Measurement of US Pollution Liabilities

by Amy Bouska and Thomas McIntyre

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Abstract

This paper discusses methods and data that can be used to quantify insurers' potential liabilities arising from pollution (as specifically defined). It provides background information on the genesis of the liabilities and then discusses why traditional actuarial techniques fail in analyzing the problem and why analyses that rely on analogies to asbestos are weak. It outlines a typical analysis, including both aggregate quantification techniques and a more detailed model of the potential liabilities. It then comments on the critical issues involved in modelling reported claims and IBNR, data requirements and problems, and reinsurance issues. A list of references and a discussion of pollution claims database issues are also included.

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Introduction

"Your mission, should you choose to accept it, ..." [1]

The underlying message of this paper is that there are methods and data that can be used to quantify insurers' liabilities arising from pollution (as defined below). After clarifying the subset of environmental liabilities under discussion, we provide some background regarding the genesis of the liabilities; this is necessary since any analysis method must reflect the underlying loss process. We then briefly discuss why traditional actuarial techniques fail in analyzing this problem and why analyses that rely on analogies to asbestos are weak. After discussing the major influences on pollution liabilities, we outline a typical analysis, including aggregate quantification techniques. We then suggest one possible structure for a more detailed model of these liabilities and then examine and comment on the critical issues involved in modelling reported claims and IBNR, data requirements and problems, and reinsurance issues. Lastly, we provide a list of references for those who would like to learn

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[1] "Mission: Impossible"

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more about the problem. One appendix includes an extensive discussion of pollution claims database formats and fields.

This paper does not address issues of disclosure, statutory or GAAP accrual of liabilities, or actuarial standards of practice. In particular, the question of whether the results of the estimation techniques discussed herein satisfy the requirements of FAS 5 is beyond the scope of this paper. However, actuaries should be aware that both the AICPA and the SEC are showing increasing concern over these potential liabilities.

Definition
"A rose is a rose is a rose ..." [2]

Not every release of hazardous materials is "pollution" as we define it. In the context of this paper, "pollution" refers to the potential losses from "gradual" releases arising under general liability and other policies that were not specifically written to cover damage to the environment. Some examples of claims that are <u>not</u> included in our definition of pollution include:

- Claims arising under environmental impairment liability (*EIL*) policies. These policies are intentionally written to cover environmental releases (usually on a claims-made form) and do not generally involve coverage disputes, long latency periods, or multiple exposure periods. Where available, however, these policies may impact true pollution losses by drawing claims away from policies where coverage is more likely to be disputed;

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[2] Gertrude Stein

- Claims arising from "sudden and accidental" incidents, such as the 1984 explosion at Union Carbide's plant in Bhopal, India;
- *Workers compensation claims arising from on-the-job exposure to hazardous* materials;
- Claims arising from radon or "sick building syndrome";
- Claims arising from the seepage or release of silicone into the body from silicone implants;
- Claims arising from non-point-source releases, such as ozone depletion;
- *Claims arising from exposure to or the removal of lead-based paint or asbestos-*containing materials, unless they are commingled with other hazardous wastes at a pollution site; and
- Claims arising from the transport of hazardous materials (*hazmat*) or hazardous wastes (*hazwaste*) unless past illegal dumping is alleged or the disposal site is a "pollution" site.

Thus, we distinguish between "pollution" (generally characterized as old policies, gradual incidents, associated with a physical site, and with disputed coverage), "environmental impairment" (policies intentionally covering sudden releases into the environment), and various types of "release," "exposure," or "remediation" claims involving particular materials or groups of people.

In many insurers' organizational charts, "environmental claims" has come to mean "all claims that we don't want the field offices to handle." It is important to keep in mind that not all "environmental claims" are "pollution" for the purposes of this discussion. Clearly, asbestos, DES, and other products claims, which are usually part of the environmental claims

unit, are not "pollution." As noted above, EIL losses are also not "pollution." These losses are generally subject to normal methods of actuarial analysis (with suitable caveats); as we will discuss later, pollution losses are not. While it may be tempting to mix the two for analytical purposes, this is not advisable, since there is no reason to believe that they develop similarly and many reasons to believe that they do not.

Any technique for analyzing potential liabilities has to make sense in the context of the development process underlying the claims and take into account any known peculiarities of that process. Therefore, it is first necessary to consider the background of "pollution" claims.

Background

Legislative and Social

"Fish gotta swim and birds gotta fly
but they don't last long if they try."[3]

In the 1960s, the air in many U.S. cities was growing dark and corrosive. In some places, the rivers burned; where they didn't, they could be fatal to swimmers. Rachel Carson's Silent Spring -- still regarded as a seminal book of the environmental/ecology movement -- brought the dangers of pesticides and bioaccumulation into the public consciousness. Earth Day and the Environmental Protection Agency (*EPA*) were both born in 1970. Industries and utilities were forced to clean up their smokestack emissions, and sewage and effluent treatment plants were built in places where raw waste discharge had been a long-accepted practice. The Clean Air and Clean Water Acts have had a noticeable

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[3] Tom Lehrer, "Pollution" (ASCAP, recorded 1965) on That Was The Year That Was

effect on air and water quality in the U.S. and have each been reauthorized several times since their original enactments, although not without serious discussion of the costs imposed on U.S. industries. The public support for these laws is best summed up by the 1990 poll that found that Americans rate a clean environment as "more important than a satisfactory sex life."[4]

The Resource Conservation and Recovery Act (*RCRA*) was originally passed in 1976 and has been reauthorized several times since then. Its many provisions included "cradle to grave" tracking of hazardous materials and engineering standards, permitting, and financial responsibility for hazwaste disposal facilities (including hazwaste landfills). Its general purpose is to control future pollution that was not regulated by the Clean Air or Clean Water Acts, although a remedial component was added in the 1984 reauthorization. There are thousands of RCRA-permitted sites in the U.S. and increasing attention is being paid to the potential costs associated with them, especially since the financial responsibility amounts put up for closure and post-closure at these sites are not intended to be sufficient for remediation.

In general (and with some exceptions), Clean Air, Clean Water, RCRA, and their many legislative kin have had little to do with "pollution" to date.

In Europe, the first great, widely-publicized environmental disasters were "sudden and accidental" -- the Amoco Cadiz spill in 1978, together with Chernobyl and the Sandoz-Rhine fire in 1986; as a result of this and the continent's reliance on surface waters for drinking,

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[4] "Cleaning Up," by Bruce Stutz in The Atlantic, October 1990, pp.46-50.

European attention initially focussed on the potential for large-scale accidents.[5] In the U.S., however, Love Canal became the archetype of the American environmental nightmare, with toxic wastes seeping into basements, and a nearby school and playground built on top of a disposal pit. Public outrage over Love Canal (officially recognized in 1978) led directly to the 1980 passage of the Comprehensive Environmental Restoration, Compensation and Liability Act (*CERCLA*), also known as the Superfund Act.

CERCLA has everything to do with "pollution."

CERCLA's purpose was to clean up (remediate) existing sites that posed a hazard to human health or the environment; where RCRA looked forward, CERCLA looked backward. It was intended to be -- and is -- a very punitive law, based on the principle of "polluter pays." The worst sites are placed on a National Priorities List (*NPL*). At these sites, CERCLA imposed strict and retroactive liability on potentially responsible parties (*PRPs*). Courts read joint and several liability into the act so quickly that it is widely considered to be part of the original legislation. Thus, any party responsible for the generation, transport, or disposal of any part (no matter how small) of the waste at a CERCLA site can theoretically be held liable for the entire cost of the remediation, even if that party's actions were both legal and state-of-the-art at the time.[6] Essentially any party coming in contact with the hazardous waste can be named as a PRP, including generators, transporters, storage facilities, treatment facilities, owners of

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[5] Greater information regarding the heavy pollution in eastern Europe, and particularly the former East Germany following reunification, has directed increased attention to the "Altlasten" (German: "old burdens").

[6] In practice, the situation is generally not quite that extreme, since the EPA has, from the beginning, recognized the existence of *de minimis* (and now *de micromis*) parties who were truly the small generators (generally less than 0.1% of the waste).

the site land, operators of the site, and lenders; as a practical matter, most PRPs with serious involvements are generators, past or present land owners, or past or present site operators.

In spite of its preference for "polluter pays," Congress recognized that there would be sites with no viable PRPs -- the so-called "orphan sites" -- and it authorized a tax on various chemical and petrochemical feedstocks to finance both the cleanup of these orphan sites and emergency measures at sites where costs could later be recovered from the PRPs. This "Superfund" gave the law its widely used nickname.

CERCLA imposes liability for remediation (including emergency response and removal) costs and natural resource damages (discussed later). It is important to remember that CERCLA does not create any cause of action for third parties claiming bodily injury or property damage (such as loss of property value). These third parties must pursue their claims under the ordinary tort law of negligence; however, the evidence discovered by the government in the course of naming PRPs or insurers in the course of disputing coverage may strengthen third parties' claims.

CERCLA was reauthorized in 1986 as SARA (the Superfund Amendment and Reauthorization Act) and again in 1990 as an undiscussed and unannounced part of the budget reconciliation bill (frequently referred to as "the midnight reauthorization"). SARA made CERCLA even more punitive. It greatly increased the preference for permanent treatment of wastes, as opposed to containment, and the cleanup process became even more lengthy, costly and litigious. Because SARA left cleanups subject to potential re-opening in the future (e.g., as detection technology increases in sensitivity), it led to the plaintive -- and unanswerable -- question of PRPs: "How clean is clean?"

A relatively small number of sites (currently about 1,286 out of 39,000 known sites) are on the NPL. (Cumulatively, 1,353 have been on the NPL.) The remainder are under the jurisdiction of the various states. CERCLA spawned a multitude of state "mini-Superfund" laws as the states struggled to deal with these sites. Like CERCLA itself, these laws tended to be very strict originally; unlike CERCLA, they have tended to become more pragmatic, and may, in fact, indicate the future direction of the federal Superfund law.[7] Estimation of the size, composition, and cost of the universe of state sites is one of the most important problems in the quantification of insurers' potential pollution liabilities.

Superfund reform is currently being debated as part of the 1994/95 reauthorization. The changes most likely to be incorporated into the ultimate reform bill appear to include: increased community participation, increased certainty with respect to share allocation (and quicker assignments), and implementation of national generic remediation standards and methods that recognize the intended future use of the land. The current version of the reform also includes taxes on insurers and reinsurers to fund reimbursements to PRPs in exchange for a reduction in coverage litigation; the fate of this change is less certain. It should be recognized that Superfund reform does not have a direct impact on non-NPL sites, but there is general agreement that, where they are possibly applicable, the changes will ultimately migrate into the non-NPL realm.

To the extent that insurers' potential pollution liabilities are replaced by a tax, the quantification problem will be "backed up" a step: Even if the tax is completely prospective

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[7] For example, New Jersey recently amended its Environmental Cleanup Responsibility Act (*ECRA*), one of the toughest of the state environmental laws. Renamed the Industrial Site Recovery Act (*ISRA*), the new law contained several provisions to streamline the ECRA process.

(and thus the same for all companies writing a coverage), questions of coverage and distribution of potential costs to individual insurers will be replaced by the issue of the overall adequacy of the tax, i.e., whether the initial level will have to be changed and how long it will persist. This does not require the methods outlined in this paper, although the questions raised in the ***External Data*** and ***IBNR*** sections will still be important. However, if the tax replaces potential liabilities for only some of the sites (e.g., NPL only) or some of the PRPs (i.e., if "opt-outs" are allowed) additional steps may be necessary in the estimation process in order to carve out the portions that have been replaced by the tax.

Sites, Costs, and Claims

"Mere anarchy is loosed upon the world,
The blood-dimmed tide is loosed, ..."[8]

Hazardous waste sites come in a wide range of sizes and problems. They can be as small as the local dry cleaner or as large as the hundreds of acres of mine tailings scattered throughout the west. The most common contaminants at NPL sites are solvents and other organic compounds, but they also include heavy metals, asbestos, wood treatment and leather tanning wastes, acids, explosives, paint, mining slag, and radioactive waste.

Whatever they contain, NPL sites all go through the same evaluation and remediation process, the so-called NPL "pipeline." The steps are generally described as:

- Preliminary assessment and listing on the NPL;
- Detailed assessment, called the remedial investigation and feasibility study (*RI/FS*);

[8] W.B. Yeats, "The Second Coming"

- Remedy selection, which culminates in the EPA promulgation of a Record of Decision (*RoD*). The RoD summaries are the best source of information about site histories, characteristics, and estimated cleanup costs;
- Remedial design, i.e., development of engineering specifications for the cleanup;
- Remedial action, i.e., construction of the remedy (e.g., construction and operation of incinerators, construction of groundwater-containing slurry walls, transportation of soil to a hazwaste landfill, etc.);
- Construction completion;
- Continuing operations and monitoring (usually groundwater pumping and treatment); and
- De-listing.

Although not officially part of the pipeline, it is well known that the first four steps are liberally interspersed with extensive litigation, PRP vs. PRP, PRP(s) vs. EPA/state, and PRP vs. insurer(s).

The enactment of SARA in 1986 significantly lengthened the average travel time through the NPL pipeline, now generally estimated at approximately twelve years.[9] The length of time required to clean up an NPL site is one of the primary causes of the current reform movement. In the past, the EPA has tried various strategies to reduce travel time, from changing the definition of "complete" in 1991 to encouraging "mixed funding" (i.e., use of both public and private funds, which was supposed to reduce litigation), and developing accelerated cleanup protocols.

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[9] CBO, Total Costs of Cleaning Up Nonfederal Superfund Sites, p. 6; Acton, Understanding Superfund, p. 16.

The EPA maintains two lists of sites: the CERCLIS list and the National Priorities List. CERCLIS (the *CERCLA Information System*) list contains every known contaminated site in the U.S., currently numbering approximately 38,000. Not every CERCLIS site is remediated; in fact, approximately half are determined to require no work at all. The NPL is a subset of CERCLIS. Table 1 shows the CERCLIS and NPL counts since 1980.

Table 1[10]
CERCLIS/NPL Site Counts

Year	CERCLIS Sites	NPL Sites
1980	8,000	--
1981	10,500	--
1982	13,934	--
1983	16,307	419
1984	18,836	546
1985	22,455	818
1986	25,161	888
1987	27,507	951
1988	29,613	1,177
1989	31,522	1,224
1990	33,760	1,218
1991	34,790 (est)	1,211
1992	35,820	1,235
1993	37,506 (est)	1,270
1994	39,191	1,286

[10] Because of different treatments of proposed and deleted sites, site counts frequently differ between sources. CERCLIS counts in this table are from the OTA (p. 11) and the EPA; NPL counts are from EPA Publication 9320.7-051, June 1993, "Supplementary Materials: National Priorities List, Proposed Rule, and EPA headquarters.

The EPA has stated that it plans to have listed 2,100 sites (cumulative) on the NPL by the year 2000.

Based on estimates published to date (RoDs and other sources), the distribution of expected cleanup costs for NPL sites is very skewed, as can be seen from **Appendix A**, which shows the percentage distribution of counts and site costs by site cost range. If five mega-sites are removed from the calculation, our current estimated average NPL site cost[11] drops from $57 million to $43 million. This skewness makes the use of averages for any sort of analysis very dangerous.

These sites are primarily -- although not completely, by any means -- a modern-day problem. The growth in the number of operating sites now on the NPL clearly reflects the post-World War II industrial growth of the U.S., as can be seen in **Appendix B**. The number of operating sites peaked in the late 1970s and then began to drop quickly, as the number of discoveries began to grow. Discoveries of NPL sites escalated rapidly in the early 1980s after the enactment of CERCLA and then dropped off; however, discovery continues into the present day (see **Appendix C**).

There are many known contaminated sites, both NPL and non-NPL, and this universe is growing daily. The most basic questions are: How big will it get, and how much is it going to cost to clean up?

Various studies have proposed ranges of answers to these questions with various levels of support for their estimates. In 1992, the University of Tennessee published the most

[11] Based on 646 sites.

sophisticated study of remediation costs to date (see ***References*** section; note that this study excludes all non-remediation costs and does not address insurers' potential liabilities). It divided the universe of polluted sites into six disjoint sets and, assuming the continuation of current remediation standards, reached the following conclusions regarding total cleanup costs:[12]

Table 2
University of Tennessee Remediation Estimates

(in billions)	Plausible Lower Bound	Best Guess	Plausible Upper Bound
NPL	$106	$151	$302
RCRA	170	234	377
Underground Tanks	32	67	67
Dep't of Defense	30	30	30
Dep't of Energy	110	240	240
State/Private	30	30	30
Total	$478	$752	$1,046

If the results of the less stringent and more stringent policy assumptions are included, the total range is from $373 billion to $1,694 billion.

Even if one accepts all of the results of the study without question, it is not appropriate to use these numbers without adjustment in an analysis of insurers' liabilities; further discussion of this point is included in the section on ***IBNR***.

[12] Hazardous Waste Remediation: The Task Ahead, p.16 (see reference list)

These numbers are material on almost any basis. They are significant enough for individual PRPs to cause them to look for financial assistance from every possible source, including their past and current insurers. Although there were earlier claims, the first important CERCLA claim was made by Shell in respect of the potential $4 billion cleanup at the Rocky Mountain Arsenal site in Colorado (now so infamous that it is frequently recorded in claim files only as "RMA"). Ten years later, the coverage decision is still under appeal.

RMA was followed by a resounding ... silence. Small numbers of claims were filed with insurers (especially primary insurers) each year. Except in a few specialty claims units, the issue of these "old" liabilities was a sleeper; when considered at all, it was generally raised in the context of the non-availability of current pollution coverage.[13] A 1991 GAO study of pollution closed claim activity through 1989 found low but growing claim counts and costs,[14] and by 1990,[15] the issue had taken on significant visibility within the U.S. insurance industry.

At first, there was relatively little reinsurance activity because the direct companies resisted putting up case reserves for fear that they might be considered an admission of coverage if discovered by insureds. However, as the discovery issue was defused and the pressure for recognition of these liabilities grew, precautionary notices began to move up

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[13] See: "Environmental Liability Insurance" ("Report of the NAIC Advisory Committee on Environmental Liability Insurance"), September, 1986; GAO/RCED-88-2, Hazardous Waste: Issues Surrounding Insurance Availability; and GAO/PEMD-89-6, Hazardous Waste: The Cost and Availability of Pollution Insurance

[14] This study should be used with care, since the GAO did not define the word "claim"; as a result, the claim counts from different respondents may not be comparable. See discussion in the ***Internal Data*** section regarding different definitions of "claim."

[15] Somewhat earlier in London due to the business practices of the London Market.

through the reinsurance and retrocessional hierarchy like toxins up the food chain. The Reinsurance Association of America (*RAA*) publishes a bi-annual study of reinsurance loss development that has excluded asbestos-related losses since 1985 but did not exclude pollution until the 1991 study (based on year-end 1990 data). The 1993 study provided some additional information separately for pollution and asbestos but did not include detailed numerical data for these two causes of loss.[16]

The general position of U.S. insurers has been that their potential pollution liabilities are not quantifiable. Although the issue is receiving increasing attention from regulators, the primary force pushing for recognition (or at least disclosure) of potential pollution liabilities has been the Securities and Exchange Commission (*SEC*). The SEC has had a long-standing information exchange agreement with the EPA with respect to PRPs, and began to develop a noticeable interest in insurers in 1991. Quantification is also an issue in the mergers and acquisitions arena, where purchasers of insurance companies have become increasingly wary of "dirty" business. The IRS, which might be expected to act as a counter-force to accrual, has been silent to date on the issue as respects insurers.[17]

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[16] Reinsurance Association of America Loss Development Study, 1993 Edition.

[17] This is contrast to the situation in the U.K., where the Inland Revenue has significant expertise regarding U.S. pollution, primarily as a result of the three-year accounting rule at Lloyd's.

The Failure of Classical Actuarial Analytical Methods

"History is bunk."[18]

It is clear that triangulation is not an appropriate tool for analysis of pollution losses. This is true for several reasons:

- Calendar year phenomena are not susceptible to triangular analysis, which relies on the history of older accident years to predict the future of younger ones. Unfortunately, history is happening to all accident years simultaneously as time proceeds forward from the enactment of CERCLA.

- For horizontal triggers, the involvement of multiple policy years confounds accident year analysis, as the costs for a single dumpsite may be spread over twenty or more "accident" years, which then all experience the same development at the same time with respect to that site.

- The legislative, judicial, technological and site-specific environments are changing. This is a serious problem in the estimation of potential pollution liabilities. For example, only 20% of the NPL sites where remediation has been completed have groundwater involvement, while 70% of the total NPL sites do.[19] Thus, it is reasonable to assume that future remediations of known sites will take longer and cost more per site (barring any effects from Superfund reform and future improvements in remediation technology). On the other hand, future remediations of currently undiscovered sites are generally expected to

[18] Usually attributed to Henry Ford.

[19] GAO/Future Challenges for Superfund Program, p. 48.

cost less per site (see section on ***IBNR***). Other examples of possible future changes include a decrease in coverage litigation as some issues are decided in key states.

- Even if triangles were meaningful, there is a lack of history. Recall that, for many companies, substantial claim activity did not really get underway at the insurance level until the late 1980s and early 1990s. Many of the largest insurers (especially among direct writers) recognized the unique qualities of these claims earlier and began to form separate specialty claims units (usually in conjunction with asbestos and other mass tort claims). However, the paid and incurred numbers were small enough to escape actuarial notice until the early 1990s, when they began to distort general liability and casualty triangles. Thus, there are only a few diagonals with any volume of claim activity.

Pollution and Asbestos

"Don't drink the water and don't breathe the air..."[20]

Pollution's resistance to traditional actuarial methods of analysis places it squarely with asbestos-related claims and other "mass torts." Like asbestos, it is a field of specialists, jargon-ridden and inaccessible. Like asbestos, it affects both very old and more recent policies. Like asbestos, it is pulled out of both analysis triangles and the normal claims processing flow. Like asbestos, it is perceived to be a significant threat to the insurance industry. In fact, pollution has so many similarities to asbestos, it is frequently thought to be asbestos ... only different and bigger.

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[20] Lehrer, "Pollution"

We disagree. **Pollution is NOT asbestos.**

The single biggest difference between the two causes of loss is the existence of the products aggregate limit. Because asbestos losses are generally covered under the products section of the general liability policy, there is almost always an aggregate limit in effect in the primary policy.[21] To date, pollution claims have generally been filed under the premises/ operations coverage, which rarely had an aggregate limit prior to 1986. This means that, under the most commonly assumed pollution trigger and occurrence definition, there is one occurrence per PRP-site-involvement year with costs spread over all years of the insured's involvement. Thus, a primary company may be faced with many (perhaps hundreds) of sites from a single insured, none of which individually produces a loss per year sufficiently large to penetrate into its reinsurance protections, and which may not be subject to aggregation in order to trigger protections.

The general result of the asbestos aggregate limits -- all other things being equal and barring the successful use of vertical or aggregating triggers for pollution claims -- is that a given gross volume of asbestos losses will penetrate much further into high excess layers and reinsurance protections than the same gross volume of pollution losses. Thus, we would generally expect the impact of asbestos to increase relative to that of pollution as the attachment point above the ground increases. Assuming the general use of a horizontal trigger for pollution, and subject to variations in policy wording -- asbestos goes high, and pollution stays low.

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[21] There are exceptions. In some cases, this was resolved by the use of an "agreed aggregate" developed as part of the Wellington Agreement; see Cross & Doucette, "Measurement of Asbestos Bodily Injury Liabilities," p.13.

The second important distinction between asbestos and pollution is that asbestos has a smaller universe of "target" insureds, i.e., insureds with massive claims relative to other industrial concerns. Among known asbestos defendants, fewer than 75 are generally considered to have major involvements, while 476 PRPs are already publicly known to be involved in more than five NPL sites. It is possible that, as the extent of PRPs' involvements in non-NPL sites (especially owned sites) becomes clearer, a small group of "targets" will emerge; however, we believe that it is unlikely to be as small as the asbestos group. As a result, total asbestos losses for a given insurer are much more of a "crap shoot."

Lastly, there are significant coverage issues with respect to pollution claims that were never present in the asbestos arena. The question of "known loss" was and continues to be litigated in the claims of the major asbestos defendants, but, in general, the applicability of the general liability policy was not a significant issue for asbestos losses. The claims of thousands of injured third-parties clearly constituted "damages" and there was rarely a protective exclusion in place. On the other hand, the applicability of insurance and reinsurance coverage is one of the core problems in estimating pollution costs for both insureds and insurers. The industry's coverage defenses have been, on average, successful (see later), but this success has contributed to the quantification problem.

Overview of a Pollution Analysis Project

"The best way out is always through."[22]

No two of our many U.S. pollution analysis projects have proceeded in the same manner. Depending on the insurer's needs, they are done in greater or lesser detail; depending

[22] Robert Frost

on the cleanliness and detail of the available data, data preparation can be more or less time-consuming; depending on the results of the various methods, selection of the final range can require more or less testing and re-testing of assumptions. However, we would generally expect a project to proceed in approximately the following order:

1. General discussion with claims department regarding policy terms, claims practices and data availability

   This step is never omitted. It is very important because practices regarding case reserving, claim recording, settlements, and other important factors vary widely. As is discussed later, even the definition of a "claim" can vary between companies. The specialists handling the claims are crucial sources of information about these items as well as general policy terms, type of business written, changes in claim reporting patterns, etc.

   During this step, we also request the list of insureds with reported pollution claims. This helps us to form an initial impression of the likely magnitude of the problem relative to the insurer's other business (see section on ***Eyeballing the Problem***). This is important since potential pollution liabilities must be viewed in the context of the company's overall reserve position. In cases where it is clear that potential pollution losses are small compared to the total reserve position, the toxic claims are being handled well, and the total non-toxic reserves are adequate, further work may be unnecessary.

2. Decide which, if any, insureds to separate from the analysis

One large insured or unusual exposure (or a small number of them) can distort the results of both the model and aggregate techniques, and it may be advisable to remove them for separate analysis. The specialist claim unit is inevitably able to list any anomalously large exposures.

3. Do market share, aggregate loss development, and MCP tests

These are described in greater detail in the later section on ***Sophisticated Eyeballing***.

[If the analysis uses the detailed model, include steps 4 - 9; otherwise, go to step 10.]

4. Receive and clean-up claims data, add necessary supplemental identification fields

This is frequently the most time-consuming part of the analysis. For discussion of the internal data, see the later section on ***Internal Data***; the selection and construction of a company's pollution database are discussed further in **Appendix E.**

We note that data preparation on repeat assignments has proved to be much more difficult than we expected for three reasons: (1) Changes in our data. As we find additional public data, we also find new relationships between PRPs.

This sometimes leads us to change the standard form of the PRP's name used in our site database or to group two PRPs together, thus causing our identifiers to change over time; (2) Changes in the insurer's data. Obviously, we expect that, over time, new claims will be reported, some known claims will close, and recorded dollar amounts will change. However, other changes may cause significant reconciliation problems; and (3) Our model requires that every unique site and every unique PRP in a review be given a distinct identifier. On an initial review, the identifiers given to small sites and PRPs not in the national data are only required to be distinct from those already in use; a repeat review requires also that they be consistent with those of the first review.

5. [if necessary] Selection of a distribution of underlying limits to be used

As discussed later, the actual distance between the first dollar of loss and the insurer's attachment point is a critical variable, particularly for horizontal triggers. Where the available internal data does not capture this information, we will insert "assumed" underlying limits that are stochastically generated from an empirical distribution. This distribution is usually selected based on our experience and discussions with the insurer. It is difficult to over-emphasize how critical this variable is.

6. Run the model

An overview of the model used to evaluate the adequacy of reported reserves is given in the section on ***Beyond Eyeballing: A Model of Pollution Liabilities***.

7. Re-run the model

We are rarely comfortable with the results of a single model run (which involves multiple simulation passes through the same set of data with the same parameters). Any given pollution analysis usually requires multiple runs -- occasionally tens of runs -- in order to clarify questions that arise with respect to the behavior of the results.

8. Analyze model results and select estimate/range for reported claims

In making our selections, we examine both the stochastic variation in the model output and the results of the sensitivity tests selected to indicate potential parameter variation (see later section on ***Sensitivity Testing and Interpretation of Results***).

9. Add IBNR, adjusting the multiplier for book being analyzed

Sources of IBNR claims and issues related to IBNR multipliers are discussed in the later section on ***IBNR***.

10. Compare model results to results of the aggregate techniques and select an estimate/range for total potential ultimate pollution losses

Although we have not made any effort to adhere to pre-set "rules" in selecting the final estimated range of ultimate losses, we have found that the high end

of the range is usually approximately twice the lower end. Individual results may differ significantly from this observation.

Eyeballing the Problem

"The curtain rises on a vast primitive wasteland, not unlike certain parts of New Jersey."[23]

Not all books of pollution claims are the same. For a direct writer, the two most important indicators of potentially large pollution losses are:

- Type of business: This attribute is recognized by various insurance industry idioms, such as "Main Street," "light commercial," and "heavy commercial." We prefer to distinguish between "national PRPs" and "local PRPs." If the list of pollution insureds is largely populated by well-known names such as Fortune 1000 companies ("national PRPs"), it is a significant warning sign because these PRPs are likely to have both multiple NPL and non-NPL involvements, and a consequent willingness to engage in expensive coverage litigation. "Local PRPs" (i.e., names we have not encountered before) are more likely to have only one or two sites, which are probably (but not necessarily) less expensive than those of the national PRPs; local PRPs also appear to be less likely to litigate coverage, probably because the expense involved would be disproportionate to the ultimate recovery.

- Average attachment point: High attachment points above the ground provide more protection against pollution claims than against asbestos. In rough terms,

[23] Woody Allen

we regard attachment points below $5 million as being in the working layer for a book of national PRPs, while it appears that there is significant safety in attachment points that are greater than $20 million. However, we note that the average can be misleading and the entire distribution of attachment points should be examined. For example, if a book of business is bimodal, i.e., is a mixture of very high and very low attachment points, the resulting high average gives a false sense of security because of the presence of the very low attachments.

Assuming the use of standard U.S. policy wording, the risk factors for potential pollution liabilities can be summarized as follows:

Table 3
Pollution Risk Factors

Characteristic	Low Risk	Medium Risk	High Risk
Policy Years (sites in operation)	Post-1985; pre-1945	1945-1970	1970-1985
Premium Volume	Varies with volume		
Exclusion Wording	Absolute pollution exclusion	"Sudden and accidental" exclusion	No pollution exclusion
Insureds	Offices, apts, only	Small/local businesses	Fortune 1000 companies
Layers Written	Very high (>$20 million above the ground)	High (between $5 and 20 million)	Low (<$5 million above the ground)
Expense Treatment (lower layers)	Indemnity only; expense only	Expense in the limit	Expense in addition to the limit
Paid Losses	Varies with losses		

In some cases, the risk factors are interdependent, e.g., the post-1985 years are safer because the absolute pollution exclusion came into wide usage with the ISO policy simplification in 1986. In some cases, the factors are interactive, e.g., fewer sites were operating per year prior to 1970 than in later years, but some excess policies attached much lower prior to 1970 and therefore may have more overall exposure in the earlier years. In other cases, the indicators are almost mutually exclusive, e.g., larger insureds would tend to buy coverage in higher layers than smaller insureds. In these cases, it is difficult to judge which factor will exert more influence. The model described below is intended to deal with such problems.

The inclusion of premiums and paid losses in the table of risk factors implies that there may be methods less onerous than the full application of our model that might be brought to bear on the problem. Three are discussed in the next section.

Sophisticated Eyeballing: Aggregate Techniques

"The time has come to realize that research is the highest human function, ..."[24]

Our analysis of pollution liabilities typically relies upon a number of methods ranging from "eyeballing" the situation through a comprehensive review utilizing the modelling techniques discussed in the next section. Between these two extremes lie several useful techniques based on aggregate data of one type or another, be it pollution claims as of a given date or net GL premiums written since 1960. We present three methods herein labeled, Market Share, Aggregate Loss Development (not to be confused with traditional development triangles), and Multiple of Current Payments.

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[24]Pierre Teilhard de Chardin, Building the Earth

Market Share Analysis

Market share analysis is a relatively straight forward, intuitive way to estimate pollution liabilities. We begin with a range of estimated ultimate pollution losses for the insurance industry as a whole. (We are currently using $60 - 90 billion.) We then allocate the estimated ultimate losses based on the years of operation and/or discovery of waste sites, depending on the desired trigger.[25] An insurer's share of the industry losses is determined directly from the industry estimates based on the company's market share (i.e., percentage of industry GL premium) throughout the period. We generally calculate the market share over periods of irregular length that are selected to reflect any significant changes in the insurer's writings compared to the market as a whole.

There are several refinements that should be incorporated into a market share estimates. Adjustments for premium that does not give rise to pollution exposure (e.g., medical malpractice, D&O) but is reported with GL premium are appropriate in many cases. (Similar adjustments to the industry premium may not be possible.) It is also necessary to adjust the market share percentages to reflect qualitative factors such as the type of business and average attachment points written, as discussed in the previous section. (If premium by layer were available for both the insurer and the industry, it would be desirable to do the analysis by layer.)

We do not incorporate any additional adjustment for reinsurers beyond that indicated by their attachment points and type of business. It is clear that significant amounts of pollution losses will ultimately be passed to reinsurers, and, at this time, we have no data

[25]See **Appendices B** and **C**.

indicating that their potential losses are less than proportional to their premium. (This is in contrast to their ultimate asbestos losses, which we estimate to be greater than proportional to their premium.)

There is an open question as to how CMP premiums (adjusted to reflect only the general liability part of the package) should be treated in doing the market share analysis. Large industrial insureds have generally been written on monoline forms. However, the use of multiperil packages penetrated well into the types of insureds with pollution claims. We would therefore expect the liability portion of the packages to produce noticeable pollution claim activity. However, we note that the claim reporting from multiperil business is substantially below the expected level. The decision as to how to treat the multiperil premium is further complicated by the fact that some companies have historically reported some or all of their multiperil premium as decomposed into the constituent monolines in their annual statements.

We note that, despite all efforts, in a limited number of cases the market share estimates may never reconcile to other approaches. Problems with market share projections usually occur when the shares or number of years involved are very small.

Aggregate Loss Development

We have rejected **traditional** loss development methods (i.e., triangles) for reasons detailed earlier; however, this does not preclude the use of **non-traditional** loss development (i.e., no triangles). A non-traditional development approach ignores accident years and

focuses on the aggregate losses paid (or reported) as of a given date and aggregate payment patterns associated with those claims.

Capturing the required aggregate pollution loss data from the insurer is quite simple, since it is only cumulative paid losses; however, we note that it is often instructive to project pollution losses from several recent evaluation dates (e.g., three or four recent year-ends) to produce a range of estimated ultimate losses.

Determining the appropriate payment patterns is more complicated. A payment pattern appropriate for projecting losses on NPL sites begins with calendar year 1980 (enactment of CERCLA/creation of the NPL). The actual past site discovery pattern is combined with projected growth in the number of sites and cost relativities by year of discovery as the starting point in determining a payment pattern. Having constructed a pattern in which sites are expected to emerge by discovery year, we then estimate the payout of costs from site discovery through final settlement of claims for each site.

We consider several elements of site costs that insurers face, including remediation studies, remediation costs, defense, coverage disputes, and third party liability. Estimated payment patterns for each component are weighted to determine the average payment pattern from discovery through payment of all claims on the site. These patterns will change for non-NPL sites and over time, so it is appropriate to vary the patterns by type of site and by discovery year. For example, we expect defense costs on a average site discovered in 1998 to be a smaller portion of the total and to pay out faster than defense costs on a site discovered in 1984. These patterns combined with the pattern of site emergence by discovery year result in expected pollution payments by calendar year.

A simplified example of how such an aggregate payment model could be constructed is shown in **Appendix D.**

Multiple of Current Payments (MCP)

Potential political and regulatory changes (e.g., Superfund reform, changes in technology or cleanup standards) may result in a level of uncertainty that precludes the determination of an estimated pollution liability that would satisfy the FAS 5 requirements for accrual. That is, while we can make projections of liabilities under alternative scenarios, we cannot say that a particular scenario is reasonably certain to occur. The MCP approach (called the "survival ratio" by A.M. Best) provides a relatively straightforward basis of comparison among insurers and appears to be emerging as a *de facto* standard.[26]

The MCP method sets pollution *reserves* equal to a selected multiple of average annual payments in recent years (e.g., the three most recent years). The selected average annual payment should consider the effect of unusual loss activity, large sites and/or PRPs. The selected number of reserved years is based on the type of business written with consideration of the distribution of attachment points, limits, shares of layers, policy years (e.g., pollution exclusions), and the type of exposure (e.g., geographic, type of insureds). It should be significantly greater for reinsurers and direct excess writers, where payment activity is less mature and is expected to increase at a faster rate than the payments of primary writers. At year-end 1993, the large primary stock companies were at approximately seven times average

[26] "While Travelers, as well as the industry, hasn't funded its environmental/asbestos reserves to its limit, A.M. Best believes that with a 7-to-1 reserve-to-paid position, its exposures being largely at primary vs. excess layers, and its aggressive resolution strategies, Travelers is ahead of the curve in addressing this problematic area." BestWeek P/C, February 7, 1994.

annual payments (asbestos and pollution combined), while the large stock reinsurers/excess writers had higher ratios. We note that disclosures generally indicate that these reserves are not fully funded to ultimate levels.

Beyond Eyeballing: A Model of Pollution Liabilities

"Computers are useless. They can only give you answers."[27]

As mentioned earlier, individual books of business may be sufficiently complicated that it is difficult to form an estimate based on aggregate information. For example, the market share and aggregate loss development methods may produce very different indications, or the net result of off-setting risk factors, such as type of business and layer of coverage, may not be clear.

In these cases, we believe that the use of a more sophisticated model is critical to movement from "guesstimates" to the development of supportable estimates of ultimate pollution liabilities. A model provides the following advantages:

- It allows explicit recognition of knowledge. Insurers have a great deal of information available to them, namely the list of their claiming insureds and the terms of coverage. However, because large corporations tend to keep larger SIRs and buy higher limits, the average attachment point tends to increase as the proportion of national PRPs increases; is the increase in protection from the higher attachment points outpacing the change in the book? Only a model can effectively answer that question in a book of 20,000 notices.

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[27] Pablo Picasso

- It allows explicit recognition of lack of knowledge. It is possible to form an estimate of the average success of coverage defenses but not the success of a single particular coverage case. In situations such as this, the model can simulate individual coverage decisions with the selected average success rate without knowing the outcome of the individual cases.

- It allows testing of alternative scenarios. What if the courts shift towards manifestation rather than an exposure-like trigger? What if the coverage defense success ratio is improved, but at the cost of a related increase in litigation costs?

- It allows documentation of assumptions and the effect of changes in assumptions over time. It is virtually certain that estimates of the various parameters in any pollution model will change over time as case law, technology, and the legal/social environments evolve. It is easier to document and explain the changes in model parameters than in 2,000 individual claim file evaluations.

So what does this "model" look like? Our model of potential pollution liabilities has two parts: reported claims and IBNR. Analysis of the reported claims is done mechanically in much greater detail, with an allowance for IBNR added outside of the detailed analysis. It is necessary to examine the reported claims carefully because the level of reserve adequacy can vary enormously between companies, even those writing similar layers and types of business.

Our model of reported pollution liabilities is claim-based (for reinsurers, notice-based), i.e., it looks at every policy exposure (separately by year and layer) for every reported PRP-site combination. For every reported site, the model accesses our site database, extracting the estimated cleanup cost, years of operation and discovery, PRPs, and groundwater involvement (Y/N). Where information regarding a specific PRP's involvement in a given site is available, from either the claim record or the site database, the model uses that information in preference to the more general site data. Where no information is available on a site, the required parameters are simulated from an empirical distribution constructed from available data from other sites.

The model simulates cleanup costs based on the database estimate and then adds defense and coverage defense costs and third-party indemnity. We are currently adding defense and coverage litigation costs as a percentage of the remediation costs (subject to a per-site maximum and minimum). Depending on the presence of groundwater contamination, we simulate the occurrence of third-party damages. If a third-party loss "occurs," we simulate the severity from a lognormal distribution with its mean selected based on the remediation costs. At this time, our model does not include natural resource damages.

For NPL sites, PRP shares are simulated based on the capped number of Fortune 1000 PRPs; for non-NPL sites, shares are simulated assuming a small number of PRPs.

Based on the trigger selected and the expense treatment indicated in the policy information, the costs for each PRP-site combination are distributed to year and compared to the coverage in order to determine the loss for that policy. Indemnity costs are set to zero if a successful coverage defense is simulated in that run; the probability of success depends on

the site's state, the policy year, and the policy wording. We are currently using an average policyholder win factor of 35%, i.e., averaged over all years and all states, we estimate that 35% of the universe of policyholders will be granted coverage. (The current version of The Superfund Reform Act incorporates a 40% policyholder win factor for "average" states.)

The simulated losses for each trial are stored while additional simulation runs are completed. They can then be analyzed as desired. Because simulation is, by its nature, an averaging process, we discourage the use of detailed output (such as individual policy estimates).

This model of potential pollution liabilities requires unusually large and detailed amounts of both external and internal data. Because the problems associated with compiling the two data sources are quite different, we will deal with them separately. We will first examine the external parameters and data. We will then return to some of the issues associated with the internal data, and finally we will discuss sensitivity testing and interpretation of the results. Lastly, we will look at IBNR and reinsurance issues.

External Issues and Data

"The truth is out there."[28]

Any model of reported claims must include specific recognition of several external items. The following are discussed below:

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[28] "The X-Files"

- Remediation costs (including study costs), including the variability among sites and the uncertainty in the estimates of individual site costs;

- Third-party indemnity costs;

- Natural resource damages;

- The insured's share of the remediation and third-party costs;

- The years of the insured's involvement (or date of discovery) at the site;

- The cost of defending the insured, both in respect of the cleanup and in respect of third-party actions;

- Coverage litigation costs;

- The likelihood that coverage will be denied; and

- The trigger/definition of occurrence.

Development and continuous maintenance of a specialized database of external information is necessary in order to provide the required information. As is noted below, we have found that the basic information is available from several sources but that it requires extensive and careful cleanup to be usable.

Remediation Costs

NPL Sites: Records of Decision issued by the EPA are the single most important source of remediation cost data for NPL sites. Virtually everyone doing meaningful analysis of NPL costs maintains a library of RoD summaries. However, caution is indicated in the use of RoD data for three reasons:

- More than one RoD may be issued for a given site. This is due to three factors: (1) A site may be divided into several operating units, each with its own sequence of RoDs; (2) Currently, RoDs are being issued separately for source control and groundwater remediation at the same operating unit; and (3) RoDs may be classified as "interim" and "final." As a result, there can be significant development from the first RoD at a site to the last.

- The EPA provides estimates of various components of the costs, together with the grand total present worth. The latter figure is discounted. Unless you believe that discounted costs are the proper basis for allocation to layer, the discount should be removed before using these estimates. We have found that the RoD cost figures captured by many firms are not reliably compiled.

- In addition, there is on-going discussion of the reliability of the EPA estimates themselves. The EPA has stated that they believe the estimates to be accurate to within -30%/+50%. (The range is probably wider for earlier RoDs.)

Although the EPA also publishes Superfund Comprehensive Accomplishments Plan (*SCAP*) data on actual expenditures to date, the reporting is very slow. Further, it includes only EPA expenditures and so, except at a few sites, SCAP data is not at all indicative of the true remediation costs.

If aggregate estimates are used rather than per-site data, careful consideration should be given to how the orphans' share is distributed and the effect of federal sites. The federal sites are a particular problem, since some of the extreme variation in total NPL remediation cost estimates frequently reflects the impact of the DoD and DoE sites, some of which are expected to be very expensive to clean up. (Most notable among these are the high level nuclear sites at Hanford, Oak Ridge, Savannah River, and Fernald.) Although there is a potential for some private sector responsibility at the federal sites, at this time it does not appear to be unreasonable to assume that the amount will be small.

Non-NPL Sites: We have not found a good source of cleanup cost data for non-NPL sites. The usual approach is to use the NPL distribution, truncated and with a significantly reduced mean. These adjustments are judgmental and would benefit greatly from further research. There are some qualitative indications that the distribution is bimodal, i.e., that there are many small non-NPL sites but also a significant population of very expensive ones. The latter may be particularly dangerous to high layer covers, since there is some evidence that they tend to involve only one or two PRPs (i.e., are owned sites) and therefore likely to produce significant high-layer exposure even when spread over many operating years.

In the universe of non-NPL sites, consideration should be given to isolating LUST (Leaking Underground Storage Tank) sites, both because they are likely to have different

characteristics than other sites (and therefore different cost distributions) and because there may be a material probability of subrogation recoveries from a state UST fund (depending on the state).

Third-Party Indemnity Costs

Third-party indemnity costs generally arise from claims for bodily injury or loss of property value. These suits seem to be prone to settle rather than go all the way to a jury verdict, and, as a result, details are scarce. The exact definition of "occurrence" and the basis of aggregation are critical to the issue of third-party costs, which tend to be multiple-plaintiff or class actions. Some reinsurers and high-layer direct excess writers believe that third-party indemnity will not be a problem for them because even large total awards produce relatively small amounts per claimant. While the ultimate allocation of these claims is still undecided, we have observed a few third-party claims in very high layers.

Third-party bodily injury claims associated with waste sites should not be confused with asbestos bodily injury. While it also produces a wide range of cancers that have been linked with asbestos but can occur in other circumstances, asbestos is best known for its "signature diseases," mesothelioma and asbestosis. With some isolated exceptions,[29] the materials disposed of at waste sites have no signature diseases. Establishing liability for bodily injury is further complicated by the fact that exposure to the contaminant rarely approaches historical levels of asbestos exposure. As a result, even where a carcinogen is present in drinking water and a cancer "hot spot" has developed, it may be impossible to

[29] Lead, mercury, asbestos, and chromium; however, these are present at relatively few waste sites in important quantities.

establish a statistical correlation, much less causation. Of course, this is not necessarily an impediment to substantial jury awards or settlements in preference to a jury trial.

In addition to claims for bodily injury, third parties can also claim non-remediation property damage. In some cases, this is direct property damage, e.g., when gasoline from a leaking underground tank migrates into the underground conduits for telephone cables and damages parts of the system. At this time, however, it appears likely that the more significant claims are likely to involve loss of property value. In some cases, the property becomes unusable, while in others the presence of a contaminated site nearby is alleged to cause a significant decrease in the value of the property.

Natural Resource Damages

Natural resource damages (*NRD*) arise under section 107(a)(4)(A) of CERCLA, as well as various other environmental laws (including the Clean Water and Oil Pollution Acts). They are intended to restore natural resources or compensate for their loss, where the term "natural resources" is quite broadly defined. This is distinct from the removal/remediation of the contamination; for example, the remedial action might require that trees or other wildlife habitat be stripped away, which would be a loss of natural resources. The valuation of the loss has frequently been done using the so-called "contingent valuation method," which is quite subjective; the EPA has publicly committed to a re-examination of the valuation method.

Only certain parties, including at least the U.S. Government (usually represented by the National Oceanic and Atmospheric Administration), states, and Indian tribes are clearly entitled

to file NRD suits. The rights of other parties appear to be subject to some dispute. In addition, CERCLA imposes time limits for the filings; these differ for NPL vs. non-NPL sites.

Natural resource damages are different from other third-party damages in that they arise under CERCLA. However, unlike cleanup costs, they appear to be more clearly "damages" and, therefore, this coverage defense against natural resource damage claims is likely to be weaker than against cleanup costs.

The amount of information available on NRD is growing but is still quite limited relative to, say, remediation costs. There is not an obvious consensus on whether NRD will be significant, much less how they will be treated within the insurance side of the issue, i.e., success of coverage defenses, trigger, etc.

Share

In our opinion, PRP share is the most difficult parameter to estimate or simulate. Although an increasing amount of information is available from consent decrees between the EPA and PRPs, it is not clear that it is useful for the projection of future allocations. It is probably true that parties with limited assets will pay relatively little. However, allocations at the multi-party sites may give very small shares to many mega-corporations or a single PRP may pay a significant share of the costs.[30]

[30] E.g., Coors will pay 90% of the remediation at the Lowry Landfill (estimated total remediation cost = $600 million); the State of California will pay 75% of the costs at Stringfellow (currently estimated at $800 million).

In spite of this, it is reasonable to assume that, on average, the presence of many other PRPs decreases the probability that an insured will pay a large share of the site costs. For this reason, the number of PRPs at the site is very useful information. Unfortunately, compilation of PRP information is a very time-consuming process. For various reasons, the EPA PRP lists are "dirty" and cannot be used directly, i.e., names are frequently misspelled, the same PRP may receive multiple notifications, etc. The PRP list published by EPA headquarters (the SETS database) is subject to a significant reporting delay; we have found that the EPA regions can supply PRP data on a more timely basis for nominal fees upon submission of a FOIA request.

Users of the EPA PRP lists may be tempted by their sheer volume into believing that they are complete. They are not. In order to minimize its own effort, the EPA has historically preferred to find one or two large PRPs and then let them attempt to decrease their share of the site costs by finding other PRPs. These "third-party" PRPs are added to the EPA lists only slowly, if at all. As a result, many insurance claims are from policyholders that are not officially PRPs. It is our experience that a significant proportion of claims related to NPL sites are from such PRPs.

Years of Involvement/Discovery

Actuaries with direct access to claim files may have significantly better data in this area than others, since the alleged dates of involvement may be recorded in the correspondence. Where the insured's specific years of involvement are not known or the data is not available, dates derived from the years of site operation are a reasonable proxy. We have found it necessary to insert a "date compression" routine in order to recognize that individual PRPs are generally not involved for the entire operational life of the site.

In order to test a manifestation or continuous trigger, it is necessary to know (or estimate or simulate) the date when the insured knew or should have known that it was causing damage. This is even more difficult to ascertain than the dates of involvement; however, a latest bound can be established by the date of the EPA's 104(e) letter.[31] This date is publicly available.

Defense of the Insured

Policyholders may require defense against the EPA (or corresponding state agency), other PRPs, and/or third-party claimants. In general, the duty to defend is broader than the duty to indemnify, so insurers may pay defense costs even if indemnity coverage can be denied. These costs can themselves be quite significant. Unfortunately, it is difficult to analyze actual historical costs since many insurers record coverage dispute costs in the same field as defense costs. As a result, it is necessary to base defense cost parameter selections on public studies such as the recent RAND studies[32]. In selecting the defense cost multiplier, it is important to remember that one should select an ultimate multiplier and not be unduly influenced by the actual current ratio of expenses to indemnity. This ratio is clearly distorted by the coverage litigation, which both accelerates legal costs and delays indemnity payments, leading to a double overstatement in the current ratio.

Policies can treat expense in many ways: pro-rata on indemnity, included in the limits, totally excluded, or expense-only. While this complicates the modelling process, it is essentially a technical problem. Even if they do not code the expense treatment by policy,

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[31] The so-called "Dear PRP" letter.

[32] See ***References***.

most insurers can describe their usual practice, either overall or by policy group (e.g., primary vs. excess).

Coverage Litigation Costs

As mentioned above, declaratory judgment action (*DJ or DJA*) costs are frequently recorded with pure defense costs (i.e., "real" allocated loss adjustment expenses). The RAND study is the best source of information on coverage litigation costs, but, again, current ratios to indemnity should not be confused with the likely ultimate ratios.

There are unresolved questions as to whether reinsurers will accept these costs, and, if so, to what extent; the question is particularly acute where large sums have been expended in a successful denial of coverage. This results in mammoth DJ costs associated with zero incurred indemnity, which complicates a pro-rata distribution. There appears to be a general open-mindedness with respect to discussing the issue. While not the most material item in developing the model, it is necessary to either make a general assumption as to how these costs will be treated or to build flexibility into the model.

Successful Denial of Coverage

As contract questions, coverage disputes are subject to state law rather than federal, producing widely varying results. As a result, it is important to consider the state law that is likely to be applied in selecting a probability of coverage to use in the model.[33]

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[33] Sometimes called the "win factor," especially in the London Market. No consensus has developed as to the exact definition of the term, i.e., whose "win" is being referenced.

Coverage denials have generally been based on four arguments:

- "As damages": The standard industry general liability form says that it will indemnify the insured for amounts that it becomes liable to pay "as damages." Insurers originally argued that costs arising from governmental remediation requirements were not "damages." An analogy to other cleanup costs has frequently been made: "If the health department comes around and tells a restaurant owner to clean up the kitchen, we don't have to indemnify those costs, so why should we indemnify site cleanup costs?" The courts were generally unmoved by this argument, citing the coercive nature of government letters/notifications. The "damages" argument is still raised, but it is generally conceded that the insureds have won on this issue at sites where an enforcement letter has been sent. Even at sites where the cleanup has been undertaken voluntarily, this defense may not be effective.

- Pollution exclusions: In the early 1970s, the standard form was modified to include the "sudden and accidental exclusion," which -- in spite of its name -- was intended to exclude all pollution-related claims except those that were sudden and accidental. In 1986, this was replaced by the "absolute exclusion," which appears to be withstanding almost all attacks. The sudden and accidental wording is still an open issue, although there seems to be a slight swing in favor of insurers.

  In selecting a probability of coverage related to the pollution exclusion, it is necessary to ascertain if the insurer used U.S. standard wording or some

variant. For example, some policies written in the London Market included exclusionary wording that was significantly stronger than the U.S. standard.[34]

If coverage is being sought under the personal and advertising injury coverage, this defense may be less effective, since the applicability of the exclusion to that coverage is being litigated.

- "Expected or intended" (fortuity): The standard coverage form excludes losses that are expected or intended by the insured. Litigation on this point is very fact-intensive,[35] examining the difference between whether the wording relates to the discharge itself or the resulting damage, as well as what the insured knew (or "should have known") at the time of the discharge. There is no obvious trend in these decisions. Even after the wording issues are litigated, this issue is less likely to be clearly determined by a state supreme court than the others because the facts are different for each insured and site.

- Owned property: General liability forms usually exclude coverage for the damage to the insured's own property; however, this can usually be circumvented where there is groundwater involvement (since groundwater is usually state property) or where there is a danger that the contamination will

[34] Notably NMA 1684, which more closely resembles the U.S. absolute pollution exclusion than the "sudden and accidental" wording that was in use at that time in the U.S.

[35] E.g., was there any employee of the insured whose job description included the removal of ducks killed by swimming in the ponds? (the so-called "dead duck" defense in the Shell/Rocky Mountain Arsenal coverage litigation)

migrate off-site (which is almost everywhere). This has not been a strong coverage defense historically.

Recently, a fifth defense has taken on new power, namely:

- Late notice: Most policies require that the insured provide prompt notice of loss to its insurer; this has tended to be a weak defense, however, unless the insurer could show that its interests were prejudiced by the delay. Increasing pressure on PRPs by the SEC to quantify and disclose environmental liabilities may accelerate both reporting and the usefulness of this defense.

The likely success of the pollution exclusion and fortuity defenses varies by policy year. In the first case, the U.S. standard wording changed substantially in 1966, 1973, and 1986, and so policy year must be considered when evaluating the success of the pollution exclusion. This is also the case with fortuity, since, in general, the strength of the "expected/intended" argument should increase in more recent policy years: In the 1950s and 1960s, many insureds will be able to make strong arguments that they simply did not know (and could not have known) that they were causing damage; this argument weakens in the 1970s and especially in the 1980s, although this may be subject to more dispute for "mom and pop" insureds.

There is a last, implicit coverage defense: If the insured cannot prove (or at least strongly hint at) the existence of a policy, they have no coverage for that year. It follows that very early policy years (prior to 1955) are less at risk than more recent ones, since it will be more difficult to prove that there was a policy. There is relatively little gain from this, since

the costs that would likely be allocated to the early years by even a horizontal trigger are minor due to the small number of sites in operation then.[36] It should be noted, however, that policies exposed in these years may suffer significant losses relative to their limits because the attachment points and limits were so low in those years.

Trigger/Definition of Occurrence/Basis of Aggregation

There are probably as many ways of allocating claims to policy years and layers as there are PRPs and insurers. However, we are aware of only four that are in widespread use:

- Exposure: Reasoning by analogy to asbestos, this triggers the years during which the insured was actively disposing of wastes at the site. The usual definition of occurrence is "one occurrence per site per year."

- Manifestation: Again making an analogy to asbestos, this triggers the year in which the damage became manifest (e.g., the year the site was put on the NPL, although there are other possibilities). There is usually one occurrence per site in this one year, although there are more possibilities for aggregating all of an insured's sites into one occurrence.

- Continuous/triple trigger: This theory triggers all policy years from the time of the insured's first involvement in the site to the time the insured knew or should have

[36] Shell/Rocky Mountain Arsenal is the notable exception to this general rule and tends to cause a bulge in costs in the late 1940s and early 1950s; if an insurer has no exposure to Shell, it would be appropriate to remove this for analysis purposes.

known it was causing damage. There is usually one occurrence per site per year. This is the provisional allocation method used in the London Market.

- Fountain: This is a variant in which a set of policy years are triggered (either exposure or continuous, for example), but the insured selects a single year for its coverage (to minimize the number of SIRs applied); the insurers in this "target" year are then left to seek contributions from insurers in the other triggered years under the "other insurance" clause. This is also referred to as "all sums" (after the policy wording that stated that the insurer would pay "all sums" that the insured became legally obligated to pay as damages). The effect of the fountain is to push losses into higher layers than would otherwise be penetrated under a true exposure or continuous trigger.

In the case of the non-manifestation triggers, there is some indication of attempts to spread the total costs over a subset of the possible years (e.g., the years with weaker coverage defenses).

In modelling, it is important to have a clear distinction between the trigger, the definition of "occurrence," and the basis of aggregation before beginning any programming.

Although there are notable exceptions, most remediation costs are currently being allocated on either an exposure or a triple trigger. However, many of these allocations are provisional and may ultimately change when the outcomes of the claims are completely finalized. We note that the allocation of a settlement may not reflect where the costs would have finally come to rest if the claim had been allowed to pay out to its natural termination, either among years or among layers.

Even at one site, the trigger/definition of occurrence used for the third-party costs may differ from that used for the remediation costs. For example, if loss of property value is alleged, an insurer may consider that to be triggered by the announcement of the site's listing on the NPL, even though the remediation claim may be spread over the years of dumping.

Internal Data

"Ful wys is he that can himselven knowe."[37]

In estimating potential pollution liabilities, detailed claims data is essential. This is because any projection methodology must reflect the underlying business, including:

- Years and volume of business written;
- Type of business written;
- Policy wording, especially pollution exclusions used;
- Attachment and width of layers written and retained;
- Limits structure; and
- Expense treatment.

In order to do this, the model requires data that is not usually recorded in a normal claims system such as site name, underlying coverage, etc. Because this data is also required for claims handling, most insurers with a significant volume of pollution claims have built PC-based supplemental systems. These can be either stand-alone systems carrying a complete set of data or linked to the main claims database and containing only the supplemental data. We have included a discussion of database formats and contents as **Appendix E.**

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[37] Geoffrey Chaucer, The Monkes Tale in "The Canterbury Tales"

Where the necessary data fields have not been captured, the data compilation task can be formidable. Even where all of the necessary fields are available in some format, we have generally found that the data from these systems requires extensive cleanup before it is usable. In fact, data preparation is almost always the major part of the analysis. This arises from two general data issues: the definition of "claim" and data entry problems.

Pollution "Claims"

What is a claim?

The registration of pollution claims by the special claims unit may reflect convenience (one file is easier to track than thirty), the company's preferred trigger theory (a preference for manifestation would mean that only one year would be involved), or simply the department's usual practices (do BI and PD claims arising from the same incident get one claim number or two?). At one extreme, all of the activity for one insured PRP may be registered under a single master file number with references to other any other policies kept in the file. At the other extreme, separate files may be set up for each insured-site-claim type-year-policy combination. In practice, most companies' claim registration systems are somewhere between the two extremes.

Seemingly small differences in the claim system can give rise to significant data preparation effort. For example, assume that a unique combination of insured and year defines a pollution claim in the claims database, while the pollution model requires a record for each unique combination of insured/policy/year. In this case, it will be necessary to expand the claims database records, creating "filler" records for multiple policies within a given year. In

the course of doing this, care must be taken to maintain whatever unique identifiers are required in a relational database (see **Appendix G**). If the model is based on one-year policies, it will be necessary to create expansion records if the claims database has only one record for a multi-year policy. Depending on the details of the model, records may have to be deleted from the claims database if BI and PD claims are registered separately or if multiple BI claimants are each assigned a distinct claim number. If the model assumes different triggers for BI vs. PD (see earlier section on ***Trigger***), it may require different registration systems from the claims database depending on the claim type.

Other Common Data Problems

Spelling is a common problem in pollution data. Inconsistent spellings impede both matching within the file and correlation with external data. The first step in preparing data for analysis is always a spelling "cleanup" so that PRP and site ID numbers can be validly and consistently assigned.

The second general class of problems arises from the use of text fields. Text fields are essentially useless for analysis purposes until they are parsed into a numeric format. While most date formats can be parsed mechanically into numeric fields, limits information in a text field creates a much greater problem, especially if the limits structure is complicated. We note that recording a limit as "3M" is usually unambiguous but it is still a text field that has to be re-formatted as numeric before it can be used.

The third type of data problem is inconsistency among records of a flat database or between tables of a relational database. These problems are can be difficult to find,

sometimes escaping detection until the model crashes while looking for a non-existent policy number. The most common problem of this type is a link field such as the policy number that has an error or a slightly variant format in either the PRP table or the policy table. For example, a policy number might appear in the PRP table as AA-123456 and in the policy table as AA123456.

Data Suggestions

We have found that a few general guidelines facilitate the growth of a clean, usable pollution database:

- Use numeric entries in all possible fields (i.e., avoid entering dates or limits as text fields)
- Enter dates in a YYYYMMDD format
- Avoid abbreviations such as M or K for millions and thousands; always use the full, correct number of zeros
- Enter text fields in capital letters only (some applications alphabetize upper and lower cases separately)
- Develop a dictionary of standard abbreviations, insured names, and site names
- If possible, assign ID numbers to insureds and/or ceding companies if applicable
- Enter multiple year policies in multiple records (one record per year)
- Avoid entering single records corresponding to more than one site (i.e., a record for "5 various" sites should be split into five records)

- Periodically test databases to be sure that all fields that should be the same actually are the same (e.g., multiple entries for the same policy limits in a flat database, or link fields in a relational database)

Sensitivity Testing and Interpretation of Results

"Parameter risk, by its very nature, cannot be precisely estimated."[38]

Given the many sources of uncertainty in the analysis, it seems reasonable to conclude that the selected range of potential ultimate liabilities should reflect both stochastic and parametric variation. The model itself will produce information on stochastic variability, but it is necessary to do sensitivity testing in order to get an indication of the potential parametric variability.

For a given set of claims and parameter selections, we have found less stochastic variation in the results than we originally expected. On the other hand, the variation in results between the different triggers can be extreme. This is a particular problem for companies that began writing only in the late 1970s and, as a result, have significantly more exposure to the manifestation trigger than to others. This can be quite troublesome in estimating a reasonable range of outcomes.

Sensitivity testing on the parameters can be very time-consuming, since the model has to be re-run with each new parameter set. Two approaches are possible: (1) construct a meta-program that randomly selects values for each parameter from specified distributions for

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[38] Stephen W. Philbrick, "Accounting for Risk Margins" in the Spring 1994 CAS Forum, p. 5.

each meta-trial, (2) select a set "normal" set of sensitivity tests to be run, varying the parameters one at a time. The latter undoubtedly misses some parameter combinations that would produce extreme values but has the advantage of a shorter run-time.

The results produced by our simulation model tend to be quite stable, i.e., small changes in the parameter selections tend to produce proportionally smaller changes in the results. One exception to this general result is that, for a given population of claims, the results can be very sensitive to the level of assumed underlying limits. Because of this, we urge direct excess and reinsurance writers to capture as much information as possible about the underlying limits (i.e., the true distance between the attachment of their coverage and the first dollar of loss).

IBNR

"Yeah, ... imagined but not real"[39]

At some point in the development of IBNR estimates, it becomes necessary to confront the critical issue of the time horizon of the projection. This selection is deeply intertwined with questions of accounting and disclosure and may reflect an insurer's philosophy as much as or more than its actuaries' technical preference. While the questions of accrual under statutory and GAAP discounting as well as the professional standards applicable to loss reserves are beyond the scope of this paper, we note that there are several time horizons that are intuitively and/or technically appealing.

[39] Overheard at a meeting on indicated rate changes.

The first of these is "horizon = now," i.e., no IBNR. According to public disclosures of insurers, this has historically been a very popular choice. It has the advantage of accurately reflecting the perceived disorder and non-quantifiability of the pollution claims process. On the other hand, it is significantly lacking in intuitive appeal, given that the number of notices being received, while erratic, does not show any signs of dropping to zero in the near future.

At the other extreme, one could select "horizon = ∞." The primary problem with this selection is the massive uncertainty regarding the ultimate underlying cleanup costs. Even assuming continuation of the current legal, social, technological and judicial environments, the question of the number of sites that will ultimately be remediated (as distinct from the number requiring remediation) is essentially indeterminate at this time.

Having ruled out both zero and infinity as acceptable goals, we selected "horizon = the year 2000." That is, we currently project the costs associated with sites discovered through the year 2000. Of course, loss emergence and payment on those sites continue for many years after that. This was an entirely pragmatic selection based on the EPA's stated plan to have 2,100 sites (cumulative) on the NPL by 2000.[40] Other selections are clearly possible.

Even given a time horizon, the estimation of a reasonable IBNR allowance is subject to significant uncertainty. Having said that, we note that IBNR can be decomposed into distinct elements, each of which can be analyzed.

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[40] GAO/Future Challenges for Superfund Program, p. 12.

The components of pollution IBNR for direct writers are:

- undiscovered policies
- unreported PRPs
- discovered but unreported sites
- undiscovered sites (NPL and non-NPL)

For reinsurers, we must add to the list:

- known but unreported primary claims

The effect of undiscovered policies is easiest to quantify. For example, if a complete list of all insureds (such as all facultative certificates) ever written is available, the effect of future policy discoveries can reasonably be assumed to be zero. (Technically, it is not zero due to the possibility that coverage may have been provided to an affiliate under a different name.) Unless a complete list of historical insureds is available, there is a potential for additional policy discoveries that appears to increase as the attachment point increases.

A properly defined and consistently maintained database of pollution claims/notices will provide the data necessary to analyze policy discoveries. In the absence of this historical data, the claims department is usually willing to provide qualitative information.

As time goes on, unreported PRPs are increasingly exposed to the late notice defense. Nonetheless, it appears undisputable that there are still PRPs who have not yet begun the claims process. This is based on a comparison of the EPA list of PRPs and the Fortune 1000

list to known claimants. It is not yet clear to what extent the non-reporting varies by size of insured. However, the most intuitively comfortable argument is that the smaller PRPs are likely to be more under-reported as a group in the primary layer of coverage. Even if this is not true, it is could be argued that the late notice defense will, on average, be more successful against larger PRPs who "should have known" their policy obligations.

Even among reported PRPs, there is obvious under-reporting of known sites. Some of this may be based on the PRPs' analyses of likely remediation costs, with PRPs simply omitting low cost sites from their claims in order to save on paperwork. Additional "under-reporting" may actually be "under-recording" due to the understandable distaste of claims departments for recording each individual site, especially if a single insured reports hundreds of sites.

Whatever the cause, our analysis indicates a substantial potential for growth due to known but unreported sites, even at the primary level. There are conflicting arguments regarding the likely average severity of these sites. On the one hand, the fact that they are unreported by a reporting PRP would indicate that such sites should involve only low costs, since a potentially high-cost site would have been more thoroughly reported. On the other hand, it is clear that the unreported sites tend to be non-Superfund sites, and there is some evidence (albeit somewhat sketchy) that such sites may tend to be owned sites subject to voluntary cleanups. Owned sites can be dangerous to high layer covers, since the lack of spreading among PRPs means that the sites can penetrate to higher layers.

Once the selection of a projection horizon has been made, the issue of the number of undiscovered Superfund sites becomes manageable. Unfortunately, the question of their

severity is less clear. One school of thought maintains that the average remediation cost (in current dollars) of sites to be added to the NPL list will be the same as those currently on the list; until recently, this was the position of the EPA. However, a consensus appears to be emerging that average per-site remediation costs will be lower for sites added to the NPL in the future for two reasons:

- As noted above, the cost distribution of known sites is highly skewed; deletion of the top 1% of the sites for which remediation cost estimates are available removes 31% of the costs and decreases the average per-site cost from $57 million to $40 million. There is a strong "gut feel" that it would be hard to overlook another site as expensive as these mega-sites. Put another way, the argument is "How many more Rocky Mountain Arsenals can there be?"[41]

- Even without any cost reduction effects from Superfund reform, the EPA is increasingly tolerant of innovative technologies, the use of which should decrease per-site costs over time.

It is frequently asserted that "undiscovered" NPL sites are actually only "unlisted," i.e., they are already known as state sites but are simply not yet on the NPL. For such sites, it is necessary only to estimate the additional costs not yet recognized. The increase arises from three causes: (1) under-estimation of the correct costs even as a non-NPL site, (2) poor remedy selection or inept implementation of a reasonable remedy[42]; and (3) the "load"

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[41] Referred to as "barrel scraping" by the CBO in their 1994 report (see **References**).

[42] The OTA (p. 11) asserts that many state sites are being remediated so poorly that substantial additional costs will be incurred in the future simply to correct current mistakes.

caused by listing on the NPL, which may as much as double the otherwise correctly estimated cost. Thus, some IBNR scenarios might assume that future NPL listings are already discovered and that all future listings are known but under-estimated.

The costs associated with undiscovered non-NPL sites are more problematic. Any analysis must consider the question of whether the inventory of non-NPL sites that will be remediated will grow in proportion to the growth in the NPL or at a faster or slower rate. For example, if the entire growth in the NPL is at the expense of the non-NPL inventory, then the non-NPL growth rate might be less than that of the NPL. On the other hand, if we accept the argument that the biggest sites have already been discovered, then it may be possible to infer that the smallest (i.e., non-NPL) site counts will grow faster than the other categories. Once an assumption (or range of assumptions) about the number of future non-NPL sites is selected, the projected costs per site must be selected so as to be compatible with the count assumptions.

If the University of Tennessee study is used in analyzing the non-NPL problem (both unreported and undiscovered), care should be taken to reflect the fact that most but not all RCRA sites have been subject to closure and post-closure financial responsibility requirements, and so additional resources may be available at these sites. Because the operating years of RCRA sites tend to be more recent than CERCLA sites, the effect of the absolute pollution exclusion will also be greater.

Reinsurance Issues

"Stick it to the next generation!"[43]

Although both outwards and inwards reinsurance pose interesting analytical problems, the outwards (ceded) side has fewer uncertainties because there are fewer data problems. On the ceded side, the basic problem tends to be one of detail: Because reinsurance programs can be very complicated, it is usually necessary to make some level of simplifying assumptions. Given the magnitude of the other uncertainties, this does not usually cause much discussion.

Having simplified the reinsurance protections into an understandable form, it is still necessary to consider the questions of aggregation/trigger/definition of occurrence and the treatment of coverage dispute costs (particularly when there is no indemnity). We note that it has been argued there was wording in some reinsurance treaties that might facilitate aggregation.

1993 SEC disclosures show an average net-to-gross ratio of approximately 0.60 (pollution and asbestos combined). Future movement in this ratio is subject to competing forces: As the larger, more complicated claims are finally settled and allocated to reinsurers, it will act to decrease the ratio. On the other hand, a move to settle with some of the smaller PRPs that are currently inactive might tend to increase the ratio, since these smaller costs would be more likely to be held net. If reinsurance treaties are fully penetrated but allow only limited reinstatements, this would first decrease and then increase the ratio.

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[43] Lucy in "Peanuts"

In analyzing a book of inwards (assumed) reinsurance, the same simplifying assumptions are likely to be necessary and the effect of different theories of aggregation becomes even more important. However, there are three even more basic problems caused by the data:

- (excess of loss covers) Even within a single book of assumed reinsurance, differences in reporting practices are obvious, with some cedents apparently reporting all or nearly all of their claims to essentially all of their reinsurers, while others are currently reporting very few claims and then only to their lower layer protections. Some ceding companies report only "various insureds, various sites."

  In analyzing a book of assumed reinsurance, the actuary should ask the claims personnel if the company has reporting agreements in place with any of its cedents. These agreements specify when and what should be reported. In exchange for more complete information on the claims that are reported, the reinsurer agrees not to assert a late notice defense against the rogue claims that penetrate into its cover without having been reported earlier. The generic version of the reporting agreement/form may be referred to as "the Preston form,"[44] but this is frequently customized by specific agreements between ceding and assuming companies. A copy of the generic agreement is included as **Appendix H**.

[44] After Preston Gates Ellis & Rouvelas Meeds, the law firm that, together with Guy Carpenter, midwifed the generic agreement.

Of course, for actuarial purposes, complete precautionary reporting of all insureds and sites (or at least all insureds) would be much more desirable, but, where it has been attempted, the flow of paper becomes unmanageable, particularly in the retrocessional layers.

- (quota share covers) For quota share covers, the problem is even more basic: pollution losses are frequently not broken out from the "normal" losses at all, much less by claim. No consensus has emerged regarding the estimation of potential pollution losses within these books.

- (all reinsurance/retrocessions; also some direct excess) As was mentioned earlier, the model results can be quite sensitive to the attachment point used. This is a problem, since many attachment points are stated as "excess of underlying" or "excess of primary." The missing layer near the ground can be large and highly variable, reacting to both the insurer's usual practice, the year/decade of the policy, and the size of the insured.

  The missing information affects the signed line/width of layer in addition to the attachment point. Where either average or specific underlyings are available, adjustments to all of the parameters are possible.[45] At the very least, some assumed underlyings should be simulated; discussions with the claims department will usually lead to a mutually agreeable distribution.

[45] See Cross and Doucette, p.32.

Reinsurance analyses also raise the issue of "underlap," i.e., the possibility that the direct coverage limit is less than the top of the reinsurer's layer so that an indemnity loss could never fully exhaust the reinsurer's coverage. In some cases, the direct limit may be so low that the reinsurer's coverage cannot be penetrated by indemnity costs at all. Limited datasets that included primary coverage information indicate that underlap may be significant.

There are also issues of coverage, since the reinsurance wording may differ from that of the direct policy.

We note that any analysis using the aggregate loss development or MCP procedures needs to take into account that reporting to reinsurers is relatively slow for this type of loss. In particular, a significantly higher multiple of current payments is necessary in order to reflect the same survival time, since reinsurance payments will increase faster than those of their ceding companies.

References

***"All hope abandon, ye who enter here."*[46]**

There is a great deal of public material available on Superfund and the U.S. remediation problem. Unfortunately, very little of it directly addresses the question of potential insurance liabilities. Additional problems are caused by the fact that different studies are intended for different uses; as a result, studies that appear to address the same question (e.g., the total remediation cost at current Superfund sites) may produce very different results. For example,

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[46] Dante Alighieri, The Divine Comedy, Hell (Canto 3, line 9) (inscription at the gates of Hell)

users looking for cost information in the following references should be wary of the following differences:

- Are the costs total, only future, or only past?
- Are the costs total, only EPA, only EPA non-recovered? Do they include PRP transaction costs? PRP "shadow" costs?
- Are the costs in nominal dollars, current dollars, or discounted dollars? If discounted, what were the discount rate and time horizon?
- Are the costs total, for non-federal sites only, federal sites only, orphan sites only, non-municipal sites only?
- Are the costs for only the current Superfund or for the projected "ultimate" NPL? (How many sites are assumed to be on the "ultimate" list?)
- Do the estimates assume level, decreasing, or increasing per-site costs?

In short, although we have found the following references useful and recommend them for those seeking to learn more, we suggest that they be used carefully. In addition to the usual citations, we have included information on ordering the material, where available; for some of the older material, this information may have changed.

The following list is meant only as an introduction; it does not encompass every article that might possibly be of interest. For example, we have included only one general reference on legal issues and none devoted solely to engineering, environmental audits, or remediation technology. Because of the current legislative attention to Superfund, additional material is being published frequently.

1. Hazardous Waste Remediation: The Task Ahead (with six related volumes), by Milton Russell et al., University of Tennessee, 1992.
   order from: The University of Tennessee
   Waste Management Research and Education Institute
   327 South Stadium Hall
   Knoxville, TN 37996-0710
   615/974-4251
   cost: $56.00 (for all seven volumes)

2. Congressional Budget Office, various studies including:
   The Total Costs of Cleaning Up Nonfederal Superfund Sites (January, 1994)
   Analyzing the Duration of Cleanup at Sites on Superfund's National Priorities List (March 1994)
   order from: Congressional Budget Office Publications Office
   Second & D Streets, S.W.
   Washington, D.C. 20515
   202/226-2809
   cost: inquire

3. U.S. General Accounting Office, various studies, including:
   Superfund: Cleanups Nearing Completion Indicate Future Challenges (GAO/RCED-93-188)
   Superfund: EPA Cost Estimates Are Not Reliable or Timely (GAO/AFMD-92-40)
   Hazardous Waste: Pollution Claims Experience of Property/Casualty Insurers (GAO/RCED-91-59)
   order from: U.S. General Accounting Office
   P.O. Box 6015
   Gaithersburg, MD 20877
   202/275-6241
   cost: first copy of each report free; additional copies $2 each

4. RAND--The Institute for Civil Justice:
   Private-Sector Cleanup Expenditures and Transaction Costs at 18 Superfund Sites, by Lloyd S. Dixon, Deborah S. Drezner, and James K. Hammitt, 1993.
   Superfund and Transaction Costs: The Experience of Insurers and Very Large Industrial Firms, by Jan Paul Acton and Lloyd S. Dixon, 1992.
   Understanding Superfund: A Progress Report, by Jan Paul Acton, 1989.
   order from: RAND
   P.O. Box 2138
   Santa Monica, CA 90407-2138
   310/451-7002
   cost: inquire

5. U.S. EPA responses to July 19, 1993, request for information from Representatives Dingell and Swift, annotated as OSWER Directive 9200.2-21, dated January 28, 1994, and signed by Elliot P. Laws, Assistant Administrator

6. Superfund Handbook: A Guide to Managing Responses to Toxic Releases Under Superfund, by Gene Lucero et al., Sidley & Austin Law Offices and ENSR Corporation, 1989.
   order from: ENSR Corporation
   Marketing Department
   33 Nagog Park
   Acton, MA 60603
   508/635-9500
   cost: $45.00

7. Cleaning Up Hazardous Waste: Is There a Better Way?, by Orin Kramer and Prof. Richard Briffault, I.I.I. Press, 1993
   order from: Insurance Information Institute
   110 William Street
   New York, NY 10038
   212/669-9200
   cost: first copy to a company free

8. Coming Clean: Superfund Problems Can Be Solved ..., by the Office of Technology Assessment, 1989.
   order from: Superintendent of Documents
   Government Printing Office
   Washington, D.C. 20402-9325
   202/783-3238
   cite GPO stock #: 052-003-01166-2
   cost: call to verify; was $10.00

9. A Review of Environmental Coverage Case Law, by V. Jeffrey Purcell et al. (editors), American Re-Insurance Company, 1994.
   order from: American Re-Insurance Company
   American Re Plaza
   555 College Road East
   P.O. Box 5241
   Princeton, NJ 08543
   609/243-4200
   cost: call to verify; was free

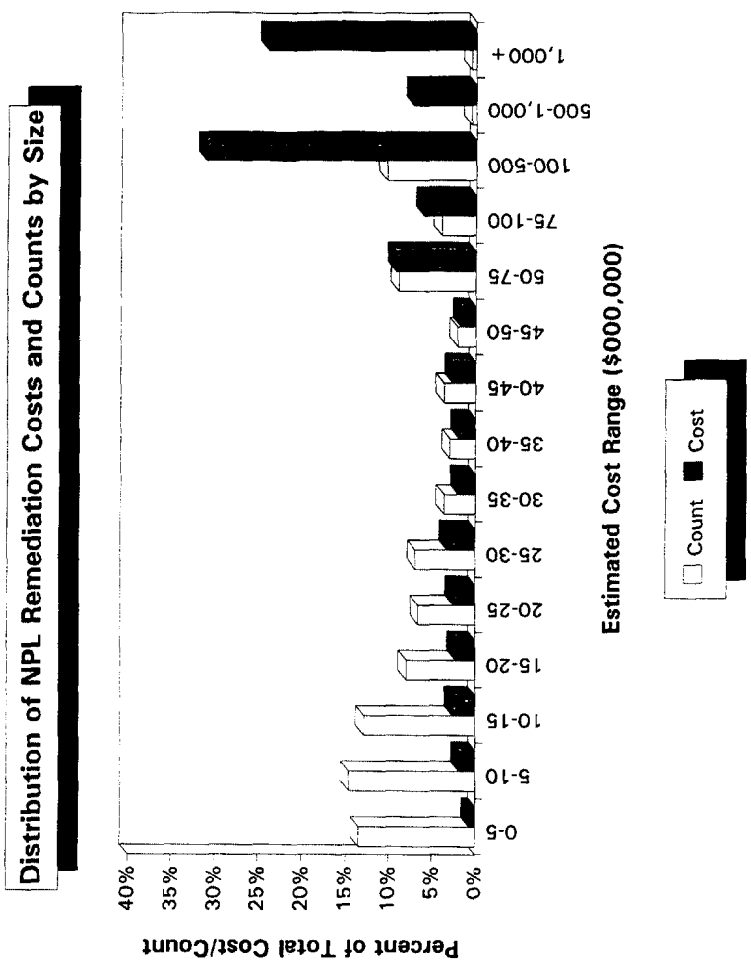
10. "U.S. Insurers' Potential Liabilities for Inactive Hazardous Waste Sites: Scenarios and Discussion" (testimony before the House Subcommittee on Policy Research and Insurance) by Amy S. Bouska, September 27, 1990.
   order from: Amy S. Bouska
   Tillinghast/Towers Perrin
   8300 Norman Center Dr., #600
   Minneapolis, MN 55437-1097
   612/897-3430
   cost: free

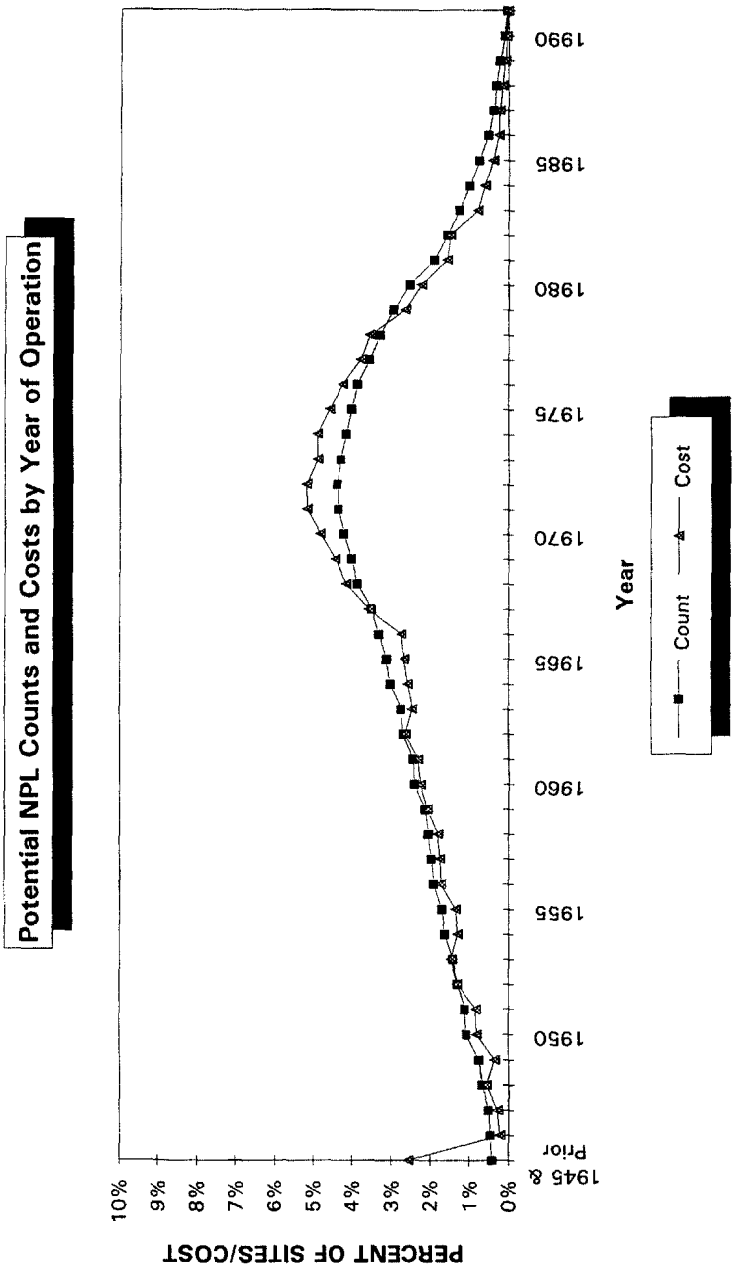
11. "Environmental/Asbestos Liability Exposures: A P/C Industry Black Hole" in BestWeek Property/Casualty Supplement, March 28, 1994.

12. "Defending a Natural Resources Damages Claim" by Roscoe Trimmier, Jr., in Environmental Claims Journal, Vol. 4, No. 2, Winter 1991/92, pp. 163-174.

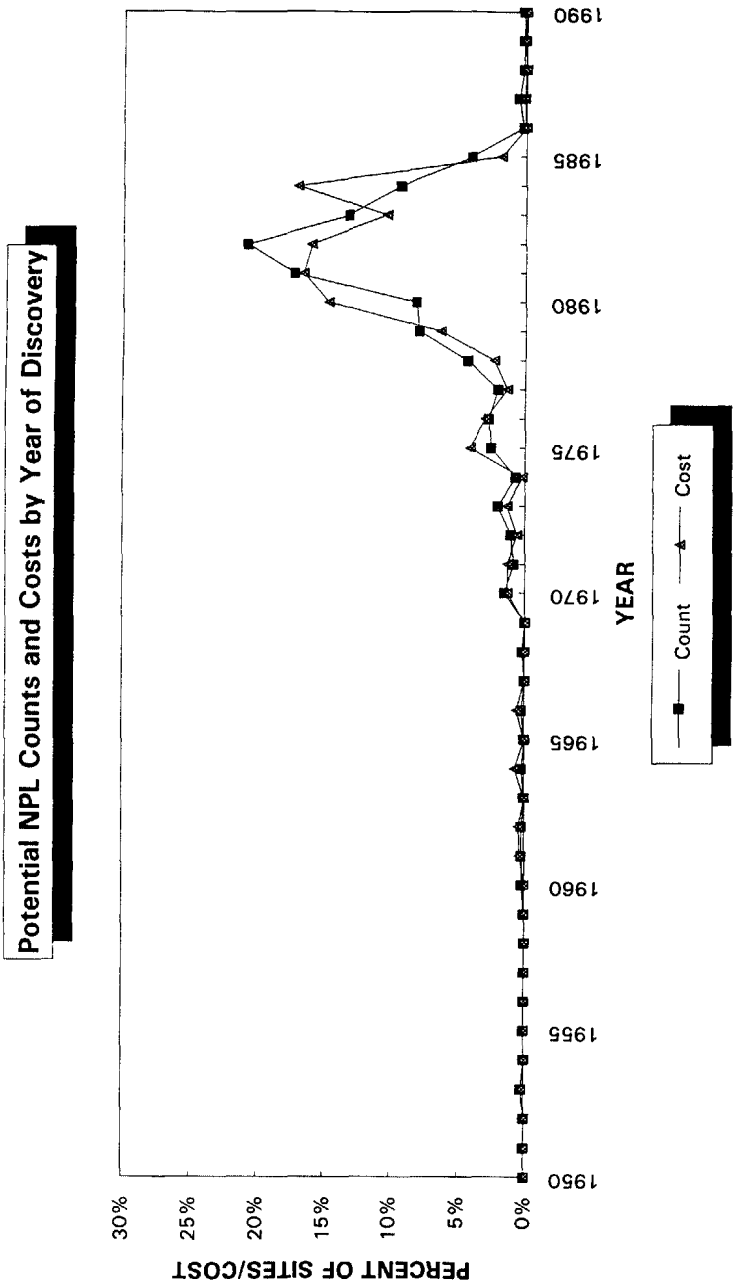
13. "Double Jeopardy" by Karen M. Tiemens, in Resources, January 1993, pp.3-5. (about natural resource damages)

Appendix A


Distribution of NPL Remediation Costs and Counts by Size
Percent of Total Cost/Count
40%
35%
30%
25%
20%
15%
10%
5%
0%
0-5
5-10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-75
75-100
100-500
500-1,000
1,000+
Estimated Cost Range ($000,000)
Count
Cost


Potential NPL Counts and Costs by Year of Operation
PERCENT OF SITES/COST
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
1945 &
Prior
1950
1955
1960
1965
1970
1975
1980
1985
1990
Year
Count
Cost

Appendix C


Potential NPL Counts and Costs by Year of Discovery
PERCENT OF SITES/COST
30%
25%
20%
15%
10%
5%
0%
1950
1955
1960
1965
1970
1975
1980
1985
1990
YEAR
Count
Cost

Example Aggregate Loss Development Payment Pattern Appendix D

Emergence of Sites by Discovery Year

Discovery Year	1990	1991	1992	Total
Number of Discovered Sites	10.0	25.0	15.0	50.0
Cost Relativity	1.10	1.00	0.90	
Estimated Relative Cost	11.0	25.0	13.5	49.5

Cost Distributions by Discovery Year

Discovery Year	1990	1991	1992
Cleanup Costs	50%	60%	60%
Defense Costs	50%	40%	40%
Total	100%	100%	100%

Percent of Estimated Relative Costs Paid by Discovery Year and Cost Component

Years since	Discovery Year: 1990			Discovery Years: 1991 & 1992		
Discovery	Cleanup	Defense	Average	Cleanup	Defense	Average
0	33%	50%	42%	50%	75%	60%
1	33%	40%	37%	30%	15%	24%
2	33%	10%	22%	20%	10%	16%

Note: Averages are weighted with the cost distributions by discovery year.

Calculation of Calendar Year Payment Pattern

Calendar	Estimated Relative Cost by Discovery Year			Estimated Relative	Percent Paid in	Cumulative Percent
Year	1990	1991	1992	Cost Paid	the Year	Paid
1990	4.6			4.6	9.3%	9.3%
1991	4.0	15.0		19.0	38.5%	47.7%
1992	2.4	6.0	8.1	16.5	33.3%	81.0%
1993		4.0	3.2	7.2	14.6%	95.6%
1994			2.2	2.2	4.4%	100.0%
Total	11.0	25.0	13.5	49.5		

Database Structure

Independent of the details of how claims are recorded, the claims database will be in one of two formats: flat or relational. Although we have come to prefer relational databases, there are advantages to each format relative to the four most important criteria:

- Simplicity
- Physical limitations of PCs and software
- Data quality
- Expandability

Flat files are two-dimensional matrices of data where each record (row) corresponds to a claim and each field (column) corresponds to a particular element of data (claim number, date of loss, insured name, ...).

Simplicity is the primary advantage of a flat database. They are easily understood and working with them requires little or no knowledge of database programming or software. In fact, their two-dimensional structure lends itself to use in spreadsheets assuming that the data is sufficiently small.

Unfortunately when using a flat file format, the physical limitations of PCs are a concern for all but the smallest pollution databases. Therefore, flat files have limited value beyond initially capturing data. Problems with random access memory (RAM), disk space,

and processing time quickly arise due to the fact that flat files store too much data in each record and too many records to relate coverage to claims. For example, coverage information on a specific policy would appear in all claim records relating to that policy (see **Appendix F**), resulting in too much data per record. Also, extraneous claim records are included for individual claims that relate to more than one policy. (A detailed example of both effects is discussed below.) Physical limitations generally preclude any significant expansion of the scope of the sample flat file structure shown in **Appendix F.**

Our experience is that inconsistencies tend to occur more often and are more difficult to detect in flat files. Although this is somewhat anti-intuitive (since relational databases are more complex), it is easily explained by an example: If an insured is claiming five sites against a single policy, a flat file will have five records with the same policy information. Because the policy data has to be entered five times, small discrepancies are common. While this may be of little importance to the claims staff (who have the policy nearby), resolution of the differences is cumulatively time-consuming when each record has to be correct in order for the model to use it.

Relational databases consist of two or more two-dimensional matrices (called tables) of information that are related by one or more fields. The primary reason for using relational databases is to overcome the physical limitations of flat files. However, there are costs and secondary benefits associated with relational files that should be recognized.

The complex format (relative to flat files) of the data is the most significant "cost" of a relational database, which can be maintained and manipulated only with the help of a relational database management system such as dBase, SQL, Access, Paradox, or a custom-designed system. We note, however, that these systems can be hidden behind more user-friendly "shells" that make data entry and retrieval easy.

The main advantage of relational data is efficiency that helps to overcome physical barriers with respect to storage space and, more importantly, memory and processing speed. To illustrate the efficiency of relational databases, consider a single PRP having coverage from 5 policies on 10 waste sites. A flat file containing 50 records (5 policies x 10 sites) and 3 fields (policy, PRP, site) is required to store the data. The file contains 150 cells of data (50 records x 3 fields) most of which are extraneous. A relational format using the PRP in both a site table (10 records x 2 fields) and a policy table (5 records x 2 fields) requires only 30 cells of data, an 80% reduction in the volume of data. Hence, relational formats are much more efficient in storing data. The improved efficiency translates into faster processing time that allows us to work on larger bodies of data and/or to compare claim data to external databases.

As discussed above, improved data quality is an important secondary benefit of relational files.

Finally, the efficiency of the relational database format allows us to consider expanding the scope of the database beyond the limitations of flat files. This can be accomplished by

either adding fields to existing tables or by adding entire tables to capture additional information. One possible expansion of the data that we propose below is a relational table containing loss transactions.

Database Content

Our discussion of pollution data fields considers a range of detail, from a minimal configuration through an extensive database including fields useful for researching the processes underlying pollution liabilities. We will also consider some current accounting practices that affect the data.

The most basic pollution claims database contains only coverage information (see Appendices E and F, fields marked with *) and assumes that all site involvement data will be supplied externally. While this configuration is easily maintained, we believe that it sacrifices a considerable amount of valuable data. As discussed in the section on *IBNR*, many insureds are involved at NPL sites where they are not a public PRP; in addition, claims records are the best source of non-NPL information.

The insured PRP name is the single most important field and consistent spelling is critical unless an insured ID number is added. The exact spelling is important, since, without the addition of some sort of fuzzy matching routine, most programs will not recognize that "Grace, WR" is the same as "The Grace Company".

Accurate coverage information is also critical to the analysis of pollution liabilities. All coverage information should be stated relative to the first dollar of loss to the PRP (i.e., "above the ground" or "ground up") including any self-insured retentions or deductibles. The ground up attachment point is particularly important to pollution liability analysis. The required coverage information includes effective date, the ground up attachment point, the width of the layer, and the percentage of the layer written. Additional useful coverage fields (marked with # in Appendices E and F) include expiration date, exclusion information, CSL vs. split limits, and expense treatment.

Unlike most claim files, the basic pollution database does not include amounts paid or outstanding. The reason for this is that losses are not relevant to the model analysis of potential ultimate losses, since the intent of the model simulation is to test the reported losses. The loss data required for the aggregate loss development and MCP approaches is usually available from the standard claims system, as are the amounts paid and outstanding by insured (for purposes of determining if certain insureds should be excluded from the analysis).

A mid-level pollution claims database captures site involvement information in addition to the basic or expanded coverage data. It is at this point that a claims system is likely to be converted to a relational database format, since addition of the site information generally causes a significant growth in the record count. The usual structure is illustrated in **Appendix G**; the insured name is associated with policy numbers and site IDs numbers, and these are the links to the coverage and claim (site) tables.

The addition of site data introduces even greater potential for spelling problems, since site names may have several aliases.[47] It is our experience that use of the EPA FINDS number solves most site identification problems. For sites where a FINDS number is not available, it is sufficient to assign a unique number to each different site (or site/PRP combination).

The optional (#) site fields contain data that can be directly extracted or simulated from external sources if necessary but which are useful if available specifically for that site/PRP combination. The specific information is always more desirable than simulated values, but cost/benefit decisions are required due to the data entry effort required. A compromise course is to enter the detailed site information only for PRPs/sites perceived to be potentially costly to the insurer.

An expanded pollution claims database adds claim transaction information or other data useful for conducting research on the claims or the underlying pollution loss process. For example, examination of the cash flows for a given site, type of claim, or groups of sites with certain characteristics (i.e., number of PRPs, cost,...) could develop useful basic information. The sample pollution database in **Appendix G** includes a claim transaction table layout that could be used to capture the data required for this analysis.

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[47] For example, Hardage/Criner = Hardage = Royal = Royal Hardage = Criner = McClain = McClain County = FINDS OKD000400093

Introduction of dollar amounts into the database creates questions of allocation, both of indemnity and expenses (which may be allocated differently). All of the analysis methods described herein are insensitive to the allocation of dollar amounts, both among years and policies and between loss and expense. As a result, the allocations generally reflect a company's position on the coverage trigger and its level of reinsurance notification activity. We can, however, envision future methods of analysis that might develop as more data becomes available and that might be more sensitive to the exact allocation protocol used.

Sample Flat Database

	Field Name	
*	1.	Insured name
	2.	Insured ID number
*	3.	Claim number
*	4.	Policy number
*	5.	Policy effective date
#	6.	Policy expiration date
*	7.	Policy attachment point **ABOVE THE GROUND** *The terms "Above the Ground" or "Ground Up" indicate that losses should be stated from the first dollar of loss incurred by the insured including any self-insured retention or deductible.*
*	8.	Percent of layer **
*	9.	Width of layer** *** width x percent = maximum loss (excluding expenses)*
#	10.	Aggregate Limit
#	11.	Expense treatment *e.g., Expenses within limits, pro rata in addition to limits, indemnity only,...*
#	12.	Pollution exclusion indicator
#	13.	Limit type (CSL/split)
*	14.	Site name
	15.	Site ID number *US EPA FINDS numbers (alphanumeric) are ideal for NPL sites.*
	16.	Site city
#	17.	Site state
	18.	Site ZIP
#	19.	Site operation date (beginning)
#	20.	Site operation date (ending)
#	21.	Site discovery date
	22.	Report date (to insurer)
#	23.	Type of loss *e.g., Cleanup, third party BI, third party PD, natural resource damages,...*
	24.	Claimant *e.g., US EPA, Jane Doe, ...*
#	25.	Declaratory judgment action indicator
	26.	Loss Paid
	27.	Expense Paid
	28.	Loss Reserve
	29.	Expense Reserve

** Indicates fields required for the minimum configuration.*
 # Indicates fields of some importance that could be incorporated directly into the analysis but can be simulated or based on overall assumptions.

Sample Relational Database

PRP Table

For each INSURED:

*	1.	Insured name
	2.	Insured identification number
*	3.	Claim number
*	4.	Policy number

Coverage Table

For each POLICY NUMBER referenced above:

*	1.	Policy number
*	2.	Policy effective date
#	3.	Policy expiration date
*	4.	Policy attachment point **ABOVE THE GROUND** *The terms "Above the Ground" or "Ground Up" indicate that losses should be stated from the first dollar of loss incurred by the insured including any self-insured retention or deductible.*
*	5.	Percent of layer **
*	6.	Width of layer** *** width x percent = maximum loss (excluding expenses)*
#	7.	Aggregate limit
#	8.	Expense treatment
#	9.	Pollution exclusion indicator
#	10.	Limit type (CSL/split)

Claim Table

For each CLAIM NUMBER:

*	1.	Claim number
*	2.	PRP number
*	3.	Site identification number
#	4.	Type of loss (e.g., clean up, 3rd party BI or PD, natural resource damages ...)
	5.	Claimant name (e.g., US EPA, Jane Doe,...)
#	6.	Declaratory judgment action indicator
	7.	Report date to insurer
	8.	Closed date
#	9.	Closed status (open, settled, defense verdict, plaintiff verdict,...)

** Indicates fields required for the minimum configuration.*
 # Indicates fields of some importance that could be incorporated directly into the analysis but can be simulated or based on overall assumptions.

Site Table

For each SITE NUMBER:

* 1. *Site name*
* 2. Site identification number (US EPA FINDS number if available)
3. Site city
\# 4. Site state
5. Site ZIP code
6. NPL (Y/N)
\# 7. Site operation date - beginning operations
\# 8. Site operation date - ending operations
\# 9. Site discovery date
10. Total estimated cleanup costs
11. Total estimated third-party costs

Claim Transaction Table

For each CLAIM NUMBER referenced above:

1. Claim number
2. Site identification number
3. Report date (to insurer)
4. Transaction date
5. Current indemnity payment
6. Current expense payment
7. Change in indemnity reserves
8. Change in expense reserves

STATEMENT OF UNDERSTANDING
REINSURANCE CLAIM REPORTING CRITERIA

The purpose of these guidelines is to provide generally agreed upon objective criteria for the initial reporting of pollution reinsurance claims. These guidelines may be amended or modified by individual cedents and reinsurers, but general adherence to these guidelines will permit efficient reporting and reduce the amount of paper and cost presently encountered.

These guidelines are not intended to, and do not, modify the legal relationship between cedents and reinsurers. The legal effect of use of these guidelines will be the subject of negotiation between individual cedents and reinsurers. This is being done as a mutual accommodation with the intent that it will result in agreement by the reinsurers not to assert late notice if the criteria are agreed to and adhered to by the cedent. Cedents will make good faith efforts to report on the Preston Form or on a report containing similar qualitative information, with supplemental information to be reported on an ongoing basis as warranted.

These guidelines are intended to identify those pollution claims which may have reinsurance exposure, and to provide early information to reinsurers so that they may evaluate those claims. Since the underlying claims are subject to coverage disputes, the criteria are keyed largely to the potential financial exposure of the policyholder, rather than the exposure to the cedent after resolution of coverage issues.

These guidelines do require cedents to notify reinsurers, as soon as practical, of those claims that meet the criteria. It is not expected that cedents will undertake investigation or evaluation of claims solely to determine whether they are subject to the criteria, and cedents shall be under no obligation to do so. The information utilized shall be that which is obtained by cedents in its normal course of business of investigating and managing pollution claims. Likewise, cedents shall be under no obligation to ascertain proportional share responsibilities of a policyholder, since determination of such shares are normally the subject of lengthy negotiations and/or litigation in the underlying claim, and require analysis of many factors, including toxicity, orphan shares and EPA enforcement strategy. When information identifying proportionate share is identified by the cedent, however, cedents shall have an obligation, as soon as practical, to provide reinsurance notice if the objective criteria are met.

A list identifying the non-NPL sites referenced in II(a) and (b) of the criteria will be compiled and distributed annually by a governmental or industry source.

As noted, these reporting criteria guidelines, except as agreed to by individual cedents and reinsurers, shall not modify the legal rights of the parties. Use of these reporting criteria will not waive contractual rights or defenses, and will not be deemed to be an interpretation of contract language or a course of performance
under any contract.

The adoption of these criteria does not nullify the effect of any and all previously given notices to reinsurers.

DISCLAIMER:

Neither this report nor application of the "Reinsurance Claim Reporting Criteria" shall constitute the adoption of any position on any issue of coverage, including but not limited to the existence, date, number of claims or occurrences in a potential reinsurance claim.

In addition, this report and the use of this criteria shall not constitute an admission that the underlying claim involves one or more covered claims or occurrences under any policy of insurance. Furthermore, this report and the use of this criteria does not constitute any position or admission on the part of the policyholder.

This report contains information taken from EPA reports and other site and/or claimant documents. The information contained in such documents cannot, in every instance, be verified for accuracy. All information disclosed is for confidential use by the cedent's reinsurers.

CLAIM REPORTING CRITERIA:

I. All pollution-related DJ actions where paid DJ expenses is in excess of $_____ on a policyholder basis; or

II. Any pollution-related claim where the policyholder is:

   a. An alleged present or past owner or operator of an NPL site or any of the ten (10) most serious non-NPL sites in each of those states which promulgate and maintain a separate list of sites ranked in order of severity; or

   b. Alleged to be responsible for _____% or greater share of response costs at an NPL site or any non-NPL site described in a. above. Share may be determined by volume or some other basis as developed in the underlying case; or

   c. Alleged to have an exposure of greater then $_____. Exposure = alleged response cost x volumetric share, or some other cost-sharing criteria (based on something other than volumetric basis) as developed in the underlying case; or

   d. Named in third party private action(s) involving a certified class action or suits involving _____ or more named claimants/plaintiffs; or

III. Any pollution-related claim(s) where the cedent has paid indemnity and expenses, including DJ expense, in excess of $_____ on a policyholder basis, regardless of allocation methodology.

ENVIRONMENTAL CLAIMS REPORTING FORM

☐ FIRST REPORT DATE: _____
☐ UPDATE LAST REPORT DATE: _____

This form is solely for the purpose of assisting cedants to report environmental claims. Usage of this form is entirely voluntary, and no views are expressed or implied as to the applicability of insurance or reinsurance coverage to particular claims.

The use, non-use, or partial use of this form by any cedant or reinsurer shall not constitute an admission as to the time at which notice must be given, the appropriate form of such notice, or the items of information required to be included in such notice. Rather, all issues and disputes regarding notice must be determined solely by reference to the pertinent reinsurance contract and/or applicable law.

Complete all three pages of the form if this is a first report. If this is an update, identify the contract, insured, and site, and use rest of the form to report any change in the information previously provided.

I. CLAIMS SUMMARY

REINSURED: _____

Reinsurance Contract: _____ Broker and Ref. No. _____

R/I Years To Which Claims Reported	R/I Limits	Retention

INSURED and/or Subsidiary Involved: _____

INSURANCE COVERAGE PROFILE:

Policy No.	Policy Period	Policy Type	Policy Layer	Policy & Underlying Limits (BI, PD, CSL)	Defense Costs	Other Inuring R/I?

Policy Type				Layer	Limits	Defense Costs
GL = General Liability	C = Gen Liability (Claims-Made)			P = Primary	BI = Bodily Injury	AD = In Addition
EIL = Environ Impair Liability	DIC = Difference in Conditions			U = Umbrella	PD = Property Damage	IN = Inclusive
P-A = Property-All Risk	H = Homeowners			E = Excess	CSL = Combined Single Limit	PR = Pro Rata
P-A/M = Prop-All Risk/Manuscript	OM = Ocean Marine (Hull/P&I)					EX = Excluded
P-N = Property-Named Peril	SMP = Special Multi-Peril					

Underlying Carriers (if known): _____

SITE: _____ Superfund: YES ☐ NO ☐

Location: _____ EPA ID No. _____

CLAIMS INCLUDED IN THIS REPORT: *(You may include all claims against one insured at one site.)*

Claim No.	Claimant	Policy No.	D/L

CURRENT RESERVE: Indemnity: _____ Expense: _____

II. CLAIMS DETAIL

Please provide the information requested in Parts A and B. If the information requested is not yet available, enter "NYA". If the information requested is not applicable, enter "NA". If the information requested is privileged, so indicate.

PART A: SITE ANALYSIS

SITE/LOCATION: _____ EPA ID No.: _____

Number of Defendants/PRPs at Site:

Years When Site in Active Use:

Alleged Date(s) Contamination Discovered:
(a) By gov't agency:
(b) By private third-party:
(c) By insured:

Alleged Cause (s) of Release: (check one or more)
- ☐ Factory emissions into air or water
- ☐ Spillage/Dumping/Leaching
- ☐ Leakage from tank, drum, barrel or other container
- ☐ Force of nature (flood, wind, fire, explosion, etc.)
- ☐ Other (specify):

Nature Of Claims:	TOTAL ESTIMATED COSTS	PAID TO DATE
Emergency (Short-Term) Removal Costs	$	$
Long-Term Remedial Action Costs	$	$
Natural Resources Damages	$	$
Third-Party BI Claims	$	$
Third-Party PD Claims	$	$

Clean-Up Claims Detail:

1. Remedial Investigation/Feasibility Study: ☐ In Progress ☐ Completed (Cost: $ _____) ☐ Not Applicable
2. Describe contamination alleged:

(A) ON-SITE

(B) OFF-SITE

Private Third-Party Claims Detail:

1. Number of Plaintiffs and Alleged Date (s) of Exposure:

2. Type of Injury/Damage Alleged:

Any Other Pertinent Site Information: *(attach separate sheet)*

Date: _____ ,19____

PART B: STATUS OF THE INSURED

INSURED: _____ SITE: _____

☐ GENERATOR ☐ Owned Site ☐ Non-Owned Site

Type of Business:

Date (s) When Site Allegedly Received Insured's Waste:

☐ TRANSPORTER Date (s) of Transport Alleged:

☐ SITE OWNER/OPERATOR Dates of Ownership/Operation Alleged:

Hazardous Substances Allegedly Contributed By Insured:

Insured's Share of Total Waste (by volume):

Status Of Clean-Up Claims Against Insured	Status Of Third-Party Claims Against Insured
1. Court:	1. Court:
2. Portion, if any, of amounts in Part A that are claimed solely against insured:	2. Portion, if any, of amounts in Part A that are claimed solely against insured:
3. Status of negotiation/litigation:	3. Status of negotiation/litigation:

Handling of Claims:

1. Date when insured gave notice:
2. Identify carriers participating in defense of insured:

Your defense costs: Paid $ _____ Outstanding $ _____

3. D.J. action brought: YES ☐ NO ☐ By whom: _____ Court: _____

Your D.J. costs: Paid $ _____ Outstanding $ _____

4. Coverage defenses asserted/reserved: *(You may attach a copy of written reservation of rights or disclaimer)*

☐ Late Notice	☐ Owned Property Exclusion
☐ Trigger of Coverage	☐ Pollution Exclusion
☐ Exhaustion of Limits	☐ Misrepresentation
☐ Application of Deductibles	☐ Number of Occurrences
☐ Clean-Up Costs Not Covered	☐ Other (specify):

5. Status of negotiation/litigation:

Date: _____, 19____