened over the last several years, with common law not providing the courts with a consistent set of criteria for evaluating contribution actions.

In response to this, and in the absence of any preferred approach, the courts have migrated to the implementation of the Gore Factors.\(^1\) The original six Gore Factors, as proposed, include:

i. **Distinguishability** — ability of the parties to demonstrate their contribution to a discharge, release, or disposal of a hazardous waste
ii. **Amount** — amount of hazardous waste contributed
iii. **Toxicity** — the degree of toxicity of the hazardous waste involved
iv. **Involvement** — the degree of involvement by the parties in the generation, transportation, treatment, storage or disposal of the hazardous waste at issue
v. **Care** — the degree of care exercised by the parties with respect to the hazardous waste at issue
vi. **Cooperation** — the degree of cooperation among the parties with federal, state or local officials to prevent any harm to the public health or the environment

Of these factors, only the Toxicity and Amount factors are inherently translatable to quantitative assessment. Neither is more significant than the other and, in fact, they must be assessed in tandem (excepting the unusual event when the same waste stream/toxicant has been contributed to a common location by multiple entities—then, toxicity is effectively factored out). The Distinguishability Factor is subject to professional interpretation, hinging on supporting science such as hydrogeology, and relies on data derived from an investigation to ascertain sources and fate and transport pathways, allowing or supporting the differentiation between contributing parties. The remaining factors are largely modifying factors, not underpinned by science. They are subjective in nature, open to interpretation and more naturally lend themselves, and their credibility, to legal argument and position.

To date, cost allocation decisions have largely considered a generalized assessment of toxicity without regard to toxic end-point. The Toxicity Adjusted Paradigm redefines application of toxicity predicated on the law and defensible science, advocating an objective approach to the allocation of culpability (or distinct harm), with a concentration on the Toxicity Factor.

**Objective Factors: Amount and Toxicity**

As previously stated, toxicity and mass of constituent contributed are the two objective factors typically considered in a defensible cost allocation scheme. The Amount factor has the capacity to influence allocation of costs according to the relative mass (quantifiable) of individual contaminants that a Potentially Responsible Party (PRP) has contributed to a waste site. The actual contaminant mass does not need to be precisely known;

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\(^1\) The Gore Factors were proposed in 1980 by then-Rep. Albert Gore Jr. as a set of judicial considerations to be used as criteria for apportioning losses in a cost recovery action, during deliberations establishing the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), better known as Superfund. Although never formally adopted, the applicability of the Gore Factors was also discussed as part of the Superfund Amendments and Reauthorization Act to renew Superfund in 1986. They have since been widely applied by many courts in contribution actions.
the Amount Factor can be based on volume of soil or groundwater required to be treated and related to discrete PRP inputs.

The Toxicity Factor presents a second quantifiable, objective metric for characterization of contribution with respect to harm. The toxicity of a given contaminant can critically modify the Amount Factor. Successful cost allocation depends on the relative PRP contributions to an impacted area and the associated danger that the contaminant may pose to human health and/or the environment. Thus, a more precise measurement tool that places a premium on the empirical foundation of toxicity can play a critical role in legal cases connected to cost allocation.

Toxicology is the study of poisons. It is the scientific discipline upon which the toxicity assessment, as one of the primary factors in cost allocation, should be predicated. The primary fundamental tenet in toxicology is that “dose makes the poison.” That is, environmental harm or health risk is conditional, based on the amount and type of constituent, as well as the method of delivery or exposure. Application of the Gore Factors, and the Toxicity Factor, in particular, requires a detailed and defensible understanding of site conditions and is not amenable to application at some sites. Effective application is dependent on an adequate number of scientific sampling points to characterize site conditions (nature and extent definition) and application of environmental forensics to identify and trace contamination source and release or fate and transport pathways.

Several courts have held that there is no minimum threshold for liability due to “quantity or concentration.” CERCLA contains no minimum “amount” definition which could assist in a determination of whether releases are significant. However, EPA policy allows for a de minimis settlement. According to EPA documentation, in general, this is a settlement between EPA and those parties who are responsible for a minimal contribution—in amount and toxicity—of the hazardous substances at a Superfund site.

The Toxicity Factor addresses a contaminant’s potential for harm: human, ecological health or resources. Thus, expert witnesses in toxicology, chemistry and related scientific disciplines should be used to testify as to a given chemical’s properties, as toxicity is grounded in science. As noted above, this factor is very important as a modifier of the Amount Factor, and the product of these variables could be viewed as a single equitable factor. It also represents a potential shift in cost allocation thinking at the legal level, owing to advances in toxicology and risk assessment science, as well as in field investigation and analytical methods. Indeed, it opens a wider potential for acceptance of the Toxicity Factor in the courtroom.

**A Toxicity Adjusted Paradigm (TAP) for Quantitative Cost Allocation Basis: An Example**

Corrective action, as practiced under EPA and most state policies and programs, is heavily influenced by risk assessment. Risk assessment is the process by which the probability of an adverse health effect is quantified, predicated on a defined set of exposure conditions.

Risk assessment endpoints are quantified on two separate bases: cancer and non-cancerous responses. The incorporation of two separate toxic endpoints is the most defensible method and basis for the Toxicity Factor and its effective incorporation into the cost allocation process. Previous cost allocation schemes which incorporated the Toxicity Factor have relied on poorly defined toxic responses and a fundamentally flawed relative toxicity approach which did not segregate for endpoint response.

Hazard refers specifically to toxic responses other than cancer. These responses are assumed to be additive, until a hazard equivalent to unity is exceeded, and then individual, constituent-specific hazards may be segregated based on the target organ system or elicited effect. Risk, although commonly used to indicate the total set of possible responses, refers specifically to carcinogenicity and quantitative carcinogenic response. All carcinogenic responses are also assumed to be additive.

Contaminants may have both carcinogenic and non-carcinogenic responses, though usually one response or the other is the leading cause for concern – and thus, the basis for decision-making. In order to effectively incorporate a quantitative approach into a cost allocation scheme, an understanding of the nature and extent of
the contamination at issue is necessary. The following approach assumes the availability of a defensible dataset capable of defining nature and extent of contamination at a given site:

In risk assessment, to form a defensible basis for risk and site management decisions, the process needs to be appropriately skewed toward the conservative end of the spectrum in order to combat inherent uncertainty and variability in the protection of public health. To that end, exposure parameter values represent a mix of upper-bound and central tendency estimates such that it is unlikely that actual incurred exposures will have the capacity to exceed the resulting quantitative point estimates of risk and hazard.

Conservative, default-based screening criteria are generally available for gross exposure comparisons from US EPA and most state programs. For the purposes of this example, we have utilized generic, health-based screening criteria applicable across the country and tailored to residential adult and child exposure to contaminated soil, groundwater and air, as well as generic routine industrial worker exposure to contaminated soil and air. These consistent, health-based screening criteria address the exposure routes predominantly associated with significant complete exposure pathways, including incidental ingestion, inhalation of volatiles and particulates, and dermal absorption. In the absence of site-specific information about potential receptor populations and land use activities, these screening criteria are appropriate for initial comparative assessments.

To maintain an effective conservative bias in risk assessment, the exposure point concentration (EPC) or concentration receptor populations are assumed to be exposed to, is typically based on an upper-bound estimate of the mean – usually, the 95 percent upper confidence limit (95UCL). For small datasets, or datasets with significant inherent variability, this descriptor can exceed the maximum detected concentration (MDC), forcing risk assessors to use the MDC as the effective EPC. In most cases, though, utilizing non-parametric statistical tests, a defensible estimate of the mean can be developed. As variability within the dataset decreases, the 95UCL approaches the true mean. Because cost allocation does not need to enlist the same degree of specificity and conservatism (cleanup goals are not being developed, but rather a ratio or relationship between separate entities degrees of culpability) the arithmetic mean is sufficient for comparative purposes. For all following discussions of EPCs, this parameter is represented by the arithmetic mean of a given dataset.

For total risk estimates at or below 1E-06, there is no assumed impetus for corrective action. For risks defined within the National Oil and Hazardous Substances Pollution Contingency Plan’s (NCP’s) Relative Risk Range (RRR), 1E-06 to 1E-04 (one-in-1 million to one-in-10,000 excess lifetime cancer cases), there is typically not a corrective action advanced, unless a sensitive subpopulation is in jeopardy, or the risk assessment is judged to have an unsupportable level of inherent uncertainty or paucity of excess conservatism. These judgments must be made by a qualified toxicologist familiar with the risk assessment process. For quantitative point estimates of risk in excess of 1E-04, a corrective action/remedial response is generally indicated.

While development of cancer risk is assumed to follow an additive, linear relationship (i.e., a mean cancer risk at 1E-05 is ten times more significant than a cancer risk at 1E-06), this is not the same paradigm in an assessment of hazard. For hazard quotients which exceed one, a corrective action may be indicated. However, the relationship between hazard estimate and potential onset of toxic response is not a simple linear one. This means that a hazard quotient of 10 does not necessarily indicate a 10-times more serious response than a hazard quotient of one. Depending on the degree of excess conservatism underpinning the hazard estimate, US EPA may not routinely take action for hazards less than three, and may not take action at levels higher than this (US EPA’s Removal Action Levels, 2010). For the purposes of this exercise, actionable levels are assumed to be indicated at hazard quotients greater than one.

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Where risk estimates for individual contaminants exceed the de minimis point of departure (i.e., 1E-06), the Toxicity Factor may be multiplied by total contaminant mass (the Amount Factor) contributed to develop a metric for cost allocation. Similarly, where hazard estimates for individual contaminants exceed one, a second metric for cost allocation related to non-carcinogens can be developed. These assessments are based on defensible estimates of the potential for diverse health effects.
Practical Application

The comparative example presented in Table 1 below shows the radically different results obtained from two approaches in application of cost allocation using: 1) a traditional consideration of state-mandated cleanup criteria, and 2) application of the TAP approach predicted on the probabilities of adverse health effects, as discussed above. For the purposes of clarity, the example assessment has been truncated to an evaluation of soil with a proposed unrestricted land use option for reuse, limited to human health endpoints (no consideration for ecological impacts or sensitive environments). In this scenario, the state compliance program allows for a risk-based approach in the assessment of potential for adverse effect. The site contaminants of concern include heavy metals, chlorinated solvents, and polynuclear aromatic hydrocarbons (PAHs), as noted in Table 1.

Table 1: Comparative Example

<table>
<thead>
<tr>
<th>Chemical</th>
<th>State Program-Based Allocation (%)</th>
<th>TAP Risk-Based Allocation (%)</th>
<th>TAP Hazard-Based Allocation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc (n)</td>
<td>5.58%</td>
<td>na</td>
<td>0.05%</td>
</tr>
<tr>
<td>Mercury (n)</td>
<td>5.53%</td>
<td>na</td>
<td>1.13%</td>
</tr>
<tr>
<td>Trichlorobenzene, 1,2,4- (c)</td>
<td>4.25%</td>
<td>9.68%</td>
<td>na</td>
</tr>
<tr>
<td>Benzene (c)</td>
<td>75.26%</td>
<td>4.90%</td>
<td>na</td>
</tr>
<tr>
<td>Dichlorobenzene, 1,2- (n)</td>
<td>1.61%</td>
<td>na</td>
<td>0.08%</td>
</tr>
<tr>
<td>Chlorobenzene (n)</td>
<td>1.46%</td>
<td>na</td>
<td>0.12%</td>
</tr>
<tr>
<td>Dibenz(a,h)anthracene (c)</td>
<td>0.90%</td>
<td>12.89%</td>
<td>na</td>
</tr>
<tr>
<td>Trichlorobenzene, 1,2,3 (n)</td>
<td>1.20%</td>
<td>na</td>
<td>98.37%</td>
</tr>
<tr>
<td>Dichlorobenzene, 1,3- (c)</td>
<td>1.25%</td>
<td>11.23%</td>
<td>na</td>
</tr>
<tr>
<td>Benzo(a)pyrene (c)</td>
<td>0.71%</td>
<td>33.82%</td>
<td>na</td>
</tr>
<tr>
<td>Copper (n)</td>
<td>0.51%</td>
<td>na</td>
<td>0.05%</td>
</tr>
<tr>
<td>Phenol (n)</td>
<td>0.24%</td>
<td>na</td>
<td>0.00%</td>
</tr>
<tr>
<td>Iron (n)</td>
<td>0.38%</td>
<td>na</td>
<td>0.16%</td>
</tr>
<tr>
<td>Dichlorobenzene, 1,4- (c)</td>
<td>0.54%</td>
<td>27.48%</td>
<td>na</td>
</tr>
<tr>
<td>Chromium (n)</td>
<td>0.30%</td>
<td>na</td>
<td>0.00%</td>
</tr>
<tr>
<td>Cadmium (n)</td>
<td>0.27%</td>
<td>na</td>
<td>0.04%</td>
</tr>
<tr>
<td>All Other Chemicals†</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

(n) = non-carcinogen; (c) = carcinogen; $T$ = target risk (1E-06) for carcinogens or target hazard quotient; (1) for non carcinogens; † Contribution not assumed to be substantive, thus not included in percentage totals

Drastically different results are derived predicated on a health-based approach which segregates for toxic endpoint and the traditional methodology, which has been historically employed in environmental contribution cost allocation studies. It is important to note here that these estimates assume a basis on the Toxicity Factor solely, without provision for inclusion of the Amount Factor, which can have a radical influence on the ultimate volume of waste (and, hence, cost) which needs to be addressed. This assessment is limited to an examination of the impact on the Toxicity Factor for use in the greater cost allocation strategy. For the purposes of discussion and clarity, a linear relationship has been assumed to occur between the resultant Toxicity Factor adjustments and percentage of cost for remediation.

In the state program-based example, a court may stipulate allocation of greater than 90 percent of the environmental “harm” (again, strictly based on toxicity, not inclusive of the Amount Factor) to four contaminants (i.e., zinc, mercury, 1,2,4-trichlorobenzene [1,2,4-TCB], and benzene). In a health-based assessment, consistent with US EPA policies and programs, these same contaminants fail to act as the
preeminent drivers of carcinogenic risk (~15%) or non-carcinogenic hazard (~1%). Zinc fails to contribute substantially to non-carcinogenic hazard, suggesting that there is no basis for mounting a remedial action in response to its release or presence. Assessment of mercury also shows a substantive difference, where 5.53 percent of the “environmental harm” is apportioned to mercury via the state program approach, while the TAP health-based approach only provides for a roughly 1 percent allocation for capacity for environmental harm. In addition, the state-based approach associates roughly 4 percent of the capacity for “environmental harm” with 1,2,4-TCB, while the TAP health-based approach results in a roughly 10 percent allocation of associated risk. One of the greatest differences results in an assessment for benzene, where the state-based approach results in an associated “environmental harm” estimate of greater than 75 percent, while the TAP health-based approach results in an associated allocation of approximately 5 percent. Similar differences are evident for the PAHs dibenz(a,h)anthracene and benzo(a)pyrene as well as 1,3-dichlorobenzene. This latter constituent, in point of fact, does not have a federally-promulgated health-based standard, and efficacy has been equated with 1,4-dichlorobenzene based on a structure-activity relationship and an assumption supporting use of the most toxic isomer for which there is a federally-promulgated standard. Special attention is called to the case for benzo(a)pyrene and 1,4-dichlorobenzene, where the state-based approach attributes less than 1.5 percent of the “environmental harm” to these contaminants, while the TAP health-based approach demonstrates that these contaminants may be related to greater than 60 percent of the associated risk at the site in question.

Conclusions

Of the six Gore Factors, Toxicity and Amount allow for an objective, empirical and quantifiable basis in establishing potential for adverse effects and, by extension, cost. Practical application of cost allocation, incorporating the Toxicity Factor can be predicated on a more traditional federal or state-promulgated standards approach or a health-based approach consistent with US EPA screening procedures as previously outlined, and referred to as the Toxicity Adjusted Paradigm. TAP can be used to provide an alternative strategy for application in the cost allocation process, providing an improvement in the health consistency and protection basis for courts to consider.

A careful analysis of site information and data can determine which approach, based on toxicity, is more beneficial to a particular PRP, and whether the inclusion of subjective factors is warranted. An approach that utilizes the Toxicity Adjusted Paradigm approach has the potential to provide litigants with a reasonable alternative basis for apportionment of culpability, while allowing the courts to more accurately assess the merits of a strictly health-based allocation, versus one based on the consideration of administrative authority-promulgated standards.

**Author Note:** Mr. Kline is a toxicologist who heads the Toxicology and Risk Assessment group at AlterEcho, an environmental consulting firm. He regularly provides expert advice and instruction to the U.S. Environmental Protection Agency and other state and local agencies. He holds a BA in Developmental Biology/Genetics from Colby College and an MEM in Environmental Toxicology from Duke University.