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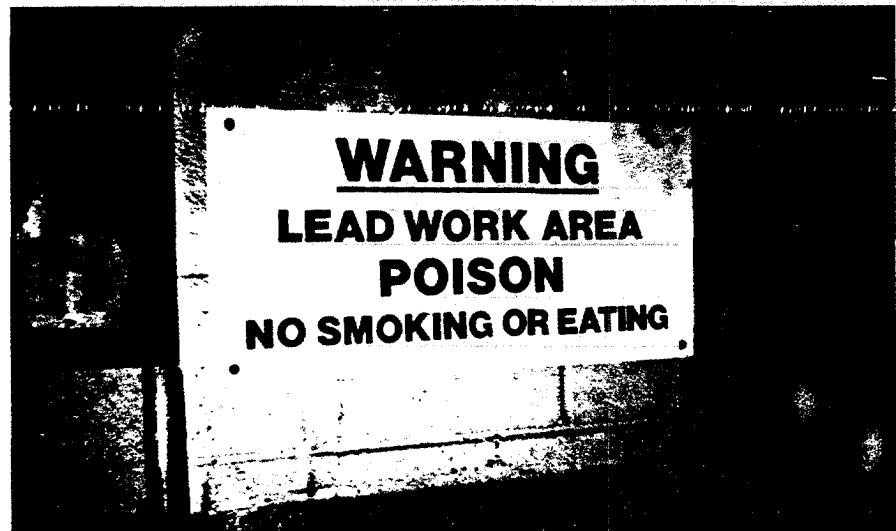
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"Get the Lead Out" May Be the Cry of the 1990s

By William L. Komianos, CIH, CSP
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Northeastern Operations

The harmful health effects of the widespread use of lead will be one of the main environmental concerns of the 1990s, with regulatory agencies tightening standards for lead in paint, drinking water, soil, and air. New data indicate that the potential for lead exposures could adversely affect nearly all businesses and families. Lead has been used for decades in scores of products ranging from paint to gasoline. This article discusses health and regulatory issues associated with lead exposures and outlines ways of managing those risks.

HEALTH RISKS

Lead poisoning is now being called
the nation's No. 1 environmental

threat to children. The past decade of research has revealed that even small doses of lead can slow development and decrease intelligence in children. High blood lead levels can seriously damage a child's brain and central nervous system. Even though the United States Environmental Protection Agency (USEPA) banned lead in residential paints in 1978, more than 3 million tons of lead remain in paint and fixtures of 70 percent of all private housing built before 1980. This equates to 42 million homes with 12 million children.

Lead exposures result from the classically identified "paint chip ingestion" that, until recently, was stereotyped as a problem of the poor. However, renovation activities, such as sanding painted surfaces,

(Continued on page 2)

significantly increase the potential for lead exposure from the inhalation of fine paint dust, even in the affluent home. In a recent report, the Department of Housing and Urban Development (HUD) states that because of lead exposure in the home, one out of nine children under the age of six has enough lead in his blood to place him at risk.

On October 7, 1991, the Secretary of Health and Human Services, Louis Sullivan, announced that threshold guidelines for lead levels in children's blood will be lowered from 25 micrograms per deciliter ($\mu\text{g}/\text{dl}$) to 10 $\mu\text{g}/\text{dl}$. Based on these new guidelines, an estimated four million children will be considered poisoned by lead. These guidelines call for the universal screening of young children and will be phased in over a period of time.

Another source of public exposure to lead is drinking water. USEPA estimates that 10 to 20 percent of overall childhood lead exposure is from lead in water. Lead levels are generally highest when water contacts lead-containing plumbing for long periods. This problem received national attention when the water systems in Vice President Quayle's living quarters and at the Capitol Building were tested for lead.

Elevated lead levels in soil may be more common than previously thought. Decades of lead-containing vehicular emissions is the main cause. The use of lead additives in gasoline was banned only recently by USEPA. Also, the soil around some schools and residential properties built on top of closed landfills has been shown to contain high lead levels. Children and adults are potentially exposed to lead when playing or gardening in the soil. Elevated lead levels in soil can also contaminate groundwater.

In adults, high blood lead levels may increase blood pressure, cause kidney damage, birth defects, and even death in the worst cases. People are exposed to lead primarily through inhalation and ingestion of lead dust. According to the National Institute for Occupational Safety and Health (NIOSH), over 800,000 workers may be exposed to lead. The Centers for Disease Control have targeted 120 occupations ranging from roofers to jewelers and dental technicians who may be exposed to lead at dangerous levels. In addition, public and private pistol and rifle ranges present a potential for lead exposure.

REGULATIONS

New scientific evidence on the effects of low-level lead exposures

Lead poisoning is now being called the nation's No. 1 environmental threat...

on children's learning ability has prompted consideration of new legislation. HUD addressed lead exposures in public and Indian housing. In 1990, HUD published interim guidelines for the identification and abatement of lead-based paint. Previous efforts were aimed at reducing lead in paint. In 1973, the Consumer Products Safety Commission established a maximum lead content of 0.5 percent in residential paint and lowered it to 0.06 percent in 1978. HUD has recently asked for funds to delead private housing. One Congressional bill would require house sellers to notify prospective buyers of the presence of lead paint.

On May 7, 1991, USEPA introduced a new standard for lead in drinking water. This standard, which is 10 times more stringent than the previous one, sets a limit of 5 parts per billion (ppb). It requires that public water works and other suppliers of drinking water monitor lead levels at household taps and institute corrosion control programs to



Lead paint removal requires stringent procedures to limit contamination.

reduce elevated lead levels. In 1978, OSHA issued its Occupational Lead Standard, which mandates a 50 microgram per cubic meter of air ($\mu\text{g}/\text{m}^3$) permissible exposure limit (PEL). However, one study estimates that only about 3 percent of the lead-using industries covered under the OSHA standard, representing 11 percent of the workers, have ever monitored workers for lead exposure. The authors of this study conclude that the lack of surveillance makes assessing the magnitude of the problem "virtually impossible."

Many industries with excessive airborne lead exposures are not covered under the current OSHA general industry standard and instead fall under OSHA's *construction* industry standard. This standard has a PEL for lead of $200 \mu\text{g}/\text{m}^3$, four times higher than the general industry standard. OSHA is currently developing a standard for the construction industry modeled after the OSHA general industry standard. A Notice of Proposed Rulemaking on this standard may be published in the summer of 1992.

On May 13, 1991, USEPA announced that it was considering rulemaking under the Toxic Substances Control Act (TSCA) to phase out or ban certain uses of lead including the manufacture of solder, bronze, brass-plumbing fixtures, and nonresidential paint.

MANAGING RISKS

Because of its widespread presence, there is no escaping the need to manage risks from lead. These risks include:

- Adverse health effects on children and adults

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- Noncompliance with OSHA and USEPA regulations
- Lead as an environmental liability in owned property or property transactions

- Disposal of lead-containing waste
- Lead as a personal injury liability in residential rental property

Liability risks mount as lead continues to receive escalating media attention. Managers and home owners should take steps now to identify the presence of lead in their business operations and even in their own homes.

Suspect materials and operations should be considered for their potential to cause lead exposures. The age and location of a building, as well as past practices and operations, should be scrutinized. Paint, water, and soil suspected of containing lead should be sampled and analyzed. Employees potentially exposed to lead should be monitored. Results of these analyses should be evaluated to determine if corrective actions are needed.

Corrective actions for lead-based paint can cause additional risks. Lead removal techniques are similar to those for asbestos, requiring stringent procedures for preventing contamination outside the work area, protecting

abatement workers, and testing for residual contamination. The disposal of lead-contaminated materials, often classified as a hazardous waste, is even more costly than asbestos disposal.

Techniques to reduce lead levels in drinking water are not difficult. Industries may want to consider implementing their own water monitoring programs to document "in-compliance" levels of lead. Further, monitoring water supplies is essential to determine if lead concentrations are from the public water supply or from internal piping.

Liability risks mount as lead continues to receive escalating media attention.

The presence of lead in soil may require a public health risk assessment to evaluate the potential adverse health effects of measured lead levels on children and adults who may be exposed.

Worker exposures to lead *can be controlled* by a combination of engineering controls, respiratory protection, improved housekeeping, and personal hygiene guidelines. However, employers should periodically monitor worker exposures to lead as required by the OSHA lead standard.

"Get the lead out" may indeed be the cry of the 1990s because of public concern as well as regulatory and legal pressures. Actions taken now to assess risks and implement corrective steps to lower lead exposures will help managers and home owners reduce future liabilities. ▼

The Regulatory Spotlight Is on Environmental Crimes

By Lisa Simkins, P.E., CIH
Vice President
Director, Western
Operations

For American executives, the prosecution of environmental crimes has added a new dimension to their environmental compliance worries. Enforcement agencies are increasingly pursuing not only corporations, but also individual employees, officers, and directors, handing out stiff penalties, sometimes including jail sentences.

REGULATORY TRENDS

Although criminal prosecution has been available by statute for many years, only recently have federal and state regulators and prosecutors been rigorously pursuing this avenue of enforcement. More resources are being committed to such approaches. For example, the Pollution Prosecution Act of 1990 will increase fourfold the number of U.S. Environmental Protection Agency (USEPA) criminal special agents by 1995.

Federal and state laws have been amended to add or increase potential criminal penalties. Provisions in the Clean Water Act (CWA) and the Resource Conservation and Recovery Act (RCRA) now allow criminal penalties of up to \$250,000 and 15 years of imprisonment per violation for individuals and up to \$1 million for companies who knowingly endanger human life.

Additionally, bills are being passed that add new criminal liability provisions. California's Corporate Liability Act (AB 2249) imposes



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criminal liabilities on employers for undisclosed workplace and environmental hazards. This Act provides criminal penalties against individuals of up to 3 years in prison with fines of up to \$25,000. Corporations may be fined as much as \$1 million.

Some local District Attorneys' offices, such as Los Angeles, San

Francisco, San Joaquin, Solano, and Napa counties in California, now have special environmental enforcement units. In Los Angeles County, the District Attorney's Environmental Crimes Division heads up the Los Angeles Toxic Waste Strike Force. This multi-agency group can escalate civil inspections to full-scale criminal investigations. So far this year, the Los Angeles District Attorney has secured prison sentences against at least 10 people.

CRIMINAL PROSECUTION CASES

Criminal prosecution for the improper handling of hazardous wastes dates back at least 10 years. In 1981, an owner of a liquid waste disposal company was prosecuted by the Justice Department's Environmental Crimes

Section for discharging pesticide wastes into the Louisville, Kentucky, sewer system (United States v. Distler). The owner was convicted under provisions of the Clean Water Act after portions of the sewer system had to be abandoned due to pesticide residue from the discharge. This resulted in 100 million gallons of untreated sewage per day being dumped into the Ohio River for several months. A \$50,000 fine and 2-year prison sentence were imposed on the defendant for these violations.

More recently, courts have been imposing stiffer criminal penalties under both federal and state statutes. In 1989, a drum recycling firm in Colorado was convicted of 16 criminal violations of RCRA for knowingly endangering three

company employees (United States v. Protex Industries Inc.). They worked in the facility where drums previously containing paints, solvents, and pesticides were cleaned. Ultimately, the company was ordered to pay \$440,000 of the fine and to make restitution in the amount of \$950,000 to the three workers.

For the first time, federal employees have been convicted of knowingly violating environmental regulatory requirements (United States v. Dee). In this case, three civilian workers at the Army's Aberdeen Proving Ground were convicted of RCRA violations for the illegal storage, treatment, and disposal of hazardous waste. The employees were also convicted of violating the Clean Water Act by dumping acid into a creek.

On August 21 of this year, a businessman was indicted in New York County Court for reckless manslaughter and second degree assault (New York v. Polvino). He was also charged with unlawful dealing with hazardous waste as well as endangering public health and safety and the environment. In this case, the businessman purchased an abandoned factory that apparently contained drums of acid and other chemicals. He then hired a man to dispose of the chemicals on private property. During the disposal, the acid reacted with the other wastes resulting in an exposure for the worker who was found dead at the private property site. If convicted, the businessman could be sentenced to 15 years in jail and may also face fines for cleaning up the chemicals that were dumped. He has pleaded "not guilty" and is expected to go to trial in the spring of 1992.

The Los Angeles County District Attorney is pursuing a case against

the president of Federated Metals Company (California v. Baker). The case includes 26 charges alleging exposure of employees to excessive lead levels. The president faces trial on October 22

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in California Municipal Court. If convicted, he faces a maximum penalty of six months in jail and a \$5,000 fine for each of 25 charges. On one other charge, alleging permanent or prolonged impairment from an employee's lead exposure, the president faces a maximum penalty of six months in jail and a \$10,000 fine. The District Attorney negotiated a settlement with the company under which Federated Metals will contribute \$200,000 to a lead education and enforcement program. The program is expected to include hiring inspectors who will visit companies most likely to have excessive lead exposures.

On a local level, a Superior Court judge in Alameda County, California, sentenced a person to 16 months in state prison for illegally disposing of metal plating waste in Oakland, California. This case involved 35 barrels of metal

plating waste being dumped on the streets in violation of California Health and Safety Code 25189.5. The defendant was also required to pay a total of \$44,900 in penalties and restitution to the state.

Another local case in Santa Clara County superior court resulted in a 5-year jail term for the owner of a drum recycling firm (California v. Lorentz et al.). The conviction also carried a \$2.1 million fine and \$100,000 in restitution to neighbors.

These are just a few examples of the increasing number of criminal prosecution cases in the environmental and health and safety arena. In 1990, the U.S. Justice Department brought charges against 100 defendants for environmental crimes related to USEPA enforcement actions. In the first six months of 1991, 10 workplace safety and health cases were referred by the Occupational Safety and Health Administration

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(OSHA) to the Department of Justice for possible criminal prosecution. The number of cases referred by OSHA is considerably less than those referred by USEPA, although in both cases, the trend is increasing. Additional cases have been filed at the state and local level as well.

(Continued on page 6)

Environmental Crimes, continued from page 5

IGNORANCE IS NOT BLISS

Most environmental statutes specify the level of intent required for criminal prosecution and conviction. For example, RCRA and most other federal environmental laws specify that a party must "knowingly" violate a provision to be held criminally responsible. However, the "knowing violation" requirement has been broadly interpreted in the courts.

In 1986, an Eleventh Circuit Court of Appeals decision presumed that

The regulatory picture is continually changing with the introduction of new laws and amendments...

because they are unaware that their company is in violation of a specific statute or that a substance is regulated.

As the trend of criminal prosecution increases, it is important for you to protect yourself and your company.

individuals and companies who handle hazardous wastes are knowledgeable of the regulatory requirements involving these wastes (United States v. Hayes). Just this year, the Fifth Circuit Court upheld the 1986 convictions under RCRA in the case of United States v. Baytank. The defendant was judged aware that the company's wastes were generally dangerous. In 1975, in the case of United States v. Park, a corporate officer was held criminally responsible for regulatory violations even though that officer had directed an employee to carry out a corrective action to come into compliance. The message in these cases is that corporate executives can no longer assume that they are insulated from criminal prosecution simply

PROTECTING YOURSELF AND YOUR COMPANY

As the trend of criminal prosecution increases, it is important for you to protect yourself and your company. As with any legal issue, if you believe that you are in trouble, it is necessary to get the advice of an experienced attorney. On a more basic level, there are some important everyday things that you can do:

Be Informed. You should be informed and knowledgeable of the environmental regulatory requirements that affect your operations. This includes federal, state, and local regulations. If you operate facilities in more than one location, you need to be aware of the different state and local regulations. Because regulations are complex, voluminous, and changing, you may need help in identifying, interpreting, and complying with various regulations. Help is available through training courses and seminars, environmental consultants, and attorneys.

Document. You should maintain written documentation of your communications and programs

related to environmental compliance. This should include reports, correspondence, and telephone conversations with both regulators and in-house personnel.

Follow up. If you have delegated the responsibility for implementing environmental compliance to others (managers, employees, consultants, etc.), be sure to follow up. Equally important, be sure that the individual or company to which you delegate responsibility has the necessary expertise, training, and authority to complete the project.

Audit. A manager of a large company cannot be everywhere at once and, therefore, needs periodic audits to check the company's compliance at various locations. Also, outsiders may pick up compliance issues that in-house personnel may miss. Thus, it may be in a company's top management's best interest to have compliance audits periodically conducted by qualified environmental consultants.

CONCLUSIONS

In these times of increasing enforcement, escalating fines, and criminal sanctions, business executives need to be aware of environmental laws and regulations. The regulatory picture is continually changing, with the introduction of new laws and amendments to existing statutes. Further, courts are interpreting laws broadly, imposing criminal sanctions on companies who are aware that they are dealing with hazardous substances, even if these companies are unaware of all applicable regulatory requirements. Therefore, to avoid stiff penalties and, in some cases, the "big house," both individuals and corporations must make every reasonable effort to achieve regulatory compliance. ▼

NVP Exposure Limit Affects Printing Industry

By Lee R. Schumann, CIH
Senior Industrial Hygienist
Supervisor, Industrial Hygiene
Services
Northeastern Operations

The chemical, n-vinyl-2-pyrrolidone (NVP) is a typical component of ultraviolet (UV) screen printing inks which are used widely in printing operations. NVP is a unique chemical that cannot be easily replaced in UV ink manufacturing.

Preliminary results of laboratory studies indicate that exposure to this chemical can increase the incidence of nasal and liver cancer in *rats*. There is no direct evidence that NVP can have adverse effects on *humans*. Nevertheless, as a result of the laboratory studies, manufacturers of NVP (International Specialty Products [ISP], formerly GAF Chemicals Corporation, and BASF Corporation) are recommending an 8-hour time-weighted average exposure limit of 0.1 part per million (ppm).

Currently, there are no *regulatory* standards for NVP. However, ISP has developed a sampling and analytical procedure that can help printing operations measure potential employee exposures to NVP. Clayton assisted ISP in the development process by further refining this methodology.

The ISP sampling and analytical procedure was developed by Mr. Robert C. Hylan, Manager of Health and Industrial Hygiene at ISP in Wayne, New Jersey. This method requires the use of 150-milligram (mg) charcoal tubes. The samples are desorbed with a multi-component solvent and then analyzed by gas chromatography using a flame ionization detector (FID).

At ISP's request, Clayton performed a short-term desorption efficiency study of NVP on charcoal



Currently, there are no regulatory standards for NVP.

and obtained recoveries of approximately 88 to 94 percent. Because NVP is a monomer, ISP has also contracted Clayton to conduct a 6-week desorption efficiency study that will determine if the compound polymerizes on charcoal over time. The results of this study will be available shortly.

One drawback to any sampling and analytical procedure is the potential interference of other organic solvents from the workplace. To circumvent the interference problem and to gain additional sensitivity, Clayton modified the ISP method by using a nitrogen phosphorous detector (NPD).

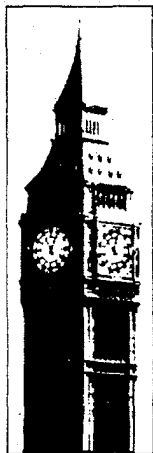
The NPD is very sensitive to organically bound nitrogen compounds such as NVP and essentially nonresponsive to most other types of compounds.

Clayton analyzed samples of NVP on charcoal tubes that were also spiked with known FID-interfering compounds. As expected, the NPD detected the NVP and was completely blind to the interferences. By using a NPD, Clayton lowered the limit of detection (1 microgram [μg] per sample by FID) by a factor of 10 to approximately 0.1 μg .

NVP users should follow the manufacturers' recommendations for controlling employee exposures to below 0.1 ppm. Monitoring employees for occupational exposures is the first step. If monitoring indicates that workplace concentrations are above the 0.1 ppm level, engineering controls and respiratory protection can be effective in reducing exposures.

Editor's note: For more information on the health effects of NVP, contact Dr. Jay Ansell, Director, Product Stewardship, at ISP in Wayne, New Jersey, at (201) 628-3958. For additional information on sampling and analysis of NVP, contact Clayton's Mr. Schumann at (908) 225-6040. ▼

Private Cases: The Spice of an Environmental Consultant's Life



By Tony C. Ellis, Ph.D., Managing Director,
and Donald Cargill, Director,
U.K. Operations
Birmingham, England

For the consulting scientist, there is a wide variety of projects and an equally wide range of clients. Some of these projects are complex while others are straightforward. Of all the projects carried out during the course of a year, which do you think can prove to be the most difficult? Is it the site investigation and remediation of a former chemical works or the complex wastewater treatment project? In our experience, it is neither, which is not to say that major projects are without their potential problems.

So far as our clients are concerned, we work for central and local government, industry and commerce, contractors, developers, and professional firms including lawyers, architects, and engineers. Last, but not least, we work for private individuals. It is with this latter category that major difficulties often arise. Probably the most significant reason for these difficulties is emotional stress. Sometimes, we can resolve these cases. At other times, however, because of lack of evidence and insufficient information, we are unable to help our clients.

We are consulted by private clients about problems that often affect their family and home. Invariably, our private clients have been trying to solve their problems on their own before consulting us as a last resort. Living with a problem for a long period of time may have caused it to be exaggerated in our clients' minds and made them less rational when discussing the problem with us.

UNRESOLVED CASES

What are these problems confronting our clients? A recent example concerns earthworms, which are not normally considered to be a cause of stress. In this case, however, the worms were not found in soil, where they should be, but emerged from a drinking water tap in a private home. They did not appear together. The first earthworm appeared in the evening when the home owner, a retired elderly man, was filling a glass of water. The second materialised the following morning, in the presence of the home-help. The home owner, after consulting his solicitor, took action against the water supply company for causing him to develop a phobia

We are consulted by private clients about problems that often affect their family and home.

against drinking the water. This meant that not only could he not use tap water to make tea, coffee, or other drinks, but he was also compelled to purchase bottled water.

The client asked us to assist with his action against the water supplier. However, our efforts were hampered because the incident had taken place six months before we were contacted. In addition, the water supply company had taken the worms, the only tangible evidence, for examination and had subsequently thrown them away. The company contends that the worms appeared in the kitchen sink not through the cold water tap, but by climbing up the waste pipe and emerging into the sink unnoticed until the tap had been turned on. The athletic ability of earthworms is therefore a key factor in the case, but does not appear to have been extensively researched. If you have, or know of, any data on this subject, we shall be pleased to hear from you.

Another case involved the water supply to a private home. The home owner complained of clothes being covered with brown stains when washed in the washing machine. The water supply company admitted that the iron levels in the water were high, giving rise to iron oxide deposits in the mains. However, this particular house appeared to be the only one in the area which was affected. Neither flushing the mains nor replacing the connection from the main to the house solved the problem. The owner felt that the water supply company had not handled the matter satisfactorily and took up the case with the local press, radio, and Member of Parliament, all to no avail. In fact, the publicity rebounded on the owner when he unsuccessfully tried to sell the house which, by that time, was known as "the house with the water problems."

Regular sampling by the water supply company did not show the presence of more than a trace of iron oxide. It was apparent that the problem was intermittent and may have been aggravated by the

owner's wife. She always used the washing machine early in the morning thereby causing any deposits to be carried into the house connection. The water company had long-term plans for iron removal, but to alleviate the problem at the house immediately, a cartridge filter was fitted into the supply pipe. Not satisfied with these efforts, the owner sought our help. We advised him that prosecuting the water supply company would be unlikely to succeed because there was not enough scientific evidence to support the conclusion that the water quality was unsatisfactory. Our client reluctantly accepted our advice and did not prosecute the water supplier.

Other members of the public have asked us to help them with environmental problems arising from a variety of sources, including cavity wall insulation, dust, fumes, and odours from adjacent factories, and domestic disputes. The latter category involved a husband requesting us to analyse a boiled egg for arsenic. Reminiscent of Agatha Christie, he suspected that his wife was attempting to poison him.

In many of these "environmental" cases, the local regulatory agency is called in but is unable to substantiate the complaint, leaving the individual to battle alone. In most cases, our role is principally to put the matter in perspective, or even to convince the persons concerned that the problem they perceive is not of the magnitude they think it is. We advise our clients not to waste their money fighting a lost cause, but if they wish to proceed, we support their case in a professional manner.

RESOLVED CASES

Not all cases involve water supply problems and not all of them are unsuccessfully resolved. Sometimes, we have enough evidence to win claims for our clients. Two particular cases come to mind.

A worker filed a claim against his employer for compensation due for ill-health caused by exposure to solvent vapours, principally xylene. He had worked for a company that made boats, fabricating hulls using glass fibre-reinforced plastic material. Clayton conducted an inspection of this client's work area. The workroom did not have any form of mechanical ventilation, and the only personal protective equipment provided was a pair of cloth gloves. Based on the inspection, Clayton concluded that substantial exposure to xylene had occurred. Subsequent to the submission of our report, our client's claim was settled in full.

In another case on land contamination, our client was a police officer who decided to build an extension to his residence. During earthwork for the foundation,

he encountered two oil drums filled with "noxious" substances. Concerned about their possible hazards to his family, particularly two young children, he sought our advice. Upon analysis, we discovered that the drums and the ground surrounding them contained high concentrations of phenols. We advised our client to vacate the property until cleanup had been conducted.

Two or three days later, our client contacted us again. Removal of the drums had caused a "flood" of contaminated water to flow from his property into the garden of the adjacent property. The local authority was threatening to prosecute our client for "causing controlled waste to be deposited on any land...not covered by a waste disposal license."

In spite of steps being taken to stem the flow at its source, a legal battle began between our client and the local authority. Six years after our first involvement in the case, the local authority accepted liability as the leachate had emanated originally from a neighbouring landfill owned by the authority. Our client received compensation for the loss of his property, several years of aggravation, and, of course, for the payment of our fees.

CONCLUSION

Even though these "private" cases are sometimes difficult to handle, time-consuming, and often not financially rewarding, we rarely turn one away. We believe that the individual has as much right to our services as the large industrial client. And, after all, private cases do add spice to an environmental consultant's life. ▼



One of our private clients found drums filled with hazardous substances in his backyard.

Phase II Environmental Assessments Can Control Remediation Costs

By Anthony S. McElligott, P.E.
Supervisor, Remediation Services
Western Operations

You have just read your consultant's Phase I report. The good news is that you have only *one* problem. The bad news is that underground storage tanks have probably leaked, causing soil and groundwater contamination. The specter of unlimited costs and liabilities is looming, and your environmental consultant is recommending a Phase II investigation.

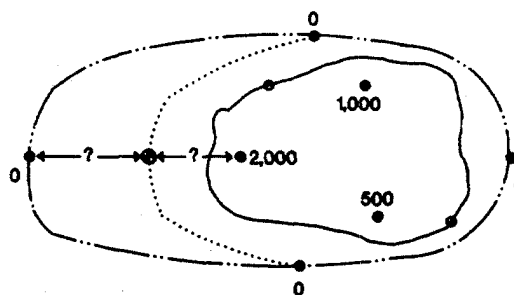
As the property owner, purchaser, or lender, you may ask "why do I need a Phase II investigation?" The answer is that a Phase II investigation provides valuable information about the extent of contamination as well as the amount of time and money required to clean it up. This information may be essential to successful property transaction negotiations, continuing with planned use of the property, controlling remediation costs, and complying with regulatory agency requirements.

WHAT IS A PHASED APPROACH?

A phased approach is the most effective way to investigate potential environmental contamination at a specific site and to decide on the best remediation program. It consists of a series of investigative steps, with the direction and scope of each step determined by information developed in the preceding steps. Generally, there are three main phases:

- **Phase I.** The Phase I *assessment* identifies "red flags" that indicate potentially contaminated soil or groundwater on the property. The Phase I environmental *audit* focuses on the regulatory compliance status

Additional Investigations Vs. Additional Cleanup



⊕ Concentration of contaminant in mg/kg

— Actual extent of contamination
- - - Assumed extent based on zero concentration samples
..... Potential extent of contamination if boring is installed

The decision to install an additional boring should be based on the investigator's judgment and a cost/benefit analysis.

A phased approach is the most effective way to investigate potential environmental contamination at a specific site and to decide on the best remediation program...

of a property. Either the assessment or the audit may indicate the desirability of a Phase II investigation if contamination or noncompliance is detected.

- **Phase II.** The Phase II investigation is tailored to a specific site based on the findings of the Phase I assessment or audit. It consists of a preliminary

subsurface investigation, additional subsurface investigations (if necessary), and a remedial investigation and feasibility study (RI/FS).

- **Phase III.** This phase is actually the design, implementation, and completion of remediation. It includes developing plans for (1) monitoring air, water, or solid waste emissions, (2) operation and maintenance of cleanup equipment, and (3) sampling and analysis to demonstrate that remediation is complete.

PHASE II INVESTIGATIONS

The purpose of the Phase II investigation is twofold: (1) determine what types of contaminants are in the soil or groundwater as well as the extent of the contamination and (2) evaluate the technical and economic feasibility of different remediation technologies for cleanup.

If Phase I indicated *suspected* contamination, the preliminary subsurface investigation in Phase II begins by identifying likely contaminated locations, such as the location of current or former underground storage tanks, for sampling. If visual or documented evidence of the location of buried drums or tanks is lacking, noninvasive screening methods, such as soil vapor surveys or geophysical surveys (see Clayton newsletter September 1989), may be used to identify the presence of contamination. Soil surveys may be used to narrow the selection of subsequent soil and groundwater sampling locations.

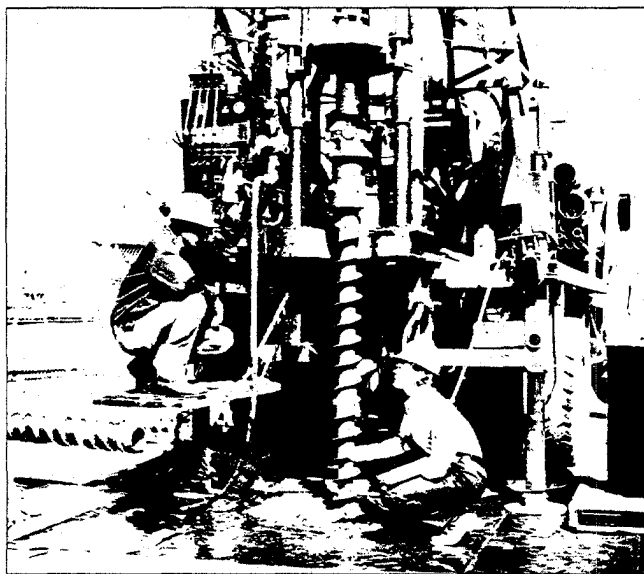
The preliminary subsurface investigation in Phase II may also include the installation of one or more groundwater monitoring wells (depending on the number of suspected locations of contamination) to assess the degree of groundwater contamination. Monitoring well design depends on the type of contaminants suspected. For gasoline and other lighter-than-water liquids, the wells should be screened so that any liquids floating on the surface of the water can enter the well and be observed, measured, and sampled. Many chlorinated solvents are heavier than water and will sink; therefore, wells for these solvents must be designed to allow sampling at the bottom of an aquifer.

If groundwater contamination was *confirmed* during Phase I or the Phase II preliminary subsurface investigation, three monitoring wells are

usually necessary to further define the degree of groundwater contamination and to determine the direction and slope of the local hydraulic gradient (i.e., groundwater flow). Knowing the direction of the gradient is critical if the source of the contamination is suspected to be a neighboring site. A gradient that indicates groundwater flow from a neighboring site to your property can help confirm that contaminants from the neighboring site have affected your property. Alternatively, your site may have the potential for affecting neighboring sites, and this risk must be addressed in any cleanup plan.

The remedial investigation and feasibility study follows the

*Phase II costs can be controlled
by understanding that the law
of diminishing returns applies...*



Phase II environmental assessments may include installing groundwater monitoring wells.

preliminary subsurface investigation. The RI FS helps determine what methods are appropriate to clean up the site, to what extent the soil and groundwater can be cleaned, the risk posed by any residual contamination, and methods of controlling that risk. It also explores the feasibility, cost, and cleanup time required for remediation options.

Depending on the results of Phase I and Phase II preliminary subsurface investigations, the RI FS may involve the installation of additional groundwater monitoring wells and collection of additional soil and groundwater samples to determine hydraulic conductivity, soil air-permeability, and other physical parameters that can affect pollutant migration and cleanup. Aquifer characterization tests, such as slug tests or pump tests, may also be performed to evaluate how groundwater will behave when the aquifer is pumped. Aquifer tests can also be used to predict how much of the aquifer an extraction well will affect (called the zone of influence), which can further help determine how many wells are necessary for effective cleanup.

The feasibility study may also include treatability testing and computer modeling. Treatability tests assist in evaluating the effectiveness of the preferred remediation technologies, selected from the RI FS, to clean the soil and groundwater contamination. Computer modeling of the site helps evaluate the movement of contaminants in the subsurface and provides

(Continued on page 12)

Phase II, continued from page 11

an estimate of the duration of the remediation program.

The end result of the feasibility study is to recommend a remediation system that is suitable to the property owner's needs and to estimate its total cost. For the property owner, the feasibility study helps translate unknown costs and liabilities to an understanding of the problem and an estimate of the financial costs to resolve it. While only an estimate, the projected cost of remediation can be very important in putting a potential purchaser's concerns about possible contamination in perspective.

PUTTING A DOLLAR VALUE ON THE PROBLEM

All of this investigation and analysis is not cheap. However, the costs can be controlled by keeping the goal of the Phase II firmly in mind. The goal is not to know everything possible about a particular site but to generate sufficient information to make cost-effective and technically sound decisions. These decisions will allow the site to be cleaned up so that the owner can receive "case closure" from regulators. A case closure is basically a seal of approval from applicable regulatory agencies that appropriate steps have been taken to remediate the contamination.

Phase II costs can be controlled by understanding that the law of diminishing returns applies. The cost of knowing the answer to a particular question about the possibility of subsurface contamination must always be balanced against the cost of not knowing. For example, it is necessary to define the extent of contamination. This is usually defined as the volume of soil and groundwater beyond the boundary of which the concentration of pollutants is below detection. If soil

...the Phase II investigation

identifies cleanup options so

that owners can return quickly

to reusing the site or continue

using it...

samples collected from a series of distant borings show no detectable contamination, while a short distance away the soil is contaminated, should additional borings be placed in between? The answer depends on whether the additional cost of sampling and analysis is considerably less than the cost of treating the additional volume of potentially contaminated soil. This situation is illustrated in the figure on page 10.

HOW DO YOU BENEFIT?

A well-planned and executed Phase II provides more than just information on the extent of contamination and a proposed solution. It also supplies strong supporting documentation of steps that have been taken to resolve the problem. This documentation will help the property owner defend possible claims that the site was not adequately investigated or that the remediation system will not achieve required cleanup levels. Most importantly, the Phase II investigation identifies cleanup options so that owners can return quickly to reusing the site or continue using it without interrupting critical activities onsite. The end product of a properly conducted Phase II investigation is a defined problem with a solution that is consistent with the property owner's needs.

Clayton Supports the 1991 AIHCE



Clayton sponsored the Edward J. Baier Technical Achievement Award at the 1991 American Industrial Hygiene Conference & Exposition held in Salt Lake City, Utah. Dr. Jaswant Singh, CIH, of Clayton (right), presented the award to the International Labor Organization (ILO). Accepting on behalf of the ILO is Ms. Karen Bury (center). Mr. Baier is to the left.



Clayton also sponsored the sixth annual "Run for the Foundation." The event raises scholarship funds for industrial hygiene graduate students. More than 200 people participated in the 5K run and the 1 mile walk. The fun run raised over \$7,000.

USEPA Proposes Significant Regulatory Changes

An overview of two recent United States Environmental Protection Agency (USEPA) regulatory activities is provided below.

STORMWATER

During the 1980s, stormwater runoff was recognized as a significant source of pollution in U.S. lakes and streams. As a first step toward controlling stormwater runoff, USEPA published final stormwater permit regulations on November 16, 1990, which became effective on December 17, 1990.

Stormwater permit applications apply to most operating facilities.

These regulations are designed to eliminate contamination of U.S. waterways by substances such as oil, grease, metals, pesticide residues, and debris collected and carried in runoff.

The regulations require over 100,000 industrial facilities that discharge stormwater to obtain a National Pollution Discharge Elimination System (NPDES) permit. Facilities that are regulated include those already subject to effluent guidelines, certain industrial operations within SIC codes 10 through 51 (some SIC codes are exempted), wastewater treatment works, construction activities on any site greater than 5 acres, hazardous waste treatment storage or disposal facilities, landfills, electric power-generating facilities, and many other manufacturing or industrial activities.

Industries have three permit options: individual permits, group permits, and general permits.

USEPA's 33/50 program

...targets...reducing

pollution by 33 percent by 1992

and 50 percent by 1995.

Individual permits are now due on October 1, 1992. Group permits allow facilities operating under the same SIC code or within the same effluent guidelines of the Clean Water Act to submit data jointly. Part 1, which identifies members of a group, provides proof of similar discharges, and identifies who in the group will be sampled, was due on September 30, 1991. Part 2, which includes the submittal of sampling data, is due on May 18, 1992, though USEPA has proposed extending this deadline to October 1, 1992.

General permits require that facilities simply file a notice with USEPA and meet general standards for discharge quality as published in the proposed general permit regulations on August 16, 1991. General permits would only apply in states that lack the authority to run the Clean Water Act permit programs. However, more states are expected to adopt the general permit program. No dates for this program have been announced. Under this program, dischargers will have to show that they employ "best management practices" for reducing contamination of stormwater discharges.

Sampling for the stormwater regulations will not be easy. Samples must be taken during a typical storm, with a rainfall of greater than 0.1 inches and at least 72 hours since the last rainfall. Flow-weighted samples are required for the first three hours

with grab samples to be taken during the first 30 minutes. All stormwater discharges must be sampled. Stormwater permit applications apply to most operating facilities. Failure to comply with these new regulations could subject a company to penalties of up to \$25,000 per day.

TOXIC REDUCTION PROGRAM 33/50

USEPA's 33/50 program is a voluntary pollution prevention program, introduced earlier this year, to reduce releases of 17 targeted chemicals from the 1988 levels reported under Section 313 of the Emergency Planning and Community Right-to-Know Act, commonly known as SARA. The program takes its name from USEPA's targets of reducing pollution by 33 percent by 1992 and 50 percent by 1995.

The targeted chemicals were selected based upon their levels of emissions and toxicity as well as ease of reduction. Targeted chemicals include:

- *Metals.* Cadmium, chromium, lead, mercury, and nickel and their compounds.
- *Cyanide.* Cyanide and its compounds.
- *Organics.* Benzene; carbon tetrachloride; chloroform; methylene chloride; 1,1,1-trichloroethane; methyl ethyl ketone; methyl isobutyl ketone; tetrachloroethylene; toluene; xylene(s); and trichloroethylene.

A total of 3,500 companies were identified for this program. Several environmentally proactive companies have already expressed their intention to participate. More details on the anticipated results of this program are expected in late 1991.

News Briefs

Platform

Mr. Tony McElligott, P.E., Supervisor, remediation services, western operations, presented "Odor Investigation and Control Strategy for VOC Emissions from a Magnetic Tape Manufacturing Plant" at the 1991 84th Annual Air and Waste Management Association Meeting in Vancouver, British Columbia.

Ms. Lisa Simkins, P.E., CIH, Vice President, Director, western operations, has been appointed to the California Division of Occupational Safety and Health advisory committee for certification of asbestos consultants and site surveillance technicians.

Mr. Ronald Peters, CIH, Director, Laboratory Services, western operations, has been named to the Lead Accreditation Task Group, a new subgroup of the American Industrial Hygiene Association Laboratory Accreditation Committee.

Mr. Douglas Shattuck, P.E., Supervisor, Indoor Air Quality Services, northeastern operations, organized and chaired a seminar in Edison, New Jersey, titled Water Treatment Practices for Building Services, sponsored by the American Society of Heating, Refrigerating, and Air-conditioning Engineers, Inc. (ASHRAE).

Ms. Colleen Williams, Microbiologist, northeastern operations, presented "Health-Related Risks" at the ASHRAE seminar in Edison, New Jersey. Ms. Williams also spoke on "Bioaerosols" at a seminar on Improving Indoor Air Quality in Nonindustrial Buildings held at the Environmental and Occupational Health Sciences Institute at Rutgers University.

Dr. Philip Morey, CIH, Manager, indoor air quality services,

northeastern operations, participated in the ASHRAE Buildings IAQ 91 conference in Washington D.C. Dr. Morey and Ms. Williams presented "Is Porous Insulation Inside a HVAC System Compatible with a Healthy Building?" Dr. Morey also chaired a workshop on "Construction and Renovation during Partial Occupancy."

Dr. Morey attended the United States Environmental Protection Agency's (USEPA's) Indoor Air Large Buildings Workshop in Denver, Colorado. He is a member of the workshop's diagnostics and mitigation team. The objective of the workshop is to develop standardized protocols to collect baseline IAQ data in large buildings.

Mr. Kirt Vora, Vice President, Director, northeastern operations, gave a presentation on "Selecting Environmental Contractors, Consultants, and Analytical Laboratories" at the Public Risk Insurance Managers Association (PRIMA) in Atlanta, Georgia.

Mr. Donald Cargill, Director, Clayton Environmental Consultants, Ltd. (U.K.), made three presentations: "Waste Disposal—A Critical Aspect of Environmental Protection" at the Association of Insurance and Risk Managers in Industry and Commerce seminar in London, England; "Services and Facilities on Offer—What Are They? How to Use Them?" at a conference titled The Control Manager, The New Profession, organized by Henry Stewart Conference Studies in London, England; "Effluent Treatment and Controls on Discharge" at the Industrial Water Society Conference on Water Quality in the Food and Drink Industries for the 90s, in Birmingham, England.

Dr. Rebecca Spearot, P.E., Assistant Vice President, Manager,

environmental engineering services, midwestern operations, presented three papers: "How to Protect Yourself When Buying and Selling Property" at the Environmental Symposium held by the Madison Heights Chamber of Commerce in Michigan; "Environmental Management in the 1990s" at the CPA Attorney Conference held in Dearborn, Michigan; and "Major Environmental Laws and Their Impact on Regulated Industrial and Commercial Operations" at the 19th annual Michigan Assessors Conference. Dr. Spearot has also been elected to the Board of Trustees of the Metal Finishing Suppliers' Association.

Dr. Derek Wong, P.E., Manager and Senior Hydrogeologist, environmental engineering services, midwestern operations, presented "Investigation and Remediation of Subsurface Contamination" also at the Michigan Assessors Conference.

Mr. Steve Rosas, Industrial Hygienist, Pacific operations, spoke on indoor air quality to the Ventura County American Public Works Association.

Mr. Brian Stratouly, P.E., Senior Heating, Ventilation, and Air-conditioning (HVAC) Engineer, Pacific operations, discussed indoor air quality at a meeting of the Los Angeles chapter of the American Society of Safety Engineers.

Dr. Jaswant Singh, CIH, Senior Vice President, Director, Pacific operations, presented "Widening Definition of Workplace Injuries. Some Emerging Occupational Health Concerns," at the Managed Care and Workers' Compensation Conference in Irvine, California.

Mr. Marc Blaustein, Senior Associate, policy and management

Promotions at Clayton



Mr. David Randell, R.G., has been promoted to Manager, environmental engineering services, Pacific operations. Mr. Randell, a senior geologist, has over 14 years of environmental consulting experience. He is responsible for managing environmental engineering services in southern California and Hawaii.



Mr. Jim Johnson, Ph.D., has been promoted to Supervisor, laboratory services, for the Canadian operations in Windsor. In his new position, Dr. Johnson, a graduate of McMaster University in Hamilton, Ontario, leads a staff of eight chemists and technicians. He has 10 years of experience in chemical analysis and development of analytical methods.



Mr. Michael Molley, CFS, REP, has been promoted to Manager, environmental engineering and industrial hygiene services, southeastern operations. Mr. Molley has over 18 years of related experience. In his new position, Mr. Molley will manage consulting activities in the southeast. ▼

group, presented "HazCost: Using Decision Analysis to Make Better Financial Decisions on Waste Site Cleanups" at the Hazardous Materials Control Northeast '91 Conference in Boston.

Announcements

Clayton's Pacific operations announces two promotions: Mr. Dan Ford, to Group Leader, environmental engineering services, at the Honolulu office and Ms. Jennifer Castro to Group Leader, industrial hygiene services, Cypress office.

Mr. Steve Rosas has joined the Pacific operations group as Industrial Hygienist and Marketing Coordinator.

Ms. Bobbie Hughes, northeastern operations, has been certified in the Comprehensive Practice of Industrial Hygiene by the American

Board of Industrial Hygiene (ABIH). Ms. Hughes has also been promoted to Senior Industrial Hygienist and Supervisor of industrial hygiene services.

Mr. Lee Schumann, Supervisor, industrial hygiene services, northeastern operations, has been certified in the Chemical Aspects of Industrial Hygiene by ABIH.

Ms. Maria Roller, Associate Industrial Hygienist, northeastern operations, has been certified as an Industrial Hygienist in Training by ABIH.

Ms. Beth Taylor, CIH, Senior Industrial Hygienist, has returned to the midwestern operations after working for 21 months in Clayton's U.K. offices. Ms. Taylor is now a Member of the Institute of Occupational Hygienists. The institute is a British organization equivalent to the American Board of Industrial Hygiene.

Mr. Bill Eissler, CIH, was granted the designation of Registered Occupational Hygienist by the Canadian Registration Board of Occupational Hygienists.

The Birmingham office welcomes two new employees: Mr. Robert Stevens as Section Leader, analytical section/public analyst, and Mr. Mark Hodgson as Senior Water Services Engineer.

Clayton's western operations announces two new employees: Mr. Tony McElligott, P.E., Supervisor, remediation services, and Mr. Mike Lynch, Technical Supervisor, laboratory services.

Ms. Cindy Mueller, CIH, has transferred from the Pacific operations' Cypress office to the western operations' Pleasanton office as Supervisor, industrial hygiene services.

Recent Asbestos Studies and Position Papers Available

HEALTH EFFECTS INSTITUTE- ASBESTOS RESEARCH (HEI-AR) STUDY

In September 1991, HEI-AR, an independent, nonprofit organization, released a study commissioned by Congress to evaluate the risks of exposure to asbestos in buildings. The study, titled *Asbestos in Public and Commercial Buildings: A Literature Review and Synthesis of Current Knowledge*, came to two major conclusions: (1) asbestos-containing materials in good repair within buildings are unlikely to expose office workers and other general building occupants to airborne asbestos concentrations above the levels found in outside air and (2) exposure risks are higher for janitorial, custodial, maintenance, renovation, and asbestos workers who might disturb or damage asbestos-containing materials during their work, with asbestos workers facing the highest risk.

Emphasizing the inadequacy of existing data, the study recommended conducting three types of studies to (1) define more accurately the sources and patterns of exposure, including the effects of remediation strategies, (2) improve methods for analyzing airborne asbestos fibers, and (3) evaluate the biomedical effects of asbestos,

with particular reference to the comparative potency of different types and sizes of fibers. Clayton's Atlanta laboratory is one of two laboratories chosen by HEI-AR to provide analysis supporting studies of airborne asbestos levels in buildings. The HEI-AR report is available from the Health Effects Institute-Asbestos Research, 141 Portland Street, Cambridge, MA 02139, (617) 225-0866.

AMA AND AIHA POSITION PAPERS

The American Medical Association (AMA) and the American Industrial Hygiene Association (AIHA) each have published position papers on the removal of asbestos-containing materials from buildings.

AIHA's position statement, *On the Removal of Asbestos-Containing Materials (ACM) from Buildings*, concludes that the decision to remove asbestos-containing materials which are in good condition and not easily accessible to building occupants should be made only after assessing other options.

In its report, *Asbestos Removal, Health Hazards, and the EPA*, AMA concludes that asbestos can never be completely eliminated from the environment and Americans should learn to live with it safely rather than try to remove all of it from buildings. Both

positions concur with the findings of the HEI-AR study as well as the United States Environmental Protection Agency *Green Book*.

NIOSH GLOVE BAG STUDY

The National Institute for Occupational Safety and Health (NIOSH) recently released a publication titled *An Evaluation of Glove Bag Containment in Asbestos Removal*. This study evaluated (1) the effectiveness of glove bags in containing asbestos fibers during removal and (2) aggressive vs. nonaggressive airborne asbestos sampling techniques used to determine the efficacy of asbestos abatement.

The study concluded that (1) glove bags did not completely contain the asbestos fibers, (2) the aggressive sampling technique is more suitable than nonaggressive sampling for detecting asbestos contamination, and (3) phase contrast microscopy analysis, as compared to transmission electron microscopy, is not reliable for clearance testing.

The study is available from NIOSH Publications, 4676 Columbia Parkway, Cincinnati, Ohio 45226, (513) 533-8287. The documentation number is DHHS (NIOSH) Publication No. 90-119. ▼

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