CONTAMINATED SITES- EVALUATION ISSUES

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INTRODUCTION

In the past five years in particular, owners of commercial properties have been faced with the issue of evaluating whether chemical contamination from transport, storage, use and/or disposal may have occurred on their properties. Assessment of properties is a relatively new experience to scientists, engineers and regulatory agencies. This paper is intended to provide a cursory review of the assessment process and to inform the wood preservation industry of the many issues which must be considered if and when the facilities are faced with the need for site assessments. Several wood preservation sites in Canada have already faced the need for assessments.

WHEN DO SITE ASSESSMENTS OCCUR?

There are four major scenarios under which assessments of commercial properties will occur to evaluate whether chemical contamination of site soils or groundwater is present.

Regulatory requirement

Under current Canadian Federal or B.C. Government legislation there is no requirement for an owner to evaluate whether his/her commercial property contains chemical contamination, except in the case where there is any suspicion that releases with capabilities for human health and/or environmental effects may be occurring from the site. The owner of the site may then be ordered to undertake an evaluation of surface and subsurface contamination and an evaluation of migration of contaminants from the site. As an example, when dioxins in concentrations deemed harmful to human health were reported in one composite sample of crabs from Cowichan Bay in British Columbia, a sawmill which once used chlorophenates for wood protection, and a

shipping terminal which once stored treated dimension lumber were both ordered to undertake assessments of their properties. The purpose was to evaluate whether dioxins/furans (impurities in the chlorophenates) were still present at the sites. The orders were given under the auspices of the Federal Environmental Protection Act, and the negotiations were restricted to the design of the site study, despite the early findings that the dioxins in the Bay were more likely a result of other sources. There are other examples, particularly in the cases of spill or tank leakage situations, where the regulatory requirements have been well justified.

Commercial bank requirements

In the United States, the courts have ruled that "if a lender forecloses on a contaminated site, it should be treated like an owner". Banks throughout the world have become extremely sensitive to lending money to companies that have (or even had) the potential to pollute. As an example, in 1980 the Bank of Montana-Butte lent $275,000 to a wood preservation company which used PCP. In 1984 the company failed, leaving behind a heavily contaminated site. The regulators not only pursued the remaining assets of the company, but also the previous owners and the Bank. The projected cost of cleanup is estimated to be $10,000,000 to $15,000,000 [1].

Now no Canadian bank will give a mortgage on a commercial property, regardless of the property's size, unless they have some assurance that the property is "clean". Even for the renewal of a mortgage, a bank will now require new information about the property with regard to its environmental status.

It is our experience that property transactions are currently the main driving force for site assessments in Canada.

Municipality building permits

By precedence in recent litigation in British Columbia, municipalities are potentially liable to future claims if a building and occupancy permit is provided for a property where the integrity or safety of a structure is deemed to be affected. As a result, some B.C. municipalities require site evaluations prior to awarding building permits for new structures on commercial land.

Municipalities are particularly sensitive to rezoned properties, i.e. commercial land rezoned to enable residential use.

Industrial self-initiatives

Many companies have initiated assessments of their own properties which may have had potential for chemical contamination. Such initiatives enable companies to remediate problems at their own pace, and further provide a data base in order that enquiries from banks, for instance, can be readily responded to.

WHAT IS A SITE ASSESSMENT?

A site assessment consists of information gathering activities which will identify:

- the existence, source, nature and extent of contamination resulting from a release into the environment of a hazardous material or chemical substance; and
- the extent of danger to the public health, safety, welfare, and the environment.

There are three major phases in a site assessment. The phases are well detailed in Section 4 of the document, "National Guidelines for Decommissioning Industrial Sites" published by the Canadian Council of Ministers of the Environment[2]. This document, which should be available from Environment Canada and from provincial environmental agencies, is highly recommended as a reference document for any company about to undertake a site assessment. Along with a brief description of the three major investigation phases, I will discuss various issues relating to investigations of sites used by the wood preservation industry.

DISCUSSION OF ISSUES

Phase I: Site Information Assessment

Phase I consists of a review of all available information relating to the industrial site. A good information base optimizes the cost-effectiveness of the site investigation. As an example, if a regulatory agency requires a 90% probability of detecting a circular 10 m diameter "hot-spot" within a 25 hectare site, then a grid of approximately 2900 sampling points would be required.

On the other hand, if the original plant and current plant settings are documented with a well defined history of activities, then as few as 20 sampling points might be acceptable to a regulatory agency, providing that the major activities were confined to only a small portion of the site. If each point was a borehole with an average drilling cost of $600 per borehole, then the cost differences are obviously significant. Likewise the analyses must be well selected to focus only on the chemicals of potential concern. Analyses of soils may cost from $105 each for metals, to $1200 each for dioxins, and "un-informative" analyses must be minimized.

It is therefore in the best interests of the site manager to cooperate fully with the site study, in the provision of all possible information regarding the site's history. For example: Were there spills at the site? What chemicals were used at the site? Were there changes in the location of the chemical storage areas? What were the chemical waste disposal practices? A careful review of all company files should be undertaken by the site manager, particularly files which predate most of the workers currently at the facility. Generally, the most significant source of historical information comes from retired individuals who once worked at the facility. Withholding of data from the study team will eventually "back fire" on a company. A study plan may have to be revised mid-stream, and considerable delays may occur in attempts to investigate data which does not coincide with existing information. In addition, a potential buyer of a property and/or a bank may hire independent study teams to undertake additional investigations.

I strongly suggest that each facility manager should take the effort of compiling a history of his/her operation with the existing knowledge base, in the event that one day, a site investigation will be required.

Phase II: Reconnaissance Testing Program

To identify potential areas of contamination, the historical data is first reviewed. Investigations then proceed to identify the locations of contamination, the types of contaminants and range of contaminant concentrations. The process may include geophysical surveys, and almost always consists of drilling boreholes and installing piezometers to enable sampling and analyses of soils and groundwaters. As discussed earlier, boreholes generally focus on areas of potential concern. Costs would prohibit a 100% coverage of the site, hence no study group can provide a 100% guarantee of the site's status.

Following completion of the field work and chemical analysis, the study team should provide an assessment of the site status, by discussing groundwater hydrology, geology, types of contaminants on the site and pathways of contaminant movement. To evaluate whether soils are "contaminated", soil and groundwater criteria developed by the CCME and/or the Province are used. The conclusions of the Phase II study will obviously have significant implications to a company; from a best case of not finding contamination (or contamination less than regulatory criteria), to a worst case of finding significant contamination. In the case of the assessment of wood preservation sites, there are numerous related issues which a site manager should be aware of:

- If a consulting company is used for a site assessment, proper selection is necessary to assure that the group has multidisciplinary expertise (hydrogeology, soil science, chemistry and environmental engineering). At least two cost quotes for services should be obtained. If there are significant differences, find out why. Do not automatically take the low bid. Ask for references. Assure yourself that the company has provided assessments which have met the requirements of regulatory agencies.

- Soil samples from industrial sites are generally heterogeneous. As a result soil samples selected for analyses may have significant implications on the site characterization. Currently, formal protocols for soil sampling and selection of portions for analyses are virtually non-existent. However, it is accepted by the B.C. Ministry of Environment that soil samples should be representative of existing physical conditions. That is, if gravel is present, then sampling should include gravel, not just fine material where contaminants are generally in highest concentrations. However in the transmittal of a sample to a laboratory, the attempt for a representative sample generally breaks down. For example, laboratory instrumentation has recently become highly sensitive to low concentrations of contaminants, and in one case we found a laboratory using 0.1 gram of soil for analyses (obviously, fine-grained material). There was no way that this amount would be representative of the actual sample and we now specify that no less than 5 grams of soil should be analyzed. In addition, we specify that all material going through a 9.5 mm mesh should be analyzed, with quantification of the amount of coarser material.

  It is our experience that the assessment of sites exposed to wood preservatives is very sensitive to sampling protocols.

The CCME Advisory Committee for the National Contaminated Sites Remediation Program has contracted studies to provide documentation which will alleviate the above issue. One document, "Sampling and Analytical Handbook for Contaminated Sites" by the Radian Corporation, is in draft stage and will be released early in 1993. Another document, "Handbook of Subsurface Assessment" is being prepared by the University of Waterloo, and is likewise expected in 1993.

- There are problems associated with the analyses of soil and groundwater samples. In particular, we frequently have problems with pentachlorophenol (PCP) determinations in groundwater. Although some laboratories claim PCP detection to 0.01 ppb, we still have problems at concentrations as high as 100 ppb in terms of reliability, despite all quality control/quality assurances provided by the laboratories. The reasons for the differences are unknown, however the differences are such that a site might be characterized as "contaminated" solely on the basis of questionable analytical data.

  Of greater concern, is the requirement for analysis of polycyclic aromatic hydrocarbons to levels as low as 0.01 ppb (the existing CCME assessment criteria). Laboratories generally confess that they cannot reliably measure to such low extremes.

  Overall, it is my general suggestion that unless a site is very obviously contaminated, there should be caution in characterizing a site solely on one set of analyses. If there are doubts, particularly for groundwater analyses, it is highly suggested that the groundwaters should be reanalysed, prior to characterizing a site "as of potential concern".

- The most significant issue associated with site assessments, is the presence of the so-called government "criteria" for soil and groundwater. Sites with soils or groundwaters in excess of the numerical criteria are generally considered as "contaminated" by many parties, including banks, lawyers and many regulatory personnel. For example, the criterion for arsenic is 50 ppm in industrial soil. If a concentration of 51 ppm is found, it is possible that a bank would be highly sensitive to mortgaging the property. On the other hand, the bank would accept a concentration of 49 ppm. The attitude may change as a result of a recent Ontario court case which found that the application of Ministry

numerical standards was inappropriate in the circumstances of a case before it (McGeek Enterprises v Shell Canada Limited).

In my view the criteria are being greatly misused for the following reasons:

- There are no scientific data to support most of the criteria, in particular criteria for soil. The origin of the criteria is generally traced to the Netherlands, and their scientific defensibility is questionable. The adoption of such criteria is totally contrary to protocols used previously by the Canadian government for development of water quality criteria, where scientific backup of the criteria and public consultation was required.

- It appears that the authors of the regulatory criteria had never intended that the criteria would be used as absolute "yes" "no" criteria. The conditions of use of the criteria are clearly spelled out in the CCME document, "Interim Canadian Environmental Quality Criteria for Contaminated Sites", whereby it is stated, "the interim assessment criteria are **approximate** background levels or analytical detection limits and are only intended to provide general guidance". If it can be shown to a regulatory agency on a site-specific basis (i.e. by use of a risk assessment) that the concentrations are not of concern, then the agency will generally re-categorize the actual status of the site. Unfortunately many lawyers, banks and other parties do not understand the limitations of the criteria nor risk assessments, and frequently property transactions have been cancelled simply because the numerical criteria have been exceeded.

- The soil criteria have little relevance to bioavailability and potential environmental or human health impacts. For example, leaching studies of soils contaminated with ACA or CCA frequently show that releases of metals into an aqueous phase are minimal. However, the criteria are based solely on "total" metal concentrations within the soil matrix, and even soils with vitrified copper slag will be classified as "contaminated".

Subsequent evaluation phases

If the Phase II study indicates that there are problems, then a Phase III study may be required to accurately define the boundaries of contamination and provide adequate data to assess cleanup options. The cleanup efforts and verification of cleanup are defined as Phases IV and V. There are numerous comments regarding cleanup of wood preservation which I would like to briefly note:

- Soils contaminated with arsenic presently have no options for remediation, except for removal, storage and/or disposal in secure landfills. Attempts to de-list arsenic contaminated soils for use in concrete or for fill materials in road construction have been unsuccessful in B.C. Our experience is that unpaved sites, which were used for CCA and ACA treatment and/or for storage of CCA and ACA products (e.g. utility pole storage yards), have a high probability of being categorized as sites of concern because of the existing low criteria of 50 ppm arsenic in soils at industrial sites.

- Soils contaminated with PCP or creosote have a higher probability of remediation. Success with bioremediation of soils has been limited, and I am optimistic about PCP bioremediation. For example, in studies of nine B.C. sawmill operations, chlorophenates which were once used, are not detected in soils where treated products were stored. Success with bioremediation of creosote contaminated soils appears to be more remote because of limitations for bioremediation of higher molecular polycyclic aromatic hydrocarbons. Incineration, although expensive, is also another option for remediation of soils contaminated with PCP or creosote.

- In many cases soil remediation will be beyond the financial capability of companies, and/or beyond the capabilities of technology, particularly when extensive subsurface contamination is present. Estimated remediation costs for some U.S. wood preservation sites are in the range of tens of millions of dollars. The only option will be risk management, whereby routes of potential exposure by workers and the receiving environment are controlled.

CONCLUSIONS

The financial implications of contamination at industrial sites are potentially ominous. It is obvious that for every dollar spent on chemical control in the process area, the benefits are likely 10-100 fold in controlling potential site remediation costs.

The science of site assessment still requires considerable development, and the CCME is obviously attempting to document protocols based on the current state of knowledge. The biggest issue is to accurately predict the environmental and human health consequences of site contamination. It is my opinion that the publication of the "criteria" has resulted in considerable unnecessary agony for many industrial site owners due to misunderstandings of the intent of the criteria. It is essential that site owners are well aware of the limitations of site assessment data and the limitation of the numerical criteria. It is likely that many of the limitations will be addressed in the future, providing that "good science" has a role in the process.

REFERENCES

(1) Hector, G. 1992. A New Reason You Can't Get a Loan. Fortune Magazine, Sept. 21, 1992.

(2) Canadian Council of Ministry of Environment. 1991. National Guidelines for Decommissioning Industrial Sites. CCME-TS/WM-TRE013E, March 1991.